U.S. Department of Interior
Bureau of Land Management
Washington, D.C.




2,4-dicholorophenoxyacetic Acid (2,4-D) Ecological Risk Assessment Final

March 2014

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EXECUTIVE SUMMARY

The United States Department of the Interior (USDOI) Bureau of Land Management (BLM), administers about 247.9 million acres in 17 western states in the continental United States (U.S.) and Alaska. One of the BLM's highest priorities is to promote ecosystem health, and one of the greatest obstacles to achieving this goal is the rapid expansion of invasive plants (including noxious weeds and other plants not native to an area) across public lands. These invasive plants can dominate and often cause permanent damage to natural plant communities. If not eradicated or controlled, invasive plants will jeopardize the health of public lands and the activities that occur on them. Herbicides are one method employed by the BLM to control these plants.

In 2007, the BLM published the *Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in 17 Western States Programmatic Environmental Impact Statement* (17-States PEIS). The Record of Decision (ROD) for the 17-States PEIS allowed the BLM to use 18 herbicide active ingredients, including 2-dichlorophenoxyacetic acid (2,4-D), available for a full range of vegetation treatments in 17 western states.

The BLM is proposing the continued use of the active ingredient 2,4-D to treat vegetation. This Ecological Risk Assessment (ERA) evaluates the potential risks to plants and animals from the use of the herbicide 2,4-D, including risks to rare, threatened, and endangered (RTE) plant and animal species. The BLM previously relied upon the 2,4-D risk assessment conducted on behalf of the U.S. Department of Agriculture Forest Service. This ERA updates information in the Forest Service risk assessment and evaluates risks to plants and animals based on treatment methods and application types and rates used by the BLM.

Herbicide Description

2,4-D is a selective, systemic herbicide used to control broadleaf weeds. Herbicides using 2,4-D as the active ingredient include soluble powders, soluble concentrates in both liquid and solid forms, emulsifiable concentrates, and a granular formulation designed for aquatic applications. There are several different 2,4-D salts and esters, as well as the acid form. The mechanisms of action for 2,4-D are thought to be increasing cell-wall plasticity, increasing protein biosynthesis, and increasing ethylene production. These increases appear to result in uncontrolled cell division and growth, which ultimately damages vascular tissue.

2,4-D is used for terrestrial vegetation control in the BLM's Rangeland, Public-Domain Forestland, Energy and Mineral Sites, Rights-of-Way, and Recreation programs. Applications are carried out through aerial and ground dispersal. Aerial applications are performed using airplanes and helicopters. Ground applications are executed on foot or on horseback with backpack sprayers, or from all-terrain vehicles, utility vehicles, or trucks equipped with spot or boom/broadcast sprayers.

2,4-D is used to control terrestrial plants. Woody varieties may be particularly difficult to control. Typical and maximum application rates for woody species (herein referred to as "woody") are 2 and 4 pounds (lbs.) acid equivalent (a.e.)/acre, respectively. Treatment of woody species with 2,4-D represents a minor use by the BLM. Other non-woody species (i.e., herbaceous varieties; herein referred to as "annual/perennial") have typical and maximum application rates of 1 and 2 lbs. a.e./acre, respectively.

2,4-D is also used for treatment of floating, emerged, and submerged aquatic vegetation. Submerged vegetation may be controlled by treating either the volume of water or the water body bottom. For control of floating and emerged aquatic vegetation or for treatment of submerged vegetation to a volume of water, 2,4-D may be applied aerially, using airplanes or helicopters, or using a boat for either spot or boom/broadcast applications. Typical and maximum application rates of 2 and 4 lbs. a.e./acre, respectively, are used for treatment of floating and emerged aquatic vegetation. Typical and maximum application rates of 5.4 and 10.8 lbs. a.e./acre-foot, respectively, are used for treatment of submerged vegetation to a volume of water. The granular formulation of 2,4-D (Navigate®) is used in the treatment of submerged vegetation at the bottom of a water body. This formulation utilizes a special heat treated attaclay granule carrier which allows the granule to drop to the bottom of the pond following application. Application is conducted using a boat for either spot or boom/broadcast applications (typical and maximum application rates of 19 and 38 lbs. a.e./acre, respectively).

ERA Objectives and Methods

The main objectives of this ERA are to evaluate the potential risks to the health and welfare of non-target plants and animals and their habitats from the use of 2,4-D and to provide risk managers with a range of generic risk estimates that vary as a function of site conditions. This ERA consisted consists of the following steps based on guidance in the *Vegetation Treatments Programmatic EIS Ecological Risk Assessment Protocol Final Report* (Methods Document). The guidance was used in conducting analyses for the 18 herbicide active ingredients evaluated in the 17-States PEIS, and was developed by the BLM in cooperation with the U.S. Environmental Protection Agency (USEPA), National Oceanic and Atmospheric Administration National Marine Fisheries Service, and USDOI U.S. Fish and Wildlife Service.

1. Exposure pathway evaluation – The effects of 2,4-D on several ecological receptor groups (in other words [i.e.], terrestrial animals, non-target terrestrial plants, fish and aquatic invertebrates, and non-target aquatic plants) via particular exposure pathways were evaluated. The resulting exposure scenarios included the following:
    - direct contact with the herbicide or a contaminated water body (terrestrial and aquatic applications);
    - indirect contact with contaminated foliage (terrestrial and aquatic applications);
    - ingestion of contaminated food items (terrestrial and aquatic applications);
    - off-site drift of spray to terrestrial areas and water bodies (terrestrial and aquatic applications);
    - surface runoff from the application area to off-site soils or water bodies (terrestrial applications only);
    - wind erosion resulting in deposition of contaminated dust (terrestrial applications only); and
    - accidental spills to water bodies (terrestrial and aquatic applications).
2. Definition of data evaluated in the ERA – Herbicide concentrations used in the ERA were based on typical and maximum application rates provided by the BLM. These application rates were used to predict herbicide concentrations in various environmental media (for example [e.g.], soils, water). Some of these calculations required computer models:
    - AgDRIFT® was used to estimate off-site herbicide transport due to spray drift.
    - GLEAMS was used to estimate off-site transport of herbicide in surface runoff and root zone groundwater.
    - AERMOD and CALPUFF were used to predict the transport and deposition of herbicides sorbed to wind-blown dust.
3. Identification of risk characterization endpoints – Endpoints used in the ERA included acute mortality; adverse direct effects on growth, reproduction, or other ecologically important sublethal processes; and adverse indirect effects on the survival, growth, or reproduction of salmonids. Each of these endpoints was associated with measures of effect such as the no observed adverse effect level and the median lethal effect dose and concentration.
4. Development of a conceptual model – The purpose of the conceptual model was to display working hypotheses about how 2,4-D might pose hazards to ecosystems and ecological receptors. These hypotheses are shown via a diagram of the possible exposure pathways and the receptors for each exposure pathway.

In the analysis phase of the ERA, estimated exposure concentrations (EECs) were identified for the various receptor groups in each of the applicable exposure scenarios via exposure modeling. Risk quotients (RQs) were then calculated by dividing the EECs by herbicide- and receptor-specific or exposure media-specific Toxicity Reference Values (TRVs) selected from the available literature. These RQs were compared to Levels of Concern (LOCs) established by the USEPA Office of Pesticide Programs (OPP) for specific risk presumption categories (i.e., acute high risk, acute high risk potentially mitigated through restricted use, acute high risk to endangered species, and chronic high risk).

Uncertainty

Uncertainty is introduced into the herbicide ERA through the selection of surrogates to represent a broad range of species on BLM lands, the use of mixtures of 2,4-D with other herbicides (pre-mixes or tank mixtures) or other potentially toxic ingredients (i.e., degradates, inert [other] ingredients, and added adjuvants), and the estimation of effects via exposure concentration models. The uncertainty inherent in screening level ERAs is especially problematic for the evaluation of risks to RTE species, which are afforded higher levels of protection through government regulations and policies. To attempt to minimize the chances of underestimating risk to RTE and other species, the lowest toxicity levels found in the literature were selected as TRVs, uncertainty factors were incorporated into these TRVs, allometric scaling was used to develop dose values, model assumptions were designed to conservatively estimate herbicide exposure, and indirect as well as direct effects on species of concern were evaluated.

Herbicide Effects

Literature Review

According to the Ecological Incident Information System database run by the USEPA OPP, the acid form of 2,4-D (the most frequently used form) has been associated with 342 reported “ecological incidents” involving damage or mortality to non-target flora or fauna. The incident reports listed the probability that 2,4-D caused the observed damage as “unrelated” in 1 incident, “unlikely” in 11 incidents, “possible” in 176 incidents, “probable” in 141 incidents, and “highly probable” in 13 incidents. The reported incidents were as the result of both aquatic and terrestrial use of the herbicide.

A review of the available ecotoxicological literature published since 2006[1] was conducted in order to evaluate the potential for 2,4-D to negatively directly or indirectly affect non-target taxa. This review was also used to identify or derive TRVs for use in the ERA. Peer-reviewed literature was only used in the present ERA if the study conformed to specific suitability parameters related to the test material, test species, exposure route, and toxicity endpoint as described in the Methods Document. Studies were excluded if they did not meet the requirements defined in the suitable study parameters.

The sources identified in this review indicate that 2,4-D poses little to no acute toxicity hazard to mammals via dermal exposure and slight toxicity via oral exposure; however, adverse effects to mammals have been documented from long-term dietary exposure to 2,4-D. 2,4-D also is moderately to practically non-toxic to birds and non-toxic to honeybees. Non-target plants are highly susceptible to 2,4-D toxicity. Concentrations of 2,4-D ester as low as 0.0003 lbs. a.e./acre have been shown to negatively affect the germination of non-target terrestrial plants (about 0.03% and 0.015% of the typical application rates for terrestrial annual/perennial and woody species, respectively). Esters of 2,4-D are highly toxic to aquatic plants. Aquatic plants were adversely affected by concentrations as low as 0.0004 mg a.e./L. Amphibians were also very sensitive to the effects of 2,4-D.

[1] A comprehensive risk assessment for 2,4-D was prepared for the Forest Service in 2006 (USDA Forest Service 2006). The objective of this literature review was to identify new ecotoxicological studies published since 2006.

ERA Results

Based on the ERA, 2,4-D presents a potential risk to ecological receptors on BLM-administered lands under certain exposure scenarios. The following summarizes the risk assessment findings for 2,4-D:

1. Direct Spray – The ERA predicted risks to terrestrial animals, non-target terrestrial and aquatic plants, aquatic invertebrates, and fish under scenarios in which plants or water bodies are accidentally sprayed at the typical or maximum application rate. Note that for aquatic herbicides, the direct application scenario may represent a normal rather than accidental exposure scenario.

2. Off-site Drift – The ERA predicted risks to non-target terrestrial plants in the majority of modeled scenarios. No acute or chronic risks were predicted for non-target aquatic plants, fish, or aquatic invertebrates based on 2,4-D acid/salts (with one exception for chronic risks to fish in the stream). The majority of the acute toxicity scenarios based on 2,4-D esters resulted in potential for risk, with much lower risks to fish than to aquatic invertebrates and aquatic plants. No risks were predicted for piscivorous birds.

3. Surface Runoff – The ERA predicted minimal risks to RTE plants as a result of surface runoff of 2,4-D acid/salts or esters and to aquatic receptors exposed to 2,4-D esters in the pond.

4. For terrestrial plants, runoff-related risks were only predicted in watersheds with clay soils. However, RQs were consistently below the LOCs in clay watersheds with precipitation of less than 100 inches per year for 2,4-D ester applications and less than 150 inches per year for 2,4-D acid/salts applications.

5. No runoff-related risks to fish or aquatic invertebrates were predicted in water bodies due to the use of 2,4-D acid/salts. No runoff-related risks due to the use of 2,4-D acid/salts or 2,4-D ester were predicted for fish, aquatic invertebrates, or aquatic plants in the stream.

6. For aquatic plants and aquatic invertebrates in the pond, runoff-related RQs for 2,4-D ester applications were consistently below the LOCs in watersheds with precipitation of less than 50 inches per year for terrestrial woody vegetation applications and less than 100 inches per year for terrestrial annual/perennial applications. Application in areas of higher precipitation may be acceptable under some watershed conditions (see Appendix C tables for scenarios with low RQs). Minimal risks to fish in the pond were predicted (acute RTE RQ exceeded in clay watershed with 250 inches per year of precipitation when using the maximum application rate to control woody vegetation); therefore, applications under most conditions are unlikely to result in risks.

7. Wind Erosion and Transport Off-site – The ERA predicted non-target terrestrial plants (typical and RTE) would not be at risk for adverse impacts under the majority of the modeled wind erosion and transport scenarios. Minimal risks from wind erosion were predicted for non-target terrestrial plants at a distance of up to 1.5 kilometers (km; 0.9 miles) from the application area in all watersheds and up to 10 km (6.2 miles) for RTE species based on conditions in Medford, Oregon.

8. Accidental Spill to Pond – The ERA predicted risks to non-target aquatic plants, fish, and aquatic invertebrates under a scenario of a spill of 2,4-D directly into a pond.

In addition, species that depend on non-target plant species for habitat, cover, and/or food may be indirectly impacted by a possible reduction in terrestrial or aquatic vegetation or prey items. For example, direct spray and off-site drift may negatively impact terrestrial and aquatic plants, reducing the cover available to RTE salmonids within the stream, and may reduce populations of prey items in the stream (i.e., fish and aquatic invertebrates). For aquatic herbicides, direct spray applications to streams may occur as part of normal applications, and in these cases impacts to non-target aquatic plants, fish, and aquatic invertebrates may occur. If a stream containing salmonids was sprayed with an aquatic 2,4-D herbicide, salmonids could be indirectly affected by a reduction in available cover or prey items.

Based on the results of the ERA, it is unlikely that RTE species would be harmed by appropriate and selective use of the herbicide 2,4-D on BLM-administered lands if the appropriate precautions are taken. Although non-target terrestrial and aquatic plants and aquatic organisms have the potential to be adversely affected by application of 2,4-D, adherence to specific application guidelines (e.g., defined application rates, equipment, herbicide mixture, and downwind distance to potentially sensitive habitat) would minimize the potential effects on non-target plants and associated indirect effects on species, such as salmonids, that depend on those plants for food, habitat, and cover.

Risks due to the aquatic application of the granular formulation of 2,4-D (Navigate®) could not be quantitatively evaluated in the ERA. This product is used in the treatment of submerged vegetation at the bottom of a water body. It is expected that, like the direct spray applications of 2,4-D for treatment of floating, emerged, and submerged aquatic vegetation, the granular formulation may pose risks to aquatic receptors once it is applied to the water. This product is designed for the treatment of the bottom of the water body, so risks would be expected to be highest in this area and lower closer to the water surface.

Recommendations

The following recommendations are designed to reduce potential unintended impacts to the environment from 2,4-D products:

1. Select herbicide products carefully to minimize additional impacts from degradates, adjuvants, inert ingredients, and tank mixtures. This is especially important for application scenarios that already predict potential risk from the active ingredient alone.

2. Review, understand, and conform to the “Environmental Hazards” section on herbicide label. This section warns of known pesticide risks to wildlife receptors or to the environment and provides practical ways to avoid harm to organisms and their environment.

3. Avoid accidental direct spray and spill conditions to reduce the most significant potential impacts. When using aquatic herbicides, consider the potential for impacts to non-target aquatic plants, fish, and aquatic invertebrates.

4. Use the typical application rate, rather than the maximum application rate, to reduce potential risks.

5. Adhere to the buffer zones presented in Tables ES-1 (non-target RTE terrestrial plants exposed to 2,4-D acid/salts or ester products), ES-2 (non-target typical terrestrial plants exposed to 2,4-D acid/salts), and ES-3 (non-target typical terrestrial plants exposed to 2,4-D ester products) to reduce potential impacts on non-target terrestrial plants due to off-site drift[2].

6. Avoid accidental direct spray and spill conditions to reduce the most significant potential impacts. When using aquatic herbicides, consider the potential for impacts to non-target aquatic plants, fish, and aquatic invertebrates.

7. Because no acute or chronic risks were predicted for non-target aquatic plants, fish, or aquatic invertebrates based on 2,4-D acid/salts (with one exception for chronic risks to fish in the stream), the buffer recommendations in Tables ES-4 and ES-5 are based on 2,4-D ester data. Buffers are not warranted for these scenarios for 2,4-D acid and salt products.

[2] Note: The ERAs evaluated potential risks due to off-site drift under several modeled distances from the application site (25, 100, and 900 feet for ground applications, and 100, 300, and 900 feet for aerial applications). Buffer distances provided in this section were obtained by plotting the RQs against the modeled distances, fitting a curve to the data, and then determining the distance at which the RQ was equivalent to an LOC of 1 for terrestrial plants (with an RQ based on a no observed adverse effect level for RTE species and the 25% effect concentration [EC_{25}] for typical species). The curve was extended beyond the largest modeled distance to extrapolate buffers beyond 900 feet.

8. Adhere to the buffer zones presented in Tables ES-4 (non-target aquatic plants, aquatic invertebrates and RTE fish species) and ES-5 (non-target aquatic plants and aquatic invertebrates and typical fish species) to reduce potential impacts due to off-site drift when using a 2,4-D ester product.

9. Because runoff is most affected by precipitation, limit terrestrial applications of 2,4-D during wet seasons or in high precipitation areas in order to limit off-site transport.

TABLE ES-1

Recommended Buffers for Application of 2,4-D Acid, Salt, or Ester Products to Reduce Potential Risks to Non-Target RTE Terrestrial Plants Due to Off-Site Drift

	Maximum Application Rate				Typical Application Rate			
Modeled Scenario (Application Rate in lbs a.e./ac)	**Annual/ Perennial (2)**	**Woody (4)**	**Floating and Emergent (4)**	**Submerged (10.8)**	**Annual/ Perennial (1)**	**Woody (2)**	**Floating and Emergent (2)**	**Submerged (5.4)**
Aerial Application								
Plane over forest	2,600	3,000	**NA**	**NA**	2,200	2,600	**NA**	**NA**
Plane over non-forested land	2,800	2,800*	2,800*	2,800	2,500	2,800*	2,800*	2,500
Helicopter over forest	800	1,000	**NA**	**NA**	600	800	**NA**	**NA**
Helicopter over non-forested land	2,500*	2,400*	2,400*	2,500*	2,500*	2,400*	2,400*	2,500*
Terrestrial Application								
Low boom	1,600	1,900	1,900	1,600	1,300	1,600	1,600	1,300
High boom	1,600	1,900	1,900	1,600	1,400	1,600	1,600	1,400

NOTES:
1. All recommended buffers are in feet (ft).
2. lbs a.e./ac – pounds acid equivalent per acre.
3. **NA** – Not applicable. Scenario not evaluated.
4. * – Due to the uncertainties associated with extrapolating buffers beyond the largest modeled distance (900 ft), in some cases, a slightly larger buffer distance was estimated for the typical application rate than for the maximum application rate. In these cases, the larger buffer distance is recommended to be protective at both the typical and the maximum application rates.
5. Buffer distances were obtained by plotting the RQs against the modeled distances (i.e., 25, 100, and 900 feet for ground applications, and 100, 300, and 900 feet for aerial applications), fitting a curve to the data, and then determining the distance at which the RQ was equivalent to an LOC of 1 (with an RQ based on a no observed adverse effect level. The curve was extended beyond the modeled distances to extrapolate buffers beyond 900 feet. Buffer distances were determined for both acid/salts and ester products and are typically within 100 feet or less of each other. Therefore, the maximum buffer distance of acid/salts and esters was selected as the recommended buffer to be protective of RTE terrestrial plants for all 2,4-D products.

10. To reduce risks to fish, aquatic invertebrates, aquatic plants, terrestrial plants, and RTE species, do not tank mix 2,4-D.

11. Consider the proximity of potential application areas to salmonid habitat and the possible off-site drift effects of herbicide application on riparian and aquatic vegetation. Buffer zones presented in Tables ES-1 through ES-5 should be reviewed to select the appropriate buffer that is 1) protective of riparian vegetation to prevent any associated indirect effects on salmonids due to a loss of cover, and 2) protective of prey items (i.e., fish and aquatic invertebrates).

TABLE ES-2

Recommended Buffers for Application of 2,4-D Acid or Salt Products to Reduce Potential Risks to Non-Target Typical Terrestrial Plants Due to Off-Site Drift

	Maximum Application Rate				**Typical Application Rate**			
Modeled Scenario (Application Rate in lbs a.e./ac)	**Annual/ Perennial (2)**	**Woody (4)**	**Floating and Emergent (4)**	**Submerged (10.8)**	**Annual/ Perennial (1)**	**Woody (2)**	**Floating and Emergent (2)**	**Submerged (5.4)**
Aerial Application								
Plane over forest	1,700	2,100	**NA**	**NA**	1,300	1,700	**NA**	**NA**
Plane over non-forested land	1,700	1,800*	1,700*	1,800	1,400	1,800*	1,700*	1,400
Helicopter over forest	200	400	**NA**	**NA**	100	200	**NA**	**NA**
Helicopter over non-forested land	1500	1,400*	1,400*	1,400	1,300*	1,400*	1,400*	1,300
Terrestrial Application								
Low boom	700	1,000	1,000	700	400	700	700	400
High boom	800	1,100	1,000	800	500	800	800	500

NOTES:
See Items 1-4 Table ES-1.
Buffer distances were obtained by plotting the RQs against the modeled distances (i.e., 25, 100, and 900 feet for ground applications, and 100, 300, and 900 feet for aerial applications), fitting a curve to the data, and then determining the distance at which the RQ was equivalent to an LOC of 1 (with an RQ based on the 25 percent effect concentration [EC_{25}]). The curve was extended beyond the modeled distances to extrapolate buffers beyond 900 feet and closer than 25 (or 100) feet.

TABLE ES-3

Recommended Buffers for Application of 2,4-D Ester Products to Reduce Potential Risks to Non-Target Typical Terrestrial Plants Due to Off-Site Drift

	Maximum Application Rate				Typical Application Rate			
Modeled Scenario (Application Rate in lbs a.e./ac)	**Annual/ Perennial (2)**	**Woody (4)**	**Floating and Emergent (4)**	**Submerged (10.8)**	**Annual/ Perennial (1)**	**Woody (2)**	**Floating and Emergent (2)**	**Submerged (5.4)**
Aerial Application								
Plane over forest	2,200	2,600	**NA**	**NA**	1,800	2,200	**NA**	**NA**
Plane over non-forested land	2,300	2,400*	2,300*	2,300	2,000	2,400*	2,300*	2,000
Helicopter over forest	500	700	**NA**	**NA**	300	500	**NA**	**NA**
Helicopter over non-forested land	2,000*	1,900*	1,900*	2,000*	2,000*	1,900*	1,900*	2,000*
Terrestrial Application								
Low boom	1,300	1,500	1,500	1,200	800	1,200	1,200	900
High boom	1,300	1,500	1,500	1,200	1,000	1,200	1,300	1,000

NOTES:
See Items 1-4 Table ES-1.
Buffer distances were obtained by plotting the RQs against the modeled distances (i.e., 25, 100, and 900 feet for ground applications, and 100, 300, and 900 feet for aerial applications), fitting a curve to the data, and then determining the distance at which the RQ was equivalent to an LOC of 1 (with an RQ based on the EC_{25}). The curve was extended beyond the modeled distances to extrapolate buffers beyond 900 feet and closer than 25 (or 100) feet.

TABLE ES-4

Recommended Buffers for Application of 2,4-D Ester Products to Reduce Potential Risks to Non-Target Aquatic Plants, Aquatic Invertebrates, and RTE Fish Species Due to Off-Site Drift

	Maximum Application Rate				Typical Application Rate			
Modeled Scenario (Application Rate in lbs a.e./ac)	**Annual/ Perennial (2)**	**Woody (4)**	**Floating and Emergent (4)**	**Submerged (10.8)**	**Annual/ Perennial (1)**	**Woody (2)**	**Floating and Emergent (2)**	**Submerged (5.4)**
Aerial Application								
Helicopter over forest and pond	300	500	**NA**	**NA**	100	300	**NA**	**NA**
Helicopter over non-forested land and pond	1,400	1,400	1,400*	1,400	1,300	1,400	1,400*	1,200
Plane over forest and pond	1,700	2,000	**NA**	**NA**	1,300	1,600	**NA**	**NA**
Plane over non-forested land and pond	1,700	1,600	1,600	1,700	1,300	1,600	1,600	1,300
Helicopter over forested land and stream	400	600	**NA**	**NA**	200	400	**NA**	**NA**
Helicopter over non-forested land and stream	1,400	1,400	1,400*	1,400	1,200	1,400	1,400*	1,200
Plane over forest and stream	1,600	1,900	**NA**	**NA**	1,300	1,600	**NA**	**NA**
Plane over non-forested land and stream	1,600	1,600	1,600	1,700	1,300	1,600	1,600	1,300
Terrestrial Application								
Low boom over pond	1,100	1,200	1,100	1,100	900	900	800	600
High boom over pond	1,100	1,100	1,100	1,100	900	900	900	600
Low boom over stream	500	900	800	600	300	600	600	400
High boom over stream	200	900	900	500*	0	700	700	500*

NOTES:
See Items 1-4 Table ES-1.
Buffer distances were obtained by plotting the RQs against the modeled distances (i.e., 25, 100, and 900 feet for ground applications, and 100, 300, and 900 feet for aerial applications), fitting a curve to the data, and then determining the distance at which the RQ was equivalent to a LOC of 0.05 for RTE fish and aquatic invertebrates, or a LOC of 1 for aquatic plants. The curve was extended beyond the modeled distances to extrapolate buffers beyond 900 feet and closer than 25 (or 100) feet.
Buffers for aquatic plants, aquatic invertebrates, and fish were calculated separately. The buffer that is protective of all species (i.e., the largest) is presented in this table.
If RTE fish species are not present in the water body, use buffers presented in Table ES-5.

TABLE ES-5

Recommended Buffers for Application of 2,4-D Ester Products to Reduce Potential Risks to Non-Target Aquatic Plants, Aquatic Invertebrates, and Typical Fish Species Due to Off-Site Drift

	Maximum Application Rate				Typical Application Rate			
Modeled Scenario (Application Rate in lbs a.e./ac)	**Annual/ Perennial (2)**	**Woody (4)**	**Floating and Emergent (4)**	**Submerged (10.8)**	**Annual/ Perennial (1)**	**Woody (2)**	**Floating and Emergent (2)**	**Submerged (5.4)**
Aerial Application								
Helicopter over forest and pond	300	300	**NA**	**NA**	100	100	**NA**	**NA**
Helicopter over non-forested land and pond	1,100	1,200*	1,200*	1,100	900	1,200*	1,200*	900
Plane over forest and pond	1,400	1,800	**NA**	**NA**	1000	1,400	**NA**	**NA**
Plane over non-forested land and pond	1,400	1,400	1,400	1,400	1000	1,400	1,400	1,000
Helicopter over forest and stream	200	400	**NA**	**NA**	100	200	**NA**	**NA**
Helicopter over non-forested land and stream	1,100	1,100	1,100	1,200	900	1,100	1,100	900
Plane over forest and stream	1,300	1,700	**NA**	**NA**	1,000	1,300	**NA**	**NA**
Plane over non-forested land and stream	1,300	1,400	1,400	1,300	1,000	1,400	1,400	1,000
Terrestrial Application								
Low boom over pond	900	800	800	500	300	500	500	200
High boom over pond	1000	900	900	900	800	600	600	300
Low boom over stream	300	600	600	400	200	400	400	200
High boom over stream	0	700	700	400	0	500	500	0

NOTES:
See Items 1-4 Table ES-1.
Buffer distances were obtained by plotting the RQs against the modeled distances (i.e., 25, 100, and 900 feet for ground applications, and 100, 300, and 900 feet for aerial applications), fitting a curve to the data, and then determining the distance at which the RQ was equivalent to a LOC of 0.5 for typical fish and aquatic invertebrate species, or a LOC of 1 for aquatic plants. The curve was extended beyond the largest modeled distances to extrapolate buffers beyond 900 feet and closer than 25 (or 100) feet.
Buffers for aquatic plants, aquatic invertebrates, and fish were calculated separately. The buffer that is protective of all species (i.e., the largest) is presented in this table.
If RTE fish species are present in the water body, use buffers presented in Table ES-4.

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LIST OF ACRONYMS, ABBREVIATIONS, AND SYMBOLS

2,4-D	2,4-dichlorophenoxyacetic acid
2-EHE	(2,4-D) 2-ethylhexyl ester
ac	Acres
a.e.	Acid equivalent
a.i.	Active ingredient
ARS	Agricultural Research Service
ATV	All Terrain Vehicle
BCF	Bioconcentration Factor
BEE	(2,4-D) 2-butoxyethyl ester
BLM	Bureau of Land Management
BW	Body Weight
°C	Degrees Celsius
CALPUFF	California Puff Model
CFR	Code of Federal Regulations
cm	Centimeter
cms	Cubic meters per second
DEA	(2,4-D) diethanolamine salt
DMA	(2,4-D) dimethylamine salt
EC_{25}	Concentration causing 25% inhibition of a process (Effect Concentration)
EC_{50}	Concentration causing 50% inhibition of a process (Median Effect Concentration)
EEC	Estimated Exposure Concentration
e.g.	For example
EHE	Ethylhexyl Ester
EI	Erosion Index
EIS	Environmental Impact Statement
EIIS	Ecological Incident Information System
ERA	Ecological Risk Assessment
ESA	Endangered Species Act
FIFRA	Federal Insecticide, Fungicide and Rodenticide Act
ft	Feet
g	Grams
GLEAMS	Groundwater Loading Effects of Agricultural Management Systems
HSDB	Hazardous Substances Data Bank
i.e.	that is
in	Inch
IPA	(2,4-D) isopropylamine salt
IPE	(2,4-D) isopropyl ester
IPM	Integrated Pest Management
kg	Kilogram
km	Kilometer
K_{oc}	Organic carbon partition coefficient
L	Liters
lbs.	Pounds
LC_{50}	Concentration causing 50% mortality (Median Lethal Concentration)
LD_{50}	Dose causing 50% mortality (Median Lethal Dose)
LOAEL	Lowest Observed Adverse Effect Level
LOC	Level of Concern
LOEC	Lowest Observed Effect Concentration
Log	Common logarithm (base 10)

LIST OF ACRONYMS, ABBREVIATIONS, AND SYMBOLS (Cont.)

L - Liters
lbs - Pounds
LC_{50} - Concentration causing 50% mortality (Median Lethal Concentration)
LD_{50} - Dose causing 50% mortality (Median Lethal Dose)
LOAEL - Lowest Observed Adverse Effect Level
LOC - Level of Concern
LOEC - Lowest Observed Effect Concentration
Log - Common logarithm (base 10)
m - Meter
mg - Milligrams
mg/kg - Milligrams per kilogram
mg/L - Milligrams per liter
MRID - Master Record Identification Number
MW - Molecular Weight
NMFS - National Marine Fisheries Service
NOAA - National Oceanic and Atmospheric Administration
NOAEC - No Observed Adverse Effect Concentration
NOAEL - No Observed Adverse Effect Level
NOEC - No Observed Effect Concentration
OPP - Office of Pesticide Programs
OPPTS - Office of Pollution Prevention and Toxic Substances
PEIS - Programmatic Environmental Impact Statement
PPDB - Pesticide Properties Database
ppm - Parts per million
ROD - Record of Decision
ROW - Right-of-Way
RQ - Risk Quotient
RTE - Rare, Threatened, and Endangered
SDTF - Spray Drift Task Force
TIPA - (2,4-D) triisopropanolamine salt
TP - Transformation Product
TRV - Toxicity Reference Value
U.S. - United States
USDA - United States Department of Agriculture
USDOI - United States Department of Interior
USEPA - United States Environmental Protection Agency
USFWS - United States Fish and Wildlife Service
µg - micrograms
UTV - Utility Vehicle
> - greater than
< - less than
= - equal to

1.0 INTRODUCTION

The Bureau of Land Management (BLM), United States Department of the Interior (USDOI), administers about 247.9 million acres in 17 western states in the continental United States (U.S.) and Alaska. One of the BLM's highest priorities is to promote ecosystem health, and one of the greatest obstacles to achieving this goal is the rapid expansion of invasive plants (including noxious weeds and other plants not native to an area) across public lands. These invasive plants can dominate and often cause permanent damage to natural plant communities. If not eradicated or controlled, invasive plants will jeopardize the health of public lands and the activities that occur on them. Herbicides are one method employed by the BLM to control these plants.

1.1 Background

In 2007, the BLM published the *Record of Decision for Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in 17 Western States Programmatic Environmental Impact Statement* (17-States PEIS; USDOI BLM 2007a). This Record of Decision (ROD) allowed the BLM to use 18 herbicide active ingredients, including 2-dichlorophenoxyacetic acid (2,4-D) (USDOI BLM 2007b). 2,4-D provides effective control of noxious weeds and invasive plants. The BLM is proposing the continued use of the active ingredient 2,4-D to treat vegetation. This Ecological Risk Assessment (ERA) evaluates the potential risks to plants and animals from the use of the herbicide 2,4-D, including risks to rare, threatened, and endangered (RTE) plant and animal species. The BLM previously relied upon the 2,4-D risk assessment conducted on behalf of the United States Forest Service (Forest Service; U.S. Department of Agriculture Forest Service 2006). This ERA updates information in the Forest Service risk assessment and evaluates risks to plants and animals based on treatment methods and application types and rates used by the BLM.

Analysis used in this ERA is based on guidance in the *Vegetation Treatments Programmatic EIS Ecological Risk Assessment Protocol Final Report* (Methods Document; ENSR 2004). The guidance was used to conduct analyses for the 18 herbicide active ingredients evaluated in the 17-States PEIS, and was developed by the BLM in cooperation with the U.S. Environmental Protection Agency (USEPA), National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS), and USDOI U.S. Fish and Wildlife Service (USFWS).

1.2 Objectives of the Ecological Risk Assessment

The purpose of this ERA is to evaluate the ecological risks of 2,4-D on the health and welfare of plants and animals, including RTE species and their habitats. This ERA contains the following sections:

Section 1: Introduction.

Section 2: BLM Herbicide Program Description – This section contains information regarding the formulation, mode of action, and specific BLM use of 2,4-D, which includes application rates and methods of dispersal. This section also contains a summary of incident reports documented with the USEPA.

Section 3: Herbicide Toxicology, Physical-chemical Properties, and Environmental Fate – This section contains a summary of scientific literature pertaining to the toxicology and the environmental fate of 2,4-D in terrestrial and aquatic environments, and discusses how its physical-chemical properties are used in the risk assessment.

Section 4: Ecological Risk Assessment – This section describes the exposure pathways and scenarios and the assessment endpoints including potential measured effects. It provides quantitative estimates of risks for several risk pathways and receptors.

Section 5: Sensitivity Analysis – This section describes the sensitivity of the three ERA models to specific input parameters. The importance of these conditions to exposure concentration estimates is discussed.

Section 6: Rare, Threatened, and Endangered Species – This section identifies RTE species potentially directly and/or indirectly affected by the herbicide program. It also describes how the ERA can be used to evaluate potential risks to RTE species.

Section 7: Uncertainty in the Ecological Risk Assessment – This section describes data gaps and assumptions made during the risk assessment process and how uncertainty should be considered in interpreting results.

Section 8: Summary – This section provides a synopsis of the ecological receptor groups, application rates, and modes of exposure. This section also provides a summary of the factors that most influence exposure concentrations with general recommendations for risk reduction.

2.0 BLM HERBICIDE PROGRAM DESCRIPTION

2.1 Problem Description

Millions of acres of once healthy, productive rangelands, forestlands, and riparian areas have been overrun by noxious weeds and other invasive plants. Noxious weeds are plants that have been designated by a federal, state, or county government as injurious to public health, agriculture, recreation, wildlife, or property (Sheley et al. 1999). Invasive plants include not only noxious weeds, but also other plants that are not native to the region. The BLM considers plants invasive if they have been introduced into an environment in which they did not evolve. Invasive plants usually have no natural enemies to limit their reproduction and spread (Westbrooks 1998). They invade recreation areas, BLM-administered public lands, national parks, state parks, roadsides, streambanks, and federal, state, and private lands. Invasive plants can:

- destroy wildlife habitat;
- displace RTE species and other species critical to ecosystem functioning (for example [e.g.], riparian plants);
- reduce plant and animal diversity;
- invade following wildland and prescribed fire (potentially into previously unaffected areas), limiting regeneration and establishment of native species and rapidly increasing acreage of infested land;
- reduce opportunities for hunting, fishing, camping and other recreational activities;
- increase fuel loads and decrease the length of fire cycles and/or increase the intensity of fires; and
- cost millions of dollars in treatment and loss of productivity to private landowners.

The BLM's ability to respond effectively to the challenge of noxious weeds and other invasive plants depends on the adequacy of the agency's resources. The BLM uses an Integrated Pest Management (IPM) approach to manage invasive plants. Management techniques may be biological, mechanical, manual, chemical, or cultural. Eighteen herbicide active ingredients, including 2,4-D, are currently used by the BLM to manage vegetation under their chemical control program. This report considers the impact to ecological receptors (animals and plants) from the use of the herbicide 2,4-D on BLM-administered lands using BLM application methods.

2.2 Overview of the BLM Vegetation Treatment Program

This section identifies the land programs, application types, application vehicles, and application methods for herbicide use in the BLM vegetation treatment program.

Land Programs

The BLM vegetation treatment program covers six land types or programs:

- Rangeland
- Public-domain Forestland
- Energy and Mineral Sites

- Rights-of-way
- Recreation and Cultural Sites
- Aquatic Sites

Herbicides are used in rangeland improvement and silvicultural practice to improve the potential for success of desired vegetation by reducing competition for light, moisture, and soil nutrients with less desirable plant species. Herbicides are used to manage or restrict noxious plant species and to suppress vegetation that interferes with man-made structures or transportation corridors.

Herbicides are a component of the BLM's integrated weed management program, and are used in varying degrees in all land treatment categories. Herbicide use under the six land programs is discussed below.

2.2.1.1 Rangeland

Rangeland vegetation treatment operations provide forage for domestic livestock and wildlife by removing undesirable competing plant species and preparing seedbeds for desirable plants. Approximately 89% of the herbicide treated acreage in the BLM vegetation treatment program falls in the rangeland improvement category. Application methods include airplane, helicopter, truck (boom/broadcast or spot applications), ATV/UTV (boom/broadcast or spot applications), horseback (spot applications), and backpack (spot applications).

2.2.1.2 Public-domain Forestland

Public-domain forestland vegetation treatment operations, designed to ensure the establishment and healthy growth of timber crop species, are one of the BLM's least extensive programs for herbicide treatment. These operations include site preparation, plantation, maintenance, conifer release, pre-commercial thinning, and non-commercial tree removal. Site preparation treatments prepare newly harvested or inadequately stocked areas for planting new tree crops. Herbicides used in site preparation reduce vegetation that competes with conifers. In the brown-and-burn method of site preparation, herbicides are used to dry the vegetation, to be burned several months later. Herbicides are used in plantations some time after planting to promote the dominance and growth of already established conifers (release). Pre-commercial thinning reduces competition among conifers, thereby improving the growth rate of desirable crop trees. Non-commercial tree removal is used to eliminate dwarf mistletoe infested host trees. These latter two silvicultural practices primarily use manual applications methods. Herbicide uses in public-domain forests constitute less than 4% of the vegetation treatment operations in the BLM program. Application methods include airplane, helicopter, truck (boom/broadcast or spot applications), ATV/UTV (boom/broadcast or spot applications), horseback (spot applications), and backpack (spot applications).

2.2.1.3 Energy and Mineral Sites

Vegetation treatments in energy and mineral sites include the preparation and regular maintenance of areas for use as fire control lines or fuel breaks, and the reduction of plant species that could pose a hazard to fire control operations. More than 50% of the vegetation treatment programs at energy and mineral sites are herbicide applications. Application methods include airplane, helicopter, truck (boom/broadcast or spot applications), ATV/UTV (boom/broadcast or spot applications), horseback (spot applications), and backpack (spot applications).

2.2.1.4 Rights-of-way

Right-of-way treatments include roadside maintenance and maintenance of power transmission lines, waterways, and railroad corridors. In roadside maintenance, vegetation in ditches and on road shoulders is removed or reduced to prevent brush encroachment into driving lanes, to maintain visibility on curves for the safety of vehicle operators, to permit drainage structures to function as intended, and to facilitate maintenance operations. Herbicides have been used in nearly 50% of the BLM's roadside vegetation maintenance programs. Application methods include airplane, helicopter, truck (boom/broadcast or spot applications), ATV/UTV (boom/broadcast or spot applications), horseback (spot applications), and backpack (spot applications).

2.2.1.5 Recreation and Cultural Sites

Recreation and cultural site maintenance operations provide for the safe and efficient use of BLM facilities and recreation sites and for permittee/grantee uses of public amenities, such as, ski runs, waterways, and utility terminals. Vegetation treatments are made for the general maintenance and visual appearance of the areas and to reduce potential threats to the site's plants and wildlife, as well as to the health and welfare of visitors. The site maintenance program includes the noxious weed and poisonous plant program. Vegetation treatments in these areas are also done for fire management purposes. The BLM uses herbicides on approximately one-third of the total recreation site acreage identified as needing regular treatment operations. Application methods include airplane, helicopter, truck (boom/broadcast or spot applications), ATV/UTV (boom/broadcast or spot applications), horseback (spot applications), and backpack (spot applications).

2.2.2 Application Methods

The BLM conducts pretreatment surveys in accordance with BLM Handbook H-9011-1 (*Chemical Pest Control*) before making a decision to use herbicides on a specific land area. The herbicides can be applied by via airplane, helicopter, boat (boom/broadcast or spot applications), truck (boom/broadcast or spot applications), ATV/UTV (boom/broadcast or spot applications), horseback (spot applications), and backpack (spot applications) with the selected technique dependent upon the following variables:

- Treatment objective (removal or reduction)
- Accessibility, topography, and size of the treatment area
- Characteristics of the target species and the desired vegetation
- Location of sensitive areas in the immediate vicinity (potential environmental impacts)
- Anticipated costs and equipment limitations
- Meteorological and vegetative conditions of the treatment area at the time of treatment

Herbicide applications are scheduled and designed such that potential impacts to non-target plants and animals are minimized, while the objectives of the vegetation treatment program are kept consistent. Herbicides are applied from either the air or ground. The herbicide formulations may be in a liquid or granular form, depending on resources and program objectives. Aerial methods employ boom-mounted nozzles for liquid formulations or rotary broadcasters for granular formulations, carried by helicopters or airplanes. Ground application methods include vehicle- and boat-mounted, backpack, and horseback application techniques. Vehicle- and boat-mounted application systems use fixed-boom or hand-held spray nozzles mounted on trucks or ATVs/UTVs. Backpack systems use a pressurized sprayer to apply an herbicide as a broadcast spray directly to one or a group of individual plants.

2.2.2.1 Aerial Application Methods

Aerial application can be conducted by airplane (fixed-wing aircraft) or helicopter (rotary-wing aircraft). Between 2006 and 2011, the BLM treated 73% of its herbicide treatment sites by air. Helicopters are preferred on rangeland projects because the treatment units are numerous, far apart, and often small and irregularly shaped.

The size and type of these aircraft may vary, but the equipment used to apply the herbicides must meet specific guidelines. Contractor-operated helicopters or fixed-wing aircraft are equipped with an herbicide tank or bin (depending on whether the herbicide is a liquid or granular formulation). For aerial spraying, the aircraft is equipped with cylindrical jet-producing nozzles no less than 1/8 inch in diameter. The nozzles are directed with the slipstream, at a maximum of 45 degrees downward for fixed-wing applications, or up to 75 degrees downward for helicopter applications, depending on the flight speed. Nozzle size and pressure are designed to produce droplets with a diameter of 200 to 400 microns. For fixed-wing aircraft, the spray boom is typically ¾ of the wingspan, and for helicopters, the spray boom is often ¾ of the rotor diameter. All spray systems must have a positive liquid shut-off device that ensures that no herbicide continues to drip from the boom once the pilot has completed a swath (in other words [i.e.], specific spray path). The nozzles are spaced to produce a uniform pattern for the length of the boom.

Using helicopters for herbicide application is often more expensive than using fixed-wing aircraft, but helicopters offer greater versatility. Helicopters are well adapted to areas dominated by irregular terrain and long, narrow, and irregularly shaped land patterns, a common characteristic of public lands. Various helicopter aircraft types are used, including, Bell, Sikorsky, and Hiller models. These helicopters must be capable of accommodating the spray equipment and the herbicide tank or bin, and of maintaining an air speed of 40 to 50 miles per hour at a height of 20 to 45 feet above the vegetation (depending upon the desired application rate), and they must meet BLM safety performance standards.

Fixed-wing aircraft include the typical, small "cropduster" type aircraft. Fixed-wing aircraft are best suited for smoother terrain and larger tracts of land where abrupt turning is not required. Because the fixed-wing aircraft spraying operations are used for treating larger land areas, the cost per acre is generally lower than that of helicopter spraying. Aircraft capability requirements for fixed-wing aircraft are similar to helicopter requirements, except that an air speed of 100 to 120 miles per hour is necessary, with spraying heights of 10 to 40 feet generally used to produce the desired application rates.

Batch trucks are an integral part of any aerial application operation. They serve as mixing tanks for preparing the correct proportions of herbicide and carrier, and they move with the operation when different landing areas are required.

The number of workers involved in a typical aerial spray project varies according to the type of activity. A small operation may require up to six individuals, while a complex operation may require as many as 20 to 35 workers. An aerial operations crew for range management, noxious weed management, and ROW maintenance usually consists of five to eight individuals. Typically, personnel on a large project include a pilot, a mixer/loader, who is responsible for mixing the herbicide and loading it to the tank, a contracting officer's representative, an observer-inspector, a one- to six-member flagging crew, one or two law enforcement officers, one or two water monitors, and one or two laborers. Optional personnel include an air operations officer, a radio technician, a weather monitor, and a recorder. Workers evaluated in the HHRA for aerial applications include a pilot and a mixer/loader, as these are the receptors most likely to be exposed to herbicides. Other personnel are expected to have less or similar herbicide exposure.

2.2.2.2 Ground Application Methods

There are two types of ground application methods: human application methods (backpack and horseback) and vehicle application, which includes ATV/UTV-based application methods (spot-treatment or boom/broadcast treatment), and truck-mounted application methods (spot-treatment or boom/broadcast treatment). These are described in greater detail below.

<u>Human Application Methods</u> - Humans may apply herbicides by backpack or on horseback. The backpack method requires the use of a backpack spray tank for carrying the herbicide, with a handgun applicator with a single nozzle for herbicide application. Backpack and horseback spraying techniques are best adapted for very small scale applications in isolated spots and areas not accessible by vehicle. These methods are primarily used for spot treatments around signposts, spraying competing trees in public-domain forestland, delineators, power poles, scattered noxious weeds, and other areas that require selective spraying.

Backpack treatment is the predominant ground-based method for silviculture and range management. The principle hand application techniques are injection and stump treatment. Injection involves applying an herbicide with a hand-held container or injector through slits cut into the stems of target plants. Individual stem treatment by the injection method is also used for thinning crop trees or removing the undesirable trees. Stump treatment entails applying liquid herbicide directly to the cut stump of the target plant to inhibit sprouting. An herbicide can be applied by dabbing or painting the exposed cambium of a stump, or by using a squeeze bottle on a freshly cut cambium surface. Along with liquid formulations, certain active ingredients are formulated in a granular form that allows for direct application to the soil surface. Pressurized backpack treatment operations typically involve a supervisor (who may also function as a mixer/loader), an inspector, a monitor, and 2 to 12 crew members. The receptor evaluated in this risk assessment for both backpack and horseback treatments is a combined applicator/mixer/loader, because these treatments are small in scale and it is likely that the same worker would mix the herbicide as well as load and apply the herbicide.

Vehicle Application Methods - Ground-based herbicide spray treatments involve use of a truck or an ATV/UTV. A vehicle application is made using a boom with several spray nozzles (boom/broadcast treatment) or a handgun with a single nozzle (spot treatment). Ground vehicle spray equipment can be mounted on ATVs/UTVs or trucks. Because of their small size and agility, the ATVs/UTVs can be adapted to many different situations.

The boom spray equipment used for vehicle operations is designed to spray wide strips of land where the vegetation does not normally exceed 18 inches in height and the terrain is generally smooth and free of deep gullies. Ground spraying from vehicles occurs along highway rights-of-way, energy and mineral sites, public-domain forestlands, and rangeland sites.

Spot-gun spraying is best adapted for spraying small, scattered plots. It may also be used to spray signposts and delineators within highway rights-of-way, and around wooden power lines as a means of reducing fire hazards within power line rights-of-way. This technique is also used to treat scattered noxious weeds, but it is limited to areas that are accessible by vehicles.

Right-of-way maintenance projects frequently use vehicle-mounted application techniques. A truck with a mixing/holding tank uses a front mounted spray boom or a hand-held pressurized nozzle to treat roadside vegetation on varying slopes. However, using this equipment for off-road ROW projects is limited to gentle slopes (less than 20%) and open terrain. Workers typically involved include a driver/mixer/loader and an applicator. Therefore, receptors evaluated in this HHRA include an applicator, a mixer/loader, and a combined applicator/mixer/loader. The applicator receptor is evaluated both separately and combined with the mixer/loader receptor to cover both smaller scale operations conducted by one person as well as larger scale operations where more workers are involved.

2.3 Herbicide Description

2,4-D is a selective systemic herbicide used to control broadleaf weeds. There are many different 2,4-D salts and esters, as well as the acid form. The mechanisms of action for 2,4-D are thought to be increasing cell-wall plasticity, increasing protein biosynthesis, and increasing ethylene production. These increases appear to result in uncontrolled cell division and growth, which ultimately damages vascular tissue (USEPA 2005). Herbicides using 2,4-D as the active ingredient include wettable powders, soluble concentrates in both liquid and solid forms, emulsifiable concentrates, and a granular formulation designed for aquatic applications. These formulations are typically applied as broadcast, banded, or directed (spray or wiper) applications during dormancy or preplant, preharvest, preemergence, emergence, postemergence, or postharvest using ground or aerial equipment.

2,4-D is used by the BLM for vegetation control in their Rangeland, Public-Domain Forestland, Energy and Mineral Sites, ROW, and Recreation programs. Applications are carried out through aerial and ground dispersal. Aerial applications are conducted using airplanes and helicopters. Ground applications are conducted on foot or on horseback with backpack sprayers or from ATVs, UTVs, or trucks equipped with spot or boom/broadcast sprayers.

2,4-D is used to control terrestrial and aquatic plants. Terrestrial woody varieties may be particularly difficult to control using 2,4-D. Typical and maximum application rates for woody species (herein referred to as “woody”) are 2 and 4 pounds (lbs.) acid equivalent (a.e.)/acre (ac), respectively. Treatment of woody species with 2,4-D represents a minor use by the BLM. Other non-woody species (i.e., herbaceous varieties; herein referred to as “annual/perennial”) have typical and maximum application rates of 1 and 2 lbs. a.e./ac, respectively.

2,4-D is used for treatment of floating, emerged, and submerged aquatic vegetation. Submerged vegetation may be controlled by treating either the volume of water or the water body bottom. For control of floating and emerged aquatic vegetation or for treatment of submerged vegetation in a volume of water, 2,4-D may be applied aerially (except in forested areas), using any of the standard ground application methods, or using a boat for either spot or boom/broadcast applications. Typical and maximum application rates of 2 and 4 lbs. a.e./ac, respectively, are used for treatment of floating and emerged aquatic vegetation. Typical and maximum application rates of 5.4 and 10.8 lbs. a.e./acre-foot, respectively, are used for treatment of submerged vegetation in a volume of water. The granular formulation of 2,4-D (Navigate®) is used to treat submerged vegetation at the bottom of a water body. This formulation utilizes a special heat-treated attaclay granule carrier, which allows the granule to drop to the bottom of the pond following application. Application is conducted using a boat for either spot or boom/broadcast applications (typical and maximum application rates of 19 and 38 lbs. a.e./ac, respectively). Details about 2,4-D application rates and method of dispersal are provided in Table 2-1 at the end of this section.

For the purposes of this ERA, the herbicide-specific modeling and toxicity evaluation were conducted on an a.e. basis to correspond with the BLM application rates. The active ingredient (a.i.) is the portion of an herbicide formulation that controls the target weed; it is identified on the product label. The a.e. is defined as the portion of a formulation that can be converted back to the corresponding parent acid.

As a weak acid, 2,4-D can donate a hydrogen ion to other compounds. When 2,4-D is formulated into a commercial product, the hydrogen ion on the parent weak acid is replaced with a different salt (ion). The salt itself does not have herbicidal properties, but results in a product that is easier to handle, mixes better with other agricultural chemicals, and/or is more effective than the parent weak acid. In the case of 2,4-D, the dimethylamine salt is the a.i. in such products as 2,4-D Amine 4 (AgriStar®), 2,4-D Amine 4 (AgriSolutions™), and Weedar® 64 (Nufarm), and the 2,4-D anion is the a.e. of the salt.

2,4-D esters act as active ingredients in several formulated products. For example, butoxyether ester is the a.i. in the product Navigate®, isooctyl(2-ethylhexyl)ester is the a.i. in the product 2,4-D L.V.6 Ester (Riverdale®), and 2-ethylhexylester is the a.i. in the product Whiteout®.

The herbicide-specific use criteria discussed in this document were obtained from 2,4-D product labels (as registered with the USEPA) as they apply to the BLM use. 2,4-D application rates and methods discussed in this section are based on BLM herbicide use, and are in accordance with product labels approved by the USEPA. The BLM should be aware of all state-specific label requirements and restrictions. In addition, new USEPA approved herbicide labels may be issued after publication of this report, and BLM land managers should be aware of all newly approved federal, state, and local restrictions on herbicide use when planning vegetation management programs.

2.4 Herbicide Incident Reports

An "ecological incident" occurs when non-target flora or fauna are killed or damaged due to application of a pesticide. When ecological incidents are reported to a state agency or other proper authority, they are investigated and an ecological incident report is generated. The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) requires product registrants to report adverse effects of their product to the USEPA.

The USEPA Office of Pesticide Programs (OPP) manages a database, the Ecological Incident Information System (EIIS), which contains much of the information provided in the ecological incident reports. As part of this ERA, all available incident reports in the EIIS listing 2,4-D as a potential source of the observed ecological damage were obtained.

A total of 342 EIIS incident reports involved the acid form of 2,4-D (the most frequently used form). The incident reports listed the probability that 2,4-D caused the observed damage as "unrelated" in one incident, "unlikely" in 11 incidents, "possible" in 176 incidents, "probable" in 141 incidents, and "highly probable" in 13 incidents. The reported incidents involved both aquatic and terrestrial use of the herbicide. Of the 13 "highly probable" incidents, four incidents involved registered use of the herbicide, two incidents involved the intentional misuse of the herbicide, three incidents involved accidental misuse of the herbicide, and the remaining four incidents did not report a legality code. The total magnitude of the damage from these incidents ranged from relatively minor to large-scale losses. A summary of these "highly probable" incidents is provided in Table 2-2, while the remaining incident reports for 2,4-D are presented in Appendix A.

TABLE 2-1

BLM 2,4-D Use Statistics

Program	Scenario	Vehicle	Method	Used?	Application Rate Typical (lbs. a.e./ac)	Application Rate Maximum (lbs. a.e./ac)
Rangeland	Aerial	Plane	Fixed Wing	Yes	1.0 (2.0)[1]	2.0 (4.0)[1]
		Helicopter	Rotary	Yes	1.0 (2.0)[1]	2.0 (4.0)[1]
	Ground	Human	Backpack	Yes	1.0 (2.0)[1]	2.0 (4.0)[1]
			Horseback	Yes	1.0 (2.0)[1]	2.0 (4.0)[1]
		ATV/UTV	Spot	Yes	1.0 (2.0)[1]	2.0 (4.0)[1]
			Boom/Broadcast	Yes	1.0 (2.0)[1]	2.0 (4.0)[1]
		Truck	Spot	Yes	1.0 (2.0)[1]	2.0 (4.0)[1]
			Boom/Broadcast	Yes	1.0 (2.0)[1]	2.0 (4.0)[1]
Public-Domain Forestland	Aerial	Plane	Fixed Wing	Yes	1.0 (2.0)[1]	2.0 (4.0)[1]
		Helicopter	Rotary	Yes	1.0 (2.0)[1]	2.0 (4.0)[1]
	Ground	Human	Backpack	Yes	1.0 (2.0)[1]	2.0 (4.0)[1]
			Horseback	Yes	1.0 (2.0)[1]	2.0 (4.0)[1]
		ATV/UTV	Spot	Yes	1.0 (2.0)[1]	2.0 (4.0)[1]
			Boom/Broadcast	Yes	1.0 (2.0)[1]	2.0 (4.0)[1]
		Truck	Spot	Yes	1.0 (2.0)[1]	2.0 (4.0)[1]
			Boom/Broadcast	Yes	1.0 (2.0)[1]	2.0 (4.0)[1]
Energy and Mineral Sites	Aerial	Plane	Fixed Wing	Yes	1.0 (2.0)[1]	2.0 (4.0)[1]
		Helicopter	Rotary	Yes	1.0 (2.0)[1]	2.0 (4.0)[1]
	Ground	Human	Backpack	Yes	1.0 (2.0)[1]	2.0 (4.0)[1]
			Horseback	Yes	1.0 (2.0)[1]	2.0 (4.0)[1]
		ATV/UTV	Spot	Yes	1.0 (2.0)[1]	2.0 (4.0)[1]
			Boom/Broadcast	Yes	1.0 (2.0)[1]	2.0 (4.0)[1]
		Truck	Spot	Yes	1.0 (2.0)[1]	2.0 (4.0)[1]
			Boom/Broadcast	Yes	1.0 (2.0)[1]	2.0 (4.0)[1]
Rights-of-Way	Aerial	Plane	Fixed Wing	Yes	1.0 (2.0)[1]	2.0 (4.0)[1]
		Helicopter	Rotary	Yes	1.0 (2.0)[1]	2.0 (4.0)[1]
	Ground	Human	Backpack	Yes	1.0 (2.0)[1]	2.0 (4.0)[1]
			Horseback	Yes	1.0 (2.0)[1]	2.0 (4.0)[1]
		ATV/UTV	Spot	Yes	1.0 (2.0)[1]	2.0 (4.0)[1]
			Boom/Broadcast	Yes	1.0 (2.0)[1]	2.0 (4.0)[1]
		Truck	Spot	Yes	1.0 (2.0)[1]	2.0 (4.0)[1]
			Boom/Broadcast	Yes	1.0 (2.0)[1]	2.0 (4.0)[1]
Recreation	Aerial	Plane	Fixed Wing	Yes	1.0 (2.0)[1]	2.0 (4.0)[1]
		Helicopter	Rotary	Yes	1.0 (2.0)[1]	2.0 (4.0)[1]
	Ground	Human	Backpack	Yes	1.0 (2.0)[1]	2.0 (4.0)[1]
			Horseback	Yes	1.0 (2.0)[1]	2.0 (4.0)[1]
		ATV/UTV	Spot	Yes	1.0 (2.0)[1]	2.0 (4.0)[1]
			Boom/Broadcast	Yes	1.0 (2.0)[1]	2.0 (4.0)[1]
		Truck	Spot	Yes	1.0 (2.0)[1]	2.0 (4.0)[1]
			Boom/Broadcast	Yes	1.0 (2.0)[1]	2.0 (4.0)[1]

TABLE 2-1 (Cont.)

BLM 2,4-D Use Statistics

Program	Scenario	Vehicle	Method	Used?	Application Rate Typical (lbs. a.e./ac)	Application Rate Maximum (lbs. a.e./ac)
Aquatic - Floating and Emerged Weeds	Aerial	Plane	Fixed Wing	Yes	2.0	4.0
		Helicopter	Rotary	Yes	2.0	4.0
	Ground	Human	Backpack	Yes	2.0	4.0
			Horseback	Yes	2.0	4.0
		ATV/UTV	Spot	Yes	2.0	4.0
			Boom/Broadcast	Yes	2.0	4.0
		Truck	Spot	Yes	2.0	4.0
			Boom/Broadcast	Yes	2.0	4.0
		Boat	Spot	Yes	2.0	4.0
			Boom/Broadcast	Yes	2.0	4.0
Aquatic - Submerged Weeds (for treating volume of water)	Aerial	Plane	Fixed Wing	Yes	5.4 [2]	10.8 [2]
		Helicopter	Rotary	Yes	5.4 [2]	10.8 [2]
	Ground	Human	Backpack	Yes	5.4 [2]	10.8 [2]
			Horseback	Yes	5.4 [2]	10.8 [2]
		ATV/UTV	Spot	Yes	5.4 [2]	10.8 [2]
			Boom/Broadcast	Yes	5.4 [2]	10.8 [2]
		Truck	Spot	Yes	5.4 [2]	10.8 [2]
			Boom/Broadcast	Yes	5.4 [2]	10.8 [2]
		Boat	Spot	Yes	5.4 [2]	10.8 [2]
			Boom/Broadcast	Yes	5.4 [2]	10.8 [2]
Aquatic - Submerged Weeds (granular product for treating bottom)	Aerial	Plane	Fixed Wing	No	-	-
		Helicopter	Rotary	No	-	-
	Ground	Human	Backpack	No	-	-
			Horseback	No	-	-
		ATV/UTV	Spot	No	-	-
			Boom/Broadcast	No	-	-
		Truck	Spot	No	-	-
			Boom/Broadcast	No	-	-
		Boat	Spot	Yes	19	38
			Boom/Broadcast	Yes	19	38

ac = acres.
a.e. = acid equivalent.
ATV = All-terrain vehicle.
lbs = pounds.
UTV = Utility vehicle.
'-' = method not used therefore no application rate
[1]Terrestrial application rates presented are for annual/perennial species. Application rates in parentheses are for woody species.
[2] Units are lbs. a.e./acre-foot.

TABLE 2-2

2,4-D Incident Report Summary

Incident #	Date	County	State	Certainty	Legal	Form	Application Method	Total Magnitude
AQUATIC								
Home/lawn								
I000636-017	4/13/1987	Audrain	MO	4	RU	RTU	Spray	Several
Not reported								
I004875-001	3/10/1996	E. Baton Rouge	LA	4	MI		Leaking drum	600
Right-of-way, rail								
I000925-001	6/10/1993	Mercer	WV	4	RU	N/R	Spraying	23,000
PLANTS								
00598-009								
I009262-033	8/9/1999		FL	4	UN	N/R	N/R	50% of lawn
Agricultural area								
I003116-001	3/1/1994	Wasco	OR	4	MA	N/R	Broadcast	80 of 97 acres
I003104-001	1/1/1996		ID	4	RU	N/R	N/R	All
I003249-006	2/3/1996	Imperial	CA	4	RU	EC	Spray	Thousands
I020998-022	4/17/2002	Klickitat	WA	4	UN			
Not reported								
I013883-026	6/28/1997	Kitsap	WA	4	UN		Direct	Not given
Right-of-way, road								
I014290-001	7/3/2003	Lemhi	ID	4	MA		Spray	900 square feet
Wheat								
I003386-001	4/11/1994	Wasco	OR	4	MI		Broadcast	665
TERRESTRIAL								
No data								
I020998-010	6/7/2002	Spokane	WA	4	UN			
Corn								
I004495-001	5/19/1996	Des Moines	IA	4	MA		Broadcast	Unknown

Certainty code: 4 = highly probable.
Legality code: RU = registered use, MA = misuse (accidental), MI = misuse (intentional), and UN = unknown.
Formulation: RTU = ready to use, EC = emulsifiable concentrate, and N/R = not reported.
Information provided by the USEPA from the EIIS. Blank cells indicate the information was not listed in the EIIS.

3.0 HERBICIDE TOXICOLOGY, PHYSICAL-CHEMICAL PROPERTIES, AND ENVIRONMENTAL FATE

This section summarizes herbicide toxicology information, describes how this information was obtained, and provides a basis for the level of concern values selected for this risk assessment. 2,4-D's physical-chemical properties and environmental fate are also discussed.

As discussed in the Methods Document (ENSR 2004), if the USEPA had reviewed an available toxicology study and classified it as "acceptable," the study's findings were considered acceptable for development of toxicity reference values (TRVs). Studies classified as "supplemental" by the USEPA were only used if acceptable ("core") studies were unavailable for a certain exposure pathway/receptor. Core studies are used to support registration of a pesticide and were conducted according to accepted methodologies. Supplemental studies are scientifically sound however, they were performed under conditions that deviated from recommended protocols. These supplemental studies are generally not used for registration purposes, but are acceptable for use in a risk assessment.

3.1 Herbicide Toxicology

A review of the available ecotoxicological literature was conducted in order to evaluate the potential for 2,4-D to negatively affect the environment and to derive TRVs (provided in italics in Sections 3.1.2 and 3.1.3) for use in the ERA. The process for the literature review and the TRV derivation is provided in the Methods Document (ENSR 2004). This review included a review of published manuscripts and registration documents, information obtained through electronic databases (e.g., USEPA pesticides ecotoxicology database, USEPA's online ECOTOX database), and other internet sources. This review included both freshwater and marine/estuarine data, although marine/estuarine data were not considered for TRV development, as discussed in the Methods Document (ENSR 2004).

Endpoints for aquatic receptors and terrestrial plants were reported based on exposure concentrations (milligrams per liter [mg/L] and lbs./ac, respectively). Dose-based endpoints (e.g., the dose causing 50% mortality [LD_{50}s] were used for birds and mammals. When possible, dose-based endpoints were obtained directly from the literature. When dosages were not reported, dietary concentration data were converted to dose-based values (e.g., the concentration causing 50% mortality [LC_{50}] to LD_{50}) following the methodology recommended in USEPA risk assessment guidelines (Sample et al. 1996). Acute TRVs were derived first to provide an upper boundary for the remaining TRVs; chronic TRVs were always equivalent to, or less than, the acute TRV. The chronic TRV was established as the highest no observed adverse effect (NOAEL) value that was less than both the chronic lowest observed adverse effect level (LOAEL) and the acute TRV. When acute or chronic toxicity data were unavailable, TRVs were extrapolated from other relevant data using an uncertainty factor of 3, as described in the Methods Document (ENSR 2004).

This section reviews the available information identified for 2,4-D and presents the TRVs selected for this ERA (Table 3-1). Appendix B presents a summary of the 2,4-D data identified during the literature review. Toxicity data are presented in the units presented in the reviewed study, which in this case applies to the active ingredient itself (2,4-D). The availability of toxicity data is discussed in Section 7.1. The review of the toxicity data did not consider potential toxic effects of inert (other) ingredients, adjuvants, surfactants, and/or degradates. Section 7.3 discusses the potential impacts of these constituents in a qualitative manner.

3.1.1 Overview

2,4-D is a selective systemic herbicide used to control broadleaf weeds. The mechanisms of action for 2,4-D are thought to be increasing cell-wall plasticity, increasing protein biosynthesis, and increasing ethylene production.

These increases appear to result in uncontrolled cell division and growth, which ultimately damages vascular tissue (USEPA 2005).

Nine forms of 2,4-D are components of registered pesticide products. Chemical forms include the acid form, sodium salt, alkylamine salts, and esters, as follows:

- 2,4-D acid
- 2,4-D sodium salt
- 2,4-D diethanolamine (DEA) salt
- 2,4-D dimethylamine (DMA) salt
- 2,4-D isopropylamine (IPA) salt
- 2,4-D triisopropanolamine (TIPA) salt
- 2,4-D 2-butoxyethyl (BEE) ester
- 2,4-D 2-ethylhexyl (2-EHE) ester
- 2,4-D isopropyl (IPE) ester

In the ERA, toxicity of the salts and esters of 2,4-D to mammals and birds are considered to be equivalent to that of the acid. Terrestrial plants as well as aquatic plants and animals, however, are much more sensitive to the effects of 2,4-D esters than the salt or acid formulations. Due to these differences in sensitivities, 2,4-D acid/salts are considered separately from 2,4-D esters for acute exposure scenarios involving terrestrial plants and aquatic plants and animals. Because 2,4-D esters degrade to the acid form, chronic risks to terrestrial plants and aquatic plants and animals are considered equal. 2,4-D acid, salts, and esters are considered as a single class for the assessment of toxicity to terrestrial animals and birds.

According to USEPA ecotoxicity classifications presented in registration materials[3], 2,4-D is slightly toxic to mammals via the oral route of exposure, but poses little to no acute toxicity hazard via dermal exposure. Adverse effects to small mammals have been documented from long-term dietary exposure to 2,4-D. The herbicide is moderately to practically non-toxic to birds via acute oral exposure. It is practically non-toxic to honeybees (*Apis mellifera*). 2,4-D acid and salts are slightly toxic to practically non-toxic to fish and aquatic invertebrates, but the ester formulation is highly toxic.

Non-target plants potentially exposed through runoff or spray drift are highly susceptible to 2,4-D toxicity. For terrestrial plants, germination of non-target terrestrial plants was completely inhibited at a concentration of 0.001 lbs. a.e./ac (0.1% of the typical application rate for annual/perennial species, or 0.05% of the typical application rate for woody species applied by the BLM) in studies conducted with 2,4-D acid or salts. In studies conducted with 2,4-D esters, germination of non-target plants was inhibited at a concentration of 0.0003 lbs. a.e./ac (0.03% of the typical application rate for annual/perennial species, or 0.015% of the typical application rate for woody species applied by the BLM). 2,4-D appears to be more toxic to dicotyledons than monocotyledons.

3.1.2 Toxicity to Terrestrial Organisms

3.1.2.1 Mammals

Based on a review of available ecotoxicological literature, 2,4-D is characterized as slightly to moderately toxic to mammals via the oral route of exposure. Via the dermal route of exposure, 2,4-D is practically non-toxic. No significant difference in toxicity of 2,4-D salts, esters, and acids has been shown in mammals, so the toxicity database for acids, salts, and esters has been pooled for the assessment of mammals in the ERA.

[3] Available at URL: http://www.epa.gov/oppefed1/ecorisk_ders/toera_analysis_eco.htm#Ecotox.

Acute dietary toxicity studies found no adverse effects to rats (*Rattus* sp.) exposed to a 97.5% 2,4-D acid product at a dose level of 25 mg a.e./kilograms (kg) body weight (BW)-day. In the same study, decreased body weight and skeletal abnormalities were observed after exposure to a dose level of 75 mg a.e./kg BW-day (Nemec et al. 1983). In another study with 2,4-D acid, the NOAEL for rats was reported as 67 mg a.e./kg BW-day, while increased incidence of incoordination, slight gait abnormalities, and decreased motor activity were observed at a dose level of 227 mg a.e./kg BW-day (Mattsson et al. 1994; Master Record Identification Number [MRID] 43115201). The lowest of the acute LOAELs reported was 17 mg a.e./kg BW-day, which was observed in rats exposed to the TIPA salt. The toxicity endpoint reported in this study was weight gain and mortality (a NOAEL was not provided; Schroeder 1990; MRID 41527102). NOAELs reported in additional acute studies ranged from 8.5 up to 67 mg a.e./kg BW-day (Hoberman 1990, Rodwell 1991, Martin 1992, Rowland 1992, Lee et al. 2001; MRIDs 42055501, 42158704, 42158705, 42304601, 41747601). Acute oral LD_{50} values for rats ranged from 579 to 1,300 mg a.e./kg BW, for the TIPA salt and IPA salt, respectively (Johnson et al. 1981a, b, Jeffrey et al. 1986, Jeffrey et al. 1987a, Mahlburg 1988a, Berdasco et al. 1989a, Schulze 1990, Lilja 1990a, USEPA/OPP 2004, 2005; MRIDs 00101605, 41920901, 00157512, 00101603, 00252291, 41709901, 41413501, 40629801, 41209001).

2,4-D acid administered dermally to rabbits (*Leporidae* sp.) for 21 days did not cause adverse effects at a dose of 1,000 mg a.e./kg-day (Schulze 1990; MRID 41735304). In acute dermal studies, 2,4-D administered to rabbits caused the death of 50% of the test organisms (i.e., the LD_{50} value) when the dose was >2,000 mg/kg BW of the tested product (acid equivalent concentrations ranged from 1,072 mg a.e./kg BW for the TIPA salt up to 2,000 mg a.e./kg BW for 2,4-D acid; Mayhew et al. 1981, Carreon et al. 1986, Jeffrey et al. 1987b, Mahlburg 1988b, Berdasco et al. 1989b, Lilja 1990b, Shults et al. 1991, USEPA/OPP 2005; MRIDs 00101596, 41920911, 00157513, 00252291, 41709902, 41413502, 40629802, 41209002).

Chronic reproductive toxicity was examined in small mammals. Daily doses of 2,4-D did not result in toxicity at a dose level of 5 mg a.e./kg BW-day over the course of two generations (Jeffries et al. 1995, USEPA; MRIDs 43612001, 00259442, 00259446, 00265489). In mice (*Mus* sp.), daily doses of 2,4-D acid did not result in toxicity at a dose level of 5 mg a.e./kg BW-day. The corresponding chronic LOAEL was reported at 62 mg a.e./kg BW-day after an increase in absolute and/or relative kidney weights and an increased incidence of renal microscopic lesions were observed (Stott et al. 1995a, b; MRIDs 43879801, 43597201).

Based on these findings, the oral LD_{50} (579 mg a.e./kg BW) and chronic NOAEL (5 mg a.e./kg BW-day) were selected as the dietary small mammal TRVs. The dermal small mammal TRV was established at > 1,072 mg a.e./kg BW.

Toxicity data for large mammals were more limited. Due to their limited ability to excrete organic acids, dogs (*Canis lupus*) are more sensitive than rats, mice, or humans to the toxic effects of 2,4-D. An acute NOAEL of 1.1 mg a.e./kg BW-day was reported for dogs exposed to a single capsule of the DMA salt. In the same study, a LOAEL value of 8.8 mg a.e./kg BW-day was reported based on neurotoxicity (Beasley et al. 1991). In a chronic study with dogs, a NOAEL of 1 mg a.e./kg BW-day and a LOAEL of 3.75 mg a.e./kg BW-day were reported after dietary exposure to 2,4-D acid for 52 weeks (Dalgard 1993; MRID 43049001). Similar results were observed in a sub-chronic study (Schulze 1990; MRID 41737301).

Since no large mammal LD_{50}s were identified in the literature, an uncertainty factor of 3 was applied to the small mammal oral LD_{50} (579 mg a.e./kg BW) to derive a surrogate value appropriate for use for large mammals. The uncertainty factor was applied to account for the increased sensitivity of dogs to weak acids. As such, a large mammal oral LD_{50} of 193 mg a.e./kg BW was established. The large mammal dietary NOAEL TRV was established at 1 mg a.e./kg BW-day.

3.1.2.2 Birds

Based on a review of available ecotoxicological literature, 2,4-D is characterized as moderately to practically non-toxic to birds. No significant difference in toxicity of 2,4-D salts, esters, and acids has been shown in birds, so the toxicity database for acids, salts, and esters has been pooled for the assessment of birds in the ERA.

The USEPA pesticide registration process requires toxicological data be supplied to evaluate avian tolerance to 2,4-D. Data from the literature indicates that 2,4-D is practically non toxic to moderately non toxic to birds. When 2,4-D salts, esters, and acid were administered to bobwhite quail (*Colinus virginianus*) and Japanese quail (*Coturnix japonica)* in the diet, a range of LC_{50} values were observed in both core and supplemental studies. In these dietary tests, the test organism was presented with the dosed food for 5 days, with 3 days of additional observations after the dosed food was removed. The endpoint reported for this assay is generally a LC_{50} value representing mg/kg food. For this ERA, the concentration-based value was converted to a dose-based value following the methodology presented in the Methods Document (ENSR 2004).[4] Then the dose-based value was multiplied by the number of days of exposure (generally 5 days) to result in an LD_{50} value representing the full herbicide exposure over the course of the test. The lowest reported LC_{50} value for small birds was 1,938 mg a.e./kg BW (USEPA 2010; supplemental study, MRID 02032053), while the highest LC_{50} value reported was 26,964 mg a.e./kg BW (USEPA 2010; MRID 02040348).

Fifty percent mortality (i.e., the LD_{50} value) was observed in small birds at a range of concentrations. The lowest LD_{50} value reported in the literature reviewed was 217 mg a.e./kg BW using 73.8% TIPA salt (USEPA 2010; MRID 00107928). In this acute study, bobwhite quail were exposed via gavage daily for 14 days. A supplemental study that was also reviewed provided similar LD_{50} results (USEPA 2010; MRID 02049115).

The lowest acute NOAEL value reported in the reviewed literature for small birds was < 52 mg a.e./kg BW-day (USEPA 2010; MRIDs 41429005, 43227401). This is a 14-day NOAEL value based on gavage/capsule exposure to the DMA salt. The highest acute dietary concentration that small birds were able to tolerate without adverse effects was 10,000 parts per million (ppm) as BEE (USEPA 2010; MRIDs 00107929, TN 0190, 00050680, TN 0288). This resulted in a NOAEL value of 4,155 mg a.e./kg BW-day. Acute LOAEL values were not found in the literature reviewed.

Dietary exposure of Japanese quail to a 602 grams (g)/L DMA salt product for 6 weeks resulted in reproductive toxicity at a dietary concentration of 688 ppm a.e., equivalent to 77.5 mg a.e./kg BW-day (USEPA 2010; MRID 46879201). In the same study, no adverse effects were observed at a dietary concentration of 242 ppm a.e., equivalent to 27.3 mg a.e./kg BW-day. In another early life study, adverse effects on reproduction were not observed in bobwhite quail after exposure to dietary concentrations equivalent to 581 mg/kg BW-day for 21 weeks (USEPA 2010; MRID 40228401). A chronic NOAEL equivalent to 76 mg a.e./kg BW-day was also reported in the literature (Mitchell et al. 1999; MRID 45336401).

Based on these findings, the bobwhite quail dietary LD_{50} (217 mg a.e./kg BW) and Japanese quail chronic NOAEL (27.3 mg a.e/kg BW-day) were selected as the small bird dietary TRVs.

Mallard ducks (*Anas platyrhynchos*) and ring-necked pheasants (*Phasianus colchicus*) were also exposed to 2,4-D products via gavage/capsule in the diet. Large birds did not appear to differ significantly from small birds in their sensitivity to 2,4-D products. A number of NOAEL values were presented in the literature for large birds (USEPA 2010; MRIDs 40228401, 40098001, 00022923, 40094602, 05001497, 43768001, 00102908). The lowest acute NOAEL value reported in the literature for large birds was 46.7 mg a.e./kg BW-day of a 66.8% DMA salt product (USEPA 2010; MRID 00022923). In this dietary test, mallard ducks were presented with the dosed food for 8 days. The results of another test report that mallard ducks did not exhibit adverse effects after receiving a gavage equivalent to 3,199 mg/kg BW-day of a 59.1% BEE product (USEPA 2010; MRID was not reported). Chronic NOAEL or LOAEL values for large birds were not found in the literature.

Several studies identified in the literature reported LC_{50}/LD_{50} values for large birds (USEPA 2010; MRIDs 40228401, 40098001, 05001497, 41353801, TN 0851, 00063066, 02049115, 02032075, 02058865, 02054612, 02040321, 00022923, 00233351). The lowest value reported was >314 mg a.e./kg BW of a 48.7% IPA salt product that was administered to mallard ducks via gavage/capsule (USEPA 2010; MRID 40098001). The highest value reported was

[4] Dose-based endpoint ($_{mg/kg\ BW/day}$) = [Concentration-based endpoint ($_{mg/kg\ food}$) x Food Ingestion Rate ($_{kg\ food/day}$)]/BW ($_{kg}$).

3,851 mg a.e./kg BW of a DMA salt product administered to mallard ducks via gavage (USEPA 2010; MRID 00233351). Supplemental studies that were also reviewed provided similar LD_{50}/LC_{50} results (USEPA 2010; MRIDs 00053988, 40098001, 02032053, 02040321, 00092162, 02054604).

Due to the lack of a chronic NOAEL for large birds, the small bird chronic NOAEL was used as a surrogate value (27.3 mg a.e./kg BW-day). The large bird dietary LD_{50} was established at >314 mg a.e/kg BW.

3.1.2.3 Terrestrial Invertebrates

A standard acute contact toxicity bioassay in honeybees is required for the USEPA pesticide registration process. In this study, 2,4-D was directly applied to the bee's thorax, and mortality was assessed during a 48- or 72-hour period. LD_{50} values reported in the literature ranged from 13 micrograms (μg) a.e./bee using technical grade 2,4-D acid (the no effect level was 8.3 μg a.e./bee in a supplemental study) to >66 μg a.e./bee using a 99.96% 2-EHE product (the no effect level was 100 μg a.e./bee; USEPA 2010; MRIDs 43935001, 41158311, 41158301, 41835209, 41353805, 43811401, 41429002).

The honeybee dermal LD_{50} TRV was set at 13 μg/bee.

3.1.2.4 Terrestrial Plants

Toxicity data indicate that 2,4-D is more toxic to dicotyledons than monocotyledons. Esters of 2,4-D appear to be more toxic to terrestrial plants than 2,4-D salts or acid, although under most conditions the ester will degrade rapidly to the acid form. As such, the toxicity of 2,4-D acid and 2,4-D salts is considered separately from that of 2,4-D esters for acute exposure scenarios for terrestrial plants. The toxicity of 2,4-D salts, acid, and esters are considered together as a single class for chronic exposure scenarios (because the esters degrade to the acid form).

Many studies report acute toxicity results for 2,4-D acid and salts, as well as acute toxicity results for 2,4-D esters. The 25% effect concentrations (EC_{25}) for 2,4-D acid and salts ranged from a minimum of 0.002 lbs. a.e./ac for carrot (*Daucus carota*; USEPA 2010; MRID 43279201) to 20.5 lbs. a.e./ac for tomato (*Lycopersicon esculentum*; USEPA 2010; MRID 41737306). In the first study, carrot seedlings were exposed to a soil treatment of technical grade DMA salt for 14 days; the reported endpoint was seedling emergence (shoot height). In the second study, tomato seedlings were exposed to a soil treatment of 55% DMA salt for 14 days, and the reported endpoint was seedling germination. Based on results from studies conducted with 2,4-D esters, EC_{25}s ranged from a minimum of 0.0007 lbs. a.e./ac for onion (*Allium cepa*) and lettuce (*Lactuca sativa*; USEPA 2010; MRIDs 43279202, 43982101) to >8.2 lbs. a.e./ac for sorghum (*Sorghum bicolor*; USEPA 2010; MRID 41848001). In the onion study, seedlings were exposed to a soil treatment of 95.7% 2-EHE for 21 days, and the reported endpoint was seedling emergence (root weight). In the lettuce study, seedlings were exposed to a soil treatment of 98.2% IPE for 14 days, and the reported endpoint was seedling emergence (shoot height). In the sorghum study, plants were exposed to a soil treatment of 63.5% 2-EHE for 6 days, and the reported endpoint was seedling germination.

The lowest observed adverse effect concentration (LOEC) reported in a chronic study was 0.0075 lbs. a.e./ac based on post-emergence vegetative vigor in onion after exposure to 2,4-D acid (Backus 1992). Several chronic NOAEL/no observed adverse effect concentrations (NOAECs) were available for terrestrial plants from core and supplemental studies. As per the methodology presented in the Methods Document (ENSR 2004), the chronic NOAEL TRV was established as the highest NOAEL value that was less than the chronic LOAEL and acute TRV. As such, the chronic NOAEL was established at 0.0003 lbs. a.e./ac based on the results of two studies: no effects after cucumber (*Cucumis sativus*) plants were exposed to 2,4-D 95.7% 2-EHE for 21 days (USEPA 2010; MRID 43279201), and no effects after onion plants were exposed to 2,4-D 2-EHE for 21 days (USEPA 2010; MRID 43279202).

Germination assay results for 2,4-D acid and salts were available for several plant species. Wheat (*Triticum aestivum*) was most sensitive to the effects of 2,4-D acid and salts, with a NOAEL reported as 0.001 lbs. a.e./ac (USEPA 2010; MRID 43982101). Tomato was a less sensitive receptor in the germination assay, with a NOAEL of 15.9 lbs. a.e./ac (USEPA 2010; MRID 41737306). Germination assay results were also available for 2,4-D esters for several plant species. Onion was most sensitive to the effects of 2,4-D esters, with a NOAEL reported as 0.0003 lbs. a.e./ac

(USEPA 2010; MRID 43279202). Sorghum was a less sensitive receptor in the germination assay, with a NOAEL of 8.2 lbs. a.e./ac (USEPA 2010; MRID 41848001).

The lowest and highest germination-based NOAELs were selected to evaluate chronic risk in surface runoff scenarios to RTE and typical species, respectively. For both 2,4-D acid and salts and 2,4-D esters, the selected TRVs were 0.0003 lbs. a.e./ac and 8.2 lbs. a.e./ac. Two additional endpoints were used to evaluate other plant scenarios. These included a life-cycle NOAEL of 0.0003 lbs. a.e./ac and an EC_{25} *of 0.002 for 2,4-D acid and salts, or 0.0007 for 2,4-D esters.*

3.1.3 Toxicity to Aquatic Organisms

In aquatic systems, the esters of 2,4-D appear to be more toxic to aquatic organisms than 2,4-D salts or acid, although under most conditions the ester will degrade rapidly to the acid form. As such, the toxicity of 2,4-D acid and 2,4-D salts is considered separately from that of 2,4-D esters for acute exposure scenarios for these receptors. The toxicity of 2,4-D salts, acid, and esters are considered together as a single class for chronic exposure scenarios (because the esters degrade to the acid form).

3.1.3.1 Fish

The toxicity of 2,4-D to freshwater fish was evaluated by testing both coldwater and warmwater fish species. Several studies examined the toxic effects of 2,4-D acid, salts, and esters on bluegill sunfish (*Lepomis macrochirus*), carp (*Cyprinidae* sp.), channel catfish (*Ictalurus punctatus*), smallmouth bass (*Micropterus dolomieui*), and fathead minnow (*Pimephales promelas*), all warmwater fish species. These studies found that 50% mortality occurred after 96 hours of exposure to concentrations of 100% 2,4-DB acid as low as 6.7 mg a.e./L (USEPA 2010; MRID 40094602), and concentrations of BEE (% active ingredient not reported) as low as 0.2 mg a.e./L (USEPA 2010; MRID 42416802). Similarly, several studies examined the toxic effects of 2,4-D acid, salts, and esters on Chinook salmon (*Oncorhynchus tshawytscha*), bull trout (*Salvelinus confluentus*), cutthroat trout (*Oncorhynchus clarki*), lake trout (*Salvelinus namaycush*), and rainbow trout (*Oncorhynchus mykiss*), all coldwater fish species. These core studies found that 50% mortality occurred after 96 hours of exposure to concentrations of 100% 2,4-DB as low as 1.8 mg a.e./L (USEPA 2010; MRID 40094602), and concentrations of 100% BEE as low as 0.28 mg a.e./L of (USEPA 2010; MRID 42416802). Supplemental studies (USEPA 2010; MRIDs 43374701, 02049421) reported LD_{50}s of 0.53 mg a.e./L for rainbow trout after 96 hours of exposure to a 63.8% DMA salt product, and as low as 0.23 mg a.e./L for cutthroat trout after 96 hours of exposure to a 100% BEE product.

Lifecycle assays were conducted with fathead minnow, carp, and rainbow trout. The lowest chronic LOEC, 0.078 mg a.e./L, was reported for fathead minnow in a 32 day study with 96% BEE, with a corresponding no observed effect concentration (NOEC) of 0.055 mg a.e./L (USEPA 2010; MRID 00077308). However, these lifecycle assays reported a wide range of results and in one study a NOEC of 108 mg a.e./L as 2,4-D acid was reported for juvenile rainbow trout after 30 days (Fairchild et al. 2009).

The lower of the coldwater and warmwater fish endpoints were selected as the TRVs for fish. Therefore, the warmwater fish NOAEL (0.055 mg a.e./L) was established as the TRV for chronic effects. The coldwater 96-hour LC_{50} *of 1.8 mg a.e./L was selected as the acute TRV for 2,4-D acid and salts, while the warmwater 96-hour* LC_{50} *of 0.2 mg a.e./L was selected as the acute TRV for 2,4-D esters.*

Bluegill sunfish exposed to 3 mg/L for 8 days exhibited a bioconcentration factor (BCF) of 1, indicating that 2,4-D is not likely to bioconcentrate in fish tissue. The BCF for channel catfish is 1 $x10^{-5}$ and for frog tadpoles is 2 $x10^{-3}$ (pH not stated, added as acid). The BCF for three seaweeds ranged from 0.001-0.003 (pH 7.8, C14 ring-labeled 2,4-D), and six for algae (*Chlorella fusca*; pH not stated, Carbon-14 ring-labeled 2,4-D; Cooke 1972, Rodgers and Stalling 1972, Freitag et al. 1982, Murty 1986, Franke et al. 1994, Hazardous Substances Data Bank [HSDB] 2009).

3.1.3.2 Amphibians

Several studies on amphibians (tadpoles) were reported in the literature. In these 96-hour studies, LC_{50} values ranged from 0.505 ppm a.e. as the 2-EHE product, to 359 ppm a.e. (359 mg a.e./L) as the 2,4-D acid, for leopard frog (*Rana pipiens*) and toad (*Bufo melanosticus*; Palmer and Krueger 1997, Vardia et al. 1984). Supplemental studies reported similar LC_{50} results for leopard frog and Fowler's toad (*Bufo woodhousei*; USEPA 2010; MRIDs 43374701, 00160000, 02049421). The lowest LC_{50} reported for amphibians exposed to 2,4-D acid and salts was 8.05 ppm a.e. (8.05 mg a.e./L; Vardia et al. 1984). The results of these toxicity tests indicate that amphibians are much more sensitive to 2,4-D esters than to the acid or salt formulations. Corresponding acute NOAEL values reported in the literature were 0.507 ppm a.e. (0.507 mg a.e./L) and 186 ppm a.e. (186 mg a.e./L) for 2-EHE and 2,4-D acid, respectively (USEPA 2010; MRIDs 43374701, 00160000).

The LC_{50} (0.505 mg a.e./L) was selected as the amphibian acute TRV for ester formulations, while the LC_{50} (8.05 mg a.e./L) was selected as the acute TRV for the acid or salt formulations. In the absence of chronic data, the acute NOAEL of 0.507 mg a.e./L was divided by an uncertainty factor of 3 to extrapolate to a chronic NOAEL of 0.169 mg a.e./L; this value was used as the NOAEL TRV for chronic effects.

3.1.3.3 Aquatic Invertebrates

Freshwater invertebrate toxicity tests are required for the USEPA pesticide registration process. Several acute toxicity tests using water fleas (*Daphnia magna* and *Simocephalus serrulatus*), scud (*Gammarus fasciatus* and *Gammarus lacustris*), sowbug (*Asellus brevicaudus*), midge (*Chironomus plumosus*), stonefly (*Pteronarcella badia* and *Pteronarcys californica*) and crayfish (*Procambarus clarkii* and *Astacus leptodactylus*) were found in the literature. In these acute studies, the statistical endpoint (LC_{50}) is the concentration that causes mortality in 50% of the test organisms after 26 to 96 hours. As discussed previously, aquatic invertebrates have an increased sensitivity to the ester form of 2,4-D in acute exposure scenarios. The lowest LC_{50} value reported for an ester product was 0.0043 ppm a.e. for BEE after 96 hours of testing with *D. magna* (USEPA 2010; MRID 44517301). The lowest LC_{50} value reported for 2,4-D acid or a salt product was 13 ppm a.e. (13 mg a.e./L) for 2,4-DB acid after 96 hours of testing with the stonefly (*Pterona* sp.*;* USEPA 2010; MRID 40094602). LC_{50} values for the acid and salt ranged up to 1,389 ppm a.e. (Cheah et al. 1980), while the highest LC_{50} reported for an ester was 173 ppm a.e. (USEPA 2010; MRID 42595903).

A *D. magna* life-cycle test was completed to assess chronic toxicity to aquatic invertebrates and to fulfill the pesticide registration requirements. This test was completed with BEE and 2,4-D acid. The LOAEL from this 21 day study with a 96% BEE product was determined to be 0.48 ppm a.e. (0.48 mg a.e./L), and the NOAEL was 0.2 ppm a.e. (0.2 mg a.e./L; (USEPA 2010; MRID 41737303). The LOAEL from the 21 day study with a 91.3% 2,4-D acid product was determined to be 151 ppm a.e., (151 mg a.e./L) and the NOAEL was 79 ppm a.e. (79 mg a.e./L; USEPA 2010; MRID 41586101). A supplemental study reported a 21-day LOAEL of 0.01 ppm a.e. for *D. magna* using a 95.4% 2-EHE product (USEPA 2010; MRID 43374802). A NOAEL was not provided for this study.

The LC_{50} (0.0043 mg a.e./L) was selected as the aquatic invertebrate acute TRV for the ester formulation, while the LC_{50} (13 mg a.e./L) was selected as the aquatic invertebrate acute TRV for the acid or salt formulation. The 21-day NOAEL (0.20 mg a.e. /L) was established as the TRV for chronic effects.

3.1.3.4 Aquatic Plants

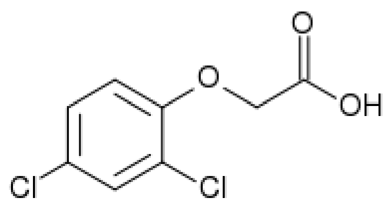
Standard toxicity tests were conducted on aquatic plants, including aquatic macrophytes and algae. Only one LOAEL value was reported in the literature. In this study, growth effects were observed in green algae (*Selenastrum capricornutum*) after 120 hours of exposure to a 26% DMA salt product (USEPA 2010; MRID 02080565). This acute test did not report a NOAEL value. Additional 14-day NOAEL results published in the literature ranged from 0.00014 mg a.e./L with a 96% BEE product up to 2.02 mg a.e./L with a 96.9% 2,4-D acid product (USEPA 2010; MRIDs 43982101, 42343902, 43197001, 42068404, 41353801, 00036935). The 14-day NOAEL of 0.1 mg a.e./L (USEPA 2010; MRID 43197001) was the highest NOAEL below the LOAEL.

In acute studies, the lowest reported EC_{50} value for aquatic plants exposed to 2,4-D acid or salts was 0.1 mg a.e./L. In this study, freshwater diatoms (*Navicula pelliculosa*) were exposed to a 61.6% DMA salt product for 5 days (USEPA 2010; MRID 42449201). The EC_{50} is the concentration that causes an effect in 50% of the test organisms. However, a considerable range of EC_{50} values were presented for aquatic plants exposed to 2,4-D acid and salts. For example, the EC_{50} for freshwater diatoms exposed to a 73.8% DEA salt product was >65.7 mg a.e./L. The lowest reported EC_{50} value for aquatic plants exposed to 2,4-D esters was 0.0004 mg a.e./L. In this study, duckweed (*Lemna gibba*) was exposed to a 96% BEE product for 14 days (USEPA 2010; MRID 42068404). As was the case for 2,4-D acid and salts, a considerable range of median effect concentration (EC_{50}) values were presented for aquatic plants. The greatest EC_{50} value reported for 2,4-D esters was 52 mg a.e./L, from a supplemental study with green algae (USEPA 2010; MRID 02049116).

The EC_{50} (0.1 mg a.e./L) was selected as the aquatic plant acute TRV for 2,4-D acid and salts, and the EC_{50} (0.0004 mg a.e./L) was selected as the aquatic plant acute TRV for 2,4-D esters. In the absence of a chronic NOAEL, the acute NOAEL (0.1 mg a.e./L) was divided by an uncertainty factor of 3 to extrapolate to a chronic NOAEL of 0.03 mg a.e./L, which was selected as the chronic TRV for aquatic plants.

3.2 Herbicide Physical-Chemical Properties

2,4-D is the common name for 2,4-dichlorophenoxyacetic acid. As described in Section 3.1.1, in addition to the acid form, eight salts and esters of 2,4-D are presently registered as active ingredients in end-use products (USEPA 2005). The chemical structure of 2,4-D acid is shown below:



2,4-D acid Chemical Structure

The physical-chemical properties and degradation rates critical to 2,4-D's environmental fate are listed in Table 3-2 which presents the range of values encountered in the literature for these parameters. To complete Table 3-2, available USEPA literature on 2,4-D was obtained from published manuscripts and registration documents. Additional sources, both on-line and in print, were consulted for information about the herbicide, and included:

Cooke, A.S. 1972. The Effects of DDT, Dieldrin and 2,4-D on Amphibian Spawn and Tadpoles. Environmental Pollution 3:51-68.

Davidson, J.M., P.S.C. Rao, L.T. Ou, W.B. Wheeler and D.F. Rothwell. 1980. Adsorption, Movement and Biological Degradation of Large Concentrations of Pesticides in Soils. USEPA-600/2-80-124. Municipal Environmental Research Laboratory, Cincinnati, Ohio.

Franke, C., G. Studinger, G. Berger, S. Bohling, U. Bruckmann, D. Cohors-Fresenborg, and U. Johncke. 1994. The Assessment of Bioaccumulation. Chemosphere 29:1501-14.

Freitag, D., H. Geyer, A. Kraus, R. Viswanathan, D. Kotzias, A. Attar, W. Klein, and F. Korte. 1982. Ecotoxicological Profile Analysis: VII. Screening Chemicals for Their Environmental Behaviour by Comparative Evaluation. Ecotoxicology and Environmental Safety 6:60-81.

Hansch, C.L., and A.D. Hoekman. 1995. Exploring QSAR – Hydrophobic, Electronic, and Steris Constants. American Chemical Society, Washington, D.C.

Hazardous Substances Data Bank. 2009. 2,4-D. Accessed Online 2011. Entry Last Updated: July 2009. Available at URL: http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB.

Howard, P.H. 1991. Handbook of Environmental Fate and Exposure Data for Organic Chemicals. Volume III. Pesticides. Lewis Publishers, Inc., Boca Raton, Florida.

Knisel, W.G., and F.M. Davis. 2000. GLEAMS (Groundwater Loading Effects on Agricultural Management Systems), Version 3.0, User Manual. United States Department of Agriculture, Agricultural Research Service, Southeast Watershed Research Laboratory, Tifton, Georgia. Publication Number: SEWRL-WGK/FMD-050199. Report Dated May 1, 1999 and revised August 15, 2000.

Meylan, W., and P. Howard. 2000. Estimation Program Interface, Version 3.10. Syracuse Research Corporation, Syracuse, New York, for United States Environmental Protection Agency, Office of Pollution, Prevention and Toxics, Washington D.C. Downloadable Copy of EPI Suite Computer Program. Available at URL: http://www.epa.gov/opptintr/exposure/docs/episuited1.htm.

Moody, R.P., J.M. Carroll, and A.M.E. Kresta. 1987. Automated High Performance Liquid Chromatography and Liquid Scintillation Counting Determination of Pesticide Mixture Octanol/water Partition Rates. Toxicology and Industrial Health 3:479-490.

Murty, A.S. 1986. Toxicity of Pesticides to Fish. Vol. I. CRC Press, Boca Raton, Florida.

Rao, P.S.C., and J.M. Davidson. 1979. Adsorption and Movement of Selected Pesticides at High Concentrations in Soils. Water Resources 13:375-80.

________, and ________. 1982. Retention and Transformation of Selected Pesticides and Phosphorous in Soil-Water Systems: A Critical Review. USEPA-600/S3-82-060.

Reinert, K.H., and J.H. Rodgers. 1987. Fate and Persistence of Aquatic Herbicides. Reviews of Environmental Contamination and Toxicology 98: 61-91.

Rice C.P., S.M. Chernyak, and L.L. McConnell. 1997. Henry's Law Constants for Pesticides Measured as a Function of Temperature and Salinity. Journal of Agricultural and Food Chemistry 45:2291-8.

Rodgers, C.A., and D.L. Stalling. 1972. Dynamics of an Ester of 2,4-D in Organs of Three Fish Species. Weed Science 72:101-5.

Sikka, H.C., G.L. Butler, and C.P. Rice. 1976. Effects, Uptake and Metabolism of Methoxychlor, Mirex and 2,4-D in Seaweeds. NTIS PB255 432.

Tomlin C.D.S. (Editor). 1997. The Pesticide Manual World Compendium. British Crop Protection Counsel.11th Edition. Surrey, England.

United States Department of Agriculture. 2001. Agricultural Research Service (ARS) Pesticide Properties Database. Available at URL: http://www.ars.usda.gov/services/docs.htm?docid=14199.

United States Environmental Protection Agency. 2005. Reregistration Eligibility Decision for 2,4-D. EPA 73B-R-05-002. Washington, D.C.

____________. 2008. 2,4-D RED Facts. Available at URL: http://www.epa.gov/oppsrrd1/REDs/factsheets/24d_fs.htm.

________ Office of Pesticide Programs 2004. Environmental Fate and Effects Division's Risk Assessment for the Registration Eligibility Document for 2,4-Dichlorophenoxyacetic Acid (2,4-D). PC Code 030001.

Values for foliar half-life and foliar washoff fraction were based on the results of a database included in the GLEAMS computer model (Knisel and Davis 2000). Values selected for use in risk assessment calculations are shown in bold in Table 3-2.

3.3 Herbicide Environmental Fate

USEPA registration material indicates that esters of 2,4-D are rapidly hydrolyzed in alkaline aquatic environments, soil/water slurries, and moist soils. The 2,4-D amine salts have been shown to dissociate rapidly in water. 2,4-D esters, however, may persist under sterile acidic aquatic conditions and on dry soil. The data indicate that under most environmental conditions, 2,4-D esters and 2,4-D amines degrade rapidly to form 2,4-D acid (USEPA 2005).

2,4-D is non-persistent in soil (Pesticide Properties DataBase [PPDB] 2010). The reported soil half life reported for 2,4-D acid in soil is 6.2 days (USEPA/OPP 2004); the reported half life for 2,4-D esters is 10 days (Knisel and Davis 2000). In terrestrial systems, biodegradation appears to be the primary loss mechanism. The soil biodegradation half-life reported for 2,4-D acid is 6.2 days in aerobic mineral soil, while the half-life for 2-EHE is reported as being between 0.11 to 0.23 days (Reinert and Rodgers 1987, USEPA 2005). The photolysis half life for 2,4-D acid is 68 days (USEPA 2005).

The K_{oc} or organic-carbon water partitioning coefficient, measures the affinity of a chemical to organic carbon relative to water. A high K_{oc} indicates that the chemical is not very soluble in water and has a high affinity to organic carbon, an important constituent of soil particles. Therefore, the higher the K_{oc}, the less mobile the chemical is expected to be. The estimated mobility range for 2,4-D acid and salts is wide, with K_{oc} values ranging from 19.6 to 68,000. The wide range of K_{oc} values indicates that, under a variety of conditions, 2,4-D could have high to very low mobility in soils (Davidson et al. 1980, Rao and Davidson 1982, Reinert and Rodgers 1987, Howard 1991, Knisel and Davis 2000, Meylan and Howard 2000, USDA 2001, USEPA/OPP 2004, HSDB 2009).

2,4-D has a low binding affinity in mineral soils and sediment. 2,4-D esters volatilize readily, particularly in conditions of high temperatures and low humidity (USEPA 2008). The field half-life for 2,4-D acid is reported as 14 days (USDA 2001), while the field half-life for 2-EHE is reported between 1 and 14 days (median 2.9 days; USEPA/OPP 2004).

As in terrestrial systems, 2,4-D is stable to hydrolysis (USEPA/OPP 2004); the hydrolysis half-life for 2,4-D BEE has been reported as 26 days (pH=6, 28 degrees Celsius [^{o}C]) and <1 day (pH=9, 28^{o}C) (Howard 1991). The reported half-life of 2,4-D acid in water is 45 days (USEPA/OPP 2004); the reported half-life for 2,4-D esters is 1 day (Howard 1991).

Photodegradation and biodegradation appear to be the primary loss mechanisms for the herbicide (USEPA/OPP 2004, USEPA 2005). The half-life for photodegradation in water has been reported as 13 days (USEPA/OPP 2004; USEPA 2005). The half-life for aquatic biodegradation has been reported as 15 days in aerobic environments, and 41 to 333 days in anaerobic aquatic laboratory studies (USEPA 2005). The estimated half-life in aquatic sediment for 2,4-D acid is 231 days (estimated 90th percentile; USEPA/OPP 2004). 2,4-D esters are assumed to be stable in aquatic sediment (USEPA/OPP 2004). Based on its Henry's Law constant, 2,4-D is unlikely to volatilize from aquatic systems (Rice et al. 1997, Meylan and Howard 2000, USEPA/OPP 2004, HSDB 2009). Several studies have investigated the likelihood of bioaccumulation of 2,4-D in aquatic organisms. Bluegill sunfish exposed to 3 mg/L 2,4-D for 8 days exhibited a BCF equal to 1 (therefore, no bioaccumulation was observed). The BCFs for channel catfish, frog tadpoles, and three seaweed species were <1, while the BCF for algae (*Chlorella fusca*) was 6 (Cooke 1972, Rogers and Stalling 1972, Sikka et al. 1976, Freitag et al. 1982, Murty 1986, Franke et al. 1994, HSDB 2009).

TABLE 3-1

Selected Toxicity Reference Values for 2,4-D

Receptor		Selected TRV	Units	Duration	Endpoint	Species	Notes
RECEPTORS INCLUDED IN FOOD WEB MODEL							
Terrestrial Animals							
Honeybee		13	μg/bee	48 h	LD_{50}	honeybee	--
Large Bird	>	314	mg/kg bw	14 d	LD_{50}	mallard	--
Large Bird		27.3	mg/kg bw-day	6 w	NOAEL	Japanese quail	surrogate species used to derive TRV
Piscivorous Bird		27.3	mg/kg bw-day	6 w	NOAEL	Japanese quail	surrogate species used to derive TRV
Small Bird		217	mg/kg bw	14 d	LD_{50}	bobwhite quail	--
Small Bird		27.3	mg/kg bw-day	6 w	NOAEL	Japanese quail	--
Large Mammal		193	mg a.e./kg bw	NR	LD_{50}	rat	surrogate species and uncertainty factor used to derive TRV
Large Mammal		1	mg a.e./kg bw-day	52 w	NOAEL	dog	--
Small Mammal		5	mg a.e./kg bw-day	2 gen	NOAEL	rat	--
Small Mammal - dermal	>	1,072	mg a.e./kg bw	NR	LD_{50}	rabbit	--
Small Mammal - ingestion		579	mg a.e./kg bw	NR	LD_{50}	rat	--
Terrestrial Plants							
Typical Species - direct spray, drift, dust		0.002	lbs. a.e./ac	14 d	EC_{25}	carrot	value for 2,4-D acid and salts
Typical Species - direct spray, drift, dust		0.0007	lbs. a.e./ac	14-21 d	EC_{25}	onion, lettuce	value for 2,4-D esters
RTE Species - direct spray, drift, dust		0.0003	lbs. a.e./ac	21 d	NOAEL	onion	--
Typical Species - runoff		8.2	lbs. a.e./ac	6 d	NOAEL	sorghum	--
RTE Species - runoff		0.0003	lbs. a.e./ac	21 d	NOAEL	onion	--
Aquatic Species							
Aquatic Invertebrates		13	mg a.e./L	96 h	LC_{50}	stonefly	value for 2,4-D acid and salts
Aquatic Invertebrates		0.0043	mg a.e./L	96 h	LC_{50}	water flea	value for 2,4-D esters
Fish		1.8	mg a.e./L	96 h	LC_{50}	rainbow trout	value for 2,4-D acid and salts

TABLE 3-1 (Cont.)

Selected Toxicity Reference Values for 2,4-D

Receptor	Selected TRV	Units	Duration	Endpoint	Species	Notes
Fish	0.2	mg a.e./L	96 h	LC_{50}	bluegill sunfish	value for 2,4-D esters
Aquatic Plants and Algae	0.1	mg a.e./L	5 d	EC_{50}	freshwater diatom	value for 2,4-D acid and salts
Aquatic Plants and Algae	0.0004	mg a.e./L	14 d	EC_{50}	duckweed	value for 2,4-D esters
Aquatic Invertebrates	0.2	mg a.e./L	21 d	NOAEL	water flea	--
Fish	0.055	mg a.e./L	32 d	NOAEL	fathead minnow	--
Aquatic Plants and Algae	0.03	mg a.e./L	14 d	NOAEL	duckweed	extrapolated from acute NOAEL
			ADDITIONAL ENDPOINTS			
Amphibian	0.505	mg a.e./L	96 h	LC_{50}	leopard frog	value for 2,4-D esters
Amphibian	8.05	mg a.e./L	96 h	LC_{50}	toad	value for 2,4-D acid and salts
Amphibian	0.169	mg a.e./L	96 h	NOAEL	leopard frog	extrapolated from acute NOAEL
Warmwater Fish	6.7	mg a.e./L	96 h	LC_{50}	bluegill sunfish	value for 2,4-D acid and salts
Warmwater Fish	0.20	mg a.e./L	96 h	LC_{50}	bluegill sunfish	value for 2,4-D esters
Warmwater Fish	0.055	mg a.e./L	32 d	NOAEL	fathead minnow	--
Coldwater Fish	1.8	mg a.e./L	96 h	LC_{50}	rainbow trout	value for 2,4-D acid and salts
Coldwater Fish	0.28	mg a.e./L	96 h	LC_{50}	rainbow trout	value for 2,4-D esters
Coldwater Fish	54	mg a.e./L	30 d	NOAEL	rainbow trout	--

Notes:

TRVs preceded by a greater than symbol (>) were applied at the specified value in the ERA. However, it should be noted that the specified effect was not observed at the highest tested concentration in these studies and therefore these values may over-estimate risks.

Toxicity endpoints for terrestrial animals:

LD_{50} - to address acute exposure; NOAEL - to address chronic exposure.

Toxicity endpoints for terrestrial plants:

EC_{25} - to address direct spray, drift, and dust impacts on typical species.

NOAEL - to address direct spray, drift, and dust impacts on threatened or endangered species.

Highest germination NOAEL - to address surface runoff impacts on typical species.

Lowest germination NOAEL - to address surface runoff impacts on threatened or endangered species.

Toxicity endpoints for aquatic receptors:

LC_{50} or EC_{50} - to address acute exposure (appropriate toxicity endpoint for non-target aquatic plants will be an EC_{50}).

NOAEL - to address chronic exposure.

Value for fish is the lower of the warmwater and coldwater values.

Piscivorous bird TRV = Large bird chronic TRV.

Fish TRV = lower of coldwater and warm water fish TRVs.

NR - Not reported.

Durations:

h - hours
d - days
w - weeks
m - months
gen - generations
y - years
-- indicates no notes are applicable to this scenario

TABLE 3-2

Physical-Chemical Properties of 2,4-D

Parameter	Value
Herbicide family	Phenoxy or phenoxyacetic acid (USEPA 2005).
Mode of action	Results in uncontrolled cell division and growth (USEPA 2005).
Chemical Abstract Service number	94-75-7 (2,4-D acid) 2008-39-1 (2,4-D DMA salt) 1929-73-3 (2,4-D BEE) 1928-43-4 (2,4-D 2-EHE; USEPA 2005).
Office of Pesticide Programs Chemical Code	030001 (2,4-D acid) 030019 (2,4-D DMA salt) 030053 (2,4-D BEE) 030063 (2,4-D 2-EHE; USEPA 2005).
Chemical name (International Union of Pure and Applied Chemistry)	2,4-dichlorophenoxyacetic acid Dimethylammonium(2,4-dichlorophenoxy)acetate 2-butoxyethyl(2,4-dichlorophenoxy)acetate Octyl(2,4-dichlorophenoxy)acetate (USEPA 2005).
Empirical formula	$C_8H_6Cl_2O_3$ (2,4-D acid) $C_{10}H_{13}Cl_2NO_3$ (2,4-D DMA salt) $C_{14}H_{18}Cl_2O_4$ (2,4-D BEE) $C_{16}H_{22}Cl_2O_3$ (2,4-D 2-EHE; USEPA 2005).
Molecular weight	**221.0** (2,4-D acid) 266.13 (2,4-D DMA salt) **321.20** (2,4-D BEE) 333.27 (2,4-D 2-EHE; USEPA 2005).
Appearance, ambient conditions	White crystalline solid (2,4-D acid; USEPA 2005).
Acid / base properties ((acid dissociation constant)	2,4-D acid: 2.73 (Tomlin 1997, HSDB 2009); 2.87, 2.73, 2.87 (USDA 2001).
Vapor pressure (millimeter mercury at 25 ºC	2,4-D acid: 1.4 $x10^{-7}$ (USEPA 2005); $2.79x10^{-5}$ 2,4-D DMA salt: 3.98 $x10^{-8}$ 2,4-D BEE: 2.4 $x10^{-6}$ (USEPA 2005); $5.29x10^{-6}$ 2,4-D 2-EHE: 1.02 $x10^{-5}$ (Meylan and Howard 2000).
Water solubility (mg/L at 25ºC)	2,4-D acid: **569** at 20 ºC (USEPA 2005); 677 (experimental), 336.2 (estimated) (Meylan and Howard 2000); 311 (pH 1), 20,031 (pH 5), 23,180 (pH 7), 34,196 (pH 9) (Tomlin 2004, USDA 2001) 2,4-D DMA salt: 5,353 (estimated) 2,4-D BEE: **12** (experimental), 2.89 (estimated) 2,4-D 2-EHE: 0.017-0.021 (estimated; Meylan and Howard 2000).
Log octanol-water partition coefficient (log (K_{ow}), unitless	2,4-D acid: 2.14 (pH 5), 0.177 (pH 7), 0.102 (pH 9; USEPA 2005); 2.81 (experimental), 2.62 (estimated); 2.83 (pH 1), **-0.75** (pH 7; USDA 2001). 2,4-D DMA salt: 0.65 (Moody et al. 1987); 0.65 (experimental), 0.84 (estimated; Meylan and Howard 2000). 2,4-D BEE: 4.13-4.17 (USEPA 2005), 4.10 (estimated; Meylan and Howard 2000); **4.35** (USEPA/OPP 2004). 2,4-D 2-EHE: 5.78 (USEPA 2005); 6.73 (estimated; Meylan and Howard 2000).
Henry's Law constant (atmosphere per cubic meter/mole)	2,4-D acid: 8.6 $x10^{-6}$ (Rice et al. 1997, HSDB 2009); 9.21 $x10^{-9}$ (Meylan and Howard 2000); $4.74x10^{-10}$ (USEPA/OPP 2004) 2,4-D DMA salt:$1.45x10^{-16}$ 2,4-D BEE: $1.25x10^{-7}$ 2,4-D 2-EHE: $5.65x10^{-5}$ (Meylan and Howard 2000)

TABLE 3-2 (Cont.)

Physical-Chemical Properties of 2,4-D

Parameter	Value
Soil partition coefficient /organic matter sorption coefficient (K_d/K_{oc})	2,4-D (K_{oc}): 19.6 (average of nine soils) to 109.1 (average of three soils and range of 72.2-135.7), and 20 to 79 (Davidson et al. 1980, Rao and Davidson 1982, USDA 2001; HSDB 2009); **61.7** (average of acceptable and supplemental values; USEPA/OPP 2004). 2,4-D DMA salt (K_{oc}): 72-136 (average of 109 in three soils, Rao and Davidson 1979); 20 (Knisel and Davis 2000); 325.4 (Meylan and Howard 2000). 2,4-D BEE (K_{oc}): 6,607-6,900 (Reinert and Rodgers 1987); 1,100 (Howard 1991); **100** (Knisel and Davis 2000); 337 (Meylan and Howard 2000). 2,4-D 2-EHE (K_{oc}): 25,000-68,000 (Howard 1991); 100 (Knisel and Davis 2000); 22,800 (Meylan and Howard 2000). 2,4-D (K_d): 0.94 (silt loam), **0.08 (sandy loam), 1.1 (loam), 1.0 (clay;** USDA 2001); 0.17 (sandy loam), 0.36 (sand), 0.52 (silty clay loam), 0.28 (loam; USEPA/OPP 2004). 2,4-D esters (K_d): **3 (clay), 1.5 (loam), 0.3 (sand;** calculated from $K_d = K_{oc}$ x fraction organic carbon assuming a fraction organic carbon Log of 0.030 for clay, 0.015 for loam, and 0.003 for sand.
Bioconcentration factor (BCF)	Bluegill sunfish exposed to 3 mg/L for 8 days exhibited a BCF of **1**. The BCF for channel catfish is 1 x10^{-5} and for frog tadpoles is 2 x10^{-3} (pH not stated; added as acid). The BCF for three seaweeds ranged from 0.001-0.003 (pH 7.8; C^{14} ring-labeled 2,4-D), and six for algae *Chlorella fusca* (pH not stated; C^{14} ring-labeled 2,4-D; Cooke 1972, Rodgers and Stalling 1972, Sikka et al. 1976, Freitag et al. 1982, Murty 1986, Franke et al. 1994, HSDB 2009).
Foliar wash-off fraction	2,4-D acid: **0.45** (Knisel and Davis 2000); 0.5 (USEPA/OPP 2004) 2,4-D DMA salt: 0.45 2,4-D BEE: **0.45** 2,4-D 2-EHE: 0.45 (Knisel and Davis 2000).
Half-life – aquatic sediment	2,4-D acid: **231 days** (estimated upper 90^{th} percentile) 2,4-D esters: stable (value for modeling set at **9,999 days** to be sufficiently high; USEPA/OPP 2004).
Half-life – foliar	2,4-D acid: 5 days (Knisel and Davis 2000); **8.8 days** (USEPA/OPP 2004) 2,4D DMA salt: 9 days 2,4-D BEE: **5 days** 2,4-D 2-EHE: 5 days (Knisel and Davis 2000).
Half-life – soil	2,4-D acid: **6.2 days** (estimated upper 90^{th} percentile; USEPA/OPP 2004). 2,4-D esters: **10 days** (Knisel and Davis 2000).
Half-life – water	2,4-D acid: **45 days** (estimated upper 90^{th} percentile; USEPA/OPP 2004). 2,4-D esters: **1 day** (Howard 1991).
Half-life – hydrolysis	2,4-D acid: stable (USEPA/OPP 2004). 2,4-D BEE: 26 days (pH 6, 28^{o}C), 0.025 days (pH 9, 28^{o}C; Howard 1991)
Half-life – photodegradation in water (photolysis)	2,4-D acid: 12.9 calendar days or 7.57 constant light days (pH 5; USEPA 2005); 13 days (USEPA/OPP 2004).
Half-life – photodegradation in soil (photolysis)	2,4-D acid: 68 days (USEPA 2005).
Half-life – soil biodegradation	2,4-D acid: 6.2 days in aerobic mineral soils (USEPA 2005). 2,4-D 2-EHE: 0.11-2.3 days (Reinert and Rodgers 1987).
Half-life – aquatic biodegradation	15 days in aerobic aquatic environments; 41 to 333 days in anaerobic aquatic laboratory studies (USEPA 2005).
Half-life – field dissipation (degradation and dissipation)	2,4-D acid: 14 days (USDA 2001). 2,4-D 2-EHE: 1 to 14 days (median 2.9 days; USEPA/OPP 2004).

Table 3-2 (Cont.)

Physical-Chemical Properties of 2,4-D

Parameter	Value
Residue rate for grass [1]	197 ppm (maximum) and 36 ppm (typical) per lbs. a.i./ac.
Residue rate for vegetation [2]	296 ppm (maximum) and 35 ppm (typical) per lbs. a.i./ac.
Residue rate for insects [3]	350 ppm (maximum) and 45 ppm (typical) per lbs. a.i./ac.
Residue rate for berries [4]	40.7 ppm (maximum) and 5.4 ppm (typical) per lbs. a.i./ac.

Notes:
Values presented in bold were used in risk assessment calculations.
[1] Residue rates selected are the high and mean values for long grass (Fletcher et al. 1994).
[2] Residue rates selected are the high and mean values for leaves and leafy crops (Fletcher et al. 1994).
[3] Residue rates selected are the high and mean values for forage such as legumes (Fletcher et al. 1994).
[4] Residue rates selected are the high and mean values for fruit (includes both woody and herbaceous; Fletcher et al. 1994).

4.0 ECOLOGICAL RISK ASSESSMENT

This section presents a screening-level evaluation of the risks to ecological receptors from potential exposure to the herbicide 2,4-D. The general approach and analytical methods for conducting the 2,4-D ERA were based on USEPA's *Guidelines for Ecological Risk Assessment* (USEPA 1998).

The ERA is a structured evaluation of scientific data (exposure chemistry, fate and transport, toxicity, etc.) that leads to quantitative estimates of risk from environmental stressors to non-human organisms and ecosystems. The current USEPA guidelines for conducting ERAs include three primary phases: problem formulation, analysis, and risk characterization. These phases are discussed in detail in the Methods Document (ENSR 2004) and briefly in the following subsections.

4.1 Problem Formulation

Problem formulation is the initial step of the standard ERA process, which provides the basis for decisions regarding the scope and objectives of the evaluation. The problem formulation phase for 2,4-D assessment included:

- definition of risk assessment objectives;
- ecological characterization;
- exposure pathway evaluation;
- definition of data evaluated in the ERA;
- identification of risk characterization endpoints; and
- development of the conceptual model.

4.1.1 Definition of Risk Assessment Objectives

The primary objective of this ERA was to evaluate the potential ecological risks from 2,4-D to the health and welfare of plants and animals and their habitats. The BLM previously relied upon the 2,4-D risk assessment conducted on behalf of the Forest Service (USDA Forest Service 2006). This ERA has been conducted using treatment methods and application rates used on BLM-administered lands.

An additional goal of this process was to provide risk managers with a tool that develops a range of generic risk estimates that vary as a function of site conditions. This tool primarily consists of Excel spreadsheets (presented in the ERA Worksheets; Appendix C), which may be used to calculate exposure concentrations and evaluate potential risks in the ERA. A number of the variables included in the worksheets can be modified by BLM land managers for future evaluations.

4.1.2 Ecological Characterization

As described in Section 2.2, 2,4-D is used by the BLM for vegetation management in their Rangeland, Public-Domain Forestland, Energy and Mineral Sites, ROW, and Recreation programs on public lands in 17 western states in the continental U.S. and Alaska. These applications have the potential to occur in a wide variety of ecological habitats that could include deserts, forests, and rangeland. 2,4-D is also used for treatment of floating and emerged aquatic vegetation, and for treatment of submerged vegetation. It is not feasible to characterize all of the potential habitats within this report This ERA, however, was designed to address generic receptors, including RTE species (see Section 6.0), that could occur within a variety of habitats.

4.1.3 Exposure Pathway Evaluation

The following ecological receptor groups were evaluated in this evaluation:

- terrestrial animals;
- non-target terrestrial plants; and
- aquatic species (fish, invertebrates, and non-target aquatic plants).

These groups of receptor species were selected for evaluation because they: 1) are potentially exposed to herbicides within BLM-administered areas; 2) are likely to play key roles in site ecosystems; 3) have complex life cycles; 4) represent a range of trophic levels; and 5) are surrogates for other species likely to be found on BLM-administered lands.

The exposure scenarios considered in the ERA were primarily organized by potential exposure pathways. In general, the exposure scenarios describe how a particular receptor group may be exposed to the herbicide as a result of a particular exposure pathway. These exposure scenarios were developed to address potential acute and chronic impacts to receptors under a variety of exposure conditions that may occur on BLM-administered lands.

2,4-D can be applied to control both terrestrial and aquatic vegetation, at varying application rates depending upon the target plant species (e.g., annual and perennial vegetation versus terrestrial woody vegetation). Therefore, the scenarios considered in this risk assessment included applications to control terrestrial annual and perennial vegetation, terrestrial woody vegetation, aquatic floating and emerged vegetation, and aquatic submerged vegetation. Different application rates are assumed for each vegetation type. As discussed in detail in the Methods Document (ENSR 2004), the following exposure scenarios were considered:

- direct contact with the herbicide or a contaminated water body (terrestrial and aquatic applications);
- indirect contact with contaminated foliage (terrestrial and aquatic applications);
- ingestion of contaminated food items (terrestrial and aquatic applications);
- off-site drift of spray to terrestrial areas and water bodies (terrestrial and aquatic applications);
- surface runoff from the application area to off-site soils or water bodies (terrestrial applications only);
- wind erosion resulting in deposition of contaminated dust (terrestrial applications only); and
- accidental spills to water bodies (terrestrial and aquatic applications).

Two generic water bodies were considered in this ERA: 1) a small pond (¼-acre pond of 1-meter [m] depth, with a volume of 1,011,715 L), and 2) a small stream representative of Pacific Northwest low-order streams that provide habitat for critical life-stages of anadromous salmonids. The stream size was established at 2 m wide and 0.2 m deep with a mean water velocity of approximately 0.3 m per second, and a base flow discharge of 0.12 cubic meters per second (cms).

As described in Section 2.2, 2,4-D may also be used to treat a water body bottom. This treatment is conducted using a granular formulation of 2,4-D that utilizes a special heat-treated attaclay granule carrier, which releases the granule to the bottom of the pond following application. Application is conducted using a boat for either spot or boom/broadcast applications (typical and maximum application rates of 19 and 38 lbs. a.e./ac, respectively). Applications of granules and slow-release pellets can be made either using a cyclone spreader or by hand. The granules sink to the bottom, where the chemical is slowly released in the relatively small volume of water where the new shoots are beginning to grow. Given that the granules are not dissolved in a liquid before being released to the water body bottom, the exposure scenarios described above are not applicable, and therefore were not considered in this ERA.

4.1.4 Definition of Data Evaluated in the ERA

Herbicide concentrations used in the ERA were based on typical and maximum application rates provided by the BLM (Table 2-1). These application rates were used to predict herbicide concentrations in various environmental media (e.g., soils, water). Some of these calculations were fairly straightforward and required only simple algebraic calculations (e.g., water concentrations from direct aerial spray), but others required more complex computer models (e.g., aerial deposition rates, transport from soils).

The AgDRIFT® computer model was used to estimate off-site herbicide transport due to spray drift. AgDRIFT® Version 2.0.05 (Spray Drift Task Force [SDTF] 2002) is a product of the Cooperative Research and Development Agreement between the USEPA's Office of Research and Development and the SDTF (a coalition of pesticide registrants). The GLEAMS computer model was used to estimate off-site transport of herbicide in surface runoff and root zone groundwater. The GLEAMS is able to estimate a wide range of potential herbicide exposure concentrations as a function of site-specific parameters, such as soil characteristics and annual precipitation.

The American Meteorological Society/USEPA's guideline air quality dispersion model (AERMOD version 11103) was used to determine potential herbicide migration due to wind-blown dust in the near-field for receptors located up to 50 kilometers (km; 31 miles) from the herbicide application locations. AERMOD is currently USEPA's preferred model for use at distances up to 50 km from an emission source. For receptors located between 50 and 100 km (31 and 62 miles) from an herbicide application area, the USEPA's California Puff (CALPUFF) air pollutant dispersion model was used to predict the transport and deposition of herbicides sorbed to wind-blown dust. The current USEPA approved version, CALPUFF version 5.8, was used with the single-station meteorological data used for the AERMOD modeling. Thus, for consistency, the near-field (AERMOD) modeling and the far-field (CALPUFF) modeling used the same set of meteorological data.

4.1.5 Identification of Risk Characterization Endpoints

Assessment endpoints and associated measures of effect were selected to evaluate whether populations of ecological receptors are potentially at risk from exposure to proposed BLM applications of 2,4-D. The selection process is discussed in detail in the Methods Document (ENSR 2004), and the selected endpoints are presented below.

Assessment Endpoint 1: Acute mortality to mammals, birds, invertebrates, and non-target plants:

- **Measures of Effect** included median lethal effect concentrations (e.g., LD_{50} and LC_{50}) from acute toxicity tests on target organisms or suitable surrogates.

Assessment Endpoint 2: Acute mortality to fish, aquatic invertebrates, and aquatic plants:

- **Measures of Effect** included median lethal effect concentrations (e.g., LC_{50} and EC_{50}) from acute toxicity tests on target organisms or suitable surrogates (e.g., data from other coldwater fish to represent threatened and endangered salmonids).

Assessment Endpoint 3: Adverse direct effects on growth, reproduction, or other ecologically important sublethal processes:

- **Measures of Effect** included standard chronic toxicity test endpoints such as the NOAEL for both terrestrial and aquatic organisms. Depending on data available for a given herbicide, chronic endpoints reflect either individual impacts (e.g., seed germination, growth, physiological impairment, or behavior), or population-level impacts (e.g., reproduction; Barnthouse 1993). For salmonids, careful attention was paid to smoltification (i.e., development of tolerance to seawater and other indications of change of parr [freshwater stage salmonids] to adulthood), thermoregulation (i.e., ability to maintain body temperature), and migratory behavior, if such data were available. With the exception of non-target plants, standard acute and chronic toxicity test endpoints were used for estimates of direct herbicide effects on RTE species. To add conservatism to the RTE assessment, levels of concern for RTE species were lower than those for typical species. Lowest available germination NOAELs were used to evaluate non-target RTE plants. Impacts to RTE species are discussed in more detail in Section 6.0.

Assessment Endpoint 4: Adverse indirect effects on the survival, growth, or reproduction of salmonid fish:

- **Measures of Effect** for this assessment endpoint depended on the availability of appropriate scientific data. Unless literature studies were found that explicitly evaluated the indirect effects of 2,4-D on salmonids and their habitat, only qualitative estimates of indirect effects were possible. Such qualitative estimates were limited to a general evaluation of the potential risks to food (typically represented by acute and/or chronic toxicity to aquatic invertebrates) and cover (typically represented by potential for destruction of riparian vegetation). Similar approaches are already being applied by the USEPA OPP for Endangered Species Effects Determinations and Consultations (Available at URL: http://www.epa.gov/oppfead1/endanger/effects).

4.1.6 Development of the Conceptual Model

The 2,4-D conceptual model is presented as a series of working hypotheses about how 2,4-D might pose hazards to the ecosystem and ecological receptors. As indicated in Figures 4-1 and 4-2, the conceptual model indicates the possible exposure pathways for the herbicide, as well as the receptors evaluated for each exposure pathway under terrestrial and aquatic application scenarios, respectively. Figure 4-3 presents the trophic levels and receptor groups evaluated in the ERA.

4.2 Analysis Phase

The analysis phase of an ERA consists of two principal steps: the characterization of exposure and the characterization of ecological effects. The exposure characterization describes the source, fate, and distribution of the herbicide using standard models that predict concentrations in various environmental media (e.g., GLEAMS). The ecological effects characterization consists of compiling exposure-response relationships from all available toxicity studies on the herbicide.

4.2.1 Characterization of Exposure

The BLM uses herbicides in a variety of programs (e.g., maintenance of rangeland, oil and gas sites, ROW, and recreational sites) with several different application methods (e.g., vehicle, ATV/UTV-mounted, backpack sprayer, and aerial application). In order to assess the potential ecological impacts of these herbicide uses, a variety of exposure scenarios were considered. These scenarios, which were selected based on actual BLM herbicide usage under a variety of conditions, are described in Section 4.1.3.

When considering the exposure scenarios and the associated predicted concentrations, it is important to recall that the frequency and duration of the various scenarios are not equal. For example, exposures associated with accidental spills are very rare, while off-site drift associated with application is relatively common. Similarly, off-site drift events are short-lived (i.e., migration occurs within minutes), while erosion of herbicide-containing soil may occur over weeks or months following application. The ERA has generally treated these differences in a conservative manner (i.e., potential risks are presented despite their likely rarity and/or transience). Thus, tables and figures summarizing risk quotients may present both relatively common and very rare exposure scenarios. Additional perspective on the frequency and duration of exposures are provided in the narrative below.

As described in Section 4.1.3, the following ecological receptor groups were selected to address the potential risks due to unintended exposure to 2,4-D: terrestrial animals, terrestrial plants, and aquatic species. A set of generic terrestrial animal receptors, listed below, were selected to cover a variety of species and feeding guilds that might be found on BLM-administered lands. Unless otherwise noted, receptor body weights were selected from the *Wildlife Exposure Factors Handbook* (USEPA 1993). This list includes surrogate species, although not all of these surrogate species will be present within each application area.

- A pollinating insect with a body weight of 0.093 grams (g). The honeybee was selected as the surrogate species to represent pollinating insects. This body weight was based on the estimated weight of receptors required for testing in 40 Code of Federal Regulations (CFR) 158.590.
- A small mammal with a body weight of 20 g (0.7 ounces) that feeds on fruit (e.g., berries). The deer mouse (*Peromyscus maniculatus*) was selected as the surrogate species to represent small mammalian omnivores consuming berries.
- A large mammal with a body weight of 70 kg (155 lbs) that feeds on plants. The mule deer (*Odocolieus hemionus*) was selected as the surrogate species to represent large mammalian herbivores, including wild horses (*Equus ferus*) and burros (*Equus asinus*; Hurt and Grossenheider 1976).
- A large mammal with a body weight of 12 kg (27 lbs) that feeds on small mammals. The coyote (*Canis latrans*) was selected as the surrogate species to represent large mammalian carnivores (Hurt and Grossenheider 1976).
- A small bird with a body weight of 80 g (3 ounces) that feeds on insects. The American robin (*Turdus migratorius*) was selected as the surrogate species to represent small avian insectivores.
- A large bird with a body weight of approximately 3.5 kg (8 lbs) that feeds on vegetation. The Canada goose (*Branta canadensis*) was selected as the surrogate species to represent large avian herbivores.
- A large bird with a body weight of approximately 5 kg (11 lbs) that feeds on fish in the pond. The northern subspecies of the bald eagle (*Haliaeetus leucocephalus alascanus*) was selected as the surrogate species to represent large avian piscivores (Brown and Amadon 1968[5]).

In addition, potential impacts to non-target terrestrial plants were considered by evaluating two types of plant receptors: the "typical" non-target species, and the RTE non-target species. Since toxicity data are only generally available for vegetable crop species, both "typical" and RTE plants were represented by vegetable crop species. 2,4-D is considered to provide selective control of broadleaf weeds; however, it is possible that rangeland and noncropland plants and grasses are not as sensitive to 2,4-D as the selected surrogate crop species.

Aquatic exposure pathways were evaluated using fish, aquatic invertebrates, and non-target aquatic plants in a pond or stream habitat (as defined in Section 4.1.3). Bluegill sunfish, fathead minnow, and rainbow trout were selected as surrogates for fish; the water flea was a surrogate for aquatic invertebrates; and non-target aquatic plants and algae were represented by duckweed and freshwater diatom.

Section 3.0 of the Methods Document (ENSR 2004) presents the details of the exposure scenarios considered in the risk assessments. The following subsections describe the scenarios that were evaluated for 2,4-D.

4.2.1.1 Direct Spray

2,4-D may be used for control of both terrestrial and aquatic vegetation. Therefore, both terrestrial (accidental application) and aquatic (normal application) exposure scenarios have been evaluated.

[5] As cited on the Virginia Tech Conservation Management Institute Endangered Species Information System website at URL http://fwie.fw.vt.edu/WWW/esis/.

Plant and wildlife species may be unintentionally impacted during normal application of a terrestrial or aquatic herbicide as a result of a direct spray of the receptor or the water body inhabited by the receptor, indirect contact with dislodgeable foliar residue after herbicide application, or consumption of food items sprayed during ground application.

These exposures may occur within the terrestrial application area (consumption of food items) or outside of the application area (water bodies accidentally sprayed during application of terrestrial herbicide). For aquatic applications, these exposures may occur within the application area (direct spray of water body) or outside of the application area (consumption of terrestrial prey items accidentally sprayed by aquatic herbicide). Generally, impacts outside of the intended application area are accidental exposures that are not typical of BLM application practices. The following terrestrial herbicide application direct spray scenarios were evaluated:

Exposure Scenarios within the Terrestrial Application Area:

- Direct Spray of Terrestrial Wildlife
- Indirect Contact With Foliage After Direct Spray
- Ingestion of Food Items Contaminated by Direct Spray
- Direct Spray of Non-target Terrestrial Plants

Exposure Scenarios outside the Terrestrial Application Area:

- Accidental Direct Spray Over Pond
- Accidental Direct Spray Over Stream

The following aquatic herbicide application direct spray scenarios were evaluated:

Exposure Scenarios within the Aquatic Application Area:

- Direct Spray to Pond (normal application)
- Direct Spray to Stream (normal application)
- Consumption of Fish From Contaminated Pond (normal application)

Exposure Scenarios outside the Aquatic Application Area:

- Accidental Direct Spray of Terrestrial Wildlife
- Accidental Direct Spray of Non-target Terrestrial Plants
- Indirect Contact with Foliage After Accidental Direct Spray
- Ingestion of Prey Items Contaminated by Accidental Direct Spray

4.2.1.2 Off-site Drift

During normal application of herbicides, it is possible for a portion of the herbicide to drift outside of the treatment area and deposit onto non-target receptors. To simulate off-site herbicide transport as spray drift, AgDRIFT® software was used to evaluate a number of possible scenarios. Depending on actual BLM herbicide practices, ground applications were modeled using a low- or high-placed boom, and aerial applications were modeled from either a helicopter or a fixed-wing plane for terrestrial annual/perennial vegetation and woody vegetation at 20 feet (ft) above the forest canopy for forest applications, and at 10 ft above the ground for non-forest applications. Ground applications were modeled using either a high boom (spray boom height set at 50 inches above the ground) or a low boom (spray boom height set at 20 inches above the ground). Deposition rates vary by the height of the application (the higher the application, the greater the off-site drift). 2,4-D also has different application rates for terrestrial applications targeting annual and perennial species versus woody species, and for aquatic applications targeting floating and emerged weeds versus submerged weeds (see Table 2-1 for rates), which were incorporated into the AgDRIFT® modeling. Drift deposition was modeled at 25, 100, and 900ft from the application area for ground applications, and 100, 300, and 900 ft from the application area for aerial applications. The AgDRIFT® model determined the fraction of the herbicide deposited off-site, without considering herbicide degradation. The following off-site drift scenarios were evaluated for terrestrial and aquatic applications of 2,4-D:

- Off-site Drift to Plants
- Off-site Drift to Pond
- Off-site Drift to Stream
- Consumption of Fish From Contaminated Pond

4.2.1.3 Surface and Groundwater Runoff

Precipitation may result in the transport of herbicides bound to soils from the terrestrial application area via surface runoff and root-zone groundwater flow. This transport to off-site soils or water bodies was modeled using GLEAMS software. It should be noted that both surface runoff (i.e., soil erosion and soluble-phase transport) and loading in root-zone groundwater were assumed to affect the water bodies in question. This transport scenario is not applicable to the aquatic herbicide exposures and was not modeled for the aquatic uses of 2,4-D.

In the application of GLEAMS, it was assumed that root-zone loading of herbicide would be transported directly to a nearby water body. This is a feasible scenario in several settings, but is very conservative in situations in which the depth to the water table might be many feet. In much of the arid and semi-arid western states, in particular, it is common for the water table to be well below the ground surface and for there to be little, if any, groundwater discharge to surface water features.

GLEAMS variables include soil type, annual precipitation, size of application area, hydraulic slope, surface roughness, and vegetation type. These variables were altered to predict 2,4-D soil concentrations in various watershed types at both the typical and maximum application rates. The following surface runoff scenarios were evaluated for the terrestrial applications of 2,4-D:

- Surface Runoff to Off-site Soils
- Surface Runoff to Off-site Pond
- Surface Runoff to Off-site Stream
- Consumption of Fish from Contaminated Pond

4.2.1.4 Wind Erosion and Transport Off-site

Dry conditions and wind may also allow transport of the herbicide from the application area as wind-blown dust onto non-target plants some distance away. This transport by wind erosion of the surface soil was modeled using AERMOD and CALPUFF software. Five distinct watersheds were evaluated to determine herbicide concentrations in dust deposited on plants after a wind event, with dust deposition estimates calculated up to 100 km (62 miles) from the application area. These watersheds were located in Winnemucca, Nevada; Tucson, Arizona; Glasgow, Montana; Medford, Oregon; and Lander, Wyoming. The models assumed that the herbicide was applied on a specific area

(1,000 acres) of undisturbed soil in each of the watersheds. This transport scenario is not applicable to the aquatic herbicide exposures, and was not modeled for the aquatic uses of 2,4-D.

4.2.1.5 Accidental Spill to Pond

To represent worst-case potential impacts to ponds, two spill scenarios were considered. These scenarios consist of a truck or a helicopter spilling entire loads (200-gallon spill and 140-gallon spill, respectively) of herbicide mixed for the maximum application rate into a ¼-ac, 1-m-deep pond.

4.2.2 Effects Characterization

The ecological effects characterization phase entailed a compilation and analysis of the stressor-response relationships and any other evidence of adverse impacts from exposure to 2,4-D. For the most part, available data consisted of the toxicity studies conducted in support of USEPA pesticide registration described in Section 3.1. As described in the Methods Document (ENSR 2004), the toxicity endpoint for most acute studies was mortality, immobilization, or failure to germinate, as assessed during a short-term exposure. The toxicity endpoint for most chronic studies was growth or reproduction, effects that were assessed over a long-term exposure. TRVs selected for use in the ERA are presented in Table 3-1. Appendix B presents the full set of toxicity information identified for 2,4-D.

In order to address potential risks to ecological receptors, risk quotients (RQs) were calculated by dividing the estimated exposure concentration (EEC) for each of the previously described scenarios by the appropriate TRV presented in Table 3-1. An RQ was calculated by dividing the EEC for a particular scenario by an herbicide specific TRV. The TRV may be a surface water or surface soil effects concentration, or a species-specific toxicity value derived from the literature.

The RQs were then compared to Levels of Concern (LOC) established by the USEPA OPP to assess potential risk to non-target organisms. Table 4-1 presents the LOCs established for this assessment. Distinct USEPA LOCs are currently defined for the following risk presumption categories:

- **Acute high risk** – the potential for acute adverse effects is high.
- **Acute restricted use** – the potential for acute adverse effects is high, but may be mitigated through restricted use.
- **Acute endangered species** – the potential for acute adverse effects to endangered species is high.
- **Chronic risk** – the potential for chronic adverse effects is high.

Additional uncertainty factors may also be applied to the standard LOCs to reflect uncertainties inherent in extrapolating from surrogate species toxicity data to obtain RQs (see Sections 6.3 and 7.0 for a discussion of uncertainty). A "chronic endangered species" risk presumption category for aquatic animals was added for this risk assessment. The LOC for this category was set to 0.5 to reflect the conservative two-fold difference in contaminant sensitivity between RTE and surrogate test fishes (Sappington et al. 2001). Risk quotients predicted for acute scenarios (e.g., direct spray, accidental spill) were compared to the three acute LOCs, and the RQs predicted for chronic scenarios (e.g., long-term ingestion) were compared to the two chronic LOCs. If all RQs were less than the most conservative LOC for a particular receptor, comparisons against other, more elevated LOCs were not necessary.

The RQ approach used in this ERA provides a conservative measure of the risk level based on a "snapshot" of environmental conditions (i.e., rainfall, slope) and receptor assumptions (i.e., body weight, ingestion rates). Sections 6.3 and 7.0 discuss several of the uncertainties inherent in the RQ methodology.

To specifically address potential impacts to RTE species, two types of RQ evaluations were conducted. For RTE terrestrial plant species, the RQ was calculated using different toxicity endpoints, but keeping the same LOC (set at 1) for all scenarios. The plant toxicity endpoints were selected to provide extra protection to the RTE species. In the direct spray, spray drift, and wind erosion scenarios, the selected toxicity endpoints were an EC_{25} for "typical" species and a NOAEL for RTE species. In runoff scenarios, high and low germination NOAELs were selected to evaluate exposure for typical and RTE species, respectively.

The evaluation of RTE terrestrial wildlife and aquatic species included a second type of RQ evaluation. The same toxicity endpoint was used for both typical and RTE species in all scenarios, but the LOC was lowered for RTE species as discussed in Section 4.2.2 (Table 4-1).

4.3 Risk Characterization

The ecological risk characterization integrates the results of the exposure and effects phases (i.e., risk analysis), and provides comprehensive estimates of actual or potential risks to ecological receptors. Risk quotients are summarized by type of application; 2,4-D is applied at different application rates for the treatment of different types of vegetation, as described in Section 2.2. For example, typical and maximum application rates of 1 and 2 lbs. a.e./ac, respectively, may be used for the control of terrestrial annual and/or perennial species, whereas rates of 2 and 4 lbs. a.e./ac (typical and maximum application rates, respectively) are used for the control of terrestrial woody species or floating and emerged aquatic plant species. Typical and maximum application rates of 5.4 and 10.8 lbs. a.e./acre-foot, respectively, are used for treatment of submerged vegetation to a volume of water.

Within each treatment type, RQs for acute and chronic scenarios are calculated based on TRVs for 2,4-D acids/salts or TRVs for 2,4-D esters, when relevant. While modeling was performed for all combinations of application rates and species (i.e., both RTE and typical species), the results for RTE species are discussed below for each of the evaluated exposure scenarios. These are the most conservative results; risks for typical species are lower (i.e., the LOCs for typical species are higher than the RTE-based LOCs discussed below).

Summaries of the RQs for every modeled scenario are presented in Tables 4-2 to 4-5 and in detail in Appendix D. Box plots are used to graphically display the range of RQs obtained from evaluating each receptor and exposure scenario combination (Appendix E). These plots illustrate how the data are distributed about the mean and their relative relationships with the various LOCs. Also, these plots help to put the risk results for RTE species exposed to the maximum application rate (i.e., the most conservative evaluation) into context with the other RQ results. Outliers (data points outside the 90^{th} or 10^{th} percentiles) were not discarded in this ERA; all risk quotient data presented in these plots were included in the risk assessment.

4.3.1 Direct Spray

As described in Section 4.2.1, potential impacts from direct spray were evaluated for exposure that could occur within the terrestrial application area (direct spray of terrestrial wildlife and non-target terrestrial plants, indirect contact with foliage, ingestion of contaminated food items) and outside the intended application area (accidental direct spray over a pond or stream). In addition, for aquatic applications, exposures could occur within the application area (normal direct spray over pond and stream, consumption of fish from contaminated pond) and outside the intended application area (accidental direct spray of terrestrial wildlife and non-target terrestrial plants, indirect contact with foliage, ingestion of contaminated prey items).

A summary of the RQs for the above scenarios for the four application types of 2,4-D (terrestrial applications to control annual/perennial vegetation, terrestrial applications to control woody vegetation, aquatic applications to control floating and emerged vegetation, and aquatic applications to control submerged vegetation) is presented in Table 4-2 and in detail in Appendix D. Appendix D provides the individual RQs calculated for all application scenarios modeled in the ERA and may be reviewed if a detailed assessment of RQs against alternate LOCs is needed. The discussion below, unless specified otherwise, relates to RTE species exposed at the maximum application rate. Graphic representations of the range of RQs and associated LOCs for all scenarios are presented in Appendix E.

4.3.1.1 Terrestrial Wildlife

For scenarios involving the treatment of terrestrial annual/perennial vegetation, the majority of the RQs calculated for terrestrial animal exposure were below the most conservative LOC (for acute endangered species) of 0.1 (Figure E-1, Appendix E). However, the scenarios involving pollinating insects resulted in RQs exceeding the LOC, with a maximum RQ of 2.26. For scenarios involving the ingestion of prey contaminated by direct spray, 6 of the 20 RQs calculated exceeded the associated LOCs. Receptors with acute or chronic RQs above the associated LOCs included large mammalian herbivores, small avian insectivores, and large avian herbivores with RQs of up to 2.84 (chronic exposure for large mammalian herbivore at the maximum application rate).

The results for scenarios involving the treatment of terrestrial woody plants were similar to the results for terrestrial annual/perennial vegetation scenarios; all pollinating insect scenarios exceeded the most conservative LOC of 0.1, with a maximum RQ of 4.53 (Figure E-2, Appendix E). Eight of the 20 RQs calculated for the ingestion of prey contaminated by direct exposure exceeded the associated LOCs. Receptors with acute or chronic RQs above the associated LOCs included large mammalian herbivores, small avian insectivores, large avian herbivores, and large mammalian carnivores, with RQs of up to 5.67 (chronic exposure for large mammalian herbivore at the maximum application rate).

The application rates for the treatment of floating and emerged vegetation are the same as those for the treatment of terrestrial woody plants; therefore, the RQs are the same (Figure E-3, Appendix E). Receptors with acute or chronic RQs above the associated LOCs included large mammalian herbivores, small avian insectivores, large avian herbivores, and large mammalian carnivores, with RQs of up to 5.67. No RQs above the LOC were predicted for the consumption of contaminated fish from the pond.

For scenarios involving the treatment of submerged vegetation, the majority of the RQs calculated for terrestrial animal exposure were below the most conservative LOC (for acute endangered species) of 0.1 (Figure E-4, Appendix E). However, the scenarios involving pollinating insects resulted in RQs exceeding the LOC, with maximum a RQ of 12.2. For scenarios involving the ingestion of prey contaminated by direct spray, 13 of the 20 RQs calculated exceeded the associated LOCs. Receptors with acute or chronic RQs above the associated LOCs included large mammalian herbivores, small avian insectivores, large avian herbivores, and large mammalian carnivores, with RQs of up to 15.3 (chronic exposure for large mammalian herbivore at the maximum application rate). No RQs above the LOC were predicted for the consumption of contaminated fish from the pond.

4.3.1.2 Non-target Plants – Terrestrial and Aquatic

As expected, because of the mode of action of herbicides, all RQs calculated for non-target terrestrial plants based on application rates (i.e., application rates for terrestrial annual/perennial vegetation, terrestrial woody vegetation, aquatic floating and emerged vegetation, and aquatic submerged vegetation), and based on both 2,4-D acid/salts TRVs and 2,4-D ester TRVs, exceeded the plant LOC of 1. The maximum RQs calculated for each application type were as high as 36,000 (Table 4-2; Figures E-5 through E-12, Appendix E).

Similarly, all RQs calculated for non-target aquatic plants, for scenarios involving all application rates and both acid/salts TRVs and ester TRVs, exceeded the LOC of 1. The maximum RQs ranged up to 15,132 (Table 4-2; Figures E-13 through E-20, Appendix E).

Because all of the RQs were above the plant LOC of 1, direct spray poses a risk to plants in both aquatic and terrestrial environments. It may be noted that the aquatic scenarios are particularly conservative because they evaluate an instantaneous concentration and do not consider flow, adsorption to particles, or degradation that may occur over time within the pond or stream.

4.3.1.3 Fish and Aquatic Invertebrates

All of the RQs calculated for fish scenarios exceeded the most conservative LOCs (0.05 and 0.5 for acute and chronic risks to endangered species, respectively) based on both acid/salts and ester TRVs, and considering all application rates, with RQs of up to 40.8 (Table 4-2; Figures E-21 through E-28, Appendix E).

The majority of aquatic invertebrate scenarios exceeded the relevant LOC, with maximum RQs of up to 1,408 (Table 4-2; Figures E-29 through E-36, Appendix E). All RQs calculated for chronic exposure aquatic invertebrate scenarios exceeded the two chronic LOCs (0.5 and 1), with RQs of up to 30.3. All acute exposure RQs based on the ester TRV also exceeded the three acute LOCs (0.05, 0.1, and 0.5), with RQs of up to 1,408. Eight of the 16 acute exposure RQs based on the acid/salts TRV exceeded the most conservative LOC (0.05), with RQs of up to 0.47 (none of these RQs exceed the acute high risk LOC of 0.5).

These results suggest that the accidental or intentional direct spray of 2,4-D (either acid/salts or esters) over a pond or a stream, for the control of aquatic or terrestrial vegetation, may pose risks to fish and aquatic invertebrates. However, it should be noted that these scenarios are particularly conservative because they evaluate an instantaneous concentration and do not consider flow, adsorption to particles, or degradation that may occur over time within the pond or stream.

4.3.2 Off-site Drift

As described in Section 4.2.1, AgDRIFT® software was used to evaluate a number of possible scenarios in which a portion of the applied herbicide drifts outside of the treatment area and deposits onto non-target receptors. Off-site drift was evaluated for four application types of 2,4-D (terrestrial applications to control annual/perennial vegetation, terrestrial applications to control woody vegetation, aquatic applications to control floating and emerged vegetation, and aquatic applications to control submerged vegetation).

Ground applications of 2,4-D were modeled using both a low- and high-placed boom (spray boom height set at 20 and 50 inches above the ground, respectively), and aerial applications were modeled from both a helicopter and a plane (aerial applications for aquatic uses only modeled non-forested lands at 10 ft above the ground). Drift deposition was modeled at 25, 100, and 900 ft from the application area for ground applications, and 100, 300, and 900 ft from the aerial application area.

A summary of the RQs for the following scenarios—off-site drift to soil, off-site drift to pond, off-site drift to stream, and consumption of fish from the contaminated pond—is presented in Table 4-3 and in detail in Appendix D. Appendix D provides the individual RQs calculated for all application scenarios modeled in the ERA and may be reviewed if a detailed assessment of RQs against alternate LOCs is needed. Unless specified otherwise, the discussion below relates to RTE species exposed at the maximum application rate. Graphic representations of the range of RQs and associated LOCs for all scenarios are presented in Figures E-37 through E-72 in Appendix E.

4.3.2.1 Non-target Plants – Terrestrial and Aquatic

The majority of the RQs calculated for non-target terrestrial plants affected by off-site drift to soil based on all application rates were above the plant LOC of 1 (98% exceed for RTE species evaluations and 89% exceed for typical species evaluations, Figures E-37 through E-44, Appendix E). Maximum RQs ranged up to 484 (Table 4-3). These results indicate the potential for adverse effects to off-site non-target terrestrial plants due to drift. Although most RQs exceeded the plant LOC of 1, the RQs that did not exceed the plant LOC were typically for scenarios involving off-site drift 900 ft from helicopter applications or ground applications with a low or a high boom.

All RQs calculated for non-target aquatic plants affected by off-site drift at all application rates and based on 2,4-D acid/salts TRVs were below the plant LOC of 1 (Table 4-3). However, when ester TRVs were considered, 77% of the RQs for acute toxicity scenarios exceeded the LOC, with a maximum RQ of 73.4. The few acute toxicity scenarios that did not result in RQs exceeding the LOC mostly involved off-site drift at distances of 900 ft, based on ground applications with a low or high boom or application by helicopter. The numerical values of RQs for scenarios that did not exceed the LOC were variable and were dependent on the application rate modeled. Graphic presentations of these scenarios based on both 2,4-D acid/salts and ester TRVs are presented in Figures E-45 through E-52, Appendix E). These results may indicate the potential for adverse effects to non-target aquatic plants due to drift, mostly at distances less than 900 ft from the application site. However, the aquatic scenarios are particularly conservative because they do not consider flow, adsorption to particles, or degradation of the herbicide over time.

4.3.2.2 Fish and Aquatic Invertebrates

All but one of the acute and chronic toxicity scenarios for fish and aquatic invertebrates resulted in RQs less than the relevant LOCs based on 2,4-D acid/salts TRVs (Table 4-3; Figures E-53, E-55, E-57, E-59, E-61, E-63, E-65, E-67, Appendix E). However, when ester TRVs were considered for the acute toxicity scenarios, 6.3% of the fish RQs and 83.3% of the invertebrate RQs for acute toxicity scenarios exceeded the acute endangered species LOC of 0.05, with a maximum RQ of 0.147 for fish and 6.83 for aquatic invertebrates.

When the ester TRVs were considered, fish acute toxicity RQs were above the associated LOC (0.05) for three scenarios involving the treatment of terrestrial annual/perennial vegetation, seven scenarios involving the treatment of terrestrial woody plants, three scenarios involving the treatment of aquatic floating and emerged vegetation, and one scenario involving the control of submerged vegetation (Figures E-54, E-56, E-58, and E-60, Appendix E). In general, the applications resulting in RQs above the LOC were for aerial applications at modeled distances of 100 ft or ground applications from a high boom at 25 ft.

For the aquatic invertebrates, when the ester TRVs were considered in the pond and stream scenarios, 81% of the acute RQs for the terrestrial applications of 2,4-D exceeded the associated LOC, and 86% of the acute RQs for the aquatic applications of 2,4-D exceeded the associated LOC (Figures E-62, E-64, E-66, and E-68, Appendix E). The scenarios that did not result in RQs above the LOC typically occurred at 900 ft from the application area. However, several scenarios still resulted in RQs above the LOC at 900 ft.

For the scenarios summarized above for the different terrestrial and aquatic applications of 2,4-D, nearly all chronic exposures to fish and aquatic invertebrates resulted in RQs lower than the LOC, which suggests that there is a low risk for chronic adverse effects to these receptors under these scenarios. Many acute exposure scenarios resulted in RQs that exceeded the LOC, particularly for scenarios involving off-site drift near the application site, which suggests the potential for acute adverse effects to these receptors. However, these aquatic scenarios are particularly conservative because they do not consider flow, adsorption to particles, or degradation of the herbicide over time, and because the discussions presented above are based on the acute endangered species LOCs.

4.3.2.3 Piscivorous Birds

Risk to piscivorous birds was assessed by evaluating impacts from consumption of fish from a pond contaminated by off-site drift. For all application rate scenarios (i.e., application rates for the treatment of aquatic floating and emerged vegetation, aquatic submerged vegetation, terrestrial annual/perennial vegetation, and terrestrial woody vegetation), RQs for the piscivorous bird were all well below the most conservative terrestrial animal LOC (0.1), indicating that exposure to 2,4-D under this scenario is not likely to adversely affect piscivorous birds (Table 4-3; Figures E-69 through E-72, Appendix E).

4.3.3 Surface Runoff

As described in Section 4.2.1, surface runoff and root zone groundwater transport of terrestrial herbicides from the application area to off-site soils and water bodies were modeled using GLEAMS software. A total of 42 GLEAMS simulations were performed with different combinations of GLEAMS variables (i.e., soil type, soil erodability factor, annual precipitation, size of application area, hydraulic slope, surface roughness, and vegetation type) to account for a wide range of possible watersheds encountered on BLM-administered lands. In 24 simulations, soil type and precipitation values were altered, while the rest of the variables were held constant in a “base watershed” condition. In the remaining 18 simulations, precipitation was held constant, while the other six variables (each with three levels) were altered.

The RQs for the following scenarios—surface runoff to off-site soils, overland flow to off-site pond, overland flow to off-site stream, and consumption of fish from contaminated pond—are summarized for terrestrial applications in Table 4-4 and presented in detail in Appendix D. Appendix D provides the individual RQs calculated for all application scenarios modeled in the ERA and may be reviewed if a detailed assessment of RQs against alternate LOCs is needed. The discussion below, unless specified otherwise, relates to RTE species exposed at the maximum application rate. Graphic representations of the range of RQs and associated LOCs for all scenarios are presented in Figures E-73 through E-90 in Appendix E. No herbicide transport from the application area was predicted for several GLEAMS scenarios, primarily for those areas with low precipitation (e.g., 5 inches of precipitation per year).

Accordingly, these conditions are not associated with off-site risk. RQs are discussed below for the scenarios predicting off-site transport and RQs greater than 0.

4.3.3.1 Non-target Plants – Terrestrial and Aquatic

All RQs calculated for typical species of non-target terrestrial plants, based on both 2,4-D acid/salts and ester TRVs, and for both terrestrial applications (i.e., woody and annual/perennial applications), were below the plant LOC of 1 (Table 4-4). Under these scenarios, this translates to application rates of 1.0 to 4.0 lbs a.e./ac of the acid/salt and ester forms of 2,4-D.

For the RTE species, 92% of the RQs were below the plant LOC. However, some scenarios did result in RQs above the LOC. Maximum RQs were 16.7 (acid/salts) and 10.5 (esters) for applications to terrestrial annual/perennial vegetation, and 33.5 (acid/salts) and 21.0 (ester) for applications to terrestrial woody vegetation.[6] The scenarios that produced the RQs above the LOC were typically limited to surface runoff to clay soils in areas with annual precipitation of at least 100 inches per year. These results indicate that in the majority of the scenarios, transport of 2,4-D due to surface runoff is not likely to pose a risk to typical or RTE terrestrial plant species. Graphic representations of the RQs for non-target terrestrial plants are presented in Figures E-73 through E-76 (Appendix E).

All acute and chronic toxicity scenarios for non-target aquatic plants resulted in RQs less than the plant LOC of 1, based on the 2,4-D acid/salts TRV (Table 4-4). When the ester TRVs were considered, all of the non-target aquatic plant acute toxicity RQs were below the LOC for the stream scenarios. In the pond scenarios, 14% of the RQs were above the plant LOC, with maximum RQs of up to 20.7 for terrestrial annual/perennial and 41.4 for woody applications. The scenarios resulting in the RQs above the LOC were typically limited to clay and sand soils in areas with annual precipitation ranging from 100 to 250 inches. Graphic representations of the RQs for non-target aquatic plants are presented in Figures E-77 and E-80 (Appendix E). These results suggest some risk for acute adverse effects to plants in ponds, under conditions of high annual rainfall conditions associated with sandy soil conditions, but not streams; however, these results do not suggest risks for chronic adverse effects to aquatic plants.

4.3.3.2 Fish and Aquatic Invertebrates

All of the acute and chronic toxicity scenarios for fish and aquatic invertebrates resulted in RQs less than the relevant LOCs, based on 2,4-D acid/salts TRVs (Table 4-4; Figures E-81, E-83, E-85, and E-87, Appendix E). When the ester TRVs were considered, all of the acute toxicity RQs were below the associated LOCs for the stream scenarios, and most of the RQs were below the LOCs for the pond scenarios. However, one fish RQ and several invertebrate RQs for acute toxicity scenarios exceeded the acute endangered species LOC of 0.05, with a maximum RQ of 0.0827 for fish and 3.85 for aquatic invertebrates when the ester TRVs were considered (Figures E-82, E-84, E-86 and E-88, Appendix E).

[6] For the runoff scenarios, the TRVs for RTE plants are the same for both acid/salts and esters; however, the different fate and transport parameters result in different doses for acid/salts and esters.

The only scenario in which the fish RQ exceeded the acute endangered species LOC (0.05) involved surface runoff to a pond following an application to terrestrial woody vegetation at the maximum rate, in a watershed with clay soils and 250 inches of precipitation per year. The fish RQs were all below the LOCs for acute restricted use and acute high risk (0.1 and 0.5, respectively)

Several acute exposure scenarios for aquatic invertebrates in a pond resulted in RQs above the LOC (17% of the RQs at application rates of 1 and 2 lbs a.e./ac and 20% of the RQs at application rates of 2 and 4 lbs a.e./ac were above the most conservative LOC). RQs above the acute endangered species LOC (0.05) typically occurred in watersheds with clay soils and at least 50 inches of precipitation per year, sandy soils and at least 150 inches of precipitation per year, and loamy soils with at least 250 inches of precipitation per year.

These results suggest some risk for acute adverse effects to aquatic invertebrates, and to a lesser degree fish, in a pond following surface runoff containing 2,4-D esters (but not 2,4-D acid/salts). However, surface runoff containing 2,4-D acid/salts and esters have a low risk for chronic adverse effects to fish or aquatic invertebrates in ponds or streams.

4.3.3.3 Piscivorous Birds

Risk to piscivorous birds was assessed by evaluating impacts from consumption of fish from a pond contaminated by surface runoff following applications to terrestrial annual/perennial and woody vegetation. RQs for the piscivorous bird were all well below the most conservative terrestrial animal LOC (0.1), indicating that this scenario has a low risk for adverse effects to piscivorous birds (Table 4-4; Figures E-89 through E-90, Appendix E).

4.3.4 Wind Erosion and Transport Off-site

As described in Sections 4.2.1 and 5.3, five distinct watersheds were modeled using AERMOD and CALPUFF to determine herbicide concentrations in dust deposited on plants after a wind event, with dust deposition estimates calculated at 1.5, 10, and 100 km (0.9, 6.2, and 62 miles) from the application area. These watersheds were located in Winnemucca, Nevada; Tucson, Arizona; Glasgow, Montana; Medford, Oregon; and Lander, Wyoming.

Deposition results for Winnemucca, Nevada, and Tucson, Arizona, are not included in the analysis because the meteorological conditions (i.e., wind speed) that must be met to trigger particulate emissions for the land cover conditions assumed for these sites did not occur for any hour of the selected year. Therefore, it was assumed herbicide migration by windblown soil would not occur at those locations during that year and risks due to dust deposition were not evaluated in these two locations.

The soil type assumed for Winnemucca, Nevada, and Tucson, Arizona, was undisturbed sandy loam, which has a higher friction velocity (i.e., is harder for wind to pick up as dust) than the soil types at the other locations (Glasgow and Lander have loamy sand, and Medford has loam soil). As further explained in Section 5.3, friction velocity is a function of the measured wind speed and the surface roughness, a property affected by land use and vegetative cover. The threshold friction velocities at the other three sites were much lower, based on differences in the assumed soil types. At these sites, wind and land cover conditions combined to predict that the soil would be eroded on several days. Similar predictions would have been made for soils of similar properties at Winnemucca and Tucson, if present, under weather conditions encountered there.

RQs were calculated for typical and RTE terrestrial plant species exposed to contaminated dust within the three watersheds with the potential for wind erosion (Glasgow, Montana; Medford, Oregon; and Lander, Wyoming) following applications of 2,4-D at typical and maximum application rates, under scenarios involving the control of terrestrial annual/perennial vegetation and terrestrial woody vegetation. A summary of the RQs are presented in Table 4-5 and in detail in Appendix D.

The majority (72%) of the RQs calculated based on acid/salts and ester TRVs were below the LOC of 1 (Figures E-91 through E-94, Appendix E). However, at a modeled distance of 1.5 km (0.9 miles) from the application site, 79% of the RQs were above the plant LOC in all three modeled watersheds at both application rate options. In the Medford, Oregon watershed scenario, an RQ above 1 was also calculated for RTE species at a distance of 10 km (6.2 miles) from the application site, for a maximum rate of application associated with the management of woody species (4.0 lbs. a.e.). RQs were as high as 19.1 for the terrestrial annual/perennial treatment scenarios, and as high as 38.3 for the terrestrial woody treatment scenarios, based on impacts to RTE species during applications at the maximum rate.

These results indicate that wind erosion may pose a risk within 1.5 km of the application site, but is not likely to adversely affect non-target terrestrial plants at distances greater than 10 km, following treatments for the control of terrestrial annual/perennial and woody vegetation.

4.3.5 Accidental Spill to Pond

As described in Section 4.2.1, two spill scenarios were considered: a truck and a helicopter spilling entire loads (200-gallon spill and 140-gallon spill, respectively) of herbicide prepared for the maximum application rate into a ¼-ac, 1-m-deep pond. The herbicide concentration in the pond was the instantaneous concentration at the moment of the spill; the volume of the pond was determined and the volume of herbicide in the truck was mixed into the pond volume.

For all terrestrial and aquatic application scenarios, all RQs for fish, aquatic invertebrates, and non-target aquatic plants, calculated based on both acid/salts and ester TRVs, exceeded the LOC (0.05) for both the truck and helicopter spills mixed for the maximum application rate (Table 4-2; Figures E-13 through E-36, Appendix E). These scenarios are highly conservative and represent unlikely and worst case conditions (e.g., limited water body volume, tank mixed for maximum application).

4.3.6 Potential Risk to Salmonids from Indirect Effects

In addition to direct effects of herbicides on salmonids and other fish species in stream habitats (i.e., mortality due to herbicide concentrations in surface water), reduction in vegetative cover or food supply may indirectly impact individuals or populations. No literature studies were identified that explicitly evaluated the direct or indirect effects of 2,4-D to salmonids and their habitat; therefore, only qualitative estimates of indirect effects are possible. These estimates were accomplished by evaluating predicted impacts to prey items and vegetative cover in the stream scenarios discussed above. These scenarios include accidental direct spray over the stream and transport to the stream via off-site drift and surface runoff. An evaluation of impacts to non-target terrestrial plants was also included as part of the discussion of vegetative cover within the riparian zone. Prey items for salmonids and other potential RTE species may include other fish species, aquatic invertebrates, or aquatic plants. Additional discussion of RTE species is provided in Section 6.0.

4.3.6.1 Qualitative Evaluation of Impacts to Prey

Fish and aquatic invertebrate species were evaluated directly in the ERA using acute and chronic TRVs based on the most sensitive warmwater or coldwater species identified during the literature search. The majority of the scenarios involving direct spray over a stream resulted in RQs that exceed the relevant LOCs for potential prey items such as fish and aquatic invertebrates. Off-site drift to the stream resulted in one chronic fish RQ above the LOC for 2,4-D acids/salt. However, acute toxicity scenarios involving transport of 2,4-D esters to the stream via off-site drift resulted in several RQs that exceed the relevant LOCs. No RQs in excess of the appropriate acute or chronic LOCs were observed for fish or aquatic invertebrates in the surface runoff stream scenarios. Therefore, these results suggest potential reductions in prey as a result of the direct spray and off-site drift scenarios, but salmonids are not likely to be indirectly affected by a reduction in prey as a result of the surface runoff scenarios.

4.3.6.2 Qualitative Evaluation of Impacts to Vegetative Cover

A qualitative evaluation of indirect impacts to salmonids due to destruction of riparian vegetation and reduction of available cover was made by considering impacts to terrestrial and aquatic plants. Aquatic plant RQs for direct spray scenarios involving a tank mixed for the typical and maximum application rates were above the plant LOC, indicating the potential for a reduction in the aquatic plant community. For the terrestrial herbicide applications, this is an extremely conservative scenario in which it is assumed that a stream is accidentally directly sprayed by a terrestrial herbicide. Because such a scenario is unlikely to occur as a result of BLM practices, it represents a worst-case scenario. However, for aquatic herbicides, direct spray applications to streams may occur as part of normal treatment programs. In these cases, impacts to non-target aquatic plants may occur. Stream flow would be likely to dilute herbicide concentrations following direct spray applications (whether accidental or intentional) and reduce potential impacts, but this dilution of 2,4-D is not considered in these scenarios. If a stream containing salmonids were sprayed, the resultant reduction in available plant cover would have the potential to cause indirect impacts to salmonids.

Elevated aquatic plant acute RQs (of up to 73.4) were also observed as a result of off-site drift to streams from selected aerial applications of 2,4-D, indicating the potential for a reduction in plant cover over time. No elevated aquatic plant chronic RQs were predicted due to drift. No RQs in excess of the LOC were observed for aquatic plant species in the stream for any of the surface runoff scenarios.

Although not specifically evaluated in the stream scenarios of the ERA, typical species of terrestrial plants were evaluated for their potential to provide overhanging cover for salmonids. A reduction in the riparian cover has the potential to indirectly impact salmonids within the stream. RQs for terrestrial plants were elevated above the LOC for direct spray scenarios at both the typical and maximum application rates, indicating the potential for a reduction in this plant community. However, direct application to non-target plants is unlikely to occur as a result of BLM practices and represents a worst-case scenario.

RQs for typical terrestrial plants were observed above the plant LOC for nearly all scenarios as a result of off-site drift. RQs for typical terrestrial plants were below the plant LOC for the surface runoff scenarios. These results indicate the potential for a reduction in riparian cover under direct spray and off-site drift scenarios.

4.3.6.3 Conclusions

This qualitative evaluation indicates that salmonids are not likely to be indirectly impacted by a reduction in food supply (i.e., fish and aquatic invertebrates) as a result of the transport of 2,4-D to streams via surface runoff, but there is potential for indirect impacts due to the transport of 2,4-D to streams via off-site drift. In addition, a reduction in vegetative cover may occur under limited conditions. Direct spray and off-site drift during aerial and ground applications may negatively impact terrestrial and aquatic plants, reducing the cover available to salmonids within the stream. However, increasing the buffer zone or reducing the application rate during aerial spraying would reduce the likelihood of these impacts.

In addition, the effects of terrestrial herbicides in water are expected to be relatively transient, and stream flow is likely to reduce herbicide concentrations over time. In a review of potential impacts of another terrestrial herbicide to threatened and endangered salmonids, the USEPA OPP indicated that “for most pesticides applied to terrestrial environment, the effects in water, even lentic water, will be relatively transient” (Turner 2003). Only very persistent pesticides would be expected to have effects beyond the year of their application. The OPP report indicated that if a listed salmonid is not present during the year of application, there would likely be no concern (Turner 2003). Therefore, it is expected that potential adverse impacts to food and cover would not occur beyond the season of application.

TABLE 4-1

Levels of Concern

Risk Presumption		RQ	LOC
Terrestrial Animals [1]			
Birds	Acute High Risk	EEC/LC_{50}	0.5
	Acute Restricted Use	EEC/LC_{50}	0.2
	Acute Endangered Species	EEC/LC_{50}	0.1
	Chronic Risk	EEC/NOAEL	1
Wild Mammals	Acute High Risk	EEC/LC_{50}	0.5
	Acute Restricted Use	EEC/LC_{50}	0.2
	Acute Endangered Species	EEC/LC_{50}	0.1
	Chronic Risk	EEC/NOAEL	1
Aquatic Animals [2]			
Fish and Aquatic Invertebrates	Acute High Risk	EEC/LC_{50} or EC_{50}	0.5
	Acute Restricted Use	EEC/LC_{50} or EC_{50}	0.1
	Acute Endangered Species	EEC/LC_{50} or EC_{50}	0.05
	Chronic Risk	EEC/NOAEL	1
	Chronic Risk, Endangered Species	EEC/NOAEL	0.5
Plants [3]			
Terrestrial Plants	Acute High Risk	EEC/EC_{25}	1
	Acute Endangered Species	EEC/NOAEL	1
Aquatic Plants	Acute High Risk	EEC/EC_{50}	1
	Acute Endangered Species	EEC/NOAEL	1

[1] Estimated Environmental Concentration (EEC) is in mg $_{prey}$/kg $_{body\ weight}$ for acute scenarios and mg $_{prey}$/kg $_{body\ weight}$/day for chronic scenarios.
[2] EEC is in mg/L.
[3] EEC is in lbs. a.i./ac.

TABLE 4-2

Summary of Risk Quotients for Direct Spray and Spill Scenarios

Direct Spray and Spill Scenarios	Application Rates for the Control of Terrestrial Annual/Perennial Vegetation[1]				Application Rates for the Control of Terrestrial Woody Vegetation[1]			
	2,4-D acid		2,4-D ester[2]		2,4-D acid		2,4-D ester[2]	
	Frequency of Exceedance[3]	Maximum RQ	Frequency of Exceedance[3]	Maximum RQ	Frequency of Exceedance[3]	Maximum RQ	Frequency of Exceedance[3]	Maximum RQ
Terrestrial Animals								
Direct Spray of Terrestrial Wildlife	2:6	**2.26E+00**	NA	NA	2:6	**4.53E+00**	NA	NA
Indirect Contact With Foliage After Direct Spray	2:6	**2.26E-01**	NA	NA	2:6	**4.53E-01**	NA	NA
Ingestion of Food Items Contaminated by Direct Spray	6:20	**2.84E+00**	NA	NA	8:20	**5.67E+00**	NA	NA
Terrestrial Plants								
Direct Spray of Non-Target Plants	4:4	**6.67E+03**	4:4	**6.67E+03**	4:4	**1.33E+04**	4:4	**1.33E+04**
Aquatic Species								
Accidental Direct Spray Over Pond								
Fish	4:4	**4.08E+00**	2:2	**1.12E+00**	4:4	**8.15E+00**	2:2	**2.24E+00**
Aquatic Invertebrates	2:4	**1.12E+00**	2:2	**5.21E+01**	2:4	**2.24E+00**	2:2	**1.04E+02**
Non-target Aquatic Plants	4:4	**7.47E+00**	2:2	**5.60E+02**	4:4	**1.49E+01**	2:2	**1.12E+03**
Accidental Direct Spray Over Stream								
Fish	4:4	**2.04E+01**	2:2	**5.60E+00**	4:4	**4.08E+01**	2:2	**1.12E+01**
Aquatic Invertebrates	3:4	**5.60E+00**	2:2	**2.61E+02**	4:4	**1.12E+01**	2:2	**5.21E+02**
Non-target Aquatic Plants	4:4	**3.74E+01**	2:2	**2.80E+03**	4:4	**7.47E+01**	2:2	**5.60E+03**
Accidental spill								
Fish	2:2	**1.39E+01**	2:2	**1.26E+02**	2:2	**2.79E+01**	2:2	**2.51E+02**
Aquatic Invertebrates	2:2	**1.93E+00**	2:2	**5.84E+03**	2:2	**3.86E+00**	2:2	**1.17E+04**
Non-target Aquatic Plants	2:2	**2.51E+02**	2:2	**6.28E+04**	2:2	**5.02E+02**	2:2	**1.26E+05**

TABLE 4-2 (Cont.)

Summary of Risk Quotients for Direct Spray and Spill Scenarios

Direct Spray and Spill Scenarios	Application Rates for the Control of Aquatic Floating and Emerged Vegetation[1]				Application Rates for the Control of Aquatic Submerged Vegetation[1]			
	2,4-D acid/salts		2,4-D ester[2]		2,4-D acid		2,4-D ester[2]	
	Frequency of Exceedance[3]	Maximum RQ	Frequency of Exceedance[3]	Maximum RQ	Frequency of Exceedance[3]	Maximum RQ	Frequency of Exceedance[3]	Maximum RQ
Terrestrial Animals								
Direct Spray of Terrestrial Wildlife	2:6	**4.53E+00**	NA	NA	3:6	**1.22E+01**	NA	NA
Indirect Contact With Foliage After Direct Spray	2:6	**4.53E+01**	NA	NA	2:6	**1.22E+00**	NA	NA
Ingestion of Food Items Contaminated by Direct Spray	6:20	**5.67E+00**	NA	NA	13:20	**1.53E+01**	NA	NA
Consumption of Fish from Contaminated Pond	0:2	1.28E-03	NA	NA	0:2	1.28E-03	NA	NA
Terrestrial Plants								
Direct Spray of Non-Target Plants	4:4	**1.33E+04**	4:4	**1.33E+04**	4:4	**3.60E+04**	4:4	**3.60E+04**
Aquatic Species								
Direct Spray Over Pond								
Fish	4:4	**8.15E+00**	2:2	**2.24E+00**	4:4	**2.20E+01**	2:2	**6.05E+00**
Aquatic Invertebrates	2:4	**2.24E+00**	2:2	**1.04E+02**	3:4	**6.05E+00**	2:2	**2.82E+02**
Non-target Aquatic Plants	4:4	**1.49E+01**	2:2	**1.12E+03**	4:4	**1.36E+03**	2:2	**3.03E+03**
Direct Spray Over Stream								
Fish	4:4	**4.08E+01**	2:2	**1.12E+01**	4:4	**1.10E+02**	2:2	**3.03E+01**
Aquatic Invertebrates	4:4	**1.12E+01**	2:2	**5.21E+02**	4:4	**3.03E+01**	2:2	**1.41E+03**
Non-target Aquatic Plants	4:4	**7.47E+01**	2:2	**5.60E+03**	4:4	**2.02E+02**	2:2	**1.51E+04**
Accidental spill								
Fish	2:2	**2.79E+01**	2:2	**2.51E+02**	2:2	**7.53E+01**	2:2	**6.78E+02**
Aquatic Invertebrates	2:2	**3.86E+00**	2:2	**1.17E+04**	2:2	**1.04E+01**	2:2	**3.15E+04**
Non-target Aquatic Plants	2:2	**5.02E+02**	2:2	**1.26E+05**	2:2	**1.36E+03**	2:2	**3.39E+05**

NA – Not applicable. Separate ester-based TRVs are not used to evaluate terrestrial animals.

[1] Risk quotients were calculated based on the different application rates of 2,4-D for the treatment of different types of vegetation (i.e., aquatic floating and emerged, submerged aquatic, terrestrial annual/perennial, and terrestrial woody vegetation); this is further described in Section 2.2.

[2] Results presented for ester scenario shows RQs when ester-based TRVs are used for terrestrial plant and acute aquatic scenarios.

Shading and boldface indicates maximum RQ is greater than the most conservative LOC: 1 for all plant risks, and 0.05 for fish and invertebrates based on acute risk to endangered species.

[3] Frequency of exceedance indicates the number of RQs above the appropriate acute or chronic LOC : the number of RQs calculated for both the typical and maximum application rates.

See Appendix E Tables 1 through 8 for individual RQ calculations for each application type.

TABLE 4-3

Summary of Risk Quotients for Off-site Drift Scenarios

Off-site Drift Scenarios	Application Rates for the Control of Terrestrial Annual/Perennial Vegetation				Application Rates for the Control of Terrestrial Woody Vegetation			
	2,4-D acid/salts		2,4-D ester[2]		2,4-D acid/salts		2,4-D ester[2]	
	Frequency of Exceedance[3]	Maximum RQ	Frequency of Exceedance[3]	Maximum RQ	Frequency of Exceedance[3]	Maximum RQ	Frequency of Exceedance[3]	Maximum RQ
Terrestrial Plants								
Spray drift to offsite soil								
Typical species	27:36	**3.53E+01**	32:36	**1.01E+02**	31:36	**7.26E+01**	34:36	**2.07E+02**
RTE species	34:36	**2.35E+02**	34:36	**2.35E+02**	35:36	**4.84E+02**	35:36	**4.84E+02**
Aquatic Species								
Off-site drift to pond - acute toxicity								
Fish	0:36	1.16E-02	3:36	**1.05E-01**	0:36	1.15E-02	3:36	**1.03E-01**
Aquatic Invertebrates	0:36	1.61E-03	31:36	**4.87E+00**	0:36	1.59E-03	31:36	**4.81E+00**
Non-target Aquatic Plants	0:36	2.10E-01	27:36	**5.24E+01**	0:36	2.07E-01	28:36	**5.17E+01**
Off-site drift to pond - chronic toxicity								
Fish	0:36	3.81E-01	NA	NA	0:36	3.76E-01	NA	NA
Aquatic Invertebrates	0:36	1.05E-01	NA	NA	0:36	1.03E-01	NA	NA
Non-target Aquatic Plants	0:36	6.99E-01	NA	NA	0:36	6.89E-01	NA	NA
Off-site drift to stream – acute toxicity								
Fish	0:36	8.06E-03	1:36	**7.25E-02**	0:36	1.63E-02	4:36	**1.47E-01**
Aquatic Invertebrates	0:36	1.12E-03	26:36	**3.37E+00**	0:36	2.26E-03	29:36	**6.83E+00**
Non-target Aquatic Plants	0:36	1.45E-01	23:36	**3.63E+01**	0:36	2.94E-01	28:36	**7.34E+01**
Off-site drift to stream – chronic toxicity								
Fish	0:36	2.64E-01	NA	NA	1:36	**5.34E-01**	NA	NA
Aquatic Invertebrates	0:36	7.25E-02	NA	NA	0:36	1.47E-01	NA	NA
Non-target Aquatic Plants	0:36	4.84E-01	NA	NA	0:36	9.79E-01	NA	NA
Terrestrial Animal – Piscivorous Bird								
Consumption of fish from contaminated pond	0:36	6.14E-05	NA	NA	0:36	6.05E-05	NA	NA

TABLE 4-3 (Cont.)

Summary of Risk Quotients for Off-site Drift Scenarios

Off-site Drift Scenarios	Application Rates for the Control of Aquatic Floating and Emerged Vegetation[1]				Application Rates for the Control of Aquatic Submerged Vegetation[1]			
	2,4-D acid/salts		2,4-D ester[2]		2,4-D acid/salts		2,4-D ester[2]	
	Frequency of Exceedance[3]	Maximum RQ	Frequency of Exceedance[3]	Maximum RQ	Frequency of Exceedance[3]	Maximum RQ	Frequency of Exceedance[3]	Maximum RQ
Terrestrial Plants								
Spray drift to offsite soil								
Typical species	22:24	**4.27E+01**	24:24	**1.22E+02**	20:24	**2.01E+01**	23:24	**5.74E+01**
RTE species	24:24	**2.82E+02**	24:24	**2.85E+02**	24:24	**1.34E+02**	24:24	**1.34E+02**
Aquatic Species								
Off-site drift to pond - acute toxicity								
Fish	0:24	6.62E-03	1:24	**5.96E-02**	0:24	1.16E-02	1:24	**1.05E-01**
Aquatic Invertebrates	0:24	9.17E-04	22:24	**2.77E+00**	0:24	1.61E-03	21:24	**4.87E+00**
Non-target Aquatic Plants	0:24	1.19E-01	20:24	**2.98E+01**	0:24	2.10E-01	20:24	**5.24E+01**
Off-site drift to pond - chronic toxicity								
Fish	0:24	2.17E-01	NA	NA	0:24	3.81E-01	NA	NA
Aquatic Invertebrates	0:24	5.96E-02	NA	NA	0:24	1.05E-01	NA	NA
Non-target Aquatic Plants	0:24	3.97E-01	NA	NA	0:24	6.99E-01	NA	NA
Off-site drift to stream – acute toxicity								
Fish	0:24	8.62E-03	2:24	**7.76E-02**	0:24	4.09E-03	0:24	3.68E-02
Aquatic Invertebrates	0:24	1.19E-03	20:24	**3.61E+00**	0:24	5.66E-04	20:24	**1.71E+00**
Non-target Aquatic Plants	0:24	1.55E-01	20:24	**3.88E+01**	0:24	7.36E-02	18:24	**1.84E+01**
Off-site drift to stream – chronic toxicity								
Fish	0:24	2.82E-01	NA	NA	0:24	1.34E-01	NA	NA
Aquatic Invertebrates	0:24	7.76E-02	NA	NA	0:24	3.68E-02	NA	NA
Non-target Aquatic Plants	0:24	5.17E-01	NA	NA	0:24	2.45E-01	NA	NA
Terrestrial Animal – Piscivorous Bird								
Consumption of fish from contaminated pond	0:24	3.49E-05	NA	NA	0:24	6.14E-05	NA	NA

NA – Not applicable. Separate ester-based TRVs are not used to evaluate terrestrial animal or chronic aquatic scenarios.
[1] Risk quotients were calculated based on the different application rates of 2,4-D for the treatment of different types of vegetation (i.e., aquatic floating and emerged, submerged aquatic, terrestrial annual/perennial, and terrestrial woody vegetation); this is further described in Section 2.2.
[2] Results presented for ester scenario shows RQs when ester-based TRVs are used for terrestrial plant and acute aquatic scenarios.
[3] Frequency of exceedance indicates the number of RQs above the appropriate acute or chronic LOC : the number of RQs calculated for both the typical and maximum application rates.
Shading and boldface indicates that scenarios include RQs greater than the most conservative LOC: 1 for all plant risks, 0.05 for fish and invertebrates based on acute risk to endangered species, 0.5 for fish and invertebrates based on chronic risk to endangered species, and 0.1 for acute risk to endangered species for terrestrial animals.
See Appendix E Tables 9 through 16 for individual RQ calculations for each application type.

TABLE 4-4

Summary of Risk Quotients for Surface Runoff Scenarios

Surface Runoff Scenarios	Application Rates for the Control of Terrestrial Annual/Perennial Vegetation[1]				Application Rates for the Control of Terrestrial Woody Vegetation[1]			
	2,4-D acid/salts		2,4-D ester[2]		2,4-D acid/salts		2,4-D ester[2]	
	Frequency of Exceedance[3]	Maximum RQ	Frequency of Exceedance[3]	Maximum RQ	Frequency of Exceedance[3]	Maximum RQ	Frequency of Exceedance[3]	Maximum RQ
Terrestrial Plants								
Spray drift to offsite soil								
Typical species	0:84	6.12E-04	0:84	3.85E-04	0:84	1.22E-03	0:84	7.69E-04
RTE species	6:84	**1.67E+01**	6:84	**1.05E+01**	6:84	**3.35E+01**	8:84	**2.10E+01**
Aquatic Species								
Overland flow to pond – acute toxicity								
Fish	0:84	5.67E-03	0:84	4.14E-02	0:84	1.13E-02	1:84	**8.27E-02**
Aquatic Invertebrates	0:84	7.86E-04	14:84	**1.92E+00**	0:84	1.57E-03	17:84	**3.85E+00**
Non-target Aquatic Plants	0:84	1.02E-01	10:84	**2.07E+01**	0:84	2.04E-01	14:84	**4.14E+01**
Overland flow to pond – chronic toxicity								
Fish	0:84	1.86E-01	NA	NA	0:84	3.71E-01	NA	NA
Aquatic Invertebrates	0:84	5.11E-02	NA	NA	0:84	1.02E-01	NA	NA
Non-target Aquatic Plants	0:84	3.40E-01	NA	NA	0:84	6.81E-01	NA	NA
Overland flow to stream – acute toxicity								
Fish	0:84	2.31E-05	0:84	1.65E-04	0:84	4.62E-05	0:84	3.31E-04
Aquatic Invertebrates	0:84	3.20E-06	0:84	7.69E-03	0:84	6.40E-06	0:84	1.54E-02
Non-target Aquatic Plants	0:84	4.16E-04	0:84	8.27E-02	0:84	8.32E-04	0:84	1.65E-01
Overland flow to stream – chronic toxicity								
Fish	0:84	7.57E-04	NA	NA	0:84	1.51E-03	NA	NA
Aquatic Invertebrates	0:84	2.08E-04	NA	NA	0:84	4.16E-04	NA	NA
Non-target Aquatic Plants	0:84	1.39E-03	NA	NA	0:84	2.77E-03	NA	NA
Terrestrial Animal – Piscivorous Bird								
Consumption of fish from contaminated pond	0:84	2.99E-05	NA	NA	0:84	5.98E-05	NA	NA

NA – Not applicable. Separate ester-based TRVs are not used to evaluate terrestrial animal or chronic aquatic scenarios.
[1] Risk quotients were calculated based on the different application rates of 2,4-D for the treatment of different types of vegetation (i.e., terrestrial annual/perennial and terrestrial woody vegetation); this is further described in Section 2.2.
[2] Results presented for ester scenario shows RQs when ester-based TRVs are used for terrestrial plant and acute aquatic scenarios.
[3] Frequency of exceedance indicates the number of RQs above the appropriate acute or chronic LOC : the number of RQs calculated for both the typical and maximum application rates.
Shading and boldface indicates that scenarios include RQs greater than the most conservative LOC: 1 for all plant risks, 0.05 for fish and invertebrates based on acute risk to endangered species, and 0.5 for fish and invertebrates based on chronic risk to endangered species.
See Appendix E Tables 17 through 20 for individual RQ calculations for each application type.

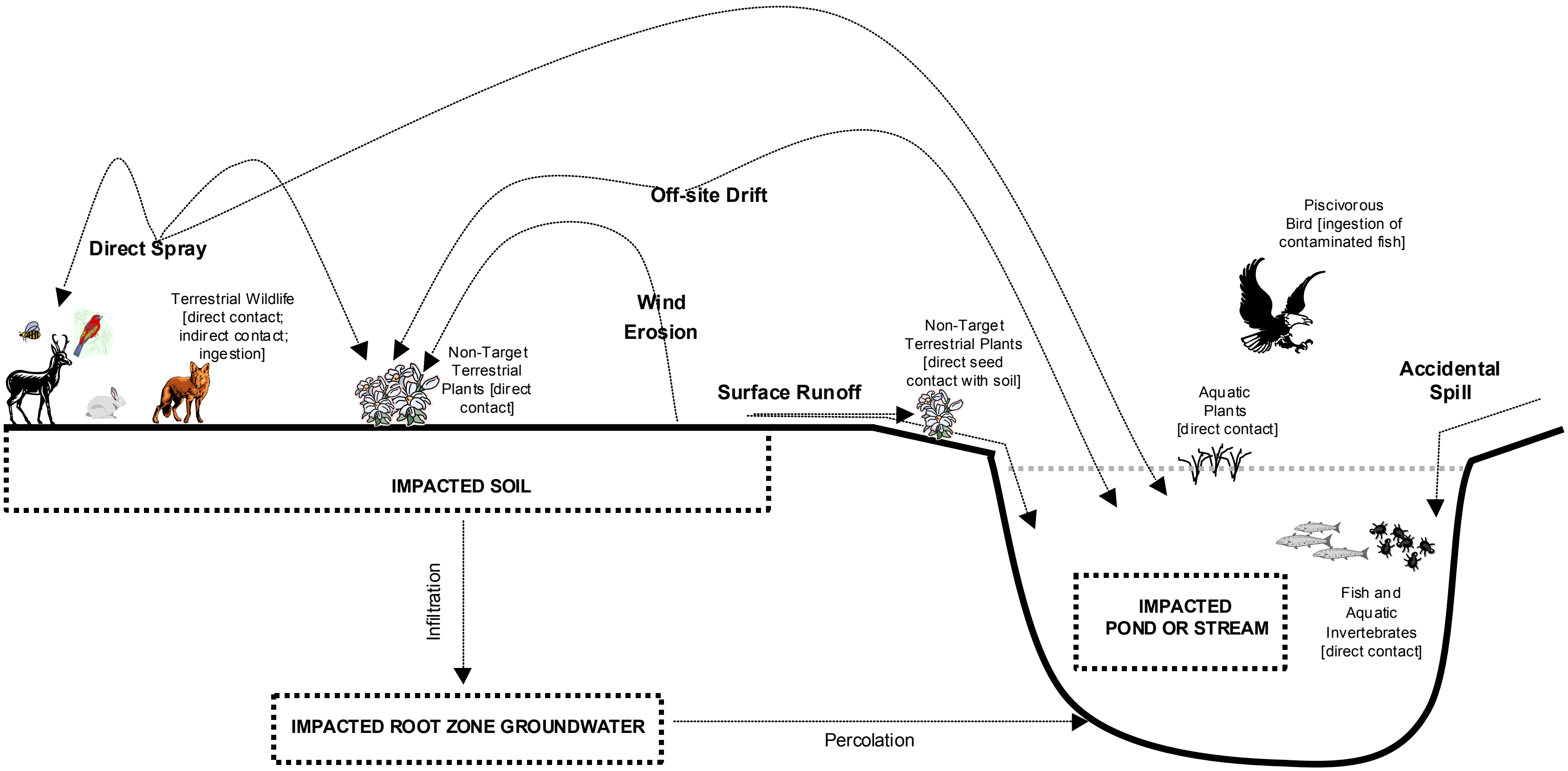
TABLE 4-5

Summary of Risk Quotients for Wind Erosion and Transport Off-site Scenarios

Wind Erosion and Transport Off-Site Scenarios		Application Rates for the Control of Terrestrial Annual/Perennial Vegetation[1]				Application Rates for the Control of Terrestrial Woody Vegetation[1]			
		2,4-D acid/salts		2,4-D ester[2]		2,4-D acid/salts		2,4-D ester[2]	
Watershed Location	**Distance from Receptor (km)**	**Frequency of exceedance[3]**	**Maximum RQ**	**Frequency of exceedance[3]**	**Maximum RQ**	**Frequency of exceedance[3]**	**Maximum RQ**	**Frequency of exceedance[3]**	**Maximum RQ**
Montana	1.5	1:4	**1.67E+00**	1:4	**1.67E+00**	2:4	**3.33E+00**	3:4	**3.33E+00**
Montana	10	0:4	4.88E-02	0:4	4.88E-02	0:4	9.77E-02	0:4	9.77E-02
Montana	100	0:4	1.71E-03	0:4	1.71E-03	0:4	3.41E-03	0:4	3.41E-03
Oregon	1.5	4:4	**1.91E+01**	4:4	**1.91E+01**	4:4	**3.83E+01**	4:4	**3.83E+01**
Oregon	10	0:4	5.11E-01	0:4	5.11E-01	1:4	**1.02E+00**	1:4	**1.02E+00**
Oregon	100	0:4	1.25E-02	0:4	1.25E-02	0:4	2.50E-02	0:4	2.50E-02
Wyoming	1.5	3:4	**9.84E+00**	4:4	**9.84E+00**	4:4	**1.97E+01**	4:4	**1.97E+01**
Wyoming	10	0:4	3.52E-01	0:4	3.52E-01	0:4	7.05E-01	0:4	7.05E-01
Wyoming	100	0:4	1.12E-02	0:4	1.12E-02	0:4	2.25E-02	0:4	2.25E-02

km = kilometers; 1.5 km = 0.9 miles, 10 km = 6.2 miles, and 100 km = 62 miles.
[1] Risk quotients were calculated based on the different application rates of 2,4-D for the treatment of different types of vegetation (i.e., terrestrial annual/perennial and terrestrial woody vegetation); this is further described in Section 2.2.
[2] Results presented for ester scenario shows RQs when ester-based TRVs are used for terrestrial plants.
[3] Frequency of exceedance indicates the number of RQs above the LOC : the number of RQs calculated for both the typical and maximum application rates.
Shading and boldface indicates plant RQs greater than 1 (LOC for all plant risks).
See Appendix E Tables 21 through 24 for individual RQ calculations for each application type.

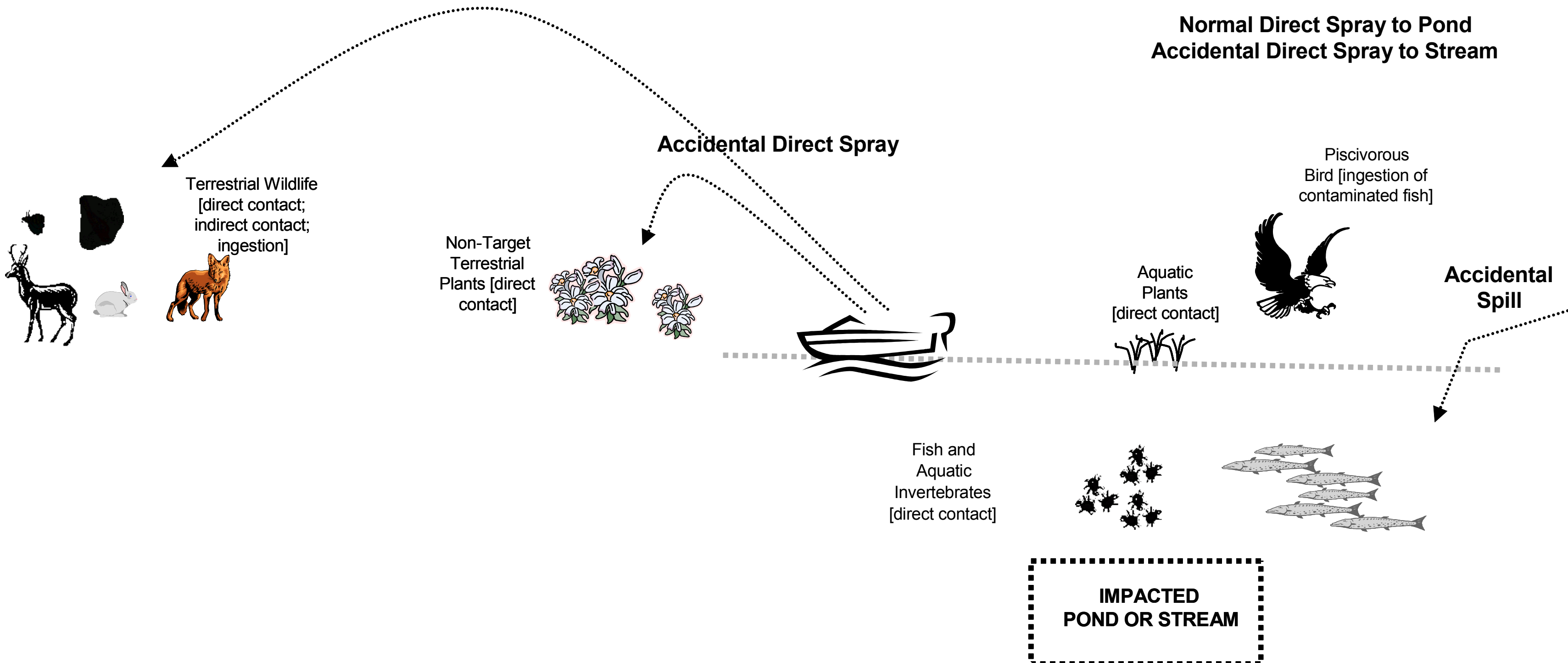
FIGURE 4-1 Conceptual Model for Terrestrial Herbicides



Application of terrestrial herbicides may occur by aerial (i.e., plane, helicopter) or ground (i.e., truck, backpack) methods.

See Figure 4-3 for simplified food web & evaluated receptors.

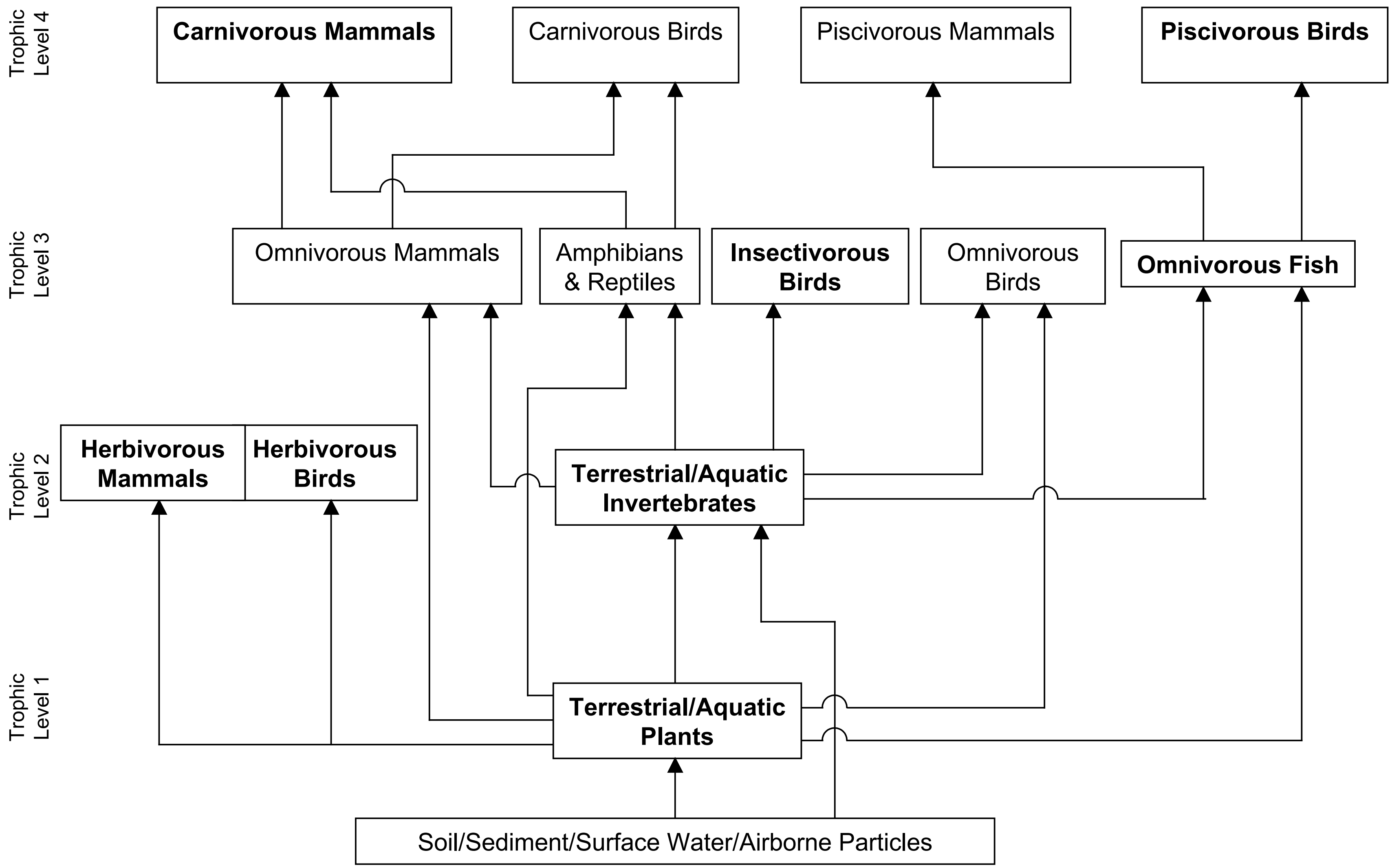
FIGURE 4-2 Conceptual Model for Aquatic Herbicides



Application of aquatic herbicides may occur by aerial (i.e., plane, helicopter), ground (i.e., truck, backpack), or boat methods.

See Figure 4 - 3 for simplified food web & evaluated receptors.

FIGURE 4-3 Simplified Food Web



Receptors in **bold** type quantitatively assessed in the BLM herbicide ERAs.

5.0 SENSITIVITY ANALYSIS

A sensitivity analysis was designed to determine which factors used to predict exposure concentrations most greatly affect exposure concentrations. In terms of aquatic use of 2,4-D, pond volume and stream flow were examined in order to estimate the importance of these factors in influencing exposure concentrations. A base case for each model used (GLEAMS, AgDRIFT®, AERMOD and CALPUFF) was established. Input factors were changed independently, allowing the importance of each factor to be estimated separately. This section provides information specific to the sensitivity of each model to select input variables.

5.1 Pond Volume and Stream Flow Sensitivity

For aquatic scenarios, the sensitivity analysis was designed to determine how pond and stream volumes affect exposure concentrations. A base case for each model was established based on the generic pond and stream modeled for the spill scenarios (Section 4.1.3). Input factors (e.g., area, depth) were changed independently, thereby resulting in an estimate of the importance of that factor on exposure concentrations. As described previously, surface runoff and wind erosion were not considered as transport mechanisms for the aquatic applications of 2,4-D. The scenarios for aquatic herbicide application are relatively simplistic and essentially represent an instantaneous concentration in the water body due to direct applications. The predicted surface water concentrations are based on the application rate and the surface area and depth of the water body. The surface water concentrations predicted in these scenarios are likely to be an overestimate, since stream flow, degradation, and adsorption are not considered.

The base case for the pond consisted of a ¼-ac pond, 1-m-deep. Table 5-1A presents the variations in the pond surface water concentrations for 2,4-D applied to floating and emerged aquatic vegetation as the area and depth of the pond are changed. Table 5-1B presents the variations in the pond surface water concentrations for 2,4-D applied to submerged aquatic vegetation as the area and depth of the pond are changed. This analysis indicates that changing the area of the pond does not alter the predicted surface water concentration, because as more herbicide is sprayed over a larger area, there is a larger pond volume in which the herbicide is dissipated. However, changing the depth does have an impact on the pond concentration by changing the pond volume while the amount of herbicide sprayed is unchanged. For example, increasing the pond depth decreases the associated herbicide concentration in the surface water.

The base case for the stream consisted of a stream 2-m-wide and 0.2-m-deep. The base case length was based on one side of a 100-acre square application area (636 meters impacted). Table 5-2A presents the variations in the stream surface water concentrations for 2,4-D applied to floating and emerged vegetation as the width, length, and depth of the impacted stream are changed. Table 5-2B presents the variations in the stream surface water concentrations for 2,4-D applied to submerged aquatic vegetation as the width, length, and depth of the impacted stream are changed. As observed in the pond sensitivity analysis, changes to stream area accomplished by varying the length or width do not result in changes to the surface water concentrations, but changes to the stream depth do. As the depth is increased, the stream concentration decreases and as the depth decreases, the stream concentration increases.

The results of this sensitivity analysis indicate that the size of the impacted water body does not have an effect on the surface water concentration (assuming that the entire water body is sprayed). However, depth has a dramatic impact on the associated surface water concentration (doubling the depth decreases the water concentration by ½). This indicates that shallow ponds and streams are more likely to be impacted by herbicide spray.

5.2 GLEAMS

GLEAMS (**G**roundwater **L**oading **E**ffects of **A**gricultural **M**anagement **S**ystems) is a model developed for field-sized areas to evaluate the effects of agricultural management systems on the movement of agricultural chemicals within and through the plant root zone (Leonard et al. 1987). The model simulates surface runoff and groundwater flow of herbicide from edge-of-field and bottom-of-root-zone loadings of water, sediment, pesticides, and plant nutrients as a result of the complex climate-soil-management interactions. Agricultural pesticides are simulated by GLEAMS using model input parameters that characterize three major components of the system: hydrology, erosion, and pesticides. This section describes the sensitivity of the model output to input variables controlling environmental conditions (i.e., precipitation, soil type). The goal of the sensitivity analysis was to investigate the control that measurable watershed variables have on the predicted outcome of a GLEAMS simulation.

5.2.1 GLEAMS Sensitivity Variables

A total of eight variables were selected for the sensitivity analysis of the GLEAMS model. The variables were selected because of their potential to affect the outcome of a simulation and their likelihood to change from site to site. These variables generally have the greatest variability among field application areas. The following parameters were included in the model sensitivity analysis:

1. *Annual Precipitation* – Variation in annual precipitation on herbicide export rates was investigated to determine the effect of runoff on predicted stream and pond concentrations. It is expected that the greater the amount of precipitation, the greater the expected exposure concentration. However, this relationship is not linear because it is influenced by additional factors, such as evapotranspiration. The lowest and highest precipitation values evaluated were 25 and 250 inches per year, respectively (representing one half and two times the precipitation level considered in the base watershed in the ERA).

2. *Application Area* – Variation in field size was investigated to determine its influence on herbicide export rates and predicted stream and pond concentrations. The lowest and highest values for application areas evaluated were 1 and 1,000 ac, respectively.

3. *Field Slope* – Variation in field slope was investigated to determine its effect on herbicide export. The slope of the application field affects predicted runoff, percolation, and the degree of sediment erosion resulting from rainfall events. The lowest and highest values for slope evaluated were 0.005 and 0.1 (unitless), respectively (equivalent to slopes of 0.5% and 10%).

4. *Surface Roughness* – The Manning Roughness value, a measure of surface roughness, was used in the GLEAMS model to predict runoff intensity and erosion of sediment. The Manning Roughness value is not measured directly, but can be estimated using the general surficial characteristics of the application area. The lowest and highest values for surface roughness evaluated were 0.015 and 0.15 (unitless), respectively.

5. *Erodibility* – Variation in soil erodibility was investigated to determine its effect on predicted river and pond concentrations. The soil erodibility factor is a composite parameter representing an integrated average annual value of the total soil and soil profile reaction to numerous erosive and hydrologic processes. These processes include soil detachment and transport by raindrop impact and surface flow, localized redeposition due to topography and tillage-induced roughness, and rainwater infiltration into the soil profile. The lowest and highest values for erodibility evaluated were 0.05 and 0.5 (tons per acre per English Erosion Index [EI]), respectively.

6. *Pond Volume or Stream Flow Rate* – The effect of variability in pond volume and stream flow on herbicide concentrations was evaluated. The lowest and highest pond volumes evaluated were 0.41 and 1,640 cubic meters, respectively. The lowest and highest stream flow values evaluated were 0.05 and 100 cms, respectively.

7. *Soil Type* – The influence of soil characteristics on predicted herbicide export rates and concentration was investigated by simulating different soil types within the application area. In this sensitivity analysis, clay, loam, and sand were evaluated.

8. *Vegetation Type* – Because vegetation type strongly affects the evapotranspiration rate, this parameter was expected to have a large influence on the hydrologic budget. Plants that cover a greater proportion of the application area for longer periods of the growing season remove more water from the subsurface, and

therefore result in diminished percolation rates through the soil. Vegetation types evaluated in this sensitivity analysis were weeds, shrubs, rye grass, conifers, and hardwoods.

5.2.2 GLEAMS Results

The effects of the eight different input model variables were evaluated to determine the relative effect of each variable on model output concentrations. A base case was established using the following values:

- annual precipitation rate of 50 inches per year;
- application area of 10 ac;
- slope of 0.05 ft/ft;
- roughness of 0.015;
- erodibility of 0.401 tons per ac per English EI;
- vegetation type of weeds; and
- loam soils.

While certain parameters used in the base case for the GLEAMS sensitivity analysis may not be representative of typical BLM lands, the base case values were selected to maximize changes in the other variables during the sensitivity analysis. For each variable, Tables 5-3A (acid) and Table 5-3B (ester) provide the difference in predicted exposure concentrations in a stream and a pond using the highest and the lowest input values, with all other variables held constant. Any increase in herbicide concentration results in an increase in RQs and ecological risk. The ratio of herbicide concentrations represents the relative increase/decrease in ecological risk, where values greater than 1.0 denote a positive relationship between herbicide concentration and the variable (increase in RQ), and values less than 1.0 denote a negative relationship (decrease in RQ). Similar tables were created for the non-numerical variables soil and vegetation type (Tables 5-4A and 5-4B for acid and ester, respectively). These tables present the difference in concentration under different soil and vegetation types relative to the base case. A ratio was created by dividing the adjusted variable concentration by the base case concentration. Values further away from 1.0, either positive or negative, indicate that predicted concentrations are more susceptible to changes within that particular variable.

Two separate results are presented in Tables 5-3A, B and 5-4A, B) relative change in average annual stream or pond concentration and 2) relative change in maximum 3-day average concentration. As indicated in Table 5-3A, precipitation is positively related to herbicide exposure concentrations (i.e., as precipitation increases, so do herbicide concentrations and associated ecological risk). Other input variables, such as area, slope, erodibility, roughness, and flow rate, do not have an impact on herbicide concentrations. For esters (Table 5-3B), precipitation and slope are positively related to herbicide exposure concentrations for both the pond and stream scenarios. Area and erodibility are also positively related to herbicide exposure concentrations for the stream scenario, but can have either a positive or negative impact on herbicide concentrations in the pond scenario. Conversely, increasing terrain roughness, flow rate (stream only), or pond volume decreases herbicide concentrations and associated ecological risk.

Tables 5-4A and 5-4B indicate that changing from loam to sand, clay, clay loam, silt loam, or silt soils increases stream and pond concentrations for both the 2,4-D acid and esters. Changing from weeds to other vegetation types does not have an effect on 2,4-D acid concentrations (no change in ecological risk). However, changing from weeds to conifer and hardwood cover decreases 2,4-D ester concentrations in the stream and pond. Changing from weeds to shrubs or rye grass also decreases 2,4-D ester concentrations in the pond, but results in no change in herbicide concentrations in the stream (no change in ecological risk).

5.3 AgDRIFT®

Changes to individual input parameters of predictive models have the potential to substantially influence the results of an analysis such as that conducted in this ERA. This is particularly true for models such as AgDRIFT® which are intended to represent complex problems such as the prediction of off-target spray drift of herbicides. Predicted off-target spray drift and downwind deposition can be substantially altered by variables intended to represent the herbicide application process including, but not limited to, nozzle type used in the spray application of an herbicide mixture, ambient wind speed, release height (application boom height), and evaporation. Hypothetically, any variable in the model that is intended to represent some part of the physical process of spray drift and deposition can substantially alter predicted downwind drift and deposition patterns. This section will present the changes that occur to the estimated exposure concentration, with changes to important input parameters and assumptions used in the AgDRIFT® model. It is important to note that changes in the EEC directly affect the estimated RQ. Thus, this information is presented in order to help local land managers understand the factors that are likely to be related to higher potential ecological risk. Table 5-5 summarizes the relative change in exposure concentrations, and therefore ecological risk, based on specific model input parameters (i.e., mode of application, application rate). Individual tables are provided for 2,4-D applied to annual/perennial terrestrial vegetation (Table 5-5A), woody terrestrial vegetation (Table 5-5B), floating and emerged aquatic vegetation (Table 5-5C), and submerged aquatic vegetation (Table 5-5D).

Factors that are thought to have the greatest influence on downwind drift and deposition are: spray drop-size distribution, release height, and wind speed (Teske and Barry 1993, Teske et al. 1998, Teske and Thistle 1999, as cited in SDTF 2002). To better quantify the influence of these and other parameters a sensitivity analysis was undertaken by the SDTF and documented in the AgDRIFT® user's manual. In this analysis AgDRIFT® Tier II model input parameters (model input parameters are discussed in Appendix B of the human health risk assessment; AECOM 2014) were varied by 10% above and below the default assumptions (four different drop-size distributions were evaluated). The findings of this analysis indicate the following:

- The largest variation in predicted downwind drift and deposition patterns occurred as a result of changes in the shape and content of the spray drop-size distribution.
- The next greatest change in predicted downwind drift and deposition patterns occurred as a result of changes in boom height (the release height of the spray mixture).
- Changes in spray boom length resulted in significant variations in drift and deposition within 200 ft downwind of the hypothetical application area.
- Changes in the assumed ambient temperature and relative humidity resulted in small variation in drift and deposition at distances greater than 200 ft downwind of the hypothetical application area.
- Varying the assumed number of application swaths (aircraft flight lines), application swath width, and wind speed resulted in little change in predicted downwind drift and deposition.
- Variation in the nonvolatile fraction of the spray mixture had no effect on downwind drift and deposition.

These results, except for the minor to negligible influence of varying wind speed and nonvolatile fraction, were consistent with previous observations. The 10% variation in wind speed and nonvolatile fraction was likely too small to produce substantial changes in downwind drift and deposition. It is expected that varying these by a larger percentage would eventually produce some effect. In addition, changes in wind speed resulted in changes in application swath width and swath offset, which masked the effect of wind speed alone on downwind drift and deposition.

Based on these findings and historic field observations, the hierarchy of parameters that have the greatest influence on downwind drift and deposition patterns is as follows:

1. Spray drop-size distribution
2. Application boom height
3. Wind speed
4. Spray boom length
5. Relative humidity
6. Ambient temperature
7. Nonvolatile fraction

An additional limitation of the AgDRIFT® user's manual sensitivity analysis is the focus on distances less than 200 ft downwind of a hypothetical application area. From a land management perspective, distance downwind from the point of deposition can represent a hypothetical buffer zone between the application area and a potentially sensitive habitat. In this ERA, distances as great as 900 ft downwind of a hypothetical application were considered. In an effort to expand on the existing AgDRIFT® sensitivity analysis provided in the user's manual, the sensitivity of mode of application, application height or vegetation type, and application rate were evaluated in this ERA. Results of this supplemental analysis are provided in Table 5-5.

The results of the expanded sensitivity analysis indicate that deposition and corresponding ecological risk drop off substantially between 25 and 900 ft downwind of hypothetical application area. Thus, from a land management perspective, the size of a hypothetical buffer zone (the downwind distance from a hypothetical application area to a potentially sensitive habitat) may be the single most controllable variable (other than the application equipment and herbicide mixtures chosen) that has a substantial impact on ecological risk (Table 5-5).

The most conservative case at the typical application rate (using the smallest downwind distance measured in this ERA – 25 ft) was then evaluated using two different boom heights. Predicted concentrations were higher with high vs. low boom height (Table 5-5). Using the minimum downwind distance, non-forest vegetation and high boom heights, a comparison was made to determine the effect of mode of application. Concentrations resulting from plane applications were highest and concentrations resulting from ground applications were lowest, with helicopter concentrations falling between the two. The final variable analyzed was application rate (maximum vs. typical), and, as expected, predicted concentrations were greatest for maximum application rates. For ground applications, exposure concentrations resulting from maximum rate applications were greater than those resulting from minimum rate applications by a factor of two. In general, the evaluation presented in Table 5-5 indicates that herbicide migration and associated ecological risk decreases with increased downward distance (i.e., buffer zone). Herbicide migration increases with increasing application height and rate.

A review of the RQ tables presented in Appendix C and the AgDRIFT® results indicates that for helicopter applications at the higher maximum applications rates (i.e., rates for control of terrestrial woody species and floating, emerged, and submerged aquatic species), the weight of the droplets is high enough that it begins to change the off-site drift pattern. As a result of the heavier droplets, fewer drops have the opportunity to drift as far from the application area, and the resulting off-site drift concentration is lower farther away. For helicopter applications in non-forested areas, when the distance from the application area is 900 ft, the off-site drift concentrations associated with typical rate applications are higher than those associated with maximum rate applications because the heavier droplets in the maximum application rate scenario are not able to drift as far. This effect becomes more pronounced as the weight of the droplet increases. Typically, the application rates are low enough that they do not significantly influence the weight of the droplets. However, for 2,4-D, some of the application rates are high enough that they may impact the typical off-site drift transport behavior.

5.4 AERMOD and CALPUFF

To determine the downwind deposition of herbicide that might occur as a result of dust-borne herbicide migration, the AERMOD and CALPUFF models were used with one year of meteorological data for Glasgow, Montana, Medford, Oregon, and Lander, Wyoming. As indicated in Section 4.3.4, the meteorological conditions (i.e., minimum wind speed) that must be met to trigger particulate emissions were not met for watersheds in Winnemucca, Nevada, and Tucson, Arizona, so dust deposition was not modeled for these two locations.

For this analysis, certain meteorological triggers were considered to determine whether herbicide migration was possible (ENSR 2004). Herbicide migration is not likely during periods of sub-freezing temperatures, precipitation events, and periods with snow cover. For example, it was assumed that herbicide migration would not be possible if the hourly ambient temperature was at or below 28 degrees Fahrenheit, because the local ground would be frozen and very resistant to soil erosion. Deposition rates predicted by the model were most affected by the meteorological conditions and the surface roughness or land use at each of the sites.

Greater surface roughness lengths (a measure of the height of obstacles to the wind flow) result in greater deposition simply because deposition is more likely to occur on obstacles to wind flow (e.g., trees) than on a smooth surface. Therefore, the type of land use affects deposition, as predicted by AERMOD and CALPUFF. For all sites evaluated, deposition computations assumed that vegetation typical of the area was in place, rather than being burned off by prescribed burning. For the closest distances in areas with lush vegetation (e.g., Medford, Oregon, and to a lesser extent, Lander, Wyoming), this assumption would cause AERMOD to overestimate herbicide deposition if the vegetation were instead denuded by fire near the herbicide application area.

In addition, a disturbed surface (e.g., through activities such as bulldozing) is subject to wind erosion because the surface soil is exposed and loosened. The surface roughness in the AERMOD and CALPUFF analysis has been selected to represent typical vegetation (1.3 m in Oregon due to forest cover, but much lower in Wyoming at 0.26 m and only 0.04 m in Montana, depicting little vegetation). The AERMOD and CALPUFF modeling is conservative in that it assumes that, during the full year modeled, herbicide was applied just before each day that had sufficient wind to cause windblown dust. In actual practice, it is unlikely that more than one herbicide application would be made in a given year at a specific site, and it is very possible that rainfall would activate the herbicide and leach it into the soil surface before a high wind event. Running the model with multiple opportunities for windblown dust can conservatively produce a high frequency of herbicide transport events. The worst-case modeled event is used for summarizing the predicted herbicide deposition as a function of transport distance.

AERMOD and CALPUFF use hourly meteorological data, in conjunction with the site surface roughness, to calculate the deposition velocities used to determine deposition rates at downwind distances. The amount of deposition at a particular distance is especially dependent on the “friction velocity.” The friction velocity is the square root of the surface shearing stress divided by the air density (a quantity with units of wind speed). Surface shearing stress is related to the vertical transfer of momentum from the air to the Earth’s surface. Shearing stress, and therefore friction velocity, increases with increasing wind speed and with increased surface roughness. Higher friction velocities result in higher deposition rates. Because the friction velocity is calculated from hourly observed wind speeds, meteorological conditions at a particular location greatly influence deposition rates as predicted by AERMOD and CALPUFF.

The threshold friction velocity is the ground level wind speed (accounting for surface roughness) that is assumed to lead to soil (and herbicide) scour. The threshold friction velocity is a function of the vegetative cover and soil type. Finer grained, less dense, and poorly vegetated soils tend to have relatively low threshold friction velocities. As the threshold friction velocity declines, wind events capable of scouring soil become more common. In fact, given the typical temporal distributions of wind speed, scour events would be predicted to be much more common as the threshold friction velocity declines from rare events to relatively common ones. The threshold wind speeds selected for the AERMOD and CALPUFF modeling effort are based on typical vegetation in the example areas. In the event that very fine soils or ash are present at the site, the threshold wind speed could be lower and scouring wind events more common, but the vegetation available for capturing the windblown dust would likely be removed, thus lowering the actual deposition rate for any given windblown soil event. Since the AERMOD and CALPUFF modeling evaluated numerous potential windblown dust events (very unlikely in actual practice due to infrequent herbicide applications), the modeling approach very likely identifies the worst-case deposition event, provided the actual friction velocity exceeds the threshold value at least a few times during the modeled year.

The size of the treatment area also impacts the predicted herbicide migration and deposition results. The size of the treatment area is directly proportional to the total amount of herbicide that can be moved via soil erosion. Because a fixed amount of herbicide per unit area is required for treatment, the larger the treatment area the greater the amount of herbicide that could migrate off site. In addition, increased herbicide mass would lead to increased downwind deposition.

In summary:

- Herbicide migration does not occur unless the surface wind speed is high enough to produce a friction velocity that can lift soil particles into the air. However, the modeling considers herbicide transport for every single hour in the course of a year in which the friction velocity exceeds the threshold value and the surface is not wet or frozen.

- The presence of surface “roughness elements” (buildings, trees and other vegetation) has an effect on the deposition rate. Areas of higher roughness result in more intense vertical eddies that can mix suspended particles down through the air and into the soil more effectively than smoother surfaces can. Thus, higher deposition of suspended soil and herbicide is predicted for areas with high roughness.

- Disturbed surfaces, such as areas recently burned and large treatment areas, experience an increase in herbicide migration. However, if the vegetation is burned off, the deposition rate per unit emissions in these areas is lower due to the lack of vegetation surfaces to intercept the airborne soil and deposition.

TABLE 5-1A

Relative Effects of Pond Variables on Herbicide Exposure Concentrations using Typical BLM Application Rate, 2,4-D Applied to Floating and Emerged Aquatic Vegetation

Pond area (acres)	Pond depth (m)	Pond volume (L)	Mass sprayed on pond (mg)	Concentration in pond (mg/L)	Comments
0.25	1	1,011,714	226,796	0.22	Base case
100	1	404,685,642	90,718,474	0.22	Increased pond area; no change in concentration
1,000	1	4,046,856,422	907,184,740	0.22	Increased pond area; no change in concentration
0.25	0.5	505,857	226,796	0.45	Decreased pond depth; increased concentration
0.25	2	2,023,428	226,796	0.112	Increased pond depth; decreased concentration
0.25	4	4,046,856	226,796	0.056	Increased pond depth; decreased concentration

TABLE 5-1B

Relative Effects of Pond Variables on Herbicide Exposure Concentrations using Typical BLM Application Rate, 2,4-D Applied to Submerged Aquatic Vegetation

Pond area (acres)	Pond depth (m)	Pond volume (L)	Mass sprayed on pond (mg)	Concentration in pond (mg/L)	Comments
0.25	1	1,011,714	612,350	0.61	Base case
100	1	404,685,642	244,939,880	0.61	Increased pond area; no change in concentration
1,000	1	4,046,856,422	2,449,398,798	0.61	Increased pond area; no change in concentration
0.25	0.5	505,857	612,350	1.21	Decreased pond depth; increased concentration
0.25	2	2,023,428	612,350	0.303	Increased pond depth; decreased concentration
0.25	4	4,046,856	612,350	0.151	Increased pond depth; decreased concentration

TABLE 5-2A

Relative Effects of Stream Variables on Herbicide Exposure Concentrations using Typical BLM Application Rate, 2,4-D Applied to Floating and Emerged Aquatic Vegetation

Stream width (m)	Stream depth (m)	Length of impacted stream (m) [1]	Stream volume (L)	Mass sprayed on stream (mg)	Concentration in stream (mg/L)	Comments
2	0.2	636	254,460	285,212	1.12	Base case
4	0.2	636	508,920	570,424	1.12	Increased stream width; no change in concentration
1	0.2	636	127,230	142,606	1.12	Decreased stream width; no change in concentration
2	0.4	636	508,920	285,212	0.56	Increased stream depth; decreased concentration
2	0.1	636	127,230	285,212	2.24	Decreased stream depth; increased concentration
2	0.2	201	80,468	90,193	1.12	Decreased stream length; no change in concentration
2	0.2	2,012	804,672	901,918	1.12	Increased stream length; no change in concentration

TABLE 5-2B

Relative Effects of Stream Variables on Herbicide Exposure Concentrations using Typical BLM Application Rate, 2,4-D Applied to Submerged Aquatic Vegetation

Stream width (m)	Stream depth (m)	Length of impacted stream (m) [1]	Stream volume (L)	Mass sprayed on stream (mg)	Concentration in stream (mg/L)	Comments
2	0.2	636	254,460	770,072	3.03	Base case
4	0.2	636	508,920	1,540,144	3.03	Increased stream width; no change in concentration
1	0.2	636	127,230	385,036	3.03	Decreased stream width; no change in concentration
2	0.4	636	508,920	770,072	1.51	Increased stream depth; decreased concentration
2	0.1	636	127,230	770,072	6.05	Decreased stream depth; increased concentration
2	0.2	201	80,468	243,520	3.03	Decreased stream length; no change in concentration
2	0.2	2,012	804,672	2,435,177	3.03	Increased stream length; no change in concentration

[1] Length of impacted stream is based on size of application area. 10 acre application area = 201 meters impacted; 100 acre application area = 636 meters impacted; 1,000 acre application area = 2,012 meters impacted.

TABLE 5-3A

Relative Effects of GLEAMS Input Variables on Herbicide Exposure Concentrations using Typical BLM Application Rate (2,4-D Acid)

Stream Scenarios											
				Low Value Predicted Concentration		High Value Predicted Concentration		Concentration $_H$ / Concentration $_L$		Relative Change in Concentration	
Input Variable	Units	Input Low Value (L)	Input High Value (H)	Average Annual Stream	Maximum 3 Day Avg. Stream	Average Annual Stream	Maximum 3 Day Avg. Stream	Average Annual Stream	Maximum 3 Day Avg. Stream	Average Annual Stream	Maximum 3 Day Avg. Stream
Precipitation	inches	25	100	0.00E+00	0.00E+00	2.52E-09	1.63E-07	NA	NA	+	+
Area	acres	1	1,000	0.00E+00	0.00E+00	0.00E+00	0.00E+00	NA	NA	No Change	No Change
Slope	unitless	0.005	0.1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	NA	NA	No Change	No Change
Erodibility	tons/acre per English EI	0.05	0.5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	NA	NA	No Change	No Change
Roughness	unitless	0.015	0.15	0.00E+00	0.00E+00	0.00E+00	0.00E+00	NA	NA	No Change	No Change
Flow Rate	m^3/sec	0.05	100	0.00E+00	0.00E+00	0.00E+00	0.00E+00	NA	NA	No Change	No Change
Pond Scenarios											
				Low Value Predicted Concentration		High Value Predicted Concentration		Concentration $_H$ / Concentration $_L$		Relative Change in Concentration	
Input Variable	Units	Input Low Value (L)	Input High Value (H)	Average Annual Pond	Maximum 3 Day Avg. Pond	Average Annual Pond	Maximum 3 Day Avg. Pond	Average Annual Pond	Maximum 3 Day Avg. Pond	Average Annual Pond	Maximum 3 Day Avg. Pond
Precipitation	inches	25	100	0.00E+00	0.00E+00	1.18E-07	3.57E-06	NA	NA	+	+
Area	acres	1	1,000	0.00E+00	0.00E+00	0.00E+00	0.00E+00	NA	NA	No Change	No Change
Slope	unitless	0.005	0.1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	NA	NA	No Change	No Change
Erodibility	tons/acre per English EI	0.05	0.5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	NA	NA	No Change	No Change
Roughness	unitless	0.015	0.15	0.00E+00	0.00E+00	0.00E+00	0.00E+00	NA	NA	No Change	No Change
Pond Volume	ac/ft	0.41	1,640	0.00E+00	0.00E+00	0.00E+00	0.00E+00	NA	NA	No Change	No Change

TABLE 5-3B

Relative Effects of GLEAMS Input Variables on Herbicide Exposure Concentrations using Typical BLM Application Rate (2,4-D Ester)

Stream Scenarios											
				Low Value Predicted Concentration		High Value Predicted Concentration		Concentration $_H$ / Concentration $_L$		Relative Change in Concentration	
Input Variable	Units	Input Low Value (L)	Input High Value (H)	Average Annual Stream	Maximum 3 Day Avg. Stream	Average Annual Stream	Maximum 3 Day Avg. Stream	Average Annual Stream	Maximum 3 Day Avg. Stream	Average Annual Stream	Maximum 3 Day Avg. Stream
Precipitation	inches	25	100	1.66E-11	2.02E-09	3.24E-08	2.21E-06	1951.81	1094.06	+	+
Area	acres	1	1,000	7.78E-12	7.12E-10	3.10E-10	2.94E-08	39.85	41.29	+	+
Slope	unitless	0.005	0.1	6.18E-11	5.78E-09	6.62E-11	6.20E-09	1.07	1.07	+	+
Erodibility	tons/acre per English EI	0.05	0.5	6.18E-11	5.78E-09	6.36E-11	5.99E-09	1.03	1.04	+	+
Roughness	unitless	0.015	0.15	6.27E-11	5.89E-09	6.18E-11	5.78E-09	0.99	0.98	-	-
Flow Rate	m^3/sec	0.05	100	1.17E-10	1.11E-08	9.60E-14	8.74E-12	0.001	0.001	-	-
Pond Scenarios											
				Low Value Predicted Concentration		High Value Predicted Concentration		Concentration $_H$ / Concentration $_L$		Relative Change in Concentration	
Input Variable	Units	Input Low Value (L)	Input High Value (H)	Average Annual Pond	Maximum 3 Day Avg. Pond	Average Annual Pond	Maximum 3 Day Avg. Pond	Average Annual Pond	Maximum 3 Day Avg. Pond	Average Annual Pond	Maximum 3 Day Avg. Pond
Precipitation	inches	25	100	2.45E-09	6.08E-08	1.81E-06	4.91E-05	738.78	807.57	+	+
Area	acres	1	1,000	1.02E-09	2.05E-08	4.63E-10	3.06E-08	0.45	1.49	-	+
Slope	unitless	0.005	0.1	1.82E-09	6.56E-08	1.97E-09	7.04E-08	1.08	1.07	+	+
Erodibility	tons/acre per English EI	0.05	0.5	1.82E-09	6.56E-08	1.87E-09	6.08E-08	1.03	0.93	+	-
Roughness	unitless	0.015	0.15	2.56E-09	7.06E-08	1.82E-09	6.56E-08	0.71	0.93	-	-
Pond Volume	ac. ft	0.41	1,640	1.38E-09	4.96E-08	2.97E-11	1.31E-10	0.02	0.003	-	-

EI = Erosion index.
m^3/sec = cubic meter per second
ac/ft = acre feet.
Concentrations were based on the average application rate.
+ = Increase in concentration from low to high input value = increase in RQ = increase in ecological risk.
- = Decrease in concentration from low to high input value = decrease in RQ = decrease in ecological risk.
Concentration $_H$ / Concentration $_L$ = Ratio of high value concentration to low value concentration.

TABLE 5-4A

Relative Effects of Soil and Vegetation Type on Herbicide Exposure Concentrations using Typical BLM Application Rate (2,4-D Acid)

Soil Type	Predicted Concentration				Concentration $_{X\ Soil\ Type}$ / Concentration $_{Loam}$				Relative Change in Concentration			
	Avg. Annual Stream	Max. 3 Day Avg. Stream	Avg. Annual Pond	Max. 3 Day Avg. Pond	Avg. Annual Stream	Max. 3 Day Avg. Stream	Avg. Annual Pond	Max. 3 Day Avg. Pond	Avg. Annual Stream	Max. 3 Day Avg. Stream	Avg. Annual Pond	Max. 3 Day Avg. Pond
***Loam*[1]**	***0.00E+00***	***0.00E+00***	***0.00E+00***	***0.00E+00***	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Sand	1.48E-10	1.79E-08	4.33E-08	5.79E-07	NA	NA	NA	NA	+	+	+	+
Clay	5.17E-08	4.43E-06	1.39E-05	1.99E-04	NA	NA	NA	NA	+	+	+	+
Clay Loam	8.76E-08	7.15E-06	1.05E-05	2.63E-04	NA	NA	NA	NA	+	+	+	+
Silt Loam	9.10E-09	9.41E-07	1.20E-06	3.05E-05	NA	NA	NA	NA	+	+	+	+
Silt	8.90E-09	6.75E-07	1.05E-06	2.62E-05	NA	NA	NA	NA	+	+	+	+

Vegetation Type	Predicted Concentration				Concentration $_{X\ Veg\ Type}$ / Concentration $_{Weeds}$				Relative Change in Concentration			
	Avg. Annual Stream	Max. 3 Day Avg. Stream	Avg. Annual Pond	Max. 3 Day Avg. Pond	Avg. Annual Stream	Max. 3 Day Avg. Stream	Avg. Annual Pond	Max. 3 Day Avg. Pond	Avg. Annual Stream	Max. 3 Day Avg. Stream	Avg. Annual Pond	Max. 3 Day Avg. Pond
***Weeds*[1]**	***0.00E+00***	***0.00E+00***	***0.00E+00***	***0.00E+00***	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Conifer + Hardwood	0.00E+00	0.00E+00	0.00E+00	0.00E+00	NA	NA	NA	NA	No Change	No Change	No Change	No Change
Shrubs	0.00E+00	0.00E+00	0.00E+00	0.00E+00	NA	NA	NA	NA	No Change	No Change	No Change	No Change
Rye Grass	0.00E+00	0.00E+00	0.00E+00	0.00E+00	NA	NA	NA	NA	No Change	No Change	No Change	No Change

TABLE 5-4B

Relative Effects of Soil and Vegetation Type on Herbicide Exposure Concentrations using Typical BLM Application Rate (2,4-D Ester)

Soil Type	Predicted Concentration				Concentration $_{X\ Soil\ Type}$ / Concentration $_{Loam}$				Relative Change in Concentration			
	Avg. Annual Stream	Max. 3 Day Avg. Stream	Avg. Annual Pond	Max. 3 Day Avg. Pond	Avg. Annual Stream	Max. 3 Day Avg. Stream	Avg. Annual Pond	Max. 3 Day Avg. Pond	Avg. Annual Stream	Max. 3 Day Avg. Stream	Avg. Annual Pond	Max. 3 Day Avg. Pond
***Loam*[1]**	***6.27E-11***	***5.89E-09***	***2.56E-09***	***7.06E-08***	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Sand	4.26E-09	4.86E-07	2.07E-07	5.83E-06	67.9585	82.6198	80.9002	82.6038	+	+	+	+
Clay	2.33E-07	1.83E-05	7.25E-05	7.56E-04	3.72E+03	3.11E+03	2.84E+04	1.07E+04	+	+	+	+
Clay Loam	4.43E-07	3.70E-05	5.20E-05	1.28E-03	7.07E+03	6.29E+03	2.04E+04	1.81E+04	+	+	+	+
Silt Loam	7.73E-08	7.33E-06	9.30E-06	2.28E-04	1.23E+03	1.25E+03	3.63E+03	3.23E+03	+	+	+	+
Silt	6.02E-08	4.69E-06	6.74E-06	1.66E-04	9.59E+02	7.97E+02	2.64E+03	2.35E+03	+	+	+	+

Vegetation Type	Predicted Concentration				Concentration $_{X\ Veg\ Type}$ / Concentration $_{Weeds}$				Relative Change in Concentration			
	Avg. Annual Stream	Max. 3 Day Avg. Stream	Avg. Annual Pond	Max. 3 Day Avg. Pond	Avg. Annual Stream	Max. 3 Day Avg. Stream	Avg. Annual Pond	Max. 3 Day Avg. Pond	Avg. Annual Stream	Max. 3 Day Avg. Stream	Avg. Annual Pond	Max. 3 Day Avg. Pond
***Weeds*[1]**	***6.27E-11***	***5.89E-09***	***2.56E-09***	***7.06E-08***	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Conifer + Hardwood	3.71E-11	3.63E-09	8.36E-10	3.85E-08	0.5911	0.6167	0.3272	0.5458	-	-	-	-
Shrubs	6.27E-11	5.89E-09	1.85E-09	6.68E-08	1.000	1.000	0.7221	0.9465	No Change	No Change	-	-
Rye Grass	6.27E-11	5.89E-09	1.85E-09	6.68E-08	1.000	1.000	0.7221	0.9465	No Change	No Change	-	-

Avg = Average.
Max = Maximum.
NA = Not an applicable comparison.
[1] ***Base Case***
Concentrations were based on the average application rate.
+ = Increase in concentration from base case = increase in RQ = increase in ecological risk.
- = Decrease in concentration from base case = decrease in RQ = decrease in ecological risk.
Concentration $_{X\ Soil\ Type}$ / Concentration $_{Loam}$ = Ratio of concentration in indicated soil type to concentration in loam model.
Concentration $_{X\ Veg\ Type}$ / Concentration $_{Weed}$ = Ratio of concentration in indicated vegetation type to concentration in weed model.

TABLE 5-5A

Herbicide Exposure Concentrations used During the Supplemental AgDRIFT® Sensitivity Analysis 2,4-D Applied to Annual and Perennial Terrestrial Vegetation

Mode of Application	Application Height or Vegetation Type	Minimum Downwind Distance (ft)	Maximum Downwind Distance (ft)	Minimum Downwind Distance Concentration			Maximum Downwind Distance Concentration		
				Terrestrial (lbs. a.e./ac)	Stream (mg/L)	Pond (mg/L)	Terrestrial (lbs. a.e./ac)	Stream (mg/L)	Pond (mg/L)
Typical Application Rate									
Plane	Forested	100	900	3.47E-02	3.67E-02	5.00E-03	5.00E-03	3.17E-03	6.00E-04
	Non-Forested	100	900	1.81E-02	1.73E-02	2.56E-03	4.40E-03	2.66E-03	5.11E-04
Helicopter	Forested	100	900	1.90E-03	2.04E-03	2.96E-04	1.00E-04	7.99E-05	1.41E-05
	Non-Forested	100	900	1.48E-02	1.45E-02	2.13E-03	3.80E-03	2.32E-03	4.48E-04
Ground	Low Boom	25	900	4.50E-03	6.26E-03	6.82E-04	6.00E-04	7.22E-05	1.90E-04
	High Boom	25	900	7.10E-03	1.09E-03	1.05E-02	8.00E-04	9.16E-05	2.51E-04
Maximum Application Rate									
Plane	Forested	100	900	7.05E-02	7.40E-02	1.01E-02	1.11E-02	6.90E-03	1.31E-03
	Non-Forested	100	900	4.02E-02	3.75E-02	5.60E-03	8.90E-03	5.57E-03	1.06E-03
Helicopter	Forested	100	900	3.60E-03	3.72E-03	5.55E-04	2.00E-04	1.63E-04	2.92E-05
	Non-Forested	100	900	3.22E-02	3.07E-02	4.56E-03	5.60E-03	3.70E-03	6.83E-04
Ground	Low Boom	25	900	9.00E-03	1.25E-02	1.36E-03	1.20E-03	1.44E-04	3.80E-04
	High Boom	25	900	1.42E-02	2.19E-03	2.10E-02	1.50E-03	1.83E-04	5.02E-04

Effect of Downwind Distance

Mode of Application	Application Height or Vegetation Type	Minimum Buffer	Maximum Buffer	Concentration $_{900}$/ Concentration $_{25\ or\ 100}$			Relative Change in Concentration		
				Terrestrial	Stream	Pond	Terrestrial	Stream	Pond
Typical Application Rate									
Plane	Forested	100	900	0.1441	0.0864	0.1198	-	-	-
	Non-Forested	100	900	0.2431	0.1541	0.1998	-	-	-
Helicopter	Forested	100	900	0.0526	0.0392	0.0475	-	-	-
	Non-Forested	100	900	0.2568	0.1605	0.2096	-	-	-
Ground	Low Boom	25	900	0.1333	0.0115	0.2783	-	-	-
	High Boom	25	900	0.1127	0.0837	0.0239	-	-	-
Maximum Application Rate									
Plane	Forest	100	900	0.1574	0.0933	0.1294	-	-	-
	Non-Forested	100	900	0.2214	0.1483	0.1888	-	-	-
Helicopter	Forest	100	900	0.0556	0.0438	0.0525	-	-	-
	Non-Forested	100	900	0.1739	0.1202	0.1497	-	-	-
Ground	Low Boom	25	900	0.1333	0.0115	0.2785	-	-	-
	High Boom	25	900	0.1056	0.0837	0.0240	-	-	-

TABLE 5-5A (Cont.)

Herbicide Exposure Concentrations used During the Supplemental AgDRIFT® Sensitivity Analysis 2,4-D Applied to Annual and Perennial Terrestrial Vegetation

Effect of Application Height (Vegetation Type or Boom Height)

Mode of Application	Application Height or Vegetation Type	Concentration Ratio[1] Terrestrial	Concentration Ratio[1] Stream	Concentration Ratio[1] Pond	Relative Change in Concentration Terrestrial	Relative Change in Concentration Stream	Relative Change in Concentration Pond
Typical Application Rate							
Plane	Forest/ Non-Forest	1.9171	2.1257	1.9551	+	+	+
Helicopter	Forest/ Non-Forest	0.1284	0.1409	0.1386	-	-	-
Ground	High/Low Boom	1.5778	0.1750	15.3689	+	-	+
Maximum Application Rate							
Plane	Forest/ Non-Forest	1.7537	1.9702	1.8074	+	+	+
Helicopter	Forest/ Non-Forest	0.1118	0.1212	0.1217	-	-	-
Ground	High/Low Boom	1.5778	0.1749	15.3754	+	-	+

Effect of Mode of Application

	Concentration Ratio[2] Terrestrial	Concentration Ratio[2] Stream	Concentration Ratio[2] Pond	Relative Change in Concentration Terrestrial	Relative Change in Concentration Stream	Relative Change in Concentration Pond
Typical Application Rate						
Plane vs. Helicopter	1.2230	1.1942	1.1988	+	+	+
Plane vs. Ground	2.5493	15.7747	0.2443	+	+	-
Helicopter vs. Ground	2.0845	13.2094	0.2038	+	+	-
Maximum Application Rate						
Plane vs. Helicopter	1.2484	1.2215	1.2263	+	+	+
Plane vs. Ground	2.8310	17.1507	0.2670	+	+	-
Helicopter vs. Ground	2.2676	14.0412	0.2177	+	+	-

TABLE 5-5A (Cont.)

Herbicide Exposure Concentrations used During the Supplemental AgDRIFT® Sensitivity Analysis 2,4-D Applied to Annual and Perennial Terrestrial Vegetation

Effect of Application Rate

	Concentration Ratio[3]			Relative Change in Concentration		
	Terrestrial	Stream	Pond	Terrestrial	Stream	Pond
Maximum vs. Typical	2.0000	2.0000	2.0008	+	+	+

a.e./ac = active ingredient per acre.
ft – feet.
mg/L = milligrams per liter.
Concentration $_{900}$ / Concentration $_{25\ or\ 100}$ = Ratio of concentration at 900 ft to concentration at 25 or 100 ft.

[1] Using concentrations modeled at minimum distance from application area.

[2] Using concentrations modeled at minimum distance from application area and non-forest aerial or high boom ground applications.

[3] Using concentrations modeled at minimum distance from application area and high boom ground applications.

+ = Increase in concentration = increase in RQ = increase in ecological risk.
- = Decrease in concentration = decrease in RQ = decrease in ecological risk.

TABLE 5-5B

Herbicide Exposure Concentrations used During the Supplemental AgDRIFT® Sensitivity Analysis 2,4-D Applied to Woody Terrestrial Vegetation

Mode of Application	Application Height or Vegetation Type	Minimum Downwind Distance (ft)	Maximum Downwind Distance (ft)	Minimum Downwind Distance Concentration: Terrestrial (lbs. a.e./ac)	Minimum Downwind Distance Concentration: Stream (mg/L)	Minimum Downwind Distance Concentration: Pond (mg/L)	Maximum Downwind Distance Concentration: Terrestrial (lbs. a.e./ac)	Maximum Downwind Distance Concentration: Stream (mg/L)	Maximum Downwind Distance Concentration: Pond (mg/L)
Typical Application Rate									
Plane	Forested	100	900	7.05E-02	7.40E-02	1.01E-02	1.11E-02	6.90E-03	1.31E-03
	Non-Forested	100	900	4.02E-02	3.75E-02	5.60E-03	8.90E-03	5.57E-03	1.06E-03
Helicopter	Forested	100	900	3.60E-03	3.72E-03	5.55E-04	2.00E-04	1.63E-04	2.92E-05
	Non-Forested	100	900	3.22E-02	3.07E-02	4.56E-03	5.60E-03	3.70E-03	6.83E-04
Ground	Low Boom	25	900	9.00E-03	1.25E-02	1.36E-03	1.20E-03	3.80E-04	1.44E-04
	High Boom	25	900	1.42E-02	2.10E-02	2.19E-03	1.50E-03	5.02E-04	1.83E-04
Maximum Application Rate									
Plane	Forested	100	900	1.45E-01	1.50E-01	2.07E-02	2.47E-02	1.54E-02	2.91E-03
	Non-Forested	100	900	8.54E-02	7.91E-02	1.19E-02	1.14E-02	7.77E-03	1.40E-03
Helicopter	Forested	100	900	7.20E-03	7.95E-03	1.15E-03	4.00E-04	2.87E-04	5.02E-05
	Non-Forested	100	900	6.93E-02	6.52E-02	9.84E-03	5.20E-03	4.01E-03	6.76E-04
Ground	Low Boom	25	900	1.79E-02	2.50E-02	2.73E-03	2.40E-03	7.59E-04	2.89E-04
	High Boom	25	900	2.84E-02	4.19E-02	4.38E-03	3.10E-03	1.00E-03	3.66E-04

Effect of Downwind Distance

Mode of Application	Application Height or Vegetation Type	Minimum Buffer (ft)	Maximum Buffer (ft)	Concentration $_{900}$/ Concentration $_{25\ or\ 100}$: Terrestrial	Concentration $_{900}$/ Concentration $_{25\ or\ 100}$: Stream	Concentration $_{900}$/ Concentration $_{25\ or\ 100}$: Pond	Relative Change in Concentration: Terrestrial	Relative Change in Concentration: Stream	Relative Change in Concentration: Pond
Typical Application Rate									
Plane	Forested	100	900	0.1574	0.0933	0.1294	-	-	-
	Non-Forested	100	900	0.2214	0.1483	0.1888	-	-	-
Helicopter	Forested	100	900	0.0556	0.0438	0.0525	-	-	-
	Non-Forested	100	900	0.1739	0.1202	0.1497	-	-	-
Ground	Low Boom	25	900	0.1333	0.0303	0.1058	-	-	-
	High Boom	25	900	0.1056	0.0240	0.0837	-	-	-
Maximum Application Rate									
Plane	Forest	100	900	0.1701	0.1026	0.1410	-	-	-
	Non-Forested	100	900	0.1335	0.0982	0.1176	-	-	-
Helicopter	Forest	100	900	0.0556	0.0361	0.0438	-	-	-
	Non-Forested	100	900	0.0750	0.0615	0.0687	-	-	-
Ground	Low Boom	25	900	0.1341	0.0303	0.1058	-	-	-
	High Boom	25	900	0.1092	0.0240	0.0837	-	-	-
	High Boom	25	900	0.1056	0.0837	0.0240	-	-	-

TABLE 5-5B (Cont.)

Herbicide Exposure Concentrations used During the Supplemental AgDRIFT® Sensitivity Analysis
2,4-D Applied to Woody Terrestrial Vegetation

Effect of Application Height (Vegetation Type or Boom Height)

Mode of Application	Application Height or Vegetation Type	Concentration Ratio[1]			Relative Change in Concentration		
		Terrestrial	Stream	Pond	Terrestrial	Stream	Pond
Typical Application Rate							
Plane	Forest/ Non-Forest	1.7537	1.9702	1.8074	+	+	+
Helicopter	Forest/ Non-Forest	0.1118	0.1212	0.1217	-	-	-
Ground	High/Low Boom	1.5778	1.6748	1.6059	+	+	+
Maximum Application Rate							
Plane	Forest/ Non-Forest	1.7002	1.8935	1.7342	+	+	+
Helicopter	Forest/ Non-Forest	0.1039	0.1219	0.1164	-	-	-
Ground	High/Low Boom	1.5866	1.6748	1.6059	+	+	+

Effect of Mode of Application

	Concentration Ratio[2]			Relative Change in Concentration		
	Terrestrial	Stream	Pond	Terrestrial	Stream	Pond
Typical Application Rate						
Plane vs. Helicopter	1.2484	1.2215	1.2263	+	+	+
Plane vs. Ground	2.8310	1.7913	2.5562	+	+	+
Helicopter vs. Ground	2.2676	1.4665	2.0844	+	+	+
Maximum Application Rate						
Plane vs. Helicopter	1.2323	1.2132	1.2110	+	+	+
Plane vs. Ground	3.0070	1.8868	2.7215	+	+	+
Helicopter vs. Ground	2.4401	1.5553	2.2474	+	+	+

TABLE 5-5B (Cont.)

Herbicide Exposure Concentrations used During the Supplemental AgDRIFT® Sensitivity Analysis 2,4-D Applied to Woody Terrestrial Vegetation

Effect of Application Rate

	Concentration Ratio[3]			Relative Change in Concentration		
	Terrestrial	Stream	Pond	Terrestrial	Stream	Pond
Maximum vs. Typical	2.0000	2.0000	2.0000	+	+	+

a.e./ac = active ingredient per acre.
ft – feet.
mg/L = milligrams per liter.
Concentration $_{900}$ / Concentration $_{25\ or\ 100}$ = Ratio of concentration at 900 ft to concentration at 25 or 100 ft.
[1] Using concentrations modeled at minimum distance from application area.
[2] Using concentrations modeled at minimum distance from application area and non-forest aerial or high boom ground applications.
[3] Using concentrations modeled at minimum distance from application area and high boom ground applications.
+ = Increase in concentration = increase in RQ = increase in ecological risk.
- = Decrease in concentration = decrease in RQ = decrease in ecological risk.

TABLE 5-5C

Herbicide Exposure Concentrations used During the Supplemental AgDRIFT® Sensitivity Analysis 2,4-D Applied to Floating and Emerged Aquatic Vegetation

Mode of Application	Application Height or Vegetation Type	Minimum Downwind Distance (ft)	Maximum Downwind Distance (ft)	Minimum Downwind Distance Concentration			Maximum Downwind Distance Concentration		
				Terrestrial (lbs. a.e./ac)	Stream (mg/L)	Pond (mg/L)	Terrestrial (lbs. a.e./ac)	Stream (mg/L)	Pond (mg/L)
Typical Application Rate									
Plane	Forested	100	900	NA	NA	NA	NA	NA	NA
	Non-Forested	100	900	4.02E-02	3.75E-02	5.60E-03	8.90E-03	5.57E-03	1.06E-03
Helicopter	Forested	100	900	NA	NA	NA	NA	NA	NA
	Non-Forested	100	900	3.22E-02	3.07E-02	4.56E-03	5.60E-03	3.70E-03	6.83E-04
Ground	Low Boom	25	900	9.00E-03	1.25E-02	1.36E-03	1.20E-03	3.80E-04	1.44E-04
	High Boom	25	900	1.42E-02	2.10E-02	2.19E-03	1.50E-03	5.02E-04	1.83E-04
Maximum Application Rate									
Plane	Forested	100	900	NA	NA	NA	NA	NA	NA
	Non-Forested	100	900	8.54E-02	7.91E-02	1.19E-02	1.14E-02	7.77E-03	1.40E-03
Helicopter	Forested	100	900	NA	NA	NA	NA	NA	NA
	Non-Forested	100	900	6.93E-02	6.52E-02	9.84E-03	5.20E-03	4.01E-03	6.76E-04
Ground	Low Boom	25	900	1.79E-02	2.50E-02	2.73E-03	2.40E-03	7.59E-04	2.89E-04
	High Boom	25	900	2.84E-02	4.19E-02	4.38E-03	3.10E-03	1.00E-03	3.66E-04

Effect of Downwind Distance

Mode of Application	Application Height or Vegetation Type	Minimum Buffer (ft)	Maximum Buffer (ft)	Concentration $_{900}$/ Concentration $_{25\ or\ 100}$			Relative Change in Concentration		
				Terrestrial	Stream	Pond	Terrestrial	Stream	Pond
Typical Application Rate									
Plane	Forested	100	900	NA	NA	NA	NA	NA	NA
	Non-Forested	100	900	0.2214	0.1483	0.1888	-	-	-
Helicopter	Forested	100	900	NA	NA	NA	NA	NA	NA
	Non-Forested	100	900	0.1739	0.1202	0.1497	-	-	-
Ground	Low Boom	25	900	0.1333	0.0303	0.1058	-	-	-
	High Boom	25	900	0.1056	0.0240	0.0837	-	-	-
Maximum Application Rate									
Plane	Forest	100	900	NA	NA	NA	NA	NA	NA
	Non-Forested	100	900	0.1335	0.0982	0.1176	-	-	-
Helicopter	Forest	100	900	NA	NA	NA	NA	NA	NA
	Non-Forested	100	900	0.0750	0.0615	0.0687	-	-	-
Ground	Low Boom	25	900	0.1341	0.0303	0.1058	-	-	-
	High Boom	25	900	0.1092	0.0240	0.0837	-	-	-
	High Boom	25	900	0.1056	0.0837	0.0240	-	-	-

TABLE 5-5C (Cont.)

Herbicide Exposure Concentrations used During the Supplemental AgDRIFT® Sensitivity Analysis 2,4-D Applied to Floating and Emerged Aquatic Vegetation

Effect of Application Height (Vegetation Type or Boom Height)

Mode of Application	Application Height or Vegetation Type	Concentration Ratio[1]			Relative Change in Concentration		
		Terrestrial	Stream	Pond	Terrestrial	Stream	Pond
Typical Application Rate							
Plane	Forest/ Non-Forest	NA	NA	NA	NA	NA	NA
Helicopter	Forest/ Non-Forest	NA	NA	NA	NA	NA	NA
Ground	High/Low Boom	1.5778	1.6748	1.6059	+	+	+
Maximum Application Rate							
Plane	Forest/ Non-Forest	NA	NA	NA	NA	NA	NA
Helicopter	Forest/ Non-Forest	NA	NA	NA	NA	NA	NA
Ground	High/Low Boom	1.5866	1.6748	1.6059	+	+	+

Effect of Mode of Application

	Concentration Ratio[2]			Relative Change in Concentration		
	Terrestrial	Stream	Pond	Terrestrial	Stream	Pond
Typical Application Rate						
Plane vs. Helicopter	1.2484	1.2215	1.2263	+	+	+
Plane vs. Ground	2.8310	1.7913	2.5562	+	+	+
Helicopter vs. Ground	2.2676	1.4665	2.0844	+	+	+
Maximum Application Rate						
Plane vs. Helicopter	1.2323	1.2132	1.2110	+	+	+
Plane vs. Ground	3.0070	1.8868	2.7215	+	+	+
Helicopter vs. Ground	2.4401	1.5553	2.2474	+	+	+

TABLE 5-5C (Cont.)

Herbicide Exposure Concentrations used During the Supplemental AgDRIFT® Sensitivity Analysis
2,4-D Applied to Floating and Emerged Aquatic Vegetation

Effect of Application Rate

	Concentration Ratio[3]			Relative Change in Concentration		
	Terrestrial	**Stream**	**Pond**	**Terrestrial**	**Stream**	**Pond**
Maximum vs. Typical	2.0000	2.0000	2.0000	+	+	+

a.e./ac = active ingredient per acre.
ft – feet.
mg/L = milligrams per liter.
Concentration $_{900}$ / Concentration $_{25 \text{ or } 100}$ = Ratio of concentration at 900 ft to concentration at 25 or 100 ft.
[1] Using concentrations modeled at minimum distance from application area.
[2] Using concentrations modeled at minimum distance from application area and non-forest aerial or high boom ground applications.
[3] Using concentrations modeled at minimum distance from application area and high boom ground applications.
+ = Increase in concentration = increase in RQ = increase in ecological risk.
- = Decrease in concentration = decrease in RQ = decrease in ecological risk

Table 5-5D

Herbicide Exposure Concentrations used During the Supplemental AgDRIFT® Sensitivity Analysis 2,4-D Applied to Submerged Aquatic Vegetation

Mode of Application	Application Height/Veg. Type	Minimum Downwind Distance (ft)	Maximum Downwind Distance (ft)	Minimum Downwind Distance Concentration			Maximum Downwind Distance Concentration		
				Terrestrial (lbs. a.e./ac)	Stream (mg/L)	Pond (mg/L)	Terrestrial (lbs. a.e./ac)	Stream (mg/L)	Pond (mg/L)
Typical Application Rate									
Plane	Forested	100	900	NA	NA	NA	NA	NA	NA
	Non-Forested	100	900	1.15E-01	1.08E-01	1.62E-02	1.14E-02	7.87E-03	1.42E-03
Helicopter	Forested	100	900	NA	NA	NA	NA	NA	NA
	Non-Forested	100	900	9.35E-02	8.96E-02	1.34E-02	4.50E-03	3.61E-03	6.01E-04
Ground	Low Boom	25	900	2.42E-02	3.38E-02	3.68E-03	3.30E-03	1.02E-03	3.90E-04
	High Boom	25	900	3.83E-02	5.66E-02	5.91E-03	4.20E-03	1.35E-03	4.95E-04
Maximum Application Rate									
Plane	Forested	100	900	NA	NA	NA	NA	NA	NA
	Non-Forested	100	900	2.18E-01	2.14E-01	3.15E-02	1.36E-02	9.39E-03	1.68E-03
Helicopter	Forested	100	900	NA	NA	NA	NA	NA	NA
	Non-Forested	100	900	1.72E-01	1.77E-01	2.59E-02	3.50E-03	2.44E-03	4.38E-04
Ground	Low Boom	25	900	4.85E-02	6.76E-02	7.36E-03	6.60E-03	2.05E-03	7.79E-04
	High Boom	25	900	7.66E-02	1.13E-01	1.18E-02	8.30E-03	2.71E-03	9.89E-04

Effect of Downwind Distance

Mode of Application	Application Height or Vegetation Type	Minimum Buffer (ft)	Maximum Buffer (ft)	Concentration $_{900}$/ Concentration $_{25\text{ or }100}$			Relative Change in Concentration		
				Terrestrial	Stream	Pond	Terrestrial	Stream	Pond
Typical Application Rate									
Plane	Forested	100	900	NA	NA	NA	NA	NA	NA
	Non-Forested	100	900	0.0990	0.0728	0.0875	-	-	-
Helicopter	Forested	100	900	NA	NA	NA	NA	NA	NA
	Non-Forested	100	900	0.0481	0.0403	0.0448	-	-	-
Ground	Low Boom	25	900	0.1364	0.0303	0.1058	-	-	-
	High Boom	25	900	0.1097	0.0239	0.0837	-	-	-
Maximum Application Rate									
Plane	Forest	100	900	NA	NA	NA	NA	NA	NA
	Non-Forested	100	900	0.0624	0.0440	0.0535	-	-	-
Helicopter	Forest	100	900	NA	NA	NA	NA	NA	NA
	Non-Forested	100	900	0.0204	0.0138	0.0169	-	-	-
Ground	Low Boom	25	900	0.1361	0.0303	0.1058	-	-	-
	High Boom	25	900	0.1084	0.0239	0.0837	-	-	-

TABLE 5-5D (Cont.)

Herbicide Exposure Concentrations used during the Supplemental AgDRIFT® Sensitivity Analysis
2,4-D Applied to Submerged Aquatic Vegetation

Effect of Application Height (Vegetation Type or Boom Height)

Mode of Application	Application Height or Vegetation Type	Concentration Ratio[1]			Relative Change in Concentration		
		Terrestrial	Stream	Pond	Terrestrial	Stream	Pond
Typical Application Rate							
Plane	Forest/ Non-Forest	NA	NA	NA	NA	NA	NA
Helicopter	Forest/ Non-Forest	NA	NA	NA	NA	NA	NA
Ground	High/Low Boom	1.5826	1.6749	1.6059	+	+	+
Maximum Application Rate							
Plane	Forest/ Non-Forest	NA	NA	NA	NA	NA	NA
Helicopter	Forest/ Non-Forest	NA	NA	NA	NA	NA	NA
Ground	High/Low Boom	1.5794	1.6749	1.6059	+	+	+

Effect of Mode of Application

	Concentration Ratio[2]			Relative Change in Concentration		
	Terrestrial	Stream	Pond	Terrestrial	Stream	Pond
Typical Application Rate						
Plane vs. Helicopter	1.2321	1.2060	1.2049	+	+	+
Plane vs. Ground	3.0078	1.9102	2.7393	+	+	+
Helicopter vs. Ground	2.4413	1.5839	2.2735	+	+	+
Maximum Application Rate						
Plane vs. Helicopter	1.2695	1.2092	1.2182	+	+	+
Plane vs. Ground	2.8473	1.8869	2.6642	+	+	+
Helicopter vs. Ground	2.2428	1.5605	2.1870	+	+	+

TABLE 5-5D (Cont.)

Herbicide Exposure Concentrations used during the Supplemental AgDRIFT® Sensitivity Analysis 2,4-D Applied to Submerged Aquatic Vegetation

Effect of Application Rate

	Concentration Ratio[3]			Relative Change in Concentration		
	Terrestrial	**Stream**	**Pond**	**Terrestrial**	**Stream**	**Pond**
Maximum vs. Typical	2.0000	2.0000	2.0000	+	+	+

a.e./ac = active ingredient per acre.
ft – feet.
mg/L = milligrams per liter.
Concentration $_{900}$ / Concentration $_{25\ or\ 100}$ = Ratio of concentration at 900 ft to concentration at 25 or 100 ft.
[1] Using concentrations modeled at minimum distance from application area.
[2] Using concentrations modeled at minimum distance from application area and non-forest aerial or high boom ground applications.
[3] Using concentrations modeled at minimum distance from application area and high boom ground applications.
+ = Increase in concentration = increase in RQ = increase in ecological risk.
- = Decrease in concentration = decrease in RQ = decrease in ecological risk.

6.0 RARE, THREATENED, AND ENDANGERED SPECIES

Rare, threatened, and endangered species have the potential to be impacted by BLM herbicide applications. Screening level ERAs utilize surrogate species and generic assessment endpoints to evaluate potential risk, rather than examining site- and species-specific effects to individual RTE species. Several factors complicate our ability to evaluate site- and species-specific effects:

- Toxicological data specific to the species (and sometimes even class) of organism are often absent from the literature.
- The other assumptions involved in the ERA (e.g., rate of food consumption, surface-to-volume ratio) may differ for RTE species relative to selected surrogates and/or data for RTE species may be unavailable.
- The high level of protection afforded RTE species suggests that secondary effects (e.g., potential loss of prey or cover), as well as site-specific circumstances that might result in higher rates of exposure, should receive more attention.

A common response to these issues is to design screening level ERAs, including this one, to be highly conservative. Such a design includes assumptions such as 100% exposure to an herbicide by simulating scenarios where the organism lives year-round in the most affected area (i.e., area of highest concentration), or in which the organism consumes only food items that have been impacted by the herbicide. Other conservative assumptions are incorporated into the herbicide concentration models such as GLEAMS (Appendix B; ENSR 2004). Even with these highly conservative assumptions, however, determining potential risk to specific RTE species may still raise concerns.

To help address these potential concerns, the following section will discuss the ERA assumptions as they relate to the protection of RTE species. The goals of this discussion are as follows:

- Present the methods the ERA employs to account for risks to RTE species and the reasons for their selection.
- Define the factors that might motivate a site- and/or species-specific evaluation[7] of potential herbicide impacts to RTE species and provide perspective useful for such an evaluation.
- Present information that can be used to assess uncertainty in the ERA's conclusions about risks to RTE species.

The following sections describe information used in the ERA to provide protection to RTE species, including mammals, birds, reptiles, amphibians, fish (e.g., salmonids), and plants potentially occurring on BLM-administered lands. It includes a discussion of the quantitative and qualitative factors used to provide additional protection to RTE species and a discussion of potential secondary effects of herbicide use on RTE species.

Section 6.1 provides a review of the selection of LOCs and TRVs to provide additional protection to RTE species. Section 6.2 provides a discussion of species-specific traits and how they relate to the RTE protection strategy in this ERA. Section 6.2 also includes a discussion of the selection of surrogate species (see Section 6.2.1), the RTE taxa of concern, and the surrogates used to represent them (Section 6.2.2), and the biological factors that affect the exposure and response of organisms to herbicides (Section 6.2.3). This discussion includes information about how the ERA

[7] Such an evaluation might include site-specific estimation of exposure point concentrations using one or more models, more focused consideration of potential risk to individual RTE species; and/or more detailed assessment of indirect effects to RTE species, such as those resulting from impacts to habitat.

was defined to assure that consideration of these factors resulted in a conservative assessment. Mechanisms for extrapolating toxicity data from one taxon to another are briefly reviewed in Section 6.3. The potential for impacts, both direct and secondary, to salmonids is discussed in Section 6.4, while conclusions are presented in Section 6.5.

6.1 Use of LOCs and TRVs to Provide Protection

Potential direct impacts to receptors, including RTE species, are the measures of effect typically used in screening level ERAs. Direct impacts, such as those resulting from direct or indirect contact or ingestion, were assessed in the 2,4-D ERA by comparing calculated RQs to receptor-specific LOCs. As described in the methodology document for this ERA (ENSR 2004), RQs are calculated as the potential dose or EEC divided by the TRV selected for that pathway. Having a RQ greater than the LOC indicates the potential for risk to that receptor group via that exposure pathway. As described below, the selection of TRVs and the use of LOCs were pursued in a conservative fashion in order to provide a greater level of protection for RTE species.

The LOCs used in the ERA (Table 4-1) were developed by the USEPA for the assessment of pesticides (LOC information obtained from Michael Davy, USEPA OPP on June 13, 2002). In essence, the LOCs act as uncertainty factors often applied to TRVs. For example, using an LOC of 1.0 provides the same result as dividing the TRV by 10. The LOC for avian and mammalian RTE species is 0.1 for acute and chronic exposures. For RTE fish and aquatic invertebrates, acute and chronic LOCs were 0.05 and 0.5, respectively. Therefore, up to a 20-fold uncertainty factor has been included in the TRVs for animal species. As noted below, such uncertainty factors provide a greater level of protection to the RTE species to account for the factors listed in the introduction to this section.

For RTE plants, the exposure concentration, TRVs, and LOCs provided a direct assessment of potential impacts. For all exposure scenarios, the maximum modeled concentrations were used as the exposure concentrations. The TRVs used for RTE plants were selected based on highly sensitive endpoints, such as germination, rather than direct mortality of seedlings or larger plants. Conservatism was built into the TRVs during their development (Section 3.1); the lowest suitable endpoint concentration available was used as the TRV for RTE plant species. Given the conservative nature of the RQ, and consistent with USEPA policy, no additional levels of protection were required for the LOC (i.e., all plant LOCs are 1).

6.2 Use of Species Traits to Provide Protection to RTE Species

Over 500 RTE species currently listed under the federal Endangered Species Act have the potential to occur in the 17 states covered under this Programmatic ERA. Some marine mammals are included in the list of RTE species, but given the low likelihood that these species would be exposed to herbicides applied to BLM-administered lands, no surrogates specific to marine species are included in this ERA. However, the terrestrial mammalian surrogate species identified for use in the ERA include species that can be considered representative of these marine species as well. The complete list is presented in Appendix D.

Of the over 500 species potentially occurring in the 17 states, just over 300 species may occur on lands administered by the BLM. Protection of these species is an integral goal of the BLM, and they are the focus of the RTE evaluation for the ERA and EIS. These species are different from one another in regards to home range, foraging strategy, trophic level, metabolic rate, and other species-specific traits. Several methods were used in the ERA to take these differences into account during the quantification of potential risk. Despite this precaution, these traits are reviewed in order to provide a basis for potential site- and species-specific risk assessment. Review of these factors provides a supplement to other sections of the ERA that discuss the uncertainty in the conclusions specific to RTE species.

6.2.1 Identification of Surrogate Species

Use of surrogate species in a screening ERA is necessary to address the broad range of species likely to be encountered on BLM-administered lands as well as to accommodate the fact that toxicity data may be restricted to a limited number of species. In this ERA, surrogates were selected to account for variation in the nature of potential herbicide exposure (e.g., direct contact, food chain) as well as to ensure that different taxa, and their behaviors, are considered. As described in Section 3.0 of the Methods Document (ENSR 2004), surrogate species were selected to represent a broad range of taxa in several trophic guilds that potentially could be impacted by herbicides on BLM-administered lands. Generally, the surrogate species that were used in the ERA are species commonly used as representative species in ecological risk assessment. Many of these species are common laboratory species, or are described in the USEPA's (1993) *Exposure Factors Handbook for Wildlife*. Other species were included in the *California Wildlife Biology*, *Exposure Factor, and Toxicity Database* (California Office of Environmental Health Hazard Assessment and University of California at Davis 2003[8]), or are those recommended by USEPA OPP for tests to support pesticide registration. Surrogate species were used to derive TRVs, and in exposure scenarios that involve organism size, weight, or diet. Surrogate species were exposed to the herbicide in the models to represent potential impact to other species that may be present on BLM-administered lands.

Toxicity data from surrogate species were used in the development of TRVs because few, if any, data are available that demonstrate the toxicity of chemicals to RTE species. Most reliable toxicity tests are performed under controlled conditions in a laboratory, using standardized test species and protocols; RTE species are not used in laboratory toxicity testing In addition, field-generated data, which are very limited in number but may include anecdotal information about RTE species, are not as reliable as laboratory data because uncontrolled factors may complicate the results of the tests (e.g., secondary stressors such as unmeasured toxicants, imperfect information on rate of exposure).

As described below, inter-species extrapolation of toxicity data often produces unknown bias in risk calculations. This ERA approached the evaluation of higher trophic level species by life history (e.g., large animals vs. small animals, herbivore vs. carnivores). Then surrogate species were used to evaluate all species of similar life history potentially found on BLM-administered lands, including RTE species. This procedure was not done for plants, invertebrates, and fish, as most exposure of these species to herbicides is via direct contact (e.g., foliar deposition, dermal deposition, dermal/gill uptake) rather than ingestion of contaminated food items. Therefore, altering the life history of these species would not result in more or less exposure.

The following subsections describe the selection of surrogate species used in two separate contexts in the ERA for the development of TRVs and to represent all potentially exposed receptors on a generic level.

6.2.1.1 Species Selected in Development of TRVs

As presented in Appendix B of the ERA, a limited numbers of species are used for toxicity testing of chemicals, including herbicides. Species are typically selected because they tolerate laboratory conditions well. The species used in laboratory tests have relatively well-known response thresholds to a variety of chemicals. Growth rates, ingestion rates, and other species-specific parameters are known; therefore, test duration and endpoints of concern (e.g., mortality, germination) have been established in protocols for many of these laboratory species. Data generated during a toxicity test, therefore, can be compared to data from other tests and relative species sensitivity can be compared. Of course, in the case of RTE species, it would be unacceptable to subject individuals to toxicity tests.

The TRVs used in the ERA were selected after reviewing available ecotoxicological literature for 2,4-D. Test quality was evaluated, and tests with multiple substances were not considered for the TRV. For most receptor groups, the lowest value available for an appropriate endpoint (e.g., mortality, germination) was selected as the TRV. Using the most sensitive species provides a conservative level of protection for all species. The surrogate species used in the 2,4-D TRVs are presented in Table 6-1.

