MAY 2000

TRANSMISSION SYSTEM VEGETATION MANAGEMENT PROGRAM

Final Environmental Impact Statement - Appendices
DOE/EIS-0285

Arrow-leaf Balsamroot

Cooperating Agencies

BONNEVILLE POWER ADMINISTRATION

Bonneville Power Administration
Transmission System Vegetation Management Program

Final Environmental Impact Statement
DOE/EIS-0285

APPENDICES

May 2000

Table of Contents

Appendix A – Public Involvement: Publications

Appendix B – Biological Weed Control Agents

Appendix C – Bonneville Pesticide Applicator Certification Plan

Appendix D – Sample Educational Information

Appendix E – Clearance Criteria

Appendix F – FS Mitigation Measures and Background

Appendix G – BLM Mitigation Measures and Background

Appendix H – Herbicide Fact Sheets

2,4-D
Azafenidin
Bromacil
Chlorsulfuron
Clopyralid
Dicamba
Dichlobenil
Diuron
Fosamine Ammonium
Glyphosate
Halosulfuron-methyl
Hexazinone
Imazapyr
Isoxaben
Mefluidide
Metsulfuron-methyl
Oryzalin
Paclobutrazol
Picloram
Sulfometuron-methyl
Tebuthiuron
Triclopyr
Trinexapac-ethyl

APPENDIX A
PUBLIC INVOLVEMENT: PUBLICATIONS

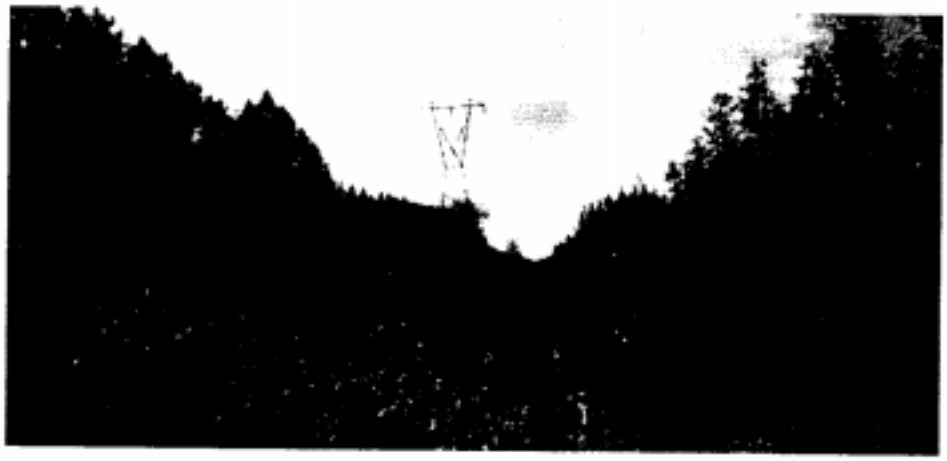
INFORMATION FROM THE BONNEVILLE POWER ADMINISTRATION

fYi

FOR YOUR INVOLVEMENT

JUNE 1997

VEGETATION MANAGEMENT PROGRAM REVIEW



Bonneville Power Administration (BPA) is starting a Draft Environmental Impact Statement on its vegetation management program. The analysis will review how BPA controls vegetation along our rights-of-way and around our facilities. This *fyi* tells you about our plans and explains how you can receive more information and provide us your ideas.

BACKGROUND

BPA provides electricity throughout the Pacific Northwest using a network of transmission lines and substations. To maintain safe and reliable power, BPA must control the vegetation, including large trees, around electrical transmission facilities. Those facilities include rights-of-way and the area next to them, substations, access roads, microwave sites and beam paths, and maintenance facilities.

A major electric power outage occurred on August 10, 1996, caused in part by trees that had grown too close to transmission lines. The outage affected a number of other utilities linked to the federal system. As a result, BPA looked at its brush control practices and decided it should make changes to increase program efficiency and effectiveness.

BPA's 1983 environmental impact statement on the vegetation management program is out of date because it does not include methods and products that are currently available. We now manage

PROJECT PARTNERS

BPA works with many others in developing an EIS. For this project we are working closely with:

U.S. Forest Service

U.S. Department of Interior, Bureau of Land Management

vegetation using a variety of techniques, depending on what's appropriate for a specific location and situation. This approach leads to inconsistency and inefficiency.

PROPOSAL

BPA proposes to review the program and establish a set of principles to guide the use of vegetation management techniques. Our objective is to provide a cost-effective, consistent, efficient, and environmentally acceptable means of controlling vegetation that may threaten transmission system safety and reliability.

ENVIRONMENTAL IMPACT STATEMENT

The EIS will identify alternative ways of controlling vegetation and analyze how each alternative affects the environment. We will look at how different vegetation control methods affect water quality, plant communities, human health and safety, cultural resources, fish and wildlife populations, land use, and other resources.

This EIS will provide the *framework* for making decisions about vegetation control. It will not replace *site-specific* environmental analysis, which will still be done when needed for individual projects.

We plan to have the Draft EIS available for review in January 1998.

EIS SCHEDULE

Start comment period	June 16, 1997
Open house meeting	July 10, 1997
Last day for comments	July 23, 1997
Draft EIS ready for public review	Jan., 1998
Final EIS	August, 1998
Decision	Nov., 1998

HOW YOU CAN HELP

Your ideas can help us analyze the vegetation management program. There are several ways for you to share your thoughts.

- Complete and mail the enclosed comment form.
- Call our toll-free comment line at 1-800-622-4519; in Oregon, call (503) 230-3478.
- Fax comments to (503) 230-3984.
- E-mail comments: *comment@bpa.gov*
- Mail comments to Public Affairs Office, Bonneville Power Administration - AC, P.O Box 12999, Portland, Oregon 97212.

Or, attend our open house meeting. You can come at any time since there will be no formal presentation.

Thursday, July 10, 1997
3 - 7 p.m.
BPA Headquarters - Room 106
905 NE 11th Avenue
Portland, Oregon

The last day to send comments is July 23, 1997.

FOR MORE INFORMATION

To continue receiving information on this EIS, please return the enclosed post card. Otherwise you may be removed from the mail list. Our next *fyi* will summarize all the comments we received.

Feel free to call the environmental staff that is developing this EIS.

- Leslie Kelleher - (503) 230-7692
- Molly Koester - (503) 230-5920
- Tammie Vincent - (503) 230-3469

Bonneville Power Administration
PO Box 3621 Portland, Oregon 97208-3621
DOE/BP-3001 JUNE 1997 BC

INFORMATION FROM THE BONNEVILLE POWER ADMINISTRATION

fYi

FOR YOUR INVOLVEMENT

DECEMBER 1997

VEGETATION MANAGEMENT PROGRAM EIS

This fyi reports back to you on what people told us about BPA's vegetation management program: problems with what we do now and ideas on how we could improve. We sought these comments to help us develop the scope and content of the Environmental Impact Statement we are preparing on the vegetation management program.

Below, we explain how we sought comments, give an overview of what we heard, and list sample comments. On the back page is a project update.

TO GET YOUR VIEWS....

In June, we mailed a letter to nearly 1500 people and groups we thought would be interested in or affected by our vegetation management program. We enclosed a comment form and asked for comments by July 23.

In July, we held meetings with BPA personnel in our seven regions—the people responsible for BPA's vegetation management. We held meetings in Covington, The Dalles, Eugene, Kalispell, Olympia, Spokane, and Walla Walla. When we couldn't arrange meetings in regional offices, we met in the field or talked on the phone. We recorded all comments on flip charts or in notebooks. Throughout those meetings, we met and talked with about 40 people.

PROJECT PARTNERS

BPA works with many others in developing an EIS. For this project we are working closely with:

U.S. Department of Agriculture, Forest Service

U. S. Department of Interior, Bureau of Land Management

BONNEVILLE POWER ADMINISTRATION

Because many BPA facilities are located on lands managed by the Forest Service and the Bureau of Land Management, we specifically targeted those agencies for comment. (Both are partners with BPA in developing this EIS.)

Our facilities also cross lands that are important to Tribes. We are meeting with Tribes that have transmission lines crossing their reservations to learn about their interests in our practices.

Our facilities also cross and abut land under private ownership. On July 10, we held an open house meeting at BPA's Portland Headquarters office. Few attended. We knew this broad program approach would not attract as many comments from private landowners as a site-specific proposal; yet, the views of private landowners who neighbor our facilities are vital. For this reason, we are reviewing public comments about vegetation management from earlier site-specific projects and will include them in the study design.

OVERVIEW

In total, we received 641 comments. Besides the comments from the meetings, we received 25 comment forms, six letters, and two phone calls. (We count each idea as a separate comment.)

The key points we heard:

- Nearly all see value in developing the environmental impact statement; most hope it will result in changes to BPA's vegetation management program; many have differing, even conflicting, expectations.
- Chemical treatment by far drew the most comments; some favor its use; some don't; most have specific ideas about when its use is appropriate.
- Other frequently mentioned topics: the Forest Service and noxious weeds.
- Commenters from outside BPA focused on rights-of-way; BPA staff commented on all BPA facilities: rights-of-way, substations, microwaves, access roads and other.
- Commenters were fairly uniform in their support for natural-looking right-of-way favoring low-growing native vegetation, especially grass, and irregular or "soft" edges.
- Main concern of BPA staff: electrical reliability and cost; of others: environmental impacts.

SUMMARY

To produce this summary, we grouped similar comments by subject; we used 10 categories: Techniques/Alternatives, Environmental Resources, Electrical Facilities, Outside Agencies, Current BPA Programs and Practices, Implementation Tools, Cost, EIS Information, Proposed Program and Practices, and Other. The table shows how many comments were in each category.

TECHNIQUES/ALTERNATIVES

The 349 comments in this category covered 10 vegetation management techniques or alternatives: chemical, manual, mechanical, low-growing plant communities, fire management, disposal, biological, reseeding, grazing, and other techniques/alternatives. Here's a sample of what we heard.

Chemical

Need to look at new industry developments for different herbicides and mixes.

Foliar spray and broadcast spray should be included in Draft EIS.

(BPA should) manual cut, then stump treat.

Workers need a current list of environmentally friendly herbicides that we can use.

COMMENT SUMMARY AT A GLANCE...

The 641 comments were grouped into 10 categories. Many comments fit more than one category for a total of 1058. Subcategories reflect specific concerns.

Techniques / Alternatives	**349**
Chemical	*174*
Manual	*45*
Mechanical	*26*
Low growing plant communities	*24*
Fire management	*18*
Biological	*17*
Disposal	*11*
Reseeding	*11*
Other techniques/alternatives	*23*
Environmental Resources	**212**
Vegetation	*86*
Wildlife	*23*
Safety	*21*
Water	*17*
Sensitive and T&E species	*15*
Aesthetics	*13*
Geology	*10*
Sensitive areas	*9*
Fish	*7*
Land use	*7*
Other environmental resources	*4*
Electrical Facilities	**120**
Rights-of-way	*42*
Substations	*34*
Access roads	*18*
Facility grounds	*14*
Microwave	*12*
Outside Agencies	**104**
Forest Service/Bureau of Land Management	*51*
Tribes	*19*
Other outside agencies	*34*
Current BPA Programs and Practices	**88**
Implementation Tools	**56**
Cost	**50**
EIS Information	**49**
Proposed Program and Practices	**20**
Other comments	**10**
TOTAL	**1058**

3

In high desert areas, we mow, but we would need to chemically treat after.

Almost all spray uses an oil base instead of water to mix it because we can use it in rain.

We want helicopter spraying at least for noxious weed control.

Need to get back into using herbicides on Forest Service and Bureau of Land Management land because we are getting 3 foot resprout in one year.

I'd prefer you use nothing dangerous to humans, animals, or the planet!

Manual

Manually cutting without (chemical) treatment causes brush to come back thicker...

We use chain saws and treat stumps ...

...hand cutting...leaves too much slash....

In areas with sensitive plants, hand methods...are preferred.

Mechanical

...Compaction with machinery is a problem in some areas.

(We) need to mow in some areas within city limits on fee-owned easements (to) promote good neighbor attitude...

EIS should cover helicopter side-trimming and manual side-trimming (of trees).

Low growing plant communities

To establish low-growing plant communities, use native species that occur in the area such as grasses, forbs, and low shrubs.

I believe management for meadow under the lines may be helpful for meadow dependent species such at the Fenders' Blue Butterfly. Also these can serve as firebreak points.

...more low growing dense rooted grasses (for) low fire and erosion control...competition with weeds, and are adapatable to soils and area's rainfall.

Fire management

Burning brush piles is not an option. We need to educate folks that smoke causes flash over.

4 *BPA should look at fire as a vegetation management technique.*

Biological

...look at biological treatments like insects and fungus.

State brought in goats (Klamath County) to eat "leafy spurge".

I'd prefer that you maintain shrub and grass for browsing and grazing...because this is "light" on the land...

Disposal

... Address amount of slash left on the ground. Slash around here doesn't rot...its a fire hazard and landowners complain.

...Consider opportunities to provide for the removal of merchantable sawtimber and other wood products...

...consider leaving sufficient trees, snags, and large down woody material adjacent to streams for eventual recruitment into the stream.

Reseeding

Use native species in any planting or seeding...

We would also like to be able to grass-seed the rights-of-way after brush control, so the weeds don't grow again.

In areas where slopes are too steep to be reshaped...reseed with species appropriate to the soils, microclimate, and terrain conditions...

Other Techniques / Alternatives

Steam: consider it as a means of ground sterilization.

...use an integrated land management approach.

...use a combination of all available methods, depending on specific situation...

ENVIRONMENTAL RESOURCES

The 212 comments on environmental resources were organized into 11 subcategories: vegetation; wildlife; safety; water; sensitive, threatened, and endangered species; aesthetics; geology; sensitive areas; fish; land use; and other environmental resources.

Vegetation

Noxious weeds are a concern. Where left unchecked, they cause social and economic loss.

County weed board takes care of noxious weeds. County picks up chemical from BPA and applies it.

(The Yakama Tribe uses) global positioning system (to show) infestations (of noxious weeds).

Your equipment has lots of weeds on them. Yellow star thistle, knapweed, and skeleton weed are spreading as a result.

Spray your weeds!

...no set process for inspecting for danger trees around substations and in microwave beam paths.

Replant rights-of-way with height-appropriate vegetation rather than "decapitate" conifers...

Wildlife

Please be sure your environmental studies include wildlife use for the right-of-way, habitat use, migration routes...

Convert area to brush species providing forage for big game and hunting areas for owls and birds of prey.

Raptor Protection. In western Wyoming, raptors, particularly osprey, will occasionally use transmission line structures for nesting...

Safety

We need to educate that building up to substations has associated hazards.

There is a safety issue on high voltage facilities; that's why ground needs to be bare of vegetation.

...Drift of herbicide and electric safety are big issues.

Water

Include impacts of all toxics (herbicides, pesticides) on water quality...

Leave vegetative buffers next to all water bodies when possible.

Sensitive, threatened, and endangered species

... the meadow concept can help restore endangered and threatened plants and animals to a more viable level.

(One of your draft EIS's)...lists ten herbicides. Everyone of these would decimate any rare plant population.

Concerned about: The need for BPA preparation of needed Biological Assessment, including those for sturgeon and bull trout.

Aesthetics

What looks better? noxious weeds or native plants?

Propose treatments which maintain, enhance or improve visual quality.

Use selective clearing of timber...to soften the edge between cleared and uncleared areas.

Geology

...mowing...causes too much ground disturbance...

I'd prefer you use mechanical removal that does not compact soil or encourage erosion.

Sensitive areas

Identify where sensitive areas are and their special treatments, then manage full right-of-way.

I am concerned about the treatment of lines near riparian areas.

Fish

...create/manage plant communities that will provide...shade to riparian areas...

Most herbicides are moderately to highly toxic to fish and aquatic organisms.

...If water based chemicals are to be applied by aircraft...minimize the possibility of water contamination by chemicals.

Land Use

...consider potential off-road vehicle effects and management implications...

Consider use of the rights-of-way for trails and trail-based recreation.

Avoid construction in or adjacent to recreation sites and areas during peak use times.

Other Environmental Resources

Include impacts on cultural plants, cultural resources, fish and wildlife.

Include economic uses of removed vegetation (mill rip trees for lumber)...

5

ELECTRICAL FACILITES

The 120 comments on electrical facilities were grouped by type of site: rights-of-way, substations, access roads, facility grounds, and microwaves.

Rights-of-way

Within the required right-of-way, trees can be allowed to grow taller and extend out into the opening near the towers...

Leave as much brush and small trees as possible...to soften the contrast between the corridor opening and the adjacent forest.

Once BPA clears right-of way, BPA should plant what it wants to grow.

Substations

In substations, we use...(ground sterilant).

...area outside substation fence must be clear of vegetation...

Substation water drains off BPA grounds and carries herbicides if application is not done right.

Substation uses burner on weeds which will cause some seeds to germinate.

Some herbicides are corrosive and we can't use them in substations.

Access roads

On access roads, we may blade, cut brush, or spray, on top of our annual grading.

...(we) use a hydro ax.

We would like to use herbicides (on access roads) so we don't have to go back so often...

Facility grounds

Mechanical control of cover crops (with brush hog) is used on BPA property outside of the substation.

Many times the quickest and most efficient mechanical control around substations would be with a string trimmer.

Microwaves

For beam paths/microwave facility, (we) use chain saws...

...uses "weed blast" around microwaves.

There are other non-BPA users at microwave sites that could do vegetation control.

OUTSIDE AGENCIES

The 104 comments about other agencies or governments were grouped by Forest Service, and Bureau of Land Management,tribes, and other outside agencies.

Forest Service and Bureau of Land Management

Each Forest Service ranger district has different requirements.

Does BPA really need to have it's own approved list of herbicides...Forest Service has a list we should be able to use.

...the Forest Service (has) more requirements and regulations...at BPA we are concerned about maintaining reliability and safety and staying in business; these goals contradict each other.

BPA has established specific protocol regarding T&E with Fish and Wildlife Service, but some Forest Service districts question it still.

Naturally, we are concerned that BPA's vegetation management proposals remain consistent with the many and varied National Forest Service resource management objectives and standards.

BLM, eastern regions, likes brush control.

On Tribal, Forest Services, or BLM land, BPA needs to get in when there is a "reasonable need" versus "emergency need".

Tribes

The tribal economy is negatively affected by vegetation management.

...tribal reservation lands deal with land in a totally different way. Tribes live off the land, have a different way of looking at land; gather roots for food.

Other outside agencies

Make sure state, county, and local agencies have input.

We contract with County weed agent to spray...for noxious weeds.

...confer with (state fish and game department)...when vegetation management (is) proposed for rights-of-way that cross habitat management units.

BPA should consult with state, county, local and federal fire management officials to ensure...proposals fully consider fire/fuel management objectives for each specific area.

CURRENT BPA PROGRAMS & PRACTICES

Current BPA vegetation management programs and practices drew 88 comments; most from BPA staff.

We are reactive, not proactive.

Every district has different vegetation management problems.

We need to do more one-on-ones (with landowners).

Rights-of-way get most attention because of safety and reliability.

Most vegetation management is crisis management at this time.

IMPLEMENTATION TOOLS

The 56 comments we received on implementation tools covered six areas: timing; education/training; landowner coordination; internal coordination; tree/brush agreements; and vegetation management plans.

We need to do more education; let people know what's safe.

All operators need to be certified.

BPA's technical staff needs to be aware of all new methods.

BPA needs to propose actions or make applications well in advance of the intended implementation date.

...Need better communication on agreements.

Need...current Standard Procedure Instruction Information (SPIF) on herbicides.

COST

Most of the 50 comments about the cost of vegetation management were in dollar-terms; a few spoke of staffing.

...we always run out of money. We can only cut the "hot spots."

The lack of money is causing us to not promote low growing plant communities which can lengthen control cycles(and) save money.

Maybe there is a way to work or cost share with private companies (industrial forests) when our objectives are compatible...

Yakama (Tribe) would prefer to receive the funding directly and do the work themselves...

(Look at using) summer program for high schoolers.

EIS INFORMATION

We received 49 comments on items we should include in the Draft EIS.

In EIS, develop prescriptions for site specific; identify which herbicide in wetlands, etc.

Pattern EIS after standards and recommendations that came out in August 10 (outage) report.

EIS needs to be open ended to cover new techniques in the future.

An EIS that only portrays ONE alternative that a reasonable person could select is not "a choice among alternatives." Convey the values behind the alternatives you portray...

PROPOSED PROGRAM & PRACTICES

We received 20 comments on a proposed vegetation management program or practices.

Suggest BPA cut everything on right-of-way on forest land. Then, go back in 1 or 2 years and do selective clearing.

Don't want restrictions on use of in-house staff or contractors because of budget and site specific factors.

OTHER COMMENTS

We received ten other comments. Most were requests for information on other BPA activities.

* * *

Each comment has been reviewed by the project team and given to the appropriate environmental specialist working on the Draft EIS. The comments will be used to develop the alternatives and conduct the analysis.

PROJECT UPDATE

We have begun to develop the Draft EIS. It will identify alternative programs for controlling vegetation and analyze how each program would affect the environment. The program analysis will include how different vegetation control methods affect water quality, plant communities, human health and safety, cultural resources, fish and wildlife populations, land use, and other resources.

The EIS will provide the framework for making decisions about vegetation control. It will address the following issues:

- Methods of controlling vegetation,
- Methods to minimize or avoid impacts to sensitive areas or species,
- Types of vegetation that need controlling,
- Types of electrical facilities and their needs for vegetation control, and
- Landowner/manager coordination.

The EIS will not address: other components of reliability or safety of the power system; other right-of-way issues, such as limiting unauthorized vehicle access; management details for implementation, such as budget and staffing; and site-specific analysis.

This EIS will not replace site-specific environmental analysis, which will still be done when needed for individual sensitive areas.

We plan to have the Draft EIS available for review this winter. We will let you know when it is available.

FOR MORE INFORMATION

If you have questions about the project,call Stacy Mason at (503) 230-5455 or Tammie Vincent at (503) 230-3469 or write them at the address below.

EIS SCHEDULE

Draft EIS/public review	**Winter 1998**
Final EIS	**Aug 1998**
Decision	**Nov 1998**

Bonneville Power Administration
PO Box 3621 Portland, Oregon 97208-3621

DOE/BP-3023 DECEMBER 1997 1715

HELPING TO ENSURE GOVERNMENT-TO-GOVERNMENT RELATIONSHIPS

CROSSINGS

Vegetation Management

Bonneville Power Administration (BPA) is just starting an environmental study on its vegetation management program. The analysis will review how BPA controls vegetation along our rights-of-way and around our facilities. Because some of our facilities may be on or near lands that are important to you, we would like to tell you about our plans, hear about your ideas and interests, and learn how we can work together.

HOW YOU CAN HELP

Your ideas can help us develop a vegetation management program that considers your cultural, natural, and economic resources. The following questions are sample discussion points.

Do BPA's actions to control vegetation affect lands or activities that are important to you? Which areas near the transmission lines are most important to you?

Do you prefer that we use some control techniques instead of others? (Examples are: mowing, hand cutting, and herbicide application.) Why?

An ideal plant cover for rights-of-way is a low-growing variety that requires little maintenance. Do you have suggestions on how to transform the rights-of-way to low-growing plant communities?

Do you have vegetation management plans or other information that we need to consider?

Would you like a BPA person to meet with you or other Tribal members to discuss these or other topics?

BACKGROUND

BPA provides electricity throughout the Pacific Northwest using a network of transmission lines and substations. To ensure safe and reliable power, BPA must control the vegetation, including large trees, around electrical transmission facilities. Those facilities include rights-of-way and the area next to them, substations, access roads, microwave sites and beam paths, and maintenance facilities.

A major electric power outage occurred on August 10, 1996, caused in part by trees that had grown too close to some transmission lines. The outage affected a number of other utilities linked to the federal system. As a result, BPA looked at its brush control practices and decided it would be best to make changes to increase program efficiency and effectiveness.

BPA's 1983 environmental impact statement on the vegetation management program is out of date because it does not include methods and products that are currently available. We now manage vegetation using a variety of techniques, depending

BONNEVILLE POWER ADMINISTRATION

on what's appropriate for a specific location and situation.

PROPOSAL

BPA proposes to review the program and establish a set of principles to guide the use of vegetation management techniques. The objective of the proposed action is to provide the most cost-effective, efficient, and environmentally acceptable means of controlling vegetation throughout BPA's system.

ENVIRONMENTAL IMPACT STATEMENT

A Draft Environmental Impact Statement (EIS) is being prepared. The EIS will identify alternative ways of controlling vegetation and analyze how each alternative affects the environment. We will look at how different vegetation control methods affect water quality, plant communities, human health and safety, cultural resources, fish and wildlife populations, land use, and other resources.

This EIS will provide the framework for making decisions about vegetation control. It will not replace site-specific environmental analysis, which will still be done when needed for individual projects.

We plan to have the Draft EIS available for review in January 1998.

We have invited the U.S. Forest Service and the Bureau of Land Management to be cooperating agencies in this EIS process because some of BPA's facilities are located on lands these agencies manage.

POTENTIAL BENEFITS

The new vegetation management principles should result in the following benefits:

- Efficiency
- Effectiveness
- Consistency
- Environmental quality
- A safe, reliable electrical system

THE PATH TO BPA

BPA wants to work with you — government to government. We'd like to talk with you about your interest in this proposal. Please tell us if there is someone on your staff you'd like us to work with.

For information on this or any BPA proposal, contact your BPA Tribal Liaison:

- Katherine Cheney - (509) 358-7470
- Darrell Eastman - (503) 230-3869
- Patricia Tawney - (503) 230-4315

Or, feel free to call one of the contacts for the environmental staff that is developing this EIS:

- Leslie Kelleher - (503) 230-7692
- Molly Koester - (503) 230-5920
- Tammie Vincent - (503) 230-3469

Bonneville Power Administration

PO Box 3621 Portland, Oregon 97208-3621

DOE/BP-2999 JULY 1997 100

HELPING TO ENSURE GOVERNMENT-TO-GOVERNMENT RELATIONSHIPS

CROSSING PATHS

Vegetation Management

Bonneville Power Administration (BPA) has just issued an environmental study on its vegetation management program for your review. The Draft Environmental Impact Statement compares alternatives and analyzes environmental impacts of managing vegetation along our rights-of-way and around our facilities. BPA's preferred alternative favors an approach that fosters low-growing plant communities; expands our vegetation management "tool-box" to include aerial herbicide application; and proposes planning steps for deciding the right tool for specific sites.

WHAT WE HEARD FROM YOU

We first contacted you about this two years ago. We received information from many of you to help us develop the alternatives and impacts for study. We heard your concerns about protecting cultural plants on and off reservation lands, and a desire to work with us to control the spread of noxious weeds and to establish native vegetation. We heard: "...the land provides us with spiritual well-being." Some said herbicide use was an appropriate method if used properly; others said from the traditional native people's perspective chemicals should not be used.

PREFERRED ALTERNATIVE

Our preferred alternative differs from our historical practices in three ways. First, BPA would promote low-growing plant communities along rights-of-way. In the long-term this could help reduce the spread of noxious weeds by lessening soil disturbance and the amount of vegetation management control needed. On some lands we may be able to work with tribes to replant low-growing traditional use plants.

Second, BPA would expand its tool-box of vegetation control methods. Those methods would include manual (mainly chainsaws), mechanical (heavy equipment use), herbicides, and biological (approved insects for noxious weeds). Herbicides would include 24 herbicide active ingredients and four herbicide application techniques: spot (one plant at a time), localized (small group of plants), broadcast (large area sprayed by truck or all-terrain vehicle) and aerial (helicopter or small plane). We would provide mitigation measures for all methods, and limit the areas where some methods could be used, such as no aerial spraying on your tribal reservations.

Third, we would develop right-of-way management plans to protect resource lands. For example, we would like to develop a right-of-way management plan when a tribe has BPA facilities on their reservation. The plan would outline environmental resources to protect (such as cultural plants) and the vegetation control methods to use. The plan could also include protections for tribal publics who may venture onto a site. We already have management plans with some tribes, but would like to have them for all tribal reservations.

BONNEVILLE POWER ADMINISTRATION

HOW YOU CAN HELP

Now that the Draft EIS is out for review, we would appreciate your help again.

- Does the Draft EIS include the right vegetation management tools?
- Does the EIS respond to the ideas and address the concerns we heard earlier?
- Is our proposed program consistent with your vegetation management plans and tribal laws? If not, how do they differ?
- Do the mitigation measures adequately protect cultural plants, fishing and hunting rights?
- Have we addressed the implementation concerns sufficiently to address concerns for protecting tribal resources and tribal publics?
- Are our proposed alternatives for managing vegetation around our electric facilities across the Northwest acceptable to the tribal government?
- What additional mitigation or implementation procedures would you recommend to address continuing concerns, if any?

BACKGROUND

BPA maintains a network of 15,000 miles of transmission line, 350 electric substations and numerous non-electric facilities such as storage yards, throughout the Northwest - a region of diverse vegetation. Because vegetation can interfere with electric power flow and pose safety problems, management of vegetation around our facilities is an important part of our work.

These facilities cross the reservation lands of at least 10 tribes. About 1,400 miles of the transmission line right-of-way cross lands where tribes may have fishing, gathering and hunting rights.

THE PATH TO BPA

BPA wants to work with you - government to government. We'd like to talk with you about your interest in this proposal. If we are not already working with your staff on this proposal, please tell us if there is someone on your staff you'd like us to work with.

For information on this or any BPA proposal, contact BPA toll free, 1-800-282-3713.

Ask for your tribal liaison:

- Darrell Eastman
- Bob Shank
- Patricia Tawney
- For tribes outside the Columbia Basin, ask for John Smith

To speak with the environmental project lead for this environmental impact statement, ask for Stacy Mason.

Bonneville Power Administration

P.O. Box 3621 Portland, Oregon 97208-3621

DOE/BP-3209 AUGUST 1999 250

B O N N E V I L L E P O W E R A D M I N I S T R A T I O N

Transmission System Vegetation Management Program

"I'd Like to Tell You . . . "

1. Of the choices offered in the Draft EIS, I prefer: _____

2. I do not like: _____

3. You can improve the choices by: _____

4. I have these other comments: _____

5. I need more information about: _____

(Use back of sheet if you need more room)

☐ Please put me on your project mailing list. (You are already on the mail list if you received this in the mail.)

Name _____

Address _____

Please mail your comments by October 9, 1999 to:
Bonneville Power Administration
Communications Office - KC-7
P.O. Box 12999
Portland, OR 97212

APPENDIX B
BIOLOGICAL WEED CONTROL AGENTS

Current Status of Biological Weed Control Agents in Oregon, Washington, and Idaho

Weed	Agent	Distribution			Infestation			Control			Availability		
		OR	WA	ID	OR	WA	ID	OR	WA	ID	OR	WA	ID
Bindweed, field	*Aceria malherbae*	—	U	—	—	O	—	—	U	—	—	O	—
Broom, Scotch	*Agonopterix nervosa*	W	W	—	H	M	—	P	U	—	M	M	—
	Apion fuscirostre	W	L	—	H	L	—	G	F	—	M	L	—
	Leucoptera spartifoliella	W	L	—	M	M	—	F	U	—	M	L	—
Gorse	*Agonopterix nervosa*	W	W	—	M	M	—	U	U	—	M	M	—
	Exapion ulicis	W	L	—	H	H	—	G	G	—	M	L	—
	Tetranychus lintearius	W	L	—	H	M	—	U	U	—	M	L	—
Hemlock, poison	*Agonopterix alstroemeriana*	W	W	W	M	H	M	G	E	G	M	M	M
Knapweed, brown	*Urophora quadrifasciata*	L	L	U	L	M	U	U	U	U	L	M	O
Knapweed, diffuse	*Bangasternus fausti*	L	U	U	M	U	U	G	U	U	L	O	O
	Larinus minutus	L	L	—	M	H	—	G	G	—	L	M	—
	Pterolonche inspersa	F	F	U	—	—	U	—	—	U	O	—	O
	Sphenoptera jugoslavica	W	W	W	H	H	H	G	G	G	M	M	M
	Urophora affinis	W	W	W	M	H	M	G	G	F	M	M	M
	Urophora quadrifasciata	W	W	W	H	H	M	G	G	F	M	M	M
Knapweed, meadow	*Urophora quadrifasciata*	L	L	—	L	M	—	U	F	—	L	M	—
Knapweed, Russian	*Subanguina picridis*	L	L	—	S	U	—	F	U	—	O	O	—
Knapweed, spotted	*Agapeta zoegana*	L	L	L	H	M	U	G	U	U	M	L	O
	Bangasternus fausti	L	U	U	L	U	U	G	U	U	L	O	O
	Chaetorellia acrolophi	L	U	—	L	L	—	U	U	—	O	O	—
	Cyphocleonus achates	L	L	U	L	L	U	U	F	U	L	O	O
	Larinus minutus	L	L	U	H	H	U	G	G	U	M	M	O
	Larinus obtusus	U	L	—	U	L	—	U	U	—	O	O	—
	Metzneria paucipunctella	W	W	W	H	H	M	G	G	G	M	M	M
	Pterolonche inspersa	F	—	—	—	—	—	—	—	—	O	—	—
	Terellia virens	L	U	—	L	U	—	U	U	—	O	O	—
	Urophora affinis	W	W	W	M	H	M	G	G	G	M	M	M
	Urophora quadrifasciata	W	W	W	H	H	M	G	G	G	M	M	M
Knapweed, squarrose	*Urophora affinis*	L	—	—	S	—	—	U	—	—	L	—	—
	Urophora quadrifasciata	L	—	—	M	—	—	U	—	—	L	—	—
Loosestrife, purple	*Galerucella calmariensis*	L	L	L	H	M	S	E	F	U	L	L	O
	Galerucella pusilla	L	L	L	H	M	S	E	F	U	L	L	O
	Hylobius transversovittatus	L	L	U	M	L	—	L	U	—	L	L	O
	Nanophyes marmoratus	L	U	—	M	U	—	F	U	—	L	O	—
Puncturevine	*Microlarinus lareynii*	L	F	F	L	—	—	G	—	—	L	—	—
	Microlarinus lypriformis	L	F	F	L	—	—	F	—	—	L	—	—
Ragwort, tansy	*Longitarsus jacobaeae*	W	W	—	H	H	—	E	E	—	M	M	—
	Pegohylemyia seneciella	W	W	—	H	H	—	F	G	—	M	M	—
	Tyria jacobaeae	W	W	—	H	H	—	E	E	—	M	M	—
Sage, Mediterranean	*Phrydiuchus tau*	W	—	W	H	—	H	G	—	U	M	—	M
St. Johnswort	*Agrilus hyperici*	L	L	W	H	H	H	E	E	E	M	L	M
	Aplocera plagiata	L	W	W	M	M	M	G	F	F	M	M	M
	Chrysolina hyperici	W	W	W	H	H	H	E	E	E	M	M	M
	Chrysolina quadrigemina	W	W	W	H	H	H	E	E	E	M	M	M
Skeletonweed, rush	*Cystiphora schmidti*	L	W	W	L	H	H	F	E	G	L	M	M
	Eriophyes chondrillae	L	W	W	L	H	H	G	E	E	L	M	M
	Puccinia chondrillina	L	W	W	L	H	H	F	E	F	M	M	M
Spurge, leafy	*Aphthona abdominalis*	U	—	—	U	—	—	U	—	—	O	—	—
	Aphthona cyparissiae	L	L	L	M	M	L	G	F	U	L	L	O
	Aphthona czwalinae	L	L	U	M	L	U	F	U	U	L	O	O
	Aphthona flava	L	L	L	M	M	L	F	F	U	L	L	O
	Aphthona lacertosa	L	L	U	M	M	U	F	U	U	L	L	O
	Aphthona nigriscutis	L	L	L	M	M	L	G	F	U	L	O	O
	Chamaesphecia crassicornis	U	—	—	U	—	—	U	—	—	O	—	—

Distribution within host range: W = widespread; L = limited sites; F = failed to establish; U = unknown status; — = not released

Infestation of hosts: H = heavy (> 70%); M = medium (> 30%); L = light (> 10%); S = slight (< 1%); O = none detected; U = unknown status

Control ability on seeds and/or plant density: E = excellent; G = good; F = fair; P = poor; U = undetermined

Availability for redistribution: M = mass collections; *L = limited; O = not collectable at present

*Limited availability indicates agent populations are slow in building or are recently introduced. Work on these species should be coordinated through biological control specialists at the state department of agriculture or state university. Collection and/or transportation of biological control agents may require special permits and procedures.

CURRENT STATUS OF BIOLOGICAL WEED CONTROL AGENTS—continued

Weed	Agent	Distribution OR	Distribution WA	Distribution ID	Infestation OR	Infestation WA	Infestation ID	Control OR	Control WA	Control ID	Availability OR	Availability WA	Availability ID
Spurge, leafy (cont'd)	*Oberea erythrocephala*	L	U	U	S	U	U	U	U	U	L	O	O
	Spurgia esulae	F	U	U	—	U	U	—	U	U	O	O	O
Starthistle, yellow	*Bangasternus orientalis*	W	W	W	H	H	M	G	G	G	M	M	M
	Chaetorellia australis	L	W	W	H	H	M	E	G	G	M	M	M
	Chaetorellia succinea	L	U	—	H	U	—	E	U	—	M	O	—
	Eustenopus villosus	L	W	L	H	H	H	E	E	E	L	M	L
	Larinus curtus	L	L	L	H	L	M	G	F	U	M	O	L
	Urophora sirunaseva	W	L	L	M	M	L	F	F	U	M	L	L
Thistle, bull	*Urophora stylata*	W	L	—	H	M	—	G	F	—	M	L	—
Thistle, Canada	*Ceutorhynchus litura*	L	F	L	L	—	M	G	—	U	L	—	L
	Larinus planus	L	W	—	H	M	—	F	F	—	M	M	—
	Rhinocyllus conicus	L	W	L	M	H	L	F	G	F	L	M	L
	Urophora cardui	L	L	U	M	M	U	F	F	U	M	M	O
Thistle, Italian	*Rhinocyllus conicus*	W	—	L	H	—	H	G	—	U	M	—	L
	Trichosirocalus horridus	U	—	—	U	—	—	U	—	—	O	—	—
Thistle, milk	*Rhinocyllus conicus*	W	—	—	H	—	—	G	—	—	M	—	—
Thistle, musk	*Rhinocyllus conicus*	W	W	W	H	H	H	G	E	G	M	M	M
	Trichosirocalus horridus	U	—	—	U	—	—	U	—	—	O	—	—
Thistle, plumeless	*Rhinocyllus conicus*	—	W	W	—	H	H	—	E	G	—	M	M
	Trichosirocalus horridus	—	L	—	—	L	—	—	U	—	—	O	—
Thistle, slenderflower	*Rhinocyllus conicus*	W	—	—	H	—	—	G	—	—	M	—	—
Toadflax, Dalmatian	*Calophasia lunula*	U	W	L	U	H	L	U	G	U	O	M	L
Toadflax, yellow	*Brachypterolus pulicarius*	L	L	L	M	M	M	F	F	F	L	L	L
	Calophasia lunula	—	—	L	—	—	M	—	—	F	—	—	L
	Gymnetron antirrhini	L	L	L	M	H	H	U	G	U	L	L	L

Biological Agents and Their Roles

The biological agents introduced into the Pacific Northwest for the biological control of weeds, the general role of each agent, and type of introduction (C = classical and A = accidental).

Species	Role
Aceria malherbae	bud/leaf gall mite C
Agapeta zoegana	root boring moth C
Agonopterix alstroemeriana	defoliating moth A
Agonopterix nervosa	shoot tip moth A
Agrilus hyperici	root boring beetle C
Aplocera plagiata	defoliating moth C
Aphthona abdominalis	root/defoliating flea beetle C
Aphthona cyparissiae	root/defoliating flea beetle C
Aphthona czwalinae	root/defoliating flea beetle C
Aphthona flava	root/defoliating flea beetle C
Aphthona lacertosa	root/defoliating flea beetle C
Aphthona nigriscutis	root/defoliating flea beetle C
Apion fuscirostre	seed weevil C
Bangasternus fausti	seed head weevil C
Bangasternus orientalis	seed head weevil C
Brachypterolus pulicarius	flower beetle A
Calophasia lunula	defoliating moth C
Ceutorhynchus litura	crown/root weevil C
Chaetorellia acrolophi	seed head fly C
Chaetorellia australis	seed head fly C
Chaetorellia succinea	seed head fly A
Chamaesphecia crassicornis	root boring moth C
Chrysolina hyperici	defoliating beetle C
Chrysolina quadrigemina	defoliating beetle C
Cyphocleonus achates	root boring/gall weevil C
Cystiphora schmidti	stem/leaf gall midge C
Eriophyes chondrillae	bud gall mite C
Eustenopus villosus	seed head weevil C
Erapion ulicis	seed weevil C
Galerucella calmariensis	leaf beetle C
Galerucella pusilla	leaf beetle C
Gymnetron antirrhini	seed head weevil A
Hylobius transversovittatus	root boring weevil C
Larinus curtus	seed head weevil C
Larinus minutus	seed head weevil C
Larinus obtusus	seed head weevil C
Larinus planus	seed head weevil A
Leucoptera spartifoliella	twig mining moth A
Longitarsus jacobaeae	root/defoliating flea beetle C
Metzneria paucipunctella	seed head moth C
Microlarinus lareynii	seed weevil C
Microlarinus lypriformis	stem boring weevil C
Nanophyes marmoratus	flower bud weevil C
Oberea erythrocephala	stem boring beetle C
Pegohylemyia seneciella	seed head fly C
Phrydiuchus tau	crown/root weevil C
Pterolonche inspersa	root boring moth C
Puccinia chondrillina	rust fungus C
Rhinocyllus conicus	seed head weevil C
Sphenoptera jugoslavica	root boring/gall beetle C
Spurgia esulae	shoot tip gall midge C
Subanguina picridis	stem/leaf gall nematode C
Tarella virens	seed head fly C
Tetranychus lintearius	spider mite C
Trichosirocalus horridus	root/crown weevil C
Tyria jacobaeae	defoliating moth C
Urophora affinis	seed head gall fly C
Urophora cardui	stem gall fly C
Urophora quadrilasciata	seed head gall fly A
Urophora sirunaseva	seed head gall fly C
Urophora stylata	seed head gall fly C

APPENDIX C
BONNEVILLE PESTICIDE APPLICATOR CERTIFICATION PLAN

BONNEVILLE POWER ADMINISTRATION PESTICIDE APPLICATOR CERTIFICATION PLAN

INTRODUCTION

The Bonneville Power Administration (BPA), Department of Energy (DOE), operates and maintains a regional electrical system covering five States (Oregon, Washington, Idaho, Montana, and Wyoming) in the Pacific Northwest. As routine maintenance activities, BPA provides for inspection and treatment of in-service wood structures, and manages vegetation on rights-of-way and at electrical substations to protect the reliability of the electrical system, provide safe and efficient work areas, and protect and enhance the environment. These activities are not limited to, but may include, the application of wood preservatives to retard agents of wood decay, and application of herbicides to manage undesirable plant species. When pesticides are used, applicators will be certified in the right-of-way certification category and/or the wood treatment category.

Section 3 of the Federal Insecticide, Fungicide, and Rodenticide Act, as amended (FIFRA) (PL 92-516) (7 U.S.C. 136B) directs the Administrator of the United States Environmental Protection Agency, (EPA) to classify the various uses of pesticides as either "General Use" or "Restricted Use." "Restricted Use" pesticides may only be applied by "certified" applicators, or those working under the direct supervision of a certified applicator. Accordingly, the Administrator of EPA is directed to establish standards for the certification of applicators of Restricted Use pesticides and is authorized to approve State and/or Federal Certification Plans, (FIFRA, Section 4), (Federal Agency Certification of Federal Employees to Apply Restricted Use Pesticides, FR 42(161):41907-41908, August 19, 1977).

Only applicators of Restricted Use pesticides are required to be certified under FIFRA. However, three of the five States in the BPA service area require certification of applicators applying General Use pesticides with motorized equipment. BPA has adopted this requirement in its plan in accord with the EPA requirement that Federal agencies adhere to State substantive standards affecting pesticide use as a condition of approval for Federal Agency Certification Plans, (FR 42(161):4108; August 19, 1977.

Therefore, this document has been prepared in support of application to the EPA by BPA for approval of a Federal Certification Plan for Federal Employees, to certify those employees of BPA who use or supervise the use of both Restricted Use and General Use pesticides, with the exception of General Use pesticides applied by non-motorized equipment. BPA certification will only be granted to BPA employees, and will only be valid in performance of their official duties.

I. RESPONSIBILITY AND AUTHORITIES FOR ADMINISTRATION OF THE PLAN

A. Departmental (DOE) Responsibility and Authority

Overall responsibility for the development, implementation , and surveillance of this Plan rests with the BPA under the guidance of the DOE. Responsibilities will be consistent with existing DOE policies as discussed below.

The DOE environmental policy provides for conduct of all operations in an environmentally safe and sound manner with paramount concern for protection of the environment and the public, and for coordination of DOE's compliance activities at the Headquarters Level. Mandatory Standards specifically include compliance with FIFRA and all relevant implementing regulations (U.S. DOE Orders No. 5480.4 (5/14/84)) for all DOE and DOE contractor operations. This Order also provides authority for independent overview to assess compliance, and corrective action and follow-up when non-compliance is noted. Heads of Field Organizations (e.g., BPA Power Administrator) are directed to assure compliance.

Environmental Protection, Safety, and Health Protection Information Reporting Requirements are specified in DOE Order 5484.1 (2/24/81). This Order provides that ". . . notification of occurrences involving DOE and DOE contractor operations be made to the responsible authority; that all occurrences be investigated; that reports be submitted to responsible DOE officials; that management take responsible action and that there be consistency in the treatment of such occurrences . . . . " This order would support the record keeping and reporting for pesticide use activities as detailed later in this proposed plan.

Enforcement of the provisions of this proposed plan is supported by DOE Order 5482.1A (8/13/81). The order describes procedures for implementing an Environmental Protection, Safety, and Health Protection Appraisal Program, and details factors to be used in performing an appraisal. Requirements of this Order have been incorporated into the BPA Environmental Appraisal Program (see below).

Compliance with the DOE policies and procedures outlined above constitutes the agency regulatory framework which both allows for and supports implementation of the provisions of this proposed plan by the BPA.

B. BPA's Responsibility and Authority

In compliance with the DOE policies outlined above, BPA will be responsible for the administration of this proposed plan. Administration will consist of development, implementation, and surveillance and funding of pesticide use training, certification, and record keeping and reporting as provided below. These procedures will be implemented upon approval of this plan, and are consistent with BPA policies and responsibilities listed below.

The BPA Environmental Manual, Chapter 955, Pesticides, states that BPA employees applying pesticides will comply with FIFRA and applicable State standards. The Chapter further designates responsibilities within the organization for various aspects of pesticide use and management. Specific responsibilities for various aspects of pesticide use and management are reiterated and emphasized again in the BPA Right-of Way Management Standards and in BPA Environmental Standard and Procedures.

Specific procedures and instructions involving application, safety, transportation, storage, and disposal of pesticides, spill clean up, residue monitoring, and other aspects of pesticide use are contained in the Transmission Line Maintenance Standards, Procedures, Instructions, and Informations (SPIF's). Responsibilities designated in these documents would not change upon approval of the plan, with the exception that BPA pesticide applicators would obtain Federal certification in lieu of State certification, and procedures for becoming certified would change in conformance with this plan.

C. BPA/State Regulator Interaction

1. Cooperation in Abating Environmental Pollution

BPA will cooperate with the Administrator, EPA, and State, interstate, and local agencies in the prevention, control, and abatement of environmental pollution caused by pesticide use. Report of instances of misuse or falsification of records by non-BPA personnel (i.e., contractor applicators) will be sent to the appropriate State or EPA regional official for enforcement. BPA will cooperate with the State(s) or EPA in any subsequent enforcement action undertaken.

2. Compliance with Standards and Regulations

In accordance with guidelines as may be issued by the EPA Administrator, BPA shall comply with more stringent State substantive standards and limitations and with Federal regulations and guidelines which affect pesticide use.

3. Environmental Assessments and/or Impact Statements

Environmental Assessments (EA) and/or Environmental Impact Statements (EIS) may support some right-of-way vegetation management programs that involve the use of pesticides. EIS's and EA's are available to States.

4. Adherence to State Standards

BPA will cooperate with individual States by adhering to substantive standards which exceed or are additional to those established in this plan in compliance with Executive Order 12088. BPA is responsible for all in-service wood structure maintenance and vegetation management program activities within its service area, and for establishment of policy, planning, and funding of policy, planning, and funding of right-of-way maintenance and vegetation management programs.

5. Resolution of BPA/State Discrepancy

If a state should decide that a given substantive standard is more stringent than, or is additional to, standards established in this plan, it should notify BPA and request compliance.

BPA will forward all such notifications to the EPA Administrator immediately and, as soon as possible thereafter, forward its opinion as to whether the standard is substantive or administrative in nature. BPA agrees that the EPA administrator will undertake liaison between the affected parties and mediate such conflicts in cases of disagreement between BPA and a State.

6. Use of State Pesticide Applicator Certification Plan

BPA personnel with pesticide application responsibilities which are not adequately addressed by this plan, or where economic or other criteria make it inefficient to use the proposed BPA Pesticide Applicator Certification Plan, shall comply instead with an EPA Approved State Pesticide Applicator Certification Plan. A State certification will be valid only for that State in which certification is granted.

II. PROVISIONS OF THE PLAN

Provisions of this plan include: (a) training and certification of pesticide applicators: (b) enforcement of pesticide misuses and/or falsification of records; (c) right-of-entry for review of records; and (d) pesticide use record keeping. The Vice President for Transmission Field Services, will be responsible for implementing and monitoring all provisions of the plan.

A. Training and Certification

BPA will certify applicators, of both General and Restricted Use pesticides, except those BPA applicators who are applying general use pesticides by non-motorized equipment.[1]* Certification will be in accordance with the EPA Standards of Competency detailed in 40CFR 171.4, with competency to be determined by a written examination. If BPA employees require training prior to the examination, educational materials and/or training courses will be provided. Specific procedures are discussed in Section IV, Standards for Certification.

B. Enforcement of Pesticide Misuse and/or Falsification of Records

Misuse of a pesticide for the intent and purpose of this Plan shall consist of any of the following:

1. Use of a pesticide not in accordance with labeling, except as allowed by Section 2 (ee) of FIFRA.

2. Use of any pesticide which is under an experimental use permit contrary to the provisions of such permit.

[1] This exemption is consistent with Oregon State Standard (ORS 634.116 (15)(b) and Washington State Standard (RCW 17.21.220).

3. Use of a pesticide not in accordance with substantive State standards.

4. Use of a pesticide not in accordance with all BPA Standards, Procedures, Instructions, or Informations (SPIF's) and with Environmental Standard and Procedures (ESP's).

Falsification of records for the intent and purpose of this plan shall consist of failure to maintain or falsification of any part of those records required by Section II.D. of this plan.

Either misuse of a pesticide or falsification of records will result in both: (1) denial, suspension, or revocation of certification as appropriate; and (2) additional administrative disciplinary actions. disciplinary actions shall be in accordance with the provisions of the Federal Insecticide, Fungicide, and Rodenticide Act. (FIFRA 171.7.b.1.ii.B), DOE regulations regarding Conduct of Employees (FR 44(82)"24696-24709, April 26, 1979) and Bonneville Manual Section 400/751A, Personnel-Disciplinary Action. Disciplinary action will be the responsibility of the employee's supervisor, who will in turn request that the Vice President for Transmission Field Services deny, suspend, or revoke certification.

Instances or misuse of a pesticide or falsification of records by BPA employees who are State or EPA certified will be reviewed under the same provisions as those for BPA certified applicators. As appropriate, BPA will administratively deny, suspend, or revoke these BPA employees' privileges to apply pesticides on BPA facilities. Since BPA cannot deny, suspend, or revoke a State or EPA issued certificate, except for use on BPA facilities, BPA will report the incident accompanied with a report of its internal actions and findings to the appropriate certifying authority. BPA will cooperate with the State or EPA any subsequent actions undertaken.

Instances of misuse or falsification of records by non-BPA employees (i.e., contractor applicators) will be forwarded to the appropriate State and/or EPA Regional Office. BPA will cooperate with the State(s) or EPA in any subsequent enforcement action undertaken.

C. Provisions for Right-of-Entry Consent

BPA will provide for entry for appropriate Federal and State pesticide enforcement and certification authorities to BPA offices, facilities, all lands owned or leased, or rights-of-way controlled or under the jurisdiction of BPA during normal working hours, or at other times, if given advance notification for the purposes of reviewing BPA certified pesticide applicator's vegetation management methods and activities, and to observe the use and application of pesticides, to inspect and/or sample any pesticide, record, device, container, product, apparatus, or equipment used in pesticide use management programs, and to inspect and/or sample any pesticide treated areas, rights-of-way, or lands where pesticides have been used, applied, or disposed.

D. Pesticide Use Record Keeping

BPA will require all BPA certified applicators to keep routine operational records of pesticide use including kinds, amounts, uses, dates, and places of application for both general and restricted use pesticides and to retain such records for at least 2 years. Records for herbicide application will be kept on BPA Form 1416 ((Appendix A), and records for wood treatment will be kept on BPA Form 1007 (Appendix B). Records will be retained in the appropriate BPA Regional Office. Such records will be available to appropriate EPA or State officials for review upon request, (see also Section II. C., Provisions for Right-of-Etry Consent).

III. REPORTING

A. BPA will submit annual reports on the certification of applicators and activities related to restricted use pesticides to the administrator of EPA as specific in 40 CFR, Section 171.7(d). Annual reports will be submitted by March 1 of each year for the fiscal year preceding. A copy of the 1996 Annual Report is attached (Appendix C).

B. Other reports may be requested and shall be made available to meet specific needs on a case-by-case basis.

IV. STANDARDS FOR CERTIFICATION

A. Who Will Be Certified

BPA employees who use or supervise the use of any pesticide either General or Restricted Use within the conduct of their official duties to BPA rights-of-way, substations, or other facilities except those applying general use pesticides by non-motorized equipment will be identified by the Regional Field Services Manager, Regional Field Services Specialist, Linemen Foreman III or Substation Chief Operator to the Vice President for Transmission Field Resources, as requiring certification. For the intent and purposes of this Plan, the term "supervise" shall mean direct supervision as defined in CFR 171.6. BPA will further require the physical presence of the supervisor or a licensed applicator within line of sight or hearing distance of the employee.

BPA personnel for whom BPA certification is not efficient or responsive to the needs of the Administration may alternatively be certified by an EPA Approves State Pesticide Applicator Certification Plan. However, State certification will be valid only in the State granting certification. (See also Section I.C.6.).

All contractors or non-BPA employees will be required to comply with applicable State certification programs.

B. Categories for Certification

BPA will certify its employees only as commercial applicators in two categories:

Right-of-Way
Wood Treatment

The BPA plan adopts the EPA Right-of-Way category as defined at 40 CFR 171.3 (b) (6) and accompanying standards of competency at 40 CFR 171.4 (c) (6).

EPA has not established a specific wood treatment category. Therefore, the BPA plan has developed a wood treatment category and accompanying standards of competency. These are contained at "C. Definition of Wood Treatment category", below).

There are presently 150 applicators certified in the right-of-way category. There are anticipated to be 100 applicators certified in the wood treatment category.

Any future requests for approval of additional categories or subcategories will be made in writing to the Administrator of EPA in conformance with 40 CFR 171.7(d)(1)(ii).

C. Definition of Wood Treatment category

Wood treatment. This category includes commercial applicators using or supervising the use of Restricted Use pesticides to treat and preserve wood products.

Wood treatment standards of competency.

Applicators shall demonstrate practical knowledge of the following:

1. Wood Properties
   a. Durability
   b. Shrinkage, checking and other defects (i.e., splits, knowts, crookedness)
   c. Treatability (permeability)

2. Biological Agents of Decay

   a. Fungi
   b. Insects
   c. Woodpeckers

3. Types of Preservatives

   a. Oil-borne preservatives (creosote)
   b. Waterborne preservatives (arsenicals)
   c. Fumigants
   d. Pentachlorophenol
   e. Copper or zinc napthenate

4. Preservative Treatment processes

d. Pentachlorophenol
e. Copper or zinc napthenate

4. Preservative Treatment processes

a. Pressure (American Wood Preservation Association standards)
b. Non-pressure

5. Handling and Installation of Treated Wood Products

a. Storage, handling, installation of fixtures
b. Remedial Preservative treatment

6. In-Service Pole Inspection

a. Inspection methods
b. Inspection tools and devices

7. In-Service Pole Treatment

a. Groundline decay control
b. Above groundline internal void treatment
c. Fumigation (above and below ground)

8. Safety and Environment
a. Adverse environmental effects of preservatives and treated wood structures
b. Proper handling of treated wood
c. Proper handling of remedial treatments (i.e. following labels)
d. Disposal of preservatives and treated wood products.
e. Preservative-health related issues and environment issues
f. Consumer Information Sheets

D. BPA Annual Certification Process

The Vice President for Transmission Field Services, will be responsible for the annual certification of BPA applicators. Applicators will be certified each year by passing an examination. Certification will be valid for one year. Those BPA employees eligible for certification will receive written notification of their scores and a pocket-sized, plasticized "license" or certificate, signed by the Manager, Pollution Prevention & Abatement, as delegated by the Vice President for Transmission Field Services. The certificate will contain an identifying number, the name of the applicator, category or categories of certification, date issued, and expiration date (Appendix D attached). BPA certification will be valid on facilities and rights-of-way maintained by BPA throughout all States in the BPA service area.

The annual examination for certification will cover all topics identified in 40 CFR 171.1, including general standards of competency and specific standards of competency for the two categories covered by this plan. Annual examinations will be written and consist of three parts: Part I will cover Laws and Regulations (25 questions), Part II will cover Substation and Right-of-Way Vegetation Management (25 questions), and Part III will cover Wood Treatment and Right-of-Way Vegetation Management (25 questions). A score of 70 percent must be obtained on each test to pass the examination. At least two separate examinations will be maintained and will be administered randomly. Examinations will be reviewed and updated each year and will be maintained, administered, and evaluated with all reasonable security precautions. No provisions will be made for those who cannot read, since all BPA employees must demonstrate reading proficiency as a condition of employment or in the performance of official duties.

BPA employees may apply for annual certification only by passing the BPA examinations, and attending BPA or State certified pesticide use training within the one year certification period. Certification training and examinations will emphasize knowledge of the most current vegetation management and wood treatment issues, techniques, alternatives, and regulatory requirements. Examination questions will be updated each year to emphasize changes in technology and use requirements. A copy of the current examination is attached (Appendix E).

To facilitate continuing education in responsible pesticide use for BPA employees, the Manager, Pollution Prevention & Abatement will continue to make available publications, training films or aids, or training courses as appropriate. Training materials will be made available which will address the certification categories. A list of current training materials and recent training course agendas is attached (Appendix F). Employees or their supervisors may request training or training materials as necessary.

97cert.doc

49978 Federal Register / Vol. 62, No. 185 / Wednesday, September 24, 1997 / Notices

ENVIRONMENTAL PROTECTION AGENCY

[OPP–42064C; FRL–5741–9]

Department of Energy Plan for Certification of Pesticide Applicators

AGENCY: Environmental Protection Agency (EPA).

ACTION: Notice of Approval of Certification Plan.

SUMMARY: On June 23, 1997, EPA announced its intention to approve a revised Department of Energy (DOE) plan for the certification of pesticide applicators. The revised DOE plan was similar to the original plan in only covering applicators in the Bonneville Power Administration. The revised plan retained the original certification category of right-of-way pest control and added a new category of wood treatment. The revised plan replaced the original 3–year recertification interval with a 1 year recertification interval. No comments were received on EPA's proposal to approve the revised DOE certification plan. Notice is hereby given of EPA's granting final approval of the revised DOE plan.

ADDRESSES: Copies of the DOE revised plan are available for viewing at the following locations during normal business hours:

1. U.S. Environmental Protection Agency, Office of Pesticide Programs, Crystal Mall #2, 1921 Jefferson Davis Highway, Rm. 1121, Arlington, VA 22202. Contact: John R. MacDonald, (703) 305–7370.

2. U.S. Department of Energy, Bonneville Power Administration, 905 Northeast Eleventh, Stop EP-5, Fifth Floor, Portland, OR 97232. Contact: James Meyer, (503) 230–5038.

3. Select U.S. Department of Energy installations. Contact: James Meyer at aforementioned location for list of locations.

FOR FURTHER INFORMATION CONTACT: By mail: John R. MacDonald (7506C), Office of Pesticide Programs, Environmental Protection Agency, 401 M St., SW., Washington, DC 20460. Office location and telephone number: Crystal Mall #2, 1921 Jefferson Davis Highway, Rm. 1121, Arlington, VA. Telephone: (703) 305–7370.

SUPPLEMENTARY INFORMATION: In the **Federal Register** of October 7, 1988, notice was published announcing the final approval of a DOE pesticide applicator certification plan. On June 23, 1997 (62 FR 33862) (FRL–5717–3), EPA announced its intention to approve a revised DOE certification plan. The revised DOE certification plan added a new wood treatment category and retained the existing right-of-way category. The revised certification plan also established an annual recertification period to replace the current 3–year period. The revised certification plan will continue to base certification and recertification on the taking and passing of a written

Federal Register / Vol. 62, No. 185 / Wednesday, September 24, 1997 / Notices 49979

examination. The revised DOE certification plan will continue to cover only employees of the Bonneville Power Administration. The DOE estimates that there will be 100 applicators certified in the new wood treatment category. There are presently approximately 150 applicators certified in the right-of-way category, whose certification will be unaffected by this action.

No comments were received on EPA's notice of intention to approve the revised DOE certification plan. Therefore, EPA approves the revised DOE certification plan.

List of Subjects

Environmental protection.

Dated: September 9, 1997.

Lynn R. Goldman,

Assistant Administrator for Prevention, Pesticides and Toxic Substances.

[FR Doc. 97–25337 Filed 9–23–97; 8:45 am]

BILLING CODE 6560–50–F

APPENDIX D
SAMPLE EDUCATIONAL INFORMATION

DANGER TREE PROGRAM

HOW CAN TREES BE DANGEROUS?

During storms — or even just strong wind — trees can bend or fall into power lines.

Recently trees were responsible for 64 power outages affecting BPA customers, causing many hours of lost power.

Tree-related power outages are more than just an inconvenience. They not only disrupt service to your home or business, they also disrupt power to hospitals, emergency response centers and life-support patients. If power flows through a tree to the ground, it can injure or kill anyone near the tree. It can also cause fires started by the electric arc.

WHAT'S BPA DOING ABOUT THIS PROBLEM?

As part of our mission to provide reliable electrical service to our customers, we periodically inspect rights-of-way in our service area, notify property owners of existing or potential problems and send out experienced crews to remove tree(s) and vegetation posing hazards to residents and our facilities.

BPA has a legal right and obligation to remove all "on" right-of-way trees that threaten our lines. Trees that are located "off" the right-of-way may also pose a threat to the power line. These "off" the right-of-way trees, we call danger trees. Once we have marked them as danger trees, we start a process with the property owner to have them removed.

WHAT YOU CAN DO TO HELP?

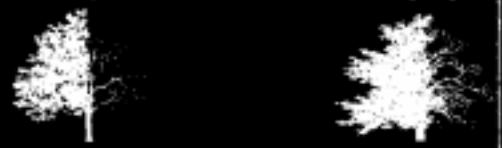
IT'S SAFE AND IT'S SIMPLE

Property owners should review the power line easement document and become familiar with the provisions. Even though we'll inspect your property, you can help BPA by contacting us if you notice anything such as trees and limbs that might interfere with our power lines.

You can also help stop potential power line problems before they start. If you're planning to plant trees on your property, **do not** plant within 30 feet of towers or poles. It's also important to limit trees and shrubs "on" the right-of-way to **not** more that 10 feet in height, and select trees well adapted to our region's climate — and able to withstand local storm conditions. A written agreement between BPA and you, called a "Tree Maintenance Agreement," is necessary for trees to remain on easements. This agreement can be obtained through your nearest BPA natural resource specialist. Call 1-800-836-6619.

HERE IS A LIST OF TREES SUITABLE FOR PLANTING NEAR POWERLINES.

Flowering Ash | California Hazel | Flowering Dogwood | Dwarf Fruit Trees | Hawthorne Maple | Japanese Dogwood | Hedge Maple | Japanese Maple | Paperbark Maple



POWERFUL FACTS

The current needed to light a 10-watt bulb is more than enough to kill you. Trees don't need to touch power lines to be dangerous. Lines can sag as much as 15 feet or more during hot weather or when carrying heavy electrical loads. Electricity from high voltage power lines also can "arc" or "flashover" from wires to nearby trees before actual contact is made.

The Danger Tree Program. It's all part of BPA's commitment to providing safe, reliable power to our customers.

For more information about trees, a permit to plant trees, transmission lines and safety on your property, call 1-800-836-6619, and ask for the following brochures:

Living and Working Safely Around High-Voltage Power Lines (DOE/BP-1821)

Landowner's Guide to Trees and Transmission Lines (DOE/BP-802)

Landowner's Guide to Use of BPA Rights-of-Way (DOE/BP-1678)

neville Power Administration
Box 3621
tland, Oregon 97208-3621

BONNEVILLE POWER ADMINISTRATION

DANGER TREE PROGRAM

APPENDIX E
CLEARANCE CRITERIA

Appendix E
Clearance Criteria

Right-of-way Clearing Criteria

Bonneville lines are designed and maintained to co-exist in a safe and reasonable manner with anticipated underlying activities, as specified by the National Electrical Safety Code (NESC). In general, the NESC requires tree trimming and removal to prevent ". . . grounding of the circuit through the tree." The provision in the NESC 1997 Edition is as follows:

Part 2. Safety Rules for the Installation and Maintenance of Overhead Electric Supply and Communication Lines

Section 21. General Requirements

218. Tree Trimming (page 67)

A. General

1. Trees that may interfere with ungrounded supply conductors should be trimmed or removed. Note: Normal tree growth, the combined movement of trees and conductors under adverse weather conditions, voltage, and sagging conductor at elevated temperatures are among the factors to be considered in determining the extent of trimming required.
2. Where trimming or removal is not practical, the conductor should be separated from the tree with suitable materials or devices to avoid conductor damage by abrasion and grounding of the circuit through the tree.

B. At Line Crossings, Railroad Crossings, and Limited-Access Highway Crossings, the crossing span and the adjoining span on each side of the crossing should be kept free from overhanging or decayed trees or limbs that otherwise might fall into the line.

In *general*, Bonneville does not allow anything higher than 14 feet (assumed truck height) under the lines (there are some situations under special permit or depending on actual conductor heights that allow for higher allowances). Therefore, Bonneville trims or removes from

under the line any "grow into" trees that are more than 14 feet tall (including future growth) or any "fall into" trees that are next to the line and that are unstable and could fall into the line if they were to topple over.

Additional codes that Bonneville follows are from the Occupational Safety and Health Administration (OSHA). These are codes to maintain safe working environments for workers.

CFR Ch. XVII (7-1-95 Edition) OSHA §1910.333

(i) Unqualified persons.

(A) When an unqualified person is working in an elevated position near overhead lines, the location shall be such that the person and the longest conductive object he or she may contact cannot come closer to any unguarded, energized overhead line than the following distances:

(1) For voltages to ground 50kV or below – 10 ft (305 cm);

(2) For voltages to ground over 50kV – 10 ft (305 cm) plus 4 in. (10 cm) for every 10kV over 50kV.

(B) When an unqualified person is working on the ground in the vicinity of overhead lines, the person may not bring any conductive object closer to unguarded, energized overhead lines than the distances given in paragraph (c)(3)(i)(A) of this section.

NOTE: For voltages normally encountered with overhead power lines, objects which do not have an insulating rating for the voltage involved are considered to be conductive.

(ii) Qualified persons. When a qualified person is working in the vicinity of overhead lines, whether in an elevated position or on the ground, the person may not approach or take any conductive object without an approved insulating handle closer to exposed energized parts than shown in Table S-5 unless:

(A) The person is insulated from the energized part (gloves, with sleeves if necessary, rated for the voltage involved are considered to be insulation of the person from the energized part on which work is performed) or

(B) The energized part is insulated both from all other conductive objects at a different potential and from the person, or

(C) The person is insulated from all conductive objects at a potential different from that of the energized part.

Table S-5 – Approach Distances for Qualified Employees – Alternating Current

Voltage range (phase to phase)	OSHA minimum approach distance (MAD)
300V and less	avoid contact
Over 300V, not over 750V	1ft 0in. (30.5 cm)
Over 750V, not over 2kV	1 ft. 6 in. (46 cm)
Over 2kV, not over 15kV	2 ft. 0 in. (61 cm)
Over 15kV, not over 37kV	3 ft. 0 in. (91 cm)
Over 37kV, not over 87.5kV	3 ft. 6 in. (107 cm)
Over 87.5kV, not over 121kV	4 ft. 0 in. (122 cm)
Over 121kV, not over 140kV	4 ft. 6 in. (137 cm)

Bonneville has used all of the above information to develop criteria to identify trees that must be removed from rights-of-way, as well as those next to rights-of-way.

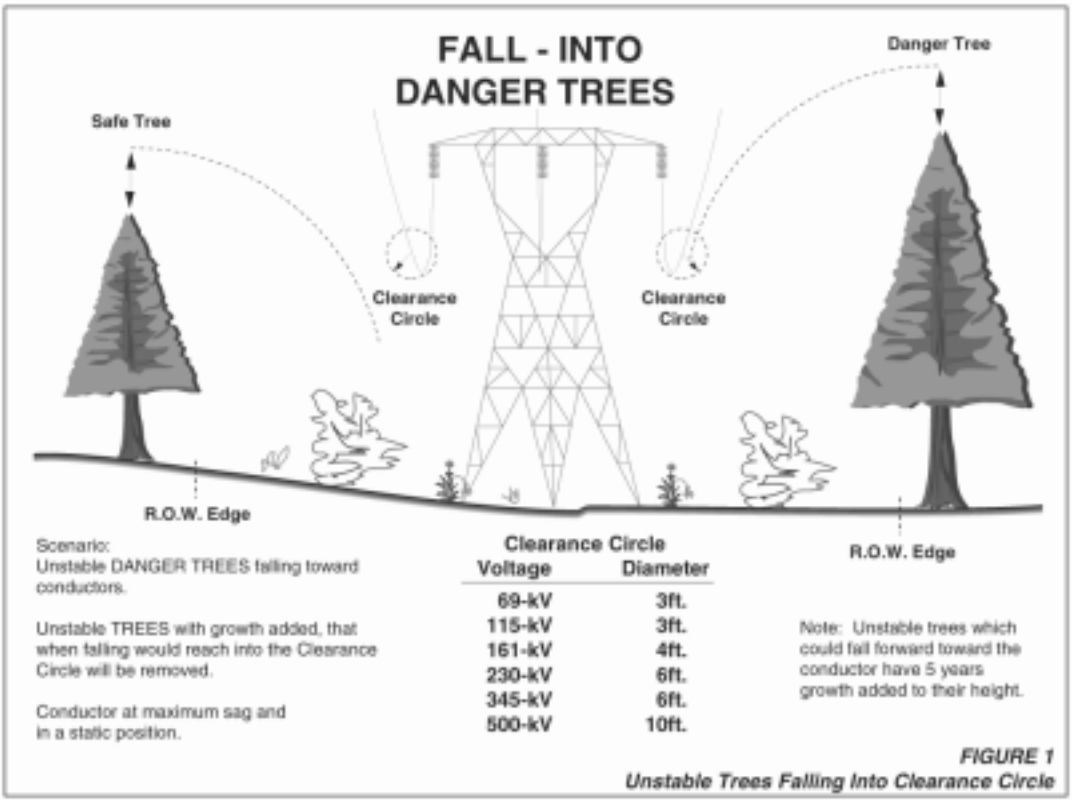


FIGURE 1
Unstable Trees Falling Into Clearance Circle

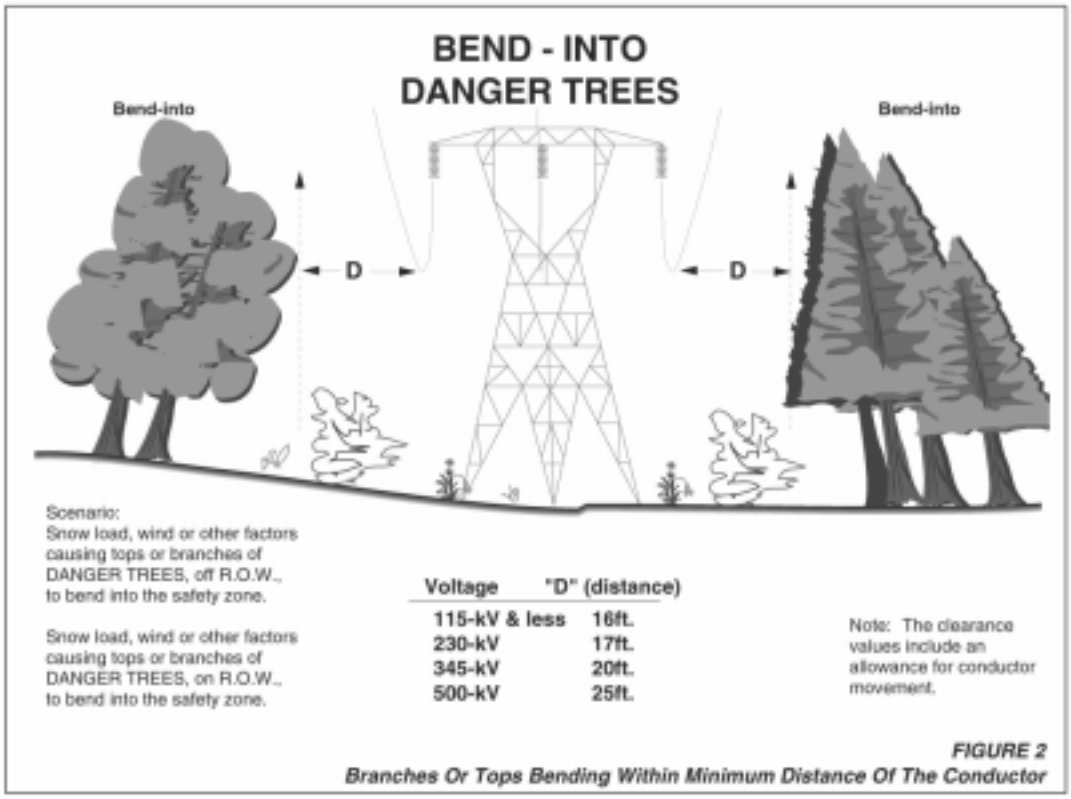


FIGURE 2
Branches Or Tops Bending Within Minimum Distance Of The Conductor

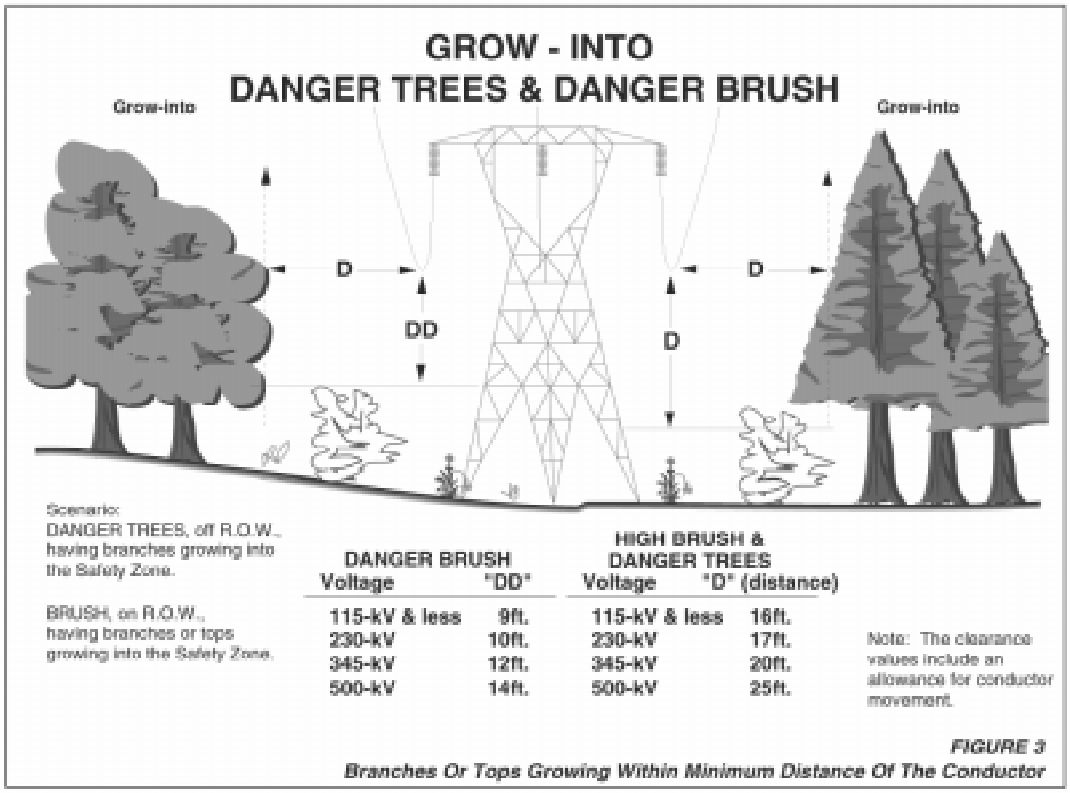
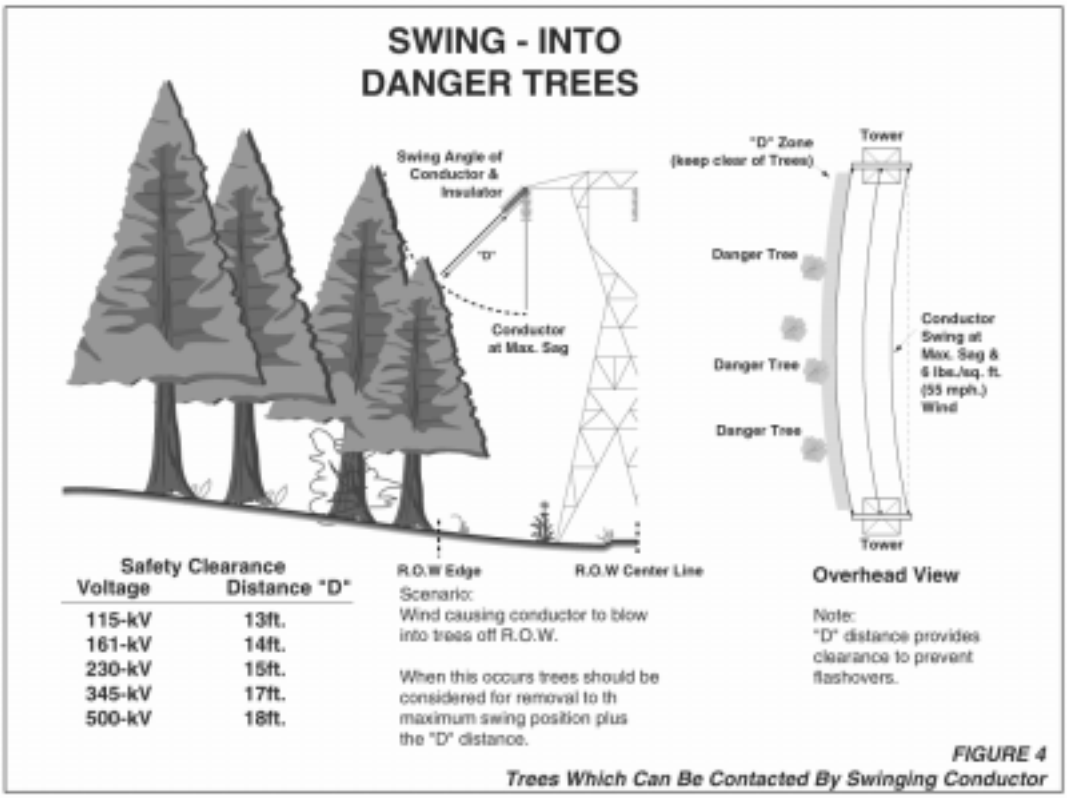


FIGURE 3
Branches Or Tops Growing Within Minimum Distance Of The Conductor



Safety Clearance Voltage	Distance "D"
115-kV	13ft.
161-kV	14ft.
230-kV	15ft.
345-kV	17ft.
500-kV	18ft.

FIGURE 4
Trees Which Can Be Contacted By Swinging Conductor

Substation Grounds Clearing Criteria

The following is from Safety Restrictions for Vegetation Around Bonneville Substations (M212) Facilities Management Information.

Poorly selected or placed vegetation could create a transferred potential hazard if it is located too close to the substation perimeter fence. Since the steepest ground potential rise gradient is at the substation perimeter grid wire, usually located just beyond the perimeter fence, the greatest step-and-touch potentials exist there as well. Grass, weedy vegetation, or bare soil under a person's feet does not provide protection from these step-and-touch potentials. Also, grass, brush, or weeds growing up through the substation surfacing rock create low impedance pathways that could allow step-and-touch potentials to bypass the rock, creating a safety hazard to workers. Blackberry vines, in particular, are a nuisance because their fast-growing, green branches can span several feet or more, and create a transferred potential hazard, especially if they are in contact with the fence.

It is important, therefore, to be intentional about the selection, placement, and maintenance of vegetation around substation yards. The following criteria are the basis for the procedures outlined below: 1) Vegetation touching the fence does not extend beyond the perimeter grid wire. 2) Green, vining vegetation, like blackberry, does not encroach on the area of steepest potential rise gradient or grow up through substation surfacing rock. 3) When the perimeter grid wire is inside the boundaries of the perimeter fence and perimeter vegetation is touching the fence, the side of the shrub or bush away from the fence should be pruned back as closely as possible to the fence or should be removed manually or chemically.

Existing ornamental trees, bushes and shrubbery outside perimeter fences. For substations where the perimeter grid wire is outside the perimeter fence: 1) prune vegetation on the fence side, back away from the fence at least one foot, or 2) for vegetation growing up against the fence, prune so that growth on the side away from the fence does not extend more than three feet out from the fence.

For substations where the perimeter grid is inside the fence: 1) prune vegetation on the fence side back away from the fence at least one foot, or 2) prune the side away form the fence back as close as possible to the fence, or 3) remove the vegetation completely. Vegetation control is especially important at substations without a perimeter grid conductor outside the fence.

New ornamental trees, bushes and shrubbery. Plant no new vegetation within 10 feet of the substation perimeter fence or building. Don't plant tall, fast-growing bushes and trees where they can grow into overhead power lines. If landscaping outside a substation is necessary, a review of grounding issues by the Substation Grounding Engineer is required before being incorporated into a site.

Substation surfacing rock. Extend the substation surfacing rock at least 4 feet beyond the outside of the perimeter fence, unless some physical boundary, such as a ditch, makes it impracticable.

Grass, weeds, brush and blackberry. Do not permit grass and weeds to grow anywhere in the substation surfacing rock. Do not permit blackberry to grow within 10 feet of the perimeter fence. If chemical application is the method selected to control vegetation, try to use a low-toxicity and non-persistent product. For established or aggressive weed infestations, use a more persistent product or a product known to control specific weeds in order to prevent setting of seed and additional emergent seedlings the following growing season.

APPENDIX F

FS MITIGATION MEASURES AND BACKGROUND

Appendix F
FS Mitigation Measures and Background

This appendix provides additional information regarding U.S. Forest Service (FS) land management. First, mitigation measures specific to the FS are listed. Second, background information is provided, including a list of documents that guide FS land management and samples of standards and guidelines from those documents that may affect Bonneville's vegetation management on those lands.

Mitigation Measures Specific to FS

This section lists examples of additional mitigation measures specific to managing vegetation on rights-of-way or other Bonneville electrical facilities on FS-managed lands. These mitigation measures are in addition to those listed in **Chapter III, Planning Step 2.) Identify surrounding land use and landowners/mangers**.

These mitigation measures are to be used as a tool to anticipate issues that may need to be addressed and documents that may need to be consulted for developing or revising site-specific vegetation management plans. These measures **do not replace the need to coordinate with the FS for development of the plans and for measures appropriate to any given forest**. Vegetation management plans should be developed or revised to be consistent with the Record of Decision of this EIS.

The measures were developed based on current FS land and resource management planning documents, but are not "all inclusive" of the measures that may apply. Because these planning documents are revised and supplemented over time, the following mitigation measures are also subject to revisions.

For FS-managed lands, project managers would apply the following measures, as appropriate.

- Proposals for herbicide use will be subject to review and either concurrence or approval by the appropriate Forest Officer.

- *If using herbicides*, use only those herbicides approved for both FS use and Bonneville use. Determine appropriate herbicides when coordinating with the appropriate forest. For many FS regions some or all of the following list *may* apply::

Bromacil	Picloram
Dicamba	Triclopyr
Glyphosate	Tebuthiuron
Hexazinone	2,4-D.

- *If using herbicides in Lolo National Forest*, use only the following herbicides that have been reviewed and approved for use in this Forest: dicamba, glyphosate, picloram, and 2,4-D.
- In Region 6, report numbers of acres treated and method of treatment (such as manual or chemical) to the Forest Pesticide Use Coordinator within a fiscal year.
- *For threatened and endangered species*, follow mitigation measures identified in **Chapter III, Planning Step 3.) Identify natural resources**, including mitigation measures for spotted owl and marbled murrelet.
- *For FS-designated sensitive plant and animal species*, use mitigation measures so as not to disturb the species (such as timing restrictions for actions, or use of selective control methods).
- Leave felled trees on-site, when appropriate to meet FS coarse-woody-debris objectives.
- Determine vegetation debris disposal based on FS input.
- *If reseeding in Late Successional Reserves*, use native species unless the use of non-native species is approved. Seed mixtures are to be approved by the appropriate FS representative. Consider topping trees as an alternative to felling.
- For cultural resources, follow mitigation measures identified in **Chapter III, 3. Identify natural resources.**
- Do not remove vegetation in spanned canyons if clearance heights are met.

The different FS documents and regions have different water buffers. Bonneville will abide by the six mitigation measures within these water buffers described in Tables F-1and F-2.

- Do not use ground-disturbing methods (such as blading) within FS-designated water buffer zones.
- Comply with appropriate Forest Plan designated buffers unless FS allows a variance.
- Do not use any localized, broadcast, or aerial herbicide applications within FS-designated water buffer zones. (In some cases, spot applications may be used.)
- *If using spot applications within water buffer zones*, permit them no closer than 3 m (10 ft.) from water's edge (unless the herbicide label states that it is appropriate for use in water).
- Use only selective control methods (manual, spot herbicide applications), and take care not to affect non-target vegetation.
- Leave vegetation intact, if possible.

Table E-1: Riparian Reserves and Water Buffers

Northwest Forest Plan Riparian Reserves are defined in the following terms:	
Stream Type	**Buffer Size**
Fish-bearing streams	The area on each side of the stream equal to the height of two site-potential trees, or 91-m (300-ft.) slope distance, whichever is greater.
Permanently flowing non-fish-bearing streams	The area on each side of the stream equal to the height of one site-potential tree, or 45.7-m (150-ft.) slope distance, whichever is greater.
Lakes and natural ponds	The body of water and the area to the outer edges of riparian vegetation, or to a distance equal to the height of two site-potential trees, or 91-m (300-ft.) slope distance, whichever is greater.
Constructed ponds and reservoirs and wetlands greater than one acre	The area from the edge of the wetland or the maximum pool elevation to a distance equal to the height of one site-potential tree, or 45.7-m (150-ft.) slope distance, whichever is greater.
Seasonally flowing or intermittent streams	The area on each side of the stream to a distance equal to the height of one site-potential tree or 30.5-m (100-ft.) slope distance, whichever is greater.
Wetlands less than one acre and unstable and potentially unstable areas	The extent of unstable and potentially unstable areas, and wetlands less than 0.4 ha (1 ac.) to the outer edges of the riparian vegetation.

In Regions 1 and 4, the Stream Management Zones are based on stream class, which is defined in the following two tables.

Table E-2: Present Water Buffer (Streamside Management Zone) Requirements for Region 1 Forest, Region 4 Forests, and Forests in the Upper Columbia River basin.

	% side slope			
Stream Class	**0-20**	**21-40**	**41-60**	**61+**
Class I	100 ft.*	150 ft.	200 ft.	250 ft.
Class II	75 ft.	100 ft.	150 ft.	175 ft.
Class III	50 ft.	75 ft.	100 ft.	125 ft.
Class IV	50 ft.	50 ft.	75 ft.	100 ft.

Table E-3: Stream Management Zones—Class Determinations for Stream Classes in Table E-2

Class	Determination
Class I Highly Significant	These are either perennial or intermittent streams, or segments thereof, that meet one or more of the following criteria: a. are habitat for large numbers of resident and/or migratory fish for spawning, rearing, or migration; b. furnish water locally for domestic or municipal supplies; c. have flows large enough to materially influence downstream water quality; d. are characterized by major fishing or other water-oriented recreational uses; e. have special classification or designation, such as wild, scenic, or recreation rivers; f. have special visual/distinctive landscape features, and are classified as variety Class A in *National Forest Landscape -Volume 2* (Agr. Handbook 462) ; g. are habitat for threatened or endangered animal species, or contain plants that are potential or viable candidates for threatened or endangered classification; and/or h. exhibit ethnological, historical, or archaeological evidence that makes them eligible for or included in the National Register of Historical Places.
Class II Significant	These are either perennial or intermittent streams, or segments thereof, that meet one of more of the following criteria: a. are used by moderate numbers of fish and spawning, rearing, or migration; b. furnish water locally for industrial or agricultural use; c. have enough water flow to exert a moderate influence on downstream quality; d. are used moderately for fishing and other recreational purposes; e. are of moderate visual quality and meet variety Class B as defined in *National Forest Landscape Management -Volume 2* (Agr. Handbook 462);and/or f. exhibit ethnological, historical, or archaeological evidence that makes them eligible for State or local registers of historical significance or interest.

Class	Determination
Class III Moderately Significant	These are either perennial or intermittent streams, or segments thereof, that meet one of more of the following criteria: a. are habitat for few fish or spawning, rearing, or migration; b. are rarely used for fishing or other recreational purposes; c. have enough water flow to exert minimum influence on downstream water quality; d. are of relatively low visual quality in the landscape and classified as variety Class B as defined in *National Forest Landscape Management - Volume 2* (Agr. Handbook 462); and/or e. exhibit historical or archaeological properties that are of archaeological interest in accordance with the Archaeological Resource Protection Act of 1979.
Class IV Minor significance	These are intermittent or ephemeral streams, or segments thereof, not previously classified.

In areas considered visually sensitive by the FS, we will consider the following mitigation measures.

- Leave sufficient vegetation—where possible—to screen view of right-of-way.
- Consider plantings of low-growing tree seedlings next to right-of-way, or softening the straight line of corridor edge by cutting additional trees.
- *If using herbicides*, consider the following to reduce large areas of dead browned vegetation: seasonal timing, herbicide selection , or application technique (limit use of broadcast foliar).

FS Background and Guidance Documents

Standards and Guidelines, as used by the FS, adhere to the following definitions:

> ***Standard****: a condition of land, normally a maximum or minimum condition that is measurable. A standard can also be expressed as a constraint on management activities or practices. Standards are established on a forest-wide, subsection, and management prescription area basis to promote achievement of desired future conditions and objectives. Deviation from compliance with a standard requires a Forest Plan amendment (except for emergency situations . . .) (USDA/FS, 1993 via Targhee Plan, pg. III-2)*

> ***Guideline:*** *a preferred or advisable course of action that is generally expected to be carried out. Deviation from compliance with a guideline does not require a Forest Plan amendment, but the rationale for such a deviation shall be documented in the project decision document. Guidelines are established on a forestwide, subsection, and management prescription area basis to promote achievement of the desired future condition and objectives in an operationally flexible manner that responds to such variations as changing site conditions or changed management circumstances. (USDAFS, 1993 via Targhee Plan,*

Following is a list of selected documents and regulations that will guide the FS during consultations.

Background and Guidance Documents

- **Forest Plans** for the respective National Forests. Each National Forest has a Forest Plan that provides management direction. These Forest Plans specify allowable activities, minimum requirements, and expected outputs and land use allocations for a 10- to 15-year period, including Standards and Guidelines for how resources will be managed, special areas protected, and land use conflicts resolved.
- **A Guide to Conducting Vegetation Management Projects in the Pacific Northwest Region** (USDA/FS 1992a) – for Region 6. This guide is the result of a Mediated Agreement to lift an injunction against using herbicides in the region. The agreement and resulting Guide dictate how the Forests manage and conduct activities within the Forests. These guidelines not only allow for a different set of herbicides to be used in Region 6 than in the rest of the Northwest, but they have more documentation and public involvement steps than the other Regions.
- **Standards & Guidelines for Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl** (Northwest Forest Plan) (USDA/FS and USDOI/BLM, 1994b). These documents provide standards and guidelines and land-use designations for all BLM and FS lands within the range of the northern spotted owl (parts of region 5 and 6). When located in this range, the FS and BLM must follow Forest Plan standards and guidelines if they are more restrictive or provide greater benefits to late-successional forest related species than do the district or forest specific plans.
- **Risk Assessment -** The FS Regions 1, 2, 3, 4, and 10 and Bonneville performed a joint risk assessment (Labat-Anderson, Inc., 1992). The FS intends to have the Forests use this herbicide risk assessment in appropriate NEPA analysis as they implement their Forest Plans.

- **The Interior Columbia River Basin Draft EISs and Appendices** (USDS/FS and USDOI/BLM, 1997a and 1997b). These two planning documents include the Eastside EIS (covering eastern Oregon and Washington) and the Upper Columbia River Basin EIS (covering the Columbia River Basin in Idaho and Montana). These plans have yet to be adopted.

Northwest Forest Plan Specifics

The elements of the Northwest Forest Plan most pertinent to Bonneville's vegetation management activities are (1) designation of Late-Successional Reserves, which are areas set aside for long-term protection as old-growth forests, and (2) the Aquatic Conservation Strategy, which outlines protection of riparian systems by establishing protection buffers referred to as riparian reserves.

Late-Successional Reserves

The Northwest Forest Plan designated these reserves for the long-term protection of old-growth forests, based on five elements:

1. Areas mapped as part of an interacting reserve system;
2. Late-Successional/Old Growth1 and 2 areas[1] within Marbled Murrelet Zone 1 and certain owl additions, mapped by the Scientific Panel on Late-Successional Forest Ecosystems (1991);
3. Sites occupied by marbled murrelets;
4. Known owl activity centers; and
5. Protection buffers for specific native species identified by the Scientific Analysis Team (1993).

The Northwest Forest Plan refers to utility corridors in late-successional reserves in a few places and states that "These developments might remain, consistent with other standards and guidelines. Routine maintenance of existing facilities is expected to have less effect on current old-growth conditions than development of new facilities."

Rare Species - In late-successional reserves, certain rare "survey and manage species" are designated for habitat protection. The species are classified as:

[1] "Most significant" old-growth, and "significant" old-growth, as mapped by the Scientific Panel on Late-Successional Forest Ecosystems, Johnson et al.,1991

- Federally threatened or endangered species;
- Federally proposed threatened or endangered species;
- Federal Candidate Species;
- State-listed species;
- FS sensitive species;
- BLM special status species;
- Other infrequently encountered species not considered by any agency or group as endangered or threatened and classified in the FEMAT Report as rare.

Land managers are required to take certain actions relative to rare "survey and manage species." These actions include:

- Managing known sites of rare organisms;
- Surveying for presence of rare organisms prior to ground-disturbing activities;
- Conducting surveys to identify locations and habitats of rare species; and
- Conducting general regional surveys for rare species.

Species that might occur near Bonneville facilities are as follows:

- *Ptilidium californicum* (Liverwort) – very limited distribution in old white pine forests with fallen trees. It occurs on trunks of trees at about the 500-foot elevation level.
- *Ulota meglospora* (Moss) – occurs in northern California and southwest Oregon.
- *Otidea leporina*, *O. onotica*, and *O. smithii* (Fungi) – occur in conifer duff, are widespread in distribution but uncommon.
- Great Gray Owl – most common in lodgepole pine forests adjacent to meadows (Willamette National Forest west of the crest of the Cascade Range).

Managed Late-Successional Areas

These areas are similar to Late-Successional Reserves but are identified for certain owl locations in the drier provinces where regular and frequent fire is a natural part of the ecosystem. Managed Late-Successional Areas have been designated for standards and guidelines based on two elements: (1) Managed Pair Areas for known owl pairs and resident singles in the California Cascades and Washington Eastern Cascades Provinces (from the Final Draft Spotted Owl

Recovery Plan:); and (2) Protection Buffers for specific endemic species identified by the Scientific Analysis Team.

Managed owl pair areas are typically found on the east side of the Cascade Range. Suitable owl habitat in areas surrounding owl activity centers will be maintained through time using various management techniques.

"Survey and manage species" within Managed Late-Successional Areas are as follows:

- *Brotherella roellii* (Moss) – very rare species, endemic to the Washington Cascades north of Snoqualmie Pass.
- *Buxaumia piperi*, *B. viridis*, *Rhizomnium nudum*, *Schistostega pennata*, and *Tetraphis geniculata* (Mosses) – occurring on rotten logs and some organic soil; shade-dependent, occurring in old-growth forests. *S. pennata* occurs only in mature western red cedar forests in the Olympic National Forest and in the Washington Cascades.
- *Polyozellus multiplex* (Fungus) – occurring in higher elevations of the Cascades in silver fir and mixed conifer (and thus outside the range of marbled murrelet mitigation).
- *Sarcosoma mexicana* (Fungus) – occurring in deep conifer litter layers in older forests. It is common to rare and is found in the Oregon and Washington Coast Range into British Columbia.
- Larch Mountain Salamander – occurring mostly within the Columbia River Gorge.
- Del Norte Salamander – occurring in talus slopes protected by overstory canopy that maintains cool, moist conditions on the ground. Species is a slope-valley inhabitant, and sometimes occurs in high numbers near riparian areas.

Aquatic Conservation Strategy

The Aquatic Conservation Strategy is also found within the Northwest Forest Plan. It identifies standards and guidelines for several areas, including riparian reserves, key watersheds, watershed analysis, and watershed restoration.

Riparian Reserves – areas along all streams, wetlands, ponds, lakes, and unstable or potentially unstable areas where the conservation of aquatic and riparian-dependent terrestrial resources receives primary emphasis. The main purpose of the reserves is to protect the health of

the aquatic system and its dependent species; the reserves also provide incidental benefits to upland species. These reserves will help maintain and restore riparian structures and functions, benefit fish and riparian-dependent non-fish species, enhance habitat conservation for organisms dependent on the transition zone between up slope and riparian areas, improve travel and dispersal corridors for terrestrial animals and plants, and provide for greater connectivity of late-successional forest habitat.

See Table f-1 for definitions of various Riparian Reserves.

Riparian reserve initial boundary widths established by the FS's ROD will remain in effect until they are modified following watershed analysis.

- Standards and guidelines for Riparian Reserves prohibit or regulate activities that retard or prevent attainment of the Aquatic Conservation Strategy objectives. Watershed analysis and appropriate NEPA compliance is required to change Riparian Reserve boundaries in all watersheds.
- FS shall adjust existing leases, permits, rights-of-way, and easements to eliminate adverse effects that retard or prevent the attainment of Aquatic Conservation Strategy objectives. If adjustments are not effective, eliminate the activity. Priority for modifying existing leases, permits, rights-of-way and easements will be based on the actual or potential impact and the ecological value of the riparian resources affected.
- Fell trees in Riparian Reserves when they pose a safety risk.
- Keep felled trees on-site when needed to meet coarse woody debris objectives.
- Herbicides, insecticides, and other toxicants, and other chemicals shall be applied only in a manner that avoids impacts that retard or prevent attainment of Aquatic Conservation Strategy objectives.

Key Watersheds – A system of Key Watersheds serves as areas that provide, or are expected to provide high-quality habitat. Key Watersheds are identified by the Plan as crucial for maintaining and recovering habitat for at-risk stocks of anadromous salmonids and resident fish species.

Watershed Analysis - Watershed analysis is required prior to management activities, except minor activities such as those Categorically Excluded under NEPA (not including timber harvest). Watershed analysis is required prior to timber harvest.

Adaptive Management Areas

The Northwest Forest Plan also designates Adaptive Management Areas (AMAs). In Region 6, four (out of ten) managed AMAs have Bonneville facilities in or near them:

- the **Olympic AMA** in Jefferson, Clallam, Grays Harbor, and Mason Counties, Washington;
- **Snoqualmie Pass AMA** in Kittitas and King Counties, Washington;
- **Northern Coast Range AMA** in Polk, Yamhill, Tillamook and Washington Counties, Oregon;
- **Central Cascades AMA** in Lane and Linn Counties, Oregon.

Samples of Standards and Guidelines from Forest Plans

For the reader's interest, we provide below a sample of standards and guidelines found in Forest Plans that might affect Bonneville's vegetation management program.

Utilities and Transportation -- Some Forests have management areas specific to utilities and transportation such as the following:

- The existing corridors for the transmission of electricity will be managed in accordance with the standards for MA [Management Area] 23. (Kootenai NF, Forest Plan: (USDA/FS, 1987d, pg. II-25))

- MA23 is composed entirely of the existing electric transmission corridor on the south end of the forest which crosses along the south boundary of the Cabinet Mountains Wilderness Area. There is a low-standard access road providing repair and inspection access for the entire length. Vegetation varies from shrubs to small conifers. All acres are in grizzly situations 1 and 2. (Kootenai NF, Forest Plan (USDA/FS, 1987d,pg. II-113))

- Management Area 5: This management area consists of potential transportation and utility corridors that might be identified on the Lolo Forest. Existing and potential rights-of-way will be evaluated to determine if they are compatible with other facilities or uses. If they are determined to be capable of accommodating more than one facility they will be designated a right-of-way corridor (36 CFR 219.27 (a) (9)). (Lolo NF, Forest Plan (USDA/FS, 1986c, pg. III-14))

- Management Area 5 will consist of the land directly under and adjacent to the facility such as a pipeline or power line. As these corridors are identified, the acreages within them will be deleted

from the management areas they cross. This area generally has road access for construction and maintenance. Public use might be restricted. (Lolo NF, Forest Plan (USDA/FS, 1986c, pg. III-14))

- Limