

SPECIALIST REPORT

# Herbicide use, an Assessment of Human Health and Ecological Risk

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*For*

Commercial Timber Harvest in the Beaver Creek  
Watershed

Daniel Boone National Forest

Cumberland Ranger District

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## Introduction

The *Commercial Timber Harvest in the Beaver Creek Watershed* (Commercial Timber Harvest) proposal includes application of herbicides as a treatment method to reduce sprouting of selected tree species following timber harvest to encourage growth of other tree species. The Forest Service places high priority on human and ecological health and safety. This is one of the reasons why the use of pesticides in forestry activities on National Forests must be based on analysis of effectiveness, specificity, environmental impact, economic efficiency and human exposure.

To assess the potential health effects of pesticides used in major forest programs and activities, pesticide Human Health and Ecological Risk Assessments are prepared. These documents are used to determine the probability of adverse effects to humans, wildlife, and the environment from the use of pesticides.

(<http://www.fs.fed.us/foresthealth/pesticide/health.shtml>)

Forest managers frequently make decisions regarding the use of pesticides on forest lands. These decisions must be based not only on the effectiveness of these tools, but also on an understanding of the risks associated with their use. For the pesticides commonly used by the Forest Service in its management activities, Human Health and Ecological Risk Assessments (HERAs) are prepared. In these documents, the process of risk assessment is used to quantitatively evaluate the probability (i.e. risk) that a pesticide use might pose harm to humans or other species in the environment. It is the same assessment process used for regulation of allowable residues of pesticides in food, as well as safety evaluations of medicines, cosmetics, and other chemicals. The Forest Service incorporates relevant information from the HERA into environmental assessment documents prepared for pesticide projects, and are used to guide decision-making and to disclose to the public potential environmental effects.

Risk is defined as the likelihood that an effect (injury, disease, death or environmental damage) may result from a specific set of circumstances. It can be expressed in quantitative or qualitative terms. While all human activities carry some degree of risk, some risks are known with a relatively high degree of accuracy, because data have been collected on the historical occurrence of related problems (e.g., lung cancer caused by smoking, auto accidents caused by alcohol impairment, and fatalities resulting from airplane travel). For several reasons, risks associated with activities including exposure to chemicals such as pesticides cannot be so readily determined. The process of risk assessment helps evaluate the risks resulting from these situations.

When evaluating risks from the use of pesticides proposed in a NEPA planning document, reliance on U.S. EPA's pesticide registration process as the sole demonstration of safety is insufficient. The Forest Service and Bureau of Land Management were involved in court cases in the early 1980's that specifically addressed this question (principally *Save Our Ecosystems v. Clark*, 747 F.2d 1240, 1248 (9th Circuit, 1984) and *Southern Oregon Citizens v. Clark*, 720 F. 2d 1475, 1480 (9th Cir. 1983)). These court decisions and others affirmed that although the Forest Service can use U.S. EPA toxicology data, it is still required to do an

independent assessment of the safety of pesticides rather than relying on FIFRA registration alone. The Courts have also found that FIFRA does not require the same examination of impacts that the Forest Service is required to undertake under NEPA. Further, Forest Service assessments consider data collected from both published scientific literature and data submitted to U.S. EPA to support FIFRA product registration, whereas U.S. EPA utilizes the latter data only. The U.S. EPA also considers many forestry pesticide uses to be minor. Thus, the project-specific application rates, spectrum of target and non-target organisms, and specialized exposure scenarios evaluated by the Forest Service are frequently not evaluated by U.S. EPA in its generalized registration assessments.

**Risk assessment** documents and **worksheets** have been developed for a number of pesticides that are used by the Forest Service. Existing risk assessments may be used in lieu of a project-specific risk assessment.

(<http://www.fs.fed.us/foresthealth/pesticide/risk.shtml>)

Risk assessment **worksheets** are a computational tool developed for the USDA Forest Service by Syracuse Environmental Research Associates, Inc. (SERA). These worksheets perform many of the calculations used in the Human Health Risk Assessments and Ecological Risk Assessments prepared for many of the pesticides used by the Forest Service.

The basic idea of these worksheets is to isolate the computations from the discussions of the computations. The worksheets contain very little discussion and they are intended as a tool to make risk assessment calculations easier to understand and review. Pesticide Coordinators and other technical specialist familiar with HHRAs and ERAs can use these worksheets to develop risk values for the pesticide application rates and application scenarios specific to their particular pesticide project.

The *Commercial Timber Harvest* Proposed Action and Alternatives A include use of the following attachments for each of the herbicides listed below:

**Imazapyr**

1. Human Health and Ecological Risk Assessment – Final Report, SERA, Inc., 12/16/2011
2. Worksheet (2)(Two Microsoft Excel spreadsheets)

**Triclopyr**

1. Human Health and Ecological Risk Assessment – Final Report, SERA, Inc., 5/24/2011
2. Worksheet (14) (Fourteen Microsoft Excel spreadsheets)

**Worker Exposure**

1. Revised and Corrected Reassessment of Worker Exposure Rates - Final Report, SERA, Inc., 11/17/2014

Disclosure of effects will be evaluated by the Responsible Official in reaching a determination on whether the action significantly affects the quality of the human environment. “Significantly” as defined by the *Regulations for Implementing the*

*Procedural Provisions of the National Environmental Policy Act (40 CFR 1500-1508)* requires consideration of both context and intensity.

The context of “significance” of impacts would be based on effects to workers applying herbicide, public use, vegetation, and wildlife occurring in the local vicinity; the term “local” being defined as the sites where herbicide treatments occur.

The intensity of “significance” refers to the severity of impact:

1. Impacts may be both beneficial and adverse
2. The degree to which the action affects public health or safety
3. Impacts to unique characteristics of the geographic area such as proximity to historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas
4. The degree to which the effects on the quality of the human environment are likely to be highly controversial
5. The degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks
6. The degree to which the action may establish a precedent for future actions with significant effects or represents a decision in principle about future consideration
7. Whether the action is related to other actions with individually insignificant but cumulatively significant impacts
8. The degree to which the action may adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural, or historical resources
9. The degree to which the action may adversely affect an endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act of 1973
10. Whether the action threatens a violation of Federal, State, or local law or requirements imposed for the protection of the environment

**Resource Indicators and Measures**

**TABLE 1: RESOURCE INDICATORS AND MEASURES FOR ASSESSING EFFECTS FROM USING HERBICIDES**

<b>Resource Element</b>	<b>Resource Indicator</b>	<b>Measure</b>	<b>Address: Purpose and Need, or key issue?</b>	<b>Source (Forest Plan S/G; law or policy, BMPs, etc)</b>
Human Health	Hazard Quotient (HQ)	HQ Less than 1.0 (<1.0)	YES	Forest Plan Standard DB-VEG-8
Ecological Risk	Hazard Quotient (HQ)	HQ Less than 1.0 (<1.0)	YES	Forest Plan Standard DB-VEG-8

**Affected Environment**

**Existing Condition**

This section is not applicable because herbicides are not a resource; rather, herbicides are a tool to be used by managers to accomplish an objective. In this case to control and/or eradicate invasive species as described in the proposal. The results of this analysis will be used by resource specialists to help address the impacts to various resources such as vegetation, wildlife, water, and human health and safety.

**Management Direction**

*Desired Condition [SEE PROPOSAL]*

*Regulatory Framework [SEE PROPOSAL]*

**Environmental Justice, EO 12898 of February 11, 1994**

Sites where herbicides would be used is dependent on the presence of selected species of trees of the appropriate size within the areas proposed for two-aged shelterwood harvest and are not determined based on proximity to low-income or minority populations. Use of herbicide as part of this project on other state, federal, or private lands would not occur.

**Environmental Consequences**

**Methodology**

For each herbicide proposed for use an analysis of risk was conducted using the SERA Risk Assessment spreadsheets. Treatment methods and application rates were entered into these spreadsheets. The output is a series of Hazard Quotients (HQ) for human health and for ecological resources that represent extreme situations. The spreadsheet discloses HQs for a variety of scenarios including accidental exposure and situations that are highly unlikely occurrences within treatment areas.

Several of the scenarios result in HQs that exceed 1.0. This does not mean that unacceptable impacts exist or the action should not occur. The results from the

spreadsheet assessments were interpreted and project design criteria and protective measures taken into consideration. **The result of this interpretation is that the use of these herbicides as proposed are within the range of acceptable risk (HQ<1.0) to human health and ecological resources.** Hazard Quotients for accidental scenarios, while they provide additional information, are not applicable to the proposed activities. That is, the Forest Service does not propose to have accidents. Interpretations of the HQs are summarized below. The results from this analysis will be used by resource specialists to incorporate into consideration of impacts to their respective resources.

***Assumptions***

- Label direction would be followed
- PPE would be used
- Forest Plan Direction would be followed
- Proposed application rates analyzed would not be exceeded
- Applications would be supervised by Forest Service certified applicators or Kentucky certified applicators
- Accidental spills are not planned
- Application rates are “maximum” planned, lower amounts may be applied
- Aquatic Zone, for this assessment, is within 30 feet of a water body
- Areas treated with herbicide will be posted/signed for a minimum of 30 days
- Treatment shall not be performed during rain, snow, sleet, dew and/or when the same is expected within the following six-hour period.

***Information Sources***

The Human Health and Ecological Risk Assessments for the herbicides were prepared for the Forest Service by Syracuse Environmental Research Associates, Inc. and are considered to be the best available science.

***Spatial and Temporal Context for Effects Analysis***

For herbicide applications, the spatial boundary will be the area(s) treated with herbicide. The proposal includes a maximum of 170 acres of NFS lands could be treated over the life of the project (estimated at three to five years) using herbicides. Temporal boundaries would be 30 days following application to allow for absorption and biological degradation of the chemical.

**Proposed Action**

This alternative includes the use of herbicides on a maximum of 170 acres over the life of the project on national forest system lands. Table 2 presents a summary of the number of trees per acre expected to be treated for the proposed action and alternatives. These treatments and acres are in addition to authorizations that currently exist or future proposals.

***Project Design Features***

The proposal includes several design criteria that would be implemented when using herbicides.





<b>Ground:</b>	<b>Temperatures</b>		<b>Humidity</b>	<b>Wind (at</b>
	<b>Higher</b>	<b>than</b>	<b>Less Than</b>	<b>Target)</b>
	<b>(°F)</b>		<b>(%)</b>	<b>Greater Than</b>
				<b>(MPH)</b>
Hand (cut surface)	n/a		n/a	n/a
Hand (other)	98		20	15
Mechanical (liquid)	95		30	10
Mechanical (granular)	n/a		n/a	10

- ✓ **DB-VEG-10.** Use only nozzles that produce large droplets (mean droplet size of 50 microns or greater) or streams of herbicide. Nozzles that produce fine droplets may be used only for hand treatment, where distance from nozzle to target does not exceed eight feet.
- ✓ **DB-VEG-11.** Areas treated with herbicides are to be clearly posted with notice signs to warn visitors of the treatment.
- ✓ **DB-VEG-12.** No herbicide is to be applied aerially.
- ✓ **DB-VEG-13.** No soil-active herbicide will be applied within 30 feet of the dripline of non-target vegetation specifically designated for retention (e.g., den trees, hardwood inclusions, adjacent stands) within or next to treated area.
- ✓ **DB-VEG-14.** Do not apply triclopyr within 60 feet of known occupied gray, Virginia big-eared, or Indiana bat hibernacula or known maternity tree.
- ✓ **DB-VEG-15.** Do not apply 2,4-D or 2,4-DP.
- ✓ **DB-VEG-16.** No broadcast treatment using herbicide is to be made within 60 feet of any known PETS plant species.
- ✓ **DB-VEG-17.** No soil-active herbicide is to be applied within 60 feet of any known PETS plant species.
- ✓ **DB-VEG-18.** Application equipment, empty herbicide containers, clothing worn during treatment, and skin are not to be cleaned in open water or wells. Mixing and cleaning water must come from a public water supply and be transported in separate, labeled containers.
- ✓ **DB-VEG-19.** No herbicide shall be applied within 30 horizontal feet of lakes, wetlands, perennial or intermittent springs (seeps) and streams. However, herbicides approved for aquatic use may be used when such treatment is required to control invasive plants.
- ✓ **DB-VEG-20.** Necessary buffer zone areas must be designated before making herbicide treatments so applicators can easily recognize and avoid the buffer area.
- ✓ **DB-VEG-21.** Herbicide mixing, loading, or cleaning areas in the field are not to be located within 200 feet of private land, open water or wells, or other sensitive areas.
- ✓ **DB-VEG-30.** No herbicide may be broadcast within 100 feet of private land or 300 feet of a private residence, unless the landowner agrees to closer treatment.

***Direct and Indirect Effects***

Herbicides are a tool and not a resource. Therefore there are no effects to herbicides. The use of herbicides could have effects to resources and have been analyzed using the Human Health and Ecological Risk Assessments for the herbicides, rates and application methods proposed. The Risk Assessments disclose impacts in the form of a Hazard Quotient (HQ). A HQ that is less than 1.0 is considered to be acceptable risk (Forest Plan, Standard DB-VEG-8). The results of the risk assessments are summarized in Appendix A. Risk Assessments include analysis at a “Central”, “Lower” and “Upper” levels. The HQs in the “Central” column are used to determine level of risk.

With the advent of the SERA risk assessments, an *Extreme Value Risk Assessment* approach was taken in which almost no values used in a risk assessment are presented as a single number. Instead, most numbers used in calculating risk values are expressed as a central estimate and a range, which is sometimes very large. The “central” estimate

In the summaries, many of the Risk Assessments resulted in HQs that are greater than 1.0. On the surface this may be alarming, but further consideration of the assumptions used in the Risk Assessments, applying the design criteria and a probability of occurrence is a reasonable way to further refine the HQs from the Risk Assessments.

### **Combination Formulation: Imazapyr and Triclopyr**

#### **TRICLOPYR FORMULATIONS**

Each of the seven treatments analyzed below have two spreadsheets; one for triclopyr and one for TCP (3,5,6-Trichloro-2-pyridinol), an environmental metabolite of triclopyr. (Triclopyr RA, 2.2, p.4)

Target species – Woody Plants

Application Method – Cut Stump

Application Rate – 1 lbs ae/acre (Triclopyr), 0.45 lbs ae/acre (Imazapyr)

Hazard Quotient Summary:

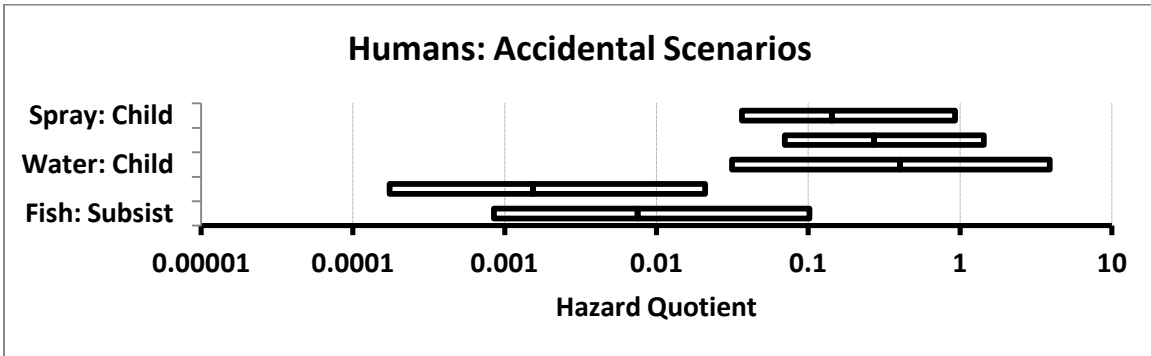
- Worker – Exposures are all less than 1.0 HQ unless noted below:
  - General Exposure – Chronic Exposures
    - **Contaminated Gloves, 1hour, HQ= 1.9 (Central), 8.0 (Upper)**
    - **General, HQ=6 (Upper)**

Applicators will wear PPE that minimizes direct contact. Gloves will be changed periodically and if they become damp from application. Properly maintain equipment to avoid leaks.

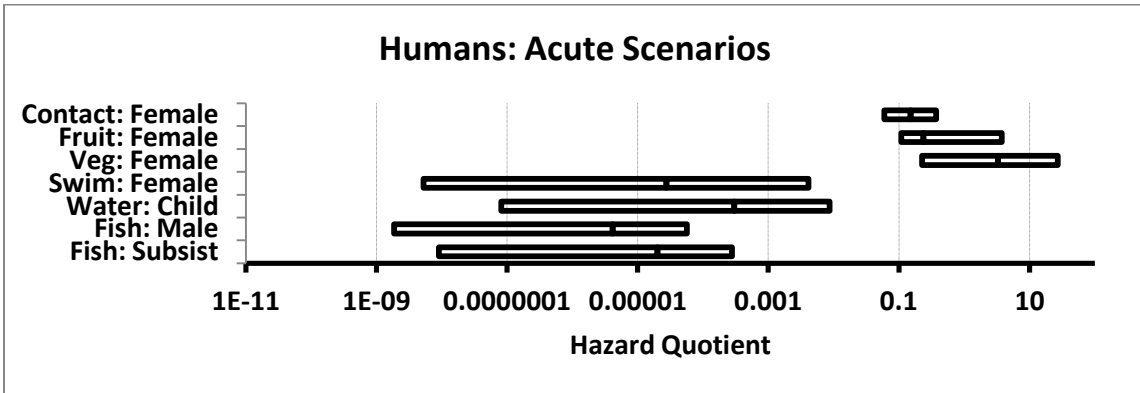
**For this reason the HQ for Workers is less than 1.0.**

- General Public - exposures are less than 1.0 HQ unless noted below:

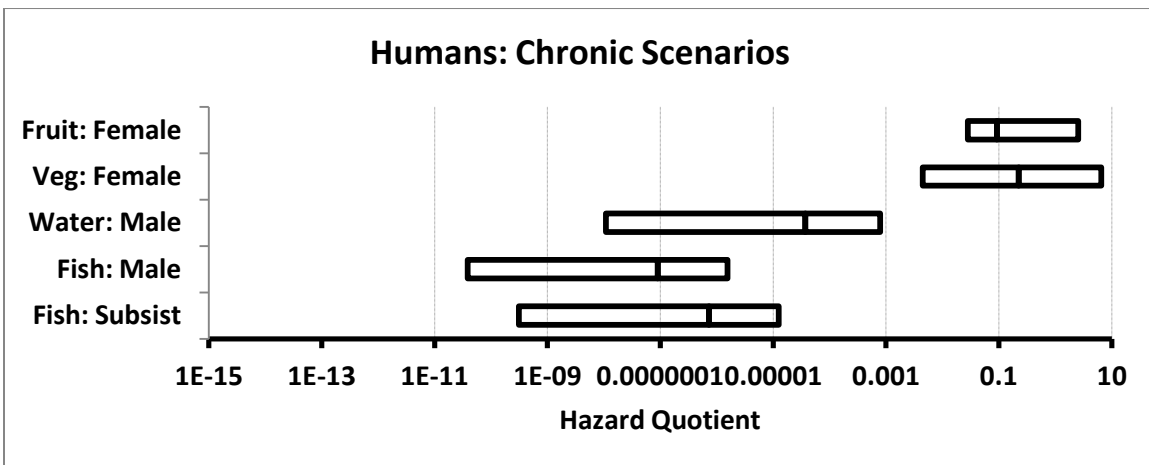
- Accidental acute exposure



- Non-accidental acute exposure



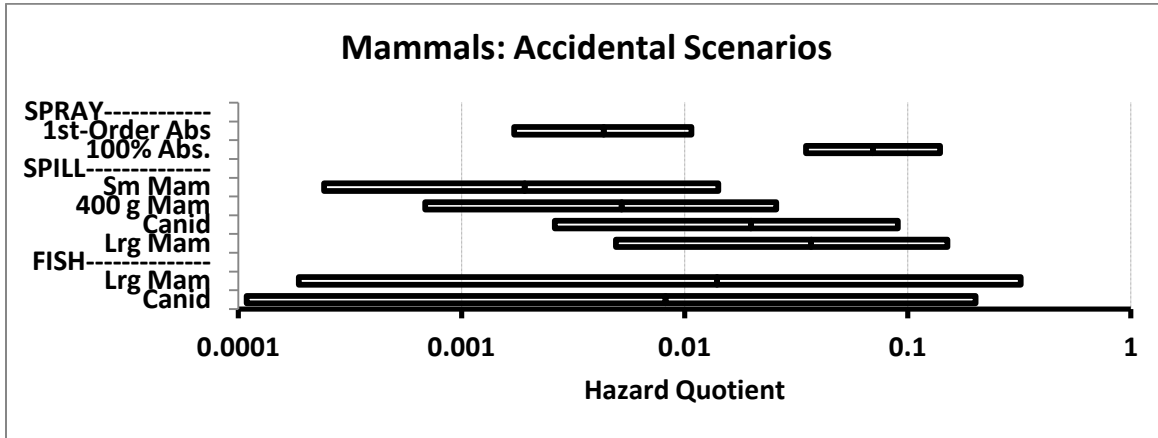
- Non-accidental chronic exposure



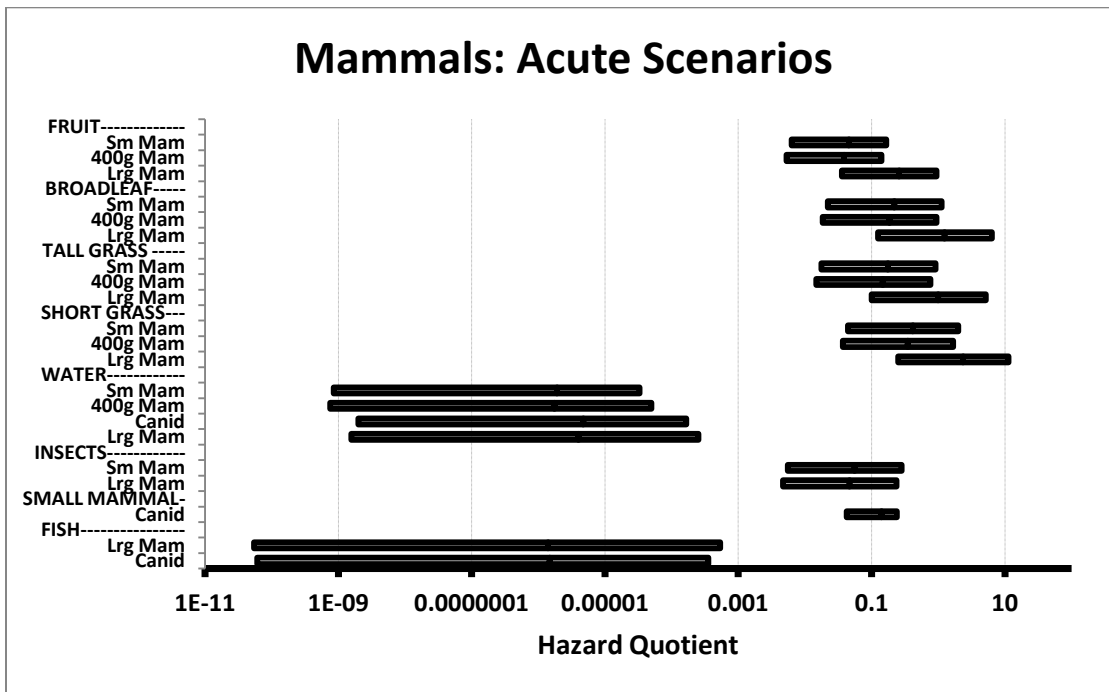
The scenario described above is highly conservative and designed to demonstrate the “worst case” scenarios for purposes of the risk assessment. They are regarded as extreme and some are to the point of limited plausibility. Following Forest Plan direction and project design criteria makes an accidental spill into water available for consumption highly unlikely. This treatment would occur greater than 30’ from any open water. This is an extreme and unlikely scenario with a probability of occurrence near zero. Treatment will not occur in Forest Plan Prescription Area – Source Water Prescription Area zone 1. There are no subsistence populations in the area. It is highly unlikely that treated vegetation/fruit would be consumed by anyone. It is highly unlikely that treated vegetation would be consumed by anyone. Treated areas would be signed.

**For these reasons the HQ for General Public is less than 1.0.**

- Terrestrial Animals – exposures are less than 1.0 HQ unless shown below:
  - Accidental Acute Exposure

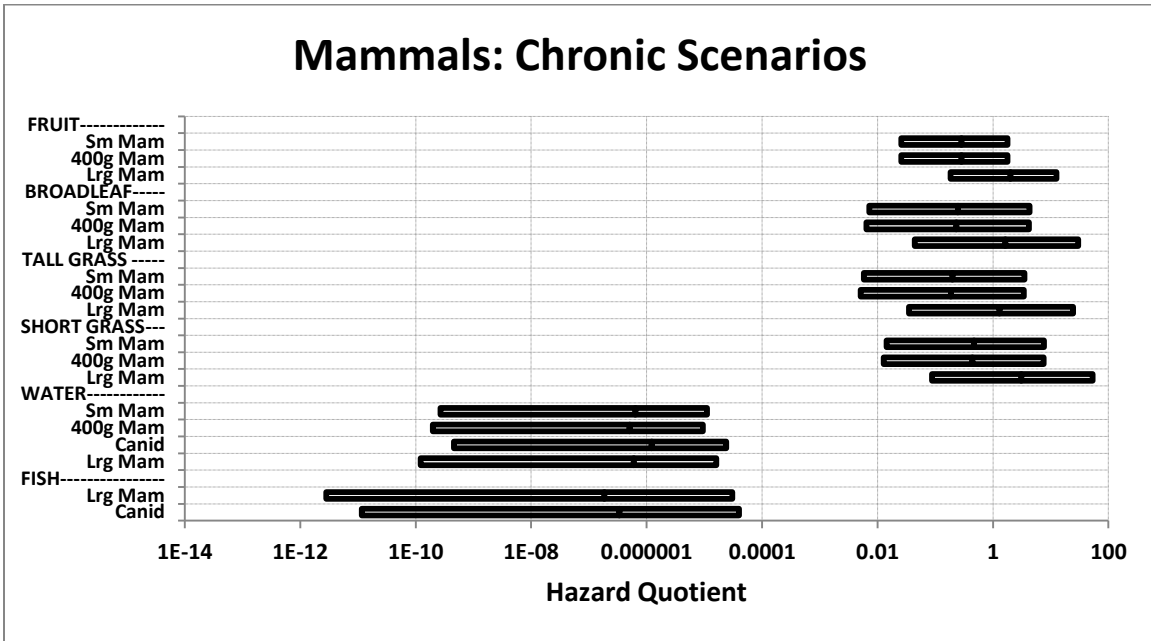


- Non-Accidental Acute Exposures



Cut Stump application is a highly directed method with very little to no overspray and it is unlikely to result in residue accumulation on short grasses or fruit. In addition, insects are unlikely to be directly sprayed. Insects may come in contact with treated stumps but are unlikely to become highly contaminated due to only a small part of the insect surface area coming in contact with the treated surface and the relatively quick drying time of this treatment. It is unlikely that all the insects eaten by a bird would be contaminated. Contamination of insects is greatly reduced once the chemical has been absorbed and dried on the cut surface, usually less than 2 hours.

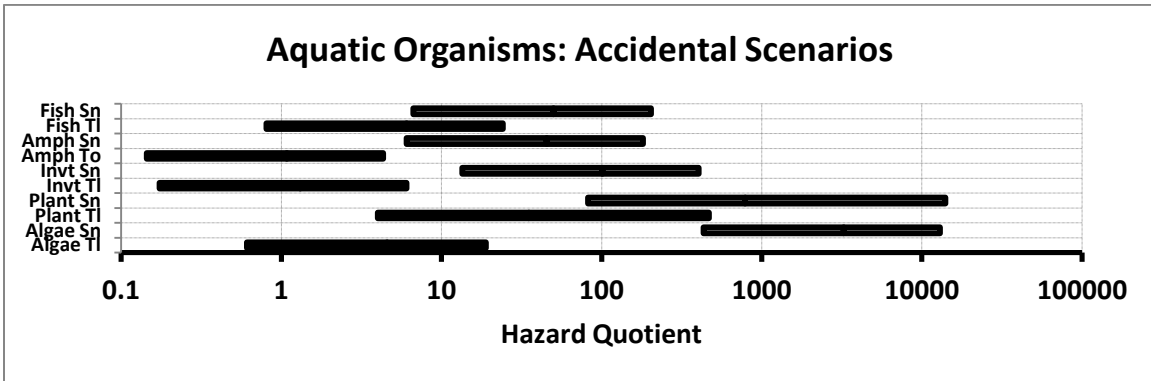
- Chronic/Longer Term Exposures



Cut Stump application is a highly directed method and it is unlikely to result in residue accumulation on short grasses or fruit.

**For this reason the HQ for Terrestrial Animals is less than 1.0.**

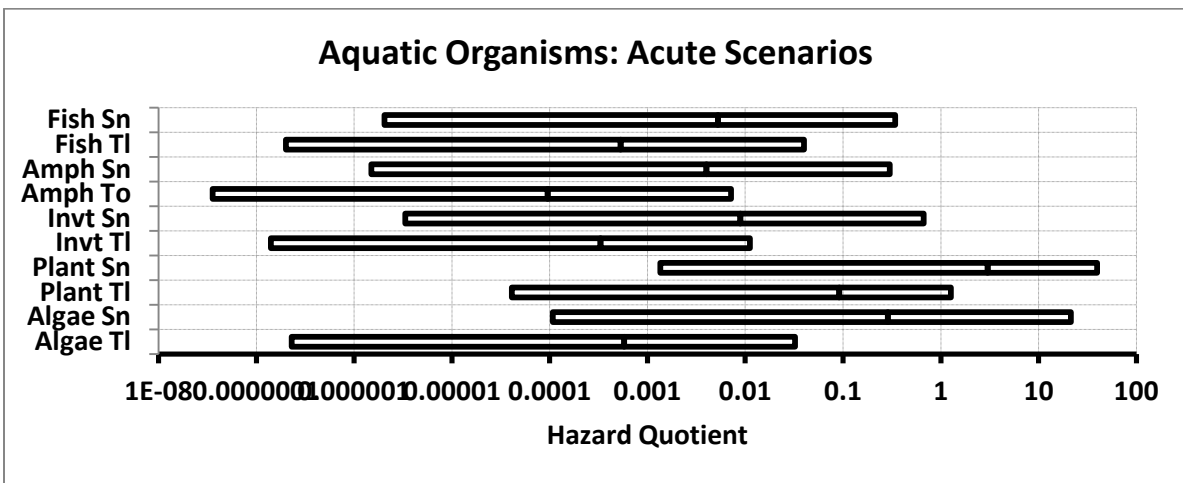
- Aquatics – exposures are less than 1.0 HQ unless shown below:
  - Accidental Acute Exposure



The scenario described above is highly conservative and designed to demonstrate the “worst case” scenarios for purposes of the risk assessment. They are regarded as extreme and some are to the point of limited plausibility. Following Forest Plan direction and project design criteria makes an accidental spill into any water highly unlikely. This treatment would occur greater than 30’ from any open water. This is an extreme and

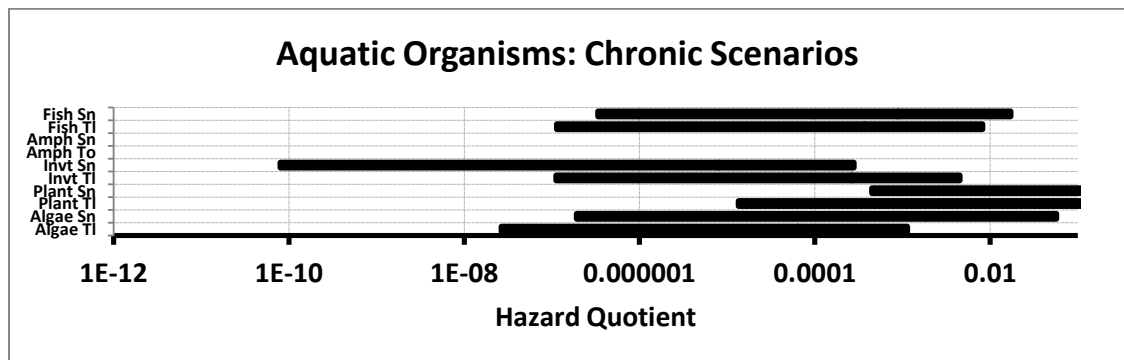
unlikely scenario with a probability of occurrence near zero. The following Forest Plan Standards further minimize the probability of occurrence: **DB-VEG-18** - Application equipment, empty herbicide containers, clothing worn during treatment, and skin are not to be cleaned in open water or wells. Mixing and cleaning water must come from a public water supply and be transported in separate, labeled containers; and **DB-VEG-19** - No herbicide shall be applied within 30 horizontal feet of lakes, wetlands, perennial or intermittent springs (seeps) and streams. However, herbicides approved for aquatic use may be used when such treatment is required to control invasive plants.

- Non-Accidental Acute Exposure



The scenario described above is highly conservative and designed to demonstrate the “worst case” scenarios for purposes of the risk assessment. They are regarded as extreme and some are to the point of limited plausibility. Following Forest Plan direction and project design criteria makes an accidental spill into any water highly unlikely. This treatment would occur greater than 30’ from any open water. This is an extreme and unlikely scenario with a probability of occurrence near zero.

- Chronic/Longer Term Exposures



The scenario described above is highly conservative and designed to demonstrate the “worst case” scenarios for purposes of the risk assessment. They are regarded as extreme and some are to the point of limited plausibility. Following Forest Plan direction and project design criteria makes an accidental spill into any water highly unlikely. This treatment would occur greater than 30’ from any open water. This is an extreme and unlikely scenario with a probability of occurrence near zero.

**For these reasons the HQ for Aquatic Species is less than 1.0.**

***Cumulative Effects***

Herbicides are a tool and not a resource therefore consideration of cumulative effects is not appropriate here. Cumulative effects to resources would be considered by resource specialists as they incorporate the results of these risk assessments into their respective assessment of effects.

**Alternative A**

Treatment of selected species of trees from this proposal would not occur with the use of herbicides. However, the use of herbicides would continue under existing authorizations and new proposals.

***Cumulative Effects***

Herbicides are a tool and not a resource therefore consideration of cumulative effects is not appropriate here. Cumulative effects to resources would be considered by resource specialists as they incorporate the results of these risk assessments into their respective assessment of effects.

**Alternative B**

Treatment of selected species of trees from this proposal would not occur with the use of herbicides. However, the use of herbicides would continue under existing authorizations and new proposals.