6.2.1.2 Species Selected as Surrogates in the ERA

Plants, fish, insects, and aquatic invertebrates were evaluated on a generic level. That is, the surrogate species evaluated to create the TRVs were selected to represent all potentially exposed species. For vertebrate terrestrial

[8] On-line http://www.oehha.org/cal_ecotox/default.htm

animals, in addition to these surrogate species, specific species were selected as surrogates to represent the populations of similar species. The species used in the ERA are presented in Table 6-2.

The surrogate terrestrial vertebrate species selected for the ERA include species from several trophic levels that represent a variety of foraging strategies. The species used in the ERA are presented in Table 6-2. Whenever possible, the species selected are found throughout the extent of land administered by the BLM; all species selected are found in at least a portion of this area. The surrogate species are common species whose life histories are well documented (USEPA 1993, California Office of Environmental Health Hazard Assessment and University of California at Davis 2003). Because species-specific data, including body weight and food ingestion rates, can vary for a single species throughout its range, data from studies conducted in western states or with western populations were selected preferentially. As necessary, site-specific data can be used to estimate potential risk to species known to occur locally.

6.2.2 Surrogates Specific to Taxa of Concern

Protection levels for different species and individuals vary. Some organisms are protected on a community level; that is, slight risk to individual species may be acceptable if the community of organisms (e.g., wildflowers, terrestrial insects) is protected. Generally, community level organisms include plants and invertebrates. Other organisms are protected on a population level; that is, slight risk to individuals of a species may be acceptable if the population, as a whole, is not endangered. However, RTE species are protected as individuals; that is, risk to any single organism is considered unacceptable. This higher level of protection motivates much of the conservative approach taken in this ERA. Surrogate species were grouped by general life strategy: sessile (i.e., plants), water dwelling (i.e., fish), and mobile terrestrial vertebrates (i.e., birds and mammals). The approach to account for RTE species was divided along the same lines.

Plants, fish, insects, and aquatic invertebrates were assessed using TRVs developed from surrogate species. All species from these taxa (identified in Appendix F) were represented by the surrogate species presented in Table 6-1. The evaluation of terrestrial vertebrates used surrogate species to develop TRVs and to estimate potential risk using simple food chain models. Tables 6-3 and 6-4 present the listed birds and mammals found on BLM-administered lands and their appropriate surrogate species.

Very few laboratory studies have been conducted using reptiles or amphibians. Therefore, data specific to the adverse effects of a chemical species of these taxa are often unavailable. These animals, being cold-blooded, have very different rates of metabolism than mammals or birds (i.e., they require lower rates of food consumption). Nonetheless, mammals and birds were used as the surrogate species for reptiles and adult amphibians because of the lack of data for these taxa. Fish were used as surrogates for juvenile amphibians. For each trophic level of RTE reptile or adult amphibian, a comparable mammal or bird was selected to represent the potential risks. Table 6-5 presents the federally listed reptiles found on BLM-administered lands and the surrogate species chosen to represent them in the ERA. Table 6-6 presents the federally listed amphibians found on BLM-administered lands and their surrogate species.

The sensitivity of reptiles and amphibians relative to other species is generally unknown. Some information about reptilian exposures to pesticides, including herbicides, is available. The following provides a brief summary of the data (see Sparling et al. 2000), including data for pesticides not evaluated in this ERA:

- Mountain garter snakes (*Thamnophis elegans elegans*) were exposed to the herbicide thiobencarb in the field and in the laboratory. No effects were noted in the snakes fed contaminated prey or in those caged and exposed directly to treated areas.

- No adverse effects to turtles were noted in a pond treated twice with the herbicide Kuron (2,4,5-T).

- Tortoises in Greece were exposed in the field to atrazine, paraquat, Kuron, and 2,4-D. No effects were noted in the tortoises exposed to atrazine or paraquat. In areas treated with Kuron and 2,4-D, no tortoises were noted following the treatment. The authors of the study concluded it was a combination of direct toxicity (tortoises were noted with swollen eyes and nasal discharge) and loss of habitat (much of the vegetation killed during the treatment had provided important ground cover for the tortoises).

- Reptilian LD_{50} values from six organochlorine pesticides were compared to avian LD_{50} values. Of the six pesticides, five lizard LD_{50}s were higher, indicating lower sensitivity. Overlapping data were available for turtle exposure to one organochlorine pesticide; the turtle was less sensitive than the birds or lizards.

- In general, reptiles were found to be less sensitive than birds to cholinesterase inhibitors.

Unfortunately, these observations do not provide any sort of rigorous review of dose and response. On the other hand, there is little evidence that reptiles are more sensitive to pesticides than other, more commonly tested organisms.

As with reptiles, some toxicity data are available describing the effects of herbicides on amphibians. The following provides a brief summary of the data (see Sparling et al. 2000):

- Leopard frog tadpoles exposed to up to 0.075 mg/L atrazine showed no adverse effects.

- In a field study, it was noted that frog eggs in a pond where atrazine was sprayed nearby suffered 100% mortality.

- Common frog (*Rana temporaria)* tadpoles showed behavioral and growth effects when exposed to 0.2 to 20 mg/L cyanatryn.

- Caged common frog and common toad (*Bufo bufo)* tadpoles showed no adverse effects when exposed to 1.0 mg/L diquat or 1.0 mg/L dichlobenil.

- All leopard frog eggs exposed to 2.0 to 10 mg/L diquat or 0.5 to 2.0 mg/L paraquat hatched normally, but showed adverse developmental effects. It was noted that commercial formulations of paraquat were more acutely toxic than technical grade paraquat. Tadpoles, however, showed significant mortality when fed paraquat-treated parrot feather watermilfoil (*Myriophyllum*).

- 4-chloro-2-methylphenoaxyacetic acid is relatively non-toxic to the African clawed frog (*Xenopus laevis)* with an LC_{50} of 3,602 mg/L and slight growth retardation at 2,000 mg/L.

- Approximately 86% of juvenile toads died when exposed to monosodium methanearsonate (ANSAR 259® HC) at 12.5% of the recommended application rate.

- Embryo hatch success, tadpole mortality, growth, paralysis, and avoidance behavior were studied in three species of ranid frogs (*Rana* sp.) exposed to hexazinone and triclopyr. No effects were noted in hexazinone exposure up to 100 mg/L. Two species showed 100% mortality at 2.4 mg/L triclopyr; no significant mortality was observed in the third species.

The acute and chronic TRVs for both acid/salts and ester formulations identified for amphibians (Section 3.1.3.2), are higher than the respective TRVs selected for fish (Table 3-1). Therefore, the fish exposure scenarios included in the ERA are protective of amphibians as well. Amphibians are particularly vulnerable to changes in their environment (chemical and physical) because they have skin with high permeability, making them at risk for adverse effects from dermal contact, and have complex life cycles, making them vulnerable to developmental defects during the many stages of metamorphosis. Although the model predicted very low risks to most animals under most exposure scenarios, the effects of regular usage of 2,4-D are uncertain. It should be noted that certain amphibians can be sensitive to pesticides, and site- and species-specific risk assessment should be carefully considered in the event that amphibian RTE species are present near a site of application.

Although the uncertainties associated with the potential risk to RTE mammals, birds, reptiles, and amphibians are valid, the vertebrate RQs generated in the ERA for 2,4-D are generally low (Section 4.3). Of the scenarios in which birds and mammals were evaluated, the highest RQs were calculated for chronic exposure of large mammalian herbivores ingesting food contaminated by direct spray at the maximum application rate (maximum RQ of 5.67). Approximately half of the terrestrial animal RQs are lower than the respective LOCs by several orders of magnitude.

6.2.3 Biological Factors Affecting Impact from Herbicide Exposure

The potential for ecological receptors to be exposed to, and affected by an herbicide is dependent upon many factors. Many of these factors are independent of the biology or life history of the receptor (e.g., timing of herbicide use, distance to receptor). These factors were explored in the ERA by simulating scenarios that vary these factors (ENSR 2004); these scenarios are discussed in Section 5.0 of this document. However, differences in life history among and between receptors also influence the potential for exposure. Therefore, individual species have a different potential for exposure as well as response. In order to provide perspective on the assumptions made here, as well as the potential need to evaluate alternatives, receptor traits that may influence species-specific exposure and response were examined. These traits are presented and discussed in Table 6-7.

In addition to providing a review of the approach used in the ERA, the factors listed in Table 6-7 can be evaluated to assess whether a site- and species-specific ERA should be considered to address potential risks to a given RTE species. They also provide perspective on the uncertainty associated with applying the conclusions of the ERA to a broad range of RTE species.

6.3 Review of Extrapolation Methods Used to Calculate Potential Exposure and Risk

Ecological risk assessment relies on extrapolation of observations from one system (e.g., species, toxicity endpoint) to another (see Table 6-7). While every effort has been made to anticipate bias in these extrapolations and to use them to provide an overestimate of risk, it is worth evaluating alternative approaches.

Toxicity Extrapolations in Terrestrial Systems (Fairbrother and Kapustka 1996) is an opinion paper that describes the difficulties associated with trying to quantitatively evaluate a particular species when toxicity data for that species, and/or for the endpoint of concern, are not available. The authors provide an overview of uncertainty factors and methods of data extrapolation used in terrestrial organism TRV development, and suggest an alternative approach to establishing inter-species TRVs. The following subsections summarize their findings for relevant methods of extrapolation.

6.3.1 Uncertainty Factors

Uncertainty factors are used often in both human health and ecological risk assessment. The uncertainty factor most commonly used in ERA is 10. This value has little empirical basis, but was developed and adopted by the risk assessment community because it seemed conservative and was "simple to use."[9] Six situations in which uncertainty factors may be applied in ecotoxicology were identified: 1) accounting for intraspecific heterogeneity, 2) supporting interspecific extrapolation, 3) converting acute to chronic endpoints and vice versa, 4) estimating LOAEL from NOAEL, 5) supplementing professional judgment, and 6) extrapolating laboratory data to field conditions. No extrapolation of toxicity data among Classes (i.e., among birds, mammals, and reptiles) was discussed. The methods to extrapolate available laboratory toxicity data to suit the requirements of the TRVs in this ERA are discussed in Section 3. For this reason, extrapolation used to develop TRVs is not discussed in this section.

Empirical data for each of the situations discussed in the Fairbrother and Kapustka paper (1996; as applicable) are presented in Tables 6-8 through 6-12. In each of these tables, the authors have presented the percentage of the

[9] Section 2, Fairbrother and Kaputska (1996:7).

available data that is included within a stated factor. For example, 90% of the observed LD_{50}s for bird species lie within a factor of ten (i.e., the highest LD_{50} within the central 90% of the population is 10-fold higher than the lowest value). This approach can be compared to the approach used in this ERA. For example, for aquatic invertebrates, an LOC of 0.05 was defined, which is analogous to application of an uncertainty factor 20 to the relevant TRV. In this case, the selected TRV is not the highest or the mid-point of the available values, but a value at the lower end of the available range. Thus, dividing the TRV by a factor of 20 is very likely to place it well below any observed TRV. With this perspective, the ranges (or uncertainty factors) provided by Fairbrother and Kapustka (1996) generally appear to support the approach used in the ERA (i.e., select low TRVs and consider comparison to an LOC < 1.0).

6.3.2 Allometric Scaling

Allometric scaling provides a formula based on body weight that allows translation of doses from one animal species to another. In this ERA, allometric scaling was used to extrapolate the terrestrial vertebrate TRVs from the laboratory species to the surrogate species used to estimate potential risk. The Environmental Sciences Division of the Oak Ridge National Laboratory (Opresko et al. 1994, Sample et al. 1996) has used allometric scaling for many years to establish benchmarks for vertebrate wildlife. The USEPA has also used allometric scaling in the development of wildlife water quality criteria in the Great Lakes Water Quality Initiative and in the development of ecological soil screening levels (USEPA 2000).

The theory behind allometric scaling is that metabolic rate is proportional to body size.[10] However, assumptions are made that toxicological processes are dependent on metabolic rate, and that toxins are equally bioavailable among species. Similar to other types of extrapolation, allometric scaling is sensitive to the species used in the toxicity test selected to develop the TRV. Given the limited amount of data, using the lowest value available for the most sensitive species is generally the best approach; however, it is still possible that site-specific receptors would be more sensitive to the toxin. Further uncertainty is introduced to allometric scaling when the species-specific parameters (e.g., body weight, ingestion rate) are selected. Interspecies variation of these parameters can be considerable, especially among geographic regions. Allometric scaling is not applicable between classes of organisms (i.e., bird to mammal). However, given these uncertainties, allometric scaling remains the most reliable easy-to-use means to establish TRVs for a variety terrestrial vertebrate species (Fairbrother and Kapustka 1996).

6.3.3 Recommendations

Fairbrother and Kapustka (1996) provided a critical evaluation of the existing, proposed, and potential means for intra-species toxicity value extrapolation. The paper they published describes the shortcomings of many methods of intra-specific extrapolation of toxicity data for terrestrial organisms. Using uncertainty factors or allometric scaling for extrapolation can often over- or under-predict the toxic effect to the receptor organism. Although using physiologically-based models may be a more scientifically correct way to predict toxicity, the logistics involved with applying them to an ERA on a large scale make them impractical. In this ERA, extrapolation was performed using techniques most often employed by the scientific risk assessment community. These techniques included the use of uncertainty factors (i.e., potential use of LOC < 1.0) and allometric scaling.

6.4 Indirect Effects on Salmonids

In addition to the potential direct toxicity associated with herbicide exposure, organisms may be harmed from indirect effects, such as habitat degradation or loss of prey. Under Section 9 of the Endangered Species Act (ESA) of 1973, it is illegal to take an endangered species of fish or wildlife. “Take” is defined as “harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct.” (16 United States Code 1532(19)).

[10] In the 1996 update to the Oak Ridge National Laboratory terrestrial wildlife screening values document (Sample et al. 1996), studies by Mineau et al. (1996) using allometric scaling indicated that, for 37 pesticides studied, avian LD_{50}s varied from 1 to 1.55, with a mean of 1.148. The LD_{50} for birds is now recommended to be 1 across all species.

The NMFS (NOAA 1999) published a final rule clarifying the definition of “harm” as it relates to take of endangered species in the ESA. The NMFS defines “harm” as any act that injures or kills fish and wildlife. Acts may include “significant habitat modification or degradation where it actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding or sheltering.” To comply with the ESA, potential secondary effects to salmonids were evaluated to ensure that use of 2,4-D on BLM-administered lands would not cause harm to salmonids.

Indirect effects can generally be categorized into effects caused by biological or physical disturbance. Biological disturbance includes impacts to the food chain; physical disturbance includes impacts to habitat[11] (Freeman and Boutin 1994). The NMFS has internal draft guidance for their ESA Section 7 pesticide evaluations (NOAA 2002). The internal draft guidance describes the steps that should be taken in an ERA to ensure salmonids are addressed appropriately. The following subsections describe how, consistent with internal draft guidance from NMFS, the 2,4-D ERA dealt with the indirect effects assessment.

6.4.1 Biological Disturbance

Potential direct effects to salmonids were evaluated in the ERA. Sensitive endpoints were selected for the RTE species RQ calculations, and worst-case scenarios were assumed. All direct spray and accidental spill scenarios for fish exposure resulted in RQs that exceed the RTE LOC of 0.05 (Table 4-2). However, these scenarios are particularly conservative because they evaluate an instantaneous concentration and do not consider flow, adsorption to particles, or degradation that may occur over time within a water body. Only a few 2,4-D acid/salts and ester RQs for fish exceeded the respective RTE LOC for off-site drift and surface runoff (Tables 4-3 and 4-4, respectively). Therefore, direct effects on salmonids are likely to be limited to direct spray and accidental spill scenarios, with some impacts possible under select drift and runoff conditions. Although direct spray of an aquatic water body is an accidental and unlikely scenario for terrestrial herbicides, it should be noted that direct applications of 2,4-D to treat aquatic vegetation may adversely impact fish (Table 4-2 indicates RQs above the LOCs for all fish exposure scenarios due to the direct application of aquatic formulations of 2,4-D).

Indirect effects caused by disturbance to the surrounding biological system were evaluated by looking at potential damage to the food chain. The majority of the salmonid diet consists of aquatic invertebrates and other fish. Sustaining the aquatic invertebrate population is vital for minimizing biological damage to salmonids from herbicide use. Consistent with ERA guidance (USEPA 1997, 1998), protection of non-RTE species, such as the aquatic invertebrates and fish serving as prey to salmonids, is at the population or community level, not the individual level. Sustainability of the numbers (population) or types (community) of aquatic invertebrates and fish is the assessment endpoint. Therefore, unless acute risks are present, it is unlikely the herbicide will cause harm to the prey base of salmonids from direct damage to the aquatic invertebrates and fish. As discussed in Section 4.3, there is potential for reductions in prey (e.g., fish and invertebrates) as a result of the direct spray or spills due to both 2,4-D acid/salts and esters. Limited reductions to prey due to 2,4-D esters may also occur as a result of off-site drift to streams.

Aquatic vegetation may be at risk from the risk of 2,4-D, and disturbance to the aquatic vegetation (as primary producers and the food base of aquatic invertebrates) may affect the aquatic invertebrate population, thereby affecting salmonids. As discussed in Section 4.3, aquatic vegetation may be at risk for adverse effects under a variety of exposure scenarios. The greatest potential for adverse effects to aquatic vegetation would occur under scenarios involving direct spray or accidental spill of an herbicide into an aquatic system. RQs exceeded LOCs by up to 5 orders of magnitude under the spill scenarios, but the runoff and drift scenarios for aquatic plants exceeded LOCs by far less than 2 orders of magnitude. No aquatic plant RQs above the LOCs were predicted for off-site drift of 2,4-D acid/salts. However, acute risks to aquatic plants due to off-site drift of 2,4-D esters, from both aerial and ground

[11] Physical damage to habitat may also be covered under an evaluation of critical habitat. Since all reaches of streams and rivers on BLM land may not be listed as critical habitat, a generalized approach to potential damage to any habitat was conducted. This should satisfy a general evaluation of critical habitats. Any potential for risk due to physical damage to habitat should be addressed specifically for areas deemed critical habitat.

applications, were predicted. This suggests that impacts to aquatic vegetation and associated indirect effects to salmonids may occur as a result of accidental spills, direct spraying, and off-site drift (if the 2,4-D ester is present).

The actual food items of many aquatic invertebrates, however, are not leafy aquatic vegetation, but detritus or benthic algae. Should aquatic vegetation be affected by an accidental herbicide exposure, the detritus in the stream should increase. Benthic algae are often the principal primary producers in streams. As such, disturbance of algal communities would cause an indirect effect (i.e., reduction in biomass at the base of the food chain) on all organisms living in the water body, including salmonids. Few data indicating the toxicity of herbicides to benthic algae are available. Of the algae data available for 2,4-D, the closest species to benthic algae (green algae) has an EC_{50} of 7.5 mg a.e./L for 2,4-D acid/salts and >0.1 mg a.e./L for 2,4-D esters. Both of these values are higher than the TRVs used in the ERA (0.1 mg a.e./L for 2,4-D acid/salts and 0.0004 mg a.e./L for 2,4-D esters, based on EC_{50} studies of diatoms and duckweed, respectively). Based on a TRV for green algae, RQs for most scenarios would be lower than the LOC, suggesting that impacts to algae and attending secondary effects are unlikely.

Based on an evaluation of the RQs calculated for this ERA, RTE fish, including salmonids, may be at risk from the indirect effects of 2,4-D on the aquatic food chain. Acute RQs above the LOCs were predicted for prey items and aquatic vegetation in streams for accidental spill, direct spray, and off-site drift scenarios. However, potential acute effects to aquatic life from accidental spills and accidental direct sprays during terrestrial applications of 2,4-D would only occur under an extreme and unlikely scenario that was considered in this ERA to add conservatism to the risk estimates. Appropriate and careful use of 2,4-D should preclude such an incident with the terrestrial herbicide.

Spills and direct applications of 2,4-D to treat aquatic vegetation may adversely impact prey items and aquatic vegetation (Table 4-2 indicates RQs above the LOCs for all fish, aquatic invertebrate, and aquatic plant exposure scenarios due to the application of aquatic formulations of 2,4-D), potentially resulting in indirect effects to RTE fish. However, these scenarios are highly conservative because they do not account for flow, adsorption to particles, or degradation that may occur over time after the application.

6.4.2 Physical Disturbance

The potential for indirect effects to salmonids due to physical disturbance is less easy to define than the potential for direct biological effects. Salmonids have distinct habitat requirements; any alteration to the coldwater streams in which they spawn and live until returning to the ocean as adults can be detrimental to the salmonid population. Among the effects of herbicide application, harm to instream and riparian vegetation would be of greatest concern. The potential adverse effects could include, but would not necessarily be limited to: loss of primary producers (Section 4.6.1); loss of overhead cover, which may serve as refuge from predators or shade to provide cooling to the water bodies; and increased sedimentation due to loss of riparian vegetation.

Adverse effects caused by herbicides can be cumulative, both in terms of toxicity stress from break-down products and other chemical stressors that may be present, and in terms of the use of herbicide on lands already stressed on a larger scale. Cumulative watershed effects often arise in conjunction with other land use practices, such as prescribed burning.[12] In forested areas, herbicides are generally used in areas that have been previously altered, by means such as cutting or burning, during vegetative succession when invasive species may dominate. The de-vegetation of these previously stressed areas can delay the stabilization of the substrate, increasing the potential for erosion and resulting sedimentation in adjacent water bodies.

Based on the results of the ERA, non-target terrestrial and aquatic plants may be at risk for adverse effects due to spills, accidental direct spray, intentional direct spray (Sections 4.3.1 and 4.3.5), and spray drift (Section 4.3.2). The accidental spills and accidental direct spray scenarios represent unlikely scenarios that were considered in this ERA to add conservatism to the risk estimates. These scenarios are not expected to occur under normal herbicide applications.

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[12] The following website provides a more detailed discussion of cumulative watershed effects available at URL: http://www.humbolt1.com/~heyenga/Herb.Drft.8_12_99.html.

Under the runoff and dust exposure scenarios, no to low risks to typical non-target plants are predicted. Therefore, it is unlikely that responsible use of 2,4-D by BLM land managers for terrestrial uses would indirectly affect salmonids through the killing of in-stream or riparian vegetation.

Risks to non-target aquatic plants are predicted for aquatic applications to treat aquatic vegetation (Section 4.3.1) or during spills of the aquatic herbicide. Land managers should consider the proximity of salmonid habitat to potential terrestrial and aquatic application areas.

6.5 Conclusions

The 2,4-D ERA evaluated the potential risks to many species under many exposure scenarios. Some exposure scenarios are likely to occur, whereas others are unlikely to occur but were included to provide a level of conservatism to the ERA. Individual RTE species were not directly evaluated. Instead, toxicity data for surrogate species were used to indirectly evaluate RTE species exposure. Higher trophic level receptors were also evaluated based on their life history strategies; RTE species were represented by one of several avian or mammalian species commonly used in ERAs. To provide a layer of conservatism to the evaluation, lower LOCs and TRVs were used to assess the potential impacts to RTE species.

Uncertainty factors and allometric scaling were used to adjust the toxicity data on a species-specific basis when they were likely to improve applicability and/or conservatism. As discussed in Section 3.1, TRVs were developed using the best available data, and uncertainty factors were applied to toxicity data consistent with recommendation of Chapman et al. (1998).

Potential secondary effects of 2,4-D use should be of primary concern for the protection of RTE species. Habitat disturbance and disruptions in the food chain are often the cause of declines of populations and species. Herbicides may reduce riparian zones or harm primary producers in the water bodies. The results of the ERA indicate that non-target terrestrial and aquatic plants may be at risk from 2,4-D, especially when accidents occur, such as spills or accidental spraying, or when herbicides are applied from the air too close to non-target receptors. Normal applications of the aquatic herbicides may also have a risk for direct effects to RTE species and indirect effects to RTE species due to reductions in prey items or vegetation (Table 4-2 indicates RQs above the LOCs for all fish , aquatic invertebrate, and aquatic plant exposure scenarios due to the direct application of aquatic formulations of 2,4-D).

In a review of potential impacts of another terrestrial herbicide to threatened and endangered salmonids, the USEPA OPP indicated that "for most pesticides applied to terrestrial environment, the effects in water, even lentic water, will be relatively transient." Only very persistent pesticides would be expected to have effects beyond the year of their application. The OPP report indicated that if a listed salmonid is not present during the year of application, there would likely be no concern (Turner 2003).

Based on the results of the ERA, it is unlikely RTE salmonids would be harmed by appropriate and responsible use of the herbicide 2,4-D on BLM lands; however, there is the potential for direct and indirect effects to RTE salmonids under certain conditions (spill, accidental direct spray, normal aquatic applications, and off-site drift). These risks can be reduced if certain application recommendations are followed (see Section 8.0). Managers can further decrease risks to RTE species and non-target populations and communities by increasing buffer zones between application areas and areas of concern, particularly if 2,4-D is applied aerially.

TABLE 6-1

Surrogate Species Used to Derive 2,4-D TRVs

Species in 2,4-D Laboratory/Toxicity Studies		Surrogate for
Honeybee	*Apis mellifera*	Pollinating insects
Rat	*Rattus* spp.	Mammals
Rabbit	*Leporidae* spp.	Mammals
Dog	*Canis lupus*	Mammals
Mallard	*Anas platyrhynchos*	Birds
Japanese quail	*Coturnix japonica*	Birds
Bobwhite quail	*Colinus virginianus*	Birds
2,4-D acid & salts		
Carrot	*Daucus carota*	Non-target terrestrial plants
Tomato	*Lycopersicon esculentum*	Non-target terrestrial plants
Wheat	*Triticum aestivum*	Non-target terrestrial plants
Cabbage	*Brassica oleracea*	Non-target terrestrial plants
Radish	*Raphanus sativus*	Non-target terrestrial plants
Stonefly	*Pteronarcys* sp.	Aquatic invertebrates
Water flea	*Daphnia magna*	Aquatic invertebrates
Rainbow trout	*Oncorhynchus mykiss*	Fish/salmonids
Fathead minnow	*Pimephales promelas*	Fish/salmonids
Bluegill sunfish	*Lepomis macrochirus*	Fish/salmonids
Freshwater diatom	*Navicula pelliculosa*	Non-target aquatic plants
Duckweed	*Lemna gibba*	Non-target aquatic plants
Toad	*Bufo melanosticus*	Amphibian
Leopard frog	*Rana pipiens*	Amphibian
2,4-D esters		
Onion	*Allium cepa*	Non-target terrestrial plants
Lettuce	*Lactuca sativa*	Non-target terrestrial plants
Sorghum	*Sorghum bicolor*	Non-target terrestrial plants
Cabbage	*Brassica oleracea*	Non-target terrestrial plants
Radish	*Raphanus sativus*	Non-target terrestrial plants
Water flea	*Daphnia magna*	Aquatic invertebrates
Bluegill sunfish	*Lepomis macrochirus*	Fish/salmonids
Fathead minnow	*Pimephales promelas*	Fish/salmonids
Rainbow trout	*Oncorhynchus mykiss*	Fish/salmonids
Duckweed	*Lemna gibba*	Non-target aquatic plants
Leopard frog	*Rana pipiens*	Amphibian

Note: As discussed in Section 3.1.1, 2,4-D acid, salts, and esters are considered as a single class for the assessment of terrestrial animals and birds, but 2,4-D acid and salts are considered separately from 2,4-D esters for acute exposures scenarios involving terrestrial plants and aquatic plants and animals. Chronic risks to terrestrial plants and aquatic plants and animals due to the acid, salt, or ester form of 2,4-D are considered equal.

TABLE 6-2

Surrogate Species Used in Quantitative ERA Evaluation

Species	**Scientific Name**	**Trophic Level/Guild**	**Pathway Evaluated**
American robin	*Turdus migratorius*	Avian invertivore/vermivore/ insectivore	Ingestion
Canada goose	*Branta canadensis*	Avian granivore/herbivore	Ingestion
Deer mouse	*Peromyscus maniculatus*	Mammalian frugivore/herbivore	Direct contact and Ingestion
Mule deer	*Odocolieus hemionus*	Mammalian herbivore/gramivore	Ingestion
Bald eagle (northern)	*Haliaeetus leucocephalus alascanus*	Avian carnivore/piscivore	Ingestion
Coyote	*Canis latrans*	Mammalian carnivore	Ingestion

Guild definitions –
Carnivore – Feeding on flesh.
Frugivore – Feeding on fruit.
Gramivore – Feeding on grain and seeds.
Herbivore – Feeding on plant material.
Insectivore – Feeding on insects.
Invertivore – Feeding on invertebrates.
Piscivore – Feeding on fish.
Vermivore – Feeding on worms.

TABLE 6-3

Federally Listed Birds and Selected Surrogates

Federally Listed Avian Species Potentially Occurring on BLM-administered Lands			
Species	**Scientific Name**	**RTE Trophic Guild**	**Surrogates**
Marbled murrelet	*Brachyramphus marmoratus marmoratus*	Piscivore	Bald eagle
Gunnison sage-grouse	*Centrocercus minimus*	Omnivore [Insectivore/ herbivore]	American robin Canada goose
Greater sage-grouse (Bi-State DPS)	*Centrocercus urophasianus*	Omnivore [Insectivore/ herbivore]	American robin Canada goose
Western snowy plover	*Charadrius alexandrinus nivosus*	Insectivore	American robin
Piping plover	*Charadrius melodus*	Insectivore	American robin
Mountain plover	*Charadrius montanus*	Insectivore	American robin
Yellow-billed cuckoo (Western DPS)	*Coccyzus americanus*	Insectivore	American robin
Southwestern willow flycatcher	*Empidonax traillii extimus*	Insectivore	American robin
Streak horned lark	*Eremophila alpestris strigata*	Insectivore	American robin
Northern aplomado falcon	*Falco femoralis septentrionalis*	Carnivore	Bald eagle Coyote Coyote
Whooping crane	*Grus Americana*	Piscivore	Bald eagle
California condor	*Gymnogyps californianus*	Carnivore	Bald eagle Coyote
Inyo California towhee	*Pipilo crissalis eremophilus*	Omnivore [Granivore/insectivore]	Canada goose American robin
Coastal California gnatcatcher	*Polioptila californica californica*	Insectivore	American robin
Stellar's eider	*Polysticta stelleri*	Piscivore	Bald eagle
Yuma clapper rail	*Rallus longirostris yumanensis*	Carnivore	Bald eagle Coyote
Spectacled eider	*Somateria fischeri*	Omnivore [Insectivore/ herbivore]	American robin Canada goose
Least tern	*Sterna antillarum*	Piscivore	Bald eagle
Northern spotted owl	*Strix occidentalis caurina*	Carnivore	Bald eagle Coyote
Mexican spotted owl	*Strix occidentalis lucida*	Carnivore	Bald eagle Coyote
Lesser prairie-chicken	*Tympanachus pallidicinctus*	Omnivore [Insectivore/ herbivore]	American robin Canada goose
Least Bell's vireo	*Vireo bellii pusillus*	Insectivore	American robin

TABLE 6-4

Federally Listed Mammals and Selected Surrogates

Federally Listed Mammalian Species Potentially Occurring on BLM-administered Lands			
Species	**Scientific Name**	**RTE Trophic Guild**	**Surrogates**
Sonoran pronghorn	*Antilocapra americana sonoriensis*	Herbivore	Mule deer
Pygmy rabbit	*Brachylagus idahoensis*	Herbivore	Mule deer
Gray wolf	*Canis lupus*	Carnivore	Coyote
Utah prairie dog	*Cynomys parvidens*	Herbivore	Deer mouse
Morro Bay kangaroo rat	*Dipodomys heermanni morroensis*	Omnivore [Herbivore/ Insectivore]	Deer mouse American robin
Giant kangaroo rat	*Dipodomys ingens*	Granivore/herbivore	Deer mouse
San Bernardino Merriam's kangaroo rat	*Dipodomys merriami parvus*	Granivore/herbivore	Deer mouse
Fresno kangaroo rat	*Dipodomys nitratoides exilis*	Granivore/herbivore	Deer mouse
Tipton kangaroo rat	*Dipodomys nitratoides nitratoides*	Granivore/herbivore	Deer mouse
Stephens' kangaroo rat	*Dipodomys stephensi (*incl. *D. cascus)*	Granivore	Deer mouse
Lesser long-nosed bat	*Leptonycteris curosoae yerbabuenae*	Frugivore/nectivore	Deer mouse
Mexican long-nosed bat	*Leptonycteris nivalis*	Herbivore	Deer mouse
Canada lynx	*Lynx canadensis*	Carnivore	Coyote
Amargosa vole	*Microtus californicus scirpensis*	Herbivore	Deer mouse
Hualapai Mexican vole	*Microtus mexicanus hualpaiensis*	Herbivore	Deer mouse
Black-footed ferret	*Mustela nigripes*	Carnivore	Coyote
Riparian (=San Joaquin Valley) woodrat	*Neotoma fuscipes riparia*	Herbivore	Deer mouse
Columbian white-tailed deer	*Odocolieus virginianus leucurus*	Herbivore	Mule deer
Bighorn sheep	*Ovis canadensis* ssp. *nelsoni*	Herbivore	Mule deer
Bighorn sheep	*Ovis canadensis* ssp. *sierrae*	Herbivore	Mule deer
Jaguar	*Panthera onca*	Carnivore	Coyote
Woodland caribou	*Rangifer tanandus caribou*	Herbivore	Mule deer
Buena Vista Lake ornate shrew	*Sorex ornatus relictus*	Granivore/herbivore	Deer mouse
Northern Idaho ground squirrel	*Spermophilus brunneus brunneus*	Herbivore	Deer mouse
Grizzly bear	*Ursus arctos horribilis*	Omnivore [herbivore/ insectivore/piscivore]	American robin Mule deer Bald eagle
San Joaquin kit fox	*Vulpes macrotis mutica*	Carnivore	Coyote
New Mexico meadow jumping mouse	*Zapus hudsonius luteus*	Omnivore [herbivore/ insectivore]	American robin Deer mouse
Preble's meadow jumping mouse	*Zapus hudsonius preblei*	Omnivore [herbivore/ insectivore]	American robin American robin

Note: Several marine mammals (e.g., whales, seals, sea otters, sea lions) are also listed species in the 17 states evaluated in this ERA. However, it is unlikely any exposure to herbicide would occur to marine species.

TABLE 6-5

Federally Listed Reptiles and Selected Surrogates

Federally Listed Reptile Species Potentially Occurring on BLM-administered Lands			
Species	**Scientific Name**	**RTE Trophic Guild**	**Surrogates**
New Mexican ridge-nosed rattlesnake	*Crotalus willardi obscurus*	Carnivore/insectivore	Coyote Bald eagle American robin
Blunt-nosed leopard lizard	*Gambelia silus*	Carnivore/insectivore	Coyote Bald eagle American robin
Desert tortoise	*Gopherus agassizii*	Herbivore	Canada goose
Northern Mexican garter snake	*Thamniphis eques megalops*	Carnivore/insectivore/piscivore	Coyote Bald eagle American robin
Giant garter snake	*Thamnophis gigas*	Carnivore/insectivore/piscivore	American robin Bald eagle Bald eagle
Narrow-headed garter snake	*Thamniphis rufipunctatus*	Carnivore/insectivore/piscivore	Coyote Bald eagle American rob
Coachella Valley fringe-toed lizard	*Uma inornata*	Insectivore	American robin

Note: Five sea turtles are also listed species in the 17 states evaluated in this ERA. However, it is unlikely any exposure to herbicide would occur to marine species.

TABLE 6-6

Federally Listed Amphibians and Selected Surrogates

Federally Listed Amphibian Species Potentially Occurring on BLM-administered Lands			
Species	**Scientific Name**	**RTE Trophic Guild**	**Surrogates**
California tiger salamander	*Ambystoma californiense*	Invertivore[1]	Bluegill sunfish Rainbow trout[3]
		Vermivore[2]	American robin[4]
Sonoran tiger salamander	*Ambystoma tigrinum stebbinsi*	Invertivore/insectivore[1]	Bluegill sunfish Rainbow trout[3]
		Carnivore/ranivore[2]	American robin[4]
Desert slender salamander	*Batrachoseps aridus*	Invertivore	American robin[4,5]
Wyoming toad	*Bufo baxteri*	Insectivore	Bluegill sunfish Rainbow trout[3] American robin[4]
Arroyo toad (=Arroyo southwestern toad)	*Bufo californicus*	Herbivore[1]	Bluegill sunfish Rainbow trout[3]
		Invertivore[2]	American robin[4]
California red-legged frog	*Rana aurora draytonii*	Herbivore[1]	Bluegill sunfish Rainbow trout[3]
		Invertivore[2]	American robin[4]
Chiricahua leopard frog	*Rana chiricahuensis*	Herbivore[1]	Bluegill sunfish Rainbow trout[3]
		Invertivore[2]	American robin[4]
Mountain yellow-legged frog (Northern DPS)	*Rana muscosa*	Herbivore[1]	Bluegill sunfish Rainbow trout[3]
		Invertivore[2]	American robin[4]
Oregon spotted frog	*Rana pretiosa*	Herbivore[1]	Bluegill sunfish Rainbow trout[3]
		Invertivore[2]	American robin[4]
Sierra Nevada yellow-legged frog	*Rana sierrae*	Herbivore[1]	Bluegill sunfish Rainbow trout[3]
		Invertivore[2]	American robin[4]
Mountain yellow-legged frog (Northern DPS)			

[1] Diet of juvenile (larval) stage.

[2] Diet of adult stage.

[3] Surrogate for juvenile stage.

[4] Surrogate for adult stage.

[5] *Bratrachoseps aridus* is a lungless salamander that has no aquatic larval stage, and is terrestrial as an adult.

TABLE 6-7

Species and Organism Traits that May Influence Herbicide Exposure and Response

Characteristic	Mode of Influence	ERA Solution
Body size	Larger organisms potentially have more surface area exposed during a direct spray exposure scenario. However, larger organisms have a smaller surface area to volume ratio, leading to a lower per body weight dose of herbicide per application event.	To evaluate potential impacts from direct spray, small organisms were selected (i.e., honeybee and deer mouse).
Habitat preference	Not all of BLM-administered lands are subject to nuisance vegetation control.	It was assumed that all organisms evaluated in the ERA were present in habitats subject to herbicide treatment.
Duration of potential exposure/ home range	Some species are migratory or present during only a fraction of year, and larger species have home ranges that likely extend beyond application areas, thereby reducing exposure duration.	It was assumed that all organisms evaluated in the ERA were present within the zone of exposure full-time.
Trophic level	Many chemical concentrations increase in higher trophic levels.	Although the herbicides evaluated in the ERA have very low potential to bioaccumulate, Bioconcentration factors were selected to estimate uptake to trophic level 3 fish (prey item for the piscivores), and several trophic levels (primary producers through top-level carnivore) were included in the ERA.
Food preference	Certain types of food or prey may be more likely to attract and retain herbicide.	It was assumed that all types of food were susceptible to high deposition and retention of herbicide.
Food ingestion rate	On a mass ingested per body weight basis, organisms with higher food ingestion rates (e.g., mammals versus reptiles) are more likely to ingest large quantities of food (therefore, herbicide).	Surrogate species were selected that consume large quantities of food, relative to body size. When ranges of ingestion rates were provided in the literature, the upper end of the values was selected for use in the ERA.
Foraging strategy	The way an organism finds and eats food can influence its potential exposure to herbicide. Organisms that consume insects or plants that are underground are less likely to be exposed via ingestion than those that consume exposed prey items, such as grasses and fruits.	It was assumed all food items evaluated in the ERA were fully exposed to herbicide during spray or runoff events.
Metabolic and excretion rate	While organisms with high metabolic rates may ingest more food, they may also have the ability to excrete herbicides quickly, lowering the potential for chronic impact.	It was assumed that no herbicide was excreted readily by any organism in the ERA.
Rate of dermal uptake	Different organisms will assimilate herbicides across their skins at different rates. For example, thick scales and shells of reptiles and the fur of mammals are likely to present a barrier to uptake relative to bare skin.	It was assumed that uptake across the skin was unimpeded by scales, shells, fur, or feathers.
Sensitivity to herbicide	Species respond to chemicals differently and some species may be more sensitive to certain chemicals.	The literature was searched and the lowest values from appropriate toxicity studies were selected as TRVs. Choosing the sensitive species as surrogates for the TRV development provides protection to more species.
Mode of toxicity	Response sites to chemical exposure may not be the same among all species. For instance, the presence of aryl hydrocarbon receptors in an organism increases its susceptibility to compounds that bind to proteins or other cellular receptors. However, not all species, even within a given taxonomic group (e.g., mammals) have aryl hydrocarbon receptors.	Mode of toxicity was not specifically addressed in the ERA. Rather, by selecting the lowest TRVs, it was assumed that all species evaluated in the ERA were also sensitive to the mode of toxicity.

TABLE 6-8

Summary of Findings - Interspecific Extrapolation Variability

Type of Data	Percentage of Data Variability Accounted for Within a Factor of:								
	2	4	10	15	20	50	100	250	300
Bird LD_{50}	--	--	90	--	--	--	99	100	--
Mammal LD_{50}	--	58	--	--	90	--	96	--	--
Bird and Mammal Chronic	--	--	--	--	--	94	--	--	--
Plants	93[1] 80[2]	--	--	80[3]	--	--	--	--	80[4]

[1] Intra-genus extrapolation.
[2] Intra-family extrapolation.
[3] Intra-order extrapolation.
[4] Intra-class extrapolation.

TABLE 6-9

Summary of Findings - Intraspecific Extrapolation Variability

Type of Data	Percentage of Data Variability Accounted for Within Factor of 10	Citation from Fairbrother and Kapustka (1996)
490 probit log-dose slopes	92	Dourson and Starta (1983) *as cited in* Abt Assoc., Inc. (1995)
Bird LC_{50}:LC_1	95	Hill et al. (1975)
Bobwhite quail LC_{50}:LC_1	71.5	Shirazi et al. (1994)

TABLE 6-10

Summary of Findings - Acute-to-Chronic Extrapolation Variability

Type of Data	Percentage of Data Variability Accounted for Within Factor of 10	Citation from Fairbrother and Kapustka (1996)
Bird and mammal dietary toxicity NOAELs (n=174)	90	Abt Assoc., Inc. (1995)

TABLE 6-11

Summary of Findings - LOAEL-to-NOAEL Extrapolation Variability

Type of Data	Percentage of Data Variability Accounted for Within Factor of:		Citation from Fairbrother and Kapustka (1996)
	6	10	
Bird and mammal LOAELs and NOAELs	80	97	Abt Assoc., Inc. (1995)

TABLE 6-12

Summary of Findings - Laboratory to Field Extrapolations

Type of Data	Response	Citation from Fairbrother and Kapustka (1996)
Plant EC_{50} Values	3 of 20 EC_{50} lab study values were 2-fold higher than field data. 3 of 20 EC_{50} values from field data were 2-fold higher than lab study data.	Fletcher et al. (1990)
Bobwhite quail	Shown to be more sensitive to cholinesterase-inhibitors when cold-stressed (i.e., more sensitive in the field).	Maguire and Williams (1987)
Gray-tailed vole and deer mouse	Laboratory data overpredicted risk.	Edge et al. (1995)

7.0 UNCERTAINTY IN THE ECOLOGICAL RISK ASSESSMENT

Every time an assumption is made, some level of uncertainty is introduced into the risk assessment. A thorough description of uncertainties is a key component that serves to identify possible weaknesses in the ERA analysis, and to elucidate what impact such weaknesses might have on the final risk conclusions. This uncertainty analysis lists the uncertainties, with a discussion of what bias—if any—the uncertainty may introduce into the risk conclusions. This bias is represented in qualitative terms that best describe whether the uncertainty might 1) underestimate risk, 2) overestimate risk, or 3) be neutral with regard to the risk estimates, or whether it cannot be determined without additional study.

Uncertainties in the ERA process are summarized in Table 7-1. Several of the uncertainties warrant further evaluation and are discussed below. In general, the assumptions made in this risk assessment have been designed to yield a conservative evaluation of the potential risks to the environment from herbicide application.

7.1 Toxicity Data Availability

The majority of the available toxicity data were obtained from studies conducted as part of the USEPA pesticide registration process. Use of this data set in the risk assessment creates numerous uncertainties. In general, it is preferable to base any ecological risk analysis on reliable field studies that clearly identify and quantify the amount of potential risk associated with particular exposure concentrations of the chemical of concern. However, in most risk assessments it is more common to extrapolate the results obtained in the laboratory to the receptors found in the field. It should be noted, however, that laboratory studies often overestimate risk relative to field studies (Fairbrother and Kapustka 1996).

A total of 342 EIIS incident reports involved 2,4-D. These reports can be used to validate exposure models and/or hazards to ecological receptors. These reports, described in Section 2.3, indicated that damage to crops might be, in part, due to unintended exposure to 2,4-D. These reports support the risk assessment's prediction of risk to non-target plants due to various exposure scenarios inside and outside of the application area. However, since the incident reports provide limited information, it is impossible to fully correlate the impacts predicted in the ERA with the incident reports.

Species for which toxicity data are available may not necessarily be the most sensitive species to a particular herbicide. These species have been selected as laboratory test organisms because they are generally sensitive to stressors yet can be maintained under laboratory conditions. Furthermore, the selected toxicity value for each receptor was based on a thorough review of the available data by qualified toxicologists and the selection of the most appropriate sensitive surrogate species. Because of the selection limitations, surrogate species are not exact matches to the wildlife receptors included in the ERA. For example, avian data for three primarily herbivorous birds, the mallard duck, the Japanese quail, and the bobwhite quail were also used to evaluate risk to insectivorous and piscivorous birds. Species with alternative feeding habits may be more or less sensitive to the herbicide than species tested in the laboratory. As discussed previously, plant toxicity data are generally only available for crop species, which may have different sensitivities than the rangeland plants occurring on BLM-administered lands. Data from toxicity testing with cabbage (*Brassica oleracea*), field mustard (*Brassica rapa*), and mustard (*Brassica juncea, Brassica kaber,* and *Brassica nigra*) likely can be used to represent sensitive species, since members of the mustard family are controlled by 2,4-D. In addition, the label also indicates that 2,4-D should not be allowed to come into contact with desirable, susceptible plants such as beans, cotton, fruit trees, grapes, legumes, ornamentals, peas, tomatoes, and other vegetables. This indicates that impacts to rangeland and noncropland species may be overestimated by the use of toxicity data based on mustard species or other vegetable crops.

In general, the most sensitive available endpoint for the appropriate surrogate test species was used to derive TRVs. This approach is conservative since there may be a wide range of data and effects for different species. For example, several 96-hour LC_{50}s for 2,4-D acid and salts were available for fish. The LC_{50}s ranged from 1.8 mg a.e./L to 6.7 mg a.e./L, and accordingly, 1.8 mg a.e./L was selected as the fish TRV for 2,4-D acid and salts, even though several results were well above this value. In general, this selection criterion for the TRVs has the potential to overestimate risk within the ERA. In some cases, chronic data were unavailable and chronic TRVs were derived from acute toxicity data, adding an additional level of uncertainty.

In some toxicological studies, a response was not observed at the highest tested concentration or dose. In these cases, the toxicological endpoint was recorded as being greater than (>) a given concentration or dose (see Section 3.1 and Table 3-1). For example, some of the avian LC_{50} studies result in mortality for 50% of the test organisms at the highest tested concentration; therefore the LC_{50} was reported as being greater than the highest concentration tested (i.e., it takes more than that concentration to result in mortality for 50% of test organisms). In the ERA, TRVs preceded by a greater than symbol were applied at the specified value, which is conservative and may lead to an overestimation of risk because a higher concentration or dose is needed to reach the specified effect.

There is also some uncertainty involved in the conversion of food concentration-based toxicity values (mg herbicide per kg food) to dose-based values (mg herbicide per kg body weight) for birds and mammals. Converting the concentration-based endpoint to a dose-based endpoint is dependent upon certain assumptions, specifically the test animal ingestion rate and test animal body weight. Default ingestion rates for different test species were used in the conversions unless test-specific values were measured and given. The ingestion rate was assumed to be constant throughout a test. However, it is possible that a test chemical may positively or negatively affect ingestion, thus resulting in an over- or underestimation of total dose.

For the purposes of pesticide registration, tests are conducted according to specific test protocols. For example, in the case of an avian oral LD_{50} study, test guidance follows the harmonized Office of Pollution Prevention and Toxic Substances (OPPTS) protocol 850.2100, Avian Acute Oral Toxicity Test or its Toxic Substances Control Act or FIFRA predecessor (e.g., 40 CFR 797.2175 and OPP 71-1). In this test the bird is given a single dose, by gavage, of the chemical and the test subject is observed for a minimum of 14 days. The LD_{50} derived from this test is the true dose (mg herbicide per kg body weight). However, dietary studies were selected preferentially for this ERA, and historical dietary studies followed 40 CFR 797.2050, OPP 71-2, or Organization for Economic Co-Operation and Development 205, the procedures for which are harmonized in OPPTS 850.2200, *Avian Dietary Toxicity Test*. In this test, the test organism is presented with the dosed food for 5 days, with 3 days of additional observations after the chemical-laden food is removed. The endpoint for this assay is reported as an LC_{50} representing mg herbicide per kg food. For this ERA, the concentration-based value was converted to a dose-based value following the methodology presented in the Methods Document (ENSR 2004).[13] Then the dose-based value was multiplied by the number of days of exposure (generally 5) to result in an LD_{50} value representing the full herbicide exposure over the course of the test.

As indicated in Section 3.1, the toxicity data within the ERA are presented in the units presented in the reviewed studies. For the toxicity evaluation, toxicity data were then converted, as necessary, from units to a.i. to a.e. to correspond with the application rates used by the BLM. Attempts were not made to adjust toxicity data to the percent active ingredient since the active ingredient was not consistently provided in all reviewed materials. In most cases the toxicity data apply to the active ingredient itself; however, some data correspond to a specific product containing the active ingredient under consideration, and potentially other ingredients (e.g., other active ingredients or inert ingredients). It is assumed that the toxicity observed in the tests is due to the active ingredient under consideration. However, it is possible that the additional ingredients in the different formulations also had an effect. The OPP's Ecotoxicity Database (a source of data for the ERAs) does not adjust the toxicity data to the percent active ingredient, and presents the data directly from the registration study in order to capture the potential effect caused by various

[13] Dose-based endpoint $_{(mg/kg\ BW/day)}$ = [Concentration-based endpoint $_{(mg/kg\ food)}$ x Food Ingestion Rate $_{(kg\ food/day)}$]/BW $_{(kg)}$

inert ingredients, additives, or other active ingredients in the tested product. In many cases the tested material represents the highest purity produced and higher exposure to the active ingredient would not be likely.

For 2,4-D, the % purity active ingredient, listed in Appendix B when available from the reviewed study, ranged from 20 to 100%. The lowest % active ingredient used in the actual TRV derivation was 96%, in the studies used to derive some of the aquatic TRVs. Adjusting the TRV to 100% of the active ingredient (by multiplying the TRV by the % active ingredient in the study) would lower these TRVs slightly and increase the associated RQs slightly. However, doing so would not result in any additional LOC exceedances. The remaining TRVs are based on studies with even higher percentages of active ingredient so the RQ changes would be even more minimal.

7.2 Potential Indirect Effects on Salmonids

No actual field studies or ecological incident reports on the effects of 2,4-D on salmonids were identified during the ERA process. Therefore, any discussion of direct or indirect impacts to salmonids was limited to qualitative estimates of potential impacts on salmonid populations and communities. The acute fish TRV used in the risk assessment was based on laboratory studies conducted with a salmonid, the brown trout (S*almo trutta*), reducing the uncertainties in this evaluation. A discussion of the potential indirect impacts to salmonids is presented in Section 4.3.6, and Section 6.4 provides a discussion of RTE salmonid species. These evaluations indicated that salmonids are not likely to be indirectly impacted by a reduction in food supply (i.e., fish and aquatic invertebrates) as a result of surface runoff, but potential reductions in prey as a result of the direct spray and off-site drift scenarios may occur. In addition, a reduction in vegetative cover may occur under limited conditions, which might impact salmonids.

It is anticipated that these qualitative evaluations overestimate the potential risk to salmonids due to the conservative selection of TRVs for salmonid prey and vegetative cover, application of additional LOCs (with uncertainty/safety factors applied) to assess risk to RTE species, and the use of conservative water body characteristics in the exposure scenarios (i.e., low order stream, relatively small instantaneous volume, limited consideration of herbicide degradation or absorption in models).

7.3 Ecological Risks of Degradates, Inert Ingredients, Adjuvants, and Tank Mixtures

In a detailed herbicide risk assessment, it is preferable to estimate risks not just from the active ingredient of an herbicide, but also from the cumulative risks of inert ingredients, adjuvants, surfactants, and degradates. Other herbicides may also factor into the risk estimates, as many herbicides can be tank mixed to expand the level of control and to accomplish multiple identified tasks. However, it is only practical, using currently available models (e.g., GLEAMS), to compare deterministic risk calculations (i.e., exposure modeling, effects assessment, and RQ calculations) for a single active ingredient.

In addition, information on inert ingredients, adjuvants, surfactants, and degradates is often limited by the availability of, and access to, reliable toxicity data for these constituents. The sections below present a qualitative evaluation the potential for adverse effects due to exposure to degradates, inert ingredients, adjuvants, and tank mixes.

7.3.1 Degradates

The potential toxicity of degradates, also called herbicide transformation products (TPs), should be considered when selecting an herbicide; however, it is beyond the scope of this risk assessment to evaluate all of the possible degradates of the various herbicide formulations containing 2,4-D. Degradates may be more or less mobile and more or less toxic in the environment than their source herbicides (Battaglin et al. 2003). Differences in environmental behavior (e.g., mobility) and toxicity between parent herbicides and TPs makes prediction of potential TP impacts challenging. For example, a less toxic, but more mobile, bioaccumulative, or persistent TP may potentially have a greater adverse impact on the environment than a more toxic, less mobile TP, as a result of residual concentrations in the environment. A recent study indicated that 70% of TPs had either similar or reduced toxicity to fish, daphnids, and algae than the parent pesticide. However, 4.2% of the TPs were more than an order of magnitude more toxic than the parent pesticide, with a few instances of acute toxicity values below 1 mg/L (Sinclair and Boxall 2003). No evaluation of impacts to terrestrial species was conducted in this study. The lack of data on the toxicity of degradates of 2,4-D represents a source of uncertainty in the risk assessment.

7.3.2 Inert Ingredients

Herbicides, like all pesticides, contain both "active" and "inert" or "other" ingredients, as stated on the label. The active ingredients are responsible for the pest management activity, while the inert ingredients are included in the formulation as solvents that may improve the active ingredient's ability to move through the leaf surface, to improve the shelf-life of the formulation, to reduce the degradation of the active ingredient, or to provide a color to the formulation. It is important to note that the term "inert" does not imply that the ingredients that that make up this portion of the formulation are nontoxic.

Unlike the active ingredient, federal law does not require that the individual ingredients be identified by name or percentage on the label, but the law does require that the total percentage of the formulation associated with the inert ingredients be stated on the label.

In the 17-States PEIS, the BLM took advantage of the List Category policy, created in 1987, for the purpose of prioritizing inert ingredients in pesticide products. The prioritization process involved the establishment of four categories of "toxicological concern." As stated on the web site (http://www.epa.gov/opprd001/inerts/) now that reassessment of food tolerances/tolerance exemptions under the Food Quality Protection Act is complete, there are no longer inert ingredients classified as List 1, 2, or 3. The "4A" category is still being used for the purposes of FIFRA Section 25(b), and USDA is still utilizing "List 4" for their National Organic Program. For non-food inert ingredients, the List Category policy remains pertinent (including labeling) for those identified as "List 1" (toxicological concern)."

For the purpose of pesticides, there are now two categories of inert ingredients approved for use in pesticides: Nonfood Use Only and Food and Nonfood Use. The BLM requires that inert ingredients found in herbicide formulations and adjuvants be listed in one of these two categories.

Nonfood Use Only – Inert ingredients permitted solely for use in pesticide products applied to nonfood use sites, such as ornamental plants, highway right-of-ways, rodent control, etc. These inert ingredients may not be applied to food.

Food and Nonfood Use – Inert ingredients approved for use in pesticide products applied to food. These inert ingredients have either tolerances or tolerance exemptions in 40 CFR Part 180 (the majority is found in Sections 180.910–960) or their residues are not found in food. All food use inert ingredients are also permitted for nonfood use.

7.3.3 Adjuvants and Tank Mixtures

Evaluating the potential additional/cumulative risks from mixtures and adjuvants of herbicides is substantially more difficult than evaluating the inert ingredients in the herbicide composition. While many herbicides are present in the natural environment along with other pesticides and toxic chemicals, the composition of such mixtures is highly site-specific, and thus nearly impossible to address at the level of the programmatic ERA.

Herbicide label information indicates whether a particular herbicide can be tank mixed with other pesticides. Adjuvants (e.g., crop oil concentrates, fertilizers) may also be added to the spray mixture to improve herbicide efficacy. Without product-specific toxicity data, it is impossible to quantify the potential impacts of these mixtures. In addition, a quantitative analysis could only be conducted if reliable scientific evidence allowed determination of whether the joint action of the mixture was additive, synergistic, or antagonistic. Such evidence is not likely to exist unless the mode of action is common among the chemicals and receptors.

7.3.3.1 Adjuvants

Adjuvants generally function to enhance or prolong the activity of an active ingredient. For terrestrial herbicides, adjuvants may aid in the absorption of the active ingredient into plant tissue. Adjuvant is a broad term that includes, among others, surfactants, crop oils, methylated seed oils, drift control compounds, buffering compounds, spreaders, stickers, and penetrants. Adjuvants are not under the same registration guidelines as pesticides, and the USEPA does not register or approve the labeling of spray adjuvants. Individual herbicide labels identify which types of adjuvants are approved for use with the particular herbicide. Not all formulations of 2,4-D will direct the applicator to include the addition of an adjuvant to the spray mixture. The individual label will specify the type and amount, along with the specific conditions or situations in which an adjuvant could be added to improve the performance of the 2,4-D.

It is recommended that an adjuvant with low toxic potential be selected. Potential toxicity of any material should be considered prior to its use as an adjuvant.

The GLEAMS model was used to estimate the potential portion of an adjuvant that might reach an adjacent water body via surface runoff. The chemical characteristics of the generalized inert ingredient/adjuvant compound were set at extremely high/low values to describe it as either a very mobile or stable compound, respectively. The application rate of the inert ingredient/adjuvant compound was fixed at 1 lbs. a.i./ac, and the test watershed was the "base case" used in the risk assessment, with sandy soil and 50 inches of precipitation per year. Under these conditions, the maximum predicted ratio of inert ingredient concentration to herbicide application rate was 0.69 mg/L per lbs. a.i./ac (3 day maximum in a pond).

Several sources (Muller 1980, Lewis 1991, Dorn et al. 1997, Wong et al. 1997) generally suggested that acute toxicity to aquatic life for surfactants and anti-foam agents ranged from 1 to 10 mg/L, and that chronic toxicity can be as low as 0.1 mg/L. At the application rate recommended for nonionic surfactants, 0.25 volume/volume percent, and the maximum ground application rate for 2,4-D (2 lbs. a.e./ac for annual/perennial species and 4 lbs. a.e./ac for woody species), the maximum predicted concentration of the adjuvant compound would be 0.345 to 0.69 mg/L. These values are greater than the chronic toxicity value for nonionic surfactants (0.1 mg/L) and at the low end of the range of behavioral and physiological effects (0.002 to 40.0 mg/L; Lewis 1991).

This evaluation indicates that adjuvants may not add significant uncertainty to the level of risk predicted for the active ingredient. However, more specific modeling and toxicity data would be necessary to define the level of uncertainty. The selection of the proper adjuvant is dictated by the site of application, the herbicide and adjuvant labels, targeted vegetation, environmental conditions, and any other precautionary states listed on both labels

7.3.3.2 Tank Mixtures

The use of tank mixtures of labeled herbicides, along with the addition of an adjuvant (when stated on the label), may be an effective use of equipment and personnel. However, knowledge of both products and their interactions is necessary to avoid unintended negative effects. In general, herbicide interactions can be classified as additive, synergistic, or antagonistic:

- Additive effects occur when mixing two herbicides produces a response equal to the combined effects of each herbicide applied alone. The products neither hurt nor enhance each other.
- Synergistic responses occur when two herbicides provide a greater response than the added effects of each herbicide applied separately.
- Antagonistic responses occur when two herbicides applied together produce less control than each herbicide applied separately.

These types of interactions also describe the potential changes to the toxic effects of the individual herbicides and the tank mixture (i.e., the mixture may have more or less toxicity than either of the individual products). A quantitative evaluation of potential 2,4-D tank mixtures is beyond the scope of this ERA.

Selection of tank mixes, like adjuvants, is under the control of BLM land managers. To reduce uncertainties and potential negative impacts, it is required that land managers follow all label instructions and abide by any warnings. Labels for tank mixed products should be thoroughly reviewed, and mixtures with the least potential for negative effects should be selected. This is especially relevant when a mixture is applied in a manner that may have increased risk (e.g., runoff to ponds in sandy watersheds). Use of a tank mix under these conditions increases the level of uncertainty in predicting risk to the environment.

7.4 Uncertainty Associated with Herbicide Exposure Concentration Models

This ERA relies on different models to predict the off-site impacts of herbicide use. These models have been developed and applied in order to develop a conservative estimate of herbicide loss from the application area to off-site locations.

As in any screening or higher-tier ERA, a discussion of potential uncertainties from fate and exposure modeling is necessary to identify potential overestimates or underestimates of risk. In particular, the uncertainty analysis focuses on which environmental characteristics (e.g., soil type, annual precipitation) exert the biggest numeric impact on model outputs. The results of this uncertainty analysis have important implications not only for the uncertainty analysis itself, but also for the ability to apply risk calculations to different site characteristics from a risk management perspective.

7.4.1 AgDRIFT®

Off-target spray drift and resulting terrestrial deposition rates and water body concentrations (hypothetical pond or stream) were predicted using the computer model, AgDRIFT® Version 2.0.05 (SDTF 2002). As with any complex ERA model, a number of simplifying assumptions were made to ensure that the risk assessment results would be protective of most environmental settings encountered in the BLM land management program.

Predicted off-site spray drift and downwind deposition can be substantially altered by variables intended to simulate the herbicide application process, including, but not limited, to nozzle type used in the spray application of an herbicide mixture, ambient wind speed, release height (application boom height), and evaporation. Hypothetically, any variable in the model that is intended to represent some part of the physical process of spray drift and deposition can substantially alter predicted downwind drift and deposition patterns. Recognizing the lack of absolute knowledge about all of the scenarios likely to be encountered in the BLM land management program, these assumptions were developed to be conservative and likely result in overestimation of actual off-site spray drift and environmental impacts.

7.4.2 GLEAMS

The GLEAMS model was used to predict the loading of 2,4-D to nearby soils, ponds, and streams from overland and surface runoff, erosion, and root zone groundwater runoff. The GLEAMS model conservatively assumes that the soil, pond, and stream are directly adjacent to the application area. The use of buffer zones would reduce potential herbicide loading to the exposure areas.

7.4.2.1 Herbicide Loss Rates

The trends in herbicide loss rates (herbicide loss computed as a percent of the herbicide applied within the watershed) and water concentrations predicted by the GLEAMS model echo trends that have been documented in a wide range of streams located in the midwestern United States. A recently published study (Lerch and Blanchard 2003) recognized that factors affecting herbicide transport to streams can be organized into four general categories:

- Intrinsic factors – soil and hydrologic properties and geomorphologic characteristics of the watershed
- Anthropogenic factors – land use and herbicide management
- Climate factors – particularly precipitation and temperature
- Herbicide factors – chemical and physical properties and formulation

These findings were based on the conclusions of several prior investigations, data collected as part of the U.S. Geological Survey's National Stream Quality Accounting Network program, and the results of runoff and baseflow water samples collected in 20 streams in northern Missouri and southern Iowa. The investigation concluded that the median runoff loss rates for atrazine, cyanazine, acetochlor, alachlor, metolachlor, and metribuzin ranged from 0.33 to 3.9% of the mass applied—loss rates that were considerably higher than in other areas of the United States. Furthermore, the study indicated that the runoff potential was a critical factor affecting herbicide transport. Table 7-2 is a statistical summary of the GLEAMS-predicted total loss rates and runoff loss rates for several herbicides. The median total loss rates range from 0.00 to 36%, and the median runoff loss rates range from 0 to 0.27%.

The results of the GLEAMS simulations indicate trends similar to those identified in the Lerch and Blanchard (2003) study. First, the GLEAMS simulations demonstrated that the most dominant factors controlling herbicide loss rates are soil type and precipitation; both are directly related to the amount of runoff from an area following an herbicide application. This was demonstrated in each of the GLEAMS simulations that considered the effect of highly variable annual precipitation rates and soil type on herbicide transport. In all cases, the GLEAMS model predicted that runoff loss rate was positively correlated with both precipitation rate and soil type.

Second, consistent with the conclusion reached by Lerch and Blanchard (2003; i.e., that runoff potential is critical to herbicide transport) and the GLEAMS model results, estimating the groundwater discharge concentrations by using the predicted root zone concentrations as a surrogate is extremely conservative. For example, while the median runoff loss rates range from 0 to 0.27%, confirming the Lerch and Blanchard study, the median total loss rates predicted using GLEAMS are substantially higher. This discrepancy may be due to the differences between the watershed characteristics in the field investigation and those used to describe the GLEAMS simulations. It is probably partially a result of the conservative nature of the baseflow predictions.

Based on the results and conclusions of prior investigations, the runoff loss rates predicted by the GLEAMS model are approximately equivalent to loss rates determined within the Mississippi River watershed and elsewhere in the United States, and the percolation loss rates are probably conservatively high. This confirms that our GLEAMS modeling approach either approximates or overestimates the rate of loadings observed in the field.

7.4.2.2 Root Zone Groundwater

In the application of GLEAMS, it was assumed that root zone loading of herbicide would be transported directly to a nearby water body. This scenario is feasible in several settings, but is very conservative in situations in which the depth to the water table is many feet. In particular, it is common in much of the arid and semi-arid western states for the water table to be well below the ground surface and for there to be little, if any, groundwater discharge to surface water features. Some ecological risk scenarios were dominated by the conservatively-estimated loading of herbicide by groundwater discharge to surface waters. Again, while possible, this is likely to be an overestimate of likely impacts in most settings on BLM-administered lands.

7.4.3 AERMOD and CALPUFF

The USEPA's AERMOD and CALPUFF air pollutant dispersion models were used to predict impacts from the potential migration of the herbicide between 1.5 and 100 km (0.9 and 62 miles)from the application area by windblown soil (fugitive dust). Several assumptions were made that could over predict or under predict the deposition rates obtained from this model.

The use of flat terrain could under predict deposition for mountainous areas. In these areas, hills and mountains would likely focus wind and deposition into certain areas, resulting in pockets of increased risk. The use of bare, undisturbed soil results in less uptake and transport than disturbed (i.e., tilled) soil. However, the BLM does not apply herbicides to agricultural areas, so this assumption may be appropriate for BLM-administered lands.

The modeling conservatively assumed that all of the herbicide would be present in the soil at the commencement of a windy event, and that no reduction due to vegetation interception/uptake, leaching, or solar or chemical half-life would have occurred since the time of aerial application. Thus, the model likely over predicts the deposition rates unless the herbicide is taken by the wind as soon as it is applied. It is more likely that a portion of the applied herbicide would be sorbed to plants or degraded over time.

Assuming a 1-millimeter penetration depth is also conservative and likely overestimates impacts. This penetration depth is less than the depth used in previous herbicide risk assessments (Syracuse Environmental Research Associates 2001) and the depth assumed in the GLEAMS model (1 cm surface soil).

The surface roughness in the vicinity of the application site directly affects the deposition rates predicted by AERMOD and CALPUFF. The surface roughness length used in the models is a measure of the height of obstacles to wind flow and varies by land-use types. Forested areas and urban areas have the highest surface roughness lengths (0.5 m to 1.3 m) while grasslands have the lowest (0.001 m to 0.10 m).

Predicted deposition rates are likely to be higher near the application area and lower at greater distances if the surface roughness in the area is relatively high (above 1 m, such as in forested areas). Therefore, overestimation of the surface roughness could over predict deposition within about 50 km (31 miles) of the application area and under predict deposition beyond 50 km. Overestimation of the surface roughness could occur if, for example, prescribed burning was used to treat a typically forested area prior to planned herbicide treatment.

The surface roughness in the vicinity of the application site also affects the calculated “friction velocity” used to determine deposition velocities, which in turn are used by the models to calculate the deposition rate. Friction velocity increases with increasing wind speed and also with increased surface roughness. Higher friction velocities result in higher deposition velocities and likewise higher deposition rates, particularly within about 50 km of the emission source.

The AERMOD and CALPUFF modeling assumes that the data from the selected National Weather Service stations is representative of meteorological conditions in the vicinity of the application sites. Site-specific meteorological data (e.g., from an on-site meteorological tower) could provide slightly different wind patterns, possibly due to local terrain, which could impact the deposition rates as well as locations of maximum deposition.

7.5 Summary of Potential Sources of Uncertainty

The analysis presented in this section has identified several potential sources of uncertainty that may introduce bias into the risk conclusions. This bias has the potential to 1) underestimate risk, 2) overestimate risk, or 3) be neutral with regard to the risk estimates, or be undetermined without additional study. In general, few of the sources of uncertainty in this ERA are likely to underestimate risk to ecological receptors. It is more likely that risk is overestimated, or that the impacts of the uncertainty are neutral or impossible to predict.

The following bullets summarize the potential impacts on the risk predictions based on the analysis presented above:

- Toxicity Data Availability – Although the species for which toxicity data are available may not necessarily be the most sensitive species to a particular herbicide, the TRV selection methodology has focused on identifying conservative toxicity values that are likely to be protective of most species. The use of various LOCs contributes an additional layer of protection for species that may be more sensitive than the tested species (i.e., RTE species).

- Potential Indirect Effects on Salmonids – Only a qualitative evaluation of indirect risk to salmonids was possible because no relevant studies or incident reports were identified. It is likely that this qualitative evaluation overestimates the potential risk to salmonids as a result of the numerous conservative assumptions related to TRVs and exposure scenarios and the application of additional LOCs (with uncertainty/safety factors applied) to assess risk to RTE species.

- Ecological Risks of Degradates, Inert Ingredients, Adjuvants, and Tank Mixtures – Only limited information is available regarding the toxicological effects of degradates, inert ingredients, adjuvants, and tank mixtures. In general, it is unlikely that highly toxic degradates or inert ingredients are present in approved herbicides. Also, selection of tank mixes and adjuvants is under the control of BLM land managers, and to reduce uncertainties and potential risks, products should be thoroughly reviewed and mixtures with the least potential for negative effects should be selected.

- Uncertainty Associated with Herbicide Exposure Concentration Models – Environmental characteristics (e.g., soil type, annual precipitation) impact the models used to predict the off-site impacts of herbicide use (i.e., AgDRIFT®, GLEAMS, AERMOD, CALPUFF); in general, the assumptions used in the models were developed to be conservative and likely result in overestimation of actual off-site environmental impacts.

- General ERA Uncertainties – The general methodology used to conduct the ERA is more likely to overestimate risk than to underestimate risk because of its conservative assumptions (i.e., entire home range and diet is assumed to be impacted, aquatic water bodies are relatively small, and herbicide degradation over time is not applied in most scenarios).

TABLE 7-1

Potential Sources of Uncertainty in the ERA Process

Potential Source of Uncertainty	Direction of Effect	Justification
Physical-chemical properties of the active ingredient	Unknown	Available sources were reviewed for a variety of parameters. However, not all sources presented the same value for a parameter (e.g., water solubility) and some values were estimated.
Food chain assumed to represent those found on BLM-administered lands	Unknown	BLM-administered lands cover a wide variety of habitat types. A number of different exposure pathways have been included, but additional pathways may occur within management areas.
Receptors included in food chain model assumed to represent those found on BLM-administered lands	Unknown	BLM-administered lands cover a wide variety of habitat types. A number of different receptors have been included, but alternative receptors may occur within management areas.
Food chain model exposure parameter assumptions	Unknown	Some exposure parameters (e.g., body weight, food ingestion rates) were obtained from the literature and some were estimated. Efforts were made to select exposure parameters representative of a variety of species or feeding guilds.
Assumption that receptor species will spend 100% of time in impacted terrestrial or aquatic area (home range = application area)	Overestimate	These model exposure assumptions do not take into consideration the ecology of the wildlife receptor species. Organisms will spend varying amounts of time in different habitats, thus affecting their overall exposures. Species are not restricted to one location within the application area, may migrate freely off-site, may undergo seasonal migrations (as appropriate), and are likely to respond to habitat quality in determining foraging, resting, nesting, and nursery activities. A likely overly conservative assumption has been made that wildlife species obtain all their food items from the application area.
Water body characteristics	Overestimate	The pond and stream were designed with conservative assumptions resulting in relatively small volumes. Larger water bodies are likely to exist within application areas.
Extrapolation from test species to representative wildlife species	Unknown	Species differ with respect to absorption, metabolism, distribution, and excretion of chemicals. The magnitude and direction of the difference may vary with species. It should be noted, though, that in most cases, laboratory studies actually overestimate risk relative to field studies (Fairbrother and Kapustka 1996).
Consumption of contaminated food	Unknown	Toxicity to prey receptors may result in sickness or mortality. Fewer prey items would be available for predators. Predators may stop foraging in areas with reduced prey populations, discriminate against, or conversely, select contaminated prey.
No evaluation of inhalation exposure pathways	Underestimate	The inhalation exposure pathways are generally considered insignificant due to the low concentration of contaminants under natural atmospheric conditions. However, under certain conditions, these exposure pathways may occur.

TABLE 7-1 (Cont.)

Potential Sources of Uncertainty in the ERA Process

Potential Source of Uncertainty	Direction of Effect	Justification
Assumption of 100% drift for chronic ingestion scenarios	Overestimate	It is unlikely that 100% of the application rate would be deposited on a plant or animal used as food by another receptor. As indicated with the AgDRIFT® model, off-site drift is only a fraction of the applied amount.
Ecological exposure concentration	Overestimate	It is unlikely that any receptor would be exposed continuously to the full predicted ecological exposure concentration.
Over-simplification of dietary composition in the food web models	Unknown	Assumptions were made that contaminated food items (e.g., vegetation, fish) were the primary food items for wildlife. In reality, other food items are likely consumed by these organisms.
Degradation or adsorption of herbicide	Overestimate	Risk estimates for direct spray and off-site drift scenarios generally do not consider degradation or adsorption. Concentrations tend to decrease over time from degradation. Organic carbon in water or soil/sediment may bind to herbicide and reduce bioavailability.
Bioavailability of herbicides	Overestimate	Most risk estimates assume a high degree of bioavailability. Environmental factors (e.g., binding to organic carbon, weathering) may reduce bioavailability.
Limited evaluation of dermal exposure pathways	Unknown	The dermal exposure pathway is generally considered insignificant due to natural barriers found in fur and feathers of most ecological receptors. However, under certain conditions (e.g., for amphibians), these exposure pathways may occur.
Amount of receptor's body exposed	Unknown	More or less than ½ of the honeybee or small mammal may be affected in the accidental direct spray scenarios.
Lack of toxicity information for RTE species	Unknown	Information is not available on the toxicity of herbicides to RTE species resulting from dietary or direct contact exposures. Uncertainty factors have been applied to attempt to assess risk to RTE receptors. See Section 7.2 for additional discussion of salmonids.
Safety factors applied to TRVs	Overestimate	Assumptions regarding the use of 3-fold uncertainty factors are based on precedent, rather than scientific data.
Use of lowest toxicity data to derive TRVs	Overestimate	The lowest data point observed in the laboratory may not be representative of the actual toxicity that might occur in the environment. Using the lowest reported toxicity data point as a benchmark concentration is a very conservative approach, especially when there is a wide range of reported toxicity values for the relevant species. See Section 7.1 for additional discussion.
Use of NOAELs	Overestimate	Use of NOAELs may overestimate effects since this measurement endpoint does not reflect any observed impacts. LOAELs may be orders of magnitudes above observed literature-based NOAELs, yet NOAELs were generally selected for use in the ERA.

TABLE 7-1 (Cont.)

Potential Sources of Uncertainty in the ERA Process

Potential Source of Uncertainty	Direction of Effect	Justification
Use of chronic exposures to estimate effects of herbicides on receptors	Overestimate	Chronic toxicity screening values assume that ecological receptors experience continuous, chronic exposure. Exposure in the environment is unlikely to be continuous for many species that may be transitory and move in and out of areas of maximum herbicide concentration.
Use of measures of effect	Overestimate	Although an attempt was made to have measures of effect reflect assessment endpoints, limited available ecotoxicological literature resulted in the selection of certain measures of effect that may overestimate assessment endpoints.
Lack of toxicity information for mammals or birds	Unknown	TRVs for certain receptors were based on a limited number of studies conducted primarily for pesticide registration. Additional studies may indicate higher or lower toxicity values. See Section 7.1 for additional discussion.
Lack of seed germination toxicity information	Unknown	TRVs were based on a limited number of studies conducted primarily for pesticide registration. A wide range of germination data were not always available. Emergence or other endpoints were also used and may be more or less sensitive to the herbicide.
Species used for testing in the laboratory assumed to be equally sensitive to herbicide as those found within application areas.	Unknown	Laboratory toxicity tests are normally conducted with species that are highly sensitive to contaminants in the media of exposure. Guidance manuals from regulatory agencies contain lists of the organisms that they consider to be sensitive enough to be protective of naturally occurring organisms. However, reaction of all species to herbicides is not known, and species found within application areas may be more or less sensitive than those used in the laboratory toxicity testing. See Section 7.1 for additional discussion.
Risk evaluated for individual receptors only	Overestimate	Effects on individual organisms may occur with little population or community level effects. However, as the number of affected individuals increases, the likelihood of population-level effects increases.
Lack of predictive capability	Unknown	The RQ approach provides a conservative estimate of risk based on a "snapshot" of conditions; this approach has no predictive capability.
Unidentified stressors	Unknown	It is possible that physical stressors other than those measured may affect ecological communities.
Effect of decreased prey item populations on predatory receptors	Unknown	Adverse population effects to prey items may reduce the foraging population for predatory receptors, but may not necessarily adversely impact the population of predatory species.
Multiple conservative assumptions	Overestimate	Cumulative impact of multiple conservative assumptions predicts high risk to ecological receptors.

TABLE 7-1 (Cont.)

Potential Sources of Uncertainty in the ERA Process

Potential Source of Uncertainty	Direction of Effect	Justification
Predictions of off-site transport	Overestimate	Assumptions are implicit in each of the software models used in the ERA (AgDRIFT®, GLEAMS, AERMOD, CALPUFF). These assumptions have been made in a conservative manner when possible. These uncertainties are discussed further in Section 7.4.
Impact of the other ingredients (e.g., inert ingredients, adjuvants) in the application of the herbicide	Unknown	Only the active ingredient has been investigated in the ERA. Inert ingredients, adjuvants, and tank mixtures may increase or decrease the impacts of the active ingredient. These uncertainties are discussed further in Section 7.3.

TABLE 7-2

Herbicide Loss Rates Predicted by the GLEAMS Model

Herbicide	Total Loss Rate (percent)			Runoff Loss Rate (percent)		
	Median	90th	Maximum	Median	90th	Maximum
2,4-D acid	0.00	0.14	1.8	0.00	0.01	1.8
2,4-D ester	0.00	0.46	1.5	0.00	0.04	1.5
2,4-D acid/W*	0.00	0.15	1.8	0.00	0.01	1.8
2,4-D ester/W*	0.00	0.46	1.5	0.00	0.04	1.5
Aminopyralid	77	85	89	0.00	0.08	0.34
Clopyralid	5.7	18	28	0.00	0.01	0.06
Fluroxypyr	0.00	4.8	22	0.00	0.13	2.9
Rimsulfuron	3.0	11	22	0.00	0.09	1.5

* "W" denotes model runs with woody vegetation.

8.0 SUMMARY

8.1 Summary of ERA Results

Ecological receptors would potentially be at risk for impacts from exposure to 2,4-D under specific conditions on BLM-administered lands. The relative magnitude of risks predicted for ecological receptors for each route of exposure are summarized in Tables 8-1 through 8-6. Risk levels were determined by comparing the RQs against the most conservative LOC, and ranking the results for each receptor-exposure route combination from “no potential” to “high potential’ for risk. The reported risk level is based on the risk level of the majority of the RQs for each exposure scenario within each of the above receptor groups and exposure categories (i.e., direct spray/spill, off-site drift, surface runoff, wind erosion). As a result, risk may be higher than the reported risk category for some scenarios within each category. The reader should consult the risk tables in Section 4 and Appendix D to determine the specific scenarios that result in the displayed level of risk for a given receptor group

As expected given the mode of action of aquatic and terrestrial herbicides, the highest risk level is predicted for non-target terrestrial and aquatic plant species, generally under accidental exposure scenarios (i.e., direct spray and accidental spills). Some risks are predicted for terrestrial animals, fish, and aquatic invertebrates. Risks to salmonids are discussed separately below.

The following bullets further summarize the risk assessment findings for 2,4-D under these conditions:

1. Direct Spray (Tables 8-1 and 8-2) – The ERA predicted moderate to high risks for terrestrial and aquatic non-target plants under scenarios in which plants or water bodies are directly sprayed at the typical or maximum application rate. For terrestrial herbicides, this scenario represents an accidental exposure, but for aquatic herbicides, direct spray of a pond or stream may represent a normal application. The risk results were generally consistent among the four application types (terrestrial applications to control annual/perennial vegetation, terrestrial applications to control woody vegetation, aquatic applications to control floating and emerged vegetation, and aquatic applications to control submerged vegetation), and are summarized below and in Tables 8-1 and 8-2.

    a. The ERA predicted minimal risk for pollinating insects and small mammals due to direct spray or contact with foliage, and for terrestrial animals due to ingestion of contaminated prey items. Although the majority of the RQs for this evaluation were below the most conservative LOC, a review of the RQs presented in Appendix D identifies some scenarios with RQs above the LOC (e.g., pollinating insects).

    b. The ERA predicted high risk for terrestrial plants, both typical and RTE species at both typical and maximum application rates.

    c. In general, lower risks were predicted for aquatic plants, fish, and aquatic invertebrates due to exposure to 2,4-D acid/salts than for 2,4-D esters. Risk levels for these aquatic receptors generally ranged between low and moderate for 2,4-D acid/salts, with moderate to high risk levels (acute risk) predicted for exposures to 2,4-D esters at both typical and maximum application rates.

2. Off-site Drift (Tables 8-3 and 8-4) – The ERA predicted low to moderate risks to terrestrial plants. No risks were predicted for fish, aquatic invertebrates, aquatic plants, or piscivorous birds due to exposure to 2,4-D acid/salts. No to moderate risks were predicted for fish, aquatic invertebrates, and aquatic plants, due to exposure to 2,4-D esters. Similar to the results for the direct spray scenarios, the results for risk potential were generally consistent among all application types, and are summarized below and in Tables 8-3 and 8-4.

a. Low to moderate risks were predicted for typical and RTE species of non-target terrestrial plants.

- The greatest risks were predicted under scenarios involving distances 100 ft or less from receptors and from aerial modes of applications (i.e., from a plane or a helicopter).

- Predicted risk levels for RTE species were greater than those predicted for typical species.

b. No risks to fish, aquatic invertebrates, aquatic plants, or piscivorous birds were predicted for exposures to 2,4-D acid/salts due to off-site drift.

c. Very few risks to fish were predicted due to off-site drift and exposure to 2,4-D esters.

d. Low to moderate risks to aquatic invertebrates and aquatic plants were predicted for exposures to 2,4-D esters due to off-site drift.

3. Surface Runoff (Table 8-5) – The ERA predicted no risks to any receptor as a result of surface runoff of 2,4-D acid/salts or esters. The surface runoff scenarios were only considered for the terrestrial vegetation applications (i.e., control of terrestrial annual/perennial or woody vegetation). Although the overall conclusion for this scenario is no risk, based on the majority of the RQ results, it should be noted that the ERA predict risks to RTE plants, aquatic invertebrates in a pond, and aquatic plants in a pond, under certain conditions (see Section 4.3.3 and Appendix D for details).

4. Wind Erosion and Transport Off-site (Table 8-6) – No risks to non-target terrestrial plants (typical and RTE) were predicted for wind erosion scenarios involving 2,4-D acid/salts or esters. The wind erosion scenarios were only considered for the terrestrial vegetation applications (i.e., control of terrestrial annual/perennial or woody vegetation). Although the overall conclusion for this scenario is that there is no risk, based on the majority of the RQ results, it should be noted that the ERA did predict minimal risks to typical and RTE species at a distance of up to 1.5 km (0.9 miles) from the application area in certain watersheds (Glasgow, Montana, and Lander, Wyoming) and up to 10 km (6.2 miles) from the application area in the Medford, Oregon watershed. The highest RQs were predicted for terrestrial applications to control woody vegetation.

5. Accidental Spill to Pond (Tables 8-1 and 8-2; included in maximum application rate results) – The ERA predicted moderate to high risks to non-target aquatic plants, fish, and aquatic invertebrates under all of the 2,4-D spill scenarios.

Species that depend on non-target plant species for habitat, cover, and/or food may be indirectly impacted by a reduction in terrestrial or aquatic vegetation or prey items. For example, direct spray and off-site drift may negatively impact terrestrial and aquatic plants, reducing the cover available to RTE salmonids within the stream, and may reduce populations of prey items in the stream (i.e., fish and aquatic invertebrates). For aquatic herbicides, direct spray applications to streams may occur as part of normal treatment programs, and may cause impacts to non-target aquatic plants, fish, and aquatic invertebrates. If a stream containing salmonids were sprayed with an aquatic 2,4-D herbicide, the resultant reduction in available cover would have the potential to cause indirect impacts to salmonids.

Based on the results of the ERA, it is unlikely that RTE species would be harmed by appropriate and selective use of the herbicide 2,4-D on BLM-administered lands. Although non-target terrestrial and aquatic plants and aquatic organisms have the potential to be adversely affected by application of 2,4-D, adherence to specific application guidelines (e.g., defined application rates, equipment, herbicide mixture, and downwind distance to potentially sensitive habitat) would minimize the potential effects on non-target plants and associated indirect effects on species, such as salmonids, that depend on those plants for food, habitat, or cover.

Risks associated with aquatic applications of the granular formulation of 2,4-D (Navigate®) could not be quantitatively evaluated in this ERA. This product is used in the treatment of submerged vegetation at the bottom of a water body. It is expected that, like the direct spray applications of 2,4-D for treatment of floating, emerged, and submerged aquatic vegetation, the granular formulation may pose risks to aquatic receptors once it is applied to the water. This product is designed for the treatment of the bottom of the water body, so risks would be expected to be higher in this area and lower closer to the water surface.

8.2 Recommendations

The following recommendations are designed to reduce potential unintended impacts to the environment from 2,4-D products:

1. Select herbicide products carefully to minimize additional impacts from degradates, adjuvants, inert ingredients, and tank mixtures. This is especially important for application scenarios that already predict potential risk from the active ingredient alone.

2. Review, understand, and conform to the "Environmental Hazards" section on herbicide label. This section warns of known pesticide risks to wildlife receptors or to the environment and provides practical ways to avoid harm to organisms and their environment.

3. Avoid accidental direct spray and spill conditions to reduce the most significant potential impacts. When using aquatic herbicides, consider the potential for impacts to non-target aquatic plants, fish, and aquatic invertebrates.

4. Use the typical application rate, rather than the maximum application rate, to reduce potential risks.

5. Adhere to the buffer zones presented in Tables 8-7 (non-target RTE terrestrial plants exposed to 2,4-D acid/salts or ester products), 8-8 (non-target typical terrestrial plants exposed to 2,4-D acid/salts), and 8-9 (non-target typical terrestrial plants exposed to 2,4-D ester products) to reduce potential impacts on non-target terrestrial plants due to off-site drift.[14]

6. Avoid accidental direct spray and spill conditions to reduce the most significant potential impacts. When using aquatic herbicides, consider the potential for impacts to non-target aquatic plants, fish, and aquatic invertebrates.

7. Because no acute or chronic risks were predicted for non-target aquatic plants, fish, or aquatic invertebrates based on 2,4-D acid/salts (with one exception for chronic risks to fish in the stream), the buffer recommendations in Tables 8-10 and 8-11 are based on 2,4-D ester data. Buffers are not warranted for these scenarios for 2,4-D acid and salt products.

8. Adhere to the buffer zones presented in Tables 8-10 (non-target aquatic plants, aquatic invertebrates and RTE fish species) and 8-11 (non-target aquatic plants and aquatic invertebrates and typical fish species) to reduce potential impacts due to off-site drift when using a 2,4-D ester product.

9. Because runoff is most affected by precipitation, limit terrestrial applications of 2,4-D during wet seasons or in high precipitation areas in order to limit off-site transport.

10. To reduce risks to fish, aquatic invertebrates, aquatic plants, terrestrial plants, and RTE species, do not tank mix 2,4-D.

[14] Note: The ERAs evaluated potential risks due to off-site drift under several modeled distances from the application site (25, 100, and 900 feet for ground applications, and 100, 300, and 900 feet for aerial applications). Buffer distances provided in this section were obtained by plotting the RQs against the modeled distances, fitting a curve to the data, and then determining the distance at which the RQ was equivalent to an LOC of 1 for terrestrial plants (with an RQ based on a no observed adverse effect level [NOAEL] for RTE species and the 25% effect concentration [EC_{25}] for typical species). The curve was extended beyond the largest modeled distance to extrapolate buffers beyond 900 feet.

11. Consider the proximity of potential application areas to salmonid habitat and the possible off-site drift effects of herbicide application on riparian and aquatic vegetation. Buffer zones presented in Tables 8-7 through 8-11 should be reviewed to select the appropriate buffer that is 1) protective of riparian vegetation to prevent any associated indirect effects on salmonids due to a loss of cover, and 2) protective of prey items (i.e., fish and aquatic invertebrates).

TABLE 8-1

Typical Risk Levels Associated with the Application of 2,4-D in Direct Spray/Spill Scenarios for the Control of Terrestrial Vegetation

	Terrestrial Annual/Perennial Applications				Terrestrial Woody Applications			
	2,4-D Acid/Salts		2,4-D Esters		2,4-D Acid/Salts		2,4-D Esters	
	Typical Application Rate	Maximum Application Rate	Typical Application Rate	Maximum Application Rate	Typical Application Rate	Maximum Application Rate	Typical Application Rate	Maximum Application Rate
Terrestrial Animals	0 [12 : 16]	0 [10 : 16]	NA	NA	0 [11 : 16]	0 [9 : 16]	NA	NA
Terrestrial Plants (Typical Species)	H [1 : 1]	H [1 : 1]	H [1 : 1]	H [1 : 1]	H [1 : 1]	H [1 : 1]	H [1 : 1]	H [1 : 1]
Terrestrial Plants (RTE Species)	H [1 : 1]	H [1 : 1]	H [1 : 1]	H [1 : 1]	H [1 : 1]	H [1 : 1]	H [1 : 1]	H [1 : 1]
Fish in the Pond	L [2 : 2]	M [2 : 4]	M [1 : 1]	H [2 : 3]	L [2 : 2]	M [2 : 4]	M [1 : 1]	H [2 : 3]
Fish in the Stream	M [1 : 2]	M [2 : 2]	M [1 : 1]	H [1 : 1]	M [2 : 2]	M [2 : 2]	H [1 : 1]	H [1 : 1]
Aquatic Invertebrates in the Pond	L [1 : 2]	L [2 : 4]	H [1 : 1]	H [3 : 3]	L [1 : 2]	L [2 : 4]	H [1 : 1]	H [3 : 3]
Aquatic Invertebrates in the Stream	L [1 : 2]	M [1 : 2]	H [1 : 1]	H [1 : 1]	M [1 : 2]	M [1 : 2]	H [1 : 1]	H [1 : 1]
Aquatic Plants in the Pond	L [2 : 2]	L [2 : 4]	H [1 : 1]	H [3: 3]	L [2 : 2]	H [2 : 4]	H [1 : 1]	H [3 : 3]
Aquatic Plants in the Stream	M [1 : 2]	M [2 : 2]	H [1 : 1]	H [1 : 1]	M [2 : 2]	M [2 : 2]	H [1 : 1]	H [1 : 1]

RISK LEVELS:
0 = No Risk (majority of RQs < most conservative LOC).
L = Low Risk (majority of RQs 1-10 times the most conservative LOC).
M = Moderate Risk (majority of RQs 10 -100 times the most conservative LOC).
H = High Risk (majority of RQs >100 times the most conservative LOC).
The reported Risk Level is based on the risk level of the majority of the RQs for each exposure scenario within each of the above receptor groups and exposure categories (i.e., direct spray/spill, off-site drift, surface runoff, wind erosion). As a result, risk may be higher than the reported risk category for some scenarios within each category. The reader should consult the risk tables in Section 4 to determine the specific scenarios that result in the displayed level of risk for a given receptor group.
Number in brackets represents Number of RQs in the Indicated Risk Level:Number of Scenarios Evaluated.
NA = Not applicable. No RQs calculated for this scenario.
In cases of a tie, the more conservative (higher) risk level was selected.

TABLE 8-2

Typical Risk Levels Associated with the Application of 2,4-D in Direct Spray/Spill Scenarios for the Control of Aquatic Vegetation

	Aquatic Floating and Emerged Applications				**Aquatic Submerged Applications**			
	2,4-D Acid/Salts		**2,4-D Esters**		**2,4-D Acid/Salts**		**2,4-D Esters**	
	Typical Application Rate	Maximum Application Rate	Typical Application Rate	Maximum Application Rate	Typical Application Rate	Maximum Application Rate	Typical Application Rate	Maximum Application Rate
Terrestrial Animals	0 [12 : 17]	0 [10 : 17]	0 [11 : 16]	0 [8 : 16]	0 [10 : 17]	0 [6 : 17]	NA	NA
Terrestrial Plants (Typical Species)	H [1 : 1]	H [1 : 1]	H [1 : 1]	H [1 : 1]	H [1 : 1]	H [1 : 1]	H [1 : 1]	H [1 : 1]
Terrestrial Plants (RTE Species)	H [1 : 1]	H [1 : 1]	H [1 : 1]	H [1 : 1]	H [1 : 1]	H [1 : 1]	H [1 : 1]	H [1 : 1]
Fish in the Pond	L [2 : 2]	M [2 : 4]	M [1 : 1]	H [2 : 3]	M [1 : 2]	H [2 : 4]	M [1 : 1]	H [3: 3]
Fish in the Stream	M [2 : 2]	M [2 : 2]	H [1 : 1]	H [1 : 1]	H [1 : 2]	H [1 : 2]	H [1 : 1]	H [1 : 1]
Aquatic Invertebrates in the Pond	L [1 : 2]	L [2 : 4]	H [1 : 1]	H [3 : 3]	L [1 : 2]	M [3 : 4]	H [1 : 1]	H [3 : 3]
Aquatic Invertebrates in the Stream	M [1 : 2]	M [1 : 2]	H [1 : 1]	H [1 : 1]	M [1 : 2]	M [1 : 2]	H [1 : 1]	H [1 : 1]
Aquatic Plants in the Pond	L [2 : 2]	H [2 : 4]	H [1 : 1]	H [3 : 3]	M [1 : 2]	H [2 : 4]	H [1 : 1]	H [3 : 3]
Aquatic Plants in the Stream	M [2 : 2]	M [2 : 2]	H [1 : 1]	H [1 : 1]	H [1 : 2]	H [1 : 2]	H [1 : 1]	H [1 : 1]

RISK LEVELS:
See Table 8-1.

TABLE 8-3

Typical Risk Levels Associated with the Application of 2,4-D in Off-site Drift Scenarios for the Control of Terrestrial Vegetation

	Terrestrial Annual/Perennial Applications				Terrestrial Woody Applications			
	2,4-D Acid/Salts		2,4-D Esters		2,4-D Acid/Salts		2,4-D Esters	
	Typical Application Rate	Maximum Application Rate	Typical Application Rate	Maximum Application Rate	Typical Application Rate	Maximum Application Rate	Typical Application Rate	Maximum Application Rate
Terrestrial Plants (Typical Species)	L [12 : 18]	L [9 : 18]	L [8 : 18]	M [10 : 18]	L [9 : 18]	L [9 : 18]	M [10 : 18]	M [11 : 18]
Terrestrial Plants (RTE Species)	M [11 : 18]	M [10 : 18]	M [11 : 18]	M [10: 18]	M [10 : 18]	M [9 : 18]	M [10 : 18]	M [9 : 18]
Fish in the Pond	0 [36 :36]	0 [36 : 36]	0 [18 :18]	0 [16 : 18]	0 [36 :36]	0 [36 : 36]	0 [17 :18]	0 [16 : 18]
Fish in the Stream	0 [36 :36]	0 [36 : 36]	0 [18 :18]	0 [17 : 18]	0 [36 :36]	0 [35 : 36]	0 [17 :18]	0 [15 : 18]
Aquatic Invertebrates in the Pond	0 [36 :36]	0 [36 : 36]	L [12 :16]	L [8 : 11]	0 [36 :36]	0 [36 : 36]	L [8 :12]	L [7 : 8]
Aquatic Invertebrates in the Stream	0 [36 :36]	0 [36 : 36]	L [11 :18]	M [7 : 18]	0 [36 :36]	0 [36 : 36]	M [8 :18]	M [9 : 18]
Aquatic Plants in the Pond	0 [36 :36]	0 [36 : 36]	L [11 :18]	L [10 : 18]	0 [36 : 36]	0 [36 : 36]	L [11 :18]	M [7 : 18]
Aquatic Plants in the Stream	0 [36 : 36]	0 [36 : 36]	L [11 : 18]	L [9 : 18]	0 [36 : 36]	0 [36 : 36]	L [9 : 18]	M [8 : 18]
Piscivorous Birds	0 [18 :18]	0 [18 :18]	NA	NA	0 [18 :18]	0 [18 :18]	NA	NA

RISK LEVELS:
See Table 8-1.

TABLE 8-4

Typical Risk Levels Associated with the Application of 2,4-D in Off-site Drift Scenarios for the Control of Aquatic Vegetation

	Aquatic Floating and Emerged Applications				Aquatic Submerged Applications			
	2,4-D Acid/Salts		2,4-D Esters		2,4-D Acid/Salts		2,4-D Esters	
	Typical Application Rate	Maximum Application Rate	Typical Application Rate	Maximum Application Rate	Typical Application Rate	Maximum Application Rate	Typical Application Rate	Maximum Application Rate
Terrestrial Plants (Typical Species)	L [7 : 12]	L [7 : 12]	M [8 : 12]	M [8 : 12]	L [10 : 12]	L [7 : 12]	L [6 : 12]	M [8 : 12]
Terrestrial Plants (RTE Species)	M [8 : 12]	M [7 : 12]	L [8 : 12]	L [8 : 12]	M [9 : 12]	M [8: 12]	M [9 : 12]	M [8 : 12]
Fish in the Pond	0 [24 : 24]	0 [24 : 24]	0 [12 : 12]	0 [11 : 12]	0 [24 : 24]	0 [24 : 24]	0 [12 : 12]	0 [11 : 12]
Fish in the Stream	0 [24 : 24]	0 [24 : 24]	0 [12 : 12]	0 [10 : 12]	0 [24 : 24]	0 [24 : 24]	0 [12 : 12]	0 [12 : 12]
Aquatic Invertebrates in the Pond	0 [24 : 24]	0 [24 : 24]	L [6 : 8]	L [5 : 5]	0 [24 : 24]	0 [24 : 24]	L [9 : 11]	L [6 : 7]
Aquatic Invertebrates in the Stream	0 [24 : 24]	0 [24 : 24]	M [6 : 12]	M [7 : 12]	0 [24 : 24]	0 [24 : 24]	L [8 : 12]	M [5 : 12]
Aquatic Plants in the Pond	0 [24 : 24]	0 [24 : 24]	L [8 : 12]	M [5 : 12]	0 [24 : 24]	0 [24 : 24]	L [9 : 12]	L [7 : 12]
Aquatic Plants in the Stream	0 [24 : 24]	0 [24 : 24]	L [7 : 12]	M [6 : 12]	0 [24 : 24]	0 [24 : 24]	L [9 : 12]	L [7 : 12]
Piscivorous Birds	0 [12 : 12]	0 [12 : 12]	NA	NA	0 [12 : 12]	0 [12 : 12]	NA	NA

RISK LEVELS

See Table 8-1.

TABLE 8-5

Typical Risk Levels Associated with the Application of 2,4-D in Surface Runoff Scenarios for the Control of Terrestrial Vegetation

	Terrestrial Annual/Perennial Applications				**Terrestrial Woody Applications**			
	2,4-D Acid/Salts		**2,4-D Esters**		**2,4-D Acid/Salts**		**2,4-D Esters**	
	Typical Application Rate	Maximum Application Rate	Typical Application Rate	Maximum Application Rate	Typical Application Rate	Maximum Application Rate	Typical Application Rate	Maximum Application Rate
Terrestrial Plants (Typical Species)	0 [42 : 42]	0 [42 : 42]	0 [42 : 42]	0 [42 : 42]	0 [42 : 42]	0 [42 : 42]	0 [42 : 42]	0 [42 : 42]
Terrestrial Plants (RTE Species)	0 [39 : 42]	0 [39 : 42]	0 [40 : 42]	0 [38 : 42]	0 [39 : 42]	0 [39 : 42]	0 [38 : 42]	0 [38 : 42]
Fish in the Pond	0 [84 : 84]	0 [84 : 84]	0 42 : 42]	0 [42 : 42]	0 [84 : 84]	0 [84 : 84]	0 [42 : 42]	0 [41 : 42]
Fish in the Stream	0 [84 : 84]	0 [84 : 84]	0 [42 : 42]	0 [42 : 42]	0 [84 : 84]	0 [84 : 84]	0 [42 : 42]	0 [42 : 42]
Aquatic Invertebrates in the Pond	0 [84 : 84]	0 [84 : 84]	0 [36 : 42]	0 [34 : 42]	0 [84 : 84]	0 [84 : 84]	0 [34 : 42]	0 [33 : 42]
Aquatic Invertebrates in the Stream	0 [84 : 84]	0 [84 : 84]	0 [42 : 42]	0 [42 : 42]	0 [84 : 84]	0 [84 : 84]	0 [42 : 42]	0 [42 : 42]
Aquatic Plants in the Pond	0 [84 : 84]	0 [84 : 84]	0 [38 : 42]	0 [36 : 42]	0 [84 : 84]	0 [84 : 84]	0 [36 : 42]	0 [34 : 42]
Aquatic Plants in the Stream	0 [84 : 84]	0 [84 : 84]	0 [42 : 42]	0 [42 : 42]	0 [84 : 84]	0 [84 : 84]	0 [42 : 42]	0 [42 : 42]
Piscivorous Birds	0 [42 : 42]	0 [42 : 42]	NA	NA	0 [42 : 42]	0 [42 : 42]	NA	NA

RISK LEVELS:

See Table 8-1.

TABLE 8-6

Typical Risk Levels Associated with the Application of 2,4-D in Wind Erosion Scenarios for the Control of Terrestrial Vegetation

	Terrestrial Annual/Perennial Applications				Terrestrial Woody Applications			
	2,4-D Acid/Salts		2,4-D Esters		2,4-D Acid/Salts		2,4-D Esters	
	Typical Application Rate	Maximum Application Rate	Typical Application Rate	Maximum Application Rate	Typical Application Rate	Maximum Application Rate	Typical Application Rate	Maximum Application Rate
Terrestrial Plants (Typical Species)	0 [8 : 9]	0 [7 : 9]	0 [7 : 9]	0 [7 : 9]	0 [7 : 9]	0 [7 : 9]	0 [7 : 9]	0 [6 : 9]
Terrestrial Plants (RTE Species)	0 [7 : 9]	0 [6 : 9]	0 [7 : 9]	0 [6 : 9]	0 [6 : 9]	0 [5 : 9]	0 [6 : 9]	0 [5 : 9]

RISK LEVELS:
See Table 8-1.

TABLE 8-7

Recommended Buffers for Application of 2,4-D Acid, Salt, or Ester Products to Reduce Potential Risks to Non-Target RTE Terrestrial Plants Due to Off-Site Drift

	Maximum Application Rate				**Typical Application Rate**			
Modeled Scenario (Application Rate in lbs a.e./ac)	**Annual/ Perennial (2)**	**Woody (4)**	**Floating and Emergent (4)**	**Submerged (10.8)**	**Annual/ Perennial (1)**	**Woody (2)**	**Floating and Emergent (2)**	**Submerged (5.4)**
Aerial Application								
Plane over forest	2,600	3,000	**NA**	**NA**	2,200	2,600	**NA**	**NA**
Plane over non-forest	2,800	2,800*	2,800*	2,800	2,500	2,800*	2,800*	2,500
Helicopter over forest	800	1,000	**NA**	**NA**	600	800	**NA**	**NA**
Helicopter over non-forest	2,500*	2,400*	2,400*	2,500*	2,500*	2,400*	2,400*	2,500*
Terrestrial Application								
Low boom	1,600	1,900	1,900	1,600	1,300	1,600	1,600	1,300
High boom	1,600	1,900	1,900	1,600	1,400	1,600	1,600	1,400

NOTES:

1. All recommended buffers are in feet (ft).
2. lbs a.e./ac = pounds acid equivalent per acre.
3. **NA** = Not applicable. Scenario not evaluated.
4. * – Due to the uncertainties associated with extrapolating buffers beyond the largest modeled distance (900 ft), in some cases, a slightly larger buffer distance was estimated for the typical application rate than for the maximum application rate. In these cases, the larger buffer distance is recommended to be protective at both the typical and the maximum application rates.
5. Buffer distances were obtained by plotting the RQs against the modeled distances (i.e., 25, 100, and 900 feet for ground applications, and 100, 300, and 900 feet for aerial applications), fitting a curve to the data, and then determining the distance at which the RQ was equivalent to an LOC of 1 (with an RQ based on a no observed adverse effect level [NOAEL]). The curve was extended beyond the modeled distances to extrapolate buffers beyond 900 feet and closer than 25 (or 100) feet. Buffer distances were determined for both acid/salts and ester products and are typically within 100 feet or less of each other. Therefore, the maximum buffer distance of acid/salts and esters was selected as the recommended buffer to be protective of RTE terrestrial plants for all 2,4-D products.

TABLE 8-8

Recommended Buffers for Application of 2,4-D Acid or Salt Products to Reduce Potential Risks to Non-Target Typical Terrestrial Plants Due to Off-Site Drift

	Maximum Application Rate				Typical Application Rate			
Modeled Scenario (Application Rate in lbs a.e./ac)	**Annual/ Perennial (2)**	**Woody (4)**	**Floating and Emergent (4)**	**Submerged (10.8)**	**Annual/ Perennial (1)**	**Woody (2)**	**Floating and Emergent (2)**	**Submerged (5.4)**
Aerial Application								
Plane over forest	1,700	2,100	**NA**	**NA**	1,300	1,700	**NA**	**NA**
Plane over non-forest	1,700	1,800*	1,700*	1,800	1,400	1,800*	1,700*	1,400
Helicopter over forest	200	400	**NA**	**NA**	100	200	**NA**	**NA**
Helicopter over non-forest	1500	1,400*	1,400*	1,400	1,300*	1,400*	1,400*	1,300
Terrestrial Application								
Low boom	700	1,000	1,000	700	400	700	700	400
High boom	800	1,100	1,000	800	500	800	800	500

NOTES:
See Items 1-4 Table 8-7.
Buffer distances were obtained by plotting the RQs against the modeled distances (i.e., 25, 100, and 900 feet for ground applications, and 100, 300, and 900 feet for aerial applications), fitting a curve to the data, and then determining the distance at which the RQ was equivalent to an LOC of 1 (with an RQ based on the 25% effect concentration [EC25]). The curve was extended beyond the modeled distances to extrapolate buffers beyond 900 feet and closer than 25 (or 100) feet.

TABLE 8-9

Recommended Buffers for Application of 2,4-D Ester Products to Reduce Potential Risks to Non-Target Typical Terrestrial Plants Due to Off-Site Drift

	Maximum Application Rate				Typical Application Rate			
Modeled Scenario (Application Rate in lbs a.e./ac)	**Annual/ Perennial (2)**	**Woody (4)**	**Floating and Emergent (4)**	**Submerged (10.8)**	**Annual/ Perennial (1)**	**Woody (2)**	**Floating and Emergent (2)**	**Submerged (5.4)**
Aerial Application								
Plane over forest	2,200	2,600	**NA**	**NA**	1,800	2,200	**NA**	**NA**
Plane over non-forest	2,300	2,400*	2,300*	2,300	2,000	2,400*	2,300*	2,000
Helicopter over forest	500	700	**NA**	**NA**	300	500	**NA**	**NA**
Helicopter over non-forest	2,000*	1,900*	1,900*	2,000*	2,000*	1,900*	1,900*	2,000*
Terrestrial Application								
Low boom	1,300	1,500	1,500	1,200	800	1,200	1,200	900
High boom	1,300	1,500	1,500	1,200	1,000	1,200	1,300	1,000

NOTES:
See Items 1-4 Table 8-7.
Buffer distances were obtained by plotting the RQs against the modeled distances (i.e., 25, 100, and 900 feet for ground applications, and 100, 300, and 900 feet for aerial applications), fitting a curve to the data, and then determining the distance at which the RQ was equivalent to an LOC of 1 (with an RQ based on the 25% effect concentration [EC25]). The curve was extended beyond the modeled distances to extrapolate buffers beyond 900 feet and closer than 25 (or 100) feet.

TABLE 8-10

Recommended Buffers for Application of 2,4-D Ester Products to Reduce Potential Risks to Non-Target Aquatic Plants, Aquatic Invertebrates, and RTE Fish Species Due to Off-Site Drift

	Maximum Application Rate				Typical Application Rate			
Modeled Scenario (Application Rate in lbs a.e./ac)	**Annual/ Perennial (2)**	**Woody (4)**	**Floating and Emergent (4)**	**Submerged (10.8)**	**Annual/ Perennial (1)**	**Woody (2)**	**Floating and Emergent (2)**	**Submerged (5.4)**
Aerial Application								
Helicopter over forest and pond	300	500	**NA**	**NA**	100	300	**NA**	**NA**
Helicopter over non-forest and pond	1,400	1,400	1,400*	1,400	1,300	1,400	1,400*	1,200
Plane over forest and pond	1,700	2,000	**NA**	**NA**	1,300	1,600	**NA**	**NA**
Plane over non-forest and pond	1,700	1,600	1,600	1,700	1,300	1,600	1,600	1,300
Helicopter over forest and stream	400	600	**NA**	**NA**	200	400	**NA**	**NA**
Helicopter over non-forest and stream	1,400	1,400	1,400*	1,400	1,200	1,400	1,400*	1,200
Plane over forest and stream	1,600	1,900	**NA**	**NA**	1,300	1,600	**NA**	**NA**
Plane over non-forest and stream	1,600	1,600	1,600	1,700	1,300	1,600	1,600	1,300
Terrestrial Application								
Low boom over pond	1,100	1,200	1,100	1,100	900	900	800	600
High boom over pond	1,100	1,100	1,100	1,100	900	900	900	600
Low boom over stream	500	900	800	600	300	600	600	400
High boom over stream	200	900	900	500*	0	700	700	500*

NOTES:
See Items 1-4 Table 8-7.
Buffer distances were obtained by plotting the RQs against the modeled distances (i.e., 25, 100, and 900 feet for ground applications, and 100, 300, and 900 feet for aerial applications), fitting a curve to the data, and then determining the distance at which the RQ was equivalent to a LOC of 0.05 for RTE fish and aquatic invertebrates, or a LOC of 1 for aquatic plants. The curve was extended beyond the modeled distances to extrapolate buffers beyond 900 feet and closer than 25 (or 100) feet.
Buffers for aquatic plants, aquatic invertebrates, and fish were calculated separately. The buffer that is protective of all species (i.e., the largest) is presented in this table.
If RTE fish species are not present in the water body, use buffers presented in Table 8-11.

TABLE 8-11

Recommended Buffers for Application of 2,4-D Ester Products to Reduce Potential Risks to Non-Target Aquatic Plants, Aquatic Invertebrates, and Typical Fish Species Due to Off-Site Drift

	Maximum Application Rate				Typical Application Rate			
Modeled Scenario (Application Rate in lbs a.e./ac)	**Annual/ Perennial (2)**	**Woody (4)**	**Floating and Emergent (4)**	**Submerged (10.8)**	**Annual/ Perennial (1)**	**Woody (2)**	**Floating and Emergent (2)**	**Submerged (5.4)**
Aerial Application								
Helicopter over forest and pond	300	300	**NA**	**NA**	100	100	**NA**	**NA**
Helicopter over non-forest and pond	1,100	1,200*	1,200*	1,100	900	1,200*	1,200*	900
Plane over forest and pond	1,400	1,800	**NA**	**NA**	1000	1,400	**NA**	**NA**
Plane over non-forest and pond	1,400	1,400	1,400	1,400	1000	1,400	1,400	1,000
Helicopter over forest and stream	200	400	**NA**	**NA**	100	200	**NA**	**NA**
Helicopter over non-forest and stream	1,100	1,100	1,100	1,200	900	1,100	1,100	900
Plane over forest and stream	1,300	1,700	**NA**	**NA**	1,000	1,300	**NA**	**NA**
Plane over non-forest and stream	1,300	1,400	1,400	1,300	1,000	1,400	1,400	1,000
Terrestrial Application								
Low boom over pond	900	800	800	500	300	500	500	200
High boom over pond	1000	900	900	900	800	600	600	300
Low boom over stream	300	600	600	400	200	400	400	200
High boom over stream	0	700	700	400	0	500	500	0

NOTES:
See Items 1-4 Table 8-7.
Buffer distances were obtained by plotting the RQs against the modeled distances (i.e., 25, 100, and 900 feet for ground applications, and 100, 300, and 900 feet for aerial applications), fitting a curve to the data, and then determining the distance at which the RQ was equivalent to a LOC of 0.5 for typical fish and aquatic invertebrate species, or a LOC of 1 for aquatic plants. The curve was extended beyond the largest modeled distances to extrapolate buffers beyond 900 feet and closer than 25 (or 100) feet.
Buffers for aquatic plants, aquatic invertebrates, and fish were calculated separately. The buffer that is protective of all species (i.e., the largest) is presented in this table.
If RTE fish species are present in the water body, use buffers presented in Table 8-10.

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APPENDIX A – USEPA OFFICE OF PESTICIDE PROGRAMS ECOLOGICAL INCIDENT INFORMATION SYSTEM INCIDENT REPORTS FOR 2,4-D

EIIS Pesticide Summary Report: General Information

2,4-D (030001)

Incident #	Date	County	State	Certainty	Legal.	Form.	Appl. Method	Total Magnitude
AQUATIC								
Agricultural Area								
I003826-024	5/5/1994	STANLY	NC	1	RU	N/R	Spray	UNKNOWN
Corn								
B000150-001	5/3/1970		IL	0	UN	N/R	N/R	40
Home/Lawn								
I000636-017	4/13/1987	Audrain	MO	4	RU	RTU	Spray	Several
Lake								
I000804-014	6/24/1991	HAAKON	SD	2	MI			UNKNOWN
I003654-004	5/14/1993	MOORE	NC	1	RU			250
N/R								
B0000-300-59	6/2/1970		NC	3	MA		Spill	1-mile stretch
B0000-300-87	6/13/1979	CHARLESTON	SC	2	UN	N/R	N/R	760
B0000-300-35	4/4/1984	BEAUFORT	SC	3	UN		N/R	N/R
B0000-300-36	7/12/1984	BEAUFORT	SC	3	UN		N/R	21
B0000-300-37	8/11/1984	BEAUFORT	SC	3	UN		N/R	300

Certainty Code: 0=Unrelated, 1=Unlikely, 2=Possible, 3=Probable, 4=Highly Probable.
Legality Code: RU=Registered Use, M=Misuse, MA=Misuse (Accidental), MI=Misuse (Intentional), U=Unknown.

Incident #	Date	County	State	Certainty	Legal.	Form.	Appl. Method	Total Magnitude
I004374-002	5/26/1995	St. Charles	MO	1	MA			150
I004875-001	3/10/1996	East Baton Rouge	LA	4	MI		LEAKING DRUM	600
I004668-001	3/10/1996	EAST BATON ROUG	LA	3	MA		SPILL	600
POND								
I003602-003	7/22/1991	DUTCHESS	NY	2	RU	N/R	N/R	1000
I003826-003	6/29/1995	BLADEN	NC	1	UN	N/R	Broadcast, unincorp	UNKNOWN
Right-of-way								
B0000-300-77	6/2/1970		NC	3	MA	N/R	Spill	1-mile stretch
Right-of-way, rail								
I000925-001	6/10/1993	MERCER	WV	4	RU	N/R	SPRAYING	23000
Right-of-way, railroad								
I000598-009	6/21/1988	SARPY	NE	2	UN	N/R	SPRAY	139
Spill								
B0000-300-78	8/27/1974		ME	3	MA	N/R	Spill	6000
Stream								
I003601-001	6/22/1993	NEW CASTLE	DE	3	RU	N/R	Broadcast, unincorp	1000
Sugarcane								
I001849-010	8/10/1994		LA	3	MA		Broadcast	20
TOBACCO								

Certainty Code: 0=Unrelated, 1=Unlikely, 2=Possible, 3=Probable, 4=Highly Probable.
Legality Code: RU=Registered Use, M=Misuse, MA=Misuse (Accidental), MI=Misuse (Intentional), U=Unknown.

Incident #	Date	County	State	Certainty	Legal.	Form.	Appl. Method	Total Magnitude
I003826-002	6/12/1995	JOHNSTON	NC	1	UN	N/R	N/R	UNKNOWN

Turf, golf course

Incident #	Date	County	State	Certainty	Legal.	Form.	Appl. Method	Total Magnitude
B0000-502-13	8/11/1984	BEAUFORT	SC	2	UN	N/R	N/R	300

PLANTS

No Data

Incident #	Date	County	State	Certainty	Legal.	Form.	Appl. Method	Total Magnitude
I020459-018	3/1/2000	Skagit	WA	2	UN			
I020459-031	6/6/2000	Klickitat	WA	2	UN			$290,000 losses
I020998-014	7/3/2002	Clark	WA	2	UN			
I020998-042	7/28/2003	Walla Walla	WA	2	UN			

00598-009

Incident #	Date	County	State	Certainty	Legal.	Form.	Appl. Method	Total Magnitude
I009262-033	8/9/1999		FL	4	UN	N/R	N/R	50% OF LAWN

Agricultural Area

Incident #	Date	County	State	Certainty	Legal.	Form.	Appl. Method	Total Magnitude
I003780-002			IA	2	UN			Unknown
I005880-046		WALWORTH	WI	3	MA		Spray	Unknown
I020627-026		Klickitat	WA	2	UN			Extensive
I003116-001	3/1/1994	WASCO	OR	4	MA	N/R	Broadcast	80 OF 97 ACRES
I002168-001	5/1/1995		FL	3	MA	F	Broadcast, unincorp	Unknown
I004848-001	1/1/1996		IL	3	RU	N/R	N/R	ALL

Certainty Code: 0=Unrelated, 1=Unlikely, 2=Possible, 3=Probable, 4=Highly Probable.
Legality Code: RU=Registered Use, M=Misuse, MA=Misuse (Accidental), MI=Misuse (Intentional), U=Unknown.

Incident #	Date	County	State	Certainty	Legal.	Form.	Appl. Method	Total Magnitude
I003104-001	1/1/1996		ID	4	RU	N/R	N/R	ALL
I003249-006	2/3/1996	IMPERIAL	CA	4	RU	EC	Spray	THOUSANDS
I006130-001	2/1/1997		MS	3	RU	N/R	Broadcast	ALL
I007251-001	1/1/1998		WI	3	RU	N/R	N/R	ALL
I007754-001	5/1/1998	LEE	IL	3	RU	N/R	Broadcast	56
I007714-001	5/24/1998	WARREN	IL	3	RU	N/R	GROUND-BROAD	20-30% PLANTS
I020998-022	4/17/2002	Klickitat	WA	4	UN			
I020998-030	8/24/2002	Walla Walla	WA	2	UN			
I020998-036	3/12/2003	Adams	WA	2	UN			
I014806-001	7/1/2003	Bannock	ID	1	RU	N/R	N/R	3020 acres
Barley								
I013587-043	5/21/1999	Klickitat	WA	3	M		Spray	Unknown
Bean								
I013883-019	6/2/1997	ADAMS	WA	3	MA		Spray	Not given
Berry, blackberry								
I020627-017	5/22/2001	Kitsap	WA	2	UN		Spray	Unknown
I020627-018	6/4/2001	Grays Harbor	WA	2	UN			Unknown
I020627-021	8/23/2001	Cowlitz	WA	2	UN			Unknown
Cherry								

Certainty Code: 0=Unrelated, 1=Unlikely, 2=Possible, 3=Probable, 4=Highly Probable.
Legality Code: RU=Registered Use, M=Misuse, MA=Misuse (Accidental), MI=Misuse (Intentional), U=Unknown.

Incident #	Date	County	State	Certainty	Legal.	Form.	Appl. Method	Total Magnitude
I014409-028	4/7/1992	Benton	WA	3	RU			Not given
Corn								
I014404-026	6/24/1991	Grant	WA	2	M		N/R	N/R
I000360-016	1/1/1993		MN	2	RU			399 acres
I006214-010	11/3/1997		MN	3	RU	N/R	N/R	UNKNOWN
I006214-009	11/3/1997		MN	3	RU	N/R	N/R	UNKNOWN
I006214-008	11/3/1997		IA	3	RU	N/R	N/R	UNKNOWN
I006214-007	11/3/1997		IL	3	RU	N/R	N/R	UNKNOWN
I006214-005	11/3/1997		IA	3	RU	N/R	N/R	UNKNOWN
I006214-003	11/3/1997		IA	3	RU	N/R	N/R	UNKNOWN
I006214-002	11/3/1997		IA	3	RU	N/R	N/R	UNKNOWN
I006214-001	11/3/1997		MN	3	RU	N/R	N/R	UNKNOWN
I006214-011	11/3/1997		MN	3	RU	N/R	N/R	UNKNOWN
I006214-006	11/3/1997		IA	3	RU	N/R	N/R	UNKNOWN
I007750-001	5/1/1998	RICHLAND	ND	3	RU	N/R	Broadcast	60 ACRES
I010927-015	5/2/1999	FRANKLIN	IA	3	RU	N/R	Spray	132 ACRES
Corn Field								
I013636-006	5/22/2002	LA PORTE	IN	2	RU		Broadcast	27 Acres
Corn, field								

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Legality Code: RU=Registered Use, M=Misuse, MA=Misuse (Accidental), MI=Misuse (Intentional), U=Unknown.

Incident #	Date	County	State	Certainty	Legal.	Form.	Appl. Method	Total Magnitude
I012366-009	4/25/2001	HARDIN	IA	2	RU		Broadcast	105 acres
I012366-063	4/26/2001	HARDIN	IA	2	UN		Broadcast	134 acres
I012366-010	4/26/2001	HARDIN	IA	2	RU		Broadcast	134 acres
I012366-008	4/27/2001	CARROLL	IA	2	RU		Broadcast	30 acres
I012366-062	5/9/2001	HARDIN	IA	2	UN	G	Broadcast	105 acres
I013636-002	4/5/2003	SENECA	OH	3	RU		Broadcast	68 out of 68 acres
Cotton								
I000358-002	1/1/1993		MS	2	UN		N/R	30 ACRES COTTON
I012243-001	7/31/2001		MO	2	RU	N/R	N/R	40,000 ACRES
ditch								
I021276-008	7/31/2004	Grant	WA	2	UN			
Driveway								
I014409-009	6/4/1992	King	WA	2	RU			Not given
Fallow								
I021276-025	8/4/2004	Columbia	WA	2	UN			
Fencerow								
I014404-019	9/12/1990	Spokane	WA	3	M		Spray	N/R
FENCEROW/SOYBEANS								
I000026-001	7/11/1991	HANCOCK	IA	3	MA		HAND-HELD WA	Unknown

Certainty Code: 0=Unrelated, 1=Unlikely, 2=Possible, 3=Probable, 4=Highly Probable.
Legality Code: RU=Registered Use, M=Misuse, MA=Misuse (Accidental), MI=Misuse (Intentional), U=Unknown.

Incident #	Date	County	State	Certainty	Legal.	Form.	Appl. Method	Total Magnitude
FIELD								
I006442-002	1/1/1998		NE	3	RU	N/R	N/R	ALL
I006442-003	1/1/1998		IL	3	RU	N/R	N/R	ALL
I006442-001	1/1/1998		WI	3	RU	N/R	N/R	ALL
Grape								
I020459-027	5/18/2000	Benton	WA	2	UN			
I020627-003	6/1/2001	Grant	WA	2	MI			350 acres
Grass								
I013550-004	7/1/2001	Dixie	FL	3	RU			18 acres
Hay								
I015748-001		Culpeper	VA	2	RU		Broadcast	10.2 acres
I008336-001	4/27/1998	RUSK	TX	2	RU	N/R	N/R	ALL
I020627-010	6/1/2001	Grant	WA	2	UN			
I021002-005	5/20/2009	Guilford	NC	1	UN			Unknown
HILLSIDE								
B0000-300-58	7/1/1969		AZ	3	MA	N/R	N/R	UNKNOWN
HOME/LAWN								
I001358-001	8/1/1994		CO	1	UN	N/R	N/R	UNSPECIFIED ACREAGE
I007340-654	5/8/1998		CO	2	UN		N/R	LAWN

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Incident #	Date	County	State	Certainty	Legal.	Form.	Appl. Method	Total Magnitude
I007340-710	5/28/1998		CA	2	UN		N/R	LAWN
I007980-029	6/16/1998	SUFFOLK	NY	2	UN		N/R	LAWN
I007980-047	6/16/1998	FALL RIVER	SD	2	UN		N/R	65% OF LAWN
I007980-042	6/17/1998	HAMILTON	OH	2	UN		N/R	LAWN
I007980-039	6/19/1998		CA	2	UN		N/R	LAWN
I007980-028	6/23/1998	FULTON	GA	2	UN		N/R	LAWN
I007980-038	6/24/1998	MONMOUTH	NJ	2	UN		N/R	LAWN
I007980-046	6/26/1998	SONOMA	CA	2	UN		N/R	LAWN
I007980-037	6/27/1998	ASHTABULA	OH	2	UN		N/R	50% OF LAWN
I007980-036	6/27/1998	NASSAU	NY	2	UN		N/R	LAWN
I007980-045	6/29/1998	LAKE	OH	2	UN		N/R	LAWN
I007980-010	7/6/1998	PHILADELPHIA	PA	2	RU		N/R	LAWN
I007980-011	7/7/1998		NY	2	MA		N/R	LAWN
I007980-012	7/7/1998	DES MOINES	IA	2	UN		N/R	LAWN
I007980-013	7/10/1998	HUDSON	NJ	2	UN		N/R	LAWN
I007980-014	7/11/1998		NV	2	UN		N/R	LAWN
I007980-015	7/11/1998	ST TAMMANY	LA	2	MA		N/R	LAWN
I007980-016	7/13/1998	BUCKS	PA	2	UN		N/R	LAWN

Certainty Code: 0=Unrelated, 1=Unlikely, 2=Possible, 3=Probable, 4=Highly Probable.
Legality Code: RU=Registered Use, M=Misuse, MA=Misuse (Accidental), MI=Misuse (Intentional), U=Unknown.

Incident #	Date	County	State	Certainty	Legal.	Form.	Appl. Method	Total Magnitude
I007980-017	7/13/1998	WESTCHESTER	NY	2	UN		N/R	LAWN
I007980-052	7/14/1998		NY	2	UN		N/R	60% OF LAWN
I007980-026	7/20/1998	JEFFERSON	CO	2	UN		N/R	60% LAWN
I007980-022	7/21/1998		MO	2	UN		N/R	80% LAWN
I007980-035	7/21/1998		NY	2	UN		N/R	LAWN
I007980-021	7/21/1998	KANAWHA	WV	2	UN		N/R	LAWN
I007980-034	7/24/1998	HARTFORD	CT	2	UN		N/R	LAWN
I007980-033	8/6/1998	RIVERSIDE	CA	2	UN		N/R	LAWN
I007980-031	8/10/1998	LOS ANGELES	CA	2	UN		N/R	LAWN
I007980-032	8/10/1998	BARNSTABLE	MA	2	UN		N/R	LAWN
I007980-053	8/10/1998	LOS ANGELES	CA	2	UN		N/R	60% OF LAWN
I007980-030	8/10/1998	NASSAU	NY	2	UN		N/R	LAWN
I007980-027	8/20/1998	CUYAHOGA	OH	2	UN		N/R	LAWN
I007980-043	8/24/1998	PHILADELPHIA	PA	2	UN		Broadcast, unincorp	LAWN
I007980-001	8/24/1998	PHILADELPHIA	PA	2	RU		N/R	UNKNOWN
I007980-040	8/24/1998		CO	2	UN		N/R	LAWN
I007980-044	8/26/1998	JEFFERSON	KY	2	UN		N/R	3 LAWNS
I007980-023	8/28/1998		MO	2	UN		N/R	LAWN'

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Legality Code: RU=Registered Use, M=Misuse, MA=Misuse (Accidental), MI=Misuse (Intentional), U=Unknown.

Incident #	Date	County	State	Certainty	Legal.	Form.	Appl. Method	Total Magnitude
I007980-051	9/1/1998	NEW HAVEN	CT	2	UN		N/R	LAWN
I007980-050	9/1/1998	FAIRFAX	VA	2	UN		N/R	LAWN
I007980-008	9/1/1998	COOK	IL	2	RU		N/R	UNKNOWN
I007980-025	9/3/1998	NEW HAVEN	CT	2	UN		N/R	75% LAWN
I007980-024	9/7/1998	SUFFOLK	NY	2	UN		N/R	50% LAWN
I007980-002	9/7/1998	MIDDLESEX	NJ	2	RU		N/R	UNKNOWN
I007980-048	9/11/1998	COOK	IL	2	UN		N/R	LAWN
I007980-009	9/11/1998	PINELLAS	FL	2	RU		N/R	UNKNOWN
I007980-054	9/14/1998	LA PORTE	IN	2	UN		N/R	75% OF LAWN
I007980-041	9/22/1998	MERCER	NJ	2	UN		N/R	LAWN
I007980-006	9/28/1998	BREVARD	FL	2	MA		N/R	UNKNOWN
I007980-007	9/28/1998	SEMINOLE	FL	2	MA		N/R	UNKNOWN
I007980-018	9/30/1998	TAZEWELL	VA	2	UN		N/R	LAWN
I007980-004	10/2/1998	WASHINGTON	RI	2	RU		N/R	UNKNOWN
I007980-005	10/2/1998	POLK	FL	2	MA		N/R	UNKNOWN
I007980-049	10/7/1998	PLACER	CA	2	UN		N/R	80-90% OF LAWN
I007980-003	10/9/1998	PINELLAS	FL	2	RU		N/R	UNKNOWN
I008027-001	10/19/1998	DALLAS	TX	2	MA		N/R	LAWN

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Incident #	Date	County	State	Certainty	Legal.	Form.	Appl. Method	Total Magnitude
I008027-003	10/19/1998		NJ	2	UN		N/R	80% OF LAWN
I007980-019	10/19/1998		NJ	2	UN		N/R	LAWN
I007980-020	10/19/1998	DALLAS	TX	2	MA		N/R	LAWN
I008027-002	10/26/1998		FL	2	MA		N/R	ALL
I008571-031	12/8/1998	SEMINOLE	FL	3	UN	N/R	N/R	HALF OF LAWN
I009262-034	3/1/1999	ROSS	OH	3	UN	N/R	Broadcast	90% OF LAWN
I009262-035	5/27/1999	ATLANTIC	NJ	3	UN	N/R	Broadcast	60% OF LAWN
I009262-038	6/25/1999	CUYAHOGA	OH	2	RU	N/R	N/R	100% OF LAWN
I009262-039	7/14/1999	BARNSTABLE	MA	3	RU	N/R	Broadcast	ALL
I009262-042	8/1/1999	VOLUSIA	FL	3	UN	N/R	Broadcast, unincorp	50% OF LAWN
I009262-064	8/2/1999	RICHMOND	NY	3	MA	G	Broadcast, unincorp	OVER 60% OF LAWN
I009262-040	8/5/1999	SARATOGA	NY	3	RU	N/R	N/R	50% OF LAWN
I009262-041	8/6/1999		OH	3	RU	N/R	Broadcast	65% OF LAWN
I009262-061	8/6/1999	CUYAHOGA	OH	3	MA	G	Broadcast, unincorp	50% OF LAWN
I009262-050	8/10/1999	LAKE	OH	3	UN	N/R	Broadcast, unincorp	100% OF LAWN
I009262-062	8/10/1999	RICHMOND CITY	VA	3	RU	G	Broadcast, unincorp	75% OF LAWN
I009262-043	8/10/1999	GREENVILLE	SC	3	RU	N/R	Broadcast, unincorp	85% OF LAWN
I009262-049	8/10/1999		NJ	3	UN	N/R	Broadcast, unincorp	1005 OF LAWN

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Incident #	Date	County	State	Certainty	Legal.	Form.	Appl. Method	Total Magnitude
I009262-048	8/11/1999	MENOMINEE	MI	3	UN	N/R	Broadcast, unincorp	50% OF LAWN
I009262-046	8/12/1999	ORANGE	FL	3	UN	N/R	Broadcast, unincorp	APPR 10,000 SQ FT
I009262-047	8/12/1999			3	UN	N/R	Broadcast, unincorp	UNKNOWN
I009262-045	8/13/1999	LAWRENCE	PA	3	UN	N/R	Broadcast, unincorp	100% OF LAWN
I009262-063	8/13/1999	TAZEWELL	IL	3	MA	G	Broadcast, unincorp	95% OF LAWN
I009262-036	8/16/1999	CAMDEN	NJ	3	RU	N/R	N/R	100% OF FRONT YARD
I009262-037	8/16/1999	RICHMOND	NY	3	MA	N/R	N/R	75% OF BACK YARD
I009262-057	8/18/1999		MI	3	RU	G	Broadcast, unincorp	50% OF LAWN
I009262-051	8/23/1999	PASCO	FL	3	MA	N/R	Broadcast, unincorp	ALL
I009262-054	8/23/1999	MIDDLESEX	NJ	3	RU	N/R	Broadcast, unincorp	ALL
I009262-052	8/24/1999	SHELBY	TN	3	MA	N/R	Broadcast, unincorp	50% OF LAWN
I009262-053	8/24/1999	PLYMOUTH	MA	3	MA	N/R	N/R	ALL
I009445-043	9/7/1999	MIDDLESEX	CT	3	RU	G	Broadcast, unincorp	50% OF LAWN
I009445-057	9/7/1999	COOK	IL	3	RU	G	Broadcast, unincorp	ALL
I009445-045	9/7/1999	SAGINAW	MI	3	UN	G	Broadcast, unincorp	UNKNOWN
I009445-044	9/7/1999	SCHENECTADY	NY	3	MA	G	Broadcast, unincorp	50% OF LAWN
I009445-047	9/10/1999	MULTNOMAH	OR	3	UN	G	Broadcast, unincorp	90% OF LAWN
I009445-040	9/13/1999		FL	3	MA	N/R	Broadcast, unincorp	ALL

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Incident #	Date	County	State	Certainty	Legal.	Form.	Appl. Method	Total Magnitude
I009445-042	9/13/1999			3	RU	G	Broadcast, unincorp	ALL
I009445-041	9/14/1999		GA	3	UN	N/R	N/R	UNKNOWN
I009445-050	9/20/1999	COBB	GA	3	UN	G	Broadcast, unincorp	90% OF LAWN
I009445-039	9/20/1999	ANNE ARUNDEL	MD	3	RU	N/R	Broadcast, unincorp	900 SQ FT (85% AREA)
I009445-051	9/20/1999	MIDDLESEX	CT	3	UN	G	Broadcast, unincorp	UNKNOWN
I009445-049	9/24/1999	NEW HAVEN	CT	3	MA	G	Broadcast, unincorp	90% OF LAWN
I009445-054	9/27/1999	NASSAU	NY	3	UN	G	Broadcast, unincorp	UNKNOWN
I009445-053	9/30/1999	MONTGOMERY	PA	3	UN	G	Broadcast, unincorp	UNKNOWN
I009445-052	9/30/1999	MACON	IL	3	UN	G	Broadcast, unincorp	50% OF LAWN
I009786-013	12/20/1999	DUVAL	FL	3	MA	N/R	N/R	ALL
I009786-011	12/20/1999	MANATEE	FL	3	MA	N/R	GROUND SPREA	50% OF LAWN
I009786-012	1/3/2000	MANATEE	FL	3	MA	N/R	DROP SPREADER	PARTS OF LAWN
I009916-014	1/5/2000	MONTGOMERY	PA	3	RU	N/R	N/R	ALL
I010546-001	7/1/2000	MONTGOMERY	OH	3	MA	G	N/R	6500 SQ FT
I010546-002	7/1/2000	SUFFOLK	NY	3	MA	G	Broadcast, unincorp	15000 TO 18000 SQ FT
I010581-089	7/6/2000	ERIE	PA	3	RU		Broadcast, unincorp	10,000 SQ FT
HOME/TREE								
I000546-001	5/14/1993	CRAIGHEAD	AR	3	UN	N/R	N/R	N/R ON 3.5 ACRES

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I008027-004	10/19/1998		IA	2	UN		N/R	40
irrigation district								
I021276-011	6/28/2004	Adams	WA	3	UN			
lawn								
I014407-034	6/30/1994	Spokane	WA	3	MA			
I013884-022	6/26/1998	SPOKANE	WA	2	RU			4 plants
MUNICIPAL SITE								
B0000-300-62			OR	3	UN		N/R	HOME GARDEN
Municpal operation								
B0000-300-63	6/1/1973		OR	2	UN		N/R	UNKNOWN
N/R								
I020627-037		Yakima	WA	2	UN			
B0000-300-61			TX	3	MA		Broadcast	UNKNOWN
I014407-043	5/16/1949	Walla Walla	WA	3	UN			
I014404-023	1/1/1990	Walla walla	WA	2	UN			30 acres
I014404-017	7/26/1990	Klickitat	WA	2	MA		Spray	N/R
I014409-002	4/27/1992	Grant	WA	2	UN			Half of alfalfa crop
I014409-003	5/3/1992	Yakima	WA	2	M			Not given
I014409-042	6/8/1992	Benton	WA	2	M			Not given

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Incident #	Date	County	State	Certainty	Legal.	Form.	Appl. Method	Total Magnitude
I014409-044	6/9/1992	Franklin	WA	2	UN			30-40 apricot trees
I014409-019	7/13/1992	Spokane	WA	2	UN			Not given
I014407-045	7/22/1994	Grant	WA	2	UN			
I014407-047	8/15/1994	Franklin	WA	2	UN			
I014405-014	7/19/1996	Spokane	WA	2	UN			
I013883-022	5/1/1997	LINCOLN	WA	2	UN		Spray	Not given
I013883-005	5/23/1997	OKANOGAN	WA	3	RU		Spray	Unknown
I013883-020	6/1/1997	SPOKANE	WA	2	UN		Spray	Not given
I013883-034	6/1/1997	Yakima	WA	2	UN			Not given
I013883-038	6/11/1997	Benton	WA	2	UN		Unknown	Not given
I005879-014	6/25/1997	CHICKASAW	IA	2	UN		N/R	UNKNOWN
I013883-026	6/28/1997	Kitsap	WA	4	UN		Direct	Not given
I013883-027	8/5/1997	Grays Harbor	WA	2	UN		Not given	Not given
I007259-001	1/1/1998		WI	2	UN			UNKNOWN
I013884-034	7/1/1998	Benton	WA	2	UN			Not given
I020459-015	4/20/2000	Clark	WA	2	UN		Spray	
I020459-026	5/27/2000	Yakima	WA	2	UN			40 acres
I020459-032	6/15/2000	Benton	WA	3	UN			

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Incident #	Date	County	State	Certainty	Legal.	Form.	Appl. Method	Total Magnitude
I014266-002	7/3/2003		MB	2	M		Spray	
I016297-001	5/24/2005	Somerset	MD	2	UN		Spray	5 acres
Orchard (unspecified)								
I013884-007	6/11/1997	Chelan	WA	2	M			Not given
Ornamental								
I014407-016	5/16/1994	Spokane	WA	3	UN			
I020459-021	9/9/2000	Clallam	WA	2	M			
Ornamental, woody								
B0000-300-70	6/15/1976		AR	3	MI	N/R	N/R	1
I012786-005	5/13/2001			2	UN			10
PASTURE								
B0000-300-65	8/25/1973		MO	3	MA	N/R	Broadcast	UNKNOWN
I007875-001	5/1/1991	DANE	WI	3	RU	F	GROUND-BROAD	55ACRES
I014409-075	9/14/1992	Spokane	WA	2	M			Not given
I013884-006	6/11/1998	Chelan	WA	3	RU			Not given
I013587-074	5/23/1999	Clark	WA	2	RU		Spray	Unknown
I011249-001	6/17/2000	Webster	NE	2	RU	SC	Spray	UNKNOWN
I017958-011	7/29/2006	Bourbon	KY	2	RU	F		6 acres
Pinto beans								

Incident #	Date	County	State	Certainty	Legal.	Form.	Appl. Method	Total Magnitude
I000360-004	1/1/1993		CO	2	RU	N/R	N/R	540 ACRES BEANS
Potato								
I013587-013	7/16/1999	ADAMS	WA	2	MA		Spray	Unknown
I014702-002	7/23/2003	Teton	ID	2	RU	N/R	N/R	N/R
Property								
I020998-011	6/1/2002	Spokane	WA	2	UN			
property line								
I020998-043	5/23/2002	Thurston	WA	2	UN		Spray	
RANGELAND								
B0000-300-56	5/25/1966		UT	3	MA		Broadcast	11,000 ACRES
I013883-006	6/15/1997	GRANT	WA	3	RU		Spray	Unknown
I013883-007	6/30/1997	GRANT	WA	3	RU		Spray	Not given
I010527-001	6/26/2000	CHEROKEE	TX	2	RU	N/R	Spray	65 ACRES
RICE								
I003578-001			CA	3	MA			1248 ACRES
RIGHT-OF-WAY								
B0000-300-48	6/3/1973		OK	3	MA		Spray	N/R
B0000-300-64	6/25/1973		TN	2	UN	N/R	N/R	UNKNOWN
I013883-012	4/1/1997	GRANT	WA	2	RU		Spray	Not given

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Incident #	Date	County	State	Certainty	Legal.	Form.	Appl. Method	Total Magnitude
I013884-030	7/9/1998	Spokane	WA	2	RU			Several trees
I013884-035	7/27/1998	Spokane	WA	3	RU		Spray	36
I020627-028	6/7/2001	Klickitat	WA	1	UN			
I020627-025	6/7/2001	Klickitat	WA	2	UN			
I020627-014	8/2/2001	Adams	WA	2	UN			
I020627-015	8/28/2001	Grant	WA	2	UN			
I021276-022	5/20/2004	Franklin	WA	2	UN			
I016680-001	4/6/2005	Douglas	OR	2	UN		Spray	13 acres
Right-of-way, railroad								
B0000-300-45	6/3/1972		OK	2	UN		Spray	174
I020459-028	5/28/2000	Klickitat	WA	2	UN			100
Right-of-way, road								
I020627-005		Grant	WA	2	MA		Spray	Unknown
I001473-001	4/1/1994		KY	2	RU	N/R	SPRAY	CROP DAMAGE
I013884-021	8/12/1998	GRANT	WA	3	M			N/R
I013587-008	6/1/1999	Okanogan	WA	2	M		Spray	N/R
I020459-003	5/1/2000	Grant	WA	2	UN			
I020627-031	7/10/2001	Benton	WA	3	MI			Unknown

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I014290-001	7/3/2003	Lemhi	ID	4	MA		Spray	900 square feet
I019442-001	7/19/2007	Brown	OH	2	MI			
Road								
I013883-028	7/23/1997	Pierce	WA	2	RU		Spray	Not given
Soybean								
I017841-001		St. Landry	LA	3	MI			1500 acres
I006214-004	11/3/1997		IL	3	RU	N/R	N/R	UNKNOWN
I006214-012	11/3/1997		IL	3	RU	N/R	N/R	UNKNOWN
SWITCH GRASS								
I003138-001			MN	3	RU			UNKNOWN
TREE FARM								
B0000-300-69	6/12/1976		OR	3	MA	N/R	N/R	UNKNOWN
Trees								
I014407-041	5/1/1994	Snohomish	WA	3	UN			
Turf, residential								
I007371-030	5/2/1997		PA	3	RU		N/R	N/R
I010581-056	6/1/2000	PASSAIC	NJ	3	RU	N/R	N/R	100 %
I010581-059	6/6/2000		MN	2	RU	N/R	Broadcast	2/3 DAMAGED
I010581-087	6/16/2000	WASHTENAW	MI	3	RU	N/R	Broadcast	ALL

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I010581-081	6/22/2000	DALLAS	TX	3	RU	N/R	N/R	ALL
I010581-070	6/28/2000	SUFFOLK	NY	3	MA	N/R	Broadcast	ALL
I010581-086	6/28/2000		WV	3	MA	N/R	Broadcast	75%
I010581-097	6/30/2000	PUTNAM	NY	3	RU	N/R	N/R	ALL
I010581-095	6/30/2000	MONMOUTH	NJ	2	RU	N/R	Broadcast	ALL
I010581-072	7/2/2000	CHAFFEE	CO	3	RU	N/R	Broadcast	ALL
I010581-094	7/3/2000	WESTCHESTER	NY	2	RU	N/R	Broadcast	50%
I010581-063	7/3/2000	MERRIMACK	NH	2	RU	N/R	Broadcast	UNKNOWN
I010581-074	7/3/2000	PALM BEACH	FL	3	MA	N/R	N/R	UNKNOWN
I010581-096	7/3/2000	MIDDLESEX	MA	3	MA	N/R	Broadcast	ALL
I010581-060	7/6/2000		NY	2	RU	N/R	Broadcast	95% DAMAGED
I010581-057	7/6/2000	CHESAPEAKE CITY	VA	2	RU	N/R	Broadcast	75%
I010581-062	7/7/2000		CA	2	RU	N/R	Broadcast	200 SQ FT
I010581-071	7/8/2000	ETOWAH	AL	2	RU	N/R	Broadcast	5000 SQ FT
I010581-099	7/9/2000	SAN MIGUEL	NM	3	MA	N/R	Broadcast	ALL
I010581-073	7/10/2000	OCEAN	NJ	2	RU	N/R	N/R	UNKNOWN
I010581-069	7/10/2000	SHELBY	TN	3	RU	N/R	N/R	ALL
I010581-066	7/11/2000	LINCOLN	NV	3	MA	N/R	Broadcast	95% DAMAGE

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Incident #	Date	County	State	Certainty	Legal.	Form.	Appl. Method	Total Magnitude
I010581-077	7/11/2000	BUTTE	CA	3	MA	N/R	Broadcast	UNKNOWN
I010581-075	7/13/2000		MN	3	RU	N/R	N/R	UNKNOWN
I010581-052	7/17/2000	BALTIMORE	MD	3	RU	N/R	N/R	7000 SQ FT
I010581-054	7/19/2000		CT	3	RU	N/R	N/R	60%
I010581-078	7/20/2000	JACKSON	OR	3	MA	N/R	Broadcast	UNKNOWN
I010581-076	7/20/2000	SNOHOMISH	WA	3	MA	N/R	N/R	2675 SQ FT
I010581-065	7/25/2000	COOK	IL	2	RU	N/R	Broadcast	3/4 DAMAGED
I010581-090	7/29/2000	LOS ANGELES	CA	3	MA	N/R	BROADCAST SPR	ALL
I020627-011	6/15/2001	Spokane	WA	2	UN			
I020627-008	6/19/2001	Spokane	WA	2	RU			
Undetermined								
I000358-003	1/1/1993		CO	2	UN		N/R	Unknown
Wheat								
I020998-012		Whitman	WA	2	UN			
I021276-001		Grant	WA	3	UN			
I014404-003	4/2/1990	Klickitat	WA	2	UN		Spray	N/R
I003386-001	4/11/1994	WASCO	OR	4	MI		Broadcast	665
I013883-003	4/1/1997	DOUGLAS	WA	3	RU		Spray	

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Incident #	Date	County	State	Certainty	Legal.	Form.	Appl. Method	Total Magnitude
I013883-037	5/12/1997	Franklin	WA	2	RU		Not given	Not given
I013884-009	5/1/1998	Whitman	WA	3	RU			Not given
I008333-001	6/25/1998	OSBORNE	KS	2	RU	N/R	Broadcast	40 ACRES
I013884-032	7/16/1998	Klickitat	WA	2	RU			
I013587-023	6/13/1999	Lincoln	WA	3	M			Unknown
I020627-007	4/18/2001	Adams	WA	2	UN		Spray	
I020998-007	4/29/2002	Douglas	WA	2	UN			
I017483-001	3/30/2006	Marion	KY	2	RU		Spray	23 acres
Wheat, winter								
I014409-048	6/15/1992	Klickitat	WA	2	M			18 acres
Yard								
I013587-053	5/31/1999	BENTON	WA	3	M		Spray	Unknown

TERRESTRIAL

Incident #	Date	County	State	Certainty	Legal.	Form.	Appl. Method	Total Magnitude
No Data								
I020998-010	6/7/2002	Spokane	WA	4	UN			
Agricultural Area								
I000309-001	5/26/1992	WASHINGTON	UT	2	UN		Spray	MORE THAN 13

Corn

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I003151-001	1/1/1996		MN	3	RU	N/R	N/R	ALL
I004495-001	5/19/1996	DES MOINES	IA	4	MA		Broadcast	UNKNOWN
HOME/LAWN								
I008033-007	8/26/1998	UNION	OH	2	UN		N/R	LAWN
N/R								
I000008-001	5/11/1992	DURHAM	NC	1	MA		Spray	3 NESTS FULL
Right-of-way								
I013884-025	6/2/1998	Lincoln	WA	2	MI		Spray	Not given
Sunflower								
I017576-001	6/13/2006	Lincoln	CO	1	RU		Broadcast, unincorp	2200
Turf, residential								
I019025-039	9/17/2007	Lancaster	PA	2	UN			4

TERRESTRIAL/AQUATIC

Incident #	Date	County	State	Certainty	Legal.	Form.	Appl. Method	Total Magnitude
Agricultural Area								
B000150-002	5/2/1970		IL	3	RU	N/R	N/R	2500
Home/Lawn								
I000799-003	5/6/1991	Alamance	NC	3	UN	N/R	N/R	Hundreds
N/R								
I006139-001	10/1/1997		OK	2	UN	N/R	N/R	UNKNOWN

Certainty Code: 0=Unrelated, 1=Unlikely, 2=Possible, 3=Probable, 4=Highly Probable.
Legality Code: RU=Registered Use, M=Misuse, MA=Misuse (Accidental), MI=Misuse (Intentional), U=Unknown.

APPENDIX B – SUMMARY OF AVAILABLE AND RELEVANT TOXICITY DATA FOR 2,4-D

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APPENDIX B.1 – BIBLIOGRAPHY LIST

COMPLETE LISTING OF TOXICITY REFERENCES EVALUATED FOR

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USEPA. 1992hh. Multi-species Toxicity Tests with Plants Exposed via Direct Spray and Soil Treatment. Evaluation Report reviewed by M. Davy and W. Evans, U.S. Environmental Protection Agency. MRID 43197001.

USEPA. 1992ii. Multi-species Seedling Emergence (Phytotoxicity) Tests with Plants Exposed via Soil Treatment. Evaluation Report reviewed by M. Davy, U.S. Environmental Protection Agency. Date Reviewed 1993. MRID 43197002.

USEPA. 1992jj. 96-hour Static Acute Toxicity Test with *Oncorhynchus mykiss.* Evaluation Report reviewed by A. Yamhure, U.S. Environmental Protection Agency. Date Reviewed 1996. MRID 43220201.

USEPA. 1992kk. Multi-species Toxicity Tests Exposed via Direct Spray, and Soil Treatment. Evaluation Report reviewed by M. Davy, U.S. Environmental Protection Agency. MRID 43279201.

USEPA. 1992ll. 14-day Vegetative Vigor (Phytotoxicity) Test with *Raphanus sativus* Exposed via Direct Spray. Evaluation Report reviewed by M.Davy, U.S. Environmental Protection Agency. Date Reviewed 1999. MRID 43279202.

USEPA. 1992mm. Multi-species Toxicity Tests Exposed via Direct Spray, Water and Soil Treatment. Evaluation Report reviewed by M. Davy and R. Petrie, U.S. Environmental Protection Agency. MRID 43374701.

USEPA. 1992nn. Multi-species Seedling Emergence (Shoot Height) Tests with Plants Exposed via Soil Treatment. Evaluation Report reviewed by M. Davy, U.S. Environmental Protection Agency. Date Reviewed 1994. MRID 43526901.

USEPA. 1992oo. 14-day Vegetative Vigor (Root Weight) Test with *Sorghum bicolor.* Evaluation Report reviewed by M. Davy, U.S. Environmental Protection Agency. Date Reviewed 1998. MRID 43930701.

USEPA. 1992pp. Seedling Emergence (Phytotoxicity) Test on *Glycine max* Exposed via Soil Treatment. Evaluation Report reviewed by W. Evans, U.S. Environmental Protection Agency. Date Reviewed 2004. MRID 43933101.

USEPA. 1992qq. Multi-species Toxicity Tests with Plants Exposed via Direct Spray and Soil Treatment. Evaluation Report reviewed by M. Davy, H. Craven (KBN) and R. Petrie, U.S. Environmental Protection Agency. MRID 43982101.

USEPA. 1992rr. 14-day Seedling Germination Test with Lycopersicon *esculentum.* Evaluation Report reviewed by K. Valente, U.S. Environmental Protection Agency. Date Reviewed 1992. MRID 44275601.

USEPA. 1992ss. Seedling Emergence (Phytotoxicity) Test with *Sorghum bicolor.* Evaluation Report reviewed by W. Evans, U.S. Environmental Protection Agency. Date Reviewed 2004. MRID TN 0317,0053991.

USEPA. 1992tt. 14-day Static Toxicity Test with *Lemna gibba.* Evaluation Report reviewed by M. Davy, U.S. Environmental Protection Agency. Date Reviewed 1993. MRID TN 0572, 00050675.

USEPA. 1992uu. 14-day Seedling Emergence (Shoot Weight) Test with *Glycine max.* Evaluation Report reviewed by K. Valente, U.S. Environmental Protection Agency. Date Reviewed 1992. MRID TN 0574, 00050676.

USEPA. 1992vv. 14-day Seedling Emergence (Shoot Height) Test with *Glycine max* Exposed via Soil Treatment. Evaluation Report reviewed by M. Davy, U.S. Environmental Protection Agency. Date Reviewed 1993. MRID TN 0684.

USEPA. 1992ww. 5-day Static Toxicity Test with *Selenastrum capricornutum.* Evaluation Report reviewed by M. Davy, U.S. Environmental Protection Agency. Date Reviewed 1993. MRID TN 0867.

USEPA. 1993a. 14-day Toxicity Test with *Colinus virginianus* Exposed Orally. Evaluation Report reviewed by A. Yamhure, U.S. Environmental Protection Agency. Date Reviewed 1996. MRID 41429005.

USEPA. 1993b. 14-day Seedling Emergence Test with *Allium cepa* Exposed via Soil Treatment. Evaluation Report reviewed by W. Evans, U.S. Environmental Protection Agency. Date Reviewed 2001. MRID 41737305.

USEPA. 1993c. 5-day Static Toxicity Test with *Navicula pelliculosa.* Evaluation Report reviewed by H. Craven (KBN), U.S. Environmental Protection Agency. Date Reviewed 1993. MRID 41975103.

USEPA. 1993d. 48-hour Flow-through Acute Toxicity Test with *Daphnia magna.* Evaluation Report reviewed by Contract Draft-KBN, U.S. Environmental Protection Agency. Date Reviewed 1993. MRID 42068403.

USEPA. 1993e. Multi-species Toxicity Tests with Plants Exposed via Soil, Water and Direct Spray. Evaluation Report reviewed by J. Goodyear, Contract Draft-KBN and W. Evans, U.S. Environmental Protection Agency. MRID 42343902.

USEPA. 1993f. Multi-species Toxicity Tests with Plants Exposed via Soil and Direct Spray. Evaluation Report reviewed by J. Goodyear and W. Evans, U.S. Environmental Protection Agency. MRID 42389501.

USEPA. 1993g. Multi-species Toxicity Tests with Plants Exposed via Soil. Evaluation Report reviewed by W. Evans, U.S. Environmental Protection Agency. Date Reviewed 2001. MRID 42416802.

USEPA. 1993h. 21-day Vegetative Vigor Test with *Lactuca sativa* Exposed via Direct Spray. Evaluation Report reviewed by J. Goodyear, U.S. Environmental Protection Agency. Date Reviewed 1994. MRID 43016701.

USEPA. 1993i. 21-day Seedling Emergence (Shoot Height) Test with *Raphanus sativus* Exposed via Soil. Evaluation Report reviewed by W. Evans, U.S. Environmental Protection Agency. Date Reviewed 2001. MRID 43197001.

USEPA. 1993j. Multi-species Toxicity Tests with Plants Exposed via Soil. Evaluation Report reviewed by J. Goodyear and W. Evans, U.S. Environmental Protection Agency. MRID 43197002.

USEPA. 1993k. 14-day Toxicity Test with *Colinus virginianus* Exposed Orally. Evaluation Report reviewed by A. Yamhure, U.S. Environmental Protection Agency. Date reviewed 1996. MRID 43227401.

USEPA. 1993l. 21-day Seedling Emergence (Phytotoxicity) Test with *Raphanus sativus* Exposed via Soil. Evaluation Report reviewed by W. Evans, U.S. Environmental Protection Agency. Date reviewed 2001. MRID 43279201.

USEPA. 1993m. Multi-species 21-day Seedling Emergence (Phytotoxicity) Tests Exposed via Soil and Direct Spray. Evaluation Report reviewed by W. Evans and J. Goodyear, U.S. Environmental Protection Agency. MRID 43279202.

USEPA. 1993n. 7-day Seedling Germination Test with *Raphanus sativus* Exposed via Soil. Evaluation Report reviewed by W. Evans, U.S. Environmental Protection Agency. Date reviewed 2001. MRID 43933201.

USEPA. 1993o. Multi-species 21-day Seedling Emergence Tests Exposed with Plants Exposed via Soil. Evaluation Report reviewed by W. Evans, U.S. Environmental Protection Agency. Date reviewed 2001. MRID 43982101.

USEPA. 1993p. 21-day Vegetative Vigor Test with *Lolium perenne* Exposed via Direct Spray. Evaluation Report reviewed by J. Goodyear, U.S. Environmental Protection Agency. Date reviewed 1994. MRID 44517305.

USEPA. 1993q. 5-day Static Toxicity Test with *Selenastrum capricornutum.* Evaluation Report reviewed by H. Craven (KBN), U.S. Environmental Protection Agency. Date reviewed 1993. MRID TN 0059.

USEPA. 1993r. 14-day Seedling Emergence Test with *Raphanus sativus* Exposed via Soil. Evaluation Report reviewed by W. Evans, U.S. Environmental Protection Agency. Date reviewed 2001. MRID TN 0683 00050674.

USEPA. 1994a. 5-day Toxicity Test with *Colinus virginianus* Exposed via Diet. Evaluation Report reviewed by Contract Draft-KBN, U.S. Environmental Protection Agency. Date reviewed 1997. MRID 00022923.

USEPA. 1994b. 14-day Static Toxicity Test with *Lemna gibba.* Evaluation Report reviewed by M. Davy, U.S. Environmental Protection Agency. Date reviewed 1998. MRID 00036935.

USEPA. 1994c. 21-day Vegetative Vigor (Root Weight) Test with *Lolium perenne* Exposed via Direct Spray. Evaluation Report reviewed by B. Montague, U.S. Environmental Protection Agency. Date reviewed 2000. MRID 00063066.

USEPA. 1994d. Multi-species 5-day Toxicity Tests with Birds Exposed via Diet. Evaluation Report reviewed by N. Cook and D. Urban, U.S. Environmental Protection Agency. MRID 40098001.

USEPA. 1994e. 5-day Toxicity Test with *Anas platyrhynchos* Exposed via Diet. Evaluation Report reviewed by N. Cook, U.S. Environmental Protection Agency. Date Reviewed 1996. MRID 40228401.

USEPA. 1994f. 28-day Seedling Emergence (Dry Weight) Test with *Raphanus sativus* Exposed via Soil. Evaluation Report reviewed by R. Hirsch, U.S. Environmental Protection Agency. Date Reviewed 2000. MRID 41158306.

USEPA. 1994g. 21-day Vegetative Vigor (Root Weight) Test with *Avena sativa* Exposed via Direct Spray. Evaluation Report reviewed by B. Montague, U.S. Environmental Protection Agency. Date Reviewed 2000. MRID 41353801.

USEPA. 1994h. 21-day Seedling Emergence (Root Weight) Test with *Avena sativa* Exposed via Soil. Evaluation Report reviewed by B. Montague, U.S. Environmental Protection Agency. Date Reviewed 2000. MRID 41735204.

USEPA. 1994i. 5-day Static Toxicity Test with *Navicula pelliculosa.* Evaluation Report reviewed by M. Davy, U.S. Environmental Protection Agency. Date Reviewed 1994. MRID 41766701.

USEPA. 1994j. 28-day Seedling Emergence (Dry Weight) Test with *Avena sativa.* Evaluation Report reviewed by R. Hirsch, U.S. Environmental Protection Agency. Date Reviewed 2000. MRID 41835203.

USEPA. 1994k. 21-day Seedling Emergence (Root Weight) Test with *Glycine max.* Evaluation Report reviewed by B. Montague, U.S. Environmental Protection Agency. Date Reviewed 2000. MRID 41835205.

USEPA. 1994l. 5-day Static Toxicity Test with *Navicula pelliculosa.* Evaluation Report reviewed by H. Craven (KBN), U.S. Environmental Protection Agency. Date Reviewed 1994. MRID 41975106.

USEPA. 1994m. 5-day Seedling germination Test with *Zea mays.* Evaluation Report reviewed by R. Hirsch, U.S. Environmental Protection Agency. Date Reviewed 2000. MRID 42068402.

USEPA. 1994n. Multi-species Toxicity Tests with Plants Exposed via Soil and Direct Spray. Evaluation Report reviewed by R. Hirsch, U.S. Environmental Protection Agency. Date Reviewed 2000. MRID 42343902.

USEPA. 1994o. Multi-species Toxicity Tests with Plants Exposed via Soil and Direct Spray. Evaluation Report reviewed by R. Hirsch and B. Montague, U.S. Environmental Protection Agency. Date Reviewed 2000. MRID 42389501.

USEPA. 1994p. 5-day Seedling Germination Test with *Lycopersicon esculentum.* Evaluation Report reviewed by R. Hirsch, U.S. Environmental Protection Agency. Date Reviewed 2000. MRID 42416802.

USEPA. 1994q. Multi-species Toxicity Tests with Plants Exposed via Soil. Evaluation Report reviewed by R. Hirsch and B. Montague, U.S. Environmental Protection Agency. Date Reviewed 2000. MRID 42449201.

USEPA. 1994r. 28-day Seedling Germination Test with *Daucus carota.* Evaluation Report reviewed by R. Hirsch, U.S. Environmental Protection Agency. Date Reviewed 2000. MRID 42767003.

USEPA. 1994s. Multi-species Toxicity Tests with Plants Exposed via Soil. Evaluation Report reviewed by R. Hirsch and B. Montague, U.S. Environmental Protection Agency. Date Reviewed 2000. MRID 43016701.

USEPA. 1994t. 5-day Seedling Germination Test with *Allium cepa.* Evaluation Report reviewed by R. Hirsch, U.S. Environmental Protection Agency. Date Reviewed 2000. MRID 43098901.

USEPA. 1994u. 5-day Seedling Germination Test with *Helianthus annus.* Evaluation Report reviewed by R. Hirsch, U.S. Environmental Protection Agency. Date Reviewed 2000. MRID 43098902.

USEPA. 1994v. Multi-species Toxicity Tests with Plants Exposed via Water and Direct Spray. Evaluation Report reviewed by B. Montague and H. Craven (KBN), U.S. Environmental Protection Agency. MRID 43197001.

USEPA. 1994w. 21-day Vegetative Vigor (Root Weight) Test with *Raphanus sativus.* Evaluation Report reviewed by B. Montague, U.S. Environmental Protection Agency. Date Reviewed 2000. MRID 43197002.

USEPA. 1994x. Multi-species Vegetative Vigor Tests with Plants Exposed via Direct Spray. Evaluation Report reviewed by B. Montague, U.S. Environmental Protection Agency. Date Reviewed 2000. MRID 43279201.

USEPA. 1994y. Multi-species Toxicity Tests with Plants Exposed via Soil. Evaluation Report reviewed by B. Montague and R. Hirsch, U.S. Environmental Protection Agency. Date Reviewed 2000. MRID 43279202.

USEPA. 1994z. 28-day Seedling Emergence Test with *Cucumis sativus.* Evaluation Report reviewed by R. Hirsch, U.S. Environmental Protection Agency. Date Reviewed 2000. MRID 43374701.

USEPA. 1994aa. 5-day Seedling Germination Test with *Avena sativa.* Evaluation Report reviewed by R. Hirsch, U.S. Environmental Protection Agency. Date Reviewed 2000. MRID 43910301.

USEPA. 1994bb. Multi-species Toxicity Tests with Plants Exposed via Soil. Evaluation Report reviewed by R. Hirsch, U.S. Environmental Protection Agency. Date Reviewed 2000. MRID 43982101.

USEPA. 1994cc. 21-day Seedling Emergence (Root Weight) Test with *Lolium perenne.* Evaluation Report reviewed by B. Montague, U.S. Environmental Protection Agency. Date Reviewed 2000. MRID TN 0608, 00024968.

USEPA. 1995a. 5-day Static Toxicity Test with *Selenastrum capricornutu.* Evaluation Report reviewed by N. Cook, U.S. Environmental Protection Agency. Date Reviewed 1996. MRID 02059454.

USEPA. 1995b. 14-day Seedling Emergence (Shoot Weight) Test with *Allium cepa.* Evaluation Report reviewed by S. Ramasamy, U.S. Environmental Protection Agency. Date Reviewed 2001. MRID 42343902.

USEPA. 1995c. 14-day Seedling Emergence (Shoot Weight) Test with *Cucumis sativus.* Evaluation Report reviewed by S. Ramasamy, U.S. Environmental Protection Agency. Date Reviewed 2001. MRID 43197002.

USEPA. 1996a. 14-day Vegetative Vigor Test with *Cucumis sativus.* Evaluation Report reviewed by Contract Draft GAI, U.S. Environmental Protection Agency. Date Reviewed 1999. MRID 00102870.

USEPA. 1996b. 14-day Toxicity Test with *Colinus virginianus* Exposed Orally. Evaluation Report reviewed by N. Federoff, U.S. Environmental Protection Agency. Date Reviewed 1996. MRID 00160000.

USEPA. 1996c. 5-day Multi-Species Toxicity Tests with Birds Exposed via Diet. Evaluation Report reviewed by N. Federoff, U.S. Environmental Protection Agency. Date Reviewed 1996. MRID 40098001.

USEPA. 1996d. 14-day Vegetative Vigor Test with *Glycine max.* Evaluation Report reviewed by Contract Draft GAI, U.S. Environmental Protection Agency. Date Reviewed 1999. MRID 41353801.

USEPA. 1996e. 14-day Vegetative Vigor Test with *Monocots.* Evaluation Report reviewed by Contract Draft GAI, U.S. Environmental Protection Agency. Date Reviewed 1999. MRID 41735202.

USEPA. 1996f. 32-day Seedling Emergence (Shoot Weight) Test with *Allium cepa.* Evaluation Report reviewed by R. Hirsch, U.S. Environmental Protection Agency. Date Reviewed 1999. MRID 41735205.

USEPA. 1996g. 96-hour Flow-through Toxicity Test with *Oncorhynchus mykiss.* Evaluation Report reviewed by N. Federoff, U.S. Environmental Protection Agency. Date Reviewed 1996. MRID 42068401.

USEPA. 1996h. Multi-species Toxicity Tests with Plants and Fish exposed via Water and Direct Spray. Evaluation Report reviewed by Contract Draft GAI and A. Stavola, U.S. Environmental Protection Agency. MRID 42343902.

USEPA. 1996i. Multi-species Toxicity Tests with Plants exposed via Soil and Direct Spray. Evaluation Report reviewed by Contract Draft GAI, U.S. Environmental Protection Agency. Date Reviewed 1999. MRID 42416801.

USEPA. 1996j. Multi-species Toxicity Tests with Plants exposed via Soil and Direct Spray. Evaluation Report reviewed by Contract Draft GAI, U.S. Environmental Protection Agency. Date Reviewed 1999. MRID 43016701.

USEPA. 1996k. 96-hour Flow-through Toxicity Test with *Lepomis macrochirus.* Evaluation Report reviewed by N. Federoff, U.S. Environmental Protection Agency. Date Reviewed 1996. MRID 43197001.

USEPA. 1996l. 14-day Seedling Emergence (Shoot Height) Test with *Cucumis sativus.* Evaluation Report reviewed by Contract Draft GAI, U.S. Environmental Protection Agency. Date Reviewed 1999. MRID 43197002.

USEPA. 1996m. 14-day Multi-Species Seedling Emergence Tests with Plants Exposed via Soil. Evaluation Report reviewed by Contract Draft GAI, U.S. Environmental Protection Agency. Date Reviewed 1999. MRID 43279201.

USEPA. 1996n. 14-day Seedling Emergence Test with *Brassica oleracea.* Evaluation Report reviewed by Contract Draft GAI, U.S. Environmental Protection Agency. Date Reviewed 1999. MRID 43279202.

USEPA. 1996o. 14-day Multi-Species Tests with Plants Exposed via Soil and Direct Spray. Evaluation Report reviewed by Contract Draft GAI, U.S. Environmental Protection Agency. Date Reviewed 1999. MRID 43982101.

USEPA. 1996p. 96-hour Flow-through Toxicity Test with *Lepomis macrochirus.* Evaluation Report reviewed by R. Mahler, U.S. Environmental Protection Agency. Date Reviewed 1997. MRID TN 0064, 54045.

USEPA. 1996q. 48-hour Flow-through Toxicity Test with *Daphnia magna.* Evaluation Report reviewed by N. Federoff, U.S. Environmental Protection Agency. Date Reviewed 1996. MRID TN 0224, 00054026.

USEPA. 1996r. 96-hour Flow-through Toxicity Test with *Oncorhynchus mykiss.* Evaluation Report reviewed by N. Federoff, U.S. Environmental Protection Agency. Date Reviewed 1996. MRID TN 0726.

USEPA. 1997a. 21-day Vegetative Vigor (Shoot Weight) Test with *Sorghum bicolor.* Evaluation Report reviewed by N. Mastrota, U.S. Environmental Protection Agency. Date Reviewed 1998. MRID 00102870.

USEPA. 1997b. 96-hour Static Acute Toxicity Test with *Rana pipiens.* Evaluation Report reviewed by S. Ramasamy, U.S. Environmental Protection Agency. Date Reviewed 2000. MRID 00160000.

USEPA. 1997c. 72-hour Acute Contact Toxicity Test with *Apis mellifera.* Evaluation Report reviewed by S. Ramasamy, U.S. Environmental Protection Agency. Date Reviewed 2000. MRID 41353805.

USEPA. 1997d. 72-hour Acute Toxicity Test with *Apis mellifera* Exposed Orally. Evaluation Report reviewed by S. Ramasamy, U.S. Environmental Protection Agency. Date Reviewed 2000. MRID 41429002.

USEPA. 1997e. 14-day Seedling Emergence (Shoot Height) Test with *Allium cepa.* Evaluation Report reviewed by D. Rieder, U.S. Environmental Protection Agency. Date Reviewed 1998. MRID 43197002.

USEPA. 1997f. 14-day Seedling Emergence (Shoot Height) Test with *Daucus carota.* Evaluation Report reviewed by D. Rieder, U.S. Environmental Protection Agency. Date Reviewed 1998. MRID 43279201.

USEPA. 1997g. 96-hour Static Acute Toxicity Test with *Rana pipiens.* Evaluation Report reviewed by S. Ramasamy, U.S. Environmental Protection Agency. Date Reviewed 2001. MRID 43374701.

USEPA. 1997h. 14-day Seedling Emergence (Root Length) Test with *Daucus carota.* Evaluation Report reviewed by D. Rieder, U.S. Environmental Protection Agency. Date Reviewed 1998. MRID 43910301.

USEPA. 1997i. Multi-species Toxicity Tests with Plants Exposed via Soil, Water and Direct Spray. Evaluation Report reviewed by N. Mastrota, D. Rieder and W. Evans, U.S. Environmental Protection Agency. MRID 43982101.

USEPA. 1999. 7-day Static Acute Toxicity Test with *Lemna minor.* Evaluation Report reviewed by L. Brown, U.S. Environmental Protection Agency. Date Reviewed 2005. MRID 41505904.

USEPA. 2000. 21-week Reproductive Test with *Colinus virginianus.* Evaluation Report reviewed by W. Evans, U.S. Environmental Protection Agency. Date Reviewed 2001. MRID 40098001.

USEPA. 2001a. 6-week Reproductive Test with *Coturnix japonica.* Evaluation Report reviewed by M. Janson, U.S. Environmental Protection Agency. Date Reviewed 2006. MRID 46879201.

USEPA. 2001b. 6-week Reproductive Test with *Coturnix japonica.* Evaluation Report reviewed by M. Janson, U.S. Environmental Protection Agency. Date Reviewed 2006. MRID 00072472.

Appendix B – Summary of Available and Relevant Toxicity Data for 2,4-D

Appendix B.2 – Spreadsheet of Toxicity Data for 2,4-D TRV Acid and Salt TRVs

Spreadsheet of Toxicity Data for 2,4-D Acid and Salt TRVs

Formulation	% purity a.i.	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint	Toxicity Value (tested product)[1]	Units	Toxicity Value (a.e.)[1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Cucumber	*Cucumis sativus*	Juvenile	Vegetative vigor (phytotoxicity)	Direct spray	21 D	21 D	Vegetative vigor	EC25	0.002	lbs ai/acre	0.0013	lbs ae/acre	Pan Agicultural Laboratory, CA	43279201	1994[3,4]	B. Montague	2000	Yes
2,4 DP-p-2-EHE	**95.7**	**Terrestrial Plant**	**Cucumber**	***Cucumis sativus***	**Juvenile**	**Vegetative vigor (phytotoxicity)**	**Direct spray**	**21 D**	**21 D**	**Vegetative vigor**	**NOEL**	**0.0004**	**lbs ai/acre**	**0.0003**	**lbs ae/acre**	**Pan Agicultural Laboratory, CA**	**43279201**	**1994[3,4]**	**B. Montague**	**2000**	**Yes**
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Onion	*Allium cepa*	Seedling	Seedling emergence (root weight)	Soil treatment	21 D	21 D	Germination	EC25	0.001	lbs ai/acre	0.0007	lbs ae/acre	Pan Agicultural Laboratory, CA	43279202	1994[3,4]	B. Montague	2000	Yes
2,4 DP-p-2-EHE	**95.7**	**Terrestrial Plant**	**Onion**	***Allium cepa***	**Seedling**	**Seedling emergence (root weight)**	**Soil treatment**	**21 D**	**21 D**	**Germination**	**NOEL**	**0.0004**	**lbs ai/acre**	**0.0003**	**lbs ae/acre**	**Pan Agicultural Laboratory, CA**	**43279202**	**1994[3,4]**	**B. Montague**	**2000**	**Yes**
2,4-D Isopropyl Ester	98.2	Terrestrial Plant	Lettuce	*Lactuca sativa*	Seedling	Seedling emergence (shoot height)	Soil treatment	14 D	14 D	Germination	EC25	0.00079	lbs ai/acre	0.0007	lbs ae/acre	Springborn Laboratory Inc., MA	43982101	1996[3,4]	Contract Draft GAI	1999	Yes
2,4-D Isopropyl Ester	98.2	Terrestrial Plant	Lettuce	*Lactuca sativa*	Seedling	Seedling emergence (shoot height)	Soil treatment	14 D	14 D	Germination	NOEL	0.00056	lbs ai/acre	0.0005	lbs ae/acre	Springborn Laboratory Inc., MA	43982101	1996[3,4]	Contract Draft GAI	1999	Yes
2,4-DB DMA	**Tech**	**Terrestrial Plant**	**Carrot**	***Daucus carota***	**Seedling**	**Seedling emergence (shoot height)**	**Soil treatment**	**14 D**	**14 D**	**Germination**	**EC25**	**0.003**	**lbs ai/acre**	**0.002**	**lbs ae/acre**	**Analytical Biochemical Laboratory, Columbia, Missouri**	**43279201**	**1997[3,4]**	**D. Rieder**	**1998**	**Yes**
2,4-DB DMA	Tech	Terrestrial Plant	Carrot	*Daucus carota*	Seedling	Seedling emergence (shoot height)	Soil treatment	14 D	14 D	Germination	NOEL	0.001	lbs ai/acre	0.001	lbs ae/acre	Analytical Biochemical Laboratory, Columbia, Missouri	43279201	1997[3,4]	D. Rieder	1998	Yes
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Onion	*Allium cepa*	Juvenile	Vegetative vigor (root weight)	Direct spray	21 D	21 D	Vegetative vigor	EC25	0.02	lbs ai/acre	0.0133	lbs ae/acre	Pan Agicultural Laboratory, CA	43279201	1994[3,4]	B. Montague	2000	Yes
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Onion	*Allium cepa*	Juvenile	Vegetative vigor (root weight)	Direct spray	21 D	21 D	Vegetative vigor	NOEL	0.001	lbs ai/acre	0.0007	lbs ae/acre	Pan Agicultural Laboratory, CA	43279201	1994[3,4]	B. Montague	2000	Yes
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Lettuce	*Lactuca sativa*	Juvenile	Vegetative vigor (root weight)	Direct spray	21 D	21 D	Vegetative vigor	EC25	0.014	lbs ai/acre	0.0093	lbs ae/acre	Pan Agicultural Laboratory, CA	43279201	1994[3,4]	B. Montague	2000	Yes
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Lettuce	*Lactuca sativa*	Juvenile	Vegetative vigor (root weight)	Direct spray	21 D	21 D	Vegetative vigor	NOEL	0.001	lbs ai/acre	0.0007	lbs ae/acre	Pan Agicultural Laboratory, CA	43279201	1994[3,4]	B. Montague	2000	Yes
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Radish	*Raphanus sativus*	Juvenile	Vegetative vigor (root weight)	Direct spray	21 D	21 D	Vegetative vigor	EC25	0.017	lbs ai/acre	0.0113	lbs ae/acre	Pan Agicultural Laboratory, CA	43197002	1994[3,4]	B. Montague	2000	Yes
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Radish	*Raphanus sativus*	Juvenile	Vegetative vigor (root weight)	Direct spray	21 D	21 D	Vegetative vigor	NOEL	0.001	lbs ai/acre	0.0007	lbs ae/acre	Pan Agicultural Laboratory, CA	43197002	1994[3,4]	B. Montague	2000	Yes
2,4-D Tri,isopropylamine salt	67.9	Terrestrial Plant	Wheat	*Triticum aestivum*	Seedling	Seedling germination	Soil treatment	5 D	5 D	Germination	EC25	0.037	lbs ai/acre	0.020	lbs ae/acre	Landis International Inc., Valdesta, GA	43982101	1994[3,4]	R. Hirsch	2000	Yes
2,4-D Tri,isopropylamine salt	**67.9**	**Terrestrial Plant**	**Wheat**	***Triticum aestivum***	**Seedling**	**Seedling germination**	**Soil treatment**	**5 D**	**5 D**	**Germination**	**NOEL**	**0.001**	**lbs ai/acre**	**0.001**	**lbs ae/acre**	**Landis International Inc., Valdesta, GA**	**43982101**	**1994[3,4]**	**R. Hirsch**	**2000**	**Yes**
2,4-D Isopropyl Ester	98.2	Terrestrial Plant	Cabbage	*Brassica oleracea*	Seedling	Seedling emergence	Soil treatment	14 D	14 D	Germination	EC25	0.0029	lbs ai/acre	0.0024	lbs ae/acre	Springborn Laboratory Inc., MA	43279202	1996[3,4]	Contract Draft GAI	1999	Yes
2,4-D Isopropyl Ester	98.2	Terrestrial Plant	Cabbage	*Brassica oleracea*	Seedling	Seedling emergence	Soil treatment	14 D	14 D	Germination	NOEL	0.0011	lbs ai/acre	0.0009	lbs ae/acre	Springborn Laboratory Inc., MA	43279202	1996[3,4]	Contract Draft GAI	1999	Yes
2,4-D Diethanolamine salt	73.8	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Juvenile	Vegetative vigor (shoot weight)	Direct spray	14 D	14 D	Vegetative vigor	EC25	0.005	lbs ai/acre	0.003	lbs ae/acre	Ricera Inc. Ohio	43982101	1992[3,4]	H. Craven (KBN)	1993	Supplemental
2,4-D Diethanolamine salt	73.8	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Juvenile	Vegetative vigor (shoot weight)	Direct spray	14 D	14 D	Vegetative vigor	NOEL	0.002	lbs ai/acre	0.001	lbs ae/acre	Ricera Inc. Ohio	43982101	1992[3,4]	H. Craven (KBN)	1993	Supplemental
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	21 D	21 D	Germination	EC25	0.009	lbs ai/acre	0.0060	lbs ae/acre	Pan Agicultural Laboratory, CA	43016701	1994[3,4]	B. Montague	2000	Yes
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	21 D	21 D	Germination	NOEL	0.003	lbs ai/acre	0.0020	lbs ae/acre	Pan Agicultural Laboratory, CA	43016701	1994[3,4]	B. Montague	2000	Yes

Formulation	% purity a.i.	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint	Toxicity Value (tested product)[1]	Units	Toxicity Value (a.e.) [1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4-D Isopropyl Ester	98.2	Terrestrial Plant	Cabbage	*Brassica oleracea*	Juvenile	Vegetative vigor (root weight)	Direct spray	14 D	14 D	Vegetative vigor	EC25	0.012	lbs ai/acre	0.0101	lbs ae/acre	Springborn Laboratory Inc., MA	43016701	1996[3,4]	Contract Draft GAI	1999	Yes
2,4-D Isopropyl Ester	98.2	Terrestrial Plant	Cabbage	*Brassica oleracea*	Juvenile	Vegetative vigor (root weight)	Direct spray	14 D	14 D	Vegetative vigor	NOEL	0.003	lbs ai/acre	0.0025	lbs ae/acre	Springborn Laboratory Inc., MA	43016701	1996[3,4]	Contract Draft GAI	1999	Yes
2,4-DP-p, DMA salt	63.	Terrestrial Plant	Lettuce	*Lactuca sativa*	Juvenile	Vegetative vigor	Direct spray	21 D	21 D	Vegetative vigor	EC25	> 0.017	lbs ai/acre	> 0.014	lbs ae/acre	California Agicultural Research Inc. Karman, CA	43016701	1993[3,4]	J. Goodyear	1994	Supplemental
2,4-DP-p, DMA salt	63.	Terrestrial Plant	Lettuce	*Lactuca sativa*	Juvenile	Vegetative vigor	Direct spray	21 D	21 D	Vegetative vigor	NOEL	0.003	lbs ai/acre	0.002	lbs ae/acre	California Agicultural Research Inc. Karman, CA	43016701	1993[3,4]	J. Goodyear	1994	Supplemental
2,4-DP-p, DMA salt	63	Terrestrial Plant	Radish	*Raphanus sativus*	Juvenile	Vegetative vigor (shoot height)	Direct spray	21 D	21 D	Vegetative vigor	EC25	0.036	lbs ai/acre	0.030	lbs ae/acre	California Agicultural Research Inc. Karman, CA	43197002	1993[3,4]	J. Goodyear	1994	Supplemental
2,4-DP-p, DMA salt	63	Terrestrial Plant	Radish	*Raphanus sativus*	Juvenile	Vegetative vigor (shoot height)	Direct spray	21 D	21 D	Vegetative vigor	NOEL	< 0.003	lbs ai/acre	< 0.002	lbs ae/acre	California Agicultural Research Inc. Karman, CA	43197002	1993[3,4]	J. Goodyear	1994	Supplemental
2,4-DP-p, DMA salt	63	Terrestrial Plant	Cabbage	*Brassica oleracea*	Juvenile	Vegetative vigor	Direct spray	21 D	21 D	Vegetative vigor	EC25	NR	lbs ai/acre	NR	lbs ae/acre	California Agicultural Research Inc. Karman, CA	43197002	1993[3,4]	J. Goodyear	1994	No
2,4-DP-p, DMA salt	63	Terrestrial Plant	Cabbage	*Brassica oleracea*	Juvenile	Vegetative vigor	Direct spray	21 D	21 D	Vegetative vigor	NOEL	0.003	lbs ai/acre	0.002	lbs ae/acre	California Agicultural Research Inc. Karman, CA	43197002	1993[3,4]	J. Goodyear	1994	Supplemental
2,4-DP-p, DMA salt	63.62	Terrestrial Plant	Onion	*Allium cepa*	Seedling	Seedling germination	Soil treatment	7 D	7 D	Germination	EC25	0.007	lbs ai/acre	0.006	lbs ae/acre	California Agicultural Research Inc. Karman, CA	43197002	1993[3,4]	W. Evans	2001	Supplemental
2,4-DP-p, DMA salt	63.62	Terrestrial Plant	Onion	*Allium cepa*	Seedling	Seedling germination	Soil treatment	7 D	7 D	Germination	NOEL	0.004	lbs ai/acre	0.003	lbs ae/acre	California Agicultural Research Inc. Karman, CA	43197002	1993[3,4]	W. Evans	2001	Supplemental
2,4-DP-p, DMA salt	63	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Juvenile	Vegetative vigor	Direct spray	21 D	21 D	Vegetative vigor	EC25	0.013	lbs ai/acre	0.011	lbs ae/acre	California Agicultural Research Inc. Karman, CA	42343902	1993[3,4]	J. Goodyear	1994	Supplemental
2,4-DP-p, DMA salt	63	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Juvenile	Vegetative vigor	Direct spray	21 D	21 D	Vegetative vigor	NOEL	0.004	lbs ai/acre	0.003	lbs ae/acre	California Agicultural Research Inc. Karman, CA	42343902	1993[3,4]	J. Goodyear	1994	Supplemental
2,4-D Tri,isopropylamine salt	67.9	Terrestrial Plant	Sunflower	*Helianthus annus*	Seedling	Seedling germination	Soil treatment	5 D	5 D	Germination	EC25	0.014	lbs ai/acre	0.008	lbs ae/acre	Landis International Inc., Valdesta, GA	43098902	1994[3,4]	R. Hirsch	2000	Yes
2,4-D Tri,isopropylamine salt	67.9	Terrestrial Plant	Sunflower	*Helianthus annus*	Seedling	Seedling germination	Soil treatment	5 D	5 D	Germination	NOEL	0.005	lbs ai/acre	0.003	lbs ae/acre	Landis International Inc., Valdesta, GA	43098902	1994[3,4]	R. Hirsch	2000	Yes
2,4-D Tri,isopropylamine salt	67.9	Terrestrial Plant	Carrot	*Daucus carota*	Seedling	Seedling germination	Soil treatment	5 D	5 D	Germination	EC25	0.019	lbs ai/acre	0.010	lbs ae/acre	Landis International Inc., Valdesta, GA	42343902	1994[3,4]	R. Hirsch	2000	Yes
2,4-D Tri,isopropylamine salt	67.9	Terrestrial Plant	Carrot	*Daucus carota*	Seedling	Seedling germination	Soil treatment	5 D	5 D	Germination	NOEL	0.005	lbs ai/acre	0.003	lbs ae/acre	Landis International Inc., Valdesta, GA	42343902	1994[3,4]	R. Hirsch	2000	Yes
2,4-D Tri,isopropylamine salt	67.9	Terrestrial Plant	Radish	*Raphanus sativus*	Seedling	Seedling germination	Soil treatment	5 D	5 D	Germination	EC25	0.014	lbs ai/acre	0.008	lbs ae/acre	Landis International Inc., Valdesta, GA	42343902	1994[3,4]	R. Hirsch	2000	Yes
2,4-D Tri,isopropylamine salt	67.9	Terrestrial Plant	Radish	*Raphanus sativus*	Seedling	Seedling germination	Soil treatment	5 D	5 D	Germination	NOEL	0.005	lbs ai/acre	0.003	lbs ae/acre	Landis International Inc., Valdesta, GA	42343902	1994[3,4]	R. Hirsch	2000	Yes
2,4-D Diethanolamine salt	73.8	Terrestrial Plant	Mustard	*Brassica juncea*	Seedling	Seedling emergence (shoot weight)	Soil treatment	7 D	7 D	Germination	EC25	< 0.005	lbs ai/acre	< 0.003	lbs ae/acre	Ricera Inc. Ohio	42343902	1992[3,4]	H. Craven (KBN)	1993	Supplemental
2,4-D Diethanolamine salt	73.8	Terrestrial Plant	Mustard	*Brassica juncea*	Seedling	Seedling emergence (shoot weight)	Soil treatment	7 D	7 D	Germination	NOEL	< 0.005	lbs ai/acre	< 0.003	lbs ae/acre	Ricera Inc. Ohio	42343902	1992[3,4]	H. Craven (KBN)	1993	Supplemental
2,4-D 2 EHE	63.5	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Not reported	Vegetative vigor (shoot height)	Direct spray	14 D	14 D	Vegetative vigor	EC25	0.01	lbs ai/acre	0.0066	lbs ae/acre	Ricera Inc. Ohio	43982101	1992[3,4]	R. Petrie	1992	Supplemental
2,4-D 2 EHE	63.5	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Not reported	Vegetative vigor (shoot height)	Direct spray	14 D	14 D	Vegetative vigor	NOEL	0.006	lbs ai/acre	0.0040	lbs ae/acre	Ricera Inc. Ohio	43982101	1992[3,4]	R. Petrie	1992	Supplemental

Formulation	% purity a.i.	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint	Toxicity Value (tested product)[1]	Units	Toxicity Value (a.e.) [1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4 DP-p-2-EHE	93.2	Aquatic Plant	Green algae	*Selenastrum capricornutum*	Not reported	Static	Water	5 D	5 D		EC50	0.26	PPM	0.2	PPM	Springborn Laboratory Inc., MA	42343902	1993[3,4]	Contract Draft-KBN	1998	Yes
2,4 DP-p-2-EHE	93.2	Aquatic Plant	Green algae	*Selenastrum capricornutum*	Not reported	Static	Water	5 D	5 D		NOEL	< 0.006	PPM	< 0.004	PPM	Springborn Laboratory Inc., MA	42343902	1993[3,4]	Contract Draft-KBN	1998	Yes
2,4-D 2-EHE	63.5	Terrestrial Plant	Sorghum	*Sorghum bicolor*	Juvenile	Vegetative vigor (root weight)	Direct spray	21 D	21 D	Vegetative vigor	EC25	0.01	lbs ai/acre	0.0066	lbs ae/acre	Ricera Inc. Ohio	43982101	1992[3,4]	M. Davy	1998	Yes
2,4-D 2-EHE	63.5	Terrestrial Plant	Sorghum	*Sorghum bicolor*	Juvenile	Vegetative vigor (root weight)	Direct spray	21 D	21 D	Vegetative vigor	NOEL	0.006	lbs ai/acre	0.0040	lbs ae/acre	Ricera Inc. Ohio	43982101	1992[3,4]	M. Davy	1998	Yes
2,4-D 2-EHE	63.5	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Juvenile	Vegetative vigor (root weight)	Direct spray	14 D	14 D	Vegetative vigor	EC25	0.01	lbs ai/acre	0.0066	lbs ae/acre	Ricera Inc. Ohio	43982101	1992[3,4]	M. Davy	1998	Yes
2,4-D 2-EHE	63.5	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Juvenile	Vegetative vigor (root weight)	Direct spray	14 D	14 D	Vegetative vigor	NOEL	0.006	lbs ai/acre	0.0040	lbs ae/acre	Ricera Inc. Ohio	43982101	1992[3,4]	M. Davy	1998	Yes
2,4-D 2-EHE	Tech	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Juvenile	Vegetative vigor (phytotoxicity)	Direct spray	21 D	21 D	Vegetative vigor	EC25	0.01	lbs ai/acre	0.0066	lbs ae/acre	Analytical Biochemical Laboratory, Columbia, Missouri	43982101	1997[3,4]	N. Mastrota	1998	Yes
2,4-D 2-EHE	Tech	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Juvenile	Vegetative vigor (phytotoxicity)	Direct spray	21 D	21 D	Vegetative vigor	NOEL	0.006	lbs ai/acre	0.0040	lbs ae/acre	Analytical Biochemical Laboratory, Columbia, Missouri	43982101	1997[3,4]	N. Mastrota	1998	Yes
2,4-D Isopropyl Ester	98.2	Terrestrial Plant	Turnip	*Brassica rapa*	Juvenile	Vegetative vigor (root weight)	Direct spray	14 D	14 D	Vegetative vigor	EC25	> 0.020	lbs ai/acre	> 0.0168	lbs ae/acre	Springborn Laboratory Inc., MA	42416801	1996[3,4]	Contract Draft GAI	1999	Yes
2,4-D Isopropyl Ester	98.2	Terrestrial Plant	Turnip	*Brassica rapa*	Juvenile	Vegetative vigor (root weight)	Direct spray	14 D	14 D	Vegetative vigor	NOEL	0.006	lbs ai/acre	0.0050	lbs ae/acre	Springborn Laboratory Inc., MA	42416801	1996[3,4]	Contract Draft GAI	1999	Yes
2,4-D 2 EHE	63.5	Terrestrial Plant	Mustard	*Brassica juncea*	Juvenile	Vegetative vigor (shoot height)	Direct spray	14 D	14 D	Vegetative vigor	EC25	0.01	lbs ai/acre	0.0066	lbs ae/acre	Ricera Inc. Ohio	42416801	1992[3,4]	M. Davy	1993	Yes
2,4-D 2 EHE	63.5	Terrestrial Plant	Mustard	*Brassica juncea*	Juvenile	Vegetative vigor (shoot height)	Direct spray	14 D	14 D	Vegetative vigor	NOEL	0.006	lbs ai/acre	0.0040	lbs ae/acre	Ricera Inc. Ohio	42416801	1992[3,4]	M. Davy	1993	Yes
2,4-D Isopropyl Ester	98.2	Terrestrial Plant	Soybean	*Glycine max*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	14 D	14 D	Germination	EC25	0.0082	lbs ai/acre	0.0069	lbs ae/acre	Springborn Laboratory Inc., MA	42416801	1996[3,4]	Contract Draft GAI	1999	Yes
2,4-D Isopropyl Ester	98.2	Terrestrial Plant	Soybean	*Glycine max*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	14 D	14 D	Germination	NOEL	0.0064	lbs ai/acre	0.0054	lbs ae/acre	Springborn Laboratory Inc., MA	42416801	1996[3,4]	Contract Draft GAI	1999	Yes
2,4-D Isopropyl Ester	98.2	Terrestrial Plant	Corn	*Zea mays*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	14 D	14 D	Germination	EC25	0.071	lbs ai/acre	0.06	lbs ae/acre	Springborn Laboratory Inc., MA	42416801	1996[3,4]	Contract Draft GAI	1999	Yes
2,4-D Isopropyl Ester	98.2	Terrestrial Plant	Corn	*Zea mays*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	14 D	14 D	Germination	NOEL	0.0064	lbs ai/acre	0.0054	lbs ae/acre	Springborn Laboratory Inc., MA	42416801	1996[3,4]	Contract Draft GAI	1999	Yes
2,4-D Isopropyl Ester	98.2	Terrestrial Plant	Onion	*Allium cepa*	Seedling	Seedling emergence (shoot height)	Soil treatment	14 D	14 D	Germination	EC25	0.0099	lbs ai/acre	0.0083	lbs ae/acre	Springborn Laboratory Inc., MA	42343902	1996[3,4]	Contract Draft GAI	1999	Yes
2,4-D Isopropyl Ester	98.2	Terrestrial Plant	Onion	*Allium cepa*	Seedling	Seedling emergence (shoot height)	Soil treatment	14 D	14 D	Germination	NOEL	0.0067	lbs ai/acre	0.0056	lbs ae/acre	Springborn Laboratory Inc., MA	42343902	1996[3,4]	Contract Draft GAI	1999	Yes
2,4-D Acid	96.7	Terrestrial Plant	Buckwheat	*Fagopyrum esculentum*	Juvenile	Vegetative vigor (phytotoxicity)	Direct spray	14 D	14 D	Vegetative vigor	EC25	0.023	lbs ai/acre	0.023	lbs ae/acre	Ricera Inc. Ohio	43982101	1991[3,4]	K. Valente	1992	Yes
2,4-D Acid	**96.7**	**Terrestrial Plant**	**Buckwheat**	***Fagopyrum esculentum***	**Juvenile**	**Vegetative vigor (phytotoxicity)**	**Direct spray**	**14 D**	**14 D**	**Vegetative vigor**	**NOEL**	**0.007**	**lbs ai/acre**	**0.007**	**lbs ae/acre**	**Ricera Inc. Ohio**	**43982101**	**1991[3,4]**	**K. Valente**	**1992**	**Yes**
2,4-D Acid	96.7	Terrestrial Plant	Cucumber	*Cucumis sativus*	Juvenile	Vegetative vigor (phytotoxicity)	Direct spray	14 D	14 D	Vegetative vigor	EC25	0.015	lbs ai/acre	0.015	lbs ae/acre	Ricera Inc. Ohio	43016701	1991[3,4]	K. Valente	1992	Yes
2,4-D Acid	96.7	Terrestrial Plant	Cucumber	*Cucumis sativus*	Juvenile	Vegetative vigor (phytotoxicity)	Direct spray	14 D	14 D	Vegetative vigor	NOEL	< 0.007	lbs ai/acre	< 0.007	lbs ae/acre	Ricera Inc. Ohio	43016701	1991[3,4]	K. Valente	1992	Yes

Formulation	% purity a.i.	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint	Toxicity Value (tested product)[1]	Units	Toxicity Value (a.e.)[1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4-D Acid	96.7	Terrestrial Plant	Mustard	*Brassica kaber*	Juvenile	Vegetative vigor (phytotoxicity)	Direct spray	14 D	14 D	Vegetative vigor	EC25	0.011	lbs ai/acre	0.011	lbs ae/acre	Ricera Inc. Ohio	43982101	1991[3,4]	K. Valente	1992	Yes
2,4-D Acid	96.7	Terrestrial Plant	Mustard	*Brassica kaber*	Juvenile	Vegetative vigor (phytotoxicity)	Direct spray	14 D	14 D	Vegetative vigor	NOEL	< 0.007	lbs ai/acre	< 0.007	lbs ae/acre	Ricera Inc. Ohio	43982101	1991[3,4]	K. Valente	1992	Yes
2,4-D Acid	96.7	Terrestrial Plant	Radish	*Raphanus sativus*	Juvenile	Vegetative vigor (phytotoxicity)	Direct spray	14 D	14 D	Vegetative vigor	EC25	0.016	lbs ai/acre	0.016	lbs ae/acre	Ricera Inc. Ohio	42416801	1991[3,4]	K. Valente	1994	Yes
2,4-D Acid	**96.7**	**Terrestrial Plant**	**Radish**	***Raphanus sativus***	**Juvenile**	**Vegetative vigor (phytotoxicity)**	**Direct spray**	**14 D**	**14 D**	**Vegetative vigor**	**NOEL**	**0.007**	**lbs ai/acre**	**0.007**	**lbs ae/acre**	**Ricera Inc. Ohio**	**42416801**	**1991[3,4]**	**K. Valente**	**1994**	**Yes**
2,4-D 2 EHE	63.5	Terrestrial Plant	Soybean	*Glycine max*	Not reported	Vegetative vigor (shoot height)	Direct spray	14 D	14 D	Vegetative vigor	EC25	0.02	lbs ai/acre	0.0133	lbs ae/acre	Ricera Inc. Ohio	42449201	1992[3,4]	R. Petrie	1992	Supplemental
2,4-D 2 EHE	63.5	Terrestrial Plant	Soybean	*Glycine max*	Not reported	Vegetative vigor (shoot height)	Direct spray	14 D	14 D	Vegetative vigor	NOEL	0.007	lbs ai/acre	0.0046	lbs ae/acre	Ricera Inc. Ohio	42449201	1992[3,4]	R. Petrie	1992	Supplemental
2,4-D Isopropyl Ester	98.2	Terrestrial Plant	Turnip	*Brassica rapa*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	14 D	14 D	Germination	EC25	0.009	lbs ai/acre	0.0076	lbs ae/acre	Springborn Laboratory Inc., MA	42416801	1996[3,4]	Contract Draft GAI	1999	Yes
2,4-D Isopropyl Ester	98.2	Terrestrial Plant	Turnip	*Brassica rapa*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	14 D	14 D	Germination	NOEL	0.007	lbs ai/acre	0.0059	lbs ae/acre	Springborn Laboratory Inc., MA	42416801	1996[3,4]	Contract Draft GAI	1999	Yes
2,4-DP-p, DMA salt	63	Terrestrial Plant	Soybean	*Glycine max*	Juvenile	Vegetative vigor	Direct spray	21 D	21 D	Vegetative vigor	EC25	0.043	lbs ai/acre	0.036	lbs ae/acre	California Agicultural Research Inc. Karman, CA	42343902	1993[3,4]	J. Goodyear	1994	Supplemental
2,4-DP-p, DMA salt	63	Terrestrial Plant	Soybean	*Glycine max*	Juvenile	Vegetative vigor	Direct spray	21 D	21 D	Vegetative vigor	NOEL	0.007	lbs ai/acre	0.006	lbs ae/acre	California Agicultural Research Inc. Karman, CA	42343902	1993[3,4]	J. Goodyear	1994	Supplemental
2,4-D Isopropyl Ester	98.2	Terrestrial Plant	Lettuce	*Lactuca sativa*	Juvenile	Vegetative vigor (root weight)	Direct spray	14 D	14 D	Vegetative vigor	EC25	0.0085	lbs ai/acre	0.0071	lbs ae/acre	Springborn Laboratory Inc., MA	42343902	1996[3,4]	Contract Draft GAI	1999	Yes
2,4-D Isopropyl Ester	98.2	Terrestrial Plant	Lettuce	*Lactuca sativa*	Juvenile	Vegetative vigor (root weight)	Direct spray	14 D	14 D	Vegetative vigor	NOEL	0.0073	lbs ai/acre	0.0061	lbs ae/acre	Springborn Laboratory Inc., MA	42343902	1996[3,4]	Contract Draft GAI	1999	Yes
2,4-D Acid	96.7	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Juvenile	Vegetative vigor	Direct spray	14 D	14 D	Vegetative vigor	EC25	< 0.0075	lbs ai/acre	< 0.0075	lbs ae/acre	Ricera Inc. Ohio	42343902	1991[3,4]	K. Valente	1992	Yes
2,4-D Acid	96.7	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Juvenile	Vegetative vigor	Direct spray	14 D	14 D	Vegetative vigor	NOEL	< 0.0075	lbs ai/acre	< 0.0075	lbs ae/acre	Ricera Inc. Ohio	42343902	1991[3,4]	K. Valente	1992	Yes
2,4-D 2 EHE	63.5	Terrestrial Plant	Mustard	*Brassica juncea*	Seedling	Seedling emergence	Soil treatment	14 D	14 D	Germination	EC25	0.033	lbs ai/acre	0.0219	lbs ae/acre	Ricera Inc. Ohio	42343902	1992[3,4]	M. Davy	1993	Supplemental
2,4-D 2 EHE	63.5	Terrestrial Plant	Mustard	*Brassica juncea*	Seedling	Seedling emergence	Soil treatment	14 D	14 D	Germination	NOEL	0.0075	lbs ai/acre	0.0050	lbs ae/acre	Ricera Inc. Ohio	42343902	1992[3,4]	M. Davy	1993	Supplemental
2,4-D Acid	96.7	Terrestrial Plant	Onion	*Allium cepa*	Juvenile	Vegetative vigor (phytotoxicity)	Direct spray	14 D	14 D	Vegetative vigor	EC25	< 0.0075	lbs ai/acre	< 0.0075	lbs ae/acre	Ricera Inc. Ohio	42343902	1991[3,4]	K. Valente	1992	Yes
2,4-D Acid	96.7	Terrestrial Plant	Onion	*Allium cepa*	Juvenile	Vegetative vigor (phytotoxicity)	Direct spray	14 D	14 D	Vegetative vigor	NOEL	< 0.0075	lbs ai/acre	< 0.0075	lbs ae/acre	Ricera Inc. Ohio	42343902	1991[3,4]	K. Valente	1992	Yes
2,4-D 2-EHE	63.5	Terrestrial Plant	Buckwheat	*Polygonum convolvulus*	Juvenile	Vegetative vigor (phytotoxicity)	Direct spray	14 D	14 D	Vegetative vigor	EC25	< 0.0075	lbs ai/acre	< 0.0050	lbs ae/acre	Ricera Inc. Ohio	42416801	1992[3,4]	M. Davy	1999	Yes
2,4-D 2-EHE	63.5	Terrestrial Plant	Buckwheat	*Polygonum convolvulus*	Juvenile	Vegetative vigor (phytotoxicity)	Direct spray	14 D	14 D	Vegetative vigor	NOEL	< 0.0075	lbs ai/acre	< 0.0050	lbs ae/acre	Ricera Inc. Ohio	42416801	1992[3,4]	M. Davy	1999	Yes
2,4-D 2-EHE	63.5	Terrestrial Plant	Cucumber	*Cucumis sativus*	Juvenile	Vegetative vigor (phytotoxicity)	Direct spray	14 D	14 D	Vegetative vigor	EC25	< 0.0075	lbs ai/acre	< 0.0050	lbs ae/acre	Ricera Inc. Ohio	43016701	1992[3,4]	M. Davy	1999	Yes
2,4-D 2-EHE	63.5	Terrestrial Plant	Cucumber	*Cucumis sativus*	Juvenile	Vegetative vigor (phytotoxicity)	Direct spray	14 D	14 D	Vegetative vigor	NOEL	< 0.0075	lbs ai/acre	< 0.0050	lbs ae/acre	Ricera Inc. Ohio	43016701	1992[3,4]	M. Davy	1999	Yes

Formulation	% purity a.i.	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint	Toxicity Value (tested product)[1]	Units	Toxicity Value (a.e.)[1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4-D 2-EHE	63.5	Terrestrial Plant	Mustard	*Brassica juncea*	Juvenile	Vegetative vigor (phytotoxicity)	Direct spray	14 D	14 D	Vegetative vigor	EC25	> 0.0075	lbs ai/acre	> 0.0050	lbs ae/acre	Ricera Inc. Ohio	43279201	1992[3,4]	M. Davy	1999	Yes
2,4-D 2-EHE	63.5	Terrestrial Plant	Mustard	*Brassica juncea*	Juvenile	Vegetative vigor (phytotoxicity)	Direct spray	14 D	14 D	Vegetative vigor	NOEL	0.0075	lbs ai/acre	0.0050	lbs ae/acre	Ricera Inc. Ohio	43279201	1992[3,4]	M. Davy	1999	Yes
2,4-D 2-EHE	63.5	Terrestrial Plant	Radish	*Raphanus sativus*	Juvenile	Vegetative vigor (phytotoxicity)	Direct spray	14 D	14 D	Vegetative vigor	EC25	> 0.0075	lbs ai/acre	> 0.0050	lbs ae/acre	Ricera Inc. Ohio	43279202	1992[3,4]	M. Davy	1999	Yes
2,4-D 2-EHE	63.5	Terrestrial Plant	Radish	*Raphanus sativus*	Juvenile	Vegetative vigor (phytotoxicity)	Direct spray	14 D	14 D	Vegetative vigor	NOEL	0.0075	lbs ai/acre	0.0050	lbs ae/acre	Ricera Inc. Ohio	43279202	1992[3,4]	M. Davy	1999	Yes
2,4-D 2-EHE	63.5	Terrestrial Plant	Onion	*Allium cepa*	Juvenile	Vegetative vigor (phytotoxicity)	Direct spray	14 D	14 D	Vegetative vigor	EC25	> 0.0075	lbs ai/acre	> 0.0050	lbs ae/acre	Ricera Inc. Ohio	43197001	1992[3,4]	M. Davy	1999	Yes
2,4-D 2-EHE	63.5	Terrestrial Plant	Onion	*Allium cepa*	Juvenile	Vegetative vigor (phytotoxicity)	Direct spray	14 D	14 D	Vegetative vigor	NOEL	0.0075	lbs ai/acre	0.0050	lbs ae/acre	Ricera Inc. Ohio	43197001	1992[3,4]	M. Davy	1999	Yes
2,4-D Acid	96.7	Terrestrial Plant	Soybean	*Glycine max*	Juvenile	Vegetative vigor (phytotoxicity)	Direct spray	14 D	14 D	Vegetative vigor	EC25	0.008	lbs ai/acre	0.008	lbs ae/acre	Ricera Inc. Ohio	43197001	1991[3,4]	K. Valente	1992	Yes
2,4-D Acid	96.7	Terrestrial Plant	Soybean	*Glycine max*	Juvenile	Vegetative vigor (phytotoxicity)	Direct spray	14 D	14 D	Vegetative vigor	NOEL	< 0.008	lbs ai/acre	< 0.008	lbs ae/acre	Ricera Inc. Ohio	43197001	1991[3,4]	K. Valente	1992	Yes
2,4-DP-p, DMA salt	63.62	Terrestrial Plant	Radish	*Raphanus sativus*	Seedling	Seedling emergence (shoot weight)	Soil treatment	21 D	21 D	Germination	EC25	0.038	lbs ai/acre	0.032	lbs ae/acre	California Agicultural Research Inc. Karman, CA	43982101	1993[3,4]	W. Evans	2001	Supplemental
2,4-DP-p, DMA salt	63.62	Terrestrial Plant	Radish	*Raphanus sativus*	Seedling	Seedling emergence (shoot weight)	Soil treatment	21 D	21 D	Germination	NOEL	0.008	lbs ai/acre	0.007	lbs ae/acre	California Agicultural Research Inc. Karman, CA	43982101	1993[3,4]	W. Evans	2001	Supplemental
2,4-DP-p, DMA salt	63.62	Terrestrial Plant	Lettuce	*Lactuca sativa*	Seedling	Seedling emergence (shoot weight)	Soil treatment	21 D	21 D	Germination	EC25	0.014	lbs ai/acre	0.012	lbs ae/acre	California Agicultural Research Inc. Karman, CA	42416802	1993[3,4]	W. Evans	2001	Supplemental
2,4-DP-p, DMA salt	63.62	Terrestrial Plant	Lettuce	*Lactuca sativa*	Seedling	Seedling emergence (shoot weight)	Soil treatment	21 D	21 D	Germination	NOEL	0.008	lbs ai/acre	0.007	lbs ae/acre	California Agicultural Research Inc. Karman, CA	42416802	1993[3,4]	W. Evans	2001	Supplemental
2,4-DP-p, DMA salt	63	Terrestrial Plant	Cucumber	*Cucumis sativus*	Juvenile	Vegetative vigor (shoot weight)	Direct spray	21 D	21 D	Vegetative vigor	EC25	0.014	lbs ai/acre	0.012	lbs ae/acre	California Agicultural Research Inc. Karman, CA	42389501	1993[3,4]	J. Goodyear	1994	Supplemental
2,4-DP-p, DMA salt	63	Terrestrial Plant	Cucumber	*Cucumis sativus*	Juvenile	Vegetative vigor (shoot weight)	Direct spray	21 D	21 D	Vegetative vigor	NOEL	0.008	lbs ai/acre	0.007	lbs ae/acre	California Agicultural Research Inc. Karman, CA	42389501	1993[3,4]	J. Goodyear	1994	Supplemental
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Cabbage	*Brassica oleracea*	Juvenile	Vegetative vigor (root weight)	Direct spray	21 D	21 D	Vegetative vigor	EC25	0.029	lbs ai/acre	0.0192	lbs ae/acre	Pan Agicultural Laboratory, CA	42389501	1994[3,4]	B. Montague	2000	Yes
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Cabbage	*Brassica oleracea*	Juvenile	Vegetative vigor (root weight)	Direct spray	21 D	21 D	Vegetative vigor	NOEL	0.01	lbs ai/acre	0.007	lbs ae/acre	Pan Agicultural Laboratory, CA	42389501	1994[3,4]	B. Montague	2000	Yes
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Radish	*Raphanus sativus*	Seedling	Seedling emergence (root weight)	Soil treatment	21 D	21 D	Germination	EC25	0.024	lbs ai/acre	0.0159	lbs ae/acre	Pan Agicultural Laboratory, CA	42389501	1994[3,4]	B. Montague	2000	Yes
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Radish	*Raphanus sativus*	Seedling	Seedling emergence (root weight)	Soil treatment	21 D	21 D	Germination	NOEL	0.01	lbs ai/acre	0.007	lbs ae/acre	Pan Agicultural Laboratory, CA	42389501	1994[3,4]	B. Montague	2000	Yes
2,4-D Butoxyethanol Ester	94.6	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Seedling	Seedling emergence (dry weight)	Soil treatment	28 D	28 D	Germination	EC25	0.05	lbs ai/acre	0.03	lbs ae/acre	Landis International Inc., Valdesta, GA	42343902	1994[3,4]	R. Hirsch	2000	Supplemental
2,4-D Butoxyethanol Ester	94.6	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Seedling	Seedling emergence (dry weight)	Soil treatment	28 D	28 D	Germination	NOEL	0.01	lbs ai/acre	0.01	lbs ae/acre	Landis International Inc., Valdesta, GA	42343902	1994[3,4]	R. Hirsch	2000	Supplemental
2,4-D Butoxyethanol Ester	94.6	Terrestrial Plant	Sunflower	*Helianthus annus*	Seedling	Seedling emergence (dry weight)	Soil treatment	28 D	28 D	Germination	EC25	0.53	lbs ai/acre	0.36	lbs ae/acre	Landis International Inc., Valdesta, GA	42449201	1994[3,4]	R. Hirsch	2000	Supplemental
2,4-D Butoxyethanol Ester	94.6	Terrestrial Plant	Sunflower	*Helianthus annus*	Seedling	Seedling emergence (dry weight)	Soil treatment	28 D	28 D	Germination	NOEL	0.01	lbs ai/acre	0.01	lbs ae/acre	Landis International Inc., Valdesta, GA	42449201	1994[3,4]	R. Hirsch	2000	Supplemental

Formulation	% purity a.i.	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint	Toxicity Value (tested product)[1]	Units	Toxicity Value (a.e.)[1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4-D Diethanolamine salt	73.8	Terrestrial Plant	Onion	*Allium cepa*	Juvenile	Vegetative vigor (shoot weight)	Direct spray	14 D	14 D	Vegetative vigor	EC25	0.037	lbs ai/acre	0.025	lbs ae/acre	Ricera Inc. Ohio	42665701	1992[3,4]	H. Craven (KBN)	1993	Yes
2,4-D Diethanolamine salt	**73.8**	**Terrestrial Plant**	**Onion**	***Allium cepa***	**Juvenile**	**Vegetative vigor (shoot weight)**	**Direct spray**	**14 D**	**14 D**	**Vegetative vigor**	**NOEL**	**0.01**	**lbs ai/acre**	**0.007**	**lbs ae/acre**	**Ricera Inc. Ohio**	**42665701**	**1992[3,4]**	**H. Craven (KBN)**	**1993**	**Yes**
2,4-DB DMA	Tech	Terrestrial Plant	Onion	*Allium cepa*	Seedling	Seedling emergence (shoot height)	Soil treatment	14 D	14 D	Germination	EC25	0.019	lbs ai/acre	0.016	lbs ae/acre	Analytical Biochemical Laboratory, Columbia, Missouri	43197002	1997[3,4]	D. Rieder	1998	Yes
2,4-DB DMA	Tech	Terrestrial Plant	Onion	*Allium cepa*	Seedling	Seedling emergence (shoot height)	Soil treatment	14 D	14 D	Germination	NOEL	0.012	lbs ai/acre	0.010	lbs ae/acre	Analytical Biochemical Laboratory, Columbia, Missouri	43197002	1997[3,4]	D. Rieder	1998	Yes
2,4-D Isopropyl Ester	98.2	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Seedling	Seedling emergence (shoot height)	Soil treatment	14 D	14 D	Germination	EC25	0.024	lbs ai/acre	0.0202	lbs ae/acre	Springborn Laboratory Inc., MA	43016701	1996[3,4]	Contract Draft GAI	1999	Yes
2,4-D Isopropyl Ester	98.2	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Seedling	Seedling emergence (shoot height)	Soil treatment	14 D	14 D	Germination	NOEL	0.013	lbs ai/acre	0.0109	lbs ae/acre	Springborn Laboratory Inc., MA	43016701	1996[3,4]	Contract Draft GAI	1999	Yes
2,4-D Acid	96.7	Terrestrial Plant	Mustard	*Brassica juncea*	Seedling	Seedling emergence	Soil treatment	14 D	14 D	Germination	EC25	0.14	lbs ai/acre	0.14	lbs ae/acre	Ricera Inc. Ohio	43016701	1992[3,4]	K. Valente	1992	Yes
2,4-D Acid	96.7	Terrestrial Plant	Mustard	*Brassica juncea*	Seedling	Seedling emergence	Soil treatment	14 D	14 D	Germination	NOEL	0.015	lbs ai/acre	0.015	lbs ae/acre	Ricera Inc. Ohio	43016701	1992[3,4]	K. Valente	1992	Yes
2,4-D Dimethylamine salt	55	Terrestrial Plant	Mustard	*Brassica juncea*	Seedling	Seedling emergence (shoot height)	Soil treatment	14 D	14 D	Germination	EC25	0.026	lbs ai/acre	0.022	lbs ae/acre	Ricera Inc. Ohio	43526901	1992[3,4]	M. Davy	1994	Supplemental
2,4-D Dimethylamine salt	55	Terrestrial Plant	Mustard	*Brassica juncea*	Seedling	Seedling emergence (shoot height)	Soil treatment	14 D	14 D	Germination	NOEL	0.015	lbs ai/acre	0.012	lbs ae/acre	Ricera Inc. Ohio	43526901	1992[3,4]	M. Davy	1994	Supplemental
2,4-D Dimethylamine salt	55	Terrestrial Plant	Sorghum	*Sorghum bicolor*	Seedling	Seedling emergence (shoot height)	Soil treatment	14 D	14 D	Germination	EC25	0.026	lbs ai/acre	0.022	lbs ae/acre	Ricera Inc. Ohio	43526901	1992[3,4]	M. Davy	1994	Supplemental
2,4-D Dimethylamine salt	55	Terrestrial Plant	Sorghum	*Sorghum bicolor*	Seedling	Seedling emergence (shoot height)	Soil treatment	14 D	14 D	Germination	NOEL	0.015	lbs ai/acre	0.012	lbs ae/acre	Ricera Inc. Ohio	43526901	1992[3,4]	M. Davy	1994	Supplemental
2,4-D Dimethylamine salt	55.5	Terrestrial Plant	Cucumber	*Cucumis sativus*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	14 D	14 D	Seedling emergence	EC25	N.R.	lbs ai/acre	NR	lbs ae/acre	Ricera Inc. Ohio	43982101	1992[3,4]	M. Davy	1993	No
2,4-D Dimethylamine salt	55.5	Terrestrial Plant	Cucumber	*Cucumis sativus*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	14 D	14 D	Seedling emergence	NOEL	0.015	lbs ai/acre	0.012	lbs ae/acre	Ricera Inc. Ohio	43982101	1992[3,4]	M. Davy	1993	Yes
2,4-D 2 EHE	63.5	Terrestrial Plant	Cucumber	*Cucumis sativus*	Not reported	Vegetative vigor (shoot height)	Direct spray	14 D	14 D	Vegetative vigor	EC25	0.19	lbs ai/acre	0.1260	lbs ae/acre	Ricera Inc. Ohio	42389501	1992[3,4]	R. Petrie	1992	Supplemental
2,4-D 2 EHE	63.5	Terrestrial Plant	Cucumber	*Cucumis sativus*	Not reported	Vegetative vigor (shoot height)	Direct spray	14 D	14 D	Vegetative vigor	NOEL	0.015	lbs ai/acre	0.0099	lbs ae/acre	Ricera Inc. Ohio	42389501	1992[3,4]	R. Petrie	1992	Supplemental
2,4-D 2 EHE	63.5	Terrestrial Plant	Radish	*Raphanus sativus*	Seedling	Seedling emergence (shoot height)	Soil treatment	14 D	14 D	Germination	EC25	< 0.12	lbs ai/acre	< 0.0796	lbs ae/acre	Ricera Inc. Ohio	42389501	1992[3,4]	M. Davy	1993	Yes
2,4-D 2 EHE	63.5	Terrestrial Plant	Radish	*Raphanus sativus*	Seedling	Seedling emergence (shoot height)	Soil treatment	14 D	14 D	Germination	NOEL	0.015	lbs ai/acre	0.0099	lbs ae/acre	Ricera Inc. Ohio	42389501	1992[3,4]	M. Davy	1993	Yes
2,4-DP-p, DMA salt	**61.6**	**Aquatic Plant**	**Freshwater diatom**	***Navicula pelliculosa***	**Not reported**	**Static**	**Water**	**5 D**	**5 D**		**EC50**	**0.089**	**PPM**	**0.1**	**PPM**	**Springborn Laboratory Inc., MA**	**42449201**	**1992[3,4]**	**M. Davy**	**1993**	**Yes**
2,4-DP-p, DMA salt	61.6	Aquatic Plant	Freshwater diatom	*Navicula pelliculosa*	Not reported	Static	Water	5 D	5 D		NOEL	0.016	PPM	0.013	PPM	Springborn Laboratory Inc., MA	42449201	1992[3,4]	M. Davy	1993	Yes
2,4-DP-p, DMA salt	63.62	Terrestrial Plant	Radish	*Raphanus sativus*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	21 D	21 D	Germination	EC25	0.02	lbs ai/acre	0.017	lbs ae/acre	California Agricultural Research Inc. Karman, CA	43279201	1993[3,4]	W. Evans	2001	Supplemental
2,4-DP-p, DMA salt	63.62	Terrestrial Plant	Radish	*Raphanus sativus*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	21 D	21 D	Germination	NOEL	0.017	lbs ai/acre	0.014	lbs ae/acre	California Agricultural Research Inc. Karman, CA	43279201	1993[3,4]	W. Evans	2001	Supplemental

Formulation	% purity a.i.	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint	Toxicity Value (tested product)[1]	Units	Toxicity Value (a.e.)[1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4-DP-p, DMA salt	63.62	Terrestrial Plant	Lettuce	*Lactuca sativa*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	21 D	21 D	Germination	EC25	0.02	lbs ai/acre	0.017	lbs ae/acre	California Agicultural Research Inc. Karman, CA	43279202	1993[3,4]	W. Evans	2001	Supplemental
2,4-DP-p, DMA salt	63.62	Terrestrial Plant	Lettuce	*Lactuca sativa*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	21 D	21 D	Germination	NOEL	0.017	lbs ai/acre	0.014	lbs ae/acre	California Agicultural Research Inc. Karman, CA	43279202	1993[3,4]	W. Evans	2001	Supplemental
2,4-DP-p, DMA salt	63.62	Terrestrial Plant	Cucumber	*Cucumis sativus*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	21 D	21 D	Germination	EC25	0.02	lbs ai/acre	0.017	lbs ae/acre	California Agicultural Research Inc. Karman, CA	43279202	1993[3,4]	W. Evans	2001	Supplemental
2,4-DP-p, DMA salt	63.62	Terrestrial Plant	Cucumber	*Cucumis sativus*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	21 D	21 D	Germination	NOEL	0.017	lbs ai/acre	0.014	lbs ae/acre	California Agicultural Research Inc. Karman, CA	43279202	1993[3,4]	W. Evans	2001	Supplemental
2,4-D Tri,isopropylamine salt	67.9	Terrestrial Plant	Cucumber	*Cucumis sativus*	Seedling	Seedling germination	Soil treatment	5 D	5 D	Germination	EC25	0.057	lbs ai/acre	0.031	lbs ae/acre	Landis International Inc., Valdesta, GA	43279202	1994[3,4]	R. Hirsch	2000	Yes
2,4-D Tri,isopropylamine salt	67.9	Terrestrial Plant	Cucumber	*Cucumis sativus*	Seedling	Seedling germination	Soil treatment	5 D	5 D	Germination	NOEL	0.019	lbs ai/acre	0.010	lbs ae/acre	Landis International Inc., Valdesta, GA	43279202	1994[3,4]	R. Hirsch	2000	Yes
2,4-D Butoxyethanol Ester	94.6	Terrestrial Plant	Soybean	*Glycine max*	Seedling	Seedling emergence (dry weight)	Soil treatment	28 D	28 D	Germination	EC25	> 0.73	lbs ai/acre	> 0.50	lbs ae/acre	Landis International Inc., Valdesta, GA	43982101	1994[3,4]	R. Hirsch	2000	Supplemental
2,4-D Butoxyethanol Ester	94.6	Terrestrial Plant	Soybean	*Glycine max*	Seedling	Seedling emergence (dry weight)	Soil treatment	28 D	28 D	Germination	NOEL	0.02	lbs ai/acre	0.01	lbs ae/acre	Landis International Inc., Valdesta, GA	43982101	1994[3,4]	R. Hirsch	2000	Supplemental
2,4-DP-p, DMA salt	63.62	Terrestrial Plant	Radish	*Raphanus sativus*	Seedling	Seedling emergence (shoot height)	Soil treatment	21 D	21 D	Germination	EC25	0.083	lbs ai/acre	0.069	lbs ae/acre	California Agicultural Research Inc. Karman, CA	43197001	1993[3,4]	W. Evans	2001	Supplemental
2,4-DP-p, DMA salt	63.62	Terrestrial Plant	Radish	*Raphanus sativus*	Seedling	Seedling emergence (shoot height)	Soil treatment	21 D	21 D	Germination	NOEL	0.02	lbs ai/acre	0.017	lbs ae/acre	California Agicultural Research Inc. Karman, CA	43197001	1993[3,4]	W. Evans	2001	Supplemental
2,4-DP-p, DMA salt	63.62	Terrestrial Plant	Lettuce	*Lactuca sativa*	Seedling	Seedling emergence (shoot height)	Soil treatment	21 D	21 D	Germination	EC25	0.071	lbs ai/acre	0.059	lbs ae/acre	California Agicultural Research Inc. Karman, CA	42343902	1993[3,4]	W. Evans	2001	Supplemental
2,4-DP-p, DMA salt	63.62	Terrestrial Plant	Lettuce	*Lactuca sativa*	Seedling	Seedling emergence (shoot height)	Soil treatment	21 D	21 D	Germination	NOEL	0.02	lbs ai/acre	0.017	lbs ae/acre	California Agicultural Research Inc. Karman, CA	42343902	1993[3,4]	W. Evans	2001	Supplemental
2,4-DP-p, DMA salt	63	Terrestrial Plant	Corn	*Zea mays*	Juvenile	Vegetative vigor	Direct spray	21 D	21 D	Vegetative vigor	EC25	NR	lbs ai/acre	NR	lbs ae/acre	California Agicultural Research Inc. Karman, CA	42343902	1993[3,4]	J. Goodyear	1994	No
2,4-DP-p, DMA salt	63	Terrestrial Plant	Corn	*Zea mays*	Juvenile	Vegetative vigor	Direct spray	21 D	21 D	Vegetative vigor	NOEL	0.02	lbs ai/acre	0.017	lbs ae/acre	California Agicultural Research Inc. Karman, CA	42343902	1993[3,4]	J. Goodyear	1994	Supplemental
2,4-DP-p, DMA salt	63	Terrestrial Plant	Onion	*Allium cepa*	Juvenile	Vegetative vigor (shoot weight)	Direct spray	21 D	21 D	Vegetative vigor	EC25	0.038	lbs ai/acre	0.032	lbs ae/acre	California Agicultural Research Inc. Karman, CA	42343902	1993[3,4]	J. Goodyear	1994	Supplemental
2,4-DP-p, DMA salt	63	Terrestrial Plant	Onion	*Allium cepa*	Juvenile	Vegetative vigor (shoot weight)	Direct spray	21 D	21 D	Vegetative vigor	NOEL	0.02	lbs ai/acre	0.017	lbs ae/acre	California Agicultural Research Inc. Karman, CA	42343902	1993[3,4]	J. Goodyear	1994	Supplemental
2,4-D 2-EHE	91.53	Terrestrial Plant	Onion	*Allium cepa*	Seedling	Seedling emergence (shoot weight)	Soil treatment	14 D	14 D	Germination	EC25	0.329	lbs ai/acre	0.2182	lbs ae/acre	Ricera Inc. Ohio	42343902	1995[3,4]	S. Ramasamy	2001	Yes
2,4-D 2-EHE	91.53	Terrestrial Plant	Onion	*Allium cepa*	Seedling	Seedling emergence (shoot weight)	Soil treatment	14 D	14 D	Germination	NOEL	0.023	lbs ai/acre	0.0153	lbs ae/acre	Ricera Inc. Ohio	42343902	1995[3,4]	S. Ramasamy	2001	Yes
2,4-D 2-EHE	91.53	Terrestrial Plant	Cucumber	*Cucumis sativus*	Seedling	Seedling emergence (shoot weight)	Soil treatment	14 D	14 D	Germination	EC25	0.068	lbs ai/acre	0.0451	lbs ae/acre	Ricera Inc. Ohio	43197002	1995[3,4]	S. Ramasamy	2001	Yes
2,4-D 2-EHE	91.53	Terrestrial Plant	Cucumber	*Cucumis sativus*	Seedling	Seedling emergence (shoot weight)	Soil treatment	14 D	14 D	Germination	NOEL	0.023	lbs ai/acre	0.0153	lbs ae/acre	Ricera Inc. Ohio	43197002	1995[3,4]	S. Ramasamy	2001	Yes
2,4-D Isopropyl Ester	98.2	Terrestrial Plant	Cucumber	*Cucumis sativus*	Seedling	Seedling emergence (shoot height)	Soil treatment	14 D	14 D	Germination	EC25	0.044	lbs ai/acre	0.04	lbs ae/acre	Springborn Laboratory Inc., MA	43197002	1996[3,4]	Contract Draft GAI	1999	Yes
2,4-D Isopropyl Ester	98.2	Terrestrial Plant	Cucumber	*Cucumis sativus*	Seedling	Seedling emergence (shoot height)	Soil treatment	14 D	14 D	Germination	NOEL	0.028	lbs ai/acre	0.0235	lbs ae/acre	Springborn Laboratory Inc., MA	43197002	1996[3,4]	Contract Draft GAI	1999	Yes

Formulation	% purity a.i.	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint	Toxicity Value (tested product)[1]	Units	Toxicity Value (a.e.)[1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4-D Dimethylamine salt	55.5	Terrestrial Plant	Radish	*Raphanus sativus*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	14 D	14 D	Seedling emergence	EC25	N.R.	lbs ai/acre	NR	lbs ae/acre	Ricera Inc. Ohio	43197002	1992[3,4]	M. Davy	1993	No
2,4-D Dimethylamine salt	55.5	Terrestrial Plant	Radish	*Raphanus sativus*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	14 D	14 D	Seedling emergence	NOEL	0.03	lbs ai/acre	0.025	lbs ae/acre	Ricera Inc. Ohio	43197002	1992[3,4]	M. Davy	1993	Yes
2,4-D Dimethylamine salt	55.5	Terrestrial Plant	Onion	*Allium cepa*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	14 D	14 D	Seedling emergence	EC25	N.R.	lbs ai/acre	NR	lbs ae/acre	Ricera Inc. Ohio	43197002	1992[3,4]	M. Davy	1993	No
2,4-D Dimethylamine salt	55.5	Terrestrial Plant	Onion	*Allium cepa*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	14 D	14 D	Seedling emergence	NOEL	0.03	lbs ai/acre	0.025	lbs ae/acre	Ricera Inc. Ohio	43197002	1992[3,4]	M. Davy	1993	Yes
2,4-D 2 EHE	63.5	Terrestrial Plant	Mustard	*Brassica juncea*	Seedling	Seedling emergence (shoot height)	Soil treatment	14 D	14 D	Germination	EC25	> 0.03	lbs ai/acre	> 0.0199	lbs ae/acre	Ricera Inc. Ohio	43279201	1992[3,4]	M. Davy	1993	Yes
2,4-D 2 EHE	63.5	Terrestrial Plant	Mustard	*Brassica juncea*	Seedling	Seedling emergence (shoot height)	Soil treatment	14 D	14 D	Germination	NOEL	0.03	lbs ai/acre	0.0199	lbs ae/acre	Ricera Inc. Ohio	43279201	1992[3,4]	M. Davy	1993	Yes
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Juvenile	Vegetative vigor (root weight)	Direct spray	21 D	21 D	Vegetative vigor	EC25	0.078	lbs ai/acre	0.0517	lbs ae/acre	Pan Agicultural Laboratory, CA	43279201	1994[3,4]	B. Montague	2000	Yes
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Juvenile	Vegetative vigor (root weight)	Direct spray	21 D	21 D	Vegetative vigor	NOEL	0.03	lbs ai/acre	0.0199	lbs ae/acre	Pan Agicultural Laboratory, CA	43279201	1994[3,4]	B. Montague	2000	Yes
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Cabbage	*Brassica oleracea*	Seedling	Seedling emergence (root weight)	Soil treatment	21 D	21 D	Germination	EC25	0.066	lbs ai/acre	0.0438	lbs ae/acre	Pan Agicultural Laboratory, CA	43279202	1994[3,4]	B. Montague	2000	Yes
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Cabbage	*Brassica oleracea*	Seedling	Seedling emergence (root weight)	Soil treatment	21 D	21 D	Germination	NOEL	0.03	lbs ai/acre	0.0199	lbs ae/acre	Pan Agicultural Laboratory, CA	43279202	1994[3,4]	B. Montague	2000	Yes
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Lettuce	*Lactuca sativa*	Seedling	Seedling emergence (root weight)	Soil treatment	21 D	21 D	Germination	EC25	0.055	lbs ai/acre	0.0365	lbs ae/acre	Pan Agicultural Laboratory, CA	43279202	1994[3,4]	B. Montague	2000	Yes
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Lettuce	*Lactuca sativa*	Seedling	Seedling emergence (root weight)	Soil treatment	21 D	21 D	Germination	NOEL	0.03	lbs ai/acre	0.0199	lbs ae/acre	Pan Agicultural Laboratory, CA	43279202	1994[3,4]	B. Montague	2000	Yes
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Oat	*Avena sativa*	Seedling	Seedling emergence (root weight)	Soil treatment	21 D	21 D	Germination	EC25	0.087	lbs ai/acre	0.0577	lbs ae/acre	Pan Agicultural Laboratory, CA	41735204	1994[3,4]	B. Montague	2000	Yes
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Oat	*Avena sativa*	Seedling	Seedling emergence (root weight)	Soil treatment	21 D	21 D	Germination	NOEL	0.03	lbs ai/acre	0.0199	lbs ae/acre	Pan Agicultural Laboratory, CA	41735204	1994[3,4]	B. Montague	2000	Yes
2,4-D Diethanolamine salt	73.8	Terrestrial Plant	Mustard	*Brassica nigra*	Seedling	Seedling emergence (shoot weight)	Soil treatment	NR	NR	Germination	EC25	< 0.03	lbs ai/acre	< 0.020	lbs ae/acre	Ricera Inc. Ohio	41735203	1992[3,4]	W. Evans	2004	Supplemental
2,4-D Diethanolamine salt	73.8	Terrestrial Plant	Mustard	*Brassica nigra*	Seedling	Seedling emergence (shoot weight)	Soil treatment	NR	NR	Germination	NOEL	< 0.03	lbs ai/acre	< 0.020	lbs ae/acre	Ricera Inc. Ohio	41735203	1992[3,4]	W. Evans	2004	Supplemental
2,4-D Isopropyl Ester	98.2	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Juvenile	Vegetative vigor (root weight)	Direct spray	14 D	14 D	Vegetative vigor	EC25	> 0.046	lbs ai/acre	> 0.04	lbs ae/acre	Springborn Laboratory Inc., MA	43982101	1996[3,4]	Contract Draft GAI	1999	Yes
2,4-D Isopropyl Ester	98.2	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Juvenile	Vegetative vigor (root weight)	Direct spray	14 D	14 D	Vegetative vigor	NOEL	0.031	lbs ai/acre	0.0260	lbs ae/acre	Springborn Laboratory Inc., MA	43982101	1996[3,4]	Contract Draft GAI	1999	Yes
2,4-DB DMA	Tech	Terrestrial Plant	Onion	*Allium cepa*	Seedling	Seedling emergence (root length)	Soil treatment	14 D	14 D	Germination	EC25	0.091	lbs ai/acre	0.076	lbs ae/acre	Analytical Biochemical Laboratory, Columbia, Missouri	43982101	1997[3,4]	D. Rieder	1998	Yes
2,4-DB DMA	Tech	Terrestrial Plant	Onion	*Allium cepa*	Seedling	Seedling emergence (root length)	Soil treatment	14 D	14 D	Germination	NOEL	0.047	lbs ai/acre	0.039	lbs ae/acre	Analytical Biochemical Laboratory, Columbia, Missouri	43982101	1997[3,4]	D. Rieder	1998	Yes
2,4-D Butoxyethanol Ester	94.6	Terrestrial Plant	Corn	*Zea mays*	Seedling	Seedling emergence (dry weight)	Soil treatment	28 D	28 D	Germination	EC25	> 0.73	lbs ai/acre	> 0.50	lbs ae/acre	Landis International Inc., Valdesta, GA	43016701	1994[3,4]	R. Hirsch	2000	Supplemental
2,4-D Butoxyethanol Ester	94.6	Terrestrial Plant	Corn	*Zea mays*	Seedling	Seedling emergence (dry weight)	Soil treatment	28 D	28 D	Germination	NOEL	0.05	lbs ai/acre	0.03	lbs ae/acre	Landis International Inc., Valdesta, GA	43016701	1994[3,4]	R. Hirsch	2000	Supplemental

Formulation	% purity a.i.	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint	Toxicity Value (tested product)[1]	Units	Toxicity Value (a.e.)[1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4-DP-p, DMA salt	63.62	Terrestrial Plant	Cabbage	*Brassica oleracea*	Seedling	Seedling germination	Soil treatment	7 D	7 D	Germination	EC25	0.082	lbs ai/acre	0.068	lbs ae/acre	California Agicultural Research Inc. Karman, CA	42416802	1993[3,4]	W. Evans	2001	Supplemental
2,4-DP-p, DMA salt	63.62	Terrestrial Plant	Cabbage	*Brassica oleracea*	Seedling	Seedling germination	Soil treatment	7 D	7 D	Germination	NOEL	0.051	lbs ai/acre	0.042	lbs ae/acre	California Agicultural Research Inc. Karman, CA	42416802	1993[3,4]	W. Evans	2001	Supplemental
2,4-DP-p, DMA salt	63.62	Terrestrial Plant	Lettuce	*Lactuca sativa*	Seedling	Seedling emergence	Soil treatment	14 D	14 D	Germination	EC25	0.091	lbs ai/acre	0.076	lbs ae/acre	California Agicultural Research Inc. Karman, CA	42389501	1993[3,4]	W. Evans	2001	Supplemental
2,4-DP-p, DMA salt	63.62	Terrestrial Plant	Lettuce	*Lactuca sativa*	Seedling	Seedling emergence	Soil treatment	14 D	14 D	Germination	NOEL	0.051	lbs ai/acre	0.042	lbs ae/acre	California Agicultural Research Inc. Karman, CA	42389501	1993[3,4]	W. Evans	2001	Supplemental
2,4-DP-p, DMA salt	63.62	Terrestrial Plant	Onion	*Allium cepa*	Seedling	Seedling emergence	Soil treatment	14 D	14 D	Germination	EC25	0.26	lbs ai/acre	0.216	lbs ae/acre	California Agicultural Research Inc. Karman, CA	41737305	1993[3,4]	W. Evans	2001	Supplemental
2,4-DP-p, DMA salt	63.62	Terrestrial Plant	Onion	*Allium cepa*	Seedling	Seedling emergence	Soil treatment	14 D	14 D	Germination	NOEL	0.051	lbs ai/acre	0.042	lbs ae/acre	California Agicultural Research Inc. Karman, CA	41737305	1993[3,4]	W. Evans	2001	Supplemental
2,4-DP-p, DMA salt	63.62	Terrestrial Plant	Onion	*Allium cepa*	Seedling	Seedling emergence (shoot height)	Soil treatment	21 D	21 D	Germination	EC25	0.091	lbs ai/acre	0.076	lbs ae/acre	California Agicultural Research Inc. Karman, CA	43982101	1993[3,4]	W. Evans	2001	Supplemental
2,4-DP-p, DMA salt	63.62	Terrestrial Plant	Onion	*Allium cepa*	Seedling	Seedling emergence (shoot height)	Soil treatment	21 D	21 D	Germination	NOEL	0.051	lbs ai/acre	0.042	lbs ae/acre	California Agicultural Research Inc. Karman, CA	43982101	1993[3,4]	W. Evans	2001	Supplemental
2,4-DP-p, DMA salt	63.62	Terrestrial Plant	Onion	*Allium cepa*	Seedling	Seedling emergence (shoot weight)	Soil treatment	21 D	21 D	Germination	EC25	0.091	lbs ai/acre	0.076	lbs ae/acre	California Agicultural Research Inc. Karman, CA	43982101	1993[3,4]	W. Evans	2001	Supplemental
2,4-DP-p, DMA salt	63.62	Terrestrial Plant	Onion	*Allium cepa*	Seedling	Seedling emergence (shoot weight)	Soil treatment	21 D	21 D	Germination	NOEL	0.051	lbs ai/acre	0.042	lbs ae/acre	California Agicultural Research Inc. Karman, CA	43982101	1993[3,4]	W. Evans	2001	Supplemental
2,4-D Acid	96.2	Aquatic Plant	Duckweed	*Lemna gibba*	Not reported	Static	Water	14 D	14 D		EC50	0.695	PPM	0.695	PPM	Carolina Ecotox Inc., Durham, NC	43982101	1997[3,4]	W. Evans	1999	Yes
2,4-D Acid	96.2	Aquatic Plant	Duckweed	*Lemna gibba*	Not reported	Static	Water	14 D	14 D		NOEL	0.058	PPM	0.058	PPM	Carolina Ecotox Inc., Durham, NC	43982101	1997[3,4]	W. Evans	1999	Yes
2,4-D 2-EHE	63.5	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Juvenile	Vegetative vigor	Direct spray	21 D	21 D	Vegetative vigor	EC25	0.218	lbs ai/acre	0.1446	lbs ae/acre	Ricera Inc. Ohio	42416802	1992[3,4]	M. Davy	1998	Yes
2,4-D 2-EHE	63.5	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Juvenile	Vegetative vigor	Direct spray	21 D	21 D	Vegetative vigor	NOEL	0.06	lbs ai/acre	0.0398	lbs ae/acre	Ricera Inc. Ohio	42416802	1992[3,4]	M. Davy	1998	Yes
2,4-D 2-EHE	63.5	Terrestrial Plant	Sorghum	*Sorghum bicolor*	Juvenile	Vegetative vigor (root weight)	Direct spray	14 D	14 D	Vegetative vigor	EC25	0.218	lbs ai/acre	0.1446	lbs ae/acre	Ricera Inc. Ohio	43930701	1992[3,4]	M. Davy	1998	Yes
2,4-D 2-EHE	63.5	Terrestrial Plant	Sorghum	*Sorghum bicolor*	Juvenile	Vegetative vigor (root weight)	Direct spray	14 D	14 D	Vegetative vigor	NOEL	0.06	lbs ai/acre	0.0398	lbs ae/acre	Ricera Inc. Ohio	43930701	1992[3,4]	M. Davy	1998	Yes
2,4-D 2-EHE	Tech	Terrestrial Plant	Sorghum	*Sorghum bicolor*	Juvenile	Vegetative vigor (shoot weight)	Direct spray	21 D	21 D	Vegetative vigor	EC25	0.218	lbs ai/acre	0.1446	lbs ae/acre	Analytical Biochemical Laboratory, Columbia, Missouri	00102870	1997[3,4]	N. Mastrota	1998	Yes
2,4-D 2-EHE	Tech	Terrestrial Plant	Sorghum	*Sorghum bicolor*	Juvenile	Vegetative vigor (shoot weight)	Direct spray	21 D	21 D	Vegetative vigor	NOEL	0.06	lbs ai/acre	0.0398	lbs ae/acre	Analytical Biochemical Laboratory, Columbia, Missouri	00102870	1997[3,4]	N. Mastrota	1998	Yes
2,4-D 2 EHE	63.5	Terrestrial Plant	Sorghum	*Sorghum bicolor*	Juvenile	Vegetative vigor (shoot height)	Direct spray	14 D	14 D	Vegetative vigor	EC25	0.218	lbs ai/acre	0.1446	lbs ae/acre	Ricera Inc. Ohio	41835206	1992[3,4]	M. Davy	1993	Yes
2,4-D 2 EHE	63.5	Terrestrial Plant	Sorghum	*Sorghum bicolor*	Juvenile	Vegetative vigor (shoot height)	Direct spray	14 D	14 D	Vegetative vigor	NOEL	0.06	lbs ai/acre	0.0398	lbs ae/acre	Ricera Inc. Ohio	41835206	1992[3,4]	M. Davy	1993	Yes
2,4-D Diethanolamine salt	73.8	Terrestrial Plant	Sorghum	*Sorghum bicolor*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	NR	NR	Germination	EC25	> 0.06	lbs ai/acre	> 0.041	lbs ae/acre	Ricera Inc. Ohio	TN 0317,005399 1	1992[3,4]	W. Evans	2004	Supplemental
2,4-D Diethanolamine salt	73.8	Terrestrial Plant	Sorghum	*Sorghum bicolor*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	NR	NR	Germination	NOEL	0.06	lbs ai/acre	0.041	lbs ae/acre	Ricera Inc. Ohio	TN 0317,005399 1	1992[3,4]	W. Evans	2004	Supplemental

Formulation	% purity a.i.	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint	Toxicity Value (tested product)[1]	Units	Toxicity Value (a.e.) [1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4-D Diethanolamine salt	73.8	Terrestrial Plant	Radish	*Raphanus sativus*	Seedling	Seedling emergence	Soil treatment	NR	NR	Germination	EC25	> 1.3	lbs ai/acre	> 0.881	lbs ae/acre	Ricera Inc. Ohio	43197001	1992[3,4]	W. Evans	2004	Supplemental
2,4-D Diethanolamine salt	73.8	Terrestrial Plant	Radish	*Raphanus sativus*	Seedling	Seedling emergence	Soil treatment	NR	NR	Germination	NOEL	0.06	lbs ai/acre	0.041	lbs ae/acre	Ricera Inc. Ohio	43197001	1992[3,4]	W. Evans	2004	Supplemental
2,4-D Diethanolamine salt	73.8	Aquatic Plant	Duckweed	*Lemna gibba*	Not reported	Static	Water	5 D	5 D		EC50	0.44	PPM	0.3	PPM	Wildlife International Inc., MD	43488602	1993[3,4]	H. Craven (KBN)	1993	Yes
2,4-D Diethanolamine salt	73.8	Aquatic Plant	Duckweed	*Lemna gibba*	Not reported	Static	Water	5 D	5 D		NOEL	0.07	PPM	0.047	PPM	Wildlife International Inc., MD	43488602	1993[3,4]	H. Craven (KBN)	1993	Yes
2,4-D Tri,isopropylamine salt	67.9	Terrestrial Plant	Soybean	*Glycine max*	Seedling	Seedling germination	Soil treatment	5 D	5 D	Germination	EC25	0.191	lbs ai/acre	0.102	lbs ae/acre	Landis International Inc., Valdesta, GA	43016701	1994[3,4]	R. Hirsch	2000	Yes
2,4-D Tri,isopropylamine salt	67.9	Terrestrial Plant	Soybean	*Glycine max*	Seedling	Seedling germination	Soil treatment	5 D	5 D	Germination	NOEL	0.075	lbs ai/acre	0.040	lbs ae/acre	Landis International Inc., Valdesta, GA	43016701	1994[3,4]	R. Hirsch	2000	Yes
2,4-D Tri,isopropylamine salt	67.9	Terrestrial Plant	Corn	*Zea mays*	Seedling	Seedling germination	Soil treatment	5 D	5 D	Germination	EC25	0.24	lbs ai/acre	0.129	lbs ae/acre	Landis International Inc., Valdesta, GA	42068402	1994[3,4]	R. Hirsch	2000	Yes
2,4-D Tri,isopropylamine salt	67.9	Terrestrial Plant	Corn	*Zea mays*	Seedling	Seedling germination	Soil treatment	5 D	5 D	Germination	NOEL	0.075	lbs ai/acre	0.040	lbs ae/acre	Landis International Inc., Valdesta, GA	42068402	1994[3,4]	R. Hirsch	2000	Yes
2,4-D Tri,isopropylamine salt	67.9	Terrestrial Plant	Oat	*Avena sativa*	Seedling	Seedling germination	Soil treatment	5 D	5 D	Germination	EC25	0.269	lbs ai/acre	0.144	lbs ae/acre	Landis International Inc., Valdesta, GA	43910301	1994[3,4]	R. Hirsch	2000	Yes
2,4-D Tri,isopropylamine salt	67.9	Terrestrial Plant	Oat	*Avena sativa*	Seedling	Seedling germination	Soil treatment	5 D	5 D	Germination	NOEL	0.075	lbs ai/acre	0.040	lbs ae/acre	Landis International Inc., Valdesta, GA	43910301	1994[3,4]	R. Hirsch	2000	Yes
2,4-D Tri,isopropylamine salt	67.9	Terrestrial Plant	Onion	*Allium cepa*	Seedling	Seedling germination	Soil treatment	5 D	5 D	Germination	EC25	0.23	lbs ai/acre	0.123	lbs ae/acre	Landis International Inc., Valdesta, GA	43098901	1994[3,4]	R. Hirsch	2000	Yes
2,4-D Tri,isopropylamine salt	67.9	Terrestrial Plant	Onion	*Allium cepa*	Seedling	Seedling germination	Soil treatment	5 D	5 D	Germination	NOEL	0.075	lbs ai/acre	0.040	lbs ae/acre	Landis International Inc., Valdesta, GA	43098901	1994[3,4]	R. Hirsch	2000	Yes
2,4-DB DMA	Tech	Terrestrial Plant	Carrot	*Daucus carota*	Seedling	Seedling emergence (root length)	Soil treatment	14 D	14 D	Germination	EC25	> 0.087	lbs ai/acre	> 0.072	lbs ae/acre	Analytical Biochemical Laboratory, Columbia, Missouri	43910301	1997[3,4]	D. Rieder	1998	Yes
2,4-DB DMA	Tech	Terrestrial Plant	Carrot	*Daucus carota*	Seedling	Seedling emergence (root length)	Soil treatment	14 D	14 D	Germination	NOEL	0.087	lbs ai/acre	0.072	lbs ae/acre	Analytical Biochemical Laboratory, Columbia, Missouri	43910301	1997[3,4]	D. Rieder	1998	Yes
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Soybean	*Glycine max*	Juvenile	Vegetative vigor (root weight)	Direct spray	21 D	21 D	Vegetative vigor	EC25	0.308	lbs ai/acre	0.2042	lbs ae/acre	Pan Agicultural Laboratory, CA	43197001	1994[3,4]	B. Montague	2000	Yes
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Soybean	*Glycine max*	Juvenile	Vegetative vigor (root weight)	Direct spray	21 D	21 D	Vegetative vigor	NOEL	0.089	lbs ai/acre	0.0590	lbs ae/acre	Pan Agicultural Laboratory, CA	43197001	1994[3,4]	B. Montague	2000	Yes
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Corn	*Zea mays*	Juvenile	Vegetative vigor (root weight)	Direct spray	21 D	21 D	Vegetative vigor	EC25	0.208	lbs ai/acre	0.1379	lbs ae/acre	Pan Agicultural Laboratory, CA	42389501	1994[3,4]	B. Montague	2000	Yes
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Corn	*Zea mays*	Juvenile	Vegetative vigor (root weight)	Direct spray	21 D	21 D	Vegetative vigor	NOEL	0.089	lbs ai/acre	0.0590	lbs ae/acre	Pan Agicultural Laboratory, CA	42389501	1994[3,4]	B. Montague	2000	Yes
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Soybean	*Glycine max*	Seedling	Seedling emergence (root weight)	Soil treatment	21 D	21 D	Germination	EC25	0.33	lbs ai/acre	0.2188	lbs ae/acre	Pan Agicultural Laboratory, CA	41835205	1994[3,4]	B. Montague	2000	Yes
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Soybean	*Glycine max*	Seedling	Seedling emergence (root weight)	Soil treatment	21 D	21 D	Germination	NOEL	0.09	lbs ai/acre	0.0597	lbs ae/acre	Pan Agicultural Laboratory, CA	41835205	1994[3,4]	B. Montague	2000	Yes
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Corn	*Zea mays*	Seedling	Seedling emergence (root weight)	Soil treatment	21 D	21 D	Germination	EC25	0.19	lbs ai/acre	0.1260	lbs ae/acre	Pan Agicultural Laboratory, CA	42449201	1994[3,4]	B. Montague	2000	Yes
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Corn	*Zea mays*	Seedling	Seedling emergence (root weight)	Soil treatment	21 D	21 D	Germination	NOEL	0.09	lbs ai/acre	0.0597	lbs ae/acre	Pan Agicultural Laboratory, CA	42449201	1994[3,4]	B. Montague	2000	Yes

Formulation	% purity a.i.	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint		Toxicity Value (tested product)[1]	Units		Toxicity Value (a.e.) [1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4-D Diethanolamine salt	73.8	Terrestrial Plant	Radish	*Raphanus sativus*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	7 D	7 D	Germination	EC25	>	0.188	lbs ai/acre	>	0.127	lbs ae/acre	Ricera Inc. Ohio	42449201	1992[3,4]	H. Craven (KBN)	1993	Yes
2,4-D Diethanolamine salt	73.8	Terrestrial Plant	Radish	*Raphanus sativus*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	7 D	7 D	Germination	NOEL		0.09	lbs ai/acre		0.061	lbs ae/acre	Ricera Inc. Ohio	42449201	1992[3,4]	H. Craven (KBN)	1993	Yes
2,4-D Diethanolamine salt	73.8	Terrestrial Plant	Radish	*Raphanus sativus*	Seedling	Seedling emergence	Soil treatment	NR	NR	Germination	EC25	>	0.188	lbs ai/acre	>	0.127	lbs ae/acre	Ricera Inc. Ohio	42449201	1992[3,4]	W. Evans	2004	Supplemental
2,4-D Diethanolamine salt	73.8	Terrestrial Plant	Radish	*Raphanus sativus*	Seedling	Seedling emergence	Soil treatment	NR	NR	Germination	NOEL		0.09	lbs ai/acre		0.061	lbs ae/acre	Ricera Inc. Ohio	42449201	1992[3,4]	W. Evans	2004	Supplemental
2,4-D 2-EHE	94.7	Aquatic Plant	Marine diatom	*Skeletonema costatum*	Not reported	Static	Water	5 D	5 D		EC50		0.23	PPM		0.153	PPM	Malcolm Pernie Inc. New York	42343902	1991[3,4]	M. Davy	1993	No
2,4-D 2-EHE	94.7	Aquatic Plant	Marine diatom	*Skeletonema costatum*	Not reported	Static	Water	5 D	5 D		NOEL		0.0938	PPM		0.062	PPM	Malcolm Pernie Inc. New York	42343902	1991[3,4]	M. Davy	1993	No
2,4-D 2-EHE	94.7	Aquatic Plant	Duckweed	*Lemna gibba*	Not reported	Static	Water	14 D	14 D		EC50		0.5	PPM		0.3	PPM	Malcolm Pernie Inc. New York	42343902	1991[3,4]	M. Davy	1993	Yes
2,4-D 2-EHE	94.7	Aquatic Plant	Duckweed	*Lemna gibba*	Not reported	Static	Water	14 D	14 D		NOEL	<	0.094	PPM	<	0.062	PPM	Malcolm Pernie Inc. New York	42343902	1991[3,4]	M. Davy	1993	Yes
2,4-DB Sodium (400 g/L formulation)	40	Aquatic Plant	Duckweed	*Lemna minor*	Not reported	Static renewal	Water	7 D	7 D		EC50		9.3	PPM		9.3	ppm		41505904	1999[3,4]	L. Brown	2005	Supplemental
2,4-DB Sodium (400 g/L formulation)	40	Aquatic Plant	Duckweed	*Lemna minor*	Not reported	Static renewal	Water	7 D	7 D		NOEL		0.098	PPM		0.098	ppm		41505904	1999[3,4]	L. Brown	2005	Supplemental
2,4-D Isopropyl Ester	98.2	Terrestrial Plant	Oat	*Avena sativa*	Seedling	Seedling emergence	Soil treatment	14 D	14 D	Germination	EC25	>	0.11	lbs ai/acre	>	0.09	lbs ae/acre	Springborn Laboratory Inc., MA	43279201	1996[3,4]	Contract Draft GAI	1999	Yes
2,4-D Isopropyl Ester	98.2	Terrestrial Plant	Oat	*Avena sativa*	Seedling	Seedling emergence	Soil treatment	14 D	14 D	Germination	NOEL		0.11	lbs ai/acre		0.09	lbs ae/acre	Springborn Laboratory Inc., MA	43279201	1996[3,4]	Contract Draft GAI	1999	Yes
2,4-D Isopropyl Ester	98.2	Terrestrial Plant	Ryegrass	*Lolium perenne*	Seedling	Seedling emergence	Soil treatment	14 D	14 D	Germination	EC25	>	0.11	lbs ai/acre	>	0.09	lbs ae/acre	Springborn Laboratory Inc., MA	43279201	1996[3,4]	Contract Draft GAI	1999	Yes
2,4-D Isopropyl Ester	98.2	Terrestrial Plant	Ryegrass	*Lolium perenne*	Seedling	Seedling emergence	Soil treatment	14 D	14 D	Germination	NOEL		0.11	lbs ai/acre		0.09	lbs ae/acre	Springborn Laboratory Inc., MA	43279201	1996[3,4]	Contract Draft GAI	1999	Yes
2,4-DP-p, DMA salt	63	Terrestrial Plant	Oat	*Avena fatua*	Juvenile	Vegetative vigor	Direct spray	21 D	21 D	Vegetative vigor	EC25		NR	lbs ai/acre		NR	lbs ae/acre	California Agricultural Research Inc. Karman, CA	43279202	1993[3,4]	J. Goodyear	1994	No
2,4-DP-p, DMA salt	63	Terrestrial Plant	Oat	*Avena fatua*	Juvenile	Vegetative vigor	Direct spray	21 D	21 D	Vegetative vigor	NOEL		0.11	lbs ai/acre		0.091	lbs ae/acre	California Agricultural Research Inc. Karman, CA	43279202	1993[3,4]	J. Goodyear	1994	Supplemental
2,4-D Acid	96.7	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Seedling	Seedling germination	Soil treatment	14 D	14 D	Germination	EC25		0.12	lbs ai/acre		0.12	lbs ae/acre	Ricera Inc. Ohio	44275601	1992[3,4]	K. Valente	1992	Yes
2,4-D Acid	96.7	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Seedling	Seedling germination	Soil treatment	14 D	14 D	Germination	NOEL	<	0.12	lbs ai/acre	<	0.12	lbs ae/acre	Ricera Inc. Ohio	44275601	1992[3,4]	K. Valente	1992	Yes
2,4-D Dimethylamine salt	55.5	Terrestrial Plant	Buckwheat	*Polygonum convolvulus*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	14 D	14 D	Seedling emergence	EC25		N.R.	lbs ai/acre		NR	lbs ae/acre	Ricera Inc. Ohio	41353802	1992[3,4]	M. Davy	1993	No
2,4-D Dimethylamine salt	55.5	Terrestrial Plant	Buckwheat	*Polygonum convolvulus*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	14 D	14 D	Seedling emergence	EC25		0.12	lbs ai/acre		0.100	lbs ae/acre	Ricera Inc. Ohio	41353802	1992[3,4]	M. Davy	1993	Yes
2,4-D 2-EHE	94.7	Fish	Fathead minnow	*Pimephales promelas*	Early life	Chronic	Water	32 D	32 D		LOEC		0.22	PPM		0.146	PPM	Dow Chemical Corporation Laboratories	43197002	1990[3,4]	M. Davy	1994	Supplemental
2,4-D 2-EHE	94.7	Fish	Fathead minnow	*Pimephales promelas*	Early life	Chronic	Water	32 D	32 D		LOEC		0.12	PPM		0.080	PPM	Dow Chemical Corporation Laboratories	43197002	1990[3,4]	M. Davy	1994	Supplemental

Formulation	% purity a.i.	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint		Toxicity Value (tested product)[1]	Units		Toxicity Value (a.e.)[1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4-D Isopropyl Ester	98.2	Terrestrial Plant	Crop plants(4 Sp.)	*Monocots*	Juvenile	Vegetative vigor (shoot height)	Direct spray	14 D	14 D	Vegetative vigor	EC25	>	0.12	lbs ai/acre	>	0.10	lbs ae/acre	Springborn Laboratory Inc., MA	41735202	1996[3,4]	Contract Draft GAI	1999	Yes
2,4-D Isopropyl Ester	98.2	Terrestrial Plant	Crop plants(4 Sp.)	*Monocots*	Juvenile	Vegetative vigor (shoot height)	Direct spray	14 D	14 D	Vegetative vigor	NOEL		0.12	lbs ai/acre		0.10	lbs ae/acre	Springborn Laboratory Inc., MA	41735202	1996[3,4]	Contract Draft GAI	1999	Yes
2,4-D Isopropyl Ester	98.2	Terrestrial Plant	Cucumber	*Cucumis sativus*	Juvenile	Vegetative vigor	Direct spray	14 D	14 D	Vegetative vigor	EC25	>	0.12	lbs ai/acre	>	0.10	lbs ae/acre	Springborn Laboratory Inc., MA	00102870	1996[3,4]	Contract Draft GAI	1999	Yes
2,4-D Isopropyl Ester	98.2	Terrestrial Plant	Cucumber	*Cucumis sativus*	Juvenile	Vegetative vigor	Direct spray	14 D	14 D	Vegetative vigor	NOEL		0.12	lbs ai/acre		0.10	lbs ae/acre	Springborn Laboratory Inc., MA	00102870	1996[3,4]	Contract Draft GAI	1999	Yes
2,4-D Isopropyl Ester	98.2	Terrestrial Plant	Soybean	*Glycine max*	Juvenile	Vegetative vigor	Direct spray	14 D	14 D	Vegetative vigor	EC25	>	0.12	lbs ai/acre	>	0.10	lbs ae/acre	Springborn Laboratory Inc., MA	41353801	1996[3,4]	Contract Draft GAI	1999	Yes
2,4-D Isopropyl Ester	98.2	Terrestrial Plant	Soybean	*Glycine max*	Juvenile	Vegetative vigor	Direct spray	14 D	14 D	Vegetative vigor	NOEL		0.12	lbs ai/acre		0.10	lbs ae/acre	Springborn Laboratory Inc., MA	41353801	1996[3,4]	Contract Draft GAI	1999	Yes
2,4-D Diethanolamine salt	73.8	Terrestrial Plant	Soybean	*Glycine max*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	NR	NR	Germination	EC25	>	0.12	lbs ai/acre	>	0.081	lbs ae/acre	Ricera Inc. Ohio	43933101	1992[3,4]	W. Evans	2004	Yes
2,4-D Diethanolamine salt	73.8	Terrestrial Plant	Soybean	*Glycine max*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	NR	NR	Germination	NOEL		0.12	lbs ai/acre		0.081	lbs ae/acre	Ricera Inc. Ohio	43933101	1992[3,4]	W. Evans	2004	Yes
2,4-D Acid	96.7	Terrestrial Plant	Cucumber	*Cucumis sativus*	Seedling	Seedling emergence (shoot weight)	Soil treatment	14 D	14 D	Germination	EC25		0.53	lbs ai/acre		0.53	lbs ae/acre	Ricera Inc. Ohio	43197001	1992[3,4]	K. Valente	1992	Yes
2,4-D Acid	96.7	Terrestrial Plant	Cucumber	*Cucumis sativus*	Seedling	Seedling emergence (shoot weight)	Soil treatment	14 D	14 D	Germination	NOEL		0.13	lbs ai/acre		0.13	lbs ae/acre	Ricera Inc. Ohio	43197001	1992[3,4]	K. Valente	1992	Yes
2,4-D Isopropyl Ester	98.2	Fish	Bluegill sunfish	*Lepomis macrochirus*	0.5 g	Flow-through	Water	96 hr	96 hr	Mortality	LC50		0.31	PPM		0.26	PPM	Wildlife International Inc., MD	43197001	1996[3,4]	N. Federoff	1996	Yes
2,4-D Isopropyl Ester	98.2	Fish	Bluegill sunfish	*Lepomis macrochirus*	0.5 g	Flow-through	Water	96 hr	96 hr		NOEL		0.13	PPM		0.11	PPM	Wildlife International Inc., MD	43197001	1996[3,4]	N. Federoff	1996	Yes
2,4-DP-p, DMA salt	63.62	Terrestrial Plant	Radish	*Raphanus sativus*	Seedling	Seedling germination	Soil treatment	7 D	7 D	Germination	EC25		0.15	lbs ai/acre		0.125	lbs ae/acre	California Agicultural Research Inc. Karman, CA	43933201	1993[3,4]	W. Evans	2001	Supplemental
2,4-DP-p, DMA salt	63.62	Terrestrial Plant	Radish	*Raphanus sativus*	Seedling	Seedling germination	Soil treatment	7 D	7 D	Germination	NOEL		0.13	lbs ai/acre		0.108	lbs ae/acre	California Agicultural Research Inc. Karman, CA	43933201	1993[3,4]	W. Evans	2001	Supplemental
2,4-DP-p, DMA salt	63.62	Terrestrial Plant	Radish	*Raphanus sativus*	Seedling	Seedling emergence	Soil treatment	14 D	14 D	Germination	EC25		0.26	lbs ai/acre		0.216	lbs ae/acre	California Agicultural Research Inc. Karman, CA	TN 0683 00050674	1993[3,4]	W. Evans	2001	Supplemental
2,4-DP-p, DMA salt	63.62	Terrestrial Plant	Radish	*Raphanus sativus*	Seedling	Seedling emergence	Soil treatment	14 D	14 D	Germination	NOEL		0.13	lbs ai/acre		0.108	lbs ae/acre	California Agicultural Research Inc. Karman, CA	TN 0683 00050674	1993[3,4]	W. Evans	2001	Supplemental
2,4-D Butyl Ester	N.R.	Fish	Bluegill sunfish	*Lepomis macrochirus*	Juvenile	Static	Water	96 hr	96 hr	Mortality	LC50		0.29	PPM		0.20	PPM	Bionomics, Inc., Wareham, MA.	42416801	1976[3,4]	T. O'Brien	1978	Yes
2,4-D Butyl Ester	N.R.	Fish	Bluegill sunfish	*Lepomis macrochirus*	Juvenile	Static	Water	96 hr	96 hr		NOEL		0.14	PPM		0.10	PPM	Bionomics, Inc., Wareham, MA.	42416801	1976[3,4]	T. O'Brien	1978	Yes
2,4-D 2-EHE	95.4	Aquatic invertebrate	Grass shrimp	*Palaemonetes pugio*	0.23 g	Flow-through	Water	96 hr	96 hr	Mortality	LC50	>	0.14	PPM	>	0.093	PPM	Envirosystem & Engineering Inc.	00077320	1991[3,4]	A. Yamhure	1994	No
2,4-D 2-EHE	95.4	Aquatic invertebrate	Grass shrimp	*Palaemonetes pugio*	0.23 g	Flow-through	Water	96 hr	96 hr		NOEL		0.14	PPM		0.093	PPM	Envirosystem & Engineering Inc.	00077320	1991[3,4]	A. Yamhure	1994	No
2,4-D Butyl Ester	Tech	Fish	Bluegill sunfish	*Lepomis macrochirus*	0.64 g	Static	Water	96 hr	96 hr	Mortality	LC50		0.30	PPM		0.21	PPM	Agricultural Research Center, USDA, Beltsville, MD.	TN 0487,000539 90	1970[3,4]	J. McCann	1987	Yes
2,4-D Butyl Ester	Tech	Fish	Bluegill sunfish	*Lepomis macrochirus*	0.64 g	Static	Water	96 hr	96 hr		NOEL		0.18	PPM		0.12	PPM	Agricultural Research Center, USDA, Beltsville, MD.	TN 0487,000539 90	1970[3,4]	J. McCann	1987	Yes

Formulation	% purity a.i.	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint	Toxicity Value (tested product)[1]	Units	Toxicity Value (a.e.)[1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4-D Butoxyethanol Ester	94.6	Terrestrial Plant	Radish	*Raphanus sativus*	Seedling	Seedling emergence (dry weight)	Soil treatment	28 D	28 D	Germination	EC25	0.40	lbs ai/acre	0.28	lbs ae/acre	Landis International Inc., Valdesta, GA	41158306	1994[3,4]	R. Hirsch	2000	Supplemental
2,4-D Butoxyethanol Ester	94.6	Terrestrial Plant	Radish	*Raphanus sativus*	Seedling	Seedling emergence (dry weight)	Soil treatment	28 D	28 D	Germination	NOEL	0.18	lbs ai/acre	0.12	lbs ae/acre	Landis International Inc., Valdesta, GA	41158306	1994[3,4]	R. Hirsch	2000	Supplemental
2,4-D Tri,isopropylamine salt	70.9	Aquatic Plant	Duckweed	*Lemna gibba*	Not reported	Static	Water	14 D	14 D		EC50	2.37	PPM	1.3	PPM	Carolina Ecotox Inc., Durham, NC	43197001	1994[3,4]	H. Craven (KBN)	1994	Yes
2,4-D Tri,isopropylamine salt	**70.9**	**Aquatic Plant**	**Duckweed**	***Lemna gibba***	**Not reported**	**Static**	**Water**	**14 D**	**14 D**		**NOEL**	**0.2**	**PPM**	**0.1**	**PPM**	**Carolina Ecotox Inc., Durham, NC**	**43197001**	**1994[3,4]**	**H. Craven (KBN)**	**1994**	**Yes**
2,4-DP-p, DMA salt	63	Terrestrial Plant	Ryegrass	*Lolium perenne*	Juvenile	Vegetative vigor	Direct spray	21 D	21 D	Vegetative vigor	EC25	NR	lbs ai/acre	NR	lbs ae/acre	California Agicultural Research Inc. Karman, CA	44517305	1993[3,4]	J. Goodyear	1994	No
2,4-DP-p, DMA salt	63	Terrestrial Plant	Ryegrass	*Lolium perenne*	Juvenile	Vegetative vigor	Direct spray	21 D	21 D	Vegetative vigor	NOEL	0.2	lbs ai/acre	0.166	lbs ae/acre	California Agicultural Research Inc. Karman, CA	44517305	1993[3,4]	J. Goodyear	1994	Supplemental
2,4-D Butoxyethanol Ester	96	Aquatic Plant	Duckweed	*Lemna gibba*	Not reported	Static	Water	14 D	14 D		EC50	0.576	PPB	0.4 [0.0004]	ppb [ppm]	Malcolm Pernie Inc. New York	42068404	1992[3,4]	M. Davy	1993	Yes
2,4-D Butoxyethanol Ester	96	Aquatic Plant	Duckweed	*Lemna gibba*	Not reported	Static	Water	14 D	14 D		NOEL	0.204	PPB	0.14 [0.00014]	ppb [ppm]	Malcolm Pernie Inc. New York	42068404	1992[3,4]	M. Davy	1993	Yes
2,4-D Isopropyl Ester (Citrus Fix Product)	45.8	Fish	Bluegill sunfish	*Lepomis macrochirus*	0.39 g	Flow-through	Water	96 hr	96 hr	Mortality	LC50	0.31	PPM	0.26	PPM	Wildlife International Inc., MD	TN 0064, 54045	1996[3,4]	R. Mahler	1997	Yes
2,4-D Isopropyl Ester (Citrus Fix Product)	45.8	Fish	Bluegill sunfish	*Lepomis macrochirus*	0.39 g	Flow-through	Water	96 hr	96 hr		NOEL	0.21	PPM	0.18	PPM	Wildlife International Inc., MD	TN 0064, 54045	1996[3,4]	R. Mahler	1997	Yes
2,4 DP-p-2-EHE	93.2	Aquatic invertebrate	Water flea	*Daphnia magna*	<24 hr	Flow-through	Water	48 hr	48 hr		EC50	> 1.5	PPM	> 1.0	PPM	Springborn Laboratory Inc., MA	42068403	1993[3,4]	Contract Draft-KBN	1993	Yes
2,4 DP-p-2-EHE	93.2	Aquatic invertebrate	Water flea	*Daphnia magna*	<24 hr	Flow-through	Water	48 hr	48 hr		NOEL	0.21	PPM	0.139	PPM	Springborn Laboratory Inc., MA	42068403	1993[3,4]	Contract Draft-KBN	1993	Yes
2,4-D Isopropyl ester	45.8	Fish	Bluegill sunfish	*Lepomis macrochirus*	0.39 g	Flow-through	Water	96 hr	96 hr	Mortality	LC50	0.31	PPM	0.26	PPM	Wildlife International Inc., MD	42343902	1996[3,4]	A. Stavola	1998	Yes
2,4-D Isopropyl ester	45.8	Fish	Bluegill sunfish	*Lepomis macrochirus*	0.39 g	Flow-through	Water	96 hr	96 hr		NOEL	0.21	PPM	0.18	PPM	Wildlife International Inc., MD	42343902	1996[3,4]	A. Stavola	1998	Yes
2,4-D Butoxyethanol Ester	94.6	Terrestrial Plant	Onion	*Allium cepa*	Seedling	Seedling emergence	Soil treatment	28 D	28 D	Germination	EC25	0.36	lbs ai/acre	0.25	lbs ae/acre	Landis International Inc., Valdesta, GA	42389501	1994[3,4]	R. Hirsch	2000	Supplemental
2,4-D Butoxyethanol Ester	94.6	Terrestrial Plant	Onion	*Allium cepa*	Seedling	Seedling emergence	Soil treatment	28 D	28 D	Germination	NOEL	0.22	lbs ai/acre	0.15	lbs ae/acre	Landis International Inc., Valdesta, GA	42389501	1994[3,4]	R. Hirsch	2000	Supplemental
2,4-D Dimethylamine salt	55.5	Terrestrial Plant	Soybean	*Glycine max*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	14 D	14 D	Seedling emergence	EC25	N.R.	lbs ai/acre	NR	lbs ae/acre	Ricera Inc. Ohio	42389501	1992[3,4]	M. Davy	1993	No
2,4-D Dimethylamine salt	55.5	Terrestrial Plant	Soybean	*Glycine max*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	14 D	14 D	Seedling emergence	NOEL	0.24	lbs ai/acre	0.199	lbs ae/acre	Ricera Inc. Ohio	42389501	1992[3,4]	M. Davy	1993	Yes
2,4-D 2-EHE	95.4	Fish	Inland silverside	*Menidia beryllina*	0.46 g	Flow-through	Water	96 hr	96 hr	Mortality	LC50	> 0.24	PPM	> 0.159	PPM	Envirosystem & Engineering Inc.	42449201	1991[3,4]	A. Yamhure	1994	No
2,4-D 2-EHE	95.4	Fish	Inland silverside	*Menidia beryllina*	0.46 g	Flow-through	Water	96 hr	96 hr		NOEL	0.24	PPM	0.159	PPM	Envirosystem & Engineering Inc.	42449201	1991[3,4]	A. Yamhure	1994	No
2,4-D 2 EHE	63.5	Terrestrial Plant	Buckwheat	*Polygonum convolvulus*	Seedling	Seedling emergence (shoot height)	Soil treatment	14 D	14 D	Germination	EC25	0.96	lbs ai/acre	0.6366	lbs ae/acre	Ricera Inc. Ohio	42449201	1992[3,4]	M. Davy	1993	Yes
2,4-D 2 EHE	63.5	Terrestrial Plant	Buckwheat	*Polygonum convolvulus*	Seedling	Seedling emergence (shoot height)	Soil treatment	14 D	14 D	Germination	NOEL	0.24	lbs ai/acre	0.1592	lbs ae/acre	Ricera Inc. Ohio	42449201	1992[3,4]	M. Davy	1993	Yes

Formulation	% purity a.i.	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint		Toxicity Value (tested product)[1]	Units		Toxicity Value (a.e.)[1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4-D 2 EHE	63.5	Terrestrial Plant	Sorghum	*Sorghum bicolor*	Seedling	Seedling emergence (shoot height)	Soil treatment	14 D	14 D	Germination	EC25		0.25	lbs ai/acre		0.1658	lbs ae/acre	Ricera Inc. Ohio	42449201	1992[3,4]	M. Davy	1993	Yes
2,4-D 2 EHE	63.5	Terrestrial Plant	Sorghum	*Sorghum bicolor*	Seedling	Seedling emergence (shoot height)	Soil treatment	14 D	14 D	Germination	NOEL		0.24	lbs ai/acre		0.1592	lbs ae/acre	Ricera Inc. Ohio	42449201	1992[3,4]	M. Davy	1993	Yes
2,4-D 2 EHE	63.5	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Seedling	Seedling emergence (shoot height)	Soil treatment	14 D	14 D	Germination	EC25	<	0.96	lbs ai/acre	<	0.6366	lbs ae/acre	Ricera Inc. Ohio	00102845	1992[3,4]	M. Davy	1993	Yes
2,4-D 2 EHE	63.5	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Seedling	Seedling emergence (shoot height)	Soil treatment	14 D	14 D	Germination	NOEL		0.24	lbs ai/acre		0.1592	lbs ae/acre	Ricera Inc. Ohio	00102845	1992[3,4]	M. Davy	1993	Yes
2,4-D 2-EHE	63.5	Terrestrial Plant	Corn	*Zea mays*	Juvenile	Vegetative vigor (phytotoxicity)	Direct spray	14 D	14 D	Vegetative vigor	EC25	>	0.24	lbs ai/acre	>	0.1592	lbs ae/acre	Ricera Inc. Ohio	00107930	1992[3,4]	M. Davy	1999	Yes
2,4-D 2-EHE	63.5	Terrestrial Plant	Corn	*Zea mays*	Juvenile	Vegetative vigor (phytotoxicity)	Direct spray	14 D	14 D	Vegetative vigor	NOEL		0.24	lbs ai/acre		0.1592	lbs ae/acre	Ricera Inc. Ohio	00107930	1992[3,4]	M. Davy	1999	Yes
2,4-D 2-EHE	63.5	Terrestrial Plant	Oat	*Avena sativa*	Juvenile	Vegetative vigor (phytotoxicity)	Direct spray	14 D	14 D	Vegetative vigor	EC25	>	0.24	lbs ai/acre	>	0.1592	lbs ae/acre	Ricera Inc. Ohio	42416802	1992[3,4]	M. Davy	1999	Yes
2,4-D 2-EHE	63.5	Terrestrial Plant	Oat	*Avena sativa*	Juvenile	Vegetative vigor (phytotoxicity)	Direct spray	14 D	14 D	Vegetative vigor	NOEL		0.24	lbs ai/acre		0.1592	lbs ae/acre	Ricera Inc. Ohio	42416802	1992[3,4]	M. Davy	1999	Yes
2,4-D Diethanolamine salt	73.8	Terrestrial Plant	Cucumber	*Cucumis sativus*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	NR	NR	Germination	EC25	>	0.25	lbs ai/acre	>	0.169	lbs ae/acre	Ricera Inc. Ohio	42416802	1992[3,4]	W. Evans	2004	Yes
2,4-D Diethanolamine salt	73.8	Terrestrial Plant	Cucumber	*Cucumis sativus*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	NR	NR	Germination	NOEL		0.25	lbs ai/acre		0.169	lbs ae/acre	Ricera Inc. Ohio	42416802	1992[3,4]	W. Evans	2004	Yes
2,4-D Diethanolamine salt	73.8	Terrestrial Plant	Oat	*Avena fatua*	Seedling	Seedling emergence	Soil treatment	NR	NR	Germination	EC25	>	0.25	Not reported	>	0.169	Not reported	Ricera Inc. Ohio	41835202	1992[3,4]	W. Evans	2004	No
2,4-D Diethanolamine salt	73.8	Terrestrial Plant	Oat	*Avena fatua*	Seedling	Seedling emergence	Soil treatment	NR	NR	Germination	NOEL		0.25	Not reported		0.169	Not reported	Ricera Inc. Ohio	41835202	1992[3,4]	W. Evans	2004	No
2,4-D Diethanolamine salt	73.8	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	NR	NR	Germination	EC25	>	0.25	Not reported	>	0.169	Not reported	Ricera Inc. Ohio	43930601	1992[3,4]	W. Evans	2004	No
2,4-D Diethanolamine salt	73.8	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	NR	NR	Germination	NOEL		0.25	Not reported		0.169	Not reported	Ricera Inc. Ohio	43930601	1992[3,4]	W. Evans	2004	No
2,4-D Diethanolamine salt	73.8	Terrestrial Plant	Buckwheat	*Fagopyrum sagittatum*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	NR	NR	Germination	EC25	>	0.25	lbs ai/acre	>	0.169	lbs ae/acre	Ricera Inc. Ohio	42767004	1992[3,4]	W. Evans	2004	Supplemental
2,4-D Diethanolamine salt	73.8	Terrestrial Plant	Buckwheat	*Fagopyrum sagittatum*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	NR	NR	Germination	NOEL		0.25	lbs ai/acre		0.169	lbs ae/acre	Ricera Inc. Ohio	42767004	1992[3,4]	W. Evans	2004	Supplemental
2,4-D Diethanolamine salt	73.8	Terrestrial Plant	Buckwheat	*Polygonum convolvulus*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	NR	NR	Germination	EC25	>	0.25	lbs ai/acre	>	0.169	lbs ae/acre	Ricera Inc. Ohio	41505903	1992[3,4]	W. Evans	2004	Supplemental
2,4-D Diethanolamine salt	73.8	Terrestrial Plant	Buckwheat	*Polygonum convolvulus*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	NR	NR	Germination	NOEL		0.25	lbs ai/acre		0.169	lbs ae/acre	Ricera Inc. Ohio	41505903	1992[3,4]	W. Evans	2004	Supplemental
2,4-D Dimethylamine salt	66.7	Aquatic Plant	Duckweed	Lemna gibba	Not reported	Static	Water	14 D	14 D	Growth	EC50		0.58	PPM		0.482	PPM	Malcolm Pernie Inc. New York	41353801	1990[3,4]	R. Petrie	1991	Yes
2,4-D Dimethylamine salt	66.7	Aquatic Plant	Duckweed	Lemna gibba	Not reported	Static	Water	14 D	14 D	Growth	NOEL		0.27	PPM		0.224	PPM	Malcolm Pernie Inc. New York	41353801	1990[3,4]	R. Petrie	1991	Yes
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Oat	*Avena sativa*	Juvenile	Vegetative vigor (root weight)	Direct spray	21 D	21 D	Vegetative vigor	EC25		2.4	lbs ai/acre		1.5915	lbs ae/acre	Pan Agicultural Laboratory, CA	41353801	1994[3,4]	B. Montague	2000	Yes
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Oat	*Avena sativa*	Juvenile	Vegetative vigor (root weight)	Direct spray	21 D	21 D	Vegetative vigor	NOEL		0.27	lbs ai/acre		0.1790	lbs ae/acre	Pan Agicultural Laboratory, CA	41353801	1994[3,4]	B. Montague	2000	Yes

Formulation	% purity a.i.	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint	Toxicity Value (tested product)[1]	Units	Toxicity Value (a.e.)[1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Ryegrass	*Lolium perenne*	Juvenile	Vegetative vigor (root weight)	Direct spray	21 D	21 D	Vegetative vigor	EC25	1.47	lbs ai/acre	0.9748	lbs ae/acre	Pan Agicultural Laboratory, CA	00063066	1994[3,4]	B. Montague	2000	Yes
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Ryegrass	*Lolium perenne*	Juvenile	Vegetative vigor (root weight)	Direct spray	21 D	21 D	Vegetative vigor	NOEL	0.27	lbs ai/acre	0.1790	lbs ae/acre	Pan Agicultural Laboratory, CA	00063066	1994[3,4]	B. Montague	2000	Yes
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Ryegrass	*Lolium perenne*	Seedling	Seedling emergence (root weight)	Soil treatment	21 D	21 D	Germination	EC25	0.30	lbs ai/acre	0.1989	lbs ae/acre	Pan Agicultural Laboratory, CA	TN 0608, 00024968	1994[3,4]	B. Montague	2000	Yes
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Ryegrass	*Lolium perenne*	Seedling	Seedling emergence (root weight)	Soil treatment	21 D	21 D	Germination	NOEL	0.27	lbs ai/acre	0.1790	lbs ae/acre	Pan Agicultural Laboratory, CA	TN 0608, 00024968	1994[3,4]	B. Montague	2000	Yes
2,4-D Diethanolamine salt	73.8	Terrestrial Plant	Onion	*Allium cepa*	Seedling	Seedling emergence (shoot weight)	Soil treatment	32 D	32 D	Germination	EC25	0.38	lbs ai/acre	0.257	lbs ae/acre	Ricera Inc. Ohio	41735205	1996[3,4]	R. Hirsch	1999	Yes
2,4-D Diethanolamine salt	73.8	Terrestrial Plant	Onion	*Allium cepa*	Seedling	Seedling emergence (shoot weight)	Soil treatment	32 D	32 D	Germination	NOEL	0.27	lbs ai/acre	0.183	lbs ae/acre	Ricera Inc. Ohio	41735205	1996[3,4]	R. Hirsch	1999	Yes
2,4-D Butoxyethanol Ester	96	Aquatic invertebrate	Water flea	*Daphnia magna*	Full lifecycle	Flow-through	Water	21 D	21 D		LOEC	0.7	PPM	0.48	PPM	Dow Chemical Corporation Laboratories	41737303	1989[3,4]	A. Roybal	1991	Yes
2,4-D Butoxyethanol Ester	**96**	**Aquatic invertebrate**	**Water flea**	***Daphnia magna***	**Full lifecycle**	**Flow-through**	**Water**	**21 D**	**21 D**		**NOEL**	**0.29**	**PPM**	**0.20**	**PPM**	**Dow Chemical Corporation Laboratories**	**41737303**	**1989[3,4]**	**A. Roybal**	**1991**	**Yes**
2,4-D Tri,isopropylamine salt	67.9	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Seedling	Seedling germination	Soil treatment	5 D	5 D	Germination	EC25	0.80	lbs ai/acre	0.429	lbs ae/acre	Landis International Inc., Valdesta, GA	42416802	1994[3,4]	R. Hirsch	2000	Yes
2,4-D Tri,isopropylamine salt	67.9	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Seedling	Seedling germination	Soil treatment	5 D	5 D	Germination	NOEL	0.3	lbs ai/acre	0.161	lbs ae/acre	Landis International Inc., Valdesta, GA	42416802	1994[3,4]	R. Hirsch	2000	Yes
2,4-D 2-EHE	94.7	Aquatic Plant	Bluegreen algae	*Anabaena flos-aquae*	Not reported	Static	Water	5 D	5 D		EC50	> 0.32	PPM	> 0.212	PPM	Malcolm Pernie Inc. New York	42416802	1991[3,4]	M. Davy	1993	No
2,4-D 2-EHE	94.7	Aquatic Plant	Bluegreen algae	*Anabaena flos-aquae*	Not reported	Static	Water	5 D	5 D		NOEL	0.32	PPM	0.212	PPM	Malcolm Pernie Inc. New York	42416802	1991[3,4]	M. Davy	1993	No
2,4-D Butyl Ester	100	Fish	Rainbow trout	*Oncorhynchus mykiss*	Juvenile	Static	Water	96 hr	96 hr	Mortality	LC50	0.4	PPM	0.28	PPM	Bionomics, Inc., Wareham, MA.	42416802	1976[3,4]	T. O'Brien	1978	Yes
2,4-D Butyl Ester	100	Fish	Rainbow trout	*Oncorhynchus mykiss*	Juvenile	Static	Water	96 hr	96 hr		NOEL	0.32	PPM	0.22	PPM	Bionomics, Inc., Wareham, MA.	42416802	1976[3,4]	T. O'Brien	1978	Yes
2,4-D Butoxyethanol Ester	97.4	Fish	Bluegill sunfish	*Lepomis macrochirus*	20 mm	Static	Water	96 hr	96 hr	Mortality	LC50	0.62	PPM	0.43	PPM	Dow Chemical Corporation Laboratories	42416802	1983[3,4]	A. Roybal	1991	Yes
2,4-D Butoxyethanol Ester	97.4	Fish	Bluegill sunfish	*Lepomis macrochirus*	20 mm	Static	Water	96 hr	96 hr		NOEL	0.34	PPM	0.23	PPM	Dow Chemical Corporation Laboratories	42416802	1983[3,4]	A. Roybal	1991	Yes
2,4-D Isopropyl Ester	98.2	Fish	Rainbow trout	*Oncorhynchus mykiss*	1.3 g	Flow-through	Water	96 hr	96 hr	Mortality	LC50	0.69	PPM	0.58	PPM	Wildlife International Inc., MD	TN 0726	1996[3,4]	N. Federoff	1996	Yes
2,4-D Isopropyl Ester	98.2	Fish	Rainbow trout	*Oncorhynchus mykiss*	1.3 g	Flow-through	Water	96 hr	96 hr		NOEL	0.34	PPM	0.29	PPM	Wildlife International Inc., MD	TN 0726	1996[3,4]	N. Federoff	1996	Yes
2,4-D Butoxyethanol Ester	94.6	Terrestrial Plant	Carrot	*Daucus carota*	Seedling	Seedling emergence	Soil treatment	28 D	28 D	Germination	EC25	0.55	lbs ai/acre	0.38	lbs ae/acre	Landis International Inc., Valdesta, GA	42767003	1994[3,4]	R. Hirsch	2000	Supplemental
2,4-D Butoxyethanol Ester	94.6	Terrestrial Plant	Carrot	*Daucus carota*	Seedling	Seedling emergence	Soil treatment	28 D	28 D	Germination	NOEL	0.34	lbs ai/acre	0.23	lbs ae/acre	Landis International Inc., Valdesta, GA	42767003	1994[3,4]	R. Hirsch	2000	Supplemental
2,4-D Butoxyethanol Ester	94.6	Terrestrial Plant	Oat	*Avena sativa*	Seedling	Seedling emergence (dry weight)	Soil treatment	28 D	28 D	Germination	EC25	0.70	lbs ai/acre	0.48	lbs ae/acre	Landis International Inc., Valdesta, GA	41835203	1994[3,4]	R. Hirsch	2000	Supplemental
2,4-D Butoxyethanol Ester	94.6	Terrestrial Plant	Oat	*Avena sativa*	Seedling	Seedling emergence (dry weight)	Soil treatment	28 D	28 D	Germination	NOEL	0.36	lbs ai/acre	0.25	lbs ae/acre	Landis International Inc., Valdesta, GA	41835203	1994[3,4]	R. Hirsch	2000	Supplemental

Formulation	% purity a.i.	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint		Toxicity Value (tested product)[1]	Units		Toxicity Value (a.e.) [1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4-D Isopropyl Ester (Citrus Fix Product)	45.8	Fish	Rainbow trout	*Oncorhynchus mykiss*	1.6 g	Flow-through	Water	96 hr	96 hr	Mortality	LC50		0.78	PPM		0.66	PPM	Wildlife International Inc., MD	42068401	1996[3,4]	N. Federoff	1996	Yes
2,4-D Isopropyl Ester (Citrus Fix Product)	45.8	Fish	Rainbow trout	*Oncorhynchus mykiss*	1.6 g	Flow-through	Water	96 hr	96 hr		NOEL		0.39	PPM		0.33	PPM	Wildlife International Inc., MD	42068401	1996[3,4]	N. Federoff	1996	Yes
2,4-D Butoxyethanol Ester -Weed-Rhap LV Oxy6D	77.5	Fish	Rainbow trout	*Oncorhynchus mykiss*	0.69 g	Static	Water	96 hr	96 hr	Mortality	LC50		0.65	PPM		0.45	PPM	Agricultural Research Center, USDA, Beltsville, MD.	41353801	1974[3,4]	C. Lewis	1987	Yes
2,4-D Butoxyethanol Ester -Weed-Rhap LV Oxy6D	77.5	Fish	Rainbow trout	*Oncorhynchus mykiss*	0.69 g	Static	Water	96 hr	96 hr		NOEL	<	0.5	PPM	<	0.34	PPM	Agricultural Research Center, USDA, Beltsville, MD.	41353801	1974[3,4]	C. Lewis	1987	Yes
2,4-D Diethanolamine salt	73.8	Aquatic Plant	Green algae	*Selenastrum capricornutum*	Not reported	Static	Water	5 D	5 D		EC50		11	PPM		7.5	PPM	Wildlife International Inc., MD	TN 0059	1993[3,4]	H. Craven (KBN)	1993	Yes
2,4-D Diethanolamine salt	73.8	Aquatic Plant	Green algae	*Selenastrum capricornutum*	Not reported	Static	Water	5 D	5 D		NOEL		0.5	PPM		0.339	PPM	Wildlife International Inc., MD	TN 0059	1993[3,4]	H. Craven (KBN)	1993	Yes
2,4-D Acid	96.7	Terrestrial Plant	Sorghum	*Sorghum bicolor*	Juvenile	Vegetative vigor (phytotoxicity)	Direct spray	14 D	14 D	Vegetative vigor	EC25		1.34	lbs ai/acre		1.34	lbs ae/acre	Ricera Inc. Ohio	41735206	1991[3,4]	K. Valente	1992	Yes
2,4-D Acid	96.7	Terrestrial Plant	Sorghum	*Sorghum bicolor*	Juvenile	Vegetative vigor (phytotoxicity)	Direct spray	14 D	14 D	Vegetative vigor	NOEL		0.53	lbs ai/acre		0.53	lbs ae/acre	Ricera Inc. Ohio	41735206	1991[3,4]	K. Valente	1992	Yes
2,4-DP 2-Butoxyethyl Ester (Weedone formula)	59.1	Fish	Bluegill sunfish	*Lepomis macrochirus*	0.38 g	Static	Water	96 hr	96 hr	Mortality	LC50		0.833	PPM		0.573	PPM	Union Carbide Environmental Services	00077321	1980[3,4]	C. Laird	1988	Supplemental
2,4-DP 2-Butoxyethyl Ester (Weedone formula)	59.1	Fish	Bluegill sunfish	*Lepomis macrochirus*	0.38 g	Static	Water	96 hr	96 hr		NOEL		0.56	PPM		0.385	PPM	Union Carbide Environmental Services	00077321	1980[3,4]	C. Laird	1988	Supplemental
2,4-D Butyl Ester	Tech	Fish	Rainbow trout	*Oncorhynchus mykiss*	0.97 g	Static	Water	96 hr	96 hr	Mortality	LC50		0.8	PPM		0.55	PPM	Agricultural Research Center, USDA, Beltsville, MD.	43374701	1972[3,4]	J. McCann	1987	Yes
2,4-D Butyl Ester	Tech	Fish	Rainbow trout	*Oncorhynchus mykiss*	0.97 g	Static	Water	96 hr	96 hr		NOEL		0.56	PPM		0.39	PPM	Agricultural Research Center, USDA, Beltsville, MD.	43374701	1972[3,4]	J. McCann	1987	Yes
2,4-D N,N-Dimethyl oleyl-linoleyl amine	63.8	Fish	Rainbow trout	*Oncorhynchus mykiss*	0.83 g	Static	Water	96 hr	96 hr	Mortality	LC50		0.64	PPM		0.53	ppm	Agricultural Research Center, USDA, Beltsville, MD.	43374701	1974[3,4]	J. McCann	1974	Supplemental
2,4-D N,N-Dimethyl oleyl-linoleyl amine	63.8	Fish	Rainbow trout	*Oncorhynchus mykiss*	0.83 g	Static	Water	96 hr	96 hr		NOEL		0.56	PPM		0.47	ppm	Agricultural Research Center, USDA, Beltsville, MD.	43374701	1974[3,4]	J. McCann	1974	Supplemental
2,4-D Isooctyl Ester	96.2	Aquatic invertebrate	Water flea	*Daphnia magna*	<24 hr	Static	Water	48 hr	48 hr		EC50	>	5.0	PPM	>	3.3	PPM	Dow Chemical Corporation Laboratories	43374701	1983[3,4]	K. Valente	1992	Yes
2,4-D Isooctyl Ester	96.2	Aquatic invertebrate	Water flea	*Daphnia magna*	<24 hr	Static	Water	48 hr	48 hr		NOEL		0.6	PPM		0.4	PPM	Dow Chemical Corporation Laboratories	43374701	1983[3,4]	K. Valente	1992	Yes
2,4-D Butoxyethanol Ester	94.6	Terrestrial Plant	Cucumber	*Cucumis sativus*	Seedling	Seedling emergence	Soil treatment	28 D	28 D	Germination	EC25	>	0.73	lbs ai/acre	>	0.50	lbs ae/acre	Landis International Inc., Valdesta, GA	43374701	1994[3,4]	R. Hirsch	2000	Supplemental
2,4-D Butoxyethanol Ester	94.6	Terrestrial Plant	Cucumber	*Cucumis sativus*	Seedling	Seedling emergence	Soil treatment	28 D	28 D	Germination	NOEL		0.73	lbs ai/acre		0.50	lbs ae/acre	Landis International Inc., Valdesta, GA	43374701	1994[3,4]	R. Hirsch	2000	Supplemental
2,4-D 2-EHE	99.96	Amphibian	Leopard frog	*Rana pipiens*	Tadple	Static	Water	96 hr	96 hr	Mortality	LC50	>	0.765	PPM	>	0.507	PPM	Wildlife International Inc., MD	43374701	1997[3,4]	S. Ramasamy	2001	Supplemental
2,4-D 2-EHE	**99.96**	**Amphibian**	**Leopard frog**	***Rana pipiens***	**Tadple**	**Static**	**Water**	**96 hr**	**96 hr**		**NOEL**		**0.765**	**PPM**		**0.507**	**PPM**	**Wildlife International Inc., MD**	**43374701**	**1997[3,4]**	**S. Ramasamy**	**2001**	**Supplemental**
2,4-D Butoxyethanol Ester	96	Aquatic Plant	Marine diatom	*Skeletonema costatum*	Not reported	Static	Water	5 D	5 D		EC50		1.48	PPM		1.02	PPM	Malcolm Pernie Inc. New York	43374701	1992[3,4]	M. Davy	1993	No
2,4-D Butoxyethanol Ester	96	Aquatic Plant	Marine diatom	*Skeletonema costatum*	Not reported	Static	Water	5 D	5 D		NOEL		0.78	PPM		0.54	PPM	Malcolm Pernie Inc. New York	43374701	1992[3,4]	M. Davy	1993	No

Formulation	% purity a.i.	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint		Toxicity Value (tested product)[1]	Units		Toxicity Value (a.e.)[1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4-D Propylene Glycol B.E. Ester	72.8	Fish	Bluegill sunfish	*Lepomis macrochirus*	1.02	Static	Water	96 hr	96 hr	Mortality	LC50		0.83	PPM		0.571	PPM	Agricultural Research Center, USDA, Beltsville, MD.	43374701	1968[3,4]	B. Montague	2004	Supplemental
2,4-D Propylene Glycol B.E. Ester	72.8	Fish	Bluegill sunfish	*Lepomis macrochirus*	1.02	Static	Water	96 hr	96 hr		NOEL	<	0.83	PPM	<	0.571	PPM	Agricultural Research Center, USDA, Beltsville, MD.	43374701	1968[3,4]	B. Montague	2004	Supplemental
2,4-D Butoxyethanol Ester	96	Aquatic Plant	Freshwater diatom	*Navicula pelliculosa*	Not reported	Static	Water	5 D	5 D		EC50		1.86	PPM		1.28	PPM	Malcolm Pernie Inc. New York	43374701	1992[3,4]	M. Davy	1993	Yes
2,4-D Butoxyethanol Ester	96	Aquatic Plant	Freshwater diatom	*Navicula pelliculosa*	Not reported	Static	Water	5 D	5 D		NOEL		0.86	PPM		0.59	PPM	Malcolm Pernie Inc. New York	43374701	1992[3,4]	M. Davy	1993	Yes
2,4-D 2 EHE	63.5	Terrestrial Plant	Corn	*Zea mays*	Juvenile	Vegetative vigor	Direct spray	14 D	14 D	Vegetative vigor	EC25	>	0.96	lbs ai/acre	>	0.6366	lbs ae/acre	Ricera Inc. Ohio	43374701	1992[3,4]	R. Petrie	1992	Supplemental
2,4-D 2 EHE	63.5	Terrestrial Plant	Corn	*Zea mays*	Juvenile	Vegetative vigor	Direct spray	14 D	14 D	Vegetative vigor	NOEL		0.96	lbs ai/acre		0.6366	lbs ae/acre	Ricera Inc. Ohio	43374701	1992[3,4]	R. Petrie	1992	Supplemental
2,4-D Dimethylamine salt	55.5	Terrestrial Plant	Corn	*Zea mays*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	14 D	14 D	Seedling emergence	EC25		N.R.	lbs ai/acre		NR	lbs ae/acre	Ricera Inc. Ohio	43374701	1992[3,4]	M. Davy	1992	No
2,4-D Dimethylamine salt	55.5	Terrestrial Plant	Corn	*Zea mays*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	14 D	14 D	Seedling emergence	NOEL		0.96	lbs ai/acre		0.797	lbs ae/acre	Ricera Inc. Ohio	43374701	1992[3,4]	M. Davy	1992	Yes
2,4-D Dimethylamine salt	55.5	Terrestrial Plant	Oat	*Avena sativa*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	14 D	14 D	Seedling emergence	EC25		N.R.	lbs ai/acre		NR	lbs ae/acre	Ricera Inc. Ohio	42416802	1992[3,4]	M. Davy	1993	No
2,4-D Dimethylamine salt	55.5	Terrestrial Plant	Oat	*Avena sativa*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	14 D	14 D	Seedling emergence	NOEL		0.96	lbs ai/acre		0.797	lbs ae/acre	Ricera Inc. Ohio	42416802	1992[3,4]	M. Davy	1993	Yes
2,4-D 2 EHE	63.5	Terrestrial Plant	Corn	*Zea mays*	Seedling	Seedling emergence (shoot height)	Soil treatment	14 D	14 D	Germination	EC25	>	0.96	lbs ai/acre	>	0.6366	lbs ae/acre	Ricera Inc. Ohio	42416801	1992[3,4]	M. Davy	1993	Yes
2,4-D 2 EHE	63.5	Terrestrial Plant	Corn	*Zea mays*	Seedling	Seedling emergence (shoot height)	Soil treatment	14 D	14 D	Germination	NOEL	>	0.96	lbs ai/acre	>	0.6366	lbs ae/acre	Ricera Inc. Ohio	42416801	1992[3,4]	M. Davy	1993	Yes
2,4-D 2 EHE	63.5	Terrestrial Plant	Oat	*Avena sativa*	Seedling	Seedling emergence (shoot height)	Soil treatment	14 D	14 D	Germination	EC25	>	0.96	lbs ai/acre	>	0.6366	lbs ae/acre	Ricera Inc. Ohio	42416801	1992[3,4]	M. Davy	1993	Yes
2,4-D 2 EHE	63.5	Terrestrial Plant	Oat	*Avena sativa*	Seedling	Seedling emergence (shoot height)	Soil treatment	14 D	14 D	Germination	NOEL	>	0.96	lbs ai/acre	>	0.6366	lbs ae/acre	Ricera Inc. Ohio	42416801	1992[3,4]	M. Davy	1993	Yes
2,4-D 2 EHE	63.5	Terrestrial Plant	Soybean	*Glycine max*	Seedling	Seedling emergence (shoot height)	Soil treatment	14 D	14 D	Germination	EC25	>	0.96	lbs ai/acre	>	0.6366	lbs ae/acre	Ricera Inc. Ohio	TN 0684	1992[3,4]	M. Davy	1993	Yes
2,4-D 2 EHE	63.5	Terrestrial Plant	Soybean	*Glycine max*	Seedling	Seedling emergence (shoot height)	Soil treatment	14 D	14 D	Germination	NOEL	>	0.96	lbs ai/acre	>	0.6366	lbs ae/acre	Ricera Inc. Ohio	TN 0684	1992[3,4]	M. Davy	1993	Yes
2,4-D Propylene Glycol B.E. Ester	Tech?	Fish	Bluegill sunfish	*Lepomis macrochirus*	Not reported	Static	Water	96 hr	96 hr	Mortality	LC50		1.2	PPM		0.826	PPM	Bionomics, Inc., Wareham, MA.	43488601	1971[3,4]	C. Lewis	1988	Supplemental
2,4-D Propylene Glycol B.E. Ester	Tech?	Fish	Bluegill sunfish	*Lepomis macrochirus*	Not reported	Static	Water	96 hr	96 hr		NOEL	<	1	PPM	<	0.688	PPM	Bionomics, Inc., Wareham, MA.	43488601	1971[3,4]	C. Lewis	1988	Supplemental
2,4-D Butyl Ester	Tech	Aquatic invertebrate	Water flea	*Daphnia magna*	<24 hr	Static	Water	96 hr	96 hr		EC50		2.8	PPM		1.9	PPM	Union Carbide Environmental Services	00067328	1977[3,4]	T. O'Brien	1978	Yes
2,4-D Butyl Ester	Tech	Aquatic invertebrate	Water flea	*Daphnia magna*	<24 hr	Static	Water	96 hr	96 hr		NOEL	<	1	PPM	<	0.69	PPM	Union Carbide Environmental Services	00067328	1977[3,4]	T. O'Brien	1978	Yes
2,4-D Diethanolamine salt	73.8	Terrestrial Plant	Corn	*Zea mays*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	NR	NR	Germination	EC25	>	1.0	lbs ai/acre	>	0.678	lbs ae/acre	Ricera Inc. Ohio	42681001	1992[3,4]	W. Evans	2004	Yes
2,4-D Diethanolamine salt	73.8	Terrestrial Plant	Corn	*Zea mays*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	NR	NR	Germination	NOEL		1	lbs ai/acre		0.678	lbs ae/acre	Ricera Inc. Ohio	42681001	1992[3,4]	W. Evans	2004	Yes

Formulation	% purity a.i.	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint	Toxicity Value (tested product)[1]	Units	Toxicity Value (a.e.)[1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4-D Acid	96.7	Terrestrial Plant	Buckwheat	*Polygonum convolvulus*	Seedling	Seedling emergence (shoot weight)	Soil treatment	14 D	14 D	Germination	EC25	1.29	lbs ai/acre	1.29	lbs ae/acre	Ricera Inc. Ohio	00045069	1992[3,4]	K. Valente	1992	Yes
2,4-D Acid	96.7	Terrestrial Plant	Buckwheat	*Polygonum convolvulus*	Seedling	Seedling emergence (shoot weight)	Soil treatment	14 D	14 D	Germination	NOEL	1.05	lbs ai/acre	1.05	lbs ae/acre	Ricera Inc. Ohio	00045069	1992[3,4]	K. Valente	1992	Yes
2,4-D Acid	96.7	Terrestrial Plant	Soybean	*Glycine max*	Seedling	Seedling emergence (shoot weight)	Soil treatment	14 D	14 D	Germination	EC25	1.71	lbs ai/acre	1.71	lbs ae/acre	Ricera Inc. Ohio	TN 0574, 00050676	1992[3,4]	K. Valente	1992	Yes
2,4-D Acid	96.7	Terrestrial Plant	Soybean	*Glycine max*	Seedling	Seedling emergence (shoot weight)	Soil treatment	14 D	14 D	Germination	NOEL	1.05	lbs ai/acre	1.05	lbs ae/acre	Ricera Inc. Ohio	TN 0574, 00050676	1992[3,4]	K. Valente	1992	Yes
2,4-D 2-EHE	66.6	Fish	Inland silverside	*Menidia beryllina*	Juvenile	Flow-through	Water	96 hr	96 hr	Mortality	LC50	> 3.0	PPM	> 2.0	PPM	Envirosystem & Engineering Inc.	42595901	1991[3,4]	J. Noles	1991	No
2,4-D 2-EHE	66.6	Fish	Inland silverside	*Menidia beryllina*	Juvenile	Flow-through	Water	96 hr	96 hr		NOEL	1.1	PPM	0.729	PPM	Envirosystem & Engineering Inc.	42595901	1991[3,4]	J. Noles	1991	No
2,4-D Isopropyl Ester	98.2	Aquatic invertebrate	Water flea	*Daphnia magna*	<24 hr	Flow-through	Water	48 hr	48 hr		EC50	2.6	PPM	2.2	PPM	Wildlife International Inc., MD	TN 0224, 00054026	1996[3,4]	N. Federoff	1996	Yes
2,4-D Isopropyl Ester	98.2	Aquatic invertebrate	Water flea	*Daphnia magna*	<24 hr	Flow-through	Water	48 hr	48 hr		NOEL	1.1	PPM	0.92	PPM	Wildlife International Inc., MD	TN 0224, 00054026	1996[3,4]	N. Federoff	1996	Yes
2,4 DP-p-2-EHE	93.2	Fish	Bluegill sunfish	*Lepomis macrochirus*	1.9 g	Static	Water	96 hr	96 hr	Mortality	LC50	7.7	PPM	5.1	PPM	BASF Corporation, Republic of Germany	41158301	1992[3,4]	A. Yamhure	1996	Yes
2,4 DP-p-2-EHE	93.2	Fish	Bluegill sunfish	*Lepomis macrochirus*	1.9 g	Static	Water	96 hr	96 hr		NOEL	1.52	PPM	1.0	PPM	BASF Corporation, Republic of Germany	41158301	1992[3,4]	A. Yamhure	1996	Yes
2,4-D Dimethylamine salt	66.7	Aquatic Plant	Freshwater diatom	Navicula pelliculosa	Not reported	Static	Water	120hr	120hr	Growth	EC50	4.67	PPM	3.878	PPM	Malcolm Pernie Inc. New York	00045068	1990[3,4]	R. Petrie	1991	Yes
2,4-D Dimethylamine salt	66.7	Aquatic Plant	Freshwater diatom	Navicula pelliculosa	Not reported	Static	Water	120hr	120hr	Growth	NOEL	1.7	PPM	1.412	PPM	Malcolm Pernie Inc. New York	00045068	1990[3,4]	R. Petrie	1991	Yes
2,4-D Butoxyethanol Ester	97.4	Fish	Rainbow trout	*Oncorhynchus mykiss*	27 mm	Static	Water	96 hr	96 hr	Mortality	LC50	2.09	PPM	1.44	PPM	Dow Chemical Corporation Laboratories	42449201	1983[3,4]	A. Roybal	1991	Yes
2,4-D Butoxyethanol Ester	97.4	Fish	Rainbow trout	*Oncorhynchus mykiss*	27 mm	Static	Water	96 hr	96 hr		NOEL	1.7	PPM	1.17	PPM	Dow Chemical Corporation Laboratories	42449201	1983[3,4]	A. Roybal	1991	Yes
2,4-D Butoxyethanol Ester	97.4	Fish	Fathead minnow	*Pimephales promelas*	16 mm	Static	Water	96 hr	96 hr	Mortality	LC50	2.5	PPM	1.72	PPM	Dow Chemical Corporation Laboratories	44517302	1983[3,4]	A. Roybal	1991	Yes
2,4-D Butoxyethanol Ester	97.4	Fish	Fathead minnow	*Pimephales promelas*	16 mm	Static	Water	96 hr	96 hr		NOEL	1.7	PPM	1.17	PPM	Dow Chemical Corporation Laboratories	44517302	1983[3,4]	A. Roybal	1991	Yes
2,4-DP 2-Butoxyethyl Ester	59.1	Fish	Rainbow trout	*Oncorhynchus mykiss*	0.35 g	Static	Water	96 hr	96 hr	Mortality	LC50	2.7	PPM	1.858	PPM	Union Carbide Environmental Services	TN 0065	1980[3,4]	C. Laird	1988	Supplemental
2,4-DP 2-Butoxyethyl Ester	59.1	Fish	Rainbow trout	*Oncorhynchus mykiss*	0.35 g	Static	Water	96 hr	96 hr		NOEL	1.8	PPM	1.238	PPM	Union Carbide Environmental Services	TN 0065	1980[3,4]	C. Laird	1988	Supplemental
2,4-D 2-EHE	94.7	Aquatic Plant	Freshwater diatom	*Navicula pelliculosa*	Not reported	Static	Water	5 D	5 D		EC50	4.1	PPM	2.7	PPM	Malcolm Pernie Inc. New York	41835207	1991[3,4]	M. Davy	1993	Yes
2,4-D 2-EHE	94.7	Aquatic Plant	Freshwater diatom	*Navicula pelliculosa*	Not reported	Static	Water	5 D	5 D		NOEL	1.875	PPM	1.2	PPM	Malcolm Pernie Inc. New York	41835207	1991[3,4]	M. Davy	1993	Yes
2,4-D Acid	96.9	Aquatic Plant	Bluegreen algae	Anabaena flos-aquae	Not reported	Static	Water	5 D	5 D	Growth	EC50	> 2.02	PPM	> 2.02	PPM	Carolina Ecotox Inc., Durham, NC	41835204	1994[3,4]	M. Davy	1998	No
2,4-D Acid	96.9	Aquatic Plant	Bluegreen algae	Anabaena flos-aquae	Not reported	Static	Water	5 D	5 D	Growth	NOEL	> 2.02	PPM	> 2.02	PPM	Carolina Ecotox Inc., Durham, NC	41835204	1994[3,4]	M. Davy	1998	No

Formulation	% purity a.i.	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint		Toxicity Value (tested product)[1]	Units		Toxicity Value (a.e.) [1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4-D Acid	96.9	Aquatic Plant	Freshwater diatom	Navicula pelliculosa	Not reported	Static	Water	5 D	5 D	Growth	EC50		2.02	PPM		2.02	PPM	Carolina Ecotox Inc., Durham, NC	41766701	1994[3,4]	M. Davy	1994	Yes
2,4-D Acid	96.9	Aquatic Plant	Freshwater diatom	Navicula pelliculosa	Not reported	Static	Water	5 D	5 D	Growth	NOEL	<	2.02	PPM	<	2.02	PPM	Carolina Ecotox Inc., Durham, NC	41766701	1994[3,4]	M. Davy	1994	Yes
2,4-D Acid	96.9	Aquatic Plant	Marine diatom	Skeletonema costatum	Not reported	Static	Water	5 D	5 D	Growth	EC50		2.02	PPM		2.02	PPM	Carolina Ecotox Inc., Durham, NC	TN 762	1994[3,4]	M. Davy	1998	No
2,4-D Acid	96.9	Aquatic Plant	Marine diatom	Skeletonema costatum	Not reported	Static	Water	5 D	5 D	Growth	NOEL	<	2.02	PPM	<	2.02	PPM	Carolina Ecotox Inc., Durham, NC	TN 762	1994[3,4]	M. Davy	1998	No
2,4-D Acid	96.9	Aquatic Plant	Duckweed	Lemna gibba	Not reported	Static	Water	14 D	14 D	Growth	EC50	<	2.02	PPM	<	2.02	PPM	Carolina Ecotox Inc., Durham, NC	00036935	1994[3,4]	M. Davy	1998	Yes
2,4-D Acid	96.9	Aquatic Plant	Duckweed	Lemna gibba	Not reported	Static	Water	14 D	14 D	Growth	NOEL	<	2.02	PPM	<	2.02	PPM	Carolina Ecotox Inc., Durham, NC	00036935	1994[3,4]	M. Davy	1998	Yes
2,4-D 2 EHE	66.9	Fish	Rainbow trout	*Oncorhynchus mykiss*	0.21 g	Flow-through	Water	96 hr	96 hr	Mortality	LC50		7.2	PPM		4.8	PPM	Dow Chemical Corporation Laboratories	41420002	1990[3,4]	W. Evans	2001	Yes
2,4-D 2 EHE	66.9	Fish	Rainbow trout	*Oncorhynchus mykiss*	0.21 g	Flow-through	Water	96 hr	96 hr		NOEL	<	2.1	PPM	<	1.4	PPM	Dow Chemical Corporation Laboratories	41420002	1990[3,4]	W. Evans	2001	Yes
2,4-D Acid	96.7	Terrestrial Plant	Corn	*Zea mays*	Seedling	Seedling emergence (shoot weight)	Soil treatment	14 D	14 D	Germination	EC25	>	4.2	lbs ai/acre	>	4.2	lbs ae/acre	Ricera Inc. Ohio	42389501	1992[3,4]	K. Valente	1992	Yes
2,4-D Acid	96.7	Terrestrial Plant	Corn	*Zea mays*	Seedling	Seedling emergence (shoot weight)	Soil treatment	14 D	14 D	Germination	NOEL		2.1	lbs ai/acre		2.1	lbs ae/acre	Ricera Inc. Ohio	42389501	1992[3,4]	K. Valente	1992	Yes
2,4-D Acid	96.7	Terrestrial Plant	Oat	*Avena sativa*	Seedling	Seedling emergence (shoot weight)	Soil treatment	14 D	14 D	Germination	EC25	>	4.2	lbs ai/acre	>	4.2	lbs ae/acre	Ricera Inc. Ohio	42621801	1992[3,4]	K. Valente	1992	Yes
2,4-D Acid	96.7	Terrestrial Plant	Oat	*Avena sativa*	Seedling	Seedling emergence (shoot weight)	Soil treatment	14 D	14 D	Germination	NOEL		2.1	lbs ai/acre		2.1	lbs ae/acre	Ricera Inc. Ohio	42621801	1992[3,4]	K. Valente	1992	Yes
2,4-D Acid	96.7	Terrestrial Plant	Onion	*Allium cepa*	Seedling	Seedling emergence (shoot weight)	Soil treatment	14 D	14 D	Germination	EC25	>	2.1	lbs ai/acre	>	2.1	lbs ae/acre	Ricera Inc. Ohio	42187301	1992[3,4]	K. Valente	1992	Yes
2,4-D Acid	96.7	Terrestrial Plant	Onion	*Allium cepa*	Seedling	Seedling emergence (shoot weight)	Soil treatment	14 D	14 D	Germination	NOEL		2.1	lbs ai/acre		2.1	lbs ae/acre	Ricera Inc. Ohio	42187301	1992[3,4]	K. Valente	1992	Yes
2,4-D Acid	96.7	Terrestrial Plant	Sorghum	*Sorghum bicolor*	Seedling	Seedling emergence (shoot weight)	Soil treatment	14 D	14 D	Germination	EC25	>	2.1	lbs ai/acre	>	2.1	lbs ae/acre	Ricera Inc. Ohio	42204601	1992[3,4]	K. Valente	1992	Yes
2,4-D Acid	96.7	Terrestrial Plant	Sorghum	*Sorghum bicolor*	Seedling	Seedling emergence (shoot weight)	Soil treatment	14 D	14 D	Germination	NOEL		2.1	lbs ai/acre		2.1	lbs ae/acre	Ricera Inc. Ohio	42204601	1992[3,4]	K. Valente	1992	Yes
2,4 DP-p-2-EHE	93.2	Fish	Rainbow trout	*Oncorhynchus mykiss*	2.8 g	Static	Water	96 hr	96 hr	Mortality	LC50		7.9	PPM		5.2	PPM	BASF Corporation, Republic of Germany	41429001	1992[3,4]	A. Yamhure	1996	Yes
2,4 DP-p-2-EHE	93.2	Fish	Rainbow trout	*Oncorhynchus mykiss*	2.8 g	Static	Water	96 hr	96 hr		NOEL		2.72	PPM		1.8	PPM	BASF Corporation, Republic of Germany	41429001	1992[3,4]	A. Yamhure	1996	Yes
2,4-D 2-EHE	67	Aquatic invertebrate	Grass shrimp	*Palaemonetes pugio*	Juvenile	Flow-through	Water	96 hr	96 hr	Mortality	LC50	>	3.0	PPB	>	2 [0.002]	ppb [ppm]	Envirosystem & Engineering Inc.	42979701	1991[3,4]	J. Noles	1991	No
2,4-D 2-EHE	67	Aquatic invertebrate	Grass shrimp	*Palaemonetes pugio*	Juvenile	Flow-through	Water	96 hr	96 hr		NOEL		3	PPB		2 [0.002]	ppb [ppm]	Envirosystem & Engineering Inc.	42979701	1991[3,4]	J. Noles	1991	No
2,4-D Butoxyethanol Ester	96	Aquatic Plant	Bluegreen algae	*Anabaena flos-aquae*	Not reported	Static	Water	5 D	5 D		EC50		6.37	PPB		4.38 [0.00438]	ppb [ppm]	Malcolm Pernie Inc. New York	TN	1992[3,4]	M. Davy	1993	No
2,4-D Butoxyethanol Ester	96	Aquatic Plant	Bluegreen algae	*Anabaena flos-aquae*	Not reported	Static	Water	5 D	5 D		NOEL		3.14	PPB		2.16 [0.00216]	ppb [ppm]	Malcolm Pernie Inc. New York	TN	1992[3,4]	M. Davy	1993	No

Formulation	% purity a.i.	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint		Toxicity Value (tested product)[1]	Units		Toxicity Value (a.e.)[1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4-D Butoxyethanol Ester	97.4	Aquatic invertebrate	Water flea	*Daphnia magna*	<24 hr	Static	Water	48 hr	48 hr		EC50		7.2	PPM		5.0	PPM	Dow Chemical Corporation Laboratories	TN 0759, 00050699	1983[3,4]	A. Roybal	1991	Yes
2,4-D Butoxyethanol Ester	97.4	Aquatic invertebrate	Water flea	*Daphnia magna*	<24 hr	Static	Water	48 hr	48 hr		NOEL	<	3.4	PPM	<	2.34	PPM	Dow Chemical Corporation Laboratories	TN 0759, 50699	1983[3,4]	A. Roybal	1991	Yes
2,4-DB DMA	26.7	Fish	Bluegill sunfish	*Lepomis macrochirus*	0.69 g	Flow-through	Water	96 hr	96 hr	Mortality	LC50		13	PPM		10.795	PPM	Springborn Laboratory Inc., MA	41973401	1990[3,4,5]	R. Lamb	1991	No
2,4-DB DMA	26.7	Fish	Bluegill sunfish	*Lepomis macrochirus*	0.69 g	Flow-through	Water	96 hr	96 hr		NOEL		3.6	PPM		2.990	PPM	Springborn Laboratory Inc., MA	41973401	1990[3,4,5]	R. Lamb	1991	No
2,4-D Isooctyl Ester/2,4,5-T mixture	15/15	Fish	Bluegill sunfish	*Lepomis macrochirus*	0.85 g	Static	Water	96 hr	96 hr	Mortality	LC50		4.9	PPM		3.2	PPM	Agricultural Research Center, USDA, Beltsville, MD.	TN 0638	1967[3,4]	B. Montague	2004	Supplemental
2,4-D Isooctyl Ester/2,4,5-T mixture	15/15	Fish	Bluegill sunfish	*Lepomis macrochirus*	0.85 g	Static	Water	96 hr	96 hr		NOEL	<	3.7	PPM	<	2.5	PPM	Agricultural Research Center, USDA, Beltsville, MD.	TN 0638	1967[3,4]	B. Montague	2004	Supplemental
2,4-D 2 EHE	94.7	Aquatic Plant	Green algae	*Selenastrum capricornutum*	Not reported	Static	Water	5 D	5 D		EC50	>	30.0	PPM	>	19.89377982	PPM	Malcolm Pernie Inc. New York	43488604	1990[3,4]	M. Davy	1993	Yes
2,4-D 2 EHE	94.7	Aquatic Plant	Green algae	*Selenastrum capricornutum*	Not reported	Static	Water	5 D	5 D		NOEL		3.75	PPM		2.5	PPM	Malcolm Pernie Inc. New York	43488604	1990[3,4]	M. Davy	1993	Yes
2,4-DP 2-Butoxyethyl Ester	63.7	Aquatic invertebrate	Water flea	*Daphnia magna*	Not reported	Static	Water	48 hr	48 hr		EC50		6.25	PPB		4.3 [0.0043]	ppb [ppm]	Union Carbide Environmental Services	44517301	1980[3,4]	EFED	1988	Yes
2,4-DP 2-Butoxyethyl Ester	63.7	Aquatic invertebrate	Water flea	*Daphnia magna*	Not reported	Static	Water	48 hr	48 hr		NOEL		3.79	PPB		2.6 [0.0026]	ppb [ppm]	Union Carbide Environmental Services	44517301	1980[3,4]	EFED	1988	Yes
2,4-D Acid	96.7	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Seedling	Seedling emergence (shoot weight)	Soil treatment	14 D	14 D	Germination	EC25	>	4.2	lbs ai/acre	>	4.2	lbs ae/acre	Ricera Inc. Ohio	41429004	1992[3,4]	K. Valente	1992	Yes
2,4-D Acid	96.7	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Seedling	Seedling emergence (shoot weight)	Soil treatment	14 D	14 D	Germination	NOEL	>	4.2	lbs ai/acre	>	4.2	lbs ae/acre	Ricera Inc. Ohio	41429004	1992[3,4]	K. Valente	1992	Yes
2,4-D Acid	96.7	Terrestrial Plant	Corn	*Zea mays*	Juvenile	Vegetative vigor (phytotoxicity)	Direct spray	14 D	14 D	Vegetative vigor	EC25	>	4.2	lbs ai/acre	>	4.2	lbs ae/acre	Ricera Inc. Ohio	07309101	1991[3,4]	K. Valente	1992	Yes
2,4-D Acid	96.7	Terrestrial Plant	Corn	*Zea mays*	Juvenile	Vegetative vigor (phytotoxicity)	Direct spray	14 D	14 D	Vegetative vigor	NOEL	>	4.2	lbs ai/acre	>	4.2	lbs ae/acre	Ricera Inc. Ohio	07309101	1991[3,4]	K. Valente	1992	Yes
2,4-D Acid	96.7	Terrestrial Plant	Oat	*Avena sativa*	Juvenile	Vegetative vigor (phytotoxicity)	Direct spray	14 D	14 D	Vegetative vigor	EC25	>	4.2	lbs ai/acre	>	4.2	lbs ae/acre	Ricera Inc. Ohio	41505901	1991[3,4]	K. Valente	1992	Yes
2,4-D Acid	96.7	Terrestrial Plant	Oat	*Avena sativa*	Juvenile	Vegetative vigor (phytotoxicity)	Direct spray	14 D	14 D	Vegetative vigor	NOEL	>	4.2	lbs ai/acre	>	4.2	lbs ae/acre	Ricera Inc. Ohio	41505901	1991[3,4]	K. Valente	1992	Yes
2,4-D butoxypropyl esters(4)	72.5	Fish	Rainbow trout	*Oncorhynchus mykiss*	0.48 g	Static	Water	96 hr	96 hr	Mortality	LC50		5.4	PPM		3.72	PPM	Agricultural Research Center, USDA, Beltsville, MD.	41975107	1974[3,4]	J. McCann	1974	Supplemental
2,4-D butoxypropyl esters(4)	72.5	Fish	Rainbow trout	*Oncorhynchus mykiss*	0.48 g	Static	Water	96 hr	96 hr		NOEL		4.2	PPM		2.89	PPM	Agricultural Research Center, USDA, Beltsville, MD.	41975107	1974[3,4]	J. McCann	1974	Supplemental
2,4-D Tri,isopropylamine salt	70.9	Aquatic Plant	Freshwater diatom	*Navicula pelliculosa*	Not reported	Static	Water	5 D	5 D		EC50		94.4	PPM		50.6	PPM	Carolina Ecotox Inc., Durham, NC	41975106	1994[3,4]	H. Craven (KBN)	1994	Yes
2,4-D Tri,isopropylamine salt	70.9	Aquatic Plant	Freshwater diatom	*Navicula pelliculosa*	Not reported	Static	Water	5 D	5 D		NOEL		5.3	PPM		2.841	PPM	Carolina Ecotox Inc., Durham, NC	41975106	1994[3,4]	H. Craven (KBN)	1994	Yes
2,4-D 2-EHE	92	Aquatic invertebrate	Water flea	*Daphnia magna*	1st-I	Static	Water	48 hr	48 hr		EC50		18.8	PPB		12.5 [0.0125]	ppb [ppm]	Uniroyal Chemical Inc.	05001465	1977[3,4]	L. Turner	1977	Yes
2,4-D 2-EHE	92	Aquatic invertebrate	Water flea	*Daphnia magna*	1st-I	Static	Water	48 hr	48 hr		NOEL	<	5.6	PPB	<	3.7 [0.0037]	ppb [ppm]	Uniroyal Chemical Inc.	05001465	1977[3,4]	L. Turner	1977	Yes

Formulation	% purity a.i.	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint		Toxicity Value (tested product)[1]	Units		Toxicity Value (a.e.) [1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4-D Diethanolamine salt	73.8	Mollusca	Eastern oyster	*Crassostrea virginica*	SPAT	Flow-through	Water	96 hr	96 hr		EC50	>	112	PPM	>	75.884	PPM	Wildlife International Inc., MD	42767001	1991[3,4]	K. Valente	1992	No
2,4-D Diethanolamine salt	73.8	Mollusca	Eastern oyster	*Crassostrea virginica*	SPAT	Flow-through	Water	96 hr	96 hr		NOEL	<	6.9	PPM	<	4.7	PPM	Wildlife International Inc., MD	42767001	1991[3,4]	K. Valente	1992	No
2,4-D Diethanolamine salt	73.8	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Seedling	Seedling germination	Soil treatment	7 D	7 D	Germination	EC25		14.9	lbs ai/acre		10.1	lbs ae/acre	Ricera Inc. Ohio	41429006	1992[3,4]	H. Craven (KBN)	1993	Supplemental
2,4-D Diethanolamine salt	73.8	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Seedling	Seedling germination	Soil treatment	7 D	7 D	Germination	NOEL		7.5	lbs ai/acre		5.1	lbs ae/acre	Ricera Inc. Ohio	41429006	1992[3,4]	H. Craven (KBN)	1993	Supplemental
2,4-DB Acid	99.6	Aquatic invertebrate	Water flea	*Daphnia magna*	<24 hr	Flow-through	Water	48 hr	48 hr		EC50		25	PPM		22	PPM	Springborn Laboratory Inc., MA	41737307	1990[3,4]	J. Noles	1991	Yes
2,4-DB Acid	99.6	Aquatic invertebrate	Water flea	*Daphnia magna*	<24 hr	Flow-through	Water	48 hr	48 hr		NOEL		8.4	PPM		7	PPM	Springborn Laboratory Inc., MA	41737307	1990[3,4]	J. Noles	1991	Yes
2,4-DB DMA	25.8	Aquatic invertebrate	Water flea	*Daphnia magna*	1st-I	Flow-through	Water	48 hr	48 hr		EC50		24	PPM		20	PPM	Springborn Laboratory Inc., MA	43374803	1990[3,4]	K. Valente	1992	Yes
2,4-DB DMA	25.8	Aquatic invertebrate	Water flea	*Daphnia magna*	1st-I	Flow-through	Water	48 hr	48 hr		NOEL		8.4	PPM		6.976	PPM	Springborn Laboratory Inc., MA	43374803	1990[3,4]	K. Valente	1992	Yes
2,4-DP-p, DMA salt	61.6	Aquatic Plant	Bluegreen algae	Anabaena flos-aquae	Not reported	Static	Water	5 D	5 D	Growth	EC50	>	9.5	PPM	>	7.889	PPM	Springborn Laboratory Inc., MA	TN 0318	1992[3,4]	M. Davy	1993	No
2,4-DP-p, DMA salt	61.6	Aquatic Plant	Bluegreen algae	Anabaena flos-aquae	Not reported	Static	Water	5 D	5 D	Growth	NOEL	>	9.5	PPM	>	7.889	PPM	Springborn Laboratory Inc., MA	TN 0318	1992[3,4]	M. Davy	1993	No
2,4-D Isooctyl Ester	92	Fish	Bluegill sunfish	*Lepomis macrochirus*	Juvenile	Static	Water	96 hr	96 hr	Mortality	LC50		18	PPM		11.9	PPM	Uniroyal Chemical Inc.	41975105	1976[3,4]	L. Turner	1977	Yes
2,4-D Isooctyl Ester	92	Fish	Bluegill sunfish	*Lepomis macrochirus*	Juvenile	Static	Water	96 hr	96 hr		NOEL		10	PPM		6.6	PPM	Uniroyal Chemical Inc.	41975105	1976[3,4]	L. Turner	1977	Yes
2,4-DP-p, DMA salt	63.6	Aquatic Plant	Marine diatom	Skeletonema costatum	Not reported	Static	Water	5 D	5 D	Growth	EC50	>	11	PPM	>	9.135	PPM	Springborn Laboratory Inc., MA	41975104	1992[3,4]	M. Davy	1993	No
2,4-DP-p, DMA salt	63.6	Aquatic Plant	Marine diatom	Skeletonema costatum	Not reported	Static	Water	5 D	5 D	Growth	NOEL		11	PPM		9.135	PPM	Springborn Laboratory Inc., MA	41975104	1992[3,4]	M. Davy	1993	No
2,4-D Isooctyl Ester (LV Ester Weed Killer)	68.2	Fish	Bluegill sunfish	*Lepomis macrochirus*	0.55 g	Static	Water	96 hr	96 hr	Mortality	LC50	<	11.5	PPM	<	7.6	PPM	Agricultural Research Center, USDA, Beltsville, MD.	41546201	1969[3,4]	J. McCann	1969	Supplemental
2,4-D Isooctyl Ester (LV Ester Weed Killer)	68.2	Fish	Bluegill sunfish	*Lepomis macrochirus*	0.55 g	Static	Water	96 hr	96 hr		NOEL	<	11.5	PPM	<	7.6	PPM	Agricultural Research Center, USDA, Beltsville, MD.	41546201	1969[3,4]	J. McCann	1969	Supplemental
2,4-D Acid	98.7	Aquatic invertebrate	Water flea	*Daphnia magna*	1st-I	Static	Water	48 hr	48 hr		EC50		25	PPM		25	PPM	Dow Chemical Corporation Laboratories	41454101	1983[3,4]	K. Valente	1992	Yes
2,4-D Acid	98.7	Aquatic invertebrate	Water flea	*Daphnia magna*	1st-I	Static	Water	48 hr	48 hr		NOEL	<	12	PPM	<	12	PPM	Dow Chemical Corporation Laboratories	41454101	1983[3,4]	K. Valente	1992	Yes
2,4-D Isooctyl Ester	92	Fish	Rainbow trout	*Oncorhynchus mykiss*	Juvenile	Static	Water	96 hr	96 hr	Mortality	LC50		22	PPM		14.6	PPM	Uniroyal Chemical Inc.	41644401	1976[3,4]	L. Turner	1977	Yes
2,4-D Isooctyl Ester	92	Fish	Rainbow trout	*Oncorhynchus mykiss*	Juvenile	Static	Water	96 hr	96 hr		NOEL		12	PPM		8.0	PPM	Uniroyal Chemical Inc.	41644401	1976[3,4]	L. Turner	1977	Yes
2,4-D 2 EHE	63.5	Terrestrial Plant	Sorghum	*Sorghum bicolor*	Not reported	Seedling germination	Soil treatment	6 D	6 D	Germination	EC25	>	12.3	lbs ai/acre	>	8.2	lbs ae/acre	Ricera Inc. Ohio	41848001	1992[3,4]	M. Davy	1993	Yes
2,4-D 2 EHE	63.5	Terrestrial Plant	Sorghum	*Sorghum bicolor*	Not reported	Seedling germination	Soil treatment	6 D	6 D	Germination	NOEL		12.3	lbs ai/acre		8.2	lbs ae/acre	Ricera Inc. Ohio	41848001	1992[3,4]	M. Davy	1993	Yes

Formulation	% purity a.i.	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint		Toxicity Value (tested product)[1]	Units		Toxicity Value (a.e.)[1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4-D 2-EHE	99.96	Insect	Honey bee	*Apis mellifera*	Adult	Oral (gavage or capsule)	Oral	72 hr	72 hr	Mortality	LD50	>	100	ug/bee	>	66	ug/bee	Wildlife International Inc., MD	41429002	1997[3,4]	S. Ramasamy	2000	Supplemental
2,4-D 2-EHE	99.96	Insect	Honey bee	*Apis mellifera*	Adult	Oral (gavage or capsule)	Oral	72 hr	72 hr		NOEL		12.5	ug/bee		8.3	ug/bee	Wildlife International Inc., MD	41429002	1997[3,4]	S. Ramasamy	2000	Supplemental
2,4-D Isooctyl Ester	68.7	Fish	Bluegill sunfish	*Lepomis macrochirus*	1.02 g	Static	Water	96 hr	96 hr	Mortality	LC50		19.3	PPM		12.8	PPM	Agricultural Research Center, USDA, Beltsville, MD.	42767002	1968[3,4]	B. Montague	2004	Supplemental
2,4-D Isooctyl Ester	68.7	Fish	Bluegill sunfish	*Lepomis macrochirus*	1.02 g	Static	Water	96 hr	96 hr		NOEL		13.5	PPM		9.0	PPM	Agricultural Research Center, USDA, Beltsville, MD.	42767002	1968[3,4]	B. Montague	2004	Supplemental
2,4-D Isopropylamine salt	51.3	Aquatic Plant	Green algae	Selenastrum capricornutum	Not reported	Static	Water	5 D	5 D	Growth	EC50		43.4	PPM		34.3	PPM	Malcolm Pernie Inc. New York	00073762	1991[3,4]	M. Davy	1993	Yes
2,4-D Isopropylamine salt	51.3	Aquatic Plant	Green algae	Selenastrum capricornutum	Not reported	Static	Water	5 D	5 D	Growth	NOEL		13.9	PPM		11.0	PPM	Malcolm Pernie Inc. New York	00073762	1991[3,4]	M. Davy	1993	Yes
2,4-D 2-EHE	95.4	Aquatic invertebrate	Water flea	*Daphnia magna*	Full lifecycle	Flow-through	Water	21 D	21 D		LOEC		15	PPB		9.9 [0.01]	ppb [ppm]	Envirosystem & Engineering Inc.	43374802	1991[3,4]	A. Yamhure	1994	Supplemental
2,4-D 2-EHE	95.4	Aquatic invertebrate	Water flea	*Daphnia magna*	Full lifecycle	Flow-through	Water	21 D	21 D		NOEL	<	15	PPB	<	9.9 [0.01]	ppb [ppm]	Envirosystem & Engineering Inc.	43374802	1991[3,4]	A. Yamhure	1994	Supplemental
2,4-D 2-EHE	95.4	Mollusca	Eastern oyster	*Crassostrea virginica*	SPAT	Flow-through	Water	96 hr	96 hr		EC50	>	16	PPB	>	10.6 [0.01]	ppb [ppm]	Envirosystem & Engineering Inc.	42333201	1991[3,4]	A. Yamhure	1994	No
2,4-D 2-EHE	95.4	Mollusca	Eastern oyster	*Crassostrea virginica*	SPAT	Flow-through	Water	96 hr	96 hr		NOEL	<	16	PPB	<	10.6 [0.01]	ppb [ppm]	Envirosystem & Engineering Inc.	42333201	1991[3,4]	A. Yamhure	1994	No
2,4-D Dimethylamine salt	99.3	Fish	Fathead minnow	*Pimephales promelas*	Early life	Chronic	Water	31 D	31 D		LOEC		28.4	PPM		23.6	PPM	Dow Chemical Corporation Laboratories	TN 0663	1990[3,4]	K.V. Montague	1994	Yes
2,4-D Dimethylamine salt	99.3	Fish	Fathead minnow	*Pimephales promelas*	Early life	Chronic	Water	31 D	31 D		NOEL		17.1	PPM		14.2	PPM	Dow Chemical Corporation Laboratories	TN 0663	1990[3,4]	K.V. Montague	1994	Yes
2,4-D 2-EHE (Slago Weed Killer)	85.9	Fish	Rainbow trout	*Oncorhynchus mykiss*	37 mm	Static	Water	96 hr	96 hr	Mortality	LC50		51	PPM		33.8	PPM	EPA Research Labs, at Beltsville, MD ,Gulfbreeze, FL, or Duluth, MN.	TN 0671	1974[3,4]	C. Lewis	1987	Yes
2,4-D 2-EHE (Slago Weed Killer)	85.9	Fish	Rainbow trout	*Oncorhynchus mykiss*	37 mm	Static	Water	96 hr	96 hr		NOEL		18	PPM		11.9	PPM	EPA Research Labs, at Beltsville, MD ,Gulfbreeze, FL, or Duluth, MN.	TN 0671	1974[3,4]	C. Lewis	1987	Yes
2,4-D Acid	Tech	Insect	Honey bee	*Apis mellifera*	adult	Contact	Direct contact	48 hr	48 hr	Mortality	LD50	>	18.13	ug/bee	>	18.13	ug/bee	University of California, Riverside	43935001	1975[3,4]	A. Vaughan	1981	Yes
2,4-D Acid	Tech	Insect	Honey bee	*Apis mellifera*	adult	Contact	Direct contact	48 hr	48 hr		NOEL	<	18.13	ug/bee	<	18.13	ug/bee	University of California, Riverside	43935001	1975[3,4]	A. Vaughan	1981	Yes
2,4-D Dimethylamine salt	66.7	Aquatic Plant	Green algae	Selenastrum capricornutum	Not reported	Static	Water	5 D	5 D	Growth	EC50		51.2	PPM		42.5	PPM	Malcolm Pernie Inc. New York	44517307	1990[3,4]	M. Davy	1994	Yes
2,4-D Dimethylamine salt	66.7	Aquatic Plant	Green algae	Selenastrum capricornutum	Not reported	Static	Water	5 D	5 D	Growth	NOEL		19.2	PPM		15.944	PPM	Malcolm Pernie Inc. New York	44517307	1990[3,4]	M. Davy	1994	Yes
2,4-D Dimethylamine salt	55	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Seedling	Seedling germination	Soil treatment	14 D	14 D	Germination	EC25		24.7	lbs ai/acre		20.5	lbs ae/acre	Ricera Inc. Ohio	41737306	1992[3,4]	M. Davy	1994	Yes
2,4-D Dimethylamine salt	**55**	**Terrestrial Plant**	**Tomato**	***Lycopersicon esculentum***	**Seedling**	**Seedling germination**	**Soil treatment**	**14 D**	**14 D**	**Germination**	**NOEL**		**19.2**	**lbs ai/acre**		**15.9**	**lbs ae/acre**	**Ricera Inc. Ohio**	**41737306**	**1992[3,4]**	**M. Davy**	**1994**	**Yes**
2,4-DP-p, DMA salt	61.6	Insect	Honey bee	*Apis mellifera*	Worker	Contact	Direct contact	48 hr	48 hr	Mortality	LD50	>	25	ug/bee	>	21	ug/bee	Wildlife International Inc., MD	41158311	1992[3,4]	M. Davy	1993	Yes
2,4-DP-p, DMA salt	61.6	Insect	Honey bee	*Apis mellifera*	Worker	Contact	Direct contact	48 hr	48 hr		NOEL		25	ug/bee		21	ug/bee	Wildlife International Inc., MD	41158311	1992[3,4]	M. Davy	1993	Yes

Formulation	% purity a.i.	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint		Toxicity Value (tested product)[1]	Units		Toxicity Value (a.e.)[1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4-DP 2-Butoxyethyl Ester	95.3	Insect	Honey bee	*Apis mellifera*	Adult	Contact	Direct contact	48 hr	48 hr	Mortality	LD50	>	25	ug/bee	>	17.2	ug/bee	Wildlife International Inc., MD	41158301	1992[3,4]	H. Craven (KBN)	1992	Yes
2,4-DP 2-Butoxyethyl Ester	95.3	Insect	Honey bee	*Apis mellifera*	Adult	Contact	Direct contact	48 hr	48 hr		NOEL		25	ug/bee		17.2	ug/bee	Wildlife International Inc., MD	41158301	1992[3,4]	H. Craven (KBN)	1992	Yes
2,4 DP-p-2-EHE	95.7	Insect	Honey bee	*Apis mellifera*	Adult	Contact	Direct contact	48 hr	48 hr	Mortality	LD50	>	25	ug/bee	>	16.6	ug/bee	Wildlife International Inc., MD	41835209	1992[3,4]	H. Craven (KBN)	1992	Yes
2,4 DP-p-2-EHE	95.7	Insect	Honey bee	*Apis mellifera*	Adult	Contact	Direct contact	48 hr	48 hr		NOEL		25	ug/bee		16.6	ug/bee	Wildlife International Inc., MD	41835209	1992[3,4]	H. Craven (KBN)	1992	Yes
2,4-D Acid	96.1	Aquatic Plant	Green algae	Selenastrum capricornutum	Not reported	Static	Water	5 D	5 D	Growth	EC50		33.2	PPM		33.2	PPM	Malcolm Pernie Inc. New York	41158311	1990[3,4]	M. Davy	1992	Supplemental
2,4-D Acid	96.1	Aquatic Plant	Green algae	Selenastrum capricornutum	Not reported	Static	Water	5 D	5 D	Growth	NOEL		26.4	PPM		26.4	PPM	Malcolm Pernie Inc. New York	41158311	1990[3,4]	M. Davy	1992	Supplemental
2,4-D Isopropylamine salt	50.2	Fish	Inland silverside	*Menidia beryllina*	0.2 g	Flow-through	Water	96 hr	96 hr	Mortality	LC50		237	PPM		187	PPM	Springborn Laboratory Inc., MA	41158301	1990[3,4]	D. Balluff	1992	No
2,4-D Isopropylamine salt	50.2	Fish	Inland silverside	*Menidia beryllina*	0.2 g	Flow-through	Water	96 hr	96 hr		NOEL	<	26.9	PPM	<	21.2	PPM	Springborn Laboratory Inc., MA	41158301	1990[3,4]	D. Balluff	1992	No
2,4-D Acid	95.1	Mollusca	Eastern oyster	*Crassostrea virginica*	SPAT	Flow-through	Water	96 hr	96 hr		EC50		58.7	PPM		58.7	PPM	T.R. Wilbury Laboratories	41158303	1993[3,4]	C. Laird/Goodyear	1996	No
2,4-D Acid	95.1	Mollusca	Eastern oyster	*Crassostrea virginica*	SPAT	Flow-through	Water	96 hr	96 hr		NOEL		30	PPM		30	PPM	T.R. Wilbury Laboratories	41158303	1993[3,4]	C. Laird/Goodyear	1996	No
2,4 DP-p-2-EHE	36	Fish	Bluegill sunfish	*Lepomis macrochirus*	0.6 g	Static	Water	96 hr	96 hr	Mortality	LC50		42	PPM		27.9	PPM	Agricultural Research Center, USDA, Beltsville, MD.	41353803	1975[3,4]	J. McCann	1976	Supplemental
2,4 DP-p-2-EHE	36	Fish	Bluegill sunfish	*Lepomis macrochirus*	0.6 g	Static	Water	96 hr	96 hr		NOEL	<	31	PPM	<	20.6	PPM	Agricultural Research Center, USDA, Beltsville, MD.	41353803	1975[3,4]	J. McCann	1976	Supplemental
2,4-D Isooctyl Ester	39.6	Fish	Rainbow trout	*Oncorhynchus mykiss*	0.35 g	Static	Water	96 hr	96 hr	Mortality	LC50		64	PPM		42.4	PPM	Agricultural Research Center, USDA, Beltsville, MD.	46879201	1974[3,4]	C. Lewis	1987	Yes
2,4-D Isooctyl Ester	39.6	Fish	Rainbow trout	*Oncorhynchus mykiss*	0.35 g	Static	Water	96 hr	96 hr		NOEL		32	PPM		21.2	PPM	Agricultural Research Center, USDA, Beltsville, MD.	46879201	1974[3,4]	C. Lewis	1987	Yes
2,4-D Dimethylamine salt	66.8	Mollusca	Eastern oyster	*Crassostrea virginica*	SPAT	Flow-through	Water	96 hr	96 hr		EC50		102.25	PPM		84.911	PPM	Toxikon Environmental Sciences, Jupiter, Florida	44275701	1991[3,4]	D. Lateulere	1991	No
2,4-D Dimethylamine salt	66.8	Mollusca	Eastern oyster	*Crassostrea virginica*	SPAT	Flow-through	Water	96 hr	96 hr		NOEL		40.6	PPM		33.715	PPM	Toxikon Environmental Sciences, Jupiter, Florida	44275701	1991[3,4]	D. Lateulere	1991	No
2,4-D Tri,isopropylamine salt	70.9	Aquatic Plant	Bluegreen algae	Anabaena flos-aquae	Not reported	Static	Water	5 D	5 D	Growth	EC50		133	PPM		71.3	PPM	Carolina Ecotox Inc., Durham, NC	41353804	1994[3,4]	H. Craven (KBN)	1994	No
2,4-D Tri,isopropylamine salt	70.9	Aquatic Plant	Bluegreen algae	Anabaena flos-aquae	Not reported	Static	Water	5 D	5 D	Growth	NOEL		47.9	PPM		25.7	PPM	Carolina Ecotox Inc., Durham, NC	41353804	1994[3,4]	H. Craven (KBN)	1994	No
2,4-D 2-EHE	99.96	Insect	Honey bee	*Apis mellifera*	Adult	Contact	Direct contact	72 hr	72 hr	Mortality	LD50	>	100	ug/bee	>	66	ug/bee	Wildlife International Inc., MD	41353805	1997[3,4]	S. Ramasamy	2000	Yes
2,4-D 2-EHE	99.96	Insect	Honey bee	*Apis mellifera*	Adult	Contact	Direct contact	72 hr	72 hr		NOEL		50	ug/bee		33.2	ug/bee	Wildlife International Inc., MD	41353805	1997[3,4]	S. Ramasamy	2000	Yes
2,4-D Tri,isopropylamine salt	70.9	Aquatic Plant	Marine diatom	Skeletonema costatum	Not reported	Static	Water	5 D	5 D	Growth	EC50		79.7	PPM		42.7	PPM	Carolina Ecotox Inc., Durham, NC	00138871	1994[3,4]	H. Craven (KBN)	1994	No
2,4-D Tri,isopropylamine salt	70.9	Aquatic Plant	Marine diatom	Skeletonema costatum	Not reported	Static	Water	5 D	5 D	Growth	NOEL		50.4	PPM		27.0	PPM	Carolina Ecotox Inc., Durham, NC	00138871	1994[3,4]	H. Craven (KBN)	1994	No

Formulation	% purity a.i.	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint		Toxicity Value (tested product)[1]	Units		Toxicity Value (a.e.)[1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4-D Tri,isopropylamine salt	73.8	Aquatic Plant	Green algae	Selenastrum capricornutum	Not reported	Static	Water	5 D	5 D	Growth	EC50		75.7	PPM		40.6	PPM	Malcolm Pernie Inc. New York	41749502	1991[3,4]	M. Davy	1993	Yes
2,4-D Tri,isopropylamine salt	73.8	Aquatic Plant	Green algae	Selenastrum capricornutum	Not reported	Static	Water	5 D	5 D	Growth	NOEL		55.4	PPM		29.7	PPM	Malcolm Pernie Inc. New York	41749502	1991[3,4]	M. Davy	1993	Yes
2,4-DP Dimethylamine salt	59.93	Bird	Bobwhite quail	*Colinus virginianus*	38WKS	Oral (gavage or capsule)	Oral	14 D	14 D	Mortality	LD50		279	mg/kg bw		232	mg/kg bw	Biolife Associates, Inc.	41429005	1993[3,4]	A. Yamhure	1996	Yes
2,4-DP Dimethylamine salt	59.93	Bird	Bobwhite quail	*Colinus virginianus*	38WKS	Oral (gavage or capsule)	Oral	14 D	14 D		NOEL	<	63	mg/kg bw/d	<	52	mg/kg bw/d	Biolife Associates, Inc.	41429005, 43227401	1993[3,4]	A. Yamhure	1996	Yes
2,4-DP-p, DMA salt	59.93	Bird	Bobwhite quail	*Colinus virginianus*	38WKS	Oral (gavage or capsule)	Oral	14 D	14 D	Mortality	LD50		279	mg/kg bw		232	mg/kg bw	Biolife Associates, Inc.	43227401	1993[3,4]	A. Yamhure	1996	Yes
2,4-D Isopropylamine salt	50.2	Mollusca	Eastern oyster	*Crassostrea virginica*	SPAT	Flow-through	Water	96 hr	96 hr		EC50		125	PPM		98.6	PPM	Springborn Laboratory Inc., MA	43935201	1990[3,4]	D. Balluff	1991	No
2,4-D Isopropylamine salt	50.2	Mollusca	Eastern oyster	*Crassostrea virginica*	SPAT	Flow-through	Water	96 hr	96 hr		NOEL		63.1	PPM		49.8	PPM	Springborn Laboratory Inc., MA	43935201	1990[3,4]	D. Balluff	1991	No
2,4-D Acid	96.1	Fish	Fathead minnow	*Pimephales promelas*	Early life	Chronic	Water	32 D	32 D		LOEC		102	PPM		102	PPM	Dow Chemical Corporation Laboratories	45336401	1990[3,4]	K. Valente	1992	Yes
2,4-D Acid	96.1	Fish	Fathead minnow	*Pimephales promelas*	Early life	Chronic	Water	32 D	32 D		NOEL		63.4	PPM		63.4	PPM	Dow Chemical Corporation Laboratories	45336401	1990[3,4]	K. Valente	1992	Yes
2,4-D Dimethylamine salt	66.7	Aquatic Plant	Bluegreen algae	Anabaena flos-aquae	Not reported	Static	Water	120hr	120hr	Growth	EC50		188.5	PPM		156.534	PPM	Malcolm Pernie Inc. New York	45336401	1990[3,4]	R. Petrie	1991	No
2,4-D Dimethylamine salt	66.7	Aquatic Plant	Bluegreen algae	Anabaena flos-aquae	Not reported	Static	Water	120hr	120hr	Growth	NOEL		68	PPM		56.469	PPM	Malcolm Pernie Inc. New York	45336401	1990[3,4]	R. Petrie	1991	No
2,4-D 2-EHE/2,4,5T IOE/Dicamba (Banvel 310)	45	Bird	Bobwhite quail	*Colinus virginianus*	14 D	Diet	Dietary	5 D	8 D	Mortality	LC50		2019	PPM		1,339 [4,043]	ppm [mg/kg bw]	Hazelton Laboratory Inc. VA	41546202	1973[3,4]	EFED	1979	Supplemental
2,4-D 2-EHE/2,4,5T IOE/Dicamba (Banvel 310)	45	Bird	Bobwhite quail	*Colinus virginianus*	14 D	Diet	Dietary	5 D	8 D		NOEL	<	75	PPM	<	50 [30.2]	ppm [mg/kg bw/d]	Hazelton Laboratory Inc. VA	41546202	1973[3,4]	EFED	1979	Supplemental
2,4-D Acid	91.3	Aquatic invertebrate	Water flea	*Daphnia magna*	Full lifecycle	Flow-through	Water	21 D	21 D		LOEC		151	PPM		151	PPM	Envirosystem & Engineering Inc.	41586101	1991[3,4]	T. Terry	1991	Yes
2,4-D Acid	91.3	Aquatic invertebrate	Water flea	*Daphnia magna*	Full lifecycle	Flow-through	Water	21 D	21 D		NOEL		79	PPM		79	PPM	Envirosystem & Engineering Inc.	41586101	1991[3,4]	T. Terry	1991	Yes
2,4-D Butoxyethanol Ester	96	Fish	Fathead minnow	*Pimephales promelas*	Early life	Chronic	Water	32 D	32 D		LOEC		114	PPB		78 [0.078]	ppb [ppm]	Dow Chemical Corporation Laboratories	00077308	1989[3,4]	R. Lamb	1994	Yes
2,4-D Butoxyethanol Ester	**96**	**Fish**	**Fathead minnow**	***Pimephales promelas***	**Early life**	**Chronic**	**Water**	**32 D**	**32 D**		**NOEL**		**80.5**	**PPB**		**55 [0.055]**	**ppb [ppm]**	**Dow Chemical Corporation Laboratories**	**00077308**	**1989[3,4]**	**R. Lamb**	**1994**	**Yes**
2,4-D Tri,isopropylamine salt	70.4	Fish	Inland silverside	*Menidia beryllina*	0.2 g	Flow-through	Water	96 hr	96 hr	Mortality	LC50		534	PPM		286.2	PPM	Springborn Laboratory Inc., MA	41429007	1990[3,4]	D. Balluff	1991	No
2,4-D Tri,isopropylamine salt	70.4	Fish	Inland silverside	*Menidia beryllina*	0.2 g	Flow-through	Water	96 hr	96 hr		NOEL		86.2	PPM		46.2	PPM	Springborn Laboratory Inc., MA	41429007	1990[3,4]	D. Balluff	1991	No
2,4-D Dimethylamine salt	N.R.	Fish	Bluegill sunfish	*Lepomis macrochirus*	2.3 g	Static	Water	96 hr	96 hr	Mortality	LC50		106	PPM		88.025	PPM	Bionomics, Inc., Wareham, MA.	43220202	1971[3,4]	C. Lewis	1988	Supplemental
2,4-D Dimethylamine salt	N.R.	Fish	Bluegill sunfish	*Lepomis macrochirus*	2.3 g	Static	Water	96 hr	96 hr		NOEL	<	87	PPM	<	72.247	PPM	Bionomics, Inc., Wareham, MA.	43220202	1971[3,4]	C. Lewis	1988	Supplemental
2,4-D Diethanolamine salt	73.8	Aquatic Plant	Marine diatom	Skeletonema costatum	Not reported	Static	Water	5 D	5 D	Growth	EC50	>	95	PPM	>	64.366	PPM	Wildlife International Inc., MD	43227402	1993[3,4]	H. Craven (KBN)	1993	No

Formulation	% purity a.i.	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint		Toxicity Value (tested product)[1]	Units		Toxicity Value (a.e.)[1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4-D Diethanolamine salt	73.8	Aquatic Plant	Marine diatom	Skeletonema costatum	Not reported	Static	Water	5 D	5 D	Growth	NOEL		95	PPM		64.366	PPM	Wildlife International Inc., MD	43227402	1993[3,4]	H. Craven (KBN)	1993	No
2,4-D Diethanolamine salt	73.8	Aquatic Plant	Bluegreen algae	Anabaena flos-aquae	Not reported	Static	Water	5 D	5 D	Growth	EC50	>	96	PPM	>	65.044	PPM	Wildlife International Inc., MD	43934901	1993[3,4]	H. Craven (KBN)	1993	No
2,4-D Diethanolamine salt	73.8	Aquatic Plant	Bluegreen algae	Anabaena flos-aquae	Not reported	Static	Water	5 D	5 D	Growth	NOEL		96	PPM		65.044	PPM	Wildlife International Inc., MD	43934901	1993[3,4]	H. Craven (KBN)	1993	No
2,4-D Dimethylamine salt	66.7	Aquatic Plant	Marine diatom	Skeletonema costatum	Not reported	Static	Water	5 D	5 D	Growth	EC50		148.5	PPM		123.318	PPM	Malcolm Pernie Inc. New York	41975102	1990[3,4]	M. Davy	1995	No
2,4-D Dimethylamine salt	66.7	Aquatic Plant	Marine diatom	Skeletonema costatum	Not reported	Static	Water	5 D	5 D	Growth	NOEL		96.25	PPM		79.928	PPM	Malcolm Pernie Inc. New York	41975102	1990[3,4]	M. Davy	1995	No
2,4-D Diethanolamine salt	73.8	Aquatic Plant	Freshwater diatom	*Navicula pelliculosa*	Not reported	Static	Water	5 D	5 D	Growth	EC50	>	97	PPM	>	65.7	PPM	Wildlife International Inc., MD	41975103	1993[3,4]	H. Craven (KBN)	1993	Yes
2,4-D Diethanolamine salt	73.8	Aquatic Plant	Freshwater diatom	*Navicula pelliculosa*	Not reported	Static	Water	5 D	5 D	Growth	NOEL		97	PPM		65.721	PPM	Wildlife International Inc., MD	41975103	1993[3,4]	H. Craven (KBN)	1993	Yes
2,4-D Diethanolamine salt	73.1	Aquatic invertebrate	Pink shrimp	*Penaeus duorarum*	4.5 g	Flow-through	Water	96 hr	96 hr	Mortality	LC50	>	99.6	PPM	>	67.483	PPM	Wildlife International Inc., MD	41158304	1991[3,4]	K. Valente	1991	No
2,4-D Diethanolamine salt	73.1	Aquatic invertebrate	Pink shrimp	*Penaeus duorarum*	4.5 g	Flow-through	Water	96 hr	96 hr		NOEL		99.6	PPM		67.483	PPM	Wildlife International Inc., MD	41158304	1991[3,4]	K. Valente	1991	No
2,4-D Diethanolamine salt	73.1	Aquatic invertebrate	Water flea	*Daphnia magna*	1st-I	Flow-through	Water	48 hr	48 hr		EC50	>	100	PPM	>	68	PPM	Wildlife International Inc., MD	41644402	1991[3,4]	K. Valente	1991	Yes
2,4-D Diethanolamine salt	73.1	Aquatic invertebrate	Water flea	*Daphnia magna*	1st-I	Flow-through	Water	48 hr	48 hr		NOEL		100	PPM		67.754	PPM	Wildlife International Inc., MD	41644402	1991[3,4]	K. Valente	1991	Yes
2,4-D Acid	Tech	Aquatic invertebrate	Water flea	*Daphnia magna*	1st-I	Static	Water	26 hr	26 hr		EC50	>	100	PPM	>	100	PPM	Fish and Wildlife Service Laboratories, Department of Interior	41644403	1970[3,4]	D. McLane	1979	Supplemental
2,4-D Acid	Tech	Aquatic invertebrate	Water flea	*Daphnia magna*	1st-I	Static	Water	26 hr	26 hr		NOEL		100	PPM		100	PPM	Fish and Wildlife Service Laboratories, Department of Interior	41644403	1970[3,4]	D. McLane	1979	Supplemental
2,4 D/Picloram TIPA salt (Tordon 101 mixture)	21/5.6	Insect	Honey bee	*Apis mellifera*	Adult	Contact	Direct contact	48 hr	48 hr	Mortality	LD50	>	100	ug/bee	>	53.6	ug/bee	Wildlife International Inc., MD	43811401	1989[3,4]	H. Mansfield	1992	Yes
2,4 D/Picloram TIPA salt (Tordon 101 mixture)	21/5.6	Insect	Honey bee	*Apis mellifera*	Adult	Contact	Direct contact	48 hr	48 hr	Mortality	NOEL		100	ug/bee		53.6	ug/bee	Wildlife International Inc., MD	43811401	1989[3,4]	H. Mansfield	1992	Yes
2,4-DP-p, DMA salt	72.9	Fish	Rainbow trout	*Oncorhynchus mykiss*	2.43 g	Static	Water	96 hr	96 hr	Mortality	LC50	>	109	PPM	>	91	PPM	BASF Corporation, Republic of Germany	43220201	1992[3,4]	A. Yamhure	1996	Yes
2,4-DP-p, DMA salt	72.9	Fish	Rainbow trout	*Oncorhynchus mykiss*	2.43 g	Static	Water	96 hr	96 hr		NOEL		109	PPM		91	PPM	BASF Corporation, Republic of Germany	43220201	1992[3,4]	A. Yamhure	1996	Yes
2,4-D Tri,isopropylamine salt	70.4	Mollusca	Eastern oyster	*Crassostrea virginica*	SPAT	Flow-through	Water	96 hr	96 hr		EC50		234	PPM		125.4	PPM	Springborn Laboratory Inc., MA	00045070	1990[3,4]	D. Balluff	1991	No
2,4-D Tri,isopropylamine salt	70.4	Mollusca	Eastern oyster	*Crassostrea virginica*	SPAT	Flow-through	Water	96 hr	96 hr		NOEL		110	PPM		59.0	PPM	Springborn Laboratory Inc., MA	00045070	1990[3,4]	D. Balluff	1991	No
2,4-D Acid	96.1	Fish	Inland silverside	*Menidia beryllina*	Not reported	Flow-through	Water	96 hr	96 hr	Mortality	LC50		175	PPM		175	PPM	Environmental Science & Technology Inc.	00022923	1991[3,4]	M. Davy	1993	No
2,4-D Acid	96.1	Fish	Inland silverside	*Menidia beryllina*	Not reported	Flow-through	Water	96 hr	96 hr		NOEL	<	111	PPM	<	111	PPM	Environmental Science & Technology Inc.	00022923	1991[3,4]	M. Davy	1993	No
2,4-D dimethylamine salt	12.5	Fish	Bluegill sunfish	*Lepomis macrochirus*	0.652	Static	Water	96 Hr	96 Hr	Mortality	LC50	>	100	PPM	>	83	PPM	Agricultural Research Center, USDA, Beltsville, MD.	41749501	1970[3,4]	J. McCann	2004	Yes

Spreadsheet of Toxicity Data for 2,4-D Acid and Salt TRVs

Formulation	% purity a.i.	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint	Toxicity Value (tested product)[1]	Units	Toxicity Value (a.e.) [1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4-D dimethylamine salt	12.5	Fish	Bluegill sunfish	*Lepomis macrochirus*	0.652	Static	Water	96 Hr	96 Hr		NOEL	< 115	PPM	< 95.498	PPM	Agricultural Research Center, USDA, Beltsville, MD.	41749501	1970[3,4]	J. McCann	2004	Yes
2,4-D Diethanolamine salt	73.8	Fish	Atlantic silverside	*Menidia menidia*	0.14 g	Flow-through	Water	96 hr	96 hr	Mortality	LC50	> 118	PPM	> 79.950	PPM	Wildlife International Inc., MD	00050688	1991[3,4]	K. Valente	1992	No
2,4-D Diethanolamine salt	73.8	Fish	Atlantic silverside	*Menidia menidia*	0.14 g	Flow-through	Water	96 hr	96 hr		NOEL	118	PPM	79.950	PPM	Wildlife International Inc., MD	00050688	1991[3,4]	K. Valente	1992	No
2,4-D Diethanolamine salt	73.1	Fish	Rainbow trout	*Oncorhynchus mykiss*	2.0 g	Flow-through	Water	96 hr	96 hr	Mortality	LC50	> 120	PPM	> 81.305	PPM	Wildlife International Inc., MD	00102871	1991[3,4]	K. Valente	1991	Yes
2,4-D Diethanolamine salt	73.1	Fish	Rainbow trout	*Oncorhynchus mykiss*	2.0 g	Flow-through	Water	96 hr	96 hr		NOEL	120	PPM	81.305	PPM	Wildlife International Inc., MD	00102871	1991[3,4]	K. Valente	1991	Yes
2,4-D Dimethylamine salt	67.3	Fish	Rainbow trout	*Oncorhynchus mykiss*	0.23 g	Static	Water	96 hr	96 hr	Mortality	LC50	250	PPM	207.605	PPM	Dow Chemical Corporation Laboratories	00072919	1983[3,4]	R. Lamb	1995	Yes
2,4-D Dimethylamine salt	67.3	Fish	Rainbow trout	*Oncorhynchus mykiss*	0.23 g	Static	Water	96 hr	96 hr		NOEL	120	PPM	99.651	PPM	Dow Chemical Corporation Laboratories	00072919	1983[3,4]	R. Lamb	1995	Yes
2,4-D Diethanolamine salt	73.1	Fish	Bluegill sunfish	*Lepomis macrochirus*	1.03g	Flow-through	Water	96 hr	96 hr	Mortality	LC50	> 121	PPM	> 82	PPM	Wildlife International Inc., MD	41448401	1991[3,4]	K. Valente	1991	Yes
2,4-D Diethanolamine salt	73.1	Fish	Bluegill sunfish	*Lepomis macrochirus*	1.03g	Flow-through	Water	96 hr	96 hr		NOEL	121	PPM	81.982	PPM	Wildlife International Inc., MD	41448401	1991[3,4]	K. Valente	1991	Yes
2,4-D Dimethylamine salt	66.8	Bird	Bobwhite quail	*Colinus virginianus*	21 WKS	Oral (gavage or capsule)	Oral	14 D	14 D	Mortality	LD50	500	mg/kg bw	415	mg/kg bw	Wildlife International Inc., MD	00072919	1990[3,4]	R. Petrie	1991	Yes
2,4-D Dimethylamine salt	66.8	Bird	Bobwhite quail	*Colinus virginianus*	21 WKS	Oral (gavage or capsule)	Oral	14 D	14 D		NOEL	< 125	mg/kg bw/d	< 104	mg/kg bw/d	Wildlife International Inc., MD	00072919	1990[3,4]	R. Petrie	1991	Yes
2,4-D Butoxyethanol Ester	96	Bird	Bobwhite quail	*Colinus virginianus*	19WKS	Oral (gavage or capsule)	Oral	14 D	14 D	Mortality	LD50	> 2000	mg/kg bw	> 1376	mg/kg bw	Dow Chemical Corporation Laboratories	00072919	1989[3,4]	D. Balluff	1991	Yes
2,4-D Butoxyethanol Ester	96	Bird	Bobwhite quail	*Colinus virginianus*	19WKS	Oral (gavage or capsule)	Oral	14 D	14 D		NOEL	125	mg/kg bw/d	86	mg/kg bw/d	Dow Chemical Corporation Laboratories	00072919	1989[3,4]	D. Balluff	1991	Yes
2,4-D Tri,isopropylamine salt	**73.8**	**Bird**	**Bobwhite quail**	***Colinus virginianus***	**27WKS**	**Oral (gavage or capsule)**	**Oral**	**14 D**	**14 D**	**Mortality**	**LD50**	**405**	**mg/kg bw**	**217**	**mg/kg bw**	**Wildlife International Inc., MD**	**00107928**	**1990[3,4]**	**G. Susanke**	**1991**	**Yes**
2,4-D Tri,isopropylamine salt	73.8	Bird	Bobwhite quail	*Colinus virginianus*	27WKS	Oral (gavage or capsule)	Oral	14 D	14 D		NOEL	125	mg/kg bw/d	67	mg/kg bw/d	Wildlife International Inc., MD	00107928	1990[3,4]	G. Susanke	1991	Yes
2,4-D Acid	96.1	Mollusca	Eastern oyster	*Crassostrea virginica*	Juvenile	Flow-through	Water	96 hr	96 hr		EC50	146	PPM	146	PPM	Environmental Science & Technology Inc.	00117158	1991[3,4]	K. Valente	1991	No
2,4-D Acid	96.1	Mollusca	Eastern oyster	*Crassostrea virginica*	Juvenile	Flow-through	Water	96 hr	96 hr		NOEL	< 135	PPM	< 135	PPM	Environmental Science & Technology Inc.	00117158	1991[3,4]	K. Valente	1991	No
2,4-D Isopropylamine salt	50.2	Aquatic invertebrate	Pink shrimp	*Penaeus duorarum*	2.5 g	Flow-through	Water	96 hr	96 hr	Mortality	LC50	605	PPM	477	PPM	Springborn Laboratory Inc., MA	00052637	1990[3,4]	D. Balluff	1991	No
2,4-D Isopropylamine salt	50.2	Aquatic invertebrate	Pink shrimp	*Penaeus duorarum*	2.5 g	Flow-through	Water	96 hr	96 hr		NOEL	140	PPM	110	PPM	Springborn Laboratory Inc., MA	00052637	1990[3,4]	D. Balluff	1991	No
2,4-DP-p, DMA salt	72.9	Fish	Bluegill sunfish	*Lepomis macrochirus*	1.96 g	Static	Water	96 hr	96 hr	Mortality	LC50	> 151	PPM	> 125	PPM	BASF Corporation, Republic of Germany	41835201	1992[3,4]	A. Yamhure	1996	Yes
2,4-DP-p, DMA salt	72.9	Fish	Bluegill sunfish	*Lepomis macrochirus*	1.96 g	Static	Water	96 hr	96 hr		NOEL	151	PPM	125	PPM	BASF Corporation, Republic of Germany	41835201	1992[3,4]	A. Yamhure	1996	Yes
2,4-DP 2-Butoxyethyl, Ester	Tech	Aquatic invertebrate	Water flea	*Daphnia magna*	<24 hr	Static	Water	48 hr	48 hr		EC50	252	PPM	173	PPM	Dow Chemical Corporation Laboratories	42595903	1979[3,4]	C. Laird	1989	Supplemental

Spreadsheet of Toxicity Data for 2,4-D Acid and Salt TRVs

Formulation	% purity a.i.	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint	Toxicity Value (tested product)[1]	Units	Toxicity Value (a.e.)[1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4-DP 2-Butoxyethyl, Ester	Tech	Aquatic invertebrate	Water flea	*Daphnia magna*	<24 hr	Static	Water	48 hr	48 hr		NOEL	155	PPM	107	PPM	Dow Chemical Corporation Laboratories	42595902	1979[3,4]	C. Laird	1989	Supplemental
2,4-DP 2-Butoxyethyl Ester	95.3	Bird	Bobwhite quail	*Colinus virginianus*	18 W	Oral (gavage or capsule)	Oral	7 D	7 D	Mortality	LD50	1517	mg/kg bw	1044	mg/kg bw	Wildlife International Inc., MD	40228401	1992[3,4]	K. Montague	1992	Yes
2,4-DP 2-Butoxyethyl Ester	95.3	Bird	Bobwhite quail	*Colinus virginianus*	18 W	Oral (gavage or capsule)	Oral	7 D	7 D		NOEL	175	mg/kg bw/d	120	mg/kg bw/d	Wildlife International Inc., MD	40228401	1992[3,4]	K. Montague	1992	Yes
2,4-D Isopropyl Ester	98.2	Bird	Bobwhite quail	*Colinus virginianus*	23WKS	Oral (gavage or capsule)	Oral	14 D	14 D	Mortality	LD50	1879	mg/kg bw	1578	mg/kg bw	Wildlife International Inc., MD	00160000	1996[3,4]	N. Federoff	1996	Yes
2,4-D Isopropyl Ester	98.2	Bird	Bobwhite quail	*Colinus virginianus*	23WKS	Oral (gavage or capsule)	Oral	14 D	14 D		NOEL	185	mg/kg bw/d	155	mg/kg bw/d	Wildlife International Inc., MD	00160000	1996[3,4]	N. Federoff	1996	Yes
2,4-D Acid	97.5	Amphibian	Leopard frog	*Rana pipiens*	Tadple	Static	Water	96 hr	96 hr	Mortality	LC50	349	PPM	349	PPM	Wildlife International Inc., MD	00160000	1997[3,4]	S. Ramasamy	2000	Supplemental
2,4-D Acid	97.5	Amphibian	Leopard frog	*Rana pipiens*	Tadple	Static	Water	96 hr	96 hr		NOEL	186	PPM	186	PPM	Wildlife International Inc., MD	00160000	1997[3,4]	S. Ramasamy	2000	Supplemental
2,4-D Acid	96.1	Aquatic invertebrate	Pink shrimp	*Penaeus duorarum*	Not reported	Flow-through	Water	96 hr	96 hr	Mortality	LC50	467	PPM	467	PPM	Environmental Science & Technology Inc.	00160000	1991[3,4]	M. Davy	1993	No
2,4-D Acid	96.1	Aquatic invertebrate	Pink shrimp	*Penaeus duorarum*	Not reported	Flow-through	Water	96 hr	96 hr		NOEL	187	PPM	187	PPM	Environmental Science & Technology Inc.	00022923	1991[3,4]	M. Davy	1993	No
2,4-D Dimethylamine salt	67.3	Fish	Bluegill sunfish	*Lepomis macrochirus*	0.28 g	Static	Water	96 hr	96 hr	Mortality	LC50	524	PPM	435	PPM	Dow Chemical Corporation Laboratories	TN 0751, 050681	1983[3,4]	R. Lamb	1995	Yes
2,4-D Dimethylamine salt	67.3	Fish	Bluegill sunfish	*Lepomis macrochirus*	0.28 g	Static	Water	96 hr	96 hr		NOEL	197	PPM	163.593	PPM	Dow Chemical Corporation Laboratories	TN 0755, 053986	1983[3,4]	R. Lamb	1995	Yes
2,4-D Acid	98.7	Fish	Bluegill sunfish	*Lepomis macrochirus*	0.15 g	Static	Water	96 hr	96 hr	Mortality	LC50	263	PPM	263	PPM	Dow Chemical Corporation Laboratories	00160000	1986[3,4]	K. Valente	1992	Yes
2,4-D Acid	98.7	Fish	Bluegill sunfish	*Lepomis macrochirus*	0.15 g	Static	Water	96 hr	96 hr		NOEL	< 204	PPM	< 204	PPM	Dow Chemical Corporation Laboratories	00102870	1986[3,4]	K. Valente	1992	Yes
2,4-D Dimethylamine salt	66.8	Fish	Inland silverside	*Menidia beryllina*	0.17 g	Flow-through	Water	96 hr	96 hr	Mortality	LC50	469	PPM	389.468	PPM	Toxikon Environmental Sciences, Jupiter, Florida	00050669	1991[3,4]	A. Yamhure	1994	No
2,4-D Dimethylamine salt	66.8	Fish	Inland silverside	*Menidia beryllina*	0.17 g	Flow-through	Water	96 hr	96 hr		NOEL	< 224	PPM	< 186.014	PPM	Toxikon Environmental Sciences, Jupiter, Florida	00138869	1991[3,4]	A. Yamhure	1994	No
2,4-D Dimethylamine salt	67.3	Fish	Fathead minnow	*Pimephales promelas*	0.104g	Static	Water	96 hr	96 hr	Mortality	LC50	318	PPM	264	PPM	Dow Chemical Corporation Laboratories	00138869	1983[3,4]	R. Lamb	1995	Yes
2,4-D Dimethylamine salt	67.3	Fish	Fathead minnow	*Pimephales promelas*	0.104g	Static	Water	96 hr	96 hr		NOEL	< 246	PPM	< 204.284	PPM	Dow Chemical Corporation Laboratories	00138869	1983[3,4]	R. Lamb	1995	Yes
2,4-D Acid	98.7	Fish	Fathead minnow	*Pimephales promelas*	0.14 g	Static	Water	96 hr	96 hr	Mortality	LC50	320	PPM	320	PPM	Dow Chemical Corporation Laboratories	00138872	1983[3,4]	K. Valente/W.Evans	1992	Yes
2,4-D Acid	98.7	Fish	Fathead minnow	*Pimephales promelas*	0.14 g	Static	Water	96 hr	96 hr		NOEL	256	PPM	256	PPM	Dow Chemical Corporation Laboratories	00138870	1983[3,4]	K. Valente/W.Evans	1992	Yes
2,4-D Isooctyl Ester	96.2	Bird	Mallard duck	*Anas platyrhynchos*	Juvenile	Oral (gavage or capsule)	Oral	14 D	14 D	Mortality	LD50	663	mg/kg bw	440	mg/kg bw	Wildlife International Inc., MD	40228401	1984[3,4]	K. Valente	1992	Yes
2,4-D Isopropylamine salt	**48.7**	**Bird**	**Mallard duck**	***Anas platyrhynchos***	**Not reported**	**Oral (gavage or capsule)**	**Oral**	**14 D**	**14 D**	**Mortality**	**LD50**	**> 398**	**mg/kg bw**	**> 314**	**mg/kg bw**	**Wildlife International Inc., MD**	**40098001**	**1983[3,4]**	**D. McLane**	**1984**	**Yes**
2,4-D Tri,isopropylamine salt	69.2	Fish	Rainbow trout	*Oncorhynchus mykiss*	0.25 g	Static	Water	96 Hr	96 Hr	Mortality	LC50	302	PPM	161.9	PPM	Dow Chemical Corporation Laboratories	40094602	1989[3,4]	A. Roybal	1991	Yes

Formulation	% purity a.i.	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint	Toxicity Value (tested product)[1]	Units	Toxicity Value (a.e.)[1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4-D Tri,isopropylamine salt	69.2	Fish	Rainbow trout	*Oncorhynchus mykiss*	0.25 g	Static	Water	96 Hr	96 Hr		NOEL	268	PPM	143.6	PPM	Dow Chemical Corporation Laboratories	N.R.	1989[3,4]	A. Roybal	1991	Yes
2,4-DP-p, DMA salt	602 g/L	Bird	Japanese quail	*Coturnix japonica*	Early life	Reproduction		6 wk	6 wk	Reproduction	LOEC	829	PPM	688 [77.5]	ppm [mg/kg bw/d]	Wildlife International Inc., MD	46879201	2001[3,4]	M. Janson	2006	Yes
2,4-DP-p, DMA salt	**602 g/L**	**Bird**	**Japanese quail**	***Coturnix japonica***	**Early life**	**Reproduction**		**6 wk**	**6 wk**	**Reproduction**	**NOEL**	**291**	**PPM**	**242 [27.3]**	**ppm [mg/kg bw/d]**	**Wildlife International Inc., MD**	**00072472**	**2001[3,4]**	**M. Janson**	**2006**	**Yes**
2,4-D Diethanolamine salt	73.1	Bird	Bobwhite quail	*Colinus virginianus*	Not reported	Oral (gavage or capsule)	Oral	14 D	14 D	Mortality	LD50	595	mg/kg bw	403	mg/kg bw	Wildlife International Inc., MD	00045071	1991[3,4]	K. Valente	1991	Yes
2,4-D Diethanolamine salt	73.1	Bird	Bobwhite quail	*Colinus virginianus*	Not reported	Oral (gavage or capsule)	Oral	14 D	14 D		NOEL	< 292	mg/kg bw/d	< 198	mg/kg bw/d	Wildlife International Inc., MD	40228401	1991[3,4]	K. Valente	1991	Yes
2, 4-D Isopropylamine salt	48.7	Bird	Bobwhite quail	*Colinus virginianus*	6 MO	Oral (gavage or capsule)	Oral	14 D	14 D	Mortality	LD50	377	mg/kg bw	298	mg/kg bw	Wildlife International Inc., MD	40228401	1985[3,4]	C. Hartless	2009	Yes
2, 4-D Isopropylamine salt	48.7	Bird	Bobwhite quail	*Colinus virginianus*	6 MO	Oral (gavage or capsule)	Oral	14 D	14 D		NOEL	< 292	mg/kg bw	< 230	mg/kg bw	Wildlife International Inc., MD	40228401	1985[3,4]	C. Hartless	2009	Yes
2,4-D Acid	98.7	Fish	Rainbow trout	*Oncorhynchus mykiss*	0.34 g	Static	Water	96 hr	96 hr	Mortality	LC50	358	PPM	358	PPM	Dow Chemical Corporation Laboratories	40228401	1983[3,4]	K. Valente	1992	Yes
2,4-D Acid	98.7	Fish	Rainbow trout	*Oncorhynchus mykiss*	0.34 g	Static	Water	96 hr	96 hr		NOEL	320	PPM	320	PPM	Dow Chemical Corporation Laboratories	40098001	1983[3,4]	K. Valente	1992	Yes
2,4-D Tri,isopropylamine salt	69.2	Fish	Bluegill sunfish	*Lepomis macrochirus*	0.3 g	Static	Water	96 hr	96 hr	Mortality	LC50	401	PPM	214.9	PPM	Dow Chemical Corporation Laboratories	40098001	1989[3,4]	A. Roybal	1991	Yes
2,4-D Tri,isopropylamine salt	69.2	Fish	Bluegill sunfish	*Lepomis macrochirus*	0.3 g	Static	Water	96 hr	96 hr		NOEL	325	PPM	174.2	PPM	Dow Chemical Corporation Laboratories	40098001	1989[3,4]	A. Roybal	1991	Yes
2,4-D Tri,isopropylamine salt	69.2	Aquatic invertebrate	Water flea	*Daphnia magna*	<24 hr	Static	Water	48 hr	48 hr		EC50	630	PPM	338	PPM	Dow Chemical Corporation Laboratories	40098001	1989[3,4]	A. Roybal	1991	Yes
2,4-D Tri,isopropylamine salt	69.2	Aquatic invertebrate	Water flea	*Daphnia magna*	<24 hr	Static	Water	48 hr	48 hr		NOEL	380	PPM	203.7	PPM	Dow Chemical Corporation Laboratories	40098001	1989[3,4]	A. Roybal	1991	Yes
2,4-D Dimethylamine salt	66.8	Bird	Mallard duck	*Anas platyrhynchos*	10 D	Diet	Dietary	5 D	8 D	Mortality	LC50	> 5620	PPM	> 4,667 [2,335]	ppm [mg/kg bw]	Wildlife International Inc., MD	40228401	1990[3,4]	N. Vyas	1992	Yes
2,4-DP-p, DMA salt	59.93	Bird	Mallard duck	*Anas platyrhynchos*	9 D	Diet	Dietary	5 D	8 D	Mortality	LC50	> 5600	PPM	> 4,650 [2,325]	ppm [mg/kg bw]	Biolife Associates, Inc.	40228401	1994[3,4]	N. Cook (KBN)	1996	Yes
2,4-DB Acid	99.6	Bird	Bobwhite quail	*Colinus virginianus*	17 WKS	Oral (gavage or capsule)	Oral	21 D	21 D	Mortality	LD50	1536	mg/kg bw	1363	mg/kg bw	Biolife Associates, Inc.	40098001	1989[3,4]	G. Susanke	1990	Yes
2,4-DB Acid	99.6	Bird	Bobwhite quail	*Colinus virginianus*	17 WKS	Oral (gavage or capsule)	Oral	21 D	21 D		NOEL	464	mg/kg bw	412	mg/kg bw	Biolife Associates, Inc.	40098001	1989[3,4]	G. Susanke	1990	Yes
2,4-D Isopropyl Ester	98.2	Bird	Mallard duck	*Anas platyrhynchos*	10 D	Diet	Dietary	5 D	8 D	Mortality	LC50	> 5218	PPM	> 4,383 [2,190]	ppm [mg/kg bw]	Wildlife International Inc., MD	40098001	1996[3,4]	N. Federoff	1996	Yes
2,4-D Acid	96	Bird	Mallard duck	*Anas platyrhynchos*	10 D	Diet	Dietary	5 D	8 D	Mortality	LC50	> 5620	PPM	> 5,620 [2,810]	ppm [mg/kg bw]	Wildlife International Inc., MD	40228401	1990[3,4]	K. Valente	1992	Yes
2,4-D Tri,isopropylamine salt	70.4	Aquatic invertebrate	Pink shrimp	*Penaeus duorarum*	2.5 g	Flow-through	Water	96 hr	96 hr	Mortality	LC50	1057	PPM	566.6	PPM	Springborn Laboratory Inc., MA	00022923	1990[3,4]	D. Balluff	1991	No
2,4-D Tri,isopropylamine salt	70.4	Aquatic invertebrate	Pink shrimp	*Penaeus duorarum*	2.5 g	Flow-through	Water	96 hr	96 hr		NOEL	582	PPM	312.0	PPM	Springborn Laboratory Inc., MA	00022923	1990[3,4]	D. Balluff	1991	No
2,4-D Butoxyethanol Ester	96	Bird	Mallard duck	*Anas platyrhynchos*	10 D	Diet	Dietary	5 D	8 D	Mortality	LC50	> 5620	PPM	> 3,867 [1,935]	ppm [mg/kg bw]	Wildlife International Inc., MD	40098001	1989[3,4]	D. Balluff	1991	Yes

Formulation	% purity a.i.	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint	Toxicity Value (tested product)[1]	Units	Toxicity Value (a.e.)[1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4 DP-p-2-EHE	93.2	Bird	Mallard duck	*Anas platyrhynchos*	10 D	Diet	Dietary	5 D	8 D	Mortality	LC50	> 5620	PPM	> 3,727 [1,865]	ppm [mg/kg bw]	Wildlife International Inc., MD	40098001	1994[3,4]	D. Urban	1995	Yes
2,4-D Diethanolamine salt	73.1	Bird	Mallard duck	*Anas platyrhynchos*	10 D	Diet	Dietary	5 D	8 D	Mortality	LC50	> 5620	PPM	> 3,808 [1,905]	ppm [mg/kg bw]	Wildlife International Inc., MD	40098001	1991[3,4]	K. Valente	1991	Yes
2,4-D Isooctyl Ester	96.2	Bird	Mallard duck	*Anas platyrhynchos*	Juvenile	Diet	Dietary	5 D	8 D	Mortality	LC50	> 5620	PPM	> 3,727 [1,865]	ppm [mg/kg bw]	Wildlife International Inc., MD	40098001	1984[3,4]	K. Valente	1992	Yes
2,4-D Acid	96.9	Bird	Bobwhite quail	*Colinus virginianus*	Early life	Reproduction		21 W	21 W	Reproduction	LOEL	> 962	PPM	> 962 [581]	ppm [mg/kg bw/d]	Wildlife International Inc., MD	40098001	2000[3,4]	W. Evans	2001	Yes
2,4-D Acid	96.9	Bird	Bobwhite quail	*Colinus virginianus*	Early life	Reproduction		21 W	21 W	Reproduction	NOEL	962	PPM	962 [581]	ppm [mg/kg bw/d]	Wildlife International Inc., MD	40228401	2000[3,4]	W. Evans	2001	Yes
2,4-D Tri,isopropylamine salt	70.4	Bird	Mallard duck	*Anas platyrhynchos*	10 D	Diet	Dietary	5 D	8 D	Mortality	LC50	> 5620	PPM	> 3,012 [1,505]	ppm [mg/kg bw]	Wildlife International Inc., MD	40098001	1990[3,4]	G. Susanke	1991	Yes
2,4-D Isooctyl Ester	92	Bird	Mallard duck	*Anas platyrhynchos*	Not reported	Diet	Dietary	5 D	8 D	Mortality	LC50	> 10000	PPM	> 6,632 [3,315]	ppm [mg/kg bw]	Uniroyal Chemical Inc.	05001497	1976[3,4]	L. Turner	1977	Yes
2,4-D Acid	96	Bird	Bobwhite quail	*Colinus virginianus*	10 D	Diet	Dietary	5 D	8 D	Mortality	LC50	> 5620	PPM	> 5,620 [16,969]	ppm [mg/kg bw]	Dow Chemical Corporation Laboratories	40098001	1989[3,4]	D. Balluff	1991	Yes
2,4-D Acid	96	Bird	Bobwhite quail	*Colinus virginianus*	10 D	Diet	Dietary	5 D	8 D		NOEL	1000	PPM	1000 [604]	ppm [mg/kg bw/d]	Dow Chemical Corporation Laboratories	40098001	1989[3,4]	D. Balluff	1991	Yes
2,4-D Diethanolamine salt	57.9	Bird	Bobwhite quail	*Colinus virginianus*	Not reported	Diet	Dietary	5 D	8 D	Mortality	LC50	> 4640	PPM	> 3,144 [9,493]	ppm [mg/kg bw]	Truslo Farm Inc.	40098001	1974[3,4]	C. Lewis	1988	Supplemental
2,4-D Diethanolamine salt	57.9	Bird	Bobwhite quail	*Colinus virginianus*	Not reported	Diet	Dietary	5 D	8 D		NOEL	1000	PPM	678 [409]	ppm [mg/kg bw/d]	Truslo Farm Inc.	40098001	1974[3,4]	C. Lewis	1988	Supplemental
2,4-D Butoxyethanol Ester	69.3	Bird	Ring-necked pheasant	*Phasianus colchicus*	10 D	Diet	Dietary	5 D	8 D	Mortality	LC50	> 5000	PPM	> 3,440 [997.5]	ppm [mg/kg bw]	Fish and Wildlife Service Laboratories, Department of Interior	40098001	1975[3,4]	Hill, E.F. et al	1975	Yes
2,4-DP 2-Butoxyethyl Ester	59.1	Bird	Mallard duck	*Anas platyrhynchos*	Not reported	Oral (gavage or capsule)	Oral	NR	NR	Mortality	LD50	> 4650	mg/kg bw	> 3,199	mg/kg bw	Wildlife International Inc., MD	41353801	1976[3,4]	G. Gavin	1977	Yes
2,4-DP 2-Butoxyethyl Ester	59.1	Bird	Mallard duck	*Anas platyrhynchos*	Not reported	Diet	Dietary	5 D	8 D	Mortality	LC50	> 10000	PPM	> 6,880 [3,440]	ppm [mg/kg bw]	Wildlife International Inc., MD	N.R.	1976[3,4]	C. Laird	1988	Yes
2,4-D Butyl Ester	Tech	Bird	Mallard duck	*Anas platyrhynchos*	Not reported	Diet	Dietary	5 D	8 D	Mortality	LC50	10000	PPM	6,880 [3,440]	ppm [mg/kg bw]	Wildlife International Inc., MD	TN 0851	1976[3,4]	T. O'Brien	1978	Yes
2,4-DP-p, DMA salt	59.93	Bird	Bobwhite quail	*Colinus virginianus*	13 D	Diet	Dietary	5 D	8 D	Mortality	LC50	> 5600	PPM	> 4,650 [14,041]	ppm [mg/kg bw]	Biolife Associates, Inc.	40098001	1994[3,4]	N. Cook (KBN)	1996	Yes
2,4-DP-p, DMA salt	59.93	Bird	Bobwhite quail	*Colinus virginianus*	13 D	Diet	Dietary	5 D	8 D		NOEL	1400	PPM	1163 [702]	ppm [mg/kg bw/d]	Biolife Associates, Inc.	40098001	1994[3,4]	N. Cook (KBN)	1996	Yes
2,4-D Isopropyl Ester	98.2	Bird	Bobwhite quail	*Colinus virginianus*	10 D	Diet	Dietary	5 D	8 D	Mortality	LC50	> 5456	PPM	> 4,583 [13,838]	ppm [mg/kg bw]	Wildlife International Inc., MD	40098001	1996[3,4]	N. Federoff	1996	Yes
2,4-D Isopropyl Ester	98.2	Bird	Bobwhite quail	*Colinus virginianus*	10 D	Diet	Dietary	5 D	8 D		NOEL	1673	PPM	1405 [848]	ppm [mg/kg bw/d]	Wildlife International Inc., MD	40098001	1996[3,4]	N. Federoff	1996	Yes
2,4-D Diethanolamine salt	73.1	Bird	Bobwhite quail	*Colinus virginianus*	10 D	Diet	Dietary	5 D	8 D	Mortality	LC50	> 5620	PPM	> 3,808 [11,498]	ppm [mg/kg bw]	Wildlife International Inc., MD	40098001	1991[3,4]	K. Valente	1991	Supplemental
2,4-D Diethanolamine salt	73.1	Bird	Bobwhite quail	*Colinus virginianus*	10 D	Diet	Dietary	5 D	8 D		NOEL	1780	PPM	1206 [728]	ppm [mg/kg bw/d]	Wildlife International Inc., MD	40098001	1991[3,4]	K. Valente	1991	Supplemental
2,4-DP 2-Butoxyethyl, Ester Mix(Alchem 76)	100	Bird	Mallard duck	*Anas platyrhynchos*	14 D	Diet	Dietary	5 D	8 D	Mortality	LC50	> 10000	PPM	> 6,880 [3,440]	ppm [mg/kg bw]	Truslo Farm Inc.	00063066	1976[3,4]	C. Laird	1989	Yes

Formulation	% purity a.i.	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint	Toxicity Value (tested product)[1]	Units	Toxicity Value (a.e.) [1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4-D Acid	>99	Bird	Mallard duck	*Anas platyrhynchos*	4 MOS	Oral (gavage or capsule)	Oral	14 D	14 D	Mortality	LD50	> 2000	mg/kg bw	> 2000	mg/kg bw	Fish and Wildlife Service Laboratories, Department of Interior	02049115	1984[3,4]	Hudson, R.H. et al	1984	Yes
2,4-D Acid	>99	Bird	Mallard duck	*Anas platyrhynchos*	3-5MOS	Oral (gavage or capsule)	Oral	14 D	14 D	Mortality	LD50	> 1000	mg/kg bw	> 1000	mg/kg bw	Fish and Wildlife Service Laboratories, Department of Interior	02049115	1984[3,4]	Hudson, R.H. et al	1984	Yes
2,4-D Acid	>99	Bird	Ring-necked pheasant	*Phasianus colchicus*	3-4MOS	Oral (gavage or capsule)	Oral	14 D	14 D	Mortality	LD50	472	mg/kg bw	472	mg/kg bw	Fish and Wildlife Service Laboratories, Department of Interior	02049115	1984[3,4]	Hudson, R.H. et al	1984	Yes
2,4-D Tri,isopropylamine salt	70.4	Bird	Bobwhite quail	*Colinus virginianus*	10 D	Diet	Dietary	5 D	8 D	Mortality	LC50	> 5620	PPM	> 3,012 [9,094]	ppm [mg/kg bw]	Wildlife International Inc., MD	40098001	1990[3,4]	G. Susanke	1991	Yes
2,4-D Tri,isopropylamine salt	70.4	Bird	Bobwhite quail	*Colinus virginianus*	10 D	Diet	Dietary	5 D	8 D		NOEL	1780	PPM	954 [576]	ppm [mg/kg bw/d]	Wildlife International Inc., MD	40098001	1990[3,4]	G. Susanke	1991	Yes
2,4-D Sodium salt	Tech	Bird	Mallard duck	*Anas platyrhynchos*	Not reported	Oral (gavage or capsule)	Oral	>=14D	>=14D	Mortality	LD50	> 2025	mg/kg bw	1,841	mg/kg bw	Fish and Wildlife Service Laboratories, Department of Interior	02032075	1984[3,4]	Hudson, R.H. et al	1987	Yes
2,4-D Isopropylamine salt	48.7	Bird	Mallard duck	*Anas platyrhynchos*	9 D	Diet	Dietary	5 D	8 D	Mortality	LC50	> 5620	PPM	> 4,435 [2,220]	ppm [mg/kg bw]	Wildlife International Inc., MD	02058865	1983[3,4]	D. McLane	1984	Yes
2,4 DP-p-2-EHE	93.2	Bird	Bobwhite quail	*Colinus virginianus*	10 D	Diet	Dietary	5 D	8 D	Mortality	LC50	> 5620	PPM	> 3,727 [11,254]	ppm [mg/kg bw]	Wildlife International Inc., MD	00022923	1994[3,4]	Contract Draft-KBN	1997	Yes
2,4 DP-p-2-EHE	93.2	Bird	Bobwhite quail	*Colinus virginianus*	10 D	Diet	Dietary	5 D	8 D		NOEL	1780	PPM	1180 [713]	ppm [mg/kg bw/d]	Wildlife International Inc., MD	00022923	1994[3,4]	Contract Draft-KBN	1997	Yes
2,4 DP-p-2-EHE	93.2	Bird	Bobwhite quail	*Colinus virginianus*	10 D	Diet	Dietary	5 D	8 D	Mortality	LC50	> 5620	PPM	> 3,727 [11,254]	ppm [mg/kg bw]	Wildlife International Inc., MD	00022923	1994[3,4]	Contract Draft-KBN	1994	Yes
2,4 DP-p-2-EHE	93.2	Bird	Bobwhite quail	*Colinus virginianus*	10 D	Diet	Dietary	5 D	8 D		NOEL	1780	PPM	1180 [713]	ppm [mg/kg bw/d]	Wildlife International Inc., MD	00022923	1994[3,4]	Contract Draft-KBN	1994	Yes
2,4-D 2-EHE	92	Bird	Mallard duck	*Anas platyrhynchos*	14 D	Oral (gavage or capsule)	Oral	8 D	8 D	Mortality	LD50	> 4640	mg/kg bw	> 3,077	mg/kg bw	Uniroyal Chemical Inc.	02054612	1976[3,4]	L. Turner	1977	Yes
2,4-D Dimethylamine salt	49.6	Bird	Ring-necked pheasant	*Phasianus colchicus*	10 D	Diet	Dietary	5 D	8 D	Mortality	LC50	> 5000	PPM	> 4,152 [1,204]	ppm [mg/kg bw]	Fish and Wildlife Service Laboratories, Department of Interior	02040321	1975[3,4]	Hill, E.F. et al	1975	Yes
2,4-DB Acid	98	Bird	Mallard duck	*Anas platyrhynchos*	10 D	Diet	Dietary	5 D	8 D	Mortality	LC50	> 5000	PPM	> 4,435 [2,220]	ppm [mg/kg bw]	Fish and Wildlife Service Laboratories, Department of Interior	00022923	1975[3,4]	Hill, E.F. et al	1988	Yes
2,4-DB Acid	98	Bird	Ring-necked pheasant	*Phasianus colchicus*	10 D	Diet	Dietary	5 D	8 D	Mortality	LC50	> 5000	PPM	> 4,436 [1,286]	ppm [mg/kg bw]	Fish and Wildlife Service Laboratories, Department of Interior	00022923	1975[3,4]	Hill, E.F. et al	1988	Yes
2,4-DB DMA	26	Bird	Bobwhite quail	*Colinus virginianus*	Not reported	Diet	Dietary	5 D	8 D	Mortality	LC50	> 5000	PPM	> 4,152 [12,537]	ppm [mg/kg bw]	Biolife Associates, Inc.	40098001	1989[3,4]	G. Susanke	1990	Yes
2,4-DB DMA	26	Bird	Bobwhite quail	*Colinus virginianus*	Not reported	Diet	Dietary	5 D	8 D		NOEL	2500	PPM	2076 [1254]	ppm [mg/kg bw/d]	Biolife Associates, Inc.	40098001	1989[3,4]	G. Susanke	1990	Yes
2,4-D Isooctyl Ester	96.2	Bird	Bobwhite quail	*Colinus virginianus*	Juvenile	Diet	Dietary	5 D	8 D	Mortality	LC50	> 5620	PPM	> 3,727 [11,254]	ppm [mg/kg bw]	Wildlife International Inc., MD	41158305	1984[3,4]	K. Valente	1992	Yes
2,4-D Isooctyl Ester	96.2	Bird	Bobwhite quail	*Colinus virginianus*	Juvenile	Diet	Dietary	5 D	8 D		NOEL	3160	PPM	2,096 [1,266]	ppm [mg/kg bw/d]	Wildlife International Inc., MD	41407803	1984[3,4]	K. Valente	1992	Yes
2,4-D Dimethylamine salt	66.8	Bird	Bobwhite quail	*Colinus virginianus*	10 D	Diet	Dietary	5 D	8 D	Mortality	LC50	> 5620	PPM	> 4,667 [14,092]	ppm [mg/kg bw]	Wildlife International Inc., MD	42416802	1990[3,4]	N. Vyas	1992	Yes
2,4-D Dimethylamine salt	66.8	Bird	Bobwhite quail	*Colinus virginianus*	10 D	Diet	Dietary	5 D	8 D		NOEL	3160	PPM	2624 [1585]	ppm [mg/kg bw/d]	Wildlife International Inc., MD	00160000	1990[3,4]	N. Vyas	1992	Yes
2,4-D Diethanolamine salt	57.9	Bird	Mallard duck	*Anas platyrhynchos*	14 D	Diet	Dietary	5 D	8 D	Mortality	LC50	> 4640	PPM	> 3,144 [1,570]	ppm [mg/kg bw]	Truslo Farm Inc.	00053988	1974[3,4]	C. Lewis	1988	Supplemental

Formulation	% purity a.i.	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint		Toxicity Value (tested product)[1]	Units		Toxicity Value (a.e.)[1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4-D Diethanolamine salt	57.9	Bird	Mallard duck	*Anas platyrhynchos*	14 D	Diet	Dietary	8 D	8 D		NOEL		4640	PPM		3144	ppm [mg/kg bw/d]	Truslo Farm Inc.	40098001	1974[3,4]	C. Lewis	1988	Supplemental
2,4-D Butyl Ester	Tech	Bird	Mallard duck	*Anas platyrhynchos*	14 D	Oral (gavage or capsule)	Oral	8 D	8 D	Mortality	LD50	>	4640	mg/kg bw	>	3193	mg/kg bw	Wildlife International Inc., MD	40098001	1976[3,4]	T. O'Brien	1978	Supplemental
2,4-D Butyl Ester	Tech	Bird	Mallard duck	*Anas platyrhynchos*	14 D	Oral (gavage or capsule)	Oral	8 D	8 D		NOEL	<	4640	mg/kg bw/d	<	3193	mg/kg bw/d	Wildlife International Inc., MD	40098001	1976[3,4]	T. O'Brien	1978	Supplemental
DMA salt		Bird	Mallard duck	*Anas platyrhynchos*		Acute	Gavage			Mortality	LD50		NR		>	3,851	mg/kg bw		00233351	Fink 1978			Yes
2,4-D Isooctyl Ester	96.2	Bird	Mallard duck	*Anas platyrhynchos*	Juvenile	Oral (gavage or capsule)	Oral	14 D	14 D		NOEL	<	259	mg/kg bw	<	171.8	mg/kg bw	Wildlife International Inc., MD	40228401	1984[3,4]	K. Valente	1992	Yes
2,4-D Butoxyethanol Ester	96	Bird	Bobwhite quail	*Colinus virginianus*	10 D	Diet	Dietary	5 D	8 D	Mortality	LC50	>	5620	PPM	>	3,867 [11,676]	ppm [mg/kg bw]	Wildlife International Inc., MD	N.R.	1989[3,4]	D. Balluff	1991	Yes
2,4-D Butoxyethanol Ester	96	Bird	Bobwhite quail	*Colinus virginianus*	10 D	Diet	Dietary	5 D	8 D		NOEL		5620	PPM		3,867 [2,335]	ppm [mg/kg bw/d]	Wildlife International Inc., MD	N.R.	1989[3,4]	D. Balluff	1991	Yes
2,4-D Isopropylamine salt	48.7	Bird	Mallard duck	*Anas platyrhynchos*	Not reported	Oral (gavage or capsule)	Oral	14 D	14 D		NOEL		398	mg/kg bw		314	mg/kg bw	Wildlife International Inc., MD	40098001	1983[3,4]	D. McLane	1984	Yes
2,4-D Dimethylamine salt	66.8	Bird	Mallard duck	*Anas platyrhynchos*	10 D	Diet	Dietary	5 D	8 D		NOEL		562	PPM		467 [46.7]	ppm [mg/kg bw/d]	Wildlife International Inc., MD	00022923	1990[3,4]	N. Vyas	1992	Yes
2,4-DP 2-Butoxyethyl Ester	59.1	Bird	Bobwhite quail	*Colinus virginianus*	Not reported	Diet	Dietary	5 D	8 D	Mortality	LC50	>	10000	PPM	>	6,880 [20,774]	ppm [mg/kg bw]	Wildlife International Inc., MD	00138869	1976[3,4]	C. Laird	1988	Yes
2,4-DP 2-Butoxyethyl Ester	59.1	Bird	Bobwhite quail	*Colinus virginianus*	Not reported	Diet	Dietary	5 D	8 D		NOEL		10,000	PPM		6,880 [4,155]	ppm [mg/kg bw/d]	Wildlife International Inc., MD	00107929	1976[3,4]	C. Laird	1988	Yes
2,4-DP-p, DMA salt	59.93	Bird	Mallard duck	*Anas platyrhynchos*	9 D	Diet	Dietary	5 D	8 D		NOEL		700	PPM		581 [58.1]	ppm [mg/kg bw/d]	Biolife Associates, Inc.	40228401	1994[3,4]	N. Cook (KBN)	1996	Yes
2,4-D Isopropyl Ester	98.2	Bird	Mallard duck	*Anas platyrhynchos*	10 D	Diet	Dietary	5 D	8 D		NOEL		901	PPM		757 [75.7]	ppm [mg/kg bw/d]	Wildlife International Inc., MD	40098001	1996[3,4]	N. Federoff	1996	Yes
2,4-D Acid	96	Bird	Mallard duck	*Anas platyrhynchos*	10 D	Diet	Dietary	5 D	8 D		NOEL		1000	PPM		1,000 [100]	ppm [mg/kg bw/d]	Wildlife International Inc., MD	40098001	1990[3,4]	K. Valente	1992	Yes
2,4-D Butoxyethanol Ester	96	Bird	Mallard duck	*Anas platyrhynchos*	10 D	Diet	Dietary	5 D	8 D		NOEL		1000	PPM		688 [68.8]	ppm [mg/kg bw/d]	Wildlife International Inc., MD	40098001	1989[3,4]	D. Balluff	1991	Yes
2,4-DP 2-Butoxyethyl, Ester	100	Bird	Bobwhite quail	*Colinus virginianus*	14 D	Diet	Dietary	5 D	8 D	Mortality	LC50	>	10000	PPM	>	6,880 [20,774]	ppm [mg/kg bw]	Truslo Farm Inc.	00022529	1976[3,4]	C. Laird	1989	Yes
2,4-DP 2-Butoxyethyl, Ester	100	Bird	Bobwhite quail	*Colinus virginianus*	14 D	Diet	Dietary	5 D	8 D		NOEL		10,000	PPM		6,880 [4,155]	ppm [mg/kg bw/d]	Truslo Farm Inc.	TN 0190, 00050680	1976[3,4]	C. Laird	1989	Yes
2,4-DP 2-Butoxyethyl, Ester Mix(Alchem 76)	100	Bird	Bobwhite quail	*Colinus virginianus*	14 D	Diet	Dietary	5 D	8 D	Mortality	LC50	>	10000	PPM	>	6,880 [20,774]	ppm [mg/kg bw]	Wildlife International Inc., MD	TN 0191	1977[3,4]	C. Laird	1989	Yes
2,4-DP 2-Butoxyethyl, Ester Mix(Alchem 76)	100	Bird	Bobwhite quail	*Colinus virginianus*	14 D	Diet	Dietary	5 D	8 D		NOEL		10000	PPM		6,880 [4,155]	ppm [mg/kg bw/d]	Wildlife International Inc., MD	TN 0288	1977[3,4]	C. Laird	1989	Yes
2,4-D 2 EHE	67	Mollusca	Eastern oyster	*Crassostrea virginica*	SPAT	Flow-through	Water	96 hr	96 hr		EC50	>	3.0	PPB	>	2 [0.002]	ppb [ppm]	Envirosystem & Engineering Inc.	TN 0087	1991[3,4]	J. Noles	1991	No
2,4-D 2 EHE	67	Mollusca	Eastern oyster	*Crassostrea virginica*	SPAT	Flow-through	Water	96 hr	96 hr		NOEL		3	PPB		2 [0.002]	ppb [ppm]	Envirosystem & Engineering Inc.	TN 0135	1991[3,4]	J. Noles	1991	No
2,4-DP-p, DMA salt	63.6	Aquatic Plant	Duckweed	Lemna gibba	Not reported	Static	Water	14 D	14 D	Growth	EC50		3.8	PPM		3.156	PPM	Springborn Laboratory Inc., MA	TN 0572, 00050675	1992[3,4]	M. Davy	1993	Supplemental

Formulation	% purity a.i.	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint	Toxicity Value (tested product)[1]	Units	Toxicity Value (a.e.) [1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4-DP-p, DMA salt	63.6	Aquatic Plant	Green algae	Selenastrum capricornutum	Not reported	Static	Water	5 D	5 D	Growth	EC50	> 11	PPM	> 9.135	PPM	Springborn Laboratory Inc., MA	TN 0867	1992[3,4]	M. Davy	1993	Yes
2,4-D Acid	97	Aquatic Plant	Marine algae	Isochrysis galbana	Not reported	Static	Water	240hr	240hr	Growth	EC50	50	PPM	50	PPM	EPA Research Labs, at Beltsville, MD ,Gulfbreeze, FL, or Duluth, MN.	TN 0851	1986[3,4]	F.L. Mayer	1986	No
2,4-D Acid	97	Aquatic Plant	Marine diatom	Phaeodactylum tricornutum	Not reported	Static	Water	240hr	240hr	Growth	EC50	50	PPM	50	PPM	EPA Research Labs, at Beltsville, MD ,Gulfbreeze, FL, or Duluth, MN.	2049116	1986[3,4]	F.L. Mayer	1986	No
2,4-D Acid	97	Aquatic Plant	Green algae	Dunaliella tertiolecta	Not reported	Static	Water	240hr	240hr	Growth	EC50	75	PPM	75	PPM	EPA Research Labs, at Beltsville, MD ,Gulfbreeze, FL, or Duluth, MN.	02049116	1986[3,4]	F.L. Mayer	1986	Supplemental
2,4-D Acid	97	Aquatic Plant	Green algae	Chlorococcum sp.	Not reported	Static	Water	240hr	240hr	Growth	EC50	50	PPM	50	PPM	EPA Research Labs, at Beltsville, MD ,Gulfbreeze, FL, or Duluth, MN.	02049116	1986[3,4]	F.L. Mayer	1986	Supplemental
2,4-D Acid	98.7	Fish	Rainbow trout	*Oncorhynchus mykiss*	0.3 g	Static	Water	96 hr	96 hr	Mortality	LC50	110	PPM	110	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Acid	98.7	Fish	Bluegill sunfish	*Lepomis macrochirus*	0.5 g	Static	Water	96 hr	96 hr	Mortality	LC50	180	PPM	180	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Acid	100	Fish	Cutthroat trout	*Oncorhynchus clarki*	0.5 g	Static	Water	96 hr	96 hr	Mortality	LC50	24.5	PPM	24.5	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Acid	100	Fish	Lake trout	*Salvelinus namaycush*	0.3 g	Static	Water	96 hr	96 hr	Mortality	LC50	44.5	PPM	44.5	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Acid	98.7	Fish	Fathead minnow	*Pimephales promelas*	0.9 g	Static	Water	96 hr	96 hr	Mortality	LC50	133	PPM	133	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4 DP-p-2-EHE	93.2	Bird	Mallard duck	*Anas platyrhynchos*	10 D	Diet	Dietary	5 D	8 D		NOEL	1000	PPM	663 [66.3]	ppm [mg/kg bw/d]	Wildlife International Inc., MD	40098001	1994[3,4]	D. Urban	1995	Yes
2,4-D Diethanolamine salt	73.1	Bird	Mallard duck	*Anas platyrhynchos*	10 D	Diet	Dietary	5 D	8 D		NOEL	1780	PPM	1,206 [120.6]	ppm [mg/kg bw/d]	Wildlife International Inc., MD	40094602	1991[3,4]	K. Valente	1991	Yes
2,4-D Isooctyl Ester	96.2	Bird	Mallard duck	*Anas platyrhynchos*	Juvenile	Diet	Dietary	5 D	8 D		NOEL	1780	PPM	1,180 [118]	ppm [mg/kg bw/d]	Wildlife International Inc., MD	40098001	1984[3,4]	K. Valente	1992	Yes
2,4-D Acid	>99	Bird	Japanese quail	*Coturnix japonica*	2 MOS	Oral (gavage or capsule)	Oral	14 D	14 D	Mortality	LD50	668	mg/kg bw	668	mg/kg bw	Fish and Wildlife Service Laboratories, Department of Interior	02049115	1984[3,4]	Hudson, R.H. et al	1984	Supplemental
2,4-D Acid	>99	Bird	Chukar	*Alectoris chukar*	4 MOS	Oral (gavage or capsule)	Oral	14 D	14 D	Mortality	LD50	200-400	mg/kg bw	200-400	mg/kg bw	Fish and Wildlife Service Laboratories, Department of Interior	2049115	1984[3,4]	Hudson, R.H. et al	1984	Supplemental
2,4-D Acid	>99	Bird	Rock dove	*Columba livia*	Not reported	Oral (gavage or capsule)	Oral	14 D	14 D	Mortality	LD50	668	mg/kg bw	668	mg/kg bw	Fish and Wildlife Service Laboratories, Department of Interior	2049115	1984[3,4]	Hudson, R.H. et al	1984	Supplemental
2,4-D Acid	75	Bird	Japanese quail	*Coturnix japonica*	14 D	Diet	Dietary	5 D	8 D	Mortality	LC50	> 5000	PPM	> 5000 [2,817]	ppm [mg/kg bw]	Fish and Wildlife Service Laboratories, Department of Interior	02049114	1975[3,4]	Hill, E.F. et al	1975	Supplemental
2,4-D Sodium salt	80	Fish	Rainbow trout	*Oncorhynchus mykiss*	0.28 g	Static	Water	96 hr	96 hr	Mortality	LC50	> 100	PPM	90.9	ppm	Agricultural Research Center, USDA, Beltsville, MD.	02032078	1973[3,4]	C. Lewis	1987	Supplemental
2,4-D Tri,isopropylamine salt	70.4	Bird	Mallard duck	*Anas platyrhynchos*	10 D	Diet	Dietary	5 D	8 D		NOEL	1780	PPM	954 [95.4]	ppm [mg/kg bw/d]	Wildlife International Inc., MD	40094602	1990[3,4]	G. Susanke	1991	Yes
2,4-D Isopropylamine salt	48.7	Aquatic invertebrate	Water flea	*Daphnia magna*	1st-I	Static	Water	48 hr	48 hr		EC50	583	PPM	460	PPM	Dow Chemical Corporation Laboratories	02058860	1983[3,4]	D. McLane	1984	Yes
2,4-D Isopropylamine salt	48.7	Fish	Bluegill sunfish	*Lepomis macrochirus*	0.6 g	Static	Water	96 hr	96 hr	Mortality	LC50	1700	PPM	1342	PPM	Dow Chemical Corporation Laboratories	02058860	1983[3,4]	H. Mansfield	1991	Yes
2,4-D Isopropylamine salt	48.7	Fish	Rainbow trout	*Oncorhynchus mykiss*	0.53g	Static	Water	96 hr	96 hr	Mortality	LC50	2840	PPM	2241	PPM	Dow Chemical Corporation Laboratories	02058860	1983[3,4]	H.N. Mansfield	1984	Yes

Formulation	% purity a.i.	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint	Toxicity Value (tested product)[1]	Units	Toxicity Value (a.e.)[1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4-D Isooctyl Ester	92	Bird	Mallard duck	*Anas platyrhynchos*	Not reported	Diet	Dietary	5 D	8 D		NOEL	2150	PPM	1,426 [142.6]	ppm [mg/kg bw/d]	Uniroyal Chemical Inc.	05001497	1976[3,4]	L. Turner	1977	Yes
2,4-D Isopropylamine salt	48.7	Bird	Bobwhite quail	*Colinus virginianus*	9 D	Diet	Dietary	5 D	8 D	Mortality	LC50	> 5620	PPM	> 4,435 [13,391]	ppm [mg/kg bw]	Wildlife International Inc., MD	02058862	1983[3,4]	D. Mclane	1984	Yes
2,4-D Isooctyl Ester	67Lq	Aquatic invertebrate	Scud	*Gammarus fasciatus*	Juvenile	Static	Water	96 hr	96 hr	Mortality	LC50	2400	PPB	1,592 [1.6]	ppb [ppm]	Fish and Wildlife Service Laboratories, Department of Interior	02079104	1980[3,4]	Johnson & Finley	1987	Yes
2,4-D Isooctyl Ester	39.6	Aquatic invertebrate	Water flea	*Daphnia magna*	1st-I	Static	Water	48 hr	48 hr		EC50	500	PPB	332 [0.3]	ppb [ppm]	EPA Research Labs, at Beltsville, MD ,Gulfbreeze, FL, or Duluth, MN.		1975[3,4]	C. Lewis	1987	Yes
2,4-D Isooctyl Ester	94.2	Fish	Rainbow trout	*Oncorhynchus mykiss*	0.26g	Static	Water	96 hr	96 hr	Mortality	LC50	96	PPM	63.7	PPM	EPA Research Labs, at Beltsville, MD ,Gulfbreeze, FL, or Duluth, MN.		1977[3,4]	C. Lewis	1987	Yes
2,4-D Butoxyethanol Ester	69.3	Bird	Ring-necked pheasant	*Phasianus colchicus*	10 D	Diet	Dietary	5 D	8 D		NOEL	2500	PPM	1,720 [172]	ppm [mg/kg bw/d]	Fish and Wildlife Service Laboratories, Department of Interior	40098001	1975[3,4]	Hill, E.F. et al	1975	Yes
2,4-D Isooctyl Ester	92.0	Bird	Bobwhite quail	*Colinus virginianus*	Juvenile	Diet	Dietary	5 D	8 D	Mortality	LC50	7187	PPM	4,766 [14,393]	ppm [mg/kg bw]	Uniroyal Chemical Inc.	02054608	1976[3,4]	L. Turner	1977	Yes
2,4-D Butoxyethanol Ester	70	Aquatic Plant	Marine algae	Isochrysis galbana	Not reported	Static	Water	240hr	240hr	Growth	EC50	75	PPM	52	PPM	EPA Research Labs, at Beltsville, MD ,Gulfbreeze, FL, or Duluth, MN.	2049116	1986[3,4]	F.L. Mayer	1986	No
2,4-D Butoxyethanol Ester	70	Aquatic Plant	Marine diatom	Phaeodactylum tricornutum	Not reported	Static	Water	240hr	240hr	Growth	EC50	150	PPM	103	PPM	EPA Research Labs, at Beltsville, MD ,Gulfbreeze, FL, or Duluth, MN.	2049116	1986[3,4]	F.L. Mayer	1986	No
2,4-D Butoxyethanol Ester	70	Aquatic Plant	Green algae	Dunaliella tertiolecta	Not reported	Static	Water	240hr	240hr	Growth	EC50	75	PPM	52	PPM	EPA Research Labs, at Beltsville, MD ,Gulfbreeze, FL, or Duluth, MN.	02049116	1986[3,4]	F.L. Mayer	1986	Supplemental
2,4-D Butoxyethanol Ester	70	Aquatic Plant	Green algae	Chlorococcum sp.	Not reported	Static	Water	240hr	240hr	Growth	EC50	75	PPM	52	PPM	EPA Research Labs, at Beltsville, MD ,Gulfbreeze, FL, or Duluth, MN.	02049116	1986[3,4]	F.L. Mayer	1986	Supplemental
2,4-D Butoxyethanol Ester	62.5	Aquatic invertebrate	Water flea	*Daphnia magna*	1st-I	Static	Water	48 hr	48 hr		EC50	6.4	PPM	4.4	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Butoxyethanol Ester	60.8	Aquatic invertebrate	Water flea	*Daphnia magna*	1st-I	Static	Water	48 hr	48 hr		EC50	1.7	PPM	1.2	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Butoxyethanol Ester	29 G	Aquatic invertebrate	Water flea	*Daphnia magna*	1st-I	Static	Water	48 hr	48 hr		EC50	4.3	PPM	3.0	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Butoxyethanol Ester	62.5	Aquatic invertebrate	Seed shrimp	*Cypridopsis vidua*	Juvenile	Static	Water	48 hr	48 hr	Mortality	LC50	2.2	PPM	1.51	PPM	Fish and Wildlife Service Laboratories, Department of Interior	2049421	1986[3,4]	Mayer & Ellersieck	1986	No
2,4-D Butoxyethanol Ester	62.5	Aquatic invertebrate	Sowbug	*Asellus brevicaudus*	Juvenile	Static	Water	96 hr	96 hr	Mortality	LC50	2.6	PPM	1.8	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Butoxyethanol Ester	62.5	Aquatic invertebrate	Scud	*Gammarus fasciatus*	Juvenile	Static	Water	96 hr	96 hr	Mortality	LC50	0.44	PPM	0.30	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Butoxyethanol Ester	62.5	Aquatic invertebrate	Glass shrimp	*Palaemonetes kadiakensis*	Juvenile	Static	Water	96 hr	96 hr	Mortality	LC50	< 1.0	PPM	< 0.69	PPM	Fish and Wildlife Service Laboratories, Department of Interior	2049421	1986[3,4]	Mayer & Ellersieck	1986	No
2,4-D Butoxyethanol Ester	60.8	Aquatic invertebrate	Midge	*Chironomus plumosus*	3rd instar	Static	Water	48 hr	48 hr	Mortality	LC50	0.79	PPM	0.54	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Butoxyethanol Ester	29GR	Aquatic invertebrate	Midge	*Chironomus plumosus*	3rd instar	Static	Water	48 hr	48 hr	Mortality	LC50	0.39	PPM	0.27	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Butoxyethanol Ester	70	Aquatic invertebrate	Brown shrimp	*Penaeus aztecus*	Juvenile	Static	Water	48 hr	48 hr	Mortality	LC50	5.6	PPM	3.85	PPM	EPA Research Labs, at Beltsville, MD ,Gulfbreeze, FL, or Duluth, MN.	2049116	1986[3,4]	F.L. Mayer	1986	No
2,4-D Butoxyethanol Ester	70	Mollusca	Eastern oyster	*Crassostrea virginica*	SPAT	Flow-through	Water	96 hr	96 hr		EC50	2.6	PPM	1.79	PPM	EPA Research Labs, at Beltsville, MD ,Gulfbreeze, FL, or Duluth, MN.	2049116	1986[3,4]	F.L. Mayer	1986	No

Formulation	% purity a.i.	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint	Toxicity Value (tested product)[1]	Units	Toxicity Value (a.e.)[1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4-D Butoxyethanol Ester	70	Fish	Longnose killifish	*Fundulus similis*	Juvenile	Static	Water	48 hr	48 hr	Mortality	LC50	5.0	PPM	3.44	PPM	EPA Research Labs, at Beltsville, MD ,Gulfbreeze, FL, or Duluth, MN.	2049116	1986[3,4]	F.L. Mayer	1986	No
2,4-D Butoxyethanol Ester	69.3	Bird	Bobwhite quail	*Colinus virginianus*	23 D	Diet	Dietary	5 D	8 D	Mortality	LC50	> 5000	PPM	> 3,440 [10,387]	ppm [mg/kg bw]	Fish and Wildlife Service Laboratories, Department of Interior	02032053	1975[3,4]	Hill, E.F. et al	1975	Supplemental
2,4-D Butoxyethanol Ester	69.3	Bird	Japanese quail	*Coturnix japonica*	12 D	Diet	Dietary	5 D	8 D	Mortality	LC50	> 5000	PPM	> 3,440 [1,938]	ppm [mg/kg bw]	Fish and Wildlife Service Laboratories, Department of Interior	02032053	1975[3,4]	Hill, E.F. et al	1975	Supplemental
2,4-D Butoxyethanol Ester	69.3	Bird	Mallard duck	*Anas platyrhynchos*	23 D	Diet	Dietary	5 D	8 D	Mortality	LC50	> 5000	PPM	> 3,440 [1,720]	ppm [mg/kg bw]	Fish and Wildlife Service Laboratories, Department of Interior	02032053	1975[3,4]	Hill, E.F. et al	1975	Supplemental
2,4-D Propylene Glycol B.E. Ester	100	Aquatic invertebrate	Brown shrimp	*Penaeus aztecus*	Adult	Flow-through	Water	48 hr	48 hr	Mortality	LC50	0.55	PPM	0.378	PPM	EPA Research Labs, at Beltsville, MD ,Gulfbreeze, FL, or Duluth, MN.	2049116	1986[3,4]	F.L. Mayer	1986	No
2,4-D Propylene Glycol B.E. Ester	100	Aquatic invertebrate	Blue crab	*Callinectes sapidus*	Juvenile	Static	Water	48 hr	48 hr	Mortality	LC50	2.8	PPM	1.927	PPM	EPA Research Labs, at Beltsville, MD ,Gulfbreeze, FL, or Duluth, MN.	2049116	1986[3,4]	F.L. Mayer	1986	No
2,4-D Propylene Glycol B.E. Ester	100	Mollusca	Eastern oyster	*Crassostrea virginica*	Adult	Flow-through	Water	96 hr	96 hr		EC50	0.055	PPM	0.038	PPM	EPA Research Labs, at Beltsville, MD ,Gulfbreeze, FL, or Duluth, MN.	2049116	1986[3,4]	F.L. Mayer	1986	No
2,4-D Propylene Glycol B.E. Ester	100	Aquatic invertebrate	Water flea	*Simocephalus serrulatus*	1st-I	Static	Water	48 hr	48 hr		EC50	4.9	PPM	3	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02079104	1980[3,4]	Johnson & Finley	1980	Yes
2,4-D Propylene Glycol B.E. Ester	100	Aquatic invertebrate	Water flea	*Daphnia magna*	1st-I	Static	Water	48 hr	48 hr		EC50	1.2	PPM	0.8	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02079104	1980[3,4]	Johnson & Finley	1980	Yes
2,4-D Propylene Glycol B.E. Ester	100	Aquatic invertebrate	Seed shrimp	*Cypridopsis vidua*	Juvenile	Static	Water	48 hr	48 hr	Mortality	LC50	0.40	PPM	0.275	PPM	Fish and Wildlife Service Laboratories, Department of Interior	2079104	1980[3,4]	Johnson & Finley	1980	No
2,4-D Propylene Glycol B.E. Ester	100	Aquatic invertebrate	Sowbug	*Asellus brevicaudus*	Juvenile	Static	Water	96 hr	96 hr	Mortality	LC50	2.85	PPM	2.0	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Propylene Glycol B.E. Ester	100	Aquatic invertebrate	Scud	*Gammarus fasciatus*	Juvenile	Static	Water	96 hr	96 hr	Mortality	LC50	1.6	PPM	1.1	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Propylene Glycol B.E. Ester	100	Aquatic invertebrate	Glass shrimp	*Palaemonetes kadiakensis*	Juvenile	Static	Water	96 hr	96 hr	Mortality	LC50	0.36	PPM	0.248	PPM	Fish and Wildlife Service Laboratories, Department of Interior	2049421	1986[3,4]	Mayer & Ellersieck	1986	No
2,4-D Propylene Glycol B.E. Ester	100	Aquatic invertebrate	Stonefly	*Pteronarcella badia*	yr	Static	Water	96 hr	96 hr	Mortality	LC50	2.4	PPM	1.7	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Propylene Glycol B.E. Ester	100	Aquatic invertebrate	Stonefly	*Pteronarcys californica*	yr	Static	Water	96 hr	96 hr	Mortality	LC50	1.8	PPM	1.2	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Propylene Glycol B.E. Ester	100	Fish	Longnose killifish	*Fundulus similis*	Adult	Static	Water	48 hr	48 hr	Mortality	LC50	4.5	PPM	3.096	PPM	EPA Research Labs, at Beltsville, MD ,Gulfbreeze, FL, or Duluth, MN.	2049116	1986[3,4]	F.L. Mayer	1986	No
2,4-D Propylene Glycol B.E. Ester	100	Fish	Spot	*Leiostomus xanthurus*	Adult	Static	Water	48 hr	48 hr	Mortality	LC50	1.5	PPM	1.032	PPM	EPA Research Labs, at Beltsville, MD ,Gulfbreeze, FL, or Duluth, MN.	2049116	1986[3,4]	F.L. Mayer	1986	No
2,4-D Propylene Glycol B.E. Ester	100	Fish	Cutthroat trout	*Oncorhynchus clarki*	0.5 g	Static	Water	96 hr	96 hr	Mortality	LC50	0.49	PPM	0.337	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Propylene Glycol B.E. Ester	100	Fish	Cutthroat trout	*Oncorhynchus clarki*	4.2 g	Flow-through	Water	96 hr	96 hr	Mortality	LC50	0.33	PPM	0.227	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Propylene Glycol B.E. Ester	100	Fish	Rainbow trout	*Oncorhynchus mykiss*	1.5 g	Static	Water	96 hr	96 hr	Mortality	LC50	0.95	PPM	0.654	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Propylene Glycol B.E. Ester	100	Fish	Bluegill sunfish	*Lepomis macrochirus*	1.0 g	Static	Water	96 hr	96 hr	Mortality	LC50	0.56	PPM	0.385	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Propylene Glycol B.E. Ester	100	Fish	Lake trout	*Salvelinus namaycush*	0.3 g	Static	Water	96 hr	96 hr	Mortality	LC50	0.63	PPM	0.433	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	Supplemental

Formulation	% purity a.i.	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint	Toxicity Value (tested product)[1]	Units	Toxicity Value (a.e.) [1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4-D Propylene Glycol B.E. Ester	100	Fish	Lake trout	*Salvelinus namaycush*	1.5 g	Flow-through	Water	96 hr	96 hr	Mortality	LC50	0.39	PPM	0.268	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Butyl Ester	98.4	Aquatic invertebrate	Stonefly	*Pteronarcella badia*	yr	Static	Water	96 hr	96 hr	Mortality	LC50	1.5	PPM	1.0	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02040355	1980[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Butyl Ester	98.4	Aquatic invertebrate	Stonefly	*Pteronarcys californica*	yr	Static	Water	96 hr	96 hr	Mortality	LC50	1.3	PPM	0.9	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02040355	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Butyl Ester	98.4	Fish	Cutthroat trout	*Oncorhynchus clarki*	0.5 g	Static	Water	96 hr	96 hr	Mortality	LC50	0.49	PPM	0.34	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02040355	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Butyl Ester	98.5	Fish	Cutthroat trout	*Oncorhynchus clarki*	4.2 g	Flow-through	Water	96 hr	96 hr	Mortality	LC50	0.55	PPM	0.38	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Butyl Ester	98.4	Fish	Lake trout	*Salvelinus namaycush*	0.4 g	Static	Water	96 hr	96 hr	Mortality	LC50	0.6	PPM	0.41	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02040355	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Butyl Ester	98.4	Fish	Lake trout	*Salvelinus namaycush*	1.5 g	Flow-through	Water	96 hr	96 hr	Mortality	LC50	0.5	PPM	0.34	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02040355	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Dimethylamine salt	49.6	Aquatic invertebrate	Water flea	*Daphnia magna*	Erly-1	Static	Water	48 hr	48 hr		EC50	4.0	PPM	3.3	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Dimethylamine salt	49.6	Aquatic invertebrate	Seed shrimp	*Cypridopsis vidua*	E-Inst	Static	Water	48 hr	48 hr	Mortality	LC50	8.0	PPM	6.643	PPM	Fish and Wildlife Service Laboratories, Department of Interior	2049421	1986[3,4]	Mayer & Ellersieck	1986	No
2,4-D Dimethylamine salt	49.6	Aquatic invertebrate	Scud	*Gammarus fasciatus*	Juvenile	Static	Water	96 hr	96 hr	Mortality	LC50	> 100	PPM	> 83	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Dimethylamine salt	49.6	Aquatic invertebrate	Midge	*Chironomus plumosus*	3rd instar	Static	Water	48 hr	48 hr	Mortality	LC50	> 100	PPM	> 83	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Dimethylamine salt	49.6	Aquatic invertebrate	Glass shrimp	*Palaemonetes kadiakensis*	Not reported	Static	Water	48 hr	48 hr	Mortality	LC50	0.15	PPM	0.125	PPM	Fish and Wildlife Service Laboratories, Department of Interior	2079104	1980[3,4]	Johnson & Finley	1980	No
2,4-D Dimethylamine salt	49.6	Fish	Chinook salmon	*Oncorhynchus tshawytscha*	1.0 g	Static	Water	96 hr	96 hr	Mortality	LC50	> 100	PPM	> 83.042	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Dimethylamine salt	49.6	Fish	Rainbow trout	*Oncorhynchus mykiss*	1.4 g	Static	Water	96 hr	96 hr	Mortality	LC50	> 100	PPM	> 83.042	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Dimethylamine salt	49.6	Fish	Fathead minnow	*Pimephales promelas*	0.8 g	Static	Water	96 hr	96 hr	Mortality	LC50	266	PPM	220.892	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Dimethylamine salt	49.6	Fish	Channel catfish	*Ictalurus punctatus*	0.4 g	Static	Water	96 hr	96 hr	Mortality	LC50	119	PPM	98.820	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Dimethylamine salt	49.6	Fish	Bluegill sunfish	*Lepomis macrochirus*	1.1 g	Static	Water	96 hr	96 hr	Mortality	LC50	168	PPM	139.511	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Dimethylamine salt	49.6	Fish	Smallmouth bass	*Micropterus dolomieui*	0.4 g	Static	Water	96 hr	96 hr	Mortality	LC50	236	PPM	196	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02079104	1980[3,4]	Johnson & Finley	1980	Yes
2,4-D Dimethylamine salt	49.6	Bird	Bobwhite quail	*Colinus virginianus*	23 D	Diet	Dietary	5 D	8 D	Mortality	LC50	> 5000	PPM	> 4,152 [12,537]	ppm [mg/kg bw]	Fish and Wildlife Service Laboratories, Department of Interior	02040321	1975[3,4]	Hill, E.F. et al	1975	Supplemental
2,4-D Dimethylamine salt	49.6	Bird	Japanese quail	*Coturnix japonica*	20 D	Diet	Dietary	5 D	8 D	Mortality	LC50	> 5000	PPM	> 4,152 [2,339]	ppm [mg/kg bw]	Fish and Wildlife Service Laboratories, Department of Interior	02040321	1975[3,4]	Hill, E.F. et al	1975	Supplemental
2,4-DP 2-Butoxyethyl Ester	59.1	Bird	Mallard duck	*Anas platyrhynchos*	Not reported	Oral (gavage or capsule)	Oral	NR	NR		NOEL	4650	mg/kg bw/d	3,199	mg/kg bw/d	Wildlife International Inc., MD	N.R.	1976[3,4]	G. Gavin	1977	Yes
2,4-D Dimethylamine salt	49.6	Bird	Mallard duck	*Anas platyrhynchos*	17 D	Diet	Dietary	5 D	8 D	Mortality	LC50	> 5000	PPM	> 4,152 [2,075]	ppm [mg/kg bw]	Fish and Wildlife Service Laboratories, Department of Interior	02040321	1975[3,4]	Hill, E.F. et al	1975	Supplemental

Formulation	% purity a.i.	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint		Toxicity Value (tested product)[1]	Units		Toxicity Value (a.e.) [1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4-D Dimethylamine salt	49.6	Aquatic invertebrate	Sowbug	*Asellus brevicaudus*	Not reported	Static	Water	48 hr	48 hr	Mortality	LC50	>	100	PPM	>	83	PPM	References	02040288	1970[3,4]	Ann Rozencranz	1979	Supplemental
2,4-D Dimethylamine salt	49.6	Aquatic invertebrate	Glass shrimp	*Palaemonetes kadiakensis*	Not reported	Static	Water	48 hr	48 hr	Mortality	LC50	>	100	PPM	>	83.042	PPM	References	2040288	1970[3,4]	Ann Rozenkranz	1979	No
2,4-D Butoxyethanol Ester	62.5	Fish	Fathead minnow	*Pimephales promelas*	0.9 g	Static	Water	96 hr	96 hr	Mortality	LC50		3.25	PPM		2.24	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1980[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Butoxyethanol Ester	62.5	Fish	Bluegill sunfish	*Lepomis macrochirus*	1.4 g	Static	Water	96 hr	96 hr	Mortality	LC50		1.2	PPM		0.83	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1980[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Butoxyethanol Ester	60.8	Fish	Bluegill sunfish	*Lepomis macrochirus*	0.6 g	Static	Water	96 hr	96 hr	Mortality	LC50		0.76	PPM		0.52	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1980[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Butoxyethanol Ester	29 G	Fish	Bluegill sunfish	*Lepomis macrochirus*	0.6 g	Static	Water	96 hr	96 hr	Mortality	LC50		0.76	PPM		0.52	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1980[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-DB Acid	**100**	**Aquatic invertebrate**	**Stonefly**	***Pteronarcys sp.***	**Juvenile**	**Static**	**Water**	**96 hr**	**96 hr**	**Mortality**	**LC50**		**15**	**PPM**		**13**	**PPM**	**Fish and Wildlife Service Laboratories, Department of Interior**	**40094602**	**1980[3,4]**	**Johnson & Finley**	**1988**	**Yes**
2,4-DB Acid	**Tech**	**Insect**	**Honey bee**	***Apis mellifera***	**Worker**	**Contact**	**Direct contact**	**48 hr**	**48 hr**	**Mortality**	**LD50**		**14.5**	**ug/bee**		**13**	**ug/bee**	**University of California, Riverside**	**NR**	**1969[3,4]**	**A. Vaughan**	**1981**	**Yes**
2,4-DB Acid	100	Fish	Bluegill sunfish	*Lepomis macrochirus*	1.4 g	Static	Water	96 hr	96 hr	Mortality	LC50		7.5	PPM		6.7	PPM	Fish and Wildlife Service Laboratories, Department of Interior	40094602	1980[3,4]	Johnson & Finley	1988	Yes
2,4-DB Acid	**100**	**Fish**	**Rainbow trout**	***Oncorhynchus mykiss***	**0.8 g**	**Static**	**Water**	**96 hr**	**96 hr**	**Mortality**	**LC50**		**2.0**	**PPM**		**1.8**	**PPM**	**Fish and Wildlife Service Laboratories, Department of Interior**	**40094602**	**1980[3,4]**	**Johnson & Finley**	**1988**	**Yes**
2,4-DB Acid	100	Fish	Fathead minnow	*Pimephales promelas*	0.5 g	Static	Water	96 hr	96 hr	Mortality	LC50		18	PPM		16	PPM	Fish and Wildlife Service Laboratories, Department of Interior	40094602	1980[3,4]	Johnson & Finley	1988	Yes
2,4-DB Acid	97	Fish	Bluegill sunfish	*Lepomis macrochirus*	0.61 g	Static	Water	96 hr	96 hr	Mortality	LC50		16.8	PPM		15	PPM	Agricultural Research Center, USDA, Beltsville, MD.	TN 0938, 40762606	1976[3,4]	R. Pilsucki	1988	Yes
2,4-DB Acid	97	Fish	Rainbow trout	*Oncorhynchus mykiss*	0.26 g	Static	Water	96 hr	96 hr	Mortality	LC50		14.3	PPM		13	PPM	Agricultural Research Center, USDA, Beltsville, MD.	TN 0928, 40762601	1976[3,4]	R. Pilsucki	1988	Yes
2,4-DB Acid	98	Bird	Bobwhite quail	*Colinus virginianus*	14 D	Diet	Dietary	5 D	8 D	Mortality	LC50	>	5000	PPM	>	4,436 [13,394]	ppm [mg/kg bw]	Fish and Wildlife Service Laboratories, Department of Interior	00022923	1975[3,4]	Hill, E.F. et al	1988	Yes
2,4-DP 2-Butoxyethyl Ester	59.1	Bird	Mallard duck	*Anas platyrhynchos*	Not reported	Diet	Dietary	5 D	8 D		NOEL		10000	PPM		6,880 [688]	ppm [mg/kg bw/d]	Wildlife International Inc., MD	N.R.	1976[3,4]	C. Laird	1988	Yes
2,4-D Butyl Ester	Tech	Bird	Mallard duck	*Anas platyrhynchos*	Not reported	Diet	Dietary	5 D	8 D		NOEL	<	10000	PPM	<	6,880 [688]	ppm [mg/kg bw/d]	Wildlife International Inc., MD	43768001	1976[3,4]	T. O'Brien	1978	Yes
2,4-DB Acid	100	Bird	Peking duck	*Anas domestica*	Not reported	Diet	Dietary	5 D	8 D	Mortality	LC50	>	1000	PPM	>	887	PPM	Hazelton Laboratory Inc. VA	00092162	1969[3,4]	R. Pilsucki	1988	Supplemental
2,4-DB DMA	26	Aquatic Plant	Green algae	Selenastrum capricornutum	Not reported	Static	Water	120hr	120hr	Growth	LOEL		1.1	PPM		0.913	PPM	Springborn Laboratory Inc., MA	02080565	1990[3,4]	R. Lamb	1991	Yes
2,4-DB DMA	26	Fish	Rainbow trout	*Oncorhynchus mykiss*	0.59g	Flow-through	Water	96 hr	96 hr	Mortality	LC50		3.7	PPM		3.073	PPM	Springborn Laboratory Inc., MA	41370104	1989[3,4]	G. Susanke	1990	Yes
2,4-D Acid	96.7	Terrestrial Plant	Radish	*Raphanus sativus*	Seedling	Seedling emergence	Soil treatment	14 D	14 D	Germination	EC25		0.14	lbs ai/acre		0.14	lbs ae/acre	Ricera Inc. Ohio	02031728	1992[3,4]	K. Valente	1992	Yes
2,4-D Acid	>99	Mammal	Mule deer	*Odocoileus hemionus*	8-11MO	Oral (gavage or capsule)	Oral	14 D	14 D	Mortality	LD50		400-800	mg/kg bw		400-800	mg/kg bw	Fish and Wildlife Service Laboratories, Department of Interior	2049115	1984[3,4]	Hudson, R.H. et al	1984	Supplemental
2,4-D Butoxyethanol Ester-Aqua Kleen 20	29	Fish	Bluegill sunfish	*Lepomis macrochirus*	1.52 g	Static	Water	96 hr	96 hr	Mortality	LC50	>	50	PPM	>	34	PPM	Agricultural Research Center, USDA, Beltsville, MD.	02041618	1969[3,4]	C. Lewis	1987	Supplemental

Formulation	% purity a.i.	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint	Toxicity Value (tested product)[1]	Units	Toxicity Value (a.e.) [1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4-D Butoxyethanol Ester	60.8	Fish	Channel catfish	*Ictalurus punctatus*	0.4 g	Static	Water	96 hr	96 hr	Mortality	LC50	0.78	PPM	0.54	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Butoxyethanol Ester	29 G	Fish	Channel catfish	*Ictalurus punctatus*	0.4 g	Static	Water	96 hr	96 hr	Mortality	LC50	1350	PPM	929	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Butoxyethanol Ester	62.5	Amphibian	Fowler's toad	*Bufo woodhousei*	Tadpole	Static	Water	96 hr	96 hr	Mortality	LC50	> 10	PPM	> 6.88	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Butoxyethanol Ester	Tech	Aquatic invertebrate	Scud	*Gammarus lacustris*	Not reported	Static	Water	48 hr	48 hr	Mortality	LC50	0.76	PPM	0.52	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02041624	1969[3,4]	EEB Review	1980	Supplemental
2,4-D Isooctyl Ester	95	Fish	Bluegill sunfish	*Lepomis macrochirus*	1.1 g	Static	Water	96 hr	96 hr	Mortality	LC50	> 180	PPM	> 119.4	PPM	Agricultural Research Center, USDA, Beltsville, MD.	TN	1975[3,4]	J. McCann	1994	Supplemental
2,4-D Isooctyl Ester	95	Fish	Rainbow trout	*Oncorhynchus mykiss*	0.49 g	Static	Water	96 hr	96 hr	Mortality	LC50	< 180	PPM	< 119.4	PPM	Agricultural Research Center, USDA, Beltsville, MD.	TN	1975[3,4]	J. McCann	1994	Supplemental
2,4-D Isooctyl Ester	95	Aquatic invertebrate	Water flea	*Daphnia magna*	<24 hr	Static	Water	48 hr	48 hr		EC50	54	PPB	35.8 [0.04]	ppb [ppm]	Agricultural Research Center, USDA, Beltsville, MD.		1976[3,4]	J. McCann	1994	Yes
2,4-D Isooctyl Ester	1	Fish	Bluegill sunfish	*Lepomis macrochirus*	2.1 g	Static	Water	96 hr	96 hr	Mortality	LC50	> 180	PPM	> 119.4	PPM	Agricultural Research Center, USDA, Beltsville, MD.	TN	1975[3,4]	J. McCann	1975	Supplemental
2,4-D Isooctyl Ester	1	Fish	Rainbow trout	*Oncorhynchus mykiss*	0.33 g	Static	Water	96 hr	96 hr	Mortality	LC50	> 180	PPM	> 119.4	PPM	Agricultural Research Center, USDA, Beltsville, MD.	TN	1975[3,4]	J. McCann	1975	Supplemental
2,4-D Isopropylamine salt	48.7	Fish	Fathead minnow	*Pimephales promelas*	0.47 g	Static	Water	96 hr	96 hr	Mortality	LC50	2180	PPM	1720	PPM	References	02058860	1983[3,4]	H. Mansfield	1991	Supplemental
2,4-D Butyl Ester	Tech	Bird	Bobwhite quail	*Colinus virginianus*	Not reported	Diet	Dietary	5 D	8 D	Mortality	LC50	12979	PPM	8,930 [26,964]	ppm [mg/kg bw]	Union Carbide Environmental Services	02040348	1976[3,4]	T. O'Brien	1978	Yes
2,4-D Ethylhexyl Ester/2,4,5-T mixture	15/7	Fish	Rainbow trout	*Oncorhynchus mykiss*	0.8 g	Static	Water	96 hr	96 hr	Mortality	LC50	7.8	PPM	5.2	PPM	Agricultural Research Center, USDA, Beltsville, MD.	TN 851	1975[3,4]	J. McCann	1975	Supplemental
2,4-D Isopropyl Ester	98.2	Aquatic Plant	Green algae	Selenastrum capricornutum	Not reported	Static	Water	5 D	5 D	Growth	EC50	> 0.13	PPM	> 0.11	PPM	Carolina Ecotox Inc., Durham, NC	02059454	1995[3,4]	N. Cook	1996	Yes
2,4-DP 2-Butoxyethyl Ester (Weedone formula)	63.7	Fish	Rainbow trout	*Oncorhynchus mykiss*	0.35 g	Static	Water	96 hr	96 hr	Mortality	LC50	1.49	PPM	1.025	PPM	Union Carbide Environmental Services	02036940	1980[3,4]	C. Natella	1981	Yes
2,4-D propylene glycol butyl ether ester	100	Aquatic invertebrate	Water flea	*Daphnia magna*	<24 hr	Static	Water	48 hr	48 hr		EC50	15.2	PPM	10	PPM	Dow Chemical Corporation Laboratories	02040391	1977[3,4]	C. Lewis	1988	Supplemental
2,4-D 2-EHE/2,4,5T IOE/Dicamba (Banvel 310)	45	Bird	Mallard duck	*Anas platyrhynchos*	14 D	Diet	Dietary	5 D	8 D	Mortality	LC50	> 4640	PPM	> 3,077 [1,540]	ppm [mg/kg bw]	Hazelton Laboratory Inc. VA	02054604	1973[3,4]	EFED	1979	Supplemental
2,4-D Diethanolamine salt	73.8	Terrestrial Plant	Mustard	*Brassica nigra*	Seedling	Seedling emergence	Soil treatment	NR	NR	Germination	EC25	0.005	lbs ai/acre	0.003	lbs ae/acre	Ricera Inc. Ohio	42609101	1992[3,4]	W. Evans	2004	Supplemental
2,4-D isooctyl ester	38.6	Fish	Rainbow trout	*Oncorhynchus mykiss*	1.173	Static	Water	96 Hr	96 Hr	Mortality	LC50	38.0	PPM	25.2	PPM	Agricultural Research Center, USDA, Beltsville, MD.	TN 190	1969[3,4]	J. McCann	2004	Yes
2,4-D isooctyl ester	68.7	Fish	Rainbow trout	*Oncorhynchus mykiss*	1.173	Static	Water	96 Hr	96 Hr	Mortality	LC50	36.5	PPM	24.2	PPM	Agricultural Research Center, USDA, Beltsville, MD.	TN 191	1969[3,4]	J. McCann	2004	Yes
2,4-D Acid/2,4,5-T mixture (Emulsamine)	31.4/29	Fish	Bluegill sunfish	*Lepomis macrochirus*	1.12 g	Static	Water	96 Hr	96 Hr	Mortality	LC50	15.0	PPM	15	ppm	Agricultural Research Center, USDA, Beltsville, MD.	TN 288	1970[3,4]	J. McCann	2004	Yes
2,4-D DEA Salt/Salt of 2,4,5-T mixture	17.5/8	Fish	Bluegill sunfish	*Lepomis macrochirus*	0.75 g	Static	Water	96 hr	96 hr	Mortality	LC50	19.2	PPM	13.0	ppm	Agricultural Research Center, USDA, Beltsville, MD.	TN 135A	1968[3,4]	J. McCann	1968	Supplemental
2,4-D 2-EHE	Tech	Aquatic invertebrate	Water flea	*Daphnia magna*	instar	Static	Water	48 hr	48 hr		EC50	0.5	PPM	0.33	PPM	Agricultural Research Center, USDA, Beltsville, MD.	02054596	1975[3,4]	J.McCann/C. Lewis	1987	Yes

Formulation	% purity a.i.	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint	Toxicity Value (tested product)[1]	Units	Toxicity Value (a.e.)[1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4-D 2-EHE/Silvex mixture	15.2	Fish	Rainbow trout	*Oncorhynchus mykiss*	0.79 g	Static	Water	96 hr	96 hr	Mortality	LC50	7.8	PPM	5.2	PPM	Agricultural Research Center, USDA, Beltsville, MD.	02054599	1975[3,4]	J. McCann	1975	Yes
EHE		Fish	Rainbow trout	*Oncorhynchus mykiss*		Acute	Water	96-hr		Mortality	LC50	NR		14.5	mg/L			Buccafusco 1976b			Yes
DMA salt		Aquatic Plant	Blue-green algae	*Anabaena flos-aquae*	Cells	Cell growth	Water	5 d	5 d	Survival and growth	NOAEC	NR		56.32	mg/L			Hughes 1989			No
DMA salt		Aquatic Plant	Freshwater diatom	*Navicula pelliculosa*	Cells	Cell growth	Water	5 d	5 d	Survival and growth	NOAEC	NR		1.41	mg/L		41505903	Hughes 1990a			Yes
DMA salt		Bird	Bobwhite quail	*Colinus virginianus*		Acute	Gavage			Mortality	LD50	NR		415	mg/kg bw			Hoxter et al. 1990			Yes
EHE		Aquatic Plant	Marine diatom	*Skelotonema costatum*	Cells	Cell growth	Water	5 d	5 d	Survival and growth	NOAEC	NR		0.062	mg/L			Hughes 1990b			No
EHE		Aquatic Plant	Green algae	*Selanastrum capricornutum*	Cells	Cell growth	Water	5 d	5 d	Survival and growth	NOAEC	NR		2.5	mg/L		41735206	Hughes 1990c			Yes
2,4-D acid		Terrestrial plant	Tomato	*Solanum lycopersicum*	Seedling	Seedling emergence	Soil treatment			Seedling emergence	NOAEC	NR		> 4.2	lbs ae/acre			Backus 1992a			Yes
2,4-D acid		Terrestrial plant	Onion	*Allium cepa*	Post-emergence	Vegetative vigor	Direct spray			Vegetative vigor	LOAEC	NR		0.0075	lbs ae/acre			Backus 1992b			Yes
2,4-D acid		Terrestrial plant	Corn	*Zea mays*	Post-emergence	Vegetative vigor	Direct spray			Vegetative vigor	NOAEC	NR		2.1	lbs ae/acre			Backus 1992b			Yes
DMA salt		Terrestrial plant	Mustard	*Brassica nigra*	Seedling	Seedling emergence	Soil treatment			Seedling emergence	NOAEC	NR		0.0093	lbs ae/acre			Backus and Crosby 1992			Yes
EHE		Fish	Tidewater silverside	*Menidia beryllina*		Acute	Water	96-hr		Mortality	LC50	NR		0.156	mg/L			Ward and Boeri 1991a			No
EHE		Aquatic invertebrate	Grass shrimp	*Palaemonestes pugio*		Acute	Water	96-hr		Mortality	LC50	NR		0.092	mg/L			Ward and Boeri 1991f			No
EHE		Mollusca	Eastern oyster	*Crassostrea virginica*		Acute	Water	96-hr		Shell deposition	EC50	NR		> 66	mg/L			Ward and Boeri 1991d			No
EHE		Terrestrial plant	Soybean	*Glycine max*	Post-emergence	Vegetative vigor	Direct spray			Vegetative vigor	NOAEC	NR		0.008	lbs ae/acre			Backus et al. 1992 (as cited in USEPA/OPP 2004b)			Yes
2,4-D acid		Fish	Carp	Family Cyprinidae		Chronic	Water				NOAEC	NR		19	mg/L			Mayes et al. 1990a; Rehwoldt et al. 1977			Yes
2,4-D acid		Fish	Fathead minnow	*Pimephales promelas*	Larva	Chronic	Water			Larval survival	NOAEC	NR		63.4	mg/L			Mayes et al. 1990a			Yes
EHE		Terrestrial plant	Radish	*Raphanus sativus*	Seedling	Seedling emergence	Soil treatment			Seedling emergence	EC25	NR		0.045	lbs ae/acre			Backus 1995 (as cited in USEPA/OPP 2004b)			Yes
2,4-D acid		Bird	Bobwhite quail	*Colinus virginianus*		Chronic				Incidence of cracked eggs	NOAEC	NR		76	mg/kg/d		45336401	Mitchell et al. 1999			Yes
2,4-D acid		Amphibian	Leopard frog	*Rana pipiens*	Tadpole	Acute	Static	96-hr	96 hr	Mortality	LC50	NR		359	mg/L			Palmer and Krueger 1997d			Yes
2-EHE		**Amphibian**	**Leopard frog**	***Rana pipiens***	**Tadpole**	**Acute**	**Static**	**96-hr**	**96 hr**	**Mortality**	**LC50**	**NR**		**0.505**	**mg/L**			**Palmer and Krueger 1997b**			**Yes**
DMA salt		Mammal	English pointer		1 year	Acute	Capsule, single dose	26 hr	26 hr	Neurotoxicity	NOAEL	1.3	mg/kg bw/d	1.1	mg/kg bw/d		NR	Beasley et al. 1991			Yes

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2,4-D acid	97.5%	Mammal	Rat	Fischer 344 Rat		Acute	Dietary	NR	NR	Developmental toxicity	NOAEL	NR		25	mg/kg/d			Nemec et al. 1983			Yes
2,4-D		Insect	Honey bee	*Apis mellifera*		Acute	Contact				NOAEL	NR		1075 [100]	mg/kg bw [ug/bee]			Palmer and Krueger 1997a,e			Yes
2,4-D acid	97.5%	Mammal	Rat	Fischer 344 Rat		Acute	Dietary			Decreased body weight and skeletal abnormality	LOAEL	NR		75	mg/kg/d			Nemec et al. 1983			Yes
2,4-D acid		Mammal	Dog (not specified)	*Canis lupus familiaris*		Chronic	Dietary	52 W	52 W	Decreased body weight and food consumption	LOAEL	NR		3.75	mg/kg/d		43049001	Dalgard 1993d			Yes
2,4-D acid		**Mammal**	**Dog (not specified)**	***Canis lupus familiaris***		**Chronic**	**Dietary**	**52 W**	**52 W**	**Decreased body weight and food consumption**	**NOAEL**	**NR**		**1**	**mg/kg/d**		**43049001**	**Dalgard 1993d**			**Yes**
2,4-D acid		**Mammal**	**Rat**	**Fischer 344 Rat**		**Chronic**	**Oral**	**2 gen**	**2 gen**	**Reproduction**	**NOAEL**	**NR**		**5**	**mg/kg/d**		**43612001, 00259442, 00259446, 00265489**	**Jeffries et al. 1995; USEPA 2004b**			**Yes**
EHE		Terrestrial plant	Tomato	*Solanum lycopersicum*	Seedling	Seedling emergence	Soil treatment			Seedling emergence	NOAEC	NR		> 0.96	lbs ae/acre			Backus 1992a			Yes
EHE		Terrestrial plant	Corn	*Zea mays*	Post-emergence	Vegetative vigor	Direct spray			Vegetative vigor	NOAEC	NR		> 0.96	lbs ae/acre			Backus 1992b			Yes
2,4-D acid		Amphibian	Toad	*Bufo melanosticus*	Tadpole	Acute		96-hr	96 hr	Mortality	LC50	NR		8.05	mg/L			Vardia et al. 1984			Yes
2,4-D acid		Fish	Carp	Family Cyprinidae		Acute	Water	96-hr		Mortality	LC50	NR		96.5	mg/L			Rehwoldt et al. 1977			Yes
DMA salt		Fish	Rainbow trout Bluegill sunfish	*Oncorhynchus mykiss* *Lepomis macrochirus*		Acute	Water	96-hr		Mortality	LC50	NR		830	mg/L			Vilkas 1997; Vilkas 1978 (as cited in USEPA/OPP 2004b)			Yes
2,4-D acid		Aquatic invertebrate	Water flea	*Daphnia magna*		Acute	Water	48-hr		Mortality	LC50	NR		25	mg/L			Alexander et al. 1983d, 1985			Yes
DMA salt		Aquatic invertebrate	Crayfish	*Procambarus clarkii*		Acute	Water	96-hr		Mortality	LC50	NR		1389	mg/L			Cheah et al. 1980			Yes
2,4-D diethanolamine		Aquatic invertebrate	Water flea	*Daphnia magna*		Chronic	Water				NOAEC	NR		16.05	mg/L			Holmes and Peters 1991			Yes
2,4-D acid		Aquatic invertebrate	Water flea	*Daphnia magna*		Chronic	Water				NOAEC	NR		75.7	mg/L			Ward 1991a			Yes
2,4-D acid		Aquatic plant		*Myriophyllum sibiricum*			Water			Survival and growth	EC25	NR		0.005	mg/L		NR	Roshon 1999			Yes
DMA salt		Aquatic plant	Sago pondweed	*Potamogeton pectinatus*			Water			Survival and growth	NOAEC	NR		2	mg/L		NR	Sprecher et al. 1998			Yes
2,4-D salt	56.7% a.i. free acid	fish	Rainbow trout	*Oncorhynchus mykiss*	post-swim-up	Static acute	water	96-hr	96-hr	mortality	ALC5	334	mg free acid/L	334	mg free acid/L			Fairchild et al 2007			Yes
2,4-D salt	56.7% a.i. free acid	fish	Rainbow trout	*Oncorhynchus mykiss*	post-swim-up	Static acute	water	96-hr	96-hr	mortality	ALC10	417	mg free acid/L	417	mg free acid/L			Fairchild et al 2007			Yes
2,4-D salt	56.7% a.i. free acid	fish	Rainbow trout	*Oncorhynchus mykiss*	post-swim-up	Static acute	water	96-hr	96-hr	mortality	ALC20	530	mg free acid/L	530	mg free acid/L			Fairchild et al 2007			Yes
2,4-D salt	56.7% a.i. free acid	fish	Rainbow trout	*Oncorhynchus mykiss*	post-swim-up	Static acute	water	96-hr	96-hr	mortality	ALC50	707	mg free acid/L	707	mg free acid/L			Fairchild et al 2007			Yes
2,4-D salt	56.7% a.i. free acid	fish	Rainbow trout	*Oncorhynchus mykiss*	post-swim-up	Static acute	water	96-hr	96-hr	mortality	30 d CLC1	56	mg free acid/L	56	mg free acid/L			Fairchild et al 2007			Yes

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2,4-D salt	56.7% a.i. free acid	fish	Bull trout	*Salvelinus confluentus*	post-swim-up	Static acute	water	96-hr	96-hr	mortality	ALC5	265	mg free acid/L	265	mg free acid/L			Fairchild et al 2007			Yes
2,4-D salt	56.7% a.i. free acid	fish	Bull trout	*Salvelinus confluentus*	post-swim-up	Static acute	water	96-hr	96-hr	mortality	ALC10	280	mg free acid/L	280	mg free acid/L			Fairchild et al 2007			Yes
2,4-D salt	56.7% a.i. free acid	fish	Bull trout	*Salvelinus confluentus*	post-swim-up	Static acute	water	96-hr	96-hr	mortality	ALC20	309	mg free acid/L	309	mg free acid/L			Fairchild et al 2007			Yes
2,4-D salt	56.7% a.i. free acid	fish	Bull trout	*Salvelinus confluentus*	post-swim-up	Static acute	water	96-hr	96-hr	mortality	ALC50	398	mg free acid/L	398	mg free acid/L			Fairchild et al 2007			Yes
2,4-D salt	56.7% a.i. free acid	fish	Bull trout	*Salvelinus confluentus*	post-swim-up	Static acute	water	96-hr	96-hr	mortality	30 d CLC1	84	mg free acid/L	84	mg free acid/L			Fairchild et al 2007			Yes
2,4-D acid	46.8% ai as salt, 39.9% ai as free acid	fish	rainbow trout	*Onchorhyncus mykiss*	Juvenile	acute	Flow-through	24 hr	96 hr	mortality	ALC50	1335	mg free acid/L	1335	mg free acid/L			Fairchild et al 2009			Yes
2,4-D acid	46.8% ai as salt, 39.9% ai as free acid	fish	rainbow trout	*Onchorhyncus mykiss*	Juvenile	acute	Flow-through	48 hr	96 hr	mortality	ALC50	628	mg free acid/L	628	mg free acid/L			Fairchild et al 2009			Yes
2,4-D acid	46.8% ai as salt, 39.9% ai as free acid	fish	rainbow trout	*Onchorhyncus mykiss*	Juvenile	acute	Flow-through	72 hr	96 hr	mortality	ALC50	499	mg free acid/L	499	mg free acid/L			Fairchild et al 2009			Yes
2,4-D acid	46.8% ai as salt, 39.9% ai as free acid	fish	rainbow trout	*Onchorhyncus mykiss*	Juvenile	acute	Flow-through	96 hr	96 hr	mortality	ALC50	494	mg free acid/L	494	mg free acid/L			Fairchild et al 2009			Yes
2,4-D acid	46.8% ai as salt, 39.9% ai as free acid	fish	rainbow trout	*Onchorhyncus mykiss*	Juvenile	chronic	Flow-through	30 d	30 d	growth	NOEC	108	mg free acid/L	108	mg free acid/L			Fairchild et al 2009			Yes
2,4-D acid	46.8% ai as salt, 39.9% ai as free acid	fish	rainbow trout	*Onchorhyncus mykiss*	swim-up fry	chronic	Flow-through	30 d	30 d	growth	NOEC	54	mg free acid/L	54	mg free acid/L			Fairchild et al 2009			Yes
2,4-D acid	46.8% ai as salt, 39.9% ai as free acid	fish	rainbow trout	*Onchorhyncus mykiss*	swim-up fry	chronic	Flow-through	30 d	30 d	growth	LOEC	108	mg free acid/L	108	mg free acid/L			Fairchild et al 2009			Yes
2,4-D acid	46.8% ai as salt, 39.9% ai as free acid	fish	rainbow trout	*Onchorhyncus mykiss*	swim-up fry	chronic	Flow-through	30 d	30 d	growth	MATC	76	mg free acid/L	76	mg free acid/L			Fairchild et al 2009			Yes
2,4-D acid	46.8% ai as salt, 39.9% ai as free acid	fish	rainbow trout	*Onchorhyncus mykiss*	swim-up fry	acute	Flow-through	96 hr	96 hr	mortality	30 d CLC1	260	mg free acid/L	260	mg free acid/L			Fairchild et al 2009			Yes
2,4-D acid	46.8% ai as salt, 39.9% ai as free acid	fish	rainbow trout	*Onchorhyncus mykiss*	swim-up fry	acute	Flow-through	96 hr	96 hr	mortality	30 d CLC10	343	mg free acid/L	343	mg free acid/L			Fairchild et al 2009			Yes
2,4-D acid		aquatic invertebrate	crayfish	*Astacus leptodactylus*		acute	water	96 hr	96 hr	mortality	LC50	32.6	mg/L	32.6	mg/L			Benli et al 2007			Yes
2,4-D acid		Aquatic plant		*Lemna triscula*		water	single application	28 d	28 d	growth-biomass	EC50	> 3000	ug/L	> 3000 [3]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Elodea nuttallii (A)*		water	single application	28 d	28 d	growth-biomass	EC50	> 3000	ug/L	> 3000 [3]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Ranunculus circinatus*		water	single application	28 d	28 d	growth-biomass	EC50	2731	ug/L	2731 [2.7]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Ranunculus aquatilis*		water	single application	28 d	28 d	growth-biomass	EC50	> 3000	ug/L	> 3000 [3]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Potamogeton crispus*		water	single application	28 d	28 d	growth-biomass	EC50	> 3000	ug/L	> 3000 [3]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Potamogeton lucens*		water	single application	28 d	28 d	growth-biomass	EC50	> 3000	ug/L	> 3000 [3]	ug/L [mg/L]			Belgers et al 2007			Yes

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2,4-D acid		Aquatic plant		*Elodea nuttallii (B)*		water	single application	28 d	28 d	growth-biomass	EC50	2243	ug/L	2243 [2.2]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Lemna triscula*		water	single application	28 d	28 d	relative growth	EC50	> 3000	ug/L	> 3000 [3]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Elodea nuttallii (A)*		water	single application	28 d	28 d	relative growth	EC50	> 3000	ug/L	> 3000 [3]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Ranunculus circinatus*		water	single application	28 d	28 d	relative growth	EC50	719	ug/L	719 [0.7]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Ranunculus aquatilis*		water	single application	28 d	28 d	relative growth	EC50	242	ug/L	242 [.2]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Potamogeton crispus*		water	single application	28 d	28 d	relative growth	EC50	> 3000	ug/L	> 3000 [3]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Potamogeton lucens*		water	single application	28 d	28 d	relative growth	EC50	1300	ug/L	1300 [1.3]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Elodea nuttallii (B)*		water	single application	28 d	28 d	relative growth	EC50	292	ug/L	292 [0.3]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Elodea nuttallii (A)*		water	single application	28 d	28 d	growth-root weight	EC50	898	ug/L	898 [0.9]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Ranunculus circinatus*		water	single application	28 d	28 d	growth-root weight	EC50	111	ug/L	111 [0.1]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Potamogeton crispus*		water	single application	28 d	28 d	growth-root weight	EC50	347	ug/L	347 [0.3]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Ranunculus peltatus*		water	single application	28 d	28 d	growth-root weight	EC50	245	ug/L	245 [0.2]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Elodea nuttallii (B)*		water	single application	28 d	28 d	growth-root weight	EC50	1096	ug/L	1096 [1.1]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Elodea nuttallii (A)*		water	single application	28 d	28 d	growth-shoot length	EC50	> 3000	ug/L	> 3000 [3]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Ranunculus circinatus*		water	single application	28 d	28 d	growth-shoot length	EC50	1120	ug/L	1120 [1.1]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Ranunculus aquatilis*		water	single application	28 d	28 d	growth-shoot length	EC50	683	ug/L	683 [0.7]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Potamogeton crispus*		water	single application	28 d	28 d	growth-shoot length	EC50	1988	ug/L	1988 [2.0]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Ranunculus peltatus*		water	single application	28 d	28 d	growth-shoot length	EC50	140	ug/L	140 [0.1]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Potamogeton lucens*		water	single application	28 d	28 d	growth-shoot length	EC50	1063	ug/L	1063 [1.1]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Elodea nuttallii (B)*		water	single application	28 d	28 d	growth-shoot length	EC50	785	ug/L	785 [0.8]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Elodea nuttallii (A)*		water	single application	28 d	28 d	growth-root length	EC50	574	ug/L	574 [0.6]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Ranunculus circinatus*		water	single application	28 d	28 d	growth-root length	EC50	100	ug/L	100 [0.1]	ug/L [mg/L]			Belgers et al 2007			Yes

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2,4-D acid		Aquatic plant		*Ranunculus aquatilis*		water	single application	28 d	28 d	growth-root length	EC50	92	ug/L	92 [0.09]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Potamogeton crispus*		water	single application	28 d	28 d	growth-root length	EC50	290	ug/L	290 [0.3]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Ranunculus peltatus*		water	single application	28 d	28 d	growth-root length	EC50	263	ug/L	263 [0.3]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Potamogeton lucens*		water	single application	28 d	28 d	growth-root length	EC50	181	ug/L	181 [0.2]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Elodea nuttallii (B)*		water	single application	28 d	28 d	growth-root length	EC50	997	ug/L	997 [1.0]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Elodea nuttallii (A)*		water	single application	28 d	28 d	growth-# of roots	EC50	982	ug/L	982 [1.0]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Ranunculus circinatus*		water	single application	28 d	28 d	growth-# of roots	EC50	112	ug/L	112 [0.1]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Potamogeton crispus*		water	single application	28 d	28 d	growth-# of roots	EC50	326	ug/L	326 [0.3]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Ranunculus peltatus*		water	single application	28 d	28 d	growth-# of roots	EC50	271	ug/L	271 [0.3]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Potamogeton lucens*		water	single application	28 d	28 d	growth-# of roots	EC50	299	ug/L	299 [0.3]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Elodea nuttallii (B)*		water	single application	28 d	28 d	growth-# of roots	EC50	1807	ug/L	1807 [1.8]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Potamogeton lucens*		water	single application	28 d	28 d	growth-biomass	EC50	> 3000	ug/L	> 3000 [3]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Potamogeton lucens*		water	single application	28 d	28 d	relative growth	EC50	1348	ug/L	1348 [1.3]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Ranunculus circinatus*		water	single application	28 d	28 d	growth-root weight	EC50	51	ug/L	51 [0.05]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Ranunculus aquatilis*		water	single application	28 d	28 d	growth-shoot length	EC50	342	ug/L	342 [0.3]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Ranunculus peltatus*		water	single application	28 d	28 d	growth-shoot length	EC50	76	ug/L	76 [0.08]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Elodea nuttallii (B)*		water	single application	28 d	28 d	growth-shoot length	EC50	1035	ug/L	1035 [1.0]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Elodea nuttallii (A)*		water	single application	28 d	28 d	growth-root length	EC50	334	ug/L	334 [0.3]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Ranunculus aquatilis*		water	single application	28 d	28 d	growth-root length	EC50	108	ug/L	108 [0.1]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Potamogeton crispus*		water	single application	28 d	28 d	growth-root length	EC50	124	ug/L	124 [0.1]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Ranunculus peltatus*		water	single application	28 d	28 d	growth-root length	EC50	499	ug/L	499 [0.5]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Elodea nuttallii (A)*		water	single application	28 d	28 d	growth-# of roots	EC50	1073	ug/L	1073 [1.1]	ug/L [mg/L]			Belgers et al 2007			Yes

Formulation	% purity a.i.	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint	Toxicity Value (tested product)[1]	Units	Toxicity Value (a.e.)[1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4-D acid		Aquatic plant		*Potamogeton crispus*		water	single application	28 d	28 d	growth-# of roots	EC50	191	ug/L	191 [0.2]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Potamogeton lucens*		water	single application	28 d	28 d	growth-# of roots	EC50	302	ug/L	302 [0.3]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Mammal	Rat	*Rattus* spp.		Acute	Oral			Mortality	LD50	639	mg/kg bw	699	mg/kg bw		00101605	Johnson et al. 1981a			Yes
DEA salt		Mammal	Rat	*Rattus* spp.		Acute	Oral			Mortality	LD50	735	mg/kg bw	618.8	mg/kg bw		41920901	Shults et al. 1990			Yes
DMA salt		Mammal	Rat	*Rattus* spp.		Acute	Oral			Mortality	LD50	949	mg/kg bw	788	mg/kg bw		00157512, 00101603	Jeffrey et al. 1986; Johnson et al. 1981b			Yes
IPA salt		Mammal	Rat	*Rattus* spp.		Acute	Oral			Mortality	LD50	1646	mg/kg	1300	mg/kg		00252291	USEPA/OPP 2005b, 2004a			Yes
IPE		Mammal	Rat	*Rattus* spp.		Acute	Oral			Mortality	LD50	1250	mg/kg bw	1050	mg/kg bw		41709901	Lilja 1990a			Yes
TIPA salt		**Mammal**	**Rat**	***Rattus* spp.**		**Acute**	**Oral**	**NR**	**NR**	**Mortality**	**LD50**	**1074**	**mg/kg bw**	**579**	**mg/kg bw**		**41413501**	**Berdasco et al. 1989a**			**Yes**
BEE ester		Mammal	Rat	*Rattus* spp.		Acute	Oral			Mortality	LD50	866	mg/kg bw	589	mg/kg bw		40629801	Jeffrey et al. 1987a			Yes
EHE ester		Mammal	Rat	*Rattus* spp.		Acute	Oral			Mortality	LD50	896	mg/kg bw	591	mg/kg bw		41209001	Mahlburg 1988a			Yes
2,4-D acid		Mammal	Rabbit	*Leporidae* spp.		Acute	Dermal			Mortality	LD50	> 2000	mg/kg bw	> 2000	mg/kg bw		00101596	Mayhew et al. 1981			Yes
DEA salt		Mammal	Rabbit	*Leporidae* spp.		Acute	Dermal			Mortality	LD50	> 2000	mg/kg bw	> 1355	mg/kg bw		41920911	Shults et al. 1991			Yes
DMA salt		Mammal	Rabbit	*Leporidae* spp.		Acute	Dermal			Mortality	LD50	> 1829	mg/kg bw	1519	mg/kg bw		00157513	Carreon et al. 1986			Yes
IPA salt		Mammal	Rabbit	*Leporidae* spp.		Acute	Dermal			Mortality	LD50	> 2000	mg/kg	> 1578	mg/kg		00252291	USEPA/OPP 2005b			Yes
IPE		Mammal	Rabbit	*Leporidae* spp.		Acute	Dermal			Mortality	LD50	> 2000	mg/kg bw	> 1680	mg/kg bw		41709902	Lilja 1990b			Yes
TIPA salt		**Mammal**	**Rabbit**	***Leporidae* spp.**		**Acute**	**Dermal**	**NR**	**NR**	**Mortality**	**LD50**	**> 2000**	**mg/kg bw**	**> 1072**	**mg/kg bw**		**41413502**	**Berdasco et al. 1989b**			**Yes**
BEE ester		Mammal	Rabbit	*Leporidae* spp.		Acute	Dermal			Mortality	LD50	> 2000	mg/kg bw	> 1376	mg/kg bw		40629802	Jeffrey et al. 1987b			Yes
EHE ester		Mammal	Rabbit	*Leporidae* spp.		Acute	Dermal			Mortality	LD50	> 2000	mg/kg bw	1326	mg/kg bw		41209002	Mahlburg 1988b			Yes
2,4-DP 2-Butoxyethyl, Ester Mix(Alchem 76)	100	Bird	Mallard duck	*Anas platyrhynchos*	14 D	Diet	Dietary	5 D	8 D		NOEL	10000	PPM	6,880 [688]	ppm [mg/kg bw/d]	Truslo Farm Inc.	00102908	1976[3,4]	C. Laird	1989	Yes
DMA salt		Mammal	English pointer		1 year	Acute	Capsule, single dose		26 hours	Neurotoxicity	LOAEL	NR		8.8	mg/kg bw/d		NR	Beasley et al. 1991			Yes
2,4-D acid		Mammal	Rat	*Rattus* spp.		Acute					NOAEL	NR		67	mg/kg bw/d		43115201	Mattsson et al. 1994a			Yes
2,4-D acid		Mammal	Rat	*Rattus* spp.		Acute				Increased incidence of incoordination and slight gait abnormalities and decreased motor activity.	LOAEL	NR		227	mg/kg bw/d		43115201	Mattsson et al. 1994a			Yes

Spreadsheet of Toxicity Data for 2,4-D Acid and Salt TRVs

Formulation	% purity a.i.	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint	Toxicity Value (tested product)[1]	Units	Toxicity Value (a.e.)[1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
TIPA salt		Mammal	Rat	*Rattus* spp.		Acute				Weight gain, mortality	LOAEL	NR		17	mg/kg/d		41527102	Schroeder 1990a			Yes
DEA salt		Mammal	Rabbit	*Leporidae* spp.		Acute				Weight gain, food consumption	NOAEL	NR		10.2	mg/kg/d		42055501	Rodwell 1991b			Yes
IPA salt		Mammal	Rabbit	*Leporidae* spp.		Acute				Maternal weight gain	NOAEL			10	mg/kg/day		42158704	Rowland 1992			Yes
TIPA salt		Mammal	Rabbit	*Leporidae* spp.		Acute				Mortality (developmental)	NOAEL	NR		10	mg/kg/d		42158705	Rowland 1992			Yes
BEE ester		Mammal	Rabbit	*Leporidae* spp.		Acute				Mortality (developmental)	NOAEL	NR		10	mg/kg/d		41527101	Schroeder 1990b			Yes
2-EHE		Mammal	Rat	*Rattus* spp.		Acute				Developmental toxicity	NOAEL	NR		10	mg/kg/d		42304601	Martin 1992d			Yes
2,4-D acid		Mammal	Mouse	*Mus* spp.		Chronic				Kidney effects	LOAEL	NR		62	mg/kg/d		43879801, 43597201	Stot et al. 1995 a,b			Yes
2,4-D acid		Mammal	Mouse	*Mus* spp.		Chronic				Kidney effects	NOAEL	NR		5	mg/kg/d		43879801, 43597201	Stot et al. 1995 a,b			Yes
DMA salt		Mammal	Mouse	*Mus* spp.			Drinking water	Days 6-16 of gestation		Developmental toxicity	NOAEL	NR		8.5	mg/kg/d			Lee et al. 2001			Yes
2,4-D acid		Mammal	Dog (not specified)	*Canis lupus familiaris*		Subchronic	Dietary	90 d			LOAEL	NR		3	mg/kg/d		41737301	Schulze 1990a			Yes
2,4-D acid		Mammal	Dog (not specified)	*Canis lupus familiaris*		Subchronic	Dietary	90 d			NOAEL	NR		1	mg/kg/d		41737301	Schulze 1990a			Yes
2,4-D acid		Mammal	Rabbit	*Leporidae* spp.						Developmental toxicity	NOAEL	NR		30	mg/kg/d		41747601	Hoberman 1990			Yes
2,4-D acid		Mammal	Rabbit	*Leporidae* spp.			Dermal	21-d			NOAEL	NR		1000	mg/kg/d		41735304	Schulze 1990b			Yes

Notes
Boldface indicates study selected for derivation of toxicity reference value (TRV) used in risk assessment.
If the USEPA had reviewed the study and classified the study as "acceptable", the study's findings were considered "acceptable" for development of TRVs. "Supplemental" studies were used to fill in gaps where "Core" studies were unavailable.
[1] Toxicity values relate the dose of a compound with a potentially adverse effect. Values are reported as they were presented in the reviewed source.
[2] See the bibliography of this ERA document, Appendix A of the associated literature review document, and source footnote for complete citations.
[3] As cited in USEPA 2010.
[4] No author listed.
[5] Invalid study. See '*Pesticide Ecological Effects Database Guidance Manual-Updated 10/26/05*' (USEPA 2005).

Abbreviations
a.i. - active ingredient
a.e. - acid equivalent
b.w. - body weight
EPA - Environmental Protection Agency
f - female
g - grams
m - male
MRID - Master Record Identification Number
NR - Not reported
ppb - parts per billion
ppm - parts per million

Endpoints
EC_{25} - 25% effect concentration
EC_{50} - 50% effect concentration
LC_{50} - median lethal concentration, 50% mortality
LD_{50} - median lethal dose, 50% mortality
LOEL - lowest observable effect level
NOEL - no observable effect level
LOEC - lowest observable effect concentration
MATC - maximum acceptable toxicant concentration
NOEC - no observable effect concentration
CLC_1 - 1% chronic lethal concentration
CLC_{10} - 10% chronic lethal concentration
ALC_{10} - 10% acute lethal concentration
ALC_{20} - 20% acute lethal concentration
ALC_5 - 5% acute lethal concentration
ALC_{50} - 50% acute lethal concentration
NOAEC - no observable adverse effect concentration
NOAEL - no observable adverse effect level

Durations
hr - hours
d - days
w - weeks
mo - months
y - years
gen - generations

Chemical forms of 2,4-D that are considered in this risk assessment:
2,4-D Acid
2,4-D Sodium salt
2,4-D Diethanolamine (DEA) salt
2,4-D Dimethylamine (DMA) salt
2,4-D Isopropylamine (IPA) salt
2,4-D Triisopropanolamine (TIPA) salt
2,4-D 2-Butoxyethyl (BEE) ester
2,4-D 2-Ethylhexyl (2-EHE) ester
2,4-D Isopropyl (IPE) ester

APPENDIX B – SUMMARY OF AVAILABLE AND RELEVANT TOXICITY DATA FOR 2,4-D

APPENDIX B.3 – SPREADSHEET OF TOXICITY DATA FOR 2,4-D TRV ESTER TRVS

Formulation	% purity	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint	Toxicity Value (tested product)[1]	Units	Toxicity Value (a.e.) [1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Cucumber	*Cucumis sativus*	Juvenile	Vegetative vigor (phytotoxicity)	Direct spray	21 D	21 D	Vegetative vigor	EC25	0.002	lbs ai/acre	0.0013	lbs ae/acre	Pan Agicultural Laboratory, CA	43279201	1994[3,4]	B. Montague	2000	Yes
2,4 DP-p-2-EHE	**95.7**	**Terrestrial Plant**	**Cucumber**	***Cucumis sativus***	**Juvenile**	**Vegetative vigor (phytotoxicity)**	**Direct spray**	**21 D**	**21 D**	**Vegetative vigor**	**NOEL**	**0.0004**	**lbs ai/acre**	**0.0003**	**lbs ae/acre**	**Pan Agicultural Laboratory, CA**	**43279201**	**1994[3,4]**	**B. Montague**	**2000**	**Yes**
2,4 DP-p-2-EHE	**95.7**	**Terrestrial Plant**	**Onion**	***Allium cepa***	**Seedling**	**Seedling emergence (root weight)**	**Soil treatment**	**21 D**	**21 D**	**Germination**	**EC25**	**0.001**	**lbs ai/acre**	**0.0007**	**lbs ae/acre**	**Pan Agicultural Laboratory, CA**	**43279202**	**1994[3,4]**	**B. Montague**	**2000**	**Yes**
2,4 DP-p-2-EHE	**95.7**	**Terrestrial Plant**	**Onion**	***Allium cepa***	**Seedling**	**Seedling emergence (root weight)**	**Soil treatment**	**21 D**	**21 D**	**Germination**	**NOEL**	**0.0004**	**lbs ai/acre**	**0.0003**	**lbs ae/acre**	**Pan Agicultural Laboratory, CA**	**43279202**	**1994[3,4]**	**B. Montague**	**2000**	**Yes**
2,4-D Isopropyl Ester	**98.2**	**Terrestrial Plant**	**Lettuce**	***Lactuca sativa***	**Seedling**	**Seedling emergence (shoot height)**	**Soil treatment**	**14 D**	**14 D**	**Germination**	**EC25**	**0.00079**	**lbs ai/acre**	**0.0007**	**lbs ae/acre**	**Springborn Laboratory Inc., MA**	**43982101**	**1996[3,4]**	**Contract Draft GAI**	**1999**	**Yes**
2,4-D Isopropyl Ester	98.2	Terrestrial Plant	Lettuce	*Lactuca sativa*	Seedling	Seedling emergence (shoot height)	Soil treatment	14 D	14 D	Germination	NOEL	0.00056	lbs ai/acre	0.0005	lbs ae/acre	Springborn Laboratory Inc., MA	43982101	1996[3,4]	Contract Draft GAI	1999	Yes
2,4-DB DMA	Tech	Terrestrial Plant	Carrot	*Daucus carota*	Seedling	Seedling emergence (shoot height)	Soil treatment	14 D	14 D	Germination	EC25	0.003	lbs ai/acre	0.002	lbs ae/acre	Analytical Biochemical Laboratory, Columbia, Missouri	43279201	1997[3,4]	D. Rieder	1998	Yes
2,4-DB DMA	Tech	Terrestrial Plant	Carrot	*Daucus carota*	Seedling	Seedling emergence (shoot height)	Soil treatment	14 D	14 D	Germination	NOEL	0.001	lbs ai/acre	0.001	lbs ae/acre	Analytical Biochemical Laboratory, Columbia, Missouri	43279201	1997[3,4]	D. Rieder	1998	Yes
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Onion	*Allium cepa*	Juvenile	Vegetative vigor (root weight)	Direct spray	21 D	21 D	Vegetative vigor	EC25	0.02	lbs ai/acre	0.0133	lbs ae/acre	Pan Agicultural Laboratory, CA	43279201	1994[3,4]	B. Montague	2000	Yes
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Onion	*Allium cepa*	Juvenile	Vegetative vigor (root weight)	Direct spray	21 D	21 D	Vegetative vigor	NOEL	0.001	lbs ai/acre	0.0007	lbs ae/acre	Pan Agicultural Laboratory, CA	43279201	1994[3,4]	B. Montague	2000	Yes
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Lettuce	*Lactuca sativa*	Juvenile	Vegetative vigor (root weight)	Direct spray	21 D	21 D	Vegetative vigor	EC25	0.014	lbs ai/acre	0.0093	lbs ae/acre	Pan Agicultural Laboratory, CA	43279201	1994[3,4]	B. Montague	2000	Yes
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Lettuce	*Lactuca sativa*	Juvenile	Vegetative vigor (root weight)	Direct spray	21 D	21 D	Vegetative vigor	NOEL	0.001	lbs ai/acre	0.0007	lbs ae/acre	Pan Agicultural Laboratory, CA	43279201	1994[3,4]	B. Montague	2000	Yes
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Radish	*Raphanus sativus*	Juvenile	Vegetative vigor (root weight)	Direct spray	21 D	21 D	Vegetative vigor	EC25	0.017	lbs ai/acre	0.0113	lbs ae/acre	Pan Agicultural Laboratory, CA	43197002	1994[3,4]	B. Montague	2000	Yes
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Radish	*Raphanus sativus*	Juvenile	Vegetative vigor (root weight)	Direct spray	21 D	21 D	Vegetative vigor	NOEL	0.001	lbs ai/acre	0.0007	lbs ae/acre	Pan Agicultural Laboratory, CA	43197002	1994[3,4]	B. Montague	2000	Yes
2,4-D Tri,isopropylamine salt	67.9	Terrestrial Plant	Wheat	*Triticum aestivum*	Seedling	Seedling germination	Soil treatment	5 D	5 D	Germination	EC25	0.037	lbs ai/acre	0.020	lbs ae/acre	Landis International Inc., Valdesta, GA	43982101	1994[3,4]	R. Hirsch	2000	Yes
2,4-D Tri,isopropylamine salt	67.9	Terrestrial Plant	Wheat	*Triticum aestivum*	Seedling	Seedling germination	Soil treatment	5 D	5 D	Germination	NOEL	0.001	lbs ai/acre	0.001	lbs ae/acre	Landis International Inc., Valdesta, GA	43982101	1994[3,4]	R. Hirsch	2000	Yes
2,4-D Isopropyl Ester	98.2	Terrestrial Plant	Cabbage	*Brassica oleracea*	Seedling	Seedling emergence	Soil treatment	14 D	14 D	Germination	EC25	0.0029	lbs ai/acre	0.0024	lbs ae/acre	Springborn Laboratory Inc., MA	43279202	1996[3,4]	Contract Draft GAI	1999	Yes
2,4-D Isopropyl Ester	98.2	Terrestrial Plant	Cabbage	*Brassica oleracea*	Seedling	Seedling emergence	Soil treatment	14 D	14 D	Germination	NOEL	0.0011	lbs ai/acre	0.0009	lbs ae/acre	Springborn Laboratory Inc., MA	43279202	1996[3,4]	Contract Draft GAI	1999	Yes
2,4-D Diethanolamine salt	73.8	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Juvenile	Vegetative vigor (shoot weight)	Direct spray	14 D	14 D	Vegetative vigor	EC25	0.005	lbs ai/acre	0.003	lbs ae/acre	Ricera Inc. Ohio	43982101	1992[3,4]	H. Craven (KBN)	1993	Supplemental
2,4-D Diethanolamine salt	73.8	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Juvenile	Vegetative vigor (shoot weight)	Direct spray	14 D	14 D	Vegetative vigor	NOEL	0.002	lbs ai/acre	0.001	lbs ae/acre	Ricera Inc. Ohio	43982101	1992[3,4]	H. Craven (KBN)	1993	Supplemental
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	21 D	21 D	Germination	EC25	0.009	lbs ai/acre	0.0060	lbs ae/acre	Pan Agicultural Laboratory, CA	43016701	1994[3,4]	B. Montague	2000	Yes
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	21 D	21 D	Germination	NOEL	0.003	lbs ai/acre	0.0020	lbs ae/acre	Pan Agicultural Laboratory, CA	43016701	1994[3,4]	B. Montague	2000	Yes

Formulation	% purity	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint	Toxicity Value (tested product)[1]	Units	Toxicity Value (a.e.)[1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4-D Isopropyl Ester	98.2	Terrestrial Plant	Cabbage	*Brassica oleracea*	Juvenile	Vegetative vigor (root weight)	Direct spray	14 D	14 D	Vegetative vigor	EC25	0.012	lbs ai/acre	0.0101	lbs ae/acre	Springborn Laboratory Inc., MA	43016701	1996[3,4]	Contract Draft GAI	1999	Yes
2,4-D Isopropyl Ester	98.2	Terrestrial Plant	Cabbage	*Brassica oleracea*	Juvenile	Vegetative vigor (root weight)	Direct spray	14 D	14 D	Vegetative vigor	NOEL	0.003	lbs ai/acre	0.0025	lbs ae/acre	Springborn Laboratory Inc., MA	43016701	1996[3,4]	Contract Draft GAI	1999	Yes
2,4-DP-p, DMA salt	63.	Terrestrial Plant	Lettuce	*Lactuca sativa*	Juvenile	Vegetative vigor	Direct spray	21 D	21 D	Vegetative vigor	EC25	> 0.017	lbs ai/acre	> 0.014	lbs ae/acre	California Agicultural Research Inc. Karman, CA	43016701	1993[3,4]	J. Goodyear	1994	Supplemental
2,4-DP-p, DMA salt	63.	Terrestrial Plant	Lettuce	*Lactuca sativa*	Juvenile	Vegetative vigor	Direct spray	21 D	21 D	Vegetative vigor	NOEL	0.003	lbs ai/acre	0.002	lbs ae/acre	California Agicultural Research Inc. Karman, CA	43016701	1993[3,4]	J. Goodyear	1994	Supplemental
2,4-DP-p, DMA salt	63	Terrestrial Plant	Radish	*Raphanus sativus*	Juvenile	Vegetative vigor (shoot height)	Direct spray	21 D	21 D	Vegetative vigor	EC25	0.036	lbs ai/acre	0.030	lbs ae/acre	California Agicultural Research Inc. Karman, CA	43197002	1993[3,4]	J. Goodyear	1994	Supplemental
2,4-DP-p, DMA salt	63	Terrestrial Plant	Radish	*Raphanus sativus*	Juvenile	Vegetative vigor (shoot height)	Direct spray	21 D	21 D	Vegetative vigor	NOEL	< 0.003	lbs ai/acre	< 0.002	lbs ae/acre	California Agicultural Research Inc. Karman, CA	43197002	1993[3,4]	J. Goodyear	1994	Supplemental
2,4-DP-p, DMA salt	63	Terrestrial Plant	Cabbage	*Brassica oleracea*	Juvenile	Vegetative vigor	Direct spray	21 D	21 D	Vegetative vigor	EC25	NR	lbs ai/acre	NR	lbs ae/acre	California Agicultural Research Inc. Karman, CA	43197002	1993[3,4]	J. Goodyear	1994	No
2,4-DP-p, DMA salt	63	Terrestrial Plant	Cabbage	*Brassica oleracea*	Juvenile	Vegetative vigor	Direct spray	21 D	21 D	Vegetative vigor	NOEL	0.003	lbs ai/acre	0.002	lbs ae/acre	California Agicultural Research Inc. Karman, CA	43197002	1993[3,4]	J. Goodyear	1994	Supplemental
2,4-DP-p, DMA salt	63.62	Terrestrial Plant	Onion	*Allium cepa*	Seedling	Seedling germination	Soil treatment	7 D	7 D	Germination	EC25	0.007	lbs ai/acre	0.006	lbs ae/acre	California Agicultural Research Inc. Karman, CA	43197002	1993[3,4]	W. Evans	2001	Supplemental
2,4-DP-p, DMA salt	63.62	Terrestrial Plant	Onion	*Allium cepa*	Seedling	Seedling germination	Soil treatment	7 D	7 D	Germination	NOEL	0.004	lbs ai/acre	0.003	lbs ae/acre	California Agicultural Research Inc. Karman, CA	43197002	1993[3,4]	W. Evans	2001	Supplemental
2,4-DP-p, DMA salt	63	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Juvenile	Vegetative vigor	Direct spray	21 D	21 D	Vegetative vigor	EC25	0.013	lbs ai/acre	0.011	lbs ae/acre	California Agicultural Research Inc. Karman, CA	42343902	1993[3,4]	J. Goodyear	1994	Supplemental
2,4-DP-p, DMA salt	63	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Juvenile	Vegetative vigor	Direct spray	21 D	21 D	Vegetative vigor	NOEL	0.004	lbs ai/acre	0.003	lbs ae/acre	California Agicultural Research Inc. Karman, CA	42343902	1993[3,4]	J. Goodyear	1994	Supplemental
2,4-D Tri,isopropylamine salt	67.9	Terrestrial Plant	Sunflower	*Helianthus annus*	Seedling	Seedling germination	Soil treatment	5 D	5 D	Germination	EC25	0.014	lbs ai/acre	0.008	lbs ae/acre	Landis International Inc., Valdesta, GA	43098902	1994[3,4]	R. Hirsch	2000	Yes
2,4-D Tri,isopropylamine salt	67.9	Terrestrial Plant	Sunflower	*Helianthus annus*	Seedling	Seedling germination	Soil treatment	5 D	5 D	Germination	NOEL	0.005	lbs ai/acre	0.003	lbs ae/acre	Landis International Inc., Valdesta, GA	43098902	1994[3,4]	R. Hirsch	2000	Yes
2,4-D Tri,isopropylamine salt	67.9	Terrestrial Plant	Carrot	*Daucus carota*	Seedling	Seedling germination	Soil treatment	5 D	5 D	Germination	EC25	0.019	lbs ai/acre	0.010	lbs ae/acre	Landis International Inc., Valdesta, GA	42343902	1994[3,4]	R. Hirsch	2000	Yes
2,4-D Tri,isopropylamine salt	67.9	Terrestrial Plant	Carrot	*Daucus carota*	Seedling	Seedling germination	Soil treatment	5 D	5 D	Germination	NOEL	0.005	lbs ai/acre	0.003	lbs ae/acre	Landis International Inc., Valdesta, GA	42343902	1994[3,4]	R. Hirsch	2000	Yes
2,4-D Tri,isopropylamine salt	67.9	Terrestrial Plant	Radish	*Raphanus sativus*	Seedling	Seedling germination	Soil treatment	5 D	5 D	Germination	EC25	0.014	lbs ai/acre	0.008	lbs ae/acre	Landis International Inc., Valdesta, GA	42343902	1994[3,4]	R. Hirsch	2000	Yes
2,4-D Tri,isopropylamine salt	67.9	Terrestrial Plant	Radish	*Raphanus sativus*	Seedling	Seedling germination	Soil treatment	5 D	5 D	Germination	NOEL	0.005	lbs ai/acre	0.003	lbs ae/acre	Landis International Inc., Valdesta, GA	42343902	1994[3,4]	R. Hirsch	2000	Yes
2,4-D Diethanolamine salt	73.8	Terrestrial Plant	Mustard	*Brassica juncea*	Seedling	Seedling emergence (shoot weight)	Soil treatment	7 D	7 D	Germination	EC25	< 0.005	lbs ai/acre	< 0.003	lbs ae/acre	Ricera Inc. Ohio	42343902	1992[3,4]	H. Craven (KBN)	1993	Supplemental
2,4-D Diethanolamine salt	73.8	Terrestrial Plant	Mustard	*Brassica juncea*	Seedling	Seedling emergence (shoot weight)	Soil treatment	7 D	7 D	Germination	NOEL	< 0.005	lbs ai/acre	< 0.003	lbs ae/acre	Ricera Inc. Ohio	42343902	1992[3,4]	H. Craven (KBN)	1993	Supplemental
2,4-D 2 EHE	63.5	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Not reported	Vegetative vigor (shoot height)	Direct spray	14 D	14 D	Vegetative vigor	EC25	0.01	lbs ai/acre	0.0066	lbs ae/acre	Ricera Inc. Ohio	43982101	1992[3,4]	R. Petrie	1992	Supplemental
2,4-D 2 EHE	63.5	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Not reported	Vegetative vigor (shoot height)	Direct spray	14 D	14 D	Vegetative vigor	NOEL	0.006	lbs ai/acre	0.0040	lbs ae/acre	Ricera Inc. Ohio	43982101	1992[3,4]	R. Petrie	1992	Supplemental

Formulation	% purity	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint	Toxicity Value (tested product)[1]	Units	Toxicity Value (a.e.)[1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4 DP-p-2-EHE	93.2	Aquatic Plant	Green algae	*Selenastrum capricornutum*	Not reported	Static	Water	5 D	5 D		EC50	0.26	PPM	0.2	PPM	Springborn Laboratory Inc., MA	42343902	1993[3,4]	Contract Draft-KBN	1998	Yes
2,4 DP-p-2-EHE	93.2	Aquatic Plant	Green algae	*Selenastrum capricornutum*	Not reported	Static	Water	5 D	5 D		NOEL	< 0.006	PPM	< 0.004	PPM	Springborn Laboratory Inc., MA	42343902	1993[3,4]	Contract Draft-KBN	1998	Yes
2,4-D 2-EHE	63.5	Terrestrial Plant	Sorghum	*Sorghum bicolor*	Juvenile	Vegetative vigor (root weight)	Direct spray	21 D	21 D	Vegetative vigor	EC25	0.01	lbs ai/acre	0.0066	lbs ae/acre	Ricera Inc. Ohio	43982101	1992[3,4]	M. Davy	1998	Yes
2,4-D 2-EHE	63.5	Terrestrial Plant	Sorghum	*Sorghum bicolor*	Juvenile	Vegetative vigor (root weight)	Direct spray	21 D	21 D	Vegetative vigor	NOEL	0.006	lbs ai/acre	0.0040	lbs ae/acre	Ricera Inc. Ohio	43982101	1992[3,4]	M. Davy	1998	Yes
2,4-D 2-EHE	63.5	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Juvenile	Vegetative vigor (root weight)	Direct spray	14 D	14 D	Vegetative vigor	EC25	0.01	lbs ai/acre	0.0066	lbs ae/acre	Ricera Inc. Ohio	43982101	1992[3,4]	M. Davy	1998	Yes
2,4-D 2-EHE	63.5	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Juvenile	Vegetative vigor (root weight)	Direct spray	14 D	14 D	Vegetative vigor	NOEL	0.006	lbs ai/acre	0.0040	lbs ae/acre	Ricera Inc. Ohio	43982101	1992[3,4]	M. Davy	1998	Yes
2,4-D 2-EHE	Tech	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Juvenile	Vegetative vigor (phytotoxicity)	Direct spray	21 D	21 D	Vegetative vigor	EC25	0.01	lbs ai/acre	0.0066	lbs ae/acre	Analytical Biochemical Laboratory, Columbia, Missouri	43982101	1997[3,4]	N. Mastrota	1998	Yes
2,4-D 2-EHE	Tech	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Juvenile	Vegetative vigor (phytotoxicity)	Direct spray	21 D	21 D	Vegetative vigor	NOEL	0.006	lbs ai/acre	0.0040	lbs ae/acre	Analytical Biochemical Laboratory, Columbia, Missouri	43982101	1997[3,4]	N. Mastrota	1998	Yes
2,4-D Isopropyl Ester	98.2	Terrestrial Plant	Turnip	*Brassica rapa*	Juvenile	Vegetative vigor (root weight)	Direct spray	14 D	14 D	Vegetative vigor	EC25	> 0.020	lbs ai/acre	> 0.0168	lbs ae/acre	Springborn Laboratory Inc., MA	42416801	1996[3,4]	Contract Draft GAI	1999	Yes
2,4-D Isopropyl Ester	98.2	Terrestrial Plant	Turnip	*Brassica rapa*	Juvenile	Vegetative vigor (root weight)	Direct spray	14 D	14 D	Vegetative vigor	NOEL	0.006	lbs ai/acre	0.0050	lbs ae/acre	Springborn Laboratory Inc., MA	42416801	1996[3,4]	Contract Draft GAI	1999	Yes
2,4-D 2 EHE	63.5	Terrestrial Plant	Mustard	*Brassica juncea*	Juvenile	Vegetative vigor (shoot height)	Direct spray	14 D	14 D	Vegetative vigor	EC25	0.01	lbs ai/acre	0.0066	lbs ae/acre	Ricera Inc. Ohio	42416801	1992[3,4]	M. Davy	1993	Yes
2,4-D 2 EHE	63.5	Terrestrial Plant	Mustard	*Brassica juncea*	Juvenile	Vegetative vigor (shoot height)	Direct spray	14 D	14 D	Vegetative vigor	NOEL	0.006	lbs ai/acre	0.0040	lbs ae/acre	Ricera Inc. Ohio	42416801	1992[3,4]	M. Davy	1993	Yes
2,4-D Isopropyl Ester	98.2	Terrestrial Plant	Soybean	*Glycine max*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	14 D	14 D	Germination	EC25	0.0082	lbs ai/acre	0.0069	lbs ae/acre	Springborn Laboratory Inc., MA	42416801	1996[3,4]	Contract Draft GAI	1999	Yes
2,4-D Isopropyl Ester	98.2	Terrestrial Plant	Soybean	*Glycine max*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	14 D	14 D	Germination	NOEL	0.0064	lbs ai/acre	0.0054	lbs ae/acre	Springborn Laboratory Inc., MA	42416801	1996[3,4]	Contract Draft GAI	1999	Yes
2,4-D Isopropyl Ester	98.2	Terrestrial Plant	Corn	*Zea mays*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	14 D	14 D	Germination	EC25	0.071	lbs ai/acre	0.06	lbs ae/acre	Springborn Laboratory Inc., MA	42416801	1996[3,4]	Contract Draft GAI	1999	Yes
2,4-D Isopropyl Ester	98.2	Terrestrial Plant	Corn	*Zea mays*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	14 D	14 D	Germination	NOEL	0.0064	lbs ai/acre	0.0054	lbs ae/acre	Springborn Laboratory Inc., MA	42416801	1996[3,4]	Contract Draft GAI	1999	Yes
2,4-D Isopropyl Ester	98.2	Terrestrial Plant	Onion	*Allium cepa*	Seedling	Seedling emergence (shoot height)	Soil treatment	14 D	14 D	Germination	EC25	0.0099	lbs ai/acre	0.0083	lbs ae/acre	Springborn Laboratory Inc., MA	42343902	1996[3,4]	Contract Draft GAI	1999	Yes
2,4-D Isopropyl Ester	98.2	Terrestrial Plant	Onion	*Allium cepa*	Seedling	Seedling emergence (shoot height)	Soil treatment	14 D	14 D	Germination	NOEL	0.0067	lbs ai/acre	0.0056	lbs ae/acre	Springborn Laboratory Inc., MA	42343902	1996[3,4]	Contract Draft GAI	1999	Yes
2,4-D Acid	96.7	Terrestrial Plant	Buckwheat	*Fagopyrum esculentum*	Juvenile	Vegetative vigor (phytotoxicity)	Direct spray	14 D	14 D	Vegetative vigor	EC25	0.023	lbs ai/acre	0.023	lbs ae/acre	Ricera Inc. Ohio	43982101	1991[3,4]	K. Valente	1992	Yes
2,4-D Acid	96.7	Terrestrial Plant	Buckwheat	*Fagopyrum esculentum*	Juvenile	Vegetative vigor (phytotoxicity)	Direct spray	14 D	14 D	Vegetative vigor	NOEL	0.007	lbs ai/acre	0.007	lbs ae/acre	Ricera Inc. Ohio	43982101	1991[3,4]	K. Valente	1992	Yes
2,4-D Acid	96.7	Terrestrial Plant	Cucumber	*Cucumis sativus*	Juvenile	Vegetative vigor (phytotoxicity)	Direct spray	14 D	14 D	Vegetative vigor	EC25	0.015	lbs ai/acre	0.015	lbs ae/acre	Ricera Inc. Ohio	43016701	1991[3,4]	K. Valente	1992	Yes
2,4-D Acid	96.7	Terrestrial Plant	Cucumber	*Cucumis sativus*	Juvenile	Vegetative vigor (phytotoxicity)	Direct spray	14 D	14 D	Vegetative vigor	NOEL	< 0.007	lbs ai/acre	< 0.007	lbs ae/acre	Ricera Inc. Ohio	43016701	1991[3,4]	K. Valente	1992	Yes

Formulation	% purity	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint	Toxicity Value (tested product)[1]	Units	Toxicity Value (a.e.)[1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4-D Acid	96.7	Terrestrial Plant	Mustard	*Brassica kaber*	Juvenile	Vegetative vigor (phytotoxicity)	Direct spray	14 D	14 D	Vegetative vigor	EC25	0.011	lbs ai/acre	0.011	lbs ae/acre	Ricera Inc. Ohio	43982101	1991[3,4]	K. Valente	1992	Yes
2,4-D Acid	96.7	Terrestrial Plant	Mustard	*Brassica kaber*	Juvenile	Vegetative vigor (phytotoxicity)	Direct spray	14 D	14 D	Vegetative vigor	NOEL	< 0.007	lbs ai/acre	< 0.007	lbs ae/acre	Ricera Inc. Ohio	43982101	1991[3,4]	K. Valente	1992	Yes
2,4-D Acid	96.7	Terrestrial Plant	Radish	*Raphanus sativus*	Juvenile	Vegetative vigor (phytotoxicity)	Direct spray	14 D	14 D	Vegetative vigor	EC25	0.016	lbs ai/acre	0.016	lbs ae/acre	Ricera Inc. Ohio	42416801	1991[3,4]	K. Valente	1994	Yes
2,4-D Acid	96.7	Terrestrial Plant	Radish	*Raphanus sativus*	Juvenile	Vegetative vigor (phytotoxicity)	Direct spray	14 D	14 D	Vegetative vigor	NOEL	0.007	lbs ai/acre	0.007	lbs ae/acre	Ricera Inc. Ohio	42416801	1991[3,4]	K. Valente	1994	Yes
2,4-D 2 EHE	63.5	Terrestrial Plant	Soybean	*Glycine max*	Not reported	Vegetative vigor (shoot height)	Direct spray	14 D	14 D	Vegetative vigor	EC25	0.02	lbs ai/acre	0.0133	lbs ae/acre	Ricera Inc. Ohio	42449201	1992[3,4]	R. Petrie	1992	Supplemental
2,4-D 2 EHE	63.5	Terrestrial Plant	Soybean	*Glycine max*	Not reported	Vegetative vigor (shoot height)	Direct spray	14 D	14 D	Vegetative vigor	NOEL	0.007	lbs ai/acre	0.0046	lbs ae/acre	Ricera Inc. Ohio	42449201	1992[3,4]	R. Petrie	1992	Supplemental
2,4-D Isopropyl Ester	98.2	Terrestrial Plant	Turnip	*Brassica rapa*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	14 D	14 D	Germination	EC25	0.009	lbs ai/acre	0.0076	lbs ae/acre	Springborn Laboratory Inc., MA	42416801	1996[3,4]	Contract Draft GAI	1999	Yes
2,4-D Isopropyl Ester	98.2	Terrestrial Plant	Turnip	*Brassica rapa*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	14 D	14 D	Germination	NOEL	0.007	lbs ai/acre	0.0059	lbs ae/acre	Springborn Laboratory Inc., MA	42416801	1996[3,4]	Contract Draft GAI	1999	Yes
2,4-DP-p, DMA salt	63	Terrestrial Plant	Soybean	*Glycine max*	Juvenile	Vegetative vigor	Direct spray	21 D	21 D	Vegetative vigor	EC25	0.043	lbs ai/acre	0.036	lbs ae/acre	California Agicultural Research Inc. Karman, CA	42343902	1993[3,4]	J. Goodyear	1994	Supplemental
2,4-DP-p, DMA salt	63	Terrestrial Plant	Soybean	*Glycine max*	Juvenile	Vegetative vigor	Direct spray	21 D	21 D	Vegetative vigor	NOEL	0.007	lbs ai/acre	0.006	lbs ae/acre	California Agicultural Research Inc. Karman, CA	42343902	1993[3,4]	J. Goodyear	1994	Supplemental
2,4-D Isopropyl Ester	98.2	Terrestrial Plant	Lettuce	*Lactuca sativa*	Juvenile	Vegetative vigor (root weight)	Direct spray	14 D	14 D	Vegetative vigor	EC25	0.0085	lbs ai/acre	0.0071	lbs ae/acre	Springborn Laboratory Inc., MA	42343902	1996[3,4]	Contract Draft GAI	1999	Yes
2,4-D Isopropyl Ester	98.2	Terrestrial Plant	Lettuce	*Lactuca sativa*	Juvenile	Vegetative vigor (root weight)	Direct spray	14 D	14 D	Vegetative vigor	NOEL	0.0073	lbs ai/acre	0.0061	lbs ae/acre	Springborn Laboratory Inc., MA	42343902	1996[3,4]	Contract Draft GAI	1999	Yes
2,4-D Acid	96.7	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Juvenile	Vegetative vigor	Direct spray	14 D	14 D	Vegetative vigor	EC25	< 0.0075	lbs ai/acre	< 0.0075	lbs ae/acre	Ricera Inc. Ohio	42343902	1991[3,4]	K. Valente	1992	Yes
2,4-D Acid	96.7	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Juvenile	Vegetative vigor	Direct spray	14 D	14 D	Vegetative vigor	NOEL	< 0.0075	lbs ai/acre	< 0.0075	lbs ae/acre	Ricera Inc. Ohio	42343902	1991[3,4]	K. Valente	1992	Yes
2,4-D 2 EHE	63.5	Terrestrial Plant	Mustard	*Brassica juncea*	Seedling	Seedling emergence	Soil treatment	14 D	14 D	Germination	EC25	0.033	lbs ai/acre	0.0219	lbs ae/acre	Ricera Inc. Ohio	42343902	1992[3,4]	M. Davy	1993	Supplemental
2,4-D 2 EHE	63.5	Terrestrial Plant	Mustard	*Brassica juncea*	Seedling	Seedling emergence	Soil treatment	14 D	14 D	Germination	NOEL	0.0075	lbs ai/acre	0.0050	lbs ae/acre	Ricera Inc. Ohio	42343902	1992[3,4]	M. Davy	1993	Supplemental
2,4-D Acid	96.7	Terrestrial Plant	Onion	*Allium cepa*	Juvenile	Vegetative vigor (phytotoxicity)	Direct spray	14 D	14 D	Vegetative vigor	EC25	< 0.0075	lbs ai/acre	< 0.0075	lbs ae/acre	Ricera Inc. Ohio	42343902	1991[3,4]	K. Valente	1992	Yes
2,4-D Acid	96.7	Terrestrial Plant	Onion	*Allium cepa*	Juvenile	Vegetative vigor (phytotoxicity)	Direct spray	14 D	14 D	Vegetative vigor	NOEL	< 0.0075	lbs ai/acre	< 0.0075	lbs ae/acre	Ricera Inc. Ohio	42343902	1991[3,4]	K. Valente	1992	Yes
2,4-D 2-EHE	63.5	Terrestrial Plant	Buckwheat	*Polygonum convolvulus*	Juvenile	Vegetative vigor (phytotoxicity)	Direct spray	14 D	14 D	Vegetative vigor	EC25	< 0.0075	lbs ai/acre	< 0.0050	lbs ae/acre	Ricera Inc. Ohio	42416801	1992[3,4]	M. Davy	1999	Yes
2,4-D 2-EHE	63.5	Terrestrial Plant	Buckwheat	*Polygonum convolvulus*	Juvenile	Vegetative vigor (phytotoxicity)	Direct spray	14 D	14 D	Vegetative vigor	NOEL	< 0.0075	lbs ai/acre	< 0.0050	lbs ae/acre	Ricera Inc. Ohio	42416801	1992[3,4]	M. Davy	1999	Yes
2,4-D 2-EHE	63.5	Terrestrial Plant	Cucumber	*Cucumis sativus*	Juvenile	Vegetative vigor (phytotoxicity)	Direct spray	14 D	14 D	Vegetative vigor	EC25	< 0.0075	lbs ai/acre	< 0.0050	lbs ae/acre	Ricera Inc. Ohio	43016701	1992[3,4]	M. Davy	1999	Yes
2,4-D 2-EHE	63.5	Terrestrial Plant	Cucumber	*Cucumis sativus*	Juvenile	Vegetative vigor (phytotoxicity)	Direct spray	14 D	14 D	Vegetative vigor	NOEL	< 0.0075	lbs ai/acre	< 0.0050	lbs ae/acre	Ricera Inc. Ohio	43016701	1992[3,4]	M. Davy	1999	Yes

Formulation	% purity	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint	Toxicity Value (tested product)[1]	Units	Toxicity Value (a.e.)[1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4-D 2-EHE	63.5	Terrestrial Plant	Mustard	*Brassica juncea*	Juvenile	Vegetative vigor (phytotoxicity)	Direct spray	14 D	14 D	Vegetative vigor	EC25	> 0.0075	lbs ai/acre	> 0.0050	lbs ae/acre	Ricera Inc. Ohio	43279201	1992[3,4]	M. Davy	1999	Yes
2,4-D 2-EHE	63.5	Terrestrial Plant	Mustard	*Brassica juncea*	Juvenile	Vegetative vigor (phytotoxicity)	Direct spray	14 D	14 D	Vegetative vigor	NOEL	0.0075	lbs ai/acre	0.0050	lbs ae/acre	Ricera Inc. Ohio	43279201	1992[3,4]	M. Davy	1999	Yes
2,4-D 2-EHE	63.5	Terrestrial Plant	Radish	*Raphanus sativus*	Juvenile	Vegetative vigor (phytotoxicity)	Direct spray	14 D	14 D	Vegetative vigor	EC25	> 0.0075	lbs ai/acre	> 0.0050	lbs ae/acre	Ricera Inc. Ohio	43279202	1992[3,4]	M. Davy	1999	Yes
2,4-D 2-EHE	63.5	Terrestrial Plant	Radish	*Raphanus sativus*	Juvenile	Vegetative vigor (phytotoxicity)	Direct spray	14 D	14 D	Vegetative vigor	NOEL	0.0075	lbs ai/acre	0.0050	lbs ae/acre	Ricera Inc. Ohio	43279202	1992[3,4]	M. Davy	1999	Yes
2,4-D 2-EHE	63.5	Terrestrial Plant	Onion	*Allium cepa*	Juvenile	Vegetative vigor (phytotoxicity)	Direct spray	14 D	14 D	Vegetative vigor	EC25	> 0.0075	lbs ai/acre	> 0.0050	lbs ae/acre	Ricera Inc. Ohio	43197001	1992[3,4]	M. Davy	1999	Yes
2,4-D 2-EHE	63.5	Terrestrial Plant	Onion	*Allium cepa*	Juvenile	Vegetative vigor (phytotoxicity)	Direct spray	14 D	14 D	Vegetative vigor	NOEL	0.0075	lbs ai/acre	0.0050	lbs ae/acre	Ricera Inc. Ohio	43197001	1992[3,4]	M. Davy	1999	Yes
2,4-D Acid	96.7	Terrestrial Plant	Soybean	*Glycine max*	Juvenile	Vegetative vigor (phytotoxicity)	Direct spray	14 D	14 D	Vegetative vigor	EC25	0.008	lbs ai/acre	0.008	lbs ae/acre	Ricera Inc. Ohio	43197001	1991[3,4]	K. Valente	1992	Yes
2,4-D Acid	96.7	Terrestrial Plant	Soybean	*Glycine max*	Juvenile	Vegetative vigor (phytotoxicity)	Direct spray	14 D	14 D	Vegetative vigor	NOEL	< 0.008	lbs ai/acre	< 0.008	lbs ae/acre	Ricera Inc. Ohio	43197001	1991[3,4]	K. Valente	1992	Yes
2,4-DP-p, DMA salt	63.62	Terrestrial Plant	Radish	*Raphanus sativus*	Seedling	Seedling emergence (shoot weight)	Soil treatment	21 D	21 D	Germination	EC25	0.038	lbs ai/acre	0.032	lbs ae/acre	California Agicultural Research Inc. Karman, CA	43982101	1993[3,4]	W. Evans	2001	Supplemental
2,4-DP-p, DMA salt	63.62	Terrestrial Plant	Radish	*Raphanus sativus*	Seedling	Seedling emergence (shoot weight)	Soil treatment	21 D	21 D	Germination	NOEL	0.008	lbs ai/acre	0.007	lbs ae/acre	California Agicultural Research Inc. Karman, CA	43982101	1993[3,4]	W. Evans	2001	Supplemental
2,4-DP-p, DMA salt	63.62	Terrestrial Plant	Lettuce	*Lactuca sativa*	Seedling	Seedling emergence (shoot weight)	Soil treatment	21 D	21 D	Germination	EC25	0.014	lbs ai/acre	0.012	lbs ae/acre	California Agicultural Research Inc. Karman, CA	42416802	1993[3,4]	W. Evans	2001	Supplemental
2,4-DP-p, DMA salt	63.62	Terrestrial Plant	Lettuce	*Lactuca sativa*	Seedling	Seedling emergence (shoot weight)	Soil treatment	21 D	21 D	Germination	NOEL	0.008	lbs ai/acre	0.007	lbs ae/acre	California Agicultural Research Inc. Karman, CA	42416802	1993[3,4]	W. Evans	2001	Supplemental
2,4-DP-p, DMA salt	63	Terrestrial Plant	Cucumber	*Cucumis sativus*	Juvenile	Vegetative vigor (shoot weight)	Direct spray	21 D	21 D	Vegetative vigor	EC25	0.014	lbs ai/acre	0.012	lbs ae/acre	California Agicultural Research Inc. Karman, CA	42389501	1993[3,4]	J. Goodyear	1994	Supplemental
2,4-DP-p, DMA salt	63	Terrestrial Plant	Cucumber	*Cucumis sativus*	Juvenile	Vegetative vigor (shoot weight)	Direct spray	21 D	21 D	Vegetative vigor	NOEL	0.008	lbs ai/acre	0.007	lbs ae/acre	California Agicultural Research Inc. Karman, CA	42389501	1993[3,4]	J. Goodyear	1994	Supplemental
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Cabbage	*Brassica oleracea*	Juvenile	Vegetative vigor (root weight)	Direct spray	21 D	21 D	Vegetative vigor	EC25	0.029	lbs ai/acre	0.0192	lbs ae/acre	Pan Agicultural Laboratory, CA	42389501	1994[3,4]	B. Montague	2000	Yes
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Cabbage	*Brassica oleracea*	Juvenile	Vegetative vigor (root weight)	Direct spray	21 D	21 D	Vegetative vigor	NOEL	0.01	lbs ai/acre	0.007	lbs ae/acre	Pan Agicultural Laboratory, CA	42389501	1994[3,4]	B. Montague	2000	Yes
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Radish	*Raphanus sativus*	Seedling	Seedling emergence (root weight)	Soil treatment	21 D	21 D	Germination	EC25	0.024	lbs ai/acre	0.0159	lbs ae/acre	Pan Agicultural Laboratory, CA	42389501	1994[3,4]	B. Montague	2000	Yes
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Radish	*Raphanus sativus*	Seedling	Seedling emergence (root weight)	Soil treatment	21 D	21 D	Germination	NOEL	0.01	lbs ai/acre	0.007	lbs ae/acre	Pan Agicultural Laboratory, CA	42389501	1994[3,4]	B. Montague	2000	Yes
2,4-D Butoxyethanol Ester	94.6	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Seedling	Seedling emergence (dry weight)	Soil treatment	28 D	28 D	Germination	EC25	0.05	lbs ai/acre	0.03	lbs ae/acre	Landis International Inc., Valdesta, GA	42343902	1994[3,4]	R. Hirsch	2000	Supplemental
2,4-D Butoxyethanol Ester	94.6	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Seedling	Seedling emergence (dry weight)	Soil treatment	28 D	28 D	Germination	NOEL	0.01	lbs ai/acre	0.01	lbs ae/acre	Landis International Inc., Valdesta, GA	42343902	1994[3,4]	R. Hirsch	2000	Supplemental
2,4-D Butoxyethanol Ester	94.6	Terrestrial Plant	Sunflower	*Helianthus annus*	Seedling	Seedling emergence (dry weight)	Soil treatment	28 D	28 D	Germination	EC25	0.53	lbs ai/acre	0.36	lbs ae/acre	Landis International Inc., Valdesta, GA	42449201	1994[3,4]	R. Hirsch	2000	Supplemental
2,4-D Butoxyethanol Ester	94.6	Terrestrial Plant	Sunflower	*Helianthus annus*	Seedling	Seedling emergence (dry weight)	Soil treatment	28 D	28 D	Germination	NOEL	0.01	lbs ai/acre	0.01	lbs ae/acre	Landis International Inc., Valdesta, GA	42449201	1994[3,4]	R. Hirsch	2000	Supplemental

Formulation	% purity	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint	Toxicity Value (tested product)[1]	Units	Toxicity Value (a.e.)[1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4-D Diethanolamine salt	73.8	Terrestrial Plant	Onion	*Allium cepa*	Juvenile	Vegetative vigor (shoot weight)	Direct spray	14 D	14 D	Vegetative vigor	EC25	0.037	lbs ai/acre	0.025	lbs ae/acre	Ricera Inc. Ohio	42665701	1992[3,4]	H. Craven (KBN)	1993	Yes
2,4-D Diethanolamine salt	73.8	Terrestrial Plant	Onion	*Allium cepa*	Juvenile	Vegetative vigor (shoot weight)	Direct spray	14 D	14 D	Vegetative vigor	NOEL	0.01	lbs ai/acre	0.007	lbs ae/acre	Ricera Inc. Ohio	42665701	1992[3,4]	H. Craven (KBN)	1993	Yes
2,4-DB DMA	Tech	Terrestrial Plant	Onion	*Allium cepa*	Seedling	Seedling emergence (shoot height)	Soil treatment	14 D	14 D	Germination	EC25	0.019	lbs ai/acre	0.016	lbs ae/acre	Analytical Biochemical Laboratory, Columbia, Missouri	43197002	1997[3,4]	D. Rieder	1998	Yes
2,4-DB DMA	Tech	Terrestrial Plant	Onion	*Allium cepa*	Seedling	Seedling emergence (shoot height)	Soil treatment	14 D	14 D	Germination	NOEL	0.012	lbs ai/acre	0.010	lbs ae/acre	Analytical Biochemical Laboratory, Columbia, Missouri	43197002	1997[3,4]	D. Rieder	1998	Yes
2,4-D Isopropyl Ester	98.2	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Seedling	Seedling emergence (shoot height)	Soil treatment	14 D	14 D	Germination	EC25	0.024	lbs ai/acre	0.0202	lbs ae/acre	Springborn Laboratory Inc., MA	43016701	1996[3,4]	Contract Draft GAI	1999	Yes
2,4-D Isopropyl Ester	98.2	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Seedling	Seedling emergence (shoot height)	Soil treatment	14 D	14 D	Germination	NOEL	0.013	lbs ai/acre	0.0109	lbs ae/acre	Springborn Laboratory Inc., MA	43016701	1996[3,4]	Contract Draft GAI	1999	Yes
2,4-D Acid	96.7	Terrestrial Plant	Mustard	*Brassica juncea*	Seedling	Seedling emergence	Soil treatment	14 D	14 D	Germination	EC25	0.14	lbs ai/acre	0.14	lbs ae/acre	Ricera Inc. Ohio	43016701	1992[3,4]	K. Valente	1992	Yes
2,4-D Acid	96.7	Terrestrial Plant	Mustard	*Brassica juncea*	Seedling	Seedling emergence	Soil treatment	14 D	14 D	Germination	NOEL	0.015	lbs ai/acre	0.015	lbs ae/acre	Ricera Inc. Ohio	43016701	1992[3,4]	K. Valente	1992	Yes
2,4-D Dimethylamine salt	55	Terrestrial Plant	Mustard	*Brassica juncea*	Seedling	Seedling emergence (shoot height)	Soil treatment	14 D	14 D	Germination	EC25	0.026	lbs ai/acre	0.022	lbs ae/acre	Ricera Inc. Ohio	43526901	1992[3,4]	M. Davy	1994	Supplemental
2,4-D Dimethylamine salt	55	Terrestrial Plant	Mustard	*Brassica juncea*	Seedling	Seedling emergence (shoot height)	Soil treatment	14 D	14 D	Germination	NOEL	0.015	lbs ai/acre	0.012	lbs ae/acre	Ricera Inc. Ohio	43526901	1992[3,4]	M. Davy	1994	Supplemental
2,4-D Dimethylamine salt	55	Terrestrial Plant	Sorghum	*Sorghum bicolor*	Seedling	Seedling emergence (shoot height)	Soil treatment	14 D	14 D	Germination	EC25	0.026	lbs ai/acre	0.022	lbs ae/acre	Ricera Inc. Ohio	43526901	1992[3,4]	M. Davy	1994	Supplemental
2,4-D Dimethylamine salt	55	Terrestrial Plant	Sorghum	*Sorghum bicolor*	Seedling	Seedling emergence (shoot height)	Soil treatment	14 D	14 D	Germination	NOEL	0.015	lbs ai/acre	0.012	lbs ae/acre	Ricera Inc. Ohio	43526901	1992[3,4]	M. Davy	1994	Supplemental
2,4-D Dimethylamine salt	55.5	Terrestrial Plant	Cucumber	*Cucumis sativus*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	14 D	14 D	Seedling emergence	EC25	N.R.	lbs ai/acre	NR	lbs ae/acre	Ricera Inc. Ohio	43982101	1992[3,4]	M. Davy	1993	No
2,4-D Dimethylamine salt	55.5	Terrestrial Plant	Cucumber	*Cucumis sativus*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	14 D	14 D	Seedling emergence	NOEL	0.015	lbs ai/acre	0.012	lbs ae/acre	Ricera Inc. Ohio	43982101	1992[3,4]	M. Davy	1993	Yes
2,4-D 2 EHE	63.5	Terrestrial Plant	Cucumber	*Cucumis sativus*	Not reported	Vegetative vigor (shoot height)	Direct spray	14 D	14 D	Vegetative vigor	EC25	0.19	lbs ai/acre	0.1260	lbs ae/acre	Ricera Inc. Ohio	42389501	1992[3,4]	R. Petrie	1992	Supplemental
2,4-D 2 EHE	63.5	Terrestrial Plant	Cucumber	*Cucumis sativus*	Not reported	Vegetative vigor (shoot height)	Direct spray	14 D	14 D	Vegetative vigor	NOEL	0.015	lbs ai/acre	0.0099	lbs ae/acre	Ricera Inc. Ohio	42389501	1992[3,4]	R. Petrie	1992	Supplemental
2,4-D 2 EHE	63.5	Terrestrial Plant	Radish	*Raphanus sativus*	Seedling	Seedling emergence (shoot height)	Soil treatment	14 D	14 D	Germination	EC25	< 0.12	lbs ai/acre	< 0.0796	lbs ae/acre	Ricera Inc. Ohio	42389501	1992[3,4]	M. Davy	1993	Yes
2,4-D 2 EHE	63.5	Terrestrial Plant	Radish	*Raphanus sativus*	Seedling	Seedling emergence (shoot height)	Soil treatment	14 D	14 D	Germination	NOEL	0.015	lbs ai/acre	0.0099	lbs ae/acre	Ricera Inc. Ohio	42389501	1992[3,4]	M. Davy	1993	Yes
2,4-DP-p, DMA salt	61.6	Aquatic Plant	Freshwater diatom	*Navicula pelliculosa*	Not reported	Static	Water	5 D	5 D		EC50	0.089	PPM	0.1	PPM	Springborn Laboratory Inc., MA	42449201	1992[3,4]	M. Davy	1993	Yes
2,4-DP-p, DMA salt	61.6	Aquatic Plant	Freshwater diatom	*Navicula pelliculosa*	Not reported	Static	Water	5 D	5 D		NOEL	0.016	PPM	0.013	PPM	Springborn Laboratory Inc., MA	42449201	1992[3,4]	M. Davy	1993	Yes
2,4-DP-p, DMA salt	63.62	Terrestrial Plant	Radish	*Raphanus sativus*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	21 D	21 D	Germination	EC25	0.02	lbs ai/acre	0.017	lbs ae/acre	California Agricultural Research Inc. Karman, CA	43279201	1993[3,4]	W. Evans	2001	Supplemental
2,4-DP-p, DMA salt	63.62	Terrestrial Plant	Radish	*Raphanus sativus*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	21 D	21 D	Germination	NOEL	0.017	lbs ai/acre	0.014	lbs ae/acre	California Agricultural Research Inc. Karman, CA	43279201	1993[3,4]	W. Evans	2001	Supplemental

Formulation	% purity	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint	Toxicity Value (tested product)[1]	Units	Toxicity Value (a.e.)[1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4-DP-p, DMA salt	63.62	Terrestrial Plant	Lettuce	*Lactuca sativa*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	21 D	21 D	Germination	EC25	0.02	lbs ai/acre	0.017	lbs ae/acre	California Agicultural Research Inc. Karman, CA	43279202	1993[3,4]	W. Evans	2001	Supplemental
2,4-DP-p, DMA salt	63.62	Terrestrial Plant	Lettuce	*Lactuca sativa*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	21 D	21 D	Germination	NOEL	0.017	lbs ai/acre	0.014	lbs ae/acre	California Agicultural Research Inc. Karman, CA	43279202	1993[3,4]	W. Evans	2001	Supplemental
2,4-DP-p, DMA salt	63.62	Terrestrial Plant	Cucumber	*Cucumis sativus*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	21 D	21 D	Germination	EC25	0.02	lbs ai/acre	0.017	lbs ae/acre	California Agicultural Research Inc. Karman, CA	43279202	1993[3,4]	W. Evans	2001	Supplemental
2,4-DP-p, DMA salt	63.62	Terrestrial Plant	Cucumber	*Cucumis sativus*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	21 D	21 D	Germination	NOEL	0.017	lbs ai/acre	0.014	lbs ae/acre	California Agicultural Research Inc. Karman, CA	43279202	1993[3,4]	W. Evans	2001	Supplemental
2,4-D Tri,isopropylamine salt	67.9	Terrestrial Plant	Cucumber	*Cucumis sativus*	Seedling	Seedling germination	Soil treatment	5 D	5 D	Germination	EC25	0.057	lbs ai/acre	0.031	lbs ae/acre	Landis International Inc., Valdesta, GA	43279202	1994[3,4]	R. Hirsch	2000	Yes
2,4-D Tri,isopropylamine salt	67.9	Terrestrial Plant	Cucumber	*Cucumis sativus*	Seedling	Seedling germination	Soil treatment	5 D	5 D	Germination	NOEL	0.019	lbs ai/acre	0.010	lbs ae/acre	Landis International Inc., Valdesta, GA	43279202	1994[3,4]	R. Hirsch	2000	Yes
2,4-D Butoxyethanol Ester	94.6	Terrestrial Plant	Soybean	*Glycine max*	Seedling	Seedling emergence (dry weight)	Soil treatment	28 D	28 D	Germination	EC25	> 0.73	lbs ai/acre	> 0.50	lbs ae/acre	Landis International Inc., Valdesta, GA	43982101	1994[3,4]	R. Hirsch	2000	Supplemental
2,4-D Butoxyethanol Ester	94.6	Terrestrial Plant	Soybean	*Glycine max*	Seedling	Seedling emergence (dry weight)	Soil treatment	28 D	28 D	Germination	NOEL	0.02	lbs ai/acre	0.01	lbs ae/acre	Landis International Inc., Valdesta, GA	43982101	1994[3,4]	R. Hirsch	2000	Supplemental
2,4-DP-p, DMA salt	63.62	Terrestrial Plant	Radish	*Raphanus sativus*	Seedling	Seedling emergence (shoot height)	Soil treatment	21 D	21 D	Germination	EC25	0.083	lbs ai/acre	0.069	lbs ae/acre	California Agicultural Research Inc. Karman, CA	43197001	1993[3,4]	W. Evans	2001	Supplemental
2,4-DP-p, DMA salt	63.62	Terrestrial Plant	Radish	*Raphanus sativus*	Seedling	Seedling emergence (shoot height)	Soil treatment	21 D	21 D	Germination	NOEL	0.02	lbs ai/acre	0.017	lbs ae/acre	California Agicultural Research Inc. Karman, CA	43197001	1993[3,4]	W. Evans	2001	Supplemental
2,4-DP-p, DMA salt	63.62	Terrestrial Plant	Lettuce	*Lactuca sativa*	Seedling	Seedling emergence (shoot height)	Soil treatment	21 D	21 D	Germination	EC25	0.071	lbs ai/acre	0.059	lbs ae/acre	California Agicultural Research Inc. Karman, CA	42343902	1993[3,4]	W. Evans	2001	Supplemental
2,4-DP-p, DMA salt	63.62	Terrestrial Plant	Lettuce	*Lactuca sativa*	Seedling	Seedling emergence (shoot height)	Soil treatment	21 D	21 D	Germination	NOEL	0.02	lbs ai/acre	0.017	lbs ae/acre	California Agicultural Research Inc. Karman, CA	42343902	1993[3,4]	W. Evans	2001	Supplemental
2,4-DP-p, DMA salt	63	Terrestrial Plant	Corn	*Zea mays*	Juvenile	Vegetative vigor	Direct spray	21 D	21 D	Vegetative vigor	EC25	NR	lbs ai/acre	NR	lbs ae/acre	California Agicultural Research Inc. Karman, CA	42343902	1993[3,4]	J. Goodyear	1994	No
2,4-DP-p, DMA salt	63	Terrestrial Plant	Corn	*Zea mays*	Juvenile	Vegetative vigor	Direct spray	21 D	21 D	Vegetative vigor	NOEL	0.02	lbs ai/acre	0.017	lbs ae/acre	California Agicultural Research Inc. Karman, CA	42343902	1993[3,4]	J. Goodyear	1994	Supplemental
2,4-DP-p, DMA salt	63	Terrestrial Plant	Onion	*Allium cepa*	Juvenile	Vegetative vigor (shoot weight)	Direct spray	21 D	21 D	Vegetative vigor	EC25	0.038	lbs ai/acre	0.032	lbs ae/acre	California Agicultural Research Inc. Karman, CA	42343902	1993[3,4]	J. Goodyear	1994	Supplemental
2,4-DP-p, DMA salt	63	Terrestrial Plant	Onion	*Allium cepa*	Juvenile	Vegetative vigor (shoot weight)	Direct spray	21 D	21 D	Vegetative vigor	NOEL	0.02	lbs ai/acre	0.017	lbs ae/acre	California Agicultural Research Inc. Karman, CA	42343902	1993[3,4]	J. Goodyear	1994	Supplemental
2,4-D 2-EHE	91.53	Terrestrial Plant	Onion	*Allium cepa*	Seedling	Seedling emergence (shoot weight)	Soil treatment	14 D	14 D	Germination	EC25	0.329	lbs ai/acre	0.2182	lbs ae/acre	Ricera Inc. Ohio	42343902	1995[3,4]	S. Ramasamy	2001	Yes
2,4-D 2-EHE	91.53	Terrestrial Plant	Onion	*Allium cepa*	Seedling	Seedling emergence (shoot weight)	Soil treatment	14 D	14 D	Germination	NOEL	0.023	lbs ai/acre	0.0153	lbs ae/acre	Ricera Inc. Ohio	42343902	1995[3,4]	S. Ramasamy	2001	Yes
2,4-D 2-EHE	91.53	Terrestrial Plant	Cucumber	*Cucumis sativus*	Seedling	Seedling emergence (shoot weight)	Soil treatment	14 D	14 D	Germination	EC25	0.068	lbs ai/acre	0.0451	lbs ae/acre	Ricera Inc. Ohio	43197002	1995[3,4]	S. Ramasamy	2001	Yes
2,4-D 2-EHE	91.53	Terrestrial Plant	Cucumber	*Cucumis sativus*	Seedling	Seedling emergence (shoot weight)	Soil treatment	14 D	14 D	Germination	NOEL	0.023	lbs ai/acre	0.0153	lbs ae/acre	Ricera Inc. Ohio	43197002	1995[3,4]	S. Ramasamy	2001	Yes
2,4-D Isopropyl Ester	98.2	Terrestrial Plant	Cucumber	*Cucumis sativus*	Seedling	Seedling emergence (shoot height)	Soil treatment	14 D	14 D	Germination	EC25	0.044	lbs ai/acre	0.04	lbs ae/acre	Springborn Laboratory Inc., MA	43197002	1996[3,4]	Contract Draft GAI	1999	Yes
2,4-D Isopropyl Ester	98.2	Terrestrial Plant	Cucumber	*Cucumis sativus*	Seedling	Seedling emergence (shoot height)	Soil treatment	14 D	14 D	Germination	NOEL	0.028	lbs ai/acre	0.0235	lbs ae/acre	Springborn Laboratory Inc., MA	43197002	1996[3,4]	Contract Draft GAI	1999	Yes

Formulation	% purity	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint	Toxicity Value (tested product)[1]	Units	Toxicity Value (a.e.)[1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4-D Dimethylamine salt	55.5	Terrestrial Plant	Radish	*Raphanus sativus*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	14 D	14 D	Seedling emergence	EC25	N.R.	lbs ai/acre	NR	lbs ae/acre	Ricera Inc. Ohio	43197002	1992[3,4]	M. Davy	1993	No
2,4-D Dimethylamine salt	55.5	Terrestrial Plant	Radish	*Raphanus sativus*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	14 D	14 D	Seedling emergence	NOEL	0.03	lbs ai/acre	0.025	lbs ae/acre	Ricera Inc. Ohio	43197002	1992[3,4]	M. Davy	1993	Yes
2,4-D Dimethylamine salt	55.5	Terrestrial Plant	Onion	*Allium cepa*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	14 D	14 D	Seedling emergence	EC25	N.R.	lbs ai/acre	NR	lbs ae/acre	Ricera Inc. Ohio	43197002	1992[3,4]	M. Davy	1993	No
2,4-D Dimethylamine salt	55.5	Terrestrial Plant	Onion	*Allium cepa*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	14 D	14 D	Seedling emergence	NOEL	0.03	lbs ai/acre	0.025	lbs ae/acre	Ricera Inc. Ohio	43197002	1992[3,4]	M. Davy	1993	Yes
2,4-D 2 EHE	63.5	Terrestrial Plant	Mustard	*Brassica juncea*	Seedling	Seedling emergence (shoot height)	Soil treatment	14 D	14 D	Germination	EC25	> 0.03	lbs ai/acre	> 0.0199	lbs ae/acre	Ricera Inc. Ohio	43279201	1992[3,4]	M. Davy	1993	Yes
2,4-D 2 EHE	63.5	Terrestrial Plant	Mustard	*Brassica juncea*	Seedling	Seedling emergence (shoot height)	Soil treatment	14 D	14 D	Germination	NOEL	0.03	lbs ai/acre	0.0199	lbs ae/acre	Ricera Inc. Ohio	43279201	1992[3,4]	M. Davy	1993	Yes
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Juvenile	Vegetative vigor (root weight)	Direct spray	21 D	21 D	Vegetative vigor	EC25	0.078	lbs ai/acre	0.0517	lbs ae/acre	Pan Agicultural Laboratory, CA	43279201	1994[3,4]	B. Montague	2000	Yes
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Juvenile	Vegetative vigor (root weight)	Direct spray	21 D	21 D	Vegetative vigor	NOEL	0.03	lbs ai/acre	0.0199	lbs ae/acre	Pan Agicultural Laboratory, CA	43279201	1994[3,4]	B. Montague	2000	Yes
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Cabbage	*Brassica oleracea*	Seedling	Seedling emergence (root weight)	Soil treatment	21 D	21 D	Germination	EC25	0.066	lbs ai/acre	0.0438	lbs ae/acre	Pan Agicultural Laboratory, CA	43279202	1994[3,4]	B. Montague	2000	Yes
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Cabbage	*Brassica oleracea*	Seedling	Seedling emergence (root weight)	Soil treatment	21 D	21 D	Germination	NOEL	0.03	lbs ai/acre	0.0199	lbs ae/acre	Pan Agicultural Laboratory, CA	43279202	1994[3,4]	B. Montague	2000	Yes
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Lettuce	*Lactuca sativa*	Seedling	Seedling emergence (root weight)	Soil treatment	21 D	21 D	Germination	EC25	0.055	lbs ai/acre	0.0365	lbs ae/acre	Pan Agicultural Laboratory, CA	43279202	1994[3,4]	B. Montague	2000	Yes
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Lettuce	*Lactuca sativa*	Seedling	Seedling emergence (root weight)	Soil treatment	21 D	21 D	Germination	NOEL	0.03	lbs ai/acre	0.0199	lbs ae/acre	Pan Agicultural Laboratory, CA	43279202	1994[3,4]	B. Montague	2000	Yes
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Oat	*Avena sativa*	Seedling	Seedling emergence (root weight)	Soil treatment	21 D	21 D	Germination	EC25	0.087	lbs ai/acre	0.0577	lbs ae/acre	Pan Agicultural Laboratory, CA	41735204	1994[3,4]	B. Montague	2000	Yes
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Oat	*Avena sativa*	Seedling	Seedling emergence (root weight)	Soil treatment	21 D	21 D	Germination	NOEL	0.03	lbs ai/acre	0.0199	lbs ae/acre	Pan Agicultural Laboratory, CA	41735204	1994[3,4]	B. Montague	2000	Yes
2,4-D Diethanolamine salt	73.8	Terrestrial Plant	Mustard	*Brassica nigra*	Seedling	Seedling emergence (shoot weight)	Soil treatment	NR	NR	Germination	EC25	< 0.03	lbs ai/acre	< 0.020	lbs ae/acre	Ricera Inc. Ohio	41735203	1992[3,4]	W. Evans	2004	Supplemental
2,4-D Diethanolamine salt	73.8	Terrestrial Plant	Mustard	*Brassica nigra*	Seedling	Seedling emergence (shoot weight)	Soil treatment	NR	NR	Germination	NOEL	< 0.03	lbs ai/acre	< 0.020	lbs ae/acre	Ricera Inc. Ohio	41735203	1992[3,4]	W. Evans	2004	Supplemental
2,4-D Isopropyl Ester	98.2	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Juvenile	Vegetative vigor (root weight)	Direct spray	14 D	14 D	Vegetative vigor	EC25	> 0.046	lbs ai/acre	> 0.04	lbs ae/acre	Springborn Laboratory Inc., MA	43982101	1996[3,4]	Contract Draft GAI	1999	Yes
2,4-D Isopropyl Ester	98.2	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Juvenile	Vegetative vigor (root weight)	Direct spray	14 D	14 D	Vegetative vigor	NOEL	0.031	lbs ai/acre	0.0260	lbs ae/acre	Springborn Laboratory Inc., MA	43982101	1996[3,4]	Contract Draft GAI	1999	Yes
2,4-DB DMA	Tech	Terrestrial Plant	Onion	*Allium cepa*	Seedling	Seedling emergence (root length)	Soil treatment	14 D	14 D	Germination	EC25	0.091	lbs ai/acre	0.076	lbs ae/acre	Analytical Biochemical Laboratory, Columbia, Missouri	43982101	1997[3,4]	D. Rieder	1998	Yes
2,4-DB DMA	Tech	Terrestrial Plant	Onion	*Allium cepa*	Seedling	Seedling emergence (root length)	Soil treatment	14 D	14 D	Germination	NOEL	0.047	lbs ai/acre	0.039	lbs ae/acre	Analytical Biochemical Laboratory, Columbia, Missouri	43982101	1997[3,4]	D. Rieder	1998	Yes
2,4-D Butoxyethanol Ester	94.6	Terrestrial Plant	Corn	*Zea mays*	Seedling	Seedling emergence (dry weight)	Soil treatment	28 D	28 D	Germination	EC25	> 0.73	lbs ai/acre	> 0.50	lbs ae/acre	Landis International Inc., Valdesta, GA	43016701	1994[3,4]	R. Hirsch	2000	Supplemental
2,4-D Butoxyethanol Ester	94.6	Terrestrial Plant	Corn	*Zea mays*	Seedling	Seedling emergence (dry weight)	Soil treatment	28 D	28 D	Germination	NOEL	0.05	lbs ai/acre	0.03	lbs ae/acre	Landis International Inc., Valdesta, GA	43016701	1994[3,4]	R. Hirsch	2000	Supplemental

Formulation	% purity	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint	Toxicity Value (tested product)[1]	Units	Toxicity Value (a.e.)[1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4-DP-p, DMA salt	63.62	Terrestrial Plant	Cabbage	*Brassica oleracea*	Seedling	Seedling germination	Soil treatment	7 D	7 D	Germination	EC25	0.082	lbs ai/acre	0.068	lbs ae/acre	California Agicultural Research Inc. Karman, CA	42416802	1993[3,4]	W. Evans	2001	Supplemental
2,4-DP-p, DMA salt	63.62	Terrestrial Plant	Cabbage	*Brassica oleracea*	Seedling	Seedling germination	Soil treatment	7 D	7 D	Germination	NOEL	0.051	lbs ai/acre	0.042	lbs ae/acre	California Agicultural Research Inc. Karman, CA	42416802	1993[3,4]	W. Evans	2001	Supplemental
2,4-DP-p, DMA salt	63.62	Terrestrial Plant	Lettuce	*Lactuca sativa*	Seedling	Seedling emergence	Soil treatment	14 D	14 D	Germination	EC25	0.091	lbs ai/acre	0.076	lbs ae/acre	California Agicultural Research Inc. Karman, CA	42389501	1993[3,4]	W. Evans	2001	Supplemental
2,4-DP-p, DMA salt	63.62	Terrestrial Plant	Lettuce	*Lactuca sativa*	Seedling	Seedling emergence	Soil treatment	14 D	14 D	Germination	NOEL	0.051	lbs ai/acre	0.042	lbs ae/acre	California Agicultural Research Inc. Karman, CA	42389501	1993[3,4]	W. Evans	2001	Supplemental
2,4-DP-p, DMA salt	63.62	Terrestrial Plant	Onion	*Allium cepa*	Seedling	Seedling emergence	Soil treatment	14 D	14 D	Germination	EC25	0.26	lbs ai/acre	0.216	lbs ae/acre	California Agicultural Research Inc. Karman, CA	41737305	1993[3,4]	W. Evans	2001	Supplemental
2,4-DP-p, DMA salt	63.62	Terrestrial Plant	Onion	*Allium cepa*	Seedling	Seedling emergence	Soil treatment	14 D	14 D	Germination	NOEL	0.051	lbs ai/acre	0.042	lbs ae/acre	California Agicultural Research Inc. Karman, CA	41737305	1993[3,4]	W. Evans	2001	Supplemental
2,4-DP-p, DMA salt	63.62	Terrestrial Plant	Onion	*Allium cepa*	Seedling	Seedling emergence (shoot height)	Soil treatment	21 D	21 D	Germination	EC25	0.091	lbs ai/acre	0.076	lbs ae/acre	California Agicultural Research Inc. Karman, CA	43982101	1993[3,4]	W. Evans	2001	Supplemental
2,4-DP-p, DMA salt	63.62	Terrestrial Plant	Onion	*Allium cepa*	Seedling	Seedling emergence (shoot height)	Soil treatment	21 D	21 D	Germination	NOEL	0.051	lbs ai/acre	0.042	lbs ae/acre	California Agicultural Research Inc. Karman, CA	43982101	1993[3,4]	W. Evans	2001	Supplemental
2,4-DP-p, DMA salt	63.62	Terrestrial Plant	Onion	*Allium cepa*	Seedling	Seedling emergence (shoot weight)	Soil treatment	21 D	21 D	Germination	EC25	0.091	lbs ai/acre	0.076	lbs ae/acre	California Agicultural Research Inc. Karman, CA	43982101	1993[3,4]	W. Evans	2001	Supplemental
2,4-DP-p, DMA salt	63.62	Terrestrial Plant	Onion	*Allium cepa*	Seedling	Seedling emergence (shoot weight)	Soil treatment	21 D	21 D	Germination	NOEL	0.051	lbs ai/acre	0.042	lbs ae/acre	California Agicultural Research Inc. Karman, CA	43982101	1993[3,4]	W. Evans	2001	Supplemental
2,4-D Acid	96.2	Aquatic Plant	Duckweed	*Lemna gibba*	Not reported	Static	Water	14 D	14 D		EC50	0.695	PPM	0.695	PPM	Carolina Ecotox Inc., Durham, NC	43982101	1997[3,4]	W. Evans	1999	Yes
2,4-D Acid	96.2	Aquatic Plant	Duckweed	*Lemna gibba*	Not reported	Static	Water	14 D	14 D		NOEL	0.058	PPM	0.058	PPM	Carolina Ecotox Inc., Durham, NC	43982101	1997[3,4]	W. Evans	1999	Yes
2,4-D 2-EHE	63.5	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Juvenile	Vegetative vigor	Direct spray	21 D	21 D	Vegetative vigor	EC25	0.218	lbs ai/acre	0.1446	lbs ae/acre	Ricera Inc. Ohio	42416802	1992[3,4]	M. Davy	1998	Yes
2,4-D 2-EHE	63.5	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Juvenile	Vegetative vigor	Direct spray	21 D	21 D	Vegetative vigor	NOEL	0.06	lbs ai/acre	0.0398	lbs ae/acre	Ricera Inc. Ohio	42416802	1992[3,4]	M. Davy	1998	Yes
2,4-D 2-EHE	63.5	Terrestrial Plant	Sorghum	*Sorghum bicolor*	Juvenile	Vegetative vigor (root weight)	Direct spray	14 D	14 D	Vegetative vigor	EC25	0.218	lbs ai/acre	0.1446	lbs ae/acre	Ricera Inc. Ohio	43930701	1992[3,4]	M. Davy	1998	Yes
2,4-D 2-EHE	63.5	Terrestrial Plant	Sorghum	*Sorghum bicolor*	Juvenile	Vegetative vigor (root weight)	Direct spray	14 D	14 D	Vegetative vigor	NOEL	0.06	lbs ai/acre	0.0398	lbs ae/acre	Ricera Inc. Ohio	43930701	1992[3,4]	M. Davy	1998	Yes
2,4-D 2-EHE	Tech	Terrestrial Plant	Sorghum	*Sorghum bicolor*	Juvenile	Vegetative vigor (shoot weight)	Direct spray	21 D	21 D	Vegetative vigor	EC25	0.218	lbs ai/acre	0.1446	lbs ae/acre	Analytical Biochemical Laboratory, Columbia, Missouri	00102870	1997[3,4]	N. Mastrota	1998	Yes
2,4-D 2-EHE	Tech	Terrestrial Plant	Sorghum	*Sorghum bicolor*	Juvenile	Vegetative vigor (shoot weight)	Direct spray	21 D	21 D	Vegetative vigor	NOEL	0.06	lbs ai/acre	0.0398	lbs ae/acre	Analytical Biochemical Laboratory, Columbia, Missouri	00102870	1997[3,4]	N. Mastrota	1998	Yes
2,4-D 2 EHE	63.5	Terrestrial Plant	Sorghum	*Sorghum bicolor*	Juvenile	Vegetative vigor (shoot height)	Direct spray	14 D	14 D	Vegetative vigor	EC25	0.218	lbs ai/acre	0.1446	lbs ae/acre	Ricera Inc. Ohio	41835206	1992[3,4]	M. Davy	1993	Yes
2,4-D 2 EHE	63.5	Terrestrial Plant	Sorghum	*Sorghum bicolor*	Juvenile	Vegetative vigor (shoot height)	Direct spray	14 D	14 D	Vegetative vigor	NOEL	0.06	lbs ai/acre	0.0398	lbs ae/acre	Ricera Inc. Ohio	41835206	1992[3,4]	M. Davy	1993	Yes
2,4-D Diethanolamine salt	73.8	Terrestrial Plant	Sorghum	*Sorghum bicolor*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	NR	NR	Germination	EC25	> 0.06	lbs ai/acre	> 0.041	lbs ae/acre	Ricera Inc. Ohio	TN 0317,005399 1	1992[3,4]	W. Evans	2004	Supplemental
2,4-D Diethanolamine salt	73.8	Terrestrial Plant	Sorghum	*Sorghum bicolor*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	NR	NR	Germination	NOEL	0.06	lbs ai/acre	0.041	lbs ae/acre	Ricera Inc. Ohio	TN 0317,005399 1	1992[3,4]	W. Evans	2004	Supplemental

Formulation	% purity	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint	Toxicity Value (tested product)[1]	Units	Toxicity Value (a.e.)[1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4-D Diethanolamine salt	73.8	Terrestrial Plant	Radish	*Raphanus sativus*	Seedling	Seedling emergence	Soil treatment	NR	NR	Germination	EC25	> 1.3	lbs ai/acre	> 0.881	lbs ae/acre	Ricera Inc. Ohio	43197001	1992[3,4]	W. Evans	2004	Supplemental
2,4-D Diethanolamine salt	73.8	Terrestrial Plant	Radish	*Raphanus sativus*	Seedling	Seedling emergence	Soil treatment	NR	NR	Germination	NOEL	0.06	lbs ai/acre	0.041	lbs ae/acre	Ricera Inc. Ohio	43197001	1992[3,4]	W. Evans	2004	Supplemental
2,4-D Diethanolamine salt	73.8	Aquatic Plant	Duckweed	*Lemna gibba*	Not reported	Static	Water	5 D	5 D		EC50	0.44	PPM	0.3	PPM	Wildlife International Inc., MD	43488602	1993[3,4]	H. Craven (KBN)	1993	Yes
2,4-D Diethanolamine salt	73.8	Aquatic Plant	Duckweed	*Lemna gibba*	Not reported	Static	Water	5 D	5 D		NOEL	0.07	PPM	0.047	PPM	Wildlife International Inc., MD	43488602	1993[3,4]	H. Craven (KBN)	1993	Yes
2,4-D Tri,isopropylamine salt	67.9	Terrestrial Plant	Soybean	*Glycine max*	Seedling	Seedling germination	Soil treatment	5 D	5 D	Germination	EC25	0.191	lbs ai/acre	0.102	lbs ae/acre	Landis International Inc., Valdesta, GA	43016701	1994[3,4]	R. Hirsch	2000	Yes
2,4-D Tri,isopropylamine salt	67.9	Terrestrial Plant	Soybean	*Glycine max*	Seedling	Seedling germination	Soil treatment	5 D	5 D	Germination	NOEL	0.075	lbs ai/acre	0.040	lbs ae/acre	Landis International Inc., Valdesta, GA	43016701	1994[3,4]	R. Hirsch	2000	Yes
2,4-D Tri,isopropylamine salt	67.9	Terrestrial Plant	Corn	*Zea mays*	Seedling	Seedling germination	Soil treatment	5 D	5 D	Germination	EC25	0.24	lbs ai/acre	0.129	lbs ae/acre	Landis International Inc., Valdesta, GA	42068402	1994[3,4]	R. Hirsch	2000	Yes
2,4-D Tri,isopropylamine salt	67.9	Terrestrial Plant	Corn	*Zea mays*	Seedling	Seedling germination	Soil treatment	5 D	5 D	Germination	NOEL	0.075	lbs ai/acre	0.040	lbs ae/acre	Landis International Inc., Valdesta, GA	42068402	1994[3,4]	R. Hirsch	2000	Yes
2,4-D Tri,isopropylamine salt	67.9	Terrestrial Plant	Oat	*Avena sativa*	Seedling	Seedling germination	Soil treatment	5 D	5 D	Germination	EC25	0.269	lbs ai/acre	0.144	lbs ae/acre	Landis International Inc., Valdesta, GA	43910301	1994[3,4]	R. Hirsch	2000	Yes
2,4-D Tri,isopropylamine salt	67.9	Terrestrial Plant	Oat	*Avena sativa*	Seedling	Seedling germination	Soil treatment	5 D	5 D	Germination	NOEL	0.075	lbs ai/acre	0.040	lbs ae/acre	Landis International Inc., Valdesta, GA	43910301	1994[3,4]	R. Hirsch	2000	Yes
2,4-D Tri,isopropylamine salt	67.9	Terrestrial Plant	Onion	*Allium cepa*	Seedling	Seedling germination	Soil treatment	5 D	5 D	Germination	EC25	0.23	lbs ai/acre	0.123	lbs ae/acre	Landis International Inc., Valdesta, GA	43098901	1994[3,4]	R. Hirsch	2000	Yes
2,4-D Tri,isopropylamine salt	67.9	Terrestrial Plant	Onion	*Allium cepa*	Seedling	Seedling germination	Soil treatment	5 D	5 D	Germination	NOEL	0.075	lbs ai/acre	0.040	lbs ae/acre	Landis International Inc., Valdesta, GA	43098901	1994[3,4]	R. Hirsch	2000	Yes
2,4-DB DMA	Tech	Terrestrial Plant	Carrot	*Daucus carota*	Seedling	Seedling emergence (root length)	Soil treatment	14 D	14 D	Germination	EC25	> 0.087	lbs ai/acre	> 0.072	lbs ae/acre	Analytical Biochemical Laboratory, Columbia, Missouri	43910301	1997[3,4]	D. Rieder	1998	Yes
2,4-DB DMA	Tech	Terrestrial Plant	Carrot	*Daucus carota*	Seedling	Seedling emergence (root length)	Soil treatment	14 D	14 D	Germination	NOEL	0.087	lbs ai/acre	0.072	lbs ae/acre	Analytical Biochemical Laboratory, Columbia, Missouri	43910301	1997[3,4]	D. Rieder	1998	Yes
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Soybean	*Glycine max*	Juvenile	Vegetative vigor (root weight)	Direct spray	21 D	21 D	Vegetative vigor	EC25	0.308	lbs ai/acre	0.2042	lbs ae/acre	Pan Agicultural Laboratory, CA	43197001	1994[3,4]	B. Montague	2000	Yes
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Soybean	*Glycine max*	Juvenile	Vegetative vigor (root weight)	Direct spray	21 D	21 D	Vegetative vigor	NOEL	0.089	lbs ai/acre	0.0590	lbs ae/acre	Pan Agicultural Laboratory, CA	43197001	1994[3,4]	B. Montague	2000	Yes
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Corn	*Zea mays*	Juvenile	Vegetative vigor (root weight)	Direct spray	21 D	21 D	Vegetative vigor	EC25	0.208	lbs ai/acre	0.1379	lbs ae/acre	Pan Agicultural Laboratory, CA	42389501	1994[3,4]	B. Montague	2000	Yes
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Corn	*Zea mays*	Juvenile	Vegetative vigor (root weight)	Direct spray	21 D	21 D	Vegetative vigor	NOEL	0.089	lbs ai/acre	0.0590	lbs ae/acre	Pan Agicultural Laboratory, CA	42389501	1994[3,4]	B. Montague	2000	Yes
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Soybean	*Glycine max*	Seedling	Seedling emergence (root weight)	Soil treatment	21 D	21 D	Germination	EC25	0.33	lbs ai/acre	0.2188	lbs ae/acre	Pan Agicultural Laboratory, CA	41835205	1994[3,4]	B. Montague	2000	Yes
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Soybean	*Glycine max*	Seedling	Seedling emergence (root weight)	Soil treatment	21 D	21 D	Germination	NOEL	0.09	lbs ai/acre	0.0597	lbs ae/acre	Pan Agicultural Laboratory, CA	41835205	1994[3,4]	B. Montague	2000	Yes
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Corn	*Zea mays*	Seedling	Seedling emergence (root weight)	Soil treatment	21 D	21 D	Germination	EC25	0.19	lbs ai/acre	0.1260	lbs ae/acre	Pan Agicultural Laboratory, CA	42449201	1994[3,4]	B. Montague	2000	Yes
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Corn	*Zea mays*	Seedling	Seedling emergence (root weight)	Soil treatment	21 D	21 D	Germination	NOEL	0.09	lbs ai/acre	0.0597	lbs ae/acre	Pan Agicultural Laboratory, CA	42449201	1994[3,4]	B. Montague	2000	Yes

Formulation	% purity	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint		Toxicity Value (tested product)[1]	Units		Toxicity Value (a.e.) [1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4-D Diethanolamine salt	73.8	Terrestrial Plant	Radish	*Raphanus sativus*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	7 D	7 D	Germination	EC25	>	0.188	lbs ai/acre	>	0.127	lbs ae/acre	Ricera Inc. Ohio	42449201	1992[3,4]	H. Craven (KBN)	1993	Yes
2,4-D Diethanolamine salt	73.8	Terrestrial Plant	Radish	*Raphanus sativus*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	7 D	7 D	Germination	NOEL		0.09	lbs ai/acre		0.061	lbs ae/acre	Ricera Inc. Ohio	42449201	1992[3,4]	H. Craven (KBN)	1993	Yes
2,4-D Diethanolamine salt	73.8	Terrestrial Plant	Radish	*Raphanus sativus*	Seedling	Seedling emergence	Soil treatment	NR	NR	Germination	EC25	>	0.188	lbs ai/acre	>	0.127	lbs ae/acre	Ricera Inc. Ohio	42449201	1992[3,4]	W. Evans	2004	Supplemental
2,4-D Diethanolamine salt	73.8	Terrestrial Plant	Radish	*Raphanus sativus*	Seedling	Seedling emergence	Soil treatment	NR	NR	Germination	NOEL		0.09	lbs ai/acre		0.061	lbs ae/acre	Ricera Inc. Ohio	42449201	1992[3,4]	W. Evans	2004	Supplemental
2,4-D 2-EHE	94.7	Aquatic Plant	Marine diatom	*Skeletonema costatum*	Not reported	Static	Water	5 D	5 D		EC50		0.23	PPM		0.153	PPM	Malcolm Pernie Inc. New York	42343902	1991[3,4]	M. Davy	1993	No
2,4-D 2-EHE	94.7	Aquatic Plant	Marine diatom	*Skeletonema costatum*	Not reported	Static	Water	5 D	5 D		NOEL		0.0938	PPM		0.062	PPM	Malcolm Pernie Inc. New York	42343902	1991[3,4]	M. Davy	1993	No
2,4-D 2-EHE	94.7	Aquatic Plant	Duckweed	*Lemna gibba*	Not reported	Static	Water	14 D	14 D		EC50		0.5	PPM		0.3	PPM	Malcolm Pernie Inc. New York	42343902	1991[3,4]	M. Davy	1993	Yes
2,4-D 2-EHE	94.7	Aquatic Plant	Duckweed	*Lemna gibba*	Not reported	Static	Water	14 D	14 D		NOEL	<	0.094	PPM	<	0.062	PPM	Malcolm Pernie Inc. New York	42343902	1991[3,4]	M. Davy	1993	Yes
2,4-DB Sodium (400 g/L formulation)	40	Aquatic Plant	Duckweed	*Lemna minor*	Not reported	Static renewal	Water	7 D	7 D		EC50		9.3	PPM		9.3	ppm		41505904	1999[3,4]	L. Brown	2005	Supplemental
2,4-DB Sodium (400 g/L formulation)	40	Aquatic Plant	Duckweed	*Lemna minor*	Not reported	Static renewal	Water	7 D	7 D		NOEL		0.098	PPM		0.098	ppm		41505904	1999[3,4]	L. Brown	2005	Supplemental
2,4-D Isopropyl Ester	98.2	Terrestrial Plant	Oat	*Avena sativa*	Seedling	Seedling emergence	Soil treatment	14 D	14 D	Germination	EC25	>	0.11	lbs ai/acre	>	0.09	lbs ae/acre	Springborn Laboratory Inc., MA	43279201	1996[3,4]	Contract Draft GAI	1999	Yes
2,4-D Isopropyl Ester	98.2	Terrestrial Plant	Oat	*Avena sativa*	Seedling	Seedling emergence	Soil treatment	14 D	14 D	Germination	NOEL		0.11	lbs ai/acre		0.09	lbs ae/acre	Springborn Laboratory Inc., MA	43279201	1996[3,4]	Contract Draft GAI	1999	Yes
2,4-D Isopropyl Ester	98.2	Terrestrial Plant	Ryegrass	*Lolium perenne*	Seedling	Seedling emergence	Soil treatment	14 D	14 D	Germination	EC25	>	0.11	lbs ai/acre	>	0.09	lbs ae/acre	Springborn Laboratory Inc., MA	43279201	1996[3,4]	Contract Draft GAI	1999	Yes
2,4-D Isopropyl Ester	98.2	Terrestrial Plant	Ryegrass	*Lolium perenne*	Seedling	Seedling emergence	Soil treatment	14 D	14 D	Germination	NOEL		0.11	lbs ai/acre		0.09	lbs ae/acre	Springborn Laboratory Inc., MA	43279201	1996[3,4]	Contract Draft GAI	1999	Yes
2,4-DP-p, DMA salt	63	Terrestrial Plant	Oat	*Avena fatua*	Juvenile	Vegetative vigor	Direct spray	21 D	21 D	Vegetative vigor	EC25		NR	lbs ai/acre		NR	lbs ae/acre	California Agricultural Research Inc. Karman, CA	43279202	1993[3,4]	J. Goodyear	1994	No
2,4-DP-p, DMA salt	63	Terrestrial Plant	Oat	*Avena fatua*	Juvenile	Vegetative vigor	Direct spray	21 D	21 D	Vegetative vigor	NOEL		0.11	lbs ai/acre		0.091	lbs ae/acre	California Agricultural Research Inc. Karman, CA	43279202	1993[3,4]	J. Goodyear	1994	Supplemental
2,4-D Acid	96.7	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Seedling	Seedling germination	Soil treatment	14 D	14 D	Germination	EC25		0.12	lbs ai/acre		0.12	lbs ae/acre	Ricera Inc. Ohio	44275601	1992[3,4]	K. Valente	1992	Yes
2,4-D Acid	96.7	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Seedling	Seedling germination	Soil treatment	14 D	14 D	Germination	NOEL	<	0.12	lbs ai/acre	<	0.12	lbs ae/acre	Ricera Inc. Ohio	44275601	1992[3,4]	K. Valente	1992	Yes
2,4-D Dimethylamine salt	55.5	Terrestrial Plant	Buckwheat	*Polygonum convolvulus*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	14 D	14 D	Seedling emergence	EC25		N.R.	lbs ai/acre		NR	lbs ae/acre	Ricera Inc. Ohio	41353802	1992[3,4]	M. Davy	1993	No
2,4-D Dimethylamine salt	55.5	Terrestrial Plant	Buckwheat	*Polygonum convolvulus*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	14 D	14 D	Seedling emergence	EC25		0.12	lbs ai/acre		0.100	lbs ae/acre	Ricera Inc. Ohio	41353802	1992[3,4]	M. Davy	1993	Yes
2,4-D 2-EHE	94.7	Fish	Fathead minnow	*Pimephales promelas*	Early life	Chronic	Water	32 D	32 D		LOEC		0.22	PPM		0.146	PPM	Dow Chemical Corporation Laboratories	43197002	1990[3,4]	M. Davy	1994	Supplemental
2,4-D 2-EHE	94.7	Fish	Fathead minnow	*Pimephales promelas*	Early life	Chronic	Water	32 D	32 D		LOEC		0.12	PPM		0.080	PPM	Dow Chemical Corporation Laboratories	43197002	1990[3,4]	M. Davy	1994	Supplemental

Formulation	% purity	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint	Toxicity Value (tested product)[1]	Units	Toxicity Value (a.e.)[1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4-D Isopropyl Ester	98.2	Terrestrial Plant	Crop plants(4 Sp.)	*Monocots*	Juvenile	Vegetative vigor (shoot height)	Direct spray	14 D	14 D	Vegetative vigor	EC25	> 0.12	lbs ai/acre	> 0.10	lbs ae/acre	Springborn Laboratory Inc., MA	41735202	1996[3,4]	Contract Draft GAI	1999	Yes
2,4-D Isopropyl Ester	98.2	Terrestrial Plant	Crop plants(4 Sp.)	*Monocots*	Juvenile	Vegetative vigor (shoot height)	Direct spray	14 D	14 D	Vegetative vigor	NOEL	0.12	lbs ai/acre	0.10	lbs ae/acre	Springborn Laboratory Inc., MA	41735202	1996[3,4]	Contract Draft GAI	1999	Yes
2,4-D Isopropyl Ester	98.2	Terrestrial Plant	Cucumber	*Cucumis sativus*	Juvenile	Vegetative vigor	Direct spray	14 D	14 D	Vegetative vigor	EC25	> 0.12	lbs ai/acre	> 0.10	lbs ae/acre	Springborn Laboratory Inc., MA	00102870	1996[3,4]	Contract Draft GAI	1999	Yes
2,4-D Isopropyl Ester	98.2	Terrestrial Plant	Cucumber	*Cucumis sativus*	Juvenile	Vegetative vigor	Direct spray	14 D	14 D	Vegetative vigor	NOEL	0.12	lbs ai/acre	0.10	lbs ae/acre	Springborn Laboratory Inc., MA	00102870	1996[3,4]	Contract Draft GAI	1999	Yes
2,4-D Isopropyl Ester	98.2	Terrestrial Plant	Soybean	*Glycine max*	Juvenile	Vegetative vigor	Direct spray	14 D	14 D	Vegetative vigor	EC25	> 0.12	lbs ai/acre	> 0.10	lbs ae/acre	Springborn Laboratory Inc., MA	41353801	1996[3,4]	Contract Draft GAI	1999	Yes
2,4-D Isopropyl Ester	98.2	Terrestrial Plant	Soybean	*Glycine max*	Juvenile	Vegetative vigor	Direct spray	14 D	14 D	Vegetative vigor	NOEL	0.12	lbs ai/acre	0.10	lbs ae/acre	Springborn Laboratory Inc., MA	41353801	1996[3,4]	Contract Draft GAI	1999	Yes
2,4-D Diethanolamine salt	73.8	Terrestrial Plant	Soybean	*Glycine max*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	NR	NR	Germination	EC25	> 0.12	lbs ai/acre	> 0.081	lbs ae/acre	Ricera Inc. Ohio	43933101	1992[3,4]	W. Evans	2004	Yes
2,4-D Diethanolamine salt	73.8	Terrestrial Plant	Soybean	*Glycine max*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	NR	NR	Germination	NOEL	0.12	lbs ai/acre	0.081	lbs ae/acre	Ricera Inc. Ohio	43933101	1992[3,4]	W. Evans	2004	Yes
2,4-D Acid	96.7	Terrestrial Plant	Cucumber	*Cucumis sativus*	Seedling	Seedling emergence (shoot weight)	Soil treatment	14 D	14 D	Germination	EC25	0.53	lbs ai/acre	0.53	lbs ae/acre	Ricera Inc. Ohio	43197001	1992[3,4]	K. Valente	1992	Yes
2,4-D Acid	96.7	Terrestrial Plant	Cucumber	*Cucumis sativus*	Seedling	Seedling emergence (shoot weight)	Soil treatment	14 D	14 D	Germination	NOEL	0.13	lbs ai/acre	0.13	lbs ae/acre	Ricera Inc. Ohio	43197001	1992[3,4]	K. Valente	1992	Yes
2,4-D Isopropyl Ester	98.2	Fish	Bluegill sunfish	*Lepomis macrochirus*	0.5 g	Flow-through	Water	96 hr	96 hr	Mortality	LC50	0.31	PPM	0.26	PPM	Wildlife International Inc., MD	43197001	1996[3,4]	N. Federoff	1996	Yes
2,4-D Isopropyl Ester	98.2	Fish	Bluegill sunfish	*Lepomis macrochirus*	0.5 g	Flow-through	Water	96 hr	96 hr		NOEL	0.13	PPM	0.11	PPM	Wildlife International Inc., MD	43197001	1996[3,4]	N. Federoff	1996	Yes
2,4-DP-p, DMA salt	63.62	Terrestrial Plant	Radish	*Raphanus sativus*	Seedling	Seedling germination	Soil treatment	7 D	7 D	Germination	EC25	0.15	lbs ai/acre	0.125	lbs ae/acre	California Agicultural Research Inc. Karman, CA	43933201	1993[3,4]	W. Evans	2001	Supplemental
2,4-DP-p, DMA salt	63.62	Terrestrial Plant	Radish	*Raphanus sativus*	Seedling	Seedling germination	Soil treatment	7 D	7 D	Germination	NOEL	0.13	lbs ai/acre	0.108	lbs ae/acre	California Agicultural Research Inc. Karman, CA	43933201	1993[3,4]	W. Evans	2001	Supplemental
2,4-DP-p, DMA salt	63.62	Terrestrial Plant	Radish	*Raphanus sativus*	Seedling	Seedling emergence	Soil treatment	14 D	14 D	Germination	EC25	0.26	lbs ai/acre	0.216	lbs ae/acre	California Agicultural Research Inc. Karman, CA	TN 0683 00050674	1993[3,4]	W. Evans	2001	Supplemental
2,4-DP-p, DMA salt	63.62	Terrestrial Plant	Radish	*Raphanus sativus*	Seedling	Seedling emergence	Soil treatment	14 D	14 D	Germination	NOEL	0.13	lbs ai/acre	0.108	lbs ae/acre	California Agicultural Research Inc. Karman, CA	TN 0683 00050674	1993[3,4]	W. Evans	2001	Supplemental
2,4-D Butyl Ester	**N.R.**	**Fish**	**Bluegill sunfish**	***Lepomis macrochirus***	**Juvenile**	**Static**	**Water**	**96 hr**	**96 hr**	**Mortality**	**LC50**	**0.29**	**PPM**	**0.20**	**PPM**	**Bionomics, Inc., Wareham, MA.**	**42416801**	**1976[3,4]**	**T. O'Brien**	**1978**	**Yes**
2,4-D Butyl Ester	N.R.	Fish	Bluegill sunfish	*Lepomis macrochirus*	Juvenile	Static	Water	96 hr	96 hr		NOEL	0.14	PPM	0.10	PPM	Bionomics, Inc., Wareham, MA.	42416801	1976[3,4]	T. O'Brien	1978	Yes
2,4-D 2-EHE	95.4	Aquatic invertebrate	Grass shrimp	*Palaemonetes pugio*	0.23 g	Flow-through	Water	96 hr	96 hr	Mortality	LC50	> 0.14	PPM	> 0.093	PPM	Envirosystem & Engineering Inc.	00077320	1991[3,4]	A. Yamhure	1994	No
2,4-D 2-EHE	95.4	Aquatic invertebrate	Grass shrimp	*Palaemonetes pugio*	0.23 g	Flow-through	Water	96 hr	96 hr		NOEL	0.14	PPM	0.093	PPM	Envirosystem & Engineering Inc.	00077320	1991[3,4]	A. Yamhure	1994	No
2,4-D Butyl Ester	Tech	Fish	Bluegill sunfish	*Lepomis macrochirus*	0.64 g	Static	Water	96 hr	96 hr	Mortality	LC50	0.30	PPM	0.21	PPM	Agricultural Research Center, USDA, Beltsville, MD.	TN 0487,000539 90	1970[3,4]	J. McCann	1987	Yes
2,4-D Butyl Ester	Tech	Fish	Bluegill sunfish	*Lepomis macrochirus*	0.64 g	Static	Water	96 hr	96 hr		NOEL	0.18	PPM	0.12	PPM	Agricultural Research Center, USDA, Beltsville, MD.	TN 0487,000539 90	1970[3,4]	J. McCann	1987	Yes

Formulation	% purity	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint	Toxicity Value (tested product)[1]	Units	Toxicity Value (a.e.)[1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4-D Butoxyethanol Ester	94.6	Terrestrial Plant	Radish	*Raphanus sativus*	Seedling	Seedling emergence (dry weight)	Soil treatment	28 D	28 D	Germination	EC25	0.40	lbs ai/acre	0.28	lbs ae/acre	Landis International Inc., Valdesta, GA	41158306	1994[3,4]	R. Hirsch	2000	Supplemental
2,4-D Butoxyethanol Ester	94.6	Terrestrial Plant	Radish	*Raphanus sativus*	Seedling	Seedling emergence (dry weight)	Soil treatment	28 D	28 D	Germination	NOEL	0.18	lbs ai/acre	0.12	lbs ae/acre	Landis International Inc., Valdesta, GA	41158306	1994[3,4]	R. Hirsch	2000	Supplemental
2,4-D Tri,isopropylamine salt	70.9	Aquatic Plant	Duckweed	*Lemna gibba*	Not reported	Static	Water	14 D	14 D		EC50	2.37	PPM	1.3	PPM	Carolina Ecotox Inc., Durham, NC	43197001	1994[3,4]	H. Craven (KBN)	1994	Yes
2,4-D Tri,isopropylamine salt	**70.9**	**Aquatic Plant**	**Duckweed**	***Lemna gibba***	**Not reported**	**Static**	**Water**	**14 D**	**14 D**		**NOEL**	**0.2**	**PPM**	**0.1**	**PPM**	**Carolina Ecotox Inc., Durham, NC**	**43197001**	**1994[3,4]**	**H. Craven (KBN)**	**1994**	**Yes**
2,4-DP-p, DMA salt	63	Terrestrial Plant	Ryegrass	*Lolium perenne*	Juvenile	Vegetative vigor	Direct spray	21 D	21 D	Vegetative vigor	EC25	NR	lbs ai/acre	NR	lbs ae/acre	California Agicultural Research Inc. Karman, CA	44517305	1993[3,4]	J. Goodyear	1994	No
2,4-DP-p, DMA salt	63	Terrestrial Plant	Ryegrass	*Lolium perenne*	Juvenile	Vegetative vigor	Direct spray	21 D	21 D	Vegetative vigor	NOEL	0.2	lbs ai/acre	0.166	lbs ae/acre	California Agicultural Research Inc. Karman, CA	44517305	1993[3,4]	J. Goodyear	1994	Supplemental
2,4-D Butoxyethanol Ester	**96**	**Aquatic Plant**	**Duckweed**	***Lemna gibba***	**Not reported**	**Static**	**Water**	**14 D**	**14 D**		**EC50**	**0.576**	**PPB**	**0.4 [0.0004]**	**ppb [ppm]**	**Malcolm Pernie Inc. New York**	**42068404**	**1992[3,4]**	**M. Davy**	**1993**	**Yes**
2,4-D Butoxyethanol Ester	96	Aquatic Plant	Duckweed	*Lemna gibba*	Not reported	Static	Water	14 D	14 D		NOEL	0.204	PPB	0.14 [0.00014]	ppb [ppm]	Malcolm Pernie Inc. New York	42068404	1992[3,4]	M. Davy	1993	Yes
2,4-D Isopropyl Ester (Citrus Fix Product)	45.8	Fish	Bluegill sunfish	*Lepomis macrochirus*	0.39 g	Flow-through	Water	96 hr	96 hr	Mortality	LC50	0.31	PPM	0.26	PPM	Wildlife International Inc., MD	TN 0064, 54045	1996[3,4]	R. Mahler	1997	Yes
2,4-D Isopropyl Ester (Citrus Fix Product)	45.8	Fish	Bluegill sunfish	*Lepomis macrochirus*	0.39 g	Flow-through	Water	96 hr	96 hr		NOEL	0.21	PPM	0.18	PPM	Wildlife International Inc., MD	TN 0064, 54045	1996[3,4]	R. Mahler	1997	Yes
2,4 DP-p-2-EHE	93.2	Aquatic invertebrate	Water flea	*Daphnia magna*	<24 hr	Flow-through	Water	48 hr	48 hr		EC50	> 1.5	PPM	> 1.0	PPM	Springborn Laboratory Inc., MA	42068403	1993[3,4]	Contract Draft-KBN	1993	Yes
2,4 DP-p-2-EHE	93.2	Aquatic invertebrate	Water flea	*Daphnia magna*	<24 hr	Flow-through	Water	48 hr	48 hr		NOEL	0.21	PPM	0.139	PPM	Springborn Laboratory Inc., MA	42068403	1993[3,4]	Contract Draft-KBN	1993	Yes
2,4-D Isopropyl ester	45.8	Fish	Bluegill sunfish	*Lepomis macrochirus*	0.39 g	Flow-through	Water	96 hr	96 hr	Mortality	LC50	0.31	PPM	0.26	PPM	Wildlife International Inc., MD	42343902	1996[3,4]	A. Stavola	1998	Yes
2,4-D Isopropyl ester	45.8	Fish	Bluegill sunfish	*Lepomis macrochirus*	0.39 g	Flow-through	Water	96 hr	96 hr		NOEL	0.21	PPM	0.18	PPM	Wildlife International Inc., MD	42343902	1996[3,4]	A. Stavola	1998	Yes
2,4-D Butoxyethanol Ester	94.6	Terrestrial Plant	Onion	*Allium cepa*	Seedling	Seedling emergence	Soil treatment	28 D	28 D	Germination	EC25	0.36	lbs ai/acre	0.25	lbs ae/acre	Landis International Inc., Valdesta, GA	42389501	1994[3,4]	R. Hirsch	2000	Supplemental
2,4-D Butoxyethanol Ester	94.6	Terrestrial Plant	Onion	*Allium cepa*	Seedling	Seedling emergence	Soil treatment	28 D	28 D	Germination	NOEL	0.22	lbs ai/acre	0.15	lbs ae/acre	Landis International Inc., Valdesta, GA	42389501	1994[3,4]	R. Hirsch	2000	Supplemental
2,4-D Dimethylamine salt	55.5	Terrestrial Plant	Soybean	*Glycine max*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	14 D	14 D	Seedling emergence	EC25	N.R.	lbs ai/acre	NR	lbs ae/acre	Ricera Inc. Ohio	42389501	1992[3,4]	M. Davy	1993	No
2,4-D Dimethylamine salt	55.5	Terrestrial Plant	Soybean	*Glycine max*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	14 D	14 D	Seedling emergence	NOEL	0.24	lbs ai/acre	0.199	lbs ae/acre	Ricera Inc. Ohio	42389501	1992[3,4]	M. Davy	1993	Yes
2,4-D 2-EHE	95.4	Fish	Inland silverside	*Menidia beryllina*	0.46 g	Flow-through	Water	96 hr	96 hr	Mortality	LC50	> 0.24	PPM	> 0.159	PPM	Envirosystem & Engineering Inc.	42449201	1991[3,4]	A. Yamhure	1994	No
2,4-D 2-EHE	95.4	Fish	Inland silverside	*Menidia beryllina*	0.46 g	Flow-through	Water	96 hr	96 hr		NOEL	0.24	PPM	0.159	PPM	Envirosystem & Engineering Inc.	42449201	1991[3,4]	A. Yamhure	1994	No
2,4-D 2 EHE	63.5	Terrestrial Plant	Buckwheat	*Polygonum convolvulus*	Seedling	Seedling emergence (shoot height)	Soil treatment	14 D	14 D	Germination	EC25	0.96	lbs ai/acre	0.6366	lbs ae/acre	Ricera Inc. Ohio	42449201	1992[3,4]	M. Davy	1993	Yes
2,4-D 2 EHE	63.5	Terrestrial Plant	Buckwheat	*Polygonum convolvulus*	Seedling	Seedling emergence (shoot height)	Soil treatment	14 D	14 D	Germination	NOEL	0.24	lbs ai/acre	0.1592	lbs ae/acre	Ricera Inc. Ohio	42449201	1992[3,4]	M. Davy	1993	Yes

Formulation	% purity	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint		Toxicity Value (tested product)[1]	Units		Toxicity Value (a.e.)[1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4-D 2 EHE	63.5	Terrestrial Plant	Sorghum	*Sorghum bicolor*	Seedling	Seedling emergence (shoot height)	Soil treatment	14 D	14 D	Germination	EC25		0.25	lbs ai/acre		0.1658	lbs ae/acre	Ricera Inc. Ohio	42449201	1992[3,4]	M. Davy	1993	Yes
2,4-D 2 EHE	63.5	Terrestrial Plant	Sorghum	*Sorghum bicolor*	Seedling	Seedling emergence (shoot height)	Soil treatment	14 D	14 D	Germination	NOEL		0.24	lbs ai/acre		0.1592	lbs ae/acre	Ricera Inc. Ohio	42449201	1992[3,4]	M. Davy	1993	Yes
2,4-D 2 EHE	63.5	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Seedling	Seedling emergence (shoot height)	Soil treatment	14 D	14 D	Germination	EC25	<	0.96	lbs ai/acre	<	0.6366	lbs ae/acre	Ricera Inc. Ohio	00102845	1992[3,4]	M. Davy	1993	Yes
2,4-D 2 EHE	63.5	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Seedling	Seedling emergence (shoot height)	Soil treatment	14 D	14 D	Germination	NOEL		0.24	lbs ai/acre		0.1592	lbs ae/acre	Ricera Inc. Ohio	00102845	1992[3,4]	M. Davy	1993	Yes
2,4-D 2-EHE	63.5	Terrestrial Plant	Corn	*Zea mays*	Juvenile	Vegetative vigor (phytotoxicity)	Direct spray	14 D	14 D	Vegetative vigor	EC25	>	0.24	lbs ai/acre	>	0.1592	lbs ae/acre	Ricera Inc. Ohio	00107930	1992[3,4]	M. Davy	1999	Yes
2,4-D 2-EHE	63.5	Terrestrial Plant	Corn	*Zea mays*	Juvenile	Vegetative vigor (phytotoxicity)	Direct spray	14 D	14 D	Vegetative vigor	NOEL		0.24	lbs ai/acre		0.1592	lbs ae/acre	Ricera Inc. Ohio	00107930	1992[3,4]	M. Davy	1999	Yes
2,4-D 2-EHE	63.5	Terrestrial Plant	Oat	*Avena sativa*	Juvenile	Vegetative vigor (phytotoxicity)	Direct spray	14 D	14 D	Vegetative vigor	EC25	>	0.24	lbs ai/acre	>	0.1592	lbs ae/acre	Ricera Inc. Ohio	42416802	1992[3,4]	M. Davy	1999	Yes
2,4-D 2-EHE	63.5	Terrestrial Plant	Oat	*Avena sativa*	Juvenile	Vegetative vigor (phytotoxicity)	Direct spray	14 D	14 D	Vegetative vigor	NOEL		0.24	lbs ai/acre		0.1592	lbs ae/acre	Ricera Inc. Ohio	42416802	1992[3,4]	M. Davy	1999	Yes
2,4-D Diethanolamine salt	73.8	Terrestrial Plant	Cucumber	*Cucumis sativus*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	NR	NR	Germination	EC25	>	0.25	lbs ai/acre	>	0.169	lbs ae/acre	Ricera Inc. Ohio	42416802	1992[3,4]	W. Evans	2004	Yes
2,4-D Diethanolamine salt	73.8	Terrestrial Plant	Cucumber	*Cucumis sativus*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	NR	NR	Germination	NOEL		0.25	lbs ai/acre		0.169	lbs ae/acre	Ricera Inc. Ohio	42416802	1992[3,4]	W. Evans	2004	Yes
2,4-D Diethanolamine salt	73.8	Terrestrial Plant	Oat	*Avena fatua*	Seedling	Seedling emergence	Soil treatment	NR	NR	Germination	EC25	>	0.25	Not reported	>	0.169	Not reported	Ricera Inc. Ohio	41835202	1992[3,4]	W. Evans	2004	No
2,4-D Diethanolamine salt	73.8	Terrestrial Plant	Oat	*Avena fatua*	Seedling	Seedling emergence	Soil treatment	NR	NR	Germination	NOEL		0.25	Not reported		0.169	Not reported	Ricera Inc. Ohio	41835202	1992[3,4]	W. Evans	2004	No
2,4-D Diethanolamine salt	73.8	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	NR	NR	Germination	EC25	>	0.25	Not reported	>	0.169	Not reported	Ricera Inc. Ohio	43930601	1992[3,4]	W. Evans	2004	No
2,4-D Diethanolamine salt	73.8	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	NR	NR	Germination	NOEL		0.25	Not reported		0.169	Not reported	Ricera Inc. Ohio	43930601	1992[3,4]	W. Evans	2004	No
2,4-D Diethanolamine salt	73.8	Terrestrial Plant	Buckwheat	*Fagopyrum sagittatum*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	NR	NR	Germination	EC25	>	0.25	lbs ai/acre	>	0.169	lbs ae/acre	Ricera Inc. Ohio	42767004	1992[3,4]	W. Evans	2004	Supplemental
2,4-D Diethanolamine salt	73.8	Terrestrial Plant	Buckwheat	*Fagopyrum sagittatum*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	NR	NR	Germination	NOEL		0.25	lbs ai/acre		0.169	lbs ae/acre	Ricera Inc. Ohio	42767004	1992[3,4]	W. Evans	2004	Supplemental
2,4-D Diethanolamine salt	73.8	Terrestrial Plant	Buckwheat	*Polygonum convolvulus*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	NR	NR	Germination	EC25	>	0.25	lbs ai/acre	>	0.169	lbs ae/acre	Ricera Inc. Ohio	41505903	1992[3,4]	W. Evans	2004	Supplemental
2,4-D Diethanolamine salt	73.8	Terrestrial Plant	Buckwheat	*Polygonum convolvulus*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	NR	NR	Germination	NOEL		0.25	lbs ai/acre		0.169	lbs ae/acre	Ricera Inc. Ohio	41505903	1992[3,4]	W. Evans	2004	Supplemental
2,4-D Dimethylamine salt	66.7	Aquatic Plant	Duckweed	Lemna gibba	Not reported	Static	Water	14 D	14 D	Growth	EC50		0.58	PPM		0.482	PPM	Malcolm Pernie Inc. New York	41353801	1990[3,4]	R. Petrie	1991	Yes
2,4-D Dimethylamine salt	66.7	Aquatic Plant	Duckweed	Lemna gibba	Not reported	Static	Water	14 D	14 D	Growth	NOEL		0.27	PPM		0.224	PPM	Malcolm Pernie Inc. New York	41353801	1990[3,4]	R. Petrie	1991	Yes
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Oat	*Avena sativa*	Juvenile	Vegetative vigor (root weight)	Direct spray	21 D	21 D	Vegetative vigor	EC25		2.4	lbs ai/acre		1.5915	lbs ae/acre	Pan Agicultural Laboratory, CA	41353801	1994[3,4]	B. Montague	2000	Yes
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Oat	*Avena sativa*	Juvenile	Vegetative vigor (root weight)	Direct spray	21 D	21 D	Vegetative vigor	NOEL		0.27	lbs ai/acre		0.1790	lbs ae/acre	Pan Agicultural Laboratory, CA	41353801	1994[3,4]	B. Montague	2000	Yes

Formulation	% purity	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint	Toxicity Value (tested product)[1]	Units	Toxicity Value (a.e.)[1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Ryegrass	*Lolium perenne*	Juvenile	Vegetative vigor (root weight)	Direct spray	21 D	21 D	Vegetative vigor	EC25	1.47	lbs ai/acre	0.9748	lbs ae/acre	Pan Agicultural Laboratory, CA	00063066	1994[3,4]	B. Montague	2000	Yes
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Ryegrass	*Lolium perenne*	Juvenile	Vegetative vigor (root weight)	Direct spray	21 D	21 D	Vegetative vigor	NOEL	0.27	lbs ai/acre	0.1790	lbs ae/acre	Pan Agicultural Laboratory, CA	00063066	1994[3,4]	B. Montague	2000	Yes
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Ryegrass	*Lolium perenne*	Seedling	Seedling emergence (root weight)	Soil treatment	21 D	21 D	Germination	EC25	0.30	lbs ai/acre	0.1989	lbs ae/acre	Pan Agicultural Laboratory, CA	TN 0608, 00024968	1994[3,4]	B. Montague	2000	Yes
2,4 DP-p-2-EHE	95.7	Terrestrial Plant	Ryegrass	*Lolium perenne*	Seedling	Seedling emergence (root weight)	Soil treatment	21 D	21 D	Germination	NOEL	0.27	lbs ai/acre	0.1790	lbs ae/acre	Pan Agicultural Laboratory, CA	TN 0608, 00024968	1994[3,4]	B. Montague	2000	Yes
2,4-D Diethanolamine salt	73.8	Terrestrial Plant	Onion	*Allium cepa*	Seedling	Seedling emergence (shoot weight)	Soil treatment	32 D	32 D	Germination	EC25	0.38	lbs ai/acre	0.257	lbs ae/acre	Ricera Inc. Ohio	41735205	1996[3,4]	R. Hirsch	1999	Yes
2,4-D Diethanolamine salt	73.8	Terrestrial Plant	Onion	*Allium cepa*	Seedling	Seedling emergence (shoot weight)	Soil treatment	32 D	32 D	Germination	NOEL	0.27	lbs ai/acre	0.183	lbs ae/acre	Ricera Inc. Ohio	41735205	1996[3,4]	R. Hirsch	1999	Yes
2,4-D Butoxyethanol Ester	96	Aquatic invertebrate	Water flea	*Daphnia magna*	Full lifecycle	Flow-through	Water	21 D	21 D		LOEC	0.7	PPM	0.48	PPM	Dow Chemical Corporation Laboratories	41737303	1989[3,4]	A. Roybal	1991	Yes
2,4-D Butoxyethanol Ester	**96**	**Aquatic invertebrate**	**Water flea**	***Daphnia magna***	**Full lifecycle**	**Flow-through**	**Water**	**21 D**	**21 D**		**NOEL**	**0.29**	**PPM**	**0.20**	**PPM**	**Dow Chemical Corporation Laboratories**	**41737303**	**1989[3,4]**	**A. Roybal**	**1991**	**Yes**
2,4-D Tri,isopropylamine salt	67.9	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Seedling	Seedling germination	Soil treatment	5 D	5 D	Germination	EC25	0.80	lbs ai/acre	0.429	lbs ae/acre	Landis International Inc., Valdesta, GA	42416802	1994[3,4]	R. Hirsch	2000	Yes
2,4-D Tri,isopropylamine salt	67.9	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Seedling	Seedling germination	Soil treatment	5 D	5 D	Germination	NOEL	0.3	lbs ai/acre	0.161	lbs ae/acre	Landis International Inc., Valdesta, GA	42416802	1994[3,4]	R. Hirsch	2000	Yes
2,4-D 2-EHE	94.7	Aquatic Plant	Bluegreen algae	*Anabaena flos-aquae*	Not reported	Static	Water	5 D	5 D		EC50	> 0.32	PPM	> 0.212	PPM	Malcolm Pernie Inc. New York	42416802	1991[3,4]	M. Davy	1993	No
2,4-D 2-EHE	94.7	Aquatic Plant	Bluegreen algae	*Anabaena flos-aquae*	Not reported	Static	Water	5 D	5 D		NOEL	0.32	PPM	0.212	PPM	Malcolm Pernie Inc. New York	42416802	1991[3,4]	M. Davy	1993	No
2,4-D Butyl Ester	100	Fish	Rainbow trout	*Oncorhynchus mykiss*	Juvenile	Static	Water	96 hr	96 hr	Mortality	LC50	0.4	PPM	0.28	PPM	Bionomics, Inc., Wareham, MA.	42416802	1976[3,4]	T. O'Brien	1978	Yes
2,4-D Butyl Ester	100	Fish	Rainbow trout	*Oncorhynchus mykiss*	Juvenile	Static	Water	96 hr	96 hr		NOEL	0.32	PPM	0.22	PPM	Bionomics, Inc., Wareham, MA.	42416802	1976[3,4]	T. O'Brien	1978	Yes
2,4-D Butoxyethanol Ester	97.4	Fish	Bluegill sunfish	*Lepomis macrochirus*	20 mm	Static	Water	96 hr	96 hr	Mortality	LC50	0.62	PPM	0.43	PPM	Dow Chemical Corporation Laboratories	42416802	1983[3,4]	A. Roybal	1991	Yes
2,4-D Butoxyethanol Ester	97.4	Fish	Bluegill sunfish	*Lepomis macrochirus*	20 mm	Static	Water	96 hr	96 hr		NOEL	0.34	PPM	0.23	PPM	Dow Chemical Corporation Laboratories	42416802	1983[3,4]	A. Roybal	1991	Yes
2,4-D Isopropyl Ester	98.2	Fish	Rainbow trout	*Oncorhynchus mykiss*	1.3 g	Flow-through	Water	96 hr	96 hr	Mortality	LC50	0.69	PPM	0.58	PPM	Wildlife International Inc., MD	TN 0726	1996[3,4]	N. Federoff	1996	Yes
2,4-D Isopropyl Ester	98.2	Fish	Rainbow trout	*Oncorhynchus mykiss*	1.3 g	Flow-through	Water	96 hr	96 hr		NOEL	0.34	PPM	0.29	PPM	Wildlife International Inc., MD	TN 0726	1996[3,4]	N. Federoff	1996	Yes
2,4-D Butoxyethanol Ester	94.6	Terrestrial Plant	Carrot	*Daucus carota*	Seedling	Seedling emergence	Soil treatment	28 D	28 D	Germination	EC25	0.55	lbs ai/acre	0.38	lbs ae/acre	Landis International Inc., Valdesta, GA	42767003	1994[3,4]	R. Hirsch	2000	Supplemental
2,4-D Butoxyethanol Ester	94.6	Terrestrial Plant	Carrot	*Daucus carota*	Seedling	Seedling emergence	Soil treatment	28 D	28 D	Germination	NOEL	0.34	lbs ai/acre	0.23	lbs ae/acre	Landis International Inc., Valdesta, GA	42767003	1994[3,4]	R. Hirsch	2000	Supplemental
2,4-D Butoxyethanol Ester	94.6	Terrestrial Plant	Oat	*Avena sativa*	Seedling	Seedling emergence (dry weight)	Soil treatment	28 D	28 D	Germination	EC25	0.70	lbs ai/acre	0.48	lbs ae/acre	Landis International Inc., Valdesta, GA	41835203	1994[3,4]	R. Hirsch	2000	Supplemental
2,4-D Butoxyethanol Ester	94.6	Terrestrial Plant	Oat	*Avena sativa*	Seedling	Seedling emergence (dry weight)	Soil treatment	28 D	28 D	Germination	NOEL	0.36	lbs ai/acre	0.25	lbs ae/acre	Landis International Inc., Valdesta, GA	41835203	1994[3,4]	R. Hirsch	2000	Supplemental

Formulation	% purity	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint	Toxicity Value (tested product)[1]	Units	Toxicity Value (a.e.)[1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4-D Isopropyl Ester (Citrus Fix Product)	45.8	Fish	Rainbow trout	*Oncorhynchus mykiss*	1.6 g	Flow-through	Water	96 hr	96 hr	Mortality	LC50	0.78	PPM	0.66	PPM	Wildlife International Inc., MD	42068401	1996[3,4]	N. Federoff	1996	Yes
2,4-D Isopropyl Ester (Citrus Fix Product)	45.8	Fish	Rainbow trout	*Oncorhynchus mykiss*	1.6 g	Flow-through	Water	96 hr	96 hr		NOEL	0.39	PPM	0.33	PPM	Wildlife International Inc., MD	42068401	1996[3,4]	N. Federoff	1996	Yes
2,4-D Butoxyethanol Ester -Weed-Rhap LV Oxy6D	77.5	Fish	Rainbow trout	*Oncorhynchus mykiss*	0.69 g	Static	Water	96 hr	96 hr	Mortality	LC50	0.65	PPM	0.45	PPM	Agricultural Research Center, USDA, Beltsville, MD.	41353801	1974[3,4]	C. Lewis	1987	Yes
2,4-D Butoxyethanol Ester -Weed-Rhap LV Oxy6D	77.5	Fish	Rainbow trout	*Oncorhynchus mykiss*	0.69 g	Static	Water	96 hr	96 hr		NOEL	< 0.5	PPM	< 0.34	PPM	Agricultural Research Center, USDA, Beltsville, MD.	41353801	1974[3,4]	C. Lewis	1987	Yes
2,4-D Diethanolamine salt	73.8	Aquatic Plant	Green algae	*Selenastrum capricornutum*	Not reported	Static	Water	5 D	5 D		EC50	11	PPM	7.5	PPM	Wildlife International Inc., MD	TN 0059	1993[3,4]	H. Craven (KBN)	1993	Yes
2,4-D Diethanolamine salt	73.8	Aquatic Plant	Green algae	*Selenastrum capricornutum*	Not reported	Static	Water	5 D	5 D		NOEL	0.5	PPM	0.339	PPM	Wildlife International Inc., MD	TN 0059	1993[3,4]	H. Craven (KBN)	1993	Yes
2,4-D Acid	96.7	Terrestrial Plant	Sorghum	*Sorghum bicolor*	Juvenile	Vegetative vigor (phytotoxicity)	Direct spray	14 D	14 D	Vegetative vigor	EC25	1.34	lbs ai/acre	1.34	lbs ae/acre	Ricera Inc. Ohio	41735206	1991[3,4]	K. Valente	1992	Yes
2,4-D Acid	96.7	Terrestrial Plant	Sorghum	*Sorghum bicolor*	Juvenile	Vegetative vigor (phytotoxicity)	Direct spray	14 D	14 D	Vegetative vigor	NOEL	0.53	lbs ai/acre	0.53	lbs ae/acre	Ricera Inc. Ohio	41735206	1991[3,4]	K. Valente	1992	Yes
2,4-DP 2-Butoxyethyl Ester (Weedone formula)	59.1	Fish	Bluegill sunfish	*Lepomis macrochirus*	0.38 g	Static	Water	96 hr	96 hr	Mortality	LC50	0.833	PPM	0.573	PPM	Union Carbide Environmental Services	00077321	1980[3,4]	C. Laird	1988	Supplemental
2,4-DP 2-Butoxyethyl Ester (Weedone formula)	59.1	Fish	Bluegill sunfish	*Lepomis macrochirus*	0.38 g	Static	Water	96 hr	96 hr		NOEL	0.56	PPM	0.385	PPM	Union Carbide Environmental Services	00077321	1980[3,4]	C. Laird	1988	Supplemental
2,4-D Butyl Ester	Tech	Fish	Rainbow trout	*Oncorhynchus mykiss*	0.97 g	Static	Water	96 hr	96 hr	Mortality	LC50	0.8	PPM	0.55	PPM	Agricultural Research Center, USDA, Beltsville, MD.	43374701	1972[3,4]	J. McCann	1987	Yes
2,4-D Butyl Ester	Tech	Fish	Rainbow trout	*Oncorhynchus mykiss*	0.97 g	Static	Water	96 hr	96 hr		NOEL	0.56	PPM	0.39	PPM	Agricultural Research Center, USDA, Beltsville, MD.	43374701	1972[3,4]	J. McCann	1987	Yes
2,4-D N,N-Dimethyl oleyl-linoleyl amine	63.8	Fish	Rainbow trout	*Oncorhynchus mykiss*	0.83 g	Static	Water	96 hr	96 hr	Mortality	LC50	0.64	PPM	0.53	ppm	Agricultural Research Center, USDA, Beltsville, MD.	43374701	1974[3,4]	J. McCann	1974	Supplemental
2,4-D N,N-Dimethyl oleyl-linoleyl amine	63.8	Fish	Rainbow trout	*Oncorhynchus mykiss*	0.83 g	Static	Water	96 hr	96 hr		NOEL	0.56	PPM	0.47	ppm	Agricultural Research Center, USDA, Beltsville, MD.	43374701	1974[3,4]	J. McCann	1974	Supplemental
2,4-D Isooctyl Ester	96.2	Aquatic invertebrate	Water flea	*Daphnia magna*	<24 hr	Static	Water	48 hr	48 hr		EC50	> 5.0	PPM	> 3.3	PPM	Dow Chemical Corporation Laboratories	43374701	1983[3,4]	K. Valente	1992	Yes
2,4-D Isooctyl Ester	96.2	Aquatic invertebrate	Water flea	*Daphnia magna*	<24 hr	Static	Water	48 hr	48 hr		NOEL	0.6	PPM	0.4	PPM	Dow Chemical Corporation Laboratories	43374701	1983[3,4]	K. Valente	1992	Yes
2,4-D Butoxyethanol Ester	94.6	Terrestrial Plant	Cucumber	*Cucumis sativus*	Seedling	Seedling emergence	Soil treatment	28 D	28 D	Germination	EC25	> 0.73	lbs ai/acre	> 0.50	lbs ae/acre	Landis International Inc., Valdesta, GA	43374701	1994[3,4]	R. Hirsch	2000	Supplemental
2,4-D Butoxyethanol Ester	94.6	Terrestrial Plant	Cucumber	*Cucumis sativus*	Seedling	Seedling emergence	Soil treatment	28 D	28 D	Germination	NOEL	0.73	lbs ai/acre	0.50	lbs ae/acre	Landis International Inc., Valdesta, GA	43374701	1994[3,4]	R. Hirsch	2000	Supplemental
2,4-D 2-EHE	99.96	Amphibian	Leopard frog	*Rana pipiens*	Tadple	Static	Water	96 hr	96 hr	Mortality	LC50	> 0.765	PPM	> 0.507	PPM	Wildlife International Inc., MD	43374701	1997[3,4]	S. Ramasamy	2001	Supplemental
2,4-D 2-EHE	**99.96**	**Amphibian**	**Leopard frog**	***Rana pipiens***	**Tadple**	**Static**	**Water**	**96 hr**	**96 hr**		**NOEL**	**0.765**	**PPM**	**0.507**	**PPM**	**Wildlife International Inc., MD**	**43374701**	**1997[3,4]**	**S. Ramasamy**	**2001**	**Supplemental**
2,4-D Butoxyethanol Ester	96	Aquatic Plant	Marine diatom	*Skeletonema costatum*	Not reported	Static	Water	5 D	5 D		EC50	1.48	PPM	1.02	PPM	Malcolm Pernie Inc. New York	43374701	1992[3,4]	M. Davy	1993	No
2,4-D Butoxyethanol Ester	96	Aquatic Plant	Marine diatom	*Skeletonema costatum*	Not reported	Static	Water	5 D	5 D		NOEL	0.78	PPM	0.54	PPM	Malcolm Pernie Inc. New York	43374701	1992[3,4]	M. Davy	1993	No

Formulation	% purity	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint		Toxicity Value (tested product)[1]	Units		Toxicity Value (a.e.)[1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4-D Propylene Glycol B.E. Ester	72.8	Fish	Bluegill sunfish	*Lepomis macrochirus*	1.02	Static	Water	96 hr	96 hr	Mortality	LC50		0.83	PPM		0.571	PPM	Agricultural Research Center, USDA, Beltsville, MD.	43374701	1968[3,4]	B. Montague	2004	Supplemental
2,4-D Propylene Glycol B.E. Ester	72.8	Fish	Bluegill sunfish	*Lepomis macrochirus*	1.02	Static	Water	96 hr	96 hr		NOEL	<	0.83	PPM	<	0.571	PPM	Agricultural Research Center, USDA, Beltsville, MD.	43374701	1968[3,4]	B. Montague	2004	Supplemental
2,4-D Butoxyethanol Ester	96	Aquatic Plant	Freshwater diatom	*Navicula pelliculosa*	Not reported	Static	Water	5 D	5 D		EC50		1.86	PPM		1.28	PPM	Malcolm Pernie Inc. New York	43374701	1992[3,4]	M. Davy	1993	Yes
2,4-D Butoxyethanol Ester	96	Aquatic Plant	Freshwater diatom	*Navicula pelliculosa*	Not reported	Static	Water	5 D	5 D		NOEL		0.86	PPM		0.59	PPM	Malcolm Pernie Inc. New York	43374701	1992[3,4]	M. Davy	1993	Yes
2,4-D 2 EHE	63.5	Terrestrial Plant	Corn	*Zea mays*	Juvenile	Vegetative vigor	Direct spray	14 D	14 D	Vegetative vigor	EC25	>	0.96	lbs ai/acre	>	0.6366	lbs ae/acre	Ricera Inc. Ohio	43374701	1992[3,4]	R. Petrie	1992	Supplemental
2,4-D 2 EHE	63.5	Terrestrial Plant	Corn	*Zea mays*	Juvenile	Vegetative vigor	Direct spray	14 D	14 D	Vegetative vigor	NOEL		0.96	lbs ai/acre		0.6366	lbs ae/acre	Ricera Inc. Ohio	43374701	1992[3,4]	R. Petrie	1992	Supplemental
2,4-D Dimethylamine salt	55.5	Terrestrial Plant	Corn	*Zea mays*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	14 D	14 D	Seedling emergence	EC25		N.R.	lbs ai/acre		NR	lbs ae/acre	Ricera Inc. Ohio	43374701	1992[3,4]	M. Davy	1992	No
2,4-D Dimethylamine salt	55.5	Terrestrial Plant	Corn	*Zea mays*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	14 D	14 D	Seedling emergence	NOEL		0.96	lbs ai/acre		0.797	lbs ae/acre	Ricera Inc. Ohio	43374701	1992[3,4]	M. Davy	1992	Yes
2,4-D Dimethylamine salt	55.5	Terrestrial Plant	Oat	*Avena sativa*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	14 D	14 D	Seedling emergence	EC25		N.R.	lbs ai/acre		NR	lbs ae/acre	Ricera Inc. Ohio	42416802	1992[3,4]	M. Davy	1993	No
2,4-D Dimethylamine salt	55.5	Terrestrial Plant	Oat	*Avena sativa*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	14 D	14 D	Seedling emergence	NOEL		0.96	lbs ai/acre		0.797	lbs ae/acre	Ricera Inc. Ohio	42416802	1992[3,4]	M. Davy	1993	Yes
2,4-D 2 EHE	63.5	Terrestrial Plant	Corn	*Zea mays*	Seedling	Seedling emergence (shoot height)	Soil treatment	14 D	14 D	Germination	EC25	>	0.96	lbs ai/acre	>	0.6366	lbs ae/acre	Ricera Inc. Ohio	42416801	1992[3,4]	M. Davy	1993	Yes
2,4-D 2 EHE	63.5	Terrestrial Plant	Corn	*Zea mays*	Seedling	Seedling emergence (shoot height)	Soil treatment	14 D	14 D	Germination	NOEL	>	0.96	lbs ai/acre	>	0.6366	lbs ae/acre	Ricera Inc. Ohio	42416801	1992[3,4]	M. Davy	1993	Yes
2,4-D 2 EHE	63.5	Terrestrial Plant	Oat	*Avena sativa*	Seedling	Seedling emergence (shoot height)	Soil treatment	14 D	14 D	Germination	EC25	>	0.96	lbs ai/acre	>	0.6366	lbs ae/acre	Ricera Inc. Ohio	42416801	1992[3,4]	M. Davy	1993	Yes
2,4-D 2 EHE	63.5	Terrestrial Plant	Oat	*Avena sativa*	Seedling	Seedling emergence (shoot height)	Soil treatment	14 D	14 D	Germination	NOEL	>	0.96	lbs ai/acre	>	0.6366	lbs ae/acre	Ricera Inc. Ohio	42416801	1992[3,4]	M. Davy	1993	Yes
2,4-D 2 EHE	63.5	Terrestrial Plant	Soybean	*Glycine max*	Seedling	Seedling emergence (shoot height)	Soil treatment	14 D	14 D	Germination	EC25	>	0.96	lbs ai/acre	>	0.6366	lbs ae/acre	Ricera Inc. Ohio	TN 0684	1992[3,4]	M. Davy	1993	Yes
2,4-D 2 EHE	63.5	Terrestrial Plant	Soybean	*Glycine max*	Seedling	Seedling emergence (shoot height)	Soil treatment	14 D	14 D	Germination	NOEL	>	0.96	lbs ai/acre	>	0.6366	lbs ae/acre	Ricera Inc. Ohio	TN 0684	1992[3,4]	M. Davy	1993	Yes
2,4-D Propylene Glycol B.E. Ester	Tech?	Fish	Bluegill sunfish	*Lepomis macrochirus*	Not reported	Static	Water	96 hr	96 hr	Mortality	LC50		1.2	PPM		0.826	PPM	Bionomics, Inc., Wareham, MA.	43488601	1971[3,4]	C. Lewis	1988	Supplemental
2,4-D Propylene Glycol B.E. Ester	Tech?	Fish	Bluegill sunfish	*Lepomis macrochirus*	Not reported	Static	Water	96 hr	96 hr		NOEL	<	1	PPM	<	0.688	PPM	Bionomics, Inc., Wareham, MA.	43488601	1971[3,4]	C. Lewis	1988	Supplemental
2,4-D Butyl Ester	Tech	Aquatic invertebrate	Water flea	*Daphnia magna*	<24 hr	Static	Water	96 hr	96 hr		EC50		2.8	PPM		1.9	PPM	Union Carbide Environmental Services	00067328	1977[3,4]	T. O'Brien	1978	Yes
2,4-D Butyl Ester	Tech	Aquatic invertebrate	Water flea	*Daphnia magna*	<24 hr	Static	Water	96 hr	96 hr		NOEL	<	1	PPM	<	0.69	PPM	Union Carbide Environmental Services	00067328	1977[3,4]	T. O'Brien	1978	Yes
2,4-D Diethanolamine salt	73.8	Terrestrial Plant	Corn	*Zea mays*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	NR	NR	Germination	EC25	>	1.0	lbs ai/acre	>	0.678	lbs ae/acre	Ricera Inc. Ohio	42681001	1992[3,4]	W. Evans	2004	Yes
2,4-D Diethanolamine salt	73.8	Terrestrial Plant	Corn	*Zea mays*	Seedling	Seedling emergence (phytotoxicity)	Soil treatment	NR	NR	Germination	NOEL		1	lbs ai/acre		0.678	lbs ae/acre	Ricera Inc. Ohio	42681001	1992[3,4]	W. Evans	2004	Yes

Formulation	% purity	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint	Toxicity Value (tested product)[1]	Units	Toxicity Value (a.e.)[1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4-D Acid	96.7	Terrestrial Plant	Buckwheat	*Polygonum convolvulus*	Seedling	Seedling emergence (shoot weight)	Soil treatment	14 D	14 D	Germination	EC25	1.29	lbs ai/acre	1.29	lbs ae/acre	Ricera Inc. Ohio	00045069	1992[3,4]	K. Valente	1992	Yes
2,4-D Acid	96.7	Terrestrial Plant	Buckwheat	*Polygonum convolvulus*	Seedling	Seedling emergence (shoot weight)	Soil treatment	14 D	14 D	Germination	NOEL	1.05	lbs ai/acre	1.05	lbs ae/acre	Ricera Inc. Ohio	00045069	1992[3,4]	K. Valente	1992	Yes
2,4-D Acid	96.7	Terrestrial Plant	Soybean	*Glycine max*	Seedling	Seedling emergence (shoot weight)	Soil treatment	14 D	14 D	Germination	EC25	1.71	lbs ai/acre	1.71	lbs ae/acre	Ricera Inc. Ohio	TN 0574, 00050676	1992[3,4]	K. Valente	1992	Yes
2,4-D Acid	96.7	Terrestrial Plant	Soybean	*Glycine max*	Seedling	Seedling emergence (shoot weight)	Soil treatment	14 D	14 D	Germination	NOEL	1.05	lbs ai/acre	1.05	lbs ae/acre	Ricera Inc. Ohio	TN 0574, 00050676	1992[3,4]	K. Valente	1992	Yes
2,4-D 2-EHE	66.6	Fish	Inland silverside	*Menidia beryllina*	Juvenile	Flow-through	Water	96 hr	96 hr	Mortality	LC50	> 3.0	PPM	> 2.0	PPM	Envirosystem & Engineering Inc.	42595901	1991[3,4]	J. Noles	1991	No
2,4-D 2-EHE	66.6	Fish	Inland silverside	*Menidia beryllina*	Juvenile	Flow-through	Water	96 hr	96 hr		NOEL	1.1	PPM	0.729	PPM	Envirosystem & Engineering Inc.	42595901	1991[3,4]	J. Noles	1991	No
2,4-D Isopropyl Ester	98.2	Aquatic invertebrate	Water flea	*Daphnia magna*	<24 hr	Flow-through	Water	48 hr	48 hr		EC50	2.6	PPM	2.2	PPM	Wildlife International Inc., MD	TN 0224, 00054026	1996[3,4]	N. Federoff	1996	Yes
2,4-D Isopropyl Ester	98.2	Aquatic invertebrate	Water flea	*Daphnia magna*	<24 hr	Flow-through	Water	48 hr	48 hr		NOEL	1.1	PPM	0.92	PPM	Wildlife International Inc., MD	TN 0224, 00054026	1996[3,4]	N. Federoff	1996	Yes
2,4 DP-p-2-EHE	93.2	Fish	Bluegill sunfish	*Lepomis macrochirus*	1.9 g	Static	Water	96 hr	96 hr	Mortality	LC50	7.7	PPM	5.1	PPM	BASF Corporation, Republic of Germany	41158301	1992[3,4]	A. Yamhure	1996	Yes
2,4 DP-p-2-EHE	93.2	Fish	Bluegill sunfish	*Lepomis macrochirus*	1.9 g	Static	Water	96 hr	96 hr		NOEL	1.52	PPM	1.0	PPM	BASF Corporation, Republic of Germany	41158301	1992[3,4]	A. Yamhure	1996	Yes
2,4-D Dimethylamine salt	66.7	Aquatic Plant	Freshwater diatom	Navicula pelliculosa	Not reported	Static	Water	120hr	120hr	Growth	EC50	4.67	PPM	3.878	PPM	Malcolm Pernie Inc. New York	00045068	1990[3,4]	R. Petrie	1991	Yes
2,4-D Dimethylamine salt	66.7	Aquatic Plant	Freshwater diatom	Navicula pelliculosa	Not reported	Static	Water	120hr	120hr	Growth	NOEL	1.7	PPM	1.412	PPM	Malcolm Pernie Inc. New York	00045068	1990[3,4]	R. Petrie	1991	Yes
2,4-D Butoxyethanol Ester	97.4	Fish	Rainbow trout	*Oncorhynchus mykiss*	27 mm	Static	Water	96 hr	96 hr	Mortality	LC50	2.09	PPM	1.44	PPM	Dow Chemical Corporation Laboratories	42449201	1983[3,4]	A. Roybal	1991	Yes
2,4-D Butoxyethanol Ester	97.4	Fish	Rainbow trout	*Oncorhynchus mykiss*	27 mm	Static	Water	96 hr	96 hr		NOEL	1.7	PPM	1.17	PPM	Dow Chemical Corporation Laboratories	42449201	1983[3,4]	A. Roybal	1991	Yes
2,4-D Butoxyethanol Ester	97.4	Fish	Fathead minnow	*Pimephales promelas*	16 mm	Static	Water	96 hr	96 hr	Mortality	LC50	2.5	PPM	1.72	PPM	Dow Chemical Corporation Laboratories	44517302	1983[3,4]	A. Roybal	1991	Yes
2,4-D Butoxyethanol Ester	97.4	Fish	Fathead minnow	*Pimephales promelas*	16 mm	Static	Water	96 hr	96 hr		NOEL	1.7	PPM	1.17	PPM	Dow Chemical Corporation Laboratories	44517302	1983[3,4]	A. Roybal	1991	Yes
2,4-DP 2-Butoxyethyl Ester	59.1	Fish	Rainbow trout	*Oncorhynchus mykiss*	0.35 g	Static	Water	96 hr	96 hr	Mortality	LC50	2.7	PPM	1.858	PPM	Union Carbide Environmental Services	TN 0065	1980[3,4]	C. Laird	1988	Supplemental
2,4-DP 2-Butoxyethyl Ester	59.1	Fish	Rainbow trout	*Oncorhynchus mykiss*	0.35 g	Static	Water	96 hr	96 hr		NOEL	1.8	PPM	1.238	PPM	Union Carbide Environmental Services	TN 0065	1980[3,4]	C. Laird	1988	Supplemental
2,4-D 2-EHE	94.7	Aquatic Plant	Freshwater diatom	*Navicula pelliculosa*	Not reported	Static	Water	5 D	5 D		EC50	4.1	PPM	2.7	PPM	Malcolm Pernie Inc. New York	41835207	1991[3,4]	M. Davy	1993	Yes
2,4-D 2-EHE	94.7	Aquatic Plant	Freshwater diatom	*Navicula pelliculosa*	Not reported	Static	Water	5 D	5 D		NOEL	1.875	PPM	1.2	PPM	Malcolm Pernie Inc. New York	41835207	1991[3,4]	M. Davy	1993	Yes
2,4-D Acid	96.9	Aquatic Plant	Bluegreen algae	Anabaena flos-aquae	Not reported	Static	Water	5 D	5 D	Growth	EC50	> 2.02	PPM	> 2.02	PPM	Carolina Ecotox Inc., Durham, NC	41835204	1994[3,4]	M. Davy	1998	No
2,4-D Acid	96.9	Aquatic Plant	Bluegreen algae	Anabaena flos-aquae	Not reported	Static	Water	5 D	5 D	Growth	NOEL	> 2.02	PPM	> 2.02	PPM	Carolina Ecotox Inc., Durham, NC	41835204	1994[3,4]	M. Davy	1998	No

Formulation	% purity	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint	Toxicity Value (tested product)[1]	Units	Toxicity Value (a.e.)[1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4-D Acid	96.9	Aquatic Plant	Freshwater diatom	Navicula pelliculosa	Not reported	Static	Water	5 D	5 D	Growth	EC50	2.02	PPM	2.02	PPM	Carolina Ecotox Inc., Durham, NC	41766701	1994[3,4]	M. Davy	1994	Yes
2,4-D Acid	96.9	Aquatic Plant	Freshwater diatom	Navicula pelliculosa	Not reported	Static	Water	5 D	5 D	Growth	NOEL	< 2.02	PPM	< 2.02	PPM	Carolina Ecotox Inc., Durham, NC	41766701	1994[3,4]	M. Davy	1994	Yes
2,4-D Acid	96.9	Aquatic Plant	Marine diatom	Skeletonema costatum	Not reported	Static	Water	5 D	5 D	Growth	EC50	2.02	PPM	2.02	PPM	Carolina Ecotox Inc., Durham, NC	TN 762	1994[3,4]	M. Davy	1998	No
2,4-D Acid	96.9	Aquatic Plant	Marine diatom	Skeletonema costatum	Not reported	Static	Water	5 D	5 D	Growth	NOEL	< 2.02	PPM	< 2.02	PPM	Carolina Ecotox Inc., Durham, NC	TN 762	1994[3,4]	M. Davy	1998	No
2,4-D Acid	96.9	Aquatic Plant	Duckweed	Lemna gibba	Not reported	Static	Water	14 D	14 D	Growth	EC50	< 2.02	PPM	< 2.02	PPM	Carolina Ecotox Inc., Durham, NC	00036935	1994[3,4]	M. Davy	1998	Yes
2,4-D Acid	96.9	Aquatic Plant	Duckweed	Lemna gibba	Not reported	Static	Water	14 D	14 D	Growth	NOEL	< 2.02	PPM	< 2.02	PPM	Carolina Ecotox Inc., Durham, NC	00036935	1994[3,4]	M. Davy	1998	Yes
2,4-D 2 EHE	66.9	Fish	Rainbow trout	*Oncorhynchus mykiss*	0.21 g	Flow-through	Water	96 hr	96 hr	Mortality	LC50	7.2	PPM	4.8	PPM	Dow Chemical Corporation Laboratories	41420002	1990[3,4]	W. Evans	2001	Yes
2,4-D 2 EHE	66.9	Fish	Rainbow trout	*Oncorhynchus mykiss*	0.21 g	Flow-through	Water	96 hr	96 hr		NOEL	< 2.1	PPM	< 1.4	PPM	Dow Chemical Corporation Laboratories	41420002	1990[3,4]	W. Evans	2001	Yes
2,4-D Acid	96.7	Terrestrial Plant	Corn	*Zea mays*	Seedling	Seedling emergence (shoot weight)	Soil treatment	14 D	14 D	Germination	EC25	> 4.2	lbs ai/acre	> 4.2	lbs ae/acre	Ricera Inc. Ohio	42389501	1992[3,4]	K. Valente	1992	Yes
2,4-D Acid	96.7	Terrestrial Plant	Corn	*Zea mays*	Seedling	Seedling emergence (shoot weight)	Soil treatment	14 D	14 D	Germination	NOEL	2.1	lbs ai/acre	2.1	lbs ae/acre	Ricera Inc. Ohio	42389501	1992[3,4]	K. Valente	1992	Yes
2,4-D Acid	96.7	Terrestrial Plant	Oat	*Avena sativa*	Seedling	Seedling emergence (shoot weight)	Soil treatment	14 D	14 D	Germination	EC25	> 4.2	lbs ai/acre	> 4.2	lbs ae/acre	Ricera Inc. Ohio	42621801	1992[3,4]	K. Valente	1992	Yes
2,4-D Acid	96.7	Terrestrial Plant	Oat	*Avena sativa*	Seedling	Seedling emergence (shoot weight)	Soil treatment	14 D	14 D	Germination	NOEL	2.1	lbs ai/acre	2.1	lbs ae/acre	Ricera Inc. Ohio	42621801	1992[3,4]	K. Valente	1992	Yes
2,4-D Acid	96.7	Terrestrial Plant	Onion	*Allium cepa*	Seedling	Seedling emergence (shoot weight)	Soil treatment	14 D	14 D	Germination	EC25	> 2.1	lbs ai/acre	> 2.1	lbs ae/acre	Ricera Inc. Ohio	42187301	1992[3,4]	K. Valente	1992	Yes
2,4-D Acid	96.7	Terrestrial Plant	Onion	*Allium cepa*	Seedling	Seedling emergence (shoot weight)	Soil treatment	14 D	14 D	Germination	NOEL	2.1	lbs ai/acre	2.1	lbs ae/acre	Ricera Inc. Ohio	42187301	1992[3,4]	K. Valente	1992	Yes
2,4-D Acid	96.7	Terrestrial Plant	Sorghum	*Sorghum bicolor*	Seedling	Seedling emergence (shoot weight)	Soil treatment	14 D	14 D	Germination	EC25	> 2.1	lbs ai/acre	> 2.1	lbs ae/acre	Ricera Inc. Ohio	42204601	1992[3,4]	K. Valente	1992	Yes
2,4-D Acid	96.7	Terrestrial Plant	Sorghum	*Sorghum bicolor*	Seedling	Seedling emergence (shoot weight)	Soil treatment	14 D	14 D	Germination	NOEL	2.1	lbs ai/acre	2.1	lbs ae/acre	Ricera Inc. Ohio	42204601	1992[3,4]	K. Valente	1992	Yes
2,4 DP-p-2-EHE	93.2	Fish	Rainbow trout	*Oncorhynchus mykiss*	2.8 g	Static	Water	96 hr	96 hr	Mortality	LC50	7.9	PPM	5.2	PPM	BASF Corporation, Republic of Germany	41429001	1992[3,4]	A. Yamhure	1996	Yes
2,4 DP-p-2-EHE	93.2	Fish	Rainbow trout	*Oncorhynchus mykiss*	2.8 g	Static	Water	96 hr	96 hr		NOEL	2.72	PPM	1.8	PPM	BASF Corporation, Republic of Germany	41429001	1992[3,4]	A. Yamhure	1996	Yes
2,4-D 2-EHE	67	Aquatic invertebrate	Grass shrimp	*Palaemonetes pugio*	Juvenile	Flow-through	Water	96 hr	96 hr	Mortality	LC50	> 3.0	PPB	> 2 [0.002]	ppb [ppm]	Envirosystem & Engineering Inc.	42979701	1991[3,4]	J. Noles	1991	No
2,4-D 2-EHE	67	Aquatic invertebrate	Grass shrimp	*Palaemonetes pugio*	Juvenile	Flow-through	Water	96 hr	96 hr		NOEL	3	PPB	2 [0.002]	ppb [ppm]	Envirosystem & Engineering Inc.	42979701	1991[3,4]	J. Noles	1991	No
2,4-D Butoxyethanol Ester	96	Aquatic Plant	Bluegreen algae	*Anabaena flos-aquae*	Not reported	Static	Water	5 D	5 D		EC50	6.37	PPB	4.38 [0.00438]	ppb [ppm]	Malcolm Pernie Inc. New York	TN	1992[3,4]	M. Davy	1993	No
2,4-D Butoxyethanol Ester	96	Aquatic Plant	Bluegreen algae	*Anabaena flos-aquae*	Not reported	Static	Water	5 D	5 D		NOEL	3.14	PPB	2.16 [0.00216]	ppb [ppm]	Malcolm Pernie Inc. New York	TN	1992[3,4]	M. Davy	1993	No

Formulation	% purity	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint		Toxicity Value (tested product)[1]	Units		Toxicity Value (a.e.)[1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4-D Butoxyethanol Ester	97.4	Aquatic invertebrate	Water flea	*Daphnia magna*	<24 hr	Static	Water	48 hr	48 hr		EC50		7.2	PPM		5.0	PPM	Dow Chemical Corporation Laboratories	TN 0759, 00050699	1983[3,4]	A. Roybal	1991	Yes
2,4-D Butoxyethanol Ester	97.4	Aquatic invertebrate	Water flea	*Daphnia magna*	<24 hr	Static	Water	48 hr	48 hr		NOEL	<	3.4	PPM	<	2.34	PPM	Dow Chemical Corporation Laboratories	TN 0759, 50699	1983[3,4]	A. Roybal	1991	Yes
2,4-DB DMA	26.7	Fish	Bluegill sunfish	*Lepomis macrochirus*	0.69 g	Flow-through	Water	96 hr	96 hr	Mortality	LC50		13	PPM		10.795	PPM	Springborn Laboratory Inc., MA	41973401	1990[3,4,5]	R. Lamb	1991	No
2,4-DB DMA	26.7	Fish	Bluegill sunfish	*Lepomis macrochirus*	0.69 g	Flow-through	Water	96 hr	96 hr		NOEL		3.6	PPM		2.990	PPM	Springborn Laboratory Inc., MA	41973401	1990[3,4,5]	R. Lamb	1991	No
2,4-D Isooctyl Ester/2,4,5-T mixture	15/15	Fish	Bluegill sunfish	*Lepomis macrochirus*	0.85 g	Static	Water	96 hr	96 hr	Mortality	LC50		4.9	PPM		3.2	PPM	Agricultural Research Center, USDA, Beltsville, MD.	TN 0638	1967[3,4]	B. Montague	2004	Supplemental
2,4-D Isooctyl Ester/2,4,5-T mixture	15/15	Fish	Bluegill sunfish	*Lepomis macrochirus*	0.85 g	Static	Water	96 hr	96 hr		NOEL	<	3.7	PPM	<	2.5	PPM	Agricultural Research Center, USDA, Beltsville, MD.	TN 0638	1967[3,4]	B. Montague	2004	Supplemental
2,4-D 2 EHE	94.7	Aquatic Plant	Green algae	*Selenastrum capricornutum*	Not reported	Static	Water	5 D	5 D		EC50	>	30.0	PPM	>	19.9	PPM	Malcolm Pernie Inc. New York	43488604	1990[3,4]	M. Davy	1993	Yes
2,4-D 2 EHE	94.7	Aquatic Plant	Green algae	*Selenastrum capricornutum*	Not reported	Static	Water	5 D	5 D		NOEL		3.75	PPM		2.5	PPM	Malcolm Pernie Inc. New York	43488604	1990[3,4]	M. Davy	1993	Yes
2,4-DP 2-Butoxyethyl Ester	**63.7**	**Aquatic invertebrate**	**Water flea**	***Daphnia magna***	**Not reported**	**Static**	**Water**	**48 hr**	**48 hr**		**EC50**		**6.25**	**PPB**		**4.3 [0.0043]**	**ppb [ppm]**	**Union Carbide Environmental Services**	**44517301**	**1980[3,4]**	**EFED**	**1988**	**Yes**
2,4-DP 2-Butoxyethyl Ester	63.7	Aquatic invertebrate	Water flea	*Daphnia magna*	Not reported	Static	Water	48 hr	48 hr		NOEL		3.79	PPB		2.6 [0.0026]	ppb [ppm]	Union Carbide Environmental Services	44517301	1980[3,4]	EFED	1988	Yes
2,4-D Acid	96.7	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Seedling	Seedling emergence (shoot weight)	Soil treatment	14 D	14 D	Germination	EC25	>	4.2	lbs ai/acre	>	4.2	lbs ae/acre	Ricera Inc. Ohio	41429004	1992[3,4]	K. Valente	1992	Yes
2,4-D Acid	96.7	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Seedling	Seedling emergence (shoot weight)	Soil treatment	14 D	14 D	Germination	NOEL	>	4.2	lbs ai/acre	>	4.2	lbs ae/acre	Ricera Inc. Ohio	41429004	1992[3,4]	K. Valente	1992	Yes
2,4-D Acid	96.7	Terrestrial Plant	Corn	*Zea mays*	Juvenile	Vegetative vigor (phytotoxicity)	Direct spray	14 D	14 D	Vegetative vigor	EC25	>	4.2	lbs ai/acre	>	4.2	lbs ae/acre	Ricera Inc. Ohio	07309101	1991[3,4]	K. Valente	1992	Yes
2,4-D Acid	96.7	Terrestrial Plant	Corn	*Zea mays*	Juvenile	Vegetative vigor (phytotoxicity)	Direct spray	14 D	14 D	Vegetative vigor	NOEL	>	4.2	lbs ai/acre	>	4.2	lbs ae/acre	Ricera Inc. Ohio	07309101	1991[3,4]	K. Valente	1992	Yes
2,4-D Acid	96.7	Terrestrial Plant	Oat	*Avena sativa*	Juvenile	Vegetative vigor (phytotoxicity)	Direct spray	14 D	14 D	Vegetative vigor	EC25	>	4.2	lbs ai/acre	>	4.2	lbs ae/acre	Ricera Inc. Ohio	41505901	1991[3,4]	K. Valente	1992	Yes
2,4-D Acid	96.7	Terrestrial Plant	Oat	*Avena sativa*	Juvenile	Vegetative vigor (phytotoxicity)	Direct spray	14 D	14 D	Vegetative vigor	NOEL	>	4.2	lbs ai/acre	>	4.2	lbs ae/acre	Ricera Inc. Ohio	41505901	1991[3,4]	K. Valente	1992	Yes
2,4-D butoxypropyl esters(4)	72.5	Fish	Rainbow trout	*Oncorhynchus mykiss*	0.48 g	Static	Water	96 hr	96 hr	Mortality	LC50		5.4	PPM		3.72	PPM	Agricultural Research Center, USDA, Beltsville, MD.	41975107	1974[3,4]	J. McCann	1974	Supplemental
2,4-D butoxypropyl esters(4)	72.5	Fish	Rainbow trout	*Oncorhynchus mykiss*	0.48 g	Static	Water	96 hr	96 hr		NOEL		4.2	PPM		2.89	PPM	Agricultural Research Center, USDA, Beltsville, MD.	41975107	1974[3,4]	J. McCann	1974	Supplemental
2,4-D Tri,isopropylamine salt	70.9	Aquatic Plant	Freshwater diatom	*Navicula pelliculosa*	Not reported	Static	Water	5 D	5 D		EC50		94.4	PPM		50.599	PPM	Carolina Ecotox Inc., Durham, NC	41975106	1994[3,4]	H. Craven (KBN)	1994	Yes
2,4-D Tri,isopropylamine salt	70.9	Aquatic Plant	Freshwater diatom	*Navicula pelliculosa*	Not reported	Static	Water	5 D	5 D		NOEL		5.3	PPM		2.841	PPM	Carolina Ecotox Inc., Durham, NC	41975106	1994[3,4]	H. Craven (KBN)	1994	Yes
2,4-D 2-EHE	92	Aquatic invertebrate	Water flea	*Daphnia magna*	1st-I	Static	Water	48 hr	48 hr		EC50		18.8	PPB		12.5 [0.0125]	ppb [ppm]	Uniroyal Chemical Inc.	05001465	1977[3,4]	L. Turner	1977	Yes
2,4-D 2-EHE	92	Aquatic invertebrate	Water flea	*Daphnia magna*	1st-I	Static	Water	48 hr	48 hr		NOEL	<	5.6	PPB	<	3.7 [0.0037]	ppb [ppm]	Uniroyal Chemical Inc.	05001465	1977[3,4]	L. Turner	1977	Yes

Formulation	% purity	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint		Toxicity Value (tested product)[1]	Units		Toxicity Value (a.e.)[1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4-D Diethanolamine salt	73.8	Mollusca	Eastern oyster	*Crassostrea virginica*	SPAT	Flow-through	Water	96 hr	96 hr		EC50	>	112	PPM	>	75.884	PPM	Wildlife International Inc., MD	42767001	1991[3,4]	K. Valente	1992	No
2,4-D Diethanolamine salt	73.8	Mollusca	Eastern oyster	*Crassostrea virginica*	SPAT	Flow-through	Water	96 hr	96 hr		NOEL	<	6.9	PPM	<	4.7	PPM	Wildlife International Inc., MD	42767001	1991[3,4]	K. Valente	1992	No
2,4-D Diethanolamine salt	73.8	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Seedling	Seedling germination	Soil treatment	7 D	7 D	Germination	EC25		14.9	lbs ai/acre		10.1	lbs ae/acre	Ricera Inc. Ohio	41429006	1992[3,4]	H. Craven (KBN)	1993	Supplemental
2,4-D Diethanolamine salt	73.8	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Seedling	Seedling germination	Soil treatment	7 D	7 D	Germination	NOEL		7.5	lbs ai/acre		5.1	lbs ae/acre	Ricera Inc. Ohio	41429006	1992[3,4]	H. Craven (KBN)	1993	Supplemental
2,4-DB Acid	99.6	Aquatic invertebrate	Water flea	*Daphnia magna*	<24 hr	Flow-through	Water	48 hr	48 hr		EC50		25	PPM		22	PPM	Springborn Laboratory Inc., MA	41737307	1990[3,4]	J. Noles	1991	Yes
2,4-DB Acid	99.6	Aquatic invertebrate	Water flea	*Daphnia magna*	<24 hr	Flow-through	Water	48 hr	48 hr		NOEL		8.4	PPM		7	PPM	Springborn Laboratory Inc., MA	41737307	1990[3,4]	J. Noles	1991	Yes
2,4-DB DMA	25.8	Aquatic invertebrate	Water flea	*Daphnia magna*	1st-I	Flow-through	Water	48 hr	48 hr		EC50		24	PPM		20	PPM	Springborn Laboratory Inc., MA	43374803	1990[3,4]	K. Valente	1992	Yes
2,4-DB DMA	25.8	Aquatic invertebrate	Water flea	*Daphnia magna*	1st-I	Flow-through	Water	48 hr	48 hr		NOEL		8.4	PPM		6.976	PPM	Springborn Laboratory Inc., MA	43374803	1990[3,4]	K. Valente	1992	Yes
2,4-DP-p, DMA salt	61.6	Aquatic Plant	Bluegreen algae	Anabaena flos-aquae	Not reported	Static	Water	5 D	5 D	Growth	EC50	>	9.5	PPM	>	7.889	PPM	Springborn Laboratory Inc., MA	TN 0318	1992[3,4]	M. Davy	1993	No
2,4-DP-p, DMA salt	61.6	Aquatic Plant	Bluegreen algae	Anabaena flos-aquae	Not reported	Static	Water	5 D	5 D	Growth	NOEL	>	9.5	PPM	>	7.889	PPM	Springborn Laboratory Inc., MA	TN 0318	1992[3,4]	M. Davy	1993	No
2,4-D Isooctyl Ester	92	Fish	Bluegill sunfish	*Lepomis macrochirus*	Juvenile	Static	Water	96 hr	96 hr	Mortality	LC50		18	PPM		11.9	PPM	Uniroyal Chemical Inc.	41975105	1976[3,4]	L. Turner	1977	Yes
2,4-D Isooctyl Ester	92	Fish	Bluegill sunfish	*Lepomis macrochirus*	Juvenile	Static	Water	96 hr	96 hr		NOEL		10	PPM		6.6	PPM	Uniroyal Chemical Inc.	41975105	1976[3,4]	L. Turner	1977	Yes
2,4-DP-p, DMA salt	63.6	Aquatic Plant	Marine diatom	Skeletonema costatum	Not reported	Static	Water	5 D	5 D	Growth	EC50	>	11	PPM	>	9.135	PPM	Springborn Laboratory Inc., MA	41975104	1992[3,4]	M. Davy	1993	No
2,4-DP-p, DMA salt	63.6	Aquatic Plant	Marine diatom	Skeletonema costatum	Not reported	Static	Water	5 D	5 D	Growth	NOEL		11	PPM		9.135	PPM	Springborn Laboratory Inc., MA	41975104	1992[3,4]	M. Davy	1993	No
2,4-D Isooctyl Ester (LV Ester Weed Killer)	68.2	Fish	Bluegill sunfish	*Lepomis macrochirus*	0.55 g	Static	Water	96 hr	96 hr	Mortality	LC50	<	11.5	PPM	<	7.6	PPM	Agricultural Research Center, USDA, Beltsville, MD.	41546201	1969[3,4]	J. McCann	1969	Supplemental
2,4-D Isooctyl Ester (LV Ester Weed Killer)	68.2	Fish	Bluegill sunfish	*Lepomis macrochirus*	0.55 g	Static	Water	96 hr	96 hr		NOEL	<	11.5	PPM	<	7.6	PPM	Agricultural Research Center, USDA, Beltsville, MD.	41546201	1969[3,4]	J. McCann	1969	Supplemental
2,4-D Acid	98.7	Aquatic invertebrate	Water flea	*Daphnia magna*	1st-I	Static	Water	48 hr	48 hr		EC50		25	PPM		25	PPM	Dow Chemical Corporation Laboratories	41454101	1983[3,4]	K. Valente	1992	Yes
2,4-D Acid	98.7	Aquatic invertebrate	Water flea	*Daphnia magna*	1st-I	Static	Water	48 hr	48 hr		NOEL	<	12	PPM	<	12	PPM	Dow Chemical Corporation Laboratories	41454101	1983[3,4]	K. Valente	1992	Yes
2,4-D Isooctyl Ester	92	Fish	Rainbow trout	*Oncorhynchus mykiss*	Juvenile	Static	Water	96 hr	96 hr	Mortality	LC50		22	PPM		14.6	PPM	Uniroyal Chemical Inc.	41644401	1976[3,4]	L. Turner	1977	Yes
2,4-D Isooctyl Ester	92	Fish	Rainbow trout	*Oncorhynchus mykiss*	Juvenile	Static	Water	96 hr	96 hr		NOEL		12	PPM		8.0	PPM	Uniroyal Chemical Inc.	41644401	1976[3,4]	L. Turner	1977	Yes
2,4-D 2 EHE	63.5	Terrestrial Plant	Sorghum	*Sorghum bicolor*	Not reported	Seedling germination	Soil treatment	6 D	6 D	Germination	EC25	>	12.3	lbs ai/acre	>	8.2	lbs ae/acre	Ricera Inc. Ohio	41848001	1992[3,4]	M. Davy	1993	Yes
2,4-D 2 EHE	**63.5**	**Terrestrial Plant**	**Sorghum**	***Sorghum bicolor***	**Not reported**	**Seedling germination**	**Soil treatment**	**6 D**	**6 D**	**Germination**	**NOEL**		**12.3**	**lbs ai/acre**		**8.2**	**lbs ae/acre**	**Ricera Inc. Ohio**	**41848001**	**1992[3,4]**	**M. Davy**	**1993**	**Yes**

Formulation	% purity	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint	Toxicity Value (tested product)[1]	Units	Toxicity Value (a.e.)[1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4-D 2-EHE	99.96	Insect	Honey bee	*Apis mellifera*	Adult	Oral (gavage or capsule)	Oral	72 hr	72 hr	Mortality	LD50	> 100	ug/bee	> 66	ug/bee	Wildlife International Inc., MD	41429002	1997[3,4]	S. Ramasamy	2000	Supplemental
2,4-D 2-EHE	99.96	Insect	Honey bee	*Apis mellifera*	Adult	Oral (gavage or capsule)	Oral	72 hr	72 hr		NOEL	12.5	ug/bee	8.3	ug/bee	Wildlife International Inc., MD	41429002	1997[3,4]	S. Ramasamy	2000	Supplemental
2,4-D Isooctyl Ester	68.7	Fish	Bluegill sunfish	*Lepomis macrochirus*	1.02 g	Static	Water	96 hr	96 hr	Mortality	LC50	19.3	PPM	12.8	PPM	Agricultural Research Center, USDA, Beltsville, MD.	42767002	1968[3,4]	B. Montague	2004	Supplemental
2,4-D Isooctyl Ester	68.7	Fish	Bluegill sunfish	*Lepomis macrochirus*	1.02 g	Static	Water	96 hr	96 hr		NOEL	13.5	PPM	9.0	PPM	Agricultural Research Center, USDA, Beltsville, MD.	42767002	1968[3,4]	B. Montague	2004	Supplemental
2,4-D Isopropylamine salt	51.3	Aquatic Plant	Green algae	Selenastrum capricornutum	Not reported	Static	Water	5 D	5 D	Growth	EC50	43.4	PPM	34.3	PPM	Malcolm Pernie Inc. New York	00073762	1991[3,4]	M. Davy	1993	Yes
2,4-D Isopropylamine salt	51.3	Aquatic Plant	Green algae	Selenastrum capricornutum	Not reported	Static	Water	5 D	5 D	Growth	NOEL	13.9	PPM	11.0	PPM	Malcolm Pernie Inc. New York	00073762	1991[3,4]	M. Davy	1993	Yes
2,4-D 2-EHE	95.4	Aquatic invertebrate	Water flea	*Daphnia magna*	Full lifecycle	Flow-through	Water	21 D	21 D		LOEC	15	PPB	9.9 [0.01]	ppb [ppm]	Envirosystem & Engineering Inc.	43374802	1991[3,4]	A. Yamhure	1994	Supplemental
2,4-D 2-EHE	95.4	Aquatic invertebrate	Water flea	*Daphnia magna*	Full lifecycle	Flow-through	Water	21 D	21 D		NOEL	< 15	PPB	< 9.9 [0.01]	ppb [ppm]	Envirosystem & Engineering Inc.	43374802	1991[3,4]	A. Yamhure	1994	Supplemental
2,4-D 2-EHE	95.4	Mollusca	Eastern oyster	*Crassostrea virginica*	SPAT	Flow-through	Water	96 hr	96 hr		EC50	> 16	PPB	> 10.6 [0.01]	ppb [ppm]	Envirosystem & Engineering Inc.	42333201	1991[3,4]	A. Yamhure	1994	No
2,4-D 2-EHE	95.4	Mollusca	Eastern oyster	*Crassostrea virginica*	SPAT	Flow-through	Water	96 hr	96 hr		NOEL	< 16	PPB	< 10.6 [0.01]	ppb [ppm]	Envirosystem & Engineering Inc.	42333201	1991[3,4]	A. Yamhure	1994	No
2,4-D Dimethylamine salt	99.3	Fish	Fathead minnow	*Pimephales promelas*	Early life	Chronic	Water	31 D	31 D		LOEC	28.4	PPM	23.584	PPM	Dow Chemical Corporation Laboratories	TN 0663	1990[3,4]	K.V. Montague	1994	Yes
2,4-D Dimethylamine salt	99.3	Fish	Fathead minnow	*Pimephales promelas*	Early life	Chronic	Water	31 D	31 D		NOEL	17.1	PPM	14.200	PPM	Dow Chemical Corporation Laboratories	TN 0663	1990[3,4]	K.V. Montague	1994	Yes
2,4-D 2-EHE (Slago Weed Killer)	85.9	Fish	Rainbow trout	*Oncorhynchus mykiss*	37 mm	Static	Water	96 hr	96 hr	Mortality	LC50	51	PPM	33.8	PPM	EPA Research Labs, at Beltsville, MD ,Gulfbreeze, FL, or Duluth, MN.	TN 0671	1974[3,4]	C. Lewis	1987	Yes
2,4-D 2-EHE (Slago Weed Killer)	85.9	Fish	Rainbow trout	*Oncorhynchus mykiss*	37 mm	Static	Water	96 hr	96 hr		NOEL	18	PPM	11.9	PPM	EPA Research Labs, at Beltsville, MD ,Gulfbreeze, FL, or Duluth, MN.	TN 0671	1974[3,4]	C. Lewis	1987	Yes
2,4-D Acid	Tech	Insect	Honey bee	*Apis mellifera*	adult	Contact	Direct contact	48 hr	48 hr	Mortality	LD50	> 18.13	ug/bee	> 18.13	ug/bee	University of California, Riverside	43935001	1975[3,4]	A. Vaughan	1981	Yes
2,4-D Acid	Tech	Insect	Honey bee	*Apis mellifera*	adult	Contact	Direct contact	48 hr	48 hr		NOEL	< 18.13	ug/bee	< 18.13	ug/bee	University of California, Riverside	43935001	1975[3,4]	A. Vaughan	1981	Yes
2,4-D Dimethylamine salt	66.7	Aquatic Plant	Green algae	Selenastrum capricornutum	Not reported	Static	Water	5 D	5 D	Growth	EC50	51.2	PPM	42.518	PPM	Malcolm Pernie Inc. New York	44517307	1990[3,4]	M. Davy	1994	Yes
2,4-D Dimethylamine salt	66.7	Aquatic Plant	Green algae	Selenastrum capricornutum	Not reported	Static	Water	5 D	5 D	Growth	NOEL	19.2	PPM	15.944	PPM	Malcolm Pernie Inc. New York	44517307	1990[3,4]	M. Davy	1994	Yes
2,4-D Dimethylamine salt	55	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Seedling	Seedling germination	Soil treatment	14 D	14 D	Germination	EC25	24.7	lbs ai/acre	20.511	lbs ae/acre	Ricera Inc. Ohio	41737306	1992[3,4]	M. Davy	1994	Yes
2,4-D Dimethylamine salt	55	Terrestrial Plant	Tomato	*Lycopersicon esculentum*	Seedling	Seedling germination	Soil treatment	14 D	14 D	Germination	NOEL	19.2	lbs ai/acre	15.9	lbs ae/acre	Ricera Inc. Ohio	41737306	1992[3,4]	M. Davy	1994	Yes
2,4-DP-p, DMA salt	61.6	Insect	Honey bee	*Apis mellifera*	Worker	Contact	Direct contact	48 hr	48 hr	Mortality	LD50	> 25	ug/bee	> 21	ug/bee	Wildlife International Inc., MD	41158311	1992[3,4]	M. Davy	1993	Yes
2,4-DP-p, DMA salt	61.6	Insect	Honey bee	*Apis mellifera*	Worker	Contact	Direct contact	48 hr	48 hr		NOEL	25	ug/bee	21	ug/bee	Wildlife International Inc., MD	41158311	1992[3,4]	M. Davy	1993	Yes

Spreadsheet of Toxicity Data for 2,4-D Ester TRVs

Formulation	% purity	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint	Toxicity Value (tested product)[1]	Units	Toxicity Value (a.e.)[1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4-DP 2-Butoxyethyl Ester	95.3	Insect	Honey bee	*Apis mellifera*	Adult	Contact	Direct contact	48 hr	48 hr	Mortality	LD50	> 25	ug/bee	> 17.2	ug/bee	Wildlife International Inc., MD	41158301	1992[3,4]	H. Craven (KBN)	1992	Yes
2,4-DP 2-Butoxyethyl Ester	95.3	Insect	Honey bee	*Apis mellifera*	Adult	Contact	Direct contact	48 hr	48 hr		NOEL	25	ug/bee	17.2	ug/bee	Wildlife International Inc., MD	41158301	1992[3,4]	H. Craven (KBN)	1992	Yes
2,4 DP-p-2-EHE	95.7	Insect	Honey bee	*Apis mellifera*	Adult	Contact	Direct contact	48 hr	48 hr	Mortality	LD50	> 25	ug/bee	> 16.6	ug/bee	Wildlife International Inc., MD	41835209	1992[3,4]	H. Craven (KBN)	1992	Yes
2,4 DP-p-2-EHE	95.7	Insect	Honey bee	*Apis mellifera*	Adult	Contact	Direct contact	48 hr	48 hr		NOEL	25	ug/bee	16.6	ug/bee	Wildlife International Inc., MD	41835209	1992[3,4]	H. Craven (KBN)	1992	Yes
2,4-D Acid	96.1	Aquatic Plant	Green algae	Selenastrum capricornutum	Not reported	Static	Water	5 D	5 D	Growth	EC50	33.2	PPM	33.2	PPM	Malcolm Pernie Inc. New York	41158311	1990[3,4]	M. Davy	1992	Supplemental
2,4-D Acid	96.1	Aquatic Plant	Green algae	Selenastrum capricornutum	Not reported	Static	Water	5 D	5 D	Growth	NOEL	26.4	PPM	26.4	PPM	Malcolm Pernie Inc. New York	41158311	1990[3,4]	M. Davy	1992	Supplemental
2,4-D Isopropylamine salt	50.2	Fish	Inland silverside	*Menidia beryllina*	0.2 g	Flow-through	Water	96 hr	96 hr	Mortality	LC50	237	PPM	187	PPM	Springborn Laboratory Inc., MA	41158301	1990[3,4]	D. Balluff	1992	No
2,4-D Isopropylamine salt	50.2	Fish	Inland silverside	*Menidia beryllina*	0.2 g	Flow-through	Water	96 hr	96 hr		NOEL	< 26.9	PPM	< 21.2	PPM	Springborn Laboratory Inc., MA	41158301	1990[3,4]	D. Balluff	1992	No
2,4-D Acid	95.1	Mollusca	Eastern oyster	*Crassostrea virginica*	SPAT	Flow-through	Water	96 hr	96 hr		EC50	58.7	PPM	58.7	PPM	T.R. Wilbury Laboratories	41158303	1993[3,4]	C. Laird/Goodyear	1996	No
2,4-D Acid	95.1	Mollusca	Eastern oyster	*Crassostrea virginica*	SPAT	Flow-through	Water	96 hr	96 hr		NOEL	30	PPM	30	PPM	T.R. Wilbury Laboratories	41158303	1993[3,4]	C. Laird/Goodyear	1996	No
2,4 DP-p-2-EHE	36	Fish	Bluegill sunfish	*Lepomis macrochirus*	0.6 g	Static	Water	96 hr	96 hr	Mortality	LC50	42	PPM	27.9	PPM	Agricultural Research Center, USDA, Beltsville, MD.	41353803	1975[3,4]	J. McCann	1976	Supplemental
2,4 DP-p-2-EHE	36	Fish	Bluegill sunfish	*Lepomis macrochirus*	0.6 g	Static	Water	96 hr	96 hr		NOEL	< 31	PPM	< 20.6	PPM	Agricultural Research Center, USDA, Beltsville, MD.	41353803	1975[3,4]	J. McCann	1976	Supplemental
2,4-D Isooctyl Ester	39.6	Fish	Rainbow trout	*Oncorhynchus mykiss*	0.35 g	Static	Water	96 hr	96 hr	Mortality	LC50	64	PPM	42.4	PPM	Agricultural Research Center, USDA, Beltsville, MD.	46879201	1974[3,4]	C. Lewis	1987	Yes
2,4-D Isooctyl Ester	39.6	Fish	Rainbow trout	*Oncorhynchus mykiss*	0.35 g	Static	Water	96 hr	96 hr		NOEL	32	PPM	21.2	PPM	Agricultural Research Center, USDA, Beltsville, MD.	46879201	1974[3,4]	C. Lewis	1987	Yes
2,4-D Dimethylamine salt	66.8	Mollusca	Eastern oyster	*Crassostrea virginica*	SPAT	Flow-through	Water	96 hr	96 hr		EC50	102.25	PPM	84.911	PPM	Toxikon Environmental Sciences, Jupiter, Florida	44275701	1991[3,4]	D. Lateulere	1991	No
2,4-D Dimethylamine salt	66.8	Mollusca	Eastern oyster	*Crassostrea virginica*	SPAT	Flow-through	Water	96 hr	96 hr		NOEL	40.6	PPM	33.715	PPM	Toxikon Environmental Sciences, Jupiter, Florida	44275701	1991[3,4]	D. Lateulere	1991	No
2,4-D Tri,isopropylamine salt	70.9	Aquatic Plant	Bluegreen algae	Anabaena flos-aquae	Not reported	Static	Water	5 D	5 D	Growth	EC50	133	PPM	71.3	PPM	Carolina Ecotox Inc., Durham, NC	41353804	1994[3,4]	H. Craven (KBN)	1994	No
2,4-D Tri,isopropylamine salt	70.9	Aquatic Plant	Bluegreen algae	Anabaena flos-aquae	Not reported	Static	Water	5 D	5 D	Growth	NOEL	47.9	PPM	25.7	PPM	Carolina Ecotox Inc., Durham, NC	41353804	1994[3,4]	H. Craven (KBN)	1994	No
2,4-D 2-EHE	99.96	Insect	Honey bee	*Apis mellifera*	Adult	Contact	Direct contact	72 hr	72 hr	Mortality	LD50	> 100	ug/bee	> 66	ug/bee	Wildlife International Inc., MD	41353805	1997[3,4]	S. Ramasamy	2000	Yes
2,4-D 2-EHE	99.96	Insect	Honey bee	*Apis mellifera*	Adult	Contact	Direct contact	72 hr	72 hr		NOEL	50	ug/bee	33.2	ug/bee	Wildlife International Inc., MD	41353805	1997[3,4]	S. Ramasamy	2000	Yes
2,4-D Tri,isopropylamine salt	70.9	Aquatic Plant	Marine diatom	Skeletonema costatum	Not reported	Static	Water	5 D	5 D	Growth	EC50	79.7	PPM	42.7	PPM	Carolina Ecotox Inc., Durham, NC	00138871	1994[3,4]	H. Craven (KBN)	1994	No
2,4-D Tri,isopropylamine salt	70.9	Aquatic Plant	Marine diatom	Skeletonema costatum	Not reported	Static	Water	5 D	5 D	Growth	NOEL	50.4	PPM	27.0	PPM	Carolina Ecotox Inc., Durham, NC	00138871	1994[3,4]	H. Craven (KBN)	1994	No

Formulation	% purity	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint	Toxicity Value (tested product)[1]	Units	Toxicity Value (a.e.)[1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4-D Tri,isopropylamine salt	73.8	Aquatic Plant	Green algae	Selenastrum capricornutum	Not reported	Static	Water	5 D	5 D	Growth	EC50	75.7	PPM	40.6	PPM	Malcolm Pernie Inc. New York	41749502	1991[3,4]	M. Davy	1993	Yes
2,4-D Tri,isopropylamine salt	73.8	Aquatic Plant	Green algae	Selenastrum capricornutum	Not reported	Static	Water	5 D	5 D	Growth	NOEL	55.4	PPM	29.7	PPM	Malcolm Pernie Inc. New York	41749502	1991[3,4]	M. Davy	1993	Yes
2,4-DP Dimethylamine salt	59.93	Bird	Bobwhite quail	*Colinus virginianus*	38WKS	Oral (gavage or capsule)	Oral	14 D	14 D	Mortality	LD50	279	mg/kg bw	232	mg/kg bw	Biolife Associates, Inc.	41429005	1993[3,4]	A. Yamhure	1996	Yes
2,4-DP Dimethylamine salt	59.93	Bird	Bobwhite quail	*Colinus virginianus*	38WKS	Oral (gavage or capsule)	Oral	14 D	14 D		NOEL	< 63	mg/kg bw/d	< 52	mg/kg bw/d	Biolife Associates, Inc.	41429005, 43227401	1993[3,4]	A. Yamhure	1996	Yes
2,4-DP-p, DMA salt	59.93	Bird	Bobwhite quail	*Colinus virginianus*	38WKS	Oral (gavage or capsule)	Oral	14 D	14 D	Mortality	LD50	279	mg/kg bw	232	mg/kg bw	Biolife Associates, Inc.	43227401	1993[3,4]	A. Yamhure	1996	Yes
2,4-D Isopropylamine salt	50.2	Mollusca	Eastern oyster	*Crassostrea virginica*	SPAT	Flow-through	Water	96 hr	96 hr		EC50	125	PPM	98.6	PPM	Springborn Laboratory Inc., MA	43935201	1990[3,4]	D. Balluff	1991	No
2,4-D Isopropylamine salt	50.2	Mollusca	Eastern oyster	*Crassostrea virginica*	SPAT	Flow-through	Water	96 hr	96 hr		NOEL	63.1	PPM	49.8	PPM	Springborn Laboratory Inc., MA	43935201	1990[3,4]	D. Balluff	1991	No
2,4-D Acid	96.1	Fish	Fathead minnow	*Pimephales promelas*	Early life	Chronic	Water	32 D	32 D		LOEC	102	PPM	102	PPM	Dow Chemical Corporation Laboratories	45336401	1990[3,4]	K. Valente	1992	Yes
2,4-D Acid	96.1	Fish	Fathead minnow	*Pimephales promelas*	Early life	Chronic	Water	32 D	32 D		NOEL	63.4	PPM	63.4	PPM	Dow Chemical Corporation Laboratories	45336401	1990[3,4]	K. Valente	1992	Yes
2,4-D Dimethylamine salt	66.7	Aquatic Plant	Bluegreen algae	Anabaena flos-aquae	Not reported	Static	Water	120hr	120hr	Growth	EC50	188.5	PPM	156.534	PPM	Malcolm Pernie Inc. New York	45336401	1990[3,4]	R. Petrie	1991	No
2,4-D Dimethylamine salt	66.7	Aquatic Plant	Bluegreen algae	Anabaena flos-aquae	Not reported	Static	Water	120hr	120hr	Growth	NOEL	68	PPM	56.469	PPM	Malcolm Pernie Inc. New York	45336401	1990[3,4]	R. Petrie	1991	No
2,4-D 2-EHE/2,4,5T IOE/Dicamba (Banvel 310)	45	Bird	Bobwhite quail	*Colinus virginianus*	14 D	Diet	Dietary	5 D	8 D	Mortality	LC50	2019	PPM	1,339 [4,043]	ppm [mg/kg bw]	Hazelton Laboratory Inc. VA	41546202	1973[3,4]	EFED	1979	Supplemental
2,4-D 2-EHE/2,4,5T IOE/Dicamba (Banvel 310)	45	Bird	Bobwhite quail	*Colinus virginianus*	14 D	Diet	Dietary	5 D	8 D		NOEL	< 75	PPM	< 50 [30.2]	ppm [mg/kg bw/d]	Hazelton Laboratory Inc. VA	41546202	1973[3,4]	EFED	1979	Supplemental
2,4-D Acid	91.3	Aquatic invertebrate	Water flea	*Daphnia magna*	Full lifecycle	Flow-through	Water	21 D	21 D		LOEC	151	PPM	151	PPM	Envirosystem & Engineering Inc.	41586101	1991[3,4]	T. Terry	1991	Yes
2,4-D Acid	91.3	Aquatic invertebrate	Water flea	*Daphnia magna*	Full lifecycle	Flow-through	Water	21 D	21 D		NOEL	79	PPM	79	PPM	Envirosystem & Engineering Inc.	41586101	1991[3,4]	T. Terry	1991	Yes
2,4-D Butoxyethanol Ester	96	Fish	Fathead minnow	*Pimephales promelas*	Early life	Chronic	Water	32 D	32 D		LOEC	114	PPB	78 [0.078]	ppb [ppm]	Dow Chemical Corporation Laboratories	00077308	1989[3,4]	R. Lamb	1994	Yes
2,4-D Butoxyethanol Ester	**96**	**Fish**	**Fathead minnow**	***Pimephales promelas***	**Early life**	**Chronic**	**Water**	**32 D**	**32 D**		**NOEL**	**80.5**	**PPB**	**55 [0.055]**	**ppb [ppm]**	**Dow Chemical Corporation Laboratories**	**00077308**	**1989[3,4]**	**R. Lamb**	**1994**	**Yes**
2,4-D Tri,isopropylamine salt	70.4	Fish	Inland silverside	*Menidia beryllina*	0.2 g	Flow-through	Water	96 hr	96 hr	Mortality	LC50	534	PPM	286.2	PPM	Springborn Laboratory Inc., MA	41429007	1990[3,4]	D. Balluff	1991	No
2,4-D Tri,isopropylamine salt	70.4	Fish	Inland silverside	*Menidia beryllina*	0.2 g	Flow-through	Water	96 hr	96 hr		NOEL	86.2	PPM	46.2	PPM	Springborn Laboratory Inc., MA	41429007	1990[3,4]	D. Balluff	1991	No
2,4-D Dimethylamine salt	N.R.	Fish	Bluegill sunfish	*Lepomis macrochirus*	2.3 g	Static	Water	96 hr	96 hr	Mortality	LC50	106	PPM	88.025	PPM	Bionomics, Inc., Wareham, MA.	43220202	1971[3,4]	C. Lewis	1988	Supplemental
2,4-D Dimethylamine salt	N.R.	Fish	Bluegill sunfish	*Lepomis macrochirus*	2.3 g	Static	Water	96 hr	96 hr		NOEL	< 87	PPM	< 72.247	PPM	Bionomics, Inc., Wareham, MA.	43220202	1971[3,4]	C. Lewis	1988	Supplemental
2,4-D Diethanolamine salt	73.8	Aquatic Plant	Marine diatom	Skeletonema costatum	Not reported	Static	Water	5 D	5 D	Growth	EC50	> 95	PPM	> 64.366	PPM	Wildlife International Inc., MD	43227402	1993[3,4]	H. Craven (KBN)	1993	No

Formulation	% purity	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint		Toxicity Value (tested product)[1]	Units		Toxicity Value (a.e.)[1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4-D Diethanolamine salt	73.8	Aquatic Plant	Marine diatom	Skeletonema costatum	Not reported	Static	Water	5 D	5 D	Growth	NOEL		95	PPM		64.366	PPM	Wildlife International Inc., MD	43227402	1993[3,4]	H. Craven (KBN)	1993	No
2,4-D Diethanolamine salt	73.8	Aquatic Plant	Bluegreen algae	Anabaena flos-aquae	Not reported	Static	Water	5 D	5 D	Growth	EC50	>	96	PPM	>	65.044	PPM	Wildlife International Inc., MD	43934901	1993[3,4]	H. Craven (KBN)	1993	No
2,4-D Diethanolamine salt	73.8	Aquatic Plant	Bluegreen algae	Anabaena flos-aquae	Not reported	Static	Water	5 D	5 D	Growth	NOEL		96	PPM		65.044	PPM	Wildlife International Inc., MD	43934901	1993[3,4]	H. Craven (KBN)	1993	No
2,4-D Dimethylamine salt	66.7	Aquatic Plant	Marine diatom	Skeletonema costatum	Not reported	Static	Water	5 D	5 D	Growth	EC50		148.5	PPM		123.318	PPM	Malcolm Pernie Inc. New York	41975102	1990[3,4]	M. Davy	1995	No
2,4-D Dimethylamine salt	66.7	Aquatic Plant	Marine diatom	Skeletonema costatum	Not reported	Static	Water	5 D	5 D	Growth	NOEL		96.25	PPM		79.928	PPM	Malcolm Pernie Inc. New York	41975102	1990[3,4]	M. Davy	1995	No
2,4-D Diethanolamine salt	73.8	Aquatic Plant	Freshwater diatom	Navicula pelliculosa	Not reported	Static	Water	5 D	5 D	Growth	EC50	>	97	PPM	>	65.721	PPM	Wildlife International Inc., MD	41975103	1993[3,4]	H. Craven (KBN)	1993	Yes
2,4-D Diethanolamine salt	73.8	Aquatic Plant	Freshwater diatom	Navicula pelliculosa	Not reported	Static	Water	5 D	5 D	Growth	NOEL		97	PPM		65.721	PPM	Wildlife International Inc., MD	41975103	1993[3,4]	H. Craven (KBN)	1993	Yes
2,4-D Diethanolamine salt	73.1	Aquatic invertebrate	Pink shrimp	*Penaeus duorarum*	4.5 g	Flow-through	Water	96 hr	96 hr	Mortality	LC50	>	99.6	PPM	>	67.483	PPM	Wildlife International Inc., MD	41158304	1991[3,4]	K. Valente	1991	No
2,4-D Diethanolamine salt	73.1	Aquatic invertebrate	Pink shrimp	*Penaeus duorarum*	4.5 g	Flow-through	Water	96 hr	96 hr		NOEL		99.6	PPM		67.483	PPM	Wildlife International Inc., MD	41158304	1991[3,4]	K. Valente	1991	No
2,4-D Diethanolamine salt	73.1	Aquatic invertebrate	Water flea	*Daphnia magna*	1st-I	Flow-through	Water	48 hr	48 hr		EC50	>	100	PPM	>	68	PPM	Wildlife International Inc., MD	41644402	1991[3,4]	K. Valente	1991	Yes
2,4-D Diethanolamine salt	73.1	Aquatic invertebrate	Water flea	*Daphnia magna*	1st-I	Flow-through	Water	48 hr	48 hr		NOEL		100	PPM		67.754	PPM	Wildlife International Inc., MD	41644402	1991[3,4]	K. Valente	1991	Yes
2,4-D Acid	Tech	Aquatic invertebrate	Water flea	*Daphnia magna*	1st-I	Static	Water	26 hr	26 hr		EC50	>	100	PPM	>	100	PPM	Fish and Wildlife Service Laboratories, Department of Interior	41644403	1970[3,4]	D. McLane	1979	Supplemental
2,4-D Acid	Tech	Aquatic invertebrate	Water flea	*Daphnia magna*	1st-I	Static	Water	26 hr	26 hr		NOEL		100	PPM		100	PPM	Fish and Wildlife Service Laboratories, Department of Interior	41644403	1970[3,4]	D. McLane	1979	Supplemental
2,4 D/Picloram TIPA salt (Tordon 101 mixture)	21/5.6	Insect	Honey bee	*Apis mellifera*	Adult	Contact	Direct contact	48 hr	48 hr	Mortality	LD50	>	100	ug/bee	>	53.6	ug/bee	Wildlife International Inc., MD	43811401	1989[3,4]	H. Mansfield	1992	Yes
2,4 D/Picloram TIPA salt (Tordon 101 mixture)	21/5.6	Insect	Honey bee	*Apis mellifera*	Adult	Contact	Direct contact	48 hr	48 hr	Mortality	NOEL		100	ug/bee		53.6	ug/bee	Wildlife International Inc., MD	43811401	1989[3,4]	H. Mansfield	1992	Yes
2,4-DP-p, DMA salt	72.9	Fish	Rainbow trout	*Oncorhynchus mykiss*	2.43 g	Static	Water	96 hr	96 hr	Mortality	LC50	>	109	PPM	>	91	PPM	BASF Corporation, Republic of Germany	43220201	1992[3,4]	A. Yamhure	1996	Yes
2,4-DP-p, DMA salt	72.9	Fish	Rainbow trout	*Oncorhynchus mykiss*	2.43 g	Static	Water	96 hr	96 hr		NOEL		109	PPM		91	PPM	BASF Corporation, Republic of Germany	43220201	1992[3,4]	A. Yamhure	1996	Yes
2,4-D Tri,isopropylamine salt	70.4	Mollusca	Eastern oyster	*Crassostrea virginica*	SPAT	Flow-through	Water	96 hr	96 hr		EC50		234	PPM		125.4	PPM	Springborn Laboratory Inc., MA	00045070	1990[3,4]	D. Balluff	1991	No
2,4-D Tri,isopropylamine salt	70.4	Mollusca	Eastern oyster	*Crassostrea virginica*	SPAT	Flow-through	Water	96 hr	96 hr		NOEL		110	PPM		59.0	PPM	Springborn Laboratory Inc., MA	00045070	1990[3,4]	D. Balluff	1991	No
2,4-D Acid	96.1	Fish	Inland silverside	*Menidia beryllina*	Not reported	Flow-through	Water	96 hr	96 hr	Mortality	LC50		175	PPM		175	PPM	Environmental Science & Technology Inc.	00022923	1991[3,4]	M. Davy	1993	No
2,4-D Acid	96.1	Fish	Inland silverside	*Menidia beryllina*	Not reported	Flow-through	Water	96 hr	96 hr		NOEL	<	111	PPM	<	111	PPM	Environmental Science & Technology Inc.	00022923	1991[3,4]	M. Davy	1993	No
2,4-D dimethylamine salt	12.5	Fish	Bluegill sunfish	*Lepomis macrochirus*	0.652	Static	Water	96 Hr	96 Hr	Mortality	LC50	>	100	PPM	>	83.042	PPM	Agricultural Research Center, USDA, Beltsville, MD.	41749501	1970[3,4]	J. McCann	2004	Yes

Formulation	% purity	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint	Toxicity Value (tested product)[1]	Units	Toxicity Value (a.e.) [1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4-D dimethylamine salt	12.5	Fish	Bluegill sunfish	*Lepomis macrochirus*	0.652	Static	Water	96 Hr	96 Hr		NOEL	< 115	PPM	< 95.498	PPM	Agricultural Research Center, USDA, Beltsville, MD.	41749501	1970[3,4]	J. McCann	2004	Yes
2,4-D Diethanolamine salt	73.8	Fish	Atlantic silverside	*Menidia menidia*	0.14 g	Flow-through	Water	96 hr	96 hr	Mortality	LC50	> 118	PPM	> 79.950	PPM	Wildlife International Inc., MD	00050688	1991[3,4]	K. Valente	1992	No
2,4-D Diethanolamine salt	73.8	Fish	Atlantic silverside	*Menidia menidia*	0.14 g	Flow-through	Water	96 hr	96 hr		NOEL	118	PPM	79.950	PPM	Wildlife International Inc., MD	00050688	1991[3,4]	K. Valente	1992	No
2,4-D Diethanolamine salt	73.1	Fish	Rainbow trout	*Oncorhynchus mykiss*	2.0 g	Flow-through	Water	96 hr	96 hr	Mortality	LC50	> 120	PPM	> 81.305	PPM	Wildlife International Inc., MD	00102871	1991[3,4]	K. Valente	1991	Yes
2,4-D Diethanolamine salt	73.1	Fish	Rainbow trout	*Oncorhynchus mykiss*	2.0 g	Flow-through	Water	96 hr	96 hr		NOEL	120	PPM	81.305	PPM	Wildlife International Inc., MD	00102871	1991[3,4]	K. Valente	1991	Yes
2,4-D Dimethylamine salt	67.3	Fish	Rainbow trout	*Oncorhynchus mykiss*	0.23 g	Static	Water	96 hr	96 hr	Mortality	LC50	250	PPM	207.605	PPM	Dow Chemical Corporation Laboratories	00072919	1983[3,4]	R. Lamb	1995	Yes
2,4-D Dimethylamine salt	67.3	Fish	Rainbow trout	*Oncorhynchus mykiss*	0.23 g	Static	Water	96 hr	96 hr		NOEL	120	PPM	99.651	PPM	Dow Chemical Corporation Laboratories	00072919	1983[3,4]	R. Lamb	1995	Yes
2,4-D Diethanolamine salt	73.1	Fish	Bluegill sunfish	*Lepomis macrochirus*	1.03g	Flow-through	Water	96 hr	96 hr	Mortality	LC50	> 121	PPM	> 81.982	PPM	Wildlife International Inc., MD	41448401	1991[3,4]	K. Valente	1991	Yes
2,4-D Diethanolamine salt	73.1	Fish	Bluegill sunfish	*Lepomis macrochirus*	1.03g	Flow-through	Water	96 hr	96 hr		NOEL	121	PPM	81.982	PPM	Wildlife International Inc., MD	41448401	1991[3,4]	K. Valente	1991	Yes
2,4-D Dimethylamine salt	66.8	Bird	Bobwhite quail	*Colinus virginianus*	21 WKS	Oral (gavage or capsule)	Oral	14 D	14 D	Mortality	LD50	500	mg/kg bw	415	mg/kg bw	Wildlife International Inc., MD	00072919	1990[3,4]	R. Petrie	1991	Yes
2,4-D Dimethylamine salt	66.8	Bird	Bobwhite quail	*Colinus virginianus*	21 WKS	Oral (gavage or capsule)	Oral	14 D	14 D		NOEL	< 125	mg/kg bw/d	< 104	mg/kg bw/d	Wildlife International Inc., MD	00072919	1990[3,4]	R. Petrie	1991	Yes
2,4-D Butoxyethanol Ester	96	Bird	Bobwhite quail	*Colinus virginianus*	19WKS	Oral (gavage or capsule)	Oral	14 D	14 D	Mortality	LD50	> 2000	mg/kg bw	> 1376	mg/kg bw	Dow Chemical Corporation Laboratories	00072919	1989[3,4]	D. Balluff	1991	Yes
2,4-D Butoxyethanol Ester	96	Bird	Bobwhite quail	*Colinus virginianus*	19WKS	Oral (gavage or capsule)	Oral	14 D	14 D		NOEL	125	mg/kg bw/d	86	mg/kg bw/d	Dow Chemical Corporation Laboratories	00072919	1989[3,4]	D. Balluff	1991	Yes
2,4-D Tri,isopropylamine salt	**73.8**	**Bird**	**Bobwhite quail**	***Colinus virginianus***	**27WKS**	**Oral (gavage or capsule)**	**Oral**	**14 D**	**14 D**	**Mortality**	**LD50**	**405**	**mg/kg bw**	**217**	**mg/kg bw**	**Wildlife International Inc., MD**	**00107928**	**1990[3,4]**	**G. Susanke**	**1991**	**Yes**
2,4-D Tri,isopropylamine salt	73.8	Bird	Bobwhite quail	*Colinus virginianus*	27WKS	Oral (gavage or capsule)	Oral	14 D	14 D		NOEL	125	mg/kg bw/d	67	mg/kg bw/d	Wildlife International Inc., MD	00107928	1990[3,4]	G. Susanke	1991	Yes
2,4-D Acid	96.1	Mollusca	Eastern oyster	*Crassostrea virginica*	Juvenile	Flow-through	Water	96 hr	96 hr		EC50	146	PPM	146	PPM	Environmental Science & Technology Inc.	00117158	1991[3,4]	K. Valente	1991	No
2,4-D Acid	96.1	Mollusca	Eastern oyster	*Crassostrea virginica*	Juvenile	Flow-through	Water	96 hr	96 hr		NOEL	< 135	PPM	< 135	PPM	Environmental Science & Technology Inc.	00117158	1991[3,4]	K. Valente	1991	No
2,4-D Isopropylamine salt	50.2	Aquatic invertebrate	Pink shrimp	*Penaeus duorarum*	2.5 g	Flow-through	Water	96 hr	96 hr	Mortality	LC50	605	PPM	477	PPM	Springborn Laboratory Inc., MA	00052637	1990[3,4]	D. Balluff	1991	No
2,4-D Isopropylamine salt	50.2	Aquatic invertebrate	Pink shrimp	*Penaeus duorarum*	2.5 g	Flow-through	Water	96 hr	96 hr		NOEL	140	PPM	110	PPM	Springborn Laboratory Inc., MA	00052637	1990[3,4]	D. Balluff	1991	No
2,4-DP-p, DMA salt	72.9	Fish	Bluegill sunfish	*Lepomis macrochirus*	1.96 g	Static	Water	96 hr	96 hr	Mortality	LC50	> 151	PPM	> 125	PPM	BASF Corporation, Republic of Germany	41835201	1992[3,4]	A. Yamhure	1996	Yes
2,4-DP-p, DMA salt	72.9	Fish	Bluegill sunfish	*Lepomis macrochirus*	1.96 g	Static	Water	96 hr	96 hr		NOEL	151	PPM	125	PPM	BASF Corporation, Republic of Germany	41835201	1992[3,4]	A. Yamhure	1996	Yes
2,4-DP 2-Butoxyethyl, Ester	Tech	Aquatic invertebrate	Water flea	*Daphnia magna*	<24 hr	Static	Water	48 hr	48 hr		EC50	252	PPM	173	PPM	Dow Chemical Corporation Laboratories	42595903	1979[3,4]	C. Laird	1989	Supplemental

Spreadsheet of Toxicity Data for 2,4-D Ester TRVs

Formulation	% purity	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint	Toxicity Value (tested product)[1]	Units	Toxicity Value (a.e.)[1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4-DP 2-Butoxyethyl, Ester	Tech	Aquatic invertebrate	Water flea	*Daphnia magna*	<24 hr	Static	Water	48 hr	48 hr		NOEL	155	PPM	107	PPM	Dow Chemical Corporation Laboratories	42595902	1979[3,4]	C. Laird	1989	Supplemental
2,4-DP 2-Butoxyethyl Ester	95.3	Bird	Bobwhite quail	*Colinus virginianus*	18 W	Oral (gavage or capsule)	Oral	7 D	7 D	Mortality	LD50	1517	mg/kg bw	1044	mg/kg bw	Wildlife International Inc., MD	40228401	1992[3,4]	K. Montague	1992	Yes
2,4-DP 2-Butoxyethyl Ester	95.3	Bird	Bobwhite quail	*Colinus virginianus*	18 W	Oral (gavage or capsule)	Oral	7 D	7 D		NOEL	175	mg/kg bw/d	120	mg/kg bw/d	Wildlife International Inc., MD	40228401	1992[3,4]	K. Montague	1992	Yes
2,4-D Isopropyl Ester	98.2	Bird	Bobwhite quail	*Colinus virginianus*	23WKS	Oral (gavage or capsule)	Oral	14 D	14 D	Mortality	LD50	1879	mg/kg bw	1578	mg/kg bw	Wildlife International Inc., MD	00160000	1996[3,4]	N. Federoff	1996	Yes
2,4-D Isopropyl Ester	98.2	Bird	Bobwhite quail	*Colinus virginianus*	23WKS	Oral (gavage or capsule)	Oral	14 D	14 D		NOEL	185	mg/kg bw/d	155	mg/kg bw/d	Wildlife International Inc., MD	00160000	1996[3,4]	N. Federoff	1996	Yes
2,4-D Acid	97.5	Amphibian	Leopard frog	*Rana pipiens*	Tadple	Static	Water	96 hr	96 hr	Mortality	LC50	349	PPM	349	PPM	Wildlife International Inc., MD	00160000	1997[3,4]	S. Ramasamy	2000	Supplemental
2,4-D Acid	97.5	Amphibian	Leopard frog	*Rana pipiens*	Tadple	Static	Water	96 hr	96 hr		NOEL	186	PPM	186	PPM	Wildlife International Inc., MD	00160000	1997[3,4]	S. Ramasamy	2000	Supplemental
2,4-D Acid	96.1	Aquatic invertebrate	Pink shrimp	*Penaeus duorarum*	Not reported	Flow-through	Water	96 hr	96 hr	Mortality	LC50	467	PPM	467	PPM	Environmental Science & Technology Inc.	00160000	1991[3,4]	M. Davy	1993	No
2,4-D Acid	96.1	Aquatic invertebrate	Pink shrimp	*Penaeus duorarum*	Not reported	Flow-through	Water	96 hr	96 hr		NOEL	187	PPM	187	PPM	Environmental Science & Technology Inc.	00022923	1991[3,4]	M. Davy	1993	No
2,4-D Dimethylamine salt	67.3	Fish	Bluegill sunfish	*Lepomis macrochirus*	0.28 g	Static	Water	96 hr	96 hr	Mortality	LC50	524	PPM	435.141	PPM	Dow Chemical Corporation Laboratories	TN 0751, 050681	1983[3,4]	R. Lamb	1995	Yes
2,4-D Dimethylamine salt	67.3	Fish	Bluegill sunfish	*Lepomis macrochirus*	0.28 g	Static	Water	96 hr	96 hr		NOEL	197	PPM	163.593	PPM	Dow Chemical Corporation Laboratories	TN 0755, 053986	1983[3,4]	R. Lamb	1995	Yes
2,4-D Acid	98.7	Fish	Bluegill sunfish	*Lepomis macrochirus*	0.15 g	Static	Water	96 hr	96 hr	Mortality	LC50	263	PPM	263	PPM	Dow Chemical Corporation Laboratories	00160000	1986[3,4]	K. Valente	1992	Yes
2,4-D Acid	98.7	Fish	Bluegill sunfish	*Lepomis macrochirus*	0.15 g	Static	Water	96 hr	96 hr		NOEL	< 204	PPM	< 204	PPM	Dow Chemical Corporation Laboratories	00102870	1986[3,4]	K. Valente	1992	Yes
2,4-D Dimethylamine salt	66.8	Fish	Inland silverside	*Menidia beryllina*	0.17 g	Flow-through	Water	96 hr	96 hr	Mortality	LC50	469	PPM	389.468	PPM	Toxikon Environmental Sciences, Jupiter, Florida	00050669	1991[3,4]	A. Yamhure	1994	No
2,4-D Dimethylamine salt	66.8	Fish	Inland silverside	*Menidia beryllina*	0.17 g	Flow-through	Water	96 hr	96 hr		NOEL	< 224	PPM	< 186.014	PPM	Toxikon Environmental Sciences, Jupiter, Florida	00138869	1991[3,4]	A. Yamhure	1994	No
2,4-D Dimethylamine salt	67.3	Fish	Fathead minnow	*Pimephales promelas*	0.104g	Static	Water	96 hr	96 hr	Mortality	LC50	318	PPM	264.074	PPM	Dow Chemical Corporation Laboratories	00138869	1983[3,4]	R. Lamb	1995	Yes
2,4-D Dimethylamine salt	67.3	Fish	Fathead minnow	*Pimephales promelas*	0.104g	Static	Water	96 hr	96 hr		NOEL	< 246	PPM	< 204.284	PPM	Dow Chemical Corporation Laboratories	00138869	1983[3,4]	R. Lamb	1995	Yes
2,4-D Acid	98.7	Fish	Fathead minnow	*Pimephales promelas*	0.14 g	Static	Water	96 hr	96 hr	Mortality	LC50	320	PPM	320	PPM	Dow Chemical Corporation Laboratories	00138872	1983[3,4]	K. Valente/W.Evans	1992	Yes
2,4-D Acid	98.7	Fish	Fathead minnow	*Pimephales promelas*	0.14 g	Static	Water	96 hr	96 hr		NOEL	256	PPM	256	PPM	Dow Chemical Corporation Laboratories	00138870	1983[3,4]	K. Valente/W.Evans	1992	Yes
2,4-D Isooctyl Ester	96.2	Bird	Mallard duck	*Anas platyrhynchos*	Juvenile	Oral (gavage or capsule)	Oral	14 D	14 D	Mortality	LD50	663	mg/kg bw	440	mg/kg bw	Wildlife International Inc., MD	40228401	1984[3,4]	K. Valente	1992	Yes
2,4-D Isopropylamine salt	**48.7**	**Bird**	**Mallard duck**	***Anas platyrhynchos***	**Not reported**	**Oral (gavage or capsule)**	**Oral**	**14 D**	**14 D**	**Mortality**	**LD50**	**> 398**	**mg/kg bw**	**> 314**	**mg/kg bw**	**Wildlife International Inc., MD**	**40098001**	**1983[3,4]**	**D. McLane**	**1984**	**Yes**
2,4-D Tri,isopropylamine salt	69.2	Fish	Rainbow trout	*Oncorhynchus mykiss*	0.25 g	Static	Water	96 Hr	96 Hr	Mortality	LC50	302	PPM	161.9	PPM	Dow Chemical Corporation Laboratories	40094602	1989[3,4]	A. Roybal	1991	Yes

Formulation	% purity	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint	Toxicity Value (tested product)[1]	Units	Toxicity Value (a.e.)[1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4-D Tri,isopropylamine salt	69.2	Fish	Rainbow trout	*Oncorhynchus mykiss*	0.25 g	Static	Water	96 Hr	96 Hr		NOEL	268	PPM	143.6	PPM	Dow Chemical Corporation Laboratories	N.R.	1989[3,4]	A. Roybal	1991	Yes
2,4-DP-p, DMA salt	602 g/L	Bird	Japanese quail	*Coturnix japonica*	Early life	Reproduction		6 wk	6 wk	Reproduction	LOEC	829	PPM	688 [77.5]	ppm [mg/kg bw/d]	Wildlife International Inc., MD	46879201	2001[3,4]	M. Janson	2006	Yes
2,4-DP-p, DMA salt	**602 g/L**	**Bird**	**Japanese quail**	***Coturnix japonica***	**Early life**	**Reproduction**		**6 wk**	**6 wk**	**Reproduction**	**NOEL**	**291**	**PPM**	**242 [27.3]**	**ppm [mg/kg bw/d]**	**Wildlife International Inc., MD**	**00072472**	**2001[3,4]**	**M. Janson**	**2006**	**Yes**
2,4-D Diethanolamine salt	73.1	Bird	Bobwhite quail	*Colinus virginianus*	Not reported	Oral (gavage or capsule)	Oral	14 D	14 D	Mortality	LD50	595	mg/kg bw	403	mg/kg bw	Wildlife International Inc., MD	00045071	1991[3,4]	K. Valente	1991	Yes
2,4-D Diethanolamine salt	73.1	Bird	Bobwhite quail	*Colinus virginianus*	Not reported	Oral (gavage or capsule)	Oral	14 D	14 D		NOEL	< 292	mg/kg bw/d	< 198	mg/kg bw/d	Wildlife International Inc., MD	40228401	1991[3,4]	K. Valente	1991	Yes
2, 4-D Isopropylamine salt	48.7	Bird	Bobwhite quail	*Colinus virginianus*	6 MO	Oral (gavage or capsule)	Oral	14 D	14 D	Mortality	LD50	377	mg/kg bw	298	mg/kg bw	Wildlife International Inc., MD	40228401	1985[3,4]	C. Hartless	2009	Yes
2, 4-D Isopropylamine salt	48.7	Bird	Bobwhite quail	*Colinus virginianus*	6 MO	Oral (gavage or capsule)	Oral	14 D	14 D		NOEL	< 292	mg/kg bw	< 230	mg/kg bw	Wildlife International Inc., MD	40228401	1985[3,4]	C. Hartless	2009	Yes
2,4-D Acid	98.7	Fish	Rainbow trout	*Oncorhynchus mykiss*	0.34 g	Static	Water	96 hr	96 hr	Mortality	LC50	358	PPM	358	PPM	Dow Chemical Corporation Laboratories	40228401	1983[3,4]	K. Valente	1992	Yes
2,4-D Acid	98.7	Fish	Rainbow trout	*Oncorhynchus mykiss*	0.34 g	Static	Water	96 hr	96 hr		NOEL	320	PPM	320	PPM	Dow Chemical Corporation Laboratories	40098001	1983[3,4]	K. Valente	1992	Yes
2,4-D Tri,isopropylamine salt	69.2	Fish	Bluegill sunfish	*Lepomis macrochirus*	0.3 g	Static	Water	96 hr	96 hr	Mortality	LC50	401	PPM	214.9	PPM	Dow Chemical Corporation Laboratories	40098001	1989[3,4]	A. Roybal	1991	Yes
2,4-D Tri,isopropylamine salt	69.2	Fish	Bluegill sunfish	*Lepomis macrochirus*	0.3 g	Static	Water	96 hr	96 hr		NOEL	325	PPM	174.2	PPM	Dow Chemical Corporation Laboratories	40098001	1989[3,4]	A. Roybal	1991	Yes
2,4-D Tri,isopropylamine salt	69.2	Aquatic invertebrate	Water flea	*Daphnia magna*	<24 hr	Static	Water	48 hr	48 hr		EC50	630	PPM	338	PPM	Dow Chemical Corporation Laboratories	40098001	1989[3,4]	A. Roybal	1991	Yes
2,4-D Tri,isopropylamine salt	69.2	Aquatic invertebrate	Water flea	*Daphnia magna*	<24 hr	Static	Water	48 hr	48 hr		NOEL	380	PPM	203.7	PPM	Dow Chemical Corporation Laboratories	40098001	1989[3,4]	A. Roybal	1991	Yes
2,4-D Dimethylamine salt	66.8	Bird	Mallard duck	*Anas platyrhynchos*	10 D	Diet	Dietary	5 D	8 D	Mortality	LC50	> 5620	PPM	> 4,667 [2,335]	ppm [mg/kg bw]	Wildlife International Inc., MD	40228401	1990[3,4]	N. Vyas	1992	Yes
2,4-DP-p, DMA salt	59.93	Bird	Mallard duck	*Anas platyrhynchos*	9 D	Diet	Dietary	5 D	8 D	Mortality	LC50	> 5600	PPM	> 4,650 [2,325]	ppm [mg/kg bw]	Biolife Associates, Inc.	40228401	1994[3,4]	N. Cook (KBN)	1996	Yes
2,4-DB Acid	99.6	Bird	Bobwhite quail	*Colinus virginianus*	17 WKS	Oral (gavage or capsule)	Oral	21 D	21 D	Mortality	LD50	1536	mg/kg bw	1363	mg/kg bw	Biolife Associates, Inc.	40098001	1989[3,4]	G. Susanke	1990	Yes
2,4-DB Acid	99.6	Bird	Bobwhite quail	*Colinus virginianus*	17 WKS	Oral (gavage or capsule)	Oral	21 D	21 D		NOEL	464	mg/kg bw	412	mg/kg bw	Biolife Associates, Inc.	40098001	1989[3,4]	G. Susanke	1990	Yes
2,4-D Isopropyl Ester	98.2	Bird	Mallard duck	*Anas platyrhynchos*	10 D	Diet	Dietary	5 D	8 D	Mortality	LC50	> 5218	PPM	> 4,383 [2,190]	ppm [mg/kg bw]	Wildlife International Inc., MD	40098001	1996[3,4]	N. Federoff	1996	Yes
2,4-D Acid	96	Bird	Mallard duck	*Anas platyrhynchos*	10 D	Diet	Dietary	5 D	8 D	Mortality	LC50	> 5620	PPM	> 5,620 [2,810]	ppm [mg/kg bw]	Wildlife International Inc., MD	40228401	1990[3,4]	K. Valente	1992	Yes
2,4-D Tri,isopropylamine salt	70.4	Aquatic invertebrate	Pink shrimp	*Penaeus duorarum*	2.5 g	Flow-through	Water	96 hr	96 hr	Mortality	LC50	1057	PPM	566.6	PPM	Springborn Laboratory Inc., MA	00022923	1990[3,4]	D. Balluff	1991	No
2,4-D Tri,isopropylamine salt	70.4	Aquatic invertebrate	Pink shrimp	*Penaeus duorarum*	2.5 g	Flow-through	Water	96 hr	96 hr		NOEL	582	PPM	312.0	PPM	Springborn Laboratory Inc., MA	00022923	1990[3,4]	D. Balluff	1991	No
2,4-D Butoxyethanol Ester	96	Bird	Mallard duck	*Anas platyrhynchos*	10 D	Diet	Dietary	5 D	8 D	Mortality	LC50	> 5620	PPM	> 3,867 [1,935]	ppm [mg/kg bw]	Wildlife International Inc., MD	40098001	1989[3,4]	D. Balluff	1991	Yes

Formulation	% purity	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint	Toxicity Value (tested product)[1]	Units	Toxicity Value (a.e.)[1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4 DP-p-2-EHE	93.2	Bird	Mallard duck	*Anas platyrhynchos*	10 D	Diet	Dietary	5 D	8 D	Mortality	LC50	> 5620	PPM	> 3,727 [1,865]	ppm [mg/kg bw]	Wildlife International Inc., MD	40098001	1994[3,4]	D. Urban	1995	Yes
2,4-D Diethanolamine salt	73.1	Bird	Mallard duck	*Anas platyrhynchos*	10 D	Diet	Dietary	5 D	8 D	Mortality	LC50	> 5620	PPM	> 3,808 [1,905]	ppm [mg/kg bw]	Wildlife International Inc., MD	40098001	1991[3,4]	K. Valente	1991	Yes
2,4-D Isooctyl Ester	96.2	Bird	Mallard duck	*Anas platyrhynchos*	Juvenile	Diet	Dietary	5 D	8 D	Mortality	LC50	> 5620	PPM	> 3,727 [1,865]	ppm [mg/kg bw]	Wildlife International Inc., MD	40098001	1984[3,4]	K. Valente	1992	Yes
2,4-D Acid	96.9	Bird	Bobwhite quail	*Colinus virginianus*	Early life	Reproduction		21 W	21 W	Reproduction	LOEL	> 962	PPM	> 962 [581]	ppm [mg/kg bw/d]	Wildlife International Inc., MD	40098001	2000[3,4]	W. Evans	2001	Yes
2,4-D Acid	96.9	Bird	Bobwhite quail	*Colinus virginianus*	Early life	Reproduction		21 W	21 W	Reproduction	NOEL	962	PPM	962 [581]	ppm [mg/kg bw/d]	Wildlife International Inc., MD	40228401	2000[3,4]	W. Evans	2001	Yes
2,4-D Tri,isopropylamine salt	70.4	Bird	Mallard duck	*Anas platyrhynchos*	10 D	Diet	Dietary	5 D	8 D	Mortality	LC50	> 5620	PPM	> 3,012 [1,505]	ppm [mg/kg bw]	Wildlife International Inc., MD	40098001	1990[3,4]	G. Susanke	1991	Yes
2,4-D Isooctyl Ester	92	Bird	Mallard duck	*Anas platyrhynchos*	Not reported	Diet	Dietary	5 D	8 D	Mortality	LC50	> 10000	PPM	> 6,632 [3,315]	ppm [mg/kg bw]	Uniroyal Chemical Inc.	05001497	1976[3,4]	L. Turner	1977	Yes
2,4-D Acid	96	Bird	Bobwhite quail	*Colinus virginianus*	10 D	Diet	Dietary	5 D	8 D	Mortality	LC50	> 5620	PPM	> 5,620 [16,969]	ppm [mg/kg bw]	Dow Chemical Corporation Laboratories	40098001	1989[3,4]	D. Balluff	1991	Yes
2,4-D Acid	96	Bird	Bobwhite quail	*Colinus virginianus*	10 D	Diet	Dietary	5 D	8 D		NOEL	1000	PPM	1000 [604]	ppm [mg/kg bw/d]	Dow Chemical Corporation Laboratories	40098001	1989[3,4]	D. Balluff	1991	Yes
2,4-D Diethanolamine salt	57.9	Bird	Bobwhite quail	*Colinus virginianus*	Not reported	Diet	Dietary	5 D	8 D	Mortality	LC50	> 4640	PPM	> 3,144 [9,493]	ppm [mg/kg bw]	Truslo Farm Inc.	40098001	1974[3,4]	C. Lewis	1988	Supplemental
2,4-D Diethanolamine salt	57.9	Bird	Bobwhite quail	*Colinus virginianus*	Not reported	Diet	Dietary	5 D	8 D		NOEL	1000	PPM	678 [409]	ppm [mg/kg bw/d]	Truslo Farm Inc.	40098001	1974[3,4]	C. Lewis	1988	Supplemental
2,4-D Butoxyethanol Ester	69.3	Bird	Ring-necked pheasant	*Phasianus colchicus*	10 D	Diet	Dietary	5 D	8 D	Mortality	LC50	> 5000	PPM	> 3,440 [997.5]	ppm [mg/kg bw]	Fish and Wildlife Service Laboratories, Department of Interior	40098001	1975[3,4]	Hill, E.F. et al	1975	Yes
2,4-DP 2-Butoxyethyl Ester	59.1	Bird	Mallard duck	*Anas platyrhynchos*	Not reported	Oral (gavage or capsule)	Oral	NR	NR	Mortality	LD50	> 4650	mg/kg bw	> 3,199	mg/kg bw	Wildlife International Inc., MD	41353801	1976[3,4]	G. Gavin	1977	Yes
2,4-DP 2-Butoxyethyl Ester	59.1	Bird	Mallard duck	*Anas platyrhynchos*	Not reported	Diet	Dietary	5 D	8 D	Mortality	LC50	> 10000	PPM	> 6,880 [3,440]	ppm [mg/kg bw]	Wildlife International Inc., MD	N.R.	1976[3,4]	C. Laird	1988	Yes
2,4-D Butyl Ester	Tech	Bird	Mallard duck	*Anas platyrhynchos*	Not reported	Diet	Dietary	5 D	8 D	Mortality	LC50	10000	PPM	6,880 [3,440]	ppm [mg/kg bw]	Wildlife International Inc., MD	TN 0851	1976[3,4]	T. O'Brien	1978	Yes
2,4-DP-p, DMA salt	59.93	Bird	Bobwhite quail	*Colinus virginianus*	13 D	Diet	Dietary	5 D	8 D	Mortality	LC50	> 5600	PPM	> 4,650 [14,041]	ppm [mg/kg bw]	Biolife Associates, Inc.	40098001	1994[3,4]	N. Cook (KBN)	1996	Yes
2,4-DP-p, DMA salt	59.93	Bird	Bobwhite quail	*Colinus virginianus*	13 D	Diet	Dietary	5 D	8 D		NOEL	1400	PPM	1163 [702]	ppm [mg/kg bw/d]	Biolife Associates, Inc.	40098001	1994[3,4]	N. Cook (KBN)	1996	Yes
2,4-D Isopropyl Ester	98.2	Bird	Bobwhite quail	*Colinus virginianus*	10 D	Diet	Dietary	5 D	8 D	Mortality	LC50	> 5456	PPM	> 4,583 [13,838]	ppm [mg/kg bw]	Wildlife International Inc., MD	40098001	1996[3,4]	N. Federoff	1996	Yes
2,4-D Isopropyl Ester	98.2	Bird	Bobwhite quail	*Colinus virginianus*	10 D	Diet	Dietary	5 D	8 D		NOEL	1673	PPM	1405 [848]	ppm [mg/kg bw/d]	Wildlife International Inc., MD	40098001	1996[3,4]	N. Federoff	1996	Yes
2,4-D Diethanolamine salt	73.1	Bird	Bobwhite quail	*Colinus virginianus*	10 D	Diet	Dietary	5 D	8 D	Mortality	LC50	> 5620	PPM	> 3,808 [11,498]	ppm [mg/kg bw]	Wildlife International Inc., MD	40098001	1991[3,4]	K. Valente	1991	Supplemental
2,4-D Diethanolamine salt	73.1	Bird	Bobwhite quail	*Colinus virginianus*	10 D	Diet	Dietary	5 D	8 D		NOEL	1780	PPM	1206 [728]	ppm [mg/kg bw/d]	Wildlife International Inc., MD	40098001	1991[3,4]	K. Valente	1991	Supplemental
2,4-DP 2-Butoxyethyl, Ester Mix(Alchem 76)	100	Bird	Mallard duck	*Anas platyrhynchos*	14 D	Diet	Dietary	5 D	8 D	Mortality	LC50	> 10000	PPM	> 6,880 [3,440]	ppm [mg/kg bw]	Truslo Farm Inc.	00063066	1976[3,4]	C. Laird	1989	Yes

Spreadsheet of Toxicity Data for 2,4-D Ester TRVs

Formulation	% purity	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint	Toxicity Value (tested product)[1]	Units	Toxicity Value (a.e.)[1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4-D Acid	>99	Bird	Mallard duck	*Anas platyrhynchos*	4 MOS	Oral (gavage or capsule)	Oral	14 D	14 D	Mortality	LD50	> 2000	mg/kg bw	> 2000	mg/kg bw	Fish and Wildlife Service Laboratories, Department of Interior	02049115	1984[3,4]	Hudson, R.H. et al	1984	Yes
2,4-D Acid	>99	Bird	Mallard duck	*Anas platyrhynchos*	3-5MOS	Oral (gavage or capsule)	Oral	14 D	14 D	Mortality	LD50	> 1000	mg/kg bw	> 1000	mg/kg bw	Fish and Wildlife Service Laboratories, Department of Interior	02049115	1984[3,4]	Hudson, R.H. et al	1984	Yes
2,4-D Acid	>99	Bird	Ring-necked pheasant	*Phasianus colchicus*	3-4MOS	Oral (gavage or capsule)	Oral	14 D	14 D	Mortality	LD50	472	mg/kg bw	472	mg/kg bw	Fish and Wildlife Service Laboratories, Department of Interior	02049115	1984[3,4]	Hudson, R.H. et al	1984	Yes
2,4-D Tri,isopropylamine salt	70.4	Bird	Bobwhite quail	*Colinus virginianus*	10 D	Diet	Dietary	5 D	8 D	Mortality	LC50	> 5620	PPM	> 3,012 [9,094]	ppm [mg/kg bw]	Wildlife International Inc., MD	40098001	1990[3,4]	G. Susanke	1991	Yes
2,4-D Tri,isopropylamine salt	70.4	Bird	Bobwhite quail	*Colinus virginianus*	10 D	Diet	Dietary	5 D	8 D		NOEL	1780	PPM	954 [576]	ppm [mg/kg bw/d]	Wildlife International Inc., MD	40098001	1990[3,4]	G. Susanke	1991	Yes
2,4-D Sodium salt	Tech	Bird	Mallard duck	*Anas platyrhynchos*	Not reported	Oral (gavage or capsule)	Oral	>=14D	>=14D	Mortality	LD50	> 2025	mg/kg bw	1,841	mg/kg bw	Fish and Wildlife Service Laboratories, Department of Interior	02032075	1984[3,4]	Hudson, R.H. et al	1987	Yes
2,4-D Isopropylamine salt	48.7	Bird	Mallard duck	*Anas platyrhynchos*	9 D	Diet	Dietary	5 D	8 D	Mortality	LC50	> 5620	PPM	> 4,435 [2,220]	ppm [mg/kg bw]	Wildlife International Inc., MD	02058865	1983[3,4]	D. McLane	1984	Yes
2,4 DP-p-2-EHE	93.2	Bird	Bobwhite quail	*Colinus virginianus*	10 D	Diet	Dietary	5 D	8 D	Mortality	LC50	> 5620	PPM	> 3,727 [11,254]	ppm [mg/kg bw]	Wildlife International Inc., MD	00022923	1994[3,4]	Contract Draft-KBN	1997	Yes
2,4 DP-p-2-EHE	93.2	Bird	Bobwhite quail	*Colinus virginianus*	10 D	Diet	Dietary	5 D	8 D		NOEL	1780	PPM	1180 [713]	ppm [mg/kg bw/d]	Wildlife International Inc., MD	00022923	1994[3,4]	Contract Draft-KBN	1997	Yes
2,4 DP-p-2-EHE	93.2	Bird	Bobwhite quail	*Colinus virginianus*	10 D	Diet	Dietary	5 D	8 D	Mortality	LC50	> 5620	PPM	> 3,727 [11,254]	ppm [mg/kg bw]	Wildlife International Inc., MD	00022923	1994[3,4]	Contract Draft-KBN	1994	Yes
2,4 DP-p-2-EHE	93.2	Bird	Bobwhite quail	*Colinus virginianus*	10 D	Diet	Dietary	5 D	8 D		NOEL	1780	PPM	1180 [713]	ppm [mg/kg bw/d]	Wildlife International Inc., MD	00022923	1994[3,4]	Contract Draft-KBN	1994	Yes
2,4-D 2-EHE	92	Bird	Mallard duck	*Anas platyrhynchos*	14 D	Oral (gavage or capsule)	Oral	8 D	8 D	Mortality	LD50	> 4640	mg/kg bw	> 3,077	mg/kg bw	Uniroyal Chemical Inc.	02054612	1976[3,4]	L. Turner	1977	Yes
2,4-D Dimethylamine salt	49.6	Bird	Ring-necked pheasant	*Phasianus colchicus*	10 D	Diet	Dietary	5 D	8 D	Mortality	LC50	> 5000	PPM	> 4,152 [1,204]	ppm [mg/kg bw]	Fish and Wildlife Service Laboratories, Department of Interior	02040321	1975[3,4]	Hill, E.F. et al	1975	Yes
2,4-DB Acid	98	Bird	Mallard duck	*Anas platyrhynchos*	10 D	Diet	Dietary	5 D	8 D	Mortality	LC50	> 5000	PPM	> 4,435 [2,220]	ppm [mg/kg bw]	Fish and Wildlife Service Laboratories, Department of Interior	00022923	1975[3,4]	Hill, E.F. et al	1988	Yes
2,4-DB Acid	98	Bird	Ring-necked pheasant	*Phasianus colchicus*	10 D	Diet	Dietary	5 D	8 D	Mortality	LC50	> 5000	PPM	> 4,436 [1,286]	ppm [mg/kg bw]	Fish and Wildlife Service Laboratories, Department of Interior	00022923	1975[3,4]	Hill, E.F. et al	1988	Yes
2,4-DB DMA	26	Bird	Bobwhite quail	*Colinus virginianus*	Not reported	Diet	Dietary	5 D	8 D	Mortality	LC50	> 5000	PPM	> 4,152 [12,537]	ppm [mg/kg bw]	Biolife Associates, Inc.	40098001	1989[3,4]	G. Susanke	1990	Yes
2,4-DB DMA	26	Bird	Bobwhite quail	*Colinus virginianus*	Not reported	Diet	Dietary	5 D	8 D		NOEL	2500	PPM	2076 [1254]	ppm [mg/kg bw/d]	Biolife Associates, Inc.	40098001	1989[3,4]	G. Susanke	1990	Yes
2,4-D Isooctyl Ester	96.2	Bird	Bobwhite quail	*Colinus virginianus*	Juvenile	Diet	Dietary	5 D	8 D	Mortality	LC50	> 5620	PPM	> 3,727 [11,254]	ppm [mg/kg bw]	Wildlife International Inc., MD	41158305	1984[3,4]	K. Valente	1992	Yes
2,4-D Isooctyl Ester	96.2	Bird	Bobwhite quail	*Colinus virginianus*	Juvenile	Diet	Dietary	5 D	8 D		NOEL	3160	PPM	2,096 [1,266]	ppm [mg/kg bw/d]	Wildlife International Inc., MD	41407803	1984[3,4]	K. Valente	1992	Yes
2,4-D Dimethylamine salt	66.8	Bird	Bobwhite quail	*Colinus virginianus*	10 D	Diet	Dietary	5 D	8 D	Mortality	LC50	> 5620	PPM	> 4,667 [14,092]	ppm [mg/kg bw]	Wildlife International Inc., MD	42416802	1990[3,4]	N. Vyas	1992	Yes
2,4-D Dimethylamine salt	66.8	Bird	Bobwhite quail	*Colinus virginianus*	10 D	Diet	Dietary	5 D	8 D		NOEL	3160	PPM	2624 [1585]	ppm [mg/kg bw/d]	Wildlife International Inc., MD	00160000	1990[3,4]	N. Vyas	1992	Yes
2,4-D Diethanolamine salt	57.9	Bird	Mallard duck	*Anas platyrhynchos*	14 D	Diet	Dietary	5 D	8 D	Mortality	LC50	> 4640	PPM	> 3,144 [1,570]	ppm [mg/kg bw]	Truslo Farm Inc.	00053988	1974[3,4]	C. Lewis	1988	Supplemental

Formulation	% purity	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint	Toxicity Value (tested product)[1]	Units	Toxicity Value (a.e.)[1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4-D Diethanolamine salt	57.9	Bird	Mallard duck	*Anas platyrhynchos*	14 D	Diet	Dietary	8 D	8 D		NOEL	4640	PPM	3144	ppm [mg/kg bw/d]	Truslo Farm Inc.	40098001	1974[3,4]	C. Lewis	1988	Supplemental
2,4-D Butyl Ester	Tech	Bird	Mallard duck	*Anas platyrhynchos*	14 D	Oral (gavage or capsule)	Oral	8 D	8 D	Mortality	LD50	> 4640	mg/kg bw	> 3193	mg/kg bw	Wildlife International Inc., MD	40098001	1976[3,4]	T. O'Brien	1978	Supplemental
2,4-D Butyl Ester	Tech	Bird	Mallard duck	*Anas platyrhynchos*	14 D	Oral (gavage or capsule)	Oral	8 D	8 D		NOEL	< 4640	mg/kg bw/d	< 3193	mg/kg bw/d	Wildlife International Inc., MD	40098001	1976[3,4]	T. O'Brien	1978	Supplemental
DMA salt		Bird	Mallard duck	*Anas platyrhynchos*		Acute	Gavage			Mortality	LD50	NR		> 3,851	mg/kg bw		00233351	Fink 1978			Yes
2,4-D Isooctyl Ester	96.2	Bird	Mallard duck	*Anas platyrhynchos*	Juvenile	Oral (gavage or capsule)	Oral	14 D	14 D		NOEL	< 259	mg/kg bw	< 171.8	mg/kg bw	Wildlife International Inc., MD	40228401	1984[3,4]	K. Valente	1992	Yes
2,4-D Butoxyethanol Ester	96	Bird	Bobwhite quail	*Colinus virginianus*	10 D	Diet	Dietary	5 D	8 D	Mortality	LC50	> 5620	PPM	> 3,867 [11,676]	ppm [mg/kg bw]	Wildlife International Inc., MD	N.R.	1989[3,4]	D. Balluff	1991	Yes
2,4-D Butoxyethanol Ester	96	Bird	Bobwhite quail	*Colinus virginianus*	10 D	Diet	Dietary	5 D	8 D		NOEL	5620	PPM	3,867 [2,335]	ppm [mg/kg bw/d]	Wildlife International Inc., MD	N.R.	1989[3,4]	D. Balluff	1991	Yes
2,4-D Isopropylamine salt	48.7	Bird	Mallard duck	*Anas platyrhynchos*	Not reported	Oral (gavage or capsule)	Oral	14 D	14 D		NOEL	398	mg/kg bw	314	mg/kg bw	Wildlife International Inc., MD	40098001	1983[3,4]	D. McLane	1984	Yes
2,4-D Dimethylamine salt	66.8	Bird	Mallard duck	*Anas platyrhynchos*	10 D	Diet	Dietary	5 D	8 D		NOEL	562	PPM	467 [46.7]	ppm [mg/kg bw/d]	Wildlife International Inc., MD	00022923	1990[3,4]	N. Vyas	1992	Yes
2,4-DP 2-Butoxyethyl Ester	59.1	Bird	Bobwhite quail	*Colinus virginianus*	Not reported	Diet	Dietary	5 D	8 D	Mortality	LC50	> 10000	PPM	> 6,880 [20,774]	ppm [mg/kg bw]	Wildlife International Inc., MD	00138869	1976[3,4]	C. Laird	1988	Yes
2,4-DP 2-Butoxyethyl Ester	59.1	Bird	Bobwhite quail	*Colinus virginianus*	Not reported	Diet	Dietary	5 D	8 D		NOEL	10,000	PPM	6,880 [4,155]	ppm [mg/kg bw/d]	Wildlife International Inc., MD	00107929	1976[3,4]	C. Laird	1988	Yes
2,4-DP-p, DMA salt	59.93	Bird	Mallard duck	*Anas platyrhynchos*	9 D	Diet	Dietary	5 D	8 D		NOEL	700	PPM	581 [58.1]	ppm [mg/kg bw/d]	Biolife Associates, Inc.	40228401	1994[3,4]	N. Cook (KBN)	1996	Yes
2,4-D Isopropyl Ester	98.2	Bird	Mallard duck	*Anas platyrhynchos*	10 D	Diet	Dietary	5 D	8 D		NOEL	901	PPM	757 [75.7]	ppm [mg/kg bw/d]	Wildlife International Inc., MD	40098001	1996[3,4]	N. Federoff	1996	Yes
2,4-D Acid	96	Bird	Mallard duck	*Anas platyrhynchos*	10 D	Diet	Dietary	5 D	8 D		NOEL	1000	PPM	1,000 [100]	ppm [mg/kg bw/d]	Wildlife International Inc., MD	40098001	1990[3,4]	K. Valente	1992	Yes
2,4-D Butoxyethanol Ester	96	Bird	Mallard duck	*Anas platyrhynchos*	10 D	Diet	Dietary	5 D	8 D		NOEL	1000	PPM	688 [68.8]	ppm [mg/kg bw/d]	Wildlife International Inc., MD	40098001	1989[3,4]	D. Balluff	1991	Yes
2,4-DP 2-Butoxyethyl, Ester	100	Bird	Bobwhite quail	*Colinus virginianus*	14 D	Diet	Dietary	5 D	8 D	Mortality	LC50	> 10000	PPM	> 6,880 [20,774]	ppm [mg/kg bw]	Truslo Farm Inc.	00022529	1976[3,4]	C. Laird	1989	Yes
2,4-DP 2-Butoxyethyl, Ester	100	Bird	Bobwhite quail	*Colinus virginianus*	14 D	Diet	Dietary	5 D	8 D		NOEL	10,000	PPM	6,880 [4,155]	ppm [mg/kg bw/d]	Truslo Farm Inc.	TN 0190, 00050680	1976[3,4]	C. Laird	1989	Yes
2,4-DP 2-Butoxyethyl, Ester Mix(Alchem 76)	100	Bird	Bobwhite quail	*Colinus virginianus*	14 D	Diet	Dietary	5 D	8 D	Mortality	LC50	> 10000	PPM	> 6,880 [20,774]	ppm [mg/kg bw]	Wildlife International Inc., MD	TN 0191	1977[3,4]	C. Laird	1989	Yes
2,4-DP 2-Butoxyethyl, Ester Mix(Alchem 76)	100	Bird	Bobwhite quail	*Colinus virginianus*	14 D	Diet	Dietary	5 D	8 D		NOEL	10000	PPM	6,880 [4,155]	ppm [mg/kg bw/d]	Wildlife International Inc., MD	TN 0288	1977[3,4]	C. Laird	1989	Yes
2,4-D 2 EHE	67	Mollusca	Eastern oyster	*Crassostrea virginica*	SPAT	Flow-through	Water	96 hr	96 hr		EC50	> 3.0	PPB	> 2 [0.002]	ppb [ppm]	Envirosystem & Engineering Inc.	TN 0087	1991[3,4]	J. Noles	1991	No
2,4-D 2 EHE	67	Mollusca	Eastern oyster	*Crassostrea virginica*	SPAT	Flow-through	Water	96 hr	96 hr		NOEL	3	PPB	2 [0.002]	ppb [ppm]	Envirosystem & Engineering Inc.	TN 0135	1991[3,4]	J. Noles	1991	No
2,4-DP-p, DMA salt	63.6	Aquatic Plant	Duckweed	Lemna gibba	Not reported	Static	Water	14 D	14 D	Growth	EC50	3.8	PPM	3.156	PPM	Springborn Laboratory Inc., MA	TN 0572, 00050675	1992[3,4]	M. Davy	1993	Supplemental

Formulation	% purity	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint	Toxicity Value (tested product)[1]	Units	Toxicity Value (a.e.) [1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4-DP-p, DMA salt	63.6	Aquatic Plant	Green algae	Selenastrum capricornutum	Not reported	Static	Water	5 D	5 D	Growth	EC50	> 11	PPM	> 9.135	PPM	Springborn Laboratory Inc., MA	TN 0867	1992[3,4]	M. Davy	1993	Yes
2,4-D Acid	97	Aquatic Plant	Marine algae	Isochrysis galbana	Not reported	Static	Water	240hr	240hr	Growth	EC50	50	PPM	50	PPM	EPA Research Labs, at Beltsville, MD ,Gulfbreeze, FL, or Duluth, MN.	TN 0851	1986[3,4]	F.L. Mayer	1986	No
2,4-D Acid	97	Aquatic Plant	Marine diatom	Phaeodactylum tricornutum	Not reported	Static	Water	240hr	240hr	Growth	EC50	50	PPM	50	PPM	EPA Research Labs, at Beltsville, MD ,Gulfbreeze, FL, or Duluth, MN.	02049116	1986[3,4]	F.L. Mayer	1986	No
2,4-D Acid	97	Aquatic Plant	Green algae	Dunaliella tertiolecta	Not reported	Static	Water	240hr	240hr	Growth	EC50	75	PPM	75	PPM	EPA Research Labs, at Beltsville, MD ,Gulfbreeze, FL, or Duluth, MN.	02049116	1986[3,4]	F.L. Mayer	1986	Supplemental
2,4-D Acid	97	Aquatic Plant	Green algae	Chlorococcum sp.	Not reported	Static	Water	240hr	240hr	Growth	EC50	50	PPM	50	PPM	EPA Research Labs, at Beltsville, MD ,Gulfbreeze, FL, or Duluth, MN.	02049116	1986[3,4]	F.L. Mayer	1986	Supplemental
2,4-D Acid	98.7	Fish	Rainbow trout	*Oncorhynchus mykiss*	0.3 g	Static	Water	96 hr	96 hr	Mortality	LC50	110	PPM	110	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Acid	98.7	Fish	Bluegill sunfish	*Lepomis macrochirus*	0.5 g	Static	Water	96 hr	96 hr	Mortality	LC50	180	PPM	180	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Acid	100	Fish	Cutthroat trout	*Oncorhynchus clarki*	0.5 g	Static	Water	96 hr	96 hr	Mortality	LC50	24.5	PPM	24.5	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Acid	100	Fish	Lake trout	*Salvelinus namaycush*	0.3 g	Static	Water	96 hr	96 hr	Mortality	LC50	44.5	PPM	44.5	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Acid	98.7	Fish	Fathead minnow	*Pimephales promelas*	0.9 g	Static	Water	96 hr	96 hr	Mortality	LC50	133	PPM	133	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4 DP-p-2-EHE	93.2	Bird	Mallard duck	*Anas platyrhynchos*	10 D	Diet	Dietary	5 D	8 D		NOEL	1000	PPM	663 [66.3]	ppm [mg/kg bw/d]	Wildlife International Inc., MD	40098001	1994[3,4]	D. Urban	1995	Yes
2,4-D Diethanolamine salt	73.1	Bird	Mallard duck	*Anas platyrhynchos*	10 D	Diet	Dietary	5 D	8 D		NOEL	1780	PPM	1,206 [120.6]	ppm [mg/kg bw/d]	Wildlife International Inc., MD	40094602	1991[3,4]	K. Valente	1991	Yes
2,4-D Isooctyl Ester	96.2	Bird	Mallard duck	*Anas platyrhynchos*	Juvenile	Diet	Dietary	5 D	8 D		NOEL	1780	PPM	1,180 [118]	ppm [mg/kg bw/d]	Wildlife International Inc., MD	40098001	1984[3,4]	K. Valente	1992	Yes
2,4-D Acid	>99	Bird	Japanese quail	*Coturnix japonica*	2 MOS	Oral (gavage or capsule)	Oral	14 D	14 D	Mortality	LD50	668	mg/kg bw	668	mg/kg bw	Fish and Wildlife Service Laboratories, Department of Interior	02049115	1984[3,4]	Hudson, R.H. et al	1984	Supplemental
2,4-D Acid	>99	Bird	Chukar	*Alectoris chukar*	4 MOS	Oral (gavage or capsule)	Oral	14 D	14 D	Mortality	LD50	200-400	mg/kg bw	200-400	mg/kg bw	Fish and Wildlife Service Laboratories, Department of Interior	02049115	1984[3,4]	Hudson, R.H. et al	1984	Supplemental
2,4-D Acid	>99	Bird	Rock dove	*Columba livia*	Not reported	Oral (gavage or capsule)	Oral	14 D	14 D	Mortality	LD50	668	mg/kg bw	668	mg/kg bw	Fish and Wildlife Service Laboratories, Department of Interior	02049115	1984[3,4]	Hudson, R.H. et al	1984	Supplemental
2,4-D Acid	75	Bird	Japanese quail	*Coturnix japonica*	14 D	Diet	Dietary	5 D	8 D	Mortality	LC50	> 5000	PPM	> 5000 [2,817]	ppm [mg/kg bw]	Fish and Wildlife Service Laboratories, Department of Interior	02049114	1975[3,4]	Hill, E.F. et al	1975	Supplemental
2,4-D Sodium salt	80	Fish	Rainbow trout	*Oncorhynchus mykiss*	0.28 g	Static	Water	96 hr	96 hr	Mortality	LC50	> 100	PPM	90.9	ppm	Agricultural Research Center, USDA, Beltsville, MD.	02032078	1973[3,4]	C. Lewis	1987	Supplemental
2,4-D Tri,isopropylamine salt	70.4	Bird	Mallard duck	*Anas platyrhynchos*	10 D	Diet	Dietary	5 D	8 D		NOEL	1780	PPM	954 [95.4]	ppm [mg/kg bw/d]	Wildlife International Inc., MD	40094602	1990[3,4]	G. Susanke	1991	Yes
2,4-D Isopropylamine salt	48.7	Aquatic invertebrate	Water flea	*Daphnia magna*	1st-I	Static	Water	48 hr	48 hr		EC50	583	PPM	460	PPM	Dow Chemical Corporation Laboratories	02058860	1983[3,4]	D. McLane	1984	Yes
2,4-D Isopropylamine salt	48.7	Fish	Bluegill sunfish	*Lepomis macrochirus*	0.6 g	Static	Water	96 hr	96 hr	Mortality	LC50	1700	PPM	1342	PPM	Dow Chemical Corporation Laboratories	02058860	1983[3,4]	H. Mansfield	1991	Yes
2,4-D Isopropylamine salt	48.7	Fish	Rainbow trout	*Oncorhynchus mykiss*	0.53g	Static	Water	96 hr	96 hr	Mortality	LC50	2840	PPM	2241	PPM	Dow Chemical Corporation Laboratories	02058860	1983[3,4]	H.N. Mansfield	1984	Yes

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2,4-D Isooctyl Ester	92	Bird	Mallard duck	*Anas platyrhynchos*	Not reported	Diet	Dietary	5 D	8 D		NOEL	2150	PPM	1,426 [142.6]	ppm [mg/kg bw/d]	Uniroyal Chemical Inc.	05001497	1976[3,4]	L. Turner	1977	Yes
2,4-D Isopropylamine salt	48.7	Bird	Bobwhite quail	*Colinus virginianus*	9 D	Diet	Dietary	5 D	8 D	Mortality	LC50	> 5620	PPM	> 4,435 [13,391]	ppm [mg/kg bw]	Wildlife International Inc., MD	02058862	1983[3,4]	D. Mclane	1984	Yes
2,4-D Isooctyl Ester	67Lq	Aquatic invertebrate	Scud	*Gammarus fasciatus*	Juvenile	Static	Water	96 hr	96 hr	Mortality	LC50	2400	PPB	1,592 [1.6]	ppb [ppm]	Fish and Wildlife Service Laboratories, Department of Interior	02079104	1980[3,4]	Johnson & Finley	1987	Yes
2,4-D Isooctyl Ester	39.6	Aquatic invertebrate	Water flea	*Daphnia magna*	1st-I	Static	Water	48 hr	48 hr		EC50	500	PPB	332 [0.3]	ppb [ppm]	EPA Research Labs, at Beltsville, MD ,Gulfbreeze, FL, or Duluth, MN.		1975[3,4]	C. Lewis	1987	Yes
2,4-D Isooctyl Ester	94.2	Fish	Rainbow trout	*Oncorhynchus mykiss*	0.26g	Static	Water	96 hr	96 hr	Mortality	LC50	96	PPM	63.7	PPM	EPA Research Labs, at Beltsville, MD ,Gulfbreeze, FL, or Duluth, MN.		1977[3,4]	C. Lewis	1987	Yes
2,4-D Butoxyethanol Ester	69.3	Bird	Ring-necked pheasant	*Phasianus colchicus*	10 D	Diet	Dietary	5 D	8 D		NOEL	2500	PPM	1,720 [172]	ppm [mg/kg bw/d]	Fish and Wildlife Service Laboratories, Department of Interior	40098001	1975[3,4]	Hill, E.F. et al	1975	Yes
2,4-D Isooctyl Ester	92.0	Bird	Bobwhite quail	*Colinus virginianus*	Juvenile	Diet	Dietary	5 D	8 D	Mortality	LC50	7187	PPM	4,766 [14,393]	ppm [mg/kg bw]	Uniroyal Chemical Inc.	02054608	1976[3,4]	L. Turner	1977	Yes
2,4-D Butoxyethanol Ester	70	Aquatic Plant	Marine algae	Isochrysis galbana	Not reported	Static	Water	240hr	240hr	Growth	EC50	75	PPM	52	PPM	EPA Research Labs, at Beltsville, MD ,Gulfbreeze, FL, or Duluth, MN.	02049116	1986[3,4]	F.L. Mayer	1986	No
2,4-D Butoxyethanol Ester	70	Aquatic Plant	Marine diatom	Phaeodactylum tricornutum	Not reported	Static	Water	240hr	240hr	Growth	EC50	150	PPM	103	PPM	EPA Research Labs, at Beltsville, MD ,Gulfbreeze, FL, or Duluth, MN.	02049116	1986[3,4]	F.L. Mayer	1986	No
2,4-D Butoxyethanol Ester	70	Aquatic Plant	Green algae	Dunaliella tertiolecta	Not reported	Static	Water	240hr	240hr	Growth	EC50	75	PPM	52	PPM	EPA Research Labs, at Beltsville, MD ,Gulfbreeze, FL, or Duluth, MN.	02049116	1986[3,4]	F.L. Mayer	1986	Supplemental
2,4-D Butoxyethanol Ester	70	Aquatic Plant	Green algae	Chlorococcum sp.	Not reported	Static	Water	240hr	240hr	Growth	EC50	75	PPM	52	PPM	EPA Research Labs, at Beltsville, MD ,Gulfbreeze, FL, or Duluth, MN.	02049116	1986[3,4]	F.L. Mayer	1986	Supplemental
2,4-D Butoxyethanol Ester	62.5	Aquatic invertebrate	Water flea	*Daphnia magna*	1st-I	Static	Water	48 hr	48 hr		EC50	6.4	PPM	4.4	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Butoxyethanol Ester	60.8	Aquatic invertebrate	Water flea	*Daphnia magna*	1st-I	Static	Water	48 hr	48 hr		EC50	1.7	PPM	1.2	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Butoxyethanol Ester	29 G	Aquatic invertebrate	Water flea	*Daphnia magna*	1st-I	Static	Water	48 hr	48 hr		EC50	4.3	PPM	3.0	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Butoxyethanol Ester	62.5	Aquatic invertebrate	Seed shrimp	*Cypridopsis vidua*	Juvenile	Static	Water	48 hr	48 hr	Mortality	LC50	2.2	PPM	1.51	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	No
2,4-D Butoxyethanol Ester	62.5	Aquatic invertebrate	Sowbug	*Asellus brevicaudus*	Juvenile	Static	Water	96 hr	96 hr	Mortality	LC50	2.6	PPM	1.8	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Butoxyethanol Ester	62.5	Aquatic invertebrate	Scud	*Gammarus fasciatus*	Juvenile	Static	Water	96 hr	96 hr	Mortality	LC50	0.44	PPM	0.30	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Butoxyethanol Ester	62.5	Aquatic invertebrate	Glass shrimp	*Palaemonetes kadiakensis*	Juvenile	Static	Water	96 hr	96 hr	Mortality	LC50	< 1.0	PPM	< 0.69	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	No
2,4-D Butoxyethanol Ester	60.8	Aquatic invertebrate	Midge	*Chironomus plumosus*	3rd instar	Static	Water	48 hr	48 hr	Mortality	LC50	0.79	PPM	0.54	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Butoxyethanol Ester	29GR	Aquatic invertebrate	Midge	*Chironomus plumosus*	3rd instar	Static	Water	48 hr	48 hr	Mortality	LC50	0.39	PPM	0.27	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Butoxyethanol Ester	70	Aquatic invertebrate	Brown shrimp	*Penaeus aztecus*	Juvenile	Static	Water	48 hr	48 hr	Mortality	LC50	5.6	PPM	3.85	PPM	EPA Research Labs, at Beltsville, MD ,Gulfbreeze, FL, or Duluth, MN.	02049116	1986[3,4]	F.L. Mayer	1986	No
2,4-D Butoxyethanol Ester	70	Mollusca	Eastern oyster	*Crassostrea virginica*	SPAT	Flow-through	Water	96 hr	96 hr		EC50	2.6	PPM	1.79	PPM	EPA Research Labs, at Beltsville, MD ,Gulfbreeze, FL, or Duluth, MN.	02049116	1986[3,4]	F.L. Mayer	1986	No

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2,4-D Butoxyethanol Ester	70	Fish	Longnose killifish	*Fundulus similis*	Juvenile	Static	Water	48 hr	48 hr	Mortality	LC50	5.0	PPM	3.44	PPM	EPA Research Labs, at Beltsville, MD ,Gulfbreeze, FL, or Duluth, MN.	02049116	1986[3,4]	F.L. Mayer	1986	No
2,4-D Butoxyethanol Ester	69.3	Bird	Bobwhite quail	*Colinus virginianus*	23 D	Diet	Dietary	5 D	8 D	Mortality	LC50	> 5000	PPM	> 3,440 [10,387]	ppm [mg/kg bw]	Fish and Wildlife Service Laboratories, Department of Interior	02032053	1975[3,4]	Hill, E.F. et al	1975	Supplemental
2,4-D Butoxyethanol Ester	69.3	Bird	Japanese quail	*Coturnix japonica*	12 D	Diet	Dietary	5 D	8 D	Mortality	LC50	> 5000	PPM	> 3,440 [1,938]	ppm [mg/kg bw]	Fish and Wildlife Service Laboratories, Department of Interior	02032053	1975[3,4]	Hill, E.F. et al	1975	Supplemental
2,4-D Butoxyethanol Ester	69.3	Bird	Mallard duck	*Anas platyrhynchos*	23 D	Diet	Dietary	5 D	8 D	Mortality	LC50	> 5000	PPM	> 3,440 [1,720]	ppm [mg/kg bw]	Fish and Wildlife Service Laboratories, Department of Interior	02032053	1975[3,4]	Hill, E.F. et al	1975	Supplemental
2,4-D Propylene Glycol B.E. Ester	100	Aquatic invertebrate	Brown shrimp	*Penaeus aztecus*	Adult	Flow-through	Water	48 hr	48 hr	Mortality	LC50	0.55	PPM	0.378	PPM	EPA Research Labs, at Beltsville, MD ,Gulfbreeze, FL, or Duluth, MN.	02049116	1986[3,4]	F.L. Mayer	1986	No
2,4-D Propylene Glycol B.E. Ester	100	Aquatic invertebrate	Blue crab	*Callinectes sapidus*	Juvenile	Static	Water	48 hr	48 hr	Mortality	LC50	2.8	PPM	1.927	PPM	EPA Research Labs, at Beltsville, MD ,Gulfbreeze, FL, or Duluth, MN.	02049116	1986[3,4]	F.L. Mayer	1986	No
2,4-D Propylene Glycol B.E. Ester	100	Mollusca	Eastern oyster	*Crassostrea virginica*	Adult	Flow-through	Water	96 hr	96 hr		EC50	0.055	PPM	0.038	PPM	EPA Research Labs, at Beltsville, MD ,Gulfbreeze, FL, or Duluth, MN.	02049116	1986[3,4]	F.L. Mayer	1986	No
2,4-D Propylene Glycol B.E. Ester	100	Aquatic invertebrate	Water flea	*Simocephalus serrulatus*	1st-I	Static	Water	48 hr	48 hr		EC50	4.9	PPM	3	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02079104	1980[3,4]	Johnson & Finley	1980	Yes
2,4-D Propylene Glycol B.E. Ester	100	Aquatic invertebrate	Water flea	*Daphnia magna*	1st-I	Static	Water	48 hr	48 hr		EC50	1.2	PPM	0.8	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02079104	1980[3,4]	Johnson & Finley	1980	Yes
2,4-D Propylene Glycol B.E. Ester	100	Aquatic invertebrate	Seed shrimp	*Cypridopsis vidua*	Juvenile	Static	Water	48 hr	48 hr	Mortality	LC50	0.40	PPM	0.275	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02079104	1980[3,4]	Johnson & Finley	1980	No
2,4-D Propylene Glycol B.E. Ester	100	Aquatic invertebrate	Sowbug	*Asellus brevicaudus*	Juvenile	Static	Water	96 hr	96 hr	Mortality	LC50	2.85	PPM	2.0	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Propylene Glycol B.E. Ester	100	Aquatic invertebrate	Scud	*Gammarus fasciatus*	Juvenile	Static	Water	96 hr	96 hr	Mortality	LC50	1.6	PPM	1.1	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Propylene Glycol B.E. Ester	100	Aquatic invertebrate	Glass shrimp	*Palaemonetes kadiakensis*	Juvenile	Static	Water	96 hr	96 hr	Mortality	LC50	0.36	PPM	0.248	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	No
2,4-D Propylene Glycol B.E. Ester	100	Aquatic invertebrate	Stonefly	*Pteronarcella badia*	yr	Static	Water	96 hr	96 hr	Mortality	LC50	2.4	PPM	1.7	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Propylene Glycol B.E. Ester	100	Aquatic invertebrate	Stonefly	*Pteronarcys californica*	yr	Static	Water	96 hr	96 hr	Mortality	LC50	1.8	PPM	1.2	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Propylene Glycol B.E. Ester	100	Fish	Longnose killifish	*Fundulus similis*	Adult	Static	Water	48 hr	48 hr	Mortality	LC50	4.5	PPM	3.096	PPM	EPA Research Labs, at Beltsville, MD ,Gulfbreeze, FL, or Duluth, MN.	02049116	1986[3,4]	F.L. Mayer	1986	No
2,4-D Propylene Glycol B.E. Ester	100	Fish	Spot	*Leiostomus xanthurus*	Adult	Static	Water	48 hr	48 hr	Mortality	LC50	1.5	PPM	1.032	PPM	EPA Research Labs, at Beltsville, MD ,Gulfbreeze, FL, or Duluth, MN.	02049116	1986[3,4]	F.L. Mayer	1986	No
2,4-D Propylene Glycol B.E. Ester	100	Fish	Cutthroat trout	*Oncorhynchus clarki*	0.5 g	Static	Water	96 hr	96 hr	Mortality	LC50	0.49	PPM	0.337	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Propylene Glycol B.E. Ester	100	Fish	Cutthroat trout	*Oncorhynchus clarki*	4.2 g	Flow-through	Water	96 hr	96 hr	Mortality	LC50	0.33	PPM	0.227	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Propylene Glycol B.E. Ester	100	Fish	Rainbow trout	*Oncorhynchus mykiss*	1.5 g	Static	Water	96 hr	96 hr	Mortality	LC50	0.95	PPM	0.654	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Propylene Glycol B.E. Ester	100	Fish	Bluegill sunfish	*Lepomis macrochirus*	1.0 g	Static	Water	96 hr	96 hr	Mortality	LC50	0.56	PPM	0.385	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Propylene Glycol B.E. Ester	100	Fish	Lake trout	*Salvelinus namaycush*	0.3 g	Static	Water	96 hr	96 hr	Mortality	LC50	0.63	PPM	0.433	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	Supplemental

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2,4-D Propylene Glycol B.E. Ester	100	Fish	Lake trout	*Salvelinus namaycush*	1.5 g	Flow-through	Water	96 hr	96 hr	Mortality	LC50	0.39	PPM	0.268	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Butyl Ester	98.4	Aquatic invertebrate	Stonefly	*Pteronarcella badia*	yr	Static	Water	96 hr	96 hr	Mortality	LC50	1.5	PPM	1.0	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02040355	1980[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Butyl Ester	98.4	Aquatic invertebrate	Stonefly	*Pteronarcys californica*	yr	Static	Water	96 hr	96 hr	Mortality	LC50	1.3	PPM	0.9	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02040355	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Butyl Ester	98.4	Fish	Cutthroat trout	*Oncorhynchus clarki*	0.5 g	Static	Water	96 hr	96 hr	Mortality	LC50	0.49	PPM	0.34	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02040355	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Butyl Ester	98.5	Fish	Cutthroat trout	*Oncorhynchus clarki*	4.2 g	Flow-through	Water	96 hr	96 hr	Mortality	LC50	0.55	PPM	0.38	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Butyl Ester	98.4	Fish	Lake trout	*Salvelinus namaycush*	0.4 g	Static	Water	96 hr	96 hr	Mortality	LC50	0.6	PPM	0.41	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02040355	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Butyl Ester	98.4	Fish	Lake trout	*Salvelinus namaycush*	1.5 g	Flow-through	Water	96 hr	96 hr	Mortality	LC50	0.5	PPM	0.34	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02040355	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Dimethylamine salt	49.6	Aquatic invertebrate	Water flea	*Daphnia magna*	Erly-1	Static	Water	48 hr	48 hr		EC50	4.0	PPM	3.3	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Dimethylamine salt	49.6	Aquatic invertebrate	Seed shrimp	*Cypridopsis vidua*	E-Inst	Static	Water	48 hr	48 hr	Mortality	LC50	8.0	PPM	6.643	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	No
2,4-D Dimethylamine salt	49.6	Aquatic invertebrate	Scud	*Gammarus fasciatus*	Juvenile	Static	Water	96 hr	96 hr	Mortality	LC50	> 100	PPM	> 83	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Dimethylamine salt	49.6	Aquatic invertebrate	Midge	*Chironomus plumosus*	3rd instar	Static	Water	48 hr	48 hr	Mortality	LC50	> 100	PPM	> 83	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Dimethylamine salt	49.6	Aquatic invertebrate	Glass shrimp	*Palaemonetes kadiakensis*	Not reported	Static	Water	48 hr	48 hr	Mortality	LC50	0.15	PPM	0.125	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02079104	1980[3,4]	Johnson & Finley	1980	No
2,4-D Dimethylamine salt	49.6	Fish	Chinook salmon	*Oncorhynchus tshawytscha*	1.0 g	Static	Water	96 hr	96 hr	Mortality	LC50	> 100	PPM	> 83.042	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Dimethylamine salt	49.6	Fish	Rainbow trout	*Oncorhynchus mykiss*	1.4 g	Static	Water	96 hr	96 hr	Mortality	LC50	> 100	PPM	> 83.042	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Dimethylamine salt	49.6	Fish	Fathead minnow	*Pimephales promelas*	0.8 g	Static	Water	96 hr	96 hr	Mortality	LC50	266	PPM	220.892	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Dimethylamine salt	49.6	Fish	Channel catfish	*Ictalurus punctatus*	0.4 g	Static	Water	96 hr	96 hr	Mortality	LC50	119	PPM	98.820	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Dimethylamine salt	49.6	Fish	Bluegill sunfish	*Lepomis macrochirus*	1.1 g	Static	Water	96 hr	96 hr	Mortality	LC50	168	PPM	139.511	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Dimethylamine salt	49.6	Fish	Smallmouth bass	*Micropterus dolomieui*	0.4 g	Static	Water	96 hr	96 hr	Mortality	LC50	236	PPM	195.979	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02079104	1980[3,4]	Johnson & Finley	1980	Yes
2,4-D Dimethylamine salt	49.6	Bird	Bobwhite quail	*Colinus virginianus*	23 D	Diet	Dietary	5 D	8 D	Mortality	LC50	> 5000	PPM	> 4,152 [12,537]	ppm [mg/kg bw]	Fish and Wildlife Service Laboratories, Department of Interior	02040321	1975[3,4]	Hill, E.F. et al	1975	Supplemental
2,4-D Dimethylamine salt	49.6	Bird	Japanese quail	*Coturnix japonica*	20 D	Diet	Dietary	5 D	8 D	Mortality	LC50	> 5000	PPM	> 4,152 [2,339]	ppm [mg/kg bw]	Fish and Wildlife Service Laboratories, Department of Interior	02040321	1975[3,4]	Hill, E.F. et al	1975	Supplemental
2,4-DP 2-Butoxyethyl Ester	59.1	Bird	Mallard duck	*Anas platyrhynchos*	Not reported	Oral (gavage or capsule)	Oral	NR	NR		NOEL	4650	mg/kg bw/d	3,199	mg/kg bw/d	Wildlife International Inc., MD	N.R.	1976[3,4]	G. Gavin	1977	Yes
2,4-D Dimethylamine salt	49.6	Bird	Mallard duck	*Anas platyrhynchos*	17 D	Diet	Dietary	5 D	8 D	Mortality	LC50	> 5000	PPM	> 4,152 [2,075]	ppm [mg/kg bw]	Fish and Wildlife Service Laboratories, Department of Interior	02040321	1975[3,4]	Hill, E.F. et al	1975	Supplemental

Formulation	% purity	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint		Toxicity Value (tested product)[1]	Units		Toxicity Value (a.e.) [1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4-D Dimethylamine salt	49.6	Aquatic invertebrate	Sowbug	*Asellus brevicaudus*	Not reported	Static	Water	48 hr	48 hr	Mortality	LC50	>	100	PPM	>	83	PPM	References	02040288	1970[3,4]	Ann Rozencranz	1979	Supplemental
2,4-D Dimethylamine salt	49.6	Aquatic invertebrate	Glass shrimp	*Palaemonetes kadiakensis*	Not reported	Static	Water	48 hr	48 hr	Mortality	LC50	>	100	PPM	>	83.042	PPM	References	02040288	1970[3,4]	Ann Rozenkranz	1979	No
2,4-D Butoxyethanol Ester	62.5	Fish	Fathead minnow	*Pimephales promelas*	0.9 g	Static	Water	96 hr	96 hr	Mortality	LC50		3.25	PPM		2.24	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1980[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Butoxyethanol Ester	62.5	Fish	Bluegill sunfish	*Lepomis macrochirus*	1.4 g	Static	Water	96 hr	96 hr	Mortality	LC50		1.2	PPM		0.83	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1980[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Butoxyethanol Ester	60.8	Fish	Bluegill sunfish	*Lepomis macrochirus*	0.6 g	Static	Water	96 hr	96 hr	Mortality	LC50		0.76	PPM		0.52	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1980[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Butoxyethanol Ester	29 G	Fish	Bluegill sunfish	*Lepomis macrochirus*	0.6 g	Static	Water	96 hr	96 hr	Mortality	LC50		0.76	PPM		0.52	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1980[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-DB Acid	100	Aquatic invertebrate	Stonefly	*Pteronarcys sp.*	Juvenile	Static	Water	96 hr	96 hr	Mortality	LC50		15	PPM		13	PPM	Fish and Wildlife Service Laboratories, Department of Interior	40094602	1980[3,4]	Johnson & Finley	1988	Yes
2,4-DB Acid	**Tech**	**Insect**	**Honey bee**	***Apis mellifera***	**Worker**	**Contact**	**Direct contact**	**48 hr**	**48 hr**	**Mortality**	**LD50**		**14.5**	**ug/bee**		**13**	**ug/bee**	**University of California, Riverside**	**NR**	**1969[3,4]**	**A. Vaughan**	**1981**	**Yes**
2,4-DB Acid	100	Fish	Bluegill sunfish	*Lepomis macrochirus*	1.4 g	Static	Water	96 hr	96 hr	Mortality	LC50		7.5	PPM		6.7	PPM	Fish and Wildlife Service Laboratories, Department of Interior	40094602	1980[3,4]	Johnson & Finley	1988	Yes
2,4-DB Acid	100	Fish	Rainbow trout	*Oncorhynchus mykiss*	0.8 g	Static	Water	96 hr	96 hr	Mortality	LC50		2.0	PPM		1.8	PPM	Fish and Wildlife Service Laboratories, Department of Interior	40094602	1980[3,4]	Johnson & Finley	1988	Yes
2,4-DB Acid	100	Fish	Fathead minnow	*Pimephales promelas*	0.5 g	Static	Water	96 hr	96 hr	Mortality	LC50		18	PPM		16	PPM	Fish and Wildlife Service Laboratories, Department of Interior	40094602	1980[3,4]	Johnson & Finley	1988	Yes
2,4-DB Acid	97	Fish	Bluegill sunfish	*Lepomis macrochirus*	0.61 g	Static	Water	96 hr	96 hr	Mortality	LC50		16.8	PPM		15	PPM	Agricultural Research Center, USDA, Beltsville, MD.	TN 0938, 40762606	1976[3,4]	R. Pilsucki	1988	Yes
2,4-DB Acid	97	Fish	Rainbow trout	*Oncorhynchus mykiss*	0.26 g	Static	Water	96 hr	96 hr	Mortality	LC50		14.3	PPM		13	PPM	Agricultural Research Center, USDA, Beltsville, MD.	TN 0928, 40762601	1976[3,4]	R. Pilsucki	1988	Yes
2,4-DB Acid	98	Bird	Bobwhite quail	*Colinus virginianus*	14 D	Diet	Dietary	5 D	8 D	Mortality	LC50	>	5000	PPM	>	4,436 [13,394]	ppm [mg/kg bw]	Fish and Wildlife Service Laboratories, Department of Interior	00022923	1975[3,4]	Hill, E.F. et al	1988	Yes
2,4-DP 2-Butoxyethyl Ester	59.1	Bird	Mallard duck	*Anas platyrhynchos*	Not reported	Diet	Dietary	5 D	8 D		NOEL		10000	PPM		6,880 [688]	ppm [mg/kg bw/d]	Wildlife International Inc., MD	N.R.	1976[3,4]	C. Laird	1988	Yes
2,4-D Butyl Ester	Tech	Bird	Mallard duck	*Anas platyrhynchos*	Not reported	Diet	Dietary	5 D	8 D		NOEL	<	10000	PPM	<	6,880 [688]	ppm [mg/kg bw/d]	Wildlife International Inc., MD	43768001	1976[3,4]	T. O'Brien	1978	Yes
2,4-DB Acid	100	Bird	Peking duck	*Anas domestica*	Not reported	Diet	Dietary	5 D	8 D	Mortality	LC50	>	1000	PPM	>	887	PPM	Hazelton Laboratory Inc. VA	00092162	1969[3,4]	R. Pilsucki	1988	Supplemental
2,4-DB DMA	26	Aquatic Plant	Green algae	Selenastrum capricornutum	Not reported	Static	Water	120hr	120hr	Growth	LOEL		1.1	PPM		0.913	PPM	Springborn Laboratory Inc., MA	02080565	1990[3,4]	R. Lamb	1991	Yes
2,4-DB DMA	26	Fish	Rainbow trout	*Oncorhynchus mykiss*	0.59g	Flow-through	Water	96 hr	96 hr	Mortality	LC50		3.7	PPM		3.073	PPM	Springborn Laboratory Inc., MA	41370104	1989[3,4]	G. Susanke	1990	Yes
2,4-D Acid	96.7	Terrestrial Plant	Radish	*Raphanus sativus*	Seedling	Seedling emergence	Soil treatment	14 D	14 D	Germination	EC25		0.14	lbs ai/acre		0.14	lbs ae/acre	Ricera Inc. Ohio	02031728	1992[3,4]	K. Valente	1992	Yes
2,4-D Acid	>99	Mammal	Mule deer	*Odocoileus hemionus*	8-11MO	Oral (gavage or capsule)	Oral	14 D	14 D	Mortality	LD50		400-800	mg/kg bw		400-800	mg/kg bw	Fish and Wildlife Service Laboratories, Department of Interior	02049115	1984[3,4]	Hudson, R.H. et al	1984	Supplemental
2,4-D Butoxyethanol Ester-Aqua Kleen 20	29	Fish	Bluegill sunfish	*Lepomis macrochirus*	1.52 g	Static	Water	96 hr	96 hr	Mortality	LC50	>	50	PPM	>	34	PPM	Agricultural Research Center, USDA, Beltsville, MD.	02041618	1969[3,4]	C. Lewis	1987	Supplemental

Formulation	% purity	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint	Toxicity Value (tested product)[1]	Units	Toxicity Value (a.e.)[1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4-D Butoxyethanol Ester	60.8	Fish	Channel catfish	*Ictalurus punctatus*	0.4 g	Static	Water	96 hr	96 hr	Mortality	LC50	0.78	PPM	0.54	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Butoxyethanol Ester	29 G	Fish	Channel catfish	*Ictalurus punctatus*	0.4 g	Static	Water	96 hr	96 hr	Mortality	LC50	1350	PPM	929	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Butoxyethanol Ester	62.5	Amphibian	Fowler's toad	*Bufo woodhousei*	Tadpole	Static	Water	96 hr	96 hr	Mortality	LC50	> 10	PPM	> 6.88	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02049421	1986[3,4]	Mayer & Ellersieck	1986	Supplemental
2,4-D Butoxyethanol Ester	Tech	Aquatic invertebrate	Scud	*Gammarus lacustris*	Not reported	Static	Water	48 hr	48 hr	Mortality	LC50	0.76	PPM	0.52	PPM	Fish and Wildlife Service Laboratories, Department of Interior	02041624	1969[3,4]	EEB Review	1980	Supplemental
2,4-D Isooctyl Ester	95	Fish	Bluegill sunfish	*Lepomis macrochirus*	1.1 g	Static	Water	96 hr	96 hr	Mortality	LC50	> 180	PPM	> 119.4	PPM	Agricultural Research Center, USDA, Beltsville, MD.	TN	1975[3,4]	J. McCann	1994	Supplemental
2,4-D Isooctyl Ester	95	Fish	Rainbow trout	*Oncorhynchus mykiss*	0.49 g	Static	Water	96 hr	96 hr	Mortality	LC50	< 180	PPM	< 119.4	PPM	Agricultural Research Center, USDA, Beltsville, MD.	TN	1975[3,4]	J. McCann	1994	Supplemental
2,4-D Isooctyl Ester	95	Aquatic invertebrate	Water flea	*Daphnia magna*	<24 hr	Static	Water	48 hr	48 hr		EC50	54	PPB	35.8 [0.04]	ppb [ppm]	Agricultural Research Center, USDA, Beltsville, MD.		1976[3,4]	J. McCann	1994	Yes
2,4-D Isooctyl Ester	1	Fish	Bluegill sunfish	*Lepomis macrochirus*	2.1 g	Static	Water	96 hr	96 hr	Mortality	LC50	> 180	PPM	> 119.4	PPM	Agricultural Research Center, USDA, Beltsville, MD.	TN	1975[3,4]	J. McCann	1975	Supplemental
2,4-D Isooctyl Ester	1	Fish	Rainbow trout	*Oncorhynchus mykiss*	0.33 g	Static	Water	96 hr	96 hr	Mortality	LC50	> 180	PPM	> 119.4	PPM	Agricultural Research Center, USDA, Beltsville, MD.	TN	1975[3,4]	J. McCann	1975	Supplemental
2,4-D Isopropylamine salt	48.7	Fish	Fathead minnow	*Pimephales promelas*	0.47 g	Static	Water	96 hr	96 hr	Mortality	LC50	2180	PPM	1720	PPM	References	02058860	1983[3,4]	H. Mansfield	1991	Supplemental
2,4-D Butyl Ester	Tech	Bird	Bobwhite quail	*Colinus virginianus*	Not reported	Diet	Dietary	5 D	8 D	Mortality	LC50	12979	PPM	8,930 [26,964]	ppm [mg/kg bw]	Union Carbide Environmental Services	02040348	1976[3,4]	T. O'Brien	1978	Yes
2,4-D Ethylhexyl Ester/2,4,5-T mixture	15/7	Fish	Rainbow trout	*Oncorhynchus mykiss*	0.8 g	Static	Water	96 hr	96 hr	Mortality	LC50	7.8	PPM	5.2	PPM	Agricultural Research Center, USDA, Beltsville, MD.	TN 851	1975[3,4]	J. McCann	1975	Supplemental
2,4-D Isopropyl Ester	98.2	Aquatic Plant	Green algae	Selenastrum capricornutum	Not reported	Static	Water	5 D	5 D	Growth	EC50	> 0.13	PPM	> 0.11	PPM	Carolina Ecotox Inc., Durham, NC	02059454	1995[3,4]	N. Cook	1996	Yes
2,4-DP 2-Butoxyethyl Ester (Weedone formula)	63.7	Fish	Rainbow trout	*Oncorhynchus mykiss*	0.35 g	Static	Water	96 hr	96 hr	Mortality	LC50	1.49	PPM	1.025	PPM	Union Carbide Environmental Services	02036940	1980[3,4]	C. Natella	1981	Yes
2,4-D propylene glycol butyl ether ester	100	Aquatic invertebrate	Water flea	*Daphnia magna*	<24 hr	Static	Water	48 hr	48 hr		EC50	15.2	PPM	10	PPM	Dow Chemical Corporation Laboratories	02040391	1977[3,4]	C. Lewis	1988	Supplemental
2,4-D 2-EHE/2,4,5T IOE/Dicamba (Banvel 310)	45	Bird	Mallard duck	*Anas platyrhynchos*	14 D	Diet	Dietary	5 D	8 D	Mortality	LC50	> 4640	PPM	> 3,077 [1,540]	ppm [mg/kg bw]	Hazelton Laboratory Inc. VA	02054604	1973[3,4]	EFED	1979	Supplemental
2,4-D Diethanolamine salt	73.8	Terrestrial Plant	Mustard	*Brassica nigra*	Seedling	Seedling emergence	Soil treatment	NR	NR	Germination	EC25	0.005	lbs ai/acre	0.003	lbs ae/acre	Ricera Inc. Ohio	42609101	1992[3,4]	W. Evans	2004	Supplemental
2,4-D isooctyl ester	38.6	Fish	Rainbow trout	*Oncorhynchus mykiss*	1.173	Static	Water	96 Hr	96 Hr	Mortality	LC50	38.0	PPM	25.2	PPM	Agricultural Research Center, USDA, Beltsville, MD.	TN 190	1969[3,4]	J. McCann	2004	Yes
2,4-D isooctyl ester	68.7	Fish	Rainbow trout	*Oncorhynchus mykiss*	1.173	Static	Water	96 Hr	96 Hr	Mortality	LC50	36.5	PPM	24.2	PPM	Agricultural Research Center, USDA, Beltsville, MD.	TN 191	1969[3,4]	J. McCann	2004	Yes
2,4-D Acid/2,4,5-T mixture (Emulsamine)	31.4/29	Fish	Bluegill sunfish	*Lepomis macrochirus*	1.12 g	Static	Water	96 Hr	96 Hr	Mortality	LC50	15.0	PPM	15	ppm	Agricultural Research Center, USDA, Beltsville, MD.	TN 288	1970[3,4]	J. McCann	2004	Yes
2,4-D DEA Salt/Salt of 2,4,5-T mixture	17.5/8	Fish	Bluegill sunfish	*Lepomis macrochirus*	0.75 g	Static	Water	96 hr	96 hr	Mortality	LC50	19.2	PPM	13.0	ppm	Agricultural Research Center, USDA, Beltsville, MD.	TN 135A	1968[3,4]	J. McCann	1968	Supplemental
2,4-D 2-EHE	Tech	Aquatic invertebrate	Water flea	*Daphnia magna*	instar	Static	Water	48 hr	48 hr		EC50	0.5	PPM	0.33	PPM	Agricultural Research Center, USDA, Beltsville, MD.	02054596	1975[3,4]	J.McCann/C. Lewis	1987	Yes

Spreadsheet of Toxicity Data for 2,4-D Ester TRVs

Formulation	% purity	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint	Toxicity Value (tested product)[1]	Units	Toxicity Value (a.e.) [1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4-D 2-EHE/Silvex mixture	15.2	Fish	Rainbow trout	*Oncorhynchus mykiss*	0.79 g	Static	Water	96 hr	96 hr	Mortality	LC50	7.8	PPM	5.2	PPM	Agricultural Research Center, USDA, Beltsville, MD.	02054599	1975[3,4]	J. McCann	1975	Yes
EHE		Fish	Rainbow trout	*Oncorhynchus mykiss*		Acute	Water	96-hr		Mortality	LC50	NR		14.5	mg/L			Buccafusco 1976b			Yes
DMA salt		Aquatic Plant	Blue-green algae	*Anabaena flos-aquae*	Cells	Cell growth	Water	5 d	5 d	Survival and growth	NOAEC	NR		56.32	mg/L			Hughes 1989			No
DMA salt		Aquatic Plant	Freshwater diatom	*Navicula pelliculosa*	Cells	Cell growth	Water	5 d	5 d	Survival and growth	NOAEC	NR		1.41	mg/L		41505903	Hughes 1990a			Yes
DMA salt		Bird	Bobwhite quail	*Colinus virginianus*		Acute	Gavage			Mortality	LD50	NR		415	mg/kg bw			Hoxter et al. 1990			Yes
EHE		Aquatic Plant	Marine diatom	*Skelotonema costatum*	Cells	Cell growth	Water	5 d	5 d	Survival and growth	NOAEC	NR		0.062	mg/L			Hughes 1990b			No
EHE		Aquatic Plant	Green algae	*Selanastrum capricornutum*	Cells	Cell growth	Water	5 d	5 d	Survival and growth	NOAEC	NR		2.5	mg/L		41735206	Hughes 1990c			Yes
2,4-D acid		Terrestrial plant	Tomato	*Solanum lycopersicum*	Seedling	Seedling emergence	Soil treatment			Seedling emergence	NOAEC	NR		> 4.2	lbs ae/acre			Backus 1992a			Yes
2,4-D acid		Terrestrial plant	Onion	*Allium cepa*	Post-emergence	Vegetative vigor	Direct spray			Vegetative vigor	LOAEC	NR		0.0075	lbs ae/acre			Backus 1992b			Yes
2,4-D acid		Terrestrial plant	Corn	*Zea mays*	Post-emergence	Vegetative vigor	Direct spray			Vegetative vigor	NOAEC	NR		2.1	lbs ae/acre			Backus 1992b			Yes
DMA salt		Terrestrial plant	Mustard	*Brassica nigra*	Seedling	Seedling emergence	Soil treatment			Seedling emergence	NOAEC	NR		0.0093	lbs ae/acre			Backus and Crosby 1992			Yes
EHE		Fish	Tidewater silverside	*Menidia beryllina*		Acute	Water	96-hr		Mortality	LC50	NR		0.156	mg/L			Ward and Boeri 1991a			No
EHE		Aquatic invertebrate	Grass shrimp	*Palaemonestes pugio*		Acute	Water	96-hr		Mortality	LC50	NR		0.092	mg/L			Ward and Boeri 1991f			No
EHE		Mollusca	Eastern oyster	*Crassostrea virginica*		Acute	Water	96-hr		Shell deposition	EC50	NR		> 66	mg/L			Ward and Boeri 1991d			No
EHE		Terrestrial plant	Soybean	*Glycine max*	Post-emergence	Vegetative vigor	Direct spray			Vegetative vigor	NOAEC	NR		0.008	lbs ae/acre			Backus et al. 1992 (as cited in USEPA/OPP 2004b)			Yes
2,4-D acid		Fish	Carp	*Family Cyprinidae*		Chronic	Water				NOAEC	NR		19	mg/L			Mayes et al. 1990a; Rehwoldt et al. 1977			Yes
2,4-D acid		Fish	Fathead minnow	*Pimephales promelas*	Larva	Chronic	Water			Larval survival	NOAEC	NR		63.4	mg/L			Mayes et al. 1990a			Yes
EHE		Terrestrial plant	Radish	*Raphanus sativus*	Seedling	Seedling emergence	Soil treatment			Seedling emergence	EC25	NR		0.045	lbs ae/acre			Backus 1995 (as cited in USEPA/OPP 2004b)			Yes
2,4-D acid		Bird	Bobwhite quail	*Colinus virginianus*		Chronic				Incidence of cracked eggs	NOAEC	NR		76	mg/kg/d		45336401	Mitchell et al. 1999			Yes
2,4-D acid		Amphibian	Leopard frog	*Rana pipiens*	Tadpole	Acute	Static	96-hr	96 hr	Mortality	LC50	NR		359	mg/L			Palmer and Krueger 1997d			Yes
2-EHE		**Amphibian**	**Leopard frog**	***Rana pipiens***	**Tadpole**	**Acute**	**Static**	**96-hr**	**96 hr**	**Mortality**	**LC50**	**NR**		**0.505**	**mg/L**			**Palmer and Krueger 1997b**			**Yes**
DMA salt		Mammal	English pointer		1 year	Acute	Capsule, single dose		26 hours	Neurotoxicity	NOAEL	1.3	mg/kg bw/d	1.1	mg/kg bw/d		NR	Beasley et al. 1991			Yes

Formulation	% purity	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint	Toxicity Value (tested product)[1]	Units	Toxicity Value (a.e.)[1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
2,4-D acid	97.5%	Mammal	Rat	Fischer 344 Rat		Acute	Dietary			Developmental toxicity	NOAEL	NR		25	mg/kg/d			Nemec et al. 1983			Yes
2,4-D		Insect	Honey bee	*Genus Apis*		Acute	Contact				NOAEL	NR		1075 [100]	mg/kg bw [ug/bee]			Palmer and Krueger 1997a,e			Yes
2,4-D acid	97.5%	Mammal	Rat	Fischer 344 Rat		Acute	Dietary			Decreased body weight and skeletal abnormality	LOAEL	NR		75	mg/kg/d			Nemec et al. 1983			Yes
2,4-D acid		Mammal	Dog (not specified)	*Canis lupus familiaris*		Chronic	Dietary	52 W	52 W	Decreased body weight and food consumption	LOAEL	NR		3.75	mg/kg/d		43049001	Dalgard 1993d			Yes
2,4-D acid		**Mammal**	**Dog (not specified)**	***Canis lupus familiaris***		**Chronic**	**Dietary**	**52 W**	**52 W**	**Decreased body weight and food consumption**	**NOAEL**	**NR**		**1**	**mg/kg/d**		**43049001**	**Dalgard 1993d**			**Yes**
2,4-D acid		**Mammal**	**Rat**	**Fischer 344 Rat**		**Chronic**	**Oral**	**2 gen**	**2 gen**	**Reproduction**	**NOAEL**	**NR**		**5**	**mg/kg/d**		**43612001, 00259442, 00259446, 00265489**	**Jeffries et al. 1995; USEPA 2004b**			**Yes**
EHE		Terrestrial plant	Tomato	*Solanum lycopersicum*	Seedling	Seedling emergence	Soil treatment			Seedling emergence	NOAEC	NR		> 0.96	lbs ae/acre			Backus 1992a			Yes
EHE		Terrestrial plant	Corn	*Zea mays*	Post-emergence	Vegetative vigor	Direct spray			Vegetative vigor	NOAEC	NR		> 0.96	lbs ae/acre			Backus 1992b			Yes
2,4-D acid		Amphibian	Toad	*Bufo melanosticus*	Tadpole	Acute		96-hr	96 hr	Mortality	LC50	NR		8.05	mg/L			Vardia et al. 1984			Yes
2,4-D acid		Fish	Carp	Family Cyprinidae		Acute	Water	96-hr		Mortality	LC50	NR		96.5	mg/L			Rehwoldt et al. 1977			Yes
DMA salt		Fish	Rainbow trout Bluegill sunfish	*Oncorhynchus mykiss Lepomis macrochirus*		Acute	Water	96-hr		Mortality	LC50	NR		830	mg/L			Vilkas 1997; Vilkas 1978 (as cited in USEPA/OPP 2004b)			Yes
2,4-D acid		Aquatic invertebrate	Water flea	*Daphnia magna*		Acute	Water	48-hr		Mortality	LC50	NR		25	mg/L			Alexander et al. 1983d, 1985			Yes
DMA salt		Aquatic invertebrate	Crayfish	*Procambarus clarkii*		Acute	Water	96-hr		Mortality	LC50	NR		1389	mg/L			Cheah et al. 1980			Yes
2,4-D diethanolamine		Aquatic invertebrate	Water flea	*Daphnia magna*		Chronic	Water				NOAEC	NR		16.05	mg/L			Holmes and Peters 1991			Yes
2,4-D acid		Aquatic invertebrate	Water flea	*Daphnia magna*		Chronic	Water				NOAEC	NR		75.7	mg/L			Ward 1991a			Yes
2,4-D acid		Aquatic plant		*Myriophyllum sibiricum*			Water			Survival and growth	EC25	NR		0.005	mg/L		NR	Roshon 1999			Yes
DMA salt		Aquatic plant	Sago pondweed	*Potamogeton pectinatus*			Water			Survival and growth	NOAEC	NR		2	mg/L		NR	Sprecher et al. 1998			Yes
2,4-D salt	56.7% a.i. free acid	fish	Rainbow trout	*Oncorhynchus mykiss*	post-swim-up	Static acute	water	96-hr	96-hr	mortality	ALC5	334	mg free acid/L	334	mg free acid/L			Fairchild et al 2007			Yes
2,4-D salt	56.7% a.i. free acid	fish	Rainbow trout	*Oncorhynchus mykiss*	post-swim-up	Static acute	water	96-hr	96-hr	mortality	ALC10	417	mg free acid/L	417	mg free acid/L			Fairchild et al 2007			Yes
2,4-D salt	56.7% a.i. free acid	fish	Rainbow trout	*Oncorhynchus mykiss*	post-swim-up	Static acute	water	96-hr	96-hr	mortality	ALC20	530	mg free acid/L	530	mg free acid/L			Fairchild et al 2007			Yes
2,4-D salt	56.7% a.i. free acid	fish	Rainbow trout	*Oncorhynchus mykiss*	post-swim-up	Static acute	water	96-hr	96-hr	mortality	ALC50	707	mg free acid/L	707	mg free acid/L			Fairchild et al 2007			Yes
2,4-D salt	56.7% a.i. free acid	fish	Rainbow trout	*Oncorhynchus mykiss*	post-swim-up	Static acute	water	96-hr	96-hr	mortality	30 d CLC1	56	mg free acid/L	56	mg free acid/L			Fairchild et al 2007			Yes

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2,4-D salt	56.7% a.i. free acid	fish	Bull trout	*Salvelinus confluentus*	post-swim-up	Static acute	water	96-hr	96-hr	mortality	ALC5	265	mg free acid/L	265	mg free acid/L			Fairchild et al 2007			Yes
2,4-D salt	56.7% a.i. free acid	fish	Bull trout	*Salvelinus confluentus*	post-swim-up	Static acute	water	96-hr	96-hr	mortality	ALC10	280	mg free acid/L	280	mg free acid/L			Fairchild et al 2007			Yes
2,4-D salt	56.7% a.i. free acid	fish	Bull trout	*Salvelinus confluentus*	post-swim-up	Static acute	water	96-hr	96-hr	mortality	ALC20	309	mg free acid/L	309	mg free acid/L			Fairchild et al 2007			Yes
2,4-D salt	56.7% a.i. free acid	fish	Bull trout	*Salvelinus confluentus*	post-swim-up	Static acute	water	96-hr	96-hr	mortality	ALC50	398	mg free acid/L	398	mg free acid/L			Fairchild et al 2007			Yes
2,4-D salt	56.7% a.i. free acid	fish	Bull trout	*Salvelinus confluentus*	post-swim-up	Static acute	water	96-hr	96-hr	mortality	30 d CLC1	84	mg free acid/L	84	mg free acid/L			Fairchild et al 2007			Yes
2,4-D acid	46.8% ai as salt, 39.9% ai as free acid	fish	rainbow trout	*Onchorhyncus mykiss*	Juvenile	acute	Flow-through	24 hr	96 hr	mortality	ALC50	1335	mg free acid/L	1335	mg free acid/L			Fairchild et al 2009			Yes
2,4-D acid	46.8% ai as salt, 39.9% ai as free acid	fish	rainbow trout	*Onchorhyncus mykiss*	Juvenile	acute	Flow-through	48 hr	96 hr	mortality	ALC50	628	mg free acid/L	628	mg free acid/L			Fairchild et al 2009			Yes
2,4-D acid	46.8% ai as salt, 39.9% ai as free acid	fish	rainbow trout	*Onchorhyncus mykiss*	Juvenile	acute	Flow-through	72 hr	96 hr	mortality	ALC50	499	mg free acid/L	499	mg free acid/L			Fairchild et al 2009			Yes
2,4-D acid	46.8% ai as salt, 39.9% ai as free acid	fish	rainbow trout	*Onchorhyncus mykiss*	Juvenile	acute	Flow-through	96 hr	96 hr	mortality	ALC50	494	mg free acid/L	494	mg free acid/L			Fairchild et al 2009			Yes
2,4-D acid	46.8% ai as salt, 39.9% ai as free acid	fish	rainbow trout	*Onchorhyncus mykiss*	Juvenile	chronic	Flow-through	30 d	30 d	growth	NOEC	108	mg free acid/L	108	mg free acid/L			Fairchild et al 2009			Yes
2,4-D acid	46.8% ai as salt, 39.9% ai as free acid	fish	rainbow trout	*Onchorhyncus mykiss*	swim-up fry	chronic	Flow-through	30 d	30 d	growth	NOEC	54	mg free acid/L	54	mg free acid/L			Fairchild et al 2009			Yes
2,4-D acid	46.8% ai as salt, 39.9% ai as free acid	fish	rainbow trout	*Onchorhyncus mykiss*	swim-up fry	chronic	Flow-through	30 d	30 d	growth	LOEC	108	mg free acid/L	108	mg free acid/L			Fairchild et al 2009			Yes
2,4-D acid	46.8% ai as salt, 39.9% ai as free acid	fish	rainbow trout	*Onchorhyncus mykiss*	swim-up fry	chronic	Flow-through	30 d	30 d	growth	MATC	76	mg free acid/L	76	mg free acid/L			Fairchild et al 2009			Yes
2,4-D acid	46.8% ai as salt, 39.9% ai as free acid	fish	rainbow trout	*Onchorhyncus mykiss*	swim-up fry	acute	Flow-through	96 hr	96 hr	mortality	30 d CLC1	260	mg free acid/L	260	mg free acid/L			Fairchild et al 2009			Yes
2,4-D acid	46.8% ai as salt, 39.9% ai as free acid	fish	rainbow trout	*Onchorhyncus mykiss*	swim-up fry	acute	Flow-through	96 hr	96 hr	mortality	30 d CLC10	343	mg free acid/L	343	mg free acid/L			Fairchild et al 2009			Yes
2,4-D acid		aquatic invertebrate	crayfish	*Astacus leptodactylus*		acute	water	96 hr	96 hr	mortality	LC50	32.6	mg/L	32.6	mg/L			Benli et al 2007			Yes
2,4-D acid		Aquatic plant		*Lemna triscula*		water	single application	28 d	28 d	growth-biomass	EC50	> 3000	ug/L	> 3000 [3]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Elodea nuttallii (A)*		water	single application	28 d	28 d	growth-biomass	EC50	> 3000	ug/L	> 3000 [3]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Ranunculus circinatus*		water	single application	28 d	28 d	growth-biomass	EC50	2731	ug/L	2731 [2.7]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Ranunculus aquatilis*		water	single application	28 d	28 d	growth-biomass	EC50	> 3000	ug/L	> 3000 [3]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Potamogeton crispus*		water	single application	28 d	28 d	growth-biomass	EC50	> 3000	ug/L	> 3000 [3]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Potamogeton lucens*		water	single application	28 d	28 d	growth-biomass	EC50	> 3000	ug/L	> 3000 [3]	ug/L [mg/L]			Belgers et al 2007			Yes

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2,4-D acid		Aquatic plant		*Elodea nuttallii (B)*		water	single application	28 d	28 d	growth-biomass	EC50	2243	ug/L	2243 [2.2]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Lemna triscula*		water	single application	28 d	28 d	relative growth	EC50	> 3000	ug/L	> 3000 [3]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Elodea nuttallii (A)*		water	single application	28 d	28 d	relative growth	EC50	> 3000	ug/L	> 3000 [3]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Ranunculus circinatus*		water	single application	28 d	28 d	relative growth	EC50	719	ug/L	719 [0.7]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Ranunculus aquatilis*		water	single application	28 d	28 d	relative growth	EC50	242	ug/L	242 [.2]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Potamogeton crispus*		water	single application	28 d	28 d	relative growth	EC50	> 3000	ug/L	> 3000 [3]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Potamogeton lucens*		water	single application	28 d	28 d	relative growth	EC50	1300	ug/L	1300 [1.3]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Elodea nuttallii (B)*		water	single application	28 d	28 d	relative growth	EC50	292	ug/L	292 [0.3]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Elodea nuttallii (A)*		water	single application	28 d	28 d	growth-root weight	EC50	898	ug/L	898 [0.9]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Ranunculus circinatus*		water	single application	28 d	28 d	growth-root weight	EC50	111	ug/L	111 [0.1]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Potamogeton crispus*		water	single application	28 d	28 d	growth-root weight	EC50	347	ug/L	347 [0.3]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Ranunculus peltatus*		water	single application	28 d	28 d	growth-root weight	EC50	245	ug/L	245 [0.2]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Elodea nuttallii (B)*		water	single application	28 d	28 d	growth-root weight	EC50	1096	ug/L	1096 [1.1]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Elodea nuttallii (A)*		water	single application	28 d	28 d	growth-shoot length	EC50	> 3000	ug/L	> 3000 [3]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Ranunculus circinatus*		water	single application	28 d	28 d	growth-shoot length	EC50	1120	ug/L	1120 [1.1]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Ranunculus aquatilis*		water	single application	28 d	28 d	growth-shoot length	EC50	683	ug/L	683 [0.7]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Potamogeton crispus*		water	single application	28 d	28 d	growth-shoot length	EC50	1988	ug/L	1988 [2.0]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Ranunculus peltatus*		water	single application	28 d	28 d	growth-shoot length	EC50	140	ug/L	140 [0.1]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Potamogeton lucens*		water	single application	28 d	28 d	growth-shoot length	EC50	1063	ug/L	1063 [1.1]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Elodea nuttallii (B)*		water	single application	28 d	28 d	growth-shoot length	EC50	785	ug/L	785 [0.8]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Elodea nuttallii (A)*		water	single application	28 d	28 d	growth-root length	EC50	574	ug/L	574 [0.6]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Ranunculus circinatus*		water	single application	28 d	28 d	growth-root length	EC50	100	ug/L	100 [0.1]	ug/L [mg/L]			Belgers et al 2007			Yes

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2,4-D acid		Aquatic plant		*Ranunculus aquatilis*		water	single application	28 d	28 d	growth-root length	EC50	92	ug/L	92 [0.09]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Potamogeton crispus*		water	single application	28 d	28 d	growth-root length	EC50	290	ug/L	290 [0.3]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Ranunculus peltatus*		water	single application	28 d	28 d	growth-root length	EC50	263	ug/L	263 [0.3]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Potamogeton lucens*		water	single application	28 d	28 d	growth-root length	EC50	181	ug/L	181 [0.2]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Elodea nuttallii (B)*		water	single application	28 d	28 d	growth-root length	EC50	997	ug/L	997 [1.0]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Elodea nuttallii (A)*		water	single application	28 d	28 d	growth-# of roots	EC50	982	ug/L	982 [1.0]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Ranunculus circinatus*		water	single application	28 d	28 d	growth-# of roots	EC50	112	ug/L	112 [0.1]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Potamogeton crispus*		water	single application	28 d	28 d	growth-# of roots	EC50	326	ug/L	326 [0.3]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Ranunculus peltatus*		water	single application	28 d	28 d	growth-# of roots	EC50	271	ug/L	271 [0.3]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Potamogeton lucens*		water	single application	28 d	28 d	growth-# of roots	EC50	299	ug/L	299 [0.3]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Elodea nuttallii (B)*		water	single application	28 d	28 d	growth-# of roots	EC50	1807	ug/L	1807 [1.8]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Potamogeton lucens*		water	single application	28 d	28 d	growth-biomass	EC50	> 3000	ug/L	> 3000 [3]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Potamogeton lucens*		water	single application	28 d	28 d	relative growth	EC50	1348	ug/L	1348 [1.3]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Ranunculus circinatus*		water	single application	28 d	28 d	growth-root weight	EC50	51	ug/L	51 [0.05]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Ranunculus aquatilis*		water	single application	28 d	28 d	growth-shoot length	EC50	342	ug/L	342 [0.3]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Ranunculus peltatus*		water	single application	28 d	28 d	growth-shoot length	EC50	76	ug/L	76 [0.08]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Elodea nuttallii (B)*		water	single application	28 d	28 d	growth-shoot length	EC50	1035	ug/L	1035 [1.0]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Elodea nuttallii (A)*		water	single application	28 d	28 d	growth-root length	EC50	334	ug/L	334 [0.3]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Ranunculus aquatilis*		water	single application	28 d	28 d	growth-root length	EC50	108	ug/L	108 [0.1]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Potamogeton crispus*		water	single application	28 d	28 d	growth-root length	EC50	124	ug/L	124 [0.1]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Ranunculus peltatus*		water	single application	28 d	28 d	growth-root length	EC50	499	ug/L	499 [0.5]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Elodea nuttallii (A)*		water	single application	28 d	28 d	growth-# of roots	EC50	1073	ug/L	1073 [1.1]	ug/L [mg/L]			Belgers et al 2007			Yes

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2,4-D acid		Aquatic plant		*Potamogeton crispus*		water	single application	28 d	28 d	growth-# of roots	EC50	191	ug/L	191 [0.2]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Aquatic plant		*Potamogeton lucens*		water	single application	28 d	28 d	growth-# of roots	EC50	302	ug/L	302 [0.3]	ug/L [mg/L]			Belgers et al 2007			Yes
2,4-D acid		Mammal	Rat	*Rattus* spp.		Acute	Oral			Mortality	LD50	639	mg/kg bw	699	mg/kg bw		00101605	Johnson et al. 1981a			Yes
DEA salt		Mammal	Rat	*Rattus* spp.		Acute	Oral			Mortality	LD50	735	mg/kg bw	618.8	mg/kg bw		41920901	Shults et al. 1990			Yes
DMA salt		Mammal	Rat	*Rattus* spp.		Acute	Oral			Mortality	LD50	949	mg/kg bw	788	mg/kg bw		00157512, 00101603	Jeffrey et al. 1986; Johnson et al. 1981b			Yes
IPA salt		Mammal	Rat	*Rattus* spp.		Acute	Oral			Mortality	LD50	1646	mg/kg	1300	mg/kg		00252291	USEPA/OPP 2005b, 2004a			Yes
IPE		Mammal	Rat	*Rattus* spp.		Acute	Oral			Mortality	LD50	1250	mg/kg bw	1050	mg/kg bw		41709901	Lilja 1990a			Yes
TIPA salt		**Mammal**	**Rat**	***Rattus* spp.**		**Acute**	**Oral**			**Mortality**	**LD50**	**1074**	**mg/kg bw**	**579**	**mg/kg bw**		**41413501**	**Berdasco et al. 1989a**			**Yes**
BEE ester		Mammal	Rat	*Rattus* spp.		Acute	Oral			Mortality	LD50	866	mg/kg bw	589	mg/kg bw		40629801	Jeffrey et al. 1987a			Yes
EHE ester		Mammal	Rat	*Rattus* spp.		Acute	Oral			Mortality	LD50	896	mg/kg bw	591	mg/kg bw		41209001	Mahlburg 1988a			Yes
2,4-D acid		Mammal	Rabbit	*Leporidae* spp.		Acute	Dermal			Mortality	LD50	> 2000	mg/kg bw	> 2000	mg/kg bw		00101596	Mayhew et al. 1981			Yes
DEA salt		Mammal	Rabbit	*Leporidae* spp.		Acute	Dermal			Mortality	LD50	> 2000	mg/kg bw	> 1355	mg/kg bw		41920911	Shults et al. 1991			Yes
DMA salt		Mammal	Rabbit	*Leporidae* spp.		Acute	Dermal			Mortality	LD50	> 1829	mg/kg bw	1519	mg/kg bw		00157513	Carreon et al. 1986			Yes
IPA salt		Mammal	Rabbit	*Leporidae* spp.		Acute	Dermal			Mortality	LD50	> 2000	mg/kg	> 1578	mg/kg		00252291	USEPA/OPP 2005b			Yes
IPE		Mammal	Rabbit	*Leporidae* spp.		Acute	Dermal			Mortality	LD50	> 2000	mg/kg bw	> 1680	mg/kg bw		41709902	Lilja 1990b			Yes
TIPA salt		**Mammal**	**Rabbit**	***Leporidae* spp.**		**Acute**	**Dermal**			**Mortality**	**LD50**	**> 2000**	**mg/kg bw**	**> 1072**	**mg/kg bw**		**41413502**	**Berdasco et al. 1989b**			**Yes**
BEE ester		Mammal	Rabbit	*Leporidae* spp.		Acute	Dermal			Mortality	LD50	> 2000	mg/kg bw	> 1376	mg/kg bw		40629802	Jeffrey et al. 1987b			Yes
EHE ester		Mammal	Rabbit	*Leporidae* spp.		Acute	Dermal			Mortality	LD50	> 2000	mg/kg bw	1326	mg/kg bw		41209002	Mahlburg 1988b			Yes
2,4-DP 2-Butoxyethyl, Ester Mix(Alchem 76)	100	Bird	Mallard duck	*Anas platyrhynchos*	14 D	Diet	Dietary	5 D	8 D		NOEL	10000	PPM	6,880 [688]	ppm [mg/kg bw/d]	Truslo Farm Inc.	00102908	1976[3,4]	C. Laird	1989	Yes
DMA salt		Mammal	English pointer		1 year	Acute	Capsule, single dose		26 hours	Neurotoxicity	LOAEL	NR		8.8	mg/kg bw/d		NR	Beasley et al. 1991			Yes
2,4-D acid		Mammal	Rat	*Rattus* spp.		Acute					NOAEL	NR		67	mg/kg bw/d		43115201	Mattsson et al. 1994a			Yes
2,4-D acid		Mammal	Rat	*Rattus* spp.		Acute				Increased incidence of incoordination and slight gait abnormalities and decreased motor activity.	LOAEL	NR		227	mg/kg bw/d		43115201	Mattsson et al. 1994a			Yes

Spreadsheet of Toxicity Data for 2,4-D Ester TRVs

Formulation	% purity	General Taxonomic Group	Common Name	Scientific Name	Age	Test Type	Means of Exposure	Exposure Duration	Test Duration	Biological Endpoint	Statistical Endpoint	Toxicity Value (tested product)[1]	Units	Toxicity Value (a.e.)[1]	Units	Lab	MRID Number	Data Source[2]	EPA Reviewer	Date Reviewed	Used for TRV derivation
TIPA salt		Mammal	Rat	*Rattus* spp.		Acute				Weight gain, mortality	LOAEL	NR		17	mg/kg/d		41527102	Schroeder 1990a			Yes
DEA salt		Mammal	Rabbit	*Leporidae* spp.		Acute				Weight gain, food consumption	NOAEL	NR		10.2	mg/kg/d		42055501	Rodwell 1991b			Yes
IPA salt		Mammal	Rabbit	*Leporidae* spp.		Acute				Maternal weight gain	NOAEL			10	mg/kg/day		42158704	Rowland 1992			Yes
TIPA salt		Mammal	Rabbit	*Leporidae* spp.		Acute				Mortality (developmental)	NOAEL	NR		10	mg/kg/d		42158705	Rowland 1992			Yes
BEE ester		Mammal	Rabbit	*Leporidae* spp.		Acute				Mortality (developmental)	NOAEL	NR		10	mg/kg/d		41527101	Schroeder 1990b			Yes
2-EHE		Mammal	Rat	*Rattus* spp.		Acute				Developmental toxicity	NOAEL	NR		10	mg/kg/d		42304601	Martin 1992d			Yes
2,4-D acid		Mammal	Mouse	*Mus* spp.		Chronic				Kidney effects	LOAEL	NR		62	mg/kg/d		43879801, 43597201	Stot et al. 1995 a,b			Yes
2,4-D acid		Mammal	Mouse	*Mus* spp.		Chronic				Kidney effects	NOAEL	NR		5	mg/kg/d		43879801, 43597201	Stot et al. 1995 a,b			Yes
DMA salt		Mammal	Mouse	*Mus* spp.			Drinking water	Days 6-16 of gestation		Developmental toxicity	NOAEL	NR		8.5	mg/kg/d			Lee et al. 2001			Yes
2,4-D acid		Mammal	Dog (not specified)	*Canis lupus familiaris*		Subchronic	Dietary	90 d			LOAEL	NR		3	mg/kg/d		41737301	Schulze 1990a			Yes
2,4-D acid		Mammal	Dog (not specified)	*Canis lupus familiaris*		Subchronic	Dietary	90 d			NOAEL	NR		1	mg/kg/d		41737301	Schulze 1990a			Yes
2,4-D acid		Mammal	Rabbit	*Leporidae* spp.						Developmental toxicity	NOAEL	NR		30	mg/kg/d		41747601	Hoberman 1990			Yes
2,4-D acid		Mammal	Rabbit	*Leporidae* spp.			Dermal	21-d			NOAEL	NR		1000	mg/kg/d		41735304	Schulze 1990b			Yes

Notes
Boldface indicates study selected for derivation of toxicity reference value (TRV) used in risk assessment.
If the USEPA had reviewed the study and classified the study as "acceptable", the study's findings were considered "acceptable" for development of TRVs. "Supplemental" studies were used to fill in gaps where "Core" studies were unavailable.
[1] Toxicity values relate the dose of a compound with a potentially adverse effect. Values are reported as they were presented in the reviewed source.
[2] See the bibliography of this ERA document, Appendix A of the associated literature review document, and source footnote for complete citations.
[3] As cited in USEPA 2010.
[4] No author listed.
[5] Invalid study. See *'Pesticide Ecological Effects Database Guidance Manual-Updated 10/26/05'* (USEPA 2005).

Abbreviations
a.i. - active ingredient
a.e. - acid equivalent
b.w. - body weight
EPA - Environmental Protection Agency
f - female
g - grams
m - male
MRID - Master Record Identification Number
NR - Not reported
ppb - parts per billion
ppm - parts per million

Endpoints
EC_{25} - 25% effect concentration
EC_{50} - 50% effect concentration
LC_{50} - median lethal concentration, 50% mortality
LD_{50} - median lethal dose, 50% mortality
LOEL - lowest observable effect level
NOEL - no observable effect level
LOEC - lowest observable effect concentration
MATC - maximum acceptable toxicant concentration
NOEC - no observable effect concentration
CLC_1 - 1% chronic lethal concentration
CLC_{10} - 10% chronic lethal concentration
ALC_{10} - 10% acute lethal concentration
ALC_{20} - 20% acute lethal concentration
ALC_5 - 5% acute lethal concentration
ALC_{50} - 50% acute lethal concentration
NOAEC - no observable adverse effect concentration
NOAEL - no observable adverse effect level

Durations
hr - hours
d - days
w - weeks
mo - months
y - years
gen - generations

Chemical forms of 2,4-D that are considered in this risk assessment:
2,4-D Acid
2,4-D Sodium salt
2,4-D Diethanolamine (DEA) salt
2,4-D Dimethylamine (DMA) salt
2,4-D Isopropylamine (IPA) salt
2,4-D Triisopropanolamine (TIPA) salt
2,4-D 2-Butoxyethyl (BEE) ester
2,4-D 2-Ethylhexyl (2-EHE) ester
2,4-D Isopropyl (IPE) ester

Appendix C – Ecological Risk Assessment Worksheets

Table C-1: Direct spray of terrestrial receptors and exposure from indirect contact with foliage

Parameter		Pollinating Insect	Small Mammal	Units
Duration of Exposure (T)		24	24	hours
Body weight (W)		0.000093	0.02	kg
Surface Areas (A): $cm^2 = 12.3 * BW(g)^{0.65}$				
		2.63	86.21	cm^2
Application rates (R)				
	Typical	1	1	mg/cm^2
	Maximum	2	2	
Amount deposited on 1/2 receptor (Amnt): 0.5 × A × R				
	Typical	0.014739168	0.48314207	mg
	Maximum	0.029478335	0.966284139	
Dose Estimate Assuming 100% Dermal Adsorption				
Absorbed Dose: Amnt × Prop ÷ W				
	Typical	1.58E+02	2.42E+01	mg/kg bw
	Maximum	3.17E+02	4.83E+01	
Dose Estimate Assuming First Order Dermal Adsorption				
First-order dermal absorption rates (k)				
	Central estimate (ka)	0.078766725	0.078766725	$hour^{-1}$
Proportion absorbed over period T (Prop): 1-exp(-k T)				
	Typical	0.028389233	0.028389233	unitless
	Maximum	0.028389233	0.028389233	
Absorbed Dose: Amnt × Prop ÷ W				
	Typical	4.50E+00	6.86E-01	mg/kg bw
	Maximum	9.00E+00	1.37E+00	

RISK QUOTIENTS - Direct Spray	Toxicity Reference Value	Typical Application	Maximum Application
Small mammal - 100% absorption	2193	1.10E-02	2.20E-02
Pollinating insect - 100% absorption	140	1.13E+00	2.26E+00
Small mammal - 1st order dermal adsorption	2193	3.13E-04	6.25E-04
Pollinating insect - 1st order dermal adsorption	140	3.21E-02	6.43E-02

RISK QUOTIENTS - Indirect Contact *	Toxicity Reference Value	Typical Application	Maximum Application
Small mammal - 100% absorption	2193	1.10E-03	2.20E-03
Pollinating insect - 100% absorption	140	1.13E-01	2.26E-01
Small mammal - 1st order dermal adsorption	2193	3.13E-05	6.25E-05
Pollinating insect - 1st order dermal adsorption	140	3.21E-03	6.43E-03

Surface area calculation for mammals from Stahl, 1967 (presented in USEPA, 1993).
No surface area calculation identified for insects. Mammalian equation used as a surrogate.
Risk Quotient = Estimated Dose/Toxicity Reference Value
* Exposure from indirect contact assumed to be 1/10 of direct spray exposure

Table C-2: Consumption of contaminated berries by a small mammal - acute exposure scenario

Parameters/Assumptions		Value	Units	Notes
Body Weight (W)		0.02	kg	
Food ingestion rate (dry weight)		0.0033641	kg dw/day	[1]
Food ingestion rate (wet weight, A)		0.014626644	kg ww/day	[2]
Application rates (R)				
	Typical	1	lb/acre	
	Maximum	2		
Residue rate - berries (rr)				
	Typical	1.5	mg/kg per lb/acre	
	Maximum	7		
Concentration on berries (C): R × rr				
	Typical	1.5	mg/kg fruit	
	Maximum	14		
Dose estimates (D): C × A / W				
	Typical	1.10E+00	mg/kg bw	
	Maximum	1.02E+01		

RISK QUOTIENTS - Ingestion	Toxicity Reference Value	Typical Application	Maximum Application
Small mammal - acute exposure	1184	9.27E-04	8.65E-03

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987 for rodents; where

Food Ingestion Rate (g dw/day) = 0.621*(BW g)^0.564; converted into kg dw/day

[2] Assumes fruit is 77% water (USEPA, 1993; Table 4-2 - value for fruit pulp and skin)

Table C-3: Consumption of contaminated fruit by a small mammal - chronic exposure scenario

Parameters/Assumptions	Value	Units	
Duration of exposure (T)	90	days	
Body Weight (W)	0.02	kg	
Food ingestion rate (dry weight)	0.0033641	kg dw/day	[1]
Food ingestion rate (wet weight, A)	0.014626644	kg ww/day	[2]
Half life on vegetation (t50)			
Herbicide specific	8.8	days	
Application rates (R)			
Typical	1	lb/acre	
Maximum	2		
Residue rate - berries (rr)			
Typical	1.5	mg/kg per lb/acre	
Maximum	7		
Drift (Drift)			
Typical	1	unitless	
Maximum	1		
Decay Coefficient (k): ln(2)/t50			
Typical	0.078766725	$days^{-1}$	
Maximum	0.078766725		
Initial concentration on berries (C0): R × rr × Drift			
Typical	1.5	mg/kg fruit	
Maximum	14		
Concentration on berries at time T: C0 * exp(-k*T)			
Typical	0.00125134	mg/kg fruit	
Maximum	0.011679175		
Time-weighted Average Concentration on vegetation (CTWA): C0 * (1-exp(-k*T))/(k*T)			
Typical	0.211418754	mg/kg fruit	
Maximum	1.973241706		
Proportion of Diet Contaminated (Prop)			
Typical	1	unitless	
Maximum	1		
Dose estimates (D): CTWA × A × Prop / W			
Typical	0.154617339	mg/kg bw	
Maximum	1.443095167		

RISK QUOTIENTS - Ingestion	Toxicity Reference Value	Typical Application	Maximum Application
Small mammal - chronic exposure	10	1.55E-02	1.44E-01

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987 for rodents; where

Food Ingestion Rate (g dw/day) = 0.621*(BW g)^0.564; converted into kg dw/day

[2] Assumes fruit is 77% water (USEPA, 1993; Table 4-2 - value for fruit pulp and skin)

Table C-4: Consumption of contaminated grass by a large mammal - acute exposure scenario

Parameters/Assumptions		Value	Units	Notes
Body Weight (W)		70	kg	
Food ingestion rate (dry weight)		1.9211536	kg dw/day	[1]
Food ingestion rate (wet weight, A)		6.40384532	kg ww/day	[2]
Duration of exposure (D)		1	day	
Application rates (R)				
	Typical	1	lb/acre	
	Maximum	2		
Residue rate - grass (rr)				
	Typical	92	mg/kg per lb/acre	
	Maximum	110		
Concentration on grass (C): R × rr				
	Typical	92	mg/kg grass	
	Maximum	220		
Drift (Drift)				
	Typical	1	unitless	
	Maximum	1		
Proportion of Diet Contaminated (Prop)				
	Typical	1	unitless	
	Maximum	1		
Dose estimates: Drift × Prop × C × A ÷W				
	Typical	8.42E+00	mg/kg bw	
	Maximum	2.01E+01		

RISK QUOTIENTS - Ingestion	Toxicity Reference Value	Typical Application	Maximum Application
Large mammal - acute exposure	51	1.65E-01	3.95E-01

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987 for herbivores; where

Food Ingestion Rate (g dw/day) = 0.577*(BW g)^0.727; converted into kg dw/day

[2] Assumes grass is 70% water (USEPA, 1993; Table 4-2 - lowest value for young grasses)

Table C-5: Consumption of contaminated grass by a large mammal - chronic exposure scenario

Parameters/Assumptions	Value	Units	Notes
Duration of exposure (T)	90	day	
Body Weight (W)	70	kg	
Food ingestion rate (dry weight)	1.921153597	kg dw/day	[1]
Food ingestion rate (wet weight, A)	6.403845323	kg ww/day	[2]
Half life on vegetation (t50)			
Herbicide specific	8.8	days	
Application rates (R)			
Typical	1	lb/acre	
Maximum	2		
Residue rate - grass (rr)			
Typical	92	mg/kg per lb/acre	
Maximum	110		
Drift (Drift)			
Typical	1	unitless	
Maximum	1		
Decay Coefficient (k): ln(2)/t50			
Typical	0.078766725	$days^{-1}$	
Maximum	0.078766725		
Initial concentration on grass (C0): R × rr × Drift			
Typical	92	mg/kg grass	
Maximum	220		
Concentration on grass at time T: C0 * exp(-k*T)			
Typical	0.076748865	mg/kg grass	
Maximum	0.183529895		
Time-weighted Average Concentration on vegetation (CTWA): C0 * (1-exp(-k*T))/(k*T)			
Typical	12.96701693	mg/kg vegetation	
Maximum	31.00808395		
Proportion of Diet Contaminated (Prop)			
Typical	1	unitless	
Maximum	1		
Dose estimates: CTWA × A × Prop / W			
Typical	1.19E+00	mg/kg bw	
Maximum	2.84E+00		

RISK QUOTIENTS - Ingestion	Toxicity Reference Value	Typical Application	Maximum Application
Large mammal - chronic exposure	1	1.19E+00	2.84E+00

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987 for herbivores; where

Food Ingestion Rate (g dw/day) = 0.577*(BW g)^0.727; converted into kg dw/day

[2] Assumes grass is 70% water (USEPA, 1993; Table 4-2 - lowest value for young grasses)

Table C-6: Consumption of contaminated small mammals by a large mammal - acute exposure scenario

Parameters/Assumptions		Value	Units	Notes
Body Weight (W)		12	kg	
Food ingestion rate (dry weight)		0.52971677	kg dw/day	[1]
Food ingestion rate (wet weight, A)		1.6553649	kg ww/day	[2]
Duration of exposure (D)		1	day	
Application rates (R)				
	Typical	1	lb/acre	
	Maximum	2		
Amount deposited on small mammal prey (Amnt_mouse): 0.5 × SurfaceArea × R				
	Typical	0.48314207	mg	
	Maximum	0.96628414		
Drift (Drift)				
	Typical	1	unitless	
	Maximum	1		
Proportion of Diet Contaminated (Prop)				
	Typical	1	unitless	
	Maximum	1		
Dose estimates: Drift × Prop × Amnt_mouse/BW_mouse × A ÷W				
	Typical	3.33E+00	mg/kg bw	
	Maximum	6.66E+00		

RISK QUOTIENTS - Ingestion	**Toxicity Reference Value**	**Typical Application**	**Maximum Application**
Large carnivorous mammal - acute exposure	80	4.17E-02	8.33E-02

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987; where

Food Ingestion Rate (g dw/day) = 0.0687*(BW g)^0.822; converted into kg dw/day

[2] Assumes mammals are 68% water (USEPA, 1993)

Table C-7: Consumption of contaminated small mammals by a large mammal - chronic exposure scenario

Parameters/Assumptions	**Value**	**Units**	**Notes**
Duration of exposure (T)	90	day	
Body Weight (W)	12	kg	
Food ingestion rate (dry weight)	0.529716769	kg dw/day	[1]
Food ingestion rate (wet weight, FIR_coyote)	1.655364903	kg ww/day	[2]
Application rates (R)			
Typical	1	lb/acre	
Maximum	2		
Drift (Drift)			
Typical	1	unitless	
Maximum	1		
Decay Coefficient (k): ln(2)/t50			
Typical	0.078766725	$days^{-1}$	
Maximum	0.078766725		
Initial concentration on mammal (C0): 0.5 × SurfaceArea × R/BW_smallmammal			
Typical	24.15710348	mg a.e./kg mammal	
Maximum	48.31420697		
Concentration absorbed in small mammal at time T (C90): C0 * exp(-k*T)			
Typical	0.685801635	mg/kg mammal	
Maximum	1.37160327		
Proportion of Diet Contaminated (Prop)			
Typical	1	unitless	
Maximum	1		
Dose estimates: C90 × FIR_coyote × Prop / W			
Typical	9.46E-02	mg/kg bw	
Maximum	1.89E-01		

RISK QUOTIENTS - Ingestion	**Toxicity Reference Value**	**Typical Application**	**Maximum Application**
Large mammal - chronic exposure	1	9.46E-02	1.89E-01

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987; where

Food Ingestion Rate (g dw/day) = 0.0687*(BW g)^0.822; converted into kg dw/day

[2] Assumes mammals are 68% water (USEPA, 1993)

Table C-8: Consumption of contaminated insects by a small bird - acute exposure scenario

Parameters/Assumptions		Value	Units	Notes
Body Weight (W)		0.08	kg	
Food ingestion rate (dry weight)		0.01124177	kg dw/day	[1]
Food ingestion rate (wet weight, A)		0.03626376	kg ww/day	[2]
Duration of exposure (D)		1	day	
Application rates (R)				
	Typical	1	lb/acre	
	Maximum	2		
Residue rate - insects (rr)				
	Typical	33	mg/kg per lb/acre	
	Maximum	58		
Concentration on insects (C): R × rr				
	Typical	33	mg/kg insect	
	Maximum	116		
Drift (Drift)				
	Typical	1	unitless	
	Maximum	1		
Proportion of Diet Contaminated (Prop)				
	Typical	1	unitless	
	Maximum	1		
Dose estimates: Drift × Prop × C × A ÷W				
	Typical	1.50E+01	mg/kg bw	
	Maximum	5.26E+01		

RISK QUOTIENTS - Ingestion	Toxicity Reference Value	Typical Application	Maximum Application
Small bird - acute exposure	217	6.89E-02	2.42E-01

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987 for all birds; where

Food Ingestion Rate (kg dw/day) = 0.0582*(BW)^0.651

[2] Assumes insects are 69% water (USEPA, 1993; Table 4-1 - value for grasshoppers and crickets)

Table C-9: Consumption of contaminated insects by a small bird - chronic exposure scenario

Parameters/Assumptions		Value	Units	Notes
Duration of exposure (T)		90	day	
Body Weight (W)		0.08	kg	
Food ingestion rate (dry weight)		0.011241767	kg dw/day	[1]
Food ingestion rate (wet weight, A)		0.036263763	kg ww/day	[2]
Half life on insect (t50)				
	Herbicide specific	8.8	days	
Application rates (R)				
	Typical	1	lb/acre	
	Maximum	2		
Residue rate - insects (rr)				
	Typical	33	mg/kg per lb/acre	
	Maximum	58		
Drift (Drift)				
	Typical	1	unitless	
	Maximum	1		
Decay Coefficient (k): ln(2)/t50				
	Typical	0.078766725	$days^{-1}$	
	Maximum	0.078766725		
Initial concentration on insects (C0): R × rr × Drift				
	Typical	33	mg/kg insect	
	Maximum	116		
Concentration on insects at time T: C0 * exp(-k*T)				
	Typical	0.027529484	mg/kg insect	
	Maximum	0.096770308		
Time-weighted Average Concentration on insects (CTWA): C0 * (1-exp(-k*T))/(k*T)				
	Typical	4.651212593	mg/kg insect	
	Maximum	16.34971699		
Proportion of Diet Contaminated (Prop)				
	Typical	1	unitless	
	Maximum	1		
Dose estimates (D): CTWA × A × Prop / W				
	Typical	2.11E+00	mg/kg bw	
	Maximum	7.41E+00		

RISK QUOTIENTS - Ingestion	Toxicity Reference Value	Typical Application	Maximum Application
Small bird - chronic exposure	27	7.81E-02	2.74E-01

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987 for all birds; where

Food Ingestion Rate (kg dw/day) = 0.0582*(BW)^0.651

[2] Assumes insects are 69% water (USEPA, 1993; Table 4-1 - value for grasshoppers and crickets)

Table C-10: Consumption of contaminated vegetation by a large bird - acute exposure scenario

Parameters/Assumptions		Value	Units	Notes
Body Weight (W)		3.72	kg	
Food ingestion rate (dry weight)		0.13688203	kg dw/day	[1]
Food ingestion rate (wet weight, A)		0.91254687	kg ww/day	[2]
Duration of exposure (D)		1	day	
Application rates (R)				
	Typical	1	lb/acre	
	Maximum	2		
Residue rate - vegetation (rr)				
	Typical	35	mg/kg per lb/acre	
	Maximum	125		
Concentration on vegetation (C): R × rr				
	Typical	35	mg/kg veg	
	Maximum	250		
Drift (Drift)				
	Typical	1	unitless	
	Maximum	1		
Proportion of Diet Contaminated (Prop)				
	Typical	1	unitless	
	Maximum	1		
Dose estimates: Drift × Prop × C × A ÷W				
	Typical	8.59E+00		
	Maximum	6.13E+01		

RISK QUOTIENTS - Ingestion	Toxicity Reference Value	Typical Application	Maximum Application
Large bird - acute exposure	314	2.73E-02	1.95E-01

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987 for all birds; where
Food Ingestion Rate (kg dw/day) = 0.0582*(BW)^0.651

[2] Assumes vegetation is 85% water (USEPA, 1993; Table 4-2 - value for dicots)

Table C-11: Consumption of contaminated vegetation by a large bird - chronic exposure scenario

Parameters/Assumptions		Value	Units	Notes
Duration of exposure (T)		90	day	
Body Weight (W)		3.72	kg	
Food ingestion rate (dry weight)		0.13688203	kg dw/day	[1]
Food ingestion rate (wet weight, A)		0.912546869	kg ww/day	[2]
Half life on vegetation (t50)				
	Herbicide specific	8.8	days	
Application rates (R)				
	Typical	1	lb/acre	
	Maximum	2		
Residue rate - vegetation (rr)				
	Typical	35	mg/kg per lb/acre	
	Maximum	125		
Drift (Drift)				
	Typical	1	unitless	
	Maximum	1		
Decay Coefficient (k): ln(2)/t50				
	Typical	0.078766725	$days^{-1}$	
	Maximum	0.078766725		
Initial concentration on vegetation (C0): R × rr × Drift				
	Typical	35	mg/kg veg	
	Maximum	250		
Concentration on vegetation at time T: C0 * exp(-k*T)				
	Typical	0.029197938	mg/kg veg	
	Maximum	0.208556699		
Time-weighted Average Concentration on vegetation (CTWA): C0 * (1-exp(-k*T))/(k*T)				
	Typical	4.933104265	mg/kg veg	
	Maximum	35.23645904		
Proportion of Diet Contaminated (Prop)				
	Typical	1	unitless	
	Maximum	1		
Dose estimates (D): CTWA × A × Prop / W				
	Typical	1.21E+00	mg/kg bw	
	Maximum	8.64E+00		

RISK QUOTIENTS - Ingestion	Toxicity Reference Value	Typical Application	Maximum Application
Large bird - chronic exposure	27	4.48E-02	3.20E-01

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987 for all birds; where
Food Ingestion Rate (kg dw/day) = 0.0582*(BW)^0.651

[2] Assumes vegetation is 85% water (USEPA, 1993; Table 4-2 - value for dicots)

Table C12: Impact to aquatic species from accidental spray drift to pond

OFF-SITE DRIFT - modeled in AgDrift
TYPICAL APPLICATION RATE

Mode of Application	Application Height or Type	Distance From Receptor (ft)	Pond Concentration (mg/L)	Risk Quotients - Acute: Fish	Risk Quotients - Acute: Aquatic Invertebrates	Risk Quotients - Acute: Non-Target Aquatic Plants	Risk Quotients - Chronic: Fish	Risk Quotients - Chronic: Aquatic Invertebrates	Risk Quotients - Chronic: Non-Target Aquatic Plants
Plane	Forested	100	5.00E-03	2.78E-03	3.85E-04	5.00E-02	9.10E-02	2.50E-02	1.67E-01
Plane	Forested	300	1.88E-03	1.05E-03	1.45E-04	1.88E-02	3.42E-02	9.42E-03	6.28E-02
Plane	Forested	900	6.00E-04	3.33E-04	4.61E-05	6.00E-03	1.09E-02	3.00E-03	2.00E-02
Plane	Non-Forested	100	2.56E-03	1.42E-03	1.97E-04	2.56E-02	4.65E-02	1.28E-02	8.53E-02
Plane	Non-Forested	300	1.15E-03	6.36E-04	8.81E-05	1.15E-02	2.08E-02	5.73E-03	3.82E-02
Plane	Non-Forested	900	5.11E-04	2.84E-04	3.93E-05	5.11E-03	9.30E-03	2.56E-03	1.70E-02
Helicopter	Forested	100	2.96E-04	1.64E-04	2.28E-05	2.96E-03	5.38E-03	1.48E-03	9.86E-03
Helicopter	Forested	300	8.38E-05	4.65E-05	6.44E-06	8.38E-04	1.52E-03	4.19E-04	2.79E-03
Helicopter	Forested	900	1.41E-05	7.81E-06	1.08E-06	1.41E-04	2.56E-04	7.03E-05	4.69E-04
Helicopter	Non-Forested	100	2.13E-03	1.19E-03	1.64E-04	2.13E-02	3.88E-02	1.07E-02	7.12E-02
Helicopter	Non-Forested	300	9.11E-04	5.06E-04	7.00E-05	9.11E-03	1.66E-02	4.55E-03	3.04E-02
Helicopter	Non-Forested	900	4.48E-04	2.49E-04	3.44E-05	4.48E-03	8.14E-03	2.24E-03	1.49E-02
Ground	Low Boom	25	6.82E-04	3.79E-04	5.24E-05	6.82E-03	1.24E-02	3.41E-03	2.27E-02
Ground	Low Boom	100	3.74E-04	2.08E-04	2.88E-05	3.74E-03	6.80E-03	1.87E-03	1.25E-02
Ground	Low Boom	900	1.90E-04	1.05E-04	1.46E-05	1.90E-03	3.45E-03	9.49E-04	6.32E-03
Ground	High Boom	25	1.05E-02	5.82E-03	8.06E-04	1.05E-01	1.90E-01	5.24E-02	3.49E-01
Ground	High Boom	100	2.97E-03	1.65E-03	2.28E-04	2.97E-02	5.39E-02	1.48E-02	9.89E-02
Ground	High Boom	900	2.51E-04	1.39E-04	1.93E-05	2.51E-03	4.56E-03	1.25E-03	8.36E-03

OFF-SITE DRIFT - modeled in AgDrift
MAXIMUM APPLICATION RATE

Mode of Application	Application Height or Type	Distance From Receptor (ft)	Pond Concentration (mg/L)	Risk Quotients - Acute: Fish	Risk Quotients - Acute: Aquatic Invertebrates	Risk Quotients - Acute: Non-Target Aquatic Plants	Risk Quotients - Chronic: Fish	Risk Quotients - Chronic: Aquatic Invertebrates	Risk Quotients - Chronic: Non-Target Aquatic Plants
Plane	Forested	100	1.01E-02	5.62E-03	7.78E-04	1.01E-01	1.84E-01	5.06E-02	3.37E-01
Plane	Forested	300	3.90E-03	2.17E-03	3.00E-04	3.90E-02	7.10E-02	1.95E-02	1.30E-01
Plane	Forested	900	1.31E-03	7.27E-04	1.01E-04	1.31E-02	2.38E-02	6.54E-03	4.36E-02
Plane	Non-Forested	100	5.60E-03	3.11E-03	4.30E-04	5.60E-02	1.02E-01	2.80E-02	1.87E-01
Plane	Non-Forested	300	2.64E-03	1.47E-03	2.03E-04	2.64E-02	4.80E-02	1.32E-02	8.80E-02
Plane	Non-Forested	900	1.06E-03	5.87E-04	8.13E-05	1.06E-02	1.92E-02	5.28E-03	3.52E-02
Helicopter	Forested	100	5.55E-04	3.09E-04	4.27E-05	5.55E-03	1.01E-02	2.78E-03	1.85E-02
Helicopter	Forested	300	1.63E-04	9.05E-05	1.25E-05	1.63E-03	2.96E-03	8.14E-04	5.43E-03
Helicopter	Forested	900	2.92E-05	1.62E-05	2.24E-06	2.92E-04	5.30E-04	1.46E-04	9.72E-04
Helicopter	Non-Forested	100	4.56E-03	2.54E-03	3.51E-04	4.56E-02	8.30E-02	2.28E-02	1.52E-01
Helicopter	Non-Forested	300	2.05E-03	1.14E-03	1.57E-04	2.05E-02	3.72E-02	1.02E-02	6.82E-02
Helicopter	Non-Forested	900	6.83E-04	3.80E-04	5.26E-05	6.83E-03	1.24E-02	3.42E-03	2.28E-02
Ground	Low Boom	25	1.36E-03	7.57E-04	1.05E-04	1.36E-02	2.48E-02	6.82E-03	4.54E-02
Ground	Low Boom	100	7.48E-04	4.15E-04	5.75E-05	7.48E-03	1.36E-02	3.74E-03	2.49E-02
Ground	Low Boom	900	3.80E-04	2.11E-04	2.92E-05	3.80E-03	6.90E-03	1.90E-03	1.27E-02
Ground	High Boom	25	2.10E-02	1.16E-02	1.61E-03	2.10E-01	3.81E-01	1.05E-01	6.99E-01
Ground	High Boom	100	5.94E-03	3.30E-03	4.57E-04	5.94E-02	1.08E-01	2.97E-02	1.98E-01
Ground	High Boom	900	5.02E-04	2.79E-04	3.86E-05	5.02E-03	9.13E-03	2.51E-03	1.67E-02

RQ = Risk Quotient = Estimated Dose/Toxicity Reference Value

Shading and boldface indicates plant RQs greater than 1.
Shading and boldface indicates acute RQs greater than 0.05 for fish and invertebrates.
Shading and boldface indicates chronic RQs greater than 0.5 for fish and invertebrates.

Table C-13: Impact to aquatic species from accidental spray drift to stream

OFF-SITE DRIFT - modeled in AgDrift
TYPICALAPPLICATION RATE

Mode of Application	Application Height or Type	Distance From Receptor (ft)	Stream Concentration (mg/L)	Risk Quotients - Acute: Fish	Risk Quotients - Acute: Aquatic Invertebrates	Risk Quotients - Acute: Non-Target Aquatic Plants	Risk Quotients - Chronic: Fish	Risk Quotients - Chronic: Aquatic Invertebrates	Risk Quotients - Chronic: Non-Target Aquatic Plants
Plane	Forested	100	7.20E-03	4.00E-03	5.54E-04	7.20E-02	1.31E-01	3.60E-02	2.40E-01
Plane	Forested	300	2.14E-03	1.19E-03	1.65E-04	2.14E-02	3.90E-02	1.07E-02	7.15E-02
Plane	Forested	900	6.22E-04	3.45E-04	4.78E-05	6.22E-03	1.13E-02	3.11E-03	2.07E-02
Plane	Non-Forested	100	3.39E-03	1.88E-03	2.60E-04	3.39E-02	6.16E-02	1.69E-02	1.13E-01
Plane	Non-Forested	300	1.23E-03	6.83E-04	9.46E-05	1.23E-02	2.23E-02	6.15E-03	4.10E-02
Plane	Non-Forested	900	5.22E-04	2.90E-04	4.01E-05	5.22E-03	9.49E-03	2.61E-03	1.74E-02
Helicopter	Forested	100	4.00E-04	2.22E-04	3.07E-05	4.00E-03	7.26E-03	2.00E-03	1.33E-02
Helicopter	Forested	300	9.80E-05	5.44E-05	7.54E-06	9.80E-04	1.78E-03	4.90E-04	3.27E-03
Helicopter	Forested	900	1.57E-05	8.70E-06	1.21E-06	1.57E-04	2.85E-04	7.83E-05	5.22E-04
Helicopter	Non-Forested	100	2.84E-03	1.58E-03	2.18E-04	2.84E-02	5.16E-02	1.42E-02	9.45E-02
Helicopter	Non-Forested	300	9.93E-04	5.52E-04	7.64E-05	9.93E-03	1.81E-02	4.97E-03	3.31E-02
Helicopter	Non-Forested	900	4.55E-04	2.53E-04	3.50E-05	4.55E-03	8.28E-03	2.28E-03	1.52E-02
Ground	Low Boom	25	1.23E-03	6.81E-04	9.43E-05	1.23E-02	2.23E-02	6.13E-03	4.09E-02
Ground	Low Boom	100	3.59E-04	2.00E-04	2.76E-05	3.59E-03	6.53E-03	1.80E-03	1.20E-02
Ground	Low Boom	900	1.41E-05	7.86E-06	1.09E-06	1.41E-04	2.57E-04	7.07E-05	4.72E-04
Ground	High Boom	25	2.15E-04	1.19E-04	1.65E-05	2.15E-03	3.90E-03	1.07E-03	7.15E-03
Ground	High Boom	100	1.13E-04	6.28E-05	8.70E-06	1.13E-03	2.06E-03	5.65E-04	3.77E-03
Ground	High Boom	900	1.80E-05	9.98E-06	1.38E-06	1.80E-04	3.26E-04	8.98E-05	5.99E-04

OFF-SITE DRIFT - modeled in AgDrift
MAXIMUM APPLICATION RATE

Mode of Application	Application Height or Type	Distance From Receptor (ft)	Stream Concentration (mg/L)	Risk Quotients - Acute: Fish	Risk Quotients - Acute: Aquatic Invertebrates	Risk Quotients - Acute: Non-Target Aquatic Plants	Risk Quotients - Chronic: Fish	Risk Quotients - Chronic: Aquatic Invertebrates	Risk Quotients - Chronic: Non-Target Aquatic Plants
Plane	Forested	100	1.45E-02	8.06E-03	1.12E-03	1.45E-01	2.64E-01	7.25E-02	4.84E-01
Plane	Forested	300	4.43E-03	2.46E-03	3.41E-04	4.43E-02	8.05E-02	2.21E-02	1.48E-01
Plane	Forested	900	1.35E-03	7.52E-04	1.04E-04	1.35E-02	2.46E-02	6.77E-03	4.51E-02
Plane	Non-Forested	100	7.36E-03	4.09E-03	5.66E-04	7.36E-02	1.34E-01	3.68E-02	2.45E-01
Plane	Non-Forested	300	2.85E-03	1.59E-03	2.20E-04	2.85E-02	5.19E-02	1.43E-02	9.51E-02
Plane	Non-Forested	900	1.09E-03	6.07E-04	8.40E-05	1.09E-02	1.99E-02	5.46E-03	3.64E-02
Helicopter	Forested	100	7.30E-04	4.06E-04	5.62E-05	7.30E-03	1.33E-02	3.65E-03	2.43E-02
Helicopter	Forested	300	1.93E-04	1.07E-04	1.48E-05	1.93E-03	3.50E-03	9.64E-04	6.43E-03
Helicopter	Forested	900	3.20E-05	1.78E-05	2.46E-06	3.20E-04	5.81E-04	1.60E-04	1.07E-03
Helicopter	Non-Forested	100	6.03E-03	3.35E-03	4.64E-04	6.03E-02	1.10E-01	3.01E-02	2.01E-01
Helicopter	Non-Forested	300	2.22E-03	1.23E-03	1.71E-04	2.22E-02	4.03E-02	1.11E-02	7.39E-02
Helicopter	Non-Forested	900	7.25E-04	4.03E-04	5.57E-05	7.25E-03	1.32E-02	3.62E-03	2.42E-02
Ground	Low Boom	25	2.45E-03	1.36E-03	1.89E-04	2.45E-02	4.46E-02	1.23E-02	8.18E-02
Ground	Low Boom	100	7.19E-04	3.99E-04	5.53E-05	7.19E-03	1.31E-02	3.60E-03	2.40E-02
Ground	Low Boom	900	2.83E-05	1.57E-05	2.18E-06	2.83E-04	5.14E-04	1.41E-04	9.43E-04
Ground	High Boom	25	4.29E-04	2.38E-04	3.30E-05	4.29E-03	7.81E-03	2.15E-03	1.43E-02
Ground	High Boom	100	2.26E-04	1.26E-04	1.74E-05	2.26E-03	4.11E-03	1.13E-03	7.54E-03
Ground	High Boom	900	3.59E-05	2.00E-05	2.76E-06	3.59E-04	6.53E-04	1.80E-04	1.20E-03

RQ = Risk Quotient = Estimated Dose/Toxicity Reference Value

Shading and boldface indicates plant RQs greater than 1.
Shading and boldface indicates acute RQs greater than 0.05 for fish and invertebrates.
Shading and boldface indicates chronic RQs greater than 0.5 for fish and invertebrates.

Table C-14: Impact to non-target terrrestrial plants from direct spray and spray drift

DIRECT SPRAY	Terrestrial Concentration (lb a.e./acre)	Typical Species RQ	Threatened & Endangered Species RQ
Typical application rate	1	**5.00E+02**	**3.33E+03**
Maximum application rate	2	**1.00E+03**	**6.67E+03**

OFF-SITE DRIFT - modeled in AgDrift
TYPICAL APPLICATION RATE

Mode of Application	Application Height or Type	Distance From Receptor (ft)	Soil Concentration (mg a.e./kg)	Typical Species RQ	Threatened & Endangered Species RQ
Plane	Forested	100	3.47E-02	**1.74E+01**	**1.16E+02**
Plane	Forested	300	1.46E-02	**7.30E+00**	**4.87E+01**
Plane	Forested	900	5.00E-03	**2.50E+00**	**1.67E+01**
Plane	Non-Forested	100	1.81E-02	**9.05E+00**	**6.03E+01**
Plane	Non-Forested	300	9.30E-03	**4.65E+00**	**3.10E+01**
Plane	Non-Forested	900	4.40E-03	**2.20E+00**	**1.47E+01**
Helicopter	Forested	100	1.90E-03	9.50E-01	**6.33E+00**
Helicopter	Forested	300	6.00E-04	3.00E-01	**2.00E+00**
Helicopter	Forested	900	1.00E-04	5.00E-02	3.33E-01
Helicopter	Non-Forested	100	1.48E-02	**7.40E+00**	**4.93E+01**
Helicopter	Non-Forested	300	7.40E-03	**3.70E+00**	**2.47E+01**
Helicopter	Non-Forested	900	3.80E-03	**1.90E+00**	**1.27E+01**
Ground	Low Boom	25	4.50E-03	**2.25E+00**	**1.50E+01**
Ground	Low Boom	100	2.80E-03	**1.40E+00**	**9.33E+00**
Ground	Low Boom	900	6.00E-04	3.00E-01	**2.00E+00**
Ground	High Boom	25	7.10E-03	**3.55E+00**	**2.37E+01**
Ground	High Boom	100	4.20E-03	**2.10E+00**	**1.40E+01**
Ground	High Boom	900	8.00E-04	4.00E-01	**2.67E+00**

OFF-SITE DRIFT - modeled in AgDrift
MAXIMUM APPLICATION RATE

Mode of Application	Application Height or Type	Distance From Receptor (ft)	Soil Concentration (mg a.e./kg)	Typical Species RQ	Threatened & Endangered Species RQ
Plane	Forested	100	7.05E-02	**3.53E+01**	**2.35E+02**
Plane	Forested	300	3.04E-02	**1.52E+01**	**1.01E+02**
Plane	Forested	900	1.11E-02	**5.55E+00**	**3.70E+01**
Plane	Non-Forested	100	4.02E-02	**2.01E+01**	**1.34E+02**
Plane	Non-Forested	300	2.12E-02	**1.06E+01**	**7.07E+01**
Plane	Non-Forested	900	8.90E-03	**4.45E+00**	**2.97E+01**
Helicopter	Forested	100	3.60E-03	**1.80E+00**	**1.20E+01**
Helicopter	Forested	300	1.20E-03	6.00E-01	**4.00E+00**
Helicopter	Forested	900	2.00E-04	1.00E-01	6.67E-01
Helicopter	Non-Forested	100	3.22E-02	**1.61E+01**	**1.07E+02**
Helicopter	Non-Forested	300	1.65E-02	**8.25E+00**	**5.50E+01**
Helicopter	Non-Forested	900	5.60E-03	**2.80E+00**	**1.87E+01**
Ground	Low Boom	25	9.00E-03	**4.50E+00**	**3.00E+01**
Ground	Low Boom	100	5.50E-03	**2.75E+00**	**1.83E+01**
Ground	Low Boom	900	1.20E-03	6.00E-01	**4.00E+00**
Ground	High Boom	25	1.42E-02	**7.10E+00**	**4.73E+01**
Ground	High Boom	100	8.40E-03	**4.20E+00**	**2.80E+01**
Ground	High Boom	900	1.50E-03	7.50E-01	**5.00E+00**

RQ = Risk Quotient = Estimated Dose/Toxicity Reference Value
Shading and boldface indicates plant RQs greater than 1.

Table C-15: Consumption of contaminated fish from pond by predatory bird - one time exposure. Pond impacted by spray drift modeled in AgDrift.

Parameters/ Assumptions	Value	Units	Notes
Body Weight (W)	5.15	kg	
Food ingestion rate (dry weight)	0.101786153	kg dw/day	[1]
Food ingestion rate (wet weight, A)	0.40714461	kg ww/day	[2]
Bioconcentration factor (BCF)	1	L/kg fish	
Proportion of Diet Contaminated (Prop)	1	unitless	
Toxicity reference value (TRV)	27	mg/kg-bw/day	

TYPICAL APPLICATION RATE

Mode of Application	Application Height or Type	Distance From Receptor (ft)	Pond Concentration (mg/L)	Concentration in fish (C_{Fish}): WC × BCF	Dose estimate (D): C_{Fish} × A × Prop / W	Risk Quotient
Plane	Forested	100	5.00E-03	5.00E-03	3.96E-04	1.47E-05
Plane	Forested	300	1.88E-03	1.88E-03	1.49E-04	5.52E-06
Plane	Forested	900	6.00E-04	6.00E-04	4.74E-05	1.76E-06
Plane	Non-Forested	100	2.56E-03	2.56E-03	2.02E-04	7.49E-06
Plane	Non-Forested	300	1.15E-03	1.15E-03	9.06E-05	3.35E-06
Plane	Non-Forested	900	5.11E-04	5.11E-04	4.04E-05	1.50E-06
Helicopter	Forested	100	2.96E-04	2.96E-04	2.34E-05	8.66E-07
Helicopter	Forested	300	8.38E-05	8.38E-05	6.62E-06	2.45E-07
Helicopter	Forested	900	1.41E-05	1.41E-05	1.11E-06	4.12E-08
Helicopter	Non-Forested	100	2.13E-03	2.13E-03	1.69E-04	6.25E-06
Helicopter	Non-Forested	300	9.11E-04	9.11E-04	7.20E-05	2.67E-06
Helicopter	Non-Forested	900	4.48E-04	4.48E-04	3.54E-05	1.31E-06
Ground	Low Boom	25	6.82E-04	6.82E-04	5.39E-05	2.00E-06
Ground	Low Boom	100	3.74E-04	3.74E-04	2.96E-05	1.09E-06
Ground	Low Boom	900	1.90E-04	1.90E-04	1.50E-05	5.55E-07
Ground	High Boom	25	1.05E-02	1.05E-02	8.28E-04	3.07E-05
Ground	High Boom	100	2.97E-03	2.97E-03	2.35E-04	8.69E-06
Ground	High Boom	900	2.51E-04	2.51E-04	1.98E-05	7.34E-07

MAXIMUM APPLICATION RATE

Mode of Application	Application Height or Type	Distance From Receptor (ft)	Pond Concentration (mg/L)	Concentration in fish (C_{Fish}): WC × BCF	Dose estimate (D): C_{Fish} × A × Prop / W	Risk Quotient
Plane	Forested	100	1.01E-02	1.01E-02	8.00E-04	2.96E-05
Plane	Forested	300	3.90E-03	3.90E-03	3.09E-04	1.14E-05
Plane	Forested	900	1.31E-03	1.31E-03	1.03E-04	3.83E-06
Plane	Non-Forested	100	5.60E-03	5.60E-03	4.42E-04	1.64E-05
Plane	Non-Forested	300	2.64E-03	2.64E-03	2.09E-04	7.73E-06
Plane	Non-Forested	900	1.06E-03	1.06E-03	8.35E-05	3.09E-06
Helicopter	Forested	100	5.55E-04	5.55E-04	4.39E-05	1.63E-06
Helicopter	Forested	300	1.63E-04	1.63E-04	1.29E-05	4.77E-07
Helicopter	Forested	900	2.92E-05	2.92E-05	2.31E-06	8.54E-08
Helicopter	Non-Forested	100	4.56E-03	4.56E-03	3.61E-04	1.34E-05
Helicopter	Non-Forested	300	2.05E-03	2.05E-03	1.62E-04	5.99E-06
Helicopter	Non-Forested	900	6.83E-04	6.83E-04	5.40E-05	2.00E-06
Ground	Low Boom	25	1.36E-03	1.36E-03	1.08E-04	3.99E-06
Ground	Low Boom	100	7.48E-04	7.48E-04	5.91E-05	2.19E-06
Ground	Low Boom	900	3.80E-04	3.80E-04	3.00E-05	1.11E-06
Ground	High Boom	25	2.10E-02	2.10E-02	1.66E-03	6.14E-05
Ground	High Boom	100	5.94E-03	5.94E-03	4.69E-04	1.74E-05
Ground	High Boom	900	5.02E-04	5.02E-04	3.97E-05	1.47E-06

Risk Quotient = Estimated Dose/Toxicity Reference Value
Shading and boldface indicates piscivorous bird RQs greater than 0.1.

[1] Calculated using alorithm developed by Nagy, 1987 for all birds; where
Food Ingestion Rate (kg dw/day) = 0.0582*(BW)^0.651
[2] Assumes fish are 75% water (USEPA, 1993; Table 4-1 - value for bony fishes)

Table C-16: Impact to aquatic species from surface runoff to pond

SURFACE RUNOFF - modeled in GLEAMS							
TYPICAL APPLICATION RATE		Risk Quotients - Acute			Risk Quotients - Chronic		
GLEAMS ID	Pond Concentration (mg/L)	Fish	Aquatic Invertebrates	Non-Target Aquatic Plants	Fish	Aquatic Invertebrates	Non-Target Aquatic Plants
G_BASE_SAND_005_POND_TYP	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_005_POND_TYP	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_005_POND_TYP	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_010_POND_TYP	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_010_POND_TYP	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_010_POND_TYP	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_025_POND_TYP	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_025_POND_TYP	2.17E-10	1.21E-10	1.67E-11	2.17E-09	3.95E-09	1.09E-09	7.23E-09
G_BASE_LOAM_025_POND_TYP	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_050_POND_TYP	4.33E-08	2.40E-08	3.33E-09	4.33E-07	7.86E-07	2.16E-07	0.00E+00
G_BASE_CLAY_050_POND_TYP	1.39E-05	7.74E-06	1.07E-06	1.39E-04	2.53E-04	6.97E-05	4.65E-04
G_BASE_LOAM_050_POND_TYP	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_100_POND_TYP	2.26E-06	1.26E-06	1.74E-07	2.26E-05	4.11E-05	1.13E-05	7.54E-05
G_BASE_CLAY_100_POND_TYP	1.09E-04	6.03E-05	8.35E-06	1.09E-03	1.97E-03	5.43E-04	3.62E-03
G_BASE_LOAM_100_POND_TYP	1.18E-07	6.57E-08	9.09E-09	1.18E-06	2.15E-06	5.91E-07	3.94E-06
G_BASE_SAND_150_POND_TYP	2.38E-05	1.32E-05	1.83E-06	2.38E-04	4.33E-04	1.19E-04	7.94E-04
G_BASE_CLAY_150_POND_TYP	1.19E-03	6.59E-04	9.12E-05	1.19E-02	2.16E-02	5.93E-03	3.95E-02
G_BASE_LOAM_150_POND_TYP	1.02E-07	5.68E-08	7.87E-09	1.02E-06	1.86E-06	5.12E-07	3.41E-06
G_BASE_SAND_200_POND_TYP	6.62E-05	3.68E-05	5.09E-06	6.62E-04	1.20E-03	3.31E-04	2.21E-03
G_BASE_CLAY_200_POND_TYP	3.16E-03	1.76E-03	2.43E-04	3.16E-02	5.75E-02	1.58E-02	1.05E-01
G_BASE_LOAM_200_POND_TYP	8.02E-08	4.46E-08	6.17E-09	8.02E-07	1.46E-06	4.01E-07	2.67E-06
G_BASE_SAND_250_POND_TYP	9.75E-05	5.41E-05	7.50E-06	9.75E-04	1.77E-03	4.87E-04	3.25E-03
G_BASE_CLAY_250_POND_TYP	5.11E-03	2.84E-03	3.93E-04	5.11E-02	9.29E-02	2.55E-02	1.70E-01
G_BASE_LOAM_250_POND_TYP	5.07E-05	2.82E-05	3.90E-06	5.07E-04	9.22E-04	2.54E-04	1.69E-03
G_ARV1_050_POND_TYP	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ARV2_050_POND_TYP	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ARV3_050_POND_TYP	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ERV1_050_POND_TYP	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ERV2_050_POND_TYP	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ERV3_050_POND_TYP	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_RGV1_050_POND_TYP	1.05E-05	5.84E-06	8.09E-07	1.05E-04	1.91E-04	5.26E-05	3.51E-04
G_RGV2_050_POND_TYP	1.05E-06	5.81E-07	8.05E-08	1.05E-05	1.90E-05	5.23E-06	3.49E-05
G_RGV3_050_POND_TYP	1.20E-06	6.64E-07	9.19E-08	1.20E-05	2.17E-05	5.98E-06	3.98E-05
G_SLV1_050_POND_TYP	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_SLV2_050_POND_TYP	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_SLV3_050_POND_TYP	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_STV1_050_POND_TYP	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_STV2_050_POND_TYP	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_STV3_050_POND_TYP	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_VGV1_050_POND_TYP	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_VGV2_050_POND_TYP	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_VGV3_050_POND_TYP	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

RQ = Risk Quotient = Estimated Dose/Toxicity Reference Value

Table C-16: Impact to aquatic species from surface runoff to pond

SURFACE RUNOFF - modeled in GLEAMS
MAXIMUM APPLICATION RATE

GLEAMS ID	Pond Concentration (mg/L)	Risk Quotients - Acute: Fish	Risk Quotients - Acute: Aquatic Invertebrates	Risk Quotients - Acute: Non-Target Aquatic Plants	Risk Quotients - Chronic: Fish	Risk Quotients - Chronic: Aquatic Invertebrates	Risk Quotients - Chronic: Non-Target Aquatic Plants
G_BASE_SAND_005_POND_MAX	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_005_POND_MAX	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_005_POND_MAX	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_010_POND_MAX	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_010_POND_MAX	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_010_POND_MAX	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_025_POND_MAX	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_025_POND_MAX	4.34E-10	2.41E-10	3.34E-11	4.34E-09	7.89E-09	2.17E-09	1.45E-08
G_BASE_LOAM_025_POND_MAX	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_050_POND_MAX	8.65E-08	4.81E-08	6.65E-09	8.65E-07	1.57E-06	4.33E-07	2.88E-06
G_BASE_CLAY_050_POND_MAX	2.79E-05	1.55E-05	2.14E-06	2.79E-04	5.07E-04	1.39E-04	9.29E-04
G_BASE_LOAM_050_POND_MAX	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_100_POND_MAX	4.52E-06	2.51E-06	3.48E-07	4.52E-05	8.23E-05	2.26E-05	1.51E-04
G_BASE_CLAY_100_POND_MAX	2.17E-04	1.21E-04	1.67E-05	2.17E-03	3.95E-03	1.09E-03	7.23E-03
G_BASE_LOAM_100_POND_MAX	2.36E-07	1.31E-07	1.82E-08	2.36E-06	4.30E-06	1.18E-06	7.88E-06
G_BASE_SAND_150_POND_MAX	4.76E-05	2.65E-05	3.66E-06	4.76E-04	8.66E-04	2.38E-04	1.59E-03
G_BASE_CLAY_150_POND_MAX	2.37E-03	1.32E-03	1.82E-04	2.37E-02	4.31E-02	1.19E-02	7.91E-02
G_BASE_LOAM_150_POND_MAX	2.05E-07	1.14E-07	1.57E-08	2.05E-06	3.72E-06	1.02E-06	6.82E-06
G_BASE_SAND_200_POND_MAX	1.32E-04	7.36E-05	1.02E-05	1.32E-03	2.41E-03	6.62E-04	4.42E-03
G_BASE_CLAY_200_POND_MAX	6.32E-03	3.51E-03	4.86E-04	6.32E-02	1.15E-01	3.16E-02	2.11E-01
G_BASE_LOAM_200_POND_MAX	1.60E-07	8.91E-08	1.23E-08	1.60E-06	2.92E-06	8.02E-07	5.35E-06
G_BASE_SAND_250_POND_MAX	1.95E-04	1.08E-04	1.50E-05	1.95E-03	3.54E-03	9.75E-04	6.50E-03
G_BASE_CLAY_250_POND_MAX	1.02E-02	5.67E-03	7.86E-04	1.02E-01	1.86E-01	5.11E-02	3.40E-01
G_BASE_LOAM_250_POND_MAX	1.01E-04	5.63E-05	7.80E-06	1.01E-03	1.84E-03	5.07E-04	3.38E-03
G_ARV1_050_POND_MAX	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ARV2_050_POND_MAX	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ARV3_050_POND_MAX	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ERV1_050_POND_MAX	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ERV2_050_POND_MAX	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ERV3_050_POND_MAX	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_RGV1_050_POND_MAX	2.10E-05	1.17E-05	1.62E-06	2.10E-04	3.83E-04	1.05E-04	7.01E-04
G_RGV2_050_POND_MAX	2.09E-06	1.16E-06	1.61E-07	2.09E-05	3.80E-05	1.05E-05	6.97E-05
G_RGV3_050_POND_MAX	2.39E-06	1.33E-06	1.84E-07	2.39E-05	4.35E-05	1.20E-05	7.97E-05
G_SLV1_050_POND_MAX	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_SLV2_050_POND_MAX	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_SLV3_050_POND_MAX	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_STV1_050_POND_MAX	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_STV2_050_POND_MAX	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_STV3_050_POND_MAX	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_VGV1_050_POND_MAX	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_VGV2_050_POND_MAX	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_VGV3_050_POND_MAX	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

RQ = Risk Quotient = Estimated Dose/Toxicity Reference Value

Shading and boldface indicates plant RQs greater than 1.
Shading and boldface indicates acute RQs greater than 0.05 for fish and invertebrates.
Shading and boldface indicates chronic RQs greater than 0.5 for fish and invertebrates.

SURFACE RUNOFF - modeled in GLEAMS
TYPICAL APPLICATION RATE

GLEAMS ID	Annual Precipitation (inches)	Application Area (acres)	Hydraulic Slope (ft/ft)	Surface Roughness	USLE Soil Erodibility Factor (ton/ac per EI)	Vegetation Type	Soil Type	Stream Concentration (mg/L)	Risk Quotients - Acute			Risk Quotients - Chronic		
									Fish	Aquatic Invertebrates	Non-Target Aquatic Plants	Fish	Aquatic Invertebrates	Non-Target Aquatic Plants
G_BASE_SAND_005_STREAM_TYP	5	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_005_STREAM_TYP	5	10	0.05	0.015	0.401	weeds (79)	Clay	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_005_STREAM_TYP	5	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_010_STREAM_TYP	10	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_010_STREAM_TYP	10	10	0.05	0.015	0.401	weeds (79)	Clay	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_010_STREAM_TYP	10	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_025_STREAM_TYP	25	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_025_STREAM_TYP	25	10	0.05	0.015	0.401	weeds (79)	Clay	1.07E-12	5.92E-13	8.20E-14	1.07E-11	1.94E-11	5.33E-12	3.55E-11
G_BASE_LOAM_025_STREAM_TYP	25	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_050_STREAM_TYP	50	10	0.05	0.015	0.401	weeds (79)	Sand	1.48E-10	8.23E-11	1.14E-11	1.48E-09	2.69E-09	7.41E-10	4.94E-09
G_BASE_CLAY_050_STREAM_TYP	50	10	0.05	0.015	0.401	weeds (79)	Clay	5.71E-08	3.17E-08	4.39E-09	5.71E-07	1.04E-06	2.85E-07	1.90E-06
G_BASE_LOAM_050_STREAM_TYP	50	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_100_STREAM_TYP	100	10	0.05	0.015	0.401	weeds (79)	Sand	2.87E-08	1.60E-08	2.21E-09	2.87E-07	5.22E-07	1.44E-07	9.58E-07
G_BASE_CLAY_100_STREAM_TYP	100	10	0.05	0.015	0.401	weeds (79)	Clay	7.56E-07	4.20E-07	5.81E-08	7.56E-06	1.37E-05	3.78E-06	2.52E-05
G_BASE_LOAM_100_STREAM_TYP	100	10	0.05	0.015	0.401	weeds (79)	Loam	2.52E-09	1.40E-09	1.94E-10	2.52E-08	4.58E-08	1.26E-08	8.39E-08
G_BASE_SAND_150_STREAM_TYP	150	10	0.05	0.015	0.401	weeds (79)	Sand	3.35E-07	1.86E-07	2.58E-08	3.35E-06	6.09E-06	1.67E-06	1.12E-05
G_BASE_CLAY_150_STREAM_TYP	150	10	0.05	0.015	0.401	weeds (79)	Clay	4.13E-06	2.29E-06	3.18E-07	4.13E-05	7.51E-05	2.06E-05	1.38E-04
G_BASE_LOAM_150_STREAM_TYP	150	10	0.05	0.015	0.401	weeds (79)	Loam	6.50E-09	3.61E-09	5.00E-10	6.50E-08	1.18E-07	3.25E-08	2.17E-07
G_BASE_SAND_200_STREAM_TYP	200	10	0.05	0.015	0.401	weeds (79)	Sand	1.46E-06	8.09E-07	1.12E-07	1.46E-05	2.65E-05	7.28E-06	4.85E-05
G_BASE_CLAY_200_STREAM_TYP	200	10	0.05	0.015	0.401	weeds (79)	Clay	1.18E-05	6.57E-06	9.10E-07	1.18E-04	2.15E-04	5.92E-05	3.94E-04
G_BASE_LOAM_200_STREAM_TYP	200	10	0.05	0.015	0.401	weeds (79)	Loam	5.66E-09	3.14E-09	4.35E-10	5.66E-08	1.03E-07	2.83E-08	1.89E-07
G_BASE_SAND_250_STREAM_TYP	250	10	0.05	0.015	0.401	weeds (79)	Sand	2.51E-06	1.39E-06	1.93E-07	2.51E-05	4.56E-05	1.26E-05	8.37E-05
G_BASE_CLAY_250_STREAM_TYP	250	10	0.05	0.015	0.401	weeds (79)	Clay	2.08E-05	1.16E-05	1.60E-06	2.08E-04	3.78E-04	1.04E-04	6.94E-04
G_BASE_LOAM_250_STREAM_TYP	250	10	0.05	0.015	0.401	weeds (79)	Loam	1.47E-07	8.14E-08	1.13E-08	1.47E-06	2.66E-06	7.33E-07	4.88E-06
G_ARV1_050_STREAM_TYP	50	1	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ARV2_050_STREAM_TYP	50	100	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ARV3_050_STREAM_TYP	50	1000	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ERV1_050_STREAM_TYP	50	10	0.05	0.015	0.05	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ERV2_050_STREAM_TYP	50	10	0.05	0.015	0.2	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ERV3_050_STREAM_TYP	50	10	0.05	0.015	0.5	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_RGV1_050_STREAM_TYP	50	10	0.05	0.023	0.401	weeds (79)	Loam	8.76E-08	4.87E-08	6.74E-09	8.76E-07	1.59E-06	4.38E-07	2.92E-06
G_RGV2_050_STREAM_TYP	50	10	0.05	0.046	0.401	weeds (79)	Loam	8.90E-09	4.94E-09	6.85E-10	8.90E-08	1.62E-07	4.45E-08	2.97E-07
G_RGV3_050_STREAM_TYP	50	10	0.05	0.15	0.401	weeds (79)	Loam	9.10E-09	5.06E-09	7.00E-10	9.10E-08	1.65E-07	4.55E-08	3.03E-07
G_SLV1_050_STREAM_TYP	50	10	0.005	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_SLV2_050_STREAM_TYP	50	10	0.01	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_SLV3_050_STREAM_TYP	50	10	0.1	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_STV1_050_STREAM_TYP	50	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_STV2_050_STREAM_TYP	50	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_STV3_050_STREAM_TYP	50	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_VGV1_050_STREAM_TYP	50	10	0.05	0.015	0.401	Shrub	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_VGV2_050_STREAM_TYP	50	10	0.05	0.015	0.401	Rye Grass	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_VGV3_050_STREAM_TYP	50	10	0.05	0.015	0.401	Conifer-Hardwood	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

RQ = Risk Quotient = Estimated Dose/Toxicity Reference Value

SURFACE RUNOFF - modeled in GLEAMS
MAXIMUM APPLICATION RATE

GLEAMS ID	Annual Precipitation (inches)	Application Area (acres)	Hydraulic Slope (ft/ft)	Surface Roughness	USLE Soil Erodibility Factor (ton/ac per EI)	Vegetation Type	Soil Type	Stream Concentration (mg/L)	Risk Quotients - Acute: Fish	Risk Quotients - Acute: Aquatic Invertebrates	Risk Quotients - Acute: Non-Target Aquatic Plants	Risk Quotients - Chronic: Fish	Risk Quotients - Chronic: Aquatic Invertebrates	Risk Quotients - Chronic: Non-Target Aquatic Plants
G_BASE_SAND_005_STREAM_MAX	5	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_005_STREAM_MAX	5	10	0.05	0.015	0.401	weeds (79)	Clay	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_005_STREAM_MAX	5	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_010_STREAM_MAX	10	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_010_STREAM_MAX	10	10	0.05	0.015	0.401	weeds (79)	Clay	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_010_STREAM_MAX	10	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_025_STREAM_MAX	25	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_025_STREAM_MAX	25	10	0.05	0.015	0.401	weeds (79)	Clay	2.13E-12	1.18E-12	1.64E-13	2.13E-11	3.88E-11	1.07E-11	7.11E-11
G_BASE_LOAM_025_STREAM_MAX	25	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_050_STREAM_MAX	50	10	0.05	0.015	0.401	weeds (79)	Sand	2.96E-10	1.65E-10	2.28E-11	2.96E-09	5.39E-09	1.48E-09	9.87E-09
G_BASE_CLAY_050_STREAM_MAX	50	10	0.05	0.015	0.401	weeds (79)	Clay	1.14E-07	6.34E-08	8.78E-09	1.14E-06	2.08E-06	5.71E-07	3.81E-06
G_BASE_LOAM_050_STREAM_MAX	50	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_100_STREAM_MAX	100	10	0.05	0.015	0.401	weeds (79)	Sand	5.75E-08	3.19E-08	4.42E-09	5.75E-07	1.04E-06	2.87E-07	1.92E-06
G_BASE_CLAY_100_STREAM_MAX	100	10	0.05	0.015	0.401	weeds (79)	Clay	1.51E-06	8.40E-07	1.16E-07	1.51E-05	2.75E-05	7.56E-06	5.04E-05
G_BASE_LOAM_100_STREAM_MAX	100	10	0.05	0.015	0.401	weeds (79)	Loam	5.04E-09	2.80E-09	3.87E-10	5.04E-08	9.16E-08	2.52E-08	1.68E-07
G_BASE_SAND_150_STREAM_MAX	150	10	0.05	0.015	0.401	weeds (79)	Sand	6.70E-07	3.72E-07	5.15E-08	6.70E-06	1.22E-05	3.35E-06	2.23E-05
G_BASE_CLAY_150_STREAM_MAX	150	10	0.05	0.015	0.401	weeds (79)	Clay	8.26E-06	4.59E-06	6.35E-07	8.26E-05	1.50E-04	4.13E-05	2.75E-04
G_BASE_LOAM_150_STREAM_MAX	150	10	0.05	0.015	0.401	weeds (79)	Loam	1.30E-08	7.23E-09	1.00E-09	1.30E-07	2.37E-07	6.50E-08	4.34E-07
G_BASE_SAND_200_STREAM_MAX	200	10	0.05	0.015	0.401	weeds (79)	Sand	2.91E-06	1.62E-06	2.24E-07	2.91E-05	5.29E-05	1.46E-05	9.71E-05
G_BASE_CLAY_200_STREAM_MAX	200	10	0.05	0.015	0.401	weeds (79)	Clay	2.37E-05	1.31E-05	1.82E-06	2.37E-04	4.30E-04	1.18E-04	7.89E-04
G_BASE_LOAM_200_STREAM_MAX	200	10	0.05	0.015	0.401	weeds (79)	Loam	1.13E-08	6.29E-09	8.70E-10	1.13E-07	2.06E-07	5.66E-08	3.77E-07
G_BASE_SAND_250_STREAM_MAX	250	10	0.05	0.015	0.401	weeds (79)	Sand	5.02E-06	2.79E-06	3.86E-07	5.02E-05	9.13E-05	2.51E-05	1.67E-04
G_BASE_CLAY_250_STREAM_MAX	250	10	0.05	0.015	0.401	weeds (79)	Clay	4.16E-05	2.31E-05	3.20E-06	4.16E-04	7.57E-04	2.08E-04	1.39E-03
G_BASE_LOAM_250_STREAM_MAX	250	10	0.05	0.015	0.401	weeds (79)	Loam	2.93E-07	1.63E-07	2.25E-08	2.93E-06	5.33E-06	1.47E-06	9.77E-06
G_ARV1_050_STREAM_MAX	50	1	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ARV2_050_STREAM_MAX	50	100	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ARV3_050_STREAM_MAX	50	1000	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ERV1_050_STREAM_MAX	50	10	0.05	0.015	0.05	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ERV2_050_STREAM_MAX	50	10	0.05	0.015	0.2	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ERV3_050_STREAM_MAX	50	10	0.05	0.015	0.5	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_RGV1_050_STREAM_MAX	50	10	0.05	0.023	0.401	weeds (79)	Loam	1.75E-07	9.73E-08	1.35E-08	1.75E-06	3.19E-06	8.76E-07	5.84E-06
G_RGV2_050_STREAM_MAX	50	10	0.05	0.046	0.401	weeds (79)	Loam	1.78E-08	9.89E-09	1.37E-09	1.78E-07	3.24E-07	8.90E-08	5.93E-07
G_RGV3_050_STREAM_MAX	50	10	0.05	0.15	0.401	weeds (79)	Loam	1.82E-08	1.01E-08	1.40E-09	1.82E-07	3.31E-07	9.10E-08	6.07E-07
G_SLV1_050_STREAM_MAX	50	10	0.005	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_SLV2_050_STREAM_MAX	50	10	0.01	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_SLV3_050_STREAM_MAX	50	10	0.1	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_STV1_050_STREAM_MAX	50	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_STV2_050_STREAM_MAX	50	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_STV3_050_STREAM_MAX	50	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_VGV1_050_STREAM_MAX	50	10	0.05	0.015	0.401	Shrub	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_VGV2_050_STREAM_MAX	50	10	0.05	0.015	0.401	Rye Grass	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_VGV3_050_STREAM_MAX	50	10	0.05	0.015	0.401	Conifer-Hardwood	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

RQ = Risk Quotient = Estimated Dose/Toxicity Reference Value

Shading and boldface indicates plant RQs greater than 1.
Shading and boldface indicates acute RQs greater than 0.05 for fish and invertebrates.
Shading and boldface indicates chronic RQs greater than 0.5 for fish and invertebrates.

Table C-18: Impact to non-target terrrestrial plants from surface runoff

SURFACE RUNOFF - modeled in GLEAMS
TYPICAL APPLICATION RATE

GLEAMS ID	Annual Precipitation (inches)	Application Area (acres)	Hydraulic Slope (ft/ft)	Surface Roughness	USLE Soil Erodibility Factor (ton/ac per EI)	Vegetation Type	Soil Type	Terrestrial Concentration (lb a.e./acre)	Typical Species RQ	Threatened & Endangered Species RQ
G_BASE_SAND_005_TERR_TYP	5	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_005_TERR_TYP	5	10	0.05	0.015	0.401	weeds (79)	Clay	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_005_TERR_TYP	5	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_010_TERR_TYP	10	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_010_TERR_TYP	10	10	0.05	0.015	0.401	weeds (79)	Clay	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_010_TERR_TYP	10	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_025_TERR_TYP	25	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_025_TERR_TYP	25	10	0.05	0.015	0.401	weeds (79)	Clay	1.27E-10	1.55E-11	4.25E-07
G_BASE_LOAM_025_TERR_TYP	25	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_050_TERR_TYP	50	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_050_TERR_TYP	50	10	0.05	0.015	0.401	weeds (79)	Clay	4.38E-06	5.34E-07	1.46E-02
G_BASE_LOAM_050_TERR_TYP	50	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_100_TERR_TYP	100	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_100_TERR_TYP	100	10	0.05	0.015	0.401	weeds (79)	Clay	4.40E-05	5.37E-06	1.47E-01
G_BASE_LOAM_100_TERR_TYP	100	10	0.05	0.015	0.401	weeds (79)	Loam	1.83E-07	2.23E-08	6.10E-04
G_BASE_SAND_150_TERR_TYP	150	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_150_TERR_TYP	150	10	0.05	0.015	0.401	weeds (79)	Clay	4.19E-04	5.11E-05	**1.40E+00**
G_BASE_LOAM_150_TERR_TYP	150	10	0.05	0.015	0.401	weeds (79)	Loam	6.32E-07	7.71E-08	2.11E-03
G_BASE_SAND_200_TERR_TYP	200	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_200_TERR_TYP	200	10	0.05	0.015	0.401	weeds (79)	Clay	1.36E-03	1.65E-04	**4.52E+00**
G_BASE_LOAM_200_TERR_TYP	200	10	0.05	0.015	0.401	weeds (79)	Loam	5.06E-07	6.17E-08	1.69E-03
G_BASE_SAND_250_TERR_TYP	250	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_250_TERR_TYP	250	10	0.05	0.015	0.401	weeds (79)	Clay	2.51E-03	3.06E-04	**8.37E+00**
G_BASE_LOAM_250_TERR_TYP	250	10	0.05	0.015	0.401	weeds (79)	Loam	1.78E-05	2.17E-06	5.93E-02
G_ARV1_050_TERR_TYP	50	1	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00
G_ARV2_050_TERR_TYP	50	100	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00
G_ARV3_050_TERR_TYP	50	1000	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00
G_ERV1_050_TERR_TYP	50	10	0.05	0.015	0.05	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00
G_ERV2_050_TERR_TYP	50	10	0.05	0.015	0.2	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00
G_ERV3_050_TERR_TYP	50	10	0.05	0.015	0.5	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00
G_RGV1_050_TERR_TYP	50	10	0.05	0.023	0.401	weeds (79)	Loam	7.24E-06	8.83E-07	2.41E-02
G_RGV2_050_TERR_TYP	50	10	0.05	0.046	0.401	weeds (79)	Loam	6.85E-07	8.35E-08	2.28E-03
G_RGV3_050_TERR_TYP	50	10	0.05	0.15	0.401	weeds (79)	Loam	9.36E-07	1.14E-07	3.12E-03
G_SLV1_050_TERR_TYP	50	10	0.005	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00
G_SLV2_050_TERR_TYP	50	10	0.01	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00
G_SLV3_050_TERR_TYP	50	10	0.1	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00
G_STV1_050_TERR_TYP	50	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00
G_STV2_050_TERR_TYP	50	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00
G_STV3_050_TERR_TYP	50	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00
G_VGV1_050_TERR_TYP	50	10	0.05	0.015	0.401	Shrub	Loam	0.00E+00	0.00E+00	0.00E+00
G_VGV2_050_TERR_TYP	50	10	0.05	0.015	0.401	Rye Grass	Loam	0.00E+00	0.00E+00	0.00E+00
G_VGV3_050_TERR_TYP	50	10	0.05	0.015	0.401	Conifer-Hardwood	Loam	0.00E+00	0.00E+00	0.00E+00

RQ = Risk Quotient = Estimated Dose/Toxicity Reference Value

Table C-18: Impact to non-target terrrestrial plants from surface runoff

SURFACE RUNOFF - modeled in GLEAMS

MAXIMUM APPLICATION RATE

GLEAMS ID	Annual Precipitation (inches)	Application Area (acres)	Hydraulic Slope (ft/ft)	Surface Roughness	USLE Soil Erodibility Factor (ton/ac per EI)	Vegetation Type	Soil Type	Terrestrial Concentration (lb a.e./acre)	Typical Species RQ	Threatened & Endangered Species RQ
G_BASE_SAND_005_TERR_MAX	5	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_005_TERR_MAX	5	10	0.05	0.015	0.401	weeds (79)	Clay	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_005_TERR_MAX	5	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_010_TERR_MAX	10	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_010_TERR_MAX	10	10	0.05	0.015	0.401	weeds (79)	Clay	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_010_TERR_MAX	10	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_025_TERR_MAX	25	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_025_TERR_MAX	25	10	0.05	0.015	0.401	weeds (79)	Clay	2.55E-10	3.11E-11	8.50E-07
G_BASE_LOAM_025_TERR_MAX	25	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_050_TERR_MAX	50	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_050_TERR_MAX	50	10	0.05	0.015	0.401	weeds (79)	Clay	8.75E-06	1.07E-06	2.92E-02
G_BASE_LOAM_050_TERR_MAX	50	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_100_TERR_MAX	100	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_100_TERR_MAX	100	10	0.05	0.015	0.401	weeds (79)	Clay	8.80E-05	1.07E-05	2.93E-01
G_BASE_LOAM_100_TERR_MAX	100	10	0.05	0.015	0.401	weeds (79)	Loam	3.66E-07	4.46E-08	1.22E-03
G_BASE_SAND_150_TERR_MAX	150	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_150_TERR_MAX	150	10	0.05	0.015	0.401	weeds (79)	Clay	8.38E-04	1.02E-04	**2.79E+00**
G_BASE_LOAM_150_TERR_MAX	150	10	0.05	0.015	0.401	weeds (79)	Loam	1.26E-06	1.54E-07	4.21E-03
G_BASE_SAND_200_TERR_MAX	200	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_200_TERR_MAX	200	10	0.05	0.015	0.401	weeds (79)	Clay	2.71E-03	3.31E-04	**9.05E+00**
G_BASE_LOAM_200_TERR_MAX	200	10	0.05	0.015	0.401	weeds (79)	Loam	1.01E-06	1.23E-07	3.37E-03
G_BASE_SAND_250_TERR_MAX	250	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_250_TERR_MAX	250	10	0.05	0.015	0.401	weeds (79)	Clay	5.02E-03	6.12E-04	**1.67E+01**
G_BASE_LOAM_250_TERR_MAX	250	10	0.05	0.015	0.401	weeds (79)	Loam	3.56E-05	4.34E-06	1.19E-01
G_ARV1_050_TERR_MAX	50	1	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00
G_ARV2_050_TERR_MAX	50	100	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00
G_ARV3_050_TERR_MAX	50	1000	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00
G_ERV1_050_TERR_MAX	50	10	0.05	0.015	0.05	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00
G_ERV2_050_TERR_MAX	50	10	0.05	0.015	0.2	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00
G_ERV3_050_TERR_MAX	50	10	0.05	0.015	0.5	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00
G_RGV1_050_TERR_MAX	50	10	0.05	0.023	0.401	weeds (79)	Loam	1.45E-05	1.77E-06	4.83E-02
G_RGV2_050_TERR_MAX	50	10	0.05	0.046	0.401	weeds (79)	Loam	1.37E-06	1.67E-07	4.56E-03
G_RGV3_050_TERR_MAX	50	10	0.05	0.15	0.401	weeds (79)	Loam	1.87E-06	2.28E-07	6.24E-03
G_SLV1_050_TERR_MAX	50	10	0.005	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00
G_SLV2_050_TERR_MAX	50	10	0.01	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00
G_SLV3_050_TERR_MAX	50	10	0.1	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00
G_STV1_050_TERR_MAX	50	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00
G_STV2_050_TERR_MAX	50	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00
G_STV3_050_TERR_MAX	50	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00
G_VGV1_050_TERR_MAX	50	10	0.05	0.015	0.401	Shrub	Loam	0.00E+00	0.00E+00	0.00E+00
G_VGV2_050_TERR_MAX	50	10	0.05	0.015	0.401	Rye Grass	Loam	0.00E+00	0.00E+00	0.00E+00
G_VGV3_050_TERR_MAX	50	10	0.05	0.015	0.401	Conifer-Hardwood	Loam	0.00E+00	0.00E+00	0.00E+00

RQ = Risk Quotient = Estimated Dose/Toxicity Reference Value

Shading and boldface indicates plant RQs greater than 1.

Table C-19: Consumption of contaminated fish from pond by predatory bird - long term exposure. Pond impacted by surface runoff modeled in GLEAMS.

Parameters/ Assumptions	Value	Units	Notes
Body Weight (W)	5.15	kg	
Food ingestion rate (dry weight)	0.101786153	kg dw/day	[1]
Food ingestion rate (wet weight, A)	0.40714461	kg ww/day	[2]
Bioconcentration factor (BCF)	1	L/kg fish	
Proportion of Diet Contaminated (Prop)	1	unitless	
Toxicity reference value (TRV)	27	mg/kg-bw/day	

TYPICAL APPLICATION RATE

GLEAMS ID	Annual Precipitation (inches)	Application Area (acres)	Hydraulic Slope (ft/ft)	Surface Roughness	USLE Soil Erodibility Factor (ton/ac per EI)	Vegetation Type	Soil Type	Pond Concentration (mg/L)	Concentrations in fish (C_{Fish}): WC × BCF	Dose estimates (D): C_{Fish} × A × Prop / W	Risk Quotient
G_BASE_SAND_005_POND_TYP	5	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_005_POND_TYP	5	10	0.05	0.015	0.401	weeds (79)	Clay	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_005_POND_TYP	5	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_010_POND_TYP	10	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_010_POND_TYP	10	10	0.05	0.015	0.401	weeds (79)	Clay	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_010_POND_TYP	10	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_025_POND_TYP	25	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_025_POND_TYP	25	10	0.05	0.015	0.401	weeds (79)	Clay	2.17E-10	2.17E-10	1.72E-11	6.35E-13
G_BASE_LOAM_025_POND_TYP	25	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_050_POND_TYP	50	10	0.05	0.015	0.401	weeds (79)	Sand	4.33E-08	4.33E-08	3.42E-09	1.27E-10
G_BASE_CLAY_050_POND_TYP	50	10	0.05	0.015	0.401	weeds (79)	Clay	1.39E-05	1.39E-05	1.10E-06	4.08E-08
G_BASE_LOAM_050_POND_TYP	50	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_100_POND_TYP	100	10	0.05	0.015	0.401	weeds (79)	Sand	2.26E-06	2.26E-06	1.79E-07	6.62E-09
G_BASE_CLAY_100_POND_TYP	100	10	0.05	0.015	0.401	weeds (79)	Clay	1.09E-04	1.09E-04	8.58E-06	3.18E-07
G_BASE_LOAM_100_POND_TYP	100	10	0.05	0.015	0.401	weeds (79)	Loam	1.18E-07	1.18E-07	9.34E-09	3.46E-10
G_BASE_SAND_150_POND_TYP	150	10	0.05	0.015	0.401	weeds (79)	Sand	2.38E-05	2.38E-05	1.88E-06	6.97E-08
G_BASE_CLAY_150_POND_TYP	150	10	0.05	0.015	0.401	weeds (79)	Clay	1.19E-03	1.19E-03	9.38E-05	3.47E-06
G_BASE_LOAM_150_POND_TYP	150	10	0.05	0.015	0.401	weeds (79)	Loam	1.02E-07	1.02E-07	8.09E-09	3.00E-10
G_BASE_SAND_200_POND_TYP	200	10	0.05	0.015	0.401	weeds (79)	Sand	6.62E-05	6.62E-05	5.24E-06	1.94E-07
G_BASE_CLAY_200_POND_TYP	200	10	0.05	0.015	0.401	weeds (79)	Clay	3.16E-03	3.16E-03	2.50E-04	9.26E-06
G_BASE_LOAM_200_POND_TYP	200	10	0.05	0.015	0.401	weeds (79)	Loam	8.02E-08	8.02E-08	6.34E-09	2.35E-10
G_BASE_SAND_250_POND_TYP	250	10	0.05	0.015	0.401	weeds (79)	Sand	9.75E-05	9.75E-05	7.70E-06	2.85E-07
G_BASE_CLAY_250_POND_TYP	250	10	0.05	0.015	0.401	weeds (79)	Clay	5.11E-03	5.11E-03	4.04E-04	1.50E-05
G_BASE_LOAM_250_POND_TYP	250	10	0.05	0.015	0.401	weeds (79)	Loam	5.07E-05	5.07E-05	4.01E-06	1.48E-07
G_ARV1_050_POND_TYP	50	1	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ARV2_050_POND_TYP	50	100	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ARV3_050_POND_TYP	50	1000	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ERV1_050_POND_TYP	50	10	0.05	0.015	0.05	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ERV2_050_POND_TYP	50	10	0.05	0.015	0.2	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ERV3_050_POND_TYP	50	10	0.05	0.015	0.5	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_RGV1_050_POND_TYP	50	10	0.05	0.023	0.401	weeds (79)	Loam	1.05E-05	1.05E-05	8.32E-07	3.08E-08
G_RGV2_050_POND_TYP	50	10	0.05	0.046	0.401	weeds (79)	Loam	1.05E-06	1.05E-06	8.27E-08	3.06E-09
G_RGV3_050_POND_TYP	50	10	0.05	0.15	0.401	weeds (79)	Loam	1.20E-06	1.20E-06	9.45E-08	3.50E-09
G_SLV1_050_POND_TYP	50	10	0.005	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_SLV2_050_POND_TYP	50	10	0.01	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_SLV3_050_POND_TYP	50	10	0.1	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_STV1_050_POND_TYP	50	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_STV2_050_POND_TYP	50	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_STV3_050_POND_TYP	50	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_VGV1_050_POND_TYP	50	10	0.05	0.015	0.401	Shrub	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_VGV2_050_POND_TYP	50	10	0.05	0.015	0.401	Rye Grass	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_VGV3_050_POND_TYP	50	10	0.05	0.015	0.401	Conifer-Hardwood	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Risk Quotient = Estimated Dose/Toxicity Reference Value
Shading and boldface indicates piscivorous bird RQs greater than 0.1.

[1] Calculated using alorithm developed by Nagy, 1987 for all birds; where
Food Ingestion Rate (kg dw/day) = 0.0582*(BW)^0.651
[2] Assumes fish are 75% water (USEPA, 1993; Table 4-1 - value for bony fishes)
GLEAMS footnotes

Table C-19: Consumption of contaminated fish from pond by predatory bird - long term exposure. Pond impacted by surface runoff modeled in GLEAMS.

Parameters/ Assumptions	Value	Units	Notes
Body Weight (W)	5.15	kg	
Food ingestion rate (dry weight)	0.101786153	kg dw/day	[1]
Food ingestion rate (wet weight, A)	0.40714461	kg ww/day	[2]
Bioconcentration factor (BCF)	1	L/kg fish	
Proportion of Diet Contaminated (Prop)	1	unitless	
Toxicity reference value (TRV)	27	mg/kg-bw/day	

MAXIMUM APPLICATION RATE

GLEAMS ID	Annual Precipitation (inches)	Application Area (acres)	Hydraulic Slope (ft/ft)	Surface Roughness	USLE Soil Erodibility Factor (ton/ac per EI)	Vegetation Type	Soil Type	Pond Concentration (mg/L)	Concentrations in fish (C_{Fish}): WC × BCF	Dose estimates (D): C_{Fish} × A × Prop / W	Risk Quotient
G_BASE_SAND_005_POND_max	5	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_005_POND_max	5	10	0.05	0.015	0.401	weeds (79)	Clay	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_005_POND_max	5	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_010_POND_max	10	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_010_POND_max	10	10	0.05	0.015	0.401	weeds (79)	Clay	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_010_POND_max	10	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_025_POND_max	25	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_025_POND_max	25	10	0.05	0.015	0.401	weeds (79)	Clay	4.34E-10	4.34E-10	3.43E-11	1.27E-12
G_BASE_LOAM_025_POND_max	25	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_050_POND_max	50	10	0.05	0.015	0.401	weeds (79)	Sand	8.65E-08	8.65E-08	6.84E-09	2.53E-10
G_BASE_CLAY_050_POND_max	50	10	0.05	0.015	0.401	weeds (79)	Clay	2.79E-05	2.79E-05	2.20E-06	8.16E-08
G_BASE_LOAM_050_POND_max	50	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_100_POND_max	100	10	0.05	0.015	0.401	weeds (79)	Sand	4.52E-06	4.52E-06	3.58E-07	1.32E-08
G_BASE_CLAY_100_POND_max	100	10	0.05	0.015	0.401	weeds (79)	Clay	2.17E-04	2.17E-04	1.72E-05	6.35E-07
G_BASE_LOAM_100_POND_max	100	10	0.05	0.015	0.401	weeds (79)	Loam	2.36E-07	2.36E-07	1.87E-08	6.92E-10
G_BASE_SAND_150_POND_max	150	10	0.05	0.015	0.401	weeds (79)	Sand	4.76E-05	4.76E-05	3.77E-06	1.39E-07
G_BASE_CLAY_150_POND_max	150	10	0.05	0.015	0.401	weeds (79)	Clay	2.37E-03	2.37E-03	1.88E-04	6.95E-06
G_BASE_LOAM_150_POND_max	150	10	0.05	0.015	0.401	weeds (79)	Loam	2.05E-07	2.05E-07	1.62E-08	5.99E-10
G_BASE_SAND_200_POND_max	200	10	0.05	0.015	0.401	weeds (79)	Sand	1.32E-04	1.32E-04	1.05E-05	3.88E-07
G_BASE_CLAY_200_POND_max	200	10	0.05	0.015	0.401	weeds (79)	Clay	6.32E-03	6.32E-03	5.00E-04	1.85E-05
G_BASE_LOAM_200_POND_max	200	10	0.05	0.015	0.401	weeds (79)	Loam	1.60E-07	1.60E-07	1.27E-08	4.70E-10
G_BASE_SAND_250_POND_max	250	10	0.05	0.015	0.401	weeds (79)	Sand	1.95E-04	1.95E-04	1.54E-05	5.71E-07
G_BASE_CLAY_250_POND_max	250	10	0.05	0.015	0.401	weeds (79)	Clay	1.02E-02	1.02E-02	8.07E-04	2.99E-05
G_BASE_LOAM_250_POND_max	250	10	0.05	0.015	0.401	weeds (79)	Loam	1.01E-04	1.01E-04	8.02E-06	2.97E-07
G_ARV1_050_POND_max	50	1	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ARV2_050_POND_max	50	100	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ARV3_050_POND_max	50	1000	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ERV1_050_POND_max	50	10	0.05	0.015	0.05	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ERV2_050_POND_max	50	10	0.05	0.015	0.2	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ERV3_050_POND_max	50	10	0.05	0.015	0.5	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_RGV1_050_POND_max	50	10	0.05	0.023	0.401	weeds (79)	Loam	2.10E-05	2.10E-05	1.66E-06	6.16E-08
G_RGV2_050_POND_max	50	10	0.05	0.046	0.401	weeds (79)	Loam	2.09E-06	2.09E-06	1.65E-07	6.13E-09
G_RGV3_050_POND_max	50	10	0.05	0.15	0.401	weeds (79)	Loam	2.39E-06	2.39E-06	1.89E-07	7.00E-09
G_SLV1_050_POND_max	50	10	0.005	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_SLV2_050_POND_max	50	10	0.01	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_SLV3_050_POND_max	50	10	0.1	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_STV1_050_POND_max	50	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_STV2_050_POND_max	50	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_STV3_050_POND_max	50	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_VGV1_050_POND_max	50	10	0.05	0.015	0.401	Shrub	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_VGV2_050_POND_max	50	10	0.05	0.015	0.401	Rye Grass	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_VGV3_050_POND_max	50	10	0.05	0.015	0.401	Conifer-Hardwooc	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Risk Quotient = Estimated Dose/Toxicity Reference Value
Shading and boldface indicates piscivorous bird RQs greater than 0.1.

[1] Calculated using alorithm developed by Nagy, 1987 for all birds; where
Food Ingestion Rate (kg dw/day) = 0.0582*(BW)^0.651
[2] Assumes fish are 75% water (USEPA, 1993; Table 4-1 - value for bony fishes)

Table C-20: Impact to non-target terrrestrial plants from wind erosion

WIND EROSION - modeled in AERMOD and CalPuff							
TYPICAL APPLICATION RATE							
AERMOD/ CalPuff Scenario ID	**Watershed Location**	**Distance From Receptor (km)**	**Terrestrial Concentration (lb a.e./acre)**	**Typical Species TRV**	**Typical Species RQ**	**Threatened & Endangered Species TRV**	**Threatened & Endangered Species RQ**
dust_MT_1.5_typ	MT	1.5	2.50E-04	2.00E-03	1.25E-01	3.00E-04	8.33E-01
dust_MT_10_typ	MT	10	7.33E-06	2.00E-03	3.66E-03	3.00E-04	2.44E-02
dust_MT_100_typ	MT	100	2.56E-07	2.00E-03	1.28E-04	3.00E-04	8.53E-04
dust_OR_1.5_typ	OR	1.5	2.87E-03	2.00E-03	**1.44E+00**	3.00E-04	**9.57E+00**
dust_OR_10_typ	OR	10	7.67E-05	2.00E-03	3.84E-02	3.00E-04	2.56E-01
dust_OR_100_typ	OR	100	1.87E-06	2.00E-03	9.37E-04	3.00E-04	6.25E-03
dust_WY_1.5_typ	WY	1.5	1.48E-03	2.00E-03	7.38E-01	3.00E-04	**4.92E+00**
dust_WY_10_typ	WY	10	5.28E-05	2.00E-03	2.64E-02	3.00E-04	1.76E-01
dust_WY_100_typ	WY	100	1.68E-06	2.00E-03	8.42E-04	3.00E-04	5.62E-03

WIND EROSION - modeled in AERMOD and CalPuff							
MAXIMUM APPLICATION RATE							
AERMOD/ CalPuff Scenario ID	**Watershed Location**	**Distance From Receptor (km)**	**Terrestrial Concentration (lb a.e./acre)**	**Typical Species TRV**	**Typical Species RQ**	**Threatened & Endangered Species TRV**	**Threatened & Endangered Species RQ**
dust_MT_1.5_max	MT	1.5	5.00E-04	2.00E-03	2.50E-01	3.00E-04	**1.67E+00**
dust_MT_10_max	MT	10	1.47E-05	2.00E-03	7.33E-03	3.00E-04	4.88E-02
dust_MT_100_max	MT	100	5.12E-07	2.00E-03	2.56E-04	3.00E-04	1.71E-03
dust_OR_1.5_max	OR	1.5	5.74E-03	2.00E-03	**2.87E+00**	3.00E-04	**1.91E+01**
dust_OR_10_max	OR	10	1.53E-04	2.00E-03	7.67E-02	3.00E-04	5.11E-01
dust_OR_100_max	OR	100	3.75E-06	2.00E-03	1.87E-03	3.00E-04	1.25E-02
dust_WY_1.5_max	WY	1.5	2.95E-03	2.00E-03	**1.48E+00**	3.00E-04	**9.84E+00**
dust_WY_10_max	WY	10	1.06E-04	2.00E-03	5.28E-02	3.00E-04	3.52E-01
dust_WY_100_max	WY	100	3.37E-06	2.00E-03	1.68E-03	3.00E-04	1.12E-02

RQ = Risk Quotient = Estimated Dose/Toxicity Reference Value

Shading and boldface indicates plant RQs greater than 1.

Table C-21: Impact to aquatic species from accidental spill to pond

Parameters/Assumptions	Value	Units
Volume of pond (Vp)	1011715	L
Volume of spill		
Truck ($Vspill_t$)	757	L
Helicopter($Vspill_h$)	529.9	L
Herbicide concentration		
Truck mixture (Cm_t)	9587.15	mg a.e./L
Helicopter mixture (Cm_h)	47935.75	mg a.e./L

			Risk Quotients		
Scenario	**Concentrations in water (Cw): Cm × Vspill / Vp**	**Units**	**Fish**	**Aquatic Invertebrates**	**Non-Target Aquatic Plants**
Truck spill into pond	7.17	mg a.e./L	**3.99E+00**	**5.52E-01**	**7.17E+01**
Helicopter spill into pond	25.11	mg a.e./L	**1.39E+01**	**1.93E+00**	**2.51E+02**

Shading and boldface indicates plant RQs greater than 1.
Shading and boldface indicates acute RQs greater than 0.05 for fish and invertebrates.

Table C-22: Impact to aquatic species from accidental direct spray of pond and stream

Parameters/Assumptions		Value	Units
Application rates (R)			
	Typical	1	lb/acre
	Maximum	2	lb/acre
Area of pond (Area)		0.25	acre
Volume of pond (Vol)		1011715	L
Mass sprayed on pond (R x Area)			
	Typical	113398	mg
	Maximum	226796	mg
Concentration in pond water (Mass/Volume)			
	Typical	0.112084925	mg/L
	Maximum	0.22416985	mg/L
Width of stream		2	m
Length of stream impacted by direct spray		636.15	m
Area of stream impacted by spray (Area)		1272.3	m2
Depth of stream		0.2	m
Instantaneous volume of stream impacted by direct spray (Vol)		254460	L
Mass sprayed on stream (R x Area)			
	Typical	1272.300	lb
	Maximum	2544.600	lb
Mass sprayed on stream - converted to mg			
	Typical	142607.060	mg
	Maximum	285214.120	mg
Concentration in stream water (Mass/Vol)			
	Typical	0.560430165	mg/L
	Maximum	1.12086033	mg/L

			Risk Quotients		
Scenario		**Concentration in water (mg/L)**	**Fish**	**Aquatic Invertebrates**	**Non-Target Aquatic Plants**
Acute					
Direct spray to pond					
	Typical application	1.12E-01	**6.23E-02**	8.62E-03	**1.12E+00**
	Maximum application	2.24E-01	**1.25E-01**	1.72E-02	**2.24E+00**
Direct spray to stream					
	Typical application	5.60E-01	**3.11E-01**	4.31E-02	**5.60E+00**
	Maximum application	1.12E+00	**6.23E-01**	**8.62E-02**	**1.12E+01**
Chronic					
Direct spray to pond					
	Typical application	1.12E-01	**2.04E+00**	**5.60E-01**	**3.74E+00**
	Maximum application	2.24E-01	**4.08E+00**	**1.12E+00**	**7.47E+00**
Direct spray to stream					
	Typical application	5.60E-01	**1.02E+01**	**2.80E+00**	**1.87E+01**
	Maximum application	1.12E+00	**2.04E+01**	**5.60E+00**	**3.74E+01**

Shading and boldface indicates plant RQs greater than 1.
Shading and boldface indicates acute RQs greater than 0.05 for fish and invertebrates.

APPENDIX B.23 – B.44 – ECOLOGICAL RISK ASSESSMENT WORKSHEETS – TERRESTRIAL APPLICATION FOR ANNUAL AND PERENNIAL VEGETATION – 2,4-D ESTERS

Table C-23: Direct spray of terrestrial receptors and exposure from indirect contact with foliage

Parameter		Pollinating Insect	Small Mammal	Units
Duration of Exposure (T)		24	24	hours
Body weight (W)		0.000093	0.02	kg
Surface Areas (A): cm^2 = 12.3 * BW(g)^0.65				
		2.63	86.21	cm^2
Application rates (R)				
	Typical	1	1	mg/cm^2
	Maximum	2	2	
Amount deposited on 1/2 receptor (Amnt): 0.5 × A × R				
	Typical	0.014739168	0.48314207	mg
	Maximum	0.029478335	0.966284139	
Dose Estimate Assuming 100% Dermal Adsorption				
Absorbed Dose: Amnt × Prop ÷ W				
	Typical	1.58E+02	2.42E+01	mg/kg bw
	Maximum	3.17E+02	4.83E+01	
Dose Estimate Assuming First Order Dermal Adsorption				
First-order dermal absorption rates (k)				
	Central estimate (ka)	0.138629436	0.138629436	$hour^{-1}$
Proportion absorbed over period T (Prop): 1-exp(-k T)				
	Typical	0.113079563	0.113079563	unitless
	Maximum	0.113079563	0.113079563	
Absorbed Dose: Amnt × Prop ÷ W				
	Typical	1.79E+01	2.73E+00	mg/kg bw
	Maximum	3.58E+01	5.46E+00	

RISK QUOTIENTS - Direct Spray	Toxicity Reference Value	Typical Application	Maximum Application
Small mammal - 100% absorption	2193	1.10E-02	2.20E-02
Pollinating insect - 100% absorption	140	1.13E+00	2.26E+00
Small mammal - 1st order dermal adsorption	2193	1.25E-03	2.49E-03
Pollinating insect - 1st order dermal adsorption	140	1.28E-01	2.56E-01

RISK QUOTIENTS - Indirect Contact *	Toxicity Reference Value	Typical Application	Maximum Application
Small mammal - 100% absorption	2193	1.10E-03	2.20E-03
Pollinating insect - 100% absorption	140	1.13E-01	2.26E-01
Small mammal - 1st order dermal adsorption	2193	1.25E-04	2.49E-04
Pollinating insect - 1st order dermal adsorption	140	1.28E-02	2.56E-02

Surface area calculation for mammals from Stahl, 1967 (presented in USEPA, 1993).
No surface area calculation identified for insects. Mammalian equation used as a surrogate.
Risk Quotient = Estimated Dose/Toxicity Reference Value
* Exposure from indirect contact assumed to be 1/10 of direct spray exposure

Table C-24: Consumption of contaminated berries by a small mammal - acute exposure scenario

Parameters/Assumptions		Value	Units	Notes
Body Weight (W)		0.02	kg	
Food ingestion rate (dry weight)		0.0033641	kg dw/day	[1]
Food ingestion rate (wet weight, A)		0.014626644	kg ww/day	[2]
Application rates (R)				
	Typical	1	lb/acre	
	Maximum	2		
Residue rate - berries (rr)				
	Typical	1.5	mg/kg per lb/acre	
	Maximum	7		
Concentration on berries (C): R × rr				
	Typical	1.5	mg/kg fruit	
	Maximum	14		
Dose estimates (D): C × A / W				
	Typical	1.10E+00	mg/kg bw	
	Maximum	1.02E+01		

RISK QUOTIENTS - Ingestion	**Toxicity Reference Value**	**Typical Application**	**Maximum Application**
Small mammal - acute exposure	1184	9.27E-04	8.65E-03

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987 for rodents; where

Food Ingestion Rate (g dw/day) = 0.621*(BW g)^0.564; converted into kg dw/day

[2] Assumes fruit is 77% water (USEPA, 1993; Table 4-2 - value for fruit pulp and skin)

Table C-25: Consumption of contaminated fruit by a small mammal - chronic exposure scenario

Parameters/Assumptions		Value	Units	
Duration of exposure (T)		90	days	
Body Weight (W)		0.02	kg	
Food ingestion rate (dry weight)		0.0033641	kg dw/day	[1]
Food ingestion rate (wet weight, A)		0.014626644	kg ww/day	[2]
Half life on vegetation (t50)				
	Herbicide specific	5	days	
Application rates (R)				
	Typical	1	lb/acre	
	Maximum	2		
Residue rate - berries (rr)				
	Typical	1.5	mg/kg per lb/acre	
	Maximum	7		
Drift (Drift)				
	Typical	1	unitless	
	Maximum	1		
Decay Coefficient (k): ln(2)/t50				
	Typical	0.138629436	$days^{-1}$	
	Maximum	0.138629436		
Initial concentration on berries (C0): R × rr × Drift				
	Typical	1.5	mg/kg fruit	
	Maximum	14		
Concentration on berries at time T: C0 * exp(-k*T)				
	Typical	5.72205E-06	mg/kg fruit	
	Maximum	5.34058E-05		
Time-weighted Average Concentration on vegetation (CTWA): C0 * (1-exp(-k*T))/(k*T)				
	Typical	0.120224128	mg/kg fruit	
	Maximum	1.122091862		
Proportion of Diet Contaminated (Prop)				
	Typical	1	unitless	
	Maximum	1		
Dose estimates (D): CTWA × A × Prop / W				
	Typical	0.087923774	mg/kg bw	
	Maximum	0.820621893		

RISK QUOTIENTS - Ingestion	Toxicity Reference Value	Typical Application	Maximum Application
Small mammal - chronic exposure	10	8.79E-03	8.21E-02

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987 for rodents; where

Food Ingestion Rate (g dw/day) = 0.621*(BW g)^0.564; converted into kg dw/day

[2] Assumes fruit is 77% water (USEPA, 1993; Table 4-2 - value for fruit pulp and skin)

Table C-26: Consumption of contaminated grass by a large mammal - acute exposure scenario

Parameters/Assumptions		Value	Units	Notes
Body Weight (W)		70	kg	
Food ingestion rate (dry weight)		1.9211536	kg dw/day	[1]
Food ingestion rate (wet weight, A)		6.40384532	kg ww/day	[2]
Duration of exposure (D)		1	day	
Application rates (R)				
	Typical	1	lb/acre	
	Maximum	2		
Residue rate - grass (rr)				
	Typical	92	mg/kg per lb/acre	
	Maximum	110		
Concentration on grass (C): R × rr				
	Typical	92	mg/kg grass	
	Maximum	220		
Drift (Drift)				
	Typical	1	unitless	
	Maximum	1		
Proportion of Diet Contaminated (Prop)				
	Typical	1	unitless	
	Maximum	1		
Dose estimates: Drift × Prop × C × A ÷W				
	Typical	8.42E+00	mg/kg bw	
	Maximum	2.01E+01		

RISK QUOTIENTS - Ingestion	Toxicity Reference Value	Typical Application	Maximum Application
Large mammal - acute exposure	51	1.65E-01	3.95E-01

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987 for herbivores; where

Food Ingestion Rate (g dw/day) = 0.577*(BW g)^0.727; converted into kg dw/day

[2] Assumes grass is 70% water (USEPA, 1993; Table 4-2 - lowest value for young grasses)

Table C-27: Consumption of contaminated grass by a large mammal - chronic exposure scenario

Parameters/Assumptions		Value	Units	Notes
Duration of exposure (T)		90	day	
Body Weight (W)		70	kg	
Food ingestion rate (dry weight)		1.921153597	kg dw/day	[1]
Food ingestion rate (wet weight, A)		6.403845323	kg ww/day	[2]
Half life on vegetation (t50)				
	Herbicide specific	5	days	
Application rates (R)				
	Typical	1	lb/acre	
	Maximum	2		
Residue rate - grass (rr)				
	Typical	92	mg/kg per lb/acre	
	Maximum	110		
Drift (Drift)				
	Typical	1	unitless	
	Maximum	1		
Decay Coefficient (k): ln(2)/t50				
	Typical	0.138629436	$days^{-1}$	
	Maximum	0.138629436		
Initial concentration on grass (C0): R × rr × Drift				
	Typical	92	mg/kg grass	
	Maximum	220		
Concentration on grass at time T: C0 * exp(-k*T)				
	Typical	0.000350952	mg/kg grass	
	Maximum	0.000839233		
Time-weighted Average Concentration on vegetation (CTWA): C0 * (1-exp(-k*T))/(k*T)				
	Typical	7.373746525	mg/kg vegetation	
	Maximum	17.63287212		
Proportion of Diet Contaminated (Prop)				
	Typical	1	unitless	
	Maximum	1		
Dose estimates: CTWA × A × Prop / W				
	Typical	6.75E-01	mg/kg bw	
	Maximum	1.61E+00		

RISK QUOTIENTS - Ingestion	Toxicity Reference Value	Typical Application	Maximum Application
Large mammal - chronic exposure	1	6.75E-01	1.61E+00

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987 for herbivores; where

Food Ingestion Rate (g dw/day) = 0.577*(BW g)^0.727; converted into kg dw/day

[2] Assumes grass is 70% water (USEPA, 1993; Table 4-2 - lowest value for young grasses)

Table C-28: Consumption of contaminated small mammals by a large mammal - acute exposure scenario

Parameters/Assumptions		Value	Units	Notes
Body Weight (W)		12	kg	
Food ingestion rate (dry weight)		0.52971677	kg dw/day	[1]
Food ingestion rate (wet weight, A)		1.6553649	kg ww/day	[2]
Duration of exposure (D)		1	day	
Application rates (R)				
	Typical	1	lb/acre	
	Maximum	2		
Amount deposited on small mammal prey (Amnt_mouse): 0.5 × SurfaceArea × R				
	Typical	0.48314207	mg	
	Maximum	0.96628414		
Drift (Drift)				
	Typical	1	unitless	
	Maximum	1		
Proportion of Diet Contaminated (Prop)				
	Typical	1	unitless	
	Maximum	1		
Dose estimates: Drift × Prop × Amnt_mouse/BW_mouse × A ÷W				
	Typical	3.33E+00	mg/kg bw	
	Maximum	6.66E+00		

RISK QUOTIENTS - Ingestion	Toxicity Reference Value	Typical Application	Maximum Application
Large carnivorous mammal - acute exposure	80	4.17E-02	8.33E-02

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987; where

Food Ingestion Rate (g dw/day) = 0.0687*(BW g)^0.822; converted into kg dw/day

[2] Assumes mammals are 68% water (USEPA, 1993)

Table C-29: Consumption of contaminated small mammals by a large mammal - chronic exposure scenario

Parameters/Assumptions		Value	Units	Notes
Duration of exposure (T)		90	day	
Body Weight (W)		12	kg	
Food ingestion rate (dry weight)		0.529716769	kg dw/day	[1]
Food ingestion rate (wet weight, FIR_coyote)		1.655364903	kg ww/day	[2]
Application rates (R)				
	Typical	1	lb/acre	
	Maximum	2		
Drift (Drift)				
	Typical	1	unitless	
	Maximum	1		
Decay Coefficient (k): ln(2)/t50				
	Typical	0.138629436	$days^{-1}$	
	Maximum	0.138629436		
Initial concentration on mammal (C0): 0.5 × SurfaceArea × R/BW_smallmammal				
	Typical	24.15710348	mg a.e./kg mammal	
	Maximum	48.31420697		
Concentration absorbed in small mammal at time T (C90): C0 * exp(-k*T)				
	Typical	2.731674712	mg/kg mammal	
	Maximum	5.463349424		
Proportion of Diet Contaminated (Prop)				
	Typical	1	unitless	
	Maximum	1		
Dose estimates: C90 × FIR_coyote × Prop / W				
	Typical	3.77E-01	mg/kg bw	
	Maximum	7.54E-01		

RISK QUOTIENTS - Ingestion	Toxicity Reference Value	Typical Application	Maximum Application
Large mammal - chronic exposure	1	3.77E-01	7.54E-01

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987; where

Food Ingestion Rate (g dw/day) = 0.0687*(BW g)^0.822; converted into kg dw/day

[2] Assumes mammals are 68% water (USEPA, 1993)

Table C-30: Consumption of contaminated insects by a small bird - acute exposure scenario

Parameters/Assumptions		Value	Units	Notes
Body Weight (W)		0.08	kg	
Food ingestion rate (dry weight)		0.01124177	kg dw/day	[1]
Food ingestion rate (wet weight, A)		0.03626376	kg ww/day	[2]
Duration of exposure (D)		1	day	
Application rates (R)				
	Typical	1	lb/acre	
	Maximum	2		
Residue rate - insects (rr)				
	Typical	33	mg/kg per lb/acre	
	Maximum	58		
Concentration on insects (C): R × rr				
	Typical	33	mg/kg insect	
	Maximum	116		
Drift (Drift)				
	Typical	1	unitless	
	Maximum	1		
Proportion of Diet Contaminated (Prop)				
	Typical	1	unitless	
	Maximum	1		
Dose estimates: Drift × Prop × C × A ÷W				
	Typical	1.50E+01	mg/kg bw	
	Maximum	5.26E+01		

RISK QUOTIENTS - Ingestion	Toxicity Reference Value	Typical Application	Maximum Application
Small bird - acute exposure	217	6.89E-02	2.42E-01

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987 for all birds; where
Food Ingestion Rate (kg dw/day) = 0.0582*(BW)^0.651

[2] Assumes insects are 69% water (USEPA, 1993; Table 4-1 - value for grasshoppers and crickets)

Table C-31: Consumption of contaminated insects by a small bird - chronic exposure scenario

Parameters/Assumptions		Value	Units	Notes
Duration of exposure (T)		90	day	
Body Weight (W)		0.08	kg	
Food ingestion rate (dry weight)		0.011241767	kg dw/day	[1]
Food ingestion rate (wet weight, A)		0.036263763	kg ww/day	[2]
Half life on insect (t50)				
	Herbicide specific	5	days	
Application rates (R)				
	Typical	1	lb/acre	
	Maximum	2		
Residue rate - insects (rr)				
	Typical	33	mg/kg per lb/acre	
	Maximum	58		
Drift (Drift)				
	Typical	1	unitless	
	Maximum	1		
Decay Coefficient (k): ln(2)/t50				
	Typical	0.138629436	$days^{-1}$	
	Maximum	0.138629436		
Initial concentration on insects (C0): R × rr × Drift				
	Typical	33	mg/kg insect	
	Maximum	116		
Concentration on insects at time T: C0 * exp(-k*T)				
	Typical	0.000125885	mg/kg insect	
	Maximum	0.000442505		
Time-weighted Average Concentration on insects (CTWA): C0 * (1-exp(-k*T))/(k*T)				
	Typical	2.644930819	mg/kg insect	
	Maximum	9.297332575		
Proportion of Diet Contaminated (Prop)				
	Typical	1	unitless	
	Maximum	1		
Dose estimates (D): CTWA × A × Prop / W				
	Typical	1.20E+00	mg/kg bw	
	Maximum	4.21E+00		

RISK QUOTIENTS - Ingestion	Toxicity Reference Value	Typical Application	Maximum Application
Small bird - chronic exposure	27	4.44E-02	1.56E-01

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987 for all birds; where

Food Ingestion Rate (kg dw/day) = 0.0582*(BW)^0.651

[2] Assumes insects are 69% water (USEPA, 1993; Table 4-1 - value for grasshoppers and crickets)

Table C-32: Consumption of contaminated vegetation by a large bird - acute exposure scenario

Parameters/Assumptions		Value	Units	Notes
Body Weight (W)		3.72	kg	
Food ingestion rate (dry weight)		0.13688203	kg dw/day	[1]
Food ingestion rate (wet weight, A)		0.91254687	kg ww/day	[2]
Duration of exposure (D)		1	day	
Application rates (R)				
	Typical	1	lb/acre	
	Maximum	2		
Residue rate - vegetation (rr)				
	Typical	35	mg/kg per lb/acre	
	Maximum	125		
Concentration on vegetation (C): R × rr				
	Typical	35	mg/kg veg	
	Maximum	250		
Drift (Drift)				
	Typical	1	unitless	
	Maximum	1		
Proportion of Diet Contaminated (Prop)				
	Typical	1	unitless	
	Maximum	1		
Dose estimates: Drift × Prop × C × A ÷W				
	Typical	8.59E+00		
	Maximum	6.13E+01		

RISK QUOTIENTS - Ingestion	Toxicity Reference Value	Typical Application	Maximum Application
Large bird - acute exposure	314	2.73E-02	1.95E-01

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987 for all birds; where

Food Ingestion Rate (kg dw/day) = 0.0582*(BW)^0.651

[2] Assumes vegetation is 85% water (USEPA, 1993; Table 4-2 - value for dicots)

Table C-33: Consumption of contaminated vegetation by a large bird - chronic exposure scenario

Parameters/Assumptions		Value	Units	Notes
Duration of exposure (T)		90	day	
Body Weight (W)		3.72	kg	
Food ingestion rate (dry weight)		0.13688203	kg dw/day	[1]
Food ingestion rate (wet weight, A)		0.912546869	kg ww/day	[2]
Half life on vegetation (t50)				
	Herbicide specific	5	days	
Application rates (R)				
	Typical	1	lb/acre	
	Maximum	2		
Residue rate - vegetation (rr)				
	Typical	35	mg/kg per lb/acre	
	Maximum	125		
Drift (Drift)				
	Typical	1	unitless	
	Maximum	1		
Decay Coefficient (k): ln(2)/t50				
	Typical	0.138629436	$days^{-1}$	
	Maximum	0.138629436		
Initial concentration on vegetation (C0): R × rr × Drift				
	Typical	35	mg/kg veg	
	Maximum	250		
Concentration on vegetation at time T: C0 * exp(-k*T)				
	Typical	0.000133514	mg/kg veg	
	Maximum	0.000953674		
Time-weighted Average Concentration on vegetation (CTWA): C0 * (1-exp(-k*T))/(k*T)				
	Typical	2.805229656	mg/kg veg	
	Maximum	20.03735469		
Proportion of Diet Contaminated (Prop)				
	Typical	1	unitless	
	Maximum	1		
Dose estimates (D): CTWA × A × Prop / W				
	Typical	6.88E-01	mg/kg bw	
	Maximum	4.92E+00		

RISK QUOTIENTS - Ingestion	Toxicity Reference Value	Typical Application	Maximum Application
Large bird - chronic exposure	27	2.55E-02	1.82E-01

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987 for all birds; where
Food Ingestion Rate (kg dw/day) = 0.0582*(BW)^0.651

[2] Assumes vegetation is 85% water (USEPA, 1993; Table 4-2 - value for dicots)

Table C-34: Impact to aquatic species from accidental spray drift to pond

OFF-SITE DRIFT - modeled in AgDrift
TYPICAL APPLICATION RATE

Mode of Application	Application Height or Type	Distance From Receptor (ft)	Pond Concentration (mg/L)	Risk Quotients - Acute: Fish	Risk Quotients - Acute: Aquatic Invertebrates	Risk Quotients - Acute: Non-Target Aquatic Plants	Risk Quotients - Chronic: Fish	Risk Quotients - Chronic: Aquatic Invertebrates	Risk Quotients - Chronic: Non-Target Aquatic Plants
Plane	Forested	100	5.00E-03	2.50E-02	**1.16E+00**	**1.25E+01**	9.10E-02	2.50E-02	1.67E-01
Plane	Forested	300	1.88E-03	9.42E-03	**4.38E-01**	**4.71E+00**	3.42E-02	9.42E-03	6.28E-02
Plane	Forested	900	6.00E-04	3.00E-03	**1.39E-01**	**1.50E+00**	1.09E-02	3.00E-03	2.00E-02
Plane	Non-Forested	100	2.56E-03	1.28E-02	**5.95E-01**	**6.40E+00**	4.65E-02	1.28E-02	8.53E-02
Plane	Non-Forested	300	1.15E-03	5.73E-03	**2.66E-01**	**2.86E+00**	2.08E-02	5.73E-03	3.82E-02
Plane	Non-Forested	900	5.11E-04	2.56E-03	**1.19E-01**	**1.28E+00**	9.30E-03	2.56E-03	1.70E-02
Helicopter	Forested	100	2.96E-04	1.48E-03	**6.88E-02**	7.40E-01	5.38E-03	1.48E-03	9.86E-03
Helicopter	Forested	300	8.38E-05	4.19E-04	1.95E-02	2.09E-01	1.52E-03	4.19E-04	2.79E-03
Helicopter	Forested	900	1.41E-05	7.03E-05	3.27E-03	3.52E-02	2.56E-04	7.03E-05	4.69E-04
Helicopter	Non-Forested	100	2.13E-03	1.07E-02	**4.96E-01**	**5.34E+00**	3.88E-02	1.07E-02	7.12E-02
Helicopter	Non-Forested	300	9.11E-04	4.55E-03	**2.12E-01**	**2.28E+00**	1.66E-02	4.55E-03	3.04E-02
Helicopter	Non-Forested	900	4.48E-04	2.24E-03	**1.04E-01**	**1.12E+00**	8.14E-03	2.24E-03	1.49E-02
Ground	Low Boom	25	6.82E-04	3.41E-03	**1.59E-01**	**1.70E+00**	1.24E-02	3.41E-03	2.27E-02
Ground	Low Boom	100	3.74E-04	1.87E-03	**8.69E-02**	9.35E-01	6.80E-03	1.87E-03	1.25E-02
Ground	Low Boom	900	1.90E-04	9.49E-04	4.41E-02	4.74E-01	3.45E-03	9.49E-04	6.32E-03
Ground	High Boom	25	1.05E-02	**5.24E-02**	**2.44E+00**	**2.62E+01**	1.90E-01	5.24E-02	3.49E-01
Ground	High Boom	100	2.97E-03	1.48E-02	**6.90E-01**	**7.42E+00**	5.39E-02	1.48E-02	9.89E-02
Ground	High Boom	900	2.51E-04	1.25E-03	**5.83E-02**	6.27E-01	4.56E-03	1.25E-03	8.36E-03

OFF-SITE DRIFT - modeled in AgDrift
MAXIMUM APPLICATION RATE

Mode of Application	Application Height or Type	Distance From Receptor (ft)	Pond Concentration (mg/L)	Risk Quotients - Acute: Fish	Risk Quotients - Acute: Aquatic Invertebrates	Risk Quotients - Acute: Non-Target Aquatic Plants	Risk Quotients - Chronic: Fish	Risk Quotients - Chronic: Aquatic Invertebrates	Risk Quotients - Chronic: Non-Target Aquatic Plants
Plane	Forested	100	1.01E-02	**5.06E-02**	**2.35E+00**	**2.53E+01**	1.84E-01	5.06E-02	3.37E-01
Plane	Forested	300	3.90E-03	1.95E-02	**9.08E-01**	**9.76E+00**	7.10E-02	1.95E-02	1.30E-01
Plane	Forested	900	1.31E-03	6.54E-03	**3.04E-01**	**3.27E+00**	2.38E-02	6.54E-03	4.36E-02
Plane	Non-Forested	100	5.60E-03	2.80E-02	**1.30E+00**	**1.40E+01**	1.02E-01	2.80E-02	1.87E-01
Plane	Non-Forested	300	2.64E-03	1.32E-02	**6.14E-01**	**6.60E+00**	4.80E-02	1.32E-02	8.80E-02
Plane	Non-Forested	900	1.06E-03	5.28E-03	**2.46E-01**	**2.64E+00**	1.92E-02	5.28E-03	3.52E-02
Helicopter	Forested	100	5.55E-04	2.78E-03	**1.29E-01**	**1.39E+00**	1.01E-02	2.78E-03	1.85E-02
Helicopter	Forested	300	1.63E-04	8.14E-04	3.79E-02	4.07E-01	2.96E-03	8.14E-04	5.43E-03
Helicopter	Forested	900	2.92E-05	1.46E-04	6.78E-03	7.29E-02	5.30E-04	1.46E-04	9.72E-04
Helicopter	Non-Forested	100	4.56E-03	2.28E-02	**1.06E+00**	**1.14E+01**	8.30E-02	2.28E-02	1.52E-01
Helicopter	Non-Forested	300	2.05E-03	1.02E-02	**4.76E-01**	**5.11E+00**	3.72E-02	1.02E-02	6.82E-02
Helicopter	Non-Forested	900	6.83E-04	3.42E-03	**1.59E-01**	**1.71E+00**	1.24E-02	3.42E-03	2.28E-02
Ground	Low Boom	25	1.36E-03	6.82E-03	**3.17E-01**	**3.41E+00**	2.48E-02	6.82E-03	4.54E-02
Ground	Low Boom	100	7.48E-04	3.74E-03	**1.74E-01**	**1.87E+00**	1.36E-02	3.74E-03	2.49E-02
Ground	Low Boom	900	3.80E-04	1.90E-03	**8.83E-02**	9.49E-01	6.90E-03	1.90E-03	1.27E-02
Ground	High Boom	25	2.10E-02	**1.05E-01**	**4.87E+00**	**5.24E+01**	3.81E-01	1.05E-01	6.99E-01
Ground	High Boom	100	5.94E-03	2.97E-02	**1.38E+00**	**1.48E+01**	1.08E-01	2.97E-02	1.98E-01
Ground	High Boom	900	5.02E-04	2.51E-03	**1.17E-01**	**1.26E+00**	9.13E-03	2.51E-03	1.67E-02

RQ = Risk Quotient = Estimated Dose/Toxicity Reference Value

Shading and boldface indicates plant RQs greater than 1.
Shading and boldface indicates acute RQs greater than 0.05 for fish and invertebrates.
Shading and boldface indicates chronic RQs greater than 0.5 for fish and invertebrates.

Table C-35: Impact to aquatic species from accidental spray drift to stream

OFF-SITE DRIFT - modeled in AgDrift
TYPICALAPPLICATION RATE

Mode of Application	Application Height or Type	Distance From Receptor (ft)	Stream Concentration (mg/L)	Risk Quotients - Acute: Fish	Risk Quotients - Acute: Aquatic Invertebrates	Risk Quotients - Acute: Non-Target Aquatic Plants	Risk Quotients - Chronic: Fish	Risk Quotients - Chronic: Aquatic Invertebrates	Risk Quotients - Chronic: Non-Target Aquatic Plants
Plane	Forested	100	7.20E-03	3.60E-02	**1.67E+00**	**1.80E+01**	1.31E-01	3.60E-02	2.40E-01
Plane	Forested	300	2.14E-03	1.07E-02	**4.99E-01**	**5.36E+00**	3.90E-02	1.07E-02	7.15E-02
Plane	Forested	900	6.22E-04	3.11E-03	**1.45E-01**	**1.55E+00**	1.13E-02	3.11E-03	2.07E-02
Plane	Non-Forested	100	3.39E-03	1.69E-02	**7.87E-01**	**8.47E+00**	6.16E-02	1.69E-02	1.13E-01
Plane	Non-Forested	300	1.23E-03	6.15E-03	**2.86E-01**	**3.07E+00**	2.23E-02	6.15E-03	4.10E-02
Plane	Non-Forested	900	5.22E-04	2.61E-03	**1.21E-01**	**1.30E+00**	9.49E-03	2.61E-03	1.74E-02
Helicopter	Forested	100	4.00E-04	2.00E-03	**9.29E-02**	9.99E-01	7.26E-03	2.00E-03	1.33E-02
Helicopter	Forested	300	9.80E-05	4.90E-04	2.28E-02	2.45E-01	1.78E-03	4.90E-04	3.27E-03
Helicopter	Forested	900	1.57E-05	7.83E-05	3.64E-03	3.92E-02	2.85E-04	7.83E-05	5.22E-04
Helicopter	Non-Forested	100	2.84E-03	1.42E-02	**6.59E-01**	**7.09E+00**	5.16E-02	1.42E-02	9.45E-02
Helicopter	Non-Forested	300	9.93E-04	4.97E-03	**2.31E-01**	**2.48E+00**	1.81E-02	4.97E-03	3.31E-02
Helicopter	Non-Forested	900	4.55E-04	2.28E-03	**1.06E-01**	**1.14E+00**	8.28E-03	2.28E-03	1.52E-02
Ground	Low Boom	25	1.23E-03	6.13E-03	**2.85E-01**	**3.07E+00**	2.23E-02	6.13E-03	4.09E-02
Ground	Low Boom	100	3.59E-04	1.80E-03	**8.36E-02**	8.98E-01	6.53E-03	1.80E-03	1.20E-02
Ground	Low Boom	900	1.41E-05	7.07E-05	3.29E-03	3.54E-02	2.57E-04	7.07E-05	4.72E-04
Ground	High Boom	25	2.15E-04	1.07E-03	4.99E-02	5.37E-01	3.90E-03	1.07E-03	7.15E-03
Ground	High Boom	100	1.13E-04	5.65E-04	2.63E-02	2.83E-01	2.06E-03	5.65E-04	3.77E-03
Ground	High Boom	900	1.80E-05	8.98E-05	4.18E-03	4.49E-02	3.26E-04	8.98E-05	5.99E-04

OFF-SITE DRIFT - modeled in AgDrift
MAXIMUM APPLICATION RATE

Mode of Application	Application Height or Type	Distance From Receptor (ft)	Stream Concentration (mg/L)	Risk Quotients - Acute: Fish	Risk Quotients - Acute: Aquatic Invertebrates	Risk Quotients - Acute: Non-Target Aquatic Plants	Risk Quotients - Chronic: Fish	Risk Quotients - Chronic: Aquatic Invertebrates	Risk Quotients - Chronic: Non-Target Aquatic Plants
Plane	Forested	100	1.45E-02	**7.25E-02**	**3.37E+00**	**3.63E+01**	2.64E-01	7.25E-02	4.84E-01
Plane	Forested	300	4.43E-03	2.21E-02	**1.03E+00**	**1.11E+01**	8.05E-02	2.21E-02	1.48E-01
Plane	Forested	900	1.35E-03	6.77E-03	**3.15E-01**	**3.38E+00**	2.46E-02	6.77E-03	4.51E-02
Plane	Non-Forested	100	7.36E-03	3.68E-02	**1.71E+00**	**1.84E+01**	1.34E-01	3.68E-02	2.45E-01
Plane	Non-Forested	300	2.85E-03	1.43E-02	**6.64E-01**	**7.14E+00**	5.19E-02	1.43E-02	9.51E-02
Plane	Non-Forested	900	1.09E-03	5.46E-03	**2.54E-01**	**2.73E+00**	1.99E-02	5.46E-03	3.64E-02
Helicopter	Forested	100	7.30E-04	3.65E-03	**1.70E-01**	**1.83E+00**	1.33E-02	3.65E-03	2.43E-02
Helicopter	Forested	300	1.93E-04	9.64E-04	4.48E-02	4.82E-01	3.50E-03	9.64E-04	6.43E-03
Helicopter	Forested	900	3.20E-05	1.60E-04	7.43E-03	7.99E-02	5.81E-04	1.60E-04	1.07E-03
Helicopter	Non-Forested	100	6.03E-03	3.01E-02	**1.40E+00**	**1.51E+01**	1.10E-01	3.01E-02	2.01E-01
Helicopter	Non-Forested	300	2.22E-03	1.11E-02	**5.16E-01**	**5.54E+00**	4.03E-02	1.11E-02	7.39E-02
Helicopter	Non-Forested	900	7.25E-04	3.62E-03	**1.69E-01**	**1.81E+00**	1.32E-02	3.62E-03	2.42E-02
Ground	Low Boom	25	2.45E-03	1.23E-02	**5.71E-01**	**6.14E+00**	4.46E-02	1.23E-02	8.18E-02
Ground	Low Boom	100	7.19E-04	3.60E-03	**1.67E-01**	**1.80E+00**	1.31E-02	3.60E-03	2.40E-02
Ground	Low Boom	900	2.83E-05	1.41E-04	6.58E-03	7.07E-02	5.14E-04	1.41E-04	9.43E-04
Ground	High Boom	25	4.29E-04	2.15E-03	**9.98E-02**	**1.07E+00**	7.81E-03	2.15E-03	1.43E-02
Ground	High Boom	100	2.26E-04	1.13E-03	**5.26E-02**	5.65E-01	4.11E-03	1.13E-03	7.54E-03
Ground	High Boom	900	3.59E-05	1.80E-04	8.35E-03	8.98E-02	6.53E-04	1.80E-04	1.20E-03

RQ = Risk Quotient = Estimated Dose/Toxicity Reference Value

Shading and boldface indicates plant RQs greater than 1.
Shading and boldface indicates acute RQs greater than 0.05 for fish and invertebrates.
Shading and boldface indicates chronic RQs greater than 0.5 for fish and invertebrates.

Table C-36: Impact to non-target terrrestrial plants from direct spray and spray drift

DIRECT SPRAY	Terrestrial Concentration (lb a.e./acre)	Typical Species RQ	Threatened & Endangered Species RQ
Typical application rate	1	**1.43E+03**	**3.33E+03**
Maximum application rate	2	**2.86E+03**	**6.67E+03**

OFF-SITE DRIFT - modeled in AgDrift
TYPICAL APPLICATION RATE

Mode of Application	Application Height or Type	Distance From Receptor (ft)	Soil Concentration (mg a.e./kg)	Typical Species RQ	Threatened & Endangered Species RQ
Plane	Forested	100	3.47E-02	**4.96E+01**	**1.16E+02**
Plane	Forested	300	1.46E-02	**2.09E+01**	**4.87E+01**
Plane	Forested	900	5.00E-03	**7.14E+00**	**1.67E+01**
Plane	Non-Forested	100	1.81E-02	**2.59E+01**	**6.03E+01**
Plane	Non-Forested	300	9.30E-03	**1.33E+01**	**3.10E+01**
Plane	Non-Forested	900	4.40E-03	**6.29E+00**	**1.47E+01**
Helicopter	Forested	100	1.90E-03	**2.71E+00**	**6.33E+00**
Helicopter	Forested	300	6.00E-04	8.57E-01	**2.00E+00**
Helicopter	Forested	900	1.00E-04	1.43E-01	3.33E-01
Helicopter	Non-Forested	100	1.48E-02	**2.11E+01**	**4.93E+01**
Helicopter	Non-Forested	300	7.40E-03	**1.06E+01**	**2.47E+01**
Helicopter	Non-Forested	900	3.80E-03	**5.43E+00**	**1.27E+01**
Ground	Low Boom	25	4.50E-03	**6.43E+00**	**1.50E+01**
Ground	Low Boom	100	2.80E-03	**4.00E+00**	**9.33E+00**
Ground	Low Boom	900	6.00E-04	8.57E-01	**2.00E+00**
Ground	High Boom	25	7.10E-03	**1.01E+01**	**2.37E+01**
Ground	High Boom	100	4.20E-03	**6.00E+00**	**1.40E+01**
Ground	High Boom	900	8.00E-04	**1.14E+00**	**2.67E+00**

OFF-SITE DRIFT - modeled in AgDrift
MAXIMUM APPLICATION RATE

Mode of Application	Application Height or Type	Distance From Receptor (ft)	Soil Concentration (mg a.e./kg)	Typical Species RQ	Threatened & Endangered Species RQ
Plane	Forested	100	7.05E-02	**1.01E+02**	**2.35E+02**
Plane	Forested	300	3.04E-02	**4.34E+01**	**1.01E+02**
Plane	Forested	900	1.11E-02	**1.59E+01**	**3.70E+01**
Plane	Non-Forested	100	4.02E-02	**5.74E+01**	**1.34E+02**
Plane	Non-Forested	300	2.12E-02	**3.03E+01**	**7.07E+01**
Plane	Non-Forested	900	8.90E-03	**1.27E+01**	**2.97E+01**
Helicopter	Forested	100	3.60E-03	**5.14E+00**	**1.20E+01**
Helicopter	Forested	300	1.20E-03	**1.71E+00**	**4.00E+00**
Helicopter	Forested	900	2.00E-04	2.86E-01	6.67E-01
Helicopter	Non-Forested	100	3.22E-02	**4.60E+01**	**1.07E+02**
Helicopter	Non-Forested	300	1.65E-02	**2.36E+01**	**5.50E+01**
Helicopter	Non-Forested	900	5.60E-03	**8.00E+00**	**1.87E+01**
Ground	Low Boom	25	9.00E-03	**1.29E+01**	**3.00E+01**
Ground	Low Boom	100	5.50E-03	**7.86E+00**	**1.83E+01**
Ground	Low Boom	900	1.20E-03	**1.71E+00**	**4.00E+00**
Ground	High Boom	25	1.42E-02	**2.03E+01**	**4.73E+01**
Ground	High Boom	100	8.40E-03	**1.20E+01**	**2.80E+01**
Ground	High Boom	900	1.50E-03	**2.14E+00**	**5.00E+00**

RQ = Risk Quotient = Estimated Dose/Toxicity Reference Value
Shading and boldface indicates plant RQs greater than 1.

Table C-37: Consumption of contaminated fish from pond by predatory bird - one time exposure. Pond impacted by spray drift modeled in AgDrift.

Parameters/ Assumptions	Value	Units	Notes
Body Weight (W)	5.15	kg	
Food ingestion rate (dry weight)	0.101786153	kg dw/day	[1]
Food ingestion rate (wet weight, A)	0.40714461	kg ww/day	[2]
Bioconcentration factor (BCF)	1	L/kg fish	
Proportion of Diet Contaminated (Prop)	1	unitless	
Toxicity reference value (TRV)	27	mg/kg-bw/day	

TYPICAL APPLICATION RATE

Mode of Application	Application Height or Type	Distance From Receptor (ft)	Pond Concentration (mg/L)	Concentration in fish (C_{Fish}): WC × BCF	Dose estimate (D): C_{Fish} × A × Prop / W	Risk Quotient
Plane	Forested	100	5.00E-03	5.00E-03	3.96E-04	1.47E-05
Plane	Forested	300	1.88E-03	1.88E-03	1.49E-04	5.52E-06
Plane	Forested	900	6.00E-04	6.00E-04	4.74E-05	1.76E-06
Plane	Non-Forested	100	2.56E-03	2.56E-03	2.02E-04	7.49E-06
Plane	Non-Forested	300	1.15E-03	1.15E-03	9.06E-05	3.35E-06
Plane	Non-Forested	900	5.11E-04	5.11E-04	4.04E-05	1.50E-06
Helicopter	Forested	100	2.96E-04	2.96E-04	2.34E-05	8.66E-07
Helicopter	Forested	300	8.38E-05	8.38E-05	6.62E-06	2.45E-07
Helicopter	Forested	900	1.41E-05	1.41E-05	1.11E-06	4.12E-08
Helicopter	Non-Forested	100	2.13E-03	2.13E-03	1.69E-04	6.25E-06
Helicopter	Non-Forested	300	9.11E-04	9.11E-04	7.20E-05	2.67E-06
Helicopter	Non-Forested	900	4.48E-04	4.48E-04	3.54E-05	1.31E-06
Ground	Low Boom	25	6.82E-04	6.82E-04	5.39E-05	2.00E-06
Ground	Low Boom	100	3.74E-04	3.74E-04	2.96E-05	1.09E-06
Ground	Low Boom	900	1.90E-04	1.90E-04	1.50E-05	5.55E-07
Ground	High Boom	25	1.05E-02	1.05E-02	8.28E-04	3.07E-05
Ground	High Boom	100	2.97E-03	2.97E-03	2.35E-04	8.69E-06
Ground	High Boom	900	2.51E-04	2.51E-04	1.98E-05	7.34E-07

MAXIMUM APPLICATION RATE

Mode of Application	Application Height or Type	Distance From Receptor (ft)	Pond Concentration (mg/L)	Concentration in fish (C_{Fish}): WC × BCF	Dose estimate (D): C_{Fish} × A × Prop / W	Risk Quotient
Plane	Forested	100	1.01E-02	1.01E-02	8.00E-04	2.96E-05
Plane	Forested	300	3.90E-03	3.90E-03	3.09E-04	1.14E-05
Plane	Forested	900	1.31E-03	1.31E-03	1.03E-04	3.83E-06
Plane	Non-Forested	100	5.60E-03	5.60E-03	4.42E-04	1.64E-05
Plane	Non-Forested	300	2.64E-03	2.64E-03	2.09E-04	7.73E-06
Plane	Non-Forested	900	1.06E-03	1.06E-03	8.35E-05	3.09E-06
Helicopter	Forested	100	5.55E-04	5.55E-04	4.39E-05	1.63E-06
Helicopter	Forested	300	1.63E-04	1.63E-04	1.29E-05	4.77E-07
Helicopter	Forested	900	2.92E-05	2.92E-05	2.31E-06	8.54E-08
Helicopter	Non-Forested	100	4.56E-03	4.56E-03	3.61E-04	1.34E-05
Helicopter	Non-Forested	300	2.05E-03	2.05E-03	1.62E-04	5.99E-06
Helicopter	Non-Forested	900	6.83E-04	6.83E-04	5.40E-05	2.00E-06
Ground	Low Boom	25	1.36E-03	1.36E-03	1.08E-04	3.99E-06
Ground	Low Boom	100	7.48E-04	7.48E-04	5.91E-05	2.19E-06
Ground	Low Boom	900	3.80E-04	3.80E-04	3.00E-05	1.11E-06
Ground	High Boom	25	2.10E-02	2.10E-02	1.66E-03	6.14E-05
Ground	High Boom	100	5.94E-03	5.94E-03	4.69E-04	1.74E-05
Ground	High Boom	900	5.02E-04	5.02E-04	3.97E-05	1.47E-06

Risk Quotient = Estimated Dose/Toxicity Reference Value
Shading and boldface indicates piscivorous bird RQs greater than 0.1.

[1] Calculated using alorithm developed by Nagy, 1987 for all birds; where
Food Ingestion Rate (kg dw/day) = 0.0582*(BW)^0.651
[2] Assumes fish are 75% water (USEPA, 1993; Table 4-1 - value for bony fishes)

Table C-38: Impact to aquatic species from surface runoff to pond

SURFACE RUNOFF - modeled in GLEAMS							
TYPICAL APPLICATION RATE			**Risk Quotients - Acute**			**Risk Quotients - Chronic**	
GLEAMS ID	**Pond Concentration (mg/L)**	**Fish**	**Aquatic Invertebrates**	**Non-Target Aquatic Plants**	**Fish**	**Aquatic Invertebrates**	**Non-Target Aquatic Plants**
G_BASE_SAND_005_POND_TYP	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_005_POND_TYP	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_005_POND_TYP	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_010_POND_TYP	1.46E-08	7.29E-08	3.39E-06	3.64E-05	2.65E-07	7.29E-08	4.86E-07
G_BASE_CLAY_010_POND_TYP	1.50E-06	7.49E-06	3.48E-04	3.75E-03	2.72E-05	7.49E-06	4.99E-05
G_BASE_LOAM_010_POND_TYP	2.58E-08	1.29E-07	6.00E-06	6.45E-05	4.69E-07	1.29E-07	8.59E-07
G_BASE_SAND_025_POND_TYP	2.50E-08	1.25E-07	5.81E-06	6.25E-05	4.55E-07	1.25E-07	8.33E-07
G_BASE_CLAY_025_POND_TYP	7.91E-07	3.96E-06	1.84E-04	1.98E-03	1.44E-05	3.96E-06	2.64E-05
G_BASE_LOAM_025_POND_TYP	2.45E-09	1.22E-08	5.69E-07	6.11E-06	4.45E-08	1.22E-08	8.15E-08
G_BASE_SAND_050_POND_TYP	2.07E-07	1.03E-06	4.81E-05	5.17E-04	3.76E-06	1.03E-06	8.33E-07
G_BASE_CLAY_050_POND_TYP	7.25E-05	3.62E-04	1.69E-02	1.81E-01	1.32E-03	3.62E-04	2.42E-03
G_BASE_LOAM_050_POND_TYP	2.56E-09	1.28E-08	5.94E-07	6.39E-06	4.65E-08	1.28E-08	8.52E-08
G_BASE_SAND_100_POND_TYP	1.28E-05	6.38E-05	2.97E-03	3.19E-02	2.32E-04	6.38E-05	4.25E-04
G_BASE_CLAY_100_POND_TYP	1.71E-04	8.54E-04	3.97E-02	4.27E-01	3.11E-03	8.54E-04	5.69E-03
G_BASE_LOAM_100_POND_TYP	1.81E-06	9.03E-06	4.20E-04	4.51E-03	3.28E-05	9.03E-06	6.02E-05
G_BASE_SAND_150_POND_TYP	2.27E-04	1.13E-03	**5.28E-02**	5.67E-01	4.13E-03	1.13E-03	7.56E-03
G_BASE_CLAY_150_POND_TYP	9.80E-04	4.90E-03	**2.28E-01**	**2.45E+00**	1.78E-02	4.90E-03	3.27E-02
G_BASE_LOAM_150_POND_TYP	1.48E-06	7.39E-06	3.44E-04	3.70E-03	2.69E-05	7.39E-06	4.93E-05
G_BASE_SAND_200_POND_TYP	3.78E-04	1.89E-03	**8.78E-02**	9.44E-01	6.87E-03	1.89E-03	1.26E-02
G_BASE_CLAY_200_POND_TYP	2.50E-03	1.25E-02	**5.80E-01**	**6.24E+00**	4.54E-02	1.25E-02	8.32E-02
G_BASE_LOAM_200_POND_TYP	1.21E-06	6.04E-06	2.81E-04	3.02E-03	2.20E-05	6.04E-06	4.03E-05
G_BASE_SAND_250_POND_TYP	4.58E-04	2.29E-03	**1.07E-01**	**1.15E+00**	8.33E-03	2.29E-03	1.53E-02
G_BASE_CLAY_250_POND_TYP	4.14E-03	2.07E-02	**9.62E-01**	**1.03E+01**	7.52E-02	2.07E-02	1.38E-01
G_BASE_LOAM_250_POND_TYP	1.18E-04	5.89E-04	2.74E-02	2.95E-01	2.14E-03	5.89E-04	3.93E-03
G_ARV1_050_POND_TYP	1.02E-09	5.08E-09	2.36E-07	2.54E-06	1.85E-08	5.08E-09	3.38E-08
G_ARV2_050_POND_TYP	4.63E-10	2.32E-09	1.08E-07	1.16E-06	8.43E-09	2.32E-09	1.54E-08
G_ARV3_050_POND_TYP	4.63E-10	2.31E-09	1.08E-07	1.16E-06	8.42E-09	2.31E-09	1.54E-08
G_ERV1_050_POND_TYP	1.82E-09	9.11E-09	4.23E-07	4.55E-06	3.31E-08	9.11E-09	6.07E-08
G_ERV2_050_POND_TYP	1.85E-09	9.23E-09	4.29E-07	4.61E-06	3.35E-08	9.23E-09	6.15E-08
G_ERV3_050_POND_TYP	1.87E-09	9.34E-09	4.34E-07	4.67E-06	3.40E-08	9.34E-09	6.23E-08
G_RGV1_050_POND_TYP	1.82E-09	9.11E-09	4.23E-07	4.55E-06	3.31E-08	9.11E-09	6.07E-08
G_RGV2_050_POND_TYP	1.82E-09	9.11E-09	4.23E-07	4.55E-06	3.31E-08	9.11E-09	6.07E-08
G_RGV3_050_POND_TYP	1.97E-09	9.87E-09	4.59E-07	4.93E-06	3.59E-08	9.87E-09	6.58E-08
G_SLV1_050_POND_TYP	5.20E-05	2.60E-04	1.21E-02	1.30E-01	9.46E-04	2.60E-04	1.73E-03
G_SLV2_050_POND_TYP	6.74E-06	3.37E-05	1.57E-03	1.68E-02	1.22E-04	3.37E-05	2.25E-04
G_SLV3_050_POND_TYP	9.30E-06	4.65E-05	2.16E-03	2.32E-02	1.69E-04	4.65E-05	3.10E-04
G_STV1_050_POND_TYP	1.82E-09	9.11E-09	4.23E-07	4.55E-06	3.31E-08	9.11E-09	6.07E-08
G_STV2_050_POND_TYP	1.85E-09	9.23E-09	4.29E-07	4.61E-06	3.35E-08	9.23E-09	6.15E-08
G_STV3_050_POND_TYP	1.82E-09	9.11E-09	4.23E-07	4.55E-06	3.31E-08	9.11E-09	6.07E-08
G_VGV1_050_POND_TYP	1.85E-09	9.23E-09	4.29E-07	4.61E-06	3.35E-08	9.23E-09	6.15E-08
G_VGV2_050_POND_TYP	1.85E-09	9.23E-09	4.29E-07	4.61E-06	3.35E-08	9.23E-09	6.15E-08
G_VGV3_050_POND_TYP	8.36E-10	4.18E-09	1.94E-07	2.09E-06	1.52E-08	4.18E-09	2.79E-08

RQ = Risk Quotient = Estimated Dose/Toxicity Reference Value

Table C-38: Impact to aquatic species from surface runoff to pond

SURFACE RUNOFF - modeled in GLEAMS
MAXIMUM APPLICATION RATE

		Risk Quotients - Acute			Risk Quotients - Chronic		
GLEAMS ID	**Pond Concentration (mg/L)**	**Fish**	**Aquatic Invertebrates**	**Non-Target Aquatic Plants**	**Fish**	**Aquatic Invertebrates**	**Non-Target Aquatic Plants**
G_BASE_SAND_005_POND_MAX	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_005_POND_MAX	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_005_POND_MAX	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_010_POND_MAX	2.91E-08	1.46E-07	6.78E-06	7.29E-05	5.30E-07	1.46E-07	9.71E-07
G_BASE_CLAY_010_POND_MAX	3.00E-06	1.50E-05	6.97E-04	7.49E-03	5.45E-05	1.50E-05	9.99E-05
G_BASE_LOAM_010_POND_MAX	5.16E-08	2.58E-07	1.20E-05	1.29E-04	9.37E-07	2.58E-07	1.72E-06
G_BASE_SAND_025_POND_MAX	5.00E-08	2.50E-07	1.16E-05	1.25E-04	9.09E-07	2.50E-07	1.67E-06
G_BASE_CLAY_025_POND_MAX	1.58E-06	7.91E-06	3.68E-04	3.96E-03	2.88E-05	7.91E-06	5.27E-05
G_BASE_LOAM_025_POND_MAX	4.89E-09	2.45E-08	1.14E-06	1.22E-05	8.89E-08	2.45E-08	1.63E-07
G_BASE_SAND_050_POND_MAX	4.13E-07	2.07E-06	9.61E-05	1.03E-03	7.52E-06	2.07E-06	1.38E-05
G_BASE_CLAY_050_POND_MAX	1.45E-04	7.25E-04	3.37E-02	3.62E-01	2.63E-03	7.25E-04	4.83E-03
G_BASE_LOAM_050_POND_MAX	5.11E-09	2.56E-08	1.19E-06	1.28E-05	9.29E-08	2.56E-08	1.70E-07
G_BASE_SAND_100_POND_MAX	2.55E-05	1.28E-04	5.93E-03	6.38E-02	4.64E-04	1.28E-04	8.51E-04
G_BASE_CLAY_100_POND_MAX	3.42E-04	1.71E-03	**7.94E-02**	8.54E-01	6.21E-03	1.71E-03	1.14E-02
G_BASE_LOAM_100_POND_MAX	3.61E-06	1.81E-05	8.40E-04	9.03E-03	6.56E-05	1.81E-05	1.20E-04
G_BASE_SAND_150_POND_MAX	4.54E-04	2.27E-03	**1.06E-01**	**1.13E+00**	8.25E-03	2.27E-03	1.51E-02
G_BASE_CLAY_150_POND_MAX	1.96E-03	9.80E-03	**4.56E-01**	**4.90E+00**	3.57E-02	9.80E-03	6.54E-02
G_BASE_LOAM_150_POND_MAX	2.96E-06	1.48E-05	6.87E-04	7.39E-03	5.37E-05	1.48E-05	9.85E-05
G_BASE_SAND_200_POND_MAX	7.55E-04	3.78E-03	**1.76E-01**	**1.89E+00**	1.37E-02	3.78E-03	2.52E-02
G_BASE_CLAY_200_POND_MAX	4.99E-03	2.50E-02	**1.16E+00**	**1.25E+01**	9.07E-02	2.50E-02	1.66E-01
G_BASE_LOAM_200_POND_MAX	2.42E-06	1.21E-05	5.62E-04	6.04E-03	4.39E-05	1.21E-05	8.05E-05
G_BASE_SAND_250_POND_MAX	9.17E-04	4.58E-03	**2.13E-01**	**2.29E+00**	1.67E-02	4.58E-03	3.06E-02
G_BASE_CLAY_250_POND_MAX	8.27E-03	4.14E-02	**1.92E+00**	**2.07E+01**	1.50E-01	4.14E-02	2.76E-01
G_BASE_LOAM_250_POND_MAX	2.36E-04	1.18E-03	**5.48E-02**	5.89E-01	4.28E-03	1.18E-03	7.85E-03
G_ARV1_050_POND_MAX	2.03E-09	1.02E-08	4.72E-07	5.08E-06	3.69E-08	1.02E-08	6.77E-08
G_ARV2_050_POND_MAX	9.27E-10	4.63E-09	2.16E-07	2.32E-06	1.69E-08	4.63E-09	3.09E-08
G_ARV3_050_POND_MAX	9.26E-10	4.63E-09	2.15E-07	2.31E-06	1.68E-08	4.63E-09	3.09E-08
G_ERV1_050_POND_MAX	3.64E-09	1.82E-08	8.47E-07	9.11E-06	6.62E-08	1.82E-08	1.21E-07
G_ERV2_050_POND_MAX	3.69E-09	1.85E-08	8.58E-07	9.23E-06	6.71E-08	1.85E-08	1.23E-07
G_ERV3_050_POND_MAX	3.74E-09	1.87E-08	8.69E-07	9.34E-06	6.79E-08	1.87E-08	1.25E-07
G_RGV1_050_POND_MAX	3.64E-09	1.82E-08	8.47E-07	9.11E-06	6.62E-08	1.82E-08	1.21E-07
G_RGV2_050_POND_MAX	3.64E-09	1.82E-08	8.47E-07	9.11E-06	6.62E-08	1.82E-08	1.21E-07
G_RGV3_050_POND_MAX	3.95E-09	1.97E-08	9.18E-07	9.87E-06	7.17E-08	1.97E-08	1.32E-07
G_SLV1_050_POND_MAX	1.04E-04	5.20E-04	2.42E-02	2.60E-01	1.89E-03	5.20E-04	3.47E-03
G_SLV2_050_POND_MAX	1.35E-05	6.74E-05	3.13E-03	3.37E-02	2.45E-04	6.74E-05	4.49E-04
G_SLV3_050_POND_MAX	1.86E-05	9.30E-05	4.33E-03	4.65E-02	3.38E-04	9.30E-05	6.20E-04
G_STV1_050_POND_MAX	3.64E-09	1.82E-08	8.47E-07	9.11E-06	6.62E-08	1.82E-08	1.21E-07
G_STV2_050_POND_MAX	3.69E-09	1.85E-08	8.58E-07	9.23E-06	6.71E-08	1.85E-08	1.23E-07
G_STV3_050_POND_MAX	3.64E-09	1.82E-08	8.47E-07	9.11E-06	6.62E-08	1.82E-08	1.21E-07
G_VGV1_050_POND_MAX	3.69E-09	1.85E-08	8.58E-07	9.23E-06	6.71E-08	1.85E-08	1.23E-07
G_VGV2_050_POND_MAX	3.69E-09	1.85E-08	8.58E-07	9.23E-06	6.71E-08	1.85E-08	1.23E-07
G_VGV3_050_POND_MAX	1.67E-09	8.36E-09	3.89E-07	4.18E-06	3.04E-08	8.36E-09	5.57E-08

RQ = Risk Quotient = Estimated Dose/Toxicity Reference Value

Shading and boldface indicates plant RQs greater than 1.
Shading and boldface indicates acute RQs greater than 0.05 for fish and invertebrates.
Shading and boldface indicates chronic RQs greater than 0.5 for fish and invertebrates.

SURFACE RUNOFF - modeled in GLEAMS
TYPICAL APPLICATION RATE

GLEAMS ID	Annual Precipitation (inches)	Application Area (acres)	Hydraulic Slope (ft/ft)	Surface Roughness	USLE Soil Erodibility Factor (ton/ac per EI)	Vegetation Type	Soil Type	Stream Concentration (mg/L)	Fish	Aquatic Invertebrates	Non-Target Aquatic Plants	Fish	Aquatic Invertebrates	Non-Target Aquatic Plants
									Risk Quotients - Acute			Risk Quotients - Chronic		
G_BASE_SAND_005_STREAM_TYP	5	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_005_STREAM_TYP	5	10	0.05	0.015	0.401	weeds (79)	Clay	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_005_STREAM_TYP	5	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_010_STREAM_TYP	10	10	0.05	0.015	0.401	weeds (79)	Sand	1.52E-11	7.59E-11	3.53E-09	3.79E-08	2.76E-10	7.59E-11	5.06E-10
G_BASE_CLAY_010_STREAM_TYP	10	10	0.05	0.015	0.401	weeds (79)	Clay	2.97E-09	1.49E-08	6.91E-07	7.43E-06	5.40E-08	1.49E-08	9.91E-08
G_BASE_LOAM_010_STREAM_TYP	10	10	0.05	0.015	0.401	weeds (79)	Loam	2.21E-11	1.11E-10	5.15E-09	5.53E-08	4.02E-10	1.11E-10	7.38E-10
G_BASE_SAND_025_STREAM_TYP	25	10	0.05	0.015	0.401	weeds (79)	Sand	1.51E-10	7.55E-10	3.51E-08	3.77E-07	2.74E-09	7.55E-10	5.03E-09
G_BASE_CLAY_025_STREAM_TYP	25	10	0.05	0.015	0.401	weeds (79)	Clay	6.15E-09	3.07E-08	1.43E-06	1.54E-05	1.12E-07	3.07E-08	2.05E-07
G_BASE_LOAM_025_STREAM_TYP	25	10	0.05	0.015	0.401	weeds (79)	Loam	1.66E-11	8.28E-11	3.85E-09	4.14E-08	3.01E-10	8.28E-11	5.52E-10
G_BASE_SAND_050_STREAM_TYP	50	10	0.05	0.015	0.401	weeds (79)	Sand	4.26E-09	2.13E-08	9.91E-07	1.07E-05	7.75E-08	2.13E-08	1.42E-07
G_BASE_CLAY_050_STREAM_TYP	50	10	0.05	0.015	0.401	weeds (79)	Clay	2.33E-07	1.17E-06	5.43E-05	5.83E-04	4.24E-06	1.17E-06	7.78E-06
G_BASE_LOAM_050_STREAM_TYP	50	10	0.05	0.015	0.401	weeds (79)	Loam	6.27E-11	3.14E-10	1.46E-08	1.57E-07	1.14E-09	3.14E-10	2.09E-09
G_BASE_SAND_100_STREAM_TYP	100	10	0.05	0.015	0.401	weeds (79)	Sand	3.15E-07	1.57E-06	7.32E-05	7.87E-04	5.73E-06	1.57E-06	1.05E-05
G_BASE_CLAY_100_STREAM_TYP	100	10	0.05	0.015	0.401	weeds (79)	Clay	2.24E-06	1.12E-05	5.20E-04	5.60E-03	4.07E-05	1.12E-05	7.46E-05
G_BASE_LOAM_100_STREAM_TYP	100	10	0.05	0.015	0.401	weeds (79)	Loam	3.24E-08	1.62E-07	7.53E-06	8.09E-05	5.89E-07	1.62E-07	1.08E-06
G_BASE_SAND_150_STREAM_TYP	150	10	0.05	0.015	0.401	weeds (79)	Sand	3.32E-06	1.66E-05	7.72E-04	8.30E-03	6.03E-05	1.66E-05	1.11E-04
G_BASE_CLAY_150_STREAM_TYP	150	10	0.05	0.015	0.401	weeds (79)	Clay	5.22E-06	2.61E-05	1.21E-03	1.31E-02	9.49E-05	2.61E-05	1.74E-04
G_BASE_LOAM_150_STREAM_TYP	150	10	0.05	0.015	0.401	weeds (79)	Loam	1.03E-07	5.13E-07	2.38E-05	2.56E-04	1.86E-06	5.13E-07	3.42E-06
G_BASE_SAND_200_STREAM_TYP	200	10	0.05	0.015	0.401	weeds (79)	Sand	6.68E-06	3.34E-05	1.55E-03	1.67E-02	1.22E-04	3.34E-05	2.23E-04
G_BASE_CLAY_200_STREAM_TYP	200	10	0.05	0.015	0.401	weeds (79)	Clay	1.05E-05	5.24E-05	2.44E-03	2.62E-02	1.91E-04	5.24E-05	3.49E-04
G_BASE_LOAM_200_STREAM_TYP	200	10	0.05	0.015	0.401	weeds (79)	Loam	1.06E-07	5.32E-07	2.47E-05	2.66E-04	1.93E-06	5.32E-07	3.55E-06
G_BASE_SAND_250_STREAM_TYP	250	10	0.05	0.015	0.401	weeds (79)	Sand	9.85E-06	4.93E-05	2.29E-03	2.46E-02	1.79E-04	4.93E-05	3.28E-04
G_BASE_CLAY_250_STREAM_TYP	250	10	0.05	0.015	0.401	weeds (79)	Clay	1.65E-05	8.27E-05	3.85E-03	4.14E-02	3.01E-04	8.27E-05	5.51E-04
G_BASE_LOAM_250_STREAM_TYP	250	10	0.05	0.015	0.401	weeds (79)	Loam	3.46E-07	1.73E-06	8.05E-05	8.66E-04	6.29E-06	1.73E-06	1.15E-05
G_ARV1_050_STREAM_TYP	50	1	0.05	0.015	0.401	weeds (79)	Loam	7.78E-12	3.89E-11	1.81E-09	1.94E-08	1.41E-10	3.89E-11	2.59E-10
G_ARV2_050_STREAM_TYP	50	100	0.05	0.015	0.401	weeds (79)	Loam	2.25E-10	1.13E-09	5.24E-08	5.64E-07	4.10E-09	1.13E-09	7.51E-09
G_ARV3_050_STREAM_TYP	50	1000	0.05	0.015	0.401	weeds (79)	Loam	3.10E-10	1.55E-09	7.20E-08	7.75E-07	5.63E-09	1.55E-09	1.03E-08
G_ERV1_050_STREAM_TYP	50	10	0.05	0.015	0.05	weeds (79)	Loam	6.18E-11	3.09E-10	1.44E-08	1.55E-07	1.12E-09	3.09E-10	2.06E-09
G_ERV2_050_STREAM_TYP	50	10	0.05	0.015	0.2	weeds (79)	Loam	6.27E-11	3.14E-10	1.46E-08	1.57E-07	1.14E-09	3.14E-10	2.09E-09
G_ERV3_050_STREAM_TYP	50	10	0.05	0.015	0.5	weeds (79)	Loam	6.36E-11	3.18E-10	1.48E-08	1.59E-07	1.16E-09	3.18E-10	2.12E-09
G_RGV1_050_STREAM_TYP	50	10	0.05	0.023	0.401	weeds (79)	Loam	6.18E-11	3.09E-10	1.44E-08	1.55E-07	1.12E-09	3.09E-10	2.06E-09
G_RGV2_050_STREAM_TYP	50	10	0.05	0.046	0.401	weeds (79)	Loam	6.18E-11	3.09E-10	1.44E-08	1.55E-07	1.12E-09	3.09E-10	2.06E-09
G_RGV3_050_STREAM_TYP	50	10	0.05	0.15	0.401	weeds (79)	Loam	6.62E-11	3.31E-10	1.54E-08	1.66E-07	1.20E-09	3.31E-10	2.21E-09
G_SLV1_050_STREAM_TYP	50	10	0.005	0.015	0.401	weeds (79)	Loam	4.43E-07	2.22E-06	1.03E-04	1.11E-03	8.06E-06	2.22E-06	1.48E-05
G_SLV2_050_STREAM_TYP	50	10	0.01	0.015	0.401	weeds (79)	Loam	6.02E-08	3.01E-07	1.40E-05	1.50E-04	1.09E-06	3.01E-07	2.01E-06
G_SLV3_050_STREAM_TYP	50	10	0.1	0.015	0.401	weeds (79)	Loam	7.73E-08	3.86E-07	1.80E-05	1.93E-04	1.40E-06	3.86E-07	2.58E-06
G_STV1_050_STREAM_TYP	50	10	0.05	0.015	0.401	weeds (79)	Loam	6.18E-11	3.09E-10	1.44E-08	1.55E-07	1.12E-09	3.09E-10	2.06E-09
G_STV2_050_STREAM_TYP	50	10	0.05	0.015	0.401	weeds (79)	Loam	6.27E-11	3.14E-10	1.46E-08	1.57E-07	1.14E-09	3.14E-10	2.09E-09
G_STV3_050_STREAM_TYP	50	10	0.05	0.015	0.401	weeds (79)	Loam	6.18E-11	3.09E-10	1.44E-08	1.55E-07	1.12E-09	3.09E-10	2.06E-09
G_VGV1_050_STREAM_TYP	50	10	0.05	0.015	0.401	Shrub	Loam	6.27E-11	3.14E-10	1.46E-08	1.57E-07	1.14E-09	3.14E-10	2.09E-09
G_VGV2_050_STREAM_TYP	50	10	0.05	0.015	0.401	Rye Grass	Loam	6.27E-11	3.14E-10	1.46E-08	1.57E-07	1.14E-09	3.14E-10	2.09E-09
G_VGV3_050_STREAM_TYP	50	10	0.05	0.015	0.401	Conifer-Hardwood	Loam	3.71E-11	1.85E-10	8.62E-09	9.27E-08	6.74E-10	1.85E-10	1.24E-09

RQ = Risk Quotient = Estimated Dose/Toxicity Reference Value

Table C-39: Impact to aquatic species from surface runoff to pond

SURFACE RUNOFF - modeled in GLEAMS
MAXIMUM APPLICATION RATE

GLEAMS ID	Annual Precipitation (inches)	Application Area (acres)	Hydraulic Slope (ft/ft)	Surface Roughness	USLE Soil Erodibility Factor (ton/ac per EI)	Vegetation Type	Soil Type	Stream Concentration (mg/L)	Risk Quotients - Acute: Fish	Risk Quotients - Acute: Aquatic Invertebrates	Risk Quotients - Acute: Non-Target Aquatic Plants	Risk Quotients - Chronic: Fish	Risk Quotients - Chronic: Aquatic Invertebrates	Risk Quotients - Chronic: Non-Target Aquatic Plants
G_BASE_SAND_005_STREAM_MAX	5	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_005_STREAM_MAX	5	10	0.05	0.015	0.401	weeds (79)	Clay	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_005_STREAM_MAX	5	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_010_STREAM_MAX	10	10	0.05	0.015	0.401	weeds (79)	Sand	3.03E-11	1.52E-10	7.06E-09	7.59E-08	5.52E-10	1.52E-10	1.01E-09
G_BASE_CLAY_010_STREAM_MAX	10	10	0.05	0.015	0.401	weeds (79)	Clay	5.94E-09	2.97E-08	1.38E-06	1.49E-05	1.08E-07	2.97E-08	1.98E-07
G_BASE_LOAM_010_STREAM_MAX	10	10	0.05	0.015	0.401	weeds (79)	Loam	4.43E-11	2.21E-10	1.03E-08	1.11E-07	8.05E-10	2.21E-10	1.48E-09
G_BASE_SAND_025_STREAM_MAX	25	10	0.05	0.015	0.401	weeds (79)	Sand	3.02E-10	1.51E-09	7.02E-08	7.55E-07	5.49E-09	1.51E-09	1.01E-08
G_BASE_CLAY_025_STREAM_MAX	25	10	0.05	0.015	0.401	weeds (79)	Clay	1.23E-08	6.15E-08	2.86E-06	3.07E-05	2.23E-07	6.15E-08	4.10E-07
G_BASE_LOAM_025_STREAM_MAX	25	10	0.05	0.015	0.401	weeds (79)	Loam	3.31E-11	1.66E-10	7.70E-09	8.28E-08	6.02E-10	1.66E-10	1.10E-09
G_BASE_SAND_050_STREAM_MAX	50	10	0.05	0.015	0.401	weeds (79)	Sand	8.52E-09	4.26E-08	1.98E-06	2.13E-05	1.55E-07	4.26E-08	2.84E-07
G_BASE_CLAY_050_STREAM_MAX	50	10	0.05	0.015	0.401	weeds (79)	Clay	4.67E-07	2.33E-06	1.09E-04	1.17E-03	8.48E-06	2.33E-06	1.56E-05
G_BASE_LOAM_050_STREAM_MAX	50	10	0.05	0.015	0.401	weeds (79)	Loam	1.25E-10	6.27E-10	2.92E-08	3.14E-07	2.28E-09	6.27E-10	4.18E-09
G_BASE_SAND_100_STREAM_MAX	100	10	0.05	0.015	0.401	weeds (79)	Sand	6.30E-07	3.15E-06	1.46E-04	1.57E-03	1.15E-05	3.15E-06	2.10E-05
G_BASE_CLAY_100_STREAM_MAX	100	10	0.05	0.015	0.401	weeds (79)	Clay	4.48E-06	2.24E-05	1.04E-03	1.12E-02	8.14E-05	2.24E-05	1.49E-04
G_BASE_LOAM_100_STREAM_MAX	100	10	0.05	0.015	0.401	weeds (79)	Loam	6.47E-08	3.24E-07	1.51E-05	1.62E-04	1.18E-06	3.24E-07	2.16E-06
G_BASE_SAND_150_STREAM_MAX	150	10	0.05	0.015	0.401	weeds (79)	Sand	6.64E-06	3.32E-05	1.54E-03	1.66E-02	1.21E-04	3.32E-05	2.21E-04
G_BASE_CLAY_150_STREAM_MAX	150	10	0.05	0.015	0.401	weeds (79)	Clay	1.04E-05	5.22E-05	2.43E-03	2.61E-02	1.90E-04	5.22E-05	3.48E-04
G_BASE_LOAM_150_STREAM_MAX	150	10	0.05	0.015	0.401	weeds (79)	Loam	2.05E-07	1.03E-06	4.77E-05	5.13E-04	3.73E-06	1.03E-06	6.83E-06
G_BASE_SAND_200_STREAM_MAX	200	10	0.05	0.015	0.401	weeds (79)	Sand	1.34E-05	6.68E-05	3.11E-03	3.34E-02	2.43E-04	6.68E-05	4.46E-04
G_BASE_CLAY_200_STREAM_MAX	200	10	0.05	0.015	0.401	weeds (79)	Clay	2.10E-05	1.05E-04	4.87E-03	5.24E-02	3.81E-04	1.05E-04	6.99E-04
G_BASE_LOAM_200_STREAM_MAX	200	10	0.05	0.015	0.401	weeds (79)	Loam	2.13E-07	1.06E-06	4.95E-05	5.32E-04	3.87E-06	1.06E-06	7.09E-06
G_BASE_SAND_250_STREAM_MAX	250	10	0.05	0.015	0.401	weeds (79)	Sand	1.97E-05	9.85E-05	4.58E-03	4.93E-02	3.58E-04	9.85E-05	6.57E-04
G_BASE_CLAY_250_STREAM_MAX	250	10	0.05	0.015	0.401	weeds (79)	Clay	3.31E-05	1.65E-04	7.69E-03	8.27E-02	6.01E-04	1.65E-04	1.10E-03
G_BASE_LOAM_250_STREAM_MAX	250	10	0.05	0.015	0.401	weeds (79)	Loam	6.92E-07	3.46E-06	1.61E-04	1.73E-03	1.26E-05	3.46E-06	2.31E-05
G_ARV1_050_STREAM_MAX	50	1	0.05	0.015	0.401	weeds (79)	Loam	1.56E-11	7.78E-11	3.62E-09	3.89E-08	2.83E-10	7.78E-11	5.18E-10
G_ARV2_050_STREAM_MAX	50	100	0.05	0.015	0.401	weeds (79)	Loam	4.51E-10	2.25E-09	1.05E-07	1.13E-06	8.20E-09	2.25E-09	1.50E-08
G_ARV3_050_STREAM_MAX	50	1000	0.05	0.015	0.401	weeds (79)	Loam	6.20E-10	3.10E-09	1.44E-07	1.55E-06	1.13E-08	3.10E-09	2.07E-08
G_ERV1_050_STREAM_MAX	50	10	0.05	0.015	0.05	weeds (79)	Loam	1.24E-10	6.18E-10	2.88E-08	3.09E-07	2.25E-09	6.18E-10	4.12E-09
G_ERV2_050_STREAM_MAX	50	10	0.05	0.015	0.2	weeds (79)	Loam	1.25E-10	6.27E-10	2.92E-08	3.14E-07	2.28E-09	6.27E-10	4.18E-09
G_ERV3_050_STREAM_MAX	50	10	0.05	0.015	0.5	weeds (79)	Loam	1.27E-10	6.36E-10	2.96E-08	3.18E-07	2.31E-09	6.36E-10	4.24E-09
G_RGV1_050_STREAM_MAX	50	10	0.05	0.023	0.401	weeds (79)	Loam	1.24E-10	6.18E-10	2.88E-08	3.09E-07	2.25E-09	6.18E-10	4.12E-09
G_RGV2_050_STREAM_MAX	50	10	0.05	0.046	0.401	weeds (79)	Loam	1.24E-10	6.18E-10	2.88E-08	3.09E-07	2.25E-09	6.18E-10	4.12E-09
G_RGV3_050_STREAM_MAX	50	10	0.05	0.15	0.401	weeds (79)	Loam	1.32E-10	6.62E-10	3.08E-08	3.31E-07	2.41E-09	6.62E-10	4.41E-09
G_SLV1_050_STREAM_MAX	50	10	0.005	0.015	0.401	weeds (79)	Loam	8.87E-07	4.43E-06	2.06E-04	2.22E-03	1.61E-05	4.43E-06	2.96E-05
G_SLV2_050_STREAM_MAX	50	10	0.01	0.015	0.401	weeds (79)	Loam	1.20E-07	6.02E-07	2.80E-05	3.01E-04	2.19E-06	6.02E-07	4.01E-06
G_SLV3_050_STREAM_MAX	50	10	0.1	0.015	0.401	weeds (79)	Loam	1.55E-07	7.73E-07	3.59E-05	3.86E-04	2.81E-06	7.73E-07	5.15E-06
G_STV1_050_STREAM_MAX	50	10	0.05	0.015	0.401	weeds (79)	Loam	1.24E-10	6.18E-10	2.88E-08	3.09E-07	2.25E-09	6.18E-10	4.12E-09
G_STV2_050_STREAM_MAX	50	10	0.05	0.015	0.401	weeds (79)	Loam	1.25E-10	6.27E-10	2.92E-08	3.14E-07	2.28E-09	6.27E-10	4.18E-09
G_STV3_050_STREAM_MAX	50	10	0.05	0.015	0.401	weeds (79)	Loam	1.24E-10	6.18E-10	2.88E-08	3.09E-07	2.25E-09	6.18E-10	4.12E-09
G_VGV1_050_STREAM_MAX	50	10	0.05	0.015	0.401	Shrub	Loam	1.25E-10	6.27E-10	2.92E-08	3.14E-07	2.28E-09	6.27E-10	4.18E-09
G_VGV2_050_STREAM_MAX	50	10	0.05	0.015	0.401	Rye Grass	Loam	1.25E-10	6.27E-10	2.92E-08	3.14E-07	2.28E-09	6.27E-10	4.18E-09
G_VGV3_050_STREAM_MAX	50	10	0.05	0.015	0.401	Conifer-Hardwood	Loam	7.41E-11	3.71E-10	1.72E-08	1.85E-07	1.35E-09	3.71E-10	2.47E-09

RQ = Risk Quotient = Estimated Dose/Toxicity Reference Value

Shading and boldface indicates plant RQs greater than 1.
Shading and boldface indicates acute RQs greater than 0.05 for fish and invertebrates.
Shading and boldface indicates chronic RQs greater than 0.5 for fish and invertebrates.

Table C-40: Impact to non-target terrrestrial plants from surface runoff

SURFACE RUNOFF - modeled in GLEAMS
TYPICAL APPLICATION RATE

GLEAMS ID	Annual Precipitation (inches)	Application Area (acres)	Hydraulic Slope (ft/ft)	Surface Roughness	USLE Soil Erodibility Factor (ton/ac per EI)	Vegetation Type	Soil Type	Terrestrial Concentration (lb a.e./acre)	Typical Species RQ	Threatened & Endangered Species RQ
G_BASE_SAND_005_TERR_TYP	5	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_005_TERR_TYP	5	10	0.05	0.015	0.401	weeds (79)	Clay	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_005_TERR_TYP	5	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_010_TERR_TYP	10	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_010_TERR_TYP	10	10	0.05	0.015	0.401	weeds (79)	Clay	3.62E-07	4.41E-08	1.21E-03
G_BASE_LOAM_010_TERR_TYP	10	10	0.05	0.015	0.401	weeds (79)	Loam	2.80E-09	3.42E-10	9.35E-06
G_BASE_SAND_025_TERR_TYP	25	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_025_TERR_TYP	25	10	0.05	0.015	0.401	weeds (79)	Clay	4.82E-07	5.88E-08	1.61E-03
G_BASE_LOAM_025_TERR_TYP	25	10	0.05	0.015	0.401	weeds (79)	Loam	2.17E-09	2.64E-10	7.22E-06
G_BASE_SAND_050_TERR_TYP	50	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_050_TERR_TYP	50	10	0.05	0.015	0.401	weeds (79)	Clay	1.81E-05	2.20E-06	6.03E-02
G_BASE_LOAM_050_TERR_TYP	50	10	0.05	0.015	0.401	weeds (79)	Loam	6.88E-09	8.39E-10	2.29E-05
G_BASE_SAND_100_TERR_TYP	100	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_100_TERR_TYP	100	10	0.05	0.015	0.401	weeds (79)	Clay	1.53E-04	1.86E-05	5.09E-01
G_BASE_LOAM_100_TERR_TYP	100	10	0.05	0.015	0.401	weeds (79)	Loam	2.50E-06	3.04E-07	8.32E-03
G_BASE_SAND_150_TERR_TYP	150	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_150_TERR_TYP	150	10	0.05	0.015	0.401	weeds (79)	Clay	2.74E-04	3.34E-05	9.13E-01
G_BASE_LOAM_150_TERR_TYP	150	10	0.05	0.015	0.401	weeds (79)	Loam	1.08E-05	1.32E-06	3.61E-02
G_BASE_SAND_200_TERR_TYP	200	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_200_TERR_TYP	200	10	0.05	0.015	0.401	weeds (79)	Clay	8.15E-04	9.94E-05	**2.72E+00**
G_BASE_LOAM_200_TERR_TYP	200	10	0.05	0.015	0.401	weeds (79)	Loam	1.21E-05	1.48E-06	4.04E-02
G_BASE_SAND_250_TERR_TYP	250	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_250_TERR_TYP	250	10	0.05	0.015	0.401	weeds (79)	Clay	1.58E-03	1.92E-04	**5.26E+00**
G_BASE_LOAM_250_TERR_TYP	250	10	0.05	0.015	0.401	weeds (79)	Loam	3.14E-05	3.83E-06	1.05E-01
G_ARV1_050_TERR_TYP	50	1	0.05	0.015	0.401	weeds (79)	Loam	6.88E-09	8.39E-10	2.29E-05
G_ARV2_050_TERR_TYP	50	100	0.05	0.015	0.401	weeds (79)	Loam	6.88E-09	8.39E-10	2.29E-05
G_ARV3_050_TERR_TYP	50	1000	0.05	0.015	0.401	weeds (79)	Loam	6.88E-09	8.39E-10	2.29E-05
G_ERV1_050_TERR_TYP	50	10	0.05	0.015	0.05	weeds (79)	Loam	6.75E-09	8.24E-10	2.25E-05
G_ERV2_050_TERR_TYP	50	10	0.05	0.015	0.2	weeds (79)	Loam	6.88E-09	8.39E-10	2.29E-05
G_ERV3_050_TERR_TYP	50	10	0.05	0.015	0.5	weeds (79)	Loam	7.01E-09	8.55E-10	2.34E-05
G_RGV1_050_TERR_TYP	50	10	0.05	0.023	0.401	weeds (79)	Loam	6.75E-09	8.24E-10	2.25E-05
G_RGV2_050_TERR_TYP	50	10	0.05	0.046	0.401	weeds (79)	Loam	6.75E-09	8.24E-10	2.25E-05
G_RGV3_050_TERR_TYP	50	10	0.05	0.15	0.401	weeds (79)	Loam	7.27E-09	8.86E-10	2.42E-05
G_SLV1_050_TERR_TYP	50	10	0.005	0.015	0.401	weeds (79)	Loam	3.75E-05	4.57E-06	1.25E-01
G_SLV2_050_TERR_TYP	50	10	0.01	0.015	0.401	weeds (79)	Loam	4.76E-06	5.80E-07	1.59E-02
G_SLV3_050_TERR_TYP	50	10	0.1	0.015	0.401	weeds (79)	Loam	7.29E-06	8.89E-07	2.43E-02
G_STV1_050_TERR_TYP	50	10	0.05	0.015	0.401	weeds (79)	Loam	6.75E-09	8.24E-10	2.25E-05
G_STV2_050_TERR_TYP	50	10	0.05	0.015	0.401	weeds (79)	Loam	6.88E-09	8.39E-10	2.29E-05
G_STV3_050_TERR_TYP	50	10	0.05	0.015	0.401	weeds (79)	Loam	6.75E-09	8.24E-10	2.25E-05
G_VGV1_050_TERR_TYP	50	10	0.05	0.015	0.401	Shrub	Loam	6.88E-09	8.39E-10	2.29E-05
G_VGV2_050_TERR_TYP	50	10	0.05	0.015	0.401	Rye Grass	Loam	6.88E-09	8.39E-10	2.29E-05
G_VGV3_050_TERR_TYP	50	10	0.05	0.015	0.401	Conifer-Hardwood	Loam	4.21E-09	5.13E-10	1.40E-05

RQ = Risk Quotient = Estimated Dose/Toxicity Reference Value

Table C-40: Impact to non-target terrrestrial plants from surface runoff

SURFACE RUNOFF - modeled in GLEAMS

MAXIMUM APPLICATION RATE

GLEAMS ID	Annual Precipitation (inches)	Application Area (acres)	Hydraulic Slope (ft/ft)	Surface Roughness	USLE Soil Erodibility Factor (ton/ac per EI)	Vegetation Type	Soil Type	Terrestrial Concentration (lb a.e./acre)	Typical Species RQ	Threatened & Endangered Species RQ
G_BASE_SAND_005_TERR_MAX	5	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_005_TERR_MAX	5	10	0.05	0.015	0.401	weeds (79)	Clay	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_005_TERR_MAX	5	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_010_TERR_MAX	10	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_010_TERR_MAX	10	10	0.05	0.015	0.401	weeds (79)	Clay	7.23E-07	8.82E-08	2.41E-03
G_BASE_LOAM_010_TERR_MAX	10	10	0.05	0.015	0.401	weeds (79)	Loam	5.61E-09	6.84E-10	1.87E-05
G_BASE_SAND_025_TERR_MAX	25	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_025_TERR_MAX	25	10	0.05	0.015	0.401	weeds (79)	Clay	9.64E-07	1.18E-07	3.21E-03
G_BASE_LOAM_025_TERR_MAX	25	10	0.05	0.015	0.401	weeds (79)	Loam	4.33E-09	5.29E-10	1.44E-05
G_BASE_SAND_050_TERR_MAX	50	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_050_TERR_MAX	50	10	0.05	0.015	0.401	weeds (79)	Clay	3.62E-05	4.41E-06	1.21E-01
G_BASE_LOAM_050_TERR_MAX	50	10	0.05	0.015	0.401	weeds (79)	Loam	1.38E-08	1.68E-09	4.59E-05
G_BASE_SAND_100_TERR_MAX	100	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_100_TERR_MAX	100	10	0.05	0.015	0.401	weeds (79)	Clay	3.05E-04	3.72E-05	**1.02E+00**
G_BASE_LOAM_100_TERR_MAX	100	10	0.05	0.015	0.401	weeds (79)	Loam	4.99E-06	6.09E-07	1.66E-02
G_BASE_SAND_150_TERR_MAX	150	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_150_TERR_MAX	150	10	0.05	0.015	0.401	weeds (79)	Clay	5.48E-04	6.68E-05	**1.83E+00**
G_BASE_LOAM_150_TERR_MAX	150	10	0.05	0.015	0.401	weeds (79)	Loam	2.17E-05	2.64E-06	7.22E-02
G_BASE_SAND_200_TERR_MAX	200	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_200_TERR_MAX	200	10	0.05	0.015	0.401	weeds (79)	Clay	1.63E-03	1.99E-04	**5.44E+00**
G_BASE_LOAM_200_TERR_MAX	200	10	0.05	0.015	0.401	weeds (79)	Loam	2.42E-05	2.96E-06	8.08E-02
G_BASE_SAND_250_TERR_MAX	250	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_250_TERR_MAX	250	10	0.05	0.015	0.401	weeds (79)	Clay	3.15E-03	3.85E-04	**1.05E+01**
G_BASE_LOAM_250_TERR_MAX	250	10	0.05	0.015	0.401	weeds (79)	Loam	6.28E-05	7.66E-06	2.09E-01
G_ARV1_050_TERR_MAX	50	1	0.05	0.015	0.401	weeds (79)	Loam	1.38E-08	1.68E-09	4.59E-05
G_ARV2_050_TERR_MAX	50	100	0.05	0.015	0.401	weeds (79)	Loam	1.38E-08	1.68E-09	4.59E-05
G_ARV3_050_TERR_MAX	50	1000	0.05	0.015	0.401	weeds (79)	Loam	1.38E-08	1.68E-09	4.59E-05
G_ERV1_050_TERR_MAX	50	10	0.05	0.015	0.05	weeds (79)	Loam	1.35E-08	1.65E-09	4.50E-05
G_ERV2_050_TERR_MAX	50	10	0.05	0.015	0.2	weeds (79)	Loam	1.38E-08	1.68E-09	4.59E-05
G_ERV3_050_TERR_MAX	50	10	0.05	0.015	0.5	weeds (79)	Loam	1.40E-08	1.71E-09	4.67E-05
G_RGV1_050_TERR_MAX	50	10	0.05	0.023	0.401	weeds (79)	Loam	1.35E-08	1.65E-09	4.50E-05
G_RGV2_050_TERR_MAX	50	10	0.05	0.046	0.401	weeds (79)	Loam	1.35E-08	1.65E-09	4.50E-05
G_RGV3_050_TERR_MAX	50	10	0.05	0.15	0.401	weeds (79)	Loam	1.45E-08	1.77E-09	4.84E-05
G_SLV1_050_TERR_MAX	50	10	0.005	0.015	0.401	weeds (79)	Loam	7.50E-05	9.14E-06	2.50E-01
G_SLV2_050_TERR_MAX	50	10	0.01	0.015	0.401	weeds (79)	Loam	9.51E-06	1.16E-06	3.17E-02
G_SLV3_050_TERR_MAX	50	10	0.1	0.015	0.401	weeds (79)	Loam	1.46E-05	1.78E-06	4.86E-02
G_STV1_050_TERR_MAX	50	10	0.05	0.015	0.401	weeds (79)	Loam	1.35E-08	1.65E-09	4.50E-05
G_STV2_050_TERR_MAX	50	10	0.05	0.015	0.401	weeds (79)	Loam	1.38E-08	1.68E-09	4.59E-05
G_STV3_050_TERR_MAX	50	10	0.05	0.015	0.401	weeds (79)	Loam	1.35E-08	1.65E-09	4.50E-05
G_VGV1_050_TERR_MAX	50	10	0.05	0.015	0.401	Shrub	Loam	1.38E-08	1.68E-09	4.59E-05
G_VGV2_050_TERR_MAX	50	10	0.05	0.015	0.401	Rye Grass	Loam	1.38E-08	1.68E-09	4.59E-05
G_VGV3_050_TERR_MAX	50	10	0.05	0.015	0.401	Conifer-Hardwood	Loam	8.41E-09	1.03E-09	2.80E-05

RQ = Risk Quotient = Estimated Dose/Toxicity Reference Value

Shading and boldface indicates plant RQs greater than 1.

Table C-41: Consumption of contaminated fish from pond by predatory bird - long term exposure. Pond impacted by surface runoff modeled in GLEAMS.

Parameters/ Assumptions	Value	Units	Notes
Body Weight (W)	5.15	kg	
Food ingestion rate (dry weight)	0.101786153	kg dw/day	[1]
Food ingestion rate (wet weight, A)	0.40714461	kg ww/day	[2]
Bioconcentration factor (BCF)	1	L/kg fish	
Proportion of Diet Contaminated (Prop)	1	unitless	
Toxicity reference value (TRV)	27	mg/kg-bw/day	

TYPICAL APPLICATION RATE

GLEAMS ID	Annual Precipitation (inches)	Application Area (acres)	Hydraulic Slope (ft/ft)	Surface Roughness	USLE Soil Erodibility Factor (ton/ac per EI)	Vegetation Type	Soil Type	Pond Concentration (mg/L)	Concentrations in fish (C_{Fish}): WC × BCF	Dose estimates (D): C_{Fish} × A × Prop / W	Risk Quotient
G_BASE_SAND_005_POND_TYP	5	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_005_POND_TYP	5	10	0.05	0.015	0.401	weeds (79)	Clay	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_005_POND_TYP	5	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_010_POND_TYP	10	10	0.05	0.015	0.401	weeds (79)	Sand	1.46E-08	1.46E-08	1.15E-09	4.27E-11
G_BASE_CLAY_010_POND_TYP	10	10	0.05	0.015	0.401	weeds (79)	Clay	1.50E-06	1.50E-06	1.18E-07	4.39E-09
G_BASE_LOAM_010_POND_TYP	10	10	0.05	0.015	0.401	weeds (79)	Loam	2.58E-08	2.58E-08	2.04E-09	7.55E-11
G_BASE_SAND_025_POND_TYP	25	10	0.05	0.015	0.401	weeds (79)	Sand	2.50E-08	2.50E-08	1.98E-09	7.32E-11
G_BASE_CLAY_025_POND_TYP	25	10	0.05	0.015	0.401	weeds (79)	Clay	7.91E-07	7.91E-07	6.25E-08	2.32E-09
G_BASE_LOAM_025_POND_TYP	25	10	0.05	0.015	0.401	weeds (79)	Loam	2.45E-09	2.45E-09	1.93E-10	7.16E-12
G_BASE_SAND_050_POND_TYP	50	10	0.05	0.015	0.401	weeds (79)	Sand	2.07E-07	2.07E-07	1.63E-08	6.05E-10
G_BASE_CLAY_050_POND_TYP	50	10	0.05	0.015	0.401	weeds (79)	Clay	7.25E-05	7.25E-05	5.73E-06	2.12E-07
G_BASE_LOAM_050_POND_TYP	50	10	0.05	0.015	0.401	weeds (79)	Loam	2.56E-09	2.56E-09	2.02E-10	7.48E-12
G_BASE_SAND_100_POND_TYP	100	10	0.05	0.015	0.401	weeds (79)	Sand	1.28E-05	1.28E-05	1.01E-06	3.74E-08
G_BASE_CLAY_100_POND_TYP	100	10	0.05	0.015	0.401	weeds (79)	Clay	1.71E-04	1.71E-04	1.35E-05	5.00E-07
G_BASE_LOAM_100_POND_TYP	100	10	0.05	0.015	0.401	weeds (79)	Loam	1.81E-06	1.81E-06	1.43E-07	5.29E-09
G_BASE_SAND_150_POND_TYP	150	10	0.05	0.015	0.401	weeds (79)	Sand	2.27E-04	2.27E-04	1.79E-05	6.64E-07
G_BASE_CLAY_150_POND_TYP	150	10	0.05	0.015	0.401	weeds (79)	Clay	9.80E-04	9.80E-04	7.75E-05	2.87E-06
G_BASE_LOAM_150_POND_TYP	150	10	0.05	0.015	0.401	weeds (79)	Loam	1.48E-06	1.48E-06	1.17E-07	4.33E-09
G_BASE_SAND_200_POND_TYP	200	10	0.05	0.015	0.401	weeds (79)	Sand	3.78E-04	3.78E-04	2.99E-05	1.11E-06
G_BASE_CLAY_200_POND_TYP	200	10	0.05	0.015	0.401	weeds (79)	Clay	2.50E-03	2.50E-03	1.97E-04	7.31E-06
G_BASE_LOAM_200_POND_TYP	200	10	0.05	0.015	0.401	weeds (79)	Loam	1.21E-06	1.21E-06	9.55E-08	3.54E-09
G_BASE_SAND_250_POND_TYP	250	10	0.05	0.015	0.401	weeds (79)	Sand	4.58E-04	4.58E-04	3.62E-05	1.34E-06
G_BASE_CLAY_250_POND_TYP	250	10	0.05	0.015	0.401	weeds (79)	Clay	4.14E-03	4.14E-03	3.27E-04	1.21E-05
G_BASE_LOAM_250_POND_TYP	250	10	0.05	0.015	0.401	weeds (79)	Loam	1.18E-04	1.18E-04	9.31E-06	3.45E-07
G_ARV1_050_POND_TYP	50	1	0.05	0.015	0.401	weeds (79)	Loam	1.02E-09	1.02E-09	8.02E-11	2.97E-12
G_ARV2_050_POND_TYP	50	100	0.05	0.015	0.401	weeds (79)	Loam	4.63E-10	4.63E-10	3.66E-11	1.36E-12
G_ARV3_050_POND_TYP	50	1000	0.05	0.015	0.401	weeds (79)	Loam	4.63E-10	4.63E-10	3.66E-11	1.36E-12
G_ERV1_050_POND_TYP	50	10	0.05	0.015	0.05	weeds (79)	Loam	1.82E-09	1.82E-09	1.44E-10	5.33E-12
G_ERV2_050_POND_TYP	50	10	0.05	0.015	0.2	weeds (79)	Loam	1.85E-09	1.85E-09	1.46E-10	5.40E-12
G_ERV3_050_POND_TYP	50	10	0.05	0.015	0.5	weeds (79)	Loam	1.87E-09	1.87E-09	1.48E-10	5.47E-12
G_RGV1_050_POND_TYP	50	10	0.05	0.023	0.401	weeds (79)	Loam	1.82E-09	1.82E-09	1.44E-10	5.33E-12
G_RGV2_050_POND_TYP	50	10	0.05	0.046	0.401	weeds (79)	Loam	1.82E-09	1.82E-09	1.44E-10	5.33E-12
G_RGV3_050_POND_TYP	50	10	0.05	0.15	0.401	weeds (79)	Loam	1.97E-09	1.97E-09	1.56E-10	5.78E-12
G_SLV1_050_POND_TYP	50	10	0.005	0.015	0.401	weeds (79)	Loam	5.20E-05	5.20E-05	4.11E-06	1.52E-07
G_SLV2_050_POND_TYP	50	10	0.01	0.015	0.401	weeds (79)	Loam	6.74E-06	6.74E-06	5.32E-07	1.97E-08
G_SLV3_050_POND_TYP	50	10	0.1	0.015	0.401	weeds (79)	Loam	9.30E-06	9.30E-06	7.35E-07	2.72E-08
G_STV1_050_POND_TYP	50	10	0.05	0.015	0.401	weeds (79)	Loam	1.82E-09	1.82E-09	1.44E-10	5.33E-12
G_STV2_050_POND_TYP	50	10	0.05	0.015	0.401	weeds (79)	Loam	1.85E-09	1.85E-09	1.46E-10	5.40E-12
G_STV3_050_POND_TYP	50	10	0.05	0.015	0.401	weeds (79)	Loam	1.82E-09	1.82E-09	1.44E-10	5.33E-12
G_VGV1_050_POND_TYP	50	10	0.05	0.015	0.401	Shrub	Loam	1.85E-09	1.85E-09	1.46E-10	5.40E-12
G_VGV2_050_POND_TYP	50	10	0.05	0.015	0.401	Rye Grass	Loam	1.85E-09	1.85E-09	1.46E-10	5.40E-12
G_VGV3_050_POND_TYP	50	10	0.05	0.015	0.401	Conifer-Hardwooc	Loam	8.36E-10	8.36E-10	6.61E-11	2.45E-12

Risk Quotient = Estimated Dose/Toxicity Reference Value
Shading and boldface indicates piscivorous bird RQs greater than 0.1.

[1] Calculated using alorithm developed by Nagy, 1987 for all birds; where
Food Ingestion Rate (kg dw/day) = 0.0582*(BW)^0.651
[2] Assumes fish are 75% water (USEPA, 1993; Table 4-1 - value for bony fishes)
GLEAMS footnotes

Table C-41: Consumption of contaminated fish from pond by predatory bird - long term exposure. Pond impacted by surface runoff modeled in GLEAMS.

Parameters/ Assumptions	Value	Units	Notes
Body Weight (W)	5.15	kg	
Food ingestion rate (dry weight)	0.101786153	kg dw/day	[1]
Food ingestion rate (wet weight, A)	0.40714461	kg ww/day	[2]
Bioconcentration factor (BCF)	1	L/kg fish	
Proportion of Diet Contaminated (Prop)	1	unitless	
Toxicity reference value (TRV)	27	mg/kg-bw/day	

MAXIMUM APPLICATION RATE

GLEAMS ID	Annual Precipitation (inches)	Application Area (acres)	Hydraulic Slope (ft/ft)	Surface Roughness	USLE Soil Erodibility Factor (ton/ac per EI)	Vegetation Type	Soil Type	Pond Concentration (mg/L)	Concentrations in fish (C_{Fish}): WC × BCF	Dose estimates (D): C_{Fish} × A × Prop / W	Risk Quotient
G_BASE_SAND_005_POND_max	5	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_005_POND_max	5	10	0.05	0.015	0.401	weeds (79)	Clay	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_005_POND_max	5	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_010_POND_max	10	10	0.05	0.015	0.401	weeds (79)	Sand	2.91E-08	2.91E-08	2.30E-09	8.53E-11
G_BASE_CLAY_010_POND_max	10	10	0.05	0.015	0.401	weeds (79)	Clay	3.00E-06	3.00E-06	2.37E-07	8.77E-09
G_BASE_LOAM_010_POND_max	10	10	0.05	0.015	0.401	weeds (79)	Loam	5.16E-08	5.16E-08	4.08E-09	1.51E-10
G_BASE_SAND_025_POND_max	25	10	0.05	0.015	0.401	weeds (79)	Sand	5.00E-08	5.00E-08	3.95E-09	1.46E-10
G_BASE_CLAY_025_POND_max	25	10	0.05	0.015	0.401	weeds (79)	Clay	1.58E-06	1.58E-06	1.25E-07	4.63E-09
G_BASE_LOAM_025_POND_max	25	10	0.05	0.015	0.401	weeds (79)	Loam	4.89E-09	4.89E-09	3.87E-10	1.43E-11
G_BASE_SAND_050_POND_max	50	10	0.05	0.015	0.401	weeds (79)	Sand	4.13E-07	4.13E-07	3.27E-08	1.21E-09
G_BASE_CLAY_050_POND_max	50	10	0.05	0.015	0.401	weeds (79)	Clay	1.45E-04	1.45E-04	1.15E-05	4.24E-07
G_BASE_LOAM_050_POND_max	50	10	0.05	0.015	0.401	weeds (79)	Loam	5.11E-09	5.11E-09	4.04E-10	1.50E-11
G_BASE_SAND_100_POND_max	100	10	0.05	0.015	0.401	weeds (79)	Sand	2.55E-05	2.55E-05	2.02E-06	7.47E-08
G_BASE_CLAY_100_POND_max	100	10	0.05	0.015	0.401	weeds (79)	Clay	3.42E-04	3.42E-04	2.70E-05	1.00E-06
G_BASE_LOAM_100_POND_max	100	10	0.05	0.015	0.401	weeds (79)	Loam	3.61E-06	3.61E-06	2.85E-07	1.06E-08
G_BASE_SAND_150_POND_max	150	10	0.05	0.015	0.401	weeds (79)	Sand	4.54E-04	4.54E-04	3.59E-05	1.33E-06
G_BASE_CLAY_150_POND_max	150	10	0.05	0.015	0.401	weeds (79)	Clay	1.96E-03	1.96E-03	1.55E-04	5.74E-06
G_BASE_LOAM_150_POND_max	150	10	0.05	0.015	0.401	weeds (79)	Loam	2.96E-06	2.96E-06	2.34E-07	8.66E-09
G_BASE_SAND_200_POND_max	200	10	0.05	0.015	0.401	weeds (79)	Sand	7.55E-04	7.55E-04	5.97E-05	2.21E-06
G_BASE_CLAY_200_POND_max	200	10	0.05	0.015	0.401	weeds (79)	Clay	4.99E-03	4.99E-03	3.94E-04	1.46E-05
G_BASE_LOAM_200_POND_max	200	10	0.05	0.015	0.401	weeds (79)	Loam	2.42E-06	2.42E-06	1.91E-07	7.07E-09
G_BASE_SAND_250_POND_max	250	10	0.05	0.015	0.401	weeds (79)	Sand	9.17E-04	9.17E-04	7.25E-05	2.68E-06
G_BASE_CLAY_250_POND_max	250	10	0.05	0.015	0.401	weeds (79)	Clay	8.27E-03	8.27E-03	6.54E-04	2.42E-05
G_BASE_LOAM_250_POND_max	250	10	0.05	0.015	0.401	weeds (79)	Loam	2.36E-04	2.36E-04	1.86E-05	6.90E-07
G_ARV1_050_POND_max	50	1	0.05	0.015	0.401	weeds (79)	Loam	2.03E-09	2.03E-09	1.60E-10	5.94E-12
G_ARV2_050_POND_max	50	100	0.05	0.015	0.401	weeds (79)	Loam	9.27E-10	9.27E-10	7.33E-11	2.71E-12
G_ARV3_050_POND_max	50	1000	0.05	0.015	0.401	weeds (79)	Loam	9.26E-10	9.26E-10	7.32E-11	2.71E-12
G_ERV1_050_POND_max	50	10	0.05	0.015	0.05	weeds (79)	Loam	3.64E-09	3.64E-09	2.88E-10	1.07E-11
G_ERV2_050_POND_max	50	10	0.05	0.015	0.2	weeds (79)	Loam	3.69E-09	3.69E-09	2.92E-10	1.08E-11
G_ERV3_050_POND_max	50	10	0.05	0.015	0.5	weeds (79)	Loam	3.74E-09	3.74E-09	2.95E-10	1.09E-11
G_RGV1_050_POND_max	50	10	0.05	0.023	0.401	weeds (79)	Loam	3.64E-09	3.64E-09	2.88E-10	1.07E-11
G_RGV2_050_POND_max	50	10	0.05	0.046	0.401	weeds (79)	Loam	3.64E-09	3.64E-09	2.88E-10	1.07E-11
G_RGV3_050_POND_max	50	10	0.05	0.15	0.401	weeds (79)	Loam	3.95E-09	3.95E-09	3.12E-10	1.16E-11
G_SLV1_050_POND_max	50	10	0.005	0.015	0.401	weeds (79)	Loam	1.04E-04	1.04E-04	8.23E-06	3.05E-07
G_SLV2_050_POND_max	50	10	0.01	0.015	0.401	weeds (79)	Loam	1.35E-05	1.35E-05	1.06E-06	3.94E-08
G_SLV3_050_POND_max	50	10	0.1	0.015	0.401	weeds (79)	Loam	1.86E-05	1.86E-05	1.47E-06	5.45E-08
G_STV1_050_POND_max	50	10	0.05	0.015	0.401	weeds (79)	Loam	3.64E-09	3.64E-09	2.88E-10	1.07E-11
G_STV2_050_POND_max	50	10	0.05	0.015	0.401	weeds (79)	Loam	3.69E-09	3.69E-09	2.92E-10	1.08E-11
G_STV3_050_POND_max	50	10	0.05	0.015	0.401	weeds (79)	Loam	3.64E-09	3.64E-09	2.88E-10	1.07E-11
G_VGV1_050_POND_max	50	10	0.05	0.015	0.401	Shrub	Loam	3.69E-09	3.69E-09	2.92E-10	1.08E-11
G_VGV2_050_POND_max	50	10	0.05	0.015	0.401	Rye Grass	Loam	3.69E-09	3.69E-09	2.92E-10	1.08E-11
G_VGV3_050_POND_max	50	10	0.05	0.015	0.401	Conifer-Hardwooc	Loam	1.67E-09	1.67E-09	1.32E-10	4.90E-12

Risk Quotient = Estimated Dose/Toxicity Reference Value
Shading and boldface indicates piscivorous bird RQs greater than 0.1.

[1] Calculated using alorithm developed by Nagy, 1987 for all birds; where
Food Ingestion Rate (kg dw/day) = 0.0582*(BW)^0.651
[2] Assumes fish are 75% water (USEPA, 1993; Table 4-1 - value for bony fishes)

Table C-42: Impact to non-target terrrestrial plants from wind erosion

WIND EROSION - modeled in AERMOD and CalPuff
TYPICAL APPLICATION RATE

AERMOD/ CalPuff Scenario ID	Watershed Location	Distance From Receptor (km)	Terrestrial Concentration (lb a.e./acre)	Typical Species TRV	Typical Species RQ	Threatened & Endangered Species TRV	Threatened & Endangered Species RQ
dust_MT_1.5_typ	MT	1.5	2.50E-04	7.00E-04	3.57E-01	3.00E-04	8.33E-01
dust_MT_10_typ	MT	10	7.33E-06	7.00E-04	1.05E-02	3.00E-04	2.44E-02
dust_MT_100_typ	MT	100	2.56E-07	7.00E-04	3.66E-04	3.00E-04	8.53E-04
dust_OR_1.5_typ	OR	1.5	2.87E-03	7.00E-04	**4.10E+00**	3.00E-04	**9.57E+00**
dust_OR_10_typ	OR	10	7.67E-05	7.00E-04	1.10E-01	3.00E-04	2.56E-01
dust_OR_100_typ	OR	100	1.87E-06	7.00E-04	2.68E-03	3.00E-04	6.25E-03
dust_WY_1.5_typ	WY	1.5	1.48E-03	7.00E-04	**2.11E+00**	3.00E-04	**4.92E+00**
dust_WY_10_typ	WY	10	5.28E-05	7.00E-04	7.55E-02	3.00E-04	1.76E-01
dust_WY_100_typ	WY	100	1.68E-06	7.00E-04	2.41E-03	3.00E-04	5.62E-03

WIND EROSION - modeled in AERMOD and CalPuff
MAXIMUM APPLICATION RATE

AERMOD/ CalPuff Scenario ID	Watershed Location	Distance From Receptor (km)	Terrestrial Concentration (lb a.e./acre)	Typical Species TRV	Typical Species RQ	Threatened & Endangered Species TRV	Threatened & Endangered Species RQ
dust_MT_1.5_max	MT	1.5	5.00E-04	7.00E-04	7.14E-01	3.00E-04	**1.67E+00**
dust_MT_10_max	MT	10	1.47E-05	7.00E-04	2.09E-02	3.00E-04	4.88E-02
dust_MT_100_max	MT	100	5.12E-07	7.00E-04	7.32E-04	3.00E-04	1.71E-03
dust_OR_1.5_max	OR	1.5	5.74E-03	7.00E-04	**8.20E+00**	3.00E-04	**1.91E+01**
dust_OR_10_max	OR	10	1.53E-04	7.00E-04	2.19E-01	3.00E-04	5.11E-01
dust_OR_100_max	OR	100	3.75E-06	7.00E-04	5.36E-03	3.00E-04	1.25E-02
dust_WY_1.5_max	WY	1.5	2.95E-03	7.00E-04	**4.22E+00**	3.00E-04	**9.84E+00**
dust_WY_10_max	WY	10	1.06E-04	7.00E-04	1.51E-01	3.00E-04	3.52E-01
dust_WY_100_max	WY	100	3.37E-06	7.00E-04	4.81E-03	3.00E-04	1.12E-02

RQ = Risk Quotient = Estimated Dose/Toxicity Reference Value

Shading and boldface indicates plant RQs greater than 1.

Table C-43: Impact to aquatic species from accidental spill to pond

Parameters/Assumptions	Value	Units
Volume of pond (Vp)	1011715	L
Volume of spill		
Truck ($Vspill_t$)	757	L
Helicopter($Vspill_h$)	529.9	L
Herbicide concentration		
Truck mixture (Cm_t)	9587.15	mg a.e./L
Helicopter mixture (Cm_h)	47935.75	mg a.e./L

			Risk Quotients		
Scenario	**Concentrations in water (Cw): Cm × Vspill / Vp**	**Units**	**Fish**	**Aquatic Invertebrates**	**Non-Target Aquatic Plants**
Truck spill into pond	7.17	mg a.e./L	**3.59E+01**	**1.67E+03**	**1.79E+04**
Helicopter spill into pond	25.11	mg a.e./L	**1.26E+02**	**5.84E+03**	**6.28E+04**

Shading and boldface indicates plant RQs greater than 1.
Shading and boldface indicates acute RQs greater than 0.05 for fish and invertebrates.

Table C-44: Impact to aquatic species from accidental direct spray of pond and stream

Parameters/Assumptions		Value	Units
Application rates (R)			
	Typical	1	lb/acre
	Maximum	2	lb/acre
Area of pond (Area)		0.25	acre
Volume of pond (Vol)		1011715	L
Mass sprayed on pond (R x Area)			
	Typical	113398	mg
	Maximum	226796	mg
Concentration in pond water (Mass/Volume)			
	Typical	0.112084925	mg/L
	Maximum	0.22416985	mg/L
Width of stream		2	m
Length of stream impacted by direct spray		636.15	m
Area of stream impacted by spray (Area)		1272.3	m2
Depth of stream		0.2	m
Instantaneous volume of stream impacted by direct spray (Vol)		254460	L
Mass sprayed on stream (R x Area)			
	Typical	1272.300	lb
	Maximum	2544.600	lb
Mass sprayed on stream - converted to mg			
	Typical	142607.060	mg
	Maximum	285214.120	mg
Concentration in stream water (Mass/Vol)			
	Typical	0.560430165	mg/L
	Maximum	1.12086033	mg/L

Scenario		Concentration in water (mg/L)	Risk Quotients Fish	Aquatic Invertebrates	Non-Target Aquatic Plants
Acute					
Direct spray to pond					
	Typical application	1.12E-01	**5.60E-01**	**2.61E+01**	**2.80E+02**
	Maximum application	2.24E-01	**1.12E+00**	**5.21E+01**	**5.60E+02**
Direct spray to stream					
	Typical application	5.60E-01	**2.80E+00**	**1.30E+02**	**1.40E+03**
	Maximum application	1.12E+00	**5.60E+00**	**2.61E+02**	**2.80E+03**
Chronic					
Direct spray to pond					
	Typical application	1.12E-01	**2.04E+00**	**5.60E-01**	**3.74E+00**
	Maximum application	2.24E-01	**4.08E+00**	**1.12E+00**	**7.47E+00**
Direct spray to stream					
	Typical application	5.60E-01	**1.02E+01**	**2.80E+00**	**1.87E+01**
	Maximum application	1.12E+00	**2.04E+01**	**5.60E+00**	**3.74E+01**

Shading and boldface indicates plant RQs greater than 1.
Shading and boldface indicates acute RQs greater than 0.05 for fish and invertebrates.

APPENDIX B.45 – B.66 – ECOLOGICAL RISK ASSESSMENT WORKSHEETS – TERRESTRIAL APPLICATION FOR WOODY VEGETATION – 2,4-D ACID AND SALTS

Table C-45: Direct spray of terrestrial receptors and exposure from indirect contact with foliage

Parameter		Pollinating Insect	Small Mammal	Units
Duration of Exposure (T)		24	24	hours
Body weight (W)		0.000093	0.02	kg
Surface Areas (A): cm^2 = 12.3 * BW(g)^0.65				
		2.63	86.21	cm^2
Application rates (R)				
	Typical	2	2	mg/cm^2
	Maximum	4	4	
Amount deposited on 1/2 receptor (Amnt): 0.5 × A × R				
	Typical	0.029478335	0.966284139	mg
	Maximum	0.058956671	1.932568279	
Dose Estimate Assuming 100% Dermal Adsorption				
Absorbed Dose: Amnt × Prop ÷ W				
	Typical	3.17E+02	4.83E+01	mg/kg bw
	Maximum	6.34E+02	9.66E+01	
Dose Estimate Assuming First Order Dermal Adsorption				
First-order dermal absorption rates (k)				
	Central estimate (ka)	0.078766725	0.078766725	$hour^{-1}$
Proportion absorbed over period T (Prop): 1-exp(-k T)				
	Typical	0.028389233	0.028389233	unitless
	Maximum	0.028389233	0.028389233	
Absorbed Dose: Amnt × Prop ÷ W				
	Typical	9.00E+00	1.37E+00	mg/kg bw
	Maximum	1.80E+01	2.74E+00	

RISK QUOTIENTS - Direct Spray	Toxicity Reference Value	Typical Application	Maximum Application
Small mammal - 100% absorption	2193	2.20E-02	4.41E-02
Pollinating insect - 100% absorption	140	2.26E+00	4.53E+00
Small mammal - 1st order dermal adsorption	2193	6.25E-04	1.25E-03
Pollinating insect - 1st order dermal adsorption	140	6.43E-02	1.29E-01

RISK QUOTIENTS - Indirect Contact *	Toxicity Reference Value	Typical Application	Maximum Application
Small mammal - 100% absorption	2193	2.20E-03	4.41E-03
Pollinating insect - 100% absorption	140	2.26E-01	4.53E-01
Small mammal - 1st order dermal adsorption	2193	6.25E-05	1.25E-04
Pollinating insect - 1st order dermal adsorption	140	6.43E-03	1.29E-02

Surface area calculation for mammals from Stahl, 1967 (presented in USEPA, 1993).
No surface area calculation identified for insects. Mammalian equation used as a surrogate.
Risk Quotient = Estimated Dose/Toxicity Reference Value
* Exposure from indirect contact assumed to be 1/10 of direct spray exposure

Table C-46: Consumption of contaminated berries by a small mammal - acute exposure scenario

Parameters/Assumptions		Value	Units	Notes
Body Weight (W)		0.02	kg	
Food ingestion rate (dry weight)		0.0033641	kg dw/day	[1]
Food ingestion rate (wet weight, A)		0.014626644	kg ww/day	[2]
Application rates (R)				
	Typical	2	lb/acre	
	Maximum	4		
Residue rate - berries (rr)				
	Typical	1.5	mg/kg per lb/acre	
	Maximum	7		
Concentration on berries (C): R × rr				
	Typical	3	mg/kg fruit	
	Maximum	28		
Dose estimates (D): C × A / W				
	Typical	2.19E+00	mg/kg bw	
	Maximum	2.05E+01		

RISK QUOTIENTS - Ingestion	**Toxicity Reference Value**	**Typical Application**	**Maximum Application**
Small mammal - acute exposure	1184	1.85E-03	1.73E-02

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987 for rodents; where

Food Ingestion Rate (g dw/day) = 0.621*(BW g)^0.564; converted into kg dw/day

[2] Assumes fruit is 77% water (USEPA, 1993; Table 4-2 - value for fruit pulp and skin)

Table C-47: Consumption of contaminated fruit by a small mammal - chronic exposure scenario

Parameters/Assumptions		Value	Units	
Duration of exposure (T)		90	days	
Body Weight (W)		0.02	kg	
Food ingestion rate (dry weight)		0.0033641	kg dw/day	[1]
Food ingestion rate (wet weight, A)		0.014626644	kg ww/day	[2]
Half life on vegetation (t50)				
	Herbicide specific	8.8	days	
Application rates (R)				
	Typical	2	lb/acre	
	Maximum	4		
Residue rate - berries (rr)				
	Typical	1.5	mg/kg per lb/acre	
	Maximum	7		
Drift (Drift)				
	Typical	1	unitless	
	Maximum	1		
Decay Coefficient (k): ln(2)/t50				
	Typical	0.078766725	$days^{-1}$	
	Maximum	0.078766725		
Initial concentration on berries (C0): R × rr × Drift				
	Typical	3	mg/kg fruit	
	Maximum	28		
Concentration on berries at time T: C0 * exp(-k*T)				
	Typical	0.00250268	mg/kg fruit	
	Maximum	0.02335835		
Time-weighted Average Concentration on vegetation (CTWA): C0 * (1-exp(-k*T))/(k*T)				
	Typical	0.422837508	mg/kg fruit	
	Maximum	3.946483412		
Proportion of Diet Contaminated (Prop)				
	Typical	1	unitless	
	Maximum	1		
Dose estimates (D): CTWA × A × Prop / W				
	Typical	0.309234679	mg/kg bw	
	Maximum	2.886190333		

RISK QUOTIENTS - Ingestion	Toxicity Reference Value	Typical Application	Maximum Application
Small mammal - chronic exposure	10	3.09E-02	2.89E-01

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987 for rodents; where

Food Ingestion Rate (g dw/day) = 0.621*(BW g)^0.564; converted into kg dw/day

[2] Assumes fruit is 77% water (USEPA, 1993; Table 4-2 - value for fruit pulp and skin)

Table C-48: Consumption of contaminated grass by a large mammal - acute exposure scenario

Parameters/Assumptions		Value	Units	Notes
Body Weight (W)		70	kg	
Food ingestion rate (dry weight)		1.9211536	kg dw/day	[1]
Food ingestion rate (wet weight, A)		6.40384532	kg ww/day	[2]
Duration of exposure (D)		1	day	
Application rates (R)				
	Typical	2	lb/acre	
	Maximum	4		
Residue rate - grass (rr)				
	Typical	92	mg/kg per lb/acre	
	Maximum	110		
Concentration on grass (C): R × rr				
	Typical	184	mg/kg grass	
	Maximum	440		
Drift (Drift)				
	Typical	1	unitless	
	Maximum	1		
Proportion of Diet Contaminated (Prop)				
	Typical	1	unitless	
	Maximum	1		
Dose estimates: Drift × Prop × C × A ÷W				
	Typical	1.68E+01	mg/kg bw	
	Maximum	4.03E+01		

RISK QUOTIENTS - Ingestion	Toxicity Reference Value	Typical Application	Maximum Application
Large mammal - acute exposure	51	3.30E-01	7.89E-01

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987 for herbivores; where
Food Ingestion Rate (g dw/day) = 0.577*(BW g)^0.727; converted into kg dw/day

[2] Assumes grass is 70% water (USEPA, 1993; Table 4-2 - lowest value for young grasses)

TableCC-49: Consumption of contaminated grass by a large mammal - chronic exposure scenario

Parameters/Assumptions		Value	Units	Notes
Duration of exposure (T)		90	day	
Body Weight (W)		70	kg	
Food ingestion rate (dry weight)		1.921153597	kg dw/day	[1]
Food ingestion rate (wet weight, A)		6.403845323	kg ww/day	[2]
Half life on vegetation (t50)				
	Herbicide specific	8.8	days	
Application rates (R)				
	Typical	2	lb/acre	
	Maximum	4		
Residue rate - grass (rr)				
	Typical	92	mg/kg per lb/acre	
	Maximum	110		
Drift (Drift)				
	Typical	1	unitless	
	Maximum	1		
Decay Coefficient (k): ln(2)/t50				
	Typical	0.078766725	$days^{-1}$	
	Maximum	0.078766725		
Initial concentration on grass (C0): R × rr × Drift				
	Typical	184	mg/kg grass	
	Maximum	440		
Concentration on grass at time T: C0 * exp(-k*T)				
	Typical	0.15349773	mg/kg grass	
	Maximum	0.36705979		
Time-weighted Average Concentration on vegetation (CTWA): C0 * (1-exp(-k*T))/(k*T)				
	Typical	25.93403385	mg/kg vegetation	
	Maximum	62.0161679		
Proportion of Diet Contaminated (Prop)				
	Typical	1	unitless	
	Maximum	1		
Dose estimates: CTWA × A × Prop / W				
	Typical	2.37E+00	mg/kg bw	
	Maximum	5.67E+00		

RISK QUOTIENTS - Ingestion	Toxicity Reference Value	Typical Application	Maximum Application
Large mammal - chronic exposure	1	2.37E+00	5.67E+00

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987 for herbivores; where

Food Ingestion Rate (g dw/day) = 0.577*(BW g)^0.727; converted into kg dw/day

[2] Assumes grass is 70% water (USEPA, 1993; Table 4-2 - lowest value for young grasses)

Table C-50: Consumption of contaminated small mammals by a large mammal - acute exposure scenario

Parameters/Assumptions		Value	Units	Notes
Body Weight (W)		12	kg	
Food ingestion rate (dry weight)		0.52971677	kg dw/day	[1]
Food ingestion rate (wet weight, A)		1.6553649	kg ww/day	[2]
Duration of exposure (D)		1	day	
Application rates (R)				
	Typical	2	lb/acre	
	Maximum	4		
Amount deposited on small mammal prey (Amnt_mouse): 0.5 × SurfaceArea × R				
	Typical	0.96628414	mg	
	Maximum	1.93256828		
Drift (Drift)				
	Typical	1	unitless	
	Maximum	1		
Proportion of Diet Contaminated (Prop)				
	Typical	1	unitless	
	Maximum	1		
Dose estimates: Drift × Prop × Amnt_mouse/BW_mouse × A ÷W				
	Typical	6.66E+00	mg/kg bw	
	Maximum	1.33E+01		

RISK QUOTIENTS - Ingestion	Toxicity Reference Value	Typical Application	Maximum Application
Large carnivorous mammal - acute exposure	80	8.33E-02	1.67E-01

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987; where

Food Ingestion Rate (g dw/day) = 0.0687*(BW g)^0.822; converted into kg dw/day

[2] Assumes mammals are 68% water (USEPA, 1993)

Table C-51: Consumption of contaminated small mammals by a large mammal - chronic exposure scenario

Parameters/Assumptions		Value	Units	Notes
Duration of exposure (T)		90	day	
Body Weight (W)		12	kg	
Food ingestion rate (dry weight)		0.529716769	kg dw/day	[1]
Food ingestion rate (wet weight, FIR_coyote)		1.655364903	kg ww/day	[2]
Application rates (R)				
	Typical	2	lb/acre	
	Maximum	4		
Drift (Drift)				
	Typical	1	unitless	
	Maximum	1		
Decay Coefficient (k): ln(2)/t50				
	Typical	0.078766725	$days^{-1}$	
	Maximum	0.078766725		
Initial concentration on mammal (C0): 0.5 × SurfaceArea × R/BW_smallmammal				
	Typical	48.31420697	mg a.e./kg mammal	
	Maximum	96.62841393		
Concentration absorbed in small mammal at time T (C90): C0 * exp(-k*T)				
	Typical	1.37160327	mg/kg mammal	
	Maximum	2.743206539		
Proportion of Diet Contaminated (Prop)				
	Typical	1	unitless	
	Maximum	1		
Dose estimates: C90 × FIR_coyote × Prop / W				
	Typical	1.89E-01	mg/kg bw	
	Maximum	3.78E-01		

RISK QUOTIENTS - Ingestion	Toxicity Reference Value	Typical Application	Maximum Application
Large mammal - chronic exposure	1	1.89E-01	3.78E-01

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987; where

Food Ingestion Rate (g dw/day) = 0.0687*(BW g)^0.822; converted into kg dw/day

[2] Assumes mammals are 68% water (USEPA, 1993)

Table C-52: Consumption of contaminated insects by a small bird - acute exposure scenario

Parameters/Assumptions		Value	Units	Notes
Body Weight (W)		0.08	kg	
Food ingestion rate (dry weight)		0.01124177	kg dw/day	[1]
Food ingestion rate (wet weight, A)		0.03626376	kg ww/day	[2]
Duration of exposure (D)		1	day	
Application rates (R)				
	Typical	2	lb/acre	
	Maximum	4		
Residue rate - insects (rr)				
	Typical	33	mg/kg per lb/acre	
	Maximum	58		
Concentration on insects (C): R × rr				
	Typical	66	mg/kg insect	
	Maximum	232		
Drift (Drift)				
	Typical	1	unitless	
	Maximum	1		
Proportion of Diet Contaminated (Prop)				
	Typical	1	unitless	
	Maximum	1		
Dose estimates: Drift × Prop × C × A ÷W				
	Typical	2.99E+01	mg/kg bw	
	Maximum	1.05E+02		

RISK QUOTIENTS - Ingestion	**Toxicity Reference Value**	**Typical Application**	**Maximum Application**
Small bird - acute exposure	217	1.38E-01	4.85E-01

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987 for all birds; where

Food Ingestion Rate (kg dw/day) = 0.0582*(BW)^0.651

[2] Assumes insects are 69% water (USEPA, 1993; Table 4-1 - value for grasshoppers and crickets)

Table C-53: Consumption of contaminated insects by a small bird - chronic exposure scenario

Parameters/Assumptions	Value	Units	Notes
Duration of exposure (T)	90	day	
Body Weight (W)	0.08	kg	
Food ingestion rate (dry weight)	0.011241767	kg dw/day	[1]
Food ingestion rate (wet weight, A)	0.036263763	kg ww/day	[2]
Half life on insect (t50)			
Herbicide specific	8.8	days	
Application rates (R)			
Typical	2	lb/acre	
Maximum	4		
Residue rate - insects (rr)			
Typical	33	mg/kg per lb/acre	
Maximum	58		
Drift (Drift)			
Typical	1	unitless	
Maximum	1		
Decay Coefficient (k): ln(2)/t50			
Typical	0.078766725	$days^{-1}$	
Maximum	0.078766725		
Initial concentration on insects (C0): R × rr × Drift			
Typical	66	mg/kg insect	
Maximum	232		
Concentration on insects at time T: C0 * exp(-k*T)			
Typical	0.055058968	mg/kg insect	
Maximum	0.193540617		
Time-weighted Average Concentration on insects (CTWA): C0 * (1-exp(-k*T))/(k*T)			
Typical	9.302425186	mg/kg insect	
Maximum	32.69943399		
Proportion of Diet Contaminated (Prop)			
Typical	1	unitless	
Maximum	1		
Dose estimates (D): CTWA × A × Prop / W			
Typical	4.22E+00	mg/kg bw	
Maximum	1.48E+01		

RISK QUOTIENTS - Ingestion	Toxicity Reference Value	Typical Application	Maximum Application
Small bird - chronic exposure	27	1.56E-01	5.49E-01

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987 for all birds; where

Food Ingestion Rate (kg dw/day) = 0.0582*(BW)^0.651

[2] Assumes insects are 69% water (USEPA, 1993; Table 4-1 - value for grasshoppers and crickets)

Table C-54: Consumption of contaminated vegetation by a large bird - acute exposure scenario

Parameters/Assumptions		Value	Units	Notes
Body Weight (W)		3.72	kg	
Food ingestion rate (dry weight)		0.13688203	kg dw/day	[1]
Food ingestion rate (wet weight, A)		0.91254687	kg ww/day	[2]
Duration of exposure (D)		1	day	
Application rates (R)				
	Typical	2	lb/acre	
	Maximum	4		
Residue rate - vegetation (rr)				
	Typical	35	mg/kg per lb/acre	
	Maximum	125		
Concentration on vegetation (C): R × rr				
	Typical	70	mg/kg veg	
	Maximum	500		
Drift (Drift)				
	Typical	1	unitless	
	Maximum	1		
Proportion of Diet Contaminated (Prop)				
	Typical	1	unitless	
	Maximum	1		
Dose estimates: Drift × Prop × C × A ÷W				
	Typical	1.72E+01		
	Maximum	1.23E+02		

RISK QUOTIENTS - Ingestion	Toxicity Reference Value	Typical Application	Maximum Application
Large bird - acute exposure	314	5.47E-02	3.91E-01

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987 for all birds; where

Food Ingestion Rate (kg dw/day) = 0.0582*(BW)^0.651

[2] Assumes vegetation is 85% water (USEPA, 1993; Table 4-2 - value for dicots)

Table C-55: Consumption of contaminated vegetation by a large bird - chronic exposure scenario

Parameters/Assumptions		Value	Units	Notes
Duration of exposure (T)		90	day	
Body Weight (W)		3.72	kg	
Food ingestion rate (dry weight)		0.13688203	kg dw/day	[1]
Food ingestion rate (wet weight, A)		0.912546869	kg ww/day	[2]
Half life on vegetation (t50)				
	Herbicide specific	8.8	days	
Application rates (R)				
	Typical	2	lb/acre	
	Maximum	4		
Residue rate - vegetation (rr)				
	Typical	35	mg/kg per lb/acre	
	Maximum	125		
Drift (Drift)				
	Typical	1	unitless	
	Maximum	1		
Decay Coefficient (k): ln(2)/t50				
	Typical	0.078766725	$days^{-1}$	
	Maximum	0.078766725		
Initial concentration on vegetation (C0): R × rr × Drift				
	Typical	70	mg/kg veg	
	Maximum	500		
Concentration on vegetation at time T: C0 * exp(-k*T)				
	Typical	0.058395876	mg/kg veg	
	Maximum	0.417113398		
Time-weighted Average Concentration on vegetation (CTWA): C0 * (1-exp(-k*T))/(k*T)				
	Typical	9.86620853	mg/kg veg	
	Maximum	70.47291807		
Proportion of Diet Contaminated (Prop)				
	Typical	1	unitless	
	Maximum	1		
Dose estimates (D): CTWA × A × Prop / W				
	Typical	2.42E+00	mg/kg bw	
	Maximum	1.73E+01		

RISK QUOTIENTS - Ingestion	Toxicity Reference Value	Typical Application	Maximum Application
Large bird - chronic exposure	27	8.96E-02	6.40E-01

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987 for all birds; where
Food Ingestion Rate (kg dw/day) = 0.0582*(BW)^0.651

[2] Assumes vegetation is 85% water (USEPA, 1993; Table 4-2 - value for dicots)

Table C-56: Impact to aquatic species from accidental spray drift to pond

OFF-SITE DRIFT - modeled in AgDrift
TYPICAL APPLICATION RATE

Mode of Application	Application Height or Type	Distance From Receptor (ft)	Pond Concentration (mg/L)	Risk Quotients - Acute: Fish	Risk Quotients - Acute: Aquatic Invertebrates	Risk Quotients - Acute: Non-Target Aquatic Plants	Risk Quotients - Chronic: Fish	Risk Quotients - Chronic: Aquatic Invertebrates	Risk Quotients - Chronic: Non-Target Aquatic Plants
Plane	Forested	100	1.01E-02	5.62E-03	7.78E-04	1.01E-01	1.84E-01	5.06E-02	3.37E-01
Plane	Forested	300	3.90E-03	2.17E-03	3.00E-04	3.90E-02	7.10E-02	1.95E-02	1.30E-01
Plane	Forested	900	1.31E-03	7.27E-04	1.01E-04	1.31E-02	2.38E-02	6.54E-03	4.36E-02
Plane	Non-Forested	100	5.60E-03	3.11E-03	4.30E-04	5.60E-02	1.02E-01	2.80E-02	1.87E-01
Plane	Non-Forested	300	2.64E-03	1.47E-03	2.03E-04	2.64E-02	4.80E-02	1.32E-02	8.80E-02
Plane	Non-Forested	900	1.06E-03	5.87E-04	8.13E-05	1.06E-02	1.92E-02	5.28E-03	3.52E-02
Helicopter	Forested	100	5.55E-04	3.09E-04	4.27E-05	5.55E-03	1.01E-02	2.78E-03	1.85E-02
Helicopter	Forested	300	1.63E-04	9.05E-05	1.25E-05	1.63E-03	2.96E-03	8.14E-04	5.43E-03
Helicopter	Forested	900	2.92E-05	1.62E-05	2.24E-06	2.92E-04	5.30E-04	1.46E-04	9.72E-04
Helicopter	Non-Forested	100	4.56E-03	2.54E-03	3.51E-04	4.56E-02	8.30E-02	2.28E-02	1.52E-01
Helicopter	Non-Forested	300	2.05E-03	1.14E-03	1.57E-04	2.05E-02	3.72E-02	1.02E-02	6.82E-02
Helicopter	Non-Forested	900	6.83E-04	3.80E-04	5.26E-05	6.83E-03	1.24E-02	3.42E-03	2.28E-02
Ground	Low Boom	25	1.36E-03	7.57E-04	1.05E-04	1.36E-02	2.48E-02	6.82E-03	4.54E-02
Ground	Low Boom	100	7.48E-04	4.15E-04	5.75E-05	7.48E-03	1.36E-02	3.74E-03	2.49E-02
Ground	Low Boom	900	1.44E-04	8.02E-05	1.11E-05	1.44E-03	2.62E-03	7.22E-04	4.81E-03
Ground	High Boom	25	2.19E-03	1.22E-03	1.68E-04	2.19E-02	3.98E-02	1.09E-02	7.30E-02
Ground	High Boom	100	1.15E-03	6.41E-04	8.87E-05	1.15E-02	2.10E-02	5.77E-03	3.84E-02
Ground	High Boom	900	1.83E-04	1.02E-04	1.41E-05	1.83E-03	3.33E-03	9.16E-04	6.11E-03

OFF-SITE DRIFT - modeled in AgDrift
MAXIMUM APPLICATION RATE

Mode of Application	Application Height or Type	Distance From Receptor (ft)	Pond Concentration (mg/L)	Risk Quotients - Acute: Fish	Risk Quotients - Acute: Aquatic Invertebrates	Risk Quotients - Acute: Non-Target Aquatic Plants	Risk Quotients - Chronic: Fish	Risk Quotients - Chronic: Aquatic Invertebrates	Risk Quotients - Chronic: Non-Target Aquatic Plants
Plane	Forested	100	2.07E-02	1.15E-02	1.59E-03	2.07E-01	3.76E-01	1.03E-01	6.89E-01
Plane	Forested	300	8.29E-03	4.61E-03	6.38E-04	8.29E-02	1.51E-01	4.15E-02	2.76E-01
Plane	Forested	900	2.91E-03	1.62E-03	2.24E-04	2.91E-02	5.30E-02	1.46E-02	9.71E-02
Plane	Non-Forested	100	1.19E-02	6.62E-03	9.17E-04	1.19E-01	2.17E-01	5.96E-02	3.97E-01
Plane	Non-Forested	300	5.34E-03	2.97E-03	4.11E-04	5.34E-02	9.71E-02	2.67E-02	1.78E-01
Plane	Non-Forested	900	1.40E-03	7.78E-04	1.08E-04	1.40E-02	2.55E-02	7.00E-03	4.67E-02
Helicopter	Forested	100	1.15E-03	6.36E-04	8.81E-05	1.15E-02	2.08E-02	5.73E-03	3.82E-02
Helicopter	Forested	300	3.18E-04	1.76E-04	2.44E-05	3.18E-03	5.77E-03	1.59E-03	1.06E-02
Helicopter	Forested	900	5.02E-05	2.79E-05	3.86E-06	5.02E-04	9.13E-04	2.51E-04	1.67E-03
Helicopter	Non-Forested	100	9.84E-03	5.47E-03	7.57E-04	9.84E-02	1.79E-01	4.92E-02	3.28E-01
Helicopter	Non-Forested	300	4.15E-03	2.30E-03	3.19E-04	4.15E-02	7.54E-02	2.07E-02	1.38E-01
Helicopter	Non-Forested	900	6.76E-04	3.76E-04	5.20E-05	6.76E-03	1.23E-02	3.38E-03	2.25E-02
Ground	Low Boom	25	2.73E-03	1.51E-03	2.10E-04	2.73E-02	4.96E-02	1.36E-02	9.09E-02
Ground	Low Boom	100	1.50E-03	8.31E-04	1.15E-04	1.50E-02	2.72E-02	7.48E-03	4.98E-02
Ground	Low Boom	900	2.89E-04	1.60E-04	2.22E-05	2.89E-03	5.25E-03	1.44E-03	9.62E-03
Ground	High Boom	25	4.38E-03	2.43E-03	3.37E-04	4.38E-02	7.96E-02	2.19E-02	1.46E-01
Ground	High Boom	100	2.31E-03	1.28E-03	1.77E-04	2.31E-02	4.19E-02	1.15E-02	7.69E-02
Ground	High Boom	900	3.66E-04	2.04E-04	2.82E-05	3.66E-03	6.66E-03	1.83E-03	1.22E-02

RQ = Risk Quotient = Estimated Dose/Toxicity Reference Value

Shading and boldface indicates plant RQs greater than 1.
Shading and boldface indicates acute RQs greater than 0.05 for fish and invertebrates.
Shading and boldface indicates chronic RQs greater than 0.5 for fish and invertebrates.

Table C-57: Impact to aquatic species from accidental spray drift to stream

OFF-SITE DRIFT - modeled in AgDrift
TYPICALAPPLICATION RATE

				Risk Quotients - Acute			Risk Quotients - Chronic		
Mode of Application	**Application Height or Type**	**Distance From Receptor (ft)**	**Stream Concentration (mg/L)**	**Fish**	**Aquatic Invertebrates**	**Non-Target Aquatic Plants**	**Fish**	**Aquatic Invertebrates**	**Non-Target Aquatic Plants**
Plane	Forested	100	1.45E-02	8.06E-03	1.12E-03	1.45E-01	2.64E-01	7.25E-02	4.84E-01
Plane	Forested	300	4.43E-03	2.46E-03	3.41E-04	4.43E-02	8.05E-02	2.21E-02	1.48E-01
Plane	Forested	900	1.35E-03	7.52E-04	1.04E-04	1.35E-02	2.46E-02	6.77E-03	4.51E-02
Plane	Non-Forested	100	7.36E-03	4.09E-03	5.66E-04	7.36E-02	1.34E-01	3.68E-02	2.45E-01
Plane	Non-Forested	300	2.85E-03	1.59E-03	2.20E-04	2.85E-02	5.19E-02	1.43E-02	9.51E-02
Plane	Non-Forested	900	1.09E-03	6.07E-04	8.40E-05	1.09E-02	1.99E-02	5.46E-03	3.64E-02
Helicopter	Forested	100	7.30E-04	4.06E-04	5.62E-05	7.30E-03	1.33E-02	3.65E-03	2.43E-02
Helicopter	Forested	300	1.93E-04	1.07E-04	1.48E-05	1.93E-03	3.50E-03	9.64E-04	6.43E-03
Helicopter	Forested	900	3.20E-05	1.78E-05	2.46E-06	3.20E-04	5.81E-04	1.60E-04	1.07E-03
Helicopter	Non-Forested	100	6.03E-03	3.35E-03	4.64E-04	6.03E-02	1.10E-01	3.01E-02	2.01E-01
Helicopter	Non-Forested	300	2.22E-03	1.23E-03	1.71E-04	2.22E-02	4.03E-02	1.11E-02	7.39E-02
Helicopter	Non-Forested	900	7.25E-04	4.03E-04	5.57E-05	7.25E-03	1.32E-02	3.62E-03	2.42E-02
Ground	Low Boom	25	2.45E-03	1.36E-03	1.89E-04	2.45E-02	4.46E-02	1.23E-02	8.18E-02
Ground	Low Boom	100	7.19E-04	3.99E-04	5.53E-05	7.19E-03	1.31E-02	3.60E-03	2.40E-02
Ground	Low Boom	900	7.45E-05	4.14E-05	5.73E-06	7.45E-04	1.35E-03	3.72E-04	2.48E-03
Ground	High Boom	25	4.11E-03	2.28E-03	3.16E-04	4.11E-02	7.47E-02	2.06E-02	1.37E-01
Ground	High Boom	100	1.16E-03	6.47E-04	8.96E-05	1.16E-02	2.12E-02	5.82E-03	3.88E-02
Ground	High Boom	900	9.84E-05	5.47E-05	7.57E-06	9.84E-04	1.79E-03	4.92E-04	3.28E-03

OFF-SITE DRIFT - modeled in AgDrift
MAXIMUM APPLICATION RATE

				Risk Quotients - Acute			Risk Quotients - Chronic		
Mode of Application	**Application Height or Type**	**Distance From Receptor (ft)**	**Stream Concentration (mg/L)**	**Fish**	**Aquatic Invertebrates**	**Non-Target Aquatic Plants**	**Fish**	**Aquatic Invertebrates**	**Non-Target Aquatic Plants**
Plane	Forested	100	2.94E-02	1.63E-02	2.26E-03	2.94E-01	**5.34E-01**	1.47E-01	9.79E-01
Plane	Forested	300	9.32E-03	5.18E-03	7.17E-04	9.32E-02	1.69E-01	4.66E-02	3.11E-01
Plane	Forested	900	3.01E-03	1.67E-03	2.32E-04	3.01E-02	5.48E-02	1.51E-02	1.00E-01
Plane	Non-Forested	100	1.55E-02	8.62E-03	1.19E-03	1.55E-01	2.82E-01	7.76E-02	5.17E-01
Plane	Non-Forested	300	6.07E-03	3.37E-03	4.67E-04	6.07E-02	1.10E-01	3.03E-02	2.02E-01
Plane	Non-Forested	900	1.52E-03	8.46E-04	1.17E-04	1.52E-02	2.77E-02	7.62E-03	5.08E-02
Helicopter	Forested	100	1.56E-03	8.66E-04	1.20E-04	1.56E-02	2.83E-02	7.79E-03	5.20E-02
Helicopter	Forested	300	3.74E-04	2.08E-04	2.88E-05	3.74E-03	6.80E-03	1.87E-03	1.25E-02
Helicopter	Forested	900	5.62E-05	3.12E-05	4.33E-06	5.62E-04	1.02E-03	2.81E-04	1.87E-03
Helicopter	Non-Forested	100	1.28E-02	7.10E-03	9.83E-04	1.28E-01	2.32E-01	6.39E-02	4.26E-01
Helicopter	Non-Forested	300	4.72E-03	2.62E-03	3.63E-04	4.72E-02	8.59E-02	2.36E-02	1.57E-01
Helicopter	Non-Forested	900	7.86E-04	4.37E-04	6.04E-05	7.86E-03	1.43E-02	3.93E-03	2.62E-02
Ground	Low Boom	25	4.91E-03	2.73E-03	3.78E-04	4.91E-02	8.92E-02	2.45E-02	1.64E-01
Ground	Low Boom	100	1.44E-03	7.99E-04	1.11E-04	1.44E-02	2.61E-02	7.19E-03	4.79E-02
Ground	Low Boom	900	1.49E-04	8.27E-05	1.15E-05	1.49E-03	2.71E-03	7.45E-04	4.96E-03
Ground	High Boom	25	8.22E-03	4.57E-03	6.32E-04	8.22E-02	1.49E-01	4.11E-02	2.74E-01
Ground	High Boom	100	2.33E-03	1.29E-03	1.79E-04	2.33E-02	4.23E-02	1.16E-02	7.76E-02
Ground	High Boom	900	1.97E-04	1.09E-04	1.51E-05	1.97E-03	3.58E-03	9.84E-04	6.56E-03

RQ = Risk Quotient = Estimated Dose/Toxicity Reference Value

Shading and boldface indicates plant RQs greater than 1.
Shading and boldface indicates acute RQs greater than 0.05 for fish and invertebrates.
Shading and boldface indicates chronic RQs greater than 0.5 for fish and invertebrates.

Table C-58: Impact to non-target terrrestrial plants from direct spray and spray drift

DIRECT SPRAY	Terrestrial Concentration (lb a.e./acre)	Typical Species RQ	Threatened & Endangered Species RQ
Typical application rate	2	**1.00E+03**	**6.67E+03**
Maximum application rate	4	**2.00E+03**	**1.33E+04**

OFF-SITE DRIFT - modeled in AgDrift
TYPICAL APPLICATION RATE

Mode of Application	Application Height or Type	Distance From Receptor (ft)	Soil Concentration (mg a.e./kg)	Typical Species RQ	Threatened & Endangered Species RQ
Plane	Forested	100	7.05E-02	**3.53E+01**	**2.35E+02**
Plane	Forested	300	3.04E-02	**1.52E+01**	**1.01E+02**
Plane	Forested	900	1.11E-02	**5.55E+00**	**3.70E+01**
Plane	Non-Forested	100	4.02E-02	**2.01E+01**	**1.34E+02**
Plane	Non-Forested	300	2.12E-02	**1.06E+01**	**7.07E+01**
Plane	Non-Forested	900	8.90E-03	**4.45E+00**	**2.97E+01**
Helicopter	Forested	100	3.60E-03	**1.80E+00**	**1.20E+01**
Helicopter	Forested	300	1.20E-03	6.00E-01	**4.00E+00**
Helicopter	Forested	900	2.00E-04	1.00E-01	6.67E-01
Helicopter	Non-Forested	100	3.22E-02	**1.61E+01**	**1.07E+02**
Helicopter	Non-Forested	300	1.65E-02	**8.25E+00**	**5.50E+01**
Helicopter	Non-Forested	900	5.60E-03	**2.80E+00**	**1.87E+01**
Ground	Low Boom	25	9.00E-03	**4.50E+00**	**3.00E+01**
Ground	Low Boom	100	5.50E-03	**2.75E+00**	**1.83E+01**
Ground	Low Boom	900	1.20E-03	6.00E-01	**4.00E+00**
Ground	High Boom	25	1.42E-02	**7.10E+00**	**4.73E+01**
Ground	High Boom	100	8.40E-03	**4.20E+00**	**2.80E+01**
Ground	High Boom	900	1.50E-03	7.50E-01	**5.00E+00**

OFF-SITE DRIFT - modeled in AgDrift
MAXIMUM APPLICATION RATE

Mode of Application	Application Height or Type	Distance From Receptor (ft)	Soil Concentration (mg a.e./kg)	Typical Species RQ	Threatened & Endangered Species RQ
Plane	Forested	100	1.45E-01	**7.26E+01**	**4.84E+02**
Plane	Forested	300	6.49E-02	**3.25E+01**	**2.16E+02**
Plane	Forested	900	2.47E-02	**1.24E+01**	**8.23E+01**
Plane	Non-Forested	100	8.54E-02	**4.27E+01**	**2.85E+02**
Plane	Non-Forested	300	4.17E-02	**2.09E+01**	**1.39E+02**
Plane	Non-Forested	900	1.14E-02	**5.70E+00**	**3.80E+01**
Helicopter	Forested	100	7.20E-03	**3.60E+00**	**2.40E+01**
Helicopter	Forested	300	2.40E-03	**1.20E+00**	**8.00E+00**
Helicopter	Forested	900	4.00E-04	2.00E-01	**1.33E+00**
Helicopter	Non-Forested	100	6.93E-02	**3.47E+01**	**2.31E+02**
Helicopter	Non-Forested	300	3.18E-02	**1.59E+01**	**1.06E+02**
Helicopter	Non-Forested	900	5.20E-03	**2.60E+00**	**1.73E+01**
Ground	Low Boom	25	1.79E-02	**8.95E+00**	**5.97E+01**
Ground	Low Boom	100	1.10E-02	**5.50E+00**	**3.67E+01**
Ground	Low Boom	900	2.40E-03	**1.20E+00**	**8.00E+00**
Ground	High Boom	25	2.84E-02	**1.42E+01**	**9.47E+01**
Ground	High Boom	100	1.68E-02	**8.40E+00**	**5.60E+01**
Ground	High Boom	900	3.10E-03	**1.55E+00**	**1.03E+01**

RQ = Risk Quotient = Estimated Dose/Toxicity Reference Value
Shading and boldface indicates plant RQs greater than 1.

Table C-59: Consumption of contaminated fish from pond by predatory bird - one time exposure. Pond impacted by spray drift modeled in AgDrift.

Parameters/ Assumptions	Value	Units	Notes
Body Weight (W)	5.15	kg	
Food ingestion rate (dry weight)	0.101786153	kg dw/day	[1]
Food ingestion rate (wet weight, A)	0.40714461	kg ww/day	[2]
Bioconcentration factor (BCF)	1	L/kg fish	
Proportion of Diet Contaminated (Prop)	1	unitless	
Toxicity reference value (TRV)	27	mg/kg-bw/day	

TYPICAL APPLICATION RATE

Mode of Application	Application Height or Type	Distance From Receptor (ft)	Pond Concentration (mg/L)	Concentration in fish (C_{Fish}): WC × BCF	Dose estimate (D): C_{Fish} × A × Prop / W	Risk Quotient
Plane	Forested	100	1.01E-02	1.01E-02	8.00E-04	2.96E-05
Plane	Forested	300	3.90E-03	3.90E-03	3.09E-04	1.14E-05
Plane	Forested	900	1.31E-03	1.31E-03	1.03E-04	3.83E-06
Plane	Non-Forested	100	5.60E-03	5.60E-03	4.42E-04	1.64E-05
Plane	Non-Forested	300	2.64E-03	2.64E-03	2.09E-04	7.73E-06
Plane	Non-Forested	900	1.06E-03	1.06E-03	8.35E-05	3.09E-06
Helicopter	Forested	100	5.55E-04	5.55E-04	4.39E-05	1.63E-06
Helicopter	Forested	300	1.63E-04	1.63E-04	1.29E-05	4.77E-07
Helicopter	Forested	900	2.92E-05	2.92E-05	2.31E-06	8.54E-08
Helicopter	Non-Forested	100	4.56E-03	4.56E-03	3.61E-04	1.34E-05
Helicopter	Non-Forested	300	2.05E-03	2.05E-03	1.62E-04	5.99E-06
Helicopter	Non-Forested	900	6.83E-04	6.83E-04	5.40E-05	2.00E-06
Ground	Low Boom	25	1.36E-03	1.36E-03	1.08E-04	3.99E-06
Ground	Low Boom	100	7.48E-04	7.48E-04	5.91E-05	2.19E-06
Ground	Low Boom	900	1.44E-04	1.44E-04	1.14E-05	4.23E-07
Ground	High Boom	25	2.19E-03	2.19E-03	1.73E-04	6.41E-06
Ground	High Boom	100	1.15E-03	1.15E-03	9.12E-05	3.38E-06
Ground	High Boom	900	1.83E-04	1.83E-04	1.45E-05	5.36E-07

MAXIMUM APPLICATION RATE

Mode of Application	Application Height or Type	Distance From Receptor (ft)	Pond Concentration (mg/L)	Concentration in fish (C_{Fish}): WC × BCF	Dose estimate (D): C_{Fish} × A × Prop / W	Risk Quotient
Plane	Forested	100	2.07E-02	2.07E-02	1.63E-03	6.05E-05
Plane	Forested	300	8.29E-03	8.29E-03	6.55E-04	2.43E-05
Plane	Forested	900	2.91E-03	2.91E-03	2.30E-04	8.53E-06
Plane	Non-Forested	100	1.19E-02	1.19E-02	9.42E-04	3.49E-05
Plane	Non-Forested	300	5.34E-03	5.34E-03	4.22E-04	1.56E-05
Plane	Non-Forested	900	1.40E-03	1.40E-03	1.11E-04	4.10E-06
Helicopter	Forested	100	1.15E-03	1.15E-03	9.06E-05	3.35E-06
Helicopter	Forested	300	3.18E-04	3.18E-04	2.51E-05	9.30E-07
Helicopter	Forested	900	5.02E-05	5.02E-05	3.97E-06	1.47E-07
Helicopter	Non-Forested	100	9.84E-03	9.84E-03	7.78E-04	2.88E-05
Helicopter	Non-Forested	300	4.15E-03	4.15E-03	3.28E-04	1.21E-05
Helicopter	Non-Forested	900	6.76E-04	6.76E-04	5.35E-05	1.98E-06
Ground	Low Boom	25	2.73E-03	2.73E-03	2.16E-04	7.98E-06
Ground	Low Boom	100	1.50E-03	1.50E-03	1.18E-04	4.38E-06
Ground	Low Boom	900	2.89E-04	2.89E-04	2.28E-05	8.45E-07
Ground	High Boom	25	4.38E-03	4.38E-03	3.46E-04	1.28E-05
Ground	High Boom	100	2.31E-03	2.31E-03	1.82E-04	6.75E-06
Ground	High Boom	900	3.66E-04	3.66E-04	2.90E-05	1.07E-06

Risk Quotient = Estimated Dose/Toxicity Reference Value
Shading and boldface indicates piscivorous bird RQs greater than 0.1.

[1] Calculated using alorithm developed by Nagy, 1987 for all birds; where
Food Ingestion Rate (kg dw/day) = 0.0582*(BW)^0.651
[2] Assumes fish are 75% water (USEPA, 1993; Table 4-1 - value for bony fishes)

Table C-60: Impact to aquatic species from surface runoff to pond

SURFACE RUNOFF - modeled in GLEAMS
TYPICAL APPLICATION RATE

GLEAMS ID	Pond Concentration (mg/L)	Risk Quotients - Acute: Fish	Risk Quotients - Acute: Aquatic Invertebrates	Risk Quotients - Acute: Non-Target Aquatic Plants	Risk Quotients - Chronic: Fish	Risk Quotients - Chronic: Aquatic Invertebrates	Risk Quotients - Chronic: Non-Target Aquatic Plants
G_BASE_SAND_005_POND_TYP	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_005_POND_TYP	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_005_POND_TYP	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_010_POND_TYP	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_010_POND_TYP	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_010_POND_TYP	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_025_POND_TYP	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_025_POND_TYP	4.34E-10	2.41E-10	3.34E-11	4.34E-09	7.89E-09	2.17E-09	1.45E-08
G_BASE_LOAM_025_POND_TYP	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_050_POND_TYP	8.65E-08	4.81E-08	6.65E-09	8.65E-07	1.57E-06	4.33E-07	0.00E+00
G_BASE_CLAY_050_POND_TYP	2.79E-05	1.55E-05	2.14E-06	2.79E-04	5.07E-04	1.39E-04	9.29E-04
G_BASE_LOAM_050_POND_TYP	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_100_POND_TYP	4.52E-06	2.51E-06	3.48E-07	4.52E-05	8.23E-05	2.26E-05	1.51E-04
G_BASE_CLAY_100_POND_TYP	2.17E-04	1.21E-04	1.67E-05	2.17E-03	3.95E-03	1.09E-03	7.23E-03
G_BASE_LOAM_100_POND_TYP	2.36E-07	1.31E-07	1.82E-08	2.36E-06	4.30E-06	1.18E-06	7.88E-06
G_BASE_SAND_150_POND_TYP	4.76E-05	2.65E-05	3.66E-06	4.76E-04	8.66E-04	2.38E-04	1.59E-03
G_BASE_CLAY_150_POND_TYP	2.37E-03	1.32E-03	1.82E-04	2.37E-02	4.31E-02	1.19E-02	7.91E-02
G_BASE_LOAM_150_POND_TYP	2.05E-07	1.14E-07	1.57E-08	2.05E-06	3.72E-06	1.02E-06	6.82E-06
G_BASE_SAND_200_POND_TYP	1.32E-04	7.36E-05	1.02E-05	1.32E-03	2.41E-03	6.62E-04	4.42E-03
G_BASE_CLAY_200_POND_TYP	6.32E-03	3.51E-03	4.86E-04	6.32E-02	1.15E-01	3.16E-02	2.11E-01
G_BASE_LOAM_200_POND_TYP	1.60E-07	8.91E-08	1.23E-08	1.60E-06	2.92E-06	8.02E-07	5.35E-06
G_BASE_SAND_250_POND_TYP	1.95E-04	1.08E-04	1.50E-05	1.95E-03	3.54E-03	9.75E-04	6.50E-03
G_BASE_CLAY_250_POND_TYP	1.02E-02	5.67E-03	7.86E-04	1.02E-01	1.86E-01	5.11E-02	3.40E-01
G_BASE_LOAM_250_POND_TYP	1.01E-04	5.63E-05	7.80E-06	1.01E-03	1.84E-03	5.07E-04	3.38E-03
G_ARV1_050_POND_TYP	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ARV2_050_POND_TYP	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ARV3_050_POND_TYP	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ERV1_050_POND_TYP	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ERV2_050_POND_TYP	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ERV3_050_POND_TYP	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_RGV1_050_POND_TYP	2.10E-05	1.17E-05	1.62E-06	2.10E-04	3.83E-04	1.05E-04	7.01E-04
G_RGV2_050_POND_TYP	2.09E-06	1.16E-06	1.61E-07	2.09E-05	3.80E-05	1.05E-05	6.97E-05
G_RGV3_050_POND_TYP	2.39E-06	1.33E-06	1.84E-07	2.39E-05	4.35E-05	1.20E-05	7.97E-05
G_SLV1_050_POND_TYP	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_SLV2_050_POND_TYP	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_SLV3_050_POND_TYP	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_STV1_050_POND_TYP	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_STV2_050_POND_TYP	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_STV3_050_POND_TYP	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_VGV1_050_POND_TYP	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_VGV2_050_POND_TYP	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_VGV3_050_POND_TYP	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

RQ = Risk Quotient = Estimated Dose/Toxicity Reference Value

Table C-60: Impact to aquatic species from surface runoff to pond

SURFACE RUNOFF - modeled in GLEAMS
MAXIMUM APPLICATION RATE

GLEAMS ID	Pond Concentration (mg/L)	Risk Quotients - Acute: Fish	Risk Quotients - Acute: Aquatic Invertebrates	Risk Quotients - Acute: Non-Target Aquatic Plants	Risk Quotients - Chronic: Fish	Risk Quotients - Chronic: Aquatic Invertebrates	Risk Quotients - Chronic: Non-Target Aquatic Plants
G_BASE_SAND_005_POND_MAX	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_005_POND_MAX	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_005_POND_MAX	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_010_POND_MAX	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_010_POND_MAX	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_010_POND_MAX	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_025_POND_MAX	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_025_POND_MAX	8.68E-10	4.82E-10	6.68E-11	8.68E-09	1.58E-08	4.34E-09	2.89E-08
G_BASE_LOAM_025_POND_MAX	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_050_POND_MAX	1.73E-07	9.61E-08	1.33E-08	1.73E-06	3.15E-06	8.65E-07	5.77E-06
G_BASE_CLAY_050_POND_MAX	5.58E-05	3.10E-05	4.29E-06	5.58E-04	1.01E-03	2.79E-04	1.86E-03
G_BASE_LOAM_050_POND_MAX	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_100_POND_MAX	9.05E-06	5.03E-06	6.96E-07	9.05E-05	1.65E-04	4.52E-05	3.02E-04
G_BASE_CLAY_100_POND_MAX	4.34E-04	2.41E-04	3.34E-05	4.34E-03	7.89E-03	2.17E-03	1.45E-02
G_BASE_LOAM_100_POND_MAX	4.73E-07	2.63E-07	3.64E-08	4.73E-06	8.60E-06	2.36E-06	1.58E-05
G_BASE_SAND_150_POND_MAX	9.53E-05	5.29E-05	7.33E-06	9.53E-04	1.73E-03	4.76E-04	3.18E-03
G_BASE_CLAY_150_POND_MAX	4.74E-03	2.64E-03	3.65E-04	4.74E-02	8.63E-02	2.37E-02	1.58E-01
G_BASE_LOAM_150_POND_MAX	4.09E-07	2.27E-07	3.15E-08	4.09E-06	7.44E-06	2.05E-06	1.36E-05
G_BASE_SAND_200_POND_MAX	2.65E-04	1.47E-04	2.04E-05	2.65E-03	4.82E-03	1.32E-03	8.83E-03
G_BASE_CLAY_200_POND_MAX	1.26E-02	7.02E-03	9.73E-04	1.26E-01	2.30E-01	6.32E-02	4.21E-01
G_BASE_LOAM_200_POND_MAX	3.21E-07	1.78E-07	2.47E-08	3.21E-06	5.83E-06	1.60E-06	1.07E-05
G_BASE_SAND_250_POND_MAX	3.90E-04	2.17E-04	3.00E-05	3.90E-03	7.09E-03	1.95E-03	1.30E-02
G_BASE_CLAY_250_POND_MAX	2.04E-02	1.13E-02	1.57E-03	2.04E-01	3.71E-01	1.02E-01	6.81E-01
G_BASE_LOAM_250_POND_MAX	2.03E-04	1.13E-04	1.56E-05	2.03E-03	3.69E-03	1.01E-03	6.76E-03
G_ARV1_050_POND_MAX	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ARV2_050_POND_MAX	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ARV3_050_POND_MAX	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ERV1_050_POND_MAX	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ERV2_050_POND_MAX	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ERV3_050_POND_MAX	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_RGV1_050_POND_MAX	4.21E-05	2.34E-05	3.24E-06	4.21E-04	7.65E-04	2.10E-04	1.40E-03
G_RGV2_050_POND_MAX	4.18E-06	2.32E-06	3.22E-07	4.18E-05	7.61E-05	2.09E-05	1.39E-04
G_RGV3_050_POND_MAX	4.78E-06	2.66E-06	3.68E-07	4.78E-05	8.69E-05	2.39E-05	1.59E-04
G_SLV1_050_POND_MAX	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_SLV2_050_POND_MAX	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_SLV3_050_POND_MAX	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_STV1_050_POND_MAX	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_STV2_050_POND_MAX	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_STV3_050_POND_MAX	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_VGV1_050_POND_MAX	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_VGV2_050_POND_MAX	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_VGV3_050_POND_MAX	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

RQ = Risk Quotient = Estimated Dose/Toxicity Reference Value

Shading and boldface indicates plant RQs greater than 1.
Shading and boldface indicates acute RQs greater than 0.05 for fish and invertebrates.
Shading and boldface indicates chronic RQs greater than 0.5 for fish and invertebrates.

SURFACE RUNOFF - modeled in GLEAMS
TYPICAL APPLICATION RATE

GLEAMS ID	Annual Precipitation (inches)	Application Area (acres)	Hydraulic Slope (ft/ft)	Surface Roughness	USLE Soil Erodibility Factor (ton/ac per EI)	Vegetation Type	Soil Type	Stream Concentration (mg/L)	Risk Quotients - Acute: Fish	Risk Quotients - Acute: Aquatic Invertebrates	Risk Quotients - Acute: Non-Target Aquatic Plants	Risk Quotients - Chronic: Fish	Risk Quotients - Chronic: Aquatic Invertebrates	Risk Quotients - Chronic: Non-Target Aquatic Plants
G_BASE_SAND_005_STREAM_TYP	5	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_005_STREAM_TYP	5	10	0.05	0.015	0.401	weeds (79)	Clay	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_005_STREAM_TYP	5	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_010_STREAM_TYP	10	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_010_STREAM_TYP	10	10	0.05	0.015	0.401	weeds (79)	Clay	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_010_STREAM_TYP	10	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_025_STREAM_TYP	25	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_025_STREAM_TYP	25	10	0.05	0.015	0.401	weeds (79)	Clay	2.13E-12	1.18E-12	1.64E-13	2.13E-11	3.88E-11	1.07E-11	7.11E-11
G_BASE_LOAM_025_STREAM_TYP	25	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_050_STREAM_TYP	50	10	0.05	0.015	0.401	weeds (79)	Sand	2.96E-10	1.65E-10	2.28E-11	2.96E-09	5.39E-09	1.48E-09	9.87E-09
G_BASE_CLAY_050_STREAM_TYP	50	10	0.05	0.015	0.401	weeds (79)	Clay	1.14E-07	6.34E-08	8.78E-09	1.14E-06	2.08E-06	5.71E-07	3.81E-06
G_BASE_LOAM_050_STREAM_TYP	50	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_100_STREAM_TYP	100	10	0.05	0.015	0.401	weeds (79)	Sand	5.75E-08	3.19E-08	4.42E-09	5.75E-07	1.04E-06	2.87E-07	1.92E-06
G_BASE_CLAY_100_STREAM_TYP	100	10	0.05	0.015	0.401	weeds (79)	Clay	1.51E-06	8.40E-07	1.16E-07	1.51E-05	2.75E-05	7.56E-06	5.04E-05
G_BASE_LOAM_100_STREAM_TYP	100	10	0.05	0.015	0.401	weeds (79)	Loam	5.04E-09	2.80E-09	3.87E-10	5.04E-08	9.16E-08	2.52E-08	1.68E-07
G_BASE_SAND_150_STREAM_TYP	150	10	0.05	0.015	0.401	weeds (79)	Sand	6.70E-07	3.72E-07	5.15E-08	6.70E-06	1.22E-05	3.35E-06	2.23E-05
G_BASE_CLAY_150_STREAM_TYP	150	10	0.05	0.015	0.401	weeds (79)	Clay	8.26E-06	4.59E-06	6.35E-07	8.26E-05	1.50E-04	4.13E-05	2.75E-04
G_BASE_LOAM_150_STREAM_TYP	150	10	0.05	0.015	0.401	weeds (79)	Loam	1.30E-08	7.23E-09	1.00E-09	1.30E-07	2.37E-07	6.50E-08	4.34E-07
G_BASE_SAND_200_STREAM_TYP	200	10	0.05	0.015	0.401	weeds (79)	Sand	2.91E-06	1.62E-06	2.24E-07	2.91E-05	5.29E-05	1.46E-05	9.71E-05
G_BASE_CLAY_200_STREAM_TYP	200	10	0.05	0.015	0.401	weeds (79)	Clay	2.37E-05	1.31E-05	1.82E-06	2.37E-04	4.30E-04	1.18E-04	7.89E-04
G_BASE_LOAM_200_STREAM_TYP	200	10	0.05	0.015	0.401	weeds (79)	Loam	1.13E-08	6.29E-09	8.70E-10	1.13E-07	2.06E-07	5.66E-08	3.77E-07
G_BASE_SAND_250_STREAM_TYP	250	10	0.05	0.015	0.401	weeds (79)	Sand	5.02E-06	2.79E-06	3.86E-07	5.02E-05	9.13E-05	2.51E-05	1.67E-04
G_BASE_CLAY_250_STREAM_TYP	250	10	0.05	0.015	0.401	weeds (79)	Clay	4.16E-05	2.31E-05	3.20E-06	4.16E-04	7.57E-04	2.08E-04	1.39E-03
G_BASE_LOAM_250_STREAM_TYP	250	10	0.05	0.015	0.401	weeds (79)	Loam	2.93E-07	1.63E-07	2.25E-08	2.93E-06	5.33E-06	1.47E-06	9.77E-06
G_ARV1_050_STREAM_TYP	50	1	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ARV2_050_STREAM_TYP	50	100	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ARV3_050_STREAM_TYP	50	1000	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ERV1_050_STREAM_TYP	50	10	0.05	0.015	0.05	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ERV2_050_STREAM_TYP	50	10	0.05	0.015	0.2	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ERV3_050_STREAM_TYP	50	10	0.05	0.015	0.5	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_RGV1_050_STREAM_TYP	50	10	0.05	0.023	0.401	weeds (79)	Loam	1.75E-07	9.73E-08	1.35E-08	1.75E-06	3.19E-06	8.76E-07	5.84E-06
G_RGV2_050_STREAM_TYP	50	10	0.05	0.046	0.401	weeds (79)	Loam	1.78E-08	9.89E-09	1.37E-09	1.78E-07	3.24E-07	8.90E-08	5.93E-07
G_RGV3_050_STREAM_TYP	50	10	0.05	0.15	0.401	weeds (79)	Loam	1.82E-08	1.01E-08	1.40E-09	1.82E-07	3.31E-07	9.10E-08	6.07E-07
G_SLV1_050_STREAM_TYP	50	10	0.005	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_SLV2_050_STREAM_TYP	50	10	0.01	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_SLV3_050_STREAM_TYP	50	10	0.1	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_STV1_050_STREAM_TYP	50	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_STV2_050_STREAM_TYP	50	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_STV3_050_STREAM_TYP	50	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_VGV1_050_STREAM_TYP	50	10	0.05	0.015	0.401	Shrub	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_VGV2_050_STREAM_TYP	50	10	0.05	0.015	0.401	Rye Grass	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_VGV3_050_STREAM_TYP	50	10	0.05	0.015	0.401	Conifer-Hardwood	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

RQ = Risk Quotient = Estimated Dose/Toxicity Reference Value

SURFACE RUNOFF - modeled in GLEAMS
MAXIMUM APPLICATION RATE

GLEAMS ID	Annual Precipitation (inches)	Application Area (acres)	Hydraulic Slope (ft/ft)	Surface Roughness	USLE Soil Erodibility Factor (ton/ac per EI)	Vegetation Type	Soil Type	Stream Concentration (mg/L)	Risk Quotients - Acute: Fish	Risk Quotients - Acute: Aquatic Invertebrates	Risk Quotients - Acute: Non-Target Aquatic Plants	Risk Quotients - Chronic: Fish	Risk Quotients - Chronic: Aquatic Invertebrates	Risk Quotients - Chronic: Non-Target Aquatic Plants
G_BASE_SAND_005_STREAM_MAX	5	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_005_STREAM_MAX	5	10	0.05	0.015	0.401	weeds (79)	Clay	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_005_STREAM_MAX	5	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_010_STREAM_MAX	10	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_010_STREAM_MAX	10	10	0.05	0.015	0.401	weeds (79)	Clay	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_010_STREAM_MAX	10	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_025_STREAM_MAX	25	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_025_STREAM_MAX	25	10	0.05	0.015	0.401	weeds (79)	Clay	4.26E-12	2.37E-12	3.28E-13	4.26E-11	7.75E-11	2.13E-11	1.42E-10
G_BASE_LOAM_025_STREAM_MAX	25	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_050_STREAM_MAX	50	10	0.05	0.015	0.401	weeds (79)	Sand	5.92E-10	3.29E-10	4.56E-11	5.92E-09	1.08E-08	2.96E-09	1.97E-08
G_BASE_CLAY_050_STREAM_MAX	50	10	0.05	0.015	0.401	weeds (79)	Clay	2.28E-07	1.27E-07	1.76E-08	2.28E-06	4.15E-06	1.14E-06	7.61E-06
G_BASE_LOAM_050_STREAM_MAX	50	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_100_STREAM_MAX	100	10	0.05	0.015	0.401	weeds (79)	Sand	1.15E-07	6.38E-08	8.84E-09	1.15E-06	2.09E-06	5.75E-07	3.83E-06
G_BASE_CLAY_100_STREAM_MAX	100	10	0.05	0.015	0.401	weeds (79)	Clay	3.02E-06	1.68E-06	2.33E-07	3.02E-05	5.50E-05	1.51E-05	1.01E-04
G_BASE_LOAM_100_STREAM_MAX	100	10	0.05	0.015	0.401	weeds (79)	Loam	1.01E-08	5.60E-09	7.75E-10	1.01E-07	1.83E-07	5.04E-08	3.36E-07
G_BASE_SAND_150_STREAM_MAX	150	10	0.05	0.015	0.401	weeds (79)	Sand	1.34E-06	7.44E-07	1.03E-07	1.34E-05	2.44E-05	6.70E-06	4.47E-05
G_BASE_CLAY_150_STREAM_MAX	150	10	0.05	0.015	0.401	weeds (79)	Clay	1.65E-05	9.17E-06	1.27E-06	1.65E-04	3.00E-04	8.26E-05	5.50E-04
G_BASE_LOAM_150_STREAM_MAX	150	10	0.05	0.015	0.401	weeds (79)	Loam	2.60E-08	1.45E-08	2.00E-09	2.60E-07	4.73E-07	1.30E-07	8.67E-07
G_BASE_SAND_200_STREAM_MAX	200	10	0.05	0.015	0.401	weeds (79)	Sand	5.82E-06	3.24E-06	4.48E-07	5.82E-05	1.06E-04	2.91E-05	1.94E-04
G_BASE_CLAY_200_STREAM_MAX	200	10	0.05	0.015	0.401	weeds (79)	Clay	4.73E-05	2.63E-05	3.64E-06	4.73E-04	8.60E-04	2.37E-04	1.58E-03
G_BASE_LOAM_200_STREAM_MAX	200	10	0.05	0.015	0.401	weeds (79)	Loam	2.26E-08	1.26E-08	1.74E-09	2.26E-07	4.11E-07	1.13E-07	7.54E-07
G_BASE_SAND_250_STREAM_MAX	250	10	0.05	0.015	0.401	weeds (79)	Sand	1.00E-05	5.58E-06	7.72E-07	1.00E-04	1.83E-04	5.02E-05	3.35E-04
G_BASE_CLAY_250_STREAM_MAX	250	10	0.05	0.015	0.401	weeds (79)	Clay	8.32E-05	4.62E-05	6.40E-06	8.32E-04	1.51E-03	4.16E-04	2.77E-03
G_BASE_LOAM_250_STREAM_MAX	250	10	0.05	0.015	0.401	weeds (79)	Loam	5.86E-07	3.26E-07	4.51E-08	5.86E-06	1.07E-05	2.93E-06	1.95E-05
G_ARV1_050_STREAM_MAX	50	1	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ARV2_050_STREAM_MAX	50	100	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ARV3_050_STREAM_MAX	50	1000	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ERV1_050_STREAM_MAX	50	10	0.05	0.015	0.05	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ERV2_050_STREAM_MAX	50	10	0.05	0.015	0.2	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ERV3_050_STREAM_MAX	50	10	0.05	0.015	0.5	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_RGV1_050_STREAM_MAX	50	10	0.05	0.023	0.401	weeds (79)	Loam	3.50E-07	1.95E-07	2.70E-08	3.50E-06	6.37E-06	1.75E-06	1.17E-05
G_RGV2_050_STREAM_MAX	50	10	0.05	0.046	0.401	weeds (79)	Loam	3.56E-08	1.98E-08	2.74E-09	3.56E-07	6.47E-07	1.78E-07	1.19E-06
G_RGV3_050_STREAM_MAX	50	10	0.05	0.15	0.401	weeds (79)	Loam	3.64E-08	2.02E-08	2.80E-09	3.64E-07	6.62E-07	1.82E-07	1.21E-06
G_SLV1_050_STREAM_MAX	50	10	0.005	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_SLV2_050_STREAM_MAX	50	10	0.01	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_SLV3_050_STREAM_MAX	50	10	0.1	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_STV1_050_STREAM_MAX	50	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_STV2_050_STREAM_MAX	50	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_STV3_050_STREAM_MAX	50	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_VGV1_050_STREAM_MAX	50	10	0.05	0.015	0.401	Shrub	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_VGV2_050_STREAM_MAX	50	10	0.05	0.015	0.401	Rye Grass	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_VGV3_050_STREAM_MAX	50	10	0.05	0.015	0.401	Conifer-Hardwood	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

RQ = Risk Quotient = Estimated Dose/Toxicity Reference Value

Shading and boldface indicates plant RQs greater than 1.
Shading and boldface indicates acute RQs greater than 0.05 for fish and invertebrates.
Shading and boldface indicates chronic RQs greater than 0.5 for fish and invertebrates.

Table C-62: Impact to non-target terrrestrial plants from surface runoff

SURFACE RUNOFF - modeled in GLEAMS
TYPICAL APPLICATION RATE

GLEAMS ID	Annual Precipitation (inches)	Application Area (acres)	Hydraulic Slope (ft/ft)	Surface Roughness	USLE Soil Erodibility Factor (ton/ac per EI)	Vegetation Type	Soil Type	Terrestrial Concentration (lb a.e./acre)	Typical Species RQ	Threatened & Endangered Species RQ
G_BASE_SAND_005_TERR_TYP	5	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_005_TERR_TYP	5	10	0.05	0.015	0.401	weeds (79)	Clay	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_005_TERR_TYP	5	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_010_TERR_TYP	10	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_010_TERR_TYP	10	10	0.05	0.015	0.401	weeds (79)	Clay	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_010_TERR_TYP	10	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_025_TERR_TYP	25	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_025_TERR_TYP	25	10	0.05	0.015	0.401	weeds (79)	Clay	2.55E-10	3.11E-11	8.50E-07
G_BASE_LOAM_025_TERR_TYP	25	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_050_TERR_TYP	50	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_050_TERR_TYP	50	10	0.05	0.015	0.401	weeds (79)	Clay	8.75E-06	1.07E-06	2.92E-02
G_BASE_LOAM_050_TERR_TYP	50	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_100_TERR_TYP	100	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_100_TERR_TYP	100	10	0.05	0.015	0.401	weeds (79)	Clay	8.80E-05	1.07E-05	2.93E-01
G_BASE_LOAM_100_TERR_TYP	100	10	0.05	0.015	0.401	weeds (79)	Loam	3.66E-07	4.46E-08	1.22E-03
G_BASE_SAND_150_TERR_TYP	150	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_150_TERR_TYP	150	10	0.05	0.015	0.401	weeds (79)	Clay	8.38E-04	1.02E-04	**2.79E+00**
G_BASE_LOAM_150_TERR_TYP	150	10	0.05	0.015	0.401	weeds (79)	Loam	1.26E-06	1.54E-07	4.21E-03
G_BASE_SAND_200_TERR_TYP	200	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_200_TERR_TYP	200	10	0.05	0.015	0.401	weeds (79)	Clay	2.71E-03	3.31E-04	**9.05E+00**
G_BASE_LOAM_200_TERR_TYP	200	10	0.05	0.015	0.401	weeds (79)	Loam	1.01E-06	1.23E-07	3.37E-03
G_BASE_SAND_250_TERR_TYP	250	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_250_TERR_TYP	250	10	0.05	0.015	0.401	weeds (79)	Clay	5.02E-03	6.12E-04	**1.67E+01**
G_BASE_LOAM_250_TERR_TYP	250	10	0.05	0.015	0.401	weeds (79)	Loam	3.56E-05	4.34E-06	1.19E-01
G_ARV1_050_TERR_TYP	50	1	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00
G_ARV2_050_TERR_TYP	50	100	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00
G_ARV3_050_TERR_TYP	50	1000	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00
G_ERV1_050_TERR_TYP	50	10	0.05	0.015	0.05	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00
G_ERV2_050_TERR_TYP	50	10	0.05	0.015	0.2	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00
G_ERV3_050_TERR_TYP	50	10	0.05	0.015	0.5	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00
G_RGV1_050_TERR_TYP	50	10	0.05	0.023	0.401	weeds (79)	Loam	1.45E-05	1.77E-06	4.83E-02
G_RGV2_050_TERR_TYP	50	10	0.05	0.046	0.401	weeds (79)	Loam	1.37E-06	1.67E-07	4.56E-03
G_RGV3_050_TERR_TYP	50	10	0.05	0.15	0.401	weeds (79)	Loam	1.87E-06	2.28E-07	6.24E-03
G_SLV1_050_TERR_TYP	50	10	0.005	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00
G_SLV2_050_TERR_TYP	50	10	0.01	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00
G_SLV3_050_TERR_TYP	50	10	0.1	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00
G_STV1_050_TERR_TYP	50	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00
G_STV2_050_TERR_TYP	50	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00
G_STV3_050_TERR_TYP	50	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00
G_VGV1_050_TERR_TYP	50	10	0.05	0.015	0.401	Shrub	Loam	0.00E+00	0.00E+00	0.00E+00
G_VGV2_050_TERR_TYP	50	10	0.05	0.015	0.401	Rye Grass	Loam	0.00E+00	0.00E+00	0.00E+00
G_VGV3_050_TERR_TYP	50	10	0.05	0.015	0.401	Conifer-Hardwood	Loam	0.00E+00	0.00E+00	0.00E+00

RQ = Risk Quotient = Estimated Dose/Toxicity Reference Value

SURFACE RUNOFF - modeled in GLEAMS
MAXIMUM APPLICATION RATE

GLEAMS ID	Annual Precipitation (inches)	Application Area (acres)	Hydraulic Slope (ft/ft)	Surface Roughness	USLE Soil Erodibility Factor (ton/ac per EI)	Vegetation Type	Soil Type	Terrestrial Concentration (lb a.e./acre)	Typical Species RQ	Threatened & Endangered Species RQ
G_BASE_SAND_005_TERR_MAX	5	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_005_TERR_MAX	5	10	0.05	0.015	0.401	weeds (79)	Clay	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_005_TERR_MAX	5	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_010_TERR_MAX	10	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_010_TERR_MAX	10	10	0.05	0.015	0.401	weeds (79)	Clay	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_010_TERR_MAX	10	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_025_TERR_MAX	25	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_025_TERR_MAX	25	10	0.05	0.015	0.401	weeds (79)	Clay	5.10E-10	6.22E-11	1.70E-06
G_BASE_LOAM_025_TERR_MAX	25	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_050_TERR_MAX	50	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_050_TERR_MAX	50	10	0.05	0.015	0.401	weeds (79)	Clay	1.75E-05	2.13E-06	5.83E-02
G_BASE_LOAM_050_TERR_MAX	50	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_100_TERR_MAX	100	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_100_TERR_MAX	100	10	0.05	0.015	0.401	weeds (79)	Clay	1.76E-04	2.15E-05	5.87E-01
G_BASE_LOAM_100_TERR_MAX	100	10	0.05	0.015	0.401	weeds (79)	Loam	7.32E-07	8.92E-08	2.44E-03
G_BASE_SAND_150_TERR_MAX	150	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_150_TERR_MAX	150	10	0.05	0.015	0.401	weeds (79)	Clay	1.68E-03	2.04E-04	**5.58E+00**
G_BASE_LOAM_150_TERR_MAX	150	10	0.05	0.015	0.401	weeds (79)	Loam	2.53E-06	3.08E-07	8.43E-03
G_BASE_SAND_200_TERR_MAX	200	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_200_TERR_MAX	200	10	0.05	0.015	0.401	weeds (79)	Clay	5.43E-03	6.62E-04	**1.81E+01**
G_BASE_LOAM_200_TERR_MAX	200	10	0.05	0.015	0.401	weeds (79)	Loam	2.02E-06	2.47E-07	6.74E-03
G_BASE_SAND_250_TERR_MAX	250	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_250_TERR_MAX	250	10	0.05	0.015	0.401	weeds (79)	Clay	1.00E-02	1.22E-03	**3.35E+01**
G_BASE_LOAM_250_TERR_MAX	250	10	0.05	0.015	0.401	weeds (79)	Loam	7.11E-05	8.67E-06	2.37E-01
G_ARV1_050_TERR_MAX	50	1	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00
G_ARV2_050_TERR_MAX	50	100	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00
G_ARV3_050_TERR_MAX	50	1000	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00
G_ERV1_050_TERR_MAX	50	10	0.05	0.015	0.05	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00
G_ERV2_050_TERR_MAX	50	10	0.05	0.015	0.2	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00
G_ERV3_050_TERR_MAX	50	10	0.05	0.015	0.5	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00
G_RGV1_050_TERR_MAX	50	10	0.05	0.023	0.401	weeds (79)	Loam	2.90E-05	3.53E-06	9.65E-02
G_RGV2_050_TERR_MAX	50	10	0.05	0.046	0.401	weeds (79)	Loam	2.74E-06	3.34E-07	9.13E-03
G_RGV3_050_TERR_MAX	50	10	0.05	0.15	0.401	weeds (79)	Loam	3.74E-06	4.57E-07	1.25E-02
G_SLV1_050_TERR_MAX	50	10	0.005	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00
G_SLV2_050_TERR_MAX	50	10	0.01	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00
G_SLV3_050_TERR_MAX	50	10	0.1	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00
G_STV1_050_TERR_MAX	50	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00
G_STV2_050_TERR_MAX	50	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00
G_STV3_050_TERR_MAX	50	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00
G_VGV1_050_TERR_MAX	50	10	0.05	0.015	0.401	Shrub	Loam	0.00E+00	0.00E+00	0.00E+00
G_VGV2_050_TERR_MAX	50	10	0.05	0.015	0.401	Rye Grass	Loam	0.00E+00	0.00E+00	0.00E+00
G_VGV3_050_TERR_MAX	50	10	0.05	0.015	0.401	Conifer-Hardwood	Loam	0.00E+00	0.00E+00	0.00E+00

RQ = Risk Quotient = Estimated Dose/Toxicity Reference Value

Shading and boldface indicates plant RQs greater than 1.

Table C-63: Consumption of contaminated fish from pond by predatory bird - long term exposure. Pond impacted by surface runoff modeled in GLEAMS.

Parameters/ Assumptions	Value	Units	Notes
Body Weight (W)	5.15	kg	
Food ingestion rate (dry weight)	0.101786153	kg dw/day	[1]
Food ingestion rate (wet weight, A)	0.40714461	kg ww/day	[2]
Bioconcentration factor (BCF)	1	L/kg fish	
Proportion of Diet Contaminated (Prop)	1	unitless	
Toxicity reference value (TRV)	27	mg/kg-bw/day	

TYPICAL APPLICATION RATE

GLEAMS ID	Annual Precipitation (inches)	Application Area (acres)	Hydraulic Slope (ft/ft)	Surface Roughness	USLE Soil Erodibility Factor (ton/ac per EI)	Vegetation Type	Soil Type	Pond Concentration (mg/L)	Concentrations in fish (C_{Fish}): WC × BCF	Dose estimates (D): C_{Fish} × A × Prop / W	Risk Quotient
G_BASE_SAND_005_POND_TYP	5	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_005_POND_TYP	5	10	0.05	0.015	0.401	weeds (79)	Clay	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_005_POND_TYP	5	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_010_POND_TYP	10	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_010_POND_TYP	10	10	0.05	0.015	0.401	weeds (79)	Clay	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_010_POND_TYP	10	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_025_POND_TYP	25	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_025_POND_TYP	25	10	0.05	0.015	0.401	weeds (79)	Clay	4.34E-10	4.34E-10	3.43E-11	1.27E-12
G_BASE_LOAM_025_POND_TYP	25	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_050_POND_TYP	50	10	0.05	0.015	0.401	weeds (79)	Sand	8.65E-08	8.65E-08	6.84E-09	2.53E-10
G_BASE_CLAY_050_POND_TYP	50	10	0.05	0.015	0.401	weeds (79)	Clay	2.79E-05	2.79E-05	2.20E-06	8.16E-08
G_BASE_LOAM_050_POND_TYP	50	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_100_POND_TYP	100	10	0.05	0.015	0.401	weeds (79)	Sand	4.52E-06	4.52E-06	3.58E-07	1.32E-08
G_BASE_CLAY_100_POND_TYP	100	10	0.05	0.015	0.401	weeds (79)	Clay	2.17E-04	2.17E-04	1.72E-05	6.35E-07
G_BASE_LOAM_100_POND_TYP	100	10	0.05	0.015	0.401	weeds (79)	Loam	2.36E-07	2.36E-07	1.87E-08	6.92E-10
G_BASE_SAND_150_POND_TYP	150	10	0.05	0.015	0.401	weeds (79)	Sand	4.76E-05	4.76E-05	3.77E-06	1.39E-07
G_BASE_CLAY_150_POND_TYP	150	10	0.05	0.015	0.401	weeds (79)	Clay	2.37E-03	2.37E-03	1.88E-04	6.95E-06
G_BASE_LOAM_150_POND_TYP	150	10	0.05	0.015	0.401	weeds (79)	Loam	2.05E-07	2.05E-07	1.62E-08	5.99E-10
G_BASE_SAND_200_POND_TYP	200	10	0.05	0.015	0.401	weeds (79)	Sand	1.32E-04	1.32E-04	1.05E-05	3.88E-07
G_BASE_CLAY_200_POND_TYP	200	10	0.05	0.015	0.401	weeds (79)	Clay	6.32E-03	6.32E-03	5.00E-04	1.85E-05
G_BASE_LOAM_200_POND_TYP	200	10	0.05	0.015	0.401	weeds (79)	Loam	1.60E-07	1.60E-07	1.27E-08	4.70E-10
G_BASE_SAND_250_POND_TYP	250	10	0.05	0.015	0.401	weeds (79)	Sand	1.95E-04	1.95E-04	1.54E-05	5.71E-07
G_BASE_CLAY_250_POND_TYP	250	10	0.05	0.015	0.401	weeds (79)	Clay	1.02E-02	1.02E-02	8.07E-04	2.99E-05
G_BASE_LOAM_250_POND_TYP	250	10	0.05	0.015	0.401	weeds (79)	Loam	1.01E-04	1.01E-04	8.02E-06	2.97E-07
G_ARV1_050_POND_TYP	50	1	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ARV2_050_POND_TYP	50	100	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ARV3_050_POND_TYP	50	1000	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ERV1_050_POND_TYP	50	10	0.05	0.015	0.05	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ERV2_050_POND_TYP	50	10	0.05	0.015	0.2	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ERV3_050_POND_TYP	50	10	0.05	0.015	0.5	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_RGV1_050_POND_TYP	50	10	0.05	0.023	0.401	weeds (79)	Loam	2.10E-05	2.10E-05	1.66E-06	6.16E-08
G_RGV2_050_POND_TYP	50	10	0.05	0.046	0.401	weeds (79)	Loam	2.09E-06	2.09E-06	1.65E-07	6.13E-09
G_RGV3_050_POND_TYP	50	10	0.05	0.15	0.401	weeds (79)	Loam	2.39E-06	2.39E-06	1.89E-07	7.00E-09
G_SLV1_050_POND_TYP	50	10	0.005	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_SLV2_050_POND_TYP	50	10	0.01	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_SLV3_050_POND_TYP	50	10	0.1	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_STV1_050_POND_TYP	50	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_STV2_050_POND_TYP	50	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_STV3_050_POND_TYP	50	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_VGV1_050_POND_TYP	50	10	0.05	0.015	0.401	Shrub	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_VGV2_050_POND_TYP	50	10	0.05	0.015	0.401	Rye Grass	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_VGV3_050_POND_TYP	50	10	0.05	0.015	0.401	Conifer-Hardwooc	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Risk Quotient = Estimated Dose/Toxicity Reference Value
Shading and boldface indicates piscivorous bird RQs greater than 0.1.

[1] Calculated using alorithm developed by Nagy, 1987 for all birds; where
Food Ingestion Rate (kg dw/day) = 0.0582*(BW)^0.651
[2] Assumes fish are 75% water (USEPA, 1993; Table 4-1 - value for bony fishes)
GLEAMS footnotes

Table C-63: Consumption of contaminated fish from pond by predatory bird - long term exposure. Pond impacted by surface runoff modeled in GLEAMS.

Parameters/ Assumptions	Value	Units	Notes
Body Weight (W)	5.15	kg	
Food ingestion rate (dry weight)	0.101786153	kg dw/day	[1]
Food ingestion rate (wet weight, A)	0.40714461	kg ww/day	[2]
Bioconcentration factor (BCF)	1	L/kg fish	
Proportion of Diet Contaminated (Prop)	1	unitless	
Toxicity reference value (TRV)	27	mg/kg-bw/day	

MAXIMUM APPLICATION RATE

GLEAMS ID	Annual Precipitation (inches)	Application Area (acres)	Hydraulic Slope (ft/ft)	Surface Roughness	USLE Soil Erodibility Factor (ton/ac per EI)	Vegetation Type	Soil Type	Pond Concentration (mg/L)	Concentrations in fish (C_{Fish}): WC × BCF	Dose estimates (D): C_{Fish} × A × Prop / W	Risk Quotient
G_BASE_SAND_005_POND_max	5	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_005_POND_max	5	10	0.05	0.015	0.401	weeds (79)	Clay	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_005_POND_max	5	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_010_POND_max	10	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_010_POND_max	10	10	0.05	0.015	0.401	weeds (79)	Clay	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_010_POND_max	10	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_025_POND_max	25	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_025_POND_max	25	10	0.05	0.015	0.401	weeds (79)	Clay	8.68E-10	8.68E-10	6.86E-11	2.54E-12
G_BASE_LOAM_025_POND_max	25	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_050_POND_max	50	10	0.05	0.015	0.401	weeds (79)	Sand	1.73E-07	1.73E-07	1.37E-08	5.07E-10
G_BASE_CLAY_050_POND_max	50	10	0.05	0.015	0.401	weeds (79)	Clay	5.58E-05	5.58E-05	4.41E-06	1.63E-07
G_BASE_LOAM_050_POND_max	50	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_100_POND_max	100	10	0.05	0.015	0.401	weeds (79)	Sand	9.05E-06	9.05E-06	7.15E-07	2.65E-08
G_BASE_CLAY_100_POND_max	100	10	0.05	0.015	0.401	weeds (79)	Clay	4.34E-04	4.34E-04	3.43E-05	1.27E-06
G_BASE_LOAM_100_POND_max	100	10	0.05	0.015	0.401	weeds (79)	Loam	4.73E-07	4.73E-07	3.74E-08	1.38E-09
G_BASE_SAND_150_POND_max	150	10	0.05	0.015	0.401	weeds (79)	Sand	9.53E-05	9.53E-05	7.53E-06	2.79E-07
G_BASE_CLAY_150_POND_max	150	10	0.05	0.015	0.401	weeds (79)	Clay	4.74E-03	4.74E-03	3.75E-04	1.39E-05
G_BASE_LOAM_150_POND_max	150	10	0.05	0.015	0.401	weeds (79)	Loam	4.09E-07	4.09E-07	3.24E-08	1.20E-09
G_BASE_SAND_200_POND_max	200	10	0.05	0.015	0.401	weeds (79)	Sand	2.65E-04	2.65E-04	2.09E-05	7.76E-07
G_BASE_CLAY_200_POND_max	200	10	0.05	0.015	0.401	weeds (79)	Clay	1.26E-02	1.26E-02	1.00E-03	3.70E-05
G_BASE_LOAM_200_POND_max	200	10	0.05	0.015	0.401	weeds (79)	Loam	3.21E-07	3.21E-07	2.54E-08	9.39E-10
G_BASE_SAND_250_POND_max	250	10	0.05	0.015	0.401	weeds (79)	Sand	3.90E-04	3.90E-04	3.08E-05	1.14E-06
G_BASE_CLAY_250_POND_max	250	10	0.05	0.015	0.401	weeds (79)	Clay	2.04E-02	2.04E-02	1.61E-03	5.98E-05
G_BASE_LOAM_250_POND_max	250	10	0.05	0.015	0.401	weeds (79)	Loam	2.03E-04	2.03E-04	1.60E-05	5.94E-07
G_ARV1_050_POND_max	50	1	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ARV2_050_POND_max	50	100	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ARV3_050_POND_max	50	1000	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ERV1_050_POND_max	50	10	0.05	0.015	0.05	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ERV2_050_POND_max	50	10	0.05	0.015	0.2	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ERV3_050_POND_max	50	10	0.05	0.015	0.5	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_RGV1_050_POND_max	50	10	0.05	0.023	0.401	weeds (79)	Loam	4.21E-05	4.21E-05	3.33E-06	1.23E-07
G_RGV2_050_POND_max	50	10	0.05	0.046	0.401	weeds (79)	Loam	4.18E-06	4.18E-06	3.31E-07	1.23E-08
G_RGV3_050_POND_max	50	10	0.05	0.15	0.401	weeds (79)	Loam	4.78E-06	4.78E-06	3.78E-07	1.40E-08
G_SLV1_050_POND_max	50	10	0.005	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_SLV2_050_POND_max	50	10	0.01	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_SLV3_050_POND_max	50	10	0.1	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_STV1_050_POND_max	50	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_STV2_050_POND_max	50	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_STV3_050_POND_max	50	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_VGV1_050_POND_max	50	10	0.05	0.015	0.401	Shrub	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_VGV2_050_POND_max	50	10	0.05	0.015	0.401	Rye Grass	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_VGV3_050_POND_max	50	10	0.05	0.015	0.401	Conifer-Hardwooc	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Risk Quotient = Estimated Dose/Toxicity Reference Value
Shading and boldface indicates piscivorous bird RQs greater than 0.1.

[1] Calculated using alorithm developed by Nagy, 1987 for all birds; where
Food Ingestion Rate (kg dw/day) = 0.0582*(BW)^0.651
[2] Assumes fish are 75% water (USEPA, 1993; Table 4-1 - value for bony fishes)

Table C-64: Impact to non-target terrrestrial plants from wind erosion

WIND EROSION - modeled in AERMOD and CalPuff
TYPICAL APPLICATION RATE

AERMOD/ CalPuff Scenario ID	Watershed Location	Distance From Receptor (km)	Terrestrial Concentration (lb a.e./acre)	Typical Species TRV	Typical Species RQ	Threatened & Endangered Species TRV	Threatened & Endangered Species RQ
dust_MT_1.5_typ	MT	1.5	5.00E-04	2.00E-03	2.50E-01	3.00E-04	**1.67E+00**
dust_MT_10_typ	MT	10	1.47E-05	2.00E-03	7.33E-03	3.00E-04	4.88E-02
dust_MT_100_typ	MT	100	5.12E-07	2.00E-03	2.56E-04	3.00E-04	1.71E-03
dust_OR_1.5_typ	OR	1.5	5.74E-03	2.00E-03	**2.87E+00**	3.00E-04	**1.91E+01**
dust_OR_10_typ	OR	10	1.53E-04	2.00E-03	7.67E-02	3.00E-04	5.11E-01
dust_OR_100_typ	OR	100	3.75E-06	2.00E-03	1.87E-03	3.00E-04	1.25E-02
dust_WY_1.5_typ	WY	1.5	2.95E-03	2.00E-03	**1.48E+00**	3.00E-04	**9.84E+00**
dust_WY_10_typ	WY	10	1.06E-04	2.00E-03	5.28E-02	3.00E-04	3.52E-01
dust_WY_100_typ	WY	100	3.37E-06	2.00E-03	1.68E-03	3.00E-04	1.12E-02

WIND EROSION - modeled in AERMOD and CalPuff
MAXIMUM APPLICATION RATE

AERMOD/ CalPuff Scenario ID	Watershed Location	Distance From Receptor (km)	Terrestrial Concentration (lb a.e./acre)	Typical Species TRV	Typical Species RQ	Threatened & Endangered Species TRV	Threatened & Endangered Species RQ
dust_MT_1.5_max	MT	1.5	9.99E-04	2.00E-03	5.00E-01	3.00E-04	**3.33E+00**
dust_MT_10_max	MT	10	2.93E-05	2.00E-03	1.47E-02	3.00E-04	9.77E-02
dust_MT_100_max	MT	100	1.02E-06	2.00E-03	5.12E-04	3.00E-04	3.41E-03
dust_OR_1.5_max	OR	1.5	1.15E-02	2.00E-03	**5.74E+00**	3.00E-04	**3.83E+01**
dust_OR_10_max	OR	10	3.07E-04	2.00E-03	1.53E-01	3.00E-04	**1.02E+00**
dust_OR_100_max	OR	100	7.50E-06	2.00E-03	3.75E-03	3.00E-04	2.50E-02
dust_WY_1.5_max	WY	1.5	5.91E-03	2.00E-03	**2.95E+00**	3.00E-04	**1.97E+01**
dust_WY_10_max	WY	10	2.11E-04	2.00E-03	1.06E-01	3.00E-04	7.05E-01
dust_WY_100_max	WY	100	6.74E-06	2.00E-03	3.37E-03	3.00E-04	2.25E-02

RQ = Risk Quotient = Estimated Dose/Toxicity Reference Value

Shading and boldface indicates plant RQs greater than 1.

Table C-65: Impact to aquatic species from accidental spill to pond

Parameters/Assumptions	Value	Units
Volume of pond (Vp)	1011715	L
Volume of spill		
Truck ($Vspill_t$)	757	L
Helicopter($Vspill_h$)	529.9	L
Herbicide concentration		
Truck mixture (Cm_t)	19174.30	mg a.e./L
Helicopter mixture (Cm_h)	95871.49	mg a.e./L

Scenario	Concentrations in water (Cw): Cm × Vspill / Vp	Units	Risk Quotients: Fish	Aquatic Invertebrates	Non-Target Aquatic Plants
Truck spill into pond	14.35	mg a.e./L	**7.97E+00**	**1.10E+00**	**1.43E+02**
Helicopter spill into pond	50.21	mg a.e./L	**2.79E+01**	**3.86E+00**	**5.02E+02**

Shading and boldface indicates plant RQs greater than 1.
Shading and boldface indicates acute RQs greater than 0.05 for fish and invertebrates.

Table C-66: Impact to aquatic species from accidental direct spray of pond and stream

Parameters/Assumptions		Value	Units
Application rates (R)			
	Typical	2	lb/acre
	Maximum	4	lb/acre
Area of pond (Area)		0.25	acre
Volume of pond (Vol)		1011715	L
Mass sprayed on pond (R x Area)			
	Typical	226796	mg
	Maximum	453592	mg
Concentration in pond water (Mass/Volume)			
	Typical	0.22416985	mg/L
	Maximum	0.4483397	mg/L
Width of stream		2	m
Length of stream impacted by direct spray		636.15	m
Area of stream impacted by spray (Area)		1272.3	m2
Depth of stream		0.2	m
Instantaneous volume of stream impacted by direct spray (Vol)		254460	L
Mass sprayed on stream (R x Area)			
	Typical	2544.600	lb
	Maximum	5089.200	lb
Mass sprayed on stream - converted to mg			
	Typical	285214.120	mg
	Maximum	570428.239	mg
Concentration in stream water (Mass/Vol)			
	Typical	1.12086033	mg/L
	Maximum	2.24172066	mg/L

Scenario		Concentration in water (mg/L)	Risk Quotients		
			Fish	**Aquatic Invertebrates**	**Non-Target Aquatic Plants**
Acute					
Direct spray to pond					
	Typical application	2.24E-01	**1.25E-01**	1.72E-02	**2.24E+00**
	Maximum application	4.48E-01	**2.49E-01**	3.45E-02	**4.48E+00**
Direct spray to stream					
	Typical application	1.12E+00	**6.23E-01**	**8.62E-02**	**1.12E+01**
	Maximum application	2.24E+00	**1.25E+00**	**1.72E-01**	**2.24E+01**
Chronic					
Direct spray to pond					
	Typical application	2.24E-01	**4.08E+00**	**1.12E+00**	**7.47E+00**
	Maximum application	4.48E-01	**8.15E+00**	**2.24E+00**	**1.49E+01**
Direct spray to stream					
	Typical application	1.12E+00	**2.04E+01**	**5.60E+00**	**3.74E+01**
	Maximum application	2.24E+00	**4.08E+01**	**1.12E+01**	**7.47E+01**

Shading and boldface indicates plant RQs greater than 1.
Shading and boldface indicates acute RQs greater than 0.05 for fish and invertebrates.

APPENDIX B.67 – B.88 – ECOLOGICAL RISK ASSESSMENT WORKSHEETS – TERRESTRIAL APPLICATION FOR WOODY VEGETATION – 2,4-D ESTERS

Table C-67: Direct spray of terrestrial receptors and exposure from indirect contact with foliage

Parameter		Pollinating Insect	Small Mammal	Units
Duration of Exposure (T)		24	24	hours
Body weight (W)		0.000093	0.02	kg
Surface Areas (A): cm^2 = 12.3 * BW(g)^0.65				
		2.63	86.21	cm^2
Application rates (R)				
	Typical	2	2	mg/cm^2
	Maximum	4	4	
Amount deposited on 1/2 receptor (Amnt): 0.5 × A × R				
	Typical	0.029478335	0.966284139	mg
	Maximum	0.058956671	1.932568279	
Dose Estimate Assuming 100% Dermal Adsorption				
Absorbed Dose: Amnt × Prop ÷ W				
	Typical	3.17E+02	4.83E+01	mg/kg bw
	Maximum	6.34E+02	9.66E+01	
Dose Estimate Assuming First Order Dermal Adsorption				
First-order dermal absorption rates (k)				
	Central estimate (ka)	0.138629436	0.138629436	$hour^{-1}$
Proportion absorbed over period T (Prop): 1-exp(-k T)				
	Typical	0.113079563	0.113079563	unitless
	Maximum	0.113079563	0.113079563	
Absorbed Dose: Amnt × Prop ÷ W				
	Typical	3.58E+01	5.46E+00	mg/kg bw
	Maximum	7.17E+01	1.09E+01	

RISK QUOTIENTS - Direct Spray	Toxicity Reference Value	Typical Application	Maximum Application
Small mammal - 100% absorption	2193	2.20E-02	4.41E-02
Pollinating insect - 100% absorption	140	2.26E+00	4.53E+00
Small mammal - 1st order dermal adsorption	2193	2.49E-03	4.98E-03
Pollinating insect - 1st order dermal adsorption	140	2.56E-01	5.12E-01

RISK QUOTIENTS - Indirect Contact *	Toxicity Reference Value	Typical Application	Maximum Application
Small mammal - 100% absorption	2193	2.20E-03	4.41E-03
Pollinating insect - 100% absorption	140	2.26E-01	4.53E-01
Small mammal - 1st order dermal adsorption	2193	2.49E-04	4.98E-04
Pollinating insect - 1st order dermal adsorption	140	2.56E-02	5.12E-02

Surface area calculation for mammals from Stahl, 1967 (presented in USEPA, 1993).
No surface area calculation identified for insects. Mammalian equation used as a surrogate.
Risk Quotient = Estimated Dose/Toxicity Reference Value
* Exposure from indirect contact assumed to be 1/10 of direct spray exposure

Table C-68: Consumption of contaminated berries by a small mammal - acute exposure scenario

Parameters/Assumptions		Value	Units	Notes
Body Weight (W)		0.02	kg	
Food ingestion rate (dry weight)		0.0033641	kg dw/day	[1]
Food ingestion rate (wet weight, A)		0.014626644	kg ww/day	[2]
Application rates (R)				
	Typical	2	lb/acre	
	Maximum	4		
Residue rate - berries (rr)				
	Typical	1.5	mg/kg per lb/acre	
	Maximum	7		
Concentration on berries (C): R × rr				
	Typical	3	mg/kg fruit	
	Maximum	28		
Dose estimates (D): C × A / W				
	Typical	2.19E+00	mg/kg bw	
	Maximum	2.05E+01		

RISK QUOTIENTS - Ingestion	Toxicity Reference Value	Typical Application	Maximum Application
Small mammal - acute exposure	1184	1.85E-03	1.73E-02

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987 for rodents; where

Food Ingestion Rate (g dw/day) = 0.621*(BW g)^0.564; converted into kg dw/day

[2] Assumes fruit is 77% water (USEPA, 1993; Table 4-2 - value for fruit pulp and skin)

Table C-69: Consumption of contaminated fruit by a small mammal - chronic exposure scenario

Parameters/Assumptions		Value	Units	
Duration of exposure (T)		90	days	
Body Weight (W)		0.02	kg	
Food ingestion rate (dry weight)		0.0033641	kg dw/day	[1]
Food ingestion rate (wet weight, A)		0.014626644	kg ww/day	[2]
Half life on vegetation (t50)				
	Herbicide specific	5	days	
Application rates (R)				
	Typical	2	lb/acre	
	Maximum	4		
Residue rate - berries (rr)				
	Typical	1.5	mg/kg per lb/acre	
	Maximum	7		
Drift (Drift)				
	Typical	1	unitless	
	Maximum	1		
Decay Coefficient (k): ln(2)/t50				
	Typical	0.138629436	$days^{-1}$	
	Maximum	0.138629436		
Initial concentration on berries (C0): R × rr × Drift				
	Typical	3	mg/kg fruit	
	Maximum	28		
Concentration on berries at time T: C0 * exp(-k*T)				
	Typical	1.14441E-05	mg/kg fruit	
	Maximum	0.000106812		
Time-weighted Average Concentration on vegetation (CTWA): C0 * (1-exp(-k*T))/(k*T)				
	Typical	0.240448256	mg/kg fruit	
	Maximum	2.244183725		
Proportion of Diet Contaminated (Prop)				
	Typical	1	unitless	
	Maximum	1		
Dose estimates (D): CTWA × A × Prop / W				
	Typical	0.175847548	mg/kg bw	
	Maximum	1.641243785		

RISK QUOTIENTS - Ingestion	Toxicity Reference Value	Typical Application	Maximum Application
Small mammal - chronic exposure	10	1.76E-02	1.64E-01

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987 for rodents; where

Food Ingestion Rate (g dw/day) = 0.621*(BW g)^0.564; converted into kg dw/day

[2] Assumes fruit is 77% water (USEPA, 1993; Table 4-2 - value for fruit pulp and skin)

Table C-70: Consumption of contaminated grass by a large mammal - acute exposure scenario

Parameters/Assumptions		Value	Units	Notes
Body Weight (W)		70	kg	
Food ingestion rate (dry weight)		1.9211536	kg dw/day	[1]
Food ingestion rate (wet weight, A)		6.40384532	kg ww/day	[2]
Duration of exposure (D)		1	day	
Application rates (R)				
	Typical	2	lb/acre	
	Maximum	4		
Residue rate - grass (rr)				
	Typical	92	mg/kg per lb/acre	
	Maximum	110		
Concentration on grass (C): R × rr				
	Typical	184	mg/kg grass	
	Maximum	440		
Drift (Drift)				
	Typical	1	unitless	
	Maximum	1		
Proportion of Diet Contaminated (Prop)				
	Typical	1	unitless	
	Maximum	1		
Dose estimates: Drift × Prop × C × A ÷W				
	Typical	1.68E+01	mg/kg bw	
	Maximum	4.03E+01		

RISK QUOTIENTS - Ingestion	Toxicity Reference Value	Typical Application	Maximum Application
Large mammal - acute exposure	51	3.30E-01	7.89E-01

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987 for herbivores; where
Food Ingestion Rate (g dw/day) = 0.577*(BW g)^0.727; converted into kg dw/day

[2] Assumes grass is 70% water (USEPA, 1993; Table 4-2 - lowest value for young grasses)

Table C-71: Consumption of contaminated grass by a large mammal - chronic exposure scenario

Parameters/Assumptions		Value	Units	Notes
Duration of exposure (T)		90	day	
Body Weight (W)		70	kg	
Food ingestion rate (dry weight)		1.921153597	kg dw/day	[1]
Food ingestion rate (wet weight, A)		6.403845323	kg ww/day	[2]
Half life on vegetation (t50)				
	Herbicide specific	5	days	
Application rates (R)				
	Typical	2	lb/acre	
	Maximum	4		
Residue rate - grass (rr)				
	Typical	92	mg/kg per lb/acre	
	Maximum	110		
Drift (Drift)				
	Typical	1	unitless	
	Maximum	1		
Decay Coefficient (k): ln(2)/t50				
	Typical	0.138629436	$days^{-1}$	
	Maximum	0.138629436		
Initial concentration on grass (C0): R × rr × Drift				
	Typical	184	mg/kg grass	
	Maximum	440		
Concentration on grass at time T: C0 * exp(-k*T)				
	Typical	0.000701904	mg/kg grass	
	Maximum	0.001678467		
Time-weighted Average Concentration on vegetation (CTWA): C0 * (1-exp(-k*T))/(k*T)				
	Typical	14.74749305	mg/kg vegetation	
	Maximum	35.26574425		
Proportion of Diet Contaminated (Prop)				
	Typical	1	unitless	
	Maximum	1		
Dose estimates: CTWA × A × Prop / W				
	Typical	1.35E+00	mg/kg bw	
	Maximum	3.23E+00		

RISK QUOTIENTS - Ingestion	Toxicity Reference Value	Typical Application	Maximum Application
Large mammal - chronic exposure	1	1.35E+00	3.23E+00

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987 for herbivores; where
Food Ingestion Rate (g dw/day) = 0.577*(BW g)^0.727; converted into kg dw/day

[2] Assumes grass is 70% water (USEPA, 1993; Table 4-2 - lowest value for young grasses)

Table C-72: Consumption of contaminated small mammals by a large mammal - acute exposure scenario

Parameters/Assumptions		Value	Units	Notes
Body Weight (W)		12	kg	
Food ingestion rate (dry weight)		0.52971677	kg dw/day	[1]
Food ingestion rate (wet weight, A)		1.6553649	kg ww/day	[2]
Duration of exposure (D)		1	day	
Application rates (R)				
	Typical	2	lb/acre	
	Maximum	4		
Amount deposited on small mammal prey (Amnt_mouse): 0.5 × SurfaceArea × R				
	Typical	0.96628414	mg	
	Maximum	1.93256828		
Drift (Drift)				
	Typical	1	unitless	
	Maximum	1		
Proportion of Diet Contaminated (Prop)				
	Typical	1	unitless	
	Maximum	1		
Dose estimates: Drift × Prop × Amnt_mouse/BW_mouse × A ÷W				
	Typical	6.66E+00	mg/kg bw	
	Maximum	1.33E+01		

RISK QUOTIENTS - Ingestion	Toxicity Reference Value	Typical Application	Maximum Application
Large carnivorous mammal - acute exposure	80	8.33E-02	1.67E-01

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987; where

Food Ingestion Rate (g dw/day) = 0.0687*(BW g)^0.822; converted into kg dw/day

[2] Assumes mammals are 68% water (USEPA, 1993)

Table C-73: Consumption of contaminated small mammals by a large mammal - chronic exposure scenario

Parameters/Assumptions		Value	Units	Notes
Duration of exposure (T)		90	day	
Body Weight (W)		12	kg	
Food ingestion rate (dry weight)		0.529716769	kg dw/day	[1]
Food ingestion rate (wet weight, FIR_coyote)		1.655364903	kg ww/day	[2]
Application rates (R)				
	Typical	2	lb/acre	
	Maximum	4		
Drift (Drift)				
	Typical	1	unitless	
	Maximum	1		
Decay Coefficient (k): ln(2)/t50				
	Typical	0.138629436	$days^{-1}$	
	Maximum	0.138629436		
Initial concentration on mammal (C0): 0.5 × SurfaceArea × R/BW_smallmammal				
	Typical	48.31420697	mg a.e./kg mammal	
	Maximum	96.62841393		
Concentration absorbed in small mammal at time T (C90): C0 * exp(-k*T)				
	Typical	5.463349424	mg/kg mammal	
	Maximum	10.92669885		
Proportion of Diet Contaminated (Prop)				
	Typical	1	unitless	
	Maximum	1		
Dose estimates: C90 × FIR_coyote × Prop / W				
	Typical	7.54E-01	mg/kg bw	
	Maximum	1.51E+00		

RISK QUOTIENTS - Ingestion	Toxicity Reference Value	Typical Application	Maximum Application
Large mammal - chronic exposure	1	7.54E-01	1.51E+00

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987; where

Food Ingestion Rate (g dw/day) = 0.0687*(BW g)^0.822; converted into kg dw/day

[2] Assumes mammals are 68% water (USEPA, 1993)

Table C-74: Consumption of contaminated insects by a small bird - acute exposure scenario

Parameters/Assumptions		Value	Units	Notes
Body Weight (W)		0.08	kg	
Food ingestion rate (dry weight)		0.01124177	kg dw/day	[1]
Food ingestion rate (wet weight, A)		0.03626376	kg ww/day	[2]
Duration of exposure (D)		1	day	
Application rates (R)				
	Typical	2	lb/acre	
	Maximum	4		
Residue rate - insects (rr)				
	Typical	33	mg/kg per lb/acre	
	Maximum	58		
Concentration on insects (C): R × rr				
	Typical	66	mg/kg insect	
	Maximum	232		
Drift (Drift)				
	Typical	1	unitless	
	Maximum	1		
Proportion of Diet Contaminated (Prop)				
	Typical	1	unitless	
	Maximum	1		
Dose estimates: Drift × Prop × C × A ÷W				
	Typical	2.99E+01	mg/kg bw	
	Maximum	1.05E+02		

RISK QUOTIENTS - Ingestion	Toxicity Reference Value	Typical Application	Maximum Application
Small bird - acute exposure	217	1.38E-01	4.85E-01

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987 for all birds; where

Food Ingestion Rate (kg dw/day) = 0.0582*(BW)^0.651

[2] Assumes insects are 69% water (USEPA, 1993; Table 4-1 - value for grasshoppers and crickets)

Table C-75: Consumption of contaminated insects by a small bird - chronic exposure scenario

Parameters/Assumptions		Value	Units	Notes
Duration of exposure (T)		90	day	
Body Weight (W)		0.08	kg	
Food ingestion rate (dry weight)		0.011241767	kg dw/day	[1]
Food ingestion rate (wet weight, A)		0.036263763	kg ww/day	[2]
Half life on insect (t50)				
	Herbicide specific	5	days	
Application rates (R)				
	Typical	2	lb/acre	
	Maximum	4		
Residue rate - insects (rr)				
	Typical	33	mg/kg per lb/acre	
	Maximum	58		
Drift (Drift)				
	Typical	1	unitless	
	Maximum	1		
Decay Coefficient (k): ln(2)/t50				
	Typical	0.138629436	$days^{-1}$	
	Maximum	0.138629436		
Initial concentration on insects (C0): R × rr × Drift				
	Typical	66	mg/kg insect	
	Maximum	232		
Concentration on insects at time T: C0 * exp(-k*T)				
	Typical	0.00025177	mg/kg insect	
	Maximum	0.00088501		
Time-weighted Average Concentration on insects (CTWA): C0 * (1-exp(-k*T))/(k*T)				
	Typical	5.289861637	mg/kg insect	
	Maximum	18.59466515		
Proportion of Diet Contaminated (Prop)				
	Typical	1	unitless	
	Maximum	1		
Dose estimates (D): CTWA × A × Prop / W				
	Typical	2.40E+00	mg/kg bw	
	Maximum	8.43E+00		

RISK QUOTIENTS - Ingestion	Toxicity Reference Value	Typical Application	Maximum Application
Small bird - chronic exposure	27	8.88E-02	3.12E-01

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987 for all birds; where

Food Ingestion Rate (kg dw/day) = 0.0582*(BW)^0.651

[2] Assumes insects are 69% water (USEPA, 1993; Table 4-1 - value for grasshoppers and crickets)

Table C-76: Consumption of contaminated vegetation by a large bird - acute exposure scenario

Parameters/Assumptions		Value	Units	Notes
Body Weight (W)		3.72	kg	
Food ingestion rate (dry weight)		0.13688203	kg dw/day	[1]
Food ingestion rate (wet weight, A)		0.91254687	kg ww/day	[2]
Duration of exposure (D)		1	day	
Application rates (R)				
	Typical	2	lb/acre	
	Maximum	4		
Residue rate - vegetation (rr)				
	Typical	35	mg/kg per lb/acre	
	Maximum	125		
Concentration on vegetation (C): R × rr				
	Typical	70	mg/kg veg	
	Maximum	500		
Drift (Drift)				
	Typical	1	unitless	
	Maximum	1		
Proportion of Diet Contaminated (Prop)				
	Typical	1	unitless	
	Maximum	1		
Dose estimates: Drift × Prop × C × A ÷W				
	Typical	1.72E+01		
	Maximum	1.23E+02		

RISK QUOTIENTS - Ingestion	Toxicity Reference Value	Typical Application	Maximum Application
Large bird - acute exposure	314	5.47E-02	3.91E-01

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987 for all birds; where

Food Ingestion Rate (kg dw/day) = 0.0582*(BW)^0.651

[2] Assumes vegetation is 85% water (USEPA, 1993; Table 4-2 - value for dicots)

Table C-77: Consumption of contaminated vegetation by a large bird - chronic exposure scenario

Parameters/Assumptions		Value	Units	Notes
Duration of exposure (T)		90	day	
Body Weight (W)		3.72	kg	
Food ingestion rate (dry weight)		0.13688203	kg dw/day	[1]
Food ingestion rate (wet weight, A)		0.912546869	kg ww/day	[2]
Half life on vegetation (t50)				
	Herbicide specific	5	days	
Application rates (R)				
	Typical	2	lb/acre	
	Maximum	4		
Residue rate - vegetation (rr)				
	Typical	35	mg/kg per lb/acre	
	Maximum	125		
Drift (Drift)				
	Typical	1	unitless	
	Maximum	1		
Decay Coefficient (k): ln(2)/t50				
	Typical	0.138629436	$days^{-1}$	
	Maximum	0.138629436		
Initial concentration on vegetation (C0): R × rr × Drift				
	Typical	70	mg/kg veg	
	Maximum	500		
Concentration on vegetation at time T: C0 * exp(-k*T)				
	Typical	0.000267029	mg/kg veg	
	Maximum	0.001907349		
Time-weighted Average Concentration on vegetation (CTWA): C0 * (1-exp(-k*T))/(k*T)				
	Typical	5.610459312	mg/kg veg	
	Maximum	40.07470937		
Proportion of Diet Contaminated (Prop)				
	Typical	1	unitless	
	Maximum	1		
Dose estimates (D): CTWA × A × Prop / W				
	Typical	1.38E+00	mg/kg bw	
	Maximum	9.83E+00		

RISK QUOTIENTS - Ingestion	Toxicity Reference Value	Typical Application	Maximum Application
Large bird - chronic exposure	27	5.10E-02	3.64E-01

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987 for all birds; where
Food Ingestion Rate (kg dw/day) = 0.0582*(BW)^0.651

[2] Assumes vegetation is 85% water (USEPA, 1993; Table 4-2 - value for dicots)

Table C-78: Impact to aquatic species from accidental spray drift to pond

OFF-SITE DRIFT - modeled in AgDrift
TYPICAL APPLICATION RATE

				Risk Quotients - Acute			Risk Quotients - Chronic		
Mode of Application	Application Height or Type	Distance From Receptor (ft)	Pond Concentration (mg/L)	Fish	Aquatic Invertebrates	Non-Target Aquatic Plants	Fish	Aquatic Invertebrates	Non-Target Aquatic Plants
Plane	Forested	100	1.01E-02	**5.06E-02**	**2.35E+00**	**2.53E+01**	1.84E-01	5.06E-02	3.37E-01
Plane	Forested	300	3.90E-03	1.95E-02	**9.08E-01**	**9.76E+00**	7.10E-02	1.95E-02	1.30E-01
Plane	Forested	900	1.31E-03	6.54E-03	**3.04E-01**	**3.27E+00**	2.38E-02	6.54E-03	4.36E-02
Plane	Non-Forested	100	5.60E-03	2.80E-02	**1.30E+00**	**1.40E+01**	1.02E-01	2.80E-02	1.87E-01
Plane	Non-Forested	300	2.64E-03	1.32E-02	**6.14E-01**	**6.60E+00**	4.80E-02	1.32E-02	8.80E-02
Plane	Non-Forested	900	1.06E-03	5.28E-03	**2.46E-01**	**2.64E+00**	1.92E-02	5.28E-03	3.52E-02
Helicopter	Forested	100	5.55E-04	2.78E-03	**1.29E-01**	**1.39E+00**	1.01E-02	2.78E-03	1.85E-02
Helicopter	Forested	300	1.63E-04	8.14E-04	3.79E-02	4.07E-01	2.96E-03	8.14E-04	5.43E-03
Helicopter	Forested	900	2.92E-05	1.46E-04	6.78E-03	7.29E-02	5.30E-04	1.46E-04	9.72E-04
Helicopter	Non-Forested	100	4.56E-03	2.28E-02	**1.06E+00**	**1.14E+01**	8.30E-02	2.28E-02	1.52E-01
Helicopter	Non-Forested	300	2.05E-03	1.02E-02	**4.76E-01**	**5.11E+00**	3.72E-02	1.02E-02	6.82E-02
Helicopter	Non-Forested	900	6.83E-04	3.42E-03	**1.59E-01**	**1.71E+00**	1.24E-02	3.42E-03	2.28E-02
Ground	Low Boom	25	1.36E-03	6.82E-03	**3.17E-01**	**3.41E+00**	2.48E-02	6.82E-03	4.54E-02
Ground	Low Boom	100	7.48E-04	3.74E-03	**1.74E-01**	**1.87E+00**	1.36E-02	3.74E-03	2.49E-02
Ground	Low Boom	900	1.44E-04	7.22E-04	3.36E-02	3.61E-01	2.62E-03	7.22E-04	4.81E-03
Ground	High Boom	25	2.19E-03	1.09E-02	**5.09E-01**	**5.47E+00**	3.98E-02	1.09E-02	7.30E-02
Ground	High Boom	100	1.15E-03	5.77E-03	**2.68E-01**	**2.88E+00**	2.10E-02	5.77E-03	3.84E-02
Ground	High Boom	900	1.83E-04	9.16E-04	4.26E-02	4.58E-01	3.33E-03	9.16E-04	6.11E-03

OFF-SITE DRIFT - modeled in AgDrift
MAXIMUM APPLICATION RATE

				Risk Quotients - Acute			Risk Quotients - Chronic		
Mode of Application	Application Height or Type	Distance From Receptor (ft)	Pond Concentration (mg/L)	Fish	Aquatic Invertebrates	Non-Target Aquatic Plants	Fish	Aquatic Invertebrates	Non-Target Aquatic Plants
Plane	Forested	100	2.07E-02	**1.03E-01**	**4.81E+00**	**5.17E+01**	3.76E-01	1.03E-01	6.89E-01
Plane	Forested	300	8.29E-03	4.15E-02	**1.93E+00**	**2.07E+01**	1.51E-01	4.15E-02	2.76E-01
Plane	Forested	900	2.91E-03	1.46E-02	**6.78E-01**	**7.29E+00**	5.30E-02	1.46E-02	9.71E-02
Plane	Non-Forested	100	1.19E-02	**5.96E-02**	**2.77E+00**	**2.98E+01**	2.17E-01	5.96E-02	3.97E-01
Plane	Non-Forested	300	5.34E-03	2.67E-02	**1.24E+00**	**1.33E+01**	9.71E-02	2.67E-02	1.78E-01
Plane	Non-Forested	900	1.40E-03	7.00E-03	**3.26E-01**	**3.50E+00**	2.55E-02	7.00E-03	4.67E-02
Helicopter	Forested	100	1.15E-03	5.73E-03	**2.66E-01**	**2.86E+00**	2.08E-02	5.73E-03	3.82E-02
Helicopter	Forested	300	3.18E-04	1.59E-03	**7.38E-02**	7.94E-01	5.77E-03	1.59E-03	1.06E-02
Helicopter	Forested	900	5.02E-05	2.51E-04	1.17E-02	1.26E-01	9.13E-04	2.51E-04	1.67E-03
Helicopter	Non-Forested	100	9.84E-03	4.92E-02	**2.29E+00**	**2.46E+01**	1.79E-01	4.92E-02	3.28E-01
Helicopter	Non-Forested	300	4.15E-03	2.07E-02	**9.64E-01**	**1.04E+01**	7.54E-02	2.07E-02	1.38E-01
Helicopter	Non-Forested	900	6.76E-04	3.38E-03	**1.57E-01**	**1.69E+00**	1.23E-02	3.38E-03	2.25E-02
Ground	Low Boom	25	2.73E-03	1.36E-02	**6.34E-01**	**6.82E+00**	4.96E-02	1.36E-02	9.09E-02
Ground	Low Boom	100	1.50E-03	7.48E-03	**3.48E-01**	**3.74E+00**	2.72E-02	7.48E-03	4.98E-02
Ground	Low Boom	900	2.89E-04	1.44E-03	**6.71E-02**	7.22E-01	5.25E-03	1.44E-03	9.62E-03
Ground	High Boom	25	4.38E-03	2.19E-02	**1.02E+00**	**1.09E+01**	7.96E-02	2.19E-02	1.46E-01
Ground	High Boom	100	2.31E-03	1.15E-02	**5.36E-01**	**5.77E+00**	4.19E-02	1.15E-02	7.69E-02
Ground	High Boom	900	3.66E-04	1.83E-03	**8.52E-02**	9.16E-01	6.66E-03	1.83E-03	1.22E-02

RQ = Risk Quotient = Estimated Dose/Toxicity Reference Value

Shading and boldface indicates plant RQs greater than 1.
Shading and boldface indicates acute RQs greater than 0.05 for fish and invertebrates.
Shading and boldface indicates chronic RQs greater than 0.5 for fish and invertebrates.

Table C-79: Impact to aquatic species from accidental spray drift to stream

OFF-SITE DRIFT - modeled in AgDrift
TYPICALAPPLICATION RATE

Mode of Application	Application Height or Type	Distance From Receptor (ft)	Stream Concentration (mg/L)	Risk Quotients - Acute: Fish	Risk Quotients - Acute: Aquatic Invertebrates	Risk Quotients - Acute: Non-Target Aquatic Plants	Risk Quotients - Chronic: Fish	Risk Quotients - Chronic: Aquatic Invertebrates	Risk Quotients - Chronic: Non-Target Aquatic Plants
Plane	Forested	100	1.45E-02	**7.25E-02**	**3.37E+00**	**3.63E+01**	2.64E-01	7.25E-02	4.84E-01
Plane	Forested	300	4.43E-03	2.21E-02	**1.03E+00**	**1.11E+01**	8.05E-02	2.21E-02	1.48E-01
Plane	Forested	900	1.35E-03	6.77E-03	**3.15E-01**	**3.38E+00**	2.46E-02	6.77E-03	4.51E-02
Plane	Non-Forested	100	7.36E-03	3.68E-02	**1.71E+00**	**1.84E+01**	1.34E-01	3.68E-02	2.45E-01
Plane	Non-Forested	300	2.85E-03	1.43E-02	**6.64E-01**	**7.14E+00**	5.19E-02	1.43E-02	9.51E-02
Plane	Non-Forested	900	1.09E-03	5.46E-03	**2.54E-01**	**2.73E+00**	1.99E-02	5.46E-03	3.64E-02
Helicopter	Forested	100	7.30E-04	3.65E-03	**1.70E-01**	**1.83E+00**	1.33E-02	3.65E-03	2.43E-02
Helicopter	Forested	300	1.93E-04	9.64E-04	4.48E-02	4.82E-01	3.50E-03	9.64E-04	6.43E-03
Helicopter	Forested	900	3.20E-05	1.60E-04	7.43E-03	7.99E-02	5.81E-04	1.60E-04	1.07E-03
Helicopter	Non-Forested	100	6.03E-03	3.01E-02	**1.40E+00**	**1.51E+01**	1.10E-01	3.01E-02	2.01E-01
Helicopter	Non-Forested	300	2.22E-03	1.11E-02	**5.16E-01**	**5.54E+00**	4.03E-02	1.11E-02	7.39E-02
Helicopter	Non-Forested	900	7.25E-04	3.62E-03	**1.69E-01**	**1.81E+00**	1.32E-02	3.62E-03	2.42E-02
Ground	Low Boom	25	2.45E-03	1.23E-02	**5.71E-01**	**6.14E+00**	4.46E-02	1.23E-02	8.18E-02
Ground	Low Boom	100	7.19E-04	3.60E-03	**1.67E-01**	**1.80E+00**	1.31E-02	3.60E-03	2.40E-02
Ground	Low Boom	900	7.45E-05	3.72E-04	1.73E-02	1.86E-01	1.35E-03	3.72E-04	2.48E-03
Ground	High Boom	25	4.11E-03	2.06E-02	**9.56E-01**	**1.03E+01**	7.47E-02	2.06E-02	1.37E-01
Ground	High Boom	100	1.16E-03	5.82E-03	**2.71E-01**	**2.91E+00**	2.12E-02	5.82E-03	3.88E-02
Ground	High Boom	900	9.84E-05	4.92E-04	2.29E-02	2.46E-01	1.79E-03	4.92E-04	3.28E-03

OFF-SITE DRIFT - modeled in AgDrift
MAXIMUM APPLICATION RATE

Mode of Application	Application Height or Type	Distance From Receptor (ft)	Stream Concentration (mg/L)	Risk Quotients - Acute: Fish	Risk Quotients - Acute: Aquatic Invertebrates	Risk Quotients - Acute: Non-Target Aquatic Plants	Risk Quotients - Chronic: Fish	Risk Quotients - Chronic: Aquatic Invertebrates	Risk Quotients - Chronic: Non-Target Aquatic Plants
Plane	Forested	100	2.94E-02	**1.47E-01**	**6.83E+00**	**7.34E+01**	**5.34E-01**	1.47E-01	9.79E-01
Plane	Forested	300	9.32E-03	4.66E-02	**2.17E+00**	**2.33E+01**	1.69E-01	4.66E-02	3.11E-01
Plane	Forested	900	3.01E-03	1.51E-02	**7.01E-01**	**7.53E+00**	5.48E-02	1.51E-02	1.00E-01
Plane	Non-Forested	100	1.55E-02	**7.76E-02**	**3.61E+00**	**3.88E+01**	2.82E-01	7.76E-02	5.17E-01
Plane	Non-Forested	300	6.07E-03	3.03E-02	**1.41E+00**	**1.52E+01**	1.10E-01	3.03E-02	2.02E-01
Plane	Non-Forested	900	1.52E-03	7.62E-03	**3.54E-01**	**3.81E+00**	2.77E-02	7.62E-03	5.08E-02
Helicopter	Forested	100	1.56E-03	7.79E-03	**3.63E-01**	**3.90E+00**	2.83E-02	7.79E-03	5.20E-02
Helicopter	Forested	300	3.74E-04	1.87E-03	**8.70E-02**	9.35E-01	6.80E-03	1.87E-03	1.25E-02
Helicopter	Forested	900	5.62E-05	2.81E-04	1.31E-02	1.41E-01	1.02E-03	2.81E-04	1.87E-03
Helicopter	Non-Forested	100	1.28E-02	**6.39E-02**	**2.97E+00**	**3.20E+01**	2.32E-01	6.39E-02	4.26E-01
Helicopter	Non-Forested	300	4.72E-03	2.36E-02	**1.10E+00**	**1.18E+01**	8.59E-02	2.36E-02	1.57E-01
Helicopter	Non-Forested	900	7.86E-04	3.93E-03	**1.83E-01**	**1.96E+00**	1.43E-02	3.93E-03	2.62E-02
Ground	Low Boom	25	4.91E-03	2.45E-02	**1.14E+00**	**1.23E+01**	8.92E-02	2.45E-02	1.64E-01
Ground	Low Boom	100	1.44E-03	7.19E-03	**3.34E-01**	**3.60E+00**	2.61E-02	7.19E-03	4.79E-02
Ground	Low Boom	900	1.49E-04	7.45E-04	3.46E-02	3.72E-01	2.71E-03	7.45E-04	4.96E-03
Ground	High Boom	25	8.22E-03	4.11E-02	**1.91E+00**	**2.06E+01**	1.49E-01	4.11E-02	2.74E-01
Ground	High Boom	100	2.33E-03	1.16E-02	**5.42E-01**	**5.82E+00**	4.23E-02	1.16E-02	7.76E-02
Ground	High Boom	900	1.97E-04	9.84E-04	4.58E-02	4.92E-01	3.58E-03	9.84E-04	6.56E-03

RQ = Risk Quotient = Estimated Dose/Toxicity Reference Value

Shading and boldface indicates plant RQs greater than 1.
Shading and boldface indicates acute RQs greater than 0.05 for fish and invertebrates.
Shading and boldface indicates chronic RQs greater than 0.5 for fish and invertebrates.

Table C-80: Impact to non-target terrrestrial plants from direct spray and spray drift

DIRECT SPRAY	Terrestrial Concentration (lb a.e./acre)	Typical Species RQ	Threatened & Endangered Species RQ
Typical application rate	2	**2.86E+03**	**6.67E+03**
Maximum application rate	4	**5.71E+03**	**1.33E+04**

OFF-SITE DRIFT - modeled in AgDrift
TYPICAL APPLICATION RATE

Mode of Application	Application Height or Type	Distance From Receptor (ft)	Soil Concentration (mg a.e./kg)	Typical Species RQ	Threatened & Endangered Species RQ
Plane	Forested	100	7.05E-02	**1.01E+02**	**2.35E+02**
Plane	Forested	300	3.04E-02	**4.34E+01**	**1.01E+02**
Plane	Forested	900	1.11E-02	**1.59E+01**	**3.70E+01**
Plane	Non-Forested	100	4.02E-02	**5.74E+01**	**1.34E+02**
Plane	Non-Forested	300	2.12E-02	**3.03E+01**	**7.07E+01**
Plane	Non-Forested	900	8.90E-03	**1.27E+01**	**2.97E+01**
Helicopter	Forested	100	3.60E-03	**5.14E+00**	**1.20E+01**
Helicopter	Forested	300	1.20E-03	**1.71E+00**	**4.00E+00**
Helicopter	Forested	900	2.00E-04	2.86E-01	6.67E-01
Helicopter	Non-Forested	100	3.22E-02	**4.60E+01**	**1.07E+02**
Helicopter	Non-Forested	300	1.65E-02	**2.36E+01**	**5.50E+01**
Helicopter	Non-Forested	900	5.60E-03	**8.00E+00**	**1.87E+01**
Ground	Low Boom	25	9.00E-03	**1.29E+01**	**3.00E+01**
Ground	Low Boom	100	5.50E-03	**7.86E+00**	**1.83E+01**
Ground	Low Boom	900	1.20E-03	**1.71E+00**	**4.00E+00**
Ground	High Boom	25	1.42E-02	**2.03E+01**	**4.73E+01**
Ground	High Boom	100	8.40E-03	**1.20E+01**	**2.80E+01**
Ground	High Boom	900	1.50E-03	**2.14E+00**	**5.00E+00**

OFF-SITE DRIFT - modeled in AgDrift
MAXIMUM APPLICATION RATE

Mode of Application	Application Height or Type	Distance From Receptor (ft)	Soil Concentration (mg a.e./kg)	Typical Species RQ	Threatened & Endangered Species RQ
Plane	Forested	100	1.45E-01	**2.07E+02**	**4.84E+02**
Plane	Forested	300	6.49E-02	**9.27E+01**	**2.16E+02**
Plane	Forested	900	2.47E-02	**3.53E+01**	**8.23E+01**
Plane	Non-Forested	100	8.54E-02	**1.22E+02**	**2.85E+02**
Plane	Non-Forested	300	4.17E-02	**5.96E+01**	**1.39E+02**
Plane	Non-Forested	900	1.14E-02	**1.63E+01**	**3.80E+01**
Helicopter	Forested	100	7.20E-03	**1.03E+01**	**2.40E+01**
Helicopter	Forested	300	2.40E-03	**3.43E+00**	**8.00E+00**
Helicopter	Forested	900	4.00E-04	5.71E-01	**1.33E+00**
Helicopter	Non-Forested	100	6.93E-02	**9.90E+01**	**2.31E+02**
Helicopter	Non-Forested	300	3.18E-02	**4.54E+01**	**1.06E+02**
Helicopter	Non-Forested	900	5.20E-03	**7.43E+00**	**1.73E+01**
Ground	Low Boom	25	1.79E-02	**2.56E+01**	**5.97E+01**
Ground	Low Boom	100	1.10E-02	**1.57E+01**	**3.67E+01**
Ground	Low Boom	900	2.40E-03	**3.43E+00**	**8.00E+00**
Ground	High Boom	25	2.84E-02	**4.06E+01**	**9.47E+01**
Ground	High Boom	100	1.68E-02	**2.40E+01**	**5.60E+01**
Ground	High Boom	900	3.10E-03	**4.43E+00**	**1.03E+01**

RQ = Risk Quotient = Estimated Dose/Toxicity Reference Value
Shading and boldface indicates plant RQs greater than 1.

Table C-81: Consumption of contaminated fish from pond by predatory bird - one time exposure. Pond impacted by spray drift modeled in AgDrift.

Parameters/ Assumptions	Value	Units	Notes
Body Weight (W)	5.15	kg	
Food ingestion rate (dry weight)	0.101786153	kg dw/day	[1]
Food ingestion rate (wet weight, A)	0.40714461	kg ww/day	[2]
Bioconcentration factor (BCF)	1	L/kg fish	
Proportion of Diet Contaminated (Prop)	1	unitless	
Toxicity reference value (TRV)	27	mg/kg-bw/day	

TYPICAL APPLICATION RATE

Mode of Application	Application Height or Type	Distance From Receptor (ft)	Pond Concentration (mg/L)	Concentration in fish (C_{Fish}): WC × BCF	Dose estimate (D): C_{Fish} × A × Prop / W	Risk Quotient
Plane	Forested	100	1.01E-02	1.01E-02	8.00E-04	2.96E-05
Plane	Forested	300	3.90E-03	3.90E-03	3.09E-04	1.14E-05
Plane	Forested	900	1.31E-03	1.31E-03	1.03E-04	3.83E-06
Plane	Non-Forested	100	5.60E-03	5.60E-03	4.42E-04	1.64E-05
Plane	Non-Forested	300	2.64E-03	2.64E-03	2.09E-04	7.73E-06
Plane	Non-Forested	900	1.06E-03	1.06E-03	8.35E-05	3.09E-06
Helicopter	Forested	100	5.55E-04	5.55E-04	4.39E-05	1.63E-06
Helicopter	Forested	300	1.63E-04	1.63E-04	1.29E-05	4.77E-07
Helicopter	Forested	900	2.92E-05	2.92E-05	2.31E-06	8.54E-08
Helicopter	Non-Forested	100	4.56E-03	4.56E-03	3.61E-04	1.34E-05
Helicopter	Non-Forested	300	2.05E-03	2.05E-03	1.62E-04	5.99E-06
Helicopter	Non-Forested	900	6.83E-04	6.83E-04	5.40E-05	2.00E-06
Ground	Low Boom	25	1.36E-03	1.36E-03	1.08E-04	3.99E-06
Ground	Low Boom	100	7.48E-04	7.48E-04	5.91E-05	2.19E-06
Ground	Low Boom	900	1.44E-04	1.44E-04	1.14E-05	4.23E-07
Ground	High Boom	25	2.19E-03	2.19E-03	1.73E-04	6.41E-06
Ground	High Boom	100	1.15E-03	1.15E-03	9.12E-05	3.38E-06
Ground	High Boom	900	1.83E-04	1.83E-04	1.45E-05	5.36E-07

MAXIMUM APPLICATION RATE

Mode of Application	Application Height or Type	Distance From Receptor (ft)	Pond Concentration (mg/L)	Concentration in fish (C_{Fish}): WC × BCF	Dose estimate (D): C_{Fish} × A × Prop / W	Risk Quotient
Plane	Forested	100	2.07E-02	2.07E-02	1.63E-03	6.05E-05
Plane	Forested	300	8.29E-03	8.29E-03	6.55E-04	2.43E-05
Plane	Forested	900	2.91E-03	2.91E-03	2.30E-04	8.53E-06
Plane	Non-Forested	100	1.19E-02	1.19E-02	9.42E-04	3.49E-05
Plane	Non-Forested	300	5.34E-03	5.34E-03	4.22E-04	1.56E-05
Plane	Non-Forested	900	1.40E-03	1.40E-03	1.11E-04	4.10E-06
Helicopter	Forested	100	1.15E-03	1.15E-03	9.06E-05	3.35E-06
Helicopter	Forested	300	3.18E-04	3.18E-04	2.51E-05	9.30E-07
Helicopter	Forested	900	5.02E-05	5.02E-05	3.97E-06	1.47E-07
Helicopter	Non-Forested	100	9.84E-03	9.84E-03	7.78E-04	2.88E-05
Helicopter	Non-Forested	300	4.15E-03	4.15E-03	3.28E-04	1.21E-05
Helicopter	Non-Forested	900	6.76E-04	6.76E-04	5.35E-05	1.98E-06
Ground	Low Boom	25	2.73E-03	2.73E-03	2.16E-04	7.98E-06
Ground	Low Boom	100	1.50E-03	1.50E-03	1.18E-04	4.38E-06
Ground	Low Boom	900	2.89E-04	2.89E-04	2.28E-05	8.45E-07
Ground	High Boom	25	4.38E-03	4.38E-03	3.46E-04	1.28E-05
Ground	High Boom	100	2.31E-03	2.31E-03	1.82E-04	6.75E-06
Ground	High Boom	900	3.66E-04	3.66E-04	2.90E-05	1.07E-06

Risk Quotient = Estimated Dose/Toxicity Reference Value
Shading and boldface indicates piscivorous bird RQs greater than 0.1.

[1] Calculated using alorithm developed by Nagy, 1987 for all birds; where
Food Ingestion Rate (kg dw/day) = 0.0582*(BW)^0.651
[2] Assumes fish are 75% water (USEPA, 1993; Table 4-1 - value for bony fishes)

Table C-82: Impact to aquatic species from surface runoff to pond

SURFACE RUNOFF - modeled in GLEAMS
TYPICAL APPLICATION RATE

GLEAMS ID	Pond Concentration (mg/L)	Risk Quotients - Acute: Fish	Risk Quotients - Acute: Aquatic Invertebrates	Risk Quotients - Acute: Non-Target Aquatic Plants	Risk Quotients - Chronic: Fish	Risk Quotients - Chronic: Aquatic Invertebrates	Risk Quotients - Chronic: Non-Target Aquatic Plants
G_BASE_SAND_005_POND_TYP	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_005_POND_TYP	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_005_POND_TYP	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_010_POND_TYP	2.91E-08	1.46E-07	6.78E-06	7.29E-05	5.30E-07	1.46E-07	9.71E-07
G_BASE_CLAY_010_POND_TYP	3.00E-06	1.50E-05	6.97E-04	7.49E-03	5.45E-05	1.50E-05	9.99E-05
G_BASE_LOAM_010_POND_TYP	5.16E-08	2.58E-07	1.20E-05	1.29E-04	9.37E-07	2.58E-07	1.72E-06
G_BASE_SAND_025_POND_TYP	5.00E-08	2.50E-07	1.16E-05	1.25E-04	9.09E-07	2.50E-07	1.67E-06
G_BASE_CLAY_025_POND_TYP	1.58E-06	7.91E-06	3.68E-04	3.96E-03	2.88E-05	7.91E-06	5.27E-05
G_BASE_LOAM_025_POND_TYP	4.89E-09	2.45E-08	1.14E-06	1.22E-05	8.89E-08	2.45E-08	1.63E-07
G_BASE_SAND_050_POND_TYP	4.13E-07	2.07E-06	9.61E-05	1.03E-03	7.52E-06	2.07E-06	1.67E-06
G_BASE_CLAY_050_POND_TYP	1.45E-04	7.25E-04	3.37E-02	3.62E-01	2.63E-03	7.25E-04	4.83E-03
G_BASE_LOAM_050_POND_TYP	5.11E-09	2.56E-08	1.19E-06	1.28E-05	9.29E-08	2.56E-08	1.70E-07
G_BASE_SAND_100_POND_TYP	2.55E-05	1.28E-04	5.93E-03	6.38E-02	4.64E-04	1.28E-04	8.51E-04
G_BASE_CLAY_100_POND_TYP	3.42E-04	1.71E-03	**7.94E-02**	8.54E-01	6.21E-03	1.71E-03	1.14E-02
G_BASE_LOAM_100_POND_TYP	3.61E-06	1.81E-05	8.40E-04	9.03E-03	6.56E-05	1.81E-05	1.20E-04
G_BASE_SAND_150_POND_TYP	4.54E-04	2.27E-03	**1.06E-01**	**1.13E+00**	8.25E-03	2.27E-03	1.51E-02
G_BASE_CLAY_150_POND_TYP	1.96E-03	9.80E-03	**4.56E-01**	**4.90E+00**	3.57E-02	9.80E-03	6.54E-02
G_BASE_LOAM_150_POND_TYP	2.96E-06	1.48E-05	6.87E-04	7.39E-03	5.37E-05	1.48E-05	9.85E-05
G_BASE_SAND_200_POND_TYP	7.55E-04	3.78E-03	**1.76E-01**	**1.89E+00**	1.37E-02	3.78E-03	2.52E-02
G_BASE_CLAY_200_POND_TYP	4.99E-03	2.50E-02	**1.16E+00**	**1.25E+01**	9.07E-02	2.50E-02	1.66E-01
G_BASE_LOAM_200_POND_TYP	2.42E-06	1.21E-05	5.62E-04	6.04E-03	4.39E-05	1.21E-05	8.05E-05
G_BASE_SAND_250_POND_TYP	9.17E-04	4.58E-03	**2.13E-01**	**2.29E+00**	1.67E-02	4.58E-03	3.06E-02
G_BASE_CLAY_250_POND_TYP	8.27E-03	4.14E-02	**1.92E+00**	**2.07E+01**	1.50E-01	4.14E-02	2.76E-01
G_BASE_LOAM_250_POND_TYP	2.36E-04	1.18E-03	**5.48E-02**	5.89E-01	4.28E-03	1.18E-03	7.85E-03
G_ARV1_050_POND_TYP	2.03E-09	1.02E-08	4.72E-07	5.08E-06	3.69E-08	1.02E-08	6.77E-08
G_ARV2_050_POND_TYP	9.27E-10	4.63E-09	2.16E-07	2.32E-06	1.69E-08	4.63E-09	3.09E-08
G_ARV3_050_POND_TYP	9.26E-10	4.63E-09	2.15E-07	2.31E-06	1.68E-08	4.63E-09	3.09E-08
G_ERV1_050_POND_TYP	3.64E-09	1.82E-08	8.47E-07	9.11E-06	6.62E-08	1.82E-08	1.21E-07
G_ERV2_050_POND_TYP	3.69E-09	1.85E-08	8.58E-07	9.23E-06	6.71E-08	1.85E-08	1.23E-07
G_ERV3_050_POND_TYP	3.74E-09	1.87E-08	8.69E-07	9.34E-06	6.79E-08	1.87E-08	1.25E-07
G_RGV1_050_POND_TYP	3.64E-09	1.82E-08	8.47E-07	9.11E-06	6.62E-08	1.82E-08	1.21E-07
G_RGV2_050_POND_TYP	3.64E-09	1.82E-08	8.47E-07	9.11E-06	6.62E-08	1.82E-08	1.21E-07
G_RGV3_050_POND_TYP	3.95E-09	1.97E-08	9.18E-07	9.87E-06	7.17E-08	1.97E-08	1.32E-07
G_SLV1_050_POND_TYP	1.04E-04	5.20E-04	2.42E-02	2.60E-01	1.89E-03	5.20E-04	3.47E-03
G_SLV2_050_POND_TYP	1.35E-05	6.74E-05	3.13E-03	3.37E-02	2.45E-04	6.74E-05	4.49E-04
G_SLV3_050_POND_TYP	1.86E-05	9.30E-05	4.33E-03	4.65E-02	3.38E-04	9.30E-05	6.20E-04
G_STV1_050_POND_TYP	3.64E-09	1.82E-08	8.47E-07	9.11E-06	6.62E-08	1.82E-08	1.21E-07
G_STV2_050_POND_TYP	3.69E-09	1.85E-08	8.58E-07	9.23E-06	6.71E-08	1.85E-08	1.23E-07
G_STV3_050_POND_TYP	3.64E-09	1.82E-08	8.47E-07	9.11E-06	6.62E-08	1.82E-08	1.21E-07
G_VGV1_050_POND_TYP	3.69E-09	1.85E-08	8.58E-07	9.23E-06	6.71E-08	1.85E-08	1.23E-07
G_VGV2_050_POND_TYP	3.69E-09	1.85E-08	8.58E-07	9.23E-06	6.71E-08	1.85E-08	1.23E-07
G_VGV3_050_POND_TYP	1.67E-09	8.36E-09	3.89E-07	4.18E-06	3.04E-08	8.36E-09	5.57E-08

RQ = Risk Quotient = Estimated Dose/Toxicity Reference Value

Table C-82: Impact to aquatic species from surface runoff to pond

SURFACE RUNOFF - modeled in GLEAMS							
MAXIMUM APPLICATION RATE		Risk Quotients - Acute			Risk Quotients - Chronic		
GLEAMS ID	Pond Concentration (mg/L)	Fish	Aquatic Invertebrates	Non-Target Aquatic Plants	Fish	Aquatic Invertebrates	Non-Target Aquatic Plants
G_BASE_SAND_005_POND_MAX	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_005_POND_MAX	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_005_POND_MAX	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_010_POND_MAX	5.83E-08	2.91E-07	1.36E-05	1.46E-04	1.06E-06	2.91E-07	1.94E-06
G_BASE_CLAY_010_POND_MAX	5.99E-06	3.00E-05	1.39E-03	1.50E-02	1.09E-04	3.00E-05	2.00E-04
G_BASE_LOAM_010_POND_MAX	1.03E-07	5.16E-07	2.40E-05	2.58E-04	1.87E-06	5.16E-07	3.44E-06
G_BASE_SAND_025_POND_MAX	1.00E-07	5.00E-07	2.33E-05	2.50E-04	1.82E-06	5.00E-07	3.33E-06
G_BASE_CLAY_025_POND_MAX	3.16E-06	1.58E-05	7.36E-04	7.91E-03	5.75E-05	1.58E-05	1.05E-04
G_BASE_LOAM_025_POND_MAX	9.78E-09	4.89E-08	2.27E-06	2.45E-05	1.78E-07	4.89E-08	3.26E-07
G_BASE_SAND_050_POND_MAX	8.27E-07	4.13E-06	1.92E-04	2.07E-03	1.50E-05	4.13E-06	2.76E-05
G_BASE_CLAY_050_POND_MAX	2.90E-04	1.45E-03	**6.74E-02**	7.25E-01	5.27E-03	1.45E-03	9.66E-03
G_BASE_LOAM_050_POND_MAX	1.02E-08	5.11E-08	2.38E-06	2.56E-05	1.86E-07	5.11E-08	3.41E-07
G_BASE_SAND_100_POND_MAX	5.10E-05	2.55E-04	1.19E-02	1.28E-01	9.28E-04	2.55E-04	1.70E-03
G_BASE_CLAY_100_POND_MAX	6.83E-04	3.42E-03	**1.59E-01**	**1.71E+00**	1.24E-02	3.42E-03	2.28E-02
G_BASE_LOAM_100_POND_MAX	7.22E-06	3.61E-05	1.68E-03	1.81E-02	1.31E-04	3.61E-05	2.41E-04
G_BASE_SAND_150_POND_MAX	9.08E-04	4.54E-03	**2.11E-01**	**2.27E+00**	1.65E-02	4.54E-03	3.03E-02
G_BASE_CLAY_150_POND_MAX	3.92E-03	1.96E-02	**9.12E-01**	**9.80E+00**	7.13E-02	1.96E-02	1.31E-01
G_BASE_LOAM_150_POND_MAX	5.91E-06	2.96E-05	1.37E-03	1.48E-02	1.07E-04	2.96E-05	1.97E-04
G_BASE_SAND_200_POND_MAX	1.51E-03	7.55E-03	**3.51E-01**	**3.78E+00**	2.75E-02	7.55E-03	5.04E-02
G_BASE_CLAY_200_POND_MAX	9.98E-03	4.99E-02	**2.32E+00**	**2.50E+01**	1.81E-01	4.99E-02	3.33E-01
G_BASE_LOAM_200_POND_MAX	4.83E-06	2.42E-05	1.12E-03	1.21E-02	8.79E-05	2.42E-05	1.61E-04
G_BASE_SAND_250_POND_MAX	1.83E-03	9.17E-03	**4.26E-01**	**4.58E+00**	3.33E-02	9.17E-03	6.11E-02
G_BASE_CLAY_250_POND_MAX	1.65E-02	**8.27E-02**	**3.85E+00**	**4.14E+01**	3.01E-01	8.27E-02	5.52E-01
G_BASE_LOAM_250_POND_MAX	4.71E-04	2.36E-03	**1.10E-01**	**1.18E+00**	8.57E-03	2.36E-03	1.57E-02
G_ARV1_050_POND_MAX	4.06E-09	2.03E-08	9.44E-07	1.02E-05	7.38E-08	2.03E-08	1.35E-07
G_ARV2_050_POND_MAX	1.85E-09	9.27E-09	4.31E-07	4.63E-06	3.37E-08	9.27E-09	6.18E-08
G_ARV3_050_POND_MAX	1.85E-09	9.26E-09	4.31E-07	4.63E-06	3.37E-08	9.26E-09	6.17E-08
G_ERV1_050_POND_MAX	7.28E-09	3.64E-08	1.69E-06	1.82E-05	1.32E-07	3.64E-08	2.43E-07
G_ERV2_050_POND_MAX	7.38E-09	3.69E-08	1.72E-06	1.85E-05	1.34E-07	3.69E-08	2.46E-07
G_ERV3_050_POND_MAX	7.47E-09	3.74E-08	1.74E-06	1.87E-05	1.36E-07	3.74E-08	2.49E-07
G_RGV1_050_POND_MAX	7.28E-09	3.64E-08	1.69E-06	1.82E-05	1.32E-07	3.64E-08	2.43E-07
G_RGV2_050_POND_MAX	7.28E-09	3.64E-08	1.69E-06	1.82E-05	1.32E-07	3.64E-08	2.43E-07
G_RGV3_050_POND_MAX	7.89E-09	3.95E-08	1.84E-06	1.97E-05	1.43E-07	3.95E-08	2.63E-07
G_SLV1_050_POND_MAX	2.08E-04	1.04E-03	4.84E-02	5.20E-01	3.78E-03	1.04E-03	6.94E-03
G_SLV2_050_POND_MAX	2.69E-05	1.35E-04	6.27E-03	6.74E-02	4.90E-04	1.35E-04	8.98E-04
G_SLV3_050_POND_MAX	3.72E-05	1.86E-04	8.65E-03	9.30E-02	6.76E-04	1.86E-04	1.24E-03
G_STV1_050_POND_MAX	7.28E-09	3.64E-08	1.69E-06	1.82E-05	1.32E-07	3.64E-08	2.43E-07
G_STV2_050_POND_MAX	7.38E-09	3.69E-08	1.72E-06	1.85E-05	1.34E-07	3.69E-08	2.46E-07
G_STV3_050_POND_MAX	7.28E-09	3.64E-08	1.69E-06	1.82E-05	1.32E-07	3.64E-08	2.43E-07
G_VGV1_050_POND_MAX	7.38E-09	3.69E-08	1.72E-06	1.85E-05	1.34E-07	3.69E-08	2.46E-07
G_VGV2_050_POND_MAX	7.38E-09	3.69E-08	1.72E-06	1.85E-05	1.34E-07	3.69E-08	2.46E-07
G_VGV3_050_POND_MAX	3.34E-09	1.67E-08	7.78E-07	8.36E-06	6.08E-08	1.67E-08	1.11E-07

RQ = Risk Quotient = Estimated Dose/Toxicity Reference Value

Shading and boldface indicates plant RQs greater than 1.
Shading and boldface indicates acute RQs greater than 0.05 for fish and invertebrates.
Shading and boldface indicates chronic RQs greater than 0.5 for fish and invertebrates.

Table C-83: Impact to aquatic species from surface runoff to pond

SURFACE RUNOFF - modeled in GLEAMS
TYPICAL APPLICATION RATE

									Risk Quotients - Acute			Risk Quotients - Chronic		
GLEAMS ID	Annual Precipitation (inches)	Application Area (acres)	Hydraulic Slope (ft/ft)	Surface Roughness	USLE Soil Erodibility Factor (ton/ac per EI)	Vegetation Type	Soil Type	Stream Concentration (mg/L)	Fish	Aquatic Invertebrates	Non-Target Aquatic Plants	Fish	Aquatic Invertebrates	Non-Target Aquatic Plants
G_BASE_SAND_005_STREAM_TYP	5	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_005_STREAM_TYP	5	10	0.05	0.015	0.401	weeds (79)	Clay	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_005_STREAM_TYP	5	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_010_STREAM_TYP	10	10	0.05	0.015	0.401	weeds (79)	Sand	3.03E-11	1.52E-10	7.06E-09	7.59E-08	5.52E-10	1.52E-10	1.01E-09
G_BASE_CLAY_010_STREAM_TYP	10	10	0.05	0.015	0.401	weeds (79)	Clay	5.94E-09	2.97E-08	1.38E-06	1.49E-05	1.08E-07	2.97E-08	1.98E-07
G_BASE_LOAM_010_STREAM_TYP	10	10	0.05	0.015	0.401	weeds (79)	Loam	4.43E-11	2.21E-10	1.03E-08	1.11E-07	8.05E-10	2.21E-10	1.48E-09
G_BASE_SAND_025_STREAM_TYP	25	10	0.05	0.015	0.401	weeds (79)	Sand	3.02E-10	1.51E-09	7.02E-08	7.55E-07	5.49E-09	1.51E-09	1.01E-08
G_BASE_CLAY_025_STREAM_TYP	25	10	0.05	0.015	0.401	weeds (79)	Clay	1.23E-08	6.15E-08	2.86E-06	3.07E-05	2.23E-07	6.15E-08	4.10E-07
G_BASE_LOAM_025_STREAM_TYP	25	10	0.05	0.015	0.401	weeds (79)	Loam	3.31E-11	1.66E-10	7.70E-09	8.28E-08	6.02E-10	1.66E-10	1.10E-09
G_BASE_SAND_050_STREAM_TYP	50	10	0.05	0.015	0.401	weeds (79)	Sand	8.52E-09	4.26E-08	1.98E-06	2.13E-05	1.55E-07	4.26E-08	2.84E-07
G_BASE_CLAY_050_STREAM_TYP	50	10	0.05	0.015	0.401	weeds (79)	Clay	4.67E-07	2.33E-06	1.09E-04	1.17E-03	8.48E-06	2.33E-06	1.56E-05
G_BASE_LOAM_050_STREAM_TYP	50	10	0.05	0.015	0.401	weeds (79)	Loam	1.25E-10	6.27E-10	2.92E-08	3.14E-07	2.28E-09	6.27E-10	4.18E-09
G_BASE_SAND_100_STREAM_TYP	100	10	0.05	0.015	0.401	weeds (79)	Sand	6.30E-07	3.15E-06	1.46E-04	1.57E-03	1.15E-05	3.15E-06	2.10E-05
G_BASE_CLAY_100_STREAM_TYP	100	10	0.05	0.015	0.401	weeds (79)	Clay	4.48E-06	2.24E-05	1.04E-03	1.12E-02	8.14E-05	2.24E-05	1.49E-04
G_BASE_LOAM_100_STREAM_TYP	100	10	0.05	0.015	0.401	weeds (79)	Loam	6.47E-08	3.24E-07	1.51E-05	1.62E-04	1.18E-06	3.24E-07	2.16E-06
G_BASE_SAND_150_STREAM_TYP	150	10	0.05	0.015	0.401	weeds (79)	Sand	6.64E-06	3.32E-05	1.54E-03	1.66E-02	1.21E-04	3.32E-05	2.21E-04
G_BASE_CLAY_150_STREAM_TYP	150	10	0.05	0.015	0.401	weeds (79)	Clay	1.04E-05	5.22E-05	2.43E-03	2.61E-02	1.90E-04	5.22E-05	3.48E-04
G_BASE_LOAM_150_STREAM_TYP	150	10	0.05	0.015	0.401	weeds (79)	Loam	2.05E-07	1.03E-06	4.77E-05	5.13E-04	3.73E-06	1.03E-06	6.83E-06
G_BASE_SAND_200_STREAM_TYP	200	10	0.05	0.015	0.401	weeds (79)	Sand	1.34E-05	6.68E-05	3.11E-03	3.34E-02	2.43E-04	6.68E-05	4.46E-04
G_BASE_CLAY_200_STREAM_TYP	200	10	0.05	0.015	0.401	weeds (79)	Clay	2.10E-05	1.05E-04	4.87E-03	5.24E-02	3.81E-04	1.05E-04	6.99E-04
G_BASE_LOAM_200_STREAM_TYP	200	10	0.05	0.015	0.401	weeds (79)	Loam	2.13E-07	1.06E-06	4.95E-05	5.32E-04	3.87E-06	1.06E-06	7.09E-06
G_BASE_SAND_250_STREAM_TYP	250	10	0.05	0.015	0.401	weeds (79)	Sand	1.97E-05	9.85E-05	4.58E-03	4.93E-02	3.58E-04	9.85E-05	6.57E-04
G_BASE_CLAY_250_STREAM_TYP	250	10	0.05	0.015	0.401	weeds (79)	Clay	3.31E-05	1.65E-04	7.69E-03	8.27E-02	6.01E-04	1.65E-04	1.10E-03
G_BASE_LOAM_250_STREAM_TYP	250	10	0.05	0.015	0.401	weeds (79)	Loam	6.92E-07	3.46E-06	1.61E-04	1.73E-03	1.26E-05	3.46E-06	2.31E-05
G_ARV1_050_STREAM_TYP	50	1	0.05	0.015	0.401	weeds (79)	Loam	1.56E-11	7.78E-11	3.62E-09	3.89E-08	2.83E-10	7.78E-11	5.18E-10
G_ARV2_050_STREAM_TYP	50	100	0.05	0.015	0.401	weeds (79)	Loam	4.51E-10	2.25E-09	1.05E-07	1.13E-06	8.20E-09	2.25E-09	1.50E-08
G_ARV3_050_STREAM_TYP	50	1000	0.05	0.015	0.401	weeds (79)	Loam	6.20E-10	3.10E-09	1.44E-07	1.55E-06	1.13E-08	3.10E-09	2.07E-08
G_ERV1_050_STREAM_TYP	50	10	0.05	0.015	0.05	weeds (79)	Loam	1.24E-10	6.18E-10	2.88E-08	3.09E-07	2.25E-09	6.18E-10	4.12E-09
G_ERV2_050_STREAM_TYP	50	10	0.05	0.015	0.2	weeds (79)	Loam	1.25E-10	6.27E-10	2.92E-08	3.14E-07	2.28E-09	6.27E-10	4.18E-09
G_ERV3_050_STREAM_TYP	50	10	0.05	0.015	0.5	weeds (79)	Loam	1.27E-10	6.36E-10	2.96E-08	3.18E-07	2.31E-09	6.36E-10	4.24E-09
G_RGV1_050_STREAM_TYP	50	10	0.05	0.023	0.401	weeds (79)	Loam	1.24E-10	6.18E-10	2.88E-08	3.09E-07	2.25E-09	6.18E-10	4.12E-09
G_RGV2_050_STREAM_TYP	50	10	0.05	0.046	0.401	weeds (79)	Loam	1.24E-10	6.18E-10	2.88E-08	3.09E-07	2.25E-09	6.18E-10	4.12E-09
G_RGV3_050_STREAM_TYP	50	10	0.05	0.15	0.401	weeds (79)	Loam	1.32E-10	6.62E-10	3.08E-08	3.31E-07	2.41E-09	6.62E-10	4.41E-09
G_SLV1_050_STREAM_TYP	50	10	0.005	0.015	0.401	weeds (79)	Loam	8.87E-07	4.43E-06	2.06E-04	2.22E-03	1.61E-05	4.43E-06	2.96E-05
G_SLV2_050_STREAM_TYP	50	10	0.01	0.015	0.401	weeds (79)	Loam	1.20E-07	6.02E-07	2.80E-05	3.01E-04	2.19E-06	6.02E-07	4.01E-06
G_SLV3_050_STREAM_TYP	50	10	0.1	0.015	0.401	weeds (79)	Loam	1.55E-07	7.73E-07	3.59E-05	3.86E-04	2.81E-06	7.73E-07	5.15E-06
G_STV1_050_STREAM_TYP	50	10	0.05	0.015	0.401	weeds (79)	Loam	1.24E-10	6.18E-10	2.88E-08	3.09E-07	2.25E-09	6.18E-10	4.12E-09
G_STV2_050_STREAM_TYP	50	10	0.05	0.015	0.401	weeds (79)	Loam	1.25E-10	6.27E-10	2.92E-08	3.14E-07	2.28E-09	6.27E-10	4.18E-09
G_STV3_050_STREAM_TYP	50	10	0.05	0.015	0.401	weeds (79)	Loam	1.24E-10	6.18E-10	2.88E-08	3.09E-07	2.25E-09	6.18E-10	4.12E-09
G_VGV1_050_STREAM_TYP	50	10	0.05	0.015	0.401	Shrub	Loam	1.25E-10	6.27E-10	2.92E-08	3.14E-07	2.28E-09	6.27E-10	4.18E-09
G_VGV2_050_STREAM_TYP	50	10	0.05	0.015	0.401	Rye Grass	Loam	1.25E-10	6.27E-10	2.92E-08	3.14E-07	2.28E-09	6.27E-10	4.18E-09
G_VGV3_050_STREAM_TYP	50	10	0.05	0.015	0.401	Conifer-Hardwood	Loam	7.41E-11	3.71E-10	1.72E-08	1.85E-07	1.35E-09	3.71E-10	2.47E-09

RQ = Risk Quotient = Estimated Dose/Toxicity Reference Value

SURFACE RUNOFF - modeled in GLEAMS
MAXIMUM APPLICATION RATE

GLEAMS ID	Annual Precipitation (inches)	Application Area (acres)	Hydraulic Slope (ft/ft)	Surface Roughness	USLE Soil Erodibility Factor (ton/ac per EI)	Vegetation Type	Soil Type	Stream Concentration (mg/L)	Risk Quotients - Acute: Fish	Risk Quotients - Acute: Aquatic Invertebrates	Risk Quotients - Acute: Non-Target Aquatic Plants	Risk Quotients - Chronic: Fish	Risk Quotients - Chronic: Aquatic Invertebrates	Risk Quotients - Chronic: Non-Target Aquatic Plants
G_BASE_SAND_005_STREAM_MAX	5	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_005_STREAM_MAX	5	10	0.05	0.015	0.401	weeds (79)	Clay	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_005_STREAM_MAX	5	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_010_STREAM_MAX	10	10	0.05	0.015	0.401	weeds (79)	Sand	6.07E-11	3.03E-10	1.41E-08	1.52E-07	1.10E-09	3.03E-10	2.02E-09
G_BASE_CLAY_010_STREAM_MAX	10	10	0.05	0.015	0.401	weeds (79)	Clay	1.19E-08	5.94E-08	2.76E-06	2.97E-05	2.16E-07	5.94E-08	3.96E-07
G_BASE_LOAM_010_STREAM_MAX	10	10	0.05	0.015	0.401	weeds (79)	Loam	8.85E-11	4.43E-10	2.06E-08	2.21E-07	1.61E-09	4.43E-10	2.95E-09
G_BASE_SAND_025_STREAM_MAX	25	10	0.05	0.015	0.401	weeds (79)	Sand	6.04E-10	3.02E-09	1.40E-07	1.51E-06	1.10E-08	3.02E-09	2.01E-08
G_BASE_CLAY_025_STREAM_MAX	25	10	0.05	0.015	0.401	weeds (79)	Clay	2.46E-08	1.23E-07	5.72E-06	6.15E-05	4.47E-07	1.23E-07	8.19E-07
G_BASE_LOAM_025_STREAM_MAX	25	10	0.05	0.015	0.401	weeds (79)	Loam	6.62E-11	3.31E-10	1.54E-08	1.66E-07	1.20E-09	3.31E-10	2.21E-09
G_BASE_SAND_050_STREAM_MAX	50	10	0.05	0.015	0.401	weeds (79)	Sand	1.70E-08	8.52E-08	3.96E-06	4.26E-05	3.10E-07	8.52E-08	5.68E-07
G_BASE_CLAY_050_STREAM_MAX	50	10	0.05	0.015	0.401	weeds (79)	Clay	9.33E-07	4.67E-06	2.17E-04	2.33E-03	1.70E-05	4.67E-06	3.11E-05
G_BASE_LOAM_050_STREAM_MAX	50	10	0.05	0.015	0.401	weeds (79)	Loam	2.51E-10	1.25E-09	5.83E-08	6.27E-07	4.56E-09	1.25E-09	8.36E-09
G_BASE_SAND_100_STREAM_MAX	100	10	0.05	0.015	0.401	weeds (79)	Sand	1.26E-06	6.30E-06	2.93E-04	3.15E-03	2.29E-05	6.30E-06	4.20E-05
G_BASE_CLAY_100_STREAM_MAX	100	10	0.05	0.015	0.401	weeds (79)	Clay	8.95E-06	4.48E-05	2.08E-03	2.24E-02	1.63E-04	4.48E-05	2.98E-04
G_BASE_LOAM_100_STREAM_MAX	100	10	0.05	0.015	0.401	weeds (79)	Loam	1.29E-07	6.47E-07	3.01E-05	3.24E-04	2.35E-06	6.47E-07	4.32E-06
G_BASE_SAND_150_STREAM_MAX	150	10	0.05	0.015	0.401	weeds (79)	Sand	1.33E-05	6.64E-05	3.09E-03	3.32E-02	2.41E-04	6.64E-05	4.42E-04
G_BASE_CLAY_150_STREAM_MAX	150	10	0.05	0.015	0.401	weeds (79)	Clay	2.09E-05	1.04E-04	4.86E-03	5.22E-02	3.80E-04	1.04E-04	6.96E-04
G_BASE_LOAM_150_STREAM_MAX	150	10	0.05	0.015	0.401	weeds (79)	Loam	4.10E-07	2.05E-06	9.53E-05	1.03E-03	7.45E-06	2.05E-06	1.37E-05
G_BASE_SAND_200_STREAM_MAX	200	10	0.05	0.015	0.401	weeds (79)	Sand	2.67E-05	1.34E-04	6.22E-03	6.68E-02	4.86E-04	1.34E-04	8.91E-04
G_BASE_CLAY_200_STREAM_MAX	200	10	0.05	0.015	0.401	weeds (79)	Clay	4.19E-05	2.10E-04	9.75E-03	1.05E-01	7.62E-04	2.10E-04	1.40E-03
G_BASE_LOAM_200_STREAM_MAX	200	10	0.05	0.015	0.401	weeds (79)	Loam	4.26E-07	2.13E-06	9.90E-05	1.06E-03	7.74E-06	2.13E-06	1.42E-05
G_BASE_SAND_250_STREAM_MAX	250	10	0.05	0.015	0.401	weeds (79)	Sand	3.94E-05	1.97E-04	9.16E-03	9.85E-02	7.16E-04	1.97E-04	1.31E-03
G_BASE_CLAY_250_STREAM_MAX	250	10	0.05	0.015	0.401	weeds (79)	Clay	6.62E-05	3.31E-04	1.54E-02	1.65E-01	1.20E-03	3.31E-04	2.21E-03
G_BASE_LOAM_250_STREAM_MAX	250	10	0.05	0.015	0.401	weeds (79)	Loam	1.38E-06	6.92E-06	3.22E-04	3.46E-03	2.52E-05	6.92E-06	4.62E-05
G_ARV1_050_STREAM_MAX	50	1	0.05	0.015	0.401	weeds (79)	Loam	3.11E-11	1.56E-10	7.23E-09	7.78E-08	5.65E-10	1.56E-10	1.04E-09
G_ARV2_050_STREAM_MAX	50	100	0.05	0.015	0.401	weeds (79)	Loam	9.02E-10	4.51E-09	2.10E-07	2.25E-06	1.64E-08	4.51E-09	3.01E-08
G_ARV3_050_STREAM_MAX	50	1000	0.05	0.015	0.401	weeds (79)	Loam	1.24E-09	6.20E-09	2.88E-07	3.10E-06	2.25E-08	6.20E-09	4.13E-08
G_ERV1_050_STREAM_MAX	50	10	0.05	0.015	0.05	weeds (79)	Loam	2.47E-10	1.24E-09	5.75E-08	6.18E-07	4.50E-09	1.24E-09	8.25E-09
G_ERV2_050_STREAM_MAX	50	10	0.05	0.015	0.2	weeds (79)	Loam	2.51E-10	1.25E-09	5.83E-08	6.27E-07	4.56E-09	1.25E-09	8.36E-09
G_ERV3_050_STREAM_MAX	50	10	0.05	0.015	0.5	weeds (79)	Loam	2.54E-10	1.27E-09	5.91E-08	6.36E-07	4.62E-09	1.27E-09	8.47E-09
G_RGV1_050_STREAM_MAX	50	10	0.05	0.023	0.401	weeds (79)	Loam	2.47E-10	1.24E-09	5.75E-08	6.18E-07	4.50E-09	1.24E-09	8.25E-09
G_RGV2_050_STREAM_MAX	50	10	0.05	0.046	0.401	weeds (79)	Loam	2.47E-10	1.24E-09	5.75E-08	6.18E-07	4.50E-09	1.24E-09	8.25E-09
G_RGV3_050_STREAM_MAX	50	10	0.05	0.15	0.401	weeds (79)	Loam	2.65E-10	1.32E-09	6.16E-08	6.62E-07	4.82E-09	1.32E-09	8.83E-09
G_SLV1_050_STREAM_MAX	50	10	0.005	0.015	0.401	weeds (79)	Loam	1.77E-06	8.87E-06	4.12E-04	4.43E-03	3.22E-05	8.87E-06	5.91E-05
G_SLV2_050_STREAM_MAX	50	10	0.01	0.015	0.401	weeds (79)	Loam	2.41E-07	1.20E-06	5.60E-05	6.02E-04	4.37E-06	1.20E-06	8.02E-06
G_SLV3_050_STREAM_MAX	50	10	0.1	0.015	0.401	weeds (79)	Loam	3.09E-07	1.55E-06	7.19E-05	7.73E-04	5.62E-06	1.55E-06	1.03E-05
G_STV1_050_STREAM_MAX	50	10	0.05	0.015	0.401	weeds (79)	Loam	2.47E-10	1.24E-09	5.75E-08	6.18E-07	4.50E-09	1.24E-09	8.25E-09
G_STV2_050_STREAM_MAX	50	10	0.05	0.015	0.401	weeds (79)	Loam	2.51E-10	1.25E-09	5.83E-08	6.27E-07	4.56E-09	1.25E-09	8.36E-09
G_STV3_050_STREAM_MAX	50	10	0.05	0.015	0.401	weeds (79)	Loam	2.47E-10	1.24E-09	5.75E-08	6.18E-07	4.50E-09	1.24E-09	8.25E-09
G_VGV1_050_STREAM_MAX	50	10	0.05	0.015	0.401	Shrub	Loam	2.51E-10	1.25E-09	5.83E-08	6.27E-07	4.56E-09	1.25E-09	8.36E-09
G_VGV2_050_STREAM_MAX	50	10	0.05	0.015	0.401	Rye Grass	Loam	2.51E-10	1.25E-09	5.83E-08	6.27E-07	4.56E-09	1.25E-09	8.36E-09
G_VGV3_050_STREAM_MAX	50	10	0.05	0.015	0.401	Conifer-Hardwood	Loam	1.48E-10	7.41E-10	3.45E-08	3.71E-07	2.70E-09	7.41E-10	4.94E-09

RQ = Risk Quotient = Estimated Dose/Toxicity Reference Value

Shading and boldface indicates plant RQs greater than 1.
Shading and boldface indicates acute RQs greater than 0.05 for fish and invertebrates.
Shading and boldface indicates chronic RQs greater than 0.5 for fish and invertebrates.

Table C-84: Impact to non-target terrrestrial plants from surface runoff

SURFACE RUNOFF - modeled in GLEAMS
TYPICAL APPLICATION RATE

GLEAMS ID	Annual Precipitation (inches)	Application Area (acres)	Hydraulic Slope (ft/ft)	Surface Roughness	USLE Soil Erodibility Factor (ton/ac per EI)	Vegetation Type	Soil Type	Terrestrial Concentration (lb a.e./acre)	Typical Species RQ	Threatened & Endangered Species RQ
G_BASE_SAND_005_TERR_TYP	5	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_005_TERR_TYP	5	10	0.05	0.015	0.401	weeds (79)	Clay	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_005_TERR_TYP	5	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_010_TERR_TYP	10	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_010_TERR_TYP	10	10	0.05	0.015	0.401	weeds (79)	Clay	7.23E-07	8.82E-08	2.41E-03
G_BASE_LOAM_010_TERR_TYP	10	10	0.05	0.015	0.401	weeds (79)	Loam	5.61E-09	6.84E-10	1.87E-05
G_BASE_SAND_025_TERR_TYP	25	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_025_TERR_TYP	25	10	0.05	0.015	0.401	weeds (79)	Clay	9.64E-07	1.18E-07	3.21E-03
G_BASE_LOAM_025_TERR_TYP	25	10	0.05	0.015	0.401	weeds (79)	Loam	4.33E-09	5.29E-10	1.44E-05
G_BASE_SAND_050_TERR_TYP	50	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_050_TERR_TYP	50	10	0.05	0.015	0.401	weeds (79)	Clay	3.62E-05	4.41E-06	1.21E-01
G_BASE_LOAM_050_TERR_TYP	50	10	0.05	0.015	0.401	weeds (79)	Loam	1.38E-08	1.68E-09	4.59E-05
G_BASE_SAND_100_TERR_TYP	100	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_100_TERR_TYP	100	10	0.05	0.015	0.401	weeds (79)	Clay	3.05E-04	3.72E-05	**1.02E+00**
G_BASE_LOAM_100_TERR_TYP	100	10	0.05	0.015	0.401	weeds (79)	Loam	4.99E-06	6.09E-07	1.66E-02
G_BASE_SAND_150_TERR_TYP	150	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_150_TERR_TYP	150	10	0.05	0.015	0.401	weeds (79)	Clay	5.48E-04	6.68E-05	**1.83E+00**
G_BASE_LOAM_150_TERR_TYP	150	10	0.05	0.015	0.401	weeds (79)	Loam	2.17E-05	2.64E-06	7.22E-02
G_BASE_SAND_200_TERR_TYP	200	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_200_TERR_TYP	200	10	0.05	0.015	0.401	weeds (79)	Clay	1.63E-03	1.99E-04	**5.44E+00**
G_BASE_LOAM_200_TERR_TYP	200	10	0.05	0.015	0.401	weeds (79)	Loam	2.42E-05	2.96E-06	8.08E-02
G_BASE_SAND_250_TERR_TYP	250	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_250_TERR_TYP	250	10	0.05	0.015	0.401	weeds (79)	Clay	3.15E-03	3.85E-04	**1.05E+01**
G_BASE_LOAM_250_TERR_TYP	250	10	0.05	0.015	0.401	weeds (79)	Loam	6.28E-05	7.66E-06	2.09E-01
G_ARV1_050_TERR_TYP	50	1	0.05	0.015	0.401	weeds (79)	Loam	1.38E-08	1.68E-09	4.59E-05
G_ARV2_050_TERR_TYP	50	100	0.05	0.015	0.401	weeds (79)	Loam	1.38E-08	1.68E-09	4.59E-05
G_ARV3_050_TERR_TYP	50	1000	0.05	0.015	0.401	weeds (79)	Loam	1.38E-08	1.68E-09	4.59E-05
G_ERV1_050_TERR_TYP	50	10	0.05	0.015	0.05	weeds (79)	Loam	1.35E-08	1.65E-09	4.50E-05
G_ERV2_050_TERR_TYP	50	10	0.05	0.015	0.2	weeds (79)	Loam	1.38E-08	1.68E-09	4.59E-05
G_ERV3_050_TERR_TYP	50	10	0.05	0.015	0.5	weeds (79)	Loam	1.40E-08	1.71E-09	4.67E-05
G_RGV1_050_TERR_TYP	50	10	0.05	0.023	0.401	weeds (79)	Loam	1.35E-08	1.65E-09	4.50E-05
G_RGV2_050_TERR_TYP	50	10	0.05	0.046	0.401	weeds (79)	Loam	1.35E-08	1.65E-09	4.50E-05
G_RGV3_050_TERR_TYP	50	10	0.05	0.15	0.401	weeds (79)	Loam	1.45E-08	1.77E-09	4.84E-05
G_SLV1_050_TERR_TYP	50	10	0.005	0.015	0.401	weeds (79)	Loam	7.50E-05	9.14E-06	2.50E-01
G_SLV2_050_TERR_TYP	50	10	0.01	0.015	0.401	weeds (79)	Loam	9.51E-06	1.16E-06	3.17E-02
G_SLV3_050_TERR_TYP	50	10	0.1	0.015	0.401	weeds (79)	Loam	1.46E-05	1.78E-06	4.86E-02
G_STV1_050_TERR_TYP	50	10	0.05	0.015	0.401	weeds (79)	Loam	1.35E-08	1.65E-09	4.50E-05
G_STV2_050_TERR_TYP	50	10	0.05	0.015	0.401	weeds (79)	Loam	1.38E-08	1.68E-09	4.59E-05
G_STV3_050_TERR_TYP	50	10	0.05	0.015	0.401	weeds (79)	Loam	1.35E-08	1.65E-09	4.50E-05
G_VGV1_050_TERR_TYP	50	10	0.05	0.015	0.401	Shrub	Loam	1.38E-08	1.68E-09	4.59E-05
G_VGV2_050_TERR_TYP	50	10	0.05	0.015	0.401	Rye Grass	Loam	1.38E-08	1.68E-09	4.59E-05
G_VGV3_050_TERR_TYP	50	10	0.05	0.015	0.401	Conifer-Hardwood	Loam	8.41E-09	1.03E-09	2.80E-05

RQ = Risk Quotient = Estimated Dose/Toxicity Reference Value

Table C-84: Impact to non-target terrrestrial plants from surface runoff

SURFACE RUNOFF - modeled in GLEAMS

MAXIMUM APPLICATION RATE

GLEAMS ID	Annual Precipitation (inches)	Application Area (acres)	Hydraulic Slope (ft/ft)	Surface Roughness	USLE Soil Erodibility Factor (ton/ac per EI)	Vegetation Type	Soil Type	Terrestrial Concentration (lb a.e./acre)	Typical Species RQ	Threatened & Endangered Species RQ
G_BASE_SAND_005_TERR_MAX	5	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_005_TERR_MAX	5	10	0.05	0.015	0.401	weeds (79)	Clay	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_005_TERR_MAX	5	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_010_TERR_MAX	10	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_010_TERR_MAX	10	10	0.05	0.015	0.401	weeds (79)	Clay	1.45E-06	1.76E-07	4.82E-03
G_BASE_LOAM_010_TERR_MAX	10	10	0.05	0.015	0.401	weeds (79)	Loam	1.12E-08	1.37E-09	3.74E-05
G_BASE_SAND_025_TERR_MAX	25	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_025_TERR_MAX	25	10	0.05	0.015	0.401	weeds (79)	Clay	1.93E-06	2.35E-07	6.43E-03
G_BASE_LOAM_025_TERR_MAX	25	10	0.05	0.015	0.401	weeds (79)	Loam	8.67E-09	1.06E-09	2.89E-05
G_BASE_SAND_050_TERR_MAX	50	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_050_TERR_MAX	50	10	0.05	0.015	0.401	weeds (79)	Clay	7.23E-05	8.82E-06	2.41E-01
G_BASE_LOAM_050_TERR_MAX	50	10	0.05	0.015	0.401	weeds (79)	Loam	2.75E-08	3.36E-09	9.18E-05
G_BASE_SAND_100_TERR_MAX	100	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_100_TERR_MAX	100	10	0.05	0.015	0.401	weeds (79)	Clay	6.11E-04	7.45E-05	**2.04E+00**
G_BASE_LOAM_100_TERR_MAX	100	10	0.05	0.015	0.401	weeds (79)	Loam	9.98E-06	1.22E-06	3.33E-02
G_BASE_SAND_150_TERR_MAX	150	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_150_TERR_MAX	150	10	0.05	0.015	0.401	weeds (79)	Clay	1.10E-03	1.34E-04	**3.65E+00**
G_BASE_LOAM_150_TERR_MAX	150	10	0.05	0.015	0.401	weeds (79)	Loam	4.33E-05	5.28E-06	1.44E-01
G_BASE_SAND_200_TERR_MAX	200	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_200_TERR_MAX	200	10	0.05	0.015	0.401	weeds (79)	Clay	3.26E-03	3.98E-04	**1.09E+01**
G_BASE_LOAM_200_TERR_MAX	200	10	0.05	0.015	0.401	weeds (79)	Loam	4.85E-05	5.91E-06	1.62E-01
G_BASE_SAND_250_TERR_MAX	250	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_250_TERR_MAX	250	10	0.05	0.015	0.401	weeds (79)	Clay	6.31E-03	7.69E-04	**2.10E+01**
G_BASE_LOAM_250_TERR_MAX	250	10	0.05	0.015	0.401	weeds (79)	Loam	1.26E-04	1.53E-05	4.19E-01
G_ARV1_050_TERR_MAX	50	1	0.05	0.015	0.401	weeds (79)	Loam	2.75E-08	3.36E-09	9.18E-05
G_ARV2_050_TERR_MAX	50	100	0.05	0.015	0.401	weeds (79)	Loam	2.75E-08	3.36E-09	9.18E-05
G_ARV3_050_TERR_MAX	50	1000	0.05	0.015	0.401	weeds (79)	Loam	2.75E-08	3.36E-09	9.18E-05
G_ERV1_050_TERR_MAX	50	10	0.05	0.015	0.05	weeds (79)	Loam	2.70E-08	3.29E-09	9.01E-05
G_ERV2_050_TERR_MAX	50	10	0.05	0.015	0.2	weeds (79)	Loam	2.75E-08	3.36E-09	9.18E-05
G_ERV3_050_TERR_MAX	50	10	0.05	0.015	0.5	weeds (79)	Loam	2.80E-08	3.42E-09	9.35E-05
G_RGV1_050_TERR_MAX	50	10	0.05	0.023	0.401	weeds (79)	Loam	2.70E-08	3.29E-09	9.01E-05
G_RGV2_050_TERR_MAX	50	10	0.05	0.046	0.401	weeds (79)	Loam	2.70E-08	3.29E-09	9.01E-05
G_RGV3_050_TERR_MAX	50	10	0.05	0.15	0.401	weeds (79)	Loam	2.91E-08	3.54E-09	9.69E-05
G_SLV1_050_TERR_MAX	50	10	0.005	0.015	0.401	weeds (79)	Loam	1.50E-04	1.83E-05	5.00E-01
G_SLV2_050_TERR_MAX	50	10	0.01	0.015	0.401	weeds (79)	Loam	1.90E-05	2.32E-06	6.34E-02
G_SLV3_050_TERR_MAX	50	10	0.1	0.015	0.401	weeds (79)	Loam	2.92E-05	3.56E-06	9.72E-02
G_STV1_050_TERR_MAX	50	10	0.05	0.015	0.401	weeds (79)	Loam	2.70E-08	3.29E-09	9.01E-05
G_STV2_050_TERR_MAX	50	10	0.05	0.015	0.401	weeds (79)	Loam	2.75E-08	3.36E-09	9.18E-05
G_STV3_050_TERR_MAX	50	10	0.05	0.015	0.401	weeds (79)	Loam	2.70E-08	3.29E-09	9.01E-05
G_VGV1_050_TERR_MAX	50	10	0.05	0.015	0.401	Shrub	Loam	2.75E-08	3.36E-09	9.18E-05
G_VGV2_050_TERR_MAX	50	10	0.05	0.015	0.401	Rye Grass	Loam	2.75E-08	3.36E-09	9.18E-05
G_VGV3_050_TERR_MAX	50	10	0.05	0.015	0.401	Conifer-Hardwood	Loam	1.68E-08	2.05E-09	5.61E-05

RQ = Risk Quotient = Estimated Dose/Toxicity Reference Value

Shading and boldface indicates plant RQs greater than 1.

Table C-85: Consumption of contaminated fish from pond by predatory bird - long term exposure. Pond impacted by surface runoff modeled in GLEAMS.

Parameters/ Assumptions	Value	Units	Notes
Body Weight (W)	5.15	kg	
Food ingestion rate (dry weight)	0.101786153	kg dw/day	[1]
Food ingestion rate (wet weight, A)	0.40714461	kg ww/day	[2]
Bioconcentration factor (BCF)	1	L/kg fish	
Proportion of Diet Contaminated (Prop)	1	unitless	
Toxicity reference value (TRV)	27	mg/kg-bw/day	

TYPICAL APPLICATION RATE

GLEAMS ID	Annual Precipitation (inches)	Application Area (acres)	Hydraulic Slope (ft/ft)	Surface Roughness	USLE Soil Erodibility Factor (ton/ac per EI)	Vegetation Type	Soil Type	Pond Concentration (mg/L)	Concentrations in fish (C_{Fish}): WC × BCF	Dose estimates (D): C_{Fish} × A × Prop / W	Risk Quotient
G_BASE_SAND_005_POND_TYP	5	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_005_POND_TYP	5	10	0.05	0.015	0.401	weeds (79)	Clay	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_005_POND_TYP	5	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_010_POND_TYP	10	10	0.05	0.015	0.401	weeds (79)	Sand	2.91E-08	2.91E-08	2.30E-09	8.53E-11
G_BASE_CLAY_010_POND_TYP	10	10	0.05	0.015	0.401	weeds (79)	Clay	3.00E-06	3.00E-06	2.37E-07	8.77E-09
G_BASE_LOAM_010_POND_TYP	10	10	0.05	0.015	0.401	weeds (79)	Loam	5.16E-08	5.16E-08	4.08E-09	1.51E-10
G_BASE_SAND_025_POND_TYP	25	10	0.05	0.015	0.401	weeds (79)	Sand	5.00E-08	5.00E-08	3.95E-09	1.46E-10
G_BASE_CLAY_025_POND_TYP	25	10	0.05	0.015	0.401	weeds (79)	Clay	1.58E-06	1.58E-06	1.25E-07	4.63E-09
G_BASE_LOAM_025_POND_TYP	25	10	0.05	0.015	0.401	weeds (79)	Loam	4.89E-09	4.89E-09	3.87E-10	1.43E-11
G_BASE_SAND_050_POND_TYP	50	10	0.05	0.015	0.401	weeds (79)	Sand	4.13E-07	4.13E-07	3.27E-08	1.21E-09
G_BASE_CLAY_050_POND_TYP	50	10	0.05	0.015	0.401	weeds (79)	Clay	1.45E-04	1.45E-04	1.15E-05	4.24E-07
G_BASE_LOAM_050_POND_TYP	50	10	0.05	0.015	0.401	weeds (79)	Loam	5.11E-09	5.11E-09	4.04E-10	1.50E-11
G_BASE_SAND_100_POND_TYP	100	10	0.05	0.015	0.401	weeds (79)	Sand	2.55E-05	2.55E-05	2.02E-06	7.47E-08
G_BASE_CLAY_100_POND_TYP	100	10	0.05	0.015	0.401	weeds (79)	Clay	3.42E-04	3.42E-04	2.70E-05	1.00E-06
G_BASE_LOAM_100_POND_TYP	100	10	0.05	0.015	0.401	weeds (79)	Loam	3.61E-06	3.61E-06	2.85E-07	1.06E-08
G_BASE_SAND_150_POND_TYP	150	10	0.05	0.015	0.401	weeds (79)	Sand	4.54E-04	4.54E-04	3.59E-05	1.33E-06
G_BASE_CLAY_150_POND_TYP	150	10	0.05	0.015	0.401	weeds (79)	Clay	1.96E-03	1.96E-03	1.55E-04	5.74E-06
G_BASE_LOAM_150_POND_TYP	150	10	0.05	0.015	0.401	weeds (79)	Loam	2.96E-06	2.96E-06	2.34E-07	8.66E-09
G_BASE_SAND_200_POND_TYP	200	10	0.05	0.015	0.401	weeds (79)	Sand	7.55E-04	7.55E-04	5.97E-05	2.21E-06
G_BASE_CLAY_200_POND_TYP	200	10	0.05	0.015	0.401	weeds (79)	Clay	4.99E-03	4.99E-03	3.94E-04	1.46E-05
G_BASE_LOAM_200_POND_TYP	200	10	0.05	0.015	0.401	weeds (79)	Loam	2.42E-06	2.42E-06	1.91E-07	7.07E-09
G_BASE_SAND_250_POND_TYP	250	10	0.05	0.015	0.401	weeds (79)	Sand	9.17E-04	9.17E-04	7.25E-05	2.68E-06
G_BASE_CLAY_250_POND_TYP	250	10	0.05	0.015	0.401	weeds (79)	Clay	8.27E-03	8.27E-03	6.54E-04	2.42E-05
G_BASE_LOAM_250_POND_TYP	250	10	0.05	0.015	0.401	weeds (79)	Loam	2.36E-04	2.36E-04	1.86E-05	6.90E-07
G_ARV1_050_POND_TYP	50	1	0.05	0.015	0.401	weeds (79)	Loam	2.03E-09	2.03E-09	1.60E-10	5.94E-12
G_ARV2_050_POND_TYP	50	100	0.05	0.015	0.401	weeds (79)	Loam	9.27E-10	9.27E-10	7.33E-11	2.71E-12
G_ARV3_050_POND_TYP	50	1000	0.05	0.015	0.401	weeds (79)	Loam	9.26E-10	9.26E-10	7.32E-11	2.71E-12
G_ERV1_050_POND_TYP	50	10	0.05	0.015	0.05	weeds (79)	Loam	3.64E-09	3.64E-09	2.88E-10	1.07E-11
G_ERV2_050_POND_TYP	50	10	0.05	0.015	0.2	weeds (79)	Loam	3.69E-09	3.69E-09	2.92E-10	1.08E-11
G_ERV3_050_POND_TYP	50	10	0.05	0.015	0.5	weeds (79)	Loam	3.74E-09	3.74E-09	2.95E-10	1.09E-11
G_RGV1_050_POND_TYP	50	10	0.05	0.023	0.401	weeds (79)	Loam	3.64E-09	3.64E-09	2.88E-10	1.07E-11
G_RGV2_050_POND_TYP	50	10	0.05	0.046	0.401	weeds (79)	Loam	3.64E-09	3.64E-09	2.88E-10	1.07E-11
G_RGV3_050_POND_TYP	50	10	0.05	0.15	0.401	weeds (79)	Loam	3.95E-09	3.95E-09	3.12E-10	1.16E-11
G_SLV1_050_POND_TYP	50	10	0.005	0.015	0.401	weeds (79)	Loam	1.04E-04	1.04E-04	8.23E-06	3.05E-07
G_SLV2_050_POND_TYP	50	10	0.01	0.015	0.401	weeds (79)	Loam	1.35E-05	1.35E-05	1.06E-06	3.94E-08
G_SLV3_050_POND_TYP	50	10	0.1	0.015	0.401	weeds (79)	Loam	1.86E-05	1.86E-05	1.47E-06	5.45E-08
G_STV1_050_POND_TYP	50	10	0.05	0.015	0.401	weeds (79)	Loam	3.64E-09	3.64E-09	2.88E-10	1.07E-11
G_STV2_050_POND_TYP	50	10	0.05	0.015	0.401	weeds (79)	Loam	3.69E-09	3.69E-09	2.92E-10	1.08E-11
G_STV3_050_POND_TYP	50	10	0.05	0.015	0.401	weeds (79)	Loam	3.64E-09	3.64E-09	2.88E-10	1.07E-11
G_VGV1_050_POND_TYP	50	10	0.05	0.015	0.401	Shrub	Loam	3.69E-09	3.69E-09	2.92E-10	1.08E-11
G_VGV2_050_POND_TYP	50	10	0.05	0.015	0.401	Rye Grass	Loam	3.69E-09	3.69E-09	2.92E-10	1.08E-11
G_VGV3_050_POND_TYP	50	10	0.05	0.015	0.401	Conifer-Hardwooc	Loam	1.67E-09	1.67E-09	1.32E-10	4.90E-12

Risk Quotient = Estimated Dose/Toxicity Reference Value
Shading and boldface indicates piscivorous bird RQs greater than 0.1.

[1] Calculated using alorithm developed by Nagy, 1987 for all birds; where
Food Ingestion Rate (kg dw/day) = 0.0582*(BW)^0.651
[2] Assumes fish are 75% water (USEPA, 1993; Table 4-1 - value for bony fishes)
GLEAMS footnotes

Table C-85: Consumption of contaminated fish from pond by predatory bird - long term exposure. Pond impacted by surface runoff modeled in GLEAMS.

Parameters/ Assumptions	Value	Units	Notes
Body Weight (W)	5.15	kg	
Food ingestion rate (dry weight)	0.101786153	kg dw/day	[1]
Food ingestion rate (wet weight, A)	0.40714461	kg ww/day	[2]
Bioconcentration factor (BCF)	1	L/kg fish	
Proportion of Diet Contaminated (Prop)	1	unitless	
Toxicity reference value (TRV)	27	mg/kg-bw/day	

MAXIMUM APPLICATION RATE

GLEAMS ID	Annual Precipitation (inches)	Application Area (acres)	Hydraulic Slope (ft/ft)	Surface Roughness	USLE Soil Erodibility Factor (ton/ac per EI)	Vegetation Type	Soil Type	Pond Concentration (mg/L)	Concentrations in fish (C_{Fish}): WC × BCF	Dose estimates (D): C_{Fish} × A × Prop / W	Risk Quotient
G_BASE_SAND_005_POND_max	5	10	0.05	0.015	0.401	weeds (79)	Sand	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_005_POND_max	5	10	0.05	0.015	0.401	weeds (79)	Clay	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_005_POND_max	5	10	0.05	0.015	0.401	weeds (79)	Loam	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_010_POND_max	10	10	0.05	0.015	0.401	weeds (79)	Sand	5.83E-08	5.83E-08	4.61E-09	1.71E-10
G_BASE_CLAY_010_POND_max	10	10	0.05	0.015	0.401	weeds (79)	Clay	5.99E-06	5.99E-06	4.74E-07	1.75E-08
G_BASE_LOAM_010_POND_max	10	10	0.05	0.015	0.401	weeds (79)	Loam	1.03E-07	1.03E-07	8.15E-09	3.02E-10
G_BASE_SAND_025_POND_max	25	10	0.05	0.015	0.401	weeds (79)	Sand	1.00E-07	1.00E-07	7.91E-09	2.93E-10
G_BASE_CLAY_025_POND_max	25	10	0.05	0.015	0.401	weeds (79)	Clay	3.16E-06	3.16E-06	2.50E-07	9.27E-09
G_BASE_LOAM_025_POND_max	25	10	0.05	0.015	0.401	weeds (79)	Loam	9.78E-09	9.78E-09	7.73E-10	2.86E-11
G_BASE_SAND_050_POND_max	50	10	0.05	0.015	0.401	weeds (79)	Sand	8.27E-07	8.27E-07	6.54E-08	2.42E-09
G_BASE_CLAY_050_POND_max	50	10	0.05	0.015	0.401	weeds (79)	Clay	2.90E-04	2.90E-04	2.29E-05	8.49E-07
G_BASE_LOAM_050_POND_max	50	10	0.05	0.015	0.401	weeds (79)	Loam	1.02E-08	1.02E-08	8.08E-10	2.99E-11
G_BASE_SAND_100_POND_max	100	10	0.05	0.015	0.401	weeds (79)	Sand	5.10E-05	5.10E-05	4.04E-06	1.49E-07
G_BASE_CLAY_100_POND_max	100	10	0.05	0.015	0.401	weeds (79)	Clay	6.83E-04	6.83E-04	5.40E-05	2.00E-06
G_BASE_LOAM_100_POND_max	100	10	0.05	0.015	0.401	weeds (79)	Loam	7.22E-06	7.22E-06	5.71E-07	2.11E-08
G_BASE_SAND_150_POND_max	150	10	0.05	0.015	0.401	weeds (79)	Sand	9.08E-04	9.08E-04	7.18E-05	2.66E-06
G_BASE_CLAY_150_POND_max	150	10	0.05	0.015	0.401	weeds (79)	Clay	3.92E-03	3.92E-03	3.10E-04	1.15E-05
G_BASE_LOAM_150_POND_max	150	10	0.05	0.015	0.401	weeds (79)	Loam	5.91E-06	5.91E-06	4.67E-07	1.73E-08
G_BASE_SAND_200_POND_max	200	10	0.05	0.015	0.401	weeds (79)	Sand	1.51E-03	1.51E-03	1.19E-04	4.42E-06
G_BASE_CLAY_200_POND_max	200	10	0.05	0.015	0.401	weeds (79)	Clay	9.98E-03	9.98E-03	7.89E-04	2.92E-05
G_BASE_LOAM_200_POND_max	200	10	0.05	0.015	0.401	weeds (79)	Loam	4.83E-06	4.83E-06	3.82E-07	1.41E-08
G_BASE_SAND_250_POND_max	250	10	0.05	0.015	0.401	weeds (79)	Sand	1.83E-03	1.83E-03	1.45E-04	5.37E-06
G_BASE_CLAY_250_POND_max	250	10	0.05	0.015	0.401	weeds (79)	Clay	1.65E-02	1.65E-02	1.31E-03	4.85E-05
G_BASE_LOAM_250_POND_max	250	10	0.05	0.015	0.401	weeds (79)	Loam	4.71E-04	4.71E-04	3.73E-05	1.38E-06
G_ARV1_050_POND_max	50	1	0.05	0.015	0.401	weeds (79)	Loam	4.06E-09	4.06E-09	3.21E-10	1.19E-11
G_ARV2_050_POND_max	50	100	0.05	0.015	0.401	weeds (79)	Loam	1.85E-09	1.85E-09	1.47E-10	5.43E-12
G_ARV3_050_POND_max	50	1000	0.05	0.015	0.401	weeds (79)	Loam	1.85E-09	1.85E-09	1.46E-10	5.42E-12
G_ERV1_050_POND_max	50	10	0.05	0.015	0.05	weeds (79)	Loam	7.28E-09	7.28E-09	5.76E-10	2.13E-11
G_ERV2_050_POND_max	50	10	0.05	0.015	0.2	weeds (79)	Loam	7.38E-09	7.38E-09	5.83E-10	2.16E-11
G_ERV3_050_POND_max	50	10	0.05	0.015	0.5	weeds (79)	Loam	7.47E-09	7.47E-09	5.91E-10	2.19E-11
G_RGV1_050_POND_max	50	10	0.05	0.023	0.401	weeds (79)	Loam	7.28E-09	7.28E-09	5.76E-10	2.13E-11
G_RGV2_050_POND_max	50	10	0.05	0.046	0.401	weeds (79)	Loam	7.28E-09	7.28E-09	5.76E-10	2.13E-11
G_RGV3_050_POND_max	50	10	0.05	0.15	0.401	weeds (79)	Loam	7.89E-09	7.89E-09	6.24E-10	2.31E-11
G_SLV1_050_POND_max	50	10	0.005	0.015	0.401	weeds (79)	Loam	2.08E-04	2.08E-04	1.65E-05	6.09E-07
G_SLV2_050_POND_max	50	10	0.01	0.015	0.401	weeds (79)	Loam	2.69E-05	2.69E-05	2.13E-06	7.89E-08
G_SLV3_050_POND_max	50	10	0.1	0.015	0.401	weeds (79)	Loam	3.72E-05	3.72E-05	2.94E-06	1.09E-07
G_STV1_050_POND_max	50	10	0.05	0.015	0.401	weeds (79)	Loam	7.28E-09	7.28E-09	5.76E-10	2.13E-11
G_STV2_050_POND_max	50	10	0.05	0.015	0.401	weeds (79)	Loam	7.38E-09	7.38E-09	5.83E-10	2.16E-11
G_STV3_050_POND_max	50	10	0.05	0.015	0.401	weeds (79)	Loam	7.28E-09	7.28E-09	5.76E-10	2.13E-11
G_VGV1_050_POND_max	50	10	0.05	0.015	0.401	Shrub	Loam	7.38E-09	7.38E-09	5.83E-10	2.16E-11
G_VGV2_050_POND_max	50	10	0.05	0.015	0.401	Rye Grass	Loam	7.38E-09	7.38E-09	5.83E-10	2.16E-11
G_VGV3_050_POND_max	50	10	0.05	0.015	0.401	Conifer-Hardwooc	Loam	3.34E-09	3.34E-09	2.64E-10	9.79E-12

Risk Quotient = Estimated Dose/Toxicity Reference Value
Shading and boldface indicates piscivorous bird RQs greater than 0.1.

[1] Calculated using alorithm developed by Nagy, 1987 for all birds; where
Food Ingestion Rate (kg dw/day) = 0.0582*(BW)^0.651
[2] Assumes fish are 75% water (USEPA, 1993; Table 4-1 - value for bony fishes)

Table C-86: Impact to non-target terrrestrial plants from wind erosion

WIND EROSION - modeled in AERMOD and CalPuff
TYPICAL APPLICATION RATE

AERMOD/ CalPuff Scenario ID	Watershed Location	Distance From Receptor (km)	Terrestrial Concentration (lb a.e./acre)	Typical Species TRV	Typical Species RQ	Threatened & Endangered Species TRV	Threatened & Endangered Species RQ
dust_MT_1.5_typ	MT	1.5	5.00E-04	7.00E-04	7.14E-01	3.00E-04	**1.67E+00**
dust_MT_10_typ	MT	10	1.47E-05	7.00E-04	2.09E-02	3.00E-04	4.88E-02
dust_MT_100_typ	MT	100	5.12E-07	7.00E-04	7.32E-04	3.00E-04	1.71E-03
dust_OR_1.5_typ	OR	1.5	5.74E-03	7.00E-04	**8.20E+00**	3.00E-04	**1.91E+01**
dust_OR_10_typ	OR	10	1.53E-04	7.00E-04	2.19E-01	3.00E-04	5.11E-01
dust_OR_100_typ	OR	100	3.75E-06	7.00E-04	5.36E-03	3.00E-04	1.25E-02
dust_WY_1.5_typ	WY	1.5	2.95E-03	7.00E-04	**4.22E+00**	3.00E-04	**9.84E+00**
dust_WY_10_typ	WY	10	1.06E-04	7.00E-04	1.51E-01	3.00E-04	3.52E-01
dust_WY_100_typ	WY	100	3.37E-06	7.00E-04	4.81E-03	3.00E-04	1.12E-02

WIND EROSION - modeled in AERMOD and CalPuff
MAXIMUM APPLICATION RATE

AERMOD/ CalPuff Scenario ID	Watershed Location	Distance From Receptor (km)	Terrestrial Concentration (lb a.e./acre)	Typical Species TRV	Typical Species RQ	Threatened & Endangered Species TRV	Threatened & Endangered Species RQ
dust_MT_1.5_max	MT	1.5	9.99E-04	7.00E-04	**1.43E+00**	3.00E-04	**3.33E+00**
dust_MT_10_max	MT	10	2.93E-05	7.00E-04	4.19E-02	3.00E-04	9.77E-02
dust_MT_100_max	MT	100	1.02E-06	7.00E-04	1.46E-03	3.00E-04	3.41E-03
dust_OR_1.5_max	OR	1.5	1.15E-02	7.00E-04	**1.64E+01**	3.00E-04	**3.83E+01**
dust_OR_10_max	OR	10	3.07E-04	7.00E-04	4.38E-01	3.00E-04	**1.02E+00**
dust_OR_100_max	OR	100	7.50E-06	7.00E-04	1.07E-02	3.00E-04	2.50E-02
dust_WY_1.5_max	WY	1.5	5.91E-03	7.00E-04	**8.44E+00**	3.00E-04	**1.97E+01**
dust_WY_10_max	WY	10	2.11E-04	7.00E-04	3.02E-01	3.00E-04	7.05E-01
dust_WY_100_max	WY	100	6.74E-06	7.00E-04	9.63E-03	3.00E-04	2.25E-02

RQ = Risk Quotient = Estimated Dose/Toxicity Reference Value

Shading and boldface indicates plant RQs greater than 1.

Table C-87: Impact to aquatic species from accidental spill to pond

Parameters/Assumptions	Value	Units
Volume of pond (Vp)	1011715	L
Volume of spill		
Truck ($Vspill_t$)	757	L
Helicopter($Vspill_h$)	529.9	L
Herbicide concentration		
Truck mixture (Cm_t)	19174.30	mg a.e./L
Helicopter mixture (Cm_h)	95871.49	mg a.e./L

Scenario	Concentrations in water (Cw): Cm × Vspill / Vp	Units	Risk Quotients Fish	Aquatic Invertebrates	Non-Target Aquatic Plants
Truck spill into pond	14.35	mg a.e./L	**7.17E+01**	**3.34E+03**	**3.59E+04**
Helicopter spill into pond	50.21	mg a.e./L	**2.51E+02**	**1.17E+04**	**1.26E+05**

Shading and boldface indicates plant RQs greater than 1.
Shading and boldface indicates acute RQs greater than 0.05 for fish and invertebrates.

Table C-88: Impact to aquatic species from accidental direct spray of pond and stream

Parameters/Assumptions		Value	Units
Application rates (R)			
	Typical	2	lb/acre
	Maximum	4	lb/acre
Area of pond (Area)		0.25	acre
Volume of pond (Vol)		1011715	L
Mass sprayed on pond (R x Area)			
	Typical	226796	mg
	Maximum	453592	mg
Concentration in pond water (Mass/Volume)			
	Typical	0.22416985	mg/L
	Maximum	0.4483397	mg/L
Width of stream		2	m
Length of stream impacted by direct spray		636.15	m
Area of stream impacted by spray (Area)		1272.3	m2
Depth of stream		0.2	m
Instantaneous volume of stream impacted by direct spray (Vol)		254460	L
Mass sprayed on stream (R x Area)			
	Typical	2544.600	lb
	Maximum	5089.200	lb
Mass sprayed on stream - converted to mg			
	Typical	285214.120	mg
	Maximum	570428.239	mg
Concentration in stream water (Mass/Vol)			
	Typical	1.12086033	mg/L
	Maximum	2.24172066	mg/L

			Risk Quotients		
Scenario		**Concentration in water (mg/L)**	**Fish**	**Aquatic Invertebrates**	**Non-Target Aquatic Plants**
Acute					
Direct spray to pond					
	Typical application	2.24E-01	**1.12E+00**	**5.21E+01**	**5.60E+02**
	Maximum application	4.48E-01	**2.24E+00**	**1.04E+02**	**1.12E+03**
Direct spray to stream					
	Typical application	1.12E+00	**5.60E+00**	**2.61E+02**	**2.80E+03**
	Maximum application	2.24E+00	**1.12E+01**	**5.21E+02**	**5.60E+03**
Chronic					
Direct spray to pond					
	Typical application	2.24E-01	**4.08E+00**	**1.12E+00**	**7.47E+00**
	Maximum application	4.48E-01	**8.15E+00**	**2.24E+00**	**1.49E+01**
Direct spray to stream					
	Typical application	1.12E+00	**2.04E+01**	**5.60E+00**	**3.74E+01**
	Maximum application	2.24E+00	**4.08E+01**	**1.12E+01**	**7.47E+01**

Shading and boldface indicates plant RQs greater than 1.
Shading and boldface indicates acute RQs greater than 0.05 for fish and invertebrates.

APPENDIX B.89 – B.106 – ECOLOGICAL RISK ASSESSMENT WORKSHEETS – AQUATIC APPLICATION FOR FLOATING AND EMERGENT VEGETATION – 2,4-D ACID AND SALTS

Table C-89: Direct spray of terrestrial receptors and exposure from indirect contact with foliage

Parameter		Pollinating Insect	Small Mammal	Units
Duration of Exposure (T)		24	24	hours
Body weight (W)		0.000093	0.02	kg
Surface Areas (A): cm^2 = 12.3 * BW(g)^0.65				
		2.63	86.21	cm^2
Application rates (R)				
	Typical	2	2	mg/cm^2
	Maximum	4	4	
Amount deposited on 1/2 receptor (Amnt): 0.5 × A × R				
	Typical	0.029478335	0.966284139	mg
	Maximum	0.058956671	1.932568279	
Dose Estimate Assuming 100% Dermal Adsorption				
Absorbed Dose: Amnt × Prop ÷ W				
	Typical	3.17E+02	4.83E+01	mg/kg bw
	Maximum	6.34E+02	9.66E+01	
Dose Estimate Assuming First Order Dermal Adsorption				
First-order dermal absorption rates (k)				
	Central estimate (ka)	0.078766725	0.078766725	$hour^{-1}$
Proportion absorbed over period T (Prop): 1-exp(-k T)				
	Typical	0.028389233	0.028389233	unitless
	Maximum	0.028389233	0.028389233	
Absorbed Dose: Amnt × Prop ÷ W				
	Typical	9.00E+00	1.37E+00	mg/kg bw
	Maximum	1.80E+01	2.74E+00	

RISK QUOTIENTS - Direct Spray	Toxicity Reference Value	Typical Application	Maximum Application
Small mammal - 100% absorption	2193	2.20E-02	4.41E-02
Pollinating insect - 100% absorption	140	2.26E+00	4.53E+00
Small mammal - 1st order dermal adsorption	2193	6.25E-04	1.25E-03
Pollinating insect - 1st order dermal adsorption	140	6.43E-02	1.29E-01

RISK QUOTIENTS - Indirect Contact *	Toxicity Reference Value	Typical Application	Maximum Application
Small mammal - 100% absorption	2193	2.20E-03	4.41E-03
Pollinating insect - 100% absorption	140	2.26E-01	4.53E-01
Small mammal - 1st order dermal adsorption	2193	6.25E-05	1.25E-04
Pollinating insect - 1st order dermal adsorption	140	6.43E-03	1.29E-02

Surface area calculation for mammals from Stahl, 1967 (presented in USEPA, 1993).
No surface area calculation identified for insects. Mammalian equation used as a surrogate.
Risk Quotient = Estimated Dose/Toxicity Reference Value
* Exposure from indirect contact assumed to be 1/10 of direct spray exposure

Table C-90: Consumption of contaminated berries by a small mammal - acute exposure scenario

Parameters/Assumptions		Value	Units	Notes
Body Weight (W)		0.02	kg	
Food ingestion rate (dry weight)		0.0033641	kg dw/day	[1]
Food ingestion rate (wet weight, A)		0.014626644	kg ww/day	[2]
Application rates (R)				
	Typical	2	lb/acre	
	Maximum	4		
Residue rate - berries (rr)				
	Typical	1.5	mg/kg per lb/acre	
	Maximum	7		
Concentration on berries (C): R × rr				
	Typical	3	mg/kg fruit	
	Maximum	28		
Dose estimates (D): C × A / W				
	Typical	2.19E+00	mg/kg bw	
	Maximum	2.05E+01		

RISK QUOTIENTS - Ingestion	**Toxicity Reference Value**	**Typical Application**	**Maximum Application**
Small mammal - acute exposure	1184	1.85E-03	1.73E-02

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987 for rodents; where

Food Ingestion Rate (g dw/day) = 0.621*(BW g)^0.564; converted into kg dw/day

[2] Assumes fruit is 77% water (USEPA, 1993; Table 4-2 - value for fruit pulp and skin)

Table C-91: Consumption of contaminated fruit by a small mammal - chronic exposure scenario

Parameters/Assumptions		Value	Units	
Duration of exposure (T)		90	days	
Body Weight (W)		0.02	kg	
Food ingestion rate (dry weight)		0.0033641	kg dw/day	[1]
Food ingestion rate (wet weight, A)		0.014626644	kg ww/day	[2]
Half life on vegetation (t50)				
	Herbicide specific	8.8	days	
Application rates (R)				
	Typical	2	lb/acre	
	Maximum	4		
Residue rate - berries (rr)				
	Typical	1.5	mg/kg per lb/acre	
	Maximum	7		
Drift (Drift)				
	Typical	1	unitless	
	Maximum	1		
Decay Coefficient (k): ln(2)/t50				
	Typical	0.078766725	$days^{-1}$	
	Maximum	0.078766725		
Initial concentration on berries (C0): R × rr × Drift				
	Typical	3	mg/kg fruit	
	Maximum	28		
Concentration on berries at time T: C0 * exp(-k*T)				
	Typical	0.00250268	mg/kg fruit	
	Maximum	0.02335835		
Time-weighted Average Concentration on vegetation (CTWA): C0 * (1-exp(-k*T))/(k*T)				
	Typical	0.422837508	mg/kg fruit	
	Maximum	3.946483412		
Proportion of Diet Contaminated (Prop)				
	Typical	1	unitless	
	Maximum	1		
Dose estimates (D): CTWA × A × Prop / W				
	Typical	0.309234679	mg/kg bw	
	Maximum	2.886190333		

RISK QUOTIENTS - Ingestion	Toxicity Reference Value	Typical Application	Maximum Application
Small mammal - chronic exposure	10	3.09E-02	2.89E-01

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987 for rodents; where

Food Ingestion Rate (g dw/day) = 0.621*(BW g)^0.564; converted into kg dw/day

[2] Assumes fruit is 77% water (USEPA, 1993; Table 4-2 - value for fruit pulp and skin)

Table C-92: Consumption of contaminated grass by a large mammal - acute exposure scenario

Parameters/Assumptions		Value	Units	Notes
Body Weight (W)		70	kg	
Food ingestion rate (dry weight)		1.9211536	kg dw/day	[1]
Food ingestion rate (wet weight, A)		6.40384532	kg ww/day	[2]
Duration of exposure (D)		1	day	
Application rates (R)				
	Typical	2	lb/acre	
	Maximum	4		
Residue rate - grass (rr)				
	Typical	92	mg/kg per lb/acre	
	Maximum	110		
Concentration on grass (C): R × rr				
	Typical	184	mg/kg grass	
	Maximum	440		
Drift (Drift)				
	Typical	1	unitless	
	Maximum	1		
Proportion of Diet Contaminated (Prop)				
	Typical	1	unitless	
	Maximum	1		
Dose estimates: Drift × Prop × C × A ÷W				
	Typical	1.68E+01	mg/kg bw	
	Maximum	4.03E+01		

RISK QUOTIENTS - Ingestion	**Toxicity Reference Value**	**Typical Application**	**Maximum Application**
Large mammal - acute exposure	51	3.30E-01	7.89E-01

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987 for herbivores; where

Food Ingestion Rate (g dw/day) = 0.577*(BW g)^0.727; converted into kg dw/day

[2] Assumes grass is 70% water (USEPA, 1993; Table 4-2 - lowest value for young grasses)

Table C-93: Consumption of contaminated grass by a large mammal - chronic exposure scenario

Parameters/Assumptions	Value	Units	Notes
Duration of exposure (T)	90	day	
Body Weight (W)	70	kg	
Food ingestion rate (dry weight)	1.921153597	kg dw/day	[1]
Food ingestion rate (wet weight, A)	6.403845323	kg ww/day	[2]
Half life on vegetation (t50)			
Herbicide specific	8.8	days	
Application rates (R)			
Typical	2	lb/acre	
Maximum	4		
Residue rate - grass (rr)			
Typical	92	mg/kg per lb/acre	
Maximum	110		
Drift (Drift)			
Typical	1	unitless	
Maximum	1		
Decay Coefficient (k): ln(2)/t50			
Typical	0.078766725	$days^{-1}$	
Maximum	0.078766725		
Initial concentration on grass (C0): R × rr × Drift			
Typical	184	mg/kg grass	
Maximum	440		
Concentration on grass at time T: C0 * exp(-k*T)			
Typical	0.15349773	mg/kg grass	
Maximum	0.36705979		
Time-weighted Average Concentration on vegetation (CTWA): C0 * (1-exp(-k*T))/(k*T)			
Typical	25.93403385	mg/kg vegetation	
Maximum	62.0161679		
Proportion of Diet Contaminated (Prop)			
Typical	1	unitless	
Maximum	1		
Dose estimates: CTWA × A × Prop / W			
Typical	2.37E+00	mg/kg bw	
Maximum	5.67E+00		

RISK QUOTIENTS - Ingestion	Toxicity Reference Value	Typical Application	Maximum Application
Large mammal - chronic exposure	1	2.37E+00	5.67E+00

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987 for herbivores; where

Food Ingestion Rate (g dw/day) = 0.577*(BW g)^0.727; converted into kg dw/day

[2] Assumes grass is 70% water (USEPA, 1993; Table 4-2 - lowest value for young grasses)

Table C-94: Consumption of contaminated small mammals by a large mammal - acute exposure scenario

Parameters/Assumptions		**Value**	**Units**	**Notes**
Body Weight (W)		12	kg	
Food ingestion rate (dry weight)		0.52971677	kg dw/day	[1]
Food ingestion rate (wet weight, A)		1.6553649	kg ww/day	[2]
Duration of exposure (D)		1	day	
Application rates (R)				
	Typical	2	lb/acre	
	Maximum	4		
Amount deposited on small mammal prey (Amnt_mouse): 0.5 × SurfaceArea × R				
	Typical	0.96628414	mg	
	Maximum	1.93256828		
Drift (Drift)				
	Typical	1	unitless	
	Maximum	1		
Proportion of Diet Contaminated (Prop)				
	Typical	1	unitless	
	Maximum	1		
Dose estimates: Drift × Prop × Amnt_mouse/BW_mouse × A ÷W				
	Typical	6.66E+00	mg/kg bw	
	Maximum	1.33E+01		

RISK QUOTIENTS - Ingestion	**Toxicity Reference Value**	**Typical Application**	**Maximum Application**
Large carnivorous mammal - acute exposure	80	8.33E-02	1.67E-01

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987; where

Food Ingestion Rate (g dw/day) = 0.0687*(BW g)^0.822; converted into kg dw/day

[2] Assumes mammals are 68% water (USEPA, 1993)

Table C-95: Consumption of contaminated small mammals by a large mammal - chronic exposure scenario

Parameters/Assumptions	Value	Units	Notes
Duration of exposure (T)	90	day	
Body Weight (W)	12	kg	
Food ingestion rate (dry weight)	0.529716769	kg dw/day	[1]
Food ingestion rate (wet weight, FIR_coyote)	1.655364903	kg ww/day	[2]
Application rates (R)			
Typical	2	lb/acre	
Maximum	4		
Drift (Drift)			
Typical	1	unitless	
Maximum	1		
Decay Coefficient (k): ln(2)/t50			
Typical	0.078766725	$days^{-1}$	
Maximum	0.078766725		
Initial concentration on mammal (C0): 0.5 × SurfaceArea × R/BW_smallmammal			
Typical	48.31420697	mg a.e./kg mammal	
Maximum	96.62841393		
Concentration absorbed in small mammal at time T (C90): C0 * exp(-k*T)			
Typical	1.37160327	mg/kg mammal	
Maximum	2.743206539		
Proportion of Diet Contaminated (Prop)			
Typical	1	unitless	
Maximum	1		
Dose estimates: C90 × FIR_coyote × Prop / W			
Typical	1.89E-01	mg/kg bw	
Maximum	3.78E-01		

RISK QUOTIENTS - Ingestion	Toxicity Reference Value	Typical Application	Maximum Application
Large mammal - chronic exposure	1	1.89E-01	3.78E-01

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987; where

Food Ingestion Rate (g dw/day) = 0.0687*(BW g)^0.822; converted into kg dw/day

[2] Assumes mammals are 68% water (USEPA, 1993)

Table C-96: Consumption of contaminated insects by a small bird - acute exposure scenario

Parameters/Assumptions		Value	Units	Notes
Body Weight (W)		0.08	kg	
Food ingestion rate (dry weight)		0.01124177	kg dw/day	[1]
Food ingestion rate (wet weight, A)		0.03626376	kg ww/day	[2]
Duration of exposure (D)		1	day	
Application rates (R)				
	Typical	2	lb/acre	
	Maximum	4		
Residue rate - insects (rr)				
	Typical	33	mg/kg per lb/acre	
	Maximum	58		
Concentration on insects (C): R × rr				
	Typical	66	mg/kg insect	
	Maximum	232		
Drift (Drift)				
	Typical	1	unitless	
	Maximum	1		
Proportion of Diet Contaminated (Prop)				
	Typical	1	unitless	
	Maximum	1		
Dose estimates: Drift × Prop × C × A ÷W				
	Typical	2.99E+01	mg/kg bw	
	Maximum	1.05E+02		

RISK QUOTIENTS - Ingestion	Toxicity Reference Value	Typical Application	Maximum Application
Small bird - acute exposure	217	1.38E-01	4.85E-01

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987 for all birds; where

Food Ingestion Rate (kg dw/day) = 0.0582*(BW)^0.651

[2] Assumes insects are 69% water (USEPA, 1993; Table 4-1 - value for grasshoppers and crickets)

Table C-97: Consumption of contaminated insects by a small bird - chronic exposure scenario

Parameters/Assumptions	Value	Units	Notes
Duration of exposure (T)	90	day	
Body Weight (W)	0.08	kg	
Food ingestion rate (dry weight)	0.011241767	kg dw/day	[1]
Food ingestion rate (wet weight, A)	0.036263763	kg ww/day	[2]
Half life on insect (t50)			
Herbicide specific	8.8	days	
Application rates (R)			
Typical	2	lb/acre	
Maximum	4		
Residue rate - insects (rr)			
Typical	33	mg/kg per lb/acre	
Maximum	58		
Drift (Drift)			
Typical	1	unitless	
Maximum	1		
Decay Coefficient (k): ln(2)/t50			
Typical	0.078766725	$days^{-1}$	
Maximum	0.078766725		
Initial concentration on insects (C0): R × rr × Drift			
Typical	66	mg/kg insect	
Maximum	232		
Concentration on insects at time T: C0 * exp(-k*T)			
Typical	0.055058968	mg/kg insect	
Maximum	0.193540617		
Time-weighted Average Concentration on insects (CTWA): C0 * (1-exp(-k*T))/(k*T)			
Typical	9.302425186	mg/kg insect	
Maximum	32.69943399		
Proportion of Diet Contaminated (Prop)			
Typical	1	unitless	
Maximum	1		
Dose estimates (D): CTWA × A × Prop / W			
Typical	4.22E+00	mg/kg bw	
Maximum	1.48E+01		

RISK QUOTIENTS - Ingestion	Toxicity Reference Value	Typical Application	Maximum Application
Small bird - chronic exposure	27	1.56E-01	5.49E-01

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987 for all birds; where

Food Ingestion Rate (kg dw/day) = 0.0582*(BW)^0.651

[2] Assumes insects are 69% water (USEPA, 1993; Table 4-1 - value for grasshoppers and crickets)

Table C-98: Consumption of contaminated vegetation by a large bird - acute exposure scenario

Parameters/Assumptions		Value	Units	Notes
Body Weight (W)		3.72	kg	
Food ingestion rate (dry weight)		0.13688203	kg dw/day	[1]
Food ingestion rate (wet weight, A)		0.91254687	kg ww/day	[2]
Duration of exposure (D)		1	day	
Application rates (R)				
	Typical	2	lb/acre	
	Maximum	4		
Residue rate - vegetation (rr)				
	Typical	35	mg/kg per lb/acre	
	Maximum	125		
Concentration on vegetation (C): R × rr				
	Typical	70	mg/kg veg	
	Maximum	500		
Drift (Drift)				
	Typical	1	unitless	
	Maximum	1		
Proportion of Diet Contaminated (Prop)				
	Typical	1	unitless	
	Maximum	1		
Dose estimates: Drift × Prop × C × A ÷W				
	Typical	1.72E+01		
	Maximum	1.23E+02		

RISK QUOTIENTS - Ingestion	Toxicity Reference Value	Typical Application	Maximum Application
Large bird - acute exposure	314	5.47E-02	3.91E-01

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987 for all birds; where

Food Ingestion Rate (kg dw/day) = 0.0582*(BW)^0.651

[2] Assumes vegetation is 85% water (USEPA, 1993; Table 4-2 - value for dicots)

Table C-99: Consumption of contaminated vegetation by a large bird - chronic exposure scenario

Parameters/Assumptions		Value	Units	Notes
Duration of exposure (T)		90	day	
Body Weight (W)		3.72	kg	
Food ingestion rate (dry weight)		0.13688203	kg dw/day	[1]
Food ingestion rate (wet weight, A)		0.912546869	kg ww/day	[2]
Half life on vegetation (t50)				
	Herbicide specific	8.8	days	
Application rates (R)				
	Typical	2	lb/acre	
	Maximum	4		
Residue rate - vegetation (rr)				
	Typical	35	mg/kg per lb/acre	
	Maximum	125		
Drift (Drift)				
	Typical	1	unitless	
	Maximum	1		
Decay Coefficient (k): ln(2)/t50				
	Typical	0.078766725	$days^{-1}$	
	Maximum	0.078766725		
Initial concentration on vegetation (C0): R × rr × Drift				
	Typical	70	mg/kg veg	
	Maximum	500		
Concentration on vegetation at time T: C0 * exp(-k*T)				
	Typical	0.058395876	mg/kg veg	
	Maximum	0.417113398		
Time-weighted Average Concentration on vegetation (CTWA): C0 * (1-exp(-k*T))/(k*T)				
	Typical	9.86620853	mg/kg veg	
	Maximum	70.47291807		
Proportion of Diet Contaminated (Prop)				
	Typical	1	unitless	
	Maximum	1		
Dose estimates (D): CTWA × A × Prop / W				
	Typical	2.42E+00	mg/kg bw	
	Maximum	1.73E+01		

RISK QUOTIENTS - Ingestion	Toxicity Reference Value	Typical Application	Maximum Application
Large bird - chronic exposure	27	8.96E-02	6.40E-01

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987 for all birds; where
Food Ingestion Rate (kg dw/day) = 0.0582*(BW)^0.651

[2] Assumes vegetation is 85% water (USEPA, 1993; Table 4-2 - value for dicots)

Table C-100: Impact to aquatic species from accidental spray drift to pond

OFF-SITE DRIFT - modeled in AgDrift
TYPICAL APPLICATION RATE

				Risk Quotients - Acute			Risk Quotients - Chronic		
Mode of Application	**Application Height or Type**	**Distance From Receptor (ft)**	**Pond Concentration (mg/L)**	**Fish**	**Aquatic Invertebrates**	**Non-Target Aquatic Plants**	**Fish**	**Aquatic Invertebrates**	**Non-Target Aquatic Plants**
Plane	Non-Forested	100	5.60E-03	3.11E-03	4.30E-04	5.60E-02	1.02E-01	2.80E-02	1.87E-01
Plane	Non-Forested	300	2.64E-03	1.47E-03	2.03E-04	2.64E-02	4.80E-02	1.32E-02	8.80E-02
Plane	Non-Forested	900	1.06E-03	5.87E-04	8.13E-05	1.06E-02	1.92E-02	5.28E-03	3.52E-02
Helicopter	Non-Forested	100	4.56E-03	2.54E-03	3.51E-04	4.56E-02	8.30E-02	2.28E-02	1.52E-01
Helicopter	Non-Forested	300	2.05E-03	1.14E-03	1.57E-04	2.05E-02	3.72E-02	1.02E-02	6.82E-02
Helicopter	Non-Forested	900	6.83E-04	3.80E-04	5.26E-05	6.83E-03	1.24E-02	3.42E-03	2.28E-02
Ground	Low Boom	25	1.36E-03	7.57E-04	1.05E-04	1.36E-02	2.48E-02	6.82E-03	4.54E-02
Ground	Low Boom	100	7.48E-04	4.15E-04	5.75E-05	7.48E-03	1.36E-02	3.74E-03	2.49E-02
Ground	Low Boom	900	1.44E-04	8.02E-05	1.11E-05	1.44E-03	2.62E-03	7.22E-04	4.81E-03
Ground	High Boom	25	2.19E-03	1.22E-03	1.68E-04	2.19E-02	3.98E-02	1.09E-02	7.30E-02
Ground	High Boom	100	1.15E-03	6.41E-04	8.87E-05	1.15E-02	2.10E-02	5.77E-03	3.84E-02
Ground	High Boom	900	1.83E-04	1.02E-04	1.41E-05	1.83E-03	3.33E-03	9.16E-04	6.11E-03

OFF-SITE DRIFT - modeled in AgDrift
MAXIMUM APPLICATION RATE

				Risk Quotients - Acute			Risk Quotients - Chronic		
Mode of Application	**Application Height or Type**	**Distance From Receptor (ft)**	**Pond Concentration (mg/L)**	**Fish**	**Aquatic Invertebrates**	**Non-Target Aquatic Plants**	**Fish**	**Aquatic Invertebrates**	**Non-Target Aquatic Plants**
Plane	Non-Forested	100	1.19E-02	6.62E-03	9.17E-04	1.19E-01	2.17E-01	5.96E-02	3.97E-01
Plane	Non-Forested	300	5.34E-03	2.97E-03	4.11E-04	5.34E-02	9.71E-02	2.67E-02	1.78E-01
Plane	Non-Forested	900	1.40E-03	7.78E-04	1.08E-04	1.40E-02	2.55E-02	7.00E-03	4.67E-02
Helicopter	Non-Forested	100	9.84E-03	5.47E-03	7.57E-04	9.84E-02	1.79E-01	4.92E-02	3.28E-01
Helicopter	Non-Forested	300	4.15E-03	2.30E-03	3.19E-04	4.15E-02	7.54E-02	2.07E-02	1.38E-01
Helicopter	Non-Forested	900	6.76E-04	3.76E-04	5.20E-05	6.76E-03	1.23E-02	3.38E-03	2.25E-02
Ground	Low Boom	25	2.73E-03	1.51E-03	2.10E-04	2.73E-02	4.96E-02	1.36E-02	9.09E-02
Ground	Low Boom	100	1.50E-03	8.31E-04	1.15E-04	1.50E-02	2.72E-02	7.48E-03	4.98E-02
Ground	Low Boom	900	2.89E-04	1.60E-04	2.22E-05	2.89E-03	5.25E-03	1.44E-03	9.62E-03
Ground	High Boom	25	4.38E-03	2.43E-03	3.37E-04	4.38E-02	7.96E-02	2.19E-02	1.46E-01
Ground	High Boom	100	2.31E-03	1.28E-03	1.77E-04	2.31E-02	4.19E-02	1.15E-02	7.69E-02
Ground	High Boom	900	3.66E-04	2.04E-04	2.82E-05	3.66E-03	6.66E-03	1.83E-03	1.22E-02

RQ = Risk Quotient = Estimated Dose/Toxicity Reference Value

Shading and boldface indicates plant RQs greater than 1.
Shading and boldface indicates acute RQs greater than 0.05 for fish and invertebrates.
Shading and boldface indicates chronic RQs greater than 0.5 for fish and invertebrates.

Table C-101: Impact to aquatic species from accidental spray drift to stream

OFF-SITE DRIFT - modeled in AgDrift
TYPICALAPPLICATION RATE

Mode of Application	Application Height or Type	Distance From Receptor (ft)	Stream Concentration (mg/L)	Risk Quotients - Acute: Fish	Risk Quotients - Acute: Aquatic Invertebrates	Risk Quotients - Acute: Non-Target Aquatic Plants	Risk Quotients - Chronic: Fish	Risk Quotients - Chronic: Aquatic Invertebrates	Risk Quotients - Chronic: Non-Target Aquatic Plants
Plane	Non-Forested	100	7.36E-03	4.09E-03	5.66E-04	7.36E-02	1.34E-01	3.68E-02	2.45E-01
Plane	Non-Forested	300	2.85E-03	1.59E-03	2.20E-04	2.85E-02	5.19E-02	1.43E-02	9.51E-02
Plane	Non-Forested	900	1.09E-03	6.07E-04	8.40E-05	1.09E-02	1.99E-02	5.46E-03	3.64E-02
Helicopter	Non-Forested	100	6.03E-03	3.35E-03	4.64E-04	6.03E-02	1.10E-01	3.01E-02	2.01E-01
Helicopter	Non-Forested	300	2.22E-03	1.23E-03	1.71E-04	2.22E-02	4.03E-02	1.11E-02	7.39E-02
Helicopter	Non-Forested	900	7.25E-04	4.03E-04	5.57E-05	7.25E-03	1.32E-02	3.62E-03	2.42E-02
Ground	Low Boom	25	2.45E-03	1.36E-03	1.89E-04	2.45E-02	4.46E-02	1.23E-02	8.18E-02
Ground	Low Boom	100	7.19E-04	3.99E-04	5.53E-05	7.19E-03	1.31E-02	3.60E-03	2.40E-02
Ground	Low Boom	900	7.45E-05	4.14E-05	5.73E-06	7.45E-04	1.35E-03	3.72E-04	2.48E-03
Ground	High Boom	25	4.11E-03	2.28E-03	3.16E-04	4.11E-02	7.47E-02	2.06E-02	1.37E-01
Ground	High Boom	100	1.16E-03	6.47E-04	8.96E-05	1.16E-02	2.12E-02	5.82E-03	3.88E-02
Ground	High Boom	900	9.84E-05	5.47E-05	7.57E-06	9.84E-04	1.79E-03	4.92E-04	3.28E-03

OFF-SITE DRIFT - modeled in AgDrift
MAXIMUM APPLICATION RATE

Mode of Application	Application Height or Type	Distance From Receptor (ft)	Stream Concentration (mg/L)	Risk Quotients - Acute: Fish	Risk Quotients - Acute: Aquatic Invertebrates	Risk Quotients - Acute: Non-Target Aquatic Plants	Risk Quotients - Chronic: Fish	Risk Quotients - Chronic: Aquatic Invertebrates	Risk Quotients - Chronic: Non-Target Aquatic Plants
Plane	Non-Forested	100	1.55E-02	8.62E-03	1.19E-03	1.55E-01	2.82E-01	7.76E-02	5.17E-01
Plane	Non-Forested	300	6.07E-03	3.37E-03	4.67E-04	6.07E-02	1.10E-01	3.03E-02	2.02E-01
Plane	Non-Forested	900	1.52E-03	8.46E-04	1.17E-04	1.52E-02	2.77E-02	7.62E-03	5.08E-02
Helicopter	Non-Forested	100	1.28E-02	7.10E-03	9.83E-04	1.28E-01	2.32E-01	6.39E-02	4.26E-01
Helicopter	Non-Forested	300	4.72E-03	2.62E-03	3.63E-04	4.72E-02	8.59E-02	2.36E-02	1.57E-01
Helicopter	Non-Forested	900	7.86E-04	4.37E-04	6.04E-05	7.86E-03	1.43E-02	3.93E-03	2.62E-02
Ground	Low Boom	25	4.91E-03	2.73E-03	3.78E-04	4.91E-02	8.92E-02	2.45E-02	1.64E-01
Ground	Low Boom	100	1.44E-03	7.99E-04	1.11E-04	1.44E-02	2.61E-02	7.19E-03	4.79E-02
Ground	Low Boom	900	1.49E-04	8.27E-05	1.15E-05	1.49E-03	2.71E-03	7.45E-04	4.96E-03
Ground	High Boom	25	8.22E-03	4.57E-03	6.32E-04	8.22E-02	1.49E-01	4.11E-02	2.74E-01
Ground	High Boom	100	2.33E-03	1.29E-03	1.79E-04	2.33E-02	4.23E-02	1.16E-02	7.76E-02
Ground	High Boom	900	1.97E-04	1.09E-04	1.51E-05	1.97E-03	3.58E-03	9.84E-04	6.56E-03

RQ = Risk Quotient = Estimated Dose/Toxicity Reference Value

Shading and boldface indicates plant RQs greater than 1.
Shading and boldface indicates acute RQs greater than 0.05 for fish and invertebrates.
Shading and boldface indicates chronic RQs greater than 0.5 for fish and invertebrates.

Table C-102: Potential risk to predatory bird from consumption of contaminated fish from pond. Pond impacted by regular application of herbicide.

Parameters/ Assumptions		Value	Units	Notes
Body Weight (W)		5.15	kg	
Food ingestion rate (dry weight)		1.02E-01	kg dw/day	[1]
Food ingestion rate (wet weight, A)		4.07E-01	kg ww/day	[2]
Bioconcentration factor (BCF)		3.01	L/kg fish	
Food Chain Multiplier Trophic Level 2 (FCM_TL2)		1	unitless	
Food Chain Multiplier Trophic Level 3 (FCM_TL3)		1	unitless	
Proportion of Diet Contaminated (Prop)		1	unitless	
Toxicity reference value (TRV)		100	mg/kg-bw/day	
Concentration in Fish = Pond_conc x BCF x FCM_TL2 x FCM_TL3				
	Typical	5.06E-02	mg a.i./kg bw fish	
	Maximum	4.39E-01	mg a.i./kg bw fish	
Dose Estimate = (Concentration in fish x A) / W				
	Typical	4.00E-03	mg a.i./kg bw fish	
	Maximum	3.47E-02	mg a.i./kg bw fish	
Toxicity reference value (TRV)		100	mg/kg-bw/day	

RISK QUOTIENTS - Ingestion	Toxicity Reference Value	Typical Application	Maximum Application
Piscivorous bird - chronic exposure	100	1.48E-04	1.28E-03

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using alorithm developed by Nagy, 1987 for all birds; where
Food Ingestion Rate (kg dw/day) = 0.0582*(BW)^0.651

[2] Assumes fish are 75% water (USEPA, 1993; Table 4-1 - value for bony fishes)

Table C-103: Impact to non-target terrrestrial plants from direct spray and spray drift

DIRECT SPRAY	Terrestrial Concentration (lb a.e./acre)	Typical Species RQ	Threatened & Endangered Species RQ
Typical application rate	2	**1.00E+03**	**6.67E+03**
Maximum application rate	4	**2.00E+03**	**1.33E+04**

OFF-SITE DRIFT - modeled in AgDrift
TYPICAL APPLICATION RATE

Mode of Application	Application Height or Type	Distance From Receptor (ft)	Soil Concentration (mg a.e./kg)	Typical Species RQ	Threatened & Endangered Species RQ
Plane	Non-Forested	100	4.02E-02	**2.01E+01**	**1.34E+02**
Plane	Non-Forested	300	2.12E-02	**1.06E+01**	**7.07E+01**
Plane	Non-Forested	900	8.90E-03	**4.45E+00**	**2.97E+01**
Helicopter	Non-Forested	100	3.22E-02	**1.61E+01**	**1.07E+02**
Helicopter	Non-Forested	300	1.65E-02	**8.25E+00**	**5.50E+01**
Helicopter	Non-Forested	900	5.60E-03	**2.80E+00**	**1.87E+01**
Ground	Low Boom	25	9.00E-03	**4.50E+00**	**3.00E+01**
Ground	Low Boom	100	5.50E-03	**2.75E+00**	**1.83E+01**
Ground	Low Boom	900	1.20E-03	6.00E-01	**4.00E+00**
Ground	High Boom	25	1.42E-02	**7.10E+00**	**4.73E+01**
Ground	High Boom	100	8.40E-03	**4.20E+00**	**2.80E+01**
Ground	High Boom	900	1.50E-03	7.50E-01	**5.00E+00**

OFF-SITE DRIFT - modeled in AgDrift
MAXIMUM APPLICATION RATE

Mode of Application	Application Height or Type	Distance From Receptor (ft)	Soil Concentration (mg a.e./kg)	Typical Species RQ	Threatened & Endangered Species RQ
Plane	Non-Forested	100	8.54E-02	**4.27E+01**	**2.85E+02**
Plane	Non-Forested	300	4.17E-02	**2.09E+01**	**1.39E+02**
Plane	Non-Forested	900	1.14E-02	**5.70E+00**	**3.80E+01**
Helicopter	Non-Forested	100	6.93E-02	**3.47E+01**	**2.31E+02**
Helicopter	Non-Forested	300	3.18E-02	**1.59E+01**	**1.06E+02**
Helicopter	Non-Forested	900	5.20E-03	**2.60E+00**	**1.73E+01**
Ground	Low Boom	25	1.79E-02	**8.95E+00**	**5.97E+01**
Ground	Low Boom	100	1.10E-02	**5.50E+00**	**3.67E+01**
Ground	Low Boom	900	2.40E-03	**1.20E+00**	**8.00E+00**
Ground	High Boom	25	2.84E-02	**1.42E+01**	**9.47E+01**
Ground	High Boom	100	1.68E-02	**8.40E+00**	**5.60E+01**
Ground	High Boom	900	3.10E-03	**1.55E+00**	**1.03E+01**

RQ = Risk Quotient = Estimated Dose/Toxicity Reference Value
Shading and boldface indicates plant RQs greater than 1.

Table C-104: Consumption of contaminated fish from pond by predatory bird - one time exposure. Pond impacted by spray drift modeled in AgDrift.

Parameters/ Assumptions	Value	Units	Notes
Body Weight (W)	5.15	kg	
Food ingestion rate (dry weight)	0.101786153	kg dw/day	[1]
Food ingestion rate (wet weight, A)	0.40714461	kg ww/day	[2]
Bioconcentration factor (BCF)	1	L/kg fish	
Proportion of Diet Contaminated (Prop)	1	unitless	
Toxicity reference value (TRV)	27	mg/kg-bw/day	

TYPICAL APPLICATION RATE

Mode of Application	Application Height or Type	Distance From Receptor (ft)	Pond Concentration (mg/L)	Concentration in fish (C_{Fish}): WC × BCF	Dose estimate (D): C_{Fish} × A × Prop / W	Risk Quotient
Plane	Non-Forested	100	5.60E-03	5.60E-03	4.42E-04	1.64E-05
Plane	Non-Forested	300	2.64E-03	2.64E-03	2.09E-04	7.73E-06
Plane	Non-Forested	900	1.06E-03	1.06E-03	8.35E-05	3.09E-06
Helicopter	Non-Forested	100	4.56E-03	4.56E-03	3.61E-04	1.34E-05
Helicopter	Non-Forested	300	2.05E-03	2.05E-03	1.62E-04	5.99E-06
Helicopter	Non-Forested	900	6.83E-04	6.83E-04	5.40E-05	2.00E-06
Ground	Low Boom	25	1.36E-03	1.36E-03	1.08E-04	3.99E-06
Ground	Low Boom	100	7.48E-04	7.48E-04	5.91E-05	2.19E-06
Ground	Low Boom	900	1.44E-04	1.44E-04	1.14E-05	4.23E-07
Ground	High Boom	25	2.19E-03	2.19E-03	1.73E-04	6.41E-06
Ground	High Boom	100	1.15E-03	1.15E-03	9.12E-05	3.38E-06
Ground	High Boom	900	1.83E-04	1.83E-04	1.45E-05	5.36E-07

MAXIMUM APPLICATION RATE

Mode of Application	Application Height or Type	Distance From Receptor (ft)	Pond Concentration (mg/L)	Concentration in fish (C_{Fish}): WC × BCF	Dose estimate (D): C_{Fish} × A × Prop / W	Risk Quotient
Plane	Non-Forested	100	1.19E-02	1.19E-02	9.42E-04	3.49E-05
Plane	Non-Forested	300	5.34E-03	5.34E-03	4.22E-04	1.56E-05
Plane	Non-Forested	900	1.40E-03	1.40E-03	1.11E-04	4.10E-06
Helicopter	Non-Forested	100	9.84E-03	9.84E-03	7.78E-04	2.88E-05
Helicopter	Non-Forested	300	4.15E-03	4.15E-03	3.28E-04	1.21E-05
Helicopter	Non-Forested	900	6.76E-04	6.76E-04	5.35E-05	1.98E-06
Ground	Low Boom	25	2.73E-03	2.73E-03	2.16E-04	7.98E-06
Ground	Low Boom	100	1.50E-03	1.50E-03	1.18E-04	4.38E-06
Ground	Low Boom	900	2.89E-04	2.89E-04	2.28E-05	8.45E-07
Ground	High Boom	25	4.38E-03	4.38E-03	3.46E-04	1.28E-05
Ground	High Boom	100	2.31E-03	2.31E-03	1.82E-04	6.75E-06
Ground	High Boom	900	3.66E-04	3.66E-04	2.90E-05	1.07E-06

Risk Quotient = Estimated Dose/Toxicity Reference Value
Shading and boldface indicates piscivorous bird RQs greater than 0.1.

[1] Calculated using alorithm developed by Nagy, 1987 for all birds; where
Food Ingestion Rate (kg dw/day) = 0.0582*(BW)^0.651
[2] Assumes fish are 75% water (USEPA, 1993; Table 4-1 - value for bony fishes)

Table C-105: Impact to aquatic species from accidental spill to pond

Parameters/Assumptions	Value	Units
Volume of pond (Vp)	1011715	L
Volume of spill		
Truck ($Vspill_t$)	757	L
Helicopter($Vspill_h$)	529.9	L
Herbicide concentration		
Truck mixture (Cm_t)	19174.30	mg a.e./L
Helicopter mixture (Cm_h)	95871.49	mg a.e./L

			Risk Quotients		
Scenario	**Concentrations in water (Cw): Cm × Vspill / Vp**	**Units**	**Fish**	**Aquatic Invertebrates**	**Non-Target Aquatic Plants**
Truck spill into pond	14.35	mg a.e./L	**7.97E+00**	**1.10E+00**	**1.43E+02**
Helicopter spill into pond	50.21	mg a.e./L	**2.79E+01**	**3.86E+00**	**5.02E+02**

Shading and boldface indicates plant RQs greater than 1.
Shading and boldface indicates acute RQs greater than 0.05 for fish and invertebrates.

Table C-106: Impact to aquatic species from direct spray of pond and stream

Parameters/Assumptions		Value	Units
Application rates (R)			
	Typical	2	lb/acre
	Maximum	4	lb/acre
Area of pond (Area)		0.25	acre
Volume of pond (Vol)		1011715	L
Mass sprayed on pond (R x Area)			
	Typical	226796	mg
	Maximum	453592	mg
Concentration in pond water (Mass/Volume)			
	Typical	0.22416985	mg/L
	Maximum	0.4483397	mg/L
Width of stream		2	m
Length of stream impacted by direct spray		636.15	m
Area of stream impacted by spray (Area)		1272.3	m2
Depth of stream		0.2	m
Instantaneous volume of stream impacted by direct spray (Vol)		254460	L
Mass sprayed on stream (R x Area)			
	Typical	2544.600	lb
	Maximum	5089.200	lb
Mass sprayed on stream - converted to mg			
	Typical	285214.120	mg
	Maximum	570428.239	mg
Concentration in stream water (Mass/Vol)			
	Typical	1.12086033	mg/L
	Maximum	2.24172066	mg/L

Scenario		Concentration in water (mg/L)	Risk Quotients Fish	Aquatic Invertebrates	Non-Target Aquatic Plants
Acute					
Direct spray to pond					
	Typical application	2.24E-01	**1.25E-01**	1.72E-02	**2.24E+00**
	Maximum application	4.48E-01	**2.49E-01**	3.45E-02	**4.48E+00**
Direct spray to stream					
	Typical application	1.12E+00	**6.23E-01**	**8.62E-02**	**1.12E+01**
	Maximum application	2.24E+00	**1.25E+00**	**1.72E-01**	**2.24E+01**
Chronic					
Direct spray to pond					
	Typical application	2.24E-01	**4.08E+00**	**1.12E+00**	**7.47E+00**
	Maximum application	4.48E-01	**8.15E+00**	**2.24E+00**	**1.49E+01**
Direct spray to stream					
	Typical application	1.12E+00	**2.04E+01**	**5.60E+00**	**3.74E+01**
	Maximum application	2.24E+00	**4.08E+01**	**1.12E+01**	**7.47E+01**

Shading and boldface indicates plant RQs greater than 1.
Shading and boldface indicates acute RQs greater than 0.05 for fish and invertebrates.

APPENDIX B.107 – B.124 – ECOLOGICAL RISK ASSESSMENT WORKSHEETS – AQUATIC APPLICATION FOR FLOATING AND EMERGENT VEGETATION – 2,4-D ESTERS

Table C-107: Direct spray of terrestrial receptors and exposure from indirect contact with foliage

Parameter		Pollinating Insect	Small Mammal	Units
Duration of Exposure (T)		24	24	hours
Body weight (W)		0.000093	0.02	kg
Surface Areas (A): cm^2 = 12.3 * BW(g)^0.65				
		2.63	86.21	cm^2
Application rates (R)				
	Typical	2	2	mg/cm^2
	Maximum	4	4	
Amount deposited on 1/2 receptor (Amnt): 0.5 × A × R				
	Typical	0.029478335	0.966284139	mg
	Maximum	0.058956671	1.932568279	
Dose Estimate Assuming 100% Dermal Adsorption				
Absorbed Dose: Amnt × Prop ÷ W				
	Typical	3.17E+02	4.83E+01	mg/kg bw
	Maximum	6.34E+02	9.66E+01	
Dose Estimate Assuming First Order Dermal Adsorption				
First-order dermal absorption rates (k)				
	Central estimate (ka)	0.138629436	0.138629436	$hour^{-1}$
Proportion absorbed over period T (Prop): 1-exp(-k T)				
	Typical	0.113079563	0.113079563	unitless
	Maximum	0.113079563	0.113079563	
Absorbed Dose: Amnt × Prop ÷ W				
	Typical	3.58E+01	5.46E+00	mg/kg bw
	Maximum	7.17E+01	1.09E+01	

RISK QUOTIENTS - Direct Spray	Toxicity Reference Value	Typical Application	Maximum Application
Small mammal - 100% absorption	2193	2.20E-02	4.41E-02
Pollinating insect - 100% absorption	140	2.26E+00	4.53E+00
Small mammal - 1st order dermal adsorption	2193	2.49E-03	4.98E-03
Pollinating insect - 1st order dermal adsorption	140	2.56E-01	5.12E-01

RISK QUOTIENTS - Indirect Contact *	Toxicity Reference Value	Typical Application	Maximum Application
Small mammal - 100% absorption	2193	2.20E-03	4.41E-03
Pollinating insect - 100% absorption	140	2.26E-01	4.53E-01
Small mammal - 1st order dermal adsorption	2193	2.49E-04	4.98E-04
Pollinating insect - 1st order dermal adsorption	140	2.56E-02	5.12E-02

Surface area calculation for mammals from Stahl, 1967 (presented in USEPA, 1993).
No surface area calculation identified for insects. Mammalian equation used as a surrogate.
Risk Quotient = Estimated Dose/Toxicity Reference Value
* Exposure from indirect contact assumed to be 1/10 of direct spray exposure

Table C-108: Consumption of contaminated berries by a small mammal - acute exposure scenario

Parameters/Assumptions		**Value**	**Units**	**Notes**
Body Weight (W)		0.02	kg	
Food ingestion rate (dry weight)		0.0033641	kg dw/day	[1]
Food ingestion rate (wet weight, A)		0.014626644	kg ww/day	[2]
Application rates (R)				
	Typical	2	lb/acre	
	Maximum	4		
Residue rate - berries (rr)				
	Typical	1.5	mg/kg per lb/acre	
	Maximum	7		
Concentration on berries (C): R × rr				
	Typical	3	mg/kg fruit	
	Maximum	28		
Dose estimates (D): C × A / W				
	Typical	2.19E+00	mg/kg bw	
	Maximum	2.05E+01		

RISK QUOTIENTS - Ingestion	**Toxicity Reference Value**	**Typical Application**	**Maximum Application**
Small mammal - acute exposure	1184	1.85E-03	1.73E-02

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987 for rodents; where

Food Ingestion Rate (g dw/day) = 0.621*(BW g)^0.564; converted into kg dw/day

[2] Assumes fruit is 77% water (USEPA, 1993; Table 4-2 - value for fruit pulp and skin)

Table C-109: Consumption of contaminated fruit by a small mammal - chronic exposure scenario

Parameters/Assumptions		Value	Units	
Duration of exposure (T)		90	days	
Body Weight (W)		0.02	kg	
Food ingestion rate (dry weight)		0.0033641	kg dw/day	[1]
Food ingestion rate (wet weight, A)		0.014626644	kg ww/day	[2]
Half life on vegetation (t50)				
	Herbicide specific	5	days	
Application rates (R)				
	Typical	2	lb/acre	
	Maximum	4		
Residue rate - berries (rr)				
	Typical	1.5	mg/kg per lb/acre	
	Maximum	7		
Drift (Drift)				
	Typical	1	unitless	
	Maximum	1		
Decay Coefficient (k): ln(2)/t50				
	Typical	0.138629436	$days^{-1}$	
	Maximum	0.138629436		
Initial concentration on berries (C0): R × rr × Drift				
	Typical	3	mg/kg fruit	
	Maximum	28		
Concentration on berries at time T: C0 * exp(-k*T)				
	Typical	1.14441E-05	mg/kg fruit	
	Maximum	0.000106812		
Time-weighted Average Concentration on vegetation (CTWA): C0 * (1-exp(-k*T))/(k*T)				
	Typical	0.240448256	mg/kg fruit	
	Maximum	2.244183725		
Proportion of Diet Contaminated (Prop)				
	Typical	1	unitless	
	Maximum	1		
Dose estimates (D): CTWA × A × Prop / W				
	Typical	0.175847548	mg/kg bw	
	Maximum	1.641243785		

RISK QUOTIENTS - Ingestion	Toxicity Reference Value	Typical Application	Maximum Application
Small mammal - chronic exposure	10	1.76E-02	1.64E-01

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987 for rodents; where

Food Ingestion Rate (g dw/day) = 0.621*(BW g)^0.564; converted into kg dw/day

[2] Assumes fruit is 77% water (USEPA, 1993; Table 4-2 - value for fruit pulp and skin)

Table C-110: Consumption of contaminated grass by a large mammal - acute exposure scenario

Parameters/Assumptions		Value	Units	Notes
Body Weight (W)		70	kg	
Food ingestion rate (dry weight)		1.9211536	kg dw/day	[1]
Food ingestion rate (wet weight, A)		6.40384532	kg ww/day	[2]
Duration of exposure (D)		1	day	
Application rates (R)				
	Typical	2	lb/acre	
	Maximum	4		
Residue rate - grass (rr)				
	Typical	92	mg/kg per lb/acre	
	Maximum	110		
Concentration on grass (C): R × rr				
	Typical	184	mg/kg grass	
	Maximum	440		
Drift (Drift)				
	Typical	1	unitless	
	Maximum	1		
Proportion of Diet Contaminated (Prop)				
	Typical	1	unitless	
	Maximum	1		
Dose estimates: Drift × Prop × C × A ÷W				
	Typical	1.68E+01	mg/kg bw	
	Maximum	4.03E+01		

RISK QUOTIENTS - Ingestion	**Toxicity Reference Value**	**Typical Application**	**Maximum Application**
Large mammal - acute exposure	51	3.30E-01	7.89E-01

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987 for herbivores; where
Food Ingestion Rate (g dw/day) = 0.577*(BW g)^0.727; converted into kg dw/day

[2] Assumes grass is 70% water (USEPA, 1993; Table 4-2 - lowest value for young grasses)

Table C-111: Consumption of contaminated grass by a large mammal - chronic exposure scenario

Parameters/Assumptions	**Value**	**Units**	**Notes**
Duration of exposure (T)	90	day	
Body Weight (W)	70	kg	
Food ingestion rate (dry weight)	1.921153597	kg dw/day	[1]
Food ingestion rate (wet weight, A)	6.403845323	kg ww/day	[2]
Half life on vegetation (t50)			
Herbicide specific	5	days	
Application rates (R)			
Typical	2	lb/acre	
Maximum	4		
Residue rate - grass (rr)			
Typical	92	mg/kg per lb/acre	
Maximum	110		
Drift (Drift)			
Typical	1	unitless	
Maximum	1		
Decay Coefficient (k): ln(2)/t50			
Typical	0.138629436	$days^{-1}$	
Maximum	0.138629436		
Initial concentration on grass (C0): R × rr × Drift			
Typical	184	mg/kg grass	
Maximum	440		
Concentration on grass at time T: C0 * exp(-k*T)			
Typical	0.000701904	mg/kg grass	
Maximum	0.001678467		
Time-weighted Average Concentration on vegetation (CTWA): C0 * (1-exp(-k*T))/(k*T)			
Typical	14.74749305	mg/kg vegetation	
Maximum	35.26574425		
Proportion of Diet Contaminated (Prop)			
Typical	1	unitless	
Maximum	1		
Dose estimates: CTWA × A × Prop / W			
Typical	1.35E+00	mg/kg bw	
Maximum	3.23E+00		

RISK QUOTIENTS - Ingestion	**Toxicity Reference Value**	**Typical Application**	**Maximum Application**
Large mammal - chronic exposure	1	1.35E+00	3.23E+00

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987 for herbivores; where

Food Ingestion Rate (g dw/day) = 0.577*(BW g)^0.727; converted into kg dw/day

[2] Assumes grass is 70% water (USEPA, 1993; Table 4-2 - lowest value for young grasses)

Table C-112: Consumption of contaminated small mammals by a large mammal - acute exposure scenario

Parameters/Assumptions		Value	Units	Notes
Body Weight (W)		12	kg	
Food ingestion rate (dry weight)		0.52971677	kg dw/day	[1]
Food ingestion rate (wet weight, A)		1.6553649	kg ww/day	[2]
Duration of exposure (D)		1	day	
Application rates (R)				
	Typical	2	lb/acre	
	Maximum	4		
Amount deposited on small mammal prey (Amnt_mouse): 0.5 × SurfaceArea × R				
	Typical	0.96628414	mg	
	Maximum	1.93256828		
Drift (Drift)				
	Typical	1	unitless	
	Maximum	1		
Proportion of Diet Contaminated (Prop)				
	Typical	1	unitless	
	Maximum	1		
Dose estimates: Drift × Prop × Amnt_mouse/BW_mouse × A ÷W				
	Typical	6.66E+00	mg/kg bw	
	Maximum	1.33E+01		

RISK QUOTIENTS - Ingestion	Toxicity Reference Value	Typical Application	Maximum Application
Large carnivorous mammal - acute exposure	80	8.33E-02	1.67E-01

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987; where

Food Ingestion Rate (g dw/day) = 0.0687*(BW g)^0.822; converted into kg dw/day

[2] Assumes mammals are 68% water (USEPA, 1993)

Table C-113: Consumption of contaminated small mammals by a large mammal - chronic exposure scenario

Parameters/Assumptions		Value	Units	Notes
Duration of exposure (T)		90	day	
Body Weight (W)		12	kg	
Food ingestion rate (dry weight)		0.529716769	kg dw/day	[1]
Food ingestion rate (wet weight, FIR_coyote)		1.655364903	kg ww/day	[2]
Application rates (R)				
	Typical	2	lb/acre	
	Maximum	4		
Drift (Drift)				
	Typical	1	unitless	
	Maximum	1		
Decay Coefficient (k): ln(2)/t50				
	Typical	0.138629436	$days^{-1}$	
	Maximum	0.138629436		
Initial concentration on mammal (C0): 0.5 × SurfaceArea × R/BW_smallmammal				
	Typical	48.31420697	mg a.e./kg mammal	
	Maximum	96.62841393		
Concentration absorbed in small mammal at time T (C90): C0 * exp(-k*T)				
	Typical	5.463349424	mg/kg mammal	
	Maximum	10.92669885		
Proportion of Diet Contaminated (Prop)				
	Typical	1	unitless	
	Maximum	1		
Dose estimates: C90 × FIR_coyote × Prop / W				
	Typical	7.54E-01	mg/kg bw	
	Maximum	1.51E+00		

RISK QUOTIENTS - Ingestion	Toxicity Reference Value	Typical Application	Maximum Application
Large mammal - chronic exposure	1	7.54E-01	1.51E+00

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987; where

Food Ingestion Rate (g dw/day) = 0.0687*(BW g)^0.822; converted into kg dw/day

[2] Assumes mammals are 68% water (USEPA, 1993)

Table C-114: Consumption of contaminated insects by a small bird - acute exposure scenario

Parameters/Assumptions		Value	Units	Notes
Body Weight (W)		0.08	kg	
Food ingestion rate (dry weight)		0.01124177	kg dw/day	[1]
Food ingestion rate (wet weight, A)		0.03626376	kg ww/day	[2]
Duration of exposure (D)		1	day	
Application rates (R)				
	Typical	2	lb/acre	
	Maximum	4		
Residue rate - insects (rr)				
	Typical	33	mg/kg per lb/acre	
	Maximum	58		
Concentration on insects (C): R × rr				
	Typical	66	mg/kg insect	
	Maximum	232		
Drift (Drift)				
	Typical	1	unitless	
	Maximum	1		
Proportion of Diet Contaminated (Prop)				
	Typical	1	unitless	
	Maximum	1		
Dose estimates: Drift × Prop × C × A ÷W				
	Typical	2.99E+01	mg/kg bw	
	Maximum	1.05E+02		

RISK QUOTIENTS - Ingestion	Toxicity Reference Value	Typical Application	Maximum Application
Small bird - acute exposure	217	1.38E-01	4.85E-01

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987 for all birds; where

Food Ingestion Rate (kg dw/day) = 0.0582*(BW)^0.651

[2] Assumes insects are 69% water (USEPA, 1993; Table 4-1 - value for grasshoppers and crickets)

Table C-115: Consumption of contaminated insects by a small bird - chronic exposure scenario

Parameters/Assumptions	Value	Units	Notes
Duration of exposure (T)	90	day	
Body Weight (W)	0.08	kg	
Food ingestion rate (dry weight)	0.011241767	kg dw/day	[1]
Food ingestion rate (wet weight, A)	0.036263763	kg ww/day	[2]
Half life on insect (t50)			
Herbicide specific	5	days	
Application rates (R)			
Typical	2	lb/acre	
Maximum	4		
Residue rate - insects (rr)			
Typical	33	mg/kg per lb/acre	
Maximum	58		
Drift (Drift)			
Typical	1	unitless	
Maximum	1		
Decay Coefficient (k): ln(2)/t50			
Typical	0.138629436	$days^{-1}$	
Maximum	0.138629436		
Initial concentration on insects (C0): R × rr × Drift			
Typical	66	mg/kg insect	
Maximum	232		
Concentration on insects at time T: C0 * exp(-k*T)			
Typical	0.00025177	mg/kg insect	
Maximum	0.00088501		
Time-weighted Average Concentration on insects (CTWA): C0 * (1-exp(-k*T))/(k*T)			
Typical	5.289861637	mg/kg insect	
Maximum	18.59466515		
Proportion of Diet Contaminated (Prop)			
Typical	1	unitless	
Maximum	1		
Dose estimates (D): CTWA × A × Prop / W			
Typical	2.40E+00	mg/kg bw	
Maximum	8.43E+00		

RISK QUOTIENTS - Ingestion	Toxicity Reference Value	Typical Application	Maximum Application
Small bird - chronic exposure	27	8.88E-02	3.12E-01

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987 for all birds; where

Food Ingestion Rate (kg dw/day) = 0.0582*(BW)^0.651

[2] Assumes insects are 69% water (USEPA, 1993; Table 4-1 - value for grasshoppers and crickets)

Table C-116: Consumption of contaminated vegetation by a large bird - acute exposure scenario

Parameters/Assumptions		Value	Units	Notes
Body Weight (W)		3.72	kg	
Food ingestion rate (dry weight)		0.13688203	kg dw/day	[1]
Food ingestion rate (wet weight, A)		0.91254687	kg ww/day	[2]
Duration of exposure (D)		1	day	
Application rates (R)				
	Typical	2	lb/acre	
	Maximum	4		
Residue rate - vegetation (rr)				
	Typical	35	mg/kg per lb/acre	
	Maximum	125		
Concentration on vegetation (C): R × rr				
	Typical	70	mg/kg veg	
	Maximum	500		
Drift (Drift)				
	Typical	1	unitless	
	Maximum	1		
Proportion of Diet Contaminated (Prop)				
	Typical	1	unitless	
	Maximum	1		
Dose estimates: Drift × Prop × C × A ÷W				
	Typical	1.72E+01		
	Maximum	1.23E+02		

RISK QUOTIENTS - Ingestion	**Toxicity Reference Value**	**Typical Application**	**Maximum Application**
Large bird - acute exposure	314	5.47E-02	3.91E-01

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987 for all birds; where

Food Ingestion Rate (kg dw/day) = 0.0582*(BW)^0.651

[2] Assumes vegetation is 85% water (USEPA, 1993; Table 4-2 - value for dicots)

Table C-117: Consumption of contaminated vegetation by a large bird - chronic exposure scenario

Parameters/Assumptions		Value	Units	Notes
Duration of exposure (T)		90	day	
Body Weight (W)		3.72	kg	
Food ingestion rate (dry weight)		0.13688203	kg dw/day	[1]
Food ingestion rate (wet weight, A)		0.912546869	kg ww/day	[2]
Half life on vegetation (t50)				
	Herbicide specific	5	days	
Application rates (R)				
	Typical	2	lb/acre	
	Maximum	4		
Residue rate - vegetation (rr)				
	Typical	35	mg/kg per lb/acre	
	Maximum	125		
Drift (Drift)				
	Typical	1	unitless	
	Maximum	1		
Decay Coefficient (k): ln(2)/t50				
	Typical	0.138629436	$days^{-1}$	
	Maximum	0.138629436		
Initial concentration on vegetation (C0): R × rr × Drift				
	Typical	70	mg/kg veg	
	Maximum	500		
Concentration on vegetation at time T: C0 * exp(-k*T)				
	Typical	0.000267029	mg/kg veg	
	Maximum	0.001907349		
Time-weighted Average Concentration on vegetation (CTWA): C0 * (1-exp(-k*T))/(k*T)				
	Typical	5.610459312	mg/kg veg	
	Maximum	40.07470937		
Proportion of Diet Contaminated (Prop)				
	Typical	1	unitless	
	Maximum	1		
Dose estimates (D): CTWA × A × Prop / W				
	Typical	1.38E+00	mg/kg bw	
	Maximum	9.83E+00		

RISK QUOTIENTS - Ingestion	Toxicity Reference Value	Typical Application	Maximum Application
Large bird - chronic exposure	27	5.10E-02	3.64E-01

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987 for all birds; where
Food Ingestion Rate (kg dw/day) = 0.0582*(BW)^0.651

[2] Assumes vegetation is 85% water (USEPA, 1993; Table 4-2 - value for dicots)

Table C-118: Impact to aquatic species from accidental spray drift to pond

OFF-SITE DRIFT - modeled in AgDrift
TYPICAL APPLICATION RATE

				Risk Quotients - Acute			Risk Quotients - Chronic		
Mode of Application	Application Height or Type	Distance From Receptor (ft)	Pond Concentration (mg/L)	Fish	Aquatic Invertebrates	Non-Target Aquatic Plants	Fish	Aquatic Invertebrates	Non-Target Aquatic Plants
Plane	Non-Forested	100	5.60E-03	2.80E-02	**1.30E+00**	**1.40E+01**	1.02E-01	2.80E-02	1.87E-01
Plane	Non-Forested	300	2.64E-03	1.32E-02	**6.14E-01**	**6.60E+00**	4.80E-02	1.32E-02	8.80E-02
Plane	Non-Forested	900	1.06E-03	5.28E-03	**2.46E-01**	**2.64E+00**	1.92E-02	5.28E-03	3.52E-02
Helicopter	Non-Forested	100	4.56E-03	2.28E-02	**1.06E+00**	**1.14E+01**	8.30E-02	2.28E-02	1.52E-01
Helicopter	Non-Forested	300	2.05E-03	1.02E-02	**4.76E-01**	**5.11E+00**	3.72E-02	1.02E-02	6.82E-02
Helicopter	Non-Forested	900	6.83E-04	3.42E-03	**1.59E-01**	**1.71E+00**	1.24E-02	3.42E-03	2.28E-02
Ground	Low Boom	25	1.36E-03	6.82E-03	**3.17E-01**	**3.41E+00**	2.48E-02	6.82E-03	4.54E-02
Ground	Low Boom	100	7.48E-04	3.74E-03	**1.74E-01**	**1.87E+00**	1.36E-02	3.74E-03	2.49E-02
Ground	Low Boom	900	1.44E-04	7.22E-04	3.36E-02	3.61E-01	2.62E-03	7.22E-04	4.81E-03
Ground	High Boom	25	2.19E-03	1.09E-02	**5.09E-01**	**5.47E+00**	3.98E-02	1.09E-02	7.30E-02
Ground	High Boom	100	1.15E-03	5.77E-03	**2.68E-01**	**2.88E+00**	2.10E-02	5.77E-03	3.84E-02
Ground	High Boom	900	1.83E-04	9.16E-04	4.26E-02	4.58E-01	3.33E-03	9.16E-04	6.11E-03

OFF-SITE DRIFT - modeled in AgDrift
MAXIMUM APPLICATION RATE

				Risk Quotients - Acute			Risk Quotients - Chronic		
Mode of Application	Application Height or Type	Distance From Receptor (ft)	Pond Concentration (mg/L)	Fish	Aquatic Invertebrates	Non-Target Aquatic Plants	Fish	Aquatic Invertebrates	Non-Target Aquatic Plants
Plane	Non-Forested	100	1.19E-02	**5.96E-02**	**2.77E+00**	**2.98E+01**	2.17E-01	5.96E-02	3.97E-01
Plane	Non-Forested	300	5.34E-03	2.67E-02	**1.24E+00**	**1.33E+01**	9.71E-02	2.67E-02	1.78E-01
Plane	Non-Forested	900	1.40E-03	7.00E-03	**3.26E-01**	**3.50E+00**	2.55E-02	7.00E-03	4.67E-02
Helicopter	Non-Forested	100	9.84E-03	4.92E-02	**2.29E+00**	**2.46E+01**	1.79E-01	4.92E-02	3.28E-01
Helicopter	Non-Forested	300	4.15E-03	2.07E-02	**9.64E-01**	**1.04E+01**	7.54E-02	2.07E-02	1.38E-01
Helicopter	Non-Forested	900	6.76E-04	3.38E-03	**1.57E-01**	**1.69E+00**	1.23E-02	3.38E-03	2.25E-02
Ground	Low Boom	25	2.73E-03	1.36E-02	**6.34E-01**	**6.82E+00**	4.96E-02	1.36E-02	9.09E-02
Ground	Low Boom	100	1.50E-03	7.48E-03	**3.48E-01**	**3.74E+00**	2.72E-02	7.48E-03	4.98E-02
Ground	Low Boom	900	2.89E-04	1.44E-03	**6.71E-02**	7.22E-01	5.25E-03	1.44E-03	9.62E-03
Ground	High Boom	25	4.38E-03	2.19E-02	**1.02E+00**	**1.09E+01**	7.96E-02	2.19E-02	1.46E-01
Ground	High Boom	100	2.31E-03	1.15E-02	**5.36E-01**	**5.77E+00**	4.19E-02	1.15E-02	7.69E-02
Ground	High Boom	900	3.66E-04	1.83E-03	**8.52E-02**	9.16E-01	6.66E-03	1.83E-03	1.22E-02

RQ = Risk Quotient = Estimated Dose/Toxicity Reference Value

Shading and boldface indicates plant RQs greater than 1.
Shading and boldface indicates acute RQs greater than 0.05 for fish and invertebrates.
Shading and boldface indicates chronic RQs greater than 0.5 for fish and invertebrates.

Table C-119: Impact to aquatic species from accidental spray drift to stream

OFF-SITE DRIFT - modeled in AgDrift
TYPICALAPPLICATION RATE

Mode of Application	Application Height or Type	Distance From Receptor (ft)	Stream Concentration (mg/L)	Risk Quotients - Acute: Fish	Risk Quotients - Acute: Aquatic Invertebrates	Risk Quotients - Acute: Non-Target Aquatic Plants	Risk Quotients - Chronic: Fish	Risk Quotients - Chronic: Aquatic Invertebrates	Risk Quotients - Chronic: Non-Target Aquatic Plants
Plane	Non-Forested	100	7.36E-03	3.68E-02	**1.71E+00**	**1.84E+01**	1.34E-01	3.68E-02	2.45E-01
Plane	Non-Forested	300	2.85E-03	1.43E-02	**6.64E-01**	**7.14E+00**	5.19E-02	1.43E-02	9.51E-02
Plane	Non-Forested	900	1.09E-03	5.46E-03	**2.54E-01**	**2.73E+00**	1.99E-02	5.46E-03	3.64E-02
Helicopter	Non-Forested	100	6.03E-03	3.01E-02	**1.40E+00**	**1.51E+01**	1.10E-01	3.01E-02	2.01E-01
Helicopter	Non-Forested	300	2.22E-03	1.11E-02	**5.16E-01**	**5.54E+00**	4.03E-02	1.11E-02	7.39E-02
Helicopter	Non-Forested	900	7.25E-04	3.62E-03	**1.69E-01**	**1.81E+00**	1.32E-02	3.62E-03	2.42E-02
Ground	Low Boom	25	2.45E-03	1.23E-02	**5.71E-01**	**6.14E+00**	4.46E-02	1.23E-02	8.18E-02
Ground	Low Boom	100	7.19E-04	3.60E-03	**1.67E-01**	**1.80E+00**	1.31E-02	3.60E-03	2.40E-02
Ground	Low Boom	900	7.45E-05	3.72E-04	1.73E-02	1.86E-01	1.35E-03	3.72E-04	2.48E-03
Ground	High Boom	25	4.11E-03	2.06E-02	**9.56E-01**	**1.03E+01**	7.47E-02	2.06E-02	1.37E-01
Ground	High Boom	100	1.16E-03	5.82E-03	**2.71E-01**	**2.91E+00**	2.12E-02	5.82E-03	3.88E-02
Ground	High Boom	900	9.84E-05	4.92E-04	2.29E-02	2.46E-01	1.79E-03	4.92E-04	3.28E-03

OFF-SITE DRIFT - modeled in AgDrift
MAXIMUM APPLICATION RATE

Mode of Application	Application Height or Type	Distance From Receptor (ft)	Stream Concentration (mg/L)	Risk Quotients - Acute: Fish	Risk Quotients - Acute: Aquatic Invertebrates	Risk Quotients - Acute: Non-Target Aquatic Plants	Risk Quotients - Chronic: Fish	Risk Quotients - Chronic: Aquatic Invertebrates	Risk Quotients - Chronic: Non-Target Aquatic Plants
Plane	Non-Forested	100	1.55E-02	**7.76E-02**	**3.61E+00**	**3.88E+01**	2.82E-01	7.76E-02	5.17E-01
Plane	Non-Forested	300	6.07E-03	3.03E-02	**1.41E+00**	**1.52E+01**	1.10E-01	3.03E-02	2.02E-01
Plane	Non-Forested	900	1.52E-03	7.62E-03	**3.54E-01**	**3.81E+00**	2.77E-02	7.62E-03	5.08E-02
Helicopter	Non-Forested	100	1.28E-02	**6.39E-02**	**2.97E+00**	**3.20E+01**	2.32E-01	6.39E-02	4.26E-01
Helicopter	Non-Forested	300	4.72E-03	2.36E-02	**1.10E+00**	**1.18E+01**	8.59E-02	2.36E-02	1.57E-01
Helicopter	Non-Forested	900	7.86E-04	3.93E-03	**1.83E-01**	**1.96E+00**	1.43E-02	3.93E-03	2.62E-02
Ground	Low Boom	25	4.91E-03	2.45E-02	**1.14E+00**	**1.23E+01**	8.92E-02	2.45E-02	1.64E-01
Ground	Low Boom	100	1.44E-03	7.19E-03	**3.34E-01**	**3.60E+00**	2.61E-02	7.19E-03	4.79E-02
Ground	Low Boom	900	1.49E-04	7.45E-04	3.46E-02	3.72E-01	2.71E-03	7.45E-04	4.96E-03
Ground	High Boom	25	8.22E-03	4.11E-02	**1.91E+00**	**2.06E+01**	1.49E-01	4.11E-02	2.74E-01
Ground	High Boom	100	2.33E-03	1.16E-02	**5.42E-01**	**5.82E+00**	4.23E-02	1.16E-02	7.76E-02
Ground	High Boom	900	1.97E-04	9.84E-04	4.58E-02	4.92E-01	3.58E-03	9.84E-04	6.56E-03

RQ = Risk Quotient = Estimated Dose/Toxicity Reference Value

Shading and boldface indicates plant RQs greater than 1.
Shading and boldface indicates acute RQs greater than 0.05 for fish and invertebrates.
Shading and boldface indicates chronic RQs greater than 0.5 for fish and invertebrates.

Table C-120: Potential risk to predatory bird from consumption of contaminated fish from pond. Pond impacted by regular application of herbicide.

Parameters/ Assumptions		Value	Units	Notes
Body Weight (W)		5.15	kg	
Food ingestion rate (dry weight)		1.02E-01	kg dw/day	[1]
Food ingestion rate (wet weight, A)		4.07E-01	kg ww/day	[2]
Bioconcentration factor (BCF)		3.01	L/kg fish	
Food Chain Multiplier Trophic Level 2 (FCM_TL2)		1	unitless	
Food Chain Multiplier Trophic Level 3 (FCM_TL3)		1	unitless	
Proportion of Diet Contaminated (Prop)		1	unitless	
Toxicity reference value (TRV)		100	mg/kg-bw/day	
Concentration in Fish = Pond_conc x BCF x FCM_TL2 x FCM_TL3				
	Typical	5.06E-02	mg a.i./kg bw fish	
	Maximum	4.39E-01	mg a.i./kg bw fish	
Dose Estimate = (Concentration in fish x A) / W				
	Typical	4.00E-03	mg a.i./kg bw fish	
	Maximum	3.47E-02	mg a.i./kg bw fish	
Toxicity reference value (TRV)		100	mg/kg-bw/day	

RISK QUOTIENTS - Ingestion	Toxicity Reference Value	Typical Application	Maximum Application
Piscivorous bird - chronic exposure	100	1.48E-04	1.28E-03

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using alorithm developed by Nagy, 1987 for all birds; where
Food Ingestion Rate (kg dw/day) = 0.0582*(BW)^0.651

[2] Assumes fish are 75% water (USEPA, 1993; Table 4-1 - value for bony fishes)

Table C-121: Impact to non-target terrrestrial plants from direct spray and spray drift

DIRECT SPRAY	Terrestrial Concentration (lb a.e./acre)	Typical Species RQ	Threatened & Endangered Species RQ
Typical application rate	2	**2.86E+03**	**6.67E+03**
Maximum application rate	4	**5.71E+03**	**1.33E+04**

OFF-SITE DRIFT - modeled in AgDrift
TYPICAL APPLICATION RATE

Mode of Application	Application Height or Type	Distance From Receptor (ft)	Soil Concentration (mg a.e./kg)	Typical Species RQ	Threatened & Endangered Species RQ
Plane	Non-Forested	100	4.02E-02	**5.74E+01**	**1.34E+02**
Plane	Non-Forested	300	2.12E-02	**3.03E+01**	**7.07E+01**
Plane	Non-Forested	900	8.90E-03	**1.27E+01**	**2.97E+01**
Helicopter	Non-Forested	100	3.22E-02	**4.60E+01**	**1.07E+02**
Helicopter	Non-Forested	300	1.65E-02	**2.36E+01**	**5.50E+01**
Helicopter	Non-Forested	900	5.60E-03	**8.00E+00**	**1.87E+01**
Ground	Low Boom	25	9.00E-03	**1.29E+01**	**3.00E+01**
Ground	Low Boom	100	5.50E-03	**7.86E+00**	**1.83E+01**
Ground	Low Boom	900	1.20E-03	**1.71E+00**	**4.00E+00**
Ground	High Boom	25	1.42E-02	**2.03E+01**	**4.73E+01**
Ground	High Boom	100	8.40E-03	**1.20E+01**	**2.80E+01**
Ground	High Boom	900	1.50E-03	**2.14E+00**	**5.00E+00**

OFF-SITE DRIFT - modeled in AgDrift
MAXIMUM APPLICATION RATE

Mode of Application	Application Height or Type	Distance From Receptor (ft)	Soil Concentration (mg a.e./kg)	Typical Species RQ	Threatened & Endangered Species RQ
Plane	Non-Forested	100	8.54E-02	**1.22E+02**	**2.85E+02**
Plane	Non-Forested	300	4.17E-02	**5.96E+01**	**1.39E+02**
Plane	Non-Forested	900	1.14E-02	**1.63E+01**	**3.80E+01**
Helicopter	Non-Forested	100	6.93E-02	**9.90E+01**	**2.31E+02**
Helicopter	Non-Forested	300	3.18E-02	**4.54E+01**	**1.06E+02**
Helicopter	Non-Forested	900	5.20E-03	**7.43E+00**	**1.73E+01**
Ground	Low Boom	25	1.79E-02	**2.56E+01**	**5.97E+01**
Ground	Low Boom	100	1.10E-02	**1.57E+01**	**3.67E+01**
Ground	Low Boom	900	2.40E-03	**3.43E+00**	**8.00E+00**
Ground	High Boom	25	2.84E-02	**4.06E+01**	**9.47E+01**
Ground	High Boom	100	1.68E-02	**2.40E+01**	**5.60E+01**
Ground	High Boom	900	3.10E-03	**4.43E+00**	**1.03E+01**

RQ = Risk Quotient = Estimated Dose/Toxicity Reference Value
Shading and boldface indicates plant RQs greater than 1.

Table C-122: Consumption of contaminated fish from pond by predatory bird - one time exposure. Pond impacted by spray drift modeled in AgDrift.

Parameters/ Assumptions	Value	Units	Notes
Body Weight (W)	5.15	kg	
Food ingestion rate (dry weight)	0.101786153	kg dw/day	[1]
Food ingestion rate (wet weight, A)	0.40714461	kg ww/day	[2]
Bioconcentration factor (BCF)	1	L/kg fish	
Proportion of Diet Contaminated (Prop)	1	unitless	
Toxicity reference value (TRV)	27	mg/kg-bw/day	

TYPICAL APPLICATION RATE

Mode of Application	Application Height or Type	Distance From Receptor (ft)	Pond Concentration (mg/L)	Concentration in fish (C_{Fish}): WC × BCF	Dose estimate (D): C_{Fish} × A × Prop / W	Risk Quotient
Plane	Non-Forested	100	5.60E-03	5.60E-03	4.42E-04	1.64E-05
Plane	Non-Forested	300	2.64E-03	2.64E-03	2.09E-04	7.73E-06
Plane	Non-Forested	900	1.06E-03	1.06E-03	8.35E-05	3.09E-06
Helicopter	Non-Forested	100	4.56E-03	4.56E-03	3.61E-04	1.34E-05
Helicopter	Non-Forested	300	2.05E-03	2.05E-03	1.62E-04	5.99E-06
Helicopter	Non-Forested	900	6.83E-04	6.83E-04	5.40E-05	2.00E-06
Ground	Low Boom	25	1.36E-03	1.36E-03	1.08E-04	3.99E-06
Ground	Low Boom	100	7.48E-04	7.48E-04	5.91E-05	2.19E-06
Ground	Low Boom	900	1.44E-04	1.44E-04	1.14E-05	4.23E-07
Ground	High Boom	25	2.19E-03	2.19E-03	1.73E-04	6.41E-06
Ground	High Boom	100	1.15E-03	1.15E-03	9.12E-05	3.38E-06
Ground	High Boom	900	1.83E-04	1.83E-04	1.45E-05	5.36E-07

MAXIMUM APPLICATION RATE

Mode of Application	Application Height or Type	Distance From Receptor (ft)	Pond Concentration (mg/L)	Concentration in fish (C_{Fish}): WC × BCF	Dose estimate (D): C_{Fish} × A × Prop / W	Risk Quotient
Plane	Non-Forested	100	1.19E-02	1.19E-02	9.42E-04	3.49E-05
Plane	Non-Forested	300	5.34E-03	5.34E-03	4.22E-04	1.56E-05
Plane	Non-Forested	900	1.40E-03	1.40E-03	1.11E-04	4.10E-06
Helicopter	Non-Forested	100	9.84E-03	9.84E-03	7.78E-04	2.88E-05
Helicopter	Non-Forested	300	4.15E-03	4.15E-03	3.28E-04	1.21E-05
Helicopter	Non-Forested	900	6.76E-04	6.76E-04	5.35E-05	1.98E-06
Ground	Low Boom	25	2.73E-03	2.73E-03	2.16E-04	7.98E-06
Ground	Low Boom	100	1.50E-03	1.50E-03	1.18E-04	4.38E-06
Ground	Low Boom	900	2.89E-04	2.89E-04	2.28E-05	8.45E-07
Ground	High Boom	25	4.38E-03	4.38E-03	3.46E-04	1.28E-05
Ground	High Boom	100	2.31E-03	2.31E-03	1.82E-04	6.75E-06
Ground	High Boom	900	3.66E-04	3.66E-04	2.90E-05	1.07E-06

Risk Quotient = Estimated Dose/Toxicity Reference Value
Shading and boldface indicates piscivorous bird RQs greater than 0.1.

[1] Calculated using alorithm developed by Nagy, 1987 for all birds; where
Food Ingestion Rate (kg dw/day) = 0.0582*(BW)^0.651
[2] Assumes fish are 75% water (USEPA, 1993; Table 4-1 - value for bony fishes)

Table C-123: Impact to aquatic species from accidental spill to pond

Parameters/Assumptions	Value	Units
Volume of pond (Vp)	1011715	L
Volume of spill		
Truck ($Vspill_t$)	757	L
Helicopter($Vspill_h$)	529.9	L
Herbicide concentration		
Truck mixture (Cm_t)	19174.30	mg a.e./L
Helicopter mixture (Cm_h)	95871.49	mg a.e./L

			Risk Quotients		
Scenario	**Concentrations in water (Cw): Cm × Vspill / Vp**	**Units**	**Fish**	**Aquatic Invertebrates**	**Non-Target Aquatic Plants**
Truck spill into pond	14.35	mg a.e./L	**7.17E+01**	**3.34E+03**	**3.59E+04**
Helicopter spill into pond	50.21	mg a.e./L	**2.51E+02**	**1.17E+04**	**1.26E+05**

Shading and boldface indicates plant RQs greater than 1.
Shading and boldface indicates acute RQs greater than 0.05 for fish and invertebrates.

Table C-124: Impact to aquatic species from direct spray of pond and stream

Parameters/Assumptions		Value	Units
Application rates (R)			
	Typical	2	lb/acre
	Maximum	4	lb/acre
Area of pond (Area)		0.25	acre
Volume of pond (Vol)		1011715	L
Mass sprayed on pond (R x Area)			
	Typical	226796	mg
	Maximum	453592	mg
Concentration in pond water (Mass/Volume)			
	Typical	0.22416985	mg/L
	Maximum	0.4483397	mg/L
Width of stream		2	m
Length of stream impacted by direct spray		636.15	m
Area of stream impacted by spray (Area)		1272.3	m2
Depth of stream		0.2	m
Instantaneous volume of stream impacted by direct spray (Vol)		254460	L
Mass sprayed on stream (R x Area)			
	Typical	2544.600	lb
	Maximum	5089.200	lb
Mass sprayed on stream - converted to mg			
	Typical	285214.120	mg
	Maximum	570428.239	mg
Concentration in stream water (Mass/Vol)			
	Typical	1.12086033	mg/L
	Maximum	2.24172066	mg/L

Scenario		Concentration in water (mg/L)	Risk Quotients Fish	Aquatic Invertebrates	Non-Target Aquatic Plants
Acute					
Direct spray to pond					
	Typical application	2.24E-01	**1.12E+00**	**5.21E+01**	**5.60E+02**
	Maximum application	4.48E-01	**2.24E+00**	**1.04E+02**	**1.12E+03**
Direct spray to stream					
	Typical application	1.12E+00	**5.60E+00**	**2.61E+02**	**2.80E+03**
	Maximum application	2.24E+00	**1.12E+01**	**5.21E+02**	**5.60E+03**
Chronic					
Direct spray to pond					
	Typical application	2.24E-01	**4.08E+00**	**1.12E+00**	**7.47E+00**
	Maximum application	4.48E-01	**8.15E+00**	**2.24E+00**	**1.49E+01**
Direct spray to stream					
	Typical application	1.12E+00	**2.04E+01**	**5.60E+00**	**3.74E+01**
	Maximum application	2.24E+00	**4.08E+01**	**1.12E+01**	**7.47E+01**

Shading and boldface indicates plant RQs greater than 1.
Shading and boldface indicates acute RQs greater than 0.05 for fish and invertebrates.

APPENDIX B.125 – B.142 – ECOLOGICAL RISK ASSESSMENT WORKSHEETS – AQUATIC APPLICATION FOR SUBMERGED VEGETATION – 2,4-D ACID AND SALTS

Table C-125: Direct spray of terrestrial receptors and exposure from indirect contact with foliage

Parameter		Pollinating Insect	Small Mammal	Units
Duration of Exposure (T)		24	24	hours
Body weight (W)		0.000093	0.02	kg
Surface Areas (A): cm^2 = 12.3 * BW(g)^0.65				
		2.63	86.21	cm^2
Application rates (R)				
	Typical	5.4	5.4	mg/cm^2
	Maximum	10.8	10.8	
Amount deposited on 1/2 receptor (Amnt): 0.5 × A × R				
	Typical	0.079591505	2.608967176	mg
	Maximum	0.159183011	5.217934352	
Dose Estimate Assuming 100% Dermal Adsorption				
Absorbed Dose: Amnt × Prop ÷ W				
	Typical	8.56E+02	1.30E+02	mg/kg bw
	Maximum	1.71E+03	2.61E+02	
Dose Estimate Assuming First Order Dermal Adsorption				
First-order dermal absorption rates (k)				
	Central estimate (ka)	0.078766725	0.078766725	$hour^{-1}$
Proportion absorbed over period T (Prop): 1-exp(-k T)				
	Typical	0.028389233	0.028389233	unitless
	Maximum	0.028389233	0.028389233	
Absorbed Dose: Amnt × Prop ÷ W				
	Typical	2.43E+01	3.70E+00	mg/kg bw
	Maximum	4.86E+01	7.41E+00	

RISK QUOTIENTS - Direct Spray	Toxicity Reference Value	Typical Application	Maximum Application
Small mammal - 100% absorption	2193	5.95E-02	1.19E-01
Pollinating insect - 100% absorption	140	6.11E+00	1.22E+01
Small mammal - 1st order dermal adsorption	2193	1.69E-03	3.38E-03
Pollinating insect - 1st order dermal adsorption	140	1.74E-01	3.47E-01

RISK QUOTIENTS - Indirect Contact *	Toxicity Reference Value	Typical Application	Maximum Application
Small mammal - 100% absorption	2193	5.95E-03	1.19E-02
Pollinating insect - 100% absorption	140	6.11E-01	1.22E+00
Small mammal - 1st order dermal adsorption	2193	1.69E-04	3.38E-04
Pollinating insect - 1st order dermal adsorption	140	1.74E-02	3.47E-02

Surface area calculation for mammals from Stahl, 1967 (presented in USEPA, 1993).
No surface area calculation identified for insects. Mammalian equation used as a surrogate.
Risk Quotient = Estimated Dose/Toxicity Reference Value
* Exposure from indirect contact assumed to be 1/10 of direct spray exposure

Table C-126: Consumption of contaminated berries by a small mammal - acute exposure scenario

Parameters/Assumptions		Value	Units	Notes
Body Weight (W)		0.02	kg	
Food ingestion rate (dry weight)		0.0033641	kg dw/day	[1]
Food ingestion rate (wet weight, A)		0.014626644	kg ww/day	[2]
Application rates (R)				
	Typical	5.4	lb/acre	
	Maximum	10.8		
Residue rate - berries (rr)				
	Typical	1.5	mg/kg per lb/acre	
	Maximum	7		
Concentration on berries (C): R × rr				
	Typical	8.1	mg/kg fruit	
	Maximum	75.6		
Dose estimates (D): C × A / W				
	Typical	5.92E+00	mg/kg bw	
	Maximum	5.53E+01		

RISK QUOTIENTS - Ingestion	**Toxicity Reference Value**	**Typical Application**	**Maximum Application**
Small mammal - acute exposure	1184	5.00E-03	4.67E-02

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987 for rodents; where

Food Ingestion Rate (g dw/day) = 0.621*(BW g)^0.564; converted into kg dw/day

[2] Assumes fruit is 77% water (USEPA, 1993; Table 4-2 - value for fruit pulp and skin)

Table C-127: Consumption of contaminated fruit by a small mammal - chronic exposure scenario

Parameters/Assumptions		**Value**	**Units**	
Duration of exposure (T)		90	days	
Body Weight (W)		0.02	kg	
Food ingestion rate (dry weight)		0.0033641	kg dw/day	[1]
Food ingestion rate (wet weight, A)		0.014626644	kg ww/day	[2]
Half life on vegetation (t50)				
	Herbicide specific	8.8	days	
Application rates (R)				
	Typical	5.4	lb/acre	
	Maximum	10.8		
Residue rate - berries (rr)				
	Typical	1.5	mg/kg per lb/acre	
	Maximum	7		
Drift (Drift)				
	Typical	1	unitless	
	Maximum	1		
Decay Coefficient (k): ln(2)/t50				
	Typical	0.078766725	$days^{-1}$	
	Maximum	0.078766725		
Initial concentration on berries (C0): R × rr × Drift				
	Typical	8.1	mg/kg fruit	
	Maximum	75.6		
Concentration on berries at time T: C0 * exp(-k*T)				
	Typical	0.006757237	mg/kg fruit	
	Maximum	0.063067546		
Time-weighted Average Concentration on vegetation (CTWA): C0 * (1-exp(-k*T))/(k*T)				
	Typical	1.141661273	mg/kg fruit	
	Maximum	10.65550521		
Proportion of Diet Contaminated (Prop)				
	Typical	1	unitless	
	Maximum	1		
Dose estimates (D): CTWA × A × Prop / W				
	Typical	0.834933632	mg/kg bw	
	Maximum	7.7927139		

RISK QUOTIENTS - Ingestion	**Toxicity Reference Value**	**Typical Application**	**Maximum Application**
Small mammal - chronic exposure	10	8.35E-02	7.79E-01

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987 for rodents; where

Food Ingestion Rate (g dw/day) = 0.621*(BW g)^0.564; converted into kg dw/day

[2] Assumes fruit is 77% water (USEPA, 1993; Table 4-2 - value for fruit pulp and skin)

Table C-128: Consumption of contaminated grass by a large mammal - acute exposure scenario

Parameters/Assumptions		Value	Units	Notes
Body Weight (W)		70	kg	
Food ingestion rate (dry weight)		1.9211536	kg dw/day	[1]
Food ingestion rate (wet weight, A)		6.40384532	kg ww/day	[2]
Duration of exposure (D)		1	day	
Application rates (R)				
	Typical	5.4	lb/acre	
	Maximum	10.8		
Residue rate - grass (rr)				
	Typical	92	mg/kg per lb/acre	
	Maximum	110		
Concentration on grass (C): R × rr				
	Typical	496.8	mg/kg grass	
	Maximum	1188		
Drift (Drift)				
	Typical	1	unitless	
	Maximum	1		
Proportion of Diet Contaminated (Prop)				
	Typical	1	unitless	
	Maximum	1		
Dose estimates: Drift × Prop × C × A ÷W				
	Typical	4.54E+01	mg/kg bw	
	Maximum	1.09E+02		

RISK QUOTIENTS - Ingestion	Toxicity Reference Value	Typical Application	Maximum Application
Large mammal - acute exposure	51	8.91E-01	2.13E+00

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987 for herbivores; where
Food Ingestion Rate (g dw/day) = 0.577*(BW g)^0.727; converted into kg dw/day

[2] Assumes grass is 70% water (USEPA, 1993; Table 4-2 - lowest value for young grasses)

Table C-129: Consumption of contaminated grass by a large mammal - chronic exposure scenario

Parameters/Assumptions	Value	Units	Notes
Duration of exposure (T)	90	day	
Body Weight (W)	70	kg	
Food ingestion rate (dry weight)	1.921153597	kg dw/day	[1]
Food ingestion rate (wet weight, A)	6.403845323	kg ww/day	[2]
Half life on vegetation (t50)			
Herbicide specific	8.8	days	
Application rates (R)			
Typical	5.4	lb/acre	
Maximum	10.8		
Residue rate - grass (rr)			
Typical	92	mg/kg per lb/acre	
Maximum	110		
Drift (Drift)			
Typical	1	unitless	
Maximum	1		
Decay Coefficient (k): ln(2)/t50			
Typical	0.078766725	$days^{-1}$	
Maximum	0.078766725		
Initial concentration on grass (C0): R × rr × Drift			
Typical	496.8	mg/kg grass	
Maximum	1188		
Concentration on grass at time T: C0 * exp(-k*T)			
Typical	0.414443872	mg/kg grass	
Maximum	0.991061433		
Time-weighted Average Concentration on vegetation (CTWA): C0 * (1-exp(-k*T))/(k*T)			
Typical	70.0218914	mg/kg vegetation	
Maximum	167.4436533		
Proportion of Diet Contaminated (Prop)			
Typical	1	unitless	
Maximum	1		
Dose estimates: CTWA × A × Prop / W			
Typical	6.41E+00	mg/kg bw	
Maximum	1.53E+01		

RISK QUOTIENTS - Ingestion	Toxicity Reference Value	Typical Application	Maximum Application
Large mammal - chronic exposure	1	6.41E+00	1.53E+01

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987 for herbivores; where

Food Ingestion Rate (g dw/day) = 0.577*(BW g)^0.727; converted into kg dw/day

[2] Assumes grass is 70% water (USEPA, 1993; Table 4-2 - lowest value for young grasses)

Table C-130: Consumption of contaminated small mammals by a large mammal - acute exposure scenario

Parameters/Assumptions		Value	Units	Notes
Body Weight (W)		12	kg	
Food ingestion rate (dry weight)		0.52971677	kg dw/day	[1]
Food ingestion rate (wet weight, A)		1.6553649	kg ww/day	[2]
Duration of exposure (D)		1	day	
Application rates (R)				
	Typical	5.4	lb/acre	
	Maximum	10.8		
Amount deposited on small mammal prey (Amnt_mouse): 0.5 × SurfaceArea × R				
	Typical	2.60896718	mg	
	Maximum	5.21793435		
Drift (Drift)				
	Typical	1	unitless	
	Maximum	1		
Proportion of Diet Contaminated (Prop)				
	Typical	1	unitless	
	Maximum	1		
Dose estimates: Drift × Prop × Amnt_mouse/BW_mouse × A ÷W				
	Typical	1.80E+01	mg/kg bw	
	Maximum	3.60E+01		

RISK QUOTIENTS - Ingestion	Toxicity Reference Value	Typical Application	Maximum Application
Large carnivorous mammal - acute exposure	80	2.25E-01	4.50E-01

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987; where

Food Ingestion Rate (g dw/day) = 0.0687*(BW g)^0.822; converted into kg dw/day

[2] Assumes mammals are 68% water (USEPA, 1993)

Table C-131: Consumption of contaminated small mammals by a large mammal - chronic exposure scenario

Parameters/Assumptions		Value	Units	Notes
Duration of exposure (T)		90	day	
Body Weight (W)		12	kg	
Food ingestion rate (dry weight)		0.529716769	kg dw/day	[1]
Food ingestion rate (wet weight, FIR_coyote)		1.655364903	kg ww/day	[2]
Application rates (R)				
	Typical	5.4	lb/acre	
	Maximum	10.8		
Drift (Drift)				
	Typical	1	unitless	
	Maximum	1		
Decay Coefficient (k): ln(2)/t50				
	Typical	0.078766725	$days^{-1}$	
	Maximum	0.078766725		
Initial concentration on mammal (C0): 0.5 × SurfaceArea × R/BW_smallmammal				
	Typical	130.4483588	mg a.e./kg mammal	
	Maximum	260.8967176		
Concentration absorbed in small mammal at time T (C90): C0 * exp(-k*T)				
	Typical	3.703328828	mg/kg mammal	
	Maximum	7.406657656		
Proportion of Diet Contaminated (Prop)				
	Typical	1	unitless	
	Maximum	1		
Dose estimates: C90 × FIR_coyote × Prop / W				
	Typical	5.11E-01	mg/kg bw	
	Maximum	1.02E+00		

RISK QUOTIENTS - Ingestion	Toxicity Reference Value	Typical Application	Maximum Application
Large mammal - chronic exposure	1	5.11E-01	1.02E+00

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987; where

Food Ingestion Rate (g dw/day) = 0.0687*(BW g)^0.822; converted into kg dw/day

[2] Assumes mammals are 68% water (USEPA, 1993)

Table C-132: Consumption of contaminated insects by a small bird - acute exposure scenario

Parameters/Assumptions		Value	Units	Notes
Body Weight (W)		0.08	kg	
Food ingestion rate (dry weight)		0.01124177	kg dw/day	[1]
Food ingestion rate (wet weight, A)		0.03626376	kg ww/day	[2]
Duration of exposure (D)		1	day	
Application rates (R)				
	Typical	5.4	lb/acre	
	Maximum	10.8		
Residue rate - insects (rr)				
	Typical	33	mg/kg per lb/acre	
	Maximum	58		
Concentration on insects (C): R × rr				
	Typical	178.2	mg/kg insect	
	Maximum	626.4		
Drift (Drift)				
	Typical	1	unitless	
	Maximum	1		
Proportion of Diet Contaminated (Prop)				
	Typical	1	unitless	
	Maximum	1		
Dose estimates: Drift × Prop × C × A ÷W				
	Typical	8.08E+01	mg/kg bw	
	Maximum	2.84E+02		

RISK QUOTIENTS - Ingestion	Toxicity Reference Value	Typical Application	Maximum Application
Small bird - acute exposure	217	3.72E-01	1.31E+00

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987 for all birds; where

Food Ingestion Rate (kg dw/day) = 0.0582*(BW)^0.651

[2] Assumes insects are 69% water (USEPA, 1993; Table 4-1 - value for grasshoppers and crickets)

Table C-133: Consumption of contaminated insects by a small bird - chronic exposure scenario

Parameters/Assumptions	Value	Units	Notes
Duration of exposure (T)	90	day	
Body Weight (W)	0.08	kg	
Food ingestion rate (dry weight)	0.011241767	kg dw/day	[1]
Food ingestion rate (wet weight, A)	0.036263763	kg ww/day	[2]
Half life on insect (t50)			
Herbicide specific	8.8	days	
Application rates (R)			
Typical	5.4	lb/acre	
Maximum	10.8		
Residue rate - insects (rr)			
Typical	33	mg/kg per lb/acre	
Maximum	58		
Drift (Drift)			
Typical	1	unitless	
Maximum	1		
Decay Coefficient (k): ln(2)/t50			
Typical	0.078766725	$days^{-1}$	
Maximum	0.078766725		
Initial concentration on insects (C0): R × rr × Drift			
Typical	178.2	mg/kg insect	
Maximum	626.4		
Concentration on insects at time T: C0 * exp(-k*T)			
Typical	0.148659215	mg/kg insect	
Maximum	0.522559665		
Time-weighted Average Concentration on insects (CTWA): C0 * (1-exp(-k*T))/(k*T)			
Typical	25.116548	mg/kg insect	
Maximum	88.28847176		
Proportion of Diet Contaminated (Prop)			
Typical	1	unitless	
Maximum	1		
Dose estimates (D): CTWA × A × Prop / W			
Typical	1.14E+01	mg/kg bw	
Maximum	4.00E+01		

RISK QUOTIENTS - Ingestion	Toxicity Reference Value	Typical Application	Maximum Application
Small bird - chronic exposure	27	4.22E-01	1.48E+00

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987 for all birds; where

Food Ingestion Rate (kg dw/day) = 0.0582*(BW)^0.651

[2] Assumes insects are 69% water (USEPA, 1993; Table 4-1 - value for grasshoppers and crickets)

Table C-134: Consumption of contaminated vegetation by a large bird - acute exposure scenario

Parameters/Assumptions		Value	Units	Notes
Body Weight (W)		3.72	kg	
Food ingestion rate (dry weight)		0.13688203	kg dw/day	[1]
Food ingestion rate (wet weight, A)		0.91254687	kg ww/day	[2]
Duration of exposure (D)		1	day	
Application rates (R)				
	Typical	5.4	lb/acre	
	Maximum	10.8		
Residue rate - vegetation (rr)				
	Typical	35	mg/kg per lb/acre	
	Maximum	125		
Concentration on vegetation (C): R × rr				
	Typical	189	mg/kg veg	
	Maximum	1350		
Drift (Drift)				
	Typical	1	unitless	
	Maximum	1		
Proportion of Diet Contaminated (Prop)				
	Typical	1	unitless	
	Maximum	1		
Dose estimates: Drift × Prop × C × A ÷W				
	Typical	4.64E+01		
	Maximum	3.31E+02		

RISK QUOTIENTS - Ingestion	Toxicity Reference Value	Typical Application	Maximum Application
Large bird - acute exposure	314	1.48E-01	1.05E+00

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987 for all birds; where

Food Ingestion Rate (kg dw/day) = 0.0582*(BW)^0.651

[2] Assumes vegetation is 85% water (USEPA, 1993; Table 4-2 - value for dicots)

Table C-135: Consumption of contaminated vegetation by a large bird - chronic exposure scenario

Parameters/Assumptions		Value	Units	Notes
Duration of exposure (T)		90	day	
Body Weight (W)		3.72	kg	
Food ingestion rate (dry weight)		0.13688203	kg dw/day	[1]
Food ingestion rate (wet weight, A)		0.912546869	kg ww/day	[2]
Half life on vegetation (t50)				
	Herbicide specific	8.8	days	
Application rates (R)				
	Typical	5.4	lb/acre	
	Maximum	10.8		
Residue rate - vegetation (rr)				
	Typical	35	mg/kg per lb/acre	
	Maximum	125		
Drift (Drift)				
	Typical	1	unitless	
	Maximum	1		
Decay Coefficient (k): ln(2)/t50				
	Typical	0.078766725	$days^{-1}$	
	Maximum	0.078766725		
Initial concentration on vegetation (C0): R × rr × Drift				
	Typical	189	mg/kg veg	
	Maximum	1350		
Concentration on vegetation at time T: C0 * exp(-k*T)				
	Typical	0.157668864	mg/kg veg	
	Maximum	1.126206174		
Time-weighted Average Concentration on vegetation (CTWA): C0 * (1-exp(-k*T))/(k*T)				
	Typical	26.63876303	mg/kg veg	
	Maximum	190.2768788		
Proportion of Diet Contaminated (Prop)				
	Typical	1	unitless	
	Maximum	1		
Dose estimates (D): CTWA × A × Prop / W				
	Typical	6.53E+00	mg/kg bw	
	Maximum	4.67E+01		

RISK QUOTIENTS - Ingestion	Toxicity Reference Value	Typical Application	Maximum Application
Large bird - chronic exposure	27	2.42E-01	1.73E+00

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987 for all birds; where
Food Ingestion Rate (kg dw/day) = 0.0582*(BW)^0.651

[2] Assumes vegetation is 85% water (USEPA, 1993; Table 4-2 - value for dicots)

Table C-136: Impact to aquatic species from accidental spray drift to pond

OFF-SITE DRIFT - modeled in AgDrift TYPICAL APPLICATION RATE				Risk Quotients - Acute			Risk Quotients - Chronic		
Mode of Application	Application Height or Type	Distance From Receptor (ft)	Pond Concentration (mg/L)	Fish	Aquatic Invertebrates	Non-Target Aquatic Plants	Fish	Aquatic Invertebrates	Non-Target Aquatic Plants
Plane	Non-Forested	100	2.56E-03	1.42E-03	1.97E-04	2.56E-02	4.65E-02	1.28E-02	8.53E-02
Plane	Non-Forested	300	1.15E-03	6.36E-04	8.81E-05	1.15E-02	2.08E-02	5.73E-03	3.82E-02
Plane	Non-Forested	900	5.11E-04	2.84E-04	3.93E-05	5.11E-03	9.30E-03	2.56E-03	1.70E-02
Helicopter	Non-Forested	100	2.13E-03	1.19E-03	1.64E-04	2.13E-02	3.88E-02	1.07E-02	7.12E-02
Helicopter	Non-Forested	300	9.11E-04	5.06E-04	7.00E-05	9.11E-03	1.66E-02	4.55E-03	3.04E-02
Helicopter	Non-Forested	900	4.48E-04	2.49E-04	3.44E-05	4.48E-03	8.14E-03	2.24E-03	1.49E-02
Ground	Low Boom	25	6.82E-04	3.79E-04	5.24E-05	6.82E-03	1.24E-02	3.41E-03	2.27E-02
Ground	Low Boom	100	3.74E-04	2.08E-04	2.88E-05	3.74E-03	6.80E-03	1.87E-03	1.25E-02
Ground	Low Boom	900	7.22E-05	4.01E-05	5.55E-06	7.22E-04	1.31E-03	3.61E-04	2.41E-03
Ground	High Boom	25	1.09E-03	6.08E-04	8.42E-05	1.09E-02	1.99E-02	5.47E-03	3.65E-02
Ground	High Boom	100	5.77E-04	3.20E-04	4.44E-05	5.77E-03	1.05E-02	2.88E-03	1.92E-02
Ground	High Boom	900	9.16E-05	5.09E-05	7.04E-06	9.16E-04	1.67E-03	4.58E-04	3.05E-03

OFF-SITE DRIFT - modeled in AgDrift MAXIMUM APPLICATION RATE				Risk Quotients - Acute			Risk Quotients - Chronic		
Mode of Application	Application Height or Type	Distance From Receptor (ft)	Pond Concentration (mg/L)	Fish	Aquatic Invertebrates	Non-Target Aquatic Plants	Fish	Aquatic Invertebrates	Non-Target Aquatic Plants
Plane	Non-Forested	100	5.60E-03	3.11E-03	4.30E-04	5.60E-02	1.02E-01	2.80E-02	1.87E-01
Plane	Non-Forested	300	2.64E-03	1.47E-03	2.03E-04	2.64E-02	4.80E-02	1.32E-02	8.80E-02
Plane	Non-Forested	900	1.06E-03	5.87E-04	8.13E-05	1.06E-02	1.92E-02	5.28E-03	3.52E-02
Helicopter	Non-Forested	100	4.56E-03	2.54E-03	3.51E-04	4.56E-02	8.30E-02	2.28E-02	1.52E-01
Helicopter	Non-Forested	300	2.05E-03	1.14E-03	1.57E-04	2.05E-02	3.72E-02	1.02E-02	6.82E-02
Helicopter	Non-Forested	900	6.83E-04	3.80E-04	5.26E-05	6.83E-03	1.24E-02	3.42E-03	2.28E-02
Ground	Low Boom	25	1.36E-03	7.57E-04	1.05E-04	1.36E-02	2.48E-02	6.82E-03	4.54E-02
Ground	Low Boom	100	7.48E-04	4.15E-04	5.75E-05	7.48E-03	1.36E-02	3.74E-03	2.49E-02
Ground	Low Boom	900	1.44E-04	8.02E-05	1.11E-05	1.44E-03	2.62E-03	7.22E-04	4.81E-03
Ground	High Boom	25	2.10E-02	1.16E-02	1.61E-03	2.10E-01	3.81E-01	1.05E-01	6.99E-01
Ground	High Boom	100	5.94E-03	3.30E-03	4.57E-04	5.94E-02	1.08E-01	2.97E-02	1.98E-01
Ground	High Boom	900	5.02E-04	2.79E-04	3.86E-05	5.02E-03	9.13E-03	2.51E-03	1.67E-02

RQ = Risk Quotient = Estimated Dose/Toxicity Reference Value

Shading and boldface indicates plant RQs greater than 1.
Shading and boldface indicates acute RQs greater than 0.05 for fish and invertebrates.
Shading and boldface indicates chronic RQs greater than 0.5 for fish and invertebrates.

Table C-137: Impact to aquatic species from accidental spray drift to stream

OFF-SITE DRIFT - modeled in AgDrift
TYPICALAPPLICATION RATE

Mode of Application	Application Height or Type	Distance From Receptor (ft)	Stream Concentration (mg/L)	Risk Quotients - Acute: Fish	Risk Quotients - Acute: Aquatic Invertebrates	Risk Quotients - Acute: Non-Target Aquatic Plants	Risk Quotients - Chronic: Fish	Risk Quotients - Chronic: Aquatic Invertebrates	Risk Quotients - Chronic: Non-Target Aquatic Plants
Plane	Non-Forested	100	3.39E-03	1.88E-03	2.60E-04	3.39E-02	6.16E-02	1.69E-02	1.13E-01
Plane	Non-Forested	300	1.23E-03	6.83E-04	9.46E-05	1.23E-02	2.23E-02	6.15E-03	4.10E-02
Plane	Non-Forested	900	5.22E-04	2.90E-04	4.01E-05	5.22E-03	9.49E-03	2.61E-03	1.74E-02
Helicopter	Non-Forested	100	2.84E-03	1.58E-03	2.18E-04	2.84E-02	5.16E-02	1.42E-02	9.45E-02
Helicopter	Non-Forested	300	9.93E-04	5.52E-04	7.64E-05	9.93E-03	1.81E-02	4.97E-03	3.31E-02
Helicopter	Non-Forested	900	4.55E-04	2.53E-04	3.50E-05	4.55E-03	8.28E-03	2.28E-03	1.52E-02
Ground	Low Boom	25	1.23E-03	6.81E-04	9.43E-05	1.23E-02	2.23E-02	6.13E-03	4.09E-02
Ground	Low Boom	100	3.59E-04	2.00E-04	2.76E-05	3.59E-03	6.53E-03	1.80E-03	1.20E-02
Ground	Low Boom	900	3.72E-05	2.07E-05	2.86E-06	3.72E-04	6.76E-04	1.86E-04	1.24E-03
Ground	High Boom	25	2.05E-03	1.14E-03	1.58E-04	2.05E-02	3.74E-02	1.03E-02	6.85E-02
Ground	High Boom	100	5.82E-04	3.23E-04	4.48E-05	5.82E-03	1.06E-02	2.91E-03	1.94E-02
Ground	High Boom	900	4.92E-05	2.73E-05	3.78E-06	4.92E-04	8.94E-04	2.46E-04	1.64E-03

OFF-SITE DRIFT - modeled in AgDrift
MAXIMUM APPLICATION RATE

Mode of Application	Application Height or Type	Distance From Receptor (ft)	Stream Concentration (mg/L)	Risk Quotients - Acute: Fish	Risk Quotients - Acute: Aquatic Invertebrates	Risk Quotients - Acute: Non-Target Aquatic Plants	Risk Quotients - Chronic: Fish	Risk Quotients - Chronic: Aquatic Invertebrates	Risk Quotients - Chronic: Non-Target Aquatic Plants
Plane	Non-Forested	100	7.36E-03	4.09E-03	5.66E-04	7.36E-02	1.34E-01	3.68E-02	2.45E-01
Plane	Non-Forested	300	2.85E-03	1.59E-03	2.20E-04	2.85E-02	5.19E-02	1.43E-02	9.51E-02
Plane	Non-Forested	900	1.09E-03	6.07E-04	8.40E-05	1.09E-02	1.99E-02	5.46E-03	3.64E-02
Helicopter	Non-Forested	100	6.03E-03	3.35E-03	4.64E-04	6.03E-02	1.10E-01	3.01E-02	2.01E-01
Helicopter	Non-Forested	300	2.22E-03	1.23E-03	1.71E-04	2.22E-02	4.03E-02	1.11E-02	7.39E-02
Helicopter	Non-Forested	900	7.25E-04	4.03E-04	5.57E-05	7.25E-03	1.32E-02	3.62E-03	2.42E-02
Ground	Low Boom	25	2.45E-03	1.36E-03	1.89E-04	2.45E-02	4.46E-02	1.23E-02	8.18E-02
Ground	Low Boom	100	7.19E-04	3.99E-04	5.53E-05	7.19E-03	1.31E-02	3.60E-03	2.40E-02
Ground	Low Boom	900	7.45E-05	4.14E-05	5.73E-06	7.45E-04	1.35E-03	3.72E-04	2.48E-03
Ground	High Boom	25	4.29E-04	2.38E-04	3.30E-05	4.29E-03	7.81E-03	2.15E-03	1.43E-02
Ground	High Boom	100	2.26E-04	1.26E-04	1.74E-05	2.26E-03	4.11E-03	1.13E-03	7.54E-03
Ground	High Boom	900	3.59E-05	2.00E-05	2.76E-06	3.59E-04	6.53E-04	1.80E-04	1.20E-03

RQ = Risk Quotient = Estimated Dose/Toxicity Reference Value

Shading and boldface indicates plant RQs greater than 1.
Shading and boldface indicates acute RQs greater than 0.05 for fish and invertebrates.
Shading and boldface indicates chronic RQs greater than 0.5 for fish and invertebrates.

Table C-138: Potential risk to predatory bird from consumption of contaminated fish from pond. Pond impacted by regular application of herbicide

Parameters/ Assumptions		Value	Units	Notes
Body Weight (W)		5.15	kg	
Food ingestion rate (dry weight)		1.02E-01	kg dw/day	[1]
Food ingestion rate (wet weight, A)		4.07E-01	kg ww/day	[2]
Bioconcentration factor (BCF)		3.01	L/kg fish	
Food Chain Multiplier Trophic Level 2 (FCM_TL2)		1	unitless	
Food Chain Multiplier Trophic Level 3 (FCM_TL3)		1	unitless	
Proportion of Diet Contaminated (Prop)		1	unitless	
Toxicity reference value (TRV)		100	mg/kg-bw/day	
Concentration in Fish = Pond_conc x BCF x FCM_TL2 x FCM_TL3				
	Typical	5.06E-02	mg a.i./kg bw fish	
	Maximum	4.39E-01	mg a.i./kg bw fish	
Dose Estimate = (Concentration in fish x A) / W				
	Typical	4.00E-03	mg a.i./kg bw fish	
	Maximum	3.47E-02	mg a.i./kg bw fish	
Toxicity reference value (TRV)		100	mg/kg-bw/day	

RISK QUOTIENTS - Ingestion	Toxicity Reference Value	Typical Application	Maximum Application
Piscivorous bird - chronic exposure	100	1.48E-04	1.28E-03

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using alorithm developed by Nagy, 1987 for all birds; where
Food Ingestion Rate (kg dw/day) = 0.0582*(BW)^0.651

[2] Assumes fish are 75% water (USEPA, 1993; Table 4-1 - value for bony fishes)

Table C-139: Impact to non-target terrrestrial plants from direct spray and spray drift

DIRECT SPRAY	Terrestrial Concentration (lb a.e./acre)	Typical Species RQ	Threatened & Endangered Species RQ
Typical application rate	5.4	**2.70E+03**	**1.80E+04**
Maximum application rate	10.8	**5.40E+03**	**3.60E+04**

OFF-SITE DRIFT - modeled in AgDrift
TYPICAL APPLICATION RATE

Mode of Application	Application Height or Type	Distance From Receptor (ft)	Soil Concentration (mg a.e./kg)	Typical Species RQ	Threatened & Endangered Species RQ
Plane	Non-Forested	100	1.81E-02	**9.05E+00**	**6.03E+01**
Plane	Non-Forested	300	9.30E-03	**4.65E+00**	**3.10E+01**
Plane	Non-Forested	900	4.40E-03	**2.20E+00**	**1.47E+01**
Helicopter	Non-Forested	100	1.48E-02	**7.40E+00**	**4.93E+01**
Helicopter	Non-Forested	300	7.40E-03	**3.70E+00**	**2.47E+01**
Helicopter	Non-Forested	900	3.80E-03	**1.90E+00**	**1.27E+01**
Ground	Low Boom	25	4.50E-03	**2.25E+00**	**1.50E+01**
Ground	Low Boom	100	2.80E-03	**1.40E+00**	**9.33E+00**
Ground	Low Boom	900	6.00E-04	3.00E-01	**2.00E+00**
Ground	High Boom	25	7.10E-03	**3.55E+00**	**2.37E+01**
Ground	High Boom	100	4.20E-03	**2.10E+00**	**1.40E+01**
Ground	High Boom	900	8.00E-04	4.00E-01	**2.67E+00**

OFF-SITE DRIFT - modeled in AgDrift
MAXIMUM APPLICATION RATE

Mode of Application	Application Height or Type	Distance From Receptor (ft)	Soil Concentration (mg a.e./kg)	Typical Species RQ	Threatened & Endangered Species RQ
Plane	Non-Forested	100	4.02E-02	**2.01E+01**	**1.34E+02**
Plane	Non-Forested	300	2.12E-02	**1.06E+01**	**7.07E+01**
Plane	Non-Forested	900	8.90E-03	**4.45E+00**	**2.97E+01**
Helicopter	Non-Forested	100	3.22E-02	**1.61E+01**	**1.07E+02**
Helicopter	Non-Forested	300	1.65E-02	**8.25E+00**	**5.50E+01**
Helicopter	Non-Forested	900	5.60E-03	**2.80E+00**	**1.87E+01**
Ground	Low Boom	25	9.00E-03	**4.50E+00**	**3.00E+01**
Ground	Low Boom	100	5.50E-03	**2.75E+00**	**1.83E+01**
Ground	Low Boom	900	1.20E-03	6.00E-01	**4.00E+00**
Ground	High Boom	25	1.42E-02	**7.10E+00**	**4.73E+01**
Ground	High Boom	100	8.40E-03	**4.20E+00**	**2.80E+01**
Ground	High Boom	900	1.50E-03	7.50E-01	**5.00E+00**

RQ = Risk Quotient = Estimated Dose/Toxicity Reference Value
Shading and boldface indicates plant RQs greater than 1.

Table C-140: Consumption of contaminated fish from pond by predatory bird - one time exposure. Pond impacted by spray drift modeled in AgDrift.

Parameters/ Assumptions	Value	Units	Notes
Body Weight (W)	5.15	kg	
Food ingestion rate (dry weight)	0.101786153	kg dw/day	[1]
Food ingestion rate (wet weight, A)	0.40714461	kg ww/day	[2]
Bioconcentration factor (BCF)	1	L/kg fish	
Proportion of Diet Contaminated (Prop)	1	unitless	
Toxicity reference value (TRV)	27	mg/kg-bw/day	

TYPICAL APPLICATION RATE

Mode of Application	Application Height or Type	Distance From Receptor (ft)	Pond Concentration (mg/L)	Concentration in fish (C_{Fish}): WC × BCF	Dose estimate (D): C_{Fish} × A × Prop / W	Risk Quotient
Plane	Non-Forested	100	2.56E-03	2.56E-03	2.02E-04	7.49E-06
Plane	Non-Forested	300	1.15E-03	1.15E-03	9.06E-05	3.35E-06
Plane	Non-Forested	900	5.11E-04	5.11E-04	4.04E-05	1.50E-06
Helicopter	Non-Forested	100	2.13E-03	2.13E-03	1.69E-04	6.25E-06
Helicopter	Non-Forested	300	9.11E-04	9.11E-04	7.20E-05	2.67E-06
Helicopter	Non-Forested	900	4.48E-04	4.48E-04	3.54E-05	1.31E-06
Ground	Low Boom	25	6.82E-04	6.82E-04	5.39E-05	2.00E-06
Ground	Low Boom	100	3.74E-04	3.74E-04	2.96E-05	1.09E-06
Ground	Low Boom	900	7.22E-05	7.22E-05	5.70E-06	2.11E-07
Ground	High Boom	25	1.09E-03	1.09E-03	8.65E-05	3.21E-06
Ground	High Boom	100	5.77E-04	5.77E-04	4.56E-05	1.69E-06
Ground	High Boom	900	9.16E-05	9.16E-05	7.24E-06	2.68E-07

MAXIMUM APPLICATION RATE

Mode of Application	Application Height or Type	Distance From Receptor (ft)	Pond Concentration (mg/L)	Concentration in fish (C_{Fish}): WC × BCF	Dose estimate (D): C_{Fish} × A × Prop / W	Risk Quotient
Plane	Non-Forested	100	5.60E-03	5.60E-03	4.42E-04	1.64E-05
Plane	Non-Forested	300	2.64E-03	2.64E-03	2.09E-04	7.73E-06
Plane	Non-Forested	900	1.06E-03	1.06E-03	8.35E-05	3.09E-06
Helicopter	Non-Forested	100	4.56E-03	4.56E-03	3.61E-04	1.34E-05
Helicopter	Non-Forested	300	2.05E-03	2.05E-03	1.62E-04	5.99E-06
Helicopter	Non-Forested	900	6.83E-04	6.83E-04	5.40E-05	2.00E-06
Ground	Low Boom	25	1.36E-03	1.36E-03	1.08E-04	3.99E-06
Ground	Low Boom	100	7.48E-04	7.48E-04	5.91E-05	2.19E-06
Ground	Low Boom	900	1.44E-04	1.44E-04	1.14E-05	4.23E-07
Ground	High Boom	25	2.10E-02	2.10E-02	1.66E-03	6.14E-05
Ground	High Boom	100	5.94E-03	5.94E-03	4.69E-04	1.74E-05
Ground	High Boom	900	5.02E-04	5.02E-04	3.97E-05	1.47E-06

Risk Quotient = Estimated Dose/Toxicity Reference Value
Shading and boldface indicates piscivorous bird RQs greater than 0.1.

[1] Calculated using alorithm developed by Nagy, 1987 for all birds; where
Food Ingestion Rate (kg dw/day) = 0.0582*(BW)^0.651
[2] Assumes fish are 75% water (USEPA, 1993; Table 4-1 - value for bony fishes)

Table C-141: Impact to aquatic species from accidental spill to pond

Parameters/Assumptions	Value	Units
Volume of pond (Vp)	1011715	L
Volume of spill		
Truck ($Vspill_t$)	757	L
Helicopter($Vspill_h$)	529.9	L
Herbicide concentration		
Truck mixture (Cm_t)	51770.61	mg a.e./L
Helicopter mixture (Cm_h)	258853.03	mg a.e./L

			Risk Quotients		
Scenario	**Concentrations in water (Cw): Cm × Vspill / Vp**	**Units**	**Fish**	**Aquatic Invertebrates**	**Non-Target Aquatic Plants**
Truck spill into pond	38.74	mg a.e./L	**2.15E+01**	**2.98E+00**	**3.87E+02**
Helicopter spill into pond	135.58	mg a.e./L	**7.53E+01**	**1.04E+01**	**1.36E+03**

Shading and boldface indicates plant RQs greater than 1.
Shading and boldface indicates acute RQs greater than 0.05 for fish and invertebrates.

Table C-142: Impact to aquatic species from direct spray of pond and stream

Parameters/Assumptions		Value	Units
Application rates (R)			
	Typical	5.4	lb/acre
	Maximum	10.8	lb/acre
Area of pond (Area)		0.25	acre
Volume of pond (Vol)		1011715	L
Mass sprayed on pond (R x Area)			
	Typical	612349.2	mg
	Maximum	1224698.4	mg
Concentration in pond water (Mass/Volume)			
	Typical	0.605258596	mg/L
	Maximum	1.210517191	mg/L
Width of stream		2	m
Length of stream impacted by direct spray		636.15	m
Area of stream impacted by spray (Area)		1272.3	m2
Depth of stream		0.2	m
Instantaneous volume of stream impacted by direct spray (Vol)		254460	L
Mass sprayed on stream (R x Area)			
	Typical	6870.420	lb
	Maximum	13740.840	lb
Mass sprayed on stream - converted to mg			
	Typical	770078.123	mg
	Maximum	1540156.245	mg
Concentration in stream water (Mass/Vol)			
	Typical	3.026322891	mg/L
	Maximum	6.052645781	mg/L

Scenario		Concentration in water (mg/L)	Risk Quotients: Fish	Risk Quotients: Aquatic Invertebrates	Risk Quotients: Non-Target Aquatic Plants
Acute					
Direct spray to pond					
	Typical application	6.05E-01	**3.36E-01**	4.66E-02	**6.05E+00**
	Maximum application	1.21E+00	**6.73E-01**	**9.31E-02**	**1.21E+01**
Direct spray to stream					
	Typical application	3.03E+00	**1.68E+00**	**2.33E-01**	**3.03E+01**
	Maximum application	6.05E+00	**3.36E+00**	**4.66E-01**	**6.05E+01**
Chronic					
Direct spray to pond					
	Typical application	6.05E-01	**1.10E+01**	**3.03E+00**	**2.02E+01**
	Maximum application	1.21E+00	**2.20E+01**	**6.05E+00**	**4.04E+01**
Direct spray to stream					
	Typical application	3.03E+00	**5.50E+01**	**1.51E+01**	**1.01E+02**
	Maximum application	6.05E+00	**1.10E+02**	**3.03E+01**	**2.02E+02**

Shading and boldface indicates plant RQs greater than 1.
Shading and boldface indicates acute RQs greater than 0.05 for fish and invertebrates.

APPENDIX B.143 – B.160 – ECOLOGICAL RISK ASSESSMENT WORKSHEETS – AQUATIC APPLICATION FOR SUBMERGED VEGETATION – 2,4-D ESTERS

Table C-143: Direct spray of terrestrial receptors and exposure from indirect contact with foliage

Parameter		Pollinating Insect	Small Mammal	Units
Duration of Exposure (T)		24	24	hours
Body weight (W)		0.000093	0.02	kg
Surface Areas (A): cm^2 = 12.3 * BW(g)^0.65				
		2.63	86.21	cm^2
Application rates (R)				
	Typical	5.4	5.4	mg/cm^2
	Maximum	10.8	10.8	
Amount deposited on 1/2 receptor (Amnt): 0.5 × A × R				
	Typical	0.079591505	2.608967176	mg
	Maximum	0.159183011	5.217934352	
Dose Estimate Assuming 100% Dermal Adsorption				
Absorbed Dose: Amnt × Prop ÷ W				
	Typical	8.56E+02	1.30E+02	mg/kg bw
	Maximum	1.71E+03	2.61E+02	
Dose Estimate Assuming First Order Dermal Adsorption				
First-order dermal absorption rates (k)				
	Central estimate (ka)	0.138629436	0.138629436	$hour^{-1}$
Proportion absorbed over period T (Prop): 1-exp(-k T)				
	Typical	0.113079563	0.113079563	unitless
	Maximum	0.113079563	0.113079563	
Absorbed Dose: Amnt × Prop ÷ W				
	Typical	9.68E+01	1.48E+01	mg/kg bw
	Maximum	1.94E+02	2.95E+01	

RISK QUOTIENTS - Direct Spray	Toxicity Reference Value	Typical Application	Maximum Application
Small mammal - 100% absorption	2193	5.95E-02	1.19E-01
Pollinating insect - 100% absorption	140	6.11E+00	1.22E+01
Small mammal - 1st order dermal adsorption	2193	6.73E-03	1.35E-02
Pollinating insect - 1st order dermal adsorption	140	6.91E-01	1.38E+00

RISK QUOTIENTS - Indirect Contact *	Toxicity Reference Value	Typical Application	Maximum Application
Small mammal - 100% absorption	2193	5.95E-03	1.19E-02
Pollinating insect - 100% absorption	140	6.11E-01	1.22E+00
Small mammal - 1st order dermal adsorption	2193	6.73E-04	1.35E-03
Pollinating insect - 1st order dermal adsorption	140	6.91E-02	1.38E-01

Surface area calculation for mammals from Stahl, 1967 (presented in USEPA, 1993).
No surface area calculation identified for insects. Mammalian equation used as a surrogate.
Risk Quotient = Estimated Dose/Toxicity Reference Value
* Exposure from indirect contact assumed to be 1/10 of direct spray exposure

Table C-144: Consumption of contaminated berries by a small mammal - acute exposure scenario

Parameters/Assumptions		Value	Units	Notes
Body Weight (W)		0.02	kg	
Food ingestion rate (dry weight)		0.0033641	kg dw/day	[1]
Food ingestion rate (wet weight, A)		0.014626644	kg ww/day	[2]
Application rates (R)				
	Typical	5.4	lb/acre	
	Maximum	10.8		
Residue rate - berries (rr)				
	Typical	1.5	mg/kg per lb/acre	
	Maximum	7		
Concentration on berries (C): R × rr				
	Typical	8.1	mg/kg fruit	
	Maximum	75.6		
Dose estimates (D): C × A / W				
	Typical	5.92E+00	mg/kg bw	
	Maximum	5.53E+01		

RISK QUOTIENTS - Ingestion	**Toxicity Reference Value**	**Typical Application**	**Maximum Application**
Small mammal - acute exposure	1184	5.00E-03	4.67E-02

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987 for rodents; where

Food Ingestion Rate (g dw/day) = 0.621*(BW g)^0.564; converted into kg dw/day

[2] Assumes fruit is 77% water (USEPA, 1993; Table 4-2 - value for fruit pulp and skin)

Table C-145: Consumption of contaminated fruit by a small mammal - chronic exposure scenario

Parameters/Assumptions		**Value**	**Units**	
Duration of exposure (T)		90	days	
Body Weight (W)		0.02	kg	
Food ingestion rate (dry weight)		0.0033641	kg dw/day	[1]
Food ingestion rate (wet weight, A)		0.014626644	kg ww/day	[2]
Half life on vegetation (t50)				
	Herbicide specific	5	days	
Application rates (R)				
	Typical	5.4	lb/acre	
	Maximum	10.8		
Residue rate - berries (rr)				
	Typical	1.5	mg/kg per lb/acre	
	Maximum	7		
Drift (Drift)				
	Typical	1	unitless	
	Maximum	1		
Decay Coefficient (k): ln(2)/t50				
	Typical	0.138629436	$days^{-1}$	
	Maximum	0.138629436		
Initial concentration on berries (C0): R × rr × Drift				
	Typical	8.1	mg/kg fruit	
	Maximum	75.6		
Concentration on berries at time T: C0 * exp(-k*T)				
	Typical	3.0899E-05	mg/kg fruit	
	Maximum	0.000288391		
Time-weighted Average Concentration on vegetation (CTWA): C0 * (1-exp(-k*T))/(k*T)				
	Typical	0.649210292	mg/kg fruit	
	Maximum	6.059296057		
Proportion of Diet Contaminated (Prop)				
	Typical	1	unitless	
	Maximum	1		
Dose estimates (D): CTWA × A × Prop / W				
	Typical	0.474788381	mg/kg bw	
	Maximum	4.43135822		

RISK QUOTIENTS - Ingestion	**Toxicity Reference Value**	**Typical Application**	**Maximum Application**
Small mammal - chronic exposure	10	4.75E-02	4.43E-01

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987 for rodents; where

Food Ingestion Rate (g dw/day) = 0.621*(BW g)^0.564; converted into kg dw/day

[2] Assumes fruit is 77% water (USEPA, 1993; Table 4-2 - value for fruit pulp and skin)

Table C-146: Consumption of contaminated grass by a large mammal - acute exposure scenario

Parameters/Assumptions		Value	Units	Notes
Body Weight (W)		70	kg	
Food ingestion rate (dry weight)		1.9211536	kg dw/day	[1]
Food ingestion rate (wet weight, A)		6.40384532	kg ww/day	[2]
Duration of exposure (D)		1	day	
Application rates (R)				
	Typical	5.4	lb/acre	
	Maximum	10.8		
Residue rate - grass (rr)				
	Typical	92	mg/kg per lb/acre	
	Maximum	110		
Concentration on grass (C): R × rr				
	Typical	496.8	mg/kg grass	
	Maximum	1188		
Drift (Drift)				
	Typical	1	unitless	
	Maximum	1		
Proportion of Diet Contaminated (Prop)				
	Typical	1	unitless	
	Maximum	1		
Dose estimates: Drift × Prop × C × A ÷W				
	Typical	4.54E+01	mg/kg bw	
	Maximum	1.09E+02		

RISK QUOTIENTS - Ingestion	**Toxicity Reference Value**	**Typical Application**	**Maximum Application**
Large mammal - acute exposure	51	8.91E-01	2.13E+00

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987 for herbivores; where

Food Ingestion Rate (g dw/day) = 0.577*(BW g)^0.727; converted into kg dw/day

[2] Assumes grass is 70% water (USEPA, 1993; Table 4-2 - lowest value for young grasses)

Table C-147: Consumption of contaminated grass by a large mammal - chronic exposure scenario

Parameters/Assumptions	Value	Units	Notes
Duration of exposure (T)	90	day	
Body Weight (W)	70	kg	
Food ingestion rate (dry weight)	1.921153597	kg dw/day	[1]
Food ingestion rate (wet weight, A)	6.403845323	kg ww/day	[2]
Half life on vegetation (t50)			
Herbicide specific	5	days	
Application rates (R)			
Typical	5.4	lb/acre	
Maximum	10.8		
Residue rate - grass (rr)			
Typical	92	mg/kg per lb/acre	
Maximum	110		
Drift (Drift)			
Typical	1	unitless	
Maximum	1		
Decay Coefficient (k): ln(2)/t50			
Typical	0.138629436	$days^{-1}$	
Maximum	0.138629436		
Initial concentration on grass (C0): R × rr × Drift			
Typical	496.8	mg/kg grass	
Maximum	1188		
Concentration on grass at time T: C0 * exp(-k*T)			
Typical	0.001895142	mg/kg grass	
Maximum	0.00453186		
Time-weighted Average Concentration on vegetation (CTWA): C0 * (1-exp(-k*T))/(k*T)			
Typical	39.81823123	mg/kg vegetation	
Maximum	95.21750947		
Proportion of Diet Contaminated (Prop)			
Typical	1	unitless	
Maximum	1		
Dose estimates: CTWA × A × Prop / W			
Typical	3.64E+00	mg/kg bw	
Maximum	8.71E+00		

RISK QUOTIENTS - Ingestion	Toxicity Reference Value	Typical Application	Maximum Application
Large mammal - chronic exposure	1	3.64E+00	8.71E+00

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987 for herbivores; where

Food Ingestion Rate (g dw/day) = 0.577*(BW g)^0.727; converted into kg dw/day

[2] Assumes grass is 70% water (USEPA, 1993; Table 4-2 - lowest value for young grasses)

Table C-148: Consumption of contaminated small mammals by a large mammal - acute exposure scenario

Parameters/Assumptions		Value	Units	Notes
Body Weight (W)		12	kg	
Food ingestion rate (dry weight)		0.52971677	kg dw/day	[1]
Food ingestion rate (wet weight, A)		1.6553649	kg ww/day	[2]
Duration of exposure (D)		1	day	
Application rates (R)				
	Typical	5.4	lb/acre	
	Maximum	10.8		
Amount deposited on small mammal prey (Amnt_mouse): 0.5 × SurfaceArea × R				
	Typical	2.60896718	mg	
	Maximum	5.21793435		
Drift (Drift)				
	Typical	1	unitless	
	Maximum	1		
Proportion of Diet Contaminated (Prop)				
	Typical	1	unitless	
	Maximum	1		
Dose estimates: Drift × Prop × Amnt_mouse/BW_mouse × A ÷W				
	Typical	1.80E+01	mg/kg bw	
	Maximum	3.60E+01		

RISK QUOTIENTS - Ingestion	Toxicity Reference Value	Typical Application	Maximum Application
Large carnivorous mammal - acute exposure	80	2.25E-01	4.50E-01

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987; where

Food Ingestion Rate (g dw/day) = 0.0687*(BW g)^0.822; converted into kg dw/day

[2] Assumes mammals are 68% water (USEPA, 1993)

Table C-149: Consumption of contaminated small mammals by a large mammal - chronic exposure scenario

Parameters/Assumptions		Value	Units	Notes
Duration of exposure (T)		90	day	
Body Weight (W)		12	kg	
Food ingestion rate (dry weight)		0.529716769	kg dw/day	[1]
Food ingestion rate (wet weight, FIR_coyote)		1.655364903	kg ww/day	[2]
Application rates (R)				
	Typical	5.4	lb/acre	
	Maximum	10.8		
Drift (Drift)				
	Typical	1	unitless	
	Maximum	1		
Decay Coefficient (k): ln(2)/t50				
	Typical	0.138629436	$days^{-1}$	
	Maximum	0.138629436		
Initial concentration on mammal (C0): 0.5 × SurfaceArea × R/BW_smallmammal				
	Typical	130.4483588	mg a.e./kg mammal	
	Maximum	260.8967176		
Concentration absorbed in small mammal at time T (C90): C0 * exp(-k*T)				
	Typical	14.75104344	mg/kg mammal	
	Maximum	29.50208689		
Proportion of Diet Contaminated (Prop)				
	Typical	1	unitless	
	Maximum	1		
Dose estimates: C90 × FIR_coyote × Prop / W				
	Typical	2.03E+00	mg/kg bw	
	Maximum	4.07E+00		

RISK QUOTIENTS - Ingestion	Toxicity Reference Value	Typical Application	Maximum Application
Large mammal - chronic exposure	1	2.03E+00	4.07E+00

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987; where

Food Ingestion Rate (g dw/day) = 0.0687*(BW g)^0.822; converted into kg dw/day

[2] Assumes mammals are 68% water (USEPA, 1993)

Table C-150: Consumption of contaminated insects by a small bird - acute exposure scenario

Parameters/Assumptions		Value	Units	Notes
Body Weight (W)		0.08	kg	
Food ingestion rate (dry weight)		0.01124177	kg dw/day	[1]
Food ingestion rate (wet weight, A)		0.03626376	kg ww/day	[2]
Duration of exposure (D)		1	day	
Application rates (R)				
	Typical	5.4	lb/acre	
	Maximum	10.8		
Residue rate - insects (rr)				
	Typical	33	mg/kg per lb/acre	
	Maximum	58		
Concentration on insects (C): R × rr				
	Typical	178.2	mg/kg insect	
	Maximum	626.4		
Drift (Drift)				
	Typical	1	unitless	
	Maximum	1		
Proportion of Diet Contaminated (Prop)				
	Typical	1	unitless	
	Maximum	1		
Dose estimates: Drift × Prop × C × A ÷W				
	Typical	8.08E+01	mg/kg bw	
	Maximum	2.84E+02		

RISK QUOTIENTS - Ingestion	Toxicity Reference Value	Typical Application	Maximum Application
Small bird - acute exposure	217	3.72E-01	1.31E+00

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987 for all birds; where

Food Ingestion Rate (kg dw/day) = 0.0582*(BW)^0.651

[2] Assumes insects are 69% water (USEPA, 1993; Table 4-1 - value for grasshoppers and crickets)

Table C-151: Consumption of contaminated insects by a small bird - chronic exposure scenario

Parameters/Assumptions		Value	Units	Notes
Duration of exposure (T)		90	day	
Body Weight (W)		0.08	kg	
Food ingestion rate (dry weight)		0.011241767	kg dw/day	[1]
Food ingestion rate (wet weight, A)		0.036263763	kg ww/day	[2]
Half life on insect (t50)				
	Herbicide specific	5	days	
Application rates (R)				
	Typical	5.4	lb/acre	
	Maximum	10.8		
Residue rate - insects (rr)				
	Typical	33	mg/kg per lb/acre	
	Maximum	58		
Drift (Drift)				
	Typical	1	unitless	
	Maximum	1		
Decay Coefficient (k): ln(2)/t50				
	Typical	0.138629436	$days^{-1}$	
	Maximum	0.138629436		
Initial concentration on insects (C0): R × rr × Drift				
	Typical	178.2	mg/kg insect	
	Maximum	626.4		
Concentration on insects at time T: C0 * exp(-k*T)				
	Typical	0.000679779	mg/kg insect	
	Maximum	0.002389526		
Time-weighted Average Concentration on insects (CTWA): C0 * (1-exp(-k*T))/(k*T)				
	Typical	14.28262642	mg/kg insect	
	Maximum	50.2055959		
Proportion of Diet Contaminated (Prop)				
	Typical	1	unitless	
	Maximum	1		
Dose estimates (D): CTWA × A × Prop / W				
	Typical	6.47E+00	mg/kg bw	
	Maximum	2.28E+01		

RISK QUOTIENTS - Ingestion	Toxicity Reference Value	Typical Application	Maximum Application
Small bird - chronic exposure	27	2.40E-01	8.43E-01

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987 for all birds; where

Food Ingestion Rate (kg dw/day) = 0.0582*(BW)^0.651

[2] Assumes insects are 69% water (USEPA, 1993; Table 4-1 - value for grasshoppers and crickets)

Table C-152: Consumption of contaminated vegetation by a large bird - acute exposure scenario

Parameters/Assumptions		Value	Units	Notes
Body Weight (W)		3.72	kg	
Food ingestion rate (dry weight)		0.13688203	kg dw/day	[1]
Food ingestion rate (wet weight, A)		0.91254687	kg ww/day	[2]
Duration of exposure (D)		1	day	
Application rates (R)				
	Typical	5.4	lb/acre	
	Maximum	10.8		
Residue rate - vegetation (rr)				
	Typical	35	mg/kg per lb/acre	
	Maximum	125		
Concentration on vegetation (C): R × rr				
	Typical	189	mg/kg veg	
	Maximum	1350		
Drift (Drift)				
	Typical	1	unitless	
	Maximum	1		
Proportion of Diet Contaminated (Prop)				
	Typical	1	unitless	
	Maximum	1		
Dose estimates: Drift × Prop × C × A ÷W				
	Typical	4.64E+01		
	Maximum	3.31E+02		

RISK QUOTIENTS - Ingestion	Toxicity Reference Value	Typical Application	Maximum Application
Large bird - acute exposure	314	1.48E-01	1.05E+00

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987 for all birds; where

Food Ingestion Rate (kg dw/day) = 0.0582*(BW)^0.651

[2] Assumes vegetation is 85% water (USEPA, 1993; Table 4-2 - value for dicots)

Table C-153: Consumption of contaminated vegetation by a large bird - chronic exposure scenario

Parameters/Assumptions		Value	Units	Notes
Duration of exposure (T)		90	day	
Body Weight (W)		3.72	kg	
Food ingestion rate (dry weight)		0.13688203	kg dw/day	[1]
Food ingestion rate (wet weight, A)		0.912546869	kg ww/day	[2]
Half life on vegetation (t50)				
	Herbicide specific	5	days	
Application rates (R)				
	Typical	5.4	lb/acre	
	Maximum	10.8		
Residue rate - vegetation (rr)				
	Typical	35	mg/kg per lb/acre	
	Maximum	125		
Drift (Drift)				
	Typical	1	unitless	
	Maximum	1		
Decay Coefficient (k): ln(2)/t50				
	Typical	0.138629436	$days^{-1}$	
	Maximum	0.138629436		
Initial concentration on vegetation (C0): R × rr × Drift				
	Typical	189	mg/kg veg	
	Maximum	1350		
Concentration on vegetation at time T: C0 * exp(-k*T)				
	Typical	0.000720978	mg/kg veg	
	Maximum	0.005149841		
Time-weighted Average Concentration on vegetation (CTWA): C0 * (1-exp(-k*T))/(k*T)				
	Typical	15.14824014	mg/kg veg	
	Maximum	108.2017153		
Proportion of Diet Contaminated (Prop)				
	Typical	1	unitless	
	Maximum	1		
Dose estimates (D): CTWA × A × Prop / W				
	Typical	3.72E+00	mg/kg bw	
	Maximum	2.65E+01		

RISK QUOTIENTS - Ingestion	Toxicity Reference Value	Typical Application	Maximum Application
Large bird - chronic exposure	27	1.38E-01	9.83E-01

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using algorithm developed by Nagy, 1987 for all birds; where
Food Ingestion Rate (kg dw/day) = 0.0582*(BW)^0.651

[2] Assumes vegetation is 85% water (USEPA, 1993; Table 4-2 - value for dicots)

Table C-154: Impact to aquatic species from accidental spray drift to pond

OFF-SITE DRIFT - modeled in AgDrift
TYPICAL APPLICATION RATE

Mode of Application	Application Height or Type	Distance From Receptor (ft)	Pond Concentration (mg/L)	Risk Quotients - Acute: Fish	Risk Quotients - Acute: Aquatic Invertebrates	Risk Quotients - Acute: Non-Target Aquatic Plants	Risk Quotients - Chronic: Fish	Risk Quotients - Chronic: Aquatic Invertebrates	Risk Quotients - Chronic: Non-Target Aquatic Plants
Plane	Non-Forested	100	2.56E-03	1.28E-02	**5.95E-01**	**6.40E+00**	4.65E-02	1.28E-02	8.53E-02
Plane	Non-Forested	300	1.15E-03	5.73E-03	**2.66E-01**	**2.86E+00**	2.08E-02	5.73E-03	3.82E-02
Plane	Non-Forested	900	5.11E-04	2.56E-03	**1.19E-01**	**1.28E+00**	9.30E-03	2.56E-03	1.70E-02
Helicopter	Non-Forested	100	2.13E-03	1.07E-02	**4.96E-01**	**5.34E+00**	3.88E-02	1.07E-02	7.12E-02
Helicopter	Non-Forested	300	9.11E-04	4.55E-03	**2.12E-01**	**2.28E+00**	1.66E-02	4.55E-03	3.04E-02
Helicopter	Non-Forested	900	4.48E-04	2.24E-03	**1.04E-01**	**1.12E+00**	8.14E-03	2.24E-03	1.49E-02
Ground	Low Boom	25	6.82E-04	3.41E-03	**1.59E-01**	**1.70E+00**	1.24E-02	3.41E-03	2.27E-02
Ground	Low Boom	100	3.74E-04	1.87E-03	**8.69E-02**	9.35E-01	6.80E-03	1.87E-03	1.25E-02
Ground	Low Boom	900	7.22E-05	3.61E-04	1.68E-02	1.80E-01	1.31E-03	3.61E-04	2.41E-03
Ground	High Boom	25	1.09E-03	5.47E-03	**2.55E-01**	**2.74E+00**	1.99E-02	5.47E-03	3.65E-02
Ground	High Boom	100	5.77E-04	2.88E-03	**1.34E-01**	**1.44E+00**	1.05E-02	2.88E-03	1.92E-02
Ground	High Boom	900	9.16E-05	4.58E-04	2.13E-02	2.29E-01	1.67E-03	4.58E-04	3.05E-03

OFF-SITE DRIFT - modeled in AgDrift
MAXIMUM APPLICATION RATE

Mode of Application	Application Height or Type	Distance From Receptor (ft)	Pond Concentration (mg/L)	Risk Quotients - Acute: Fish	Risk Quotients - Acute: Aquatic Invertebrates	Risk Quotients - Acute: Non-Target Aquatic Plants	Risk Quotients - Chronic: Fish	Risk Quotients - Chronic: Aquatic Invertebrates	Risk Quotients - Chronic: Non-Target Aquatic Plants
Plane	Non-Forested	100	5.60E-03	2.80E-02	**1.30E+00**	**1.40E+01**	1.02E-01	2.80E-02	1.87E-01
Plane	Non-Forested	300	2.64E-03	1.32E-02	**6.14E-01**	**6.60E+00**	4.80E-02	1.32E-02	8.80E-02
Plane	Non-Forested	900	1.06E-03	5.28E-03	**2.46E-01**	**2.64E+00**	1.92E-02	5.28E-03	3.52E-02
Helicopter	Non-Forested	100	4.56E-03	2.28E-02	**1.06E+00**	**1.14E+01**	8.30E-02	2.28E-02	1.52E-01
Helicopter	Non-Forested	300	2.05E-03	1.02E-02	**4.76E-01**	**5.11E+00**	3.72E-02	1.02E-02	6.82E-02
Helicopter	Non-Forested	900	6.83E-04	3.42E-03	**1.59E-01**	**1.71E+00**	1.24E-02	3.42E-03	2.28E-02
Ground	Low Boom	25	1.36E-03	6.82E-03	**3.17E-01**	**3.41E+00**	2.48E-02	6.82E-03	4.54E-02
Ground	Low Boom	100	7.48E-04	3.74E-03	**1.74E-01**	**1.87E+00**	1.36E-02	3.74E-03	2.49E-02
Ground	Low Boom	900	1.44E-04	7.22E-04	3.36E-02	3.61E-01	2.62E-03	7.22E-04	4.81E-03
Ground	High Boom	25	2.10E-02	**1.05E-01**	**4.87E+00**	**5.24E+01**	3.81E-01	1.05E-01	6.99E-01
Ground	High Boom	100	5.94E-03	2.97E-02	**1.38E+00**	**1.48E+01**	1.08E-01	2.97E-02	1.98E-01
Ground	High Boom	900	5.02E-04	2.51E-03	**1.17E-01**	**1.26E+00**	9.13E-03	2.51E-03	1.67E-02

RQ = Risk Quotient = Estimated Dose/Toxicity Reference Value

Shading and boldface indicates plant RQs greater than 1.
Shading and boldface indicates acute RQs greater than 0.05 for fish and invertebrates.
Shading and boldface indicates chronic RQs greater than 0.5 for fish and invertebrates.

Table C-155: Impact to aquatic species from accidental spray drift to stream

OFF-SITE DRIFT - modeled in AgDrift TYPICALAPPLICATION RATE				**Risk Quotients - Acute**			**Risk Quotients - Chronic**		
Mode of Application	**Application Height or Type**	**Distance From Receptor (ft)**	**Stream Concentration (mg/L)**	**Fish**	**Aquatic Invertebrates**	**Non-Target Aquatic Plants**	**Fish**	**Aquatic Invertebrates**	**Non-Target Aquatic Plants**
Plane	Non-Forested	100	3.39E-03	1.69E-02	**7.87E-01**	**8.47E+00**	6.16E-02	1.69E-02	1.13E-01
Plane	Non-Forested	300	1.23E-03	6.15E-03	**2.86E-01**	**3.07E+00**	2.23E-02	6.15E-03	4.10E-02
Plane	Non-Forested	900	5.22E-04	2.61E-03	**1.21E-01**	**1.30E+00**	9.49E-03	2.61E-03	1.74E-02
Helicopter	Non-Forested	100	2.84E-03	1.42E-02	**6.59E-01**	**7.09E+00**	5.16E-02	1.42E-02	9.45E-02
Helicopter	Non-Forested	300	9.93E-04	4.97E-03	**2.31E-01**	**2.48E+00**	1.81E-02	4.97E-03	3.31E-02
Helicopter	Non-Forested	900	4.55E-04	2.28E-03	**1.06E-01**	**1.14E+00**	8.28E-03	2.28E-03	1.52E-02
Ground	Low Boom	25	1.23E-03	6.13E-03	**2.85E-01**	**3.07E+00**	2.23E-02	6.13E-03	4.09E-02
Ground	Low Boom	100	3.59E-04	1.80E-03	**8.36E-02**	8.98E-01	6.53E-03	1.80E-03	1.20E-02
Ground	Low Boom	900	3.72E-05	1.86E-04	8.65E-03	9.30E-02	6.76E-04	1.86E-04	1.24E-03
Ground	High Boom	25	2.05E-03	1.03E-02	**4.78E-01**	**5.14E+00**	3.74E-02	1.03E-02	6.85E-02
Ground	High Boom	100	5.82E-04	2.91E-03	**1.35E-01**	**1.45E+00**	1.06E-02	2.91E-03	1.94E-02
Ground	High Boom	900	4.92E-05	2.46E-04	1.14E-02	1.23E-01	8.94E-04	2.46E-04	1.64E-03

OFF-SITE DRIFT - modeled in AgDrift MAXIMUM APPLICATION RATE				**Risk Quotients - Acute**			**Risk Quotients - Chronic**		
Mode of Application	**Application Height or Type**	**Distance From Receptor (ft)**	**Stream Concentration (mg/L)**	**Fish**	**Aquatic Invertebrates**	**Non-Target Aquatic Plants**	**Fish**	**Aquatic Invertebrates**	**Non-Target Aquatic Plants**
Plane	Non-Forested	100	7.36E-03	3.68E-02	**1.71E+00**	**1.84E+01**	1.34E-01	3.68E-02	2.45E-01
Plane	Non-Forested	300	2.85E-03	1.43E-02	**6.64E-01**	**7.14E+00**	5.19E-02	1.43E-02	9.51E-02
Plane	Non-Forested	900	1.09E-03	5.46E-03	**2.54E-01**	**2.73E+00**	1.99E-02	5.46E-03	3.64E-02
Helicopter	Non-Forested	100	6.03E-03	3.01E-02	**1.40E+00**	**1.51E+01**	1.10E-01	3.01E-02	2.01E-01
Helicopter	Non-Forested	300	2.22E-03	1.11E-02	**5.16E-01**	**5.54E+00**	4.03E-02	1.11E-02	7.39E-02
Helicopter	Non-Forested	900	7.25E-04	3.62E-03	**1.69E-01**	**1.81E+00**	1.32E-02	3.62E-03	2.42E-02
Ground	Low Boom	25	2.45E-03	1.23E-02	**5.71E-01**	**6.14E+00**	4.46E-02	1.23E-02	8.18E-02
Ground	Low Boom	100	7.19E-04	3.60E-03	**1.67E-01**	**1.80E+00**	1.31E-02	3.60E-03	2.40E-02
Ground	Low Boom	900	7.45E-05	3.72E-04	1.73E-02	1.86E-01	1.35E-03	3.72E-04	2.48E-03
Ground	High Boom	25	4.29E-04	2.15E-03	**9.98E-02**	**1.07E+00**	7.81E-03	2.15E-03	1.43E-02
Ground	High Boom	100	2.26E-04	1.13E-03	**5.26E-02**	5.65E-01	4.11E-03	1.13E-03	7.54E-03
Ground	High Boom	900	3.59E-05	1.80E-04	8.35E-03	8.98E-02	6.53E-04	1.80E-04	1.20E-03

RQ = Risk Quotient = Estimated Dose/Toxicity Reference Value

Shading and boldface indicates plant RQs greater than 1.
Shading and boldface indicates acute RQs greater than 0.05 for fish and invertebrates.
Shading and boldface indicates chronic RQs greater than 0.5 for fish and invertebrates.

Table C-156: Potential risk to predatory bird from consumption of contaminated fish from pond. Pond impacted by regular application of herbicide.

Parameters/ Assumptions		Value	Units	Notes
Body Weight (W)		5.15	kg	
Food ingestion rate (dry weight)		1.02E-01	kg dw/day	[1]
Food ingestion rate (wet weight, A)		4.07E-01	kg ww/day	[2]
Bioconcentration factor (BCF)		3.01	L/kg fish	
Food Chain Multiplier Trophic Level 2 (FCM_TL2)		1	unitless	
Food Chain Multiplier Trophic Level 3 (FCM_TL3)		1	unitless	
Proportion of Diet Contaminated (Prop)		1	unitless	
Toxicity reference value (TRV)		100	mg/kg-bw/day	
Concentration in Fish = Pond_conc x BCF x FCM_TL2 x FCM_TL3				
	Typical	5.06E-02	mg a.i./kg bw fish	
	Maximum	4.39E-01	mg a.i./kg bw fish	
Dose Estimate = (Concentration in fish x A) / W				
	Typical	4.00E-03	mg a.i./kg bw fish	
	Maximum	3.47E-02	mg a.i./kg bw fish	
Toxicity reference value (TRV)		100	mg/kg-bw/day	

RISK QUOTIENTS - Ingestion	Toxicity Reference Value	Typical Application	Maximum Application
Piscivorous bird - chronic exposure	100	1.48E-04	1.28E-03

Risk Quotient = Estimated Dose/Toxicity Reference Value

[1] Calculated using alorithm developed by Nagy, 1987 for all birds; where
Food Ingestion Rate (kg dw/day) = 0.0582*(BW)^0.651

[2] Assumes fish are 75% water (USEPA, 1993; Table 4-1 - value for bony fishes)

Table C-157: Impact to non-target terrrestrial plants from direct spray and spray drift

DIRECT SPRAY	Terrestrial Concentration (lb a.e./acre)	Typical Species RQ	Threatened & Endangered Species RQ
Typical application rate	5.4	**7.71E+03**	**1.80E+04**
Maximum application rate	10.8	**1.54E+04**	**3.60E+04**

OFF-SITE DRIFT - modeled in AgDrift
TYPICAL APPLICATION RATE

Mode of Application	Application Height or Type	Distance From Receptor (ft)	Soil Concentration (mg a.e./kg)	Typical Species RQ	Threatened & Endangered Species RQ
Plane	Non-Forested	100	1.81E-02	**2.59E+01**	**6.03E+01**
Plane	Non-Forested	300	9.30E-03	**1.33E+01**	**3.10E+01**
Plane	Non-Forested	900	4.40E-03	**6.29E+00**	**1.47E+01**
Helicopter	Non-Forested	100	1.48E-02	**2.11E+01**	**4.93E+01**
Helicopter	Non-Forested	300	7.40E-03	**1.06E+01**	**2.47E+01**
Helicopter	Non-Forested	900	3.80E-03	**5.43E+00**	**1.27E+01**
Ground	Low Boom	25	4.50E-03	**6.43E+00**	**1.50E+01**
Ground	Low Boom	100	2.80E-03	**4.00E+00**	**9.33E+00**
Ground	Low Boom	900	6.00E-04	8.57E-01	**2.00E+00**
Ground	High Boom	25	7.10E-03	**1.01E+01**	**2.37E+01**
Ground	High Boom	100	4.20E-03	**6.00E+00**	**1.40E+01**
Ground	High Boom	900	8.00E-04	**1.14E+00**	**2.67E+00**

OFF-SITE DRIFT - modeled in AgDrift
MAXIMUM APPLICATION RATE

Mode of Application	Application Height or Type	Distance From Receptor (ft)	Soil Concentration (mg a.e./kg)	Typical Species RQ	Threatened & Endangered Species RQ
Plane	Non-Forested	100	4.02E-02	**5.74E+01**	**1.34E+02**
Plane	Non-Forested	300	2.12E-02	**3.03E+01**	**7.07E+01**
Plane	Non-Forested	900	8.90E-03	**1.27E+01**	**2.97E+01**
Helicopter	Non-Forested	100	3.22E-02	**4.60E+01**	**1.07E+02**
Helicopter	Non-Forested	300	1.65E-02	**2.36E+01**	**5.50E+01**
Helicopter	Non-Forested	900	5.60E-03	**8.00E+00**	**1.87E+01**
Ground	Low Boom	25	9.00E-03	**1.29E+01**	**3.00E+01**
Ground	Low Boom	100	5.50E-03	**7.86E+00**	**1.83E+01**
Ground	Low Boom	900	1.20E-03	**1.71E+00**	**4.00E+00**
Ground	High Boom	25	1.42E-02	**2.03E+01**	**4.73E+01**
Ground	High Boom	100	8.40E-03	**1.20E+01**	**2.80E+01**
Ground	High Boom	900	1.50E-03	**2.14E+00**	**5.00E+00**

RQ = Risk Quotient = Estimated Dose/Toxicity Reference Value
Shading and boldface indicates plant RQs greater than 1.

Table C-158: Consumption of contaminated fish from pond by predatory bird - one time exposure. Pond impacted by spray drift modeled in AgDrift.

Parameters/ Assumptions	Value	Units	Notes
Body Weight (W)	5.15	kg	
Food ingestion rate (dry weight)	0.101786153	kg dw/day	[1]
Food ingestion rate (wet weight, A)	0.40714461	kg ww/day	[2]
Bioconcentration factor (BCF)	1	L/kg fish	
Proportion of Diet Contaminated (Prop)	1	unitless	
Toxicity reference value (TRV)	27	mg/kg-bw/day	

TYPICAL APPLICATION RATE

Mode of Application	Application Height or Type	Distance From Receptor (ft)	Pond Concentration (mg/L)	Concentration in fish (C_{Fish}): WC × BCF	Dose estimate (D): C_{Fish} × A × Prop / W	Risk Quotient
Plane	Non-Forested	100	2.56E-03	2.56E-03	2.02E-04	7.49E-06
Plane	Non-Forested	300	1.15E-03	1.15E-03	9.06E-05	3.35E-06
Plane	Non-Forested	900	5.11E-04	5.11E-04	4.04E-05	1.50E-06
Helicopter	Non-Forested	100	2.13E-03	2.13E-03	1.69E-04	6.25E-06
Helicopter	Non-Forested	300	9.11E-04	9.11E-04	7.20E-05	2.67E-06
Helicopter	Non-Forested	900	4.48E-04	4.48E-04	3.54E-05	1.31E-06
Ground	Low Boom	25	6.82E-04	6.82E-04	5.39E-05	2.00E-06
Ground	Low Boom	100	3.74E-04	3.74E-04	2.96E-05	1.09E-06
Ground	Low Boom	900	7.22E-05	7.22E-05	5.70E-06	2.11E-07
Ground	High Boom	25	1.09E-03	1.09E-03	8.65E-05	3.21E-06
Ground	High Boom	100	5.77E-04	5.77E-04	4.56E-05	1.69E-06
Ground	High Boom	900	9.16E-05	9.16E-05	7.24E-06	2.68E-07

MAXIMUM APPLICATION RATE

Mode of Application	Application Height or Type	Distance From Receptor (ft)	Pond Concentration (mg/L)	Concentration in fish (C_{Fish}): WC × BCF	Dose estimate (D): C_{Fish} × A × Prop / W	Risk Quotient
Plane	Non-Forested	100	5.60E-03	5.60E-03	4.42E-04	1.64E-05
Plane	Non-Forested	300	2.64E-03	2.64E-03	2.09E-04	7.73E-06
Plane	Non-Forested	900	1.06E-03	1.06E-03	8.35E-05	3.09E-06
Helicopter	Non-Forested	100	4.56E-03	4.56E-03	3.61E-04	1.34E-05
Helicopter	Non-Forested	300	2.05E-03	2.05E-03	1.62E-04	5.99E-06
Helicopter	Non-Forested	900	6.83E-04	6.83E-04	5.40E-05	2.00E-06
Ground	Low Boom	25	1.36E-03	1.36E-03	1.08E-04	3.99E-06
Ground	Low Boom	100	7.48E-04	7.48E-04	5.91E-05	2.19E-06
Ground	Low Boom	900	1.44E-04	1.44E-04	1.14E-05	4.23E-07
Ground	High Boom	25	2.10E-02	2.10E-02	1.66E-03	6.14E-05
Ground	High Boom	100	5.94E-03	5.94E-03	4.69E-04	1.74E-05
Ground	High Boom	900	5.02E-04	5.02E-04	3.97E-05	1.47E-06

Risk Quotient = Estimated Dose/Toxicity Reference Value
Shading and boldface indicates piscivorous bird RQs greater than 0.1.

[1] Calculated using alorithm developed by Nagy, 1987 for all birds; where
Food Ingestion Rate (kg dw/day) = 0.0582*(BW)^0.651
[2] Assumes fish are 75% water (USEPA, 1993; Table 4-1 - value for bony fishes)

Table C-159: Impact to aquatic species from accidental spill to pond

Parameters/Assumptions	Value	Units
Volume of pond (Vp)	1011715	L
Volume of spill		
Truck ($Vspill_t$)	757	L
Helicopter($Vspill_h$)	529.9	L
Herbicide concentration		
Truck mixture (Cm_t)	51770.61	mg a.e./L
Helicopter mixture (Cm_h)	258853.03	mg a.e./L

			Risk Quotients		
Scenario	**Concentrations in water (Cw): Cm × Vspill / Vp**	**Units**	**Fish**	**Aquatic Invertebrates**	**Non-Target Aquatic Plants**
Truck spill into pond	38.74	mg a.e./L	**1.94E+02**	**9.01E+03**	**9.68E+04**
Helicopter spill into pond	135.58	mg a.e./L	**6.78E+02**	**3.15E+04**	**3.39E+05**

Shading and boldface indicates plant RQs greater than 1.
Shading and boldface indicates acute RQs greater than 0.05 for fish and invertebrates.

Table C-160: Impact to aquatic species from direct spray of pond and stream

Parameters/Assumptions		Value	Units
Application rates (R)			
	Typical	5.4	lb/acre
	Maximum	10.8	lb/acre
Area of pond (Area)		0.25	acre
Volume of pond (Vol)		1011715	L
Mass sprayed on pond (R x Area)			
	Typical	612349.2	mg
	Maximum	1224698.4	mg
Concentration in pond water (Mass/Volume)			
	Typical	0.605258596	mg/L
	Maximum	1.210517191	mg/L
Width of stream		2	m
Length of stream impacted by direct spray		636.15	m
Area of stream impacted by spray (Area)		1272.3	m2
Depth of stream		0.2	m
Instantaneous volume of stream impacted by direct spray (Vol)		254460	L
Mass sprayed on stream (R x Area)			
	Typical	6870.420	lb
	Maximum	13740.840	lb
Mass sprayed on stream - converted to mg			
	Typical	770078.123	mg
	Maximum	1540156.245	mg
Concentration in stream water (Mass/Vol)			
	Typical	3.026322891	mg/L
	Maximum	6.052645781	mg/L

Scenario		Concentration in water (mg/L)	Risk Quotients Fish	Aquatic Invertebrates	Non-Target Aquatic Plants
Acute					
Direct spray to pond					
	Typical application	6.05E-01	**3.03E+00**	**1.41E+02**	**1.51E+03**
	Maximum application	1.21E+00	**6.05E+00**	**2.82E+02**	**3.03E+03**
Direct spray to stream					
	Typical application	3.03E+00	**1.51E+01**	**7.04E+02**	**7.57E+03**
	Maximum application	6.05E+00	**3.03E+01**	**1.41E+03**	**1.51E+04**
Chronic					
Direct spray to pond					
	Typical application	6.05E-01	**1.10E+01**	**3.03E+00**	**2.02E+01**
	Maximum application	1.21E+00	**2.20E+01**	**6.05E+00**	**4.04E+01**
Direct spray to stream					
	Typical application	3.03E+00	**5.50E+01**	**1.51E+01**	**1.01E+02**
	Maximum application	6.05E+00	**1.10E+02**	**3.03E+01**	**2.02E+02**

Shading and boldface indicates plant RQs greater than 1.
Shading and boldface indicates acute RQs greater than 0.05 for fish and invertebrates.

APPENDIX D – RISK QUOTIENTS

Table D-1 - Risk Quotients for Direct Spray and Spill Scenarios – Terrestrial Application for Annual and Perennial Vegetation - 2,4-D acid and salts

Terrestrial Animals	Typical Application Rate	Maximum Application Rate
Direct Spray of Terrestrial Wildlife		
Small mammal - 100% absorption	1.10E-02	2.20E-02
Pollinating insect - 100% absorption	**1.13E+00**	**2.26E+00**
Small mammal - 1st order dermal adsorption	3.13E-04	6.25E-04
Indirect Contact With Foliage After Direct Spray		
Small mammal - 100% absorption	1.10E-03	2.20E-03
Pollinating insect - 100% absorption	**1.13E-01**	**2.26E-01**
Small mammal - 1st order dermal adsorption	3.13E-05	6.25E-05
Ingestion of Prey Items Contaminated by Direct Spray		
Small mammalian herbivore - acute exposure	9.27E-04	8.65E-03
Small mammalian herbivore - chronic exposure	1.55E-02	1.44E-01
Large mammalian herbivore - acute exposure	**1.65E-01**	**3.95E-01**
Large mammalian herbivore - chronic exposure	**1.19E+00**	**2.84E+00**
Small avian insectivore - acute exposure	6.89E-02	**2.42E-01**
Small avian insectivore - chronic exposure	7.81E-02	2.74E-01
Large avian herbivore - acute exposure	2.73E-02	**1.95E-01**
Large avian herbivore - chronic exposure	4.48E-02	3.20E-01
Large mammalian carnivore - acute exposure	4.17E-02	8.33E-02
Large mammalian carnivore - chronic exposure	9.46E-02	1.89E-01

	Typical Species		Threatened & Endangered Species	
Terrestrial Plants	Typical Application Rate	Maximum Application Rate	Typical Application Rate	Maximum Application Rate
Direct Spray of Non-Target Terrestrial Plants				
Accidental direct spray	**5.00E+02**	**1.00E+03**	**3.33E+03**	**6.67E+03**

		Fish		Aquatic Invertebrates		Non-Target Aquatic Plants	
Aquatic Species		Typical Application	Maximum Application	Typical Application	Maximum Application	Typical Application	Maximum Application
Accidental Direct Spray Over Pond							
	Acute	**6.23E-02**	**1.25E-01**	8.62E-03	1.72E-02	**1.12E+00**	**2.24E+00**
	Chronic	**2.04E+00**	**4.08E+00**	**5.60E-01**	**1.12E+00**	**3.74E+00**	**7.47E+00**
Accidental Direct Spray Over Stream							
	Acute	**3.11E-01**	**6.23E-01**	4.31E-02	**8.62E-02**	**5.60E+00**	**1.12E+01**
	Chronic	**1.02E+01**	**2.04E+01**	**2.80E+00**	**5.60E+00**	**1.87E+01**	**3.74E+01**
Accidental spill							
Truck spill into pond		--	**3.99E+00**	--	**5.52E-01**	--	**7.17E+01**
Helicopter spill into pond		--	**1.39E+01**	--	**1.93E+00**	--	**2.51E+02**

Shading and boldface indicates plant RQs greater than 1.
Shading and boldface indicates terrestrial animal acute scenario RQs greater than 0.1 (LOC for acute risk to endangered species - most conservative).
Shading and boldface indicates terrestrial animal chronic scenario RQs greater than 1.
Shading and boldface indicates RQs greater than 0.05 for fish and invertebrates (LOC for acute risk to endangered species).
Shading and boldface indicates chronic RQs greater than 0.5 for fish and invertebrates (LOC for chronic risk to endangered species).

Table D-2 - Risk Quotients for Direct Spray and Spill Scenarios – Terrestrial Application for Annual and Perennial Vegetation - 2,4-D esters

Terrestrial Plants	Typical Species: Typical Application Rate	Typical Species: Maximum Application Rate	Threatened & Endangered Species: Typical Application Rate	Threatened & Endangered Species: Maximum Application Rate
Direct Spray of Non-Target Terrestrial Plants				
Accidental direct spray	**1.43E+03**	**2.86E+03**	**3.33E+03**	**6.67E+03**

Aquatic Species		Fish: Typical Application	Fish: Maximum Application	Aquatic Invertebrates: Typical Application	Aquatic Invertebrates: Maximum Application	Non-Target Aquatic Plants: Typical Application	Non-Target Aquatic Plants: Maximum Application
Accidental Direct Spray Over Pond							
	Acute	**5.60E-01**	**1.12E+00**	**2.61E+01**	**5.21E+01**	**2.80E+02**	**5.60E+02**
Accidental Direct Spray Over Stream							
	Acute	**2.80E+00**	**5.60E+00**	**1.30E+02**	**2.61E+02**	**1.40E+03**	**2.80E+03**
Accidental spill							
Truck spill into pond		--	**3.59E+01**	--	**1.67E+03**	--	**1.79E+04**
Helicopter spill into pond		--	**1.26E+02**	--	**5.84E+03**	--	**6.28E+04**

Shading and boldface indicates plant RQs greater than 1.
Shading and boldface indicates RQs greater than 0.05 for fish and invertebrates (LOC for acute risk to endangered species).

Table D-3 – Risk Quotients for Direct Spray and Spill Scenarios – Terrestrial Application for Woody Vegetation- 2,4-D acid and salts

Terrestrial Animals	Typical Application Rate	Maximum Application Rate
Direct Spray of Terrestrial Wildlife		
Small mammal - 100% absorption	2.20E-02	4.41E-02
Pollinating insect - 100% absorption	**2.26E+00**	**4.53E+00**
Small mammal - 1st order dermal adsorption	6.25E-04	1.25E-03
Indirect Contact With Foliage After Direct Spray		
Small mammal - 100% absorption	2.20E-03	4.41E-03
Pollinating insect - 100% absorption	**2.26E-01**	**4.53E-01**
Small mammal - 1st order dermal adsorption	6.25E-05	1.25E-04
Ingestion of Prey Items Contaminated by Direct Spray		
Small mammalian herbivore - acute exposure	1.85E-03	1.73E-02
Small mammalian herbivore - chronic exposure	3.09E-02	2.89E-01
Large mammalian herbivore - acute exposure	**3.30E-01**	**7.89E-01**
Large mammalian herbivore - chronic exposure	**2.37E+00**	**5.67E+00**
Small avian insectivore - acute exposure	**1.38E-01**	**4.85E-01**
Small avian insectivore - chronic exposure	1.56E-01	5.49E-01
Large avian herbivore - acute exposure	5.47E-02	**3.91E-01**
Large avian herbivore - chronic exposure	8.96E-02	6.40E-01
Large mammalian carnivore - acute exposure	8.33E-02	**1.67E-01**
Large mammalian carnivore - chronic exposure	1.89E-01	3.78E-01

	Typical Species		Threatened & Endangered Species	
Terrestrial Plants	Typical Application Rate	Maximum Application Rate	Typical Application Rate	Maximum Application Rate
Direct Spray of Non-Target Terrestrial Plants				
Accidental direct spray	**1.00E+03**	**2.00E+03**	**6.67E+03**	**1.33E+04**

		Fish		Aquatic Invertebrates		Non-Target Aquatic Plants	
Aquatic Species		Typical Application	Maximum Application	Typical Application	Maximum Application	Typical Application	Maximum Application
Accidental Direct Spray Over Pond							
	Acute	**1.25E-01**	**2.49E-01**	1.72E-02	3.45E-02	**2.24E+00**	**4.48E+00**
	Chronic	**4.08E+00**	**8.15E+00**	**1.12E+00**	**2.24E+00**	**7.47E+00**	**1.49E+01**
Accidental Direct Spray Over Stream							
	Acute	**6.23E-01**	**1.25E+00**	**8.62E-02**	**1.72E-01**	**1.12E+01**	**2.24E+01**
	Chronic	**2.04E+01**	**4.08E+01**	**5.60E+00**	**1.12E+01**	**3.74E+01**	**7.47E+01**
Accidental spill							
Truck spill into pond		--	**7.97E+00**	--	**1.10E+00**	--	**1.43E+02**
Helicopter spill into pond		--	**2.79E+01**	--	**3.86E+00**	--	**5.02E+02**

Shading and boldface indicates plant RQs greater than 1.
Shading and boldface indicates terrestrial animal acute scenario RQs greater than 0.1 (LOC for acute risk to endangered species - most conservative).
Shading and boldface indicates terrestrial animal chronic scenario RQs greater than 1.
Shading and boldface indicates RQs greater than 0.05 for fish and invertebrates (LOC for acute risk to endangered species).
Shading and boldface indicates chronic RQs greater than 0.5 for fish and invertebrates (LOC for chronic risk to endangered species).

Table D-4 – Risk Quotients for Direct Spray and Spill Scenarios – Terrestrial Application for Woody Vegetation - 2,4-D esters

Terrestrial Plants	Typical Species: Typical Application Rate	Typical Species: Maximum Application Rate	Threatened & Endangered Species: Typical Application Rate	Threatened & Endangered Species: Maximum Application Rate
Direct Spray of Non-Target Terrestrial Plants				
Accidental direct spray	**2.86E+03**	**5.71E+03**	**6.67E+03**	**1.33E+04**

Aquatic Species		Fish: Typical Application	Fish: Maximum Application	Aquatic Invertebrates: Typical Application	Aquatic Invertebrates: Maximum Application	Non-Target Aquatic Plants: Typical Application	Non-Target Aquatic Plants: Maximum Application
Accidental Direct Spray Over Pond							
	Acute	**1.12E+00**	**2.24E+00**	**5.21E+01**	**1.04E+02**	**5.60E+02**	**1.12E+03**
Accidental Direct Spray Over Stream							
	Acute	**5.60E+00**	**1.12E+01**	**2.61E+02**	**5.21E+02**	**2.80E+03**	**5.60E+03**
Accidental spill							
Truck spill into pond		--	**7.17E+01**	--	**3.34E+03**	--	**3.59E+04**
Helicopter spill into pond		--	**2.51E+02**	--	**1.17E+04**	--	**1.26E+05**

Shading and boldface indicates plant RQs greater than 1.
Shading and boldface indicates RQs greater than 0.05 for fish and invertebrates (LOC for acute risk to endangered species).

Table D-5 – Risk Quotients for Direct Spray and Spill Scenarios – Aquatic Application for Floating and Emerged Vegetation- 2,4-D acid and salts

Terrestrial Animals	Typical Application Rate	Maximum Application Rate
Direct Spray of Terrestrial Wildlife		
Small mammal - 100% absorption	2.20E-02	4.41E-02
Pollinating insect - 100% absorption	**2.26E+00**	**4.53E+00**
Small mammal - 1st order dermal adsorption	6.25E-04	1.25E-03
Indirect Contact With Foliage After Direct Spray		
Small mammal - 100% absorption	2.20E-03	4.41E-03
Pollinating insect - 100% absorption	**2.26E-01**	**4.53E-01**
Small mammal - 1st order dermal adsorption	6.25E-05	1.25E-04
Ingestion of Prey Items Contaminated by Direct Spray		
Small mammalian herbivore - acute exposure	1.85E-03	1.73E-02
Small mammalian herbivore - chronic exposure	3.09E-02	2.89E-01
Large mammalian herbivore - acute exposure	**3.30E-01**	**7.89E-01**
Large mammalian herbivore - chronic exposure	**2.37E+00**	**5.67E+00**
Small avian insectivore - acute exposure	**1.38E-01**	**4.85E-01**
Small avian insectivore - chronic exposure	1.56E-01	5.49E-01
Large avian herbivore - acute exposure	5.47E-02	**3.91E-01**
Large avian herbivore - chronic exposure	8.96E-02	6.40E-01
Large mammalian carnivore - acute exposure	8.33E-02	**1.67E-01**
Large mammalian carnivore - chronic exposure	1.89E-01	3.78E-01

Semi-Aquatic Wildlife	Typical Application Rate	Maximum Application Rate
Ingestion of Prey Items Contaminated by Normal Application to Pond		
Avian piscivore - chronic exposure	1.48E-04	1.28E-03

	Typical Species		Threatened & Endangered Species	
Terrestrial Plants	Typical Application Rate	Maximum Application Rate	Typical Application Rate	Maximum Application Rate
Direct Spray of Non-Target Terrestrial Plants				
Accidental direct spray	**1.00E+03**	**2.00E+03**	**6.67E+03**	**1.33E+04**

		Fish		Aquatic Invertebrates		Non-Target Aquatic Plants	
Aquatic Species		Typical Application	Maximum Application	Typical Application	Maximum Application	Typical Application	Maximum Application
Direct Spray Over Pond							
	Acute	**1.25E-01**	**2.49E-01**	1.72E-02	3.45E-02	**2.24E+00**	**4.48E+00**
	Chronic	**4.08E+00**	**8.15E+00**	**1.12E+00**	**2.24E+00**	**7.47E+00**	**1.49E+01**
Direct Spray Over Stream							
	Acute	**6.23E-01**	**1.25E+00**	**8.62E-02**	**1.72E-01**	**1.12E+01**	**2.24E+01**
	Chronic	**2.04E+01**	**4.08E+01**	**5.60E+00**	**1.12E+01**	**3.74E+01**	**7.47E+01**
Accidental spill							
Truck spill into pond		--	**7.97E+00**	--	**1.10E+00**	--	**1.43E+02**
Helicopter spill into pond		--	**2.79E+01**	--	**3.86E+00**	--	**5.02E+02**

Shading and boldface indicates plant RQs greater than 1.
Shading and boldface indicates terrestrial animal acute scenario RQs greater than 0.1 (LOC for acute risk to endangered species - most conservative).
Shading and boldface indicates terrestrial animal chronic scenario RQs greater than 1.
Shading and boldface indicates RQs greater than 0.05 for fish and invertebrates (LOC for acute risk to endangered species).
Shading and boldface indicates chronic RQs greater than 0.5 for fish and invertebrates (LOC for chronic risk to endangered species).

Table D-6 – Risk Quotients for Direct Spray and Spill Scenarios – Aquatic Application for Floating and Emerged Vegetation - 2,4-D esters

Terrestrial Plants	Typical Species: Typical Application Rate	Typical Species: Maximum Application Rate	Threatened & Endangered Species: Typical Application Rate	Threatened & Endangered Species: Maximum Application Rate
Direct Spray of Non-Target Terrestrial Plants				
Accidental direct spray	**2.86E+03**	**5.71E+03**	**6.67E+03**	**1.33E+04**

Aquatic Species		Fish: Typical Application	Fish: Maximum Application	Aquatic Invertebrates: Typical Application	Aquatic Invertebrates: Maximum Application	Non-Target Aquatic Plants: Typical Application	Non-Target Aquatic Plants: Maximum Application
Direct Spray Over Pond							
	Acute	**1.12E+00**	**2.24E+00**	**5.21E+01**	**1.04E+02**	**5.60E+02**	**1.12E+03**
Direct Spray Over Stream							
	Acute	**5.60E+00**	**1.12E+01**	**2.61E+02**	**5.21E+02**	**2.80E+03**	**5.60E+03**
Accidental spill							
Truck spill into pond		--	**7.17E+01**	--	**3.34E+03**	--	**3.59E+04**
Helicopter spill into pond		--	**2.51E+02**	--	**1.17E+04**	--	**1.26E+05**

Shading and boldface indicates plant RQs greater than 1.
Shading and boldface indicates terrestrial animal acute scenario RQs greater than 0.1 (LOC for acute risk to endangered species - most conservative).
Shading and boldface indicates RQs greater than 0.05 for fish and invertebrates (LOC for acute risk to endangered species).

Table D-7 – Risk Quotients for Direct Spray and Spill Scenarios – Aquatic Application for Submerged Vegetation - 2,4-D acid and salts

Terrestrial Animals	Typical Application Rate	Maximum Application Rate
Direct Spray of Terrestrial Wildlife		
Small mammal - 100% absorption	5.95E-02	**1.19E-01**
Pollinating insect - 100% absorption	**6.11E+00**	**1.22E+01**
Small mammal - 1st order dermal adsorption	1.69E-03	3.38E-03
Indirect Contact With Foliage After Direct Spray		
Small mammal - 100% absorption	5.95E-03	1.19E-02
Pollinating insect - 100% absorption	**6.11E-01**	**1.22E+00**
Small mammal - 1st order dermal adsorption	1.69E-04	3.38E-04
Ingestion of Prey Items Contaminated by Direct Spray		
Small mammalian herbivore - acute exposure	5.00E-03	4.67E-02
Small mammalian herbivore - chronic exposure	8.35E-02	7.79E-01
Large mammalian herbivore - acute exposure	**8.91E-01**	**2.13E+00**
Large mammalian herbivore - chronic exposure	**6.41E+00**	**1.53E+01**
Small avian insectivore - acute exposure	**3.72E-01**	**1.31E+00**
Small avian insectivore - chronic exposure	4.22E-01	**1.48E+00**
Large avian herbivore - acute exposure	**1.48E-01**	**1.05E+00**
Large avian herbivore - chronic exposure	2.42E-01	**1.73E+00**
Large mammalian carnivore - acute exposure	**2.25E-01**	**4.50E-01**
Large mammalian carnivore - chronic exposure	5.11E-01	**1.02E+00**

Semi-Aquatic Wildlife	Typical Application Rate	Maximum Application Rate
Ingestion of Prey Items Contaminated by Normal Application to Pond		
Avian piscivore - chronic exposure	1.48E-04	1.28E-03

	Typical Species		Threatened & Endangered Species	
Terrestrial Plants	Typical Application Rate	Maximum Application Rate	Typical Application Rate	Maximum Application Rate
Direct Spray of Non-Target Terrestrial Plants				
Accidental direct spray	**2.70E+03**	**5.40E+03**	**1.80E+04**	**3.60E+04**

		Fish		Aquatic Invertebrates		Non-Target Aquatic Plants	
Aquatic Species		Typical Application	Maximum Application	Typical Application	Maximum Application	Typical Application	Maximum Application
Direct Spray Over Pond							
	Acute	**3.36E-01**	**6.73E-01**	4.66E-02	**9.31E-02**	**6.05E+00**	**1.21E+01**
	Chronic	**1.10E+01**	**2.20E+01**	**3.03E+00**	**6.05E+00**	**2.02E+01**	**4.04E+01**
Direct Spray Over Stream							
	Acute	**1.68E+00**	**3.36E+00**	**2.33E-01**	**4.66E-01**	**3.03E+01**	**6.05E+01**
	Chronic	**5.50E+01**	**1.10E+02**	**1.51E+01**	**3.03E+01**	**1.01E+02**	**2.02E+02**
Accidental spill							
Truck spill into pond		--	**2.15E+01**	--	**2.98E+00**	--	**3.87E+02**
Helicopter spill into pond		--	**7.53E+01**	--	**1.04E+01**	--	**1.36E+03**

Shading and boldface indicates plant RQs greater than 1.
Shading and boldface indicates terrestrial animal acute scenario RQs greater than 0.1 (LOC for acute risk to endangered species - most conservative).
Shading and boldface indicates terrestrial animal chronic scenario RQs greater than 1.
Shading and boldface indicates RQs greater than 0.05 for fish and invertebrates (LOC for acute risk to endangered species).
Shading and boldface indicates chronic RQs greater than 0.5 for fish and invertebrates (LOC for chronic risk to endangered species).

Table D-8 – Risk Quotients for Direct Spray and Spill Scenarios – Aquatic Application for Submerged Vegetation - 2,4-D esters

Terrestrial Plants	Typical Species: Typical Application Rate	Typical Species: Maximum Application Rate	Threatened & Endangered Species: Typical Application Rate	Threatened & Endangered Species: Maximum Application Rate
Direct Spray of Non-Target Terrestrial Plants				
Accidental direct spray	**7.71E+03**	**1.54E+04**	**1.80E+04**	**3.60E+04**

Aquatic Species		Fish: Typical Application	Fish: Maximum Application	Aquatic Invertebrates: Typical Application	Aquatic Invertebrates: Maximum Application	Non-Target Aquatic Plants: Typical Application	Non-Target Aquatic Plants: Maximum Application
Direct Spray Over Pond							
	Acute	**3.03E+00**	**6.05E+00**	**1.41E+02**	**2.82E+02**	**1.51E+03**	**3.03E+03**
Direct Spray Over Stream							
	Acute	**1.51E+01**	**3.03E+01**	**7.04E+02**	**1.41E+03**	**7.57E+03**	**1.51E+04**
Accidental spill							
Truck spill into pond		--	**1.94E+02**	--	**9.01E+03**	--	**9.68E+04**
Helicopter spill into pond		--	**6.78E+02**	--	**3.15E+04**	--	**3.39E+05**

Shading and boldface indicates plant RQs greater than 1.
Shading and boldface indicates RQs greater than 0.05 for fish and invertebrates (LOC for acute risk to endangered species).

Table D-9 - Risk Quotients for Off-site Drift Scenarios – Terrestrial Application for Annual and Perennial Vegetation - 2,4-D acid and salts

	Typical Species		Threatened & Endangered Species	
Terrestrial Plants	**Typical Application Rate**	**Maximum Application Rate**	**Typical Application Rate**	**Maximum Application Rate**
Off-site Drift to Plants				
Spray drift to off-site soil modeled by AgDrift				
plane_forest_100	**1.74E+01**	**3.53E+01**	**1.16E+02**	**2.35E+02**
plane_forest_300	**7.30E+00**	**1.52E+01**	**4.87E+01**	**1.01E+02**
plane_forest_900	**2.50E+00**	**5.55E+00**	**1.67E+01**	**3.70E+01**
plane_nonforest_100	**9.05E+00**	**2.01E+01**	**6.03E+01**	**1.34E+02**
plane_nonforest_300	**4.65E+00**	**1.06E+01**	**3.10E+01**	**7.07E+01**
plane_nonforest_900	**2.20E+00**	**4.45E+00**	**1.47E+01**	**2.97E+01**
heli_forest_100	9.50E-01	**1.80E+00**	**6.33E+00**	**1.20E+01**
heli_forest_300	3.00E-01	6.00E-01	**2.00E+00**	**4.00E+00**
heli_forest_900	5.00E-02	1.00E-01	3.33E-01	6.67E-01
heli_nonforest_100	**7.40E+00**	**1.61E+01**	**4.93E+01**	**1.07E+02**
heli_nonforest_300	**3.70E+00**	**8.25E+00**	**2.47E+01**	**5.50E+01**
heli_nonforest_900	**1.90E+00**	**2.80E+00**	**1.27E+01**	**1.87E+01**
ground_lowboom_25	**2.25E+00**	**4.50E+00**	**1.50E+01**	**3.00E+01**
ground_lowboom_100	**1.40E+00**	**2.75E+00**	**9.33E+00**	**1.83E+01**
ground_lowboom_900	3.00E-01	6.00E-01	**2.00E+00**	**4.00E+00**
ground_highboom_25	**3.55E+00**	**7.10E+00**	**2.37E+01**	**4.73E+01**
ground_highboom_100	**2.10E+00**	**4.20E+00**	**1.40E+01**	**2.80E+01**
ground_highboom_900	4.00E-01	7.50E-01	**2.67E+00**	**5.00E+00**

Table D-9 - Risk Quotients for Off-site Drift Scenarios – Terrestrial Application for Annual and Perennial Vegetation - 2,4-D acid and salts

Aquatic Receptors	Fish		Aquatic Invertebrates		Non-Target Aquatic Plants	
	Typical Application	Maximum Application	Typical Application	Maximum Application	Typical Application	Maximum Application
Off-site Drift to Pond						
Acute Toxicity						
plane_forest_100	2.78E-03	5.62E-03	3.85E-04	7.78E-04	5.00E-02	1.01E-01
plane_forest_300	1.05E-03	2.17E-03	1.45E-04	3.00E-04	1.88E-02	3.90E-02
plane_forest_900	3.33E-04	7.27E-04	4.61E-05	1.01E-04	6.00E-03	1.31E-02
plane_nonforest_100	1.42E-03	3.11E-03	1.97E-04	4.30E-04	2.56E-02	5.60E-02
plane_nonforest_300	6.36E-04	1.47E-03	8.81E-05	2.03E-04	1.15E-02	2.64E-02
plane_nonforest_900	2.84E-04	5.87E-04	3.93E-05	8.13E-05	5.11E-03	1.06E-02
heli_forest_100	1.64E-04	3.09E-04	2.28E-05	4.27E-05	2.96E-03	5.55E-03
heli_forest_300	4.65E-05	9.05E-05	6.44E-06	1.25E-05	8.38E-04	1.63E-03
heli_forest_900	7.81E-06	1.62E-05	1.08E-06	2.24E-06	1.41E-04	2.92E-04
heli_nonforest_100	1.19E-03	2.54E-03	1.64E-04	3.51E-04	2.13E-02	4.56E-02
heli_nonforest_300	5.06E-04	1.14E-03	7.00E-05	1.57E-04	9.11E-03	2.05E-02
heli_nonforest_900	2.49E-04	3.80E-04	3.44E-05	5.26E-05	4.48E-03	6.83E-03
ground_lowboom_25	3.79E-04	7.57E-04	5.24E-05	1.05E-04	6.82E-03	1.36E-02
ground_lowboom_100	2.08E-04	4.15E-04	2.88E-05	5.75E-05	3.74E-03	7.48E-03
ground_lowboom_900	1.05E-04	2.11E-04	1.46E-05	2.92E-05	1.90E-03	3.80E-03
ground_highboom_25	5.82E-03	1.16E-02	8.06E-04	1.61E-03	1.05E-01	2.10E-01
ground_highboom_100	1.65E-03	3.30E-03	2.28E-04	4.57E-04	2.97E-02	5.94E-02
ground_highboom_900	1.39E-04	2.79E-04	1.93E-05	3.86E-05	2.51E-03	5.02E-03
Off-site Drift to Pond						
Chronic Toxicity						
plane_forest_100	9.10E-02	1.84E-01	2.50E-02	5.06E-02	1.67E-01	3.37E-01
plane_forest_300	3.42E-02	7.10E-02	9.42E-03	1.95E-02	6.28E-02	1.30E-01
plane_forest_900	1.09E-02	2.38E-02	3.00E-03	6.54E-03	2.00E-02	4.36E-02
plane_nonforest_100	4.65E-02	1.02E-01	1.28E-02	2.80E-02	8.53E-02	1.87E-01
plane_nonforest_300	2.08E-02	4.80E-02	5.73E-03	1.32E-02	3.82E-02	8.80E-02
plane_nonforest_900	9.30E-03	1.92E-02	2.56E-03	5.28E-03	1.70E-02	3.52E-02
heli_forest_100	5.38E-03	1.01E-02	1.48E-03	2.78E-03	9.86E-03	1.85E-02
heli_forest_300	1.52E-03	2.96E-03	4.19E-04	8.14E-04	2.79E-03	5.43E-03
heli_forest_900	2.56E-04	5.30E-04	7.03E-05	1.46E-04	4.69E-04	9.72E-04
heli_nonforest_100	3.88E-02	8.30E-02	1.07E-02	2.28E-02	7.12E-02	1.52E-01
heli_nonforest_300	1.66E-02	3.72E-02	4.55E-03	1.02E-02	3.04E-02	6.82E-02
heli_nonforest_900	8.14E-03	1.24E-02	2.24E-03	3.42E-03	1.49E-02	2.28E-02
ground_lowboom_25	1.24E-02	2.48E-02	3.41E-03	6.82E-03	2.27E-02	4.54E-02
ground_lowboom_100	6.80E-03	1.36E-02	1.87E-03	3.74E-03	1.25E-02	2.49E-02
ground_lowboom_900	3.45E-03	6.90E-03	9.49E-04	1.90E-03	6.32E-03	1.27E-02
ground_highboom_25	1.90E-01	3.81E-01	5.24E-02	1.05E-01	3.49E-01	6.99E-01
ground_highboom_100	5.39E-02	1.08E-01	1.48E-02	2.97E-02	9.89E-02	1.98E-01
ground_highboom_900	4.56E-03	9.13E-03	1.25E-03	2.51E-03	8.36E-03	1.67E-02

Table D-9 - Risk Quotients for Off-site Drift Scenarios – Terrestrial Application for Annual and Perennial Vegetation - 2,4-D acid and salts

	Fish		Aquatic Invertebrates		Non-Target Aquatic Plants	
Aquatic Receptors	**Typical Application**	**Maximum Application**	**Typical Application**	**Maximum Application**	**Typical Application**	**Maximum Application**
Off-site Drift to Stream						
Acute Toxicity						
plane_forest_100	4.00E-03	8.06E-03	5.54E-04	1.12E-03	7.20E-02	1.45E-01
plane_forest_300	1.19E-03	2.46E-03	1.65E-04	3.41E-04	2.14E-02	4.43E-02
plane_forest_900	3.45E-04	7.52E-04	4.78E-05	1.04E-04	6.22E-03	1.35E-02
plane_nonforest_100	1.88E-03	4.09E-03	2.60E-04	5.66E-04	3.39E-02	7.36E-02
plane_nonforest_300	6.83E-04	1.59E-03	9.46E-05	2.20E-04	1.23E-02	2.85E-02
plane_nonforest_900	2.90E-04	6.07E-04	4.01E-05	8.40E-05	5.22E-03	1.09E-02
heli_forest_100	2.22E-04	4.06E-04	3.07E-05	5.62E-05	4.00E-03	7.30E-03
heli_forest_300	5.44E-05	1.07E-04	7.54E-06	1.48E-05	9.80E-04	1.93E-03
heli_forest_900	8.70E-06	1.78E-05	1.21E-06	2.46E-06	1.57E-04	3.20E-04
heli_nonforest_100	1.58E-03	3.35E-03	2.18E-04	4.64E-04	2.84E-02	6.03E-02
heli_nonforest_300	5.52E-04	1.23E-03	7.64E-05	1.71E-04	9.93E-03	2.22E-02
heli_nonforest_900	2.53E-04	4.03E-04	3.50E-05	5.57E-05	4.55E-03	7.25E-03
ground_lowboom_25	6.81E-04	1.36E-03	9.43E-05	1.89E-04	1.23E-02	2.45E-02
ground_lowboom_100	2.00E-04	3.99E-04	2.76E-05	5.53E-05	3.59E-03	7.19E-03
ground_lowboom_900	7.86E-06	1.57E-05	1.09E-06	2.18E-06	1.41E-04	2.83E-04
ground_highboom_25	1.19E-04	2.38E-04	1.65E-05	3.30E-05	2.15E-03	4.29E-03
ground_highboom_100	6.28E-05	1.26E-04	8.70E-06	1.74E-05	1.13E-03	2.26E-03
ground_highboom_900	9.98E-06	2.00E-05	1.38E-06	2.76E-06	1.80E-04	3.59E-04
Off-site Drift to Stream						
Chronic Toxicity						
plane_forest_100	1.31E-01	2.64E-01	3.60E-02	7.25E-02	2.40E-01	4.84E-01
plane_forest_300	3.90E-02	8.05E-02	1.07E-02	2.21E-02	7.15E-02	1.48E-01
plane_forest_900	1.13E-02	2.46E-02	3.11E-03	6.77E-03	2.07E-02	4.51E-02
plane_nonforest_100	6.16E-02	1.34E-01	1.69E-02	3.68E-02	1.13E-01	2.45E-01
plane_nonforest_300	2.23E-02	5.19E-02	6.15E-03	1.43E-02	4.10E-02	9.51E-02
plane_nonforest_900	9.49E-03	1.99E-02	2.61E-03	5.46E-03	1.74E-02	3.64E-02
heli_forest_100	7.26E-03	1.33E-02	2.00E-03	3.65E-03	1.33E-02	2.43E-02
heli_forest_300	1.78E-03	3.50E-03	4.90E-04	9.64E-04	3.27E-03	6.43E-03
heli_forest_900	2.85E-04	5.81E-04	7.83E-05	1.60E-04	5.22E-04	1.07E-03
heli_nonforest_100	5.16E-02	1.10E-01	1.42E-02	3.01E-02	9.45E-02	2.01E-01
heli_nonforest_300	1.81E-02	4.03E-02	4.97E-03	1.11E-02	3.31E-02	7.39E-02
heli_nonforest_900	8.28E-03	1.32E-02	2.28E-03	3.62E-03	1.52E-02	2.42E-02
ground_lowboom_25	2.23E-02	4.46E-02	6.13E-03	1.23E-02	4.09E-02	8.18E-02
ground_lowboom_100	6.53E-03	1.31E-02	1.80E-03	3.60E-03	1.20E-02	2.40E-02
ground_lowboom_900	2.57E-04	5.14E-04	7.07E-05	1.41E-04	4.72E-04	9.43E-04
ground_highboom_25	3.90E-03	7.81E-03	1.07E-03	2.15E-03	7.15E-03	1.43E-02
ground_highboom_100	2.06E-03	4.11E-03	5.65E-04	1.13E-03	3.77E-03	7.54E-03
ground_highboom_900	3.26E-04	6.53E-04	8.98E-05	1.80E-04	5.99E-04	1.20E-03

Table D-9 - Risk Quotients for Off-site Drift Scenarios – Terrestrial Application for Annual and Perennial Vegetation - 2,4-D acid and salts

Terrestrial Animal - Piscivorous Bird	Typical Application Rate	Maximum Application Rate
Consumption of Fish From Contaminated Pond		
Spray drift to pond modeled by AgDrift		
plane_forest_100	1.47E-05	2.96E-05
plane_forest_300	5.52E-06	1.14E-05
plane_forest_900	1.76E-06	3.83E-06
plane_nonforest_100	7.49E-06	1.64E-05
plane_nonforest_300	3.35E-06	7.73E-06
plane_nonforest_900	1.50E-06	3.09E-06
heli_forest_100	8.66E-07	1.63E-06
heli_forest_300	2.45E-07	4.77E-07
heli_forest_900	4.12E-08	8.54E-08
heli_nonforest_100	6.25E-06	1.34E-05
heli_nonforest_300	2.67E-06	5.99E-06
heli_nonforest_900	1.31E-06	2.00E-06
ground_lowboom_25	2.00E-06	3.99E-06
ground_lowboom_100	1.09E-06	2.19E-06
ground_lowboom_900	5.55E-07	1.11E-06
ground_highboom_25	3.07E-05	6.14E-05
ground_highboom_100	8.69E-06	1.74E-05
ground_highboom_900	7.34E-07	1.47E-06

AgDrift Scenario ID consists of the following information in order: Mode of Application_Application Height or Type_Distance From Receptor in Feet
Shading and boldface indicates plant RQs greater than 1.
Shading and boldface indicates terrestrial animal RQs greater than 0.1 (LOC for acute risk to endangered species - most conservative).
Shading and boldface indicates RQs greater than 0.05 for fish and invertebrates (LOC for acute risk to endangered species).
Shading and boldface indicates chronic RQs greater than 0.5 for fish and invertebrates (LOC for chronic risk to endangered species).

Table D-10 - Risk Quotients for Off-site Drift Scenarios – Terrestrial Application for Annual and Perennial Vegetation - 2,4-D esters

Terrestrial Plants	Typical Species: Typical Application Rate	Typical Species: Maximum Application Rate	Threatened & Endangered Species: Typical Application Rate	Threatened & Endangered Species: Maximum Application Rate
Off-site Drift to Plants				
Spray drift to off-site soil modeled by AgDrift				
plane_forest_100	**4.96E+01**	**1.01E+02**	**1.16E+02**	**2.35E+02**
plane_forest_300	**2.09E+01**	**4.34E+01**	**4.87E+01**	**1.01E+02**
plane_forest_900	**7.14E+00**	**1.59E+01**	**1.67E+01**	**3.70E+01**
plane_nonforest_100	**2.59E+01**	**5.74E+01**	**6.03E+01**	**1.34E+02**
plane_nonforest_300	**1.33E+01**	**3.03E+01**	**3.10E+01**	**7.07E+01**
plane_nonforest_900	**6.29E+00**	**1.27E+01**	**1.47E+01**	**2.97E+01**
heli_forest_100	**2.71E+00**	**5.14E+00**	**6.33E+00**	**1.20E+01**
heli_forest_300	8.57E-01	**1.71E+00**	**2.00E+00**	**4.00E+00**
heli_forest_900	1.43E-01	2.86E-01	3.33E-01	6.67E-01
heli_nonforest_100	**2.11E+01**	**4.60E+01**	**4.93E+01**	**1.07E+02**
heli_nonforest_300	**1.06E+01**	**2.36E+01**	**2.47E+01**	**5.50E+01**
heli_nonforest_900	**5.43E+00**	**8.00E+00**	**1.27E+01**	**1.87E+01**
ground_lowboom_25	**6.43E+00**	**1.29E+01**	**1.50E+01**	**3.00E+01**
ground_lowboom_100	**4.00E+00**	**7.86E+00**	**9.33E+00**	**1.83E+01**
ground_lowboom_900	8.57E-01	**1.71E+00**	**2.00E+00**	**4.00E+00**
ground_highboom_25	**1.01E+01**	**2.03E+01**	**2.37E+01**	**4.73E+01**
ground_highboom_100	**6.00E+00**	**1.20E+01**	**1.40E+01**	**2.80E+01**
ground_highboom_900	**1.14E+00**	**2.14E+00**	**2.67E+00**	**5.00E+00**

Table D-10 - Risk Quotients for Off-site Drift Scenarios – Terrestrial Application for Annual and Perennial Vegetation - 2,4-D esters

Aquatic Receptors	Fish		Aquatic Invertebrates		Non-Target Aquatic Plants	
	Typical Application	Maximum Application	Typical Application	Maximum Application	Typical Application	Maximum Application
Off-site Drift to Pond						
Acute Toxicity						
plane_forest_100	2.50E-02	**5.06E-02**	**1.16E+00**	**2.35E+00**	**1.25E+01**	**2.53E+01**
plane_forest_300	9.42E-03	1.95E-02	**4.38E-01**	**9.08E-01**	**4.71E+00**	**9.76E+00**
plane_forest_900	3.00E-03	6.54E-03	**1.39E-01**	**3.04E-01**	**1.50E+00**	**3.27E+00**
plane_nonforest_100	1.28E-02	2.80E-02	**5.95E-01**	**1.30E+00**	**6.40E+00**	**1.40E+01**
plane_nonforest_300	5.73E-03	1.32E-02	**2.66E-01**	**6.14E-01**	**2.86E+00**	**6.60E+00**
plane_nonforest_900	2.56E-03	5.28E-03	**1.19E-01**	**2.46E-01**	**1.28E+00**	**2.64E+00**
heli_forest_100	1.48E-03	2.78E-03	**6.88E-02**	**1.29E-01**	7.40E-01	**1.39E+00**
heli_forest_300	4.19E-04	8.14E-04	1.95E-02	3.79E-02	2.09E-01	4.07E-01
heli_forest_900	7.03E-05	1.46E-04	3.27E-03	6.78E-03	3.52E-02	7.29E-02
heli_nonforest_100	1.07E-02	2.28E-02	**4.96E-01**	**1.06E+00**	**5.34E+00**	**1.14E+01**
heli_nonforest_300	4.55E-03	1.02E-02	**2.12E-01**	**4.76E-01**	**2.28E+00**	**5.11E+00**
heli_nonforest_900	2.24E-03	3.42E-03	**1.04E-01**	**1.59E-01**	**1.12E+00**	**1.71E+00**
ground_lowboom_25	3.41E-03	6.82E-03	**1.59E-01**	**3.17E-01**	**1.70E+00**	**3.41E+00**
ground_lowboom_100	1.87E-03	3.74E-03	**8.69E-02**	**1.74E-01**	9.35E-01	**1.87E+00**
ground_lowboom_900	9.49E-04	1.90E-03	4.41E-02	**8.83E-02**	4.74E-01	9.49E-01
ground_highboom_25	**5.24E-02**	**1.05E-01**	**2.44E+00**	**4.87E+00**	**2.62E+01**	**5.24E+01**
ground_highboom_100	1.48E-02	2.97E-02	**6.90E-01**	**1.38E+00**	**7.42E+00**	**1.48E+01**
ground_highboom_900	1.25E-03	2.51E-03	**5.83E-02**	**1.17E-01**	6.27E-01	**1.26E+00**

Aquatic Receptors	Fish		Aquatic Invertebrates		Non-Target Aquatic Plants	
	Typical Application	Maximum Application	Typical Application	Maximum Application	Typical Application	Maximum Application
Off-site Drift to Stream						
Acute Toxicity						
plane_forest_100	3.60E-02	**7.25E-02**	**1.67E+00**	**3.37E+00**	**1.80E+01**	**3.63E+01**
plane_forest_300	1.07E-02	2.21E-02	**4.99E-01**	**1.03E+00**	**5.36E+00**	**1.11E+01**
plane_forest_900	3.11E-03	6.77E-03	**1.45E-01**	**3.15E-01**	**1.55E+00**	**3.38E+00**
plane_nonforest_100	1.69E-02	3.68E-02	**7.87E-01**	**1.71E+00**	**8.47E+00**	**1.84E+01**
plane_nonforest_300	6.15E-03	1.43E-02	**2.86E-01**	**6.64E-01**	**3.07E+00**	**7.14E+00**
plane_nonforest_900	2.61E-03	5.46E-03	**1.21E-01**	**2.54E-01**	**1.30E+00**	**2.73E+00**
heli_forest_100	2.00E-03	3.65E-03	**9.29E-02**	**1.70E-01**	9.99E-01	**1.83E+00**
heli_forest_300	4.90E-04	9.64E-04	2.28E-02	4.48E-02	2.45E-01	4.82E-01
heli_forest_900	7.83E-05	1.60E-04	3.64E-03	7.43E-03	3.92E-02	7.99E-02
heli_nonforest_100	1.42E-02	3.01E-02	**6.59E-01**	**1.40E+00**	**7.09E+00**	**1.51E+01**
heli_nonforest_300	4.97E-03	1.11E-02	**2.31E-01**	**5.16E-01**	**2.48E+00**	**5.54E+00**
heli_nonforest_900	2.28E-03	3.62E-03	**1.06E-01**	**1.69E-01**	**1.14E+00**	**1.81E+00**
ground_lowboom_25	6.13E-03	1.23E-02	**2.85E-01**	**5.71E-01**	**3.07E+00**	**6.14E+00**
ground_lowboom_100	1.80E-03	3.60E-03	**8.36E-02**	**1.67E-01**	8.98E-01	**1.80E+00**
ground_lowboom_900	7.07E-05	1.41E-04	3.29E-03	6.58E-03	3.54E-02	7.07E-02
ground_highboom_25	1.07E-03	2.15E-03	4.99E-02	**9.98E-02**	5.37E-01	**1.07E+00**
ground_highboom_100	5.65E-04	1.13E-03	2.63E-02	**5.26E-02**	2.83E-01	5.65E-01
ground_highboom_900	8.98E-05	1.80E-04	4.18E-03	8.35E-03	4.49E-02	8.98E-02

AgDrift Scenario ID consists of the following information in order: Mode of Application_Application Height or Type_Distance From Receptor in Feet
Shading and boldface indicates plant RQs greater than 1.
Shading and boldface indicates acute RQs greater than 0.05 for fish and invertebrates (LOC for acute risk to endangered species).

Table D-11 – Risk Quotients for Off-site Drift Scenarios – Terrestrial Application for Woody Vegetation - 2,4-D acid and salts

Terrestrial Plants	Typical Species: Typical Application Rate	Typical Species: Maximum Application Rate	Threatened & Endangered Species: Typical Application Rate	Threatened & Endangered Species: Maximum Application Rate
Off-site Drift to Plants				
Spray drift to off-site soil modeled by AgDrift				
plane_forest_100	**3.53E+01**	**7.26E+01**	**2.35E+02**	**4.84E+02**
plane_forest_300	**1.52E+01**	**3.25E+01**	**1.01E+02**	**2.16E+02**
plane_forest_900	**5.55E+00**	**1.24E+01**	**3.70E+01**	**8.23E+01**
plane_nonforest_100	**2.01E+01**	**4.27E+01**	**1.34E+02**	**2.85E+02**
plane_nonforest_300	**1.06E+01**	**2.09E+01**	**7.07E+01**	**1.39E+02**
plane_nonforest_900	**4.45E+00**	**5.70E+00**	**2.97E+01**	**3.80E+01**
heli_forest_100	**1.80E+00**	**3.60E+00**	**1.20E+01**	**2.40E+01**
heli_forest_300	6.00E-01	**1.20E+00**	**4.00E+00**	**8.00E+00**
heli_forest_900	1.00E-01	2.00E-01	6.67E-01	**1.33E+00**
heli_nonforest_100	**1.61E+01**	**3.47E+01**	**1.07E+02**	**2.31E+02**
heli_nonforest_300	**8.25E+00**	**1.59E+01**	**5.50E+01**	**1.06E+02**
heli_nonforest_900	**2.80E+00**	**2.60E+00**	**1.87E+01**	**1.73E+01**
ground_lowboom_25	**4.50E+00**	**8.95E+00**	**3.00E+01**	**5.97E+01**
ground_lowboom_100	**2.75E+00**	**5.50E+00**	**1.83E+01**	**3.67E+01**
ground_lowboom_900	6.00E-01	**1.20E+00**	**4.00E+00**	**8.00E+00**
ground_highboom_25	**7.10E+00**	**1.42E+01**	**4.73E+01**	**9.47E+01**
ground_highboom_100	**4.20E+00**	**8.40E+00**	**2.80E+01**	**5.60E+01**
ground_highboom_900	7.50E-01	**1.55E+00**	**5.00E+00**	**1.03E+01**

Table D-11 – Risk Quotients for Off-site Drift Scenarios – Terrestrial Application for Woody Vegetation - 2,4-D acid and salts

Aquatic Receptors	Fish		Aquatic Invertebrates		Non-Target Aquatic Plants	
	Typical Application	Maximum Application	Typical Application	Maximum Application	Typical Application	Maximum Application
Off-site Drift to Pond						
Acute Toxicity						
plane_forest_100	5.62E-03	1.15E-02	7.78E-04	1.59E-03	1.01E-01	2.07E-01
plane_forest_300	2.17E-03	4.61E-03	3.00E-04	6.38E-04	3.90E-02	8.29E-02
plane_forest_900	7.27E-04	1.62E-03	1.01E-04	2.24E-04	1.31E-02	2.91E-02
plane_nonforest_100	3.11E-03	6.62E-03	4.30E-04	9.17E-04	5.60E-02	1.19E-01
plane_nonforest_300	1.47E-03	2.97E-03	2.03E-04	4.11E-04	2.64E-02	5.34E-02
plane_nonforest_900	5.87E-04	7.78E-04	8.13E-05	1.08E-04	1.06E-02	1.40E-02
heli_forest_100	3.09E-04	6.36E-04	4.27E-05	8.81E-05	5.55E-03	1.15E-02
heli_forest_300	9.05E-05	1.76E-04	1.25E-05	2.44E-05	1.63E-03	3.18E-03
heli_forest_900	1.62E-05	2.79E-05	2.24E-06	3.86E-06	2.92E-04	5.02E-04
heli_nonforest_100	2.54E-03	5.47E-03	3.51E-04	7.57E-04	4.56E-02	9.84E-02
heli_nonforest_300	1.14E-03	2.30E-03	1.57E-04	3.19E-04	2.05E-02	4.15E-02
heli_nonforest_900	3.80E-04	3.76E-04	5.26E-05	5.20E-05	6.83E-03	6.76E-03
ground_lowboom_25	7.57E-04	1.51E-03	1.05E-04	2.10E-04	1.36E-02	2.73E-02
ground_lowboom_100	4.15E-04	8.31E-04	5.75E-05	1.15E-04	7.48E-03	1.50E-02
ground_lowboom_900	8.02E-05	1.60E-04	1.11E-05	2.22E-05	1.44E-03	2.89E-03
ground_highboom_25	1.22E-03	2.43E-03	1.68E-04	3.37E-04	2.19E-02	4.38E-02
ground_highboom_100	6.41E-04	1.28E-03	8.87E-05	1.77E-04	1.15E-02	2.31E-02
ground_highboom_900	1.02E-04	2.04E-04	1.41E-05	2.82E-05	1.83E-03	3.66E-03
Off-site Drift to Pond						
Chronic Toxicity						
plane_forest_100	1.84E-01	3.76E-01	5.06E-02	1.03E-01	3.37E-01	6.89E-01
plane_forest_300	7.10E-02	1.51E-01	1.95E-02	4.15E-02	1.30E-01	2.76E-01
plane_forest_900	2.38E-02	5.30E-02	6.54E-03	1.46E-02	4.36E-02	9.71E-02
plane_nonforest_100	1.02E-01	2.17E-01	2.80E-02	5.96E-02	1.87E-01	3.97E-01
plane_nonforest_300	4.80E-02	9.71E-02	1.32E-02	2.67E-02	8.80E-02	1.78E-01
plane_nonforest_900	1.92E-02	2.55E-02	5.28E-03	7.00E-03	3.52E-02	4.67E-02
heli_forest_100	1.01E-02	2.08E-02	2.78E-03	5.73E-03	1.85E-02	3.82E-02
heli_forest_300	2.96E-03	5.77E-03	8.14E-04	1.59E-03	5.43E-03	1.06E-02
heli_forest_900	5.30E-04	9.13E-04	1.46E-04	2.51E-04	9.72E-04	1.67E-03
heli_nonforest_100	8.30E-02	1.79E-01	2.28E-02	4.92E-02	1.52E-01	3.28E-01
heli_nonforest_300	3.72E-02	7.54E-02	1.02E-02	2.07E-02	6.82E-02	1.38E-01
heli_nonforest_900	1.24E-02	1.23E-02	3.42E-03	3.38E-03	2.28E-02	2.25E-02
ground_lowboom_25	2.48E-02	4.96E-02	6.82E-03	1.36E-02	4.54E-02	9.09E-02
ground_lowboom_100	1.36E-02	2.72E-02	3.74E-03	7.48E-03	2.49E-02	4.98E-02
ground_lowboom_900	2.62E-03	5.25E-03	7.22E-04	1.44E-03	4.81E-03	9.62E-03
ground_highboom_25	3.98E-02	7.96E-02	1.09E-02	2.19E-02	7.30E-02	1.46E-01
ground_highboom_100	2.10E-02	4.19E-02	5.77E-03	1.15E-02	3.84E-02	7.69E-02
ground_highboom_900	3.33E-03	6.66E-03	9.16E-04	1.83E-03	6.11E-03	1.22E-02

Table D-11 – Risk Quotients for Off-site Drift Scenarios – Terrestrial Application for Woody Vegetation - 2,4-D acid and salts

Aquatic Receptors	Fish		Aquatic Invertebrates		Non-Target Aquatic Plants	
	Typical Application	Maximum Application	Typical Application	Maximum Application	Typical Application	Maximum Application
Off-site Drift to Stream						
Acute Toxicity						
plane_forest_100	8.06E-03	1.63E-02	1.12E-03	2.26E-03	1.45E-01	2.94E-01
plane_forest_300	2.46E-03	5.18E-03	3.41E-04	7.17E-04	4.43E-02	9.32E-02
plane_forest_900	7.52E-04	1.67E-03	1.04E-04	2.32E-04	1.35E-02	3.01E-02
plane_nonforest_100	4.09E-03	8.62E-03	5.66E-04	1.19E-03	7.36E-02	1.55E-01
plane_nonforest_300	1.59E-03	3.37E-03	2.20E-04	4.67E-04	2.85E-02	6.07E-02
plane_nonforest_900	6.07E-04	8.46E-04	8.40E-05	1.17E-04	1.09E-02	1.52E-02
heli_forest_100	4.06E-04	8.66E-04	5.62E-05	1.20E-04	7.30E-03	1.56E-02
heli_forest_300	1.07E-04	2.08E-04	1.48E-05	2.88E-05	1.93E-03	3.74E-03
heli_forest_900	1.78E-05	3.12E-05	2.46E-06	4.33E-06	3.20E-04	5.62E-04
heli_nonforest_100	3.35E-03	7.10E-03	4.64E-04	9.83E-04	6.03E-02	1.28E-01
heli_nonforest_300	1.23E-03	2.62E-03	1.71E-04	3.63E-04	2.22E-02	4.72E-02
heli_nonforest_900	4.03E-04	4.37E-04	5.57E-05	6.04E-05	7.25E-03	7.86E-03
ground_lowboom_25	1.36E-03	2.73E-03	1.89E-04	3.78E-04	2.45E-02	4.91E-02
ground_lowboom_100	3.99E-04	7.99E-04	5.53E-05	1.11E-04	7.19E-03	1.44E-02
ground_lowboom_900	4.14E-05	8.27E-05	5.73E-06	1.15E-05	7.45E-04	1.49E-03
ground_highboom_25	2.28E-03	4.57E-03	3.16E-04	6.32E-04	4.11E-02	8.22E-02
ground_highboom_100	6.47E-04	1.29E-03	8.96E-05	1.79E-04	1.16E-02	2.33E-02
ground_highboom_900	5.47E-05	1.09E-04	7.57E-06	1.51E-05	9.84E-04	1.97E-03
Off-site Drift to Stream						
Chronic Toxicity						
plane_forest_100	2.64E-01	**5.34E-01**	7.25E-02	1.47E-01	4.84E-01	9.79E-01
plane_forest_300	8.05E-02	1.69E-01	2.21E-02	4.66E-02	1.48E-01	3.11E-01
plane_forest_900	2.46E-02	5.48E-02	6.77E-03	1.51E-02	4.51E-02	1.00E-01
plane_nonforest_100	1.34E-01	2.82E-01	3.68E-02	7.76E-02	2.45E-01	5.17E-01
plane_nonforest_300	5.19E-02	1.10E-01	1.43E-02	3.03E-02	9.51E-02	2.02E-01
plane_nonforest_900	1.99E-02	2.77E-02	5.46E-03	7.62E-03	3.64E-02	5.08E-02
heli_forest_100	1.33E-02	2.83E-02	3.65E-03	7.79E-03	2.43E-02	5.20E-02
heli_forest_300	3.50E-03	6.80E-03	9.64E-04	1.87E-03	6.43E-03	1.25E-02
heli_forest_900	5.81E-04	1.02E-03	1.60E-04	2.81E-04	1.07E-03	1.87E-03
heli_nonforest_100	1.10E-01	2.32E-01	3.01E-02	6.39E-02	2.01E-01	4.26E-01
heli_nonforest_300	4.03E-02	8.59E-02	1.11E-02	2.36E-02	7.39E-02	1.57E-01
heli_nonforest_900	1.32E-02	1.43E-02	3.62E-03	3.93E-03	2.42E-02	2.62E-02
ground_lowboom_25	4.46E-02	8.92E-02	1.23E-02	2.45E-02	8.18E-02	1.64E-01
ground_lowboom_100	1.31E-02	2.61E-02	3.60E-03	7.19E-03	2.40E-02	4.79E-02
ground_lowboom_900	1.35E-03	2.71E-03	3.72E-04	7.45E-04	2.48E-03	4.96E-03
ground_highboom_25	7.47E-02	1.49E-01	2.06E-02	4.11E-02	1.37E-01	2.74E-01
ground_highboom_100	2.12E-02	4.23E-02	5.82E-03	1.16E-02	3.88E-02	7.76E-02
ground_highboom_900	1.79E-03	3.58E-03	4.92E-04	9.84E-04	3.28E-03	6.56E-03

Table D-11 – Risk Quotients for Off-site Drift Scenarios – Terrestrial Application for Woody Vegetation - 2,4-D acid and salts

Terrestrial Animal - Piscivorous Bird	Typical Application Rate	Maximum Application Rate
Consumption of Fish From Contaminated Pond		
Spray drift to pond modeled by AgDrift		
plane_forest_100	2.96E-05	6.05E-05
plane_forest_300	1.14E-05	2.43E-05
plane_forest_900	3.83E-06	8.53E-06
plane_nonforest_100	1.64E-05	3.49E-05
plane_nonforest_300	7.73E-06	1.56E-05
plane_nonforest_900	3.09E-06	4.10E-06
heli_forest_100	1.63E-06	3.35E-06
heli_forest_300	4.77E-07	9.30E-07
heli_forest_900	8.54E-08	1.47E-07
heli_nonforest_100	1.34E-05	2.88E-05
heli_nonforest_300	5.99E-06	1.21E-05
heli_nonforest_900	2.00E-06	1.98E-06
ground_lowboom_25	3.99E-06	7.98E-06
ground_lowboom_100	2.19E-06	4.38E-06
ground_lowboom_900	4.23E-07	8.45E-07
ground_highboom_25	6.41E-06	1.28E-05
ground_highboom_100	3.38E-06	6.75E-06
ground_highboom_900	5.36E-07	1.07E-06

AgDrift Scenario ID consists of the following information in order: Mode of Application_Application Height or Type_Distance From Receptor in Feet
Shading and boldface indicates plant RQs greater than 1.
Shading and boldface indicates terrestrial animal RQs greater than 0.1 (LOC for acute risk to endangered species - most conservative).
Shading and boldface indicates RQs greater than 0.05 for fish and invertebrates (LOC for acute risk to endangered species).
Shading and boldface indicates chronic RQs greater than 0.5 for fish and invertebrates (LOC for chronic risk to endangered species).

Table D-12 – Risk Quotients for Off-site Drift Scenarios – Terrestrial Application for Woody Vegetation- 2,4-D esters

Terrestrial Plants	Typical Species: Typical Application Rate	Typical Species: Maximum Application Rate	Threatened & Endangered Species: Typical Application Rate	Threatened & Endangered Species: Maximum Application Rate
Off-site Drift to Plants				
Spray drift to off-site soil modeled by AgDrift				
plane_forest_100	**1.01E+02**	**2.07E+02**	**2.35E+02**	**4.84E+02**
plane_forest_300	**4.34E+01**	**9.27E+01**	**1.01E+02**	**2.16E+02**
plane_forest_900	**1.59E+01**	**3.53E+01**	**3.70E+01**	**8.23E+01**
plane_nonforest_100	**5.74E+01**	**1.22E+02**	**1.34E+02**	**2.85E+02**
plane_nonforest_300	**3.03E+01**	**5.96E+01**	**7.07E+01**	**1.39E+02**
plane_nonforest_900	**1.27E+01**	**1.63E+01**	**2.97E+01**	**3.80E+01**
heli_forest_100	**5.14E+00**	**1.03E+01**	**1.20E+01**	**2.40E+01**
heli_forest_300	**1.71E+00**	**3.43E+00**	**4.00E+00**	**8.00E+00**
heli_forest_900	2.86E-01	5.71E-01	6.67E-01	**1.33E+00**
heli_nonforest_100	**4.60E+01**	**9.90E+01**	**1.07E+02**	**2.31E+02**
heli_nonforest_300	**2.36E+01**	**4.54E+01**	**5.50E+01**	**1.06E+02**
heli_nonforest_900	**8.00E+00**	**7.43E+00**	**1.87E+01**	**1.73E+01**
ground_lowboom_25	**1.29E+01**	**2.56E+01**	**3.00E+01**	**5.97E+01**
ground_lowboom_100	**7.86E+00**	**1.57E+01**	**1.83E+01**	**3.67E+01**
ground_lowboom_900	**1.71E+00**	**3.43E+00**	**4.00E+00**	**8.00E+00**
ground_highboom_25	**2.03E+01**	**4.06E+01**	**4.73E+01**	**9.47E+01**
ground_highboom_100	**1.20E+01**	**2.40E+01**	**2.80E+01**	**5.60E+01**
ground_highboom_900	**2.14E+00**	**4.43E+00**	**5.00E+00**	**1.03E+01**

Table D-12 – Risk Quotients for Off-site Drift Scenarios – Terrestrial Application for Woody Vegetation- 2,4-D esters

Aquatic Receptors	Fish: Typical Application	Fish: Maximum Application	Aquatic Invertebrates: Typical Application	Aquatic Invertebrates: Maximum Application	Non-Target Aquatic Plants: Typical Application	Non-Target Aquatic Plants: Maximum Application
Off-site Drift to Pond						
Acute Toxicity						
plane_forest_100	**5.06E-02**	**1.03E-01**	**2.35E+00**	**4.81E+00**	**2.53E+01**	**5.17E+01**
plane_forest_300	1.95E-02	4.15E-02	**9.08E-01**	**1.93E+00**	**9.76E+00**	**2.07E+01**
plane_forest_900	6.54E-03	1.46E-02	**3.04E-01**	**6.78E-01**	**3.27E+00**	**7.29E+00**
plane_nonforest_100	2.80E-02	**5.96E-02**	**1.30E+00**	**2.77E+00**	**1.40E+01**	**2.98E+01**
plane_nonforest_300	1.32E-02	2.67E-02	**6.14E-01**	**1.24E+00**	**6.60E+00**	**1.33E+01**
plane_nonforest_900	5.28E-03	7.00E-03	**2.46E-01**	**3.26E-01**	**2.64E+00**	**3.50E+00**
heli_forest_100	2.78E-03	5.73E-03	**1.29E-01**	**2.66E-01**	**1.39E+00**	**2.86E+00**
heli_forest_300	8.14E-04	1.59E-03	3.79E-02	**7.38E-02**	4.07E-01	7.94E-01
heli_forest_900	1.46E-04	2.51E-04	6.78E-03	1.17E-02	7.29E-02	1.26E-01
heli_nonforest_100	2.28E-02	4.92E-02	**1.06E+00**	**2.29E+00**	**1.14E+01**	**2.46E+01**
heli_nonforest_300	1.02E-02	2.07E-02	**4.76E-01**	**9.64E-01**	**5.11E+00**	**1.04E+01**
heli_nonforest_900	3.42E-03	3.38E-03	**1.59E-01**	**1.57E-01**	**1.71E+00**	**1.69E+00**
ground_lowboom_25	6.82E-03	1.36E-02	**3.17E-01**	**6.34E-01**	**3.41E+00**	**6.82E+00**
ground_lowboom_100	3.74E-03	7.48E-03	**1.74E-01**	**3.48E-01**	**1.87E+00**	**3.74E+00**
ground_lowboom_900	7.22E-04	1.44E-03	3.36E-02	**6.71E-02**	3.61E-01	7.22E-01
ground_highboom_25	1.09E-02	2.19E-02	**5.09E-01**	**1.02E+00**	**5.47E+00**	**1.09E+01**
ground_highboom_100	5.77E-03	1.15E-02	**2.68E-01**	**5.36E-01**	**2.88E+00**	**5.77E+00**
ground_highboom_900	9.16E-04	1.83E-03	4.26E-02	**8.52E-02**	4.58E-01	9.16E-01

Aquatic Receptors	Fish: Typical Application	Fish: Maximum Application	Aquatic Invertebrates: Typical Application	Aquatic Invertebrates: Maximum Application	Non-Target Aquatic Plants: Typical Application	Non-Target Aquatic Plants: Maximum Application
Off-site Drift to Stream						
Acute Toxicity						
plane_forest_100	**7.25E-02**	**1.47E-01**	**3.37E+00**	**6.83E+00**	**3.63E+01**	**7.34E+01**
plane_forest_300	2.21E-02	4.66E-02	**1.03E+00**	**2.17E+00**	**1.11E+01**	**2.33E+01**
plane_forest_900	6.77E-03	1.51E-02	**3.15E-01**	**7.01E-01**	**3.38E+00**	**7.53E+00**
plane_nonforest_100	3.68E-02	**7.76E-02**	**1.71E+00**	**3.61E+00**	**1.84E+01**	**3.88E+01**
plane_nonforest_300	1.43E-02	3.03E-02	**6.64E-01**	**1.41E+00**	**7.14E+00**	**1.52E+01**
plane_nonforest_900	5.46E-03	7.62E-03	**2.54E-01**	**3.54E-01**	**2.73E+00**	**3.81E+00**
heli_forest_100	3.65E-03	7.79E-03	**1.70E-01**	**3.63E-01**	**1.83E+00**	**3.90E+00**
heli_forest_300	9.64E-04	1.87E-03	4.48E-02	**8.70E-02**	4.82E-01	9.35E-01
heli_forest_900	1.60E-04	2.81E-04	7.43E-03	1.31E-02	7.99E-02	1.41E-01
heli_nonforest_100	3.01E-02	**6.39E-02**	**1.40E+00**	**2.97E+00**	**1.51E+01**	**3.20E+01**
heli_nonforest_300	1.11E-02	2.36E-02	**5.16E-01**	**1.10E+00**	**5.54E+00**	**1.18E+01**
heli_nonforest_900	3.62E-03	3.93E-03	**1.69E-01**	**1.83E-01**	**1.81E+00**	**1.96E+00**
ground_lowboom_25	1.23E-02	2.45E-02	**5.71E-01**	**1.14E+00**	**6.14E+00**	**1.23E+01**
ground_lowboom_100	3.60E-03	7.19E-03	**1.67E-01**	**3.34E-01**	**1.80E+00**	**3.60E+00**
ground_lowboom_900	3.72E-04	7.45E-04	1.73E-02	3.46E-02	1.86E-01	3.72E-01
ground_highboom_25	2.06E-02	4.11E-02	**9.56E-01**	**1.91E+00**	**1.03E+01**	**2.06E+01**
ground_highboom_100	5.82E-03	1.16E-02	**2.71E-01**	**5.42E-01**	**2.91E+00**	**5.82E+00**
ground_highboom_900	4.92E-04	9.84E-04	2.29E-02	4.58E-02	2.46E-01	4.92E-01

AgDrift Scenario ID consists of the following information in order: Mode of Application_Application Height or Type_Distance From Receptor in Feet
Shading and boldface indicates plant RQs greater than 1.
Shading and boldface indicates acute RQs greater than 0.05 for fish and invertebrates (LOC for acute risk to endangered species).

Table D-13 – Risk Quotients for Off-site Drift Scenarios – Aquatic Application for Floating and Emerged Vegetation - 2,4-D acid and salts

Terrestrial Plants	Typical Species: Typical Application Rate	Typical Species: Maximum Application Rate	Threatened & Endangered Species: Typical Application Rate	Threatened & Endangered Species: Maximum Application Rate
Off-site Drift to Plants				
Spray drift to off-site soil modeled by AgDrift				
plane_nonforest_100	**2.01E+01**	**4.27E+01**	**1.34E+02**	**2.85E+02**
plane_nonforest_300	**1.06E+01**	**2.09E+01**	**7.07E+01**	**1.39E+02**
plane_nonforest_900	**4.45E+00**	**5.70E+00**	**2.97E+01**	**3.80E+01**
heli_nonforest_100	**1.61E+01**	**3.47E+01**	**1.07E+02**	**2.31E+02**
heli_nonforest_300	**8.25E+00**	**1.59E+01**	**5.50E+01**	**1.06E+02**
heli_nonforest_900	**2.80E+00**	**2.60E+00**	**1.87E+01**	**1.73E+01**
ground_lowboom_25	**4.50E+00**	**8.95E+00**	**3.00E+01**	**5.97E+01**
ground_lowboom_100	**2.75E+00**	**5.50E+00**	**1.83E+01**	**3.67E+01**
ground_lowboom_900	6.00E-01	**1.20E+00**	**4.00E+00**	**8.00E+00**
ground_highboom_25	**7.10E+00**	**1.42E+01**	**4.73E+01**	**9.47E+01**
ground_highboom_100	**4.20E+00**	**8.40E+00**	**2.80E+01**	**5.60E+01**
ground_highboom_900	7.50E-01	**1.55E+00**	**5.00E+00**	**1.03E+01**

Table D-13 – Risk Quotients for Off-site Drift Scenarios – Aquatic Application for Floating and Emerged Vegetation - 2,4-D acid and salts

Aquatic Receptors	Fish		Aquatic Invertebrates		Non-Target Aquatic Plants	
	Typical Application	Maximum Application	Typical Application	Maximum Application	Typical Application	Maximum Application
Off-site Drift to Pond						
Acute Toxicity						
plane_nonforest_100	3.11E-03	6.62E-03	4.30E-04	9.17E-04	5.60E-02	1.19E-01
plane_nonforest_300	1.47E-03	2.97E-03	2.03E-04	4.11E-04	2.64E-02	5.34E-02
plane_nonforest_900	5.87E-04	7.78E-04	8.13E-05	1.08E-04	1.06E-02	1.40E-02
heli_nonforest_100	2.54E-03	5.47E-03	3.51E-04	7.57E-04	4.56E-02	9.84E-02
heli_nonforest_300	1.14E-03	2.30E-03	1.57E-04	3.19E-04	2.05E-02	4.15E-02
heli_nonforest_900	3.80E-04	3.76E-04	5.26E-05	5.20E-05	6.83E-03	6.76E-03
ground_lowboom_25	7.57E-04	1.51E-03	1.05E-04	2.10E-04	1.36E-02	2.73E-02
ground_lowboom_100	4.15E-04	8.31E-04	5.75E-05	1.15E-04	7.48E-03	1.50E-02
ground_lowboom_900	8.02E-05	1.60E-04	1.11E-05	2.22E-05	1.44E-03	2.89E-03
ground_highboom_25	1.22E-03	2.43E-03	1.68E-04	3.37E-04	2.19E-02	4.38E-02
ground_highboom_100	6.41E-04	1.28E-03	8.87E-05	1.77E-04	1.15E-02	2.31E-02
ground_highboom_900	1.02E-04	2.04E-04	1.41E-05	2.82E-05	1.83E-03	3.66E-03
Off-site Drift to Pond						
Chronic Toxicity						
plane_nonforest_100	1.02E-01	2.17E-01	2.80E-02	5.96E-02	1.87E-01	3.97E-01
plane_nonforest_300	4.80E-02	9.71E-02	1.32E-02	2.67E-02	8.80E-02	1.78E-01
plane_nonforest_900	1.92E-02	2.55E-02	5.28E-03	7.00E-03	3.52E-02	4.67E-02
heli_nonforest_100	8.30E-02	1.79E-01	2.28E-02	4.92E-02	1.52E-01	3.28E-01
heli_nonforest_300	3.72E-02	7.54E-02	1.02E-02	2.07E-02	6.82E-02	1.38E-01
heli_nonforest_900	1.24E-02	1.23E-02	3.42E-03	3.38E-03	2.28E-02	2.25E-02
ground_lowboom_25	2.48E-02	4.96E-02	6.82E-03	1.36E-02	4.54E-02	9.09E-02
ground_lowboom_100	1.36E-02	2.72E-02	3.74E-03	7.48E-03	2.49E-02	4.98E-02
ground_lowboom_900	2.62E-03	5.25E-03	7.22E-04	1.44E-03	4.81E-03	9.62E-03
ground_highboom_25	3.98E-02	7.96E-02	1.09E-02	2.19E-02	7.30E-02	1.46E-01
ground_highboom_100	2.10E-02	4.19E-02	5.77E-03	1.15E-02	3.84E-02	7.69E-02
ground_highboom_900	3.33E-03	6.66E-03	9.16E-04	1.83E-03	6.11E-03	1.22E-02

Table D-13 – Risk Quotients for Off-site Drift Scenarios – Aquatic Application for Floating and Emerged Vegetation - 2,4-D acid and salts

Aquatic Receptors	Fish Typical Application	Fish Maximum Application	Aquatic Invertebrates Typical Application	Aquatic Invertebrates Maximum Application	Non-Target Aquatic Plants Typical Application	Non-Target Aquatic Plants Maximum Application
Off-site Drift to Stream						
Acute Toxicity						
plane_nonforest_100	4.09E-03	8.62E-03	5.66E-04	1.19E-03	7.36E-02	1.55E-01
plane_nonforest_300	1.59E-03	3.37E-03	2.20E-04	4.67E-04	2.85E-02	6.07E-02
plane_nonforest_900	6.07E-04	8.46E-04	8.40E-05	1.17E-04	1.09E-02	1.52E-02
heli_nonforest_100	3.35E-03	7.10E-03	4.64E-04	9.83E-04	6.03E-02	1.28E-01
heli_nonforest_300	1.23E-03	2.62E-03	1.71E-04	3.63E-04	2.22E-02	4.72E-02
heli_nonforest_900	4.03E-04	4.37E-04	5.57E-05	6.04E-05	7.25E-03	7.86E-03
ground_lowboom_25	1.36E-03	2.73E-03	1.89E-04	3.78E-04	2.45E-02	4.91E-02
ground_lowboom_100	3.99E-04	7.99E-04	5.53E-05	1.11E-04	7.19E-03	1.44E-02
ground_lowboom_900	4.14E-05	8.27E-05	5.73E-06	1.15E-05	7.45E-04	1.49E-03
ground_highboom_25	2.28E-03	4.57E-03	3.16E-04	6.32E-04	4.11E-02	8.22E-02
ground_highboom_100	6.47E-04	1.29E-03	8.96E-05	1.79E-04	1.16E-02	2.33E-02
ground_highboom_900	5.47E-05	1.09E-04	7.57E-06	1.51E-05	9.84E-04	1.97E-03
Off-site Drift to Stream						
Chronic Toxicity						
plane_nonforest_100	1.34E-01	2.82E-01	3.68E-02	7.76E-02	2.45E-01	5.17E-01
plane_nonforest_300	5.19E-02	1.10E-01	1.43E-02	3.03E-02	9.51E-02	2.02E-01
plane_nonforest_900	1.99E-02	2.77E-02	5.46E-03	7.62E-03	3.64E-02	5.08E-02
heli_nonforest_100	1.10E-01	2.32E-01	3.01E-02	6.39E-02	2.01E-01	4.26E-01
heli_nonforest_300	4.03E-02	8.59E-02	1.11E-02	2.36E-02	7.39E-02	1.57E-01
heli_nonforest_900	1.32E-02	1.43E-02	3.62E-03	3.93E-03	2.42E-02	2.62E-02
ground_lowboom_25	4.46E-02	8.92E-02	1.23E-02	2.45E-02	8.18E-02	1.64E-01
ground_lowboom_100	1.31E-02	2.61E-02	3.60E-03	7.19E-03	2.40E-02	4.79E-02
ground_lowboom_900	1.35E-03	2.71E-03	3.72E-04	7.45E-04	2.48E-03	4.96E-03
ground_highboom_25	7.47E-02	1.49E-01	2.06E-02	4.11E-02	1.37E-01	2.74E-01
ground_highboom_100	2.12E-02	4.23E-02	5.82E-03	1.16E-02	3.88E-02	7.76E-02
ground_highboom_900	1.79E-03	3.58E-03	4.92E-04	9.84E-04	3.28E-03	6.56E-03

Table D-13 – Risk Quotients for Off-site Drift Scenarios – Aquatic Application for Floating and Emerged Vegetation - 2,4-D acid and salts

Terrestrial Animal - Piscivorous Bird	Typical Application Rate	Maximum Application Rate
Consumption of Fish From Contaminated Pond		
Spray drift to pond modeled by AgDrift		
plane_nonforest_100	1.64E-05	3.49E-05
plane_nonforest_300	7.73E-06	1.56E-05
plane_nonforest_900	3.09E-06	4.10E-06
heli_nonforest_100	1.34E-05	2.88E-05
heli_nonforest_300	5.99E-06	1.21E-05
heli_nonforest_900	2.00E-06	1.98E-06
ground_lowboom_25	3.99E-06	7.98E-06
ground_lowboom_100	2.19E-06	4.38E-06
ground_lowboom_900	4.23E-07	8.45E-07
ground_highboom_25	6.41E-06	1.28E-05
ground_highboom_100	3.38E-06	6.75E-06
ground_highboom_900	5.36E-07	1.07E-06

AgDrift Scenario ID consists of the following information in order: Mode of Application_Application Height or Type_Distance From Receptor in Feet
Shading and boldface indicates plant RQs greater than 1.
Shading and boldface indicates terrestrial animal RQs greater than 0.1 (LOC for acute risk to endangered species - most conservative).
Shading and boldface indicates acute RQs greater than 0.05 for fish and invertebrates.
Shading and boldface indicates chronic RQs greater than 0.5 for fish and invertebrates.

Table D-14 – Risk Quotients for Off-site Drift Scenarios – Aquatic Application for Floating and Emerged Vegetation- 2,4-D esters

Terrestrial Plants	Typical Species		Threatened & Endangered Species	
	Typical Application Rate	Maximum Application Rate	Typical Application Rate	Maximum Application Rate
Off-site Drift to Plants				
Spray drift to off-site soil modeled by AgDrift				
plane_nonforest_100	**5.74E+01**	**1.22E+02**	**1.34E+02**	**2.85E+02**
plane_nonforest_300	**3.03E+01**	**5.96E+01**	**7.07E+01**	**1.39E+02**
plane_nonforest_900	**1.27E+01**	**1.63E+01**	**2.97E+01**	**3.80E+01**
heli_nonforest_100	**4.60E+01**	**9.90E+01**	**1.07E+02**	**2.31E+02**
heli_nonforest_300	**2.36E+01**	**4.54E+01**	**5.50E+01**	**1.06E+02**
heli_nonforest_900	**8.00E+00**	**7.43E+00**	**1.87E+01**	**1.73E+01**
ground_lowboom_25	**1.29E+01**	**2.56E+01**	**3.00E+01**	**5.97E+01**
ground_lowboom_100	**7.86E+00**	**1.57E+01**	**1.83E+01**	**3.67E+01**
ground_lowboom_900	**1.71E+00**	**3.43E+00**	**4.00E+00**	**8.00E+00**
ground_highboom_25	**2.03E+01**	**4.06E+01**	**4.73E+01**	**9.47E+01**
ground_highboom_100	**1.20E+01**	**2.40E+01**	**2.80E+01**	**5.60E+01**
ground_highboom_900	**2.14E+00**	**4.43E+00**	**5.00E+00**	**1.03E+01**

Table D-14 – Risk Quotients for Off-site Drift Scenarios – Aquatic Application for Floating and Emerged Vegetation- 2,4-D esters

Aquatic Receptors	Fish		Aquatic Invertebrates		Non-Target Aquatic Plants	
	Typical Application	Maximum Application	Typical Application	Maximum Application	Typical Application	Maximum Application
Off-site Drift to Pond						
Acute Toxicity						
plane_nonforest_100	2.80E-02	**5.96E-02**	**1.30E+00**	**2.77E+00**	**1.40E+01**	**2.98E+01**
plane_nonforest_300	1.32E-02	2.67E-02	**6.14E-01**	**1.24E+00**	**6.60E+00**	**1.33E+01**
plane_nonforest_900	5.28E-03	7.00E-03	**2.46E-01**	**3.26E-01**	**2.64E+00**	**3.50E+00**
heli_nonforest_100	2.28E-02	4.92E-02	**1.06E+00**	**2.29E+00**	**1.14E+01**	**2.46E+01**
heli_nonforest_300	1.02E-02	2.07E-02	**4.76E-01**	**9.64E-01**	**5.11E+00**	**1.04E+01**
heli_nonforest_900	3.42E-03	3.38E-03	**1.59E-01**	**1.57E-01**	**1.71E+00**	**1.69E+00**
ground_lowboom_25	6.82E-03	1.36E-02	**3.17E-01**	**6.34E-01**	**3.41E+00**	**6.82E+00**
ground_lowboom_100	3.74E-03	7.48E-03	**1.74E-01**	**3.48E-01**	**1.87E+00**	**3.74E+00**
ground_lowboom_900	7.22E-04	1.44E-03	3.36E-02	**6.71E-02**	3.61E-01	7.22E-01
ground_highboom_25	1.09E-02	2.19E-02	**5.09E-01**	**1.02E+00**	**5.47E+00**	**1.09E+01**
ground_highboom_100	5.77E-03	1.15E-02	**2.68E-01**	**5.36E-01**	**2.88E+00**	**5.77E+00**
ground_highboom_900	9.16E-04	1.83E-03	4.26E-02	**8.52E-02**	4.58E-01	9.16E-01

Aquatic Receptors	Fish		Aquatic Invertebrates		Non-Target Aquatic Plants	
	Typical Application	Maximum Application	Typical Application	Maximum Application	Typical Application	Maximum Application
Off-site Drift to Stream						
Acute Toxicity						
plane_nonforest_100	3.68E-02	**7.76E-02**	**1.71E+00**	**3.61E+00**	**1.84E+01**	**3.88E+01**
plane_nonforest_300	1.43E-02	3.03E-02	**6.64E-01**	**1.41E+00**	**7.14E+00**	**1.52E+01**
plane_nonforest_900	5.46E-03	7.62E-03	**2.54E-01**	**3.54E-01**	**2.73E+00**	**3.81E+00**
heli_nonforest_100	3.01E-02	**6.39E-02**	**1.40E+00**	**2.97E+00**	**1.51E+01**	**3.20E+01**
heli_nonforest_300	1.11E-02	2.36E-02	**5.16E-01**	**1.10E+00**	**5.54E+00**	**1.18E+01**
heli_nonforest_900	3.62E-03	3.93E-03	**1.69E-01**	**1.83E-01**	**1.81E+00**	**1.96E+00**
ground_lowboom_25	1.23E-02	2.45E-02	**5.71E-01**	**1.14E+00**	**6.14E+00**	**1.23E+01**
ground_lowboom_100	3.60E-03	7.19E-03	**1.67E-01**	**3.34E-01**	**1.80E+00**	**3.60E+00**
ground_lowboom_900	3.72E-04	7.45E-04	1.73E-02	3.46E-02	1.86E-01	3.72E-01
ground_highboom_25	2.06E-02	4.11E-02	**9.56E-01**	**1.91E+00**	**1.03E+01**	**2.06E+01**
ground_highboom_100	5.82E-03	1.16E-02	**2.71E-01**	**5.42E-01**	**2.91E+00**	**5.82E+00**
ground_highboom_900	4.92E-04	9.84E-04	2.29E-02	4.58E-02	2.46E-01	4.92E-01

AgDrift Scenario ID consists of the following information in order: Mode of Application_Application Height or Type_Distance From Receptor in Feet
Shading and boldface indicates plant RQs greater than 1.
Shading and boldface indicates acute RQs greater than 0.05 for fish and invertebrates.

Table D-15 – Risk Quotients for Off-site Drift Scenarios – Aquatic Application for Submerged Vegetation - 2,4-D acid and salts

Terrestrial Plants	Typical Species: Typical Application Rate	Typical Species: Maximum Application Rate	Threatened & Endangered Species: Typical Application Rate	Threatened & Endangered Species: Maximum Application Rate
Off-site Drift to Plants				
Spray drift to off-site soil modeled by AgDrift				
plane_nonforest_100	**9.05E+00**	**2.01E+01**	**6.03E+01**	**1.34E+02**
plane_nonforest_300	**4.65E+00**	**1.06E+01**	**3.10E+01**	**7.07E+01**
plane_nonforest_900	**2.20E+00**	**4.45E+00**	**1.47E+01**	**2.97E+01**
heli_nonforest_100	**7.40E+00**	**1.61E+01**	**4.93E+01**	**1.07E+02**
heli_nonforest_300	**3.70E+00**	**8.25E+00**	**2.47E+01**	**5.50E+01**
heli_nonforest_900	**1.90E+00**	**2.80E+00**	**1.27E+01**	**1.87E+01**
ground_lowboom_25	**2.25E+00**	**4.50E+00**	**1.50E+01**	**3.00E+01**
ground_lowboom_100	**1.40E+00**	**2.75E+00**	**9.33E+00**	**1.83E+01**
ground_lowboom_900	3.00E-01	6.00E-01	**2.00E+00**	**4.00E+00**
ground_highboom_25	**3.55E+00**	**7.10E+00**	**2.37E+01**	**4.73E+01**
ground_highboom_100	**2.10E+00**	**4.20E+00**	**1.40E+01**	**2.80E+01**
ground_highboom_900	4.00E-01	7.50E-01	**2.67E+00**	**5.00E+00**

Table D-15 – Risk Quotients for Off-site Drift Scenarios – Aquatic Application for Submerged Vegetation - 2,4-D acid and salts

Aquatic Receptors	Fish Typical Application	Fish Maximum Application	Aquatic Invertebrates Typical Application	Aquatic Invertebrates Maximum Application	Non-Target Aquatic Plants Typical Application	Non-Target Aquatic Plants Maximum Application
Off-site Drift to Pond						
Acute Toxicity						
plane_nonforest_100	1.42E-03	3.11E-03	1.97E-04	4.30E-04	2.56E-02	5.60E-02
plane_nonforest_300	6.36E-04	1.47E-03	8.81E-05	2.03E-04	1.15E-02	2.64E-02
plane_nonforest_900	2.84E-04	5.87E-04	3.93E-05	8.13E-05	5.11E-03	1.06E-02
heli_nonforest_100	1.19E-03	2.54E-03	1.64E-04	3.51E-04	2.13E-02	4.56E-02
heli_nonforest_300	5.06E-04	1.14E-03	7.00E-05	1.57E-04	9.11E-03	2.05E-02
heli_nonforest_900	2.49E-04	3.80E-04	3.44E-05	5.26E-05	4.48E-03	6.83E-03
ground_lowboom_25	3.79E-04	7.57E-04	5.24E-05	1.05E-04	6.82E-03	1.36E-02
ground_lowboom_100	2.08E-04	4.15E-04	2.88E-05	5.75E-05	3.74E-03	7.48E-03
ground_lowboom_900	4.01E-05	8.02E-05	5.55E-06	1.11E-05	7.22E-04	1.44E-03
ground_highboom_25	6.08E-04	1.16E-02	8.42E-05	1.61E-03	1.09E-02	2.10E-01
ground_highboom_100	3.20E-04	3.30E-03	4.44E-05	4.57E-04	5.77E-03	5.94E-02
ground_highboom_900	5.09E-05	2.79E-04	7.04E-06	3.86E-05	9.16E-04	5.02E-03
Off-site Drift to Pond						
Chronic Toxicity						
plane_nonforest_100	4.65E-02	1.02E-01	1.28E-02	2.80E-02	8.53E-02	1.87E-01
plane_nonforest_300	2.08E-02	4.80E-02	5.73E-03	1.32E-02	3.82E-02	8.80E-02
plane_nonforest_900	9.30E-03	1.92E-02	2.56E-03	5.28E-03	1.70E-02	3.52E-02
heli_nonforest_100	3.88E-02	8.30E-02	1.07E-02	2.28E-02	7.12E-02	1.52E-01
heli_nonforest_300	1.66E-02	3.72E-02	4.55E-03	1.02E-02	3.04E-02	6.82E-02
heli_nonforest_900	8.14E-03	1.24E-02	2.24E-03	3.42E-03	1.49E-02	2.28E-02
ground_lowboom_25	1.24E-02	2.48E-02	3.41E-03	6.82E-03	2.27E-02	4.54E-02
ground_lowboom_100	6.80E-03	1.36E-02	1.87E-03	3.74E-03	1.25E-02	2.49E-02
ground_lowboom_900	1.31E-03	2.62E-03	3.61E-04	7.22E-04	2.41E-03	4.81E-03
ground_highboom_25	1.99E-02	3.81E-01	5.47E-03	1.05E-01	3.65E-02	6.99E-01
ground_highboom_100	1.05E-02	1.08E-01	2.88E-03	2.97E-02	1.92E-02	1.98E-01
ground_highboom_900	1.67E-03	9.13E-03	4.58E-04	2.51E-03	3.05E-03	1.67E-02

Table D-15 – Risk Quotients for Off-site Drift Scenarios – Aquatic Application for Submerged Vegetation - 2,4-D acid and salts

Aquatic Receptors	Fish		Aquatic Invertebrates		Non-Target Aquatic Plants	
	Typical Application	Maximum Application	Typical Application	Maximum Application	Typical Application	Maximum Application
Off-site Drift to Stream						
Acute Toxicity						
plane_nonforest_100	1.88E-03	4.09E-03	2.60E-04	5.66E-04	3.39E-02	7.36E-02
plane_nonforest_300	6.83E-04	1.59E-03	9.46E-05	2.20E-04	1.23E-02	2.85E-02
plane_nonforest_900	2.90E-04	6.07E-04	4.01E-05	8.40E-05	5.22E-03	1.09E-02
heli_nonforest_100	1.58E-03	3.35E-03	2.18E-04	4.64E-04	2.84E-02	6.03E-02
heli_nonforest_300	5.52E-04	1.23E-03	7.64E-05	1.71E-04	9.93E-03	2.22E-02
heli_nonforest_900	2.53E-04	4.03E-04	3.50E-05	5.57E-05	4.55E-03	7.25E-03
ground_lowboom_25	6.81E-04	1.36E-03	9.43E-05	1.89E-04	1.23E-02	2.45E-02
ground_lowboom_100	2.00E-04	3.99E-04	2.76E-05	5.53E-05	3.59E-03	7.19E-03
ground_lowboom_900	2.07E-05	4.14E-05	2.86E-06	5.73E-06	3.72E-04	7.45E-04
ground_highboom_25	1.14E-03	2.38E-04	1.58E-04	3.30E-05	2.05E-02	4.29E-03
ground_highboom_100	3.23E-04	1.26E-04	4.48E-05	1.74E-05	5.82E-03	2.26E-03
ground_highboom_900	2.73E-05	2.00E-05	3.78E-06	2.76E-06	4.92E-04	3.59E-04
Off-site Drift to Stream						
Chronic Toxicity						
plane_nonforest_100	6.16E-02	1.34E-01	1.69E-02	3.68E-02	1.13E-01	2.45E-01
plane_nonforest_300	2.23E-02	5.19E-02	6.15E-03	1.43E-02	4.10E-02	9.51E-02
plane_nonforest_900	9.49E-03	1.99E-02	2.61E-03	5.46E-03	1.74E-02	3.64E-02
heli_nonforest_100	5.16E-02	1.10E-01	1.42E-02	3.01E-02	9.45E-02	2.01E-01
heli_nonforest_300	1.81E-02	4.03E-02	4.97E-03	1.11E-02	3.31E-02	7.39E-02
heli_nonforest_900	8.28E-03	1.32E-02	2.28E-03	3.62E-03	1.52E-02	2.42E-02
ground_lowboom_25	2.23E-02	4.46E-02	6.13E-03	1.23E-02	4.09E-02	8.18E-02
ground_lowboom_100	6.53E-03	1.31E-02	1.80E-03	3.60E-03	1.20E-02	2.40E-02
ground_lowboom_900	6.76E-04	1.35E-03	1.86E-04	3.72E-04	1.24E-03	2.48E-03
ground_highboom_25	3.74E-02	7.81E-03	1.03E-02	2.15E-03	6.85E-02	1.43E-02
ground_highboom_100	1.06E-02	4.11E-03	2.91E-03	1.13E-03	1.94E-02	7.54E-03
ground_highboom_900	8.94E-04	6.53E-04	2.46E-04	1.80E-04	1.64E-03	1.20E-03

Table D-15 – Risk Quotients for Off-site Drift Scenarios – Aquatic Application for Submerged Vegetation - 2,4-D acid and salts

Terrestrial Animal - Piscivorous Bird	Typical Application Rate	Maximum Application Rate
Consumption of Fish From Contaminated Pond		
Spray drift to pond modeled by AgDrift		
plane_nonforest_100	7.49E-06	1.64E-05
plane_nonforest_300	3.35E-06	7.73E-06
plane_nonforest_900	1.50E-06	3.09E-06
heli_nonforest_100	6.25E-06	1.34E-05
heli_nonforest_300	2.67E-06	5.99E-06
heli_nonforest_900	1.31E-06	2.00E-06
ground_lowboom_25	2.00E-06	3.99E-06
ground_lowboom_100	1.09E-06	2.19E-06
ground_lowboom_900	2.11E-07	4.23E-07
ground_highboom_25	3.21E-06	6.14E-05
ground_highboom_100	1.69E-06	1.74E-05
ground_highboom_900	2.68E-07	1.47E-06

AgDrift Scenario ID consists of the following information in order: Mode of Application_Application Height or Type_Distance From Receptor in Feet
Shading and boldface indicates plant RQs greater than 1.
Shading and boldface indicates terrestrial animal RQs greater than 0.1 (LOC for acute risk to endangered species - most conservative).
Shading and boldface indicates acute RQs greater than 0.05 for fish and invertebrates.
Shading and boldface indicates chronic RQs greater than 0.5 for fish and invertebrates.

Table D-16 – Risk Quotients for Off-site Drift Scenarios – Aquatic Application for Submerged Vegetation- 2,4-D esters

Terrestrial Plants	Typical Species: Typical Application Rate	Typical Species: Maximum Application Rate	Threatened & Endangered Species: Typical Application Rate	Threatened & Endangered Species: Maximum Application Rate
Off-site Drift to Plants				
Spray drift to off-site soil modeled by AgDrift				
plane_nonforest_100	**2.59E+01**	**5.74E+01**	**6.03E+01**	**1.34E+02**
plane_nonforest_300	**1.33E+01**	**3.03E+01**	**3.10E+01**	**7.07E+01**
plane_nonforest_900	**6.29E+00**	**1.27E+01**	**1.47E+01**	**2.97E+01**
heli_nonforest_100	**2.11E+01**	**4.60E+01**	**4.93E+01**	**1.07E+02**
heli_nonforest_300	**1.06E+01**	**2.36E+01**	**2.47E+01**	**5.50E+01**
heli_nonforest_900	**5.43E+00**	**8.00E+00**	**1.27E+01**	**1.87E+01**
ground_lowboom_25	**6.43E+00**	**1.29E+01**	**1.50E+01**	**3.00E+01**
ground_lowboom_100	**4.00E+00**	**7.86E+00**	**9.33E+00**	**1.83E+01**
ground_lowboom_900	8.57E-01	**1.71E+00**	**2.00E+00**	**4.00E+00**
ground_highboom_25	**1.01E+01**	**2.03E+01**	**2.37E+01**	**4.73E+01**
ground_highboom_100	**6.00E+00**	**1.20E+01**	**1.40E+01**	**2.80E+01**
ground_highboom_900	**1.14E+00**	**2.14E+00**	**2.67E+00**	**5.00E+00**

Table D-16 – Risk Quotients for Off-site Drift Scenarios – Aquatic Application for Submerged Vegetation- 2,4-D esters

Aquatic Receptors	Fish		Aquatic Invertebrates		Non-Target Aquatic Plants	
	Typical Application	Maximum Application	Typical Application	Maximum Application	Typical Application	Maximum Application
Off-site Drift to Pond						
Acute Toxicity						
plane_nonforest_100	1.28E-02	2.80E-02	**5.95E-01**	**1.30E+00**	**6.40E+00**	**1.40E+01**
plane_nonforest_300	5.73E-03	1.32E-02	**2.66E-01**	**6.14E-01**	**2.86E+00**	**6.60E+00**
plane_nonforest_900	2.56E-03	5.28E-03	**1.19E-01**	**2.46E-01**	**1.28E+00**	**2.64E+00**
heli_nonforest_100	1.07E-02	2.28E-02	**4.96E-01**	**1.06E+00**	**5.34E+00**	**1.14E+01**
heli_nonforest_300	4.55E-03	1.02E-02	**2.12E-01**	**4.76E-01**	**2.28E+00**	**5.11E+00**
heli_nonforest_900	2.24E-03	3.42E-03	**1.04E-01**	**1.59E-01**	**1.12E+00**	**1.71E+00**
ground_lowboom_25	3.41E-03	6.82E-03	**1.59E-01**	**3.17E-01**	**1.70E+00**	**3.41E+00**
ground_lowboom_100	1.87E-03	3.74E-03	**8.69E-02**	**1.74E-01**	9.35E-01	**1.87E+00**
ground_lowboom_900	3.61E-04	7.22E-04	1.68E-02	3.36E-02	1.80E-01	3.61E-01
ground_highboom_25	5.47E-03	**1.05E-01**	**2.55E-01**	**4.87E+00**	**2.74E+00**	**5.24E+01**
ground_highboom_100	2.88E-03	2.97E-02	**1.34E-01**	**1.38E+00**	**1.44E+00**	**1.48E+01**
ground_highboom_900	4.58E-04	2.51E-03	2.13E-02	**1.17E-01**	2.29E-01	**1.26E+00**
Off-site Drift to Stream						
Acute Toxicity						
plane_nonforest_100	1.69E-02	3.68E-02	**7.87E-01**	**1.71E+00**	**8.47E+00**	**1.84E+01**
plane_nonforest_300	6.15E-03	1.43E-02	**2.86E-01**	**6.64E-01**	**3.07E+00**	**7.14E+00**
plane_nonforest_900	2.61E-03	5.46E-03	**1.21E-01**	**2.54E-01**	**1.30E+00**	**2.73E+00**
heli_nonforest_100	1.42E-02	3.01E-02	**6.59E-01**	**1.40E+00**	**7.09E+00**	**1.51E+01**
heli_nonforest_300	4.97E-03	1.11E-02	**2.31E-01**	**5.16E-01**	**2.48E+00**	**5.54E+00**
heli_nonforest_900	2.28E-03	3.62E-03	**1.06E-01**	**1.69E-01**	**1.14E+00**	**1.81E+00**
ground_lowboom_25	6.13E-03	1.23E-02	**2.85E-01**	**5.71E-01**	**3.07E+00**	**6.14E+00**
ground_lowboom_100	1.80E-03	3.60E-03	**8.36E-02**	**1.67E-01**	8.98E-01	**1.80E+00**
ground_lowboom_900	1.86E-04	3.72E-04	8.65E-03	1.73E-02	9.30E-02	1.86E-01
ground_highboom_25	1.03E-02	2.15E-03	**4.78E-01**	**9.98E-02**	**5.14E+00**	**1.07E+00**
ground_highboom_100	2.91E-03	1.13E-03	**1.35E-01**	**5.26E-02**	**1.45E+00**	5.65E-01
ground_highboom_900	2.46E-04	1.80E-04	1.14E-02	8.35E-03	1.23E-01	8.98E-02

AgDrift Scenario ID consists of the following information in order: Mode of Application_Application Height or Type_Distance From Receptor in Feet
Shading and boldface indicates plant RQs greater than 1.
Shading and boldface indicates acute RQs greater than 0.05 for fish and invertebrates.

Table D-17 - Risk Quotients for Surface Runoff Scenarios – Terrestrial Application for Annual and Perennial Vegetation - 2,4-D acid and salts

	Typical Species		Threatened & Endangered Species	
Terrestrial Plants	Typical Application Rate	Maximum Application Rate	Typical Application Rate	Maximum Application Rate
Surface Runoff to Off-site Soils				
Surface run-off to off-site soil modeled by GLEAMS				
G_BASE_SAND_005_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_005_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_005_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_010_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_010_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_010_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_025_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_025_TERR	1.55E-11	3.11E-11	4.25E-07	8.50E-07
G_BASE_LOAM_025_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_050_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_050_TERR	5.34E-07	1.07E-06	1.46E-02	2.92E-02
G_BASE_LOAM_050_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_100_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_100_TERR	5.37E-06	1.07E-05	1.47E-01	2.93E-01
G_BASE_LOAM_100_TERR	2.23E-08	4.46E-08	6.10E-04	1.22E-03
G_BASE_SAND_150_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_150_TERR	5.11E-05	1.02E-04	**1.40E+00**	**2.79E+00**
G_BASE_LOAM_150_TERR	7.71E-08	1.54E-07	2.11E-03	4.21E-03
G_BASE_SAND_200_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_200_TERR	1.65E-04	3.31E-04	**4.52E+00**	**9.05E+00**
G_BASE_LOAM_200_TERR	6.17E-08	1.23E-07	1.69E-03	3.37E-03
G_BASE_SAND_250_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_250_TERR	3.06E-04	6.12E-04	**8.37E+00**	**1.67E+01**
G_BASE_LOAM_250_TERR	2.17E-06	4.34E-06	5.93E-02	1.19E-01
G_ARV1_050_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ARV2_050_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ARV3_050_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ERV1_050_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ERV2_050_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ERV3_050_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_RGV1_050_TERR	8.83E-07	1.77E-06	2.41E-02	4.83E-02
G_RGV2_050_TERR	8.35E-08	1.67E-07	2.28E-03	4.56E-03
G_RGV3_050_TERR	1.14E-07	2.28E-07	3.12E-03	6.24E-03
G_SLV1_050_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_SLV2_050_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_SLV3_050_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_STV1_050_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_STV2_050_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_STV3_050_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_VGV1_050_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_VGV2_050_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_VGV3_050_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table D-17 - Risk Quotients for Surface Runoff Scenarios – Terrestrial Application for Annual and Perennial Vegetation - 2,4-D acid and salts

	Fish		Aquatic Invertebrates		Non-Target Aquatic Plants	
Aquatic Species	Typical Application	Maximum Application	Typical Application	Maximum Application	Typical Application	Maximum Application
Overland Flow to Off-site Pond						
Acute Toxicity						
G_BASE_SAND_005_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_005_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_005_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_010_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_010_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_010_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_025_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_025_POND	1.21E-10	2.41E-10	1.67E-11	3.34E-11	2.17E-09	4.34E-09
G_BASE_LOAM_025_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_050_POND	2.40E-08	4.81E-08	3.33E-09	6.65E-09	4.33E-07	8.65E-07
G_BASE_CLAY_050_POND	7.74E-06	1.55E-05	1.07E-06	2.14E-06	1.39E-04	2.79E-04
G_BASE_LOAM_050_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_100_POND	1.26E-06	2.51E-06	1.74E-07	3.48E-07	2.26E-05	4.52E-05
G_BASE_CLAY_100_POND	6.03E-05	1.21E-04	8.35E-06	1.67E-05	1.09E-03	2.17E-03
G_BASE_LOAM_100_POND	6.57E-08	1.31E-07	9.09E-09	1.82E-08	1.18E-06	2.36E-06
G_BASE_SAND_150_POND	1.32E-05	2.65E-05	1.83E-06	3.66E-06	2.38E-04	4.76E-04
G_BASE_CLAY_150_POND	6.59E-04	1.32E-03	9.12E-05	1.82E-04	1.19E-02	2.37E-02
G_BASE_LOAM_150_POND	5.68E-08	1.14E-07	7.87E-09	1.57E-08	1.02E-06	2.05E-06
G_BASE_SAND_200_POND	3.68E-05	7.36E-05	5.09E-06	1.02E-05	6.62E-04	1.32E-03
G_BASE_CLAY_200_POND	1.76E-03	3.51E-03	2.43E-04	4.86E-04	3.16E-02	6.32E-02
G_BASE_LOAM_200_POND	4.46E-08	8.91E-08	6.17E-09	1.23E-08	8.02E-07	1.60E-06
G_BASE_SAND_250_POND	5.41E-05	1.08E-04	7.50E-06	1.50E-05	9.75E-04	1.95E-03
G_BASE_CLAY_250_POND	2.84E-03	5.67E-03	3.93E-04	7.86E-04	5.11E-02	1.02E-01
G_BASE_LOAM_250_POND	2.82E-05	5.63E-05	3.90E-06	7.80E-06	5.07E-04	1.01E-03
G_ARV1_050_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ARV2_050_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ARV3_050_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ERV1_050_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ERV2_050_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ERV3_050_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_RGV1_050_POND	5.84E-06	1.17E-05	8.09E-07	1.62E-06	1.05E-04	2.10E-04
G_RGV2_050_POND	5.81E-07	1.16E-06	8.05E-08	1.61E-07	1.05E-05	2.09E-05
G_RGV3_050_POND	6.64E-07	1.33E-06	9.19E-08	1.84E-07	1.20E-05	2.39E-05
G_SLV1_050_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_SLV2_050_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_SLV3_050_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_STV1_050_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_STV2_050_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_STV3_050_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_VGV1_050_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_VGV2_050_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_VGV3_050_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table D-17 - Risk Quotients for Surface Runoff Scenarios – Terrestrial Application for Annual and Perennial Vegetation - 2,4-D acid and salts

	Fish		Aquatic Invertebrates		Non-Target Aquatic Plants	
Aquatic Species	Typical Application	Maximum Application	Typical Application	Maximum Application	Typical Application	Maximum Application
Overland Flow to Off-site Pond						
Chronic Toxicity						
G_BASE_SAND_005_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_005_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_005_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_010_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_010_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_010_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_025_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_025_POND	3.95E-09	7.89E-09	1.09E-09	2.17E-09	7.23E-09	1.45E-08
G_BASE_LOAM_025_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_050_POND	7.86E-07	1.57E-06	2.16E-07	4.33E-07	0.00E+00	2.88E-06
G_BASE_CLAY_050_POND	2.53E-04	5.07E-04	6.97E-05	1.39E-04	4.65E-04	9.29E-04
G_BASE_LOAM_050_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_100_POND	4.11E-05	8.23E-05	1.13E-05	2.26E-05	7.54E-05	1.51E-04
G_BASE_CLAY_100_POND	1.97E-03	3.95E-03	5.43E-04	1.09E-03	3.62E-03	7.23E-03
G_BASE_LOAM_100_POND	2.15E-06	4.30E-06	5.91E-07	1.18E-06	3.94E-06	7.88E-06
G_BASE_SAND_150_POND	4.33E-04	8.66E-04	1.19E-04	2.38E-04	7.94E-04	1.59E-03
G_BASE_CLAY_150_POND	2.16E-02	4.31E-02	5.93E-03	1.19E-02	3.95E-02	7.91E-02
G_BASE_LOAM_150_POND	1.86E-06	3.72E-06	5.12E-07	1.02E-06	3.41E-06	6.82E-06
G_BASE_SAND_200_POND	1.20E-03	2.41E-03	3.31E-04	6.62E-04	2.21E-03	4.42E-03
G_BASE_CLAY_200_POND	5.75E-02	1.15E-01	1.58E-02	3.16E-02	1.05E-01	2.11E-01
G_BASE_LOAM_200_POND	1.46E-06	2.92E-06	4.01E-07	8.02E-07	2.67E-06	5.35E-06
G_BASE_SAND_250_POND	1.77E-03	3.54E-03	4.87E-04	9.75E-04	3.25E-03	6.50E-03
G_BASE_CLAY_250_POND	9.29E-02	1.86E-01	2.55E-02	5.11E-02	1.70E-01	3.40E-01
G_BASE_LOAM_250_POND	9.22E-04	1.84E-03	2.54E-04	5.07E-04	1.69E-03	3.38E-03
G_ARV1_050_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ARV2_050_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ARV3_050_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ERV1_050_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ERV2_050_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ERV3_050_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_RGV1_050_POND	1.91E-04	3.83E-04	5.26E-05	1.05E-04	3.51E-04	7.01E-04
G_RGV2_050_POND	1.90E-05	3.80E-05	5.23E-06	1.05E-05	3.49E-05	6.97E-05
G_RGV3_050_POND	2.17E-05	4.35E-05	5.98E-06	1.20E-05	3.98E-05	7.97E-05
G_SLV1_050_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_SLV2_050_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_SLV3_050_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_STV1_050_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_STV2_050_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_STV3_050_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_VGV1_050_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_VGV2_050_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_VGV3_050_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table D-17 - Risk Quotients for Surface Runoff Scenarios – Terrestrial Application for Annual and Perennial Vegetation - 2,4-D acid and salts

	Fish		Aquatic Invertebrates		Non-Target Aquatic Plants	
Aquatic Species	Typical Application	Maximum Application	Typical Application	Maximum Application	Typical Application	Maximum Application
Overland Flow to Off-site Stream						
Acute Toxicity						
G_BASE_SAND_005_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_005_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_005_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_010_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_010_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_010_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_025_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_025_STREAM	5.92E-13	1.18E-12	8.20E-14	1.64E-13	1.07E-11	2.13E-11
G_BASE_LOAM_025_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_050_STREAM	8.23E-11	1.65E-10	1.14E-11	2.28E-11	1.48E-09	2.96E-09
G_BASE_CLAY_050_STREAM	3.17E-08	6.34E-08	4.39E-09	8.78E-09	5.71E-07	1.14E-06
G_BASE_LOAM_050_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_100_STREAM	1.60E-08	3.19E-08	2.21E-09	4.42E-09	2.87E-07	5.75E-07
G_BASE_CLAY_100_STREAM	4.20E-07	8.40E-07	5.81E-08	1.16E-07	7.56E-06	1.51E-05
G_BASE_LOAM_100_STREAM	1.40E-09	2.80E-09	1.94E-10	3.87E-10	2.52E-08	5.04E-08
G_BASE_SAND_150_STREAM	1.86E-07	3.72E-07	2.58E-08	5.15E-08	3.35E-06	6.70E-06
G_BASE_CLAY_150_STREAM	2.29E-06	4.59E-06	3.18E-07	6.35E-07	4.13E-05	8.26E-05
G_BASE_LOAM_150_STREAM	3.61E-09	7.23E-09	5.00E-10	1.00E-09	6.50E-08	1.30E-07
G_BASE_SAND_200_STREAM	8.09E-07	1.62E-06	1.12E-07	2.24E-07	1.46E-05	2.91E-05
G_BASE_CLAY_200_STREAM	6.57E-06	1.31E-05	9.10E-07	1.82E-06	1.18E-04	2.37E-04
G_BASE_LOAM_200_STREAM	3.14E-09	6.29E-09	4.35E-10	8.70E-10	5.66E-08	1.13E-07
G_BASE_SAND_250_STREAM	1.39E-06	2.79E-06	1.93E-07	3.86E-07	2.51E-05	5.02E-05
G_BASE_CLAY_250_STREAM	1.16E-05	2.31E-05	1.60E-06	3.20E-06	2.08E-04	4.16E-04
G_BASE_LOAM_250_STREAM	8.14E-08	1.63E-07	1.13E-08	2.25E-08	1.47E-06	2.93E-06
G_ARV1_050_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ARV2_050_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ARV3_050_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ERV1_050_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ERV2_050_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ERV3_050_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_RGV1_050_STREAM	4.87E-08	9.73E-08	6.74E-09	1.35E-08	8.76E-07	1.75E-06
G_RGV2_050_STREAM	4.94E-09	9.89E-09	6.85E-10	1.37E-09	8.90E-08	1.78E-07
G_RGV3_050_STREAM	5.06E-09	1.01E-08	7.00E-10	1.40E-09	9.10E-08	1.82E-07
G_SLV1_050_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_SLV2_050_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_SLV3_050_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_STV1_050_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_STV2_050_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_STV3_050_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_VGV1_050_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_VGV2_050_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_VGV3_050_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table D-17 - Risk Quotients for Surface Runoff Scenarios – Terrestrial Application for Annual and Perennial Vegetation - 2,4-D acid and salts

	Fish		Aquatic Invertebrates		Non-Target Aquatic Plants	
Aquatic Species	Typical Application	Maximum Application	Typical Application	Maximum Application	Typical Application	Maximum Application
Overland Flow to Off-site Stream						
Chronic Toxicity						
G_BASE_SAND_005_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_005_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_005_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_010_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_010_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_010_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_025_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_025_STREAM	1.94E-11	3.88E-11	5.33E-12	1.07E-11	3.55E-11	7.11E-11
G_BASE_LOAM_025_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_050_STREAM	2.69E-09	5.39E-09	7.41E-10	1.48E-09	4.94E-09	9.87E-09
G_BASE_CLAY_050_STREAM	1.04E-06	2.08E-06	2.85E-07	5.71E-07	1.90E-06	3.81E-06
G_BASE_LOAM_050_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_100_STREAM	5.22E-07	1.04E-06	1.44E-07	2.87E-07	9.58E-07	1.92E-06
G_BASE_CLAY_100_STREAM	1.37E-05	2.75E-05	3.78E-06	7.56E-06	2.52E-05	5.04E-05
G_BASE_LOAM_100_STREAM	4.58E-08	9.16E-08	1.26E-08	2.52E-08	8.39E-08	1.68E-07
G_BASE_SAND_150_STREAM	6.09E-06	1.22E-05	1.67E-06	3.35E-06	1.12E-05	2.23E-05
G_BASE_CLAY_150_STREAM	7.51E-05	1.50E-04	2.06E-05	4.13E-05	1.38E-04	2.75E-04
G_BASE_LOAM_150_STREAM	1.18E-07	2.37E-07	3.25E-08	6.50E-08	2.17E-07	4.34E-07
G_BASE_SAND_200_STREAM	2.65E-05	5.29E-05	7.28E-06	1.46E-05	4.85E-05	9.71E-05
G_BASE_CLAY_200_STREAM	2.15E-04	4.30E-04	5.92E-05	1.18E-04	3.94E-04	7.89E-04
G_BASE_LOAM_200_STREAM	1.03E-07	2.06E-07	2.83E-08	5.66E-08	1.89E-07	3.77E-07
G_BASE_SAND_250_STREAM	4.56E-05	9.13E-05	1.26E-05	2.51E-05	8.37E-05	1.67E-04
G_BASE_CLAY_250_STREAM	3.78E-04	7.57E-04	1.04E-04	2.08E-04	6.94E-04	1.39E-03
G_BASE_LOAM_250_STREAM	2.66E-06	5.33E-06	7.33E-07	1.47E-06	4.88E-06	9.77E-06
G_ARV1_050_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ARV2_050_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ARV3_050_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ERV1_050_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ERV2_050_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ERV3_050_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_RGV1_050_STREAM	1.59E-06	3.19E-06	4.38E-07	8.76E-07	2.92E-06	5.84E-06
G_RGV2_050_STREAM	1.62E-07	3.24E-07	4.45E-08	8.90E-08	2.97E-07	5.93E-07
G_RGV3_050_STREAM	1.65E-07	3.31E-07	4.55E-08	9.10E-08	3.03E-07	6.07E-07
G_SLV1_050_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_SLV2_050_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_SLV3_050_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_STV1_050_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_STV2_050_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_STV3_050_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_VGV1_050_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_VGV2_050_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_VGV3_050_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table D-17 - Risk Quotients for Surface Runoff Scenarios – Terrestrial Application for Annual and Perennial Vegetation - 2,4-D acid and salts

Terrestrial Animal - Piscivorous Bird	Typical Application Rate	Maximum Application Rate
Consumption of Fish From Contaminated Pond		
Surface run-off to pond modeled by GLEAMS		
G_BASE_SAND_005_POND	0.00E+00	0.00E+00
G_BASE_CLAY_005_POND	0.00E+00	0.00E+00
G_BASE_LOAM_005_POND	0.00E+00	0.00E+00
G_BASE_SAND_010_POND	0.00E+00	0.00E+00
G_BASE_CLAY_010_POND	0.00E+00	0.00E+00
G_BASE_LOAM_010_POND	0.00E+00	0.00E+00
G_BASE_SAND_025_POND	0.00E+00	0.00E+00
G_BASE_CLAY_025_POND	6.35E-13	1.27E-12
G_BASE_LOAM_025_POND	0.00E+00	0.00E+00
G_BASE_SAND_050_POND	1.27E-10	2.53E-10
G_BASE_CLAY_050_POND	4.08E-08	8.16E-08
G_BASE_LOAM_050_POND	0.00E+00	0.00E+00
G_BASE_SAND_100_POND	6.62E-09	1.32E-08
G_BASE_CLAY_100_POND	3.18E-07	6.35E-07
G_BASE_LOAM_100_POND	3.46E-10	6.92E-10
G_BASE_SAND_150_POND	6.97E-08	1.39E-07
G_BASE_CLAY_150_POND	3.47E-06	6.95E-06
G_BASE_LOAM_150_POND	3.00E-10	5.99E-10
G_BASE_SAND_200_POND	1.94E-07	3.88E-07
G_BASE_CLAY_200_POND	9.26E-06	1.85E-05
G_BASE_LOAM_200_POND	2.35E-10	4.70E-10
G_BASE_SAND_250_POND	2.85E-07	5.71E-07
G_BASE_CLAY_250_POND	1.50E-05	2.99E-05
G_BASE_LOAM_250_POND	1.48E-07	2.97E-07
G_ARV1_050_POND	0.00E+00	0.00E+00
G_ARV2_050_POND	0.00E+00	0.00E+00
G_ARV3_050_POND	0.00E+00	0.00E+00
G_ERV1_050_POND	0.00E+00	0.00E+00
G_ERV2_050_POND	0.00E+00	0.00E+00
G_ERV3_050_POND	0.00E+00	0.00E+00
G_RGV1_050_POND	3.08E-08	6.16E-08
G_RGV2_050_POND	3.06E-09	6.13E-09
G_RGV3_050_POND	3.50E-09	7.00E-09
G_SLV1_050_POND	0.00E+00	0.00E+00
G_SLV2_050_POND	0.00E+00	0.00E+00
G_SLV3_050_POND	0.00E+00	0.00E+00
G_STV1_050_POND	0.00E+00	0.00E+00
G_STV2_050_POND	0.00E+00	0.00E+00
G_STV3_050_POND	0.00E+00	0.00E+00
G_VGV1_050_POND	0.00E+00	0.00E+00
G_VGV2_050_POND	0.00E+00	0.00E+00
G_VGV3_050_POND	0.00E+00	0.00E+00

GLEAMS Scenario ID described in Appendix B of the Methods document (ENSR, 2004).

For example, in the label "G_BASE_SAND_005", "G" refers to the GLEAMS model, and "BASE" indicates that it is a base model scenario (Phase I). "SAND" refers to the soil type (other labels may be "LOAM" or "CLAY"), and the number "005" indicates the amount of precipitation (5 inches). "TERR" refers to runoff to soils (other labels may be "POND" or "STREAM"). In the base model scenarios, the application area, hydraulic slope, surface roughness, USLE soil erodibility factor, and vegetation type remained constant.

In Phase II of the modeling, the precipitation rate remained constant (50 inches), while each of the other six parameters were varied, using three different values. The labels for Phase II (e.g., G_VGV1_050) identify the data as a GLEAMS run ("G"), indicate the amount of precipitation (e.g., 050 for 50 inches), and identify which parameter was varied (application area [ARV], hydraulic slope [SLV], surface roughness [RGV], USLE soil erodibility factor [ERV], vegetation type [VGV], or soil type [STV]) and at which interval (i.e., 1, 2, or 3).

Shading and boldface indicates plant RQs greater than 1.

Shading and boldface indicates terrestrial animal RQs greater than 0.1 (LOC for acute risk to endangered species - most conservative).

Shading and boldface indicates RQs greater than 0.05 for fish and invertebrates (LOC for acute risk to endangered species).

Shading and boldface indicates chronic RQs greater than 0.5 for fish and invertebrates (LOC for chronic risk to endangered species).

Table D-18 - Risk Quotients for Surface Runoff Scenarios – Terrestrial Application for Annual and Perennial Vegetation- 2,4-D esters

	Typical Species		Threatened & Endangered Species	
Terrestrial Plants	**Typical Application Rate**	**Maximum Application Rate**	**Typical Application Rate**	**Maximum Application Rate**
Surface Runoff to Off-site Soils				
Surface run-off to off-site soil modeled by GLEAMS				
G_BASE_SAND_005_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_005_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_005_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_010_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_010_TERR	4.41E-08	8.82E-08	1.21E-03	2.41E-03
G_BASE_LOAM_010_TERR	3.42E-10	6.84E-10	9.35E-06	1.87E-05
G_BASE_SAND_025_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_025_TERR	5.88E-08	1.18E-07	1.61E-03	3.21E-03
G_BASE_LOAM_025_TERR	2.64E-10	5.29E-10	7.22E-06	1.44E-05
G_BASE_SAND_050_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_050_TERR	2.20E-06	4.41E-06	6.03E-02	1.21E-01
G_BASE_LOAM_050_TERR	8.39E-10	1.68E-09	2.29E-05	4.59E-05
G_BASE_SAND_100_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_100_TERR	1.86E-05	3.72E-05	5.09E-01	**1.02E+00**
G_BASE_LOAM_100_TERR	3.04E-07	6.09E-07	8.32E-03	1.66E-02
G_BASE_SAND_150_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_150_TERR	3.34E-05	6.68E-05	9.13E-01	**1.83E+00**
G_BASE_LOAM_150_TERR	1.32E-06	2.64E-06	3.61E-02	7.22E-02
G_BASE_SAND_200_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_200_TERR	9.94E-05	1.99E-04	**2.72E+00**	**5.44E+00**
G_BASE_LOAM_200_TERR	1.48E-06	2.96E-06	4.04E-02	8.08E-02
G_BASE_SAND_250_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_250_TERR	1.92E-04	3.85E-04	**5.26E+00**	**1.05E+01**
G_BASE_LOAM_250_TERR	3.83E-06	7.66E-06	1.05E-01	2.09E-01
G_ARV1_050_TERR	8.39E-10	1.68E-09	2.29E-05	4.59E-05
G_ARV2_050_TERR	8.39E-10	1.68E-09	2.29E-05	4.59E-05
G_ARV3_050_TERR	8.39E-10	1.68E-09	2.29E-05	4.59E-05
G_ERV1_050_TERR	8.24E-10	1.65E-09	2.25E-05	4.50E-05
G_ERV2_050_TERR	8.39E-10	1.68E-09	2.29E-05	4.59E-05
G_ERV3_050_TERR	8.55E-10	1.71E-09	2.34E-05	4.67E-05
G_RGV1_050_TERR	8.24E-10	1.65E-09	2.25E-05	4.50E-05
G_RGV2_050_TERR	8.24E-10	1.65E-09	2.25E-05	4.50E-05
G_RGV3_050_TERR	8.86E-10	1.77E-09	2.42E-05	4.84E-05
G_SLV1_050_TERR	4.57E-06	9.14E-06	1.25E-01	2.50E-01
G_SLV2_050_TERR	5.80E-07	1.16E-06	1.59E-02	3.17E-02
G_SLV3_050_TERR	8.89E-07	1.78E-06	2.43E-02	4.86E-02
G_STV1_050_TERR	8.24E-10	1.65E-09	2.25E-05	4.50E-05
G_STV2_050_TERR	8.39E-10	1.68E-09	2.29E-05	4.59E-05
G_STV3_050_TERR	8.24E-10	1.65E-09	2.25E-05	4.50E-05
G_VGV1_050_TERR	8.39E-10	1.68E-09	2.29E-05	4.59E-05
G_VGV2_050_TERR	8.39E-10	1.68E-09	2.29E-05	4.59E-05
G_VGV3_050_TERR	5.13E-10	1.03E-09	1.40E-05	2.80E-05

Table D-I8 - Risk Quotients for Surface Runoff Scenarios – Terrestrial Application for Annual and Perennial Vegetation- 2,4-D esters

Aquatic Species	Fish		Aquatic Invertebrates		Non-Target Aquatic Plants	
	Typical Application	Maximum Application	Typical Application	Maximum Application	Typical Application	Maximum Application
Overland Flow to Off-site Pond						
Acute Toxicity						
G_BASE_SAND_005_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_005_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_005_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_010_POND	7.29E-08	1.46E-07	3.39E-06	6.78E-06	3.64E-05	7.29E-05
G_BASE_CLAY_010_POND	7.49E-06	1.50E-05	3.48E-04	6.97E-04	3.75E-03	7.49E-03
G_BASE_LOAM_010_POND	1.29E-07	2.58E-07	6.00E-06	1.20E-05	6.45E-05	1.29E-04
G_BASE_SAND_025_POND	1.25E-07	2.50E-07	5.81E-06	1.16E-05	6.25E-05	1.25E-04
G_BASE_CLAY_025_POND	3.96E-06	7.91E-06	1.84E-04	3.68E-04	1.98E-03	3.96E-03
G_BASE_LOAM_025_POND	1.22E-08	2.45E-08	5.69E-07	1.14E-06	6.11E-06	1.22E-05
G_BASE_SAND_050_POND	1.03E-06	2.07E-06	4.81E-05	9.61E-05	5.17E-04	1.03E-03
G_BASE_CLAY_050_POND	3.62E-04	7.25E-04	1.69E-02	3.37E-02	1.81E-01	3.62E-01
G_BASE_LOAM_050_POND	1.28E-08	2.56E-08	5.94E-07	1.19E-06	6.39E-06	1.28E-05
G_BASE_SAND_100_POND	6.38E-05	1.28E-04	2.97E-03	5.93E-03	3.19E-02	6.38E-02
G_BASE_CLAY_100_POND	8.54E-04	1.71E-03	3.97E-02	**7.94E-02**	4.27E-01	8.54E-01
G_BASE_LOAM_100_POND	9.03E-06	1.81E-05	4.20E-04	8.40E-04	4.51E-03	9.03E-03
G_BASE_SAND_150_POND	1.13E-03	2.27E-03	**5.28E-02**	**1.06E-01**	5.67E-01	**1.13E+00**
G_BASE_CLAY_150_POND	4.90E-03	9.80E-03	**2.28E-01**	**4.56E-01**	**2.45E+00**	**4.90E+00**
G_BASE_LOAM_150_POND	7.39E-06	1.48E-05	3.44E-04	6.87E-04	3.70E-03	7.39E-03
G_BASE_SAND_200_POND	1.89E-03	3.78E-03	**8.78E-02**	**1.76E-01**	9.44E-01	**1.89E+00**
G_BASE_CLAY_200_POND	1.25E-02	2.50E-02	**5.80E-01**	**1.16E+00**	**6.24E+00**	**1.25E+01**
G_BASE_LOAM_200_POND	6.04E-06	1.21E-05	2.81E-04	5.62E-04	3.02E-03	6.04E-03
G_BASE_SAND_250_POND	2.29E-03	4.58E-03	**1.07E-01**	**2.13E-01**	**1.15E+00**	**2.29E+00**
G_BASE_CLAY_250_POND	2.07E-02	4.14E-02	**9.62E-01**	**1.92E+00**	**1.03E+01**	**2.07E+01**
G_BASE_LOAM_250_POND	5.89E-04	1.18E-03	2.74E-02	**5.48E-02**	2.95E-01	5.89E-01
G_ARV1_050_POND	5.08E-09	1.02E-08	2.36E-07	4.72E-07	2.54E-06	5.08E-06
G_ARV2_050_POND	2.32E-09	4.63E-09	1.08E-07	2.16E-07	1.16E-06	2.32E-06
G_ARV3_050_POND	2.31E-09	4.63E-09	1.08E-07	2.15E-07	1.16E-06	2.31E-06
G_ERV1_050_POND	9.11E-09	1.82E-08	4.23E-07	8.47E-07	4.55E-06	9.11E-06
G_ERV2_050_POND	9.23E-09	1.85E-08	4.29E-07	8.58E-07	4.61E-06	9.23E-06
G_ERV3_050_POND	9.34E-09	1.87E-08	4.34E-07	8.69E-07	4.67E-06	9.34E-06
G_RGV1_050_POND	9.11E-09	1.82E-08	4.23E-07	8.47E-07	4.55E-06	9.11E-06
G_RGV2_050_POND	9.11E-09	1.82E-08	4.23E-07	8.47E-07	4.55E-06	9.11E-06
G_RGV3_050_POND	9.87E-09	1.97E-08	4.59E-07	9.18E-07	4.93E-06	9.87E-06
G_SLV1_050_POND	2.60E-04	5.20E-04	1.21E-02	2.42E-02	1.30E-01	2.60E-01
G_SLV2_050_POND	3.37E-05	6.74E-05	1.57E-03	3.13E-03	1.68E-02	3.37E-02
G_SLV3_050_POND	4.65E-05	9.30E-05	2.16E-03	4.33E-03	2.32E-02	4.65E-02
G_STV1_050_POND	9.11E-09	1.82E-08	4.23E-07	8.47E-07	4.55E-06	9.11E-06
G_STV2_050_POND	9.23E-09	1.85E-08	4.29E-07	8.58E-07	4.61E-06	9.23E-06
G_STV3_050_POND	9.11E-09	1.82E-08	4.23E-07	8.47E-07	4.55E-06	9.11E-06
G_VGV1_050_POND	9.23E-09	1.85E-08	4.29E-07	8.58E-07	4.61E-06	9.23E-06
G_VGV2_050_POND	9.23E-09	1.85E-08	4.29E-07	8.58E-07	4.61E-06	9.23E-06
G_VGV3_050_POND	4.18E-09	8.36E-09	1.94E-07	3.89E-07	2.09E-06	4.18E-06

Table D-18 - Risk Quotients for Surface Runoff Scenarios – Terrestrial Application for Annual and Perennial Vegetation- 2,4-D esters

Aquatic Species	Fish		Aquatic Invertebrates		Non-Target Aquatic Plants	
	Typical Application	Maximum Application	Typical Application	Maximum Application	Typical Application	Maximum Application
Overland Flow to Off-site Stream						
Acute Toxicity						
G_BASE_SAND_005_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_005_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_005_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_010_STREAM	7.59E-11	1.52E-10	3.53E-09	7.06E-09	3.79E-08	7.59E-08
G_BASE_CLAY_010_STREAM	1.49E-08	2.97E-08	6.91E-07	1.38E-06	7.43E-06	1.49E-05
G_BASE_LOAM_010_STREAM	1.11E-10	2.21E-10	5.15E-09	1.03E-08	5.53E-08	1.11E-07
G_BASE_SAND_025_STREAM	7.55E-10	1.51E-09	3.51E-08	7.02E-08	3.77E-07	7.55E-07
G_BASE_CLAY_025_STREAM	3.07E-08	6.15E-08	1.43E-06	2.86E-06	1.54E-05	3.07E-05
G_BASE_LOAM_025_STREAM	8.28E-11	1.66E-10	3.85E-09	7.70E-09	4.14E-08	8.28E-08
G_BASE_SAND_050_STREAM	2.13E-08	4.26E-08	9.91E-07	1.98E-06	1.07E-05	2.13E-05
G_BASE_CLAY_050_STREAM	1.17E-06	2.33E-06	5.43E-05	1.09E-04	5.83E-04	1.17E-03
G_BASE_LOAM_050_STREAM	3.14E-10	6.27E-10	1.46E-08	2.92E-08	1.57E-07	3.14E-07
G_BASE_SAND_100_STREAM	1.57E-06	3.15E-06	7.32E-05	1.46E-04	7.87E-04	1.57E-03
G_BASE_CLAY_100_STREAM	1.12E-05	2.24E-05	5.20E-04	1.04E-03	5.60E-03	1.12E-02
G_BASE_LOAM_100_STREAM	1.62E-07	3.24E-07	7.53E-06	1.51E-05	8.09E-05	1.62E-04
G_BASE_SAND_150_STREAM	1.66E-05	3.32E-05	7.72E-04	1.54E-03	8.30E-03	1.66E-02
G_BASE_CLAY_150_STREAM	2.61E-05	5.22E-05	1.21E-03	2.43E-03	1.31E-02	2.61E-02
G_BASE_LOAM_150_STREAM	5.13E-07	1.03E-06	2.38E-05	4.77E-05	2.56E-04	5.13E-04
G_BASE_SAND_200_STREAM	3.34E-05	6.68E-05	1.55E-03	3.11E-03	1.67E-02	3.34E-02
G_BASE_CLAY_200_STREAM	5.24E-05	1.05E-04	2.44E-03	4.87E-03	2.62E-02	5.24E-02
G_BASE_LOAM_200_STREAM	5.32E-07	1.06E-06	2.47E-05	4.95E-05	2.66E-04	5.32E-04
G_BASE_SAND_250_STREAM	4.93E-05	9.85E-05	2.29E-03	4.58E-03	2.46E-02	4.93E-02
G_BASE_CLAY_250_STREAM	8.27E-05	1.65E-04	3.85E-03	7.69E-03	4.14E-02	8.27E-02
G_BASE_LOAM_250_STREAM	1.73E-06	3.46E-06	8.05E-05	1.61E-04	8.66E-04	1.73E-03
G_ARV1_050_STREAM	3.89E-11	7.78E-11	1.81E-09	3.62E-09	1.94E-08	3.89E-08
G_ARV2_050_STREAM	1.13E-09	2.25E-09	5.24E-08	1.05E-07	5.64E-07	1.13E-06
G_ARV3_050_STREAM	1.55E-09	3.10E-09	7.20E-08	1.44E-07	7.75E-07	1.55E-06
G_ERV1_050_STREAM	3.09E-10	6.18E-10	1.44E-08	2.88E-08	1.55E-07	3.09E-07
G_ERV2_050_STREAM	3.14E-10	6.27E-10	1.46E-08	2.92E-08	1.57E-07	3.14E-07
G_ERV3_050_STREAM	3.18E-10	6.36E-10	1.48E-08	2.96E-08	1.59E-07	3.18E-07
G_RGV1_050_STREAM	3.09E-10	6.18E-10	1.44E-08	2.88E-08	1.55E-07	3.09E-07
G_RGV2_050_STREAM	3.09E-10	6.18E-10	1.44E-08	2.88E-08	1.55E-07	3.09E-07
G_RGV3_050_STREAM	3.31E-10	6.62E-10	1.54E-08	3.08E-08	1.66E-07	3.31E-07
G_SLV1_050_STREAM	2.22E-06	4.43E-06	1.03E-04	2.06E-04	1.11E-03	2.22E-03
G_SLV2_050_STREAM	3.01E-07	6.02E-07	1.40E-05	2.80E-05	1.50E-04	3.01E-04
G_SLV3_050_STREAM	3.86E-07	7.73E-07	1.80E-05	3.59E-05	1.93E-04	3.86E-04
G_STV1_050_STREAM	3.09E-10	6.18E-10	1.44E-08	2.88E-08	1.55E-07	3.09E-07
G_STV2_050_STREAM	3.14E-10	6.27E-10	1.46E-08	2.92E-08	1.57E-07	3.14E-07
G_STV3_050_STREAM	3.09E-10	6.18E-10	1.44E-08	2.88E-08	1.55E-07	3.09E-07
G_VGV1_050_STREAM	3.14E-10	6.27E-10	1.46E-08	2.92E-08	1.57E-07	3.14E-07
G_VGV2_050_STREAM	3.14E-10	6.27E-10	1.46E-08	2.92E-08	1.57E-07	3.14E-07
G_VGV3_050_STREAM	1.85E-10	3.71E-10	8.62E-09	1.72E-08	9.27E-08	1.85E-07

GLEAMS Scenario ID described in Appendix B of the Methods document (ENSR, 2004).

For example, in the label "G_BASE_SAND_005", "G" refers to the GLEAMS model, and "BASE" indicates that it is a base model scenario (Phase I). "SAND" refers to the soil type (other labels may be "LOAM" or "CLAY"), and the number "005" indicates the amount of precipitation (5 inches). "TERR" refers to runoff to soils (other labels may be "POND" or "STREAM"). In the base model scenarios, the application area, hydraulic slope, surface roughness, USLE soil erodibility factor, and vegetation type remained constant.

In Phase II of the modeling, the precipitation rate remained constant (50 inches), while each of the other six parameters were varied, using three different values. The labels for Phase II (e.g., G_VGV1_050) identify the data as a GLEAMS run ("G"), indicate the amount of precipitation (e.g., 050 for 50 inches), and identify which parameter was varied (application area [ARV], hydraulic slope [SLV], surface roughness [RGV], USLE soil erodibility factor [ERV], vegetation type [VGV], or soil type [STV]) and at which interval (i.e., 1, 2, or 3).
Shading and boldface indicates plant RQs greater than 1.
Shading and boldface indicates acute RQs greater than 0.05 for fish and invertebrates (LOC for acute risk to endangered species).

Table D-19 – Risk Quotients for Surface Runoff Scenarios – Terrestrial Application for Woody Vegetation - 2,4-D acid and salts

	Typical Species		Threatened & Endangered Species	
Terrestrial Plants	**Typical Application Rate**	**Maximum Application Rate**	**Typical Application Rate**	**Maximum Application Rate**
Surface Runoff to Off-site Soils				
Surface run-off to off-site soil modeled by GLEAMS				
G_BASE_SAND_005_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_005_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_005_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_010_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_010_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_010_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_025_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_025_TERR	3.11E-11	6.22E-11	8.50E-07	1.70E-06
G_BASE_LOAM_025_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_050_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_050_TERR	1.07E-06	2.13E-06	2.92E-02	5.83E-02
G_BASE_LOAM_050_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_100_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_100_TERR	1.07E-05	2.15E-05	2.93E-01	5.87E-01
G_BASE_LOAM_100_TERR	4.46E-08	8.92E-08	1.22E-03	2.44E-03
G_BASE_SAND_150_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_150_TERR	1.02E-04	2.04E-04	**2.79E+00**	**5.58E+00**
G_BASE_LOAM_150_TERR	1.54E-07	3.08E-07	4.21E-03	8.43E-03
G_BASE_SAND_200_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_200_TERR	3.31E-04	6.62E-04	**9.05E+00**	**1.81E+01**
G_BASE_LOAM_200_TERR	1.23E-07	2.47E-07	3.37E-03	6.74E-03
G_BASE_SAND_250_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_250_TERR	6.12E-04	1.22E-03	**1.67E+01**	**3.35E+01**
G_BASE_LOAM_250_TERR	4.34E-06	8.67E-06	1.19E-01	2.37E-01
G_ARV1_050_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ARV2_050_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ARV3_050_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ERV1_050_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ERV2_050_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ERV3_050_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_RGV1_050_TERR	1.77E-06	3.53E-06	4.83E-02	9.65E-02
G_RGV2_050_TERR	1.67E-07	3.34E-07	4.56E-03	9.13E-03
G_RGV3_050_TERR	2.28E-07	4.57E-07	6.24E-03	1.25E-02
G_SLV1_050_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_SLV2_050_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_SLV3_050_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_STV1_050_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_STV2_050_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_STV3_050_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_VGV1_050_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_VGV2_050_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_VGV3_050_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table D-D- – Risk Quotients for Surface Runoff Scenarios – Terrestrial Application for Woody Vegetation - 2,4-D acid and salts

Aquatic Species	Fish		Aquatic Invertebrates		Non-Target Aquatic Plants	
	Typical Application	Maximum Application	Typical Application	Maximum Application	Typical Application	Maximum Application
Overland Flow to Off-site Pond						
Acute Toxicity						
G_BASE_SAND_005_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_005_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_005_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_010_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_010_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_010_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_025_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_025_POND	2.41E-10	4.82E-10	3.34E-11	6.68E-11	4.34E-09	8.68E-09
G_BASE_LOAM_025_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_050_POND	4.81E-08	9.61E-08	6.65E-09	1.33E-08	8.65E-07	1.73E-06
G_BASE_CLAY_050_POND	1.55E-05	3.10E-05	2.14E-06	4.29E-06	2.79E-04	5.58E-04
G_BASE_LOAM_050_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_100_POND	2.51E-06	5.03E-06	3.48E-07	6.96E-07	4.52E-05	9.05E-05
G_BASE_CLAY_100_POND	1.21E-04	2.41E-04	1.67E-05	3.34E-05	2.17E-03	4.34E-03
G_BASE_LOAM_100_POND	1.31E-07	2.63E-07	1.82E-08	3.64E-08	2.36E-06	4.73E-06
G_BASE_SAND_150_POND	2.65E-05	5.29E-05	3.66E-06	7.33E-06	4.76E-04	9.53E-04
G_BASE_CLAY_150_POND	1.32E-03	2.64E-03	1.82E-04	3.65E-04	2.37E-02	4.74E-02
G_BASE_LOAM_150_POND	1.14E-07	2.27E-07	1.57E-08	3.15E-08	2.05E-06	4.09E-06
G_BASE_SAND_200_POND	7.36E-05	1.47E-04	1.02E-05	2.04E-05	1.32E-03	2.65E-03
G_BASE_CLAY_200_POND	3.51E-03	7.02E-03	4.86E-04	9.73E-04	6.32E-02	1.26E-01
G_BASE_LOAM_200_POND	8.91E-08	1.78E-07	1.23E-08	2.47E-08	1.60E-06	3.21E-06
G_BASE_SAND_250_POND	1.08E-04	2.17E-04	1.50E-05	3.00E-05	1.95E-03	3.90E-03
G_BASE_CLAY_250_POND	5.67E-03	1.13E-02	7.86E-04	1.57E-03	1.02E-01	2.04E-01
G_BASE_LOAM_250_POND	5.63E-05	1.13E-04	7.80E-06	1.56E-05	1.01E-03	2.03E-03
G_ARV1_050_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ARV2_050_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ARV3_050_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ERV1_050_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ERV2_050_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ERV3_050_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_RGV1_050_POND	1.17E-05	2.34E-05	1.62E-06	3.24E-06	2.10E-04	4.21E-04
G_RGV2_050_POND	1.16E-06	2.32E-06	1.61E-07	3.22E-07	2.09E-05	4.18E-05
G_RGV3_050_POND	1.33E-06	2.66E-06	1.84E-07	3.68E-07	2.39E-05	4.78E-05
G_SLV1_050_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_SLV2_050_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_SLV3_050_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_STV1_050_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_STV2_050_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_STV3_050_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_VGV1_050_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_VGV2_050_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_VGV3_050_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table D-19 – Risk Quotients for Surface Runoff Scenarios – Terrestrial Application for Woody Vegetation - 2,4-D acid and salts

	Fish		Aquatic Invertebrates		Non-Target Aquatic Plants	
Aquatic Species	Typical Application	Maximum Application	Typical Application	Maximum Application	Typical Application	Maximum Application
Overland Flow to Off-site Pond						
Chronic Toxicity						
G_BASE_SAND_005_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_005_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_005_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_010_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_010_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_010_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_025_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_025_POND	7.89E-09	1.58E-08	2.17E-09	4.34E-09	1.45E-08	2.89E-08
G_BASE_LOAM_025_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_050_POND	1.57E-06	3.15E-06	4.33E-07	8.65E-07	0.00E+00	5.77E-06
G_BASE_CLAY_050_POND	5.07E-04	1.01E-03	1.39E-04	2.79E-04	9.29E-04	1.86E-03
G_BASE_LOAM_050_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_100_POND	8.23E-05	1.65E-04	2.26E-05	4.52E-05	1.51E-04	3.02E-04
G_BASE_CLAY_100_POND	3.95E-03	7.89E-03	1.09E-03	2.17E-03	7.23E-03	1.45E-02
G_BASE_LOAM_100_POND	4.30E-06	8.60E-06	1.18E-06	2.36E-06	7.88E-06	1.58E-05
G_BASE_SAND_150_POND	8.66E-04	1.73E-03	2.38E-04	4.76E-04	1.59E-03	3.18E-03
G_BASE_CLAY_150_POND	4.31E-02	8.63E-02	1.19E-02	2.37E-02	7.91E-02	1.58E-01
G_BASE_LOAM_150_POND	3.72E-06	7.44E-06	1.02E-06	2.05E-06	6.82E-06	1.36E-05
G_BASE_SAND_200_POND	2.41E-03	4.82E-03	6.62E-04	1.32E-03	4.42E-03	8.83E-03
G_BASE_CLAY_200_POND	1.15E-01	2.30E-01	3.16E-02	6.32E-02	2.11E-01	4.21E-01
G_BASE_LOAM_200_POND	2.92E-06	5.83E-06	8.02E-07	1.60E-06	5.35E-06	1.07E-05
G_BASE_SAND_250_POND	3.54E-03	7.09E-03	9.75E-04	1.95E-03	6.50E-03	1.30E-02
G_BASE_CLAY_250_POND	1.86E-01	3.71E-01	5.11E-02	1.02E-01	3.40E-01	6.81E-01
G_BASE_LOAM_250_POND	1.84E-03	3.69E-03	5.07E-04	1.01E-03	3.38E-03	6.76E-03
G_ARV1_050_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ARV2_050_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ARV3_050_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ERV1_050_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ERV2_050_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ERV3_050_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_RGV1_050_POND	3.83E-04	7.65E-04	1.05E-04	2.10E-04	7.01E-04	1.40E-03
G_RGV2_050_POND	3.80E-05	7.61E-05	1.05E-05	2.09E-05	6.97E-05	1.39E-04
G_RGV3_050_POND	4.35E-05	8.69E-05	1.20E-05	2.39E-05	7.97E-05	1.59E-04
G_SLV1_050_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_SLV2_050_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_SLV3_050_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_STV1_050_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_STV2_050_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_STV3_050_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_VGV1_050_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_VGV2_050_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_VGV3_050_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table D-19 – Risk Quotients for Surface Runoff Scenarios – Terrestrial Application for Woody Vegetation - 2,4-D acid and salts

Aquatic Species	Fish		Aquatic Invertebrates		Non-Target Aquatic Plants	
	Typical Application	Maximum Application	Typical Application	Maximum Application	Typical Application	Maximum Application
Overland Flow to Off-site Stream						
Acute Toxicity						
G_BASE_SAND_005_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_005_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_005_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_010_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_010_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_010_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_025_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_025_STREAM	1.18E-12	2.37E-12	1.64E-13	3.28E-13	2.13E-11	4.26E-11
G_BASE_LOAM_025_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_050_STREAM	1.65E-10	3.29E-10	2.28E-11	4.56E-11	2.96E-09	5.92E-09
G_BASE_CLAY_050_STREAM	6.34E-08	1.27E-07	8.78E-09	1.76E-08	1.14E-06	2.28E-06
G_BASE_LOAM_050_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_100_STREAM	3.19E-08	6.38E-08	4.42E-09	8.84E-09	5.75E-07	1.15E-06
G_BASE_CLAY_100_STREAM	8.40E-07	1.68E-06	1.16E-07	2.33E-07	1.51E-05	3.02E-05
G_BASE_LOAM_100_STREAM	2.80E-09	5.60E-09	3.87E-10	7.75E-10	5.04E-08	1.01E-07
G_BASE_SAND_150_STREAM	3.72E-07	7.44E-07	5.15E-08	1.03E-07	6.70E-06	1.34E-05
G_BASE_CLAY_150_STREAM	4.59E-06	9.17E-06	6.35E-07	1.27E-06	8.26E-05	1.65E-04
G_BASE_LOAM_150_STREAM	7.23E-09	1.45E-08	1.00E-09	2.00E-09	1.30E-07	2.60E-07
G_BASE_SAND_200_STREAM	1.62E-06	3.24E-06	2.24E-07	4.48E-07	2.91E-05	5.82E-05
G_BASE_CLAY_200_STREAM	1.31E-05	2.63E-05	1.82E-06	3.64E-06	2.37E-04	4.73E-04
G_BASE_LOAM_200_STREAM	6.29E-09	1.26E-08	8.70E-10	1.74E-09	1.13E-07	2.26E-07
G_BASE_SAND_250_STREAM	2.79E-06	5.58E-06	3.86E-07	7.72E-07	5.02E-05	1.00E-04
G_BASE_CLAY_250_STREAM	2.31E-05	4.62E-05	3.20E-06	6.40E-06	4.16E-04	8.32E-04
G_BASE_LOAM_250_STREAM	1.63E-07	3.26E-07	2.25E-08	4.51E-08	2.93E-06	5.86E-06
G_ARV1_050_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ARV2_050_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ARV3_050_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ERV1_050_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ERV2_050_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ERV3_050_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_RGV1_050_STREAM	9.73E-08	1.95E-07	1.35E-08	2.70E-08	1.75E-06	3.50E-06
G_RGV2_050_STREAM	9.89E-09	1.98E-08	1.37E-09	2.74E-09	1.78E-07	3.56E-07
G_RGV3_050_STREAM	1.01E-08	2.02E-08	1.40E-09	2.80E-09	1.82E-07	3.64E-07
G_SLV1_050_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_SLV2_050_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_SLV3_050_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_STV1_050_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_STV2_050_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_STV3_050_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_VGV1_050_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_VGV2_050_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_VGV3_050_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table D-19 – Risk Quotients for Surface Runoff Scenarios – Terrestrial Application for Woody Vegetation - 2,4-D acid and salts

	Fish		Aquatic Invertebrates		Non-Target Aquatic Plants	
Aquatic Species	**Typical Application**	**Maximum Application**	**Typical Application**	**Maximum Application**	**Typical Application**	**Maximum Application**
Overland Flow to Off-site Stream						
Chronic Toxicity						
G_BASE_SAND_005_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_005_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_005_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_010_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_010_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_010_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_025_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_025_STREAM	3.88E-11	7.75E-11	1.07E-11	2.13E-11	7.11E-11	1.42E-10
G_BASE_LOAM_025_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_050_STREAM	5.39E-09	1.08E-08	1.48E-09	2.96E-09	9.87E-09	1.97E-08
G_BASE_CLAY_050_STREAM	2.08E-06	4.15E-06	5.71E-07	1.14E-06	3.81E-06	7.61E-06
G_BASE_LOAM_050_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_100_STREAM	1.04E-06	2.09E-06	2.87E-07	5.75E-07	1.92E-06	3.83E-06
G_BASE_CLAY_100_STREAM	2.75E-05	5.50E-05	7.56E-06	1.51E-05	5.04E-05	1.01E-04
G_BASE_LOAM_100_STREAM	9.16E-08	1.83E-07	2.52E-08	5.04E-08	1.68E-07	3.36E-07
G_BASE_SAND_150_STREAM	1.22E-05	2.44E-05	3.35E-06	6.70E-06	2.23E-05	4.47E-05
G_BASE_CLAY_150_STREAM	1.50E-04	3.00E-04	4.13E-05	8.26E-05	2.75E-04	5.50E-04
G_BASE_LOAM_150_STREAM	2.37E-07	4.73E-07	6.50E-08	1.30E-07	4.34E-07	8.67E-07
G_BASE_SAND_200_STREAM	5.29E-05	1.06E-04	1.46E-05	2.91E-05	9.71E-05	1.94E-04
G_BASE_CLAY_200_STREAM	4.30E-04	8.60E-04	1.18E-04	2.37E-04	7.89E-04	1.58E-03
G_BASE_LOAM_200_STREAM	2.06E-07	4.11E-07	5.66E-08	1.13E-07	3.77E-07	7.54E-07
G_BASE_SAND_250_STREAM	9.13E-05	1.83E-04	2.51E-05	5.02E-05	1.67E-04	3.35E-04
G_BASE_CLAY_250_STREAM	7.57E-04	1.51E-03	2.08E-04	4.16E-04	1.39E-03	2.77E-03
G_BASE_LOAM_250_STREAM	5.33E-06	1.07E-05	1.47E-06	2.93E-06	9.77E-06	1.95E-05
G_ARV1_050_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ARV2_050_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ARV3_050_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ERV1_050_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ERV2_050_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_ERV3_050_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_RGV1_050_STREAM	3.19E-06	6.37E-06	8.76E-07	1.75E-06	5.84E-06	1.17E-05
G_RGV2_050_STREAM	3.24E-07	6.47E-07	8.90E-08	1.78E-07	5.93E-07	1.19E-06
G_RGV3_050_STREAM	3.31E-07	6.62E-07	9.10E-08	1.82E-07	6.07E-07	1.21E-06
G_SLV1_050_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_SLV2_050_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_SLV3_050_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_STV1_050_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_STV2_050_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_STV3_050_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_VGV1_050_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_VGV2_050_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_VGV3_050_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table D-19 – Risk Quotients for Surface Runoff Scenarios – Terrestrial Application for Woody Vegetation - 2,4-D acid and salts

Terrestrial Animal - Piscivorous Bird	Typical Application Rate	Maximum Application Rate
Consumption of Fish From Contaminated Pond		
Surface run-off to pond modeled by GLEAMS		
G_BASE_SAND_005_POND	0.00E+00	0.00E+00
G_BASE_CLAY_005_POND	0.00E+00	0.00E+00
G_BASE_LOAM_005_POND	0.00E+00	0.00E+00
G_BASE_SAND_010_POND	0.00E+00	0.00E+00
G_BASE_CLAY_010_POND	0.00E+00	0.00E+00
G_BASE_LOAM_010_POND	0.00E+00	0.00E+00
G_BASE_SAND_025_POND	0.00E+00	0.00E+00
G_BASE_CLAY_025_POND	1.27E-12	2.54E-12
G_BASE_LOAM_025_POND	0.00E+00	0.00E+00
G_BASE_SAND_050_POND	2.53E-10	5.07E-10
G_BASE_CLAY_050_POND	8.16E-08	1.63E-07
G_BASE_LOAM_050_POND	0.00E+00	0.00E+00
G_BASE_SAND_100_POND	1.32E-08	2.65E-08
G_BASE_CLAY_100_POND	6.35E-07	1.27E-06
G_BASE_LOAM_100_POND	6.92E-10	1.38E-09
G_BASE_SAND_150_POND	1.39E-07	2.79E-07
G_BASE_CLAY_150_POND	6.95E-06	1.39E-05
G_BASE_LOAM_150_POND	5.99E-10	1.20E-09
G_BASE_SAND_200_POND	3.88E-07	7.76E-07
G_BASE_CLAY_200_POND	1.85E-05	3.70E-05
G_BASE_LOAM_200_POND	4.70E-10	9.39E-10
G_BASE_SAND_250_POND	5.71E-07	1.14E-06
G_BASE_CLAY_250_POND	2.99E-05	5.98E-05
G_BASE_LOAM_250_POND	2.97E-07	5.94E-07
G_ARV1_050_POND	0.00E+00	0.00E+00
G_ARV2_050_POND	0.00E+00	0.00E+00
G_ARV3_050_POND	0.00E+00	0.00E+00
G_ERV1_050_POND	0.00E+00	0.00E+00
G_ERV2_050_POND	0.00E+00	0.00E+00
G_ERV3_050_POND	0.00E+00	0.00E+00
G_RGV1_050_POND	6.16E-08	1.23E-07
G_RGV2_050_POND	6.13E-09	1.23E-08
G_RGV3_050_POND	7.00E-09	1.40E-08
G_SLV1_050_POND	0.00E+00	0.00E+00
G_SLV2_050_POND	0.00E+00	0.00E+00
G_SLV3_050_POND	0.00E+00	0.00E+00
G_STV1_050_POND	0.00E+00	0.00E+00
G_STV2_050_POND	0.00E+00	0.00E+00
G_STV3_050_POND	0.00E+00	0.00E+00
G_VGV1_050_POND	0.00E+00	0.00E+00
G_VGV2_050_POND	0.00E+00	0.00E+00
G_VGV3_050_POND	0.00E+00	0.00E+00

GLEAMS Scenario ID described in Appendix B of the Methods document (ENSR, 2004).

For example, in the label “G_BASE_SAND_005”, “G” refers to the GLEAMS model, and “BASE” indicates that it is a base model scenario (Phase I). “SAND” refers to the soil type (other labels may be “LOAM” or “CLAY”), and the number “005” indicates the amount of precipitation (5 inches). "TERR" refers to runoff to soils (other labels may be "POND" or "STREAM"). In the base model scenarios, the application area, hydraulic slope, surface roughness, USLE soil erodibility factor, and vegetation type remained constant.

In Phase II of the modeling, the precipitation rate remained constant (50 inches), while each of the other six parameters were varied, using three different values. The labels for Phase II (e.g., G_VGV1_050) identify the data as a GLEAMS run (“G”), indicate the amount of precipitation (e.g., 050 for 50 inches), and identify which parameter was varied (application area [ARV], hydraulic slope [SLV], surface roughness [RGV], USLE soil erodibility factor [ERV], vegetation type [VGV], or soil type [STV]) and at which interval (i.e., 1, 2, or 3).
Shading and boldface indicates plant RQs greater than 1.
Shading and boldface indicates terrestrial animal RQs greater than 0.1 (LOC for acute risk to endangered species - most conservative).
Shading and boldface indicates acute RQs greater than 0.05 for fish and invertebrates (LOC for acute risk to endangered species).
Shading and boldface indicates chronic RQs greater than 0.5 for fish and invertebrates (LOC for chronic risk to endangered species).

Table D-20 – Risk Quotients for Surface Runoff Scenarios – Terrestrial Application for Woody Vegetation- 2,4-D esters

Terrestrial Plants	Typical Species: Typical Application Rate	Typical Species: Maximum Application Rate	Threatened & Endangered Species: Typical Application Rate	Threatened & Endangered Species: Maximum Application Rate
Surface Runoff to Off-site Soils				
Surface run-off to off-site soil modeled by GLEAMS				
G_BASE_SAND_005_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_005_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_005_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_010_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_010_TERR	8.82E-08	1.76E-07	2.41E-03	4.82E-03
G_BASE_LOAM_010_TERR	6.84E-10	1.37E-09	1.87E-05	3.74E-05
G_BASE_SAND_025_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_025_TERR	1.18E-07	2.35E-07	3.21E-03	6.43E-03
G_BASE_LOAM_025_TERR	5.29E-10	1.06E-09	1.44E-05	2.89E-05
G_BASE_SAND_050_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_050_TERR	4.41E-06	8.82E-06	1.21E-01	2.41E-01
G_BASE_LOAM_050_TERR	1.68E-09	3.36E-09	4.59E-05	9.18E-05
G_BASE_SAND_100_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_100_TERR	3.72E-05	7.45E-05	**1.02E+00**	**2.04E+00**
G_BASE_LOAM_100_TERR	6.09E-07	1.22E-06	1.66E-02	3.33E-02
G_BASE_SAND_150_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_150_TERR	6.68E-05	1.34E-04	**1.83E+00**	**3.65E+00**
G_BASE_LOAM_150_TERR	2.64E-06	5.28E-06	7.22E-02	1.44E-01
G_BASE_SAND_200_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_200_TERR	1.99E-04	3.98E-04	**5.44E+00**	**1.09E+01**
G_BASE_LOAM_200_TERR	2.96E-06	5.91E-06	8.08E-02	1.62E-01
G_BASE_SAND_250_TERR	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_250_TERR	3.85E-04	7.69E-04	**1.05E+01**	**2.10E+01**
G_BASE_LOAM_250_TERR	7.66E-06	1.53E-05	2.09E-01	4.19E-01
G_ARV1_050_TERR	1.68E-09	3.36E-09	4.59E-05	9.18E-05
G_ARV2_050_TERR	1.68E-09	3.36E-09	4.59E-05	9.18E-05
G_ARV3_050_TERR	1.68E-09	3.36E-09	4.59E-05	9.18E-05
G_ERV1_050_TERR	1.65E-09	3.29E-09	4.50E-05	9.01E-05
G_ERV2_050_TERR	1.68E-09	3.36E-09	4.59E-05	9.18E-05
G_ERV3_050_TERR	1.71E-09	3.42E-09	4.67E-05	9.35E-05
G_RGV1_050_TERR	1.65E-09	3.29E-09	4.50E-05	9.01E-05
G_RGV2_050_TERR	1.65E-09	3.29E-09	4.50E-05	9.01E-05
G_RGV3_050_TERR	1.77E-09	3.54E-09	4.84E-05	9.69E-05
G_SLV1_050_TERR	9.14E-06	1.83E-05	2.50E-01	5.00E-01
G_SLV2_050_TERR	1.16E-06	2.32E-06	3.17E-02	6.34E-02
G_SLV3_050_TERR	1.78E-06	3.56E-06	4.86E-02	9.72E-02
G_STV1_050_TERR	1.65E-09	3.29E-09	4.50E-05	9.01E-05
G_STV2_050_TERR	1.68E-09	3.36E-09	4.59E-05	9.18E-05
G_STV3_050_TERR	1.65E-09	3.29E-09	4.50E-05	9.01E-05
G_VGV1_050_TERR	1.68E-09	3.36E-09	4.59E-05	9.18E-05
G_VGV2_050_TERR	1.68E-09	3.36E-09	4.59E-05	9.18E-05
G_VGV3_050_TERR	1.03E-09	2.05E-09	2.80E-05	5.61E-05

Table D-20 – Risk Quotients for Surface Runoff Scenarios – Terrestrial Application for Woody Vegetation- 2,4-D esters

Aquatic Species	Fish		Aquatic Invertebrates		Non-Target Aquatic Plants	
	Typical Application	Maximum Application	Typical Application	Maximum Application	Typical Application	Maximum Application
Overland Flow to Off-site Pond						
Acute Toxicity						
G_BASE_SAND_005_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_005_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_005_POND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_010_POND	1.46E-07	2.91E-07	6.78E-06	1.36E-05	7.29E-05	1.46E-04
G_BASE_CLAY_010_POND	1.50E-05	3.00E-05	6.97E-04	1.39E-03	7.49E-03	1.50E-02
G_BASE_LOAM_010_POND	2.58E-07	5.16E-07	1.20E-05	2.40E-05	1.29E-04	2.58E-04
G_BASE_SAND_025_POND	2.50E-07	5.00E-07	1.16E-05	2.33E-05	1.25E-04	2.50E-04
G_BASE_CLAY_025_POND	7.91E-06	1.58E-05	3.68E-04	7.36E-04	3.96E-03	7.91E-03
G_BASE_LOAM_025_POND	2.45E-08	4.89E-08	1.14E-06	2.27E-06	1.22E-05	2.45E-05
G_BASE_SAND_050_POND	2.07E-06	4.13E-06	9.61E-05	1.92E-04	1.03E-03	2.07E-03
G_BASE_CLAY_050_POND	7.25E-04	1.45E-03	3.37E-02	**6.74E-02**	3.62E-01	7.25E-01
G_BASE_LOAM_050_POND	2.56E-08	5.11E-08	1.19E-06	2.38E-06	1.28E-05	2.56E-05
G_BASE_SAND_100_POND	1.28E-04	2.55E-04	5.93E-03	1.19E-02	6.38E-02	1.28E-01
G_BASE_CLAY_100_POND	1.71E-03	3.42E-03	**7.94E-02**	**1.59E-01**	8.54E-01	**1.71E+00**
G_BASE_LOAM_100_POND	1.81E-05	3.61E-05	8.40E-04	1.68E-03	9.03E-03	1.81E-02
G_BASE_SAND_150_POND	2.27E-03	4.54E-03	**1.06E-01**	**2.11E-01**	**1.13E+00**	**2.27E+00**
G_BASE_CLAY_150_POND	9.80E-03	1.96E-02	**4.56E-01**	**9.12E-01**	**4.90E+00**	**9.80E+00**
G_BASE_LOAM_150_POND	1.48E-05	2.96E-05	6.87E-04	1.37E-03	7.39E-03	1.48E-02
G_BASE_SAND_200_POND	3.78E-03	7.55E-03	**1.76E-01**	**3.51E-01**	**1.89E+00**	**3.78E+00**
G_BASE_CLAY_200_POND	2.50E-02	4.99E-02	**1.16E+00**	**2.32E+00**	**1.25E+01**	**2.50E+01**
G_BASE_LOAM_200_POND	1.21E-05	2.42E-05	5.62E-04	1.12E-03	6.04E-03	1.21E-02
G_BASE_SAND_250_POND	4.58E-03	9.17E-03	**2.13E-01**	**4.26E-01**	**2.29E+00**	**4.58E+00**
G_BASE_CLAY_250_POND	4.14E-02	**8.27E-02**	**1.92E+00**	**3.85E+00**	**2.07E+01**	**4.14E+01**
G_BASE_LOAM_250_POND	1.18E-03	2.36E-03	**5.48E-02**	**1.10E-01**	5.89E-01	**1.18E+00**
G_ARV1_050_POND	1.02E-08	2.03E-08	4.72E-07	9.44E-07	5.08E-06	1.02E-05
G_ARV2_050_POND	4.63E-09	9.27E-09	2.16E-07	4.31E-07	2.32E-06	4.63E-06
G_ARV3_050_POND	4.63E-09	9.26E-09	2.15E-07	4.31E-07	2.31E-06	4.63E-06
G_ERV1_050_POND	1.82E-08	3.64E-08	8.47E-07	1.69E-06	9.11E-06	1.82E-05
G_ERV2_050_POND	1.85E-08	3.69E-08	8.58E-07	1.72E-06	9.23E-06	1.85E-05
G_ERV3_050_POND	1.87E-08	3.74E-08	8.69E-07	1.74E-06	9.34E-06	1.87E-05
G_RGV1_050_POND	1.82E-08	3.64E-08	8.47E-07	1.69E-06	9.11E-06	1.82E-05
G_RGV2_050_POND	1.82E-08	3.64E-08	8.47E-07	1.69E-06	9.11E-06	1.82E-05
G_RGV3_050_POND	1.97E-08	3.95E-08	9.18E-07	1.84E-06	9.87E-06	1.97E-05
G_SLV1_050_POND	5.20E-04	1.04E-03	2.42E-02	4.84E-02	2.60E-01	5.20E-01
G_SLV2_050_POND	6.74E-05	1.35E-04	3.13E-03	6.27E-03	3.37E-02	6.74E-02
G_SLV3_050_POND	9.30E-05	1.86E-04	4.33E-03	8.65E-03	4.65E-02	9.30E-02
G_STV1_050_POND	1.82E-08	3.64E-08	8.47E-07	1.69E-06	9.11E-06	1.82E-05
G_STV2_050_POND	1.85E-08	3.69E-08	8.58E-07	1.72E-06	9.23E-06	1.85E-05
G_STV3_050_POND	1.82E-08	3.64E-08	8.47E-07	1.69E-06	9.11E-06	1.82E-05
G_VGV1_050_POND	1.85E-08	3.69E-08	8.58E-07	1.72E-06	9.23E-06	1.85E-05
G_VGV2_050_POND	1.85E-08	3.69E-08	8.58E-07	1.72E-06	9.23E-06	1.85E-05
G_VGV3_050_POND	8.36E-09	1.67E-08	3.89E-07	7.78E-07	4.18E-06	8.36E-06

Table D-20 – Risk Quotients for Surface Runoff Scenarios – Terrestrial Application for Woody Vegetation- 2,4-D esters

Aquatic Species	Fish		Aquatic Invertebrates		Non-Target Aquatic Plants	
	Typical Application	Maximum Application	Typical Application	Maximum Application	Typical Application	Maximum Application
Overland Flow to Off-site Stream						
Acute Toxicity						
G_BASE_SAND_005_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_CLAY_005_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_LOAM_005_STREAM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G_BASE_SAND_010_STREAM	1.52E-10	3.03E-10	7.06E-09	1.41E-08	7.59E-08	1.52E-07
G_BASE_CLAY_010_STREAM	2.97E-08	5.94E-08	1.38E-06	2.76E-06	1.49E-05	2.97E-05
G_BASE_LOAM_010_STREAM	2.21E-10	4.43E-10	1.03E-08	2.06E-08	1.11E-07	2.21E-07
G_BASE_SAND_025_STREAM	1.51E-09	3.02E-09	7.02E-08	1.40E-07	7.55E-07	1.51E-06
G_BASE_CLAY_025_STREAM	6.15E-08	1.23E-07	2.86E-06	5.72E-06	3.07E-05	6.15E-05
G_BASE_LOAM_025_STREAM	1.66E-10	3.31E-10	7.70E-09	1.54E-08	8.28E-08	1.66E-07
G_BASE_SAND_050_STREAM	4.26E-08	8.52E-08	1.98E-06	3.96E-06	2.13E-05	4.26E-05
G_BASE_CLAY_050_STREAM	2.33E-06	4.67E-06	1.09E-04	2.17E-04	1.17E-03	2.33E-03
G_BASE_LOAM_050_STREAM	6.27E-10	1.25E-09	2.92E-08	5.83E-08	3.14E-07	6.27E-07
G_BASE_SAND_100_STREAM	3.15E-06	6.30E-06	1.46E-04	2.93E-04	1.57E-03	3.15E-03
G_BASE_CLAY_100_STREAM	2.24E-05	4.48E-05	1.04E-03	2.08E-03	1.12E-02	2.24E-02
G_BASE_LOAM_100_STREAM	3.24E-07	6.47E-07	1.51E-05	3.01E-05	1.62E-04	3.24E-04
G_BASE_SAND_150_STREAM	3.32E-05	6.64E-05	1.54E-03	3.09E-03	1.66E-02	3.32E-02
G_BASE_CLAY_150_STREAM	5.22E-05	1.04E-04	2.43E-03	4.86E-03	2.61E-02	5.22E-02
G_BASE_LOAM_150_STREAM	1.03E-06	2.05E-06	4.77E-05	9.53E-05	5.13E-04	1.03E-03
G_BASE_SAND_200_STREAM	6.68E-05	1.34E-04	3.11E-03	6.22E-03	3.34E-02	6.68E-02
G_BASE_CLAY_200_STREAM	1.05E-04	2.10E-04	4.87E-03	9.75E-03	5.24E-02	1.05E-01
G_BASE_LOAM_200_STREAM	1.06E-06	2.13E-06	4.95E-05	9.90E-05	5.32E-04	1.06E-03
G_BASE_SAND_250_STREAM	9.85E-05	1.97E-04	4.58E-03	9.16E-03	4.93E-02	9.85E-02
G_BASE_CLAY_250_STREAM	1.65E-04	3.31E-04	7.69E-03	1.54E-02	8.27E-02	1.65E-01
G_BASE_LOAM_250_STREAM	3.46E-06	6.92E-06	1.61E-04	3.22E-04	1.73E-03	3.46E-03
G_ARV1_050_STREAM	7.78E-11	1.56E-10	3.62E-09	7.23E-09	3.89E-08	7.78E-08
G_ARV2_050_STREAM	2.25E-09	4.51E-09	1.05E-07	2.10E-07	1.13E-06	2.25E-06
G_ARV3_050_STREAM	3.10E-09	6.20E-09	1.44E-07	2.88E-07	1.55E-06	3.10E-06
G_ERV1_050_STREAM	6.18E-10	1.24E-09	2.88E-08	5.75E-08	3.09E-07	6.18E-07
G_ERV2_050_STREAM	6.27E-10	1.25E-09	2.92E-08	5.83E-08	3.14E-07	6.27E-07
G_ERV3_050_STREAM	6.36E-10	1.27E-09	2.96E-08	5.91E-08	3.18E-07	6.36E-07
G_RGV1_050_STREAM	6.18E-10	1.24E-09	2.88E-08	5.75E-08	3.09E-07	6.18E-07
G_RGV2_050_STREAM	6.18E-10	1.24E-09	2.88E-08	5.75E-08	3.09E-07	6.18E-07
G_RGV3_050_STREAM	6.62E-10	1.32E-09	3.08E-08	6.16E-08	3.31E-07	6.62E-07
G_SLV1_050_STREAM	4.43E-06	8.87E-06	2.06E-04	4.12E-04	2.22E-03	4.43E-03
G_SLV2_050_STREAM	6.02E-07	1.20E-06	2.80E-05	5.60E-05	3.01E-04	6.02E-04
G_SLV3_050_STREAM	7.73E-07	1.55E-06	3.59E-05	7.19E-05	3.86E-04	7.73E-04
G_STV1_050_STREAM	6.18E-10	1.24E-09	2.88E-08	5.75E-08	3.09E-07	6.18E-07
G_STV2_050_STREAM	6.27E-10	1.25E-09	2.92E-08	5.83E-08	3.14E-07	6.27E-07
G_STV3_050_STREAM	6.18E-10	1.24E-09	2.88E-08	5.75E-08	3.09E-07	6.18E-07
G_VGV1_050_STREAM	6.27E-10	1.25E-09	2.92E-08	5.83E-08	3.14E-07	6.27E-07
G_VGV2_050_STREAM	6.27E-10	1.25E-09	2.92E-08	5.83E-08	3.14E-07	6.27E-07
G_VGV3_050_STREAM	3.71E-10	7.41E-10	1.72E-08	3.45E-08	1.85E-07	3.71E-07

GLEAMS Scenario ID described in Appendix B of the Methods document (ENSR, 2004).

For example, in the label "G_BASE_SAND_005", "G" refers to the GLEAMS model, and "BASE" indicates that it is a base model scenario (Phase I). "SAND" refers to the soil type (other labels may be "LOAM" or "CLAY"), and the number "005" indicates the amount of precipitation (5 inches). "TERR" refers to runoff to soils (other labels may be "POND" or "STREAM"). In the base model scenarios, the application area, hydraulic slope, surface roughness, USLE soil erodibility factor, and vegetation type remained constant.

In Phase II of the modeling, the precipitation rate remained constant (50 inches), while each of the other six parameters were varied, using three different values. The labels for Phase II (e.g., G_VGV1_050) identify the data as a GLEAMS run ("G"), indicate the amount of precipitation (e.g., 050 for 50 inches), and identify which parameter was varied (application area [ARV], hydraulic slope [SLV], surface roughness [RGV], USLE soil erodibility factor [ERV], vegetation type [VGV], or soil type [STV]) and at which interval (i.e., 1, 2, or 3).
Shading and boldface indicates plant RQs greater than 1.
Shading and boldface indicates acute RQs greater than 0.05 for fish and invertebrates (LOC for acute risk to endangered species).

Table D-21 - Risk Quotients for Wind Erosion Scenarios – Terrestrial Application for Annual and Perennial Vegetation - 2,4-D acid and salts

Terrestrial Plants	Typical Species: Typical Application Rate	Typical Species: Maximum Application Rate	Threatened & Endangered Species: Typical Application Rate	Threatened & Endangered Species: Maximum Application Rate
Wind Erosion				
Wind erosion to off-site soil modeled by AERMOD and CalPuff				
MT_1.5	1.25E-01	2.50E-01	8.33E-01	**1.67E+00**
MT_10	3.66E-03	7.33E-03	2.44E-02	4.88E-02
MT_100	1.28E-04	2.56E-04	8.53E-04	1.71E-03
OR_1.5	**1.44E+00**	**2.87E+00**	**9.57E+00**	**1.91E+01**
OR_10	3.84E-02	7.67E-02	2.56E-01	5.11E-01
OR_100	9.37E-04	1.87E-03	6.25E-03	1.25E-02
WY_1.5	7.38E-01	**1.48E+00**	**4.92E+00**	**9.84E+00**
WY_10	2.64E-02	5.28E-02	1.76E-01	3.52E-01
WY_100	8.42E-04	1.68E-03	5.62E-03	1.12E-02

AERMOD/CalPuff Scenario ID consists of the following information in order: Watershed Location_Distance From Receptor in Kilometers
Shading and boldface indicates RQs greater than 1 (LOC for plants).

Table D-22 - Risk Quotients for Wind Erosion Scenarios – Terrestrial Application for Annual and Perennial Vegetation- 2,4-D esters

Terrestrial Plants	Typical Species: Typical Application Rate	Typical Species: Maximum Application Rate	Threatened & Endangered Species: Typical Application Rate	Threatened & Endangered Species: Maximum Application Rate
Wind Erosion				
Wind erosion to off-site soil modeled by AERMOD and CalPuff				
MT_1.5	3.57E-01	7.14E-01	8.33E-01	**1.67E+00**
MT_10	1.05E-02	2.09E-02	2.44E-02	4.88E-02
MT_100	3.66E-04	7.32E-04	8.53E-04	1.71E-03
OR_1.5	**4.10E+00**	**8.20E+00**	**9.57E+00**	**1.91E+01**
OR_10	1.10E-01	2.19E-01	2.56E-01	5.11E-01
OR_100	2.68E-03	5.36E-03	6.25E-03	1.25E-02
WY_1.5	**2.11E+00**	**4.22E+00**	**4.92E+00**	**9.84E+00**
WY_10	7.55E-02	1.51E-01	1.76E-01	3.52E-01
WY_100	2.41E-03	4.81E-03	5.62E-03	1.12E-02

AERMOD/CalPuff Scenario ID consists of the following information in order: Watershed Location_Distance From Receptor in Kilometers
Shading and boldface indicates RQs greater than 1 (LOC for plants).

Table D-23 – Risk Quotients for Wind Erosion Scenarios – Terrestrial Application for Woody Vegetation - 2,4-D acid and salts

Terrestrial Plants	Typical Species: Typical Application Rate	Typical Species: Maximum Application Rate	Threatened & Endangered Species: Typical Application Rate	Threatened & Endangered Species: Maximum Application Rate
Wind Erosion				
Wind erosion to off-site soil modeled by AERMOD and CalPuff				
MT_1.5	2.50E-01	5.00E-01	**1.67E+00**	**3.33E+00**
MT_10	7.33E-03	1.47E-02	4.88E-02	9.77E-02
MT_100	2.56E-04	5.12E-04	1.71E-03	3.41E-03
OR_1.5	**2.87E+00**	**5.74E+00**	**1.91E+01**	**3.83E+01**
OR_10	7.67E-02	1.53E-01	5.11E-01	**1.02E+00**
OR_100	1.87E-03	3.75E-03	1.25E-02	2.50E-02
WY_1.5	**1.48E+00**	**2.95E+00**	**9.84E+00**	**1.97E+01**
WY_10	5.28E-02	1.06E-01	3.52E-01	7.05E-01
WY_100	1.68E-03	3.37E-03	1.12E-02	2.25E-02

AERMOD/CalPuff Scenario ID consists of the following information in order: Watershed Location_Distance From Receptor in Kilometers
Shading and boldface indicates RQs greater than 1 (LOC for plants).

Table D-24 – Risk Quotients for Wind Erosion Scenarios – Terrestrial Application for Woody Vegetation- 2,4-D esters

Terrestrial Plants	Typical Species		Threatened & Endangered Species	
	Typical Application Rate	Maximum Application Rate	Typical Application Rate	Maximum Application Rate
Wind Erosion				
Wind erosion to off-site soil modeled by AERMOD and CalPuff				
MT_1.5	7.14E-01	**1.43E+00**	**1.67E+00**	**3.33E+00**
MT_10	2.09E-02	4.19E-02	4.88E-02	9.77E-02
MT_100	7.32E-04	1.46E-03	1.71E-03	3.41E-03
OR_1.5	**8.20E+00**	**1.64E+01**	**1.91E+01**	**3.83E+01**
OR_10	2.19E-01	4.38E-01	5.11E-01	**1.02E+00**
OR_100	5.36E-03	1.07E-02	1.25E-02	2.50E-02
WY_1.5	**4.22E+00**	**8.44E+00**	**9.84E+00**	**1.97E+01**
WY_10	1.51E-01	3.02E-01	3.52E-01	7.05E-01
WY_100	4.81E-03	9.63E-03	1.12E-02	2.25E-02

AERMOD/CalPuff Scenario ID consists of the following information in order: Watershed Location_Distance From Receptor in Kilometers
Shading and boldface indicates RQs greater than 1 (LOC for plants).

APPENDIX E – BOXPLOTS OF RISK QUOTIENTS

Figure E-1. Risk Quotients for Terrestrial Animals Exposed to 2,4-D Acids and Salts in Direct Spray Scenarios at Application Rates for Terrestrial Annual or Perennial Vegetation

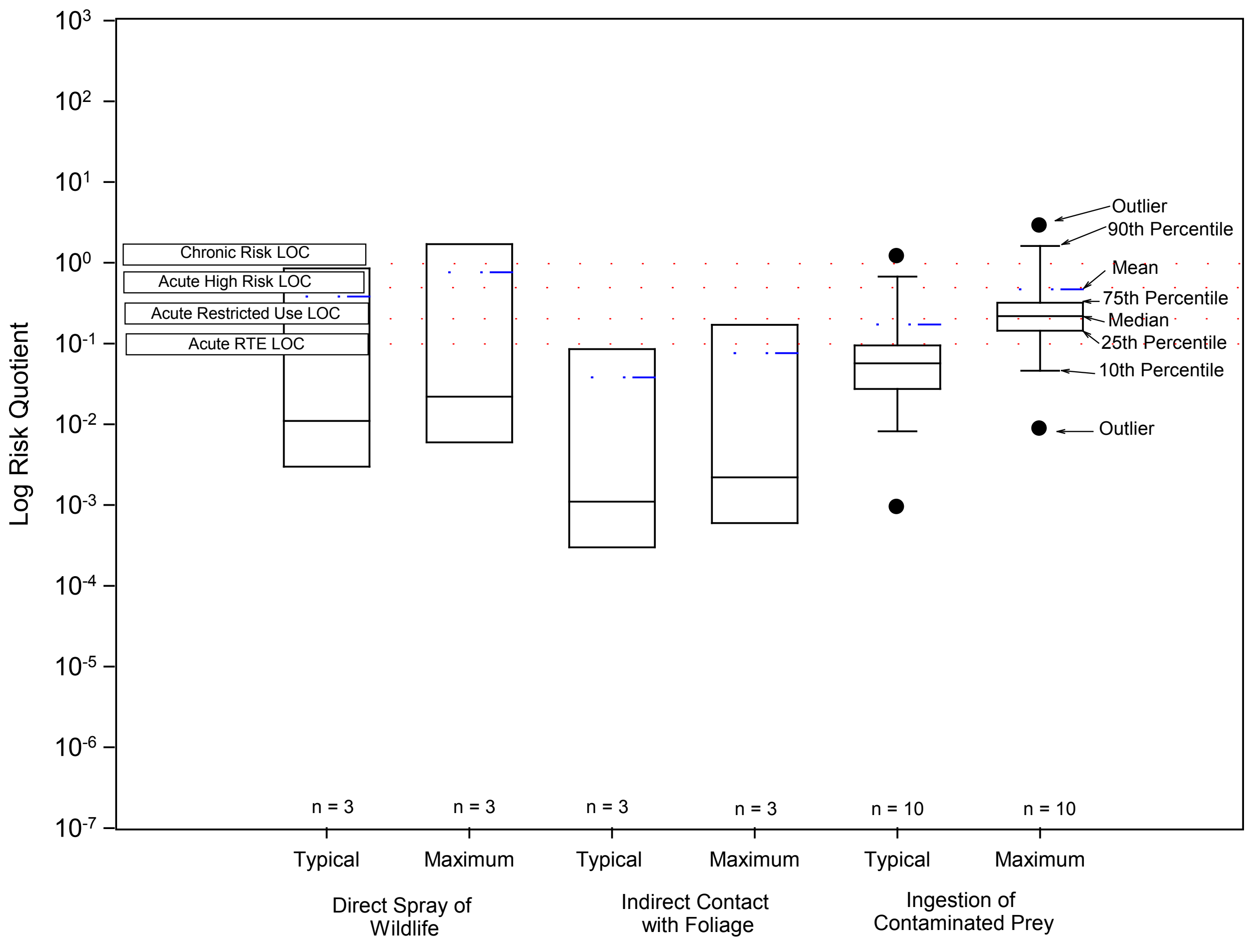


Figure E-2. Risk Quotients for Terrestrial Animals Exposed to 2,4-D Acids and Salts in Direct Spray Scenarios at Application Rates for Terrestrial Woody Vegetation

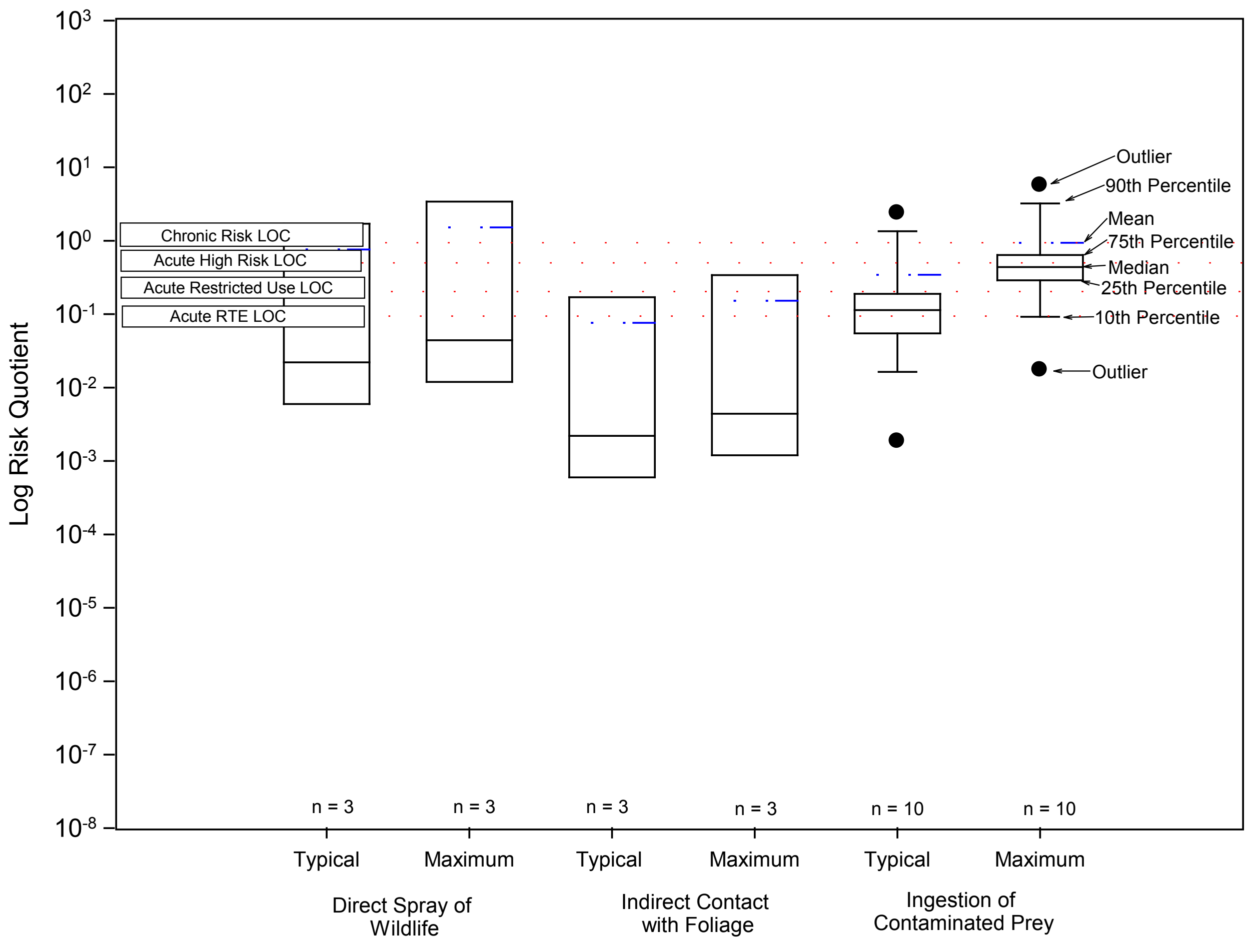


Figure E-3. Risk Quotients for Terrestrial Animals Exposed to 2,4-D Acids and Salts in Direct Spray Scenarios at Application Rates for Aquatic Floating and Emerged Vegetation

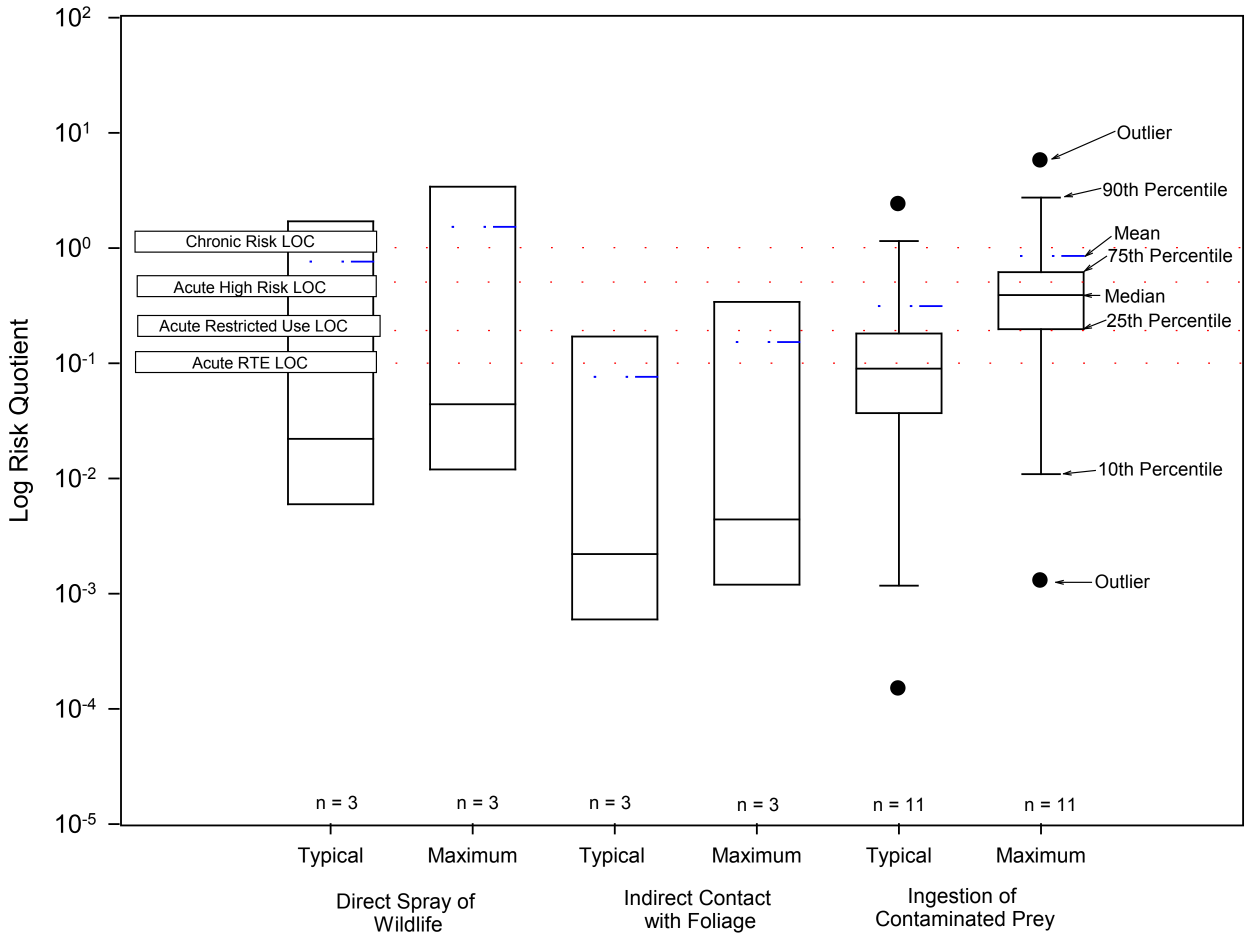


Figure E-4. Risk Quotients for Terrestrial Animals Exposed to 2,4-D Acids and Salts in Direct Spray Scenarios at Application Rates for Aquatic Submerged Vegetation

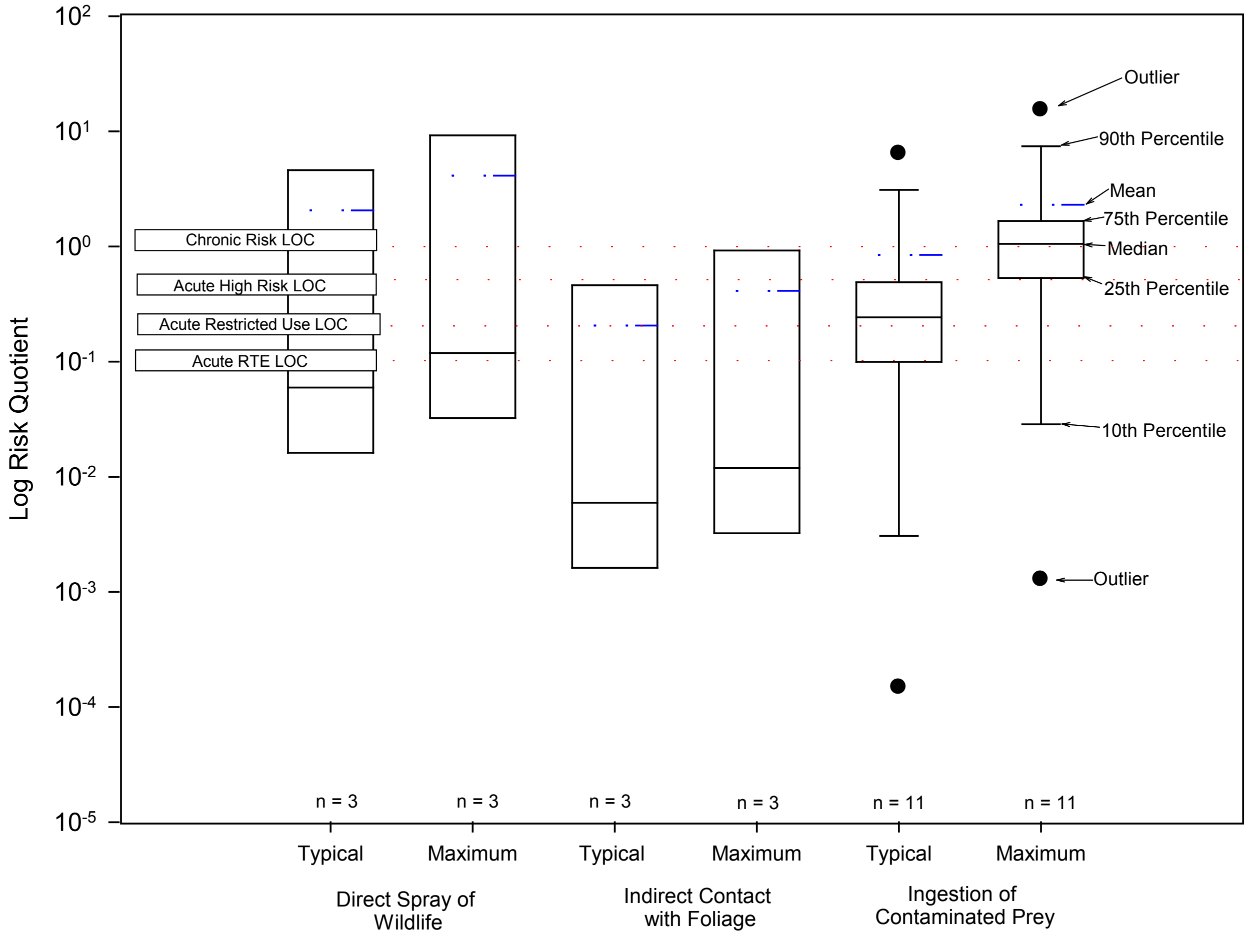


Figure E-5. Risk Quotients for Non-Target Terrestrial Plants Exposed to 2,4-D Acids and Salts in Direct Spray Scenarios at Application Rates for Terrestrial Annual or Perennial Vegetation

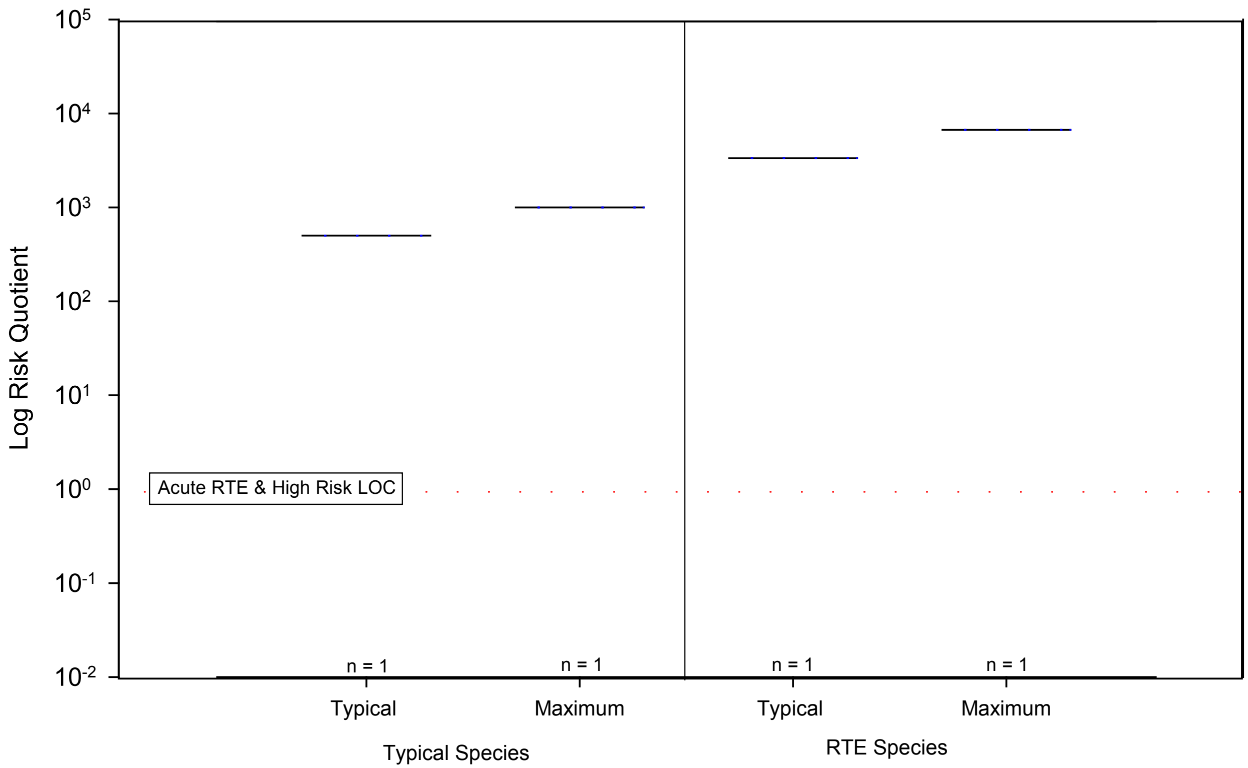


Figure E-6. Risk Quotients for Non-Target Terrestrial Plants Exposed to 2,4-D Esters in Direct Spray Scenarios at Application Rates for Terrestrial Annual or Perennial Vegetation

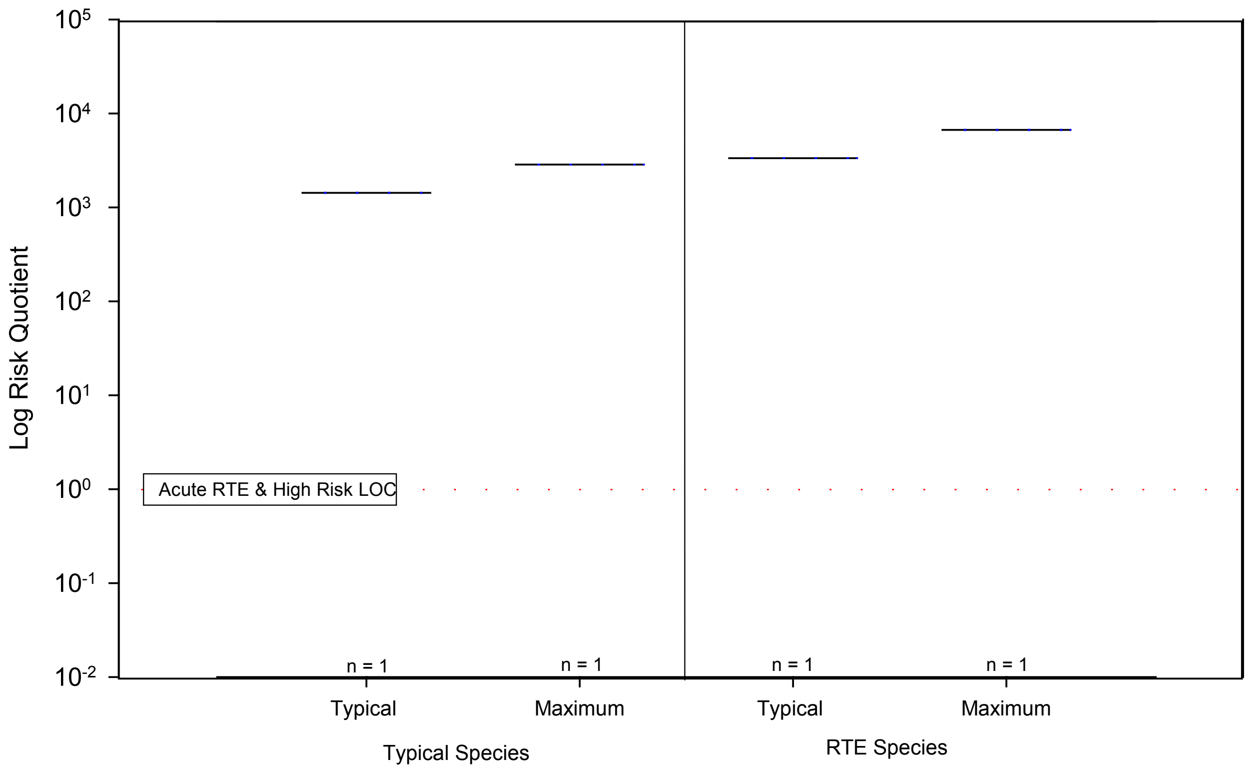


Figure E-7. Risk Quotients for Non-Target Terrestrial Plants Exposed to 2,4-D Acids and Salts in Direct Spray Scenarios at Application Rates for Terrestrial Woody Vegetation

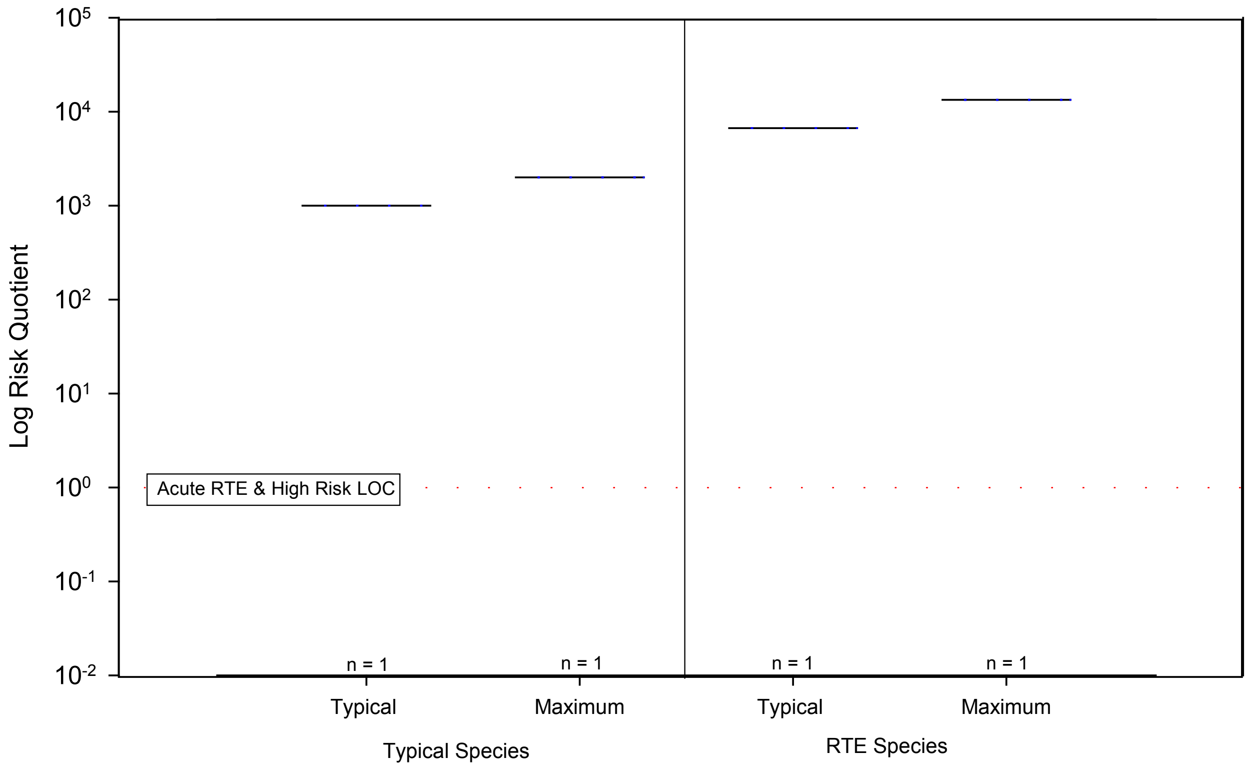


Figure E-8. Risk Quotients for Non-Target Terrestrial Plants Exposed to 2,4-D Esters in Direct Spray Scenarios at Application Rates for Terrestrial Woody Vegetation

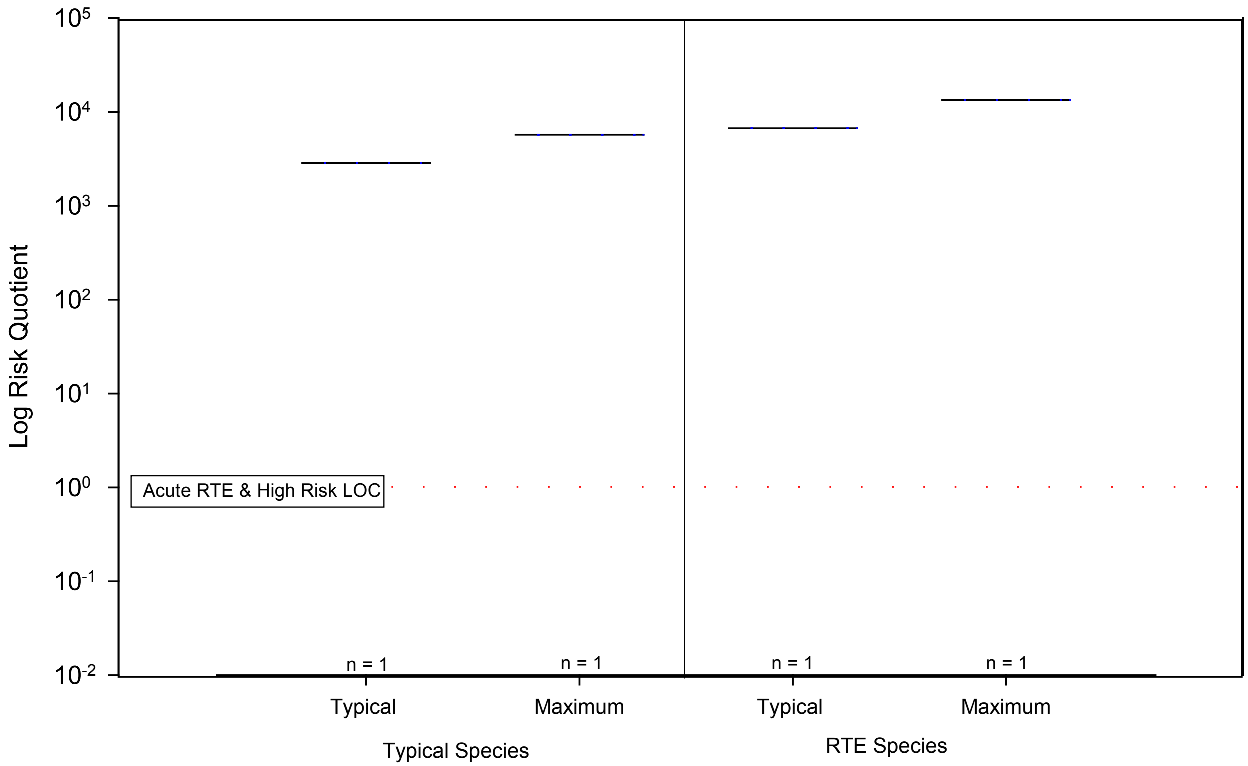


Figure E-9. Risk Quotients for Non-Target Terrestrial Plants Exposed to 2,4-D Acids and Salts in Direct Spray Scenarios at Application Rates for Aquatic Floating and Emerged Vegetation

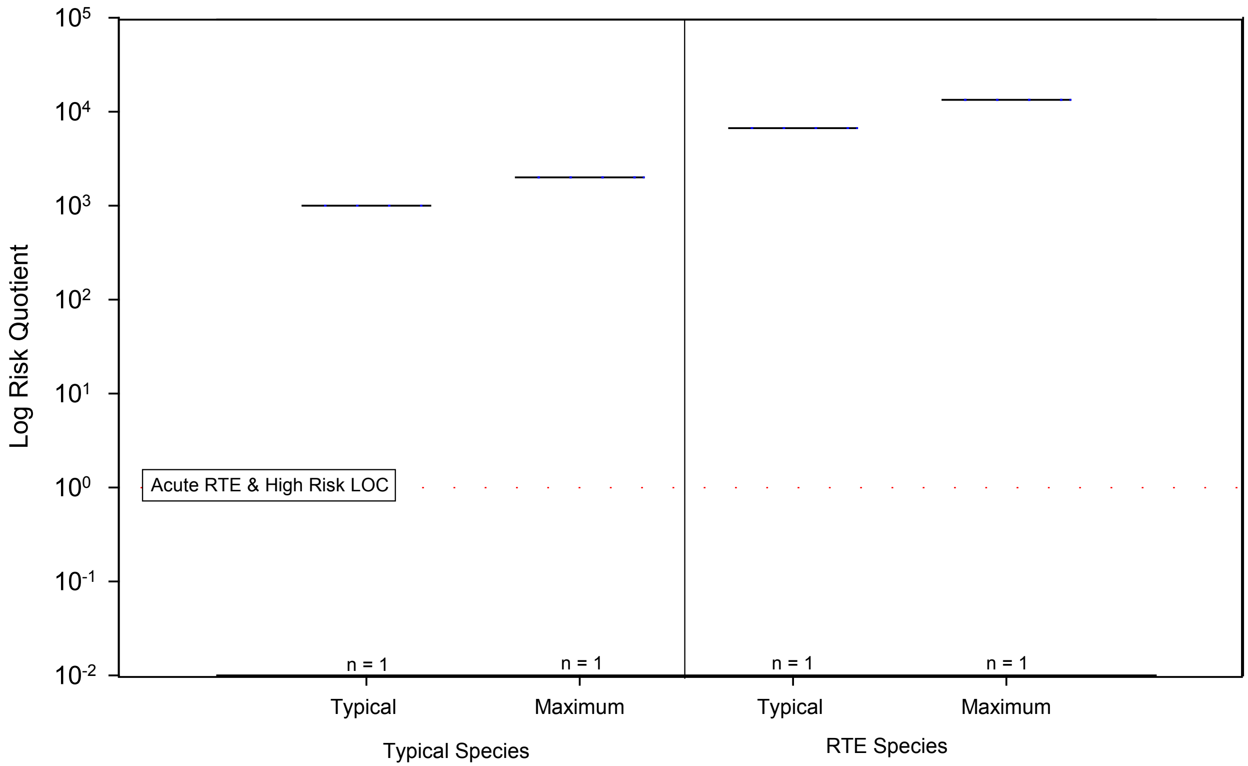


Figure E-10. Risk Quotients for Non-Target Terrestrial Plants Exposed to 2,4-D Esters in Direct Spray Scenarios at Application Rates for Aquatic Floating and Emerged Vegetation

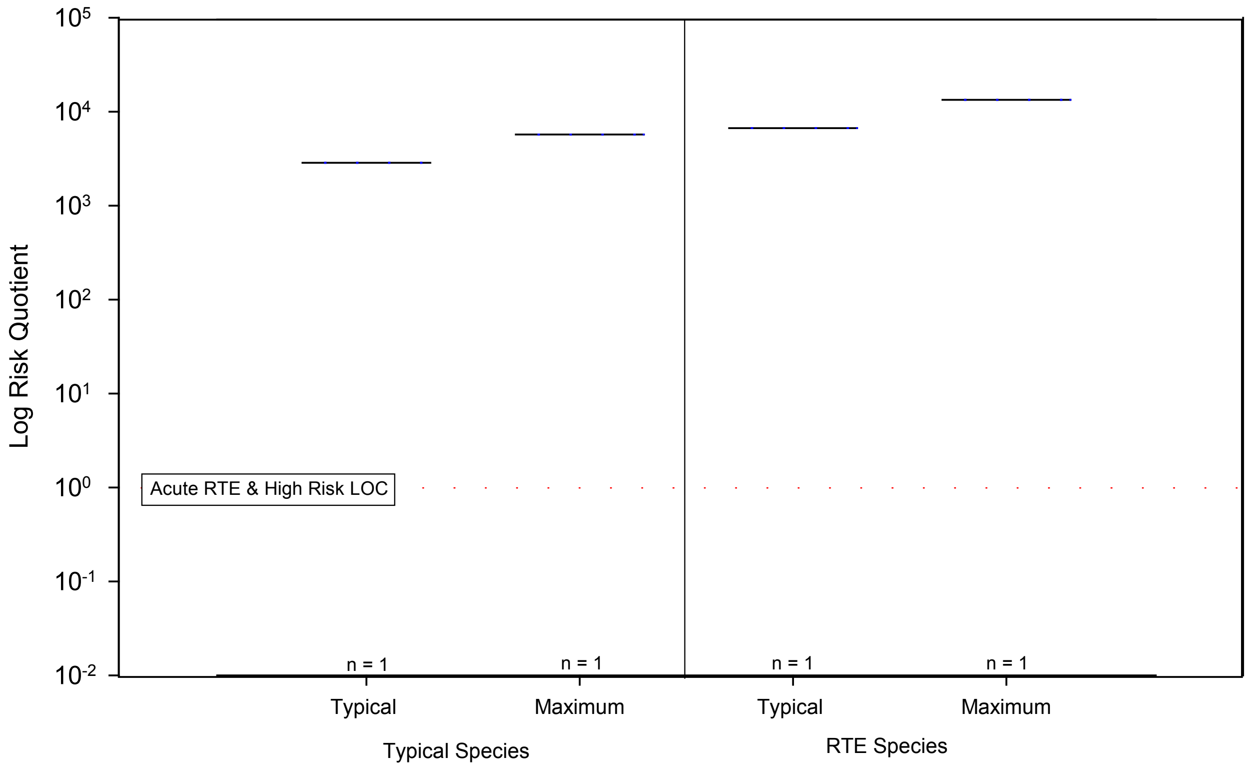


Figure E-11. Risk Quotients for Non-Target Terrestrial Plants Exposed to 2,4-D Acids and Salts in Direct Spray Scenarios at Application Rates for Aquatic Submerged Vegetation

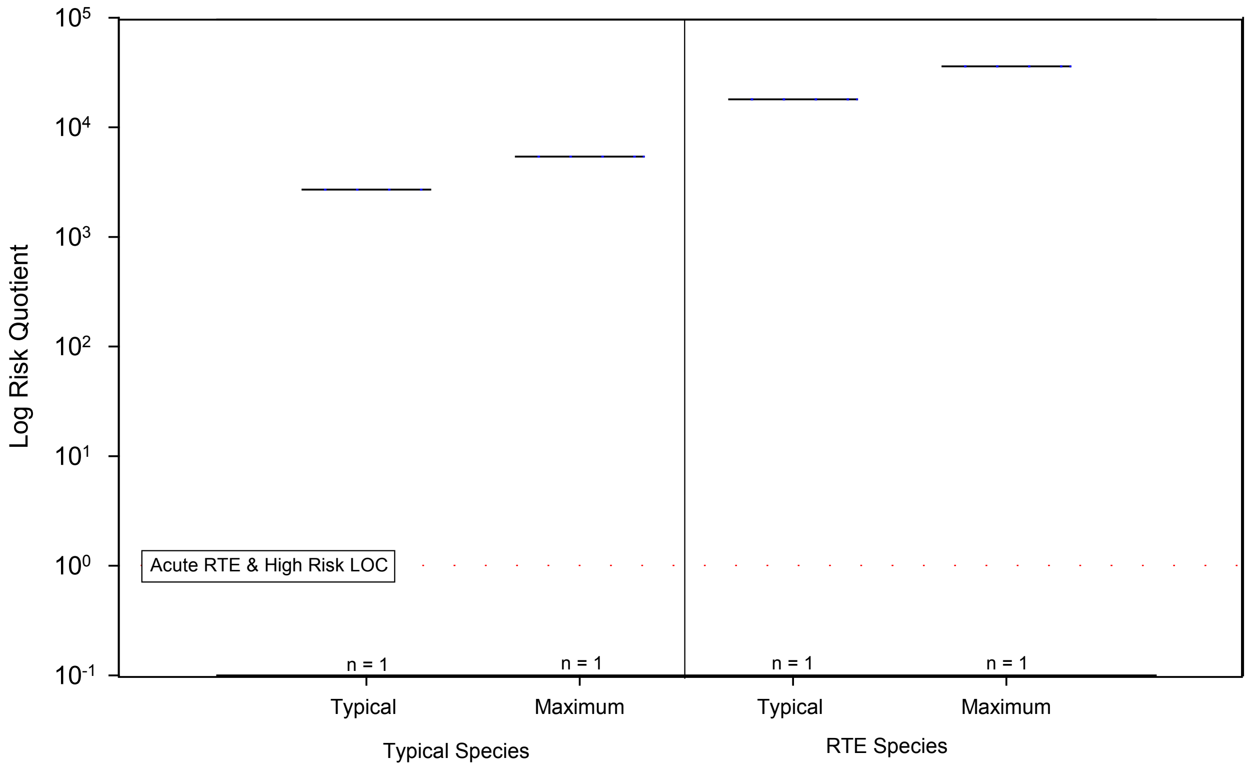


Figure E-12. Risk Quotients for Non-Target Terrestrial Plants Exposed to 2,4-D Esters in Direct Spray Scenarios at Application Rates for Aquatic Submerged Vegetation

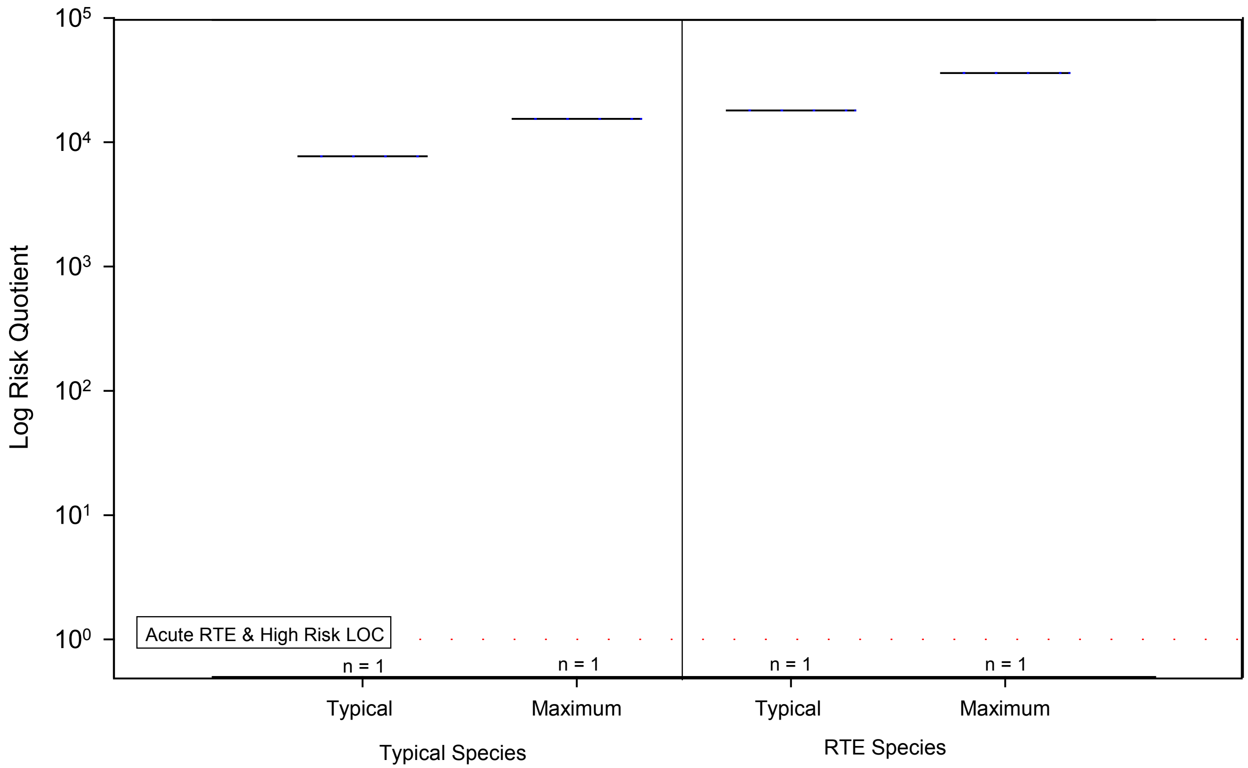


Figure E-13. Risk Quotients for Non-Target Aquatic Plants Exposed to 2,4-D Acids and Salts in Accidental Direct Spray and Spills Scenarios at Application Rates for Terrestrial Annual or Perennial Vegetation

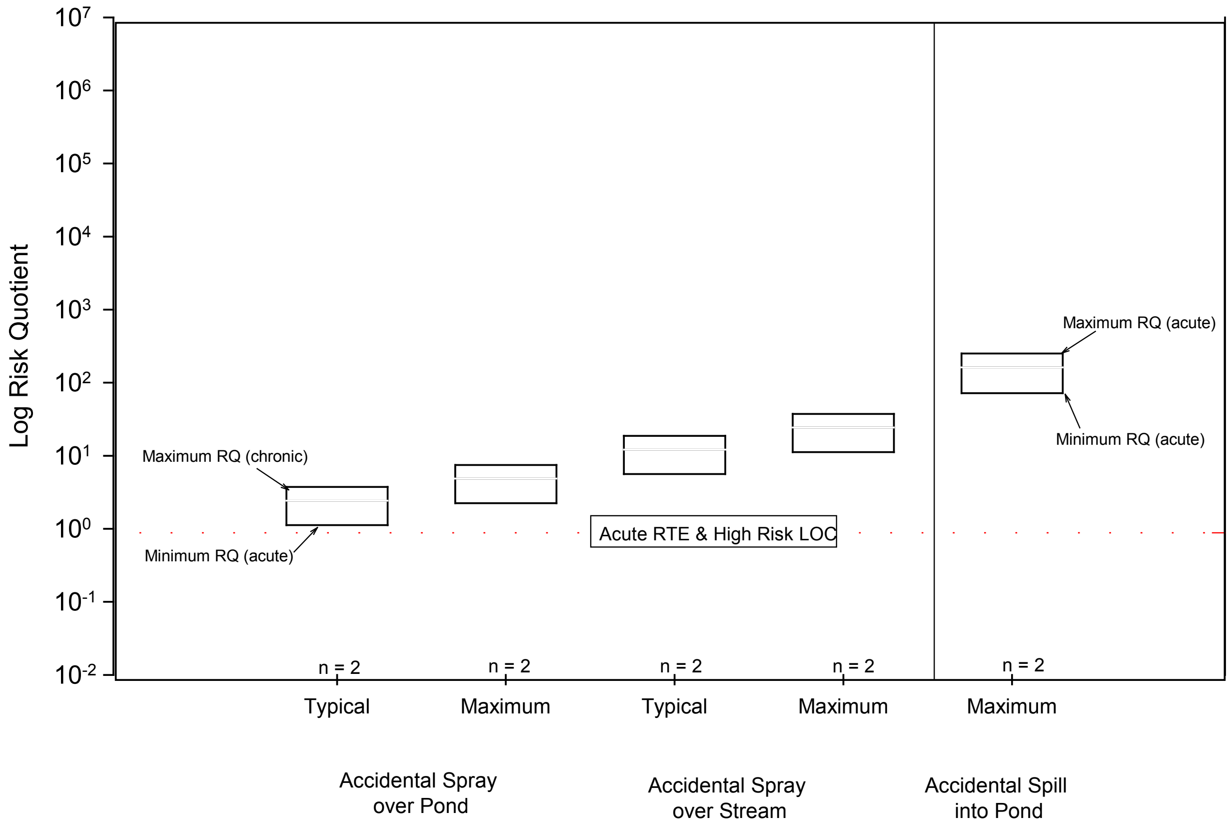


Figure E-14. Risk Quotients for Non-Target Aquatic Plants Exposed to 2,4-D Esters in Accidental Direct Spray and Spills Scenarios at Application Rates for Terrestrial Annual or Perennial Vegetation

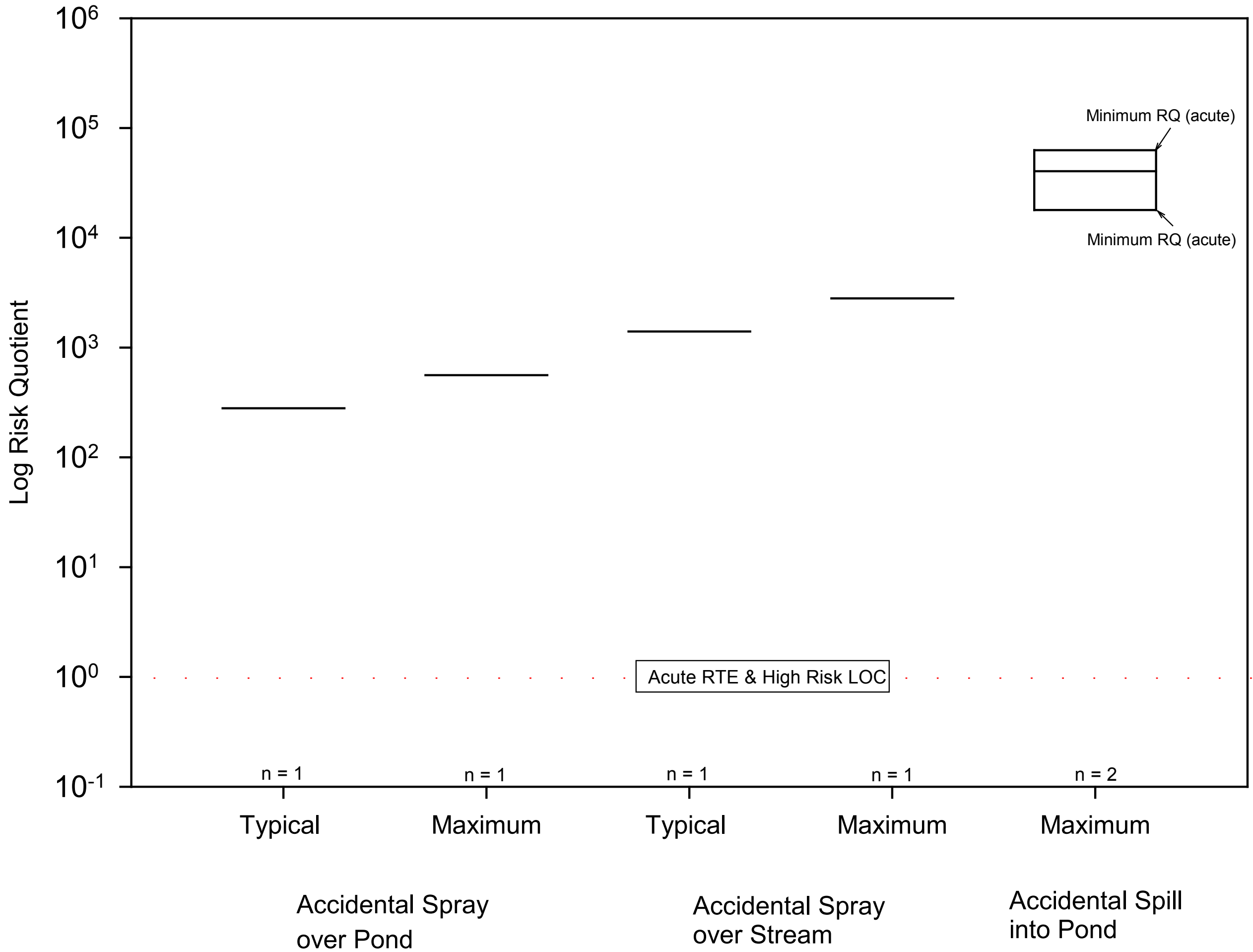


Figure E-15. Risk Quotients for Non-Target Aquatic Plants Exposed to 2,4-D Acids and Salts in Accidental Direct Spray and Spills Scenarios at Application Rates for Terrestrial Woody Vegetation

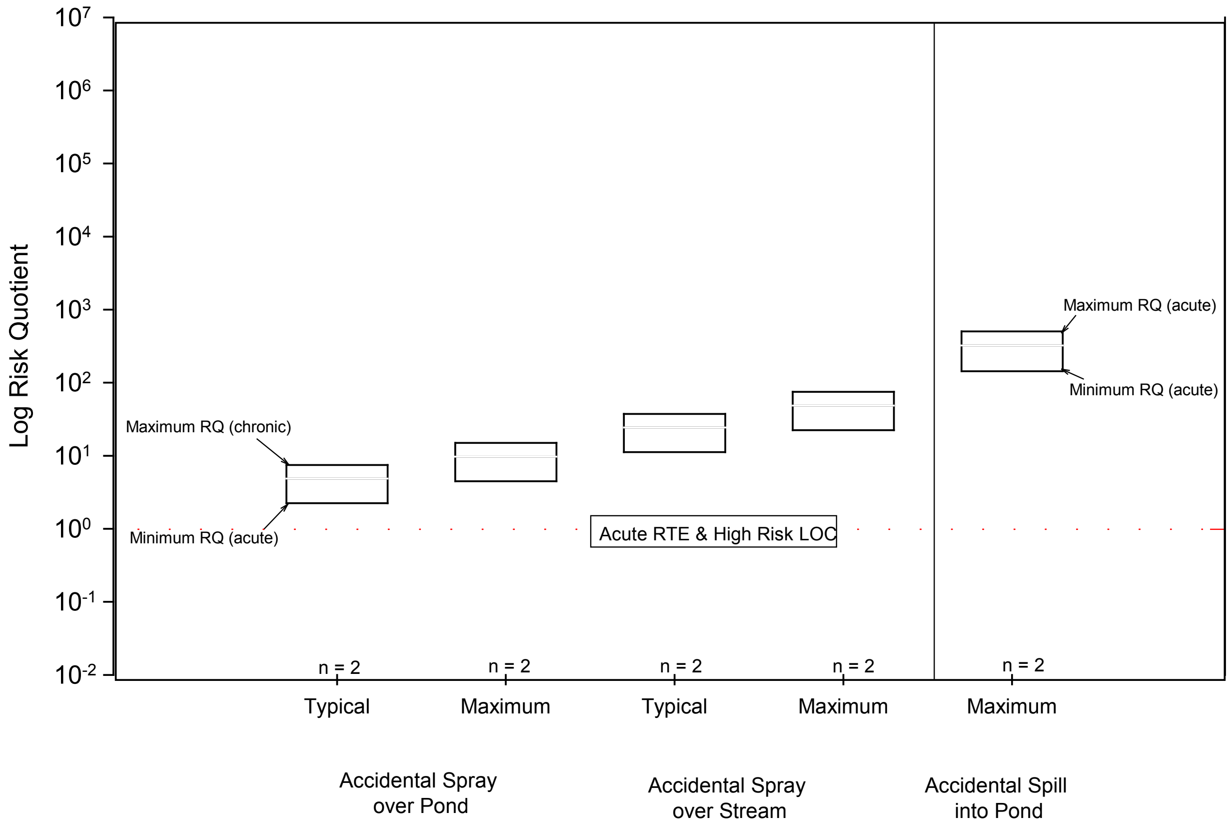


Figure E-16. Risk Quotients for Non-Target Aquatic Plants Exposed to 2,4-D Esters in Accidental Direct Spray and Spills Scenarios at Application Rates for Terrestrial Woody Vegetation

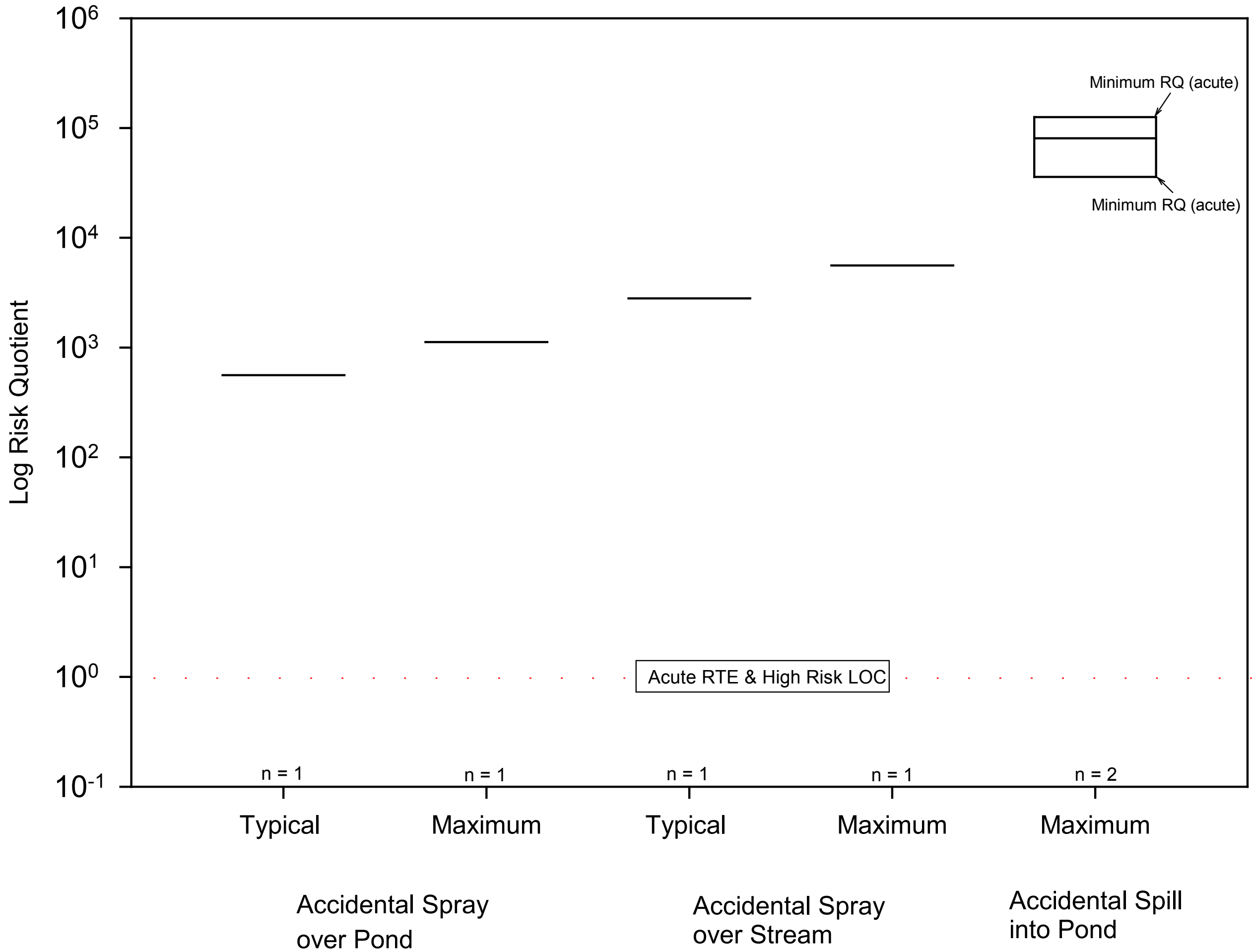


Figure E-17. Risk Quotients for Non-Target Aquatic Plants Exposed to 2,4-D Acids and Salts in Direct Spray and Spills Scenarios at Application Rates for Aquatic Floating and Emerged Vegetation

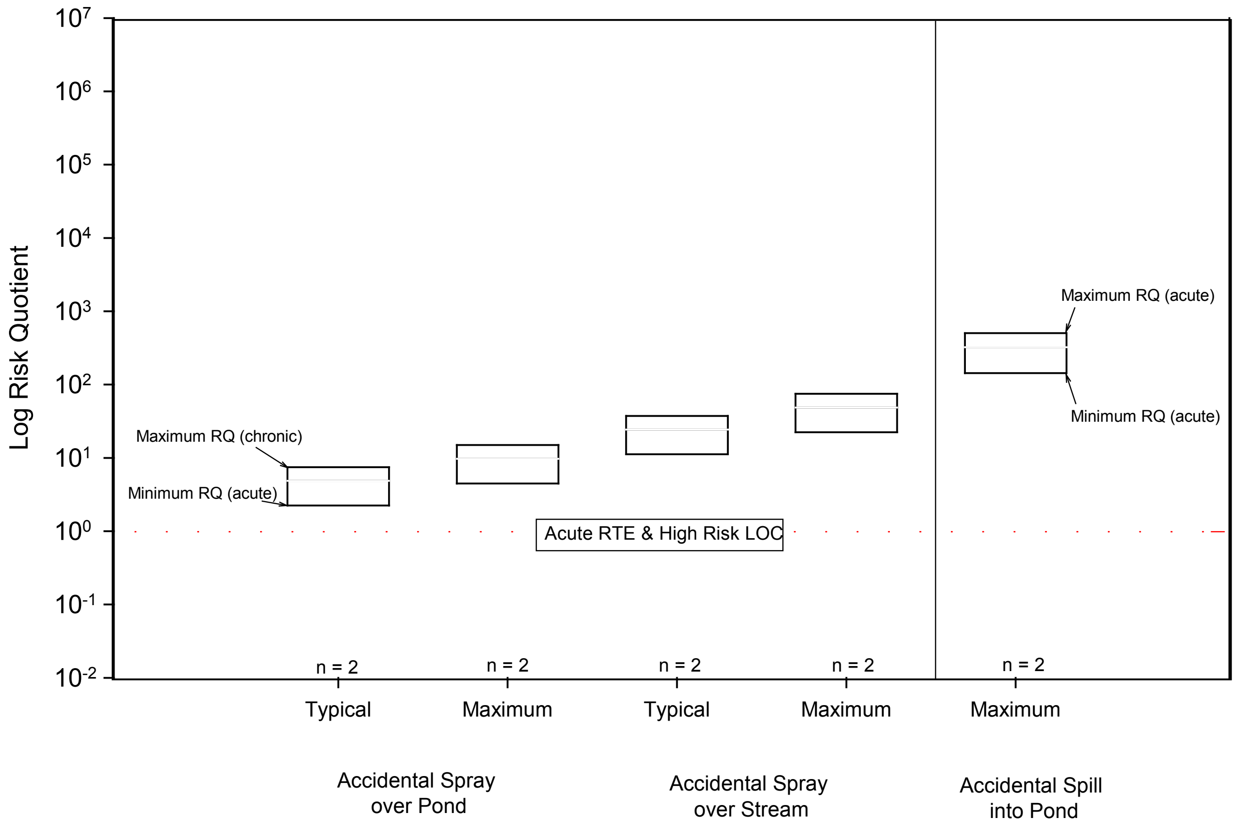


Figure E-18. Risk Quotients for Non-Target Aquatic Plants Exposed to 2,4-D Esters in Direct Spray and Spills Scenarios at Application Rates for Aquatic Floating and Emerged Vegetation

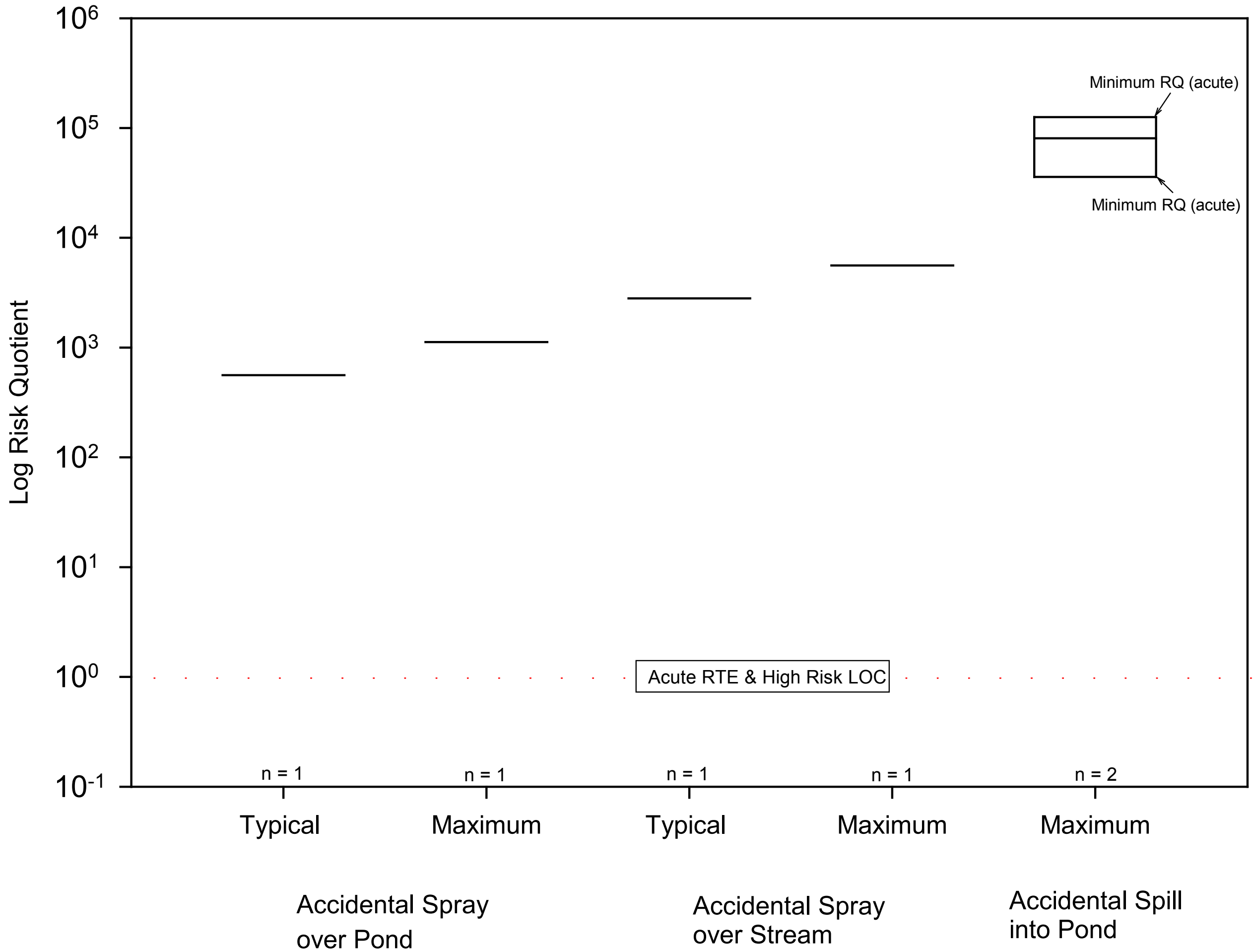


Figure E-19. Risk Quotients for Non-Target Aquatic Plants Exposed to 2,4-D Acids and Salts in Direct Spray and Spills Scenarios at Application Rates for Aquatic Submerged Vegetation

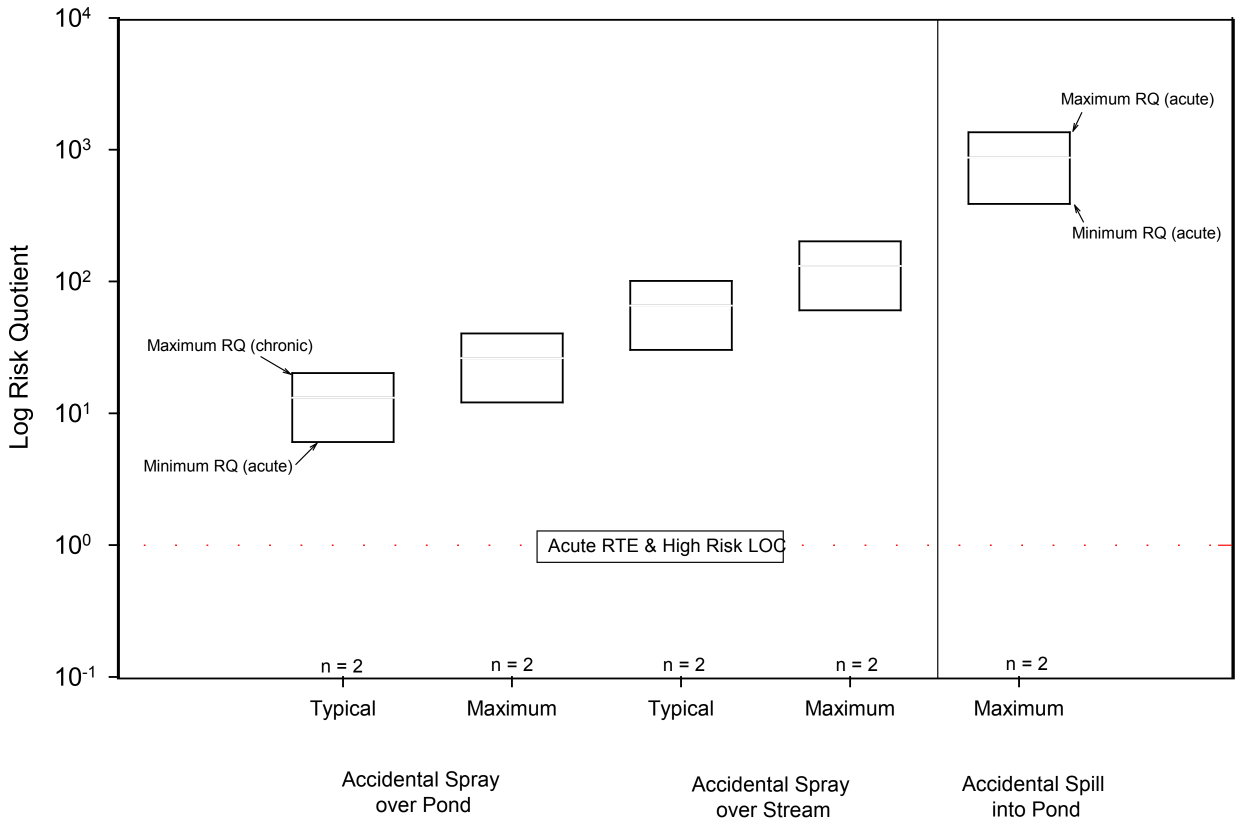


Figure E-20. Risk Quotients for Non-Target Aquatic Plants Exposed to 2,4-D Esters in Direct Spray and Spills Scenarios at Application Rates for Aquatic Submerged Vegetation

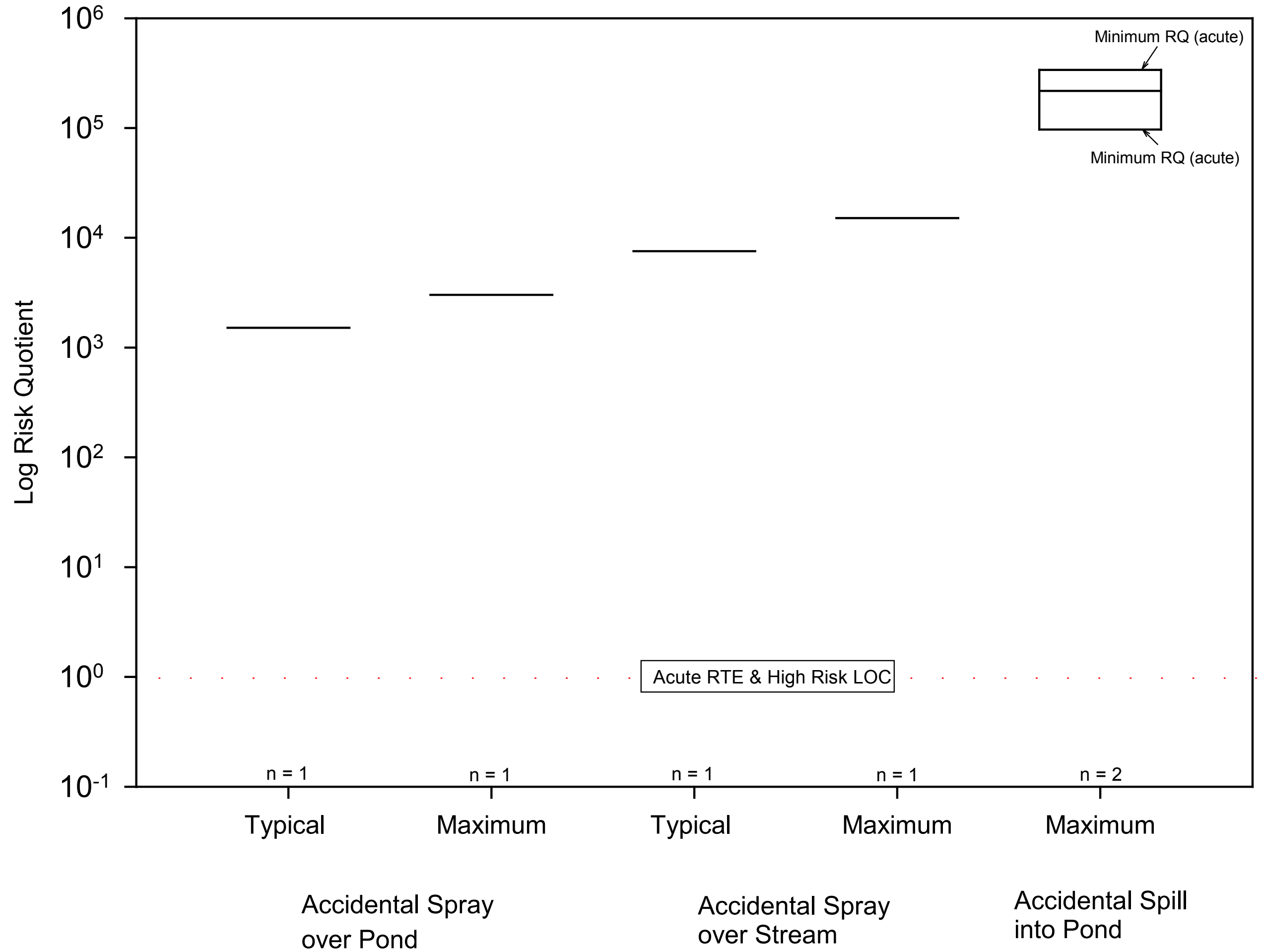


Figure E-21. Risk Quotients for Fish Exposed to 2,4-D Acids and Salts in Accidental Direct Spray and Spills Scenarios at Application Rates for Terrestrial Annual or Perennial Vegetation

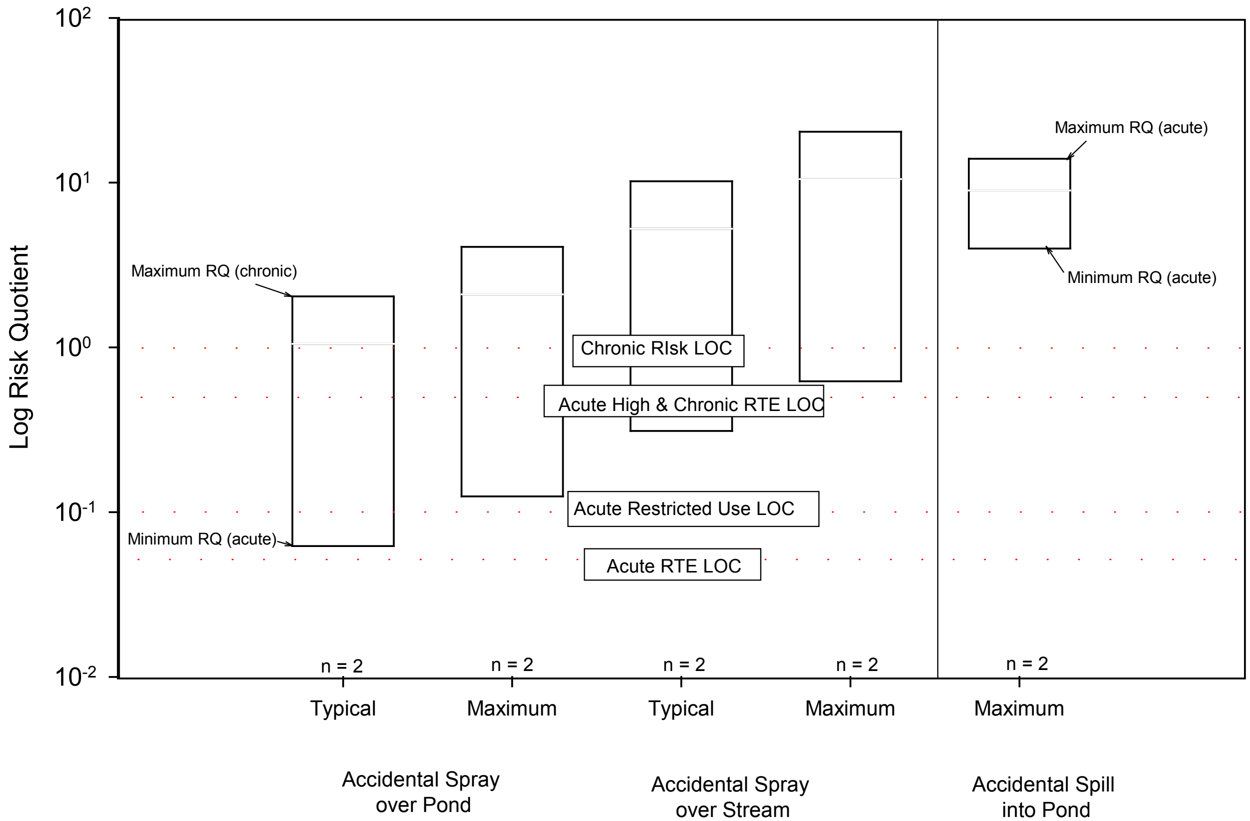


Figure E-22. Risk Quotients for Fish Exposed to 2,4-D Esters in Accidental Direct Spray and Spills Scenarios at Application Rates for Terrestrial Annual or Perennial Vegetation

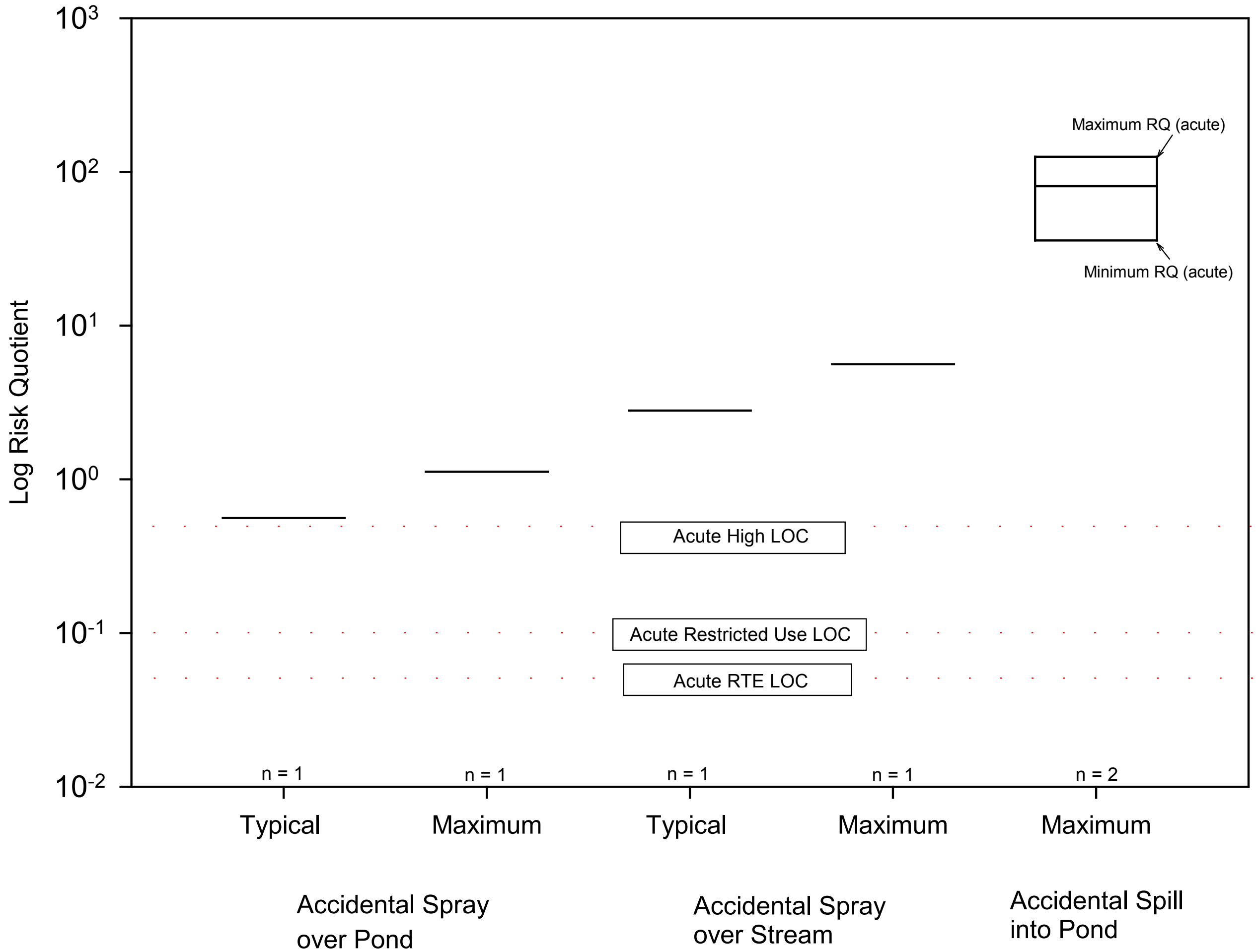


Figure E-23. Risk Quotients for Fish Exposed to 2,4-D Acids and Salts in Accidental Direct Spray and Spills Scenarios at Application Rates for Terrestrial Woody Vegetation

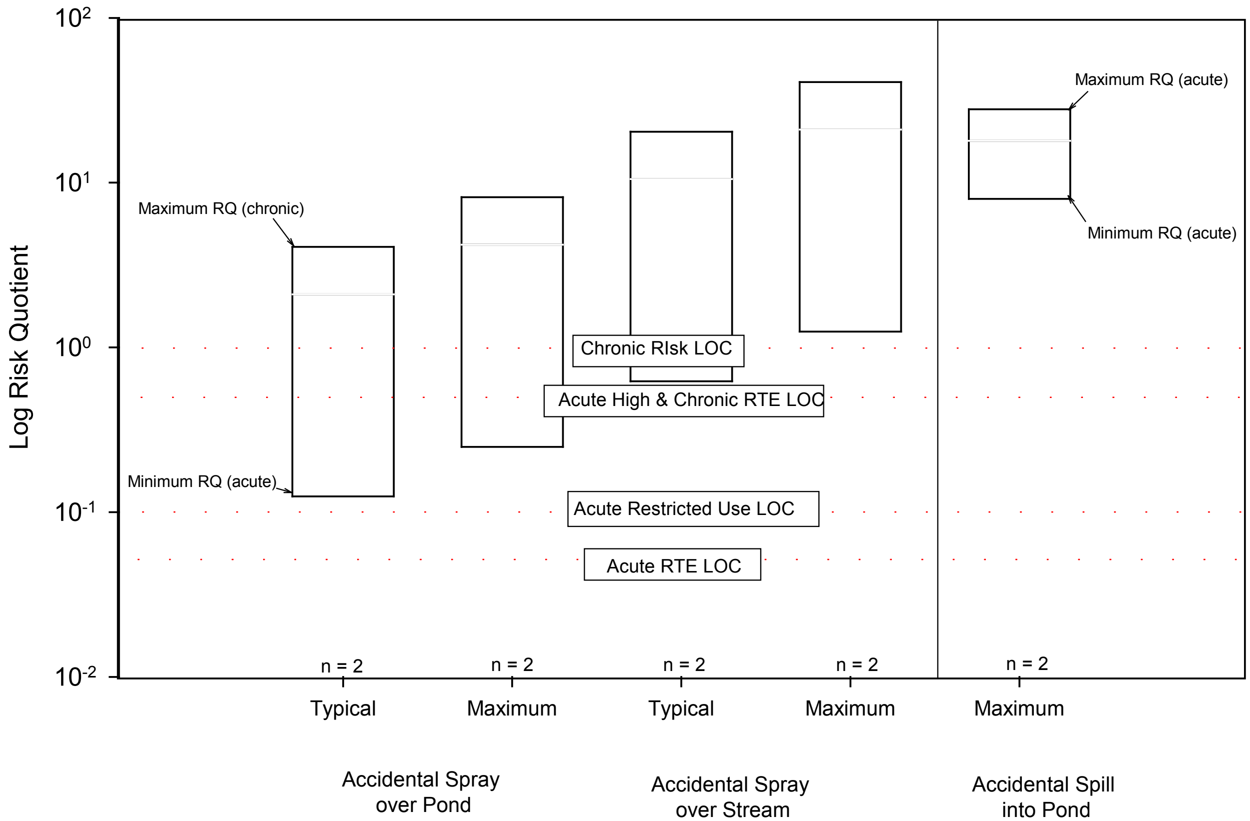


Figure E-24. Risk Quotients for Fish Exposed to 2,4-D Esters in Accidental Direct Spray and Spills Scenarios at Application Rates for Terrestrial Woody Vegetation

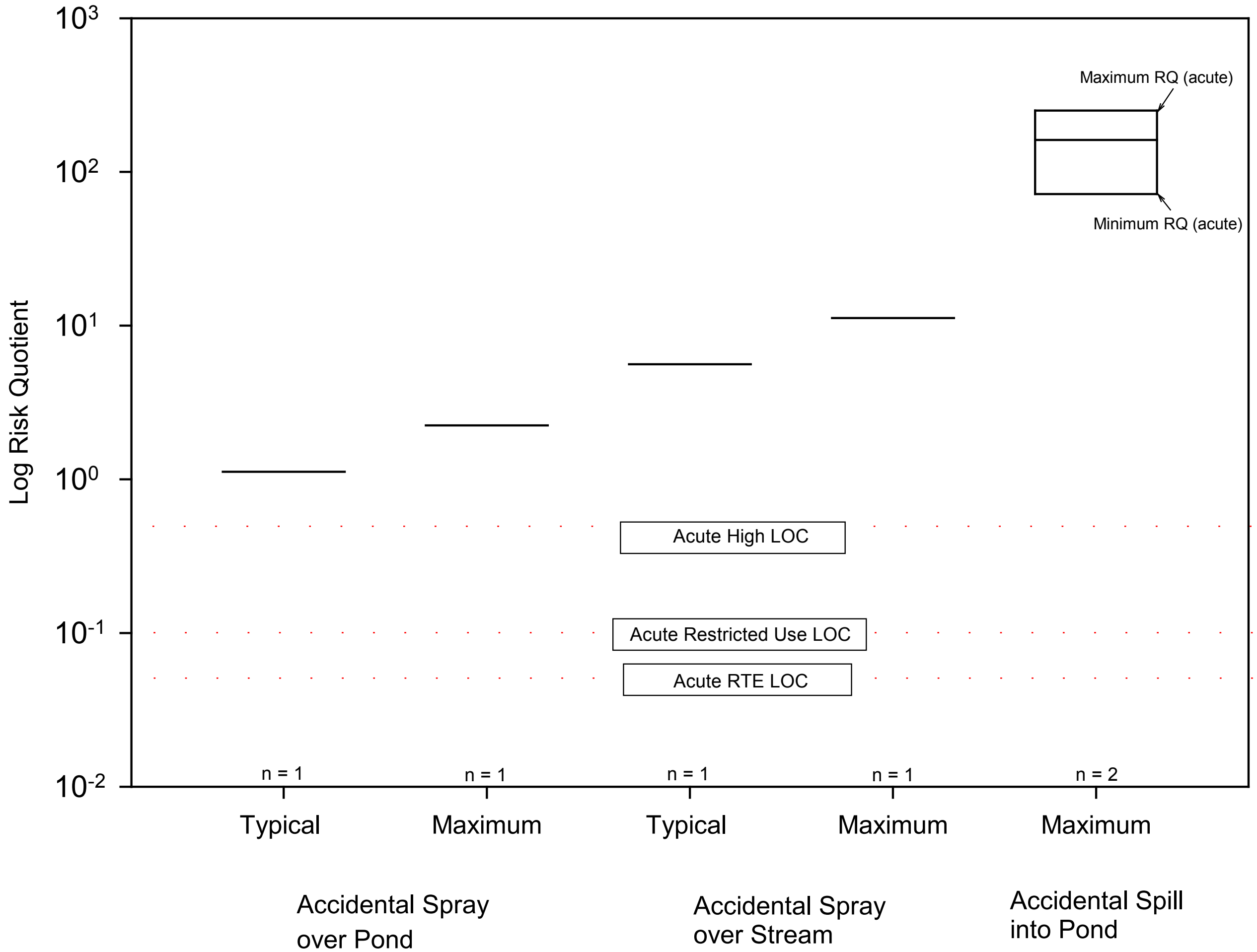


Figure E-25. Risk Quotients for Fish Exposed to 2,4-D Acids and Salts in Direct Spray and Spills Scenarios at Application Rates for Aquatic Floating and Emerged Vegetation

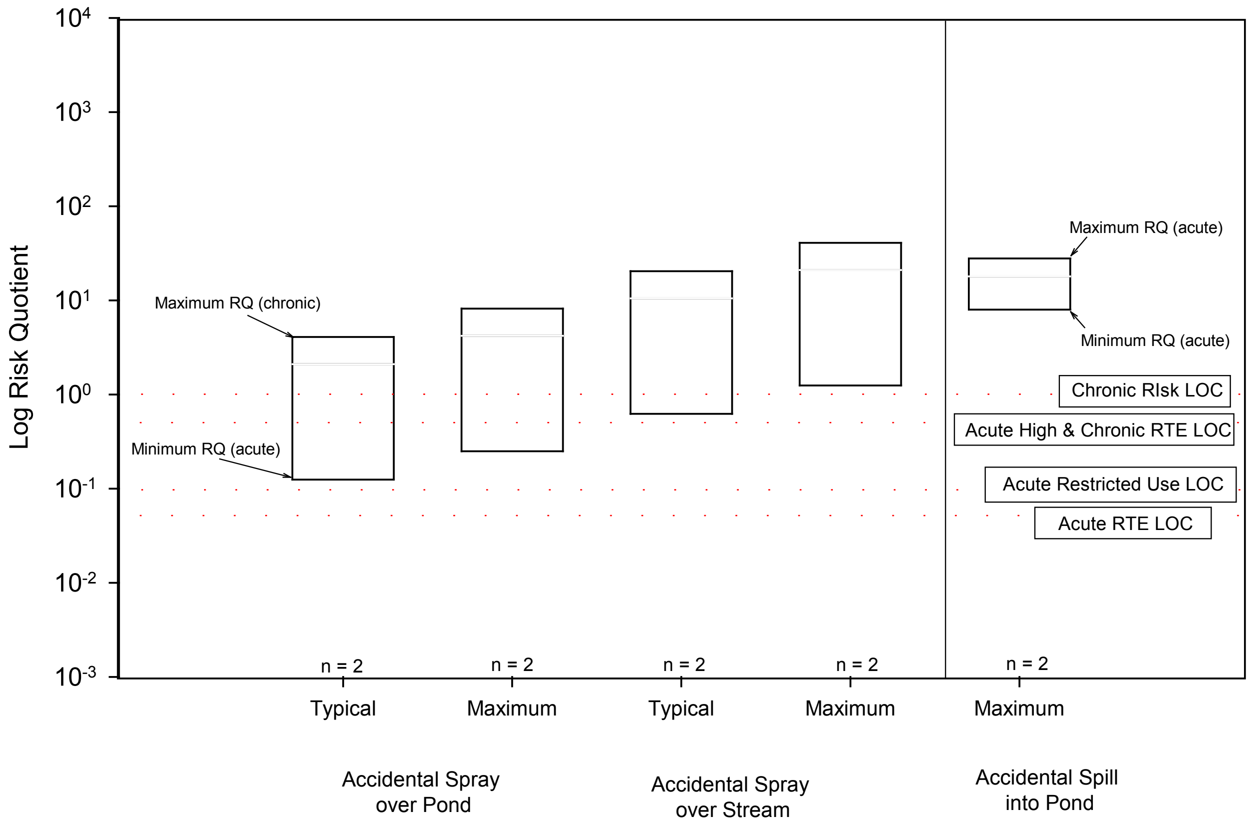


Figure E-26. Risk Quotients for Fish Exposed to 2,4-D Esters in Direct Spray and Spills Scenarios at Application Rates for Aquatic Floating and Emerged Vegetation

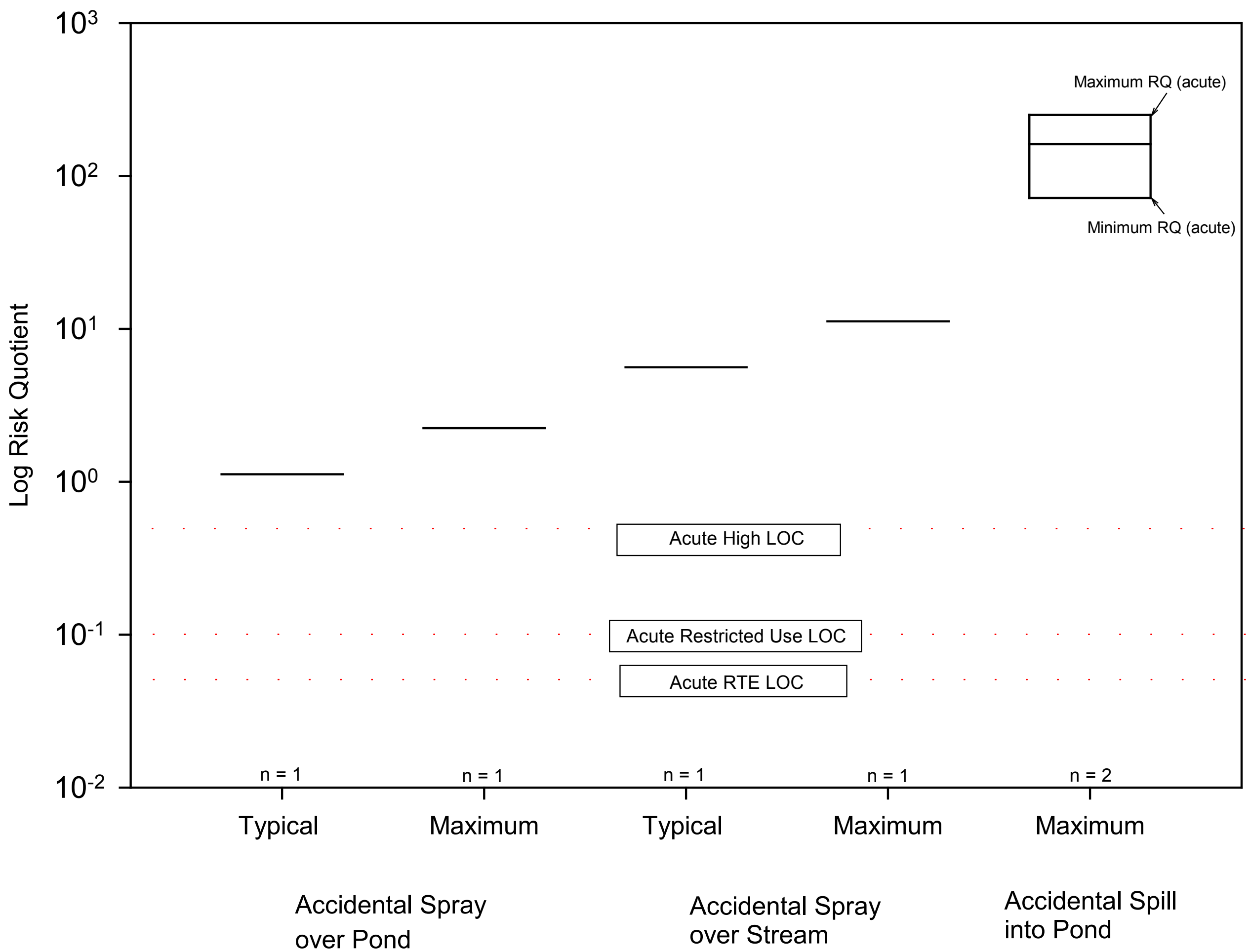


Figure E-27. Risk Quotients for Fish Exposed to 2,4-D Acids and Salts in Direct Spray and Spills Scenarios at Application Rates for Aquatic Submerged Vegetation

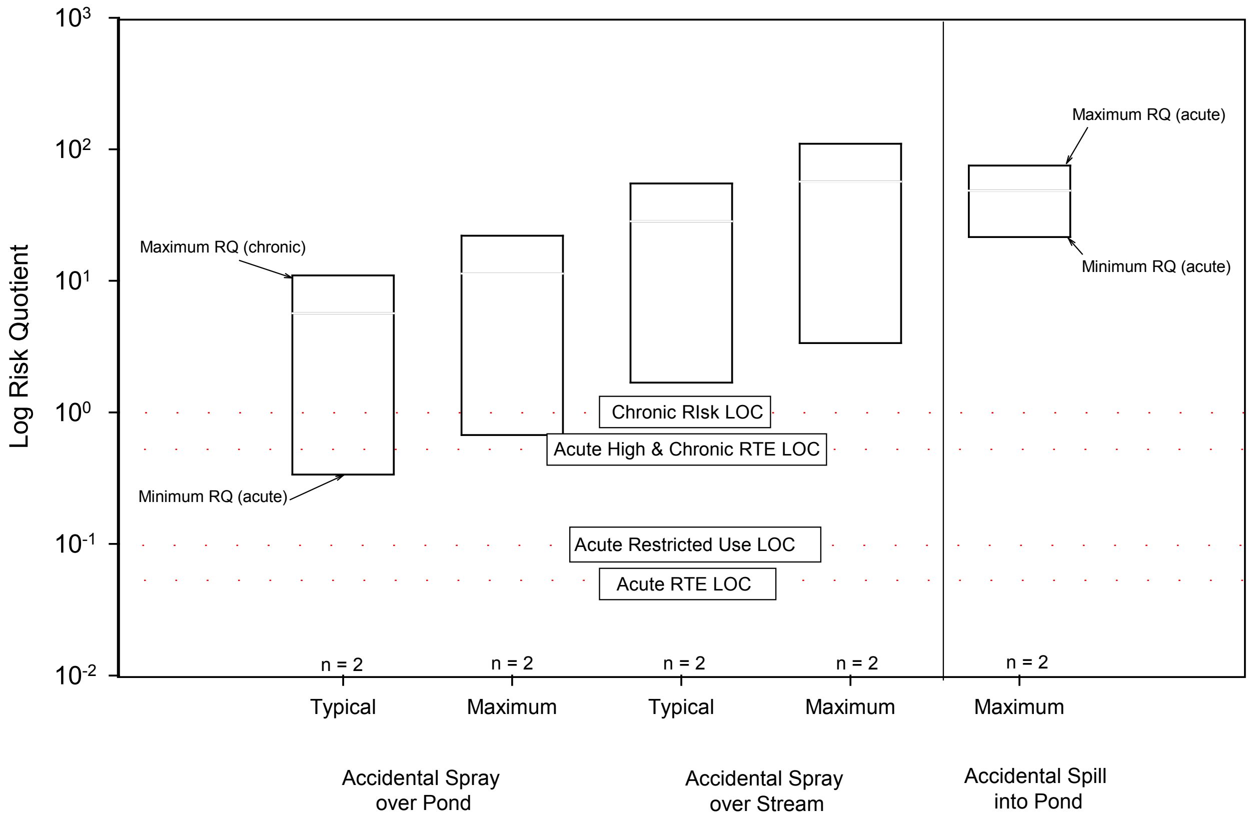


Figure E-28. Risk Quotients for Fish Exposed to 2,4-D Esters in Direct Spray and Spills Scenarios at Application Rates for Aquatic Submerged Vegetation

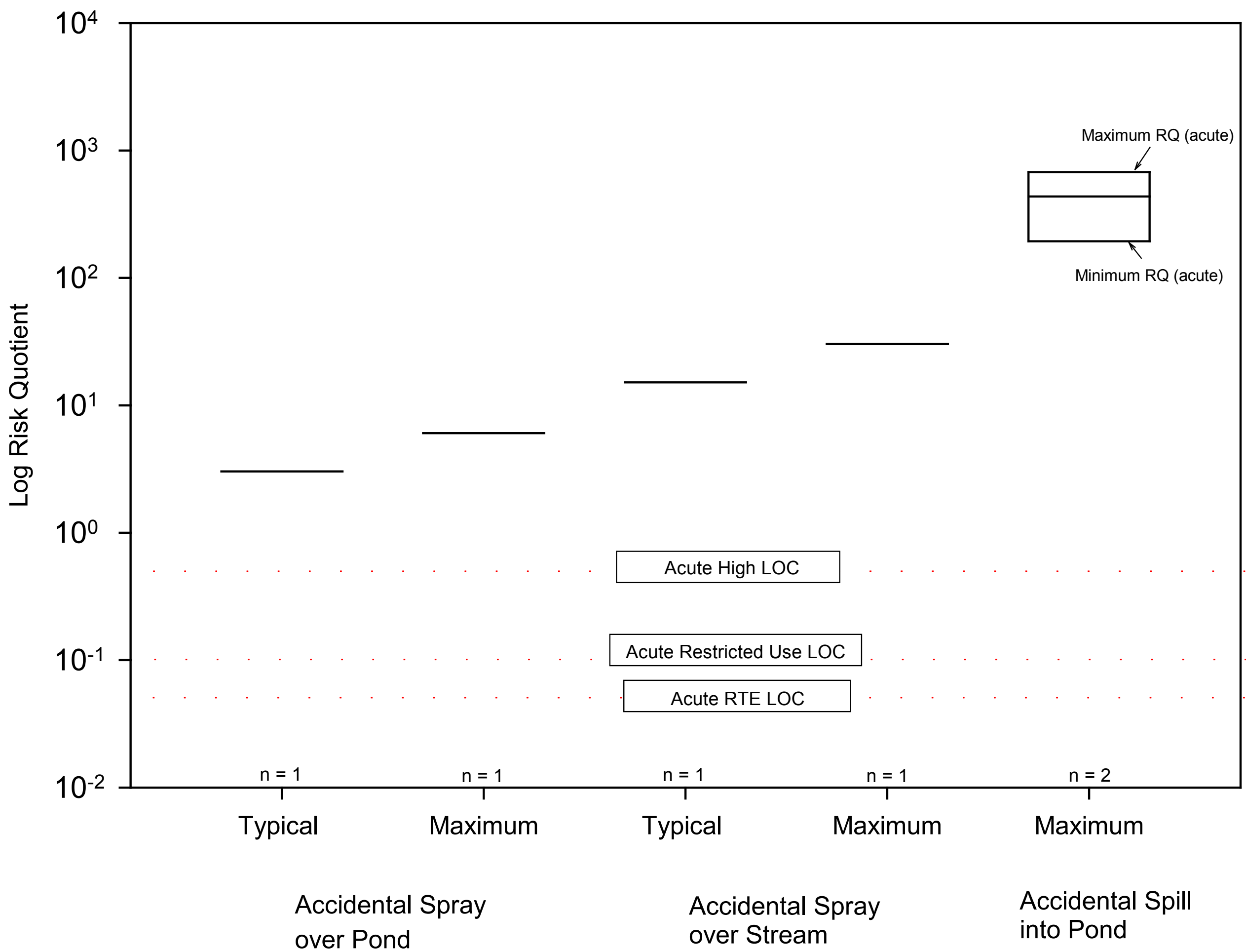


Figure E-29. Risk Quotients for Aquatic Invertebrates Exposed to 2,4-D Acids and Salts in Accidental Direct Spray and Spills Scenarios at Application Rates for Terrestrial Annual or Perennial Vegetation

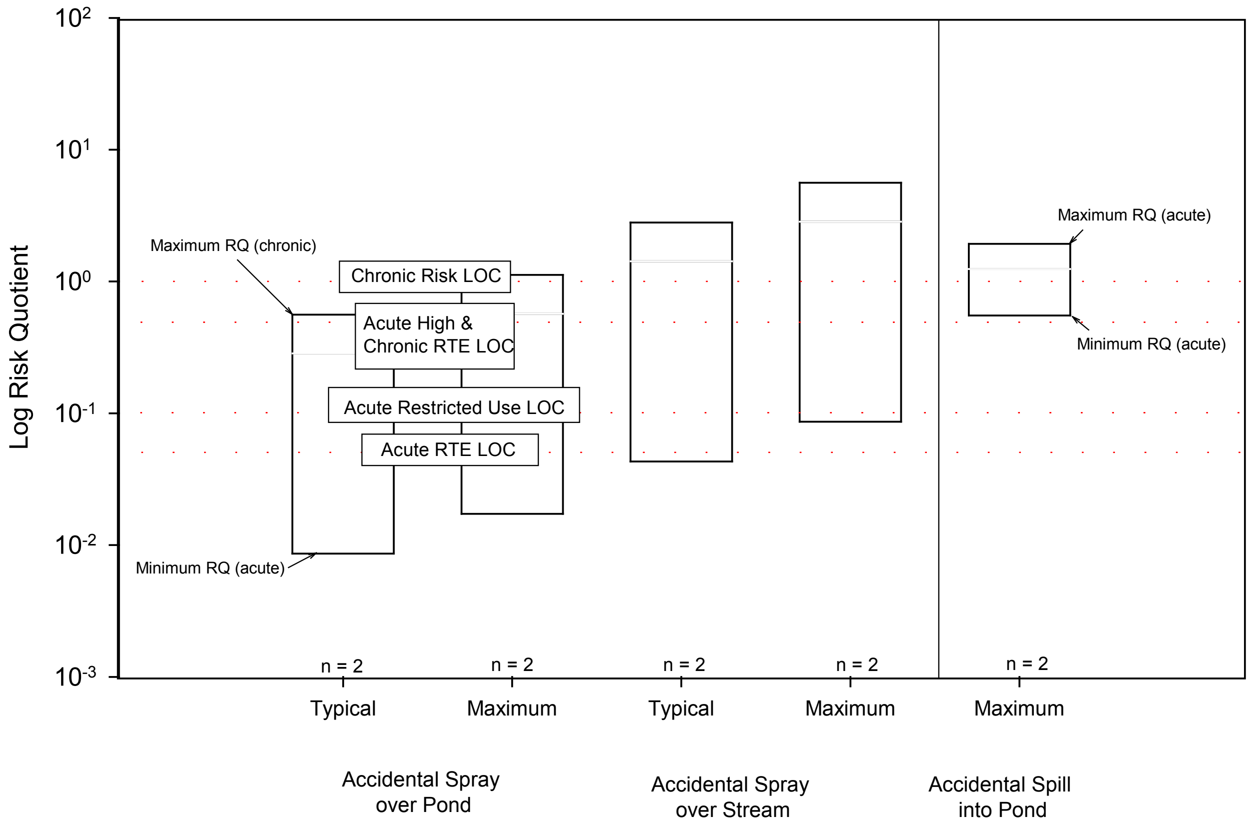


Figure E-30. Risk Quotients for Aquatic Invertebrates Exposed to 2,4-D Esters in Accidental Direct Spray and Spills Scenarios at Application Rates for Terrestrial Annual or Perennial Vegetation

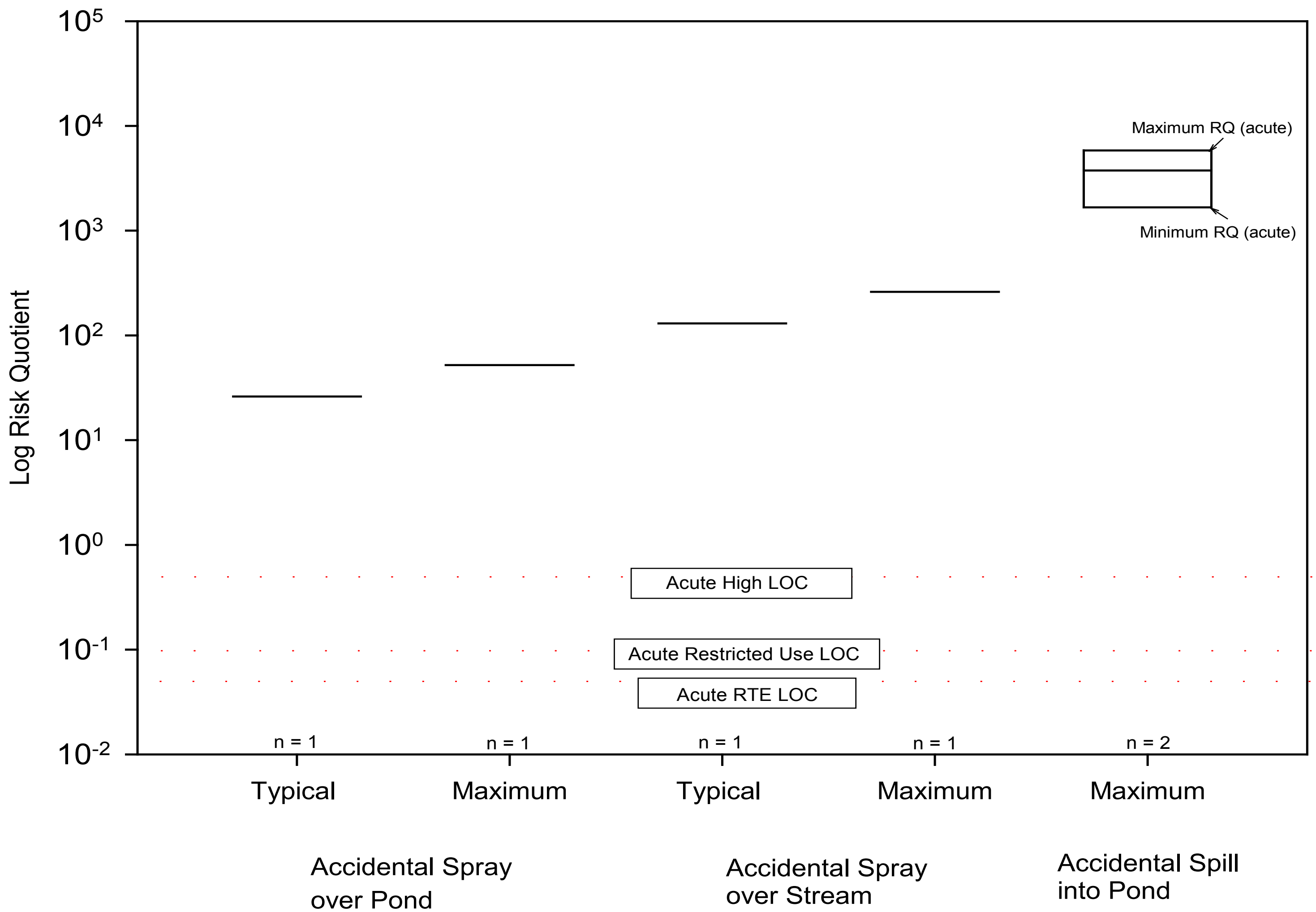


Figure E-31. Risk Quotients for Aquatic Invertebrates Exposed to 2,4-D Acids and Salts in Accidental Direct Spray and Spills Scenarios at Application Rates for Terrestrial Woody Vegetation

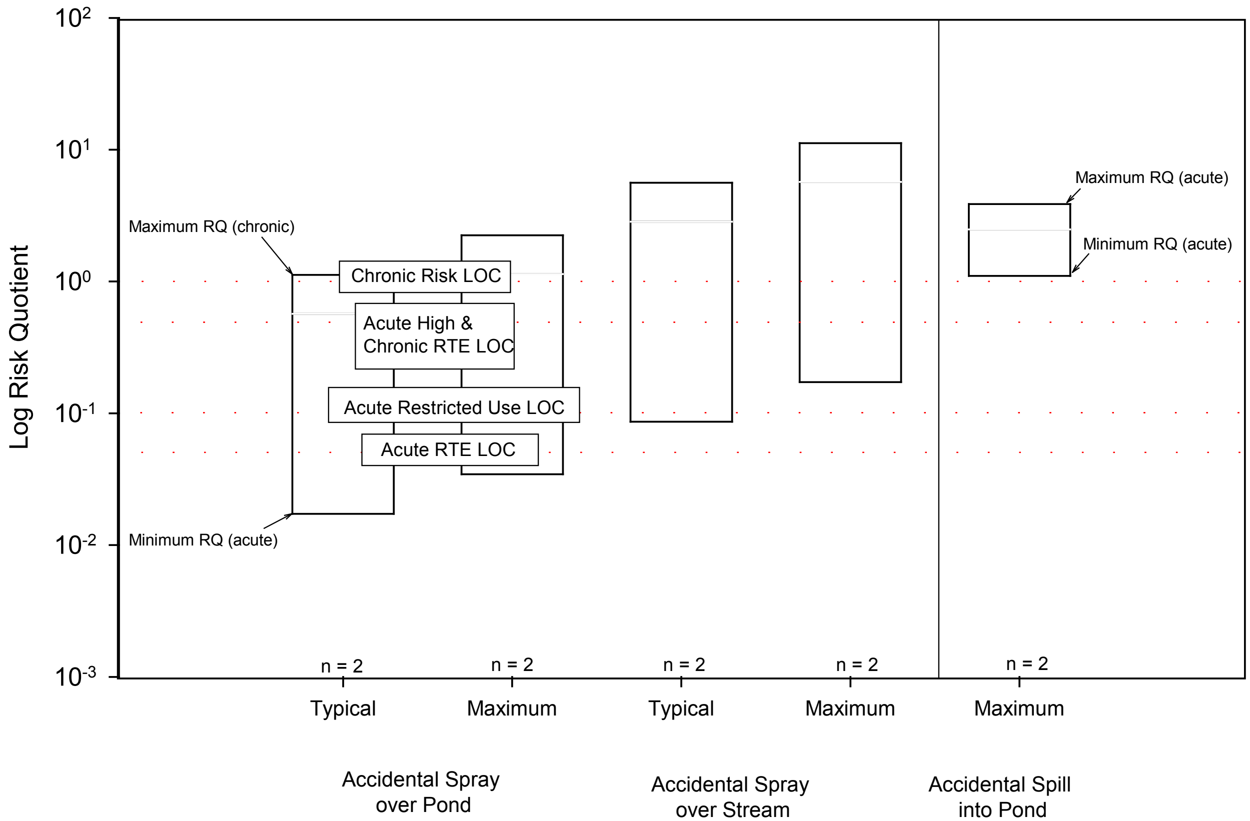


Figure E-32. Risk Quotients for Aquatic Invertebrates Exposed to 2,4-D Esters in Accidental Direct Spray and Spills Scenarios at Application Rates for Terrestrial Woody Vegetation

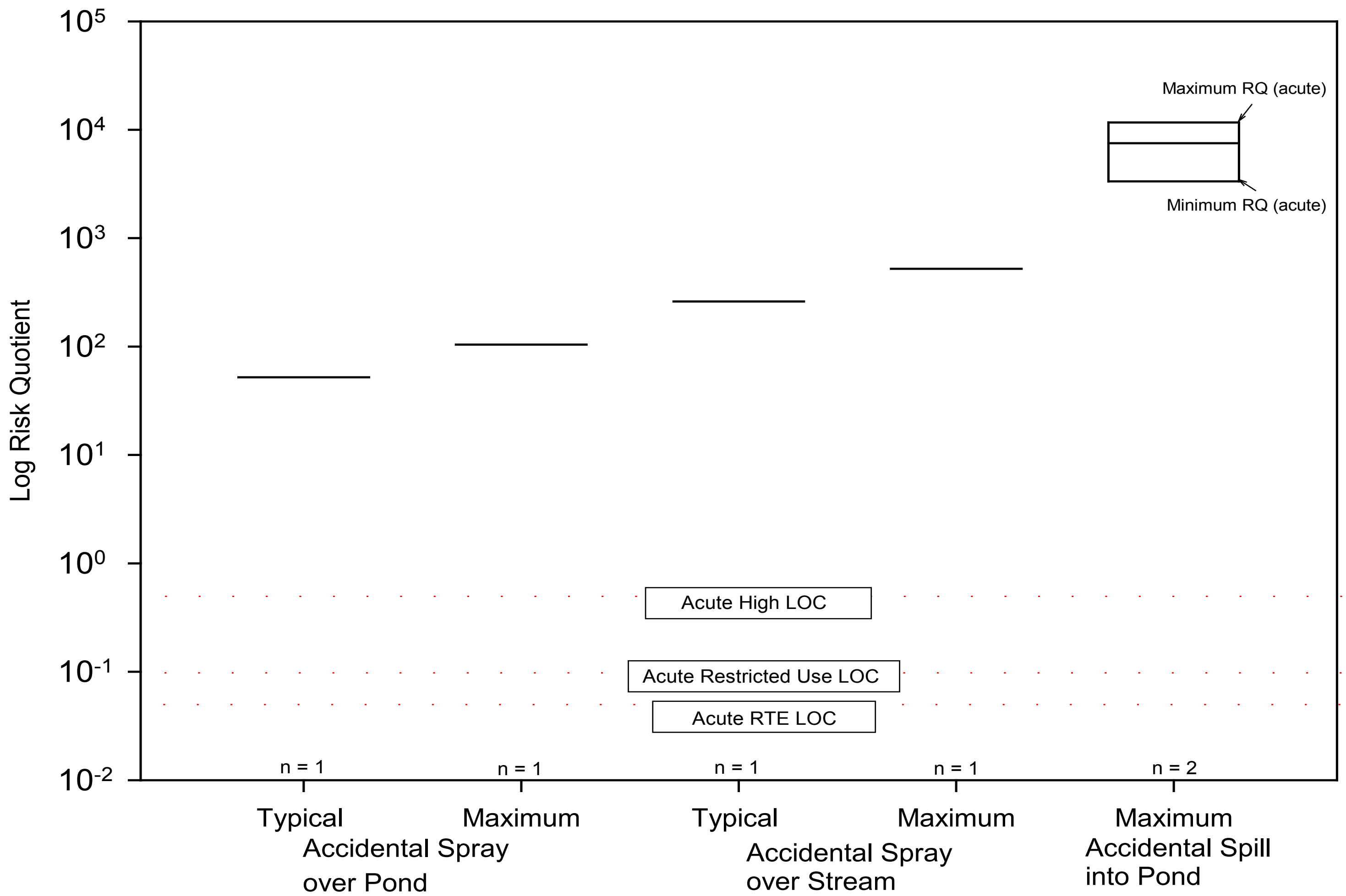


Figure E-33. Risk Quotients for Aquatic Invertebrates Exposed to 2,4-D Acids and Salts in Direct Spray and Spills Scenarios at Application Rates for Aquatic Floating and Emerged Vegetation

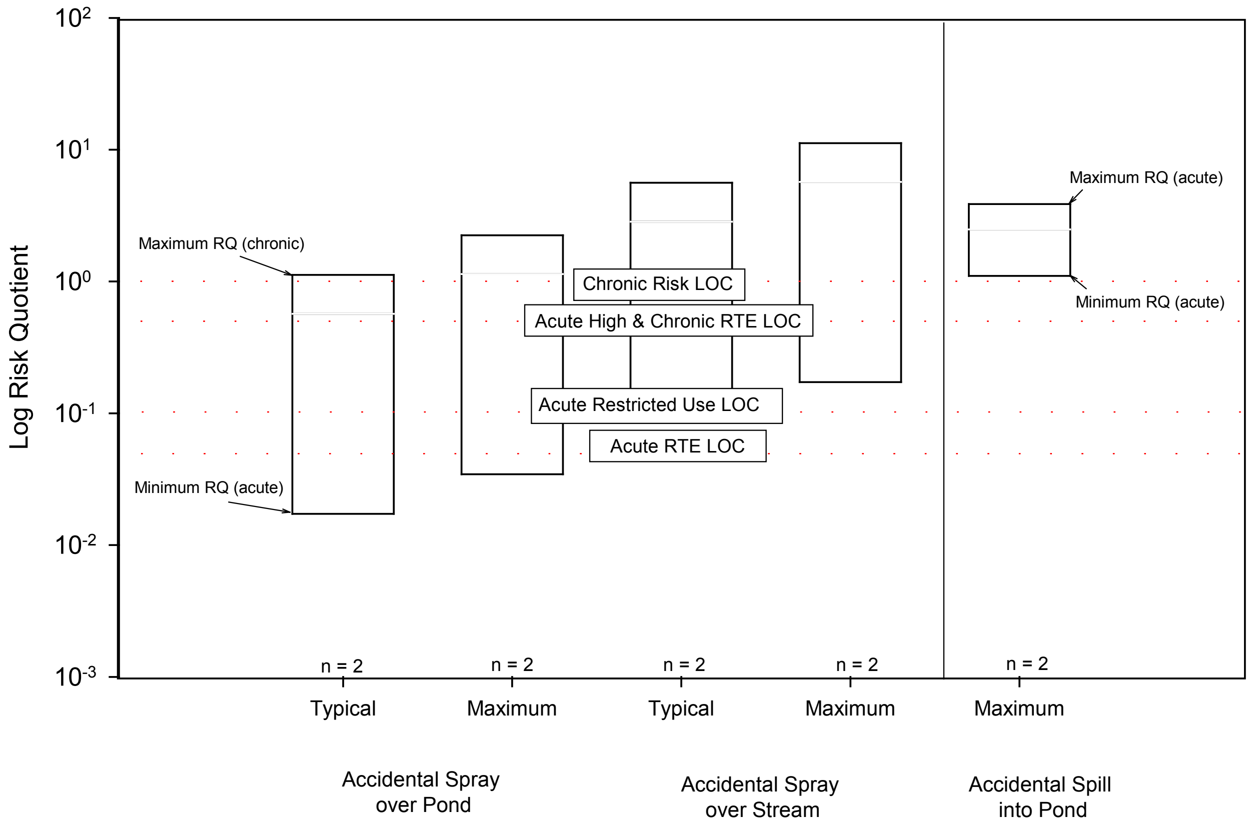


Figure E-34. Risk Quotients for Aquatic Invertebrates Exposed to 2,4-D Esters in Direct Spray and Spills Scenarios at Application Rates for Aquatic Floating and Emerged Vegetation

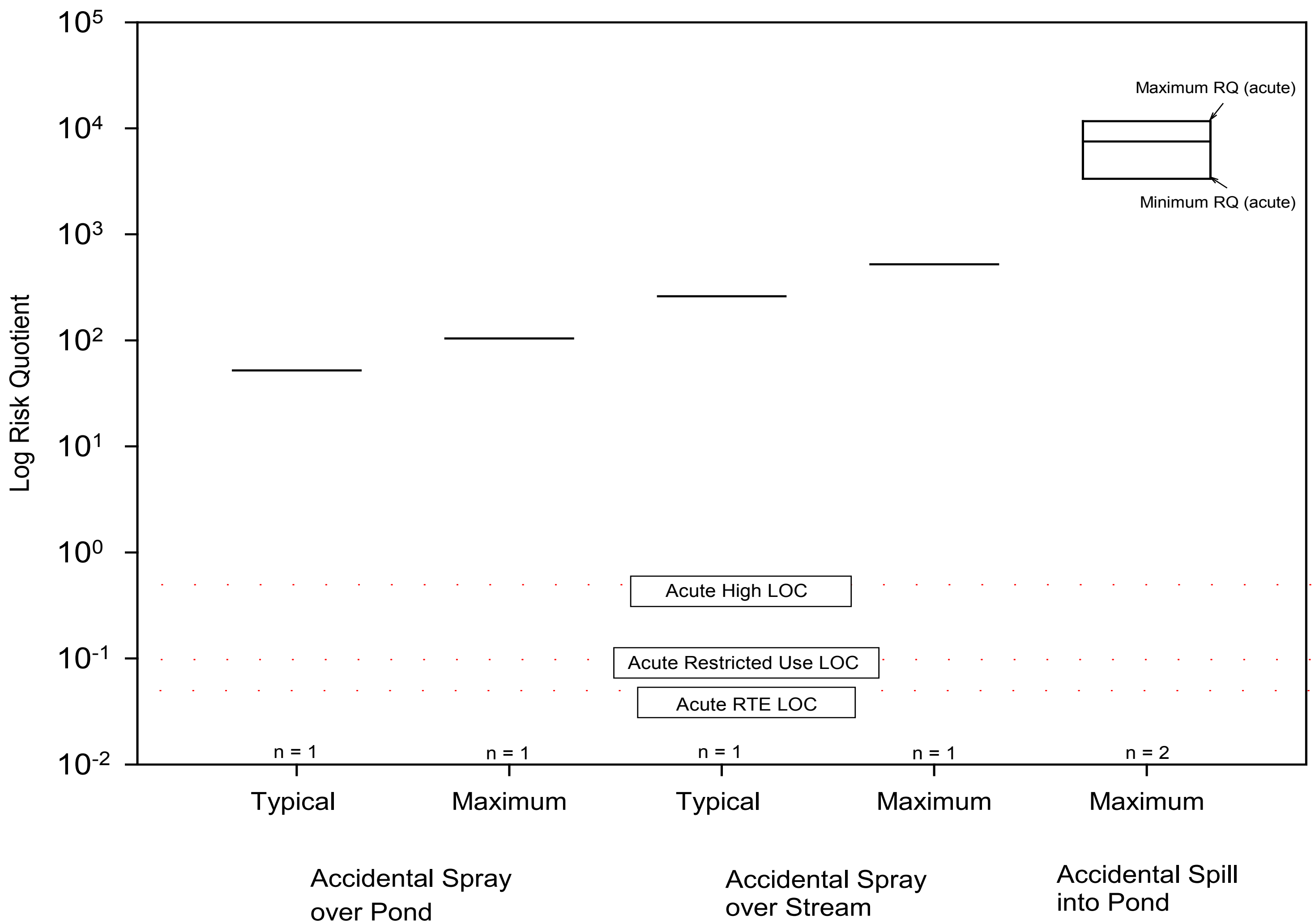


Figure E-35. Risk Quotients for Aquatic Invertebrates Exposed to 2,4-D Acids and Salts in Direct Spray and Spills Scenarios at Application Rates for Aquatic Submerged Vegetation

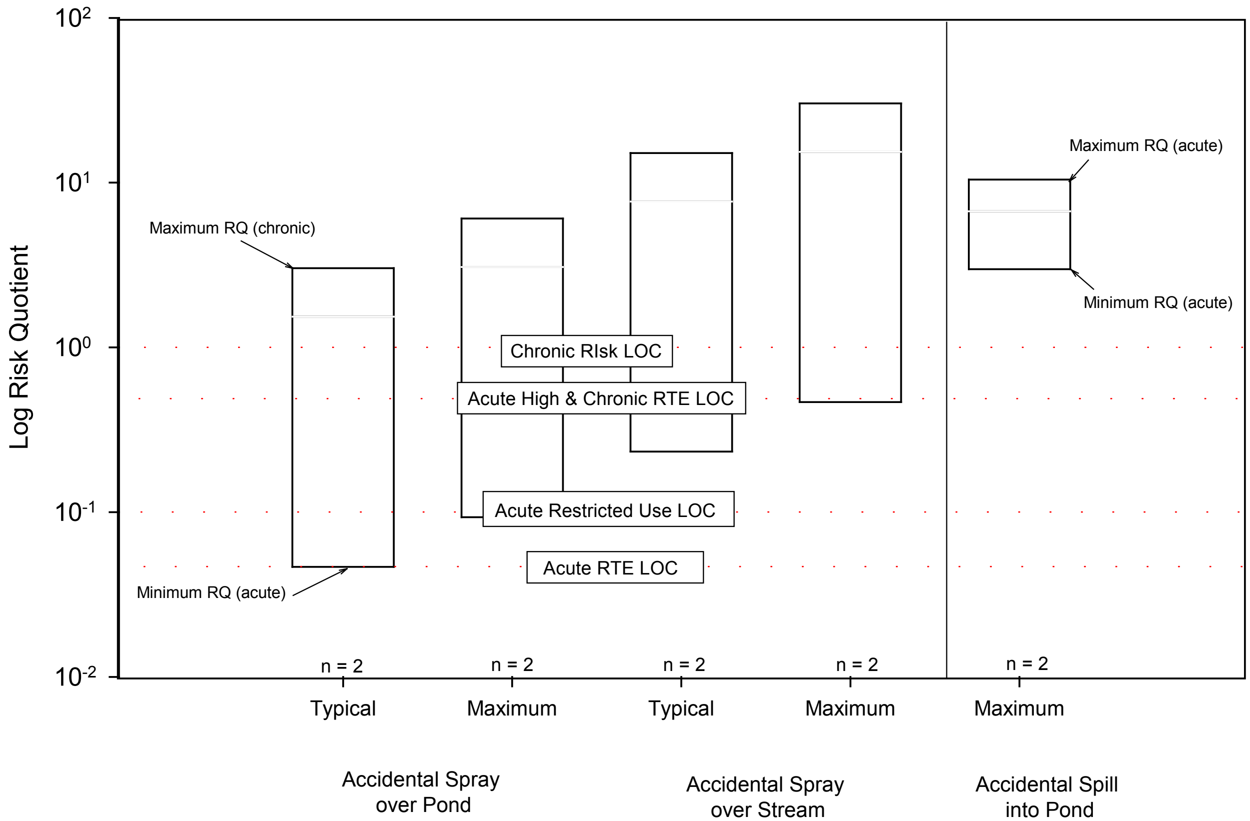


Figure E-36. Risk Quotients for Aquatic Invertebrates Exposed to 2,4-D Esters in Direct Spray and Spills Scenarios at Application Rates for Aquatic Submerged Vegetation

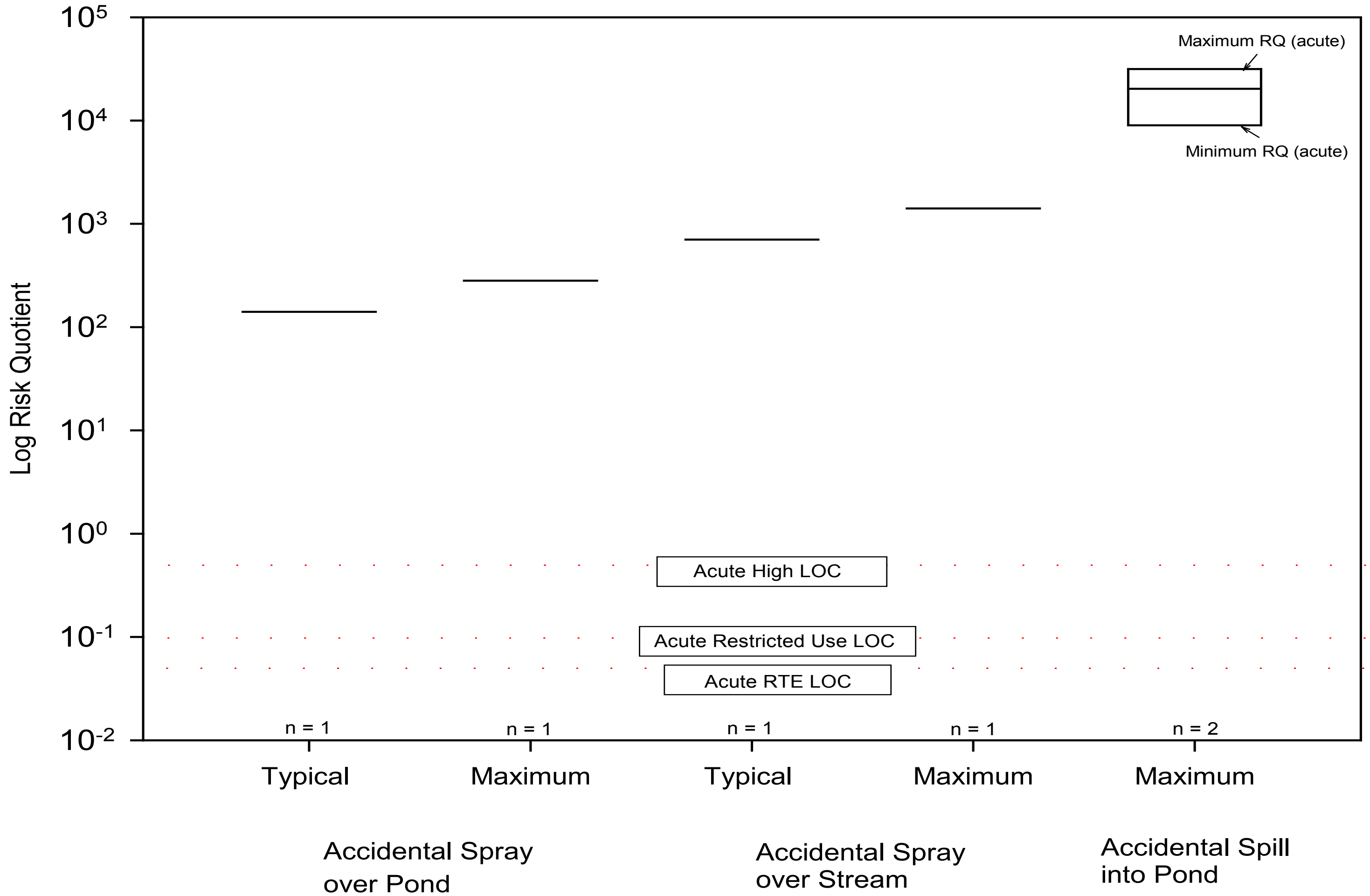


Figure E-37. Risk Quotients for Non-Target Terrestrial Plants Exposed to 2,4-D Acids and Salts in Off-Site Drift Scenarios at Application Rates for Terrestrial Annual or Perennial Vegetation

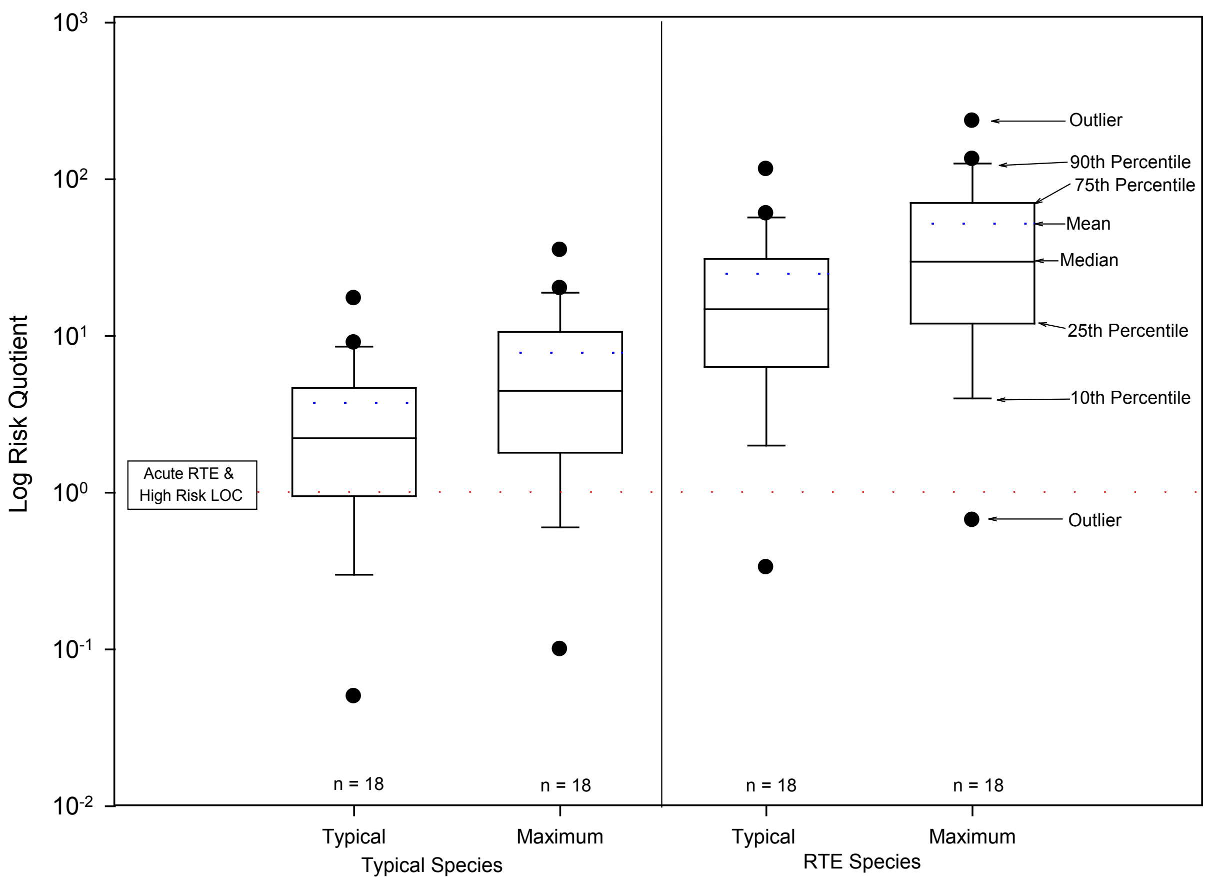


Figure E-38. Risk Quotients for Non-Target Terrestrial Plants Exposed to 2,4-D Esters in Off-Site Drift Scenarios at Application Rates for Terrestrial Annual or Perennial Vegetation

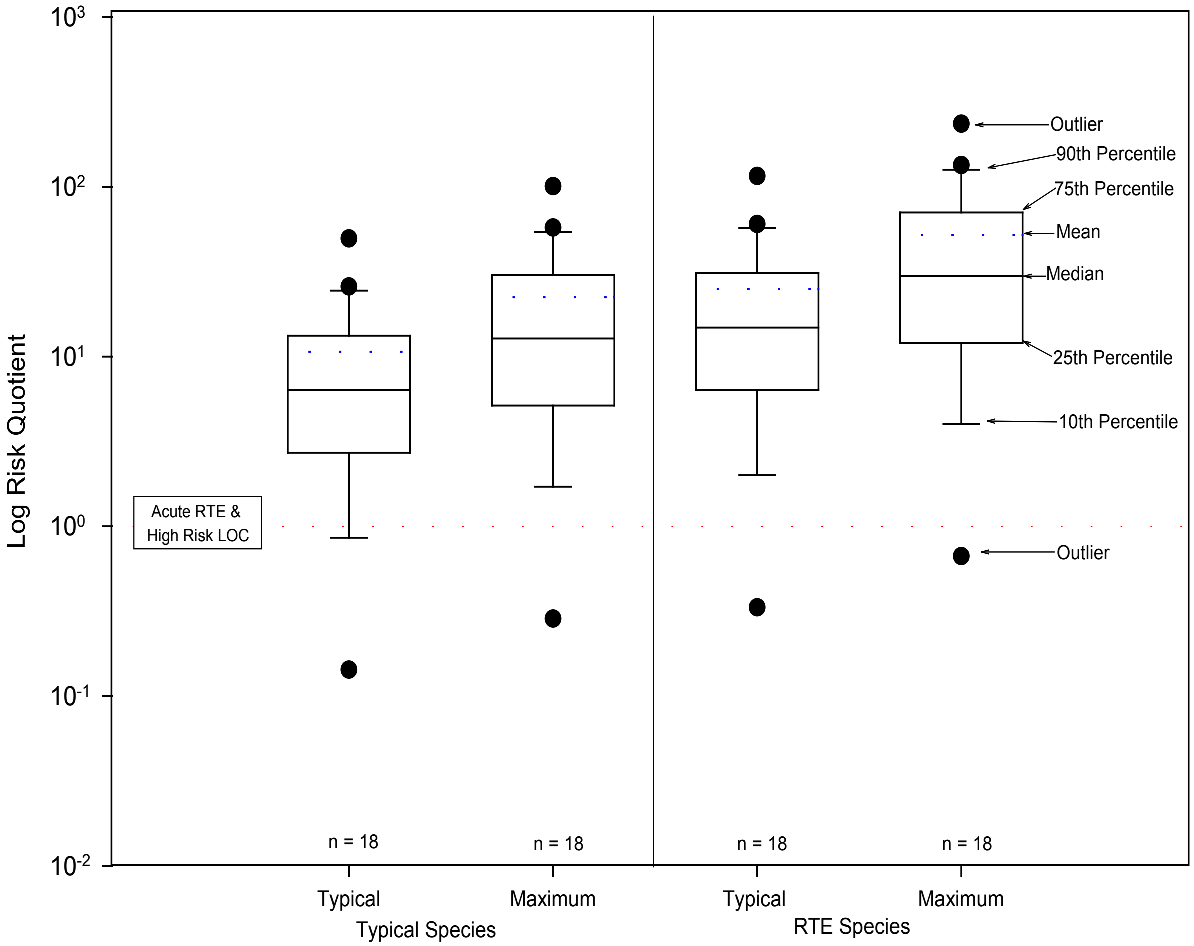


Figure E-39. Risk Quotients for Non-Target Terrestrial Plants Exposed to 2,4-D Acids and Salts in Off-Site Drift Scenarios at Application Rates for Terrestrial Woody Vegetation

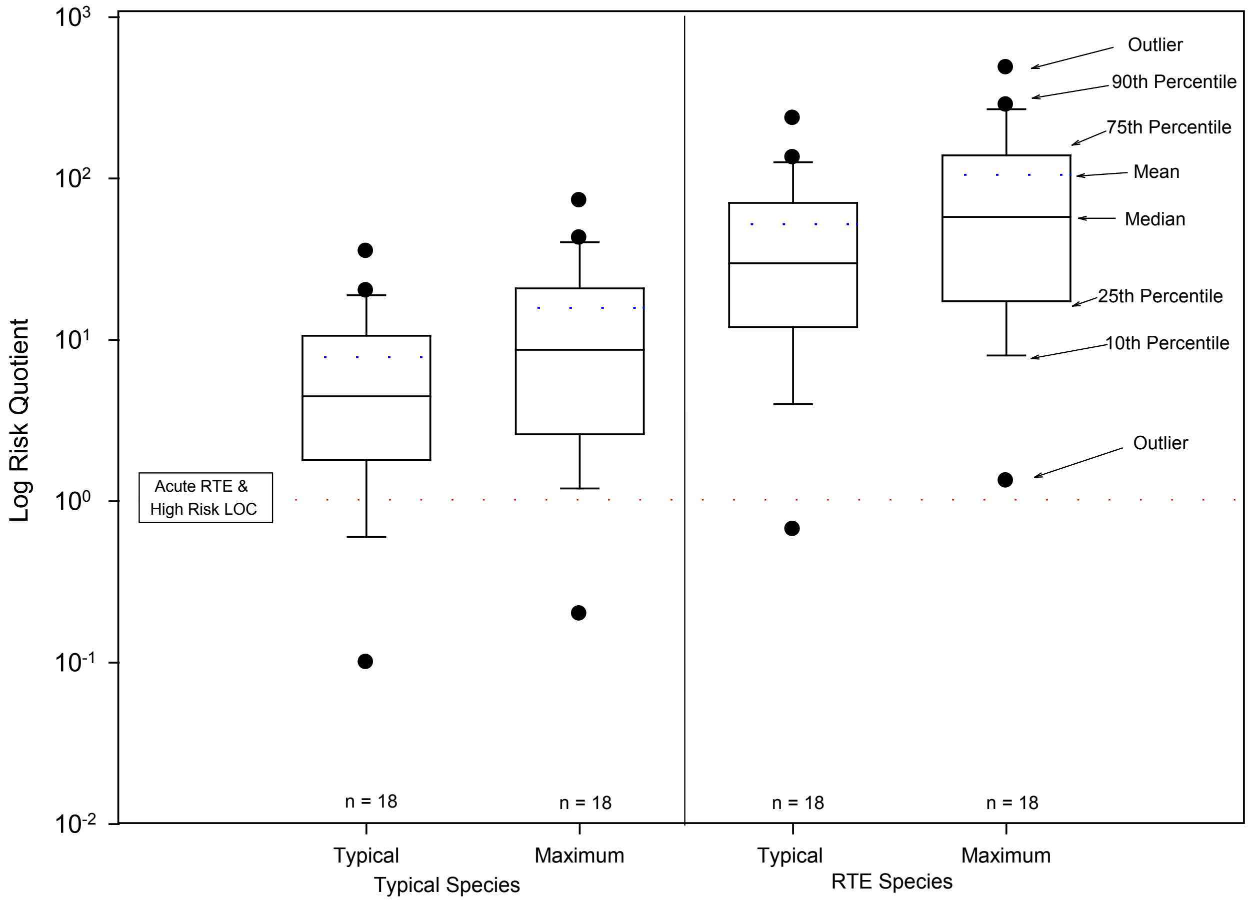


Figure E-40. Risk Quotients for Non-Target Terrestrial Plants Exposed to 2,4-D Esters in Off-Site Drift Scenarios at Application Rates for Terrestrial Woody Vegetation

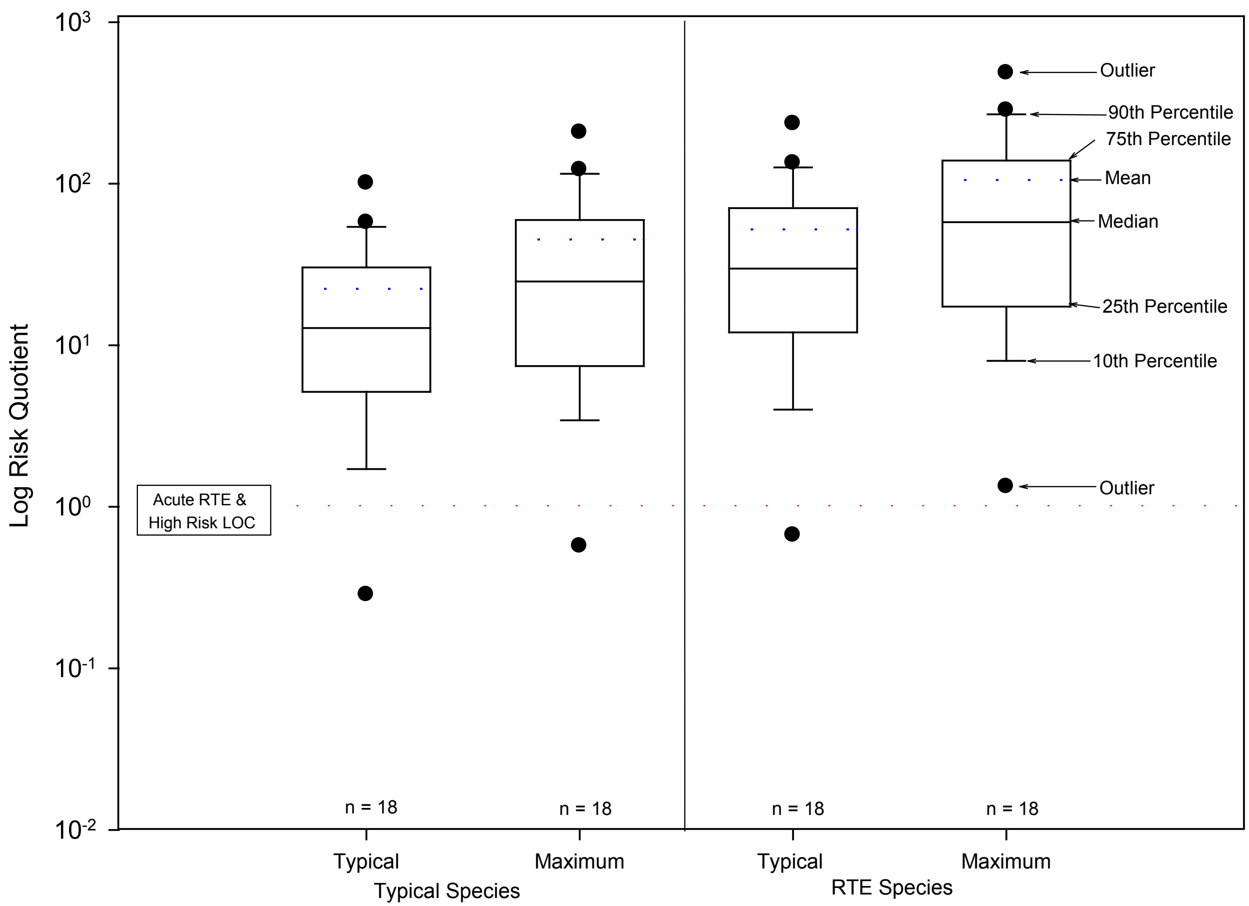


Figure E-41. Risk Quotients for Non-Target Terrestrial Plants Exposed to 2,4-D Acids and Salts in Off-Site Drift Scenarios at Application Rates for Aquatic Floating and Emerged Vegetation

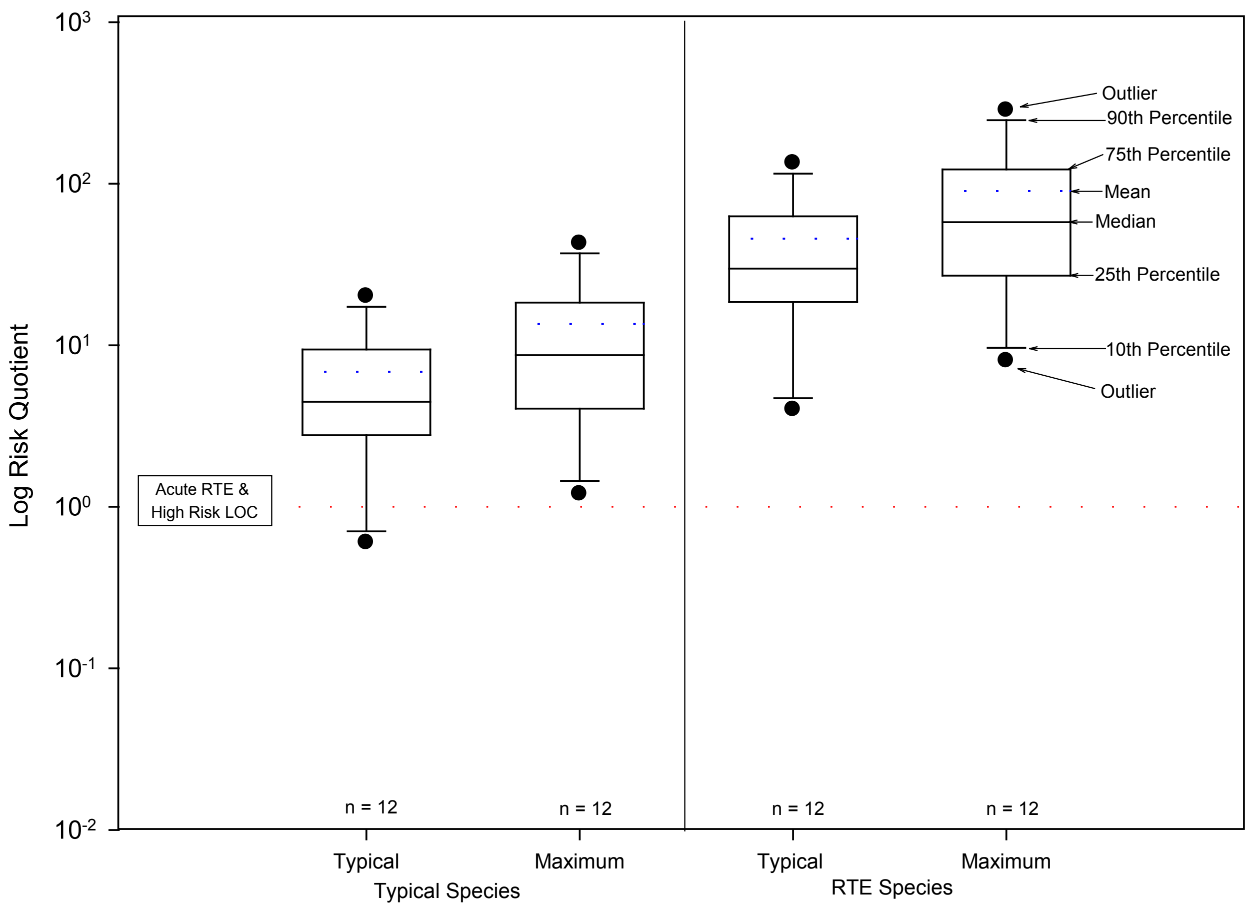


Figure E-42. Risk Quotients for Non-Target Terrestrial Plants Exposed to 2,4-D Esters in Off-Site Drift Scenarios at Application Rates for Aquatic Floating and Emerged Vegetation

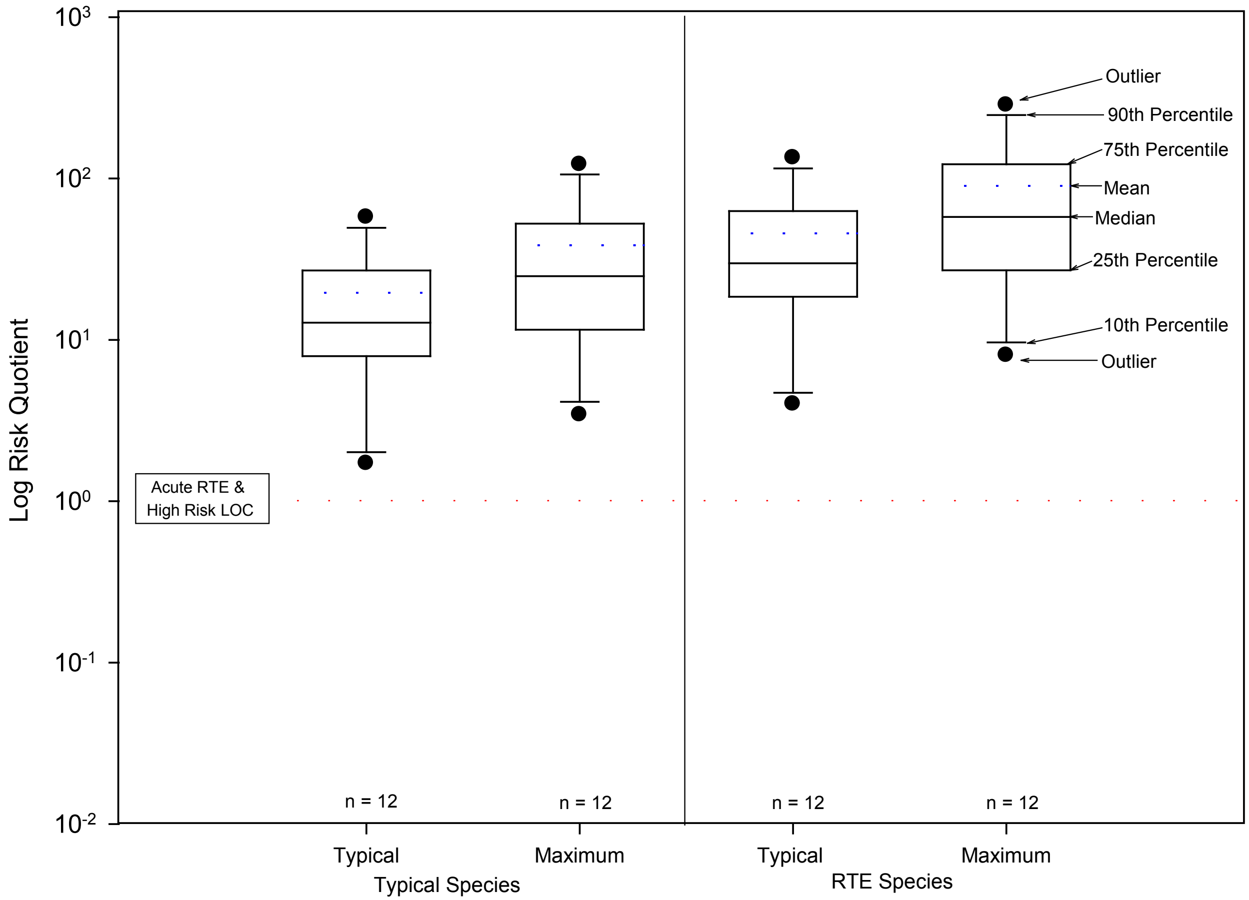


Figure E-43. Risk Quotients for Non-Target Terrestrial Plants Exposed to 2,4-D Acids and Salts in Off-Site Drift Scenarios at Application Rates for Aquatic Submerged Vegetation

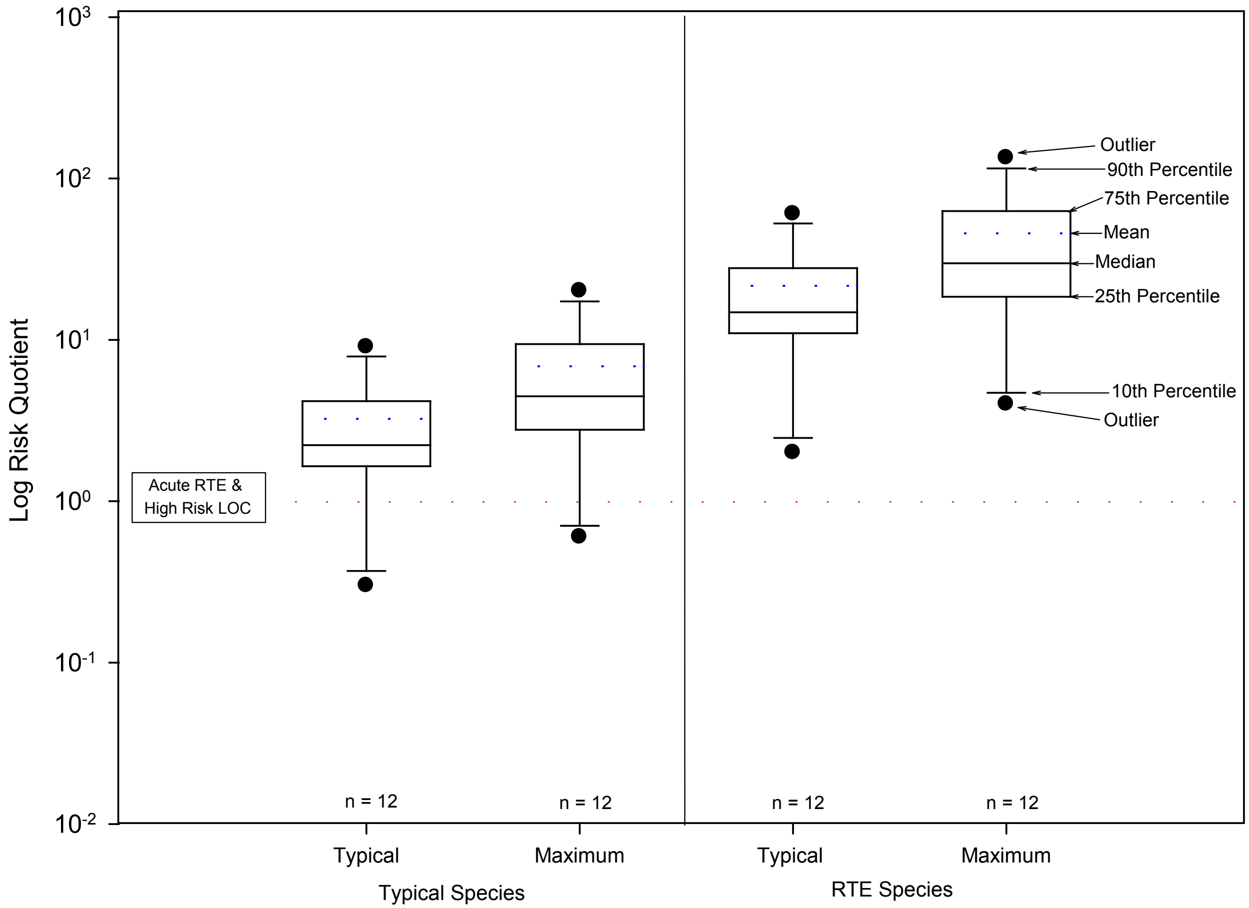


Figure E-44. Risk Quotients for Non-Target Terrestrial Plants Exposed to 2,4-D Esters in Off-Site Drift Scenarios at Application Rates for Aquatic Submerged Vegetation

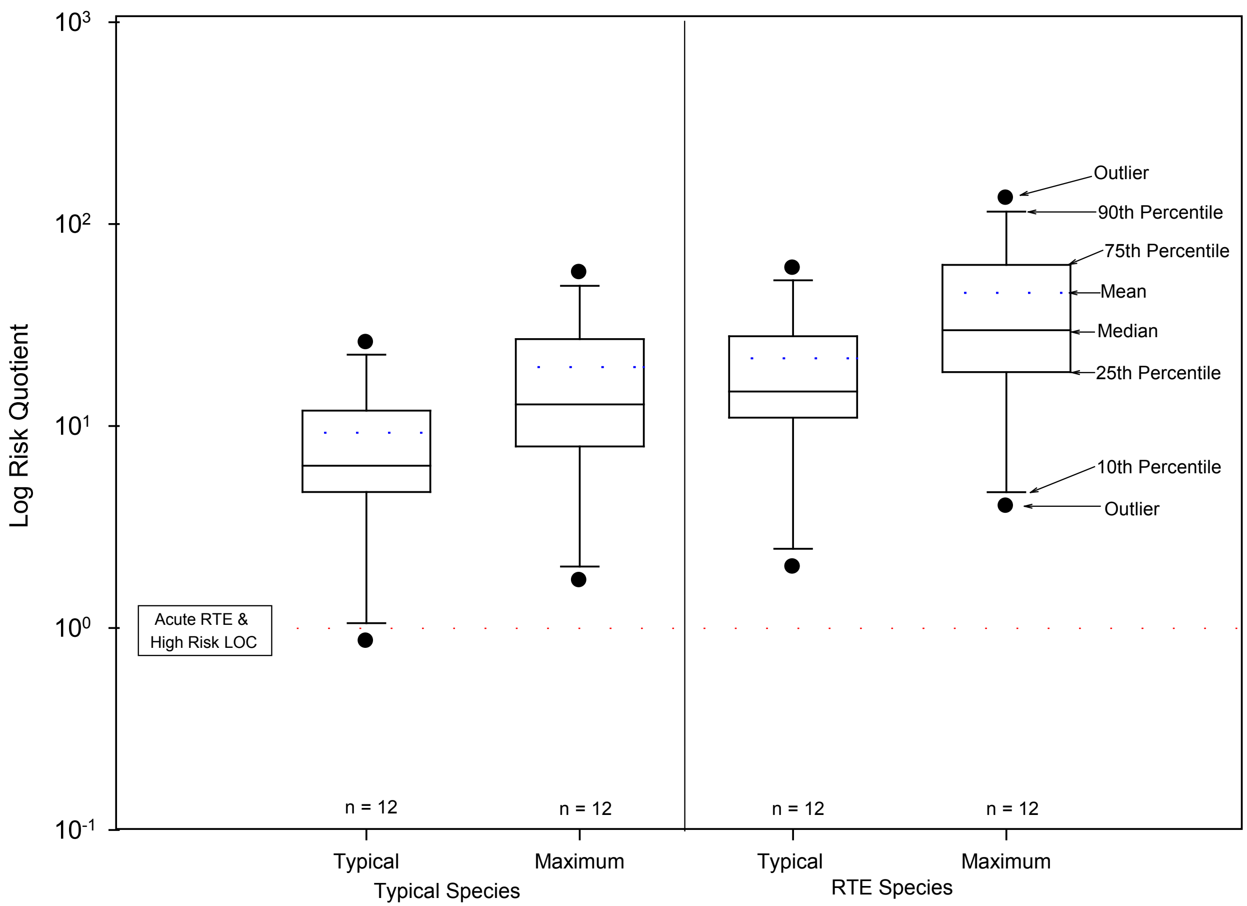


Figure E-45. Risk Quotients for Non-Target Aquatic Plants Exposed to 2,4-D Acids and Salts in Off-Site Drift Scenarios at Application Rates for Terrestrial Annual or Perennial Vegetation

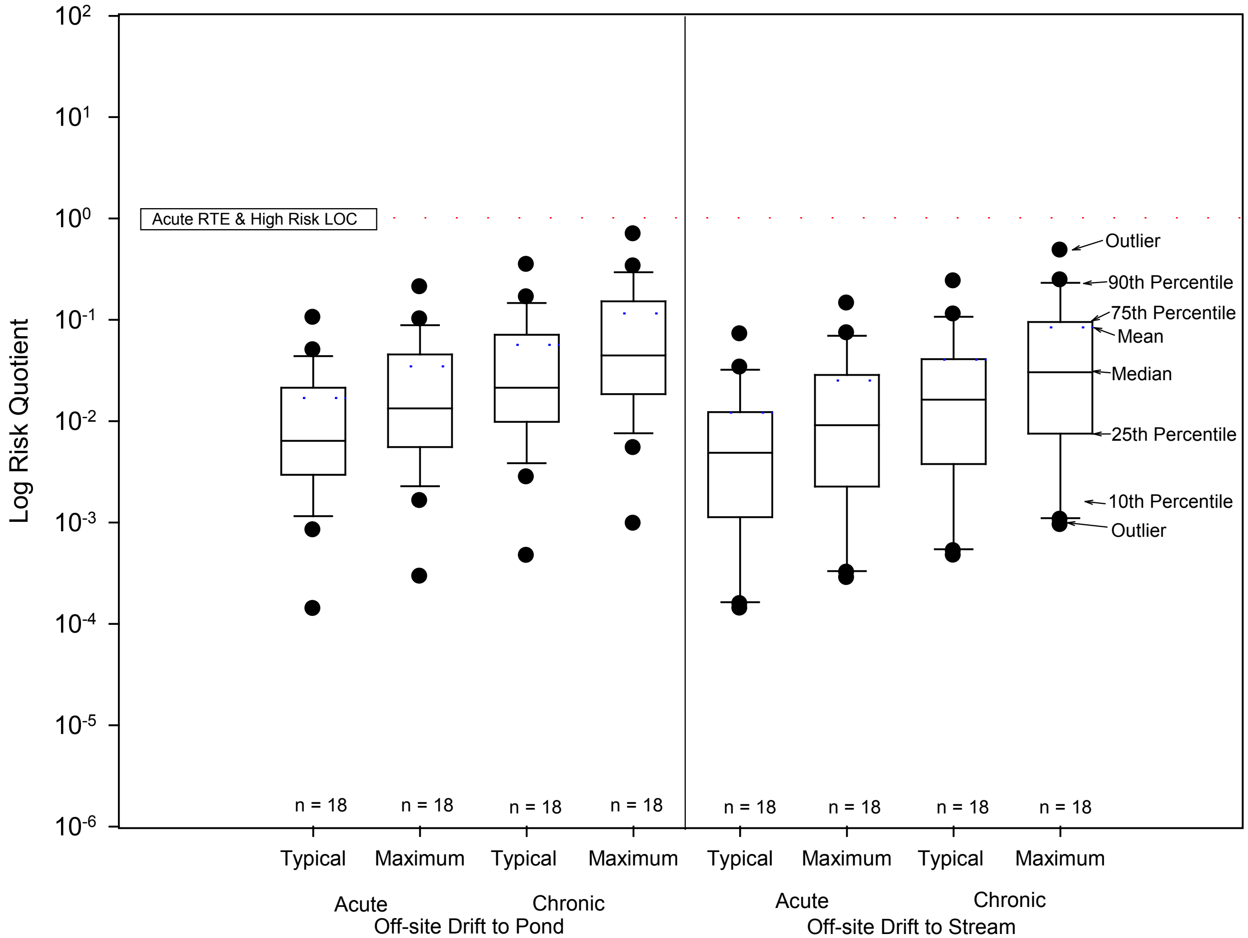


Figure E-46. Risk Quotients for Non-Target Aquatic Plants Exposed to 2,4-D Esters in Off-Site Drift Scenarios at Application Rates for Terrestrial Annual or Perennial Vegetation

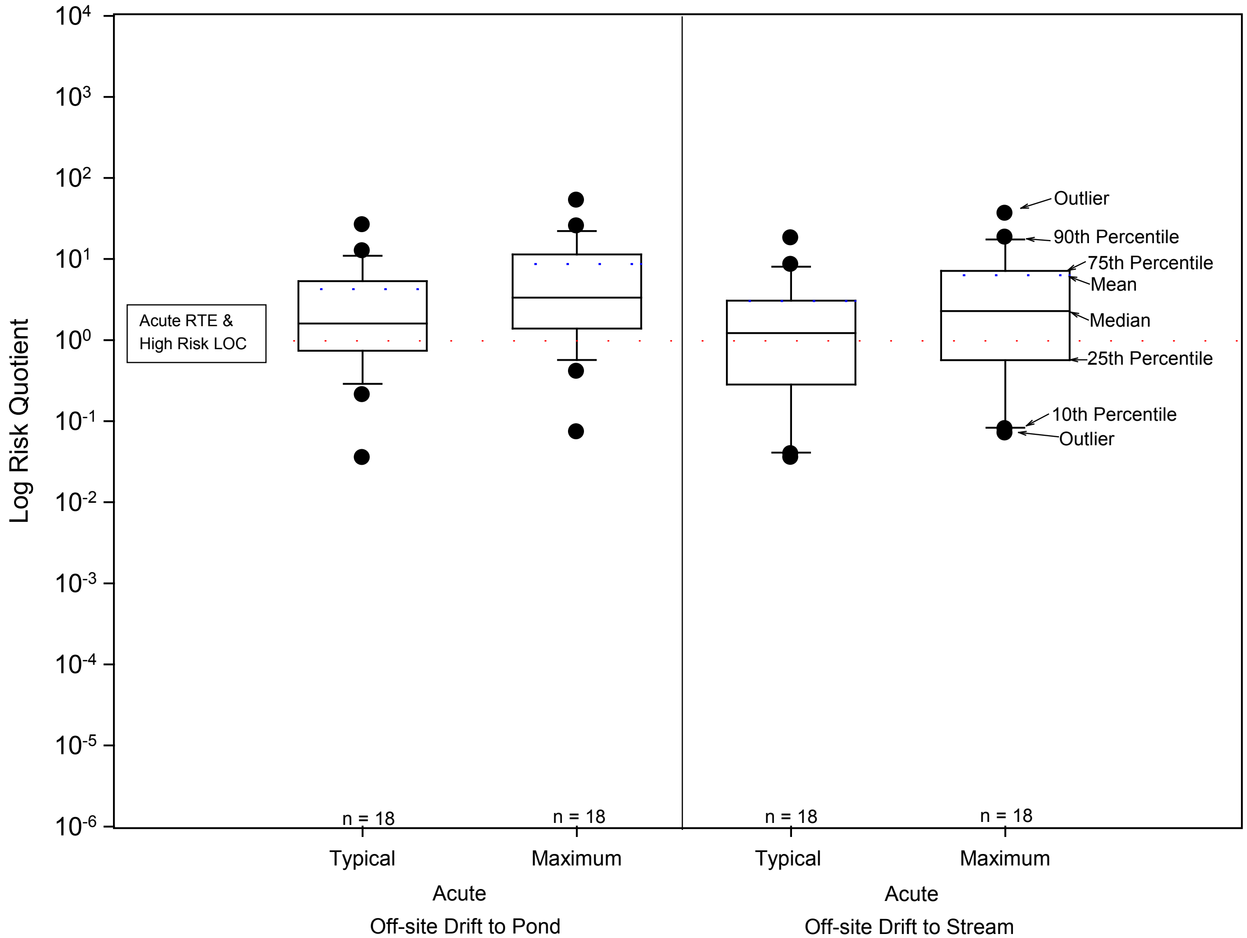


Figure E-47. Risk Quotients for Non-Target Aquatic Plants Exposed to 2,4-D Acids and Salts in Off-Site Drift Scenarios at Application Rates for Terrestrial Woody Vegetation

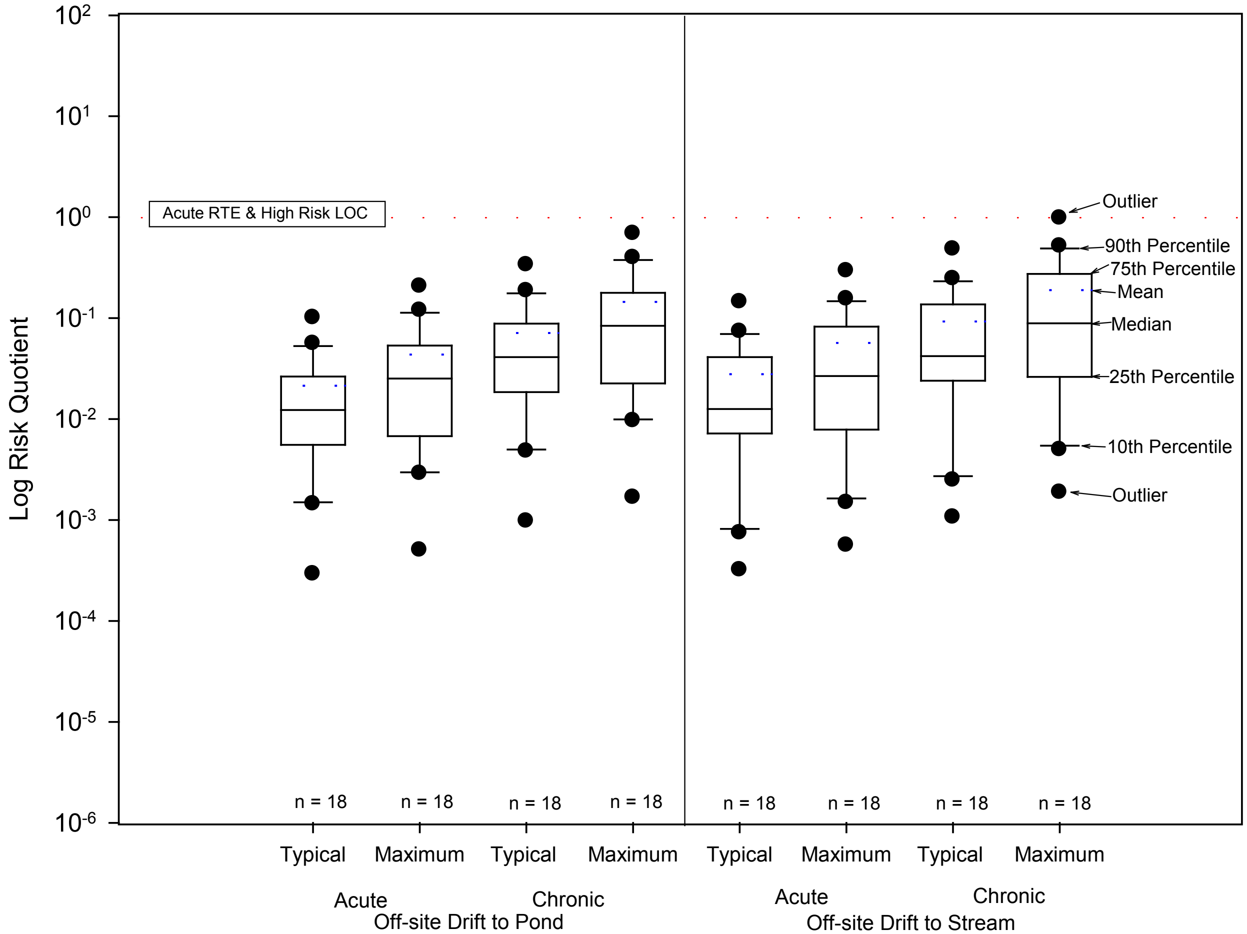


Figure E-48. Risk Quotients for Non-Target Aquatic Plants Exposed to 2,4-D Esters in Off-Site Drift Scenarios at Application Rates for Terrestrial Woody Vegetation

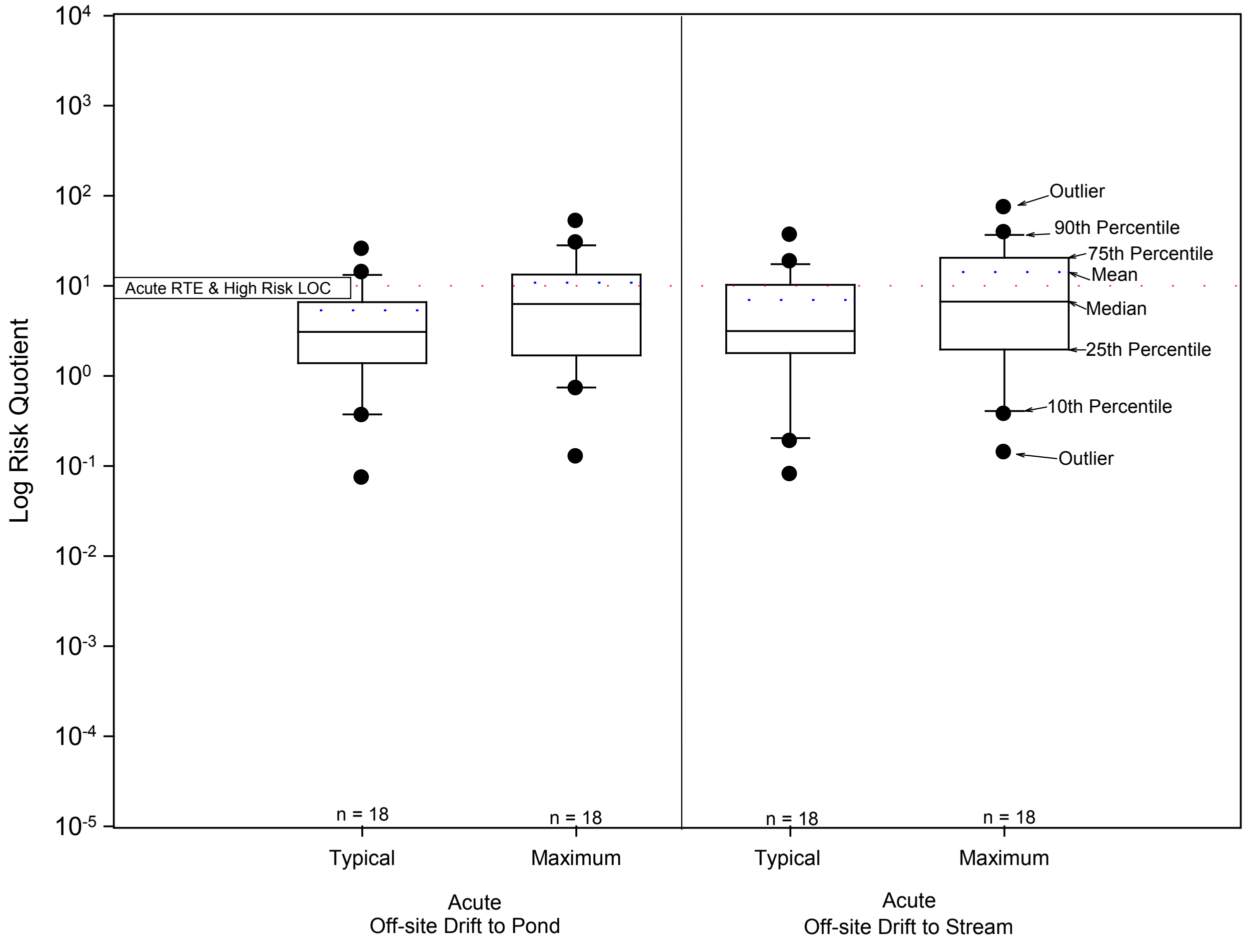


Figure E-49. Risk Quotients for Non-Target Aquatic Plants Exposed to 2,4-D Acids and Salts in Off-Site Drift Scenarios at Application Rates for Aquatic Floating and Emerged Vegetation

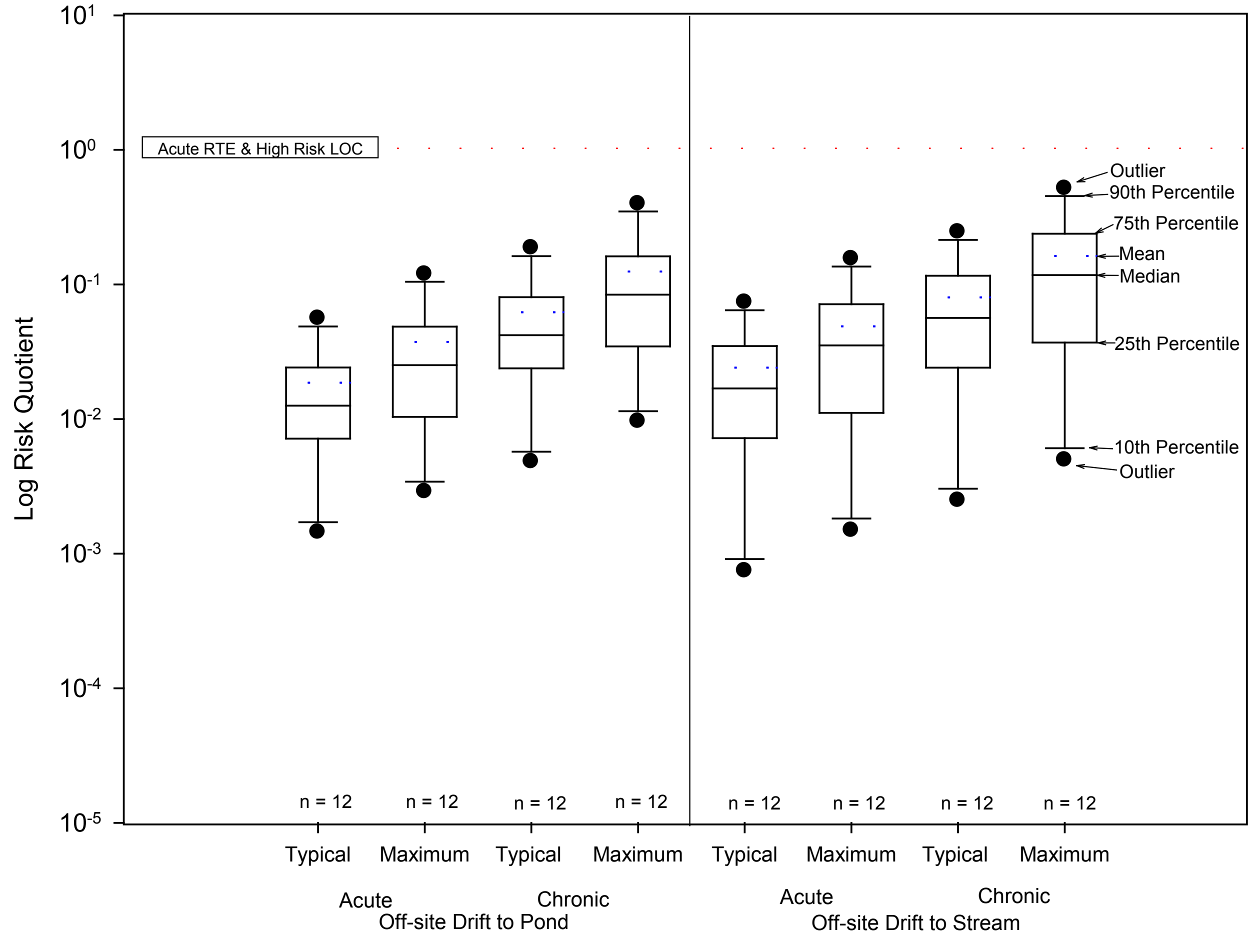


Figure E-50. Risk Quotients for Non-Target Aquatic Plants Exposed to 2,4-D Esters in Off-Site Drift Scenarios at Application Rates for Aquatic Floating and Emerged Vegetation

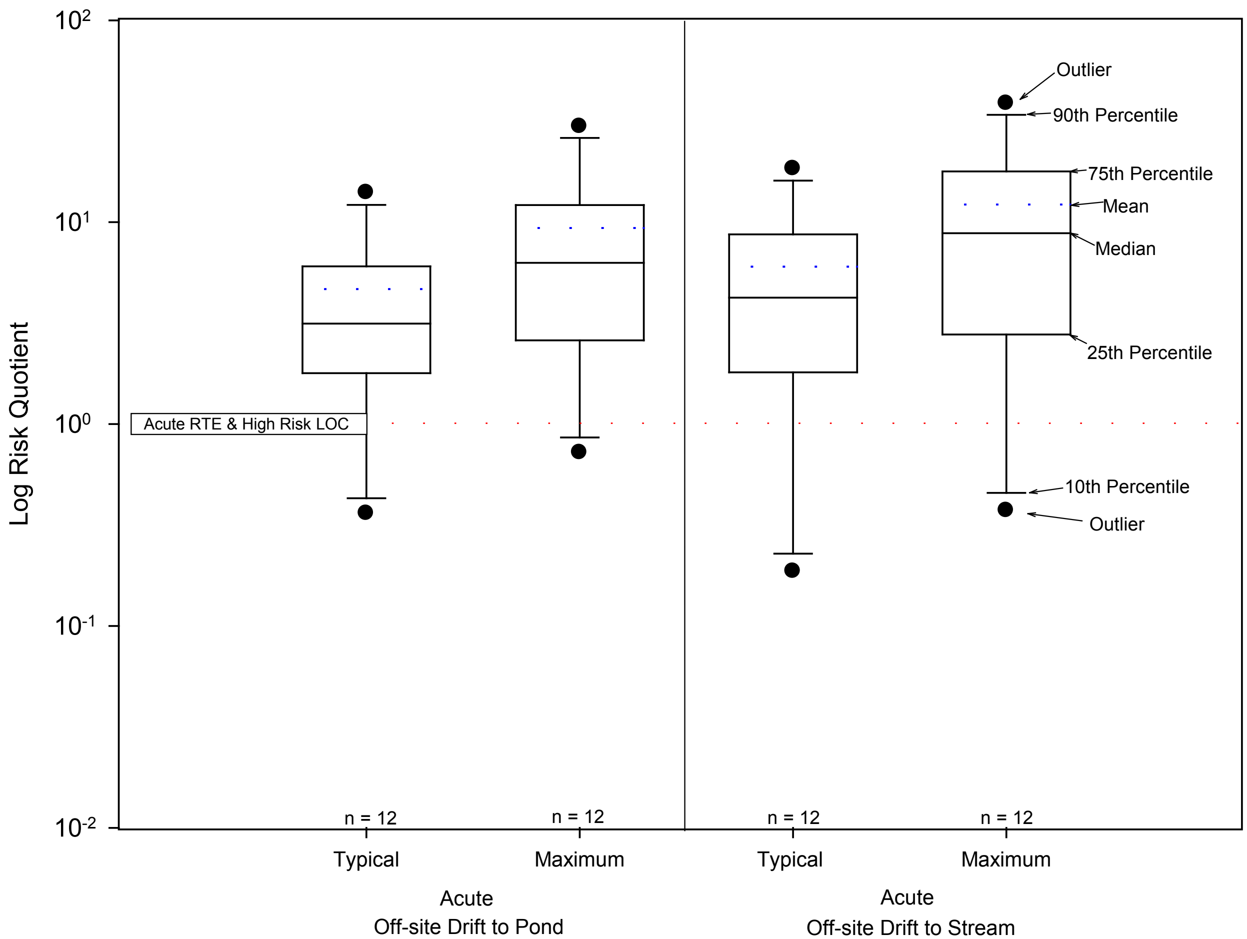


Figure E-51. Risk Quotients for Non-Target Aquatic Plants Exposed to 2,4-D Acids and Salts in Off-Site Drift Scenarios at Application Rates for Aquatic Submerged Vegetation

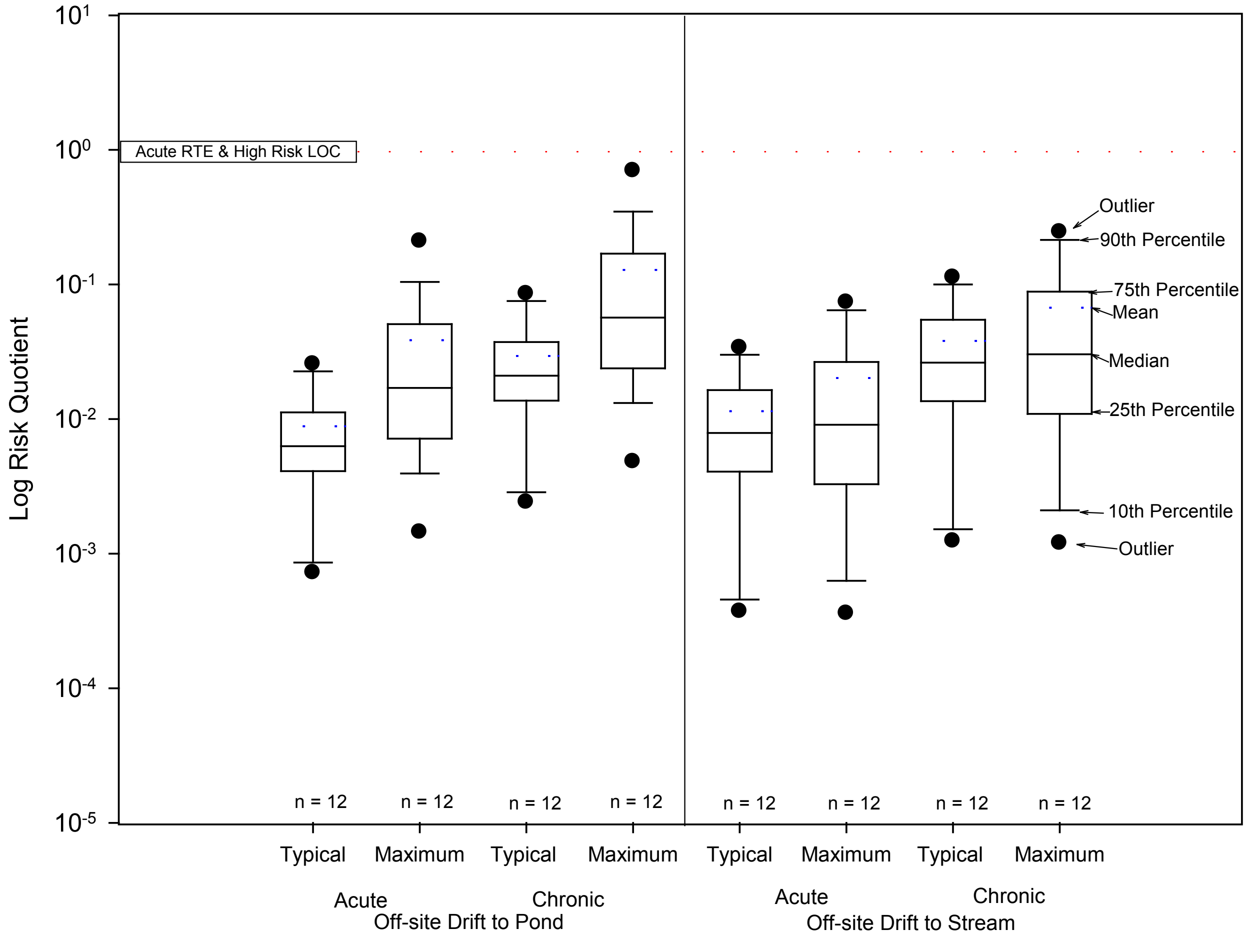


Figure E-52. Risk Quotients for Non-Target Aquatic Plants Exposed to 2,4-D Esters in Off-Site Drift Scenarios at Application Rates for Aquatic Submerged Vegetation

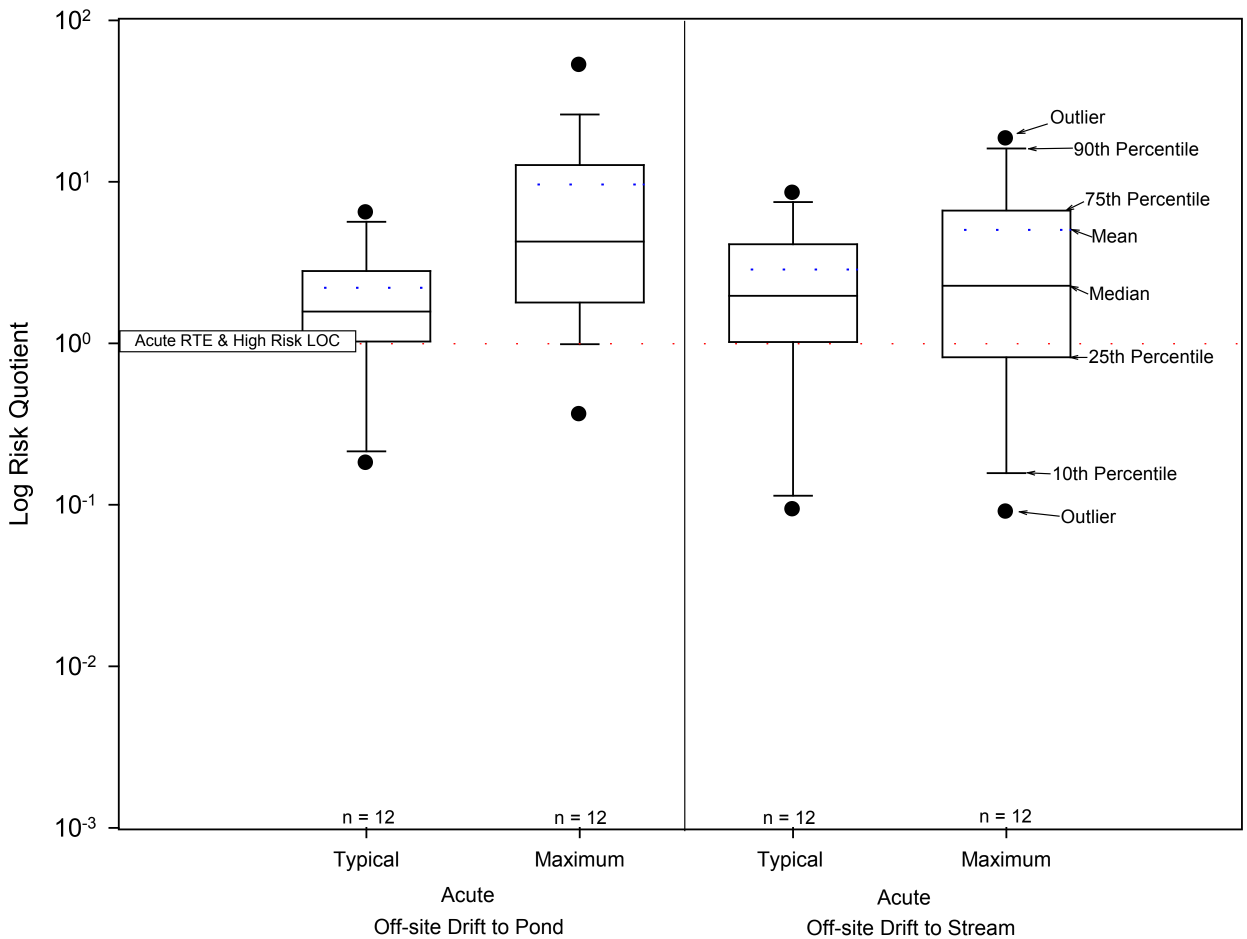


Figure E-53. Risk Quotients for Fish Exposed to 2,4-D Acids and Salts in Off-Site Drift Scenarios at Application Rates for Terrestrial Annual or Perennial Vegetation

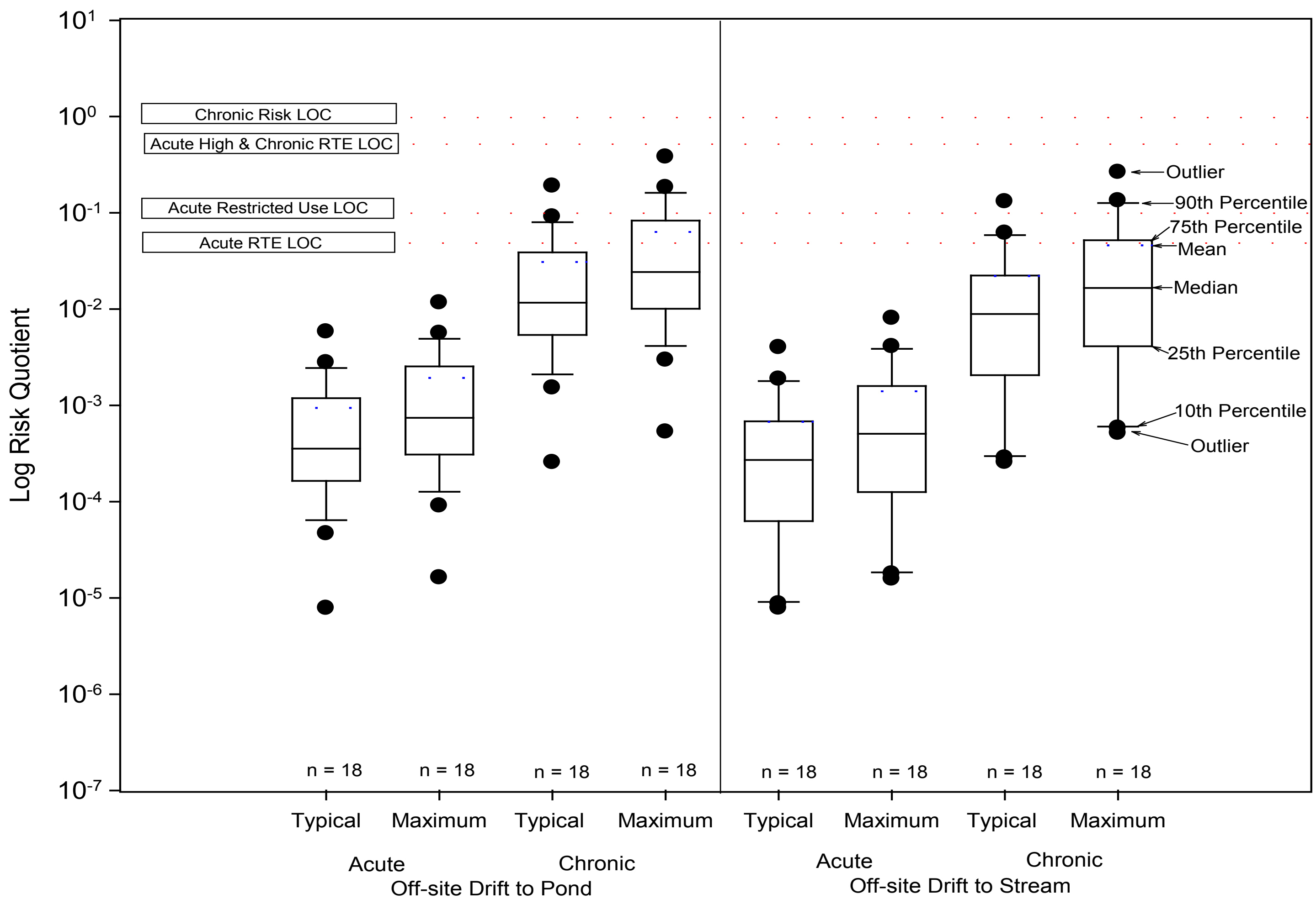


Figure E-54. Risk Quotients for Fish Exposed to 2,4-D Esters in Off-Site Drift Scenarios at Application Rates for Terrestrial Annual or Perennial Vegetation

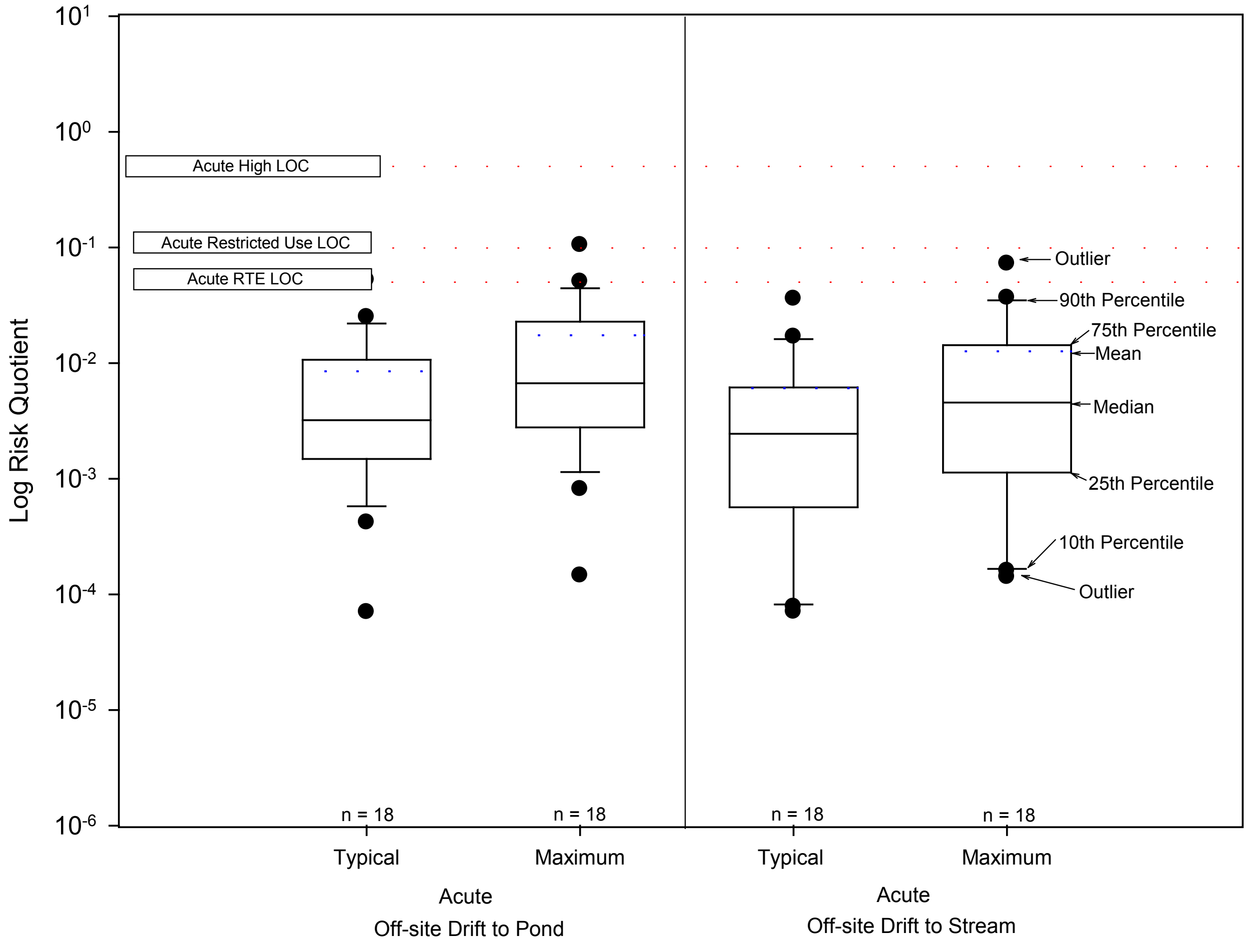


Figure E-55. Risk Quotients for Fish Exposed to 2,4-D Acids and Salts in Off-Site Drift Scenarios at Application Rates for Terrestrial Woody Vegetation

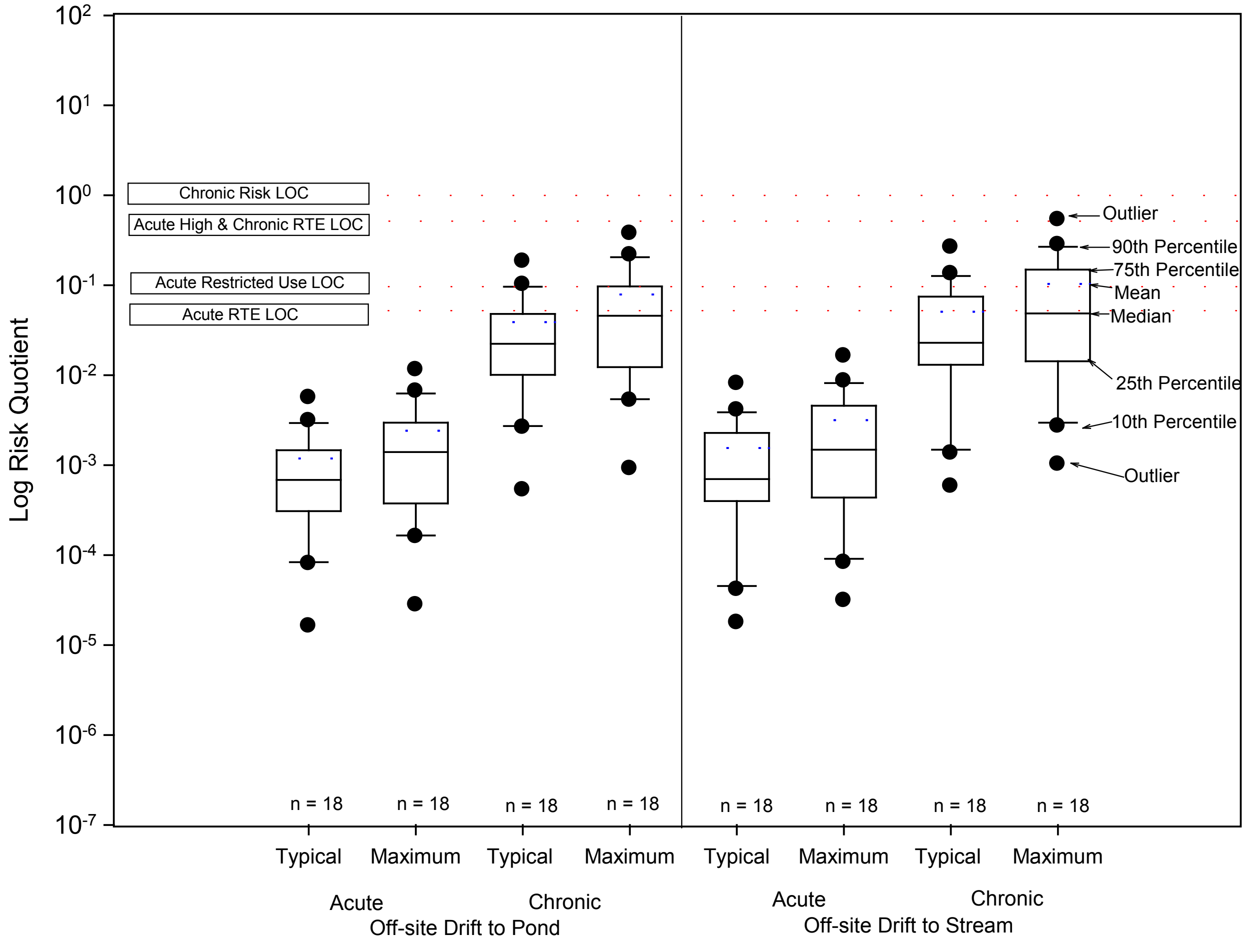


Figure E-56. Risk Quotients for Fish Exposed to 2,4-D Esters in Off-Site Drift Scenarios at Application Rates for Terrestrial Woody Vegetation

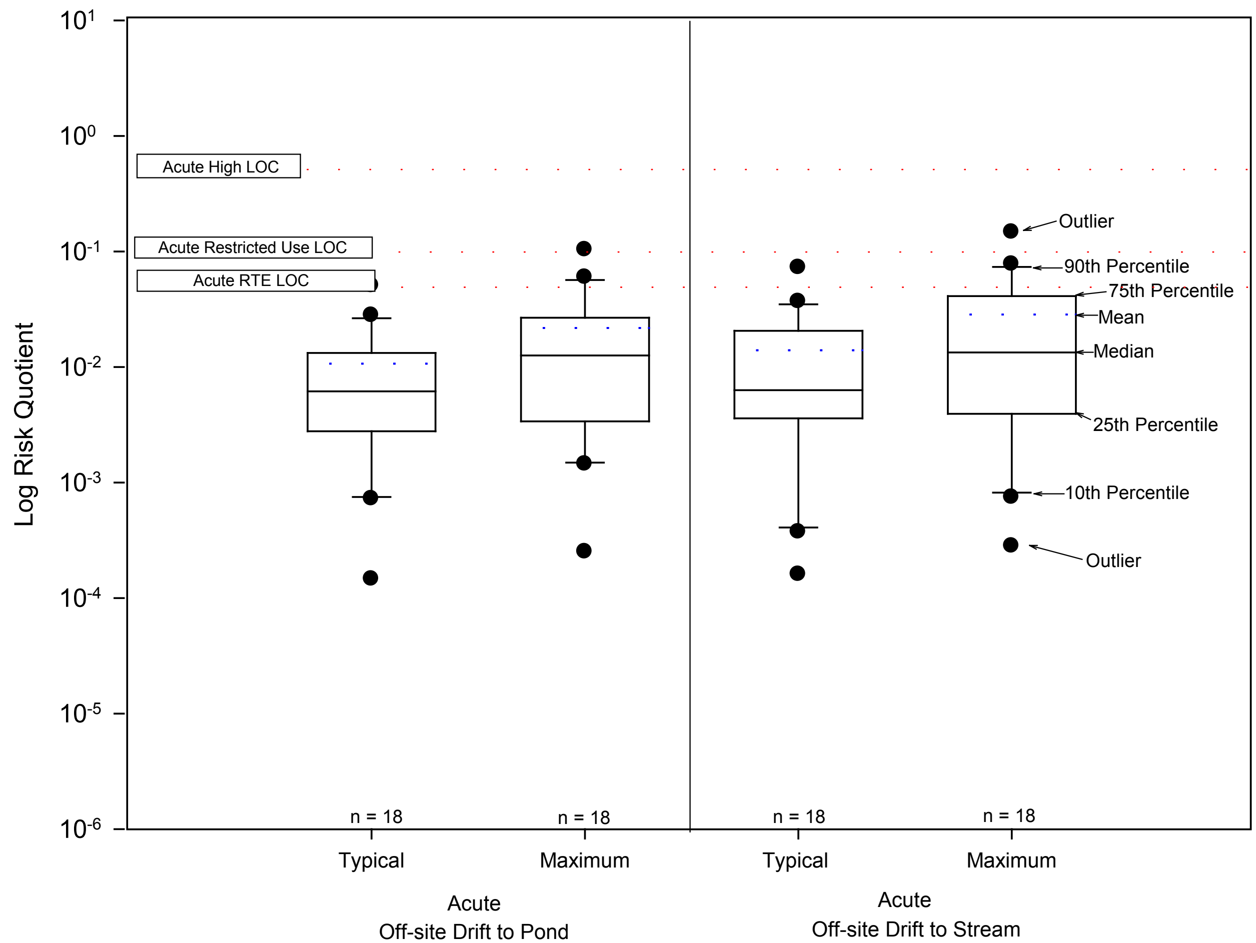


Figure E-57. Risk Quotients for Fish Exposed to 2,4-D Acids and Salts in Off-Site Drift Scenarios at Application Rates for Aquatic Floating and Emerged Vegetation

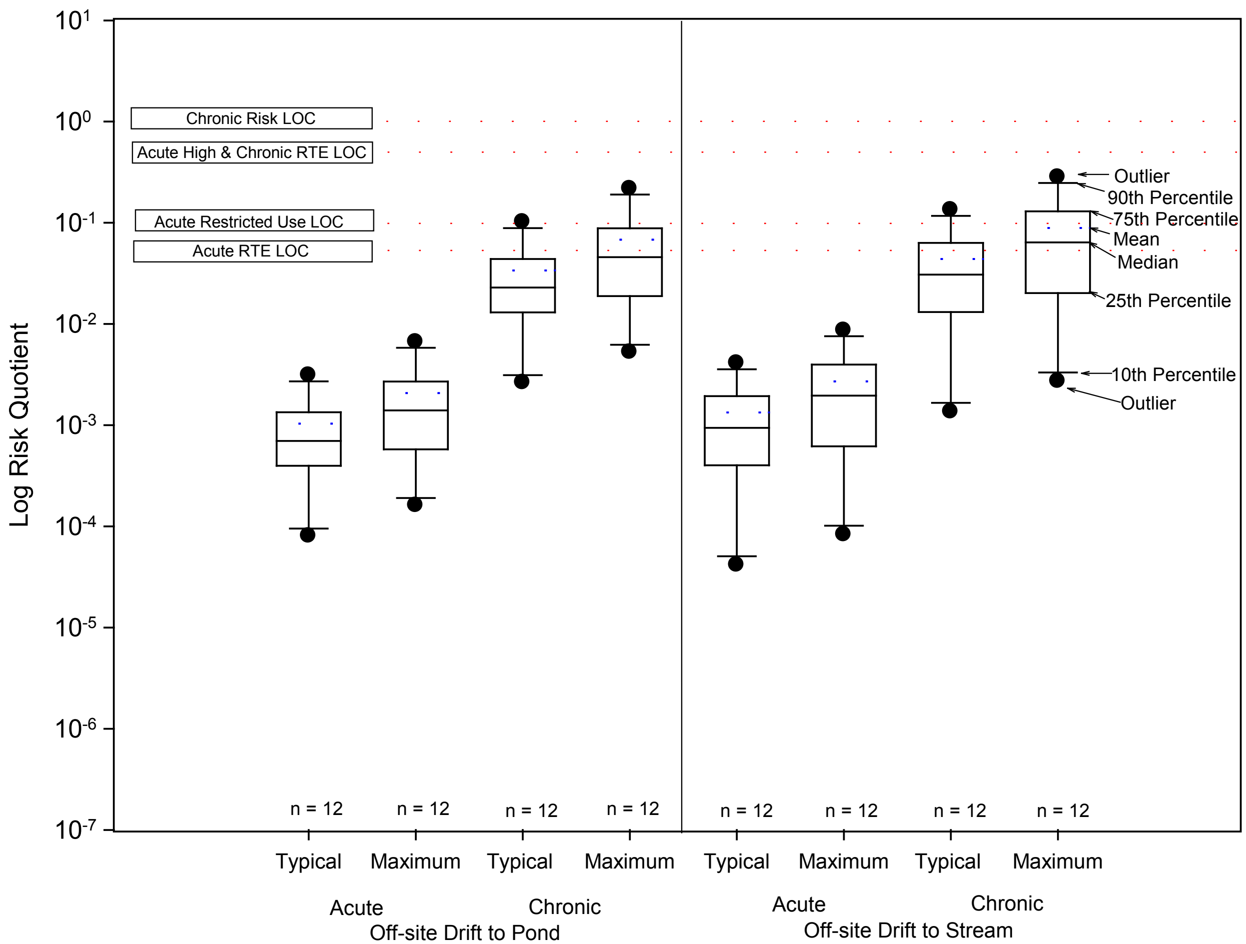


Figure E-58. Risk Quotients for Fish Exposed to 2,4-D Esters in Off-Site Drift Scenarios at Application Rates for Aquatic Floating and Emerged Vegetation

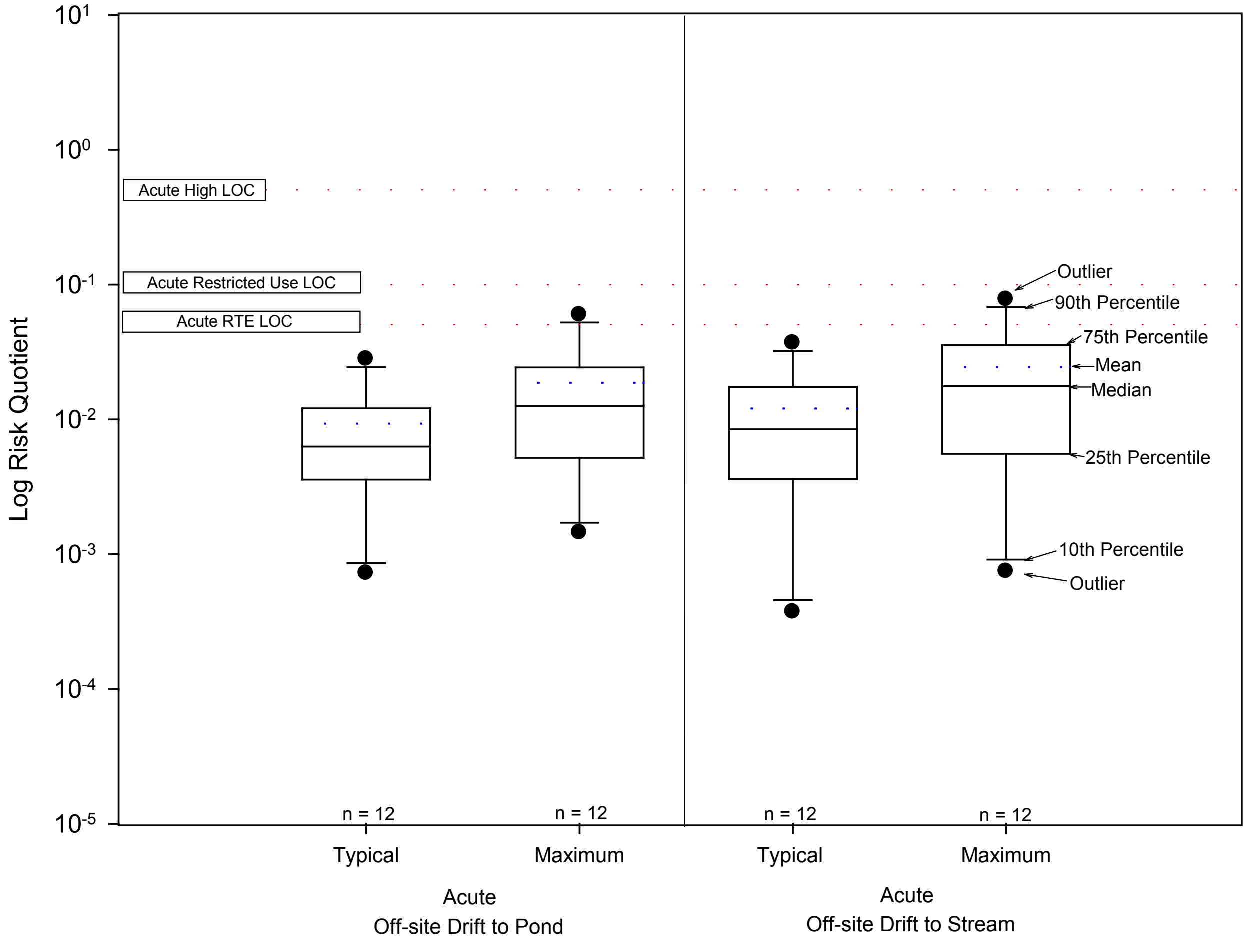


Figure E-59. Risk Quotients for Fish Exposed to 2,4-D Acids and Salts in Off-Site Drift Scenarios at Application Rates for Aquatic Submerged Vegetation

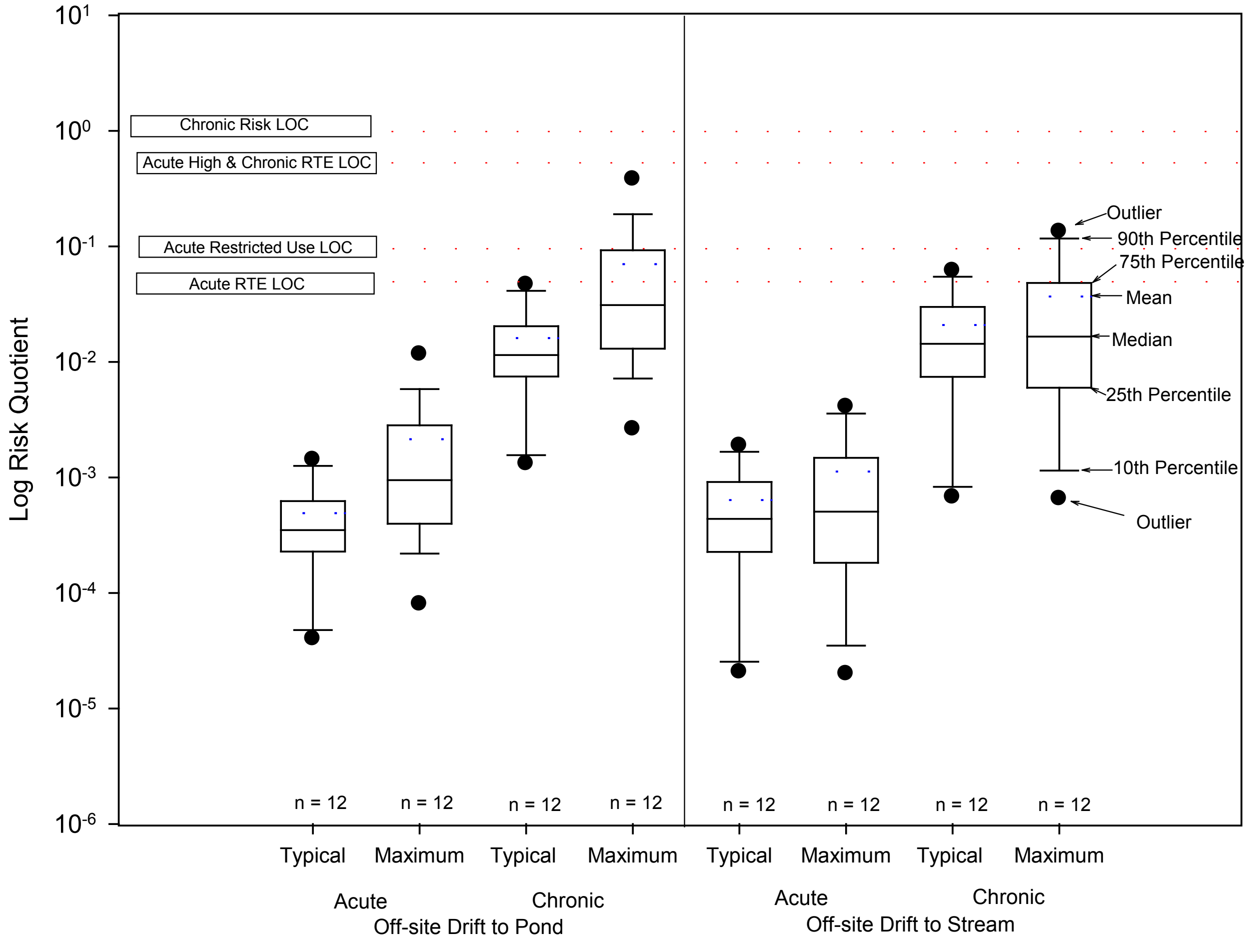


Figure E-60. Risk Quotients for Fish Exposed to 2,4-D Esters in Off-Site Drift Scenarios at Application Rates for Aquatic Submerged Vegetation

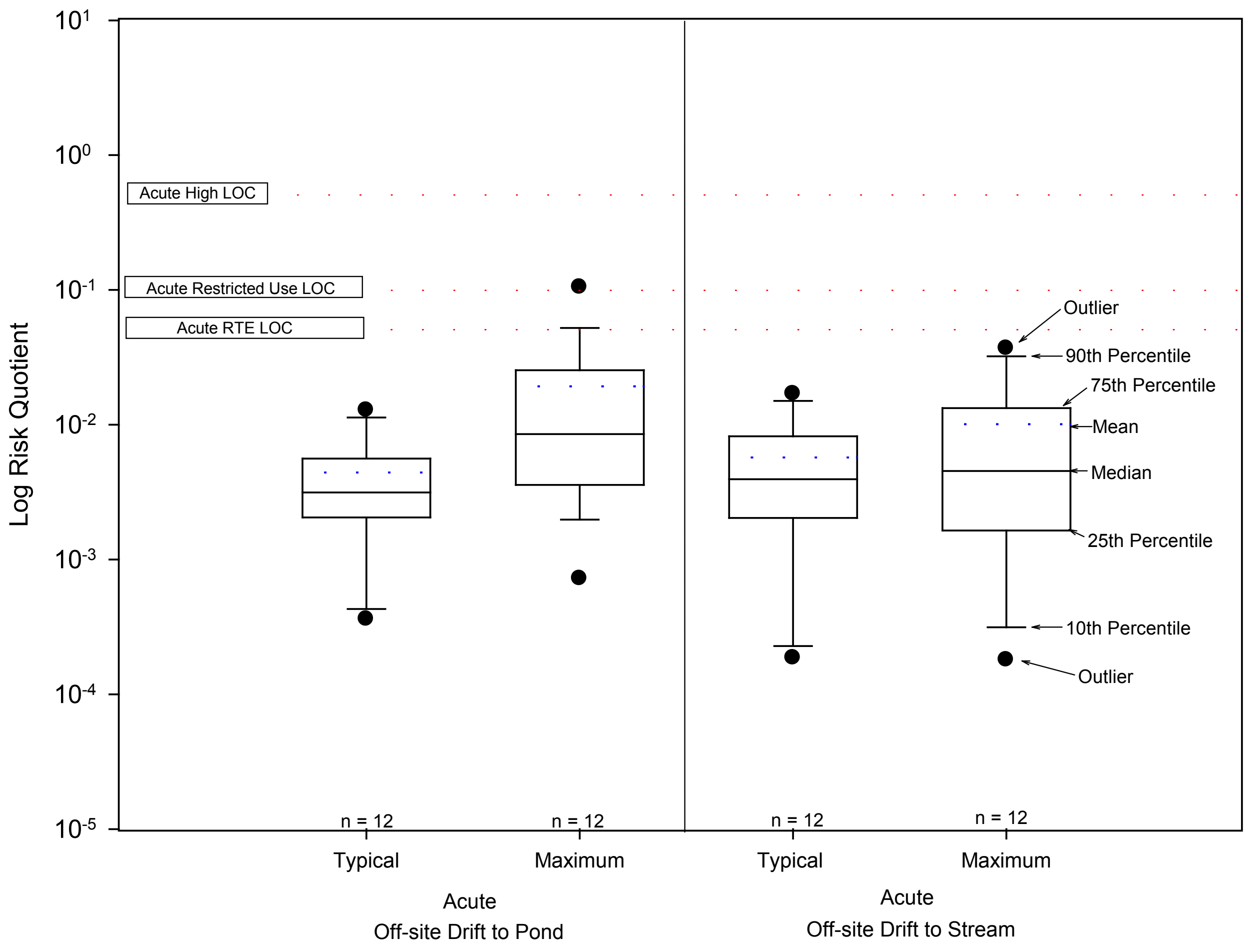


Figure E-61. Risk Quotients for Aquatic Invertebrates Exposed to 2,4-D Acids and Salts in Off-Site Drift Scenarios at Application Rates for Terrestrial Annual or Perennial Vegetation

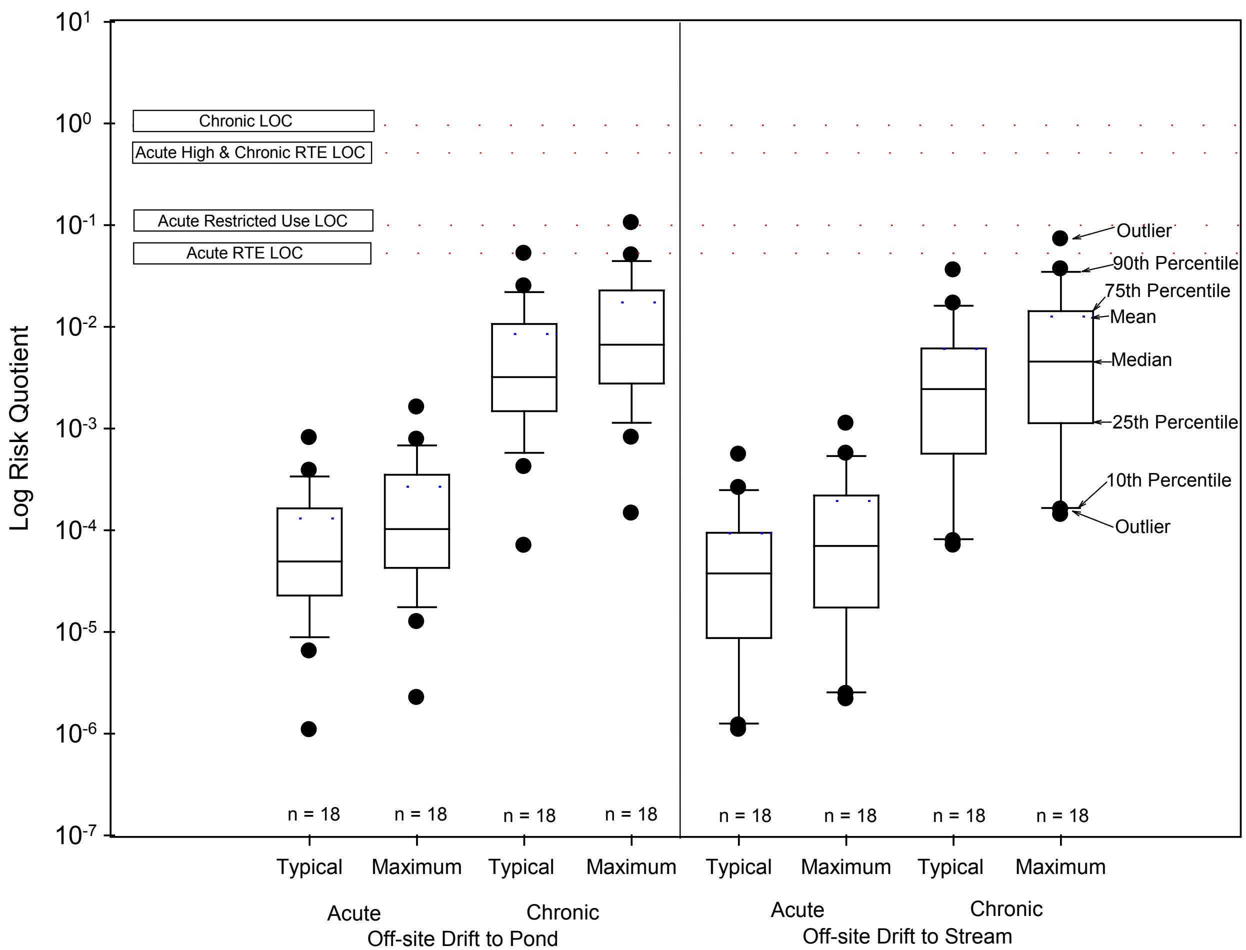


Figure E-62. Risk Quotients for Aquatic Invertebrates Exposed to 2,4-D Esters in Off-Site Drift Scenarios at Application Rates for Terrestrial Annual or Perennial Vegetation

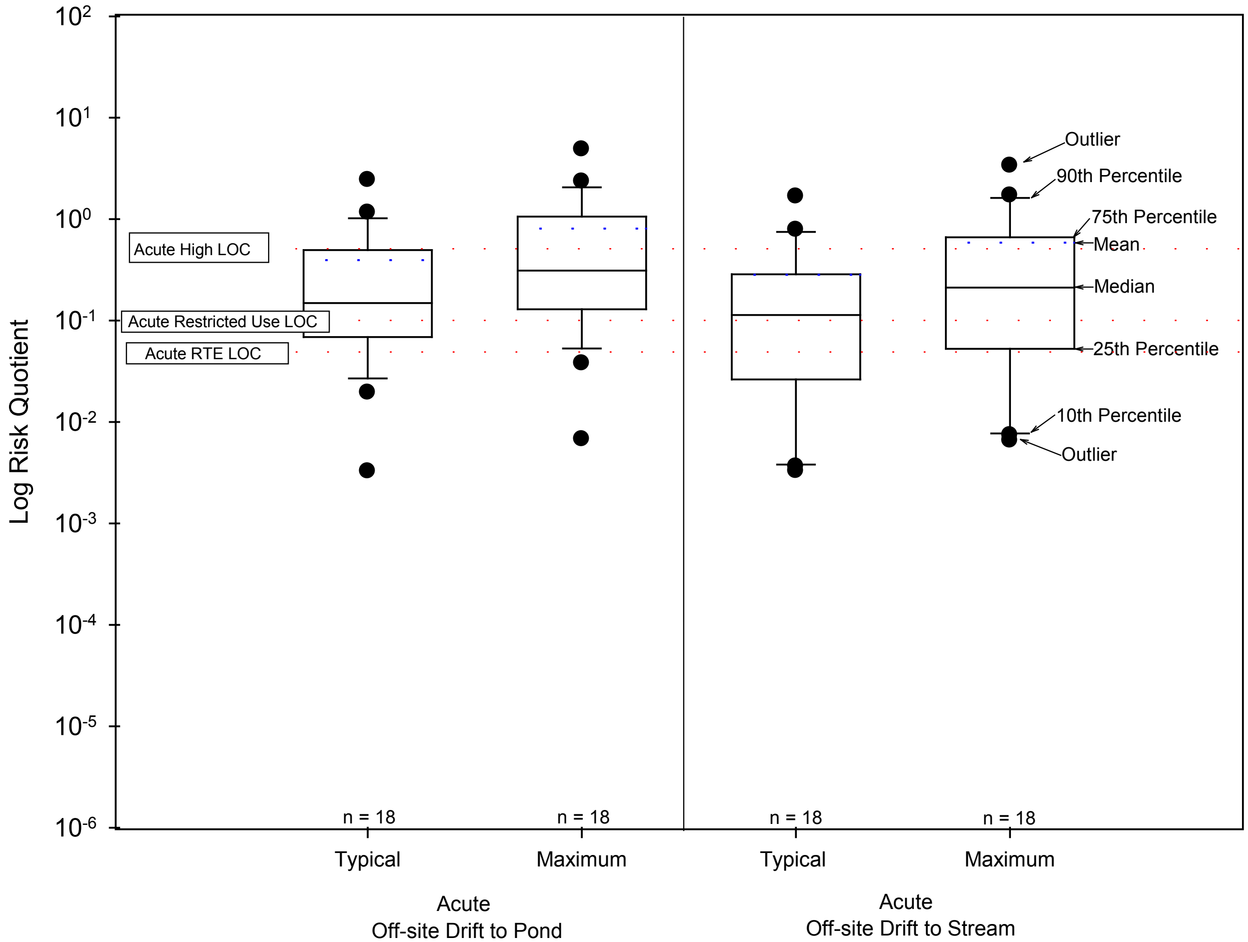


Figure E-63. Risk Quotients for Aquatic Invertebrates Exposed to 2,4-D Acids and Salts in Off-Site Drift Scenarios at Application Rates for Terrestrial Woody Vegetation

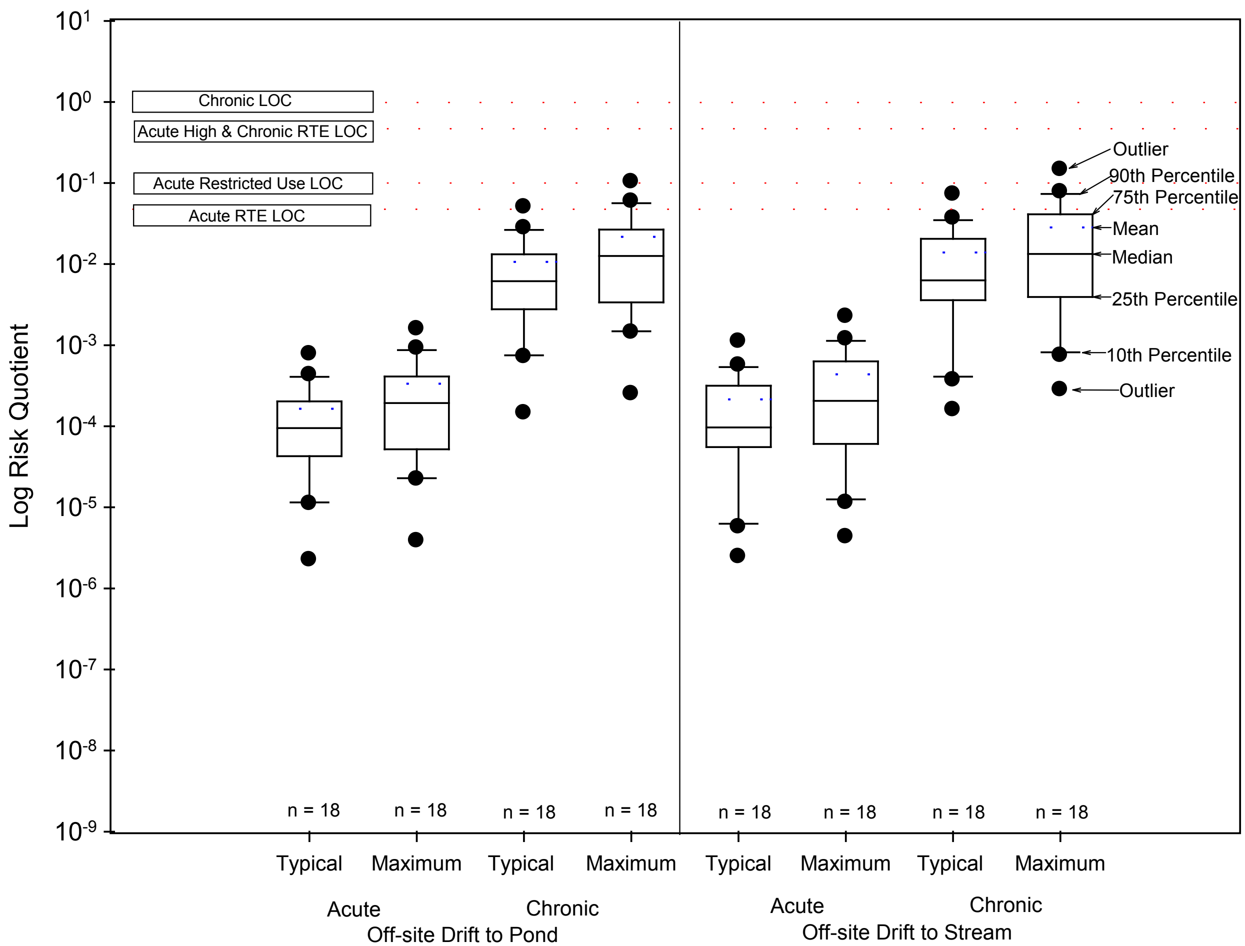


Figure E-64. Risk Quotients for Aquatic Invertebrates Exposed to 2,4-D Esters in Off-Site Drift Scenarios at Application Rates for Terrestrial Woody Vegetation

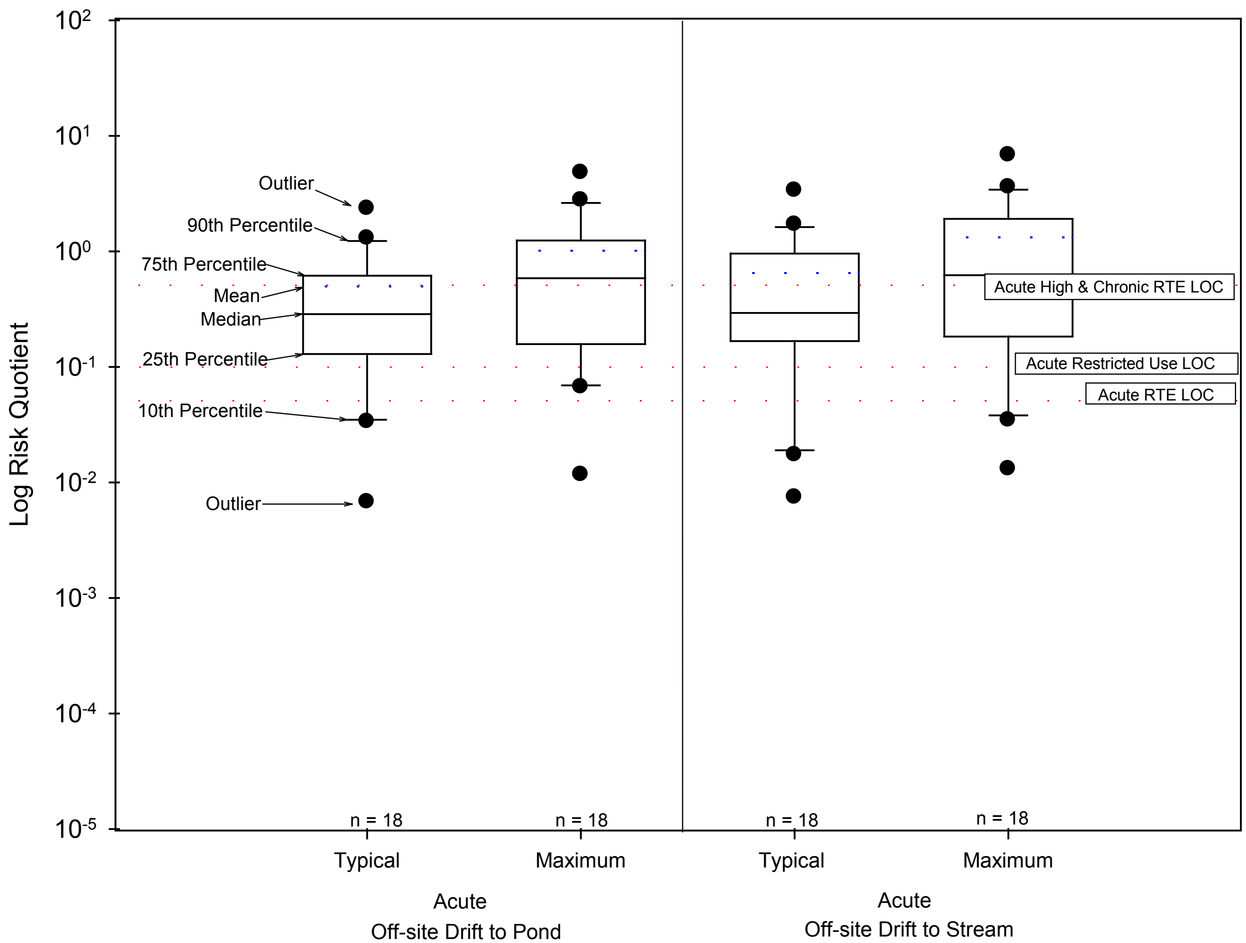


Figure E-65. Risk Quotients for Aquatic Invertebrates Exposed to 2,4-D Acids and Salts in Off-Site Drift Scenarios at Application Rates for Aquatic Floating and Emerged Vegetation

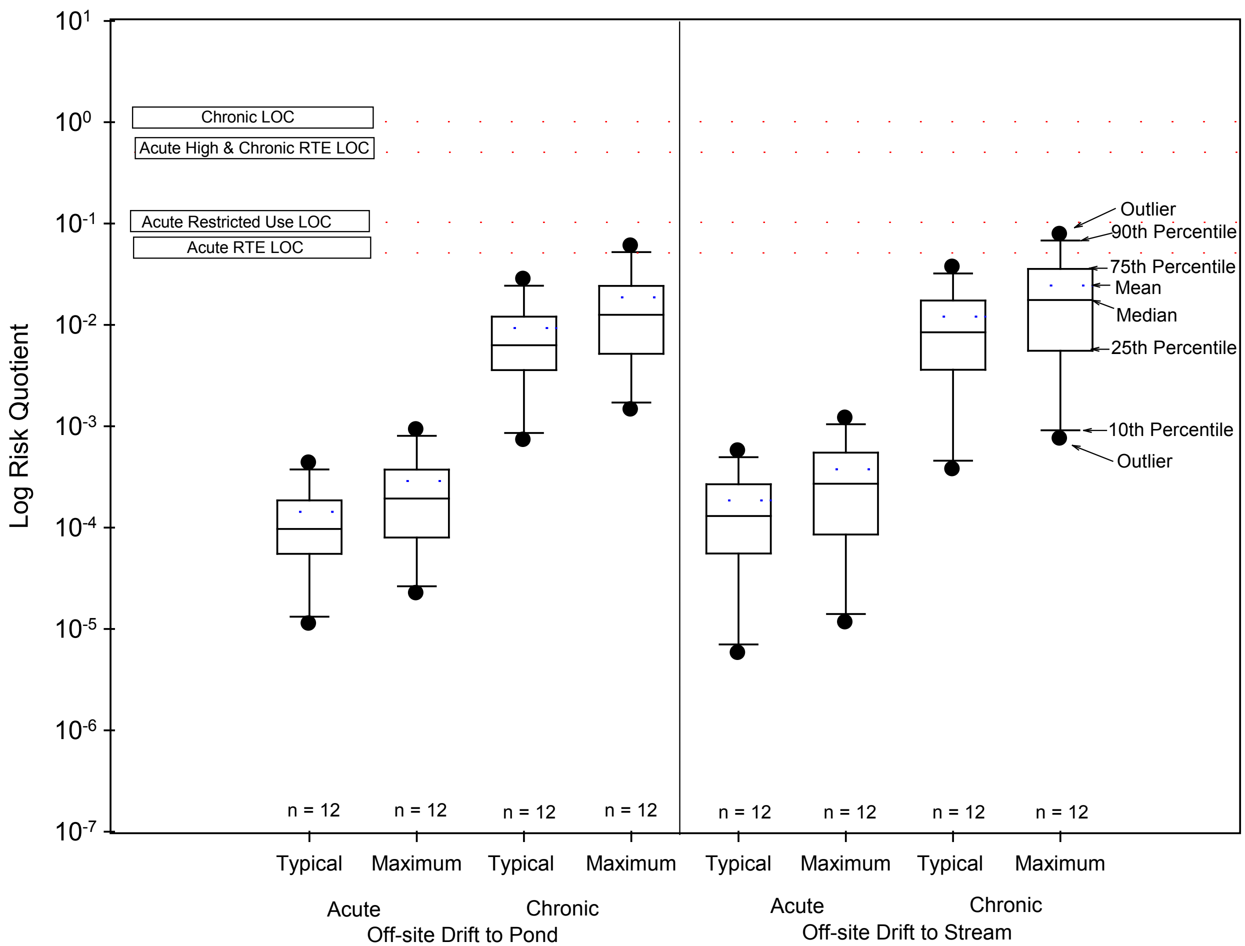


Figure E-66. Risk Quotients for Aquatic Invertebrates Exposed to 2,4-D Esters in Off-Site Drift Scenarios at Application Rates for Aquatic Floating and Emerged Vegetation

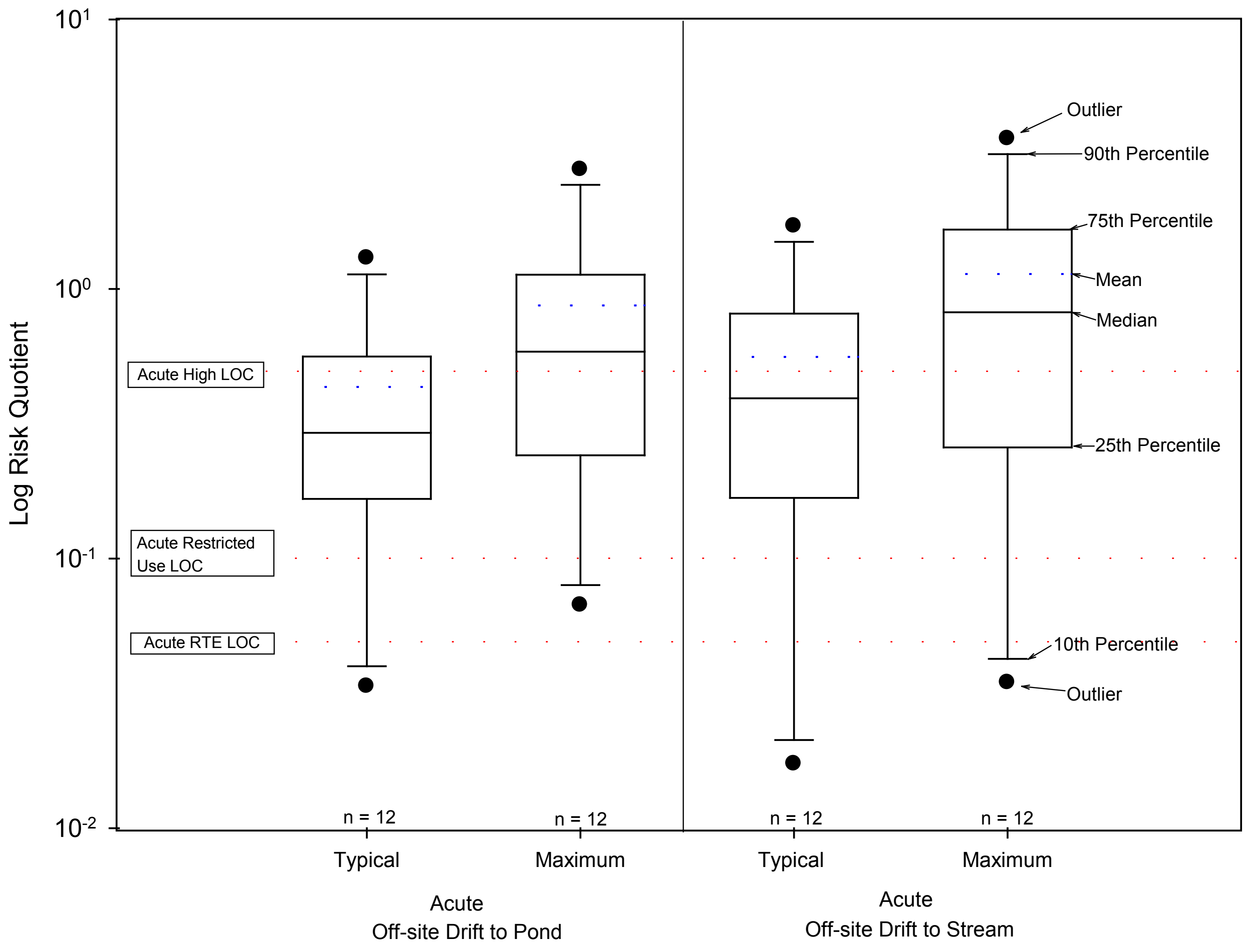


Figure E-67. Risk Quotients for Aquatic Invertebrates Exposed to 2,4-D Acids and Salts in Off-Site Drift Scenarios at Application Rates for Aquatic Submerged Vegetation

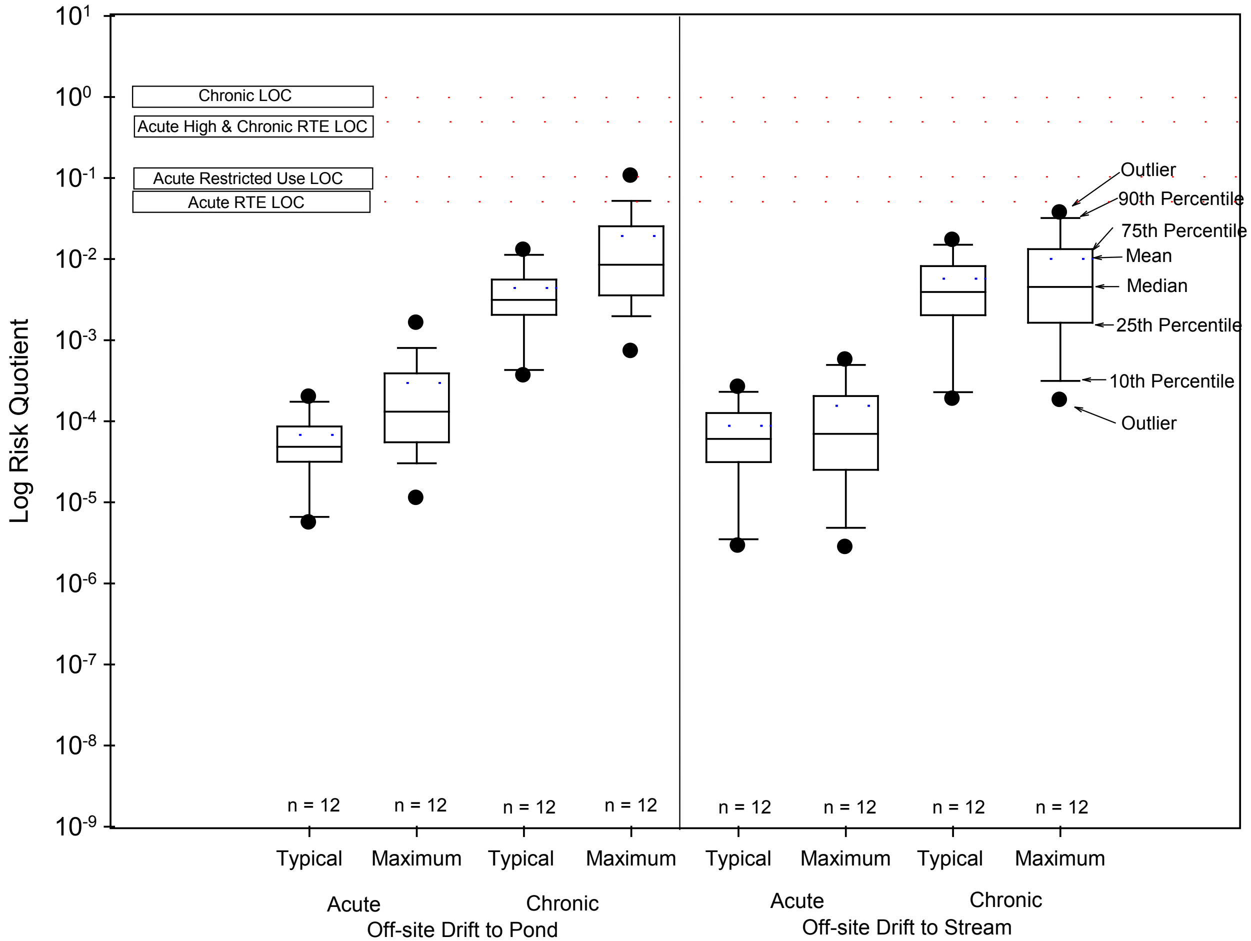


Figure E-68. Risk Quotients for Aquatic Invertebrates Exposed to 2,4-D Esters in Off-Site Drift Scenarios at Application Rates for Aquatic Submerged Vegetation

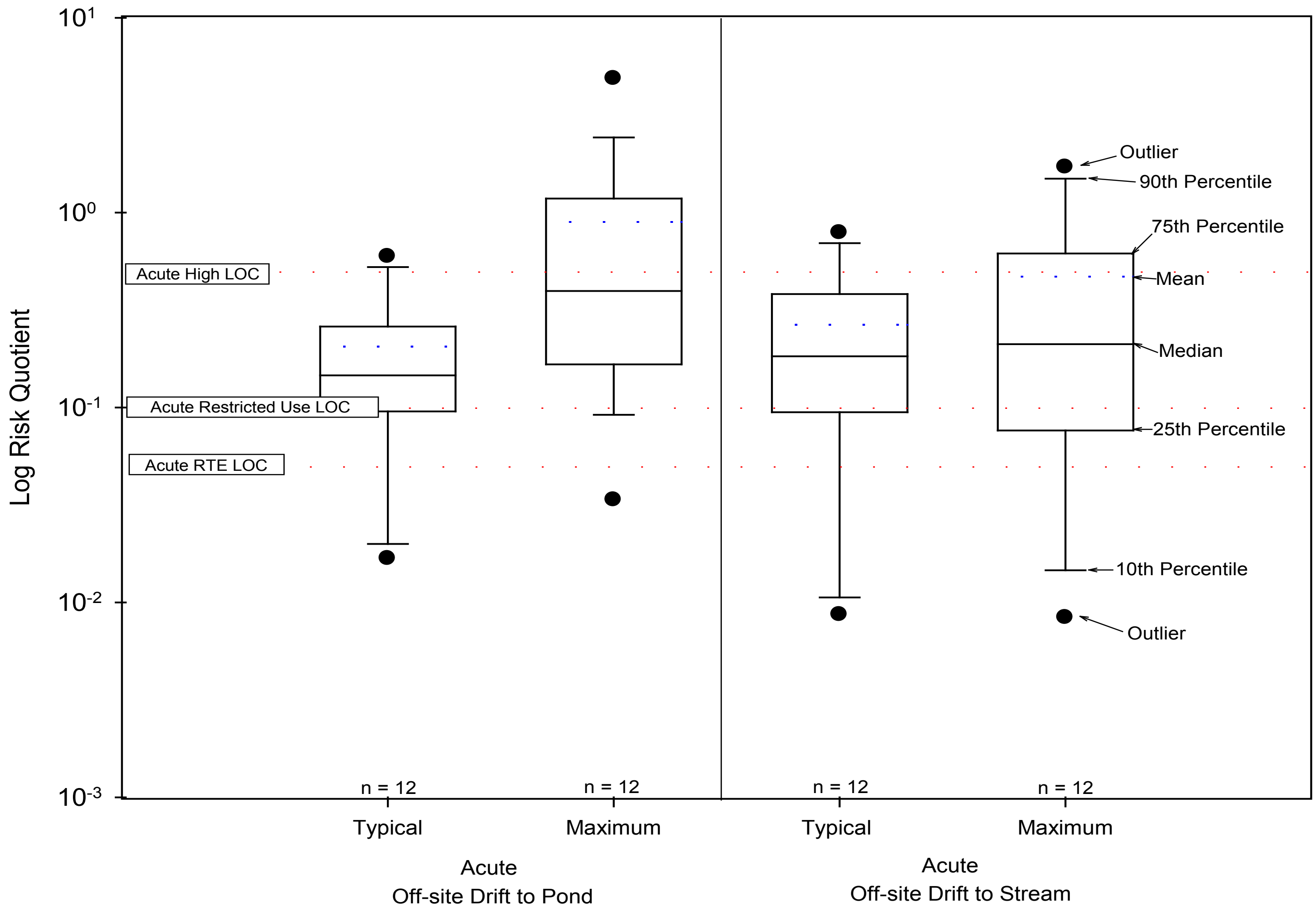


Figure E-69. Risk Quotients for Piscivorous Birds Exposed to 2,4-D Acids and Salts in Off-Site Drift Scenarios at Application Rates for Terrestrial Annual or Perennial Vegetation

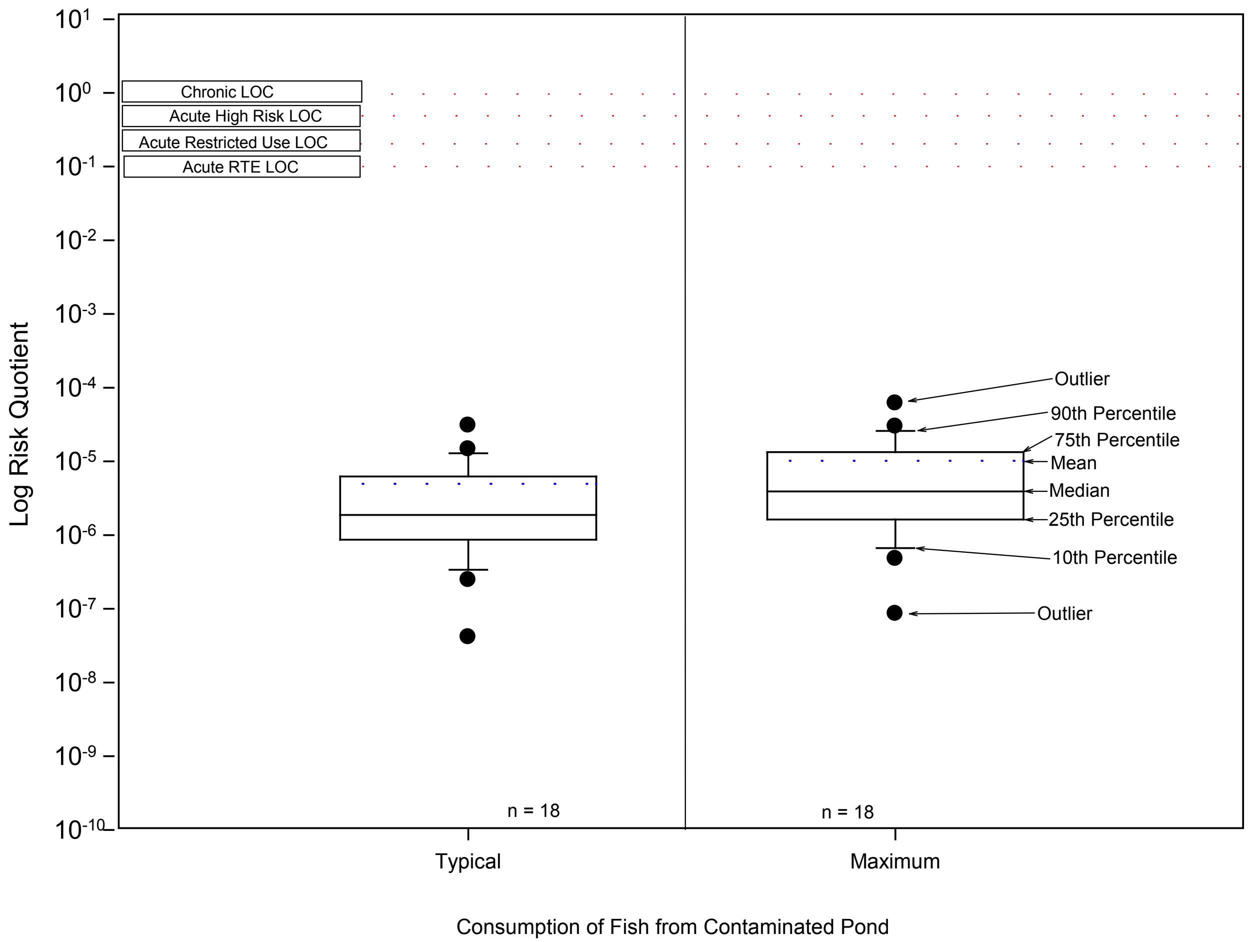


Figure E-70. Risk Quotients for Piscivorous Birds Exposed to 2,4-D Acids and Salts in Off-Site Drift Scenarios at Application Rates for Terrestrial Woody Vegetation

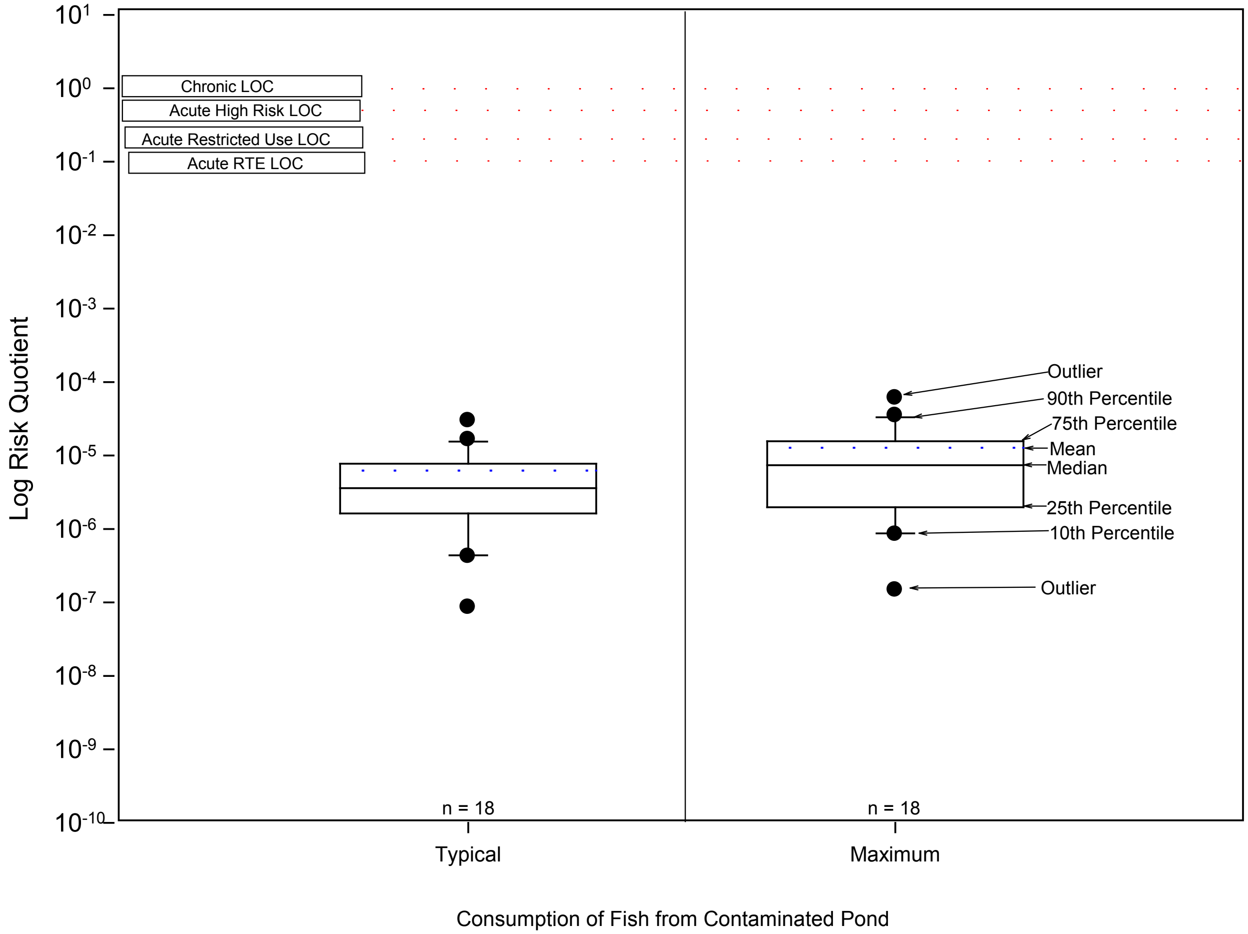


Figure E-71. Risk Quotients for Piscivorous Birds Exposed to 2,4-D Acids and Salts in Off-Site Drift Scenarios at Application Rates for Aquatic Floating and Emerged Vegetation

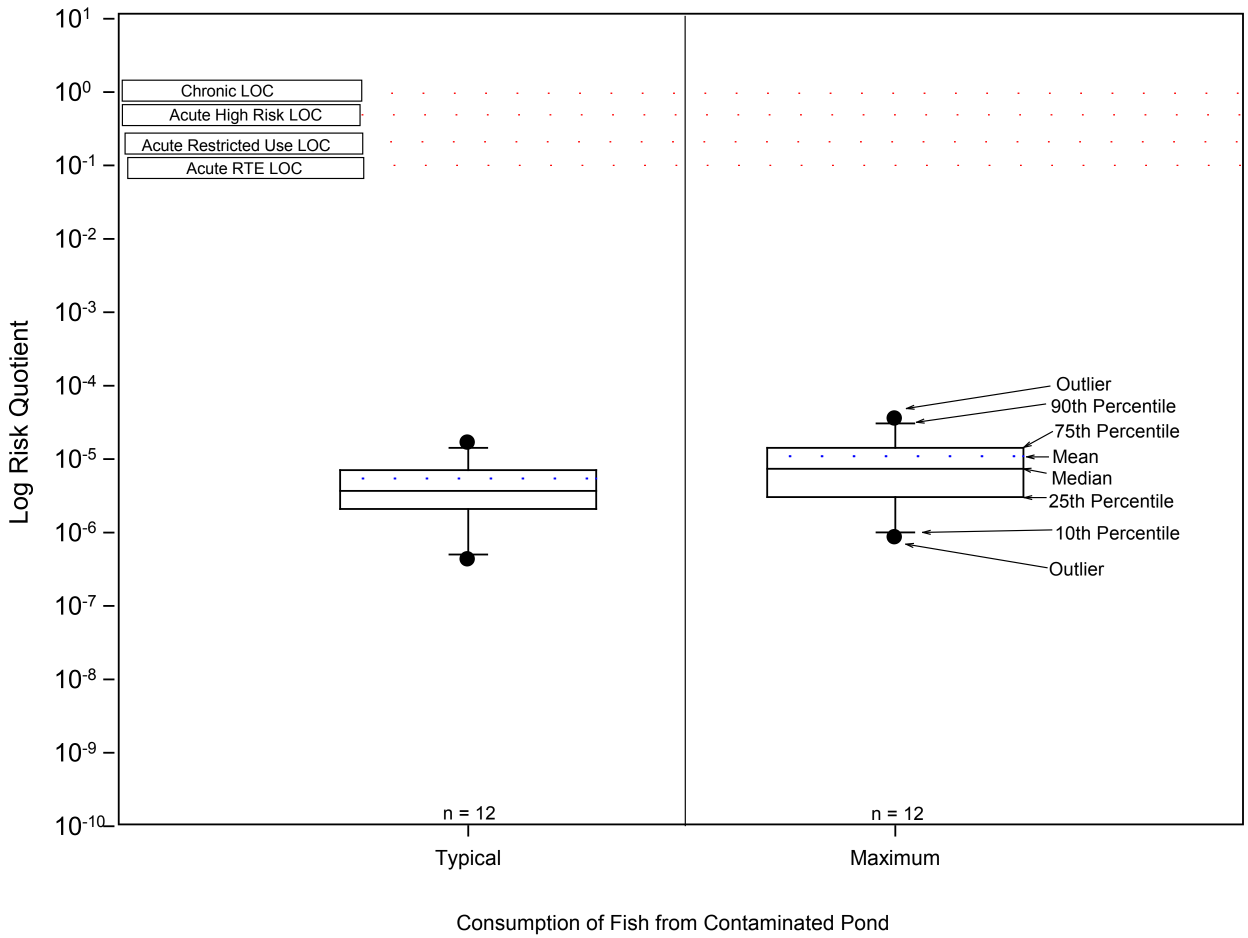


Figure E-72. Risk Quotients for Piscivorous Birds Exposed to 2,4-D Acids and Salts in Off-Site Drift Scenarios at Application Rates for Aquatic Submerged Vegetation

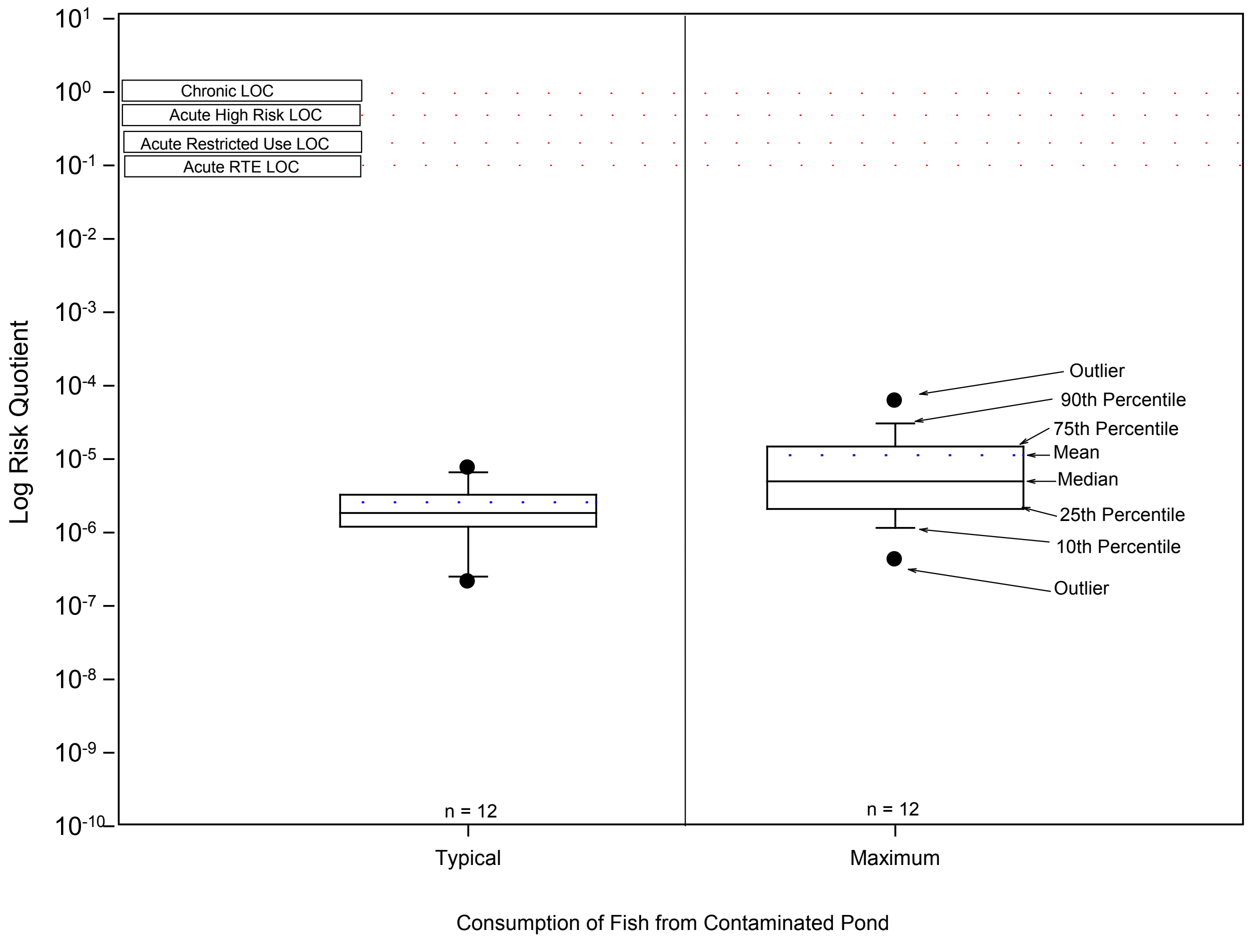


Figure E-73. Risk Quotients for Non-Target Terrestrial Plants Exposed to 2,4-D Acids and Salts in Surface Runoff Scenarios at Application Rates for Terrestrial Annual or Perennial Vegetation

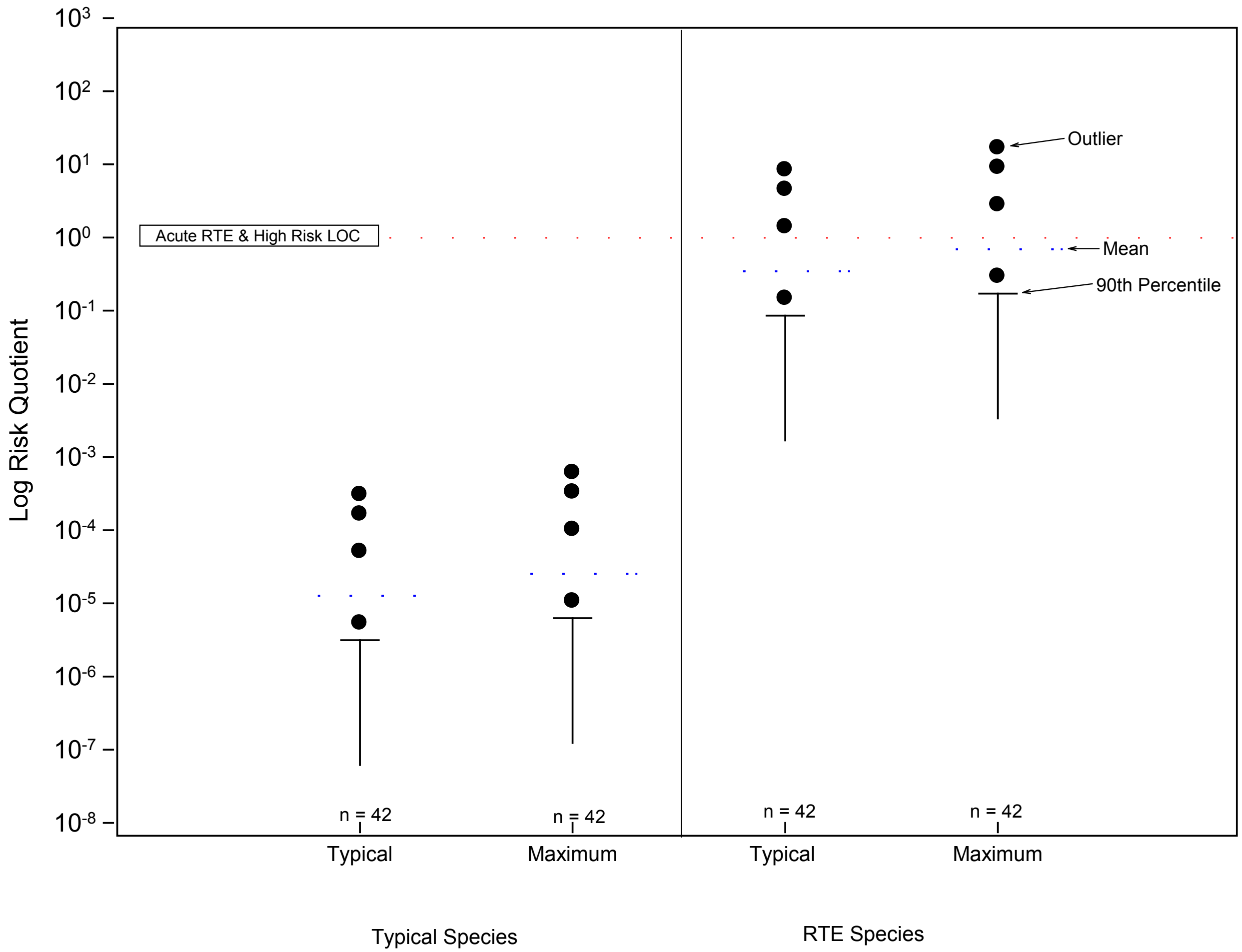


Figure E-74. Risk Quotients for Non-Target Terrestrial Plants Exposed to 2,4-D Esters in Surface Runoff Scenarios at Application Rates for Terrestrial Annual or Perennial Vegetation

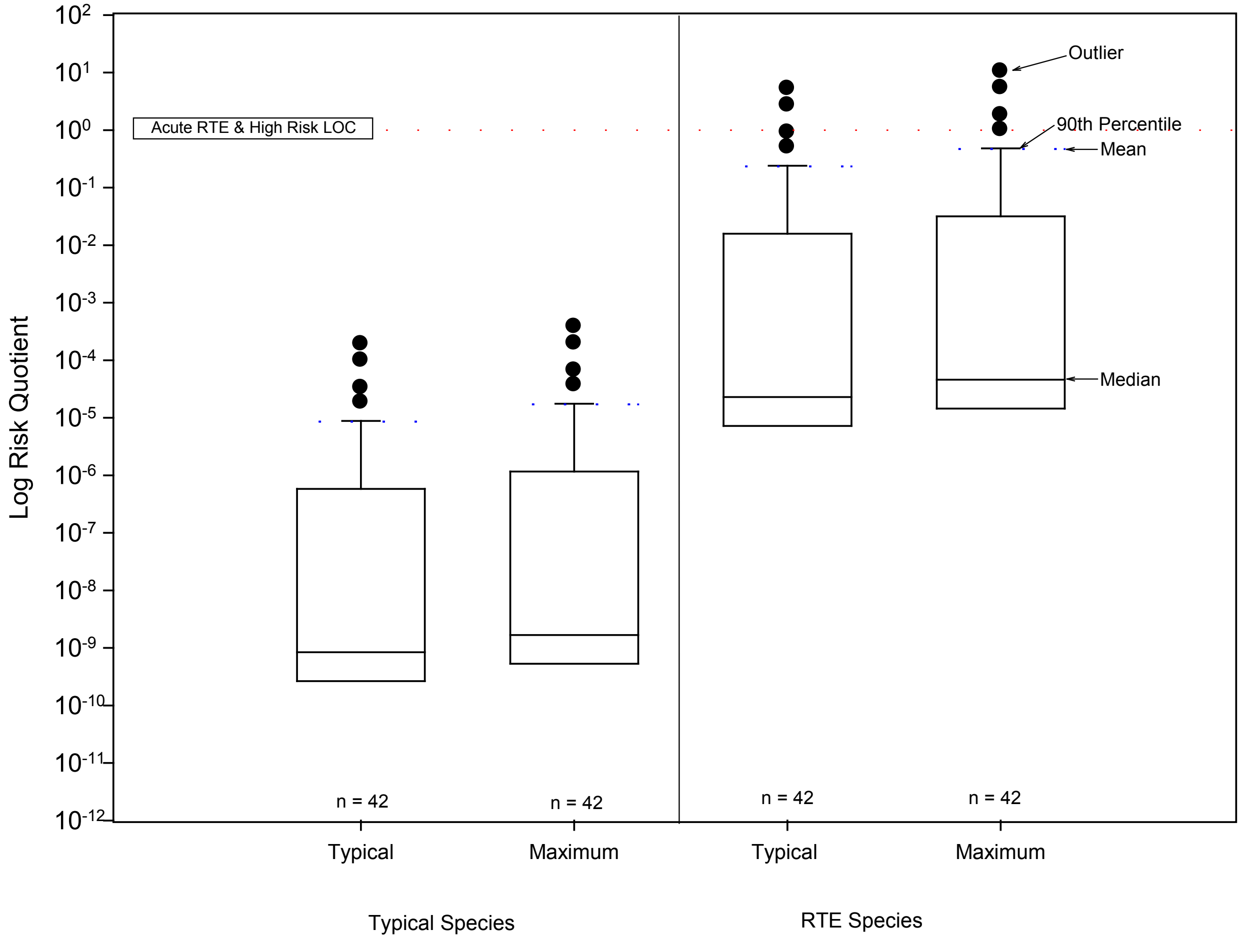


Figure E-75. Risk Quotients for Non-Target Terrestrial Plants Exposed to 2,4-D Acids and Salts in Surface Runoff Scenarios at Application Rates for Terrestrial Woody Vegetation

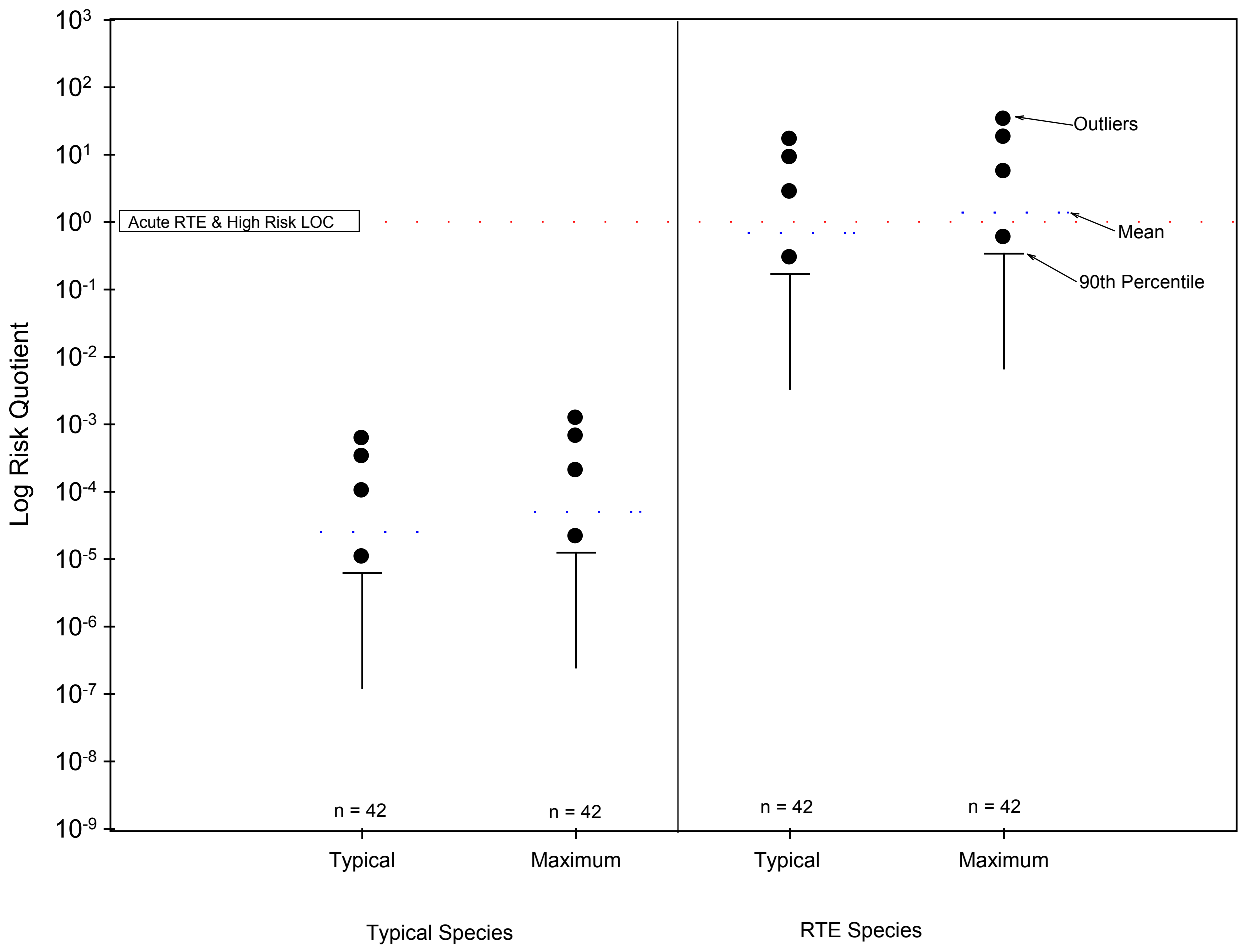


Figure E-764. Risk Quotients for Non-Target Terrestrial Plants Exposed to 2,4-D Esters in Surface Runoff Scenarios at Application Rates for Terrestrial Woody Vegetation

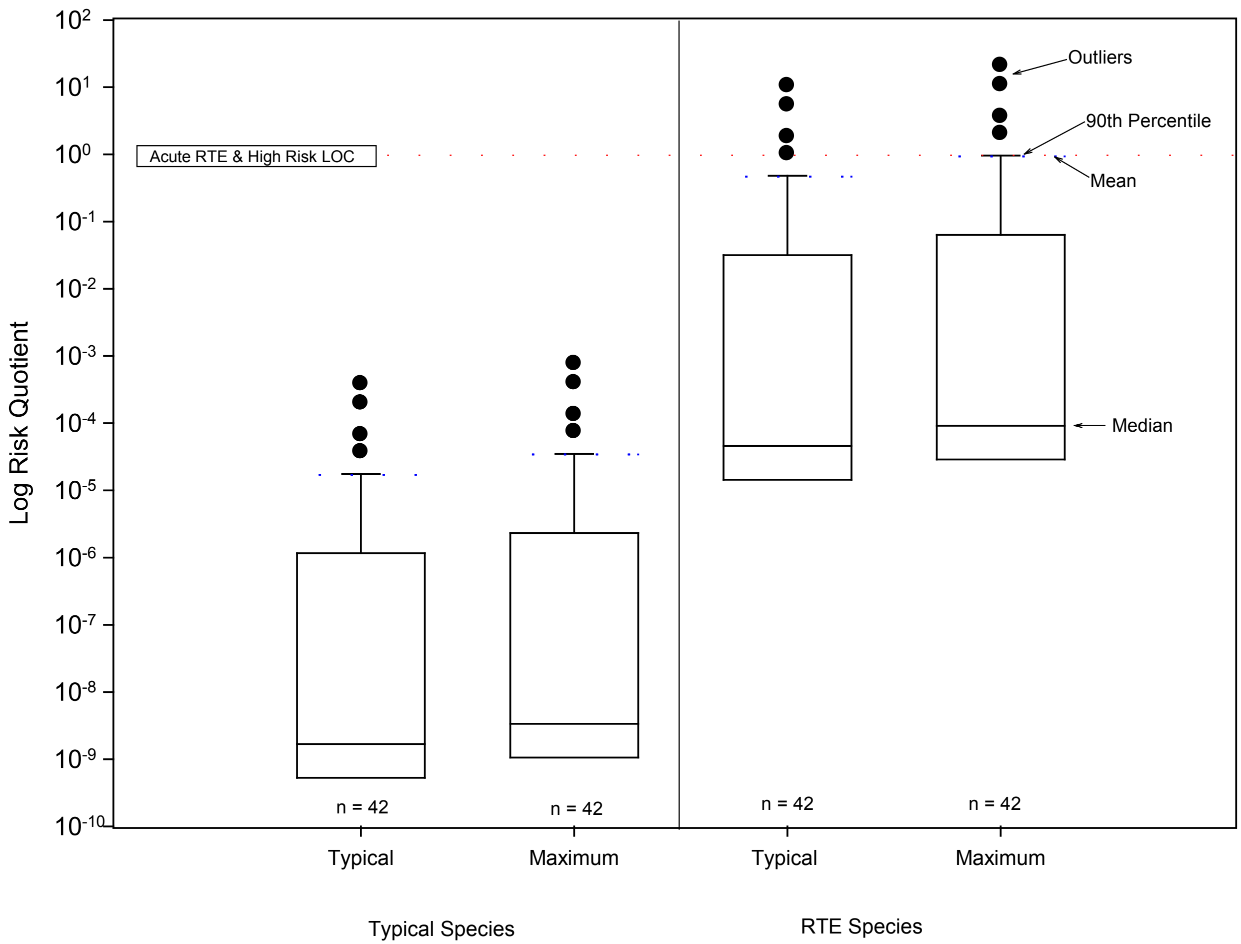


Figure E-77. Risk Quotients for Non-Target Aquatic Plants Exposed to 2,4-D Acids and Salts in Surface Runoff Scenarios at Application Rates for Terrestrial Annual or Perennial Vegetation

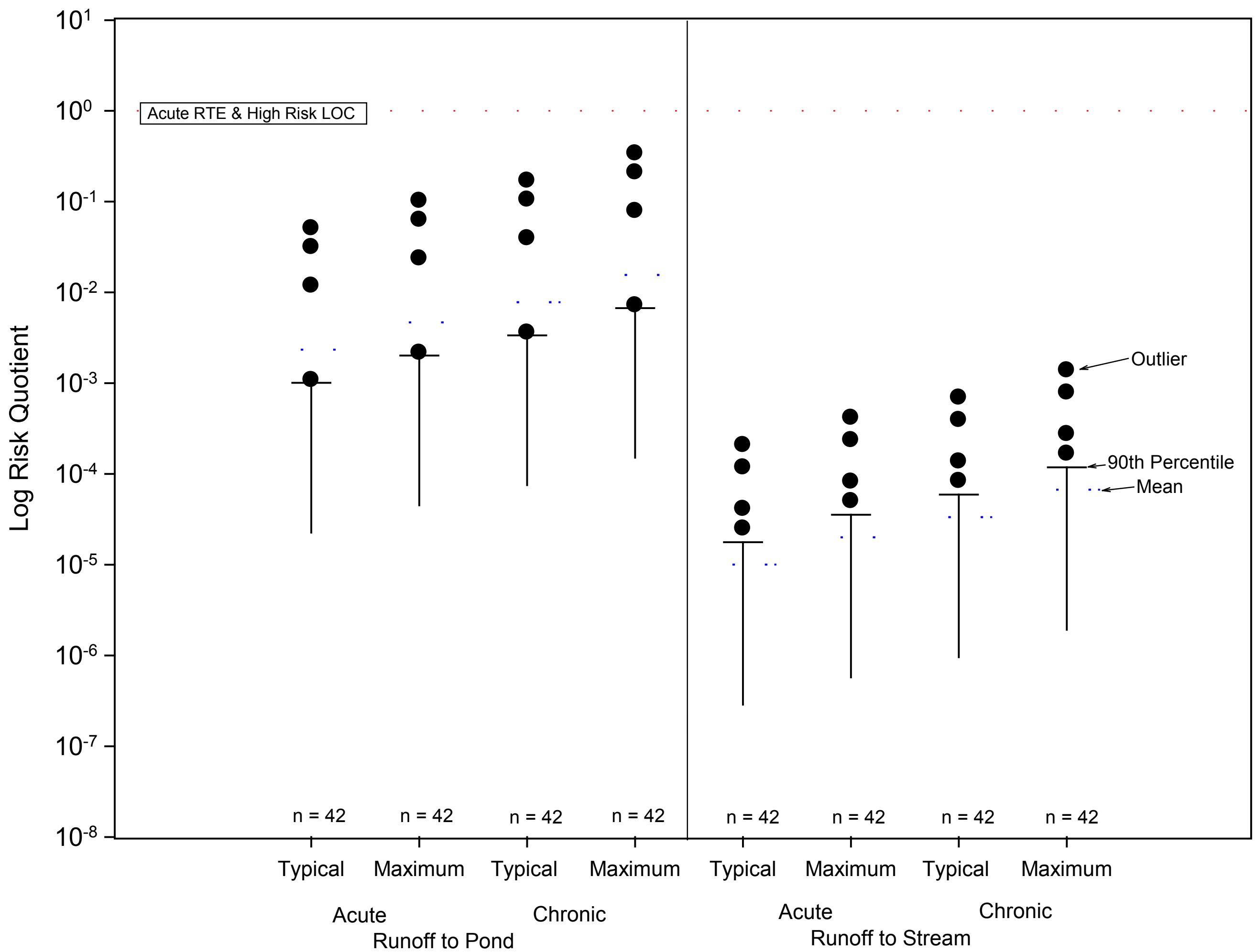


Figure E-78. Risk Quotients for Non-Target Aquatic Plants Exposed to 2,4-D Esters in Surface Runoff Scenarios at Application Rates for Terrestrial Annual or Perennial Vegetation

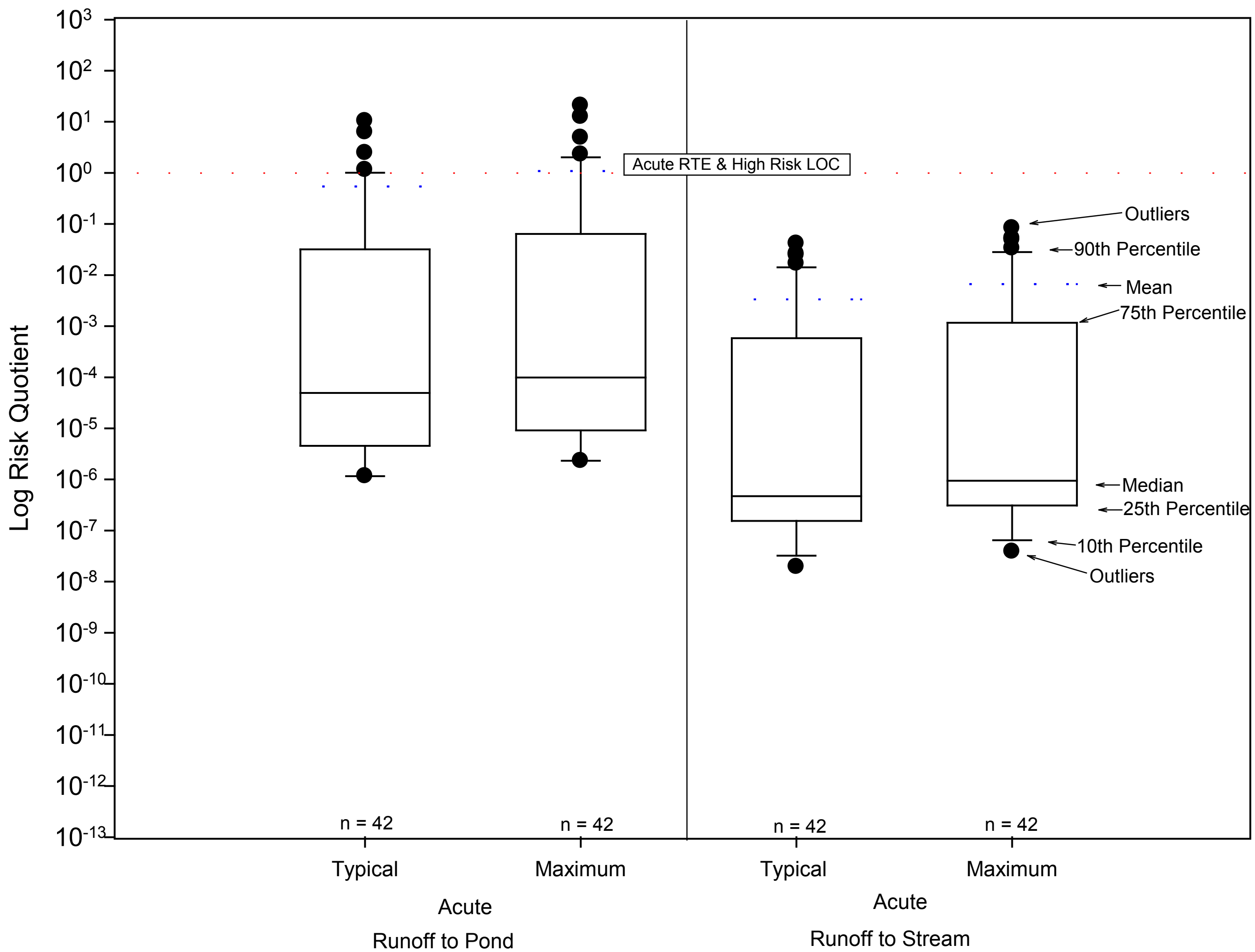


Figure E-79. Risk Quotients for Non-Target Aquatic Plants Exposed to 2,4-D Acids and Salts in Surface Runoff Scenarios at Application Rates for Terrestrial Woody Vegetation

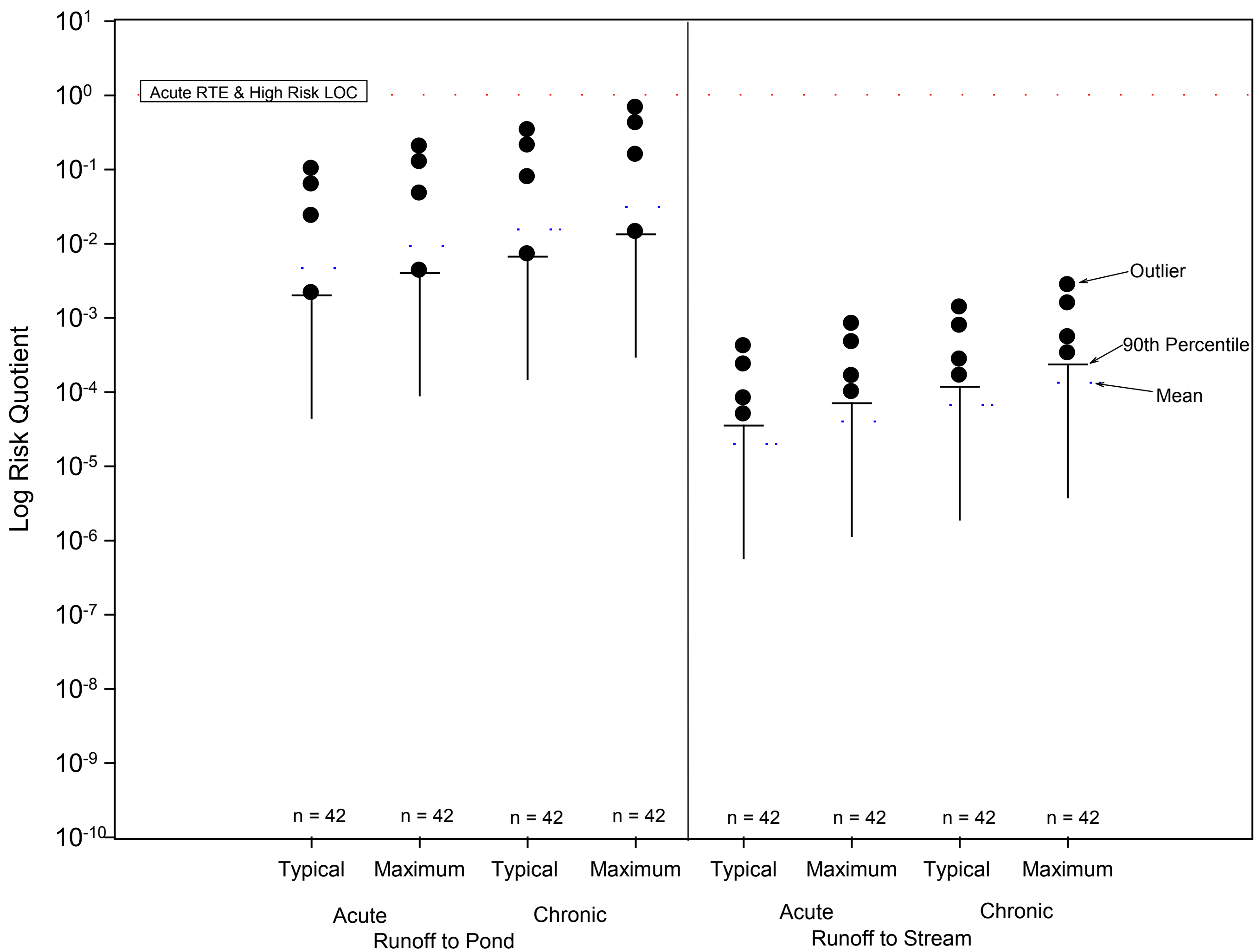


Figure E-80. Risk Quotients for Non-Target Aquatic Plants Exposed to 2,4-D Esters in Surface Runoff Scenarios at Application Rates for Terrestrial Woody Vegetation

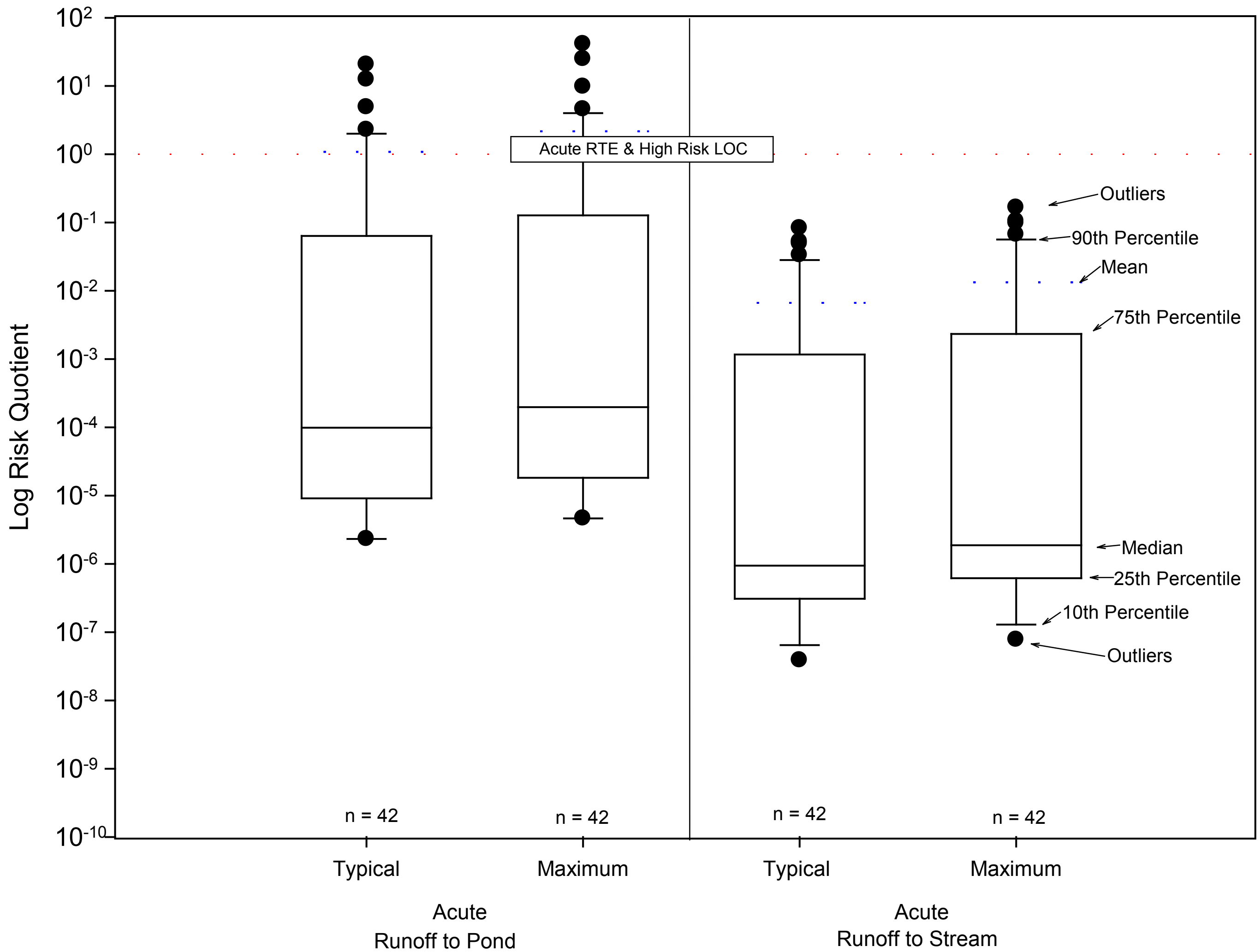


Figure E-81. Risk Quotients for Fish Exposed to 2,4-D Acids and Salts in Surface Runoff Scenarios at Application Rates for Terrestrial Annual or Perennial Vegetation

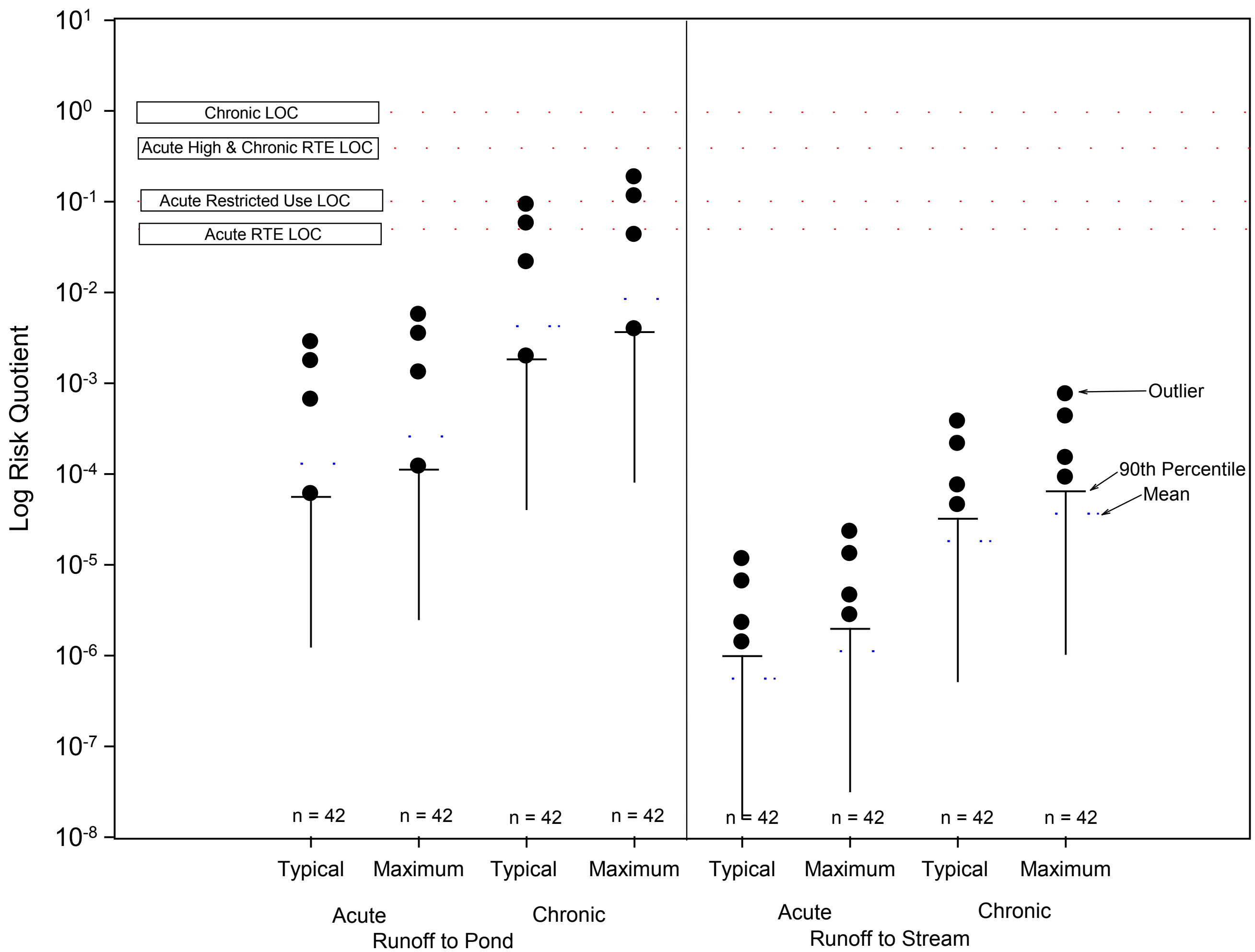


Figure E-82. Risk Quotients for Fish Exposed to 2,4-D Esters in Surface Runoff Scenarios at Application Rates for Terrestrial Annual or Perennial Vegetation

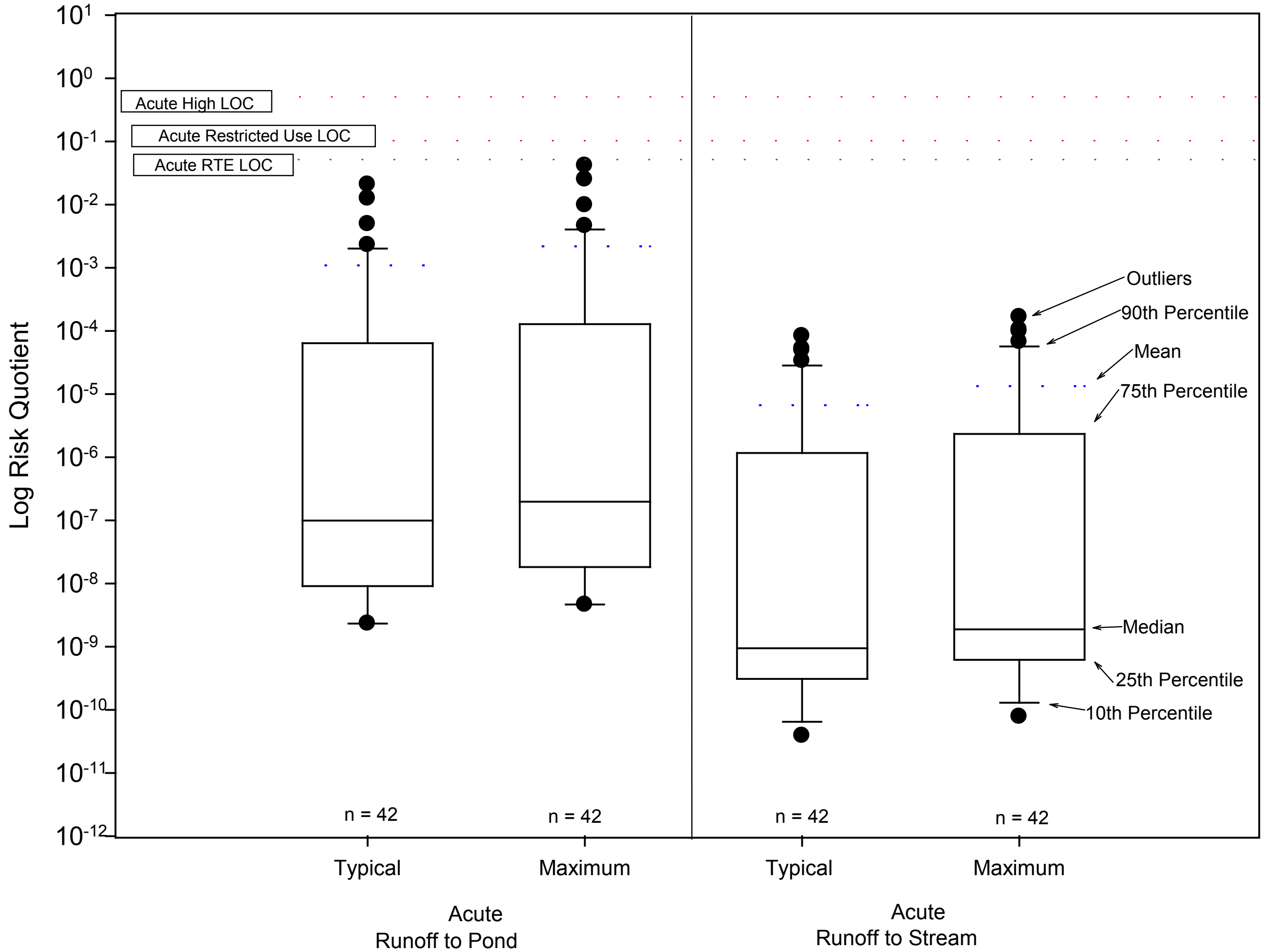


Figure E-83. Risk Quotients for Fish Exposed to 2,4-D Acids and Salts in Surface Runoff Scenarios at Application Rates for Terrestrial Woody Vegetation

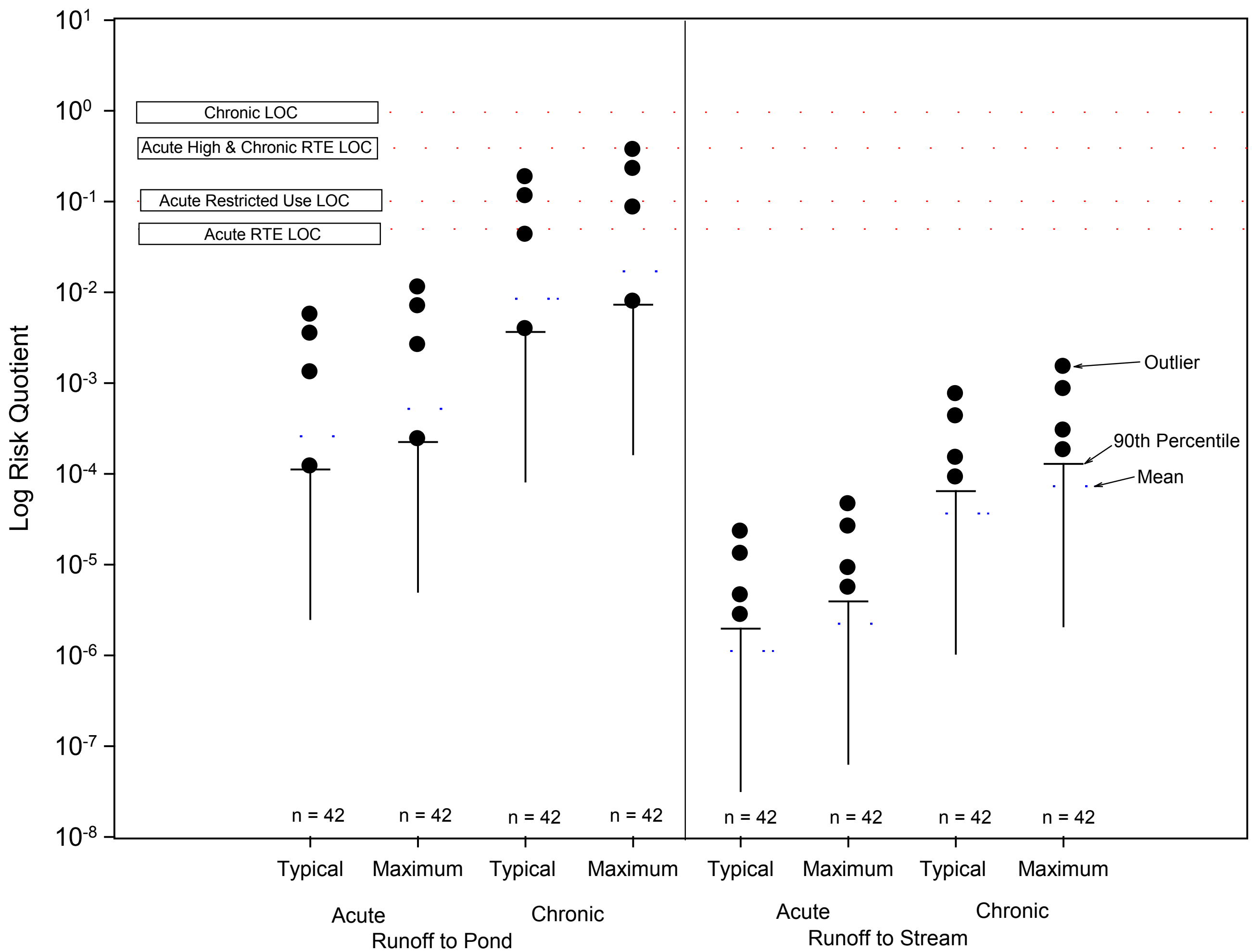


Figure E-84. Risk Quotients for Fish Exposed to 2,4-D Esters in Surface Runoff Scenarios at Application Rates for Terrestrial Woody Vegetation

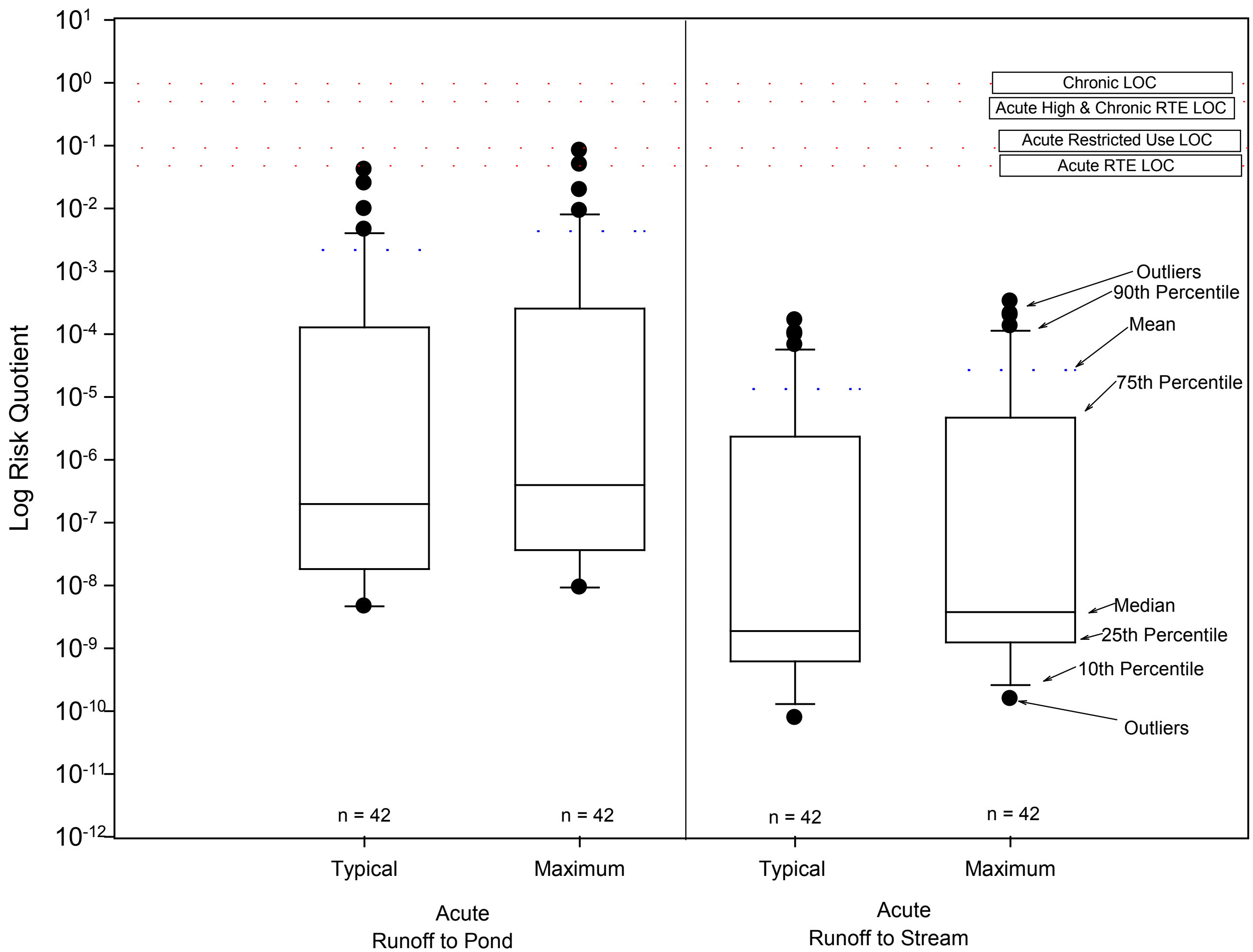


Figure E-85. Risk Quotients for Aquatic Invertebrates Exposed to 2,4-D Acids and Salts in Surface Runoff Scenarios at Application Rates for Terrestrial Annual or Perennial Vegetation

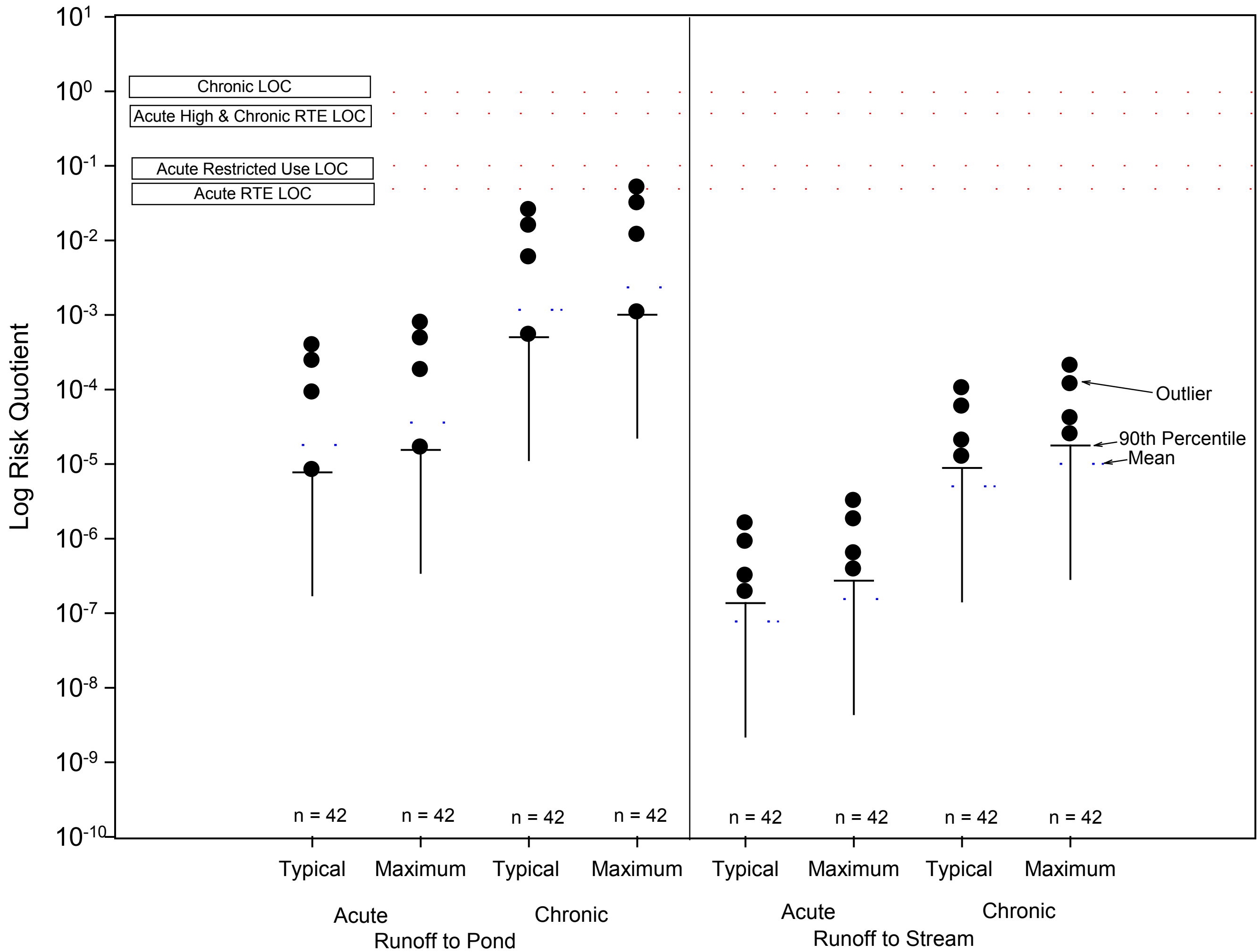


Figure E-86. Risk Quotients for Aquatic Invertebrates Exposed to 2,4-D Esters in Surface Runoff Scenarios at Application Rates for Terrestrial Annual or Perennial Vegetation

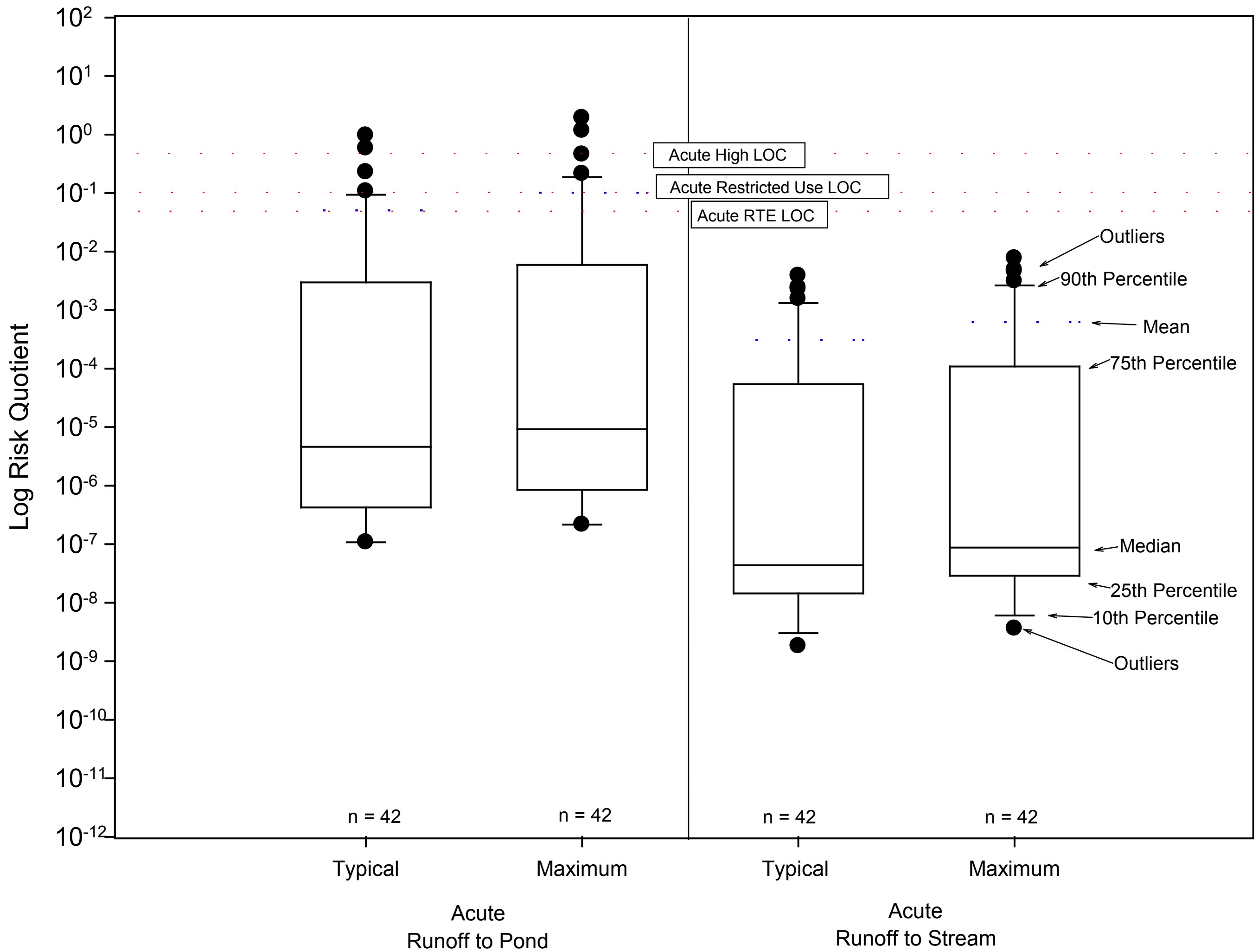


Figure E-87. Risk Quotients for Aquatic Invertebrates Exposed to 2,4-D Acids and Salts in Surface Runoff Scenarios at Application Rates for Terrestrial Woody Vegetation

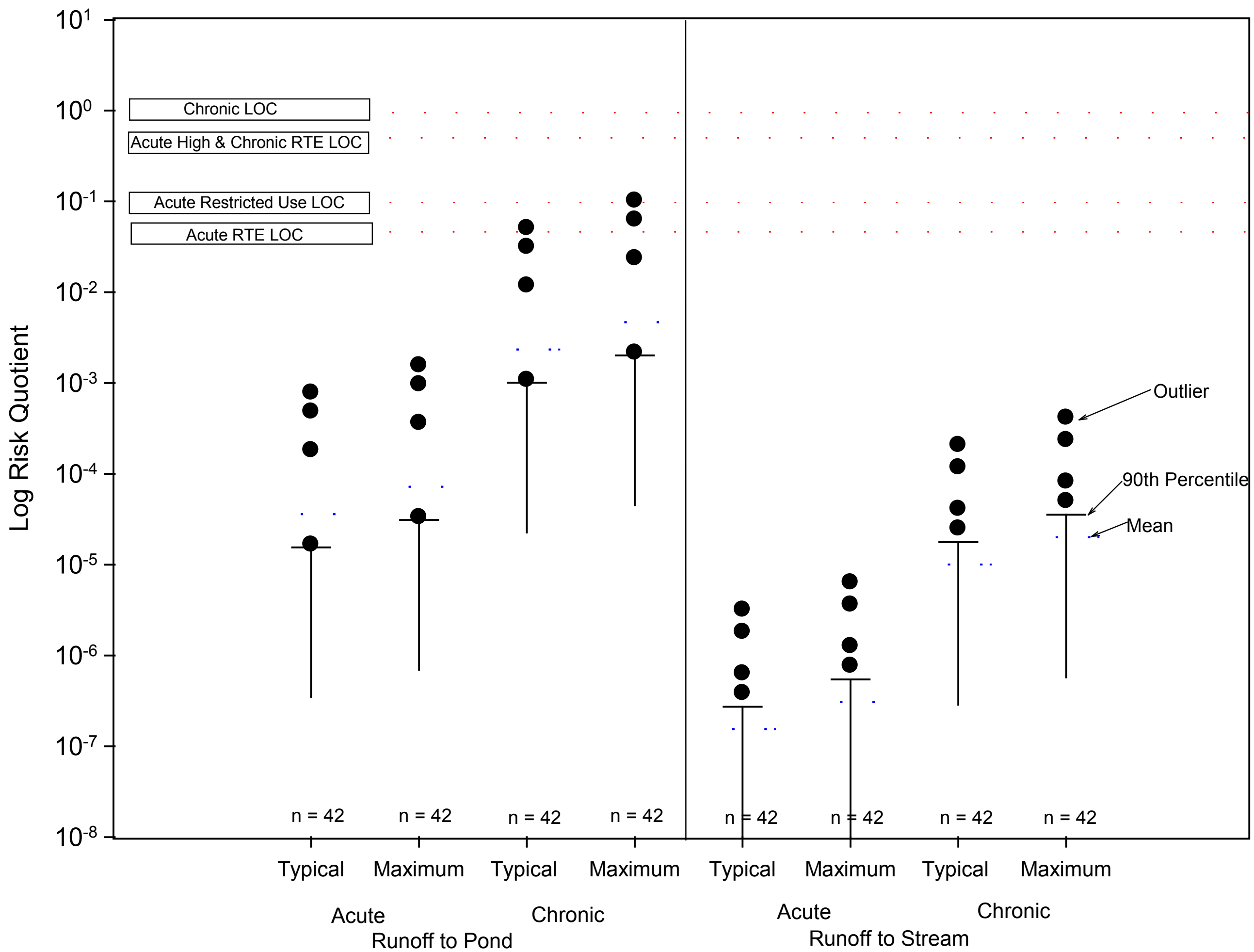


Figure E-88. Risk Quotients for Aquatic Invertebrates Exposed to 2,4-D Esters in Surface Runoff Scenarios at Application Rates for Terrestrial Woody Vegetation

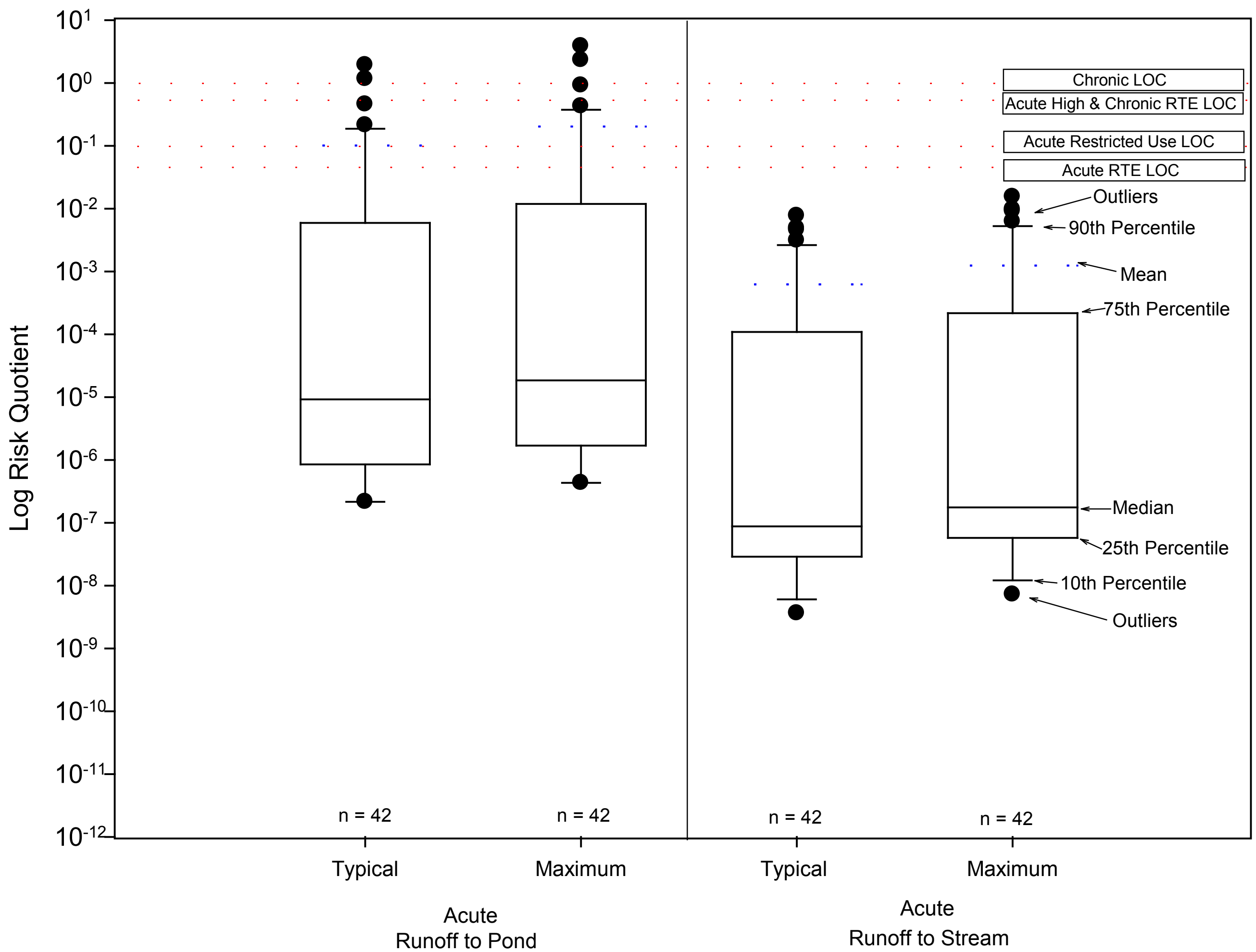


Figure E-89. Risk Quotients for Piscivorous Birds Exposed to 2,4-D Acids and Salts in Surface Runoff Scenarios at Application Rates for Terrestrial Annual or Perennial Vegetation

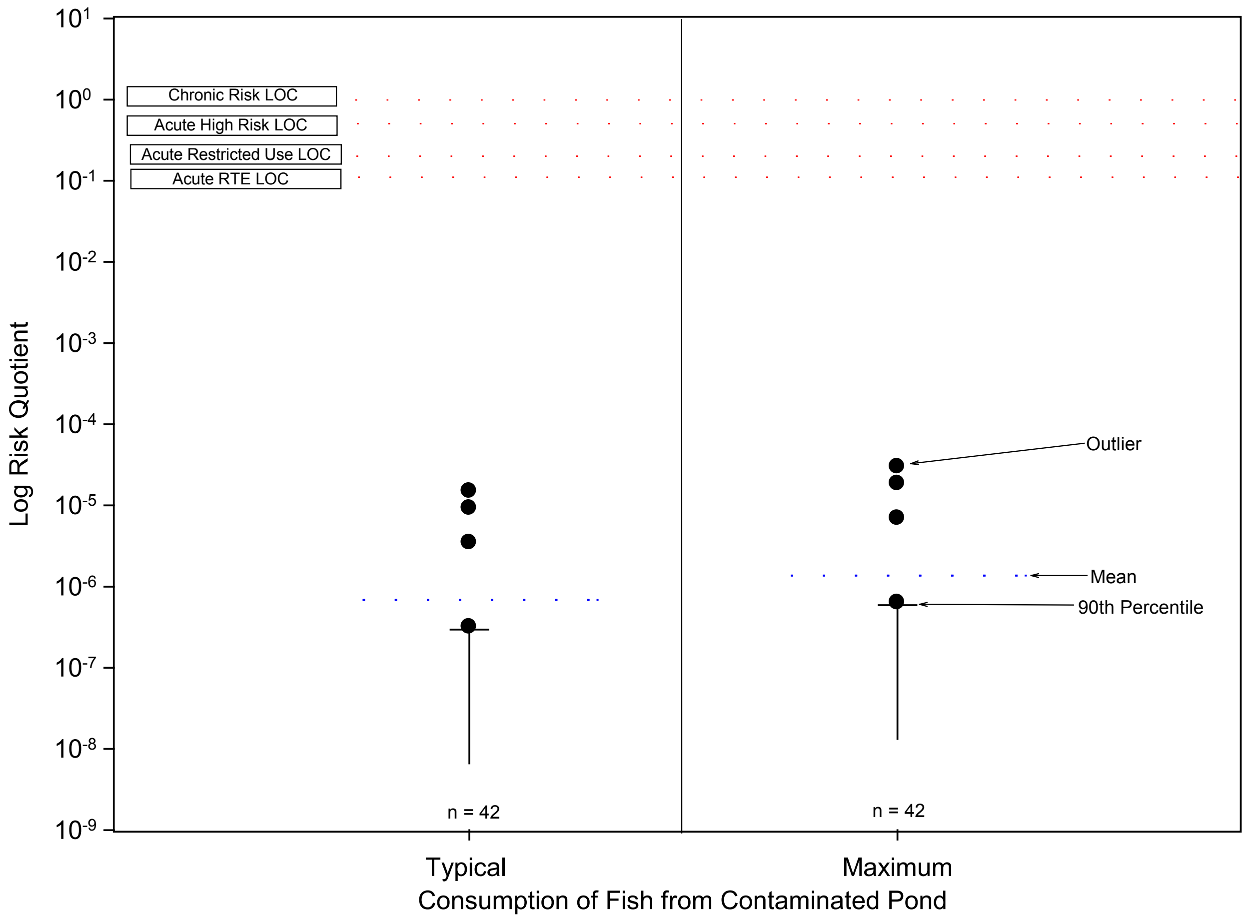


Figure E-90. Risk Quotients for Piscivorous Birds Exposed to 2,4-D Acids and Salts in Surface Runoff Scenarios at Application Rates for Terrestrial Woody Vegetation

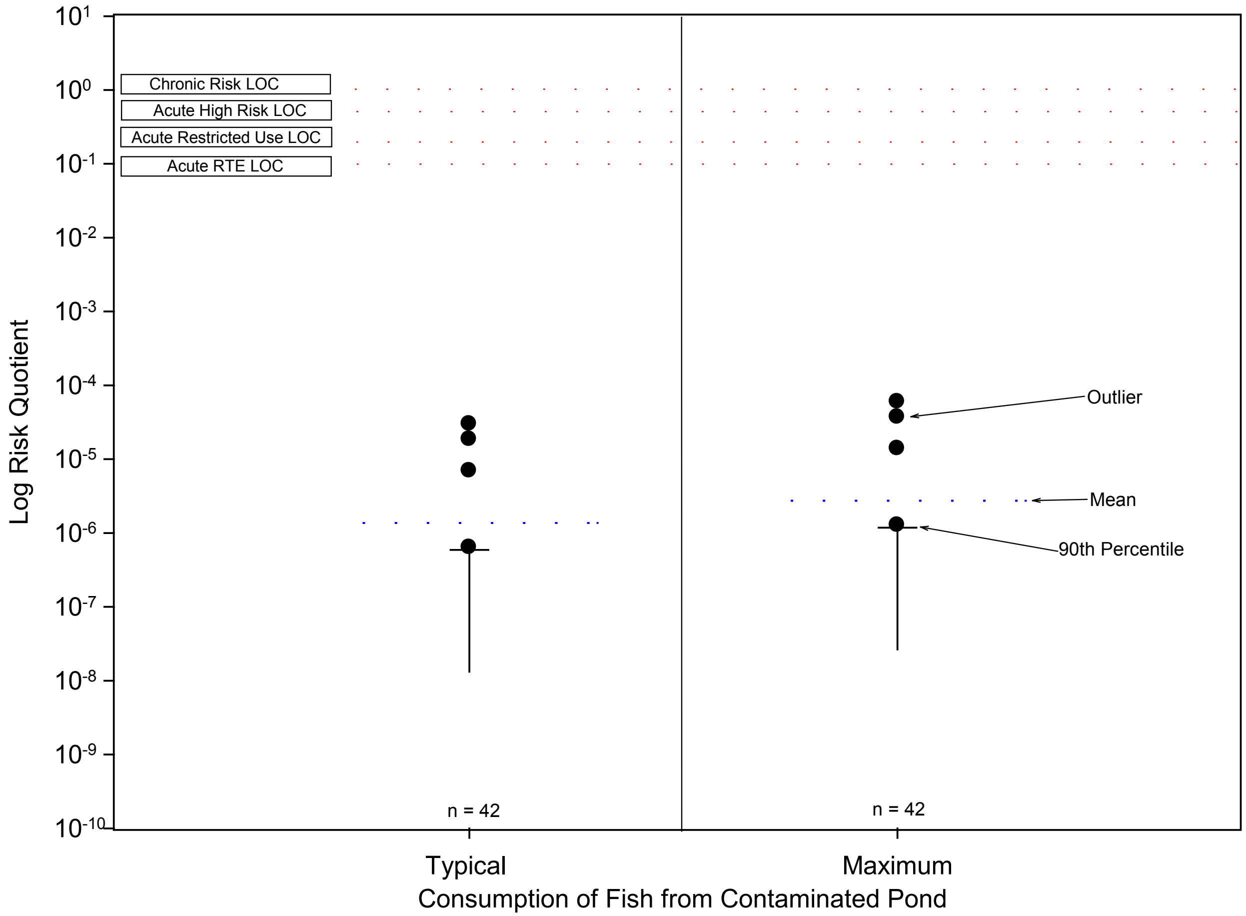


Figure E-91. Risk Quotients for Non-Target Terrestrial Plants Exposed to 2,4-D Acids and Salts in Wind Erosion and Transport Off-Site Scenarios at Application Rates for Terrestrial Annual or Perennial Vegetation

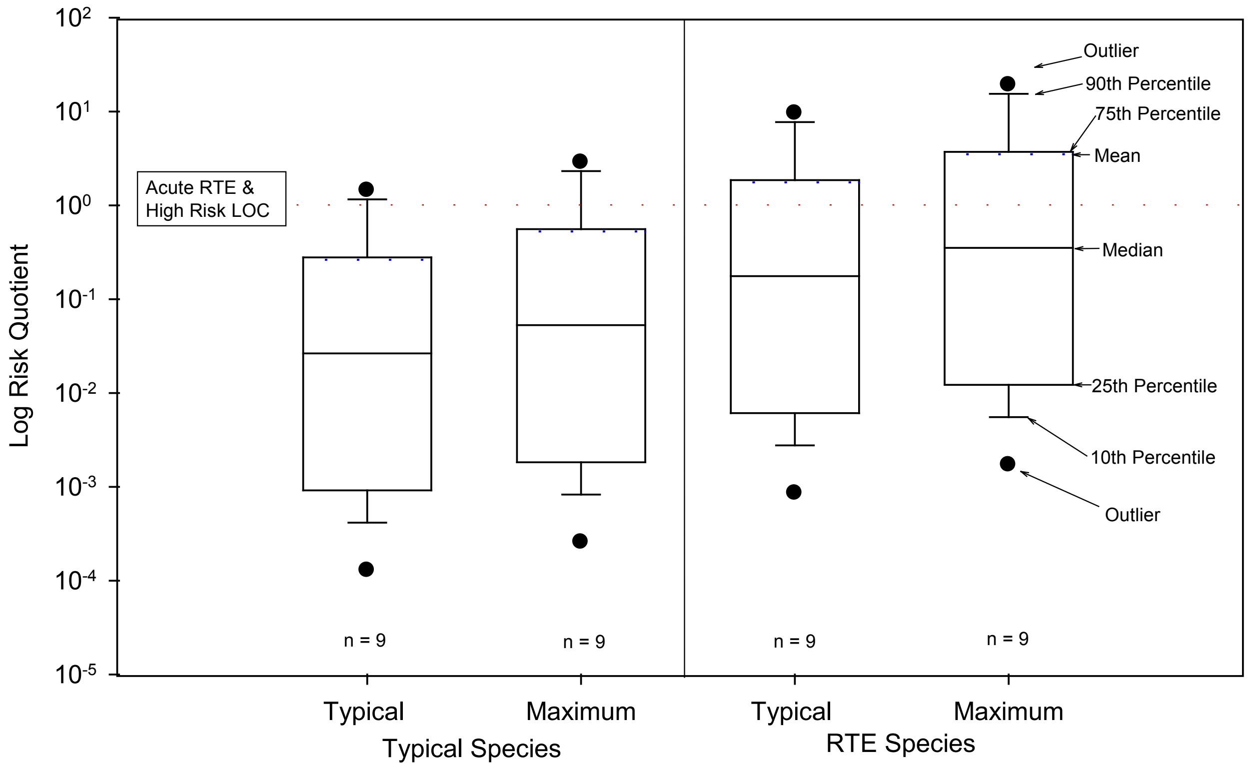


Figure E-92. Risk Quotients for Non-Target Terrestrial Plants Exposed to 2,4-D Esters in Wind Erosion and Transport Off-Site Scenarios at Application Rates for Terrestrial Annual or Perennial Vegetation

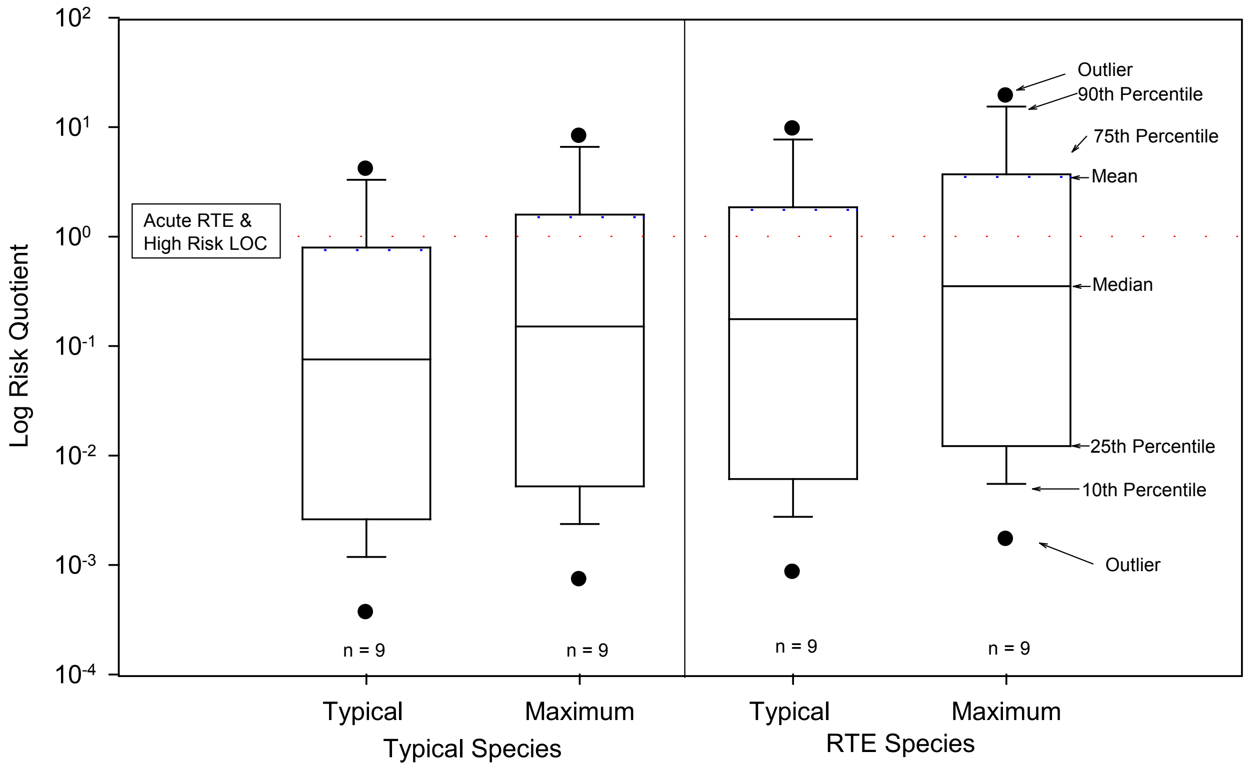


Figure E-93. Risk Quotients for Non-Target Terrestrial Plants Exposed to 2,4-D Acids and Salts in Wind Erosion and Transport Off-Site Scenarios at Application Rates for Terrestrial Woody Vegetation

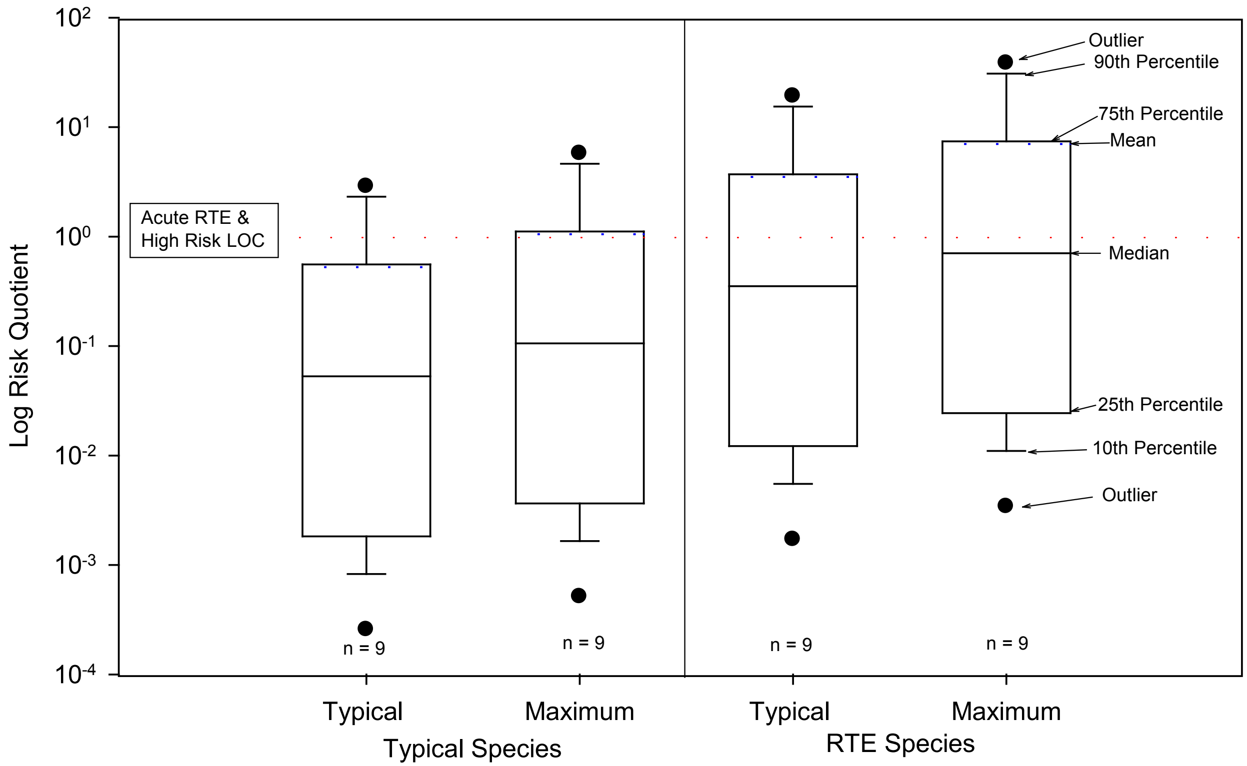
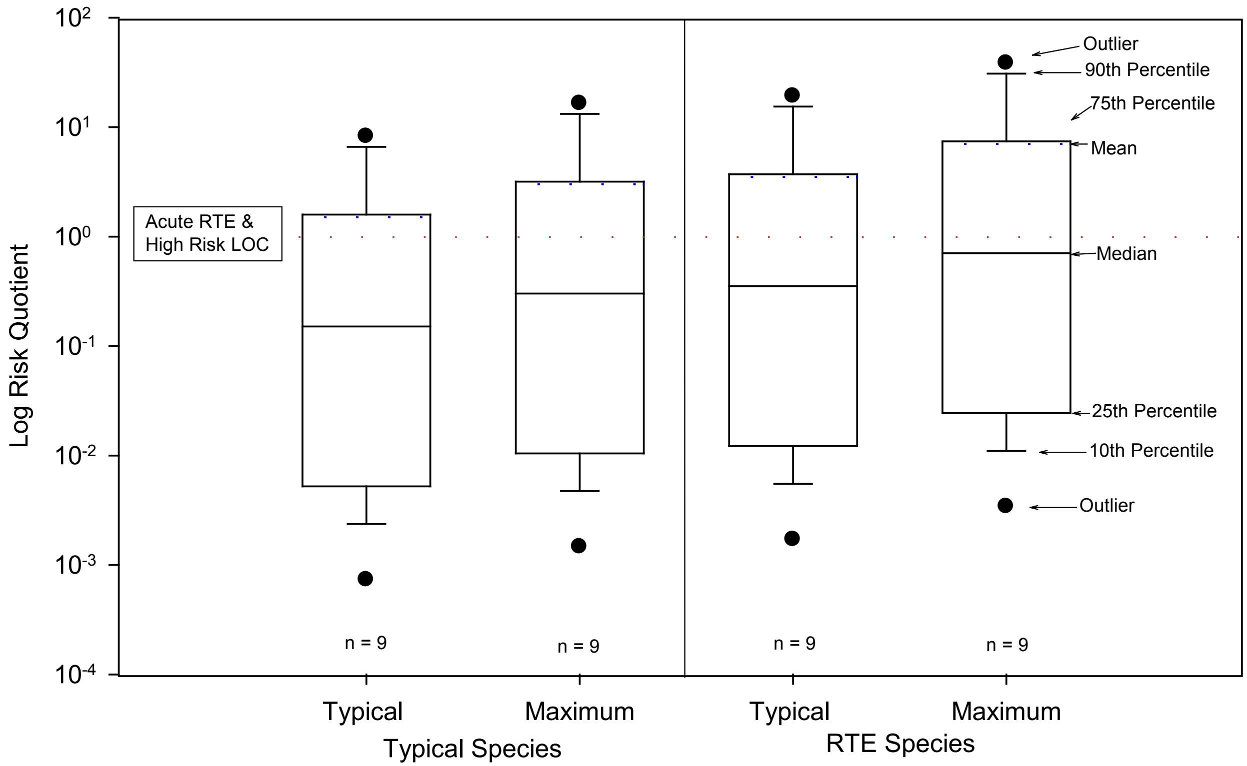


Figure E-94. Risk Quotients for Non-Target Terrestrial Plants Exposed to 2,4-D Esters in Wind Erosion and Transport Off-Site Scenarios at Application Rates for Terrestrial Woody Vegetation



APPENDIX F – SPECIES LISTED UNDER THE ENDANGERED SPECIES ACT FOR 17 BLM STATES

TABLE F-1

Species Addressed in This Ecological Risk Assessment

Scientific Name	Common Name	Status	State[1]	Critical Habitat	Critical Habitat on BLM Lands	USFWS/NMFS Recovery Plan
Plants						
Acanthomintha ilicifolia	San Diego thornmint	T[2]	CA	Yes	None	No
Allium munzii	Munz's onion	E	CA	Yes	63 acres	No
Ambrosia pumila	San Diego ambrosia	E	CA	Yes	None	No
Amsonia kearneyana	Kearney's blue-star	E	AZ	No	--	Yes
Arabis mcdonaldiana	McDonald's rock-cress	E	CA, OR	No	--	Yes
Arctomecon humilis	Dwarf bear-poppy	E	UT	No	--	Yes
Arctostaphylos morroensis	Morro manzanita	T	CA	No	--	Yes
Arctostaphylos myrtifolia	Ione manzanita	T	CA	No	--	No
Arenaria paludicola	Marsh sandwort	E	OR	No	--	Yes
Argemone pleiacantha ssp. *pinnatisecta*	Sacramento prickly poppy	E	NM	No	--	Yes
Asclepias welshii	Welsh's milkweed	T	AZ, UT	Yes	1,760 acres (UT)	Yes
Astragalus albens	Cushenbury milk-vetch	E	CA	Yes	839 acres	Yes
Astragalus ampullarioides	Shivwitz milk-vetch	E	UT	Yes	819 acres	Yes
Astragalus applegatei	Applegate's milk-vetch	E	OR	No	--	Yes
Astragalus brauntonii	Braunton's milk-vetch	E	CA	Yes	None	Yes
Astragalus desereticus	Deseret milk-vetch	T	UT	No	--	No
Astragalus holmgreniorum	Holmgren milk-vetch	E	AZ, UT	Yes	362 acres (AZ); 2,447 acres (UT)	Yes
Astragalus humillimus	Mancos milk-vetch	E	CO, NM	No	--	Yes
Astragalus jaegerianus	Lane Mountain milk-vetch	E	CA	Yes	9,897 acres	No
Astragalus lentiginosus var. *coachellae*	Coachella Valley milk-vetch	E	CA	Yes	3,494 acres	No
Astragalus magdalenae var. *peirsonii*	Peirson's milk-vetch	T	CA	Yes	20,779 acres	No
Astragalus lentiginosus var. *piscinensis*	Fish Slough milk-vetch	T	CA	Yes	5,430 acres	Yes
Astragalus montii	Heliotrope milk-vetch	T	UT	Yes	None	Draft
Astragalus osterhoutii	Osterhout milk-vetch	E	CO	No	--	Yes
Astragalus phoenix	Ash Meadows milk-vetch	T	NV	Yes	458 acres	Yes
Astragalus tricarinatus	Triple-ribbed milk-vetch	E	CA	No	--	No
Atriplex coronata var. *notatior*	San Jacinto Valley crownscale	E	CA	Yes	None	No
Baccharis vanessae	Encinitis baccharis	T	CA	No	--	No
Berberis nevinii	Nevin's barberry	E	CA	Yes	5 acres	No
Brodiaea filifolia	Thread-leaved brodiaea	T	CA	Yes	53 acres	No
Calyptridium pulchellum	Mariposa pussypaws	T	CA	No	No	No
Calystegia stebbinsii	Stebbins' morning-glory	E	CA	No	--	Yes
Camissonia benitensis	San Benito evening-primrose	T	CA	No	--	Yes
Carex specuicola	Navajo sedge	T	UT	Yes	None	Yes
Castilleja campestris ssp. *succulenta*	Fleshy owl's-clover	T	CA	Yes	289 acres	Yes
Caulanthus californicus	California jewelflower	E	CA	No	--	Yes

TABLE F-1 (Cont.)

Species Addressed in This Ecological Risk Assessment

Scientific Name	Common Name	Status	State[1]	Critical Habitat	Critical Habitat on BLM Lands	USFWS/NMFS Recovery Plan
Plants (Cont.)						
Ceanothus ferrisae	Coyote ceanothus	E	CA	No	No	Yes
Ceanothus roderickii	Pine Hill ceanothus	E	CA	No	--	Yes
Centaurium namophilum	Spring-loving centaury	T	CA, NV	Yes	806 acres (NV)	Yes
Chamaesyce hooveri	Hoover's spurge	T	CA	Yes	38 acres	Yes
Chlorogalum purpureum var. *purpureum*	Purple amole	T	CA	Yes	None	No
Chorizanthe howellii	Howell's spineflower	E	CA	No	--	Yes
Chorizanthe orcuttiana	Orcutt's spineflower	E	CA	No	--	No
Chorizanthe pungens var.*pungens*	Monterey spineflower	T	CA	Yes	1,204 acres	Yes
Chorizanthe rogusta var. *robusta*	Robust spineflower	E	CA	No	--	No
Cirsium fontinale var. *obispoense*	Chorro Creek bog thistle	E	CA	No	--	Yes
Cirsium scariosum var. *loncholepis*	La Graciosa thistle	E	CA	Yes	None	No
Clarkia springvillensis	Springville clarkia	T	CA	No	--	No
Coryphantha robbinsorum	Cochise pincushion cactus	T	AZ	No	--	Yes
Coryphantha scheeri var. *robustispina*	Pima pineapple cactus	E	AZ	No	--	No
Coryphantha sneedii var. *leei*	Lee pincushion cactus	T	NM	No	--	Yes
Coryphantha sneedii var. *sneedii*	Sneed pincushion cactus	E	NM	No	--	Yes
Cycladenia humilis var. *jonesii*	Jones cycladenia	T	CA, AZ, UT	No	--	Outline
Deinandra (= *hemizonia*) *conjugens*	Otay tarplant	T	CA	Yes	None	Yes
Deinandra increscens ssp. *villosa*	Gaviota tarplant	E	CA	Yes	None	No
Delphinium luteum	Yellow larkspur	E	CA	Yes	None	No
Dodecahema leptoceras	Slender-horned spineflower	E	CA	No	--	No
Dudleya cymosa ssp. *marcescens*	Marcescent dudleya	T	CA	No	--	Yes
Echinocactus horizonthalonius var. *nicholli*	Nichol's Turk's head cactus	E	AZ	No	--	Yes
Echinocereus fendleri var. *kuenzleri*	Kuenzler hedgehog cactus	E	NM	No	--	Yes
Echinocereus triglochidiatus var. *arizonicus*	Arizona hedgehog cactus	E	AZ	No	--	No (Draft)
Echinomastus erectocentrus var. *acunensis*	Acuna cactus	E	AZ	Proposed	--	No
Enceliopsis nudicaulis var. *corrugata*	Ash Meadows sunray	T	NV	Yes	773 acres	Yes
Eremalche kernensis	Kern mallow	E	CA	No	--	Yes
Eriastrum densifolium ssp. *sanctorum*	Santa Ana River woolly-star	E	CA	No	--	No
Erigeron decumbens var. *decumbens*	Willamette daisy	E	OR	Yes	208 acres	Yes
Erigeron parishii	Parish's daisy	T	CA	Yes	945 acres	Yes
Erigeron rhizomatus	Zuni fleabane	T	AZ, NM	No	--	Yes
Eriodictyon altissimum	Indian Knob mountain balm	E	CA	No	--	Yes
Eriodictyon capitatum	Lompoc yerba santa	E	CA	Yes	None	No

TABLE F-1 (Cont.)

Species Addressed in This Ecological Risk Assessment

Scientific Name	Common Name	Status	State[1]	Critical Habitat	Critical Habitat on BLM Lands	USFWS/NMFS Recovery Plan
INTRODUCTION **Plants (Cont.)**						
Eriogonum apricum	Ione buckwheat	E	CA	No	--	No
Eriogonum gypsophilum	Gypsum wild-buckwheat	T	NM	Yes	537 acres	Yes
Eriogonum ovalifolium var. *vineum*	Cushenbury buckwheat	E	CA	Yes	423 acres	Yes
Eriogonum ovalifolium var. *williamsiae*	Steamboat buckwheat	E	NV	No	--	Yes
Eriogonum pelinophilum	Clay-loving wild-buckwheat	E	CO	Yes	None	Yes
Erysimum menziesii	Menzies' wallflower	E	CA	No	--	Yes
Eutrema penlandii	Penland alpine fen mustard	T	CO	No	--	No
Fremontodendron californicum ssp. *decumbens*	Pine Hill flannelbush	E	CA	No	--	Yes
Fremontodendron mexicanum	Mexican flannelbush	E	CA	Yes	224 acres	No
Fritillaria gentneri	Gentner's fritillary	E	OR	No	--	Yes
Galium californicum ssp. *sierrae*	El Dorado bedstraw	E	CA	No	--	Yes
Gaura neomexicana var. *coloradensis*	Colorado butterfly plant	T	CO, WY	Yes	None	Outline
Gilia tenuiflora ssp. *arenaria*	Monterey gilia	E	CA	No	--	Yes
Grindelia fraxino-pratensis	Ash Meadows gumplant	T	CA, NV	Yes	292 acres (CA)	Yes
Hackelia venusta	Showy stickseed	E	OR	No	--	Yes
Hedeoma todsenii	Todsen's pennyroyal	E	NM	Yes	None	Yes
Helianthus paradoxus	Pecos sunflower	T	NM	Yes	None	Yes
Howellia aquatilis	Water howellia	T	CA, ID, MT, OR	No	--	Draft
Ipomopsis polyantha	Pagosa skyrocket	E	CO	Yes	42 acres	Outline
Ivesia kingii var. *eremica*	Ash Meadows ivesia	T	NV	Yes	335 acres	Yes
Ivesia webberi	Webber ivesia	PT	CA, NV	Proposed	Proposed	No
Lasthenia conjugens	Contra Costa goldfields	E	CA	Yes	None	Yes
Layia carnosa	Beach layia	E	CA	No	--	Yes
Lepidium barnebyanum	Barneby ridge-cress	E	UT	No	--	Yes
Lepidium papilliferum	Slickspot peppergrass	T	ID	Proposed	57,756 acres (proposed)	No
Lesquerella congesta	Dudley Bluffs bladderpod	T	CO	No	--	Yes
Lesquerella tumulosa	Kodachrome bladderpod	E	UT	No	--	Outline
Lilaeopsis schaffneriana var. *recurva*	Huachuca water-umbel	E	AZ	Yes	484 acres	No
Lilium occidentale	Western lily	E	CA, OR	No	--	Yes
Limnanthes floccosa ssp. *californica*	Butte County meadowfoam	E	CA	Yes	None	Yes
Limnanthes floccosa ssp. *grandiflora*	Large-flowered woolly meadowfoam	E	OR	Yes	None	Draft
Lomatium bradshawii	Bradshaw's desert-parsley	E	OR	No	--	Yes
Lomatium cookii	Cook's lomatium	E	OR	Yes	1,621 acres	Draft
Lupinus sulphureus ssp. *kincaidii*	Kincaid's lupine	T	OR, WA	Yes	34 acres (OR)	Yes

TABLE F-1 (Cont.)

Species Addressed in This Ecological Risk Assessment

Scientific Name	Common Name	Status	State[1]	Critical Habitat	Critical Habitat on BLM Lands	USFWS/NMFS Recovery Plan
Plants (Cont.)						
Mentzelia leucophylla	Ash Meadows blazingstar	T	NV	Yes	509 acres	Yes
Mirabilis macfarlanei	MacFarlane's four-o'clock	T	ID, OR	No	--	Yes
Monardella viminea	Willowy monardella	E	CA	Yes	No	No
Monolopia congdonii (formerly *Lembertia congdonii*)	San Joaquin woolly-threads	E	CA	No	--	Yes
Neostapfia colusana	Colusa grass	T	CA	Yes	7 acres	Yes
Nitrophila mohavensis	Amargosa niterwort	E	CA, NV	Yes	1,200 acres (CA)	Yes
Opuntia treleasei	Bakersfield cactus	E	CA	No	--	Yes
Orcuttia californica	California orcutt grass	E	CA	No	--	Yes
Orcuttia inaequalis	San Joaquin Valley orcutt grass	T	CA	Yes	289 acres	Yes
Orcuttia pilosa	Hairy orcutt grass	E	CA	Yes	18 acres	Yes
Orcuttia tenuis	Slender orcutt grass	T	CA	Yes	17,077 acres	Yes
Oxytheca parishii var. *goodmaniana*	Cushenbury oxytheca	E	CA	Yes	84 acres	Draft
Pediocactus bradyi	Brady pincushion cactus	E	AZ	No	--	Yes
Pediocactus despainii	San Rafael cactus	E	NM, UT	No	--	Draft
Pediocactus knowltonii	Knowlton's cactus	E	CO, NM	No	--	Yes
Pediocactus peeblesianus var. *fickeiseniae*	Fickeisen plains cactus	E	AZ	Proposed	--	No
Pediocactus peeblesianus var. *peeblesianus*	Peebles Navajo cactus	E	AZ	No	--	Yes
Pediocactus sileri	Siler pincushion cactus	T	AZ, UT	No	--	Yes
Pediocactus winkleri	Winkler cactus	T	UT	No	--	Draft
Penstemon debilis	Parachute beardtongue	T	CO	Yes	13,912 acres	Outline
Penstemon grahamii	Graham's beardtongue	PT	CO, UT	Proposed	Proposed	No
Penstemon haydenii	Blowout penstemon	E	WY	No	--	Yes
Penstemon penlandii	Penland beardtongue	E	CO	No	--	Yes
Penstemon scariosus var. *albifluvis*	White River beardtongue	PT	CO, UT	Proposed	Proposed	No
Phacelia argillacea	Clay phacelia	E	UT	No	--	No
Phacelia formosula	North Park phacelia	E	CO	No	--	Yes
Phacelia submutica	DeBeque phacelia	T	CO	Yes	22,013 acres	Outline
Phlox hirsuta	Yreka phlox	E	CA	No	--	Yes
Physaria obcordata	Dudley Bluffs (Piceance) twinpod	T	CO, UT	No	--	Yes
Piperia yadonii	Yadon's piperia	E	CA	Yes	No	Yes
Plagiobothrys hirtus	Rough popcornflower	E	OR	No	--	Yes
Plantanthera praeclara	Western prairie fringed orchid	T	MT, WY	No	--	Yes
Pogogyne nudiuscula	Otay mesa-mint	E	CA	No	--	Yes
Primula maguirei	Maguire primrose	T	UT	No	--	Yes
Pseudobahia bahiifolia	Hartweg's golden sunburst	E	CA	No	--	No

TABLE F-1 (Cont.)

Species Addressed in This Ecological Risk Assessment

Scientific Name	Common Name	Status	State[1]	Critical Habitat	Critical Habitat on BLM Lands	USFWS/NMFS Recovery Plan
Plants (Cont.)						
Pseudobahia peirsonii	San Joaquin adobe sunburst	T	CA	No	--	No
Purshia subintegra	Arizona cliff-rose	E	AZ	No	--	Yes
Ranunculus aestivalis	Autumn buttercup	E	UT	No	--	Yes
Schoenocrambe argillacea	Clay reed-mustard	T	NM, UT	No	--	Yes
Schoenocrambe barnebyi	Barneby reed-mustard	E	ID, UT	No	--	Yes
Schoenocrambe suffrutescens	Shrubby reed-mustard	E	UT	No	--	Yes
Sclerocactus brevispinus	Pariette cactus	T	UT	No	--	Outline
Sclerocactus glaucus	Colorado hookless cactus	T	CO	No	--	Outline
Sclerocactus mesae-verdae	Mesa Verde cactus	T	CO, NM, UT	No	--	Yes
Sclerocactus wrightiae	Wright fishhook cactus	E	UT	No	--	Yes
Senecio layneae	Layne's butterweed	T	CA	No	--	Yes
Sidalcea keckii	Keck's checker-mallow	E	CA	Yes	0.2 acres	No
Sidalcea nelsoniana	Nelson's checker-mallow	T	OR	No	--	Yes
Sidalcea oregana var. *calva*	Wenatchee Mountains checker-mallow	E	OR	Yes	None	Yes
Silene spaldingii	Spalding's catchfly	T	ID, MT, OR, WA	No	--	Yes
Sphaeralcea gierischii	Gierisch mallow	E	AZ, UT	Yes	9,406 acres (AZ) 1,982 acres (UT)	No
Spiranthes delitescens	Canelo Hills ladies'-tresses	E	AZ	No	--	No
Spiranthes diluvialis	Ute ladies'-tresses	T	CO, ID, MT, NV, OR, UT, WY, NE, WA	No	--	Draft
Stephanomeria malheurensis	Malheur wire-lettuce	E	OR	Yes	103 acres	Yes
Streptanthus albidus ssp. *albidus*	Metcalf Canyon jewelflower	E	CA	No	--	Yes
Thelypodium howellii ssp. *spectabilis*	Howell's spectacular thelypody	T	OR	No	--	Yes
Townsendia aprica	Last Chance townsendia	T	UT	No	--	Yes
Tuctoria greenei	Greene's tuctoria	E	CA	Yes	7.2 acres	Yes
Verbena californica	Red Hills vervain	T	CA	No	--	No
Yermo xanthocephalus	Desert yellowhead	T	WY	Yes	357 acres	Outline
Mollusks						
Assiminea pecos	Pecos assiminea snail	E	NM	Yes	No	No (state plan)
Helminthoglypta walkeriana	Morro shoulderband snail	E	CA	Yes	5 acres	Yes
Juturnia kosteri	Koster's springsnail	E	NM	Yes	No	No (state plan)
Lanx sp.	Banbury Springs limpet	E	ID	No	--	Yes
Oxyloma haydeni kanabensis	Kanab ambersnail	E	AZ, UT	Proposed	--	Yes
Physa natricina	Snake River physa snail	E	ID	No	--	Yes
Pyrgulopsis bruneauensis	Bruneau Hot springsnail	E	ID	No	--	Yes

TABLE F-1 (Cont.)

Species Addressed in This Ecological Risk Assessment

Scientific Name	Common Name	Status	State[1]	Critical Habitat	Critical Habitat on BLM Lands	USFWS/NMFS Recovery Plan
Mollusks (Cont.)						
Pyrgulopsis neomexicana	Socorro springsnail	E	NM	No	--	Yes
Pyrgulopsis roswellensis	Roswell springsnail	E	NM	Yes	No	No
Taylorconcha serpenticola	Bliss Rapids snail	T	ID	No	--	Yes
Tryonia alamosae	Alamosa springsnail	E	NM	No	--	Yes
Arthropods						
Ambrysus amargosus	Ash Meadows naucorid	T	NV	Yes	None	Yes
Boloria acrocnema	Uncompahgre fritillary butterfly	E	CO	No	--	Yes
Branchinecta conservatio	Conservancy fairy shrimp	E	CA	Yes	7 acres	Yes
Branchinecta longiantenna	Longhorn fairy shrimp	E	CA	Yes	31 acres	Yes
Branchinecta lynchi	Vernal pool fairy shrimp	T	CA, OR	Yes	4,122 acres (CA); 423 acres (OR)	Yes
Desmocerus californicus dimorphus	Valley elderberry longhorn beetle	T	CA	Yes	None	Yes
Euphydryas editha quino	Quino checkerspot butterfly	E	CA	Yes	11,444 acres	Yes
Euphydryas editha taylori	Taylor's checkerspot butterfly	E	OR	Yes	None	No
Euproserpinus euterpe	Kern primrose sphinx moth	T	CA	No	--	Yes
Gammarus desperatus	Noel's amphipod	E	NM	Yes	None	No
Hesperia leonardus montana	Pawnee montane skipper	T	CO	No	--	Yes
Icaricia icarioides fenderi	Fender's blue butterfly	E	OR	Yes	249 acres	Yes
Lepidurus packardi	Vernal pool tadpole shrimp	E	CA	Yes	15,749 acres	Yes
Nicrophorus americanus	American burying beetle	E	MT, WY	No	--	Yes
Pseudocopaeodes eunus obscurus	Carson wandering skipper	E	CA, NV	No	--	Yes
Speyeria zerene hippolyta	Oregon silverspot butterfly	T	OR	Yes	None	Yes
Thermosphaeroma thermophilus	Socorro isopod	E	NM	No	--	No
Fishes						
Acipenser transmontanus	White sturgeon (Kootenia River population)	E	ID, MT	Yes	42 acres (ID)	Yes
Catostomus microps	Modoc sucker	E	CA	Yes	None	No
Catostomus santaanae	Santa Ana sucker	T	CA	Yes	26 acres	No
Catostomus warnerensis	Warner sucker	T	CA, NV, WA	Yes	None	Yes
Chasmistes brevirostris	Shortnose sucker	E	CA, OR	Yes	9 miles stream, 1,390 acres lake (OR)	Yes
Chasmistes cujus	Cui-ui	E	NV	No	--	Yes
Chasmistes liorus	June sucker	E	UT	Yes	None	Yes
Crenichthys baileyi baileyi	White River springfish	E	NV	Yes	1 acre	Yes
Crenichthys baileyi grandis	Hiko White River springfish	E	NV	Yes	None	Yes

TABLE F-1 (Cont.)

Species Addressed in This Ecological Risk Assessment

Scientific Name	Common Name	Status	State[1]	Critical Habitat	Critical Habitat on BLM Lands	USFWS/NMFS Recovery Plan
Fishes (Cont.)						
Crenichthys nevadae	Railroad Valley springfish	T	NV	Yes	129 acres	Yes
Cyprinella formosa	Beautiful shiner	T	AZ, NM	Yes	None	Yes
Cyprinodon diabolis	Devil's Hole pupfish	E	NV	No	--	Yes
Cyprinodon macularius	Desert pupfish	E	AZ, CA	Yes	485 acres (CA)	Yes
Cyprinodon nevadensis mionectes	Ash Meadows Amargosa pupfish	E	NV	Yes	62 acres	Yes
Cyprinodon nevadensis pectoralis	Warm Springs pupfish	E	NV	No	--	Yes
Cyprinodon radiosus	Owens pupfish	E	CA	No	--	Yes
Deltistes luxatus	Lost River sucker	E	CA, OR	Yes	351 acres (OR)	Yes
Empetrichthys latos	Pahrump poolfish	E	NV	No	--	Yes
Eremichthys acros	Desert dace	T	NV	Yes	1,955 acres	Yes
Eucyclogobius newberryi	Tidewater goby	E	CA	Yes	None	Yes
Gambusia nobilis	Pecos gambusia	E	NM	No	--	Yes
Gasterosteus aculeatus williamsoni	Unarmored threespine stickleback	E	CA	No	--	Yes
Gila bicolor mohavensis	Mohave tui chub	E	CA	No	--	Yes
Gila bicolor snyderi	Owens tui chub	E	CA	Yes	None	Yes
Gila bicolor ssp.	Hutton tui chub	T	OR	No	--	Yes
Gila boraxobius	Borax Lake chub	E	OR	Yes	320 acres	Yes
Gila cypha	Humpback chub	E	AZ, CO, UT, WY	Yes	1,953 acres (UT); 323 acres (CO)	Yes
Gila elegans	Bonytail chub	E	AZ, CA, CO, NV, UT, WY	Yes	6,214 acres (AZ); 1,480 acres (CA); 323 acres (CO); 1,953 acres (UT)	Yes
Gila intermedia	Gila chub	E	AZ, NM	Yes	1,911 acres (AZ)	No
Gila robusta jordani	Pahranagat roundtail chub	E	NV	No	--	Yes
Gila seminuda	Virgin River chub	E	AZ, NV, UT	Yes	879 acres (AZ); 818 acres (NV); 420 acres (UT)	Yes
Hybognathus amarus	Rio Grande silvery minnow	E	NM	Yes	96 acres	Yes
Hypomesus transpacificus	Delta smelt	T	CA	Yes	1,752 acres	Yes
Lepidomeda albivallis	White River spinedace	E	NV	Yes	None	Yes
Lepidomeda mollispinis pratensis	Big Spring spinedace	T	NV	Yes	32 acres	Yes
Lepidomeda vittata	Little Colorado spinedace	T	AZ	Yes	None	Yes
Meda fulgida	Spikedace	E	AZ, NM	Yes	41 miles (AZ); 12 miles (NM)	Yes
Moapa coriacea	Moapa dace	E	NV	No	--	Yes
Notropis girardi	Arkansas River shiner	T	NM	Yes	None	No

TABLE F-1 (Cont.)

Species Addressed in This Ecological Risk Assessment

Scientific Name	Common Name	Status	State[1]	Critical Habitat	Critical Habitat on BLM Lands	USFWS/NMFS Recovery Plan
Fishes (Cont.)						
Notropis simus pecosensis	Pecos bluntnose shiner	T	NM	Yes	293 acres	Yes
Oncorhynchus clarki ssp. *henshawi*	Lahontan cutthroat trout	T	CA, CO, NV, OR, UT	No	--	Yes
Oncorhynchus clarki ssp. *stomias*	Greenback cutthroat trout	T	CO	No	--	Yes
Oncorhynchus gilae	Gila trout	T	AZ, NM	No	--	Yes
Oncorhynchus keta	Chum salmon					
	Columbia River ESU[3]	T	OR	Yes	<1 mile (WA)	No
	Hood Canal Summer-run ESU	T	OR	Yes	None	Yes
Oncorhynchus kisutch	Coho salmon					
	Central California Coast ESU	E	CA, OR	Yes	NA	Yes
	Oregon Coast ESU	T	OR	Yes	688 miles	No
	Southern Oregon/Northern California Coasts ESU	T	CA, OR	Yes	NA	No
	Lower Columbia River ESU	T	OR	Proposed	--	Yes
Oncorhynchus mykiss	Steelhead					
	Southern California DPS[4]	E	CA	Yes	1 mile	Yes
	South Central California Coast DPS	T	CA	Yes	9 miles	Yes (Draft)
	California Central Valley DPS	T	CA	Yes	56 miles	No
	Northern California DPS	T	CA	Yes	125 miles	No
	Central California Coast DPS	T	CA	Yes	4 miles	No
	Snake River Basin DPS	T	ID, OR	Yes	147 miles (ID); 24 miles (OR); 7 miles (WA)	No
	Upper Willamette River DPS	T	OR	Yes	42 miles (OR)	Yes
	Upper Columbia River DPS	T	OR	Yes	4 miles (WA)	Yes
	Lower Columbia River DPS	T	OR	Yes	16 miles (OR); 2 miles (WA)	Yes
	Middle Columbia River DPS	T	OR	Yes	324 miles (OR); 21 miles (WA)	Yes
Oncorhynchus nerka	Sockeye salmon					
	Snake River, Idaho ESU	E	ID, OR	Yes	None	No
Oncorhynchus tshawytscha	Chinook salmon					
	California Coastal ESU	T	CA	Yes	63 miles	No
	Central Valley Spring-run ESU	T	CA	Yes	32 miles	No
	Sacramento River Winter-run ESU	E	CA, OR	Yes	NA	No
	Snake River Fall-run ESU	T	ID, OR	Yes	NA	No

TABLE F-1 (Cont.)

Species Addressed in This Ecological Risk Assessment

Scientific Name	Common Name	Status	State[1]	Critical Habitat	Critical Habitat on BLM Lands	USFWS/NMFS Recovery Plan
Fishes (Cont.)						
Oncorhynchus tshawytscha (cont.)	Chinook salmon (Cont.)					
	Snake River Spring/Summer-run ESU	T	ID, OR	Yes	NA	No
	Lower Columbia River ESU	T	OR	Yes	8 miles (OR/WA)	Yes
	Upper Willamette River ESU	T	OR	Yes	37 miles (OR)	Yes
	Upper Columbia River Spring-run ESU	E	OR	Yes	1 mile (WA)	Yes
Oregonichythys crameri	Oregon chub	T	OR	Yes	None	Yes
Plagopterus argentissimus	Woundfin	E	AZ, NV, NM, UT	Yes	879 acres (AZ); 420 acres (UT)	Yes
Poeciliopsis occidentalis	Gila topminnow	E	AZ, NM	No	--	Yes (Draft)
Ptychocheilus lucius	Colorado pikeminnow	E, XN	AZ, CA, CO, NM, UT, WY	Yes	2,644 acres (CO); 67 acres NM; 5,119 acres (UT)	Yes
Rhinichthys osculus lethoporus	Independence Valley speckled dace	E	NV	No	--	Yes
Rhinichthys osculus nevadensis	Ash Meadows speckled dace	E	NV	Yes	60 acres	Yes
Rhinichthys osculus oligoporus	Clover Valley speckled dace	E	NV	No	--	Yes
Rhinichthys osculus ssp.	Foskett speckled dace	T	OR	No	--	Yes
Rhinichthys osculus thermalis	Kendall Warm Springs dace	E	WY	No	--	Yes
Salvelinus confluentus	Bull trout	T, XN	ID, MT, NV, OR	Yes	7,669 acres, 907 miles (ID); 2,048 acres, 210 miles (OR); 25 miles (MT); 12 miles (NV)	Yes
Scaphirhynchus albus	Pallid sturgeon	E	CO, MT, WY	No	--	Yes
Tiaroga cobitis	Loach minnow	E	AZ, NM	Yes	41 miles (AZ); 13 miles (NM)	Yes
Xyrauchen texanus	Razorback sucker	E	AZ, CA, CO, NM, NV, UT, WY	Yes	822 acres (AZ); 1,076 acres (CA); 1,996 acres (CO); 4,734 acres (UT)	Yes
Amphibians						
Ambystoma californiense	California tiger salamander	T, E	CA	Yes	38 acres	No
Ambystoma tigrinum stebbinsi	Sonora tiger salamander	E	AZ	No	--	Yes
Anaxyrus canorus	Yosemite toad	PT	CA	Proposed	Proposed	No
Batrachoseps aridus	Desert slender salamander	E	CA	No	--	Yes

TABLE F-1 (Cont.)

Species Addressed in This Ecological Risk Assessment

Scientific Name	Common Name	Status	State[1]	Critical Habitat	Critical Habitat on BLM Lands	USFWS/NMFS Recovery Plan
Amphibians (Cont.)						
Bufo baxteri	Wyoming toad	E	WY	No	--	Yes
Bufo californicus (= *microscaphus*)	Arroyo toad	E	CA	Yes	453 acres	Yes
Rana chiricahuensis	Chiricahua leopard frog	T	AZ, NM	Yes	1,364 acres (AZ) 27 acres (NM)	Yes
Rana draytonii	California red-legged frog	T	CA	Yes	5,207 acres	Yes
Rana muscosa	Mountain yellow-legged frog (Northern DPS)	PE	CA	Proposed	None	No
Rana pretiosa	Oregon spotted frog	PT	OR	Proposed	Proposed	No
Rana sierrae	Sierra Nevada yellow-legged frog	PE	CA	Proposed	None	No
Reptiles						
Crotalus willardi obscurus	New Mexican ridge-nosed rattlesnake	T	AZ, NM	Yes	None	Yes
Gambelia silus	Blunt-nosed leopard lizard	E	CA	No	--	Yes
Gopherus agassizii	Desert tortoise (Mojave population)	T	AZ, CA, NV, UT	Yes	288,069 acres (AZ); 2,720,438 acres (CA); 1,024,579 acres (NV); 96,002 acres (UT)	Yes
Thamnophis eques megalops	Northern Mexican garter snake	PT	AZ	Proposed	Proposed	No
Thamnophis gigas	Giant garter snake	T	CA	No	--	Yes (Draft)
Thamnophis rufipunctatus	Narrow-headed garter snake	PT	AZ, NM	Proposed	Proposed	No
Uma inornata	Coachella Valley fringe-toed lizard	T	CA	Yes	2,358 acres	Yes
Birds						
Brachyramphus marmoratus	Marbled murrelet	T	CA, OR	Yes	85,495 acres (CA); 483,018 acres (OR)	Yes
Centrocercus minimus	Gunnison sage-grouse	PE	CO, UT	Proposed	Proposed	No
Centrocercus urophasianus	Greater sage-grouse (Bi-State DPS)	PT	CA	Proposed	Proposed	No
Charadrius melodus	Piping plover	T	CO, MT, NM, WY	Yes	1,758 acres (MT)	Yes
Charadrius nivosus nivosus	Western snowy plover (Pacific population)	T	CA, OR	Yes	67 acres (CA); 273 acres (OR)	Yes
Coccyzus americanus	Yellow-billed cuckoo (Western DPS)	PT	AZ, CA, CO, ID, MT, NM, NV, OR, WY, UT	No	--	No

TABLE F-1 (Cont.)

Species Addressed in This Ecological Risk Assessment

Scientific Name	Common Name	Status	State[1]	Critical Habitat	Critical Habitat on BLM Lands	USFWS/NMFS Recovery Plan
Birds (Cont.)						
Empidonax traillii extimus	Southwestern willow flycatcher	E	AZ, CA, CO, NV, NM, UT	Yes	96 miles (AZ); 9.4 miles (CA); 20.6 miles (CO); 22 miles (NM); 19 miles (NV); 25 miles (UT)	Yes
Eremophila alpestris strigata	Streaked horned lark	T	OR	Yes	None	No
Falco femoralis ssp. *septentrionalis*	Northern aplomado falcon	E, XN	AZ, NM	No	--	Yes
Grus americana	Whooping crane	E, XN	CO, ID, MT, WY	Yes	35 acres (CO); 379 acres (ID)	Yes
Gymnogyps californianus	California condor	E, XN	E = CA XN = UT, AZ	Yes	3,964 acres (CA)	Yes
Pipilo crissalis eremophilus	Inyo California towhee	T	CA	Yes	695 acres	Yes
Polioptila californica californica	Coastal California gnatcatcher	T	CA	Yes	8,862 acres	No
Polysticta stelleri	Steller's eider	T	AK	Yes	597 acres	Yes
Rallus longirostris yumanensis	Yuma clapper rail	E	AZ, CA, NV	No	--	Yes (Draft)
Somateria fischeri	Spectacled eider	T	AK	Yes	1 acre	Yes
Sterna antillarum	Least (interior) tern	E	CO, MT, NM, WY	No	--	Yes
Strix occidentalis caurina	Northern spotted owl	T	CA, OR	Yes	1,328,612 acres	Yes
Strix occidentalis lucida	Mexican spotted owl	T	AZ, CA, CO, NM, UT	Yes	795 acres (AZ); 61,994 acres (CO); 2,341 acres (NM); 1,456,144 acres (UT)	Yes (Draft)
Tympanachus pallidicinctus	Lesser prairie-chicken	PT	CO, NM, OK	No	--	No
Vireo bellii pusillus	Least Bell's vireo	E	CA	Yes	None	Yes (Draft)
Mammals						
Antilocapra americana sonoriensis	Sonoran pronghorn	E, XN	AZ	No	--	Yes
Brachylagus idahoensis	Pygmy rabbit	E	OR	No	--	Yes (Draft)
Canis lupus	Gray wolf	E, XN	AZ, CO, ID, NM, NV, MT, OR, UT, WY	Yes	None	Yes
Cynomys parvidens	Utah prairie dog	T	UT	No	--	Yes
Dipodomys heermanni morroensis	Morro Bay kangaroo rat	E	CA	Yes	None	Yes (Draft)
Dipodomys ingens	Giant kangaroo rat	E	CA	No	--	Yes
Dipodomys merriami parvus	San Bernardino Merriam's kangaroo rat	E	CA	Yes	1,030 acres	No

TABLE F-1 (Cont.)

Species Addressed in This Ecological Risk Assessment

Scientific Name	Common Name	Status	State[1]	Critical Habitat	Critical Habitat on BLM Lands	USFWS/NMFS Recovery Plan
Mammals (Cont.)						
Dipodomys nitratoides exilis	Fresno kangaroo rat	E	CA	Yes	None	Yes
Dipodomys nitratoides nitratoides	Tipton kangaroo rat	E	CA	No	--	Yes
Dipodomys stephensi	Stephens' kangaroo rat	E	CA	No	--	Yes (Draft)
Gulo gulo luscus	North American wolverine	PT	ID, MT, WY	No	--	No
Leopardus pardalis	Ocelot	E	AZ	No	--	Yes
Leptonycteris curosoae yerbabuenae	Lesser long-nosed bat	E	AZ, NM	No	--	Yes
Leptonycteris nivalis	Mexican long-nosed bat	E	NM	No	--	Yes
Lynx canadensis	Canada lynx	T, PT	AK, CO, ID, MT, NM, OR, UT, WY	Yes	3 acres (ID); 103,475 acres (MT); 2,531 acres (OR); 1,426 acres (WY)	(Recovery Outline)
Microtus californicus scirpensis	Amargosa vole	E	CA	Yes	3,847 acres	Yes
Microtus mexicanus hualpaiensis	Hualapai Mexican vole	E	AZ	No	--	Yes
Mustela nigripes	Black-footed ferret	E, XN	E = AZ, CO, MT, UT, WY XN = AZ, CO, MT, UT, WY	No	--	Yes
Neotoma fuscipes riparia	Riparian woodrat	E	CA	No	--	Yes
Odocoileus virginianus leucurus	Columbian white-tailed deer	E	OR	No	--	Yes
Ovis canadensis ssp. *nelsoni*	Peninsular bighorn sheep	E	CA	Yes	102,686 acres	Yes
Ovis canadensis ssp. *sierrae*	Sierra Nevada bighorn sheep	E	CA	Yes	990 acres	Yes
Panthera onca	Jaguar	E	AZ, NM	Proposed	Proposed	Yes
Rangifer tarandus caribou	Woodland caribou	E	OR	Proposed	None	Yes
Sorex ornatus relictus	Buena Vista Lake ornate shrew	E	CA	Yes	None	Yes
Spermophilus brunneus brunneus	Northern Idaho ground squirrel	T	ID	No	--	Yes
Ursus arctos horribilis	Grizzly bear	T	ID, MT, OR, WY	No	--	Yes
Vulpes macrotis mutica	San Joaquin kit fox	E	CA	No	--	Yes
Zapus hudsonius luteus	New Mexico meadow jumping mouse	PE	AZ, CO, NM	Proposed	None	No
Zapus hudsonius preblei	Preble's meadow jumping mouse	T	CO, WY	Yes	6 acres (CO)	No

[1]State refers to the administrative jurisdiction of the BLM state office for the state listed. Therefore, MT indicates that the species may occur in Montana, North Dakota, and/or South Dakota; NM indicates that the species may occur in New Mexico, Texas, and/or Kansas; OR indicates that the species may occur in Oregon and/or Washington; and WY indicates that the species may occur in Wyoming and/or Nebraska. Some aquatic species do not occur in all the states listed, but could still be affected by activities in those states if aquatic systems were altered.
[2]E = Federally listed as endangered; T = federally listed as threatened; PE = proposed for listing as endangered; PT = proposed for listing as threatened; and XN = experimental, non-essential population.
[3]ESU = Evolutionarily Significant Unit.
[4]DPS = Distinct Population Segment.
NA = Due to incomplete information, recent listing, or recent change in the status of critical habitat, number of acres of critical habitat on BLM-administered lands is unknown at this time.
Note: Some estimates of critical habitat are based on digital information downloaded from the USFWS critical habitat data portal (http://ecos.fws.gov/crithab/). Therefore, they may not reflect additional critical habitat that was not digitized at the time the data were downloaded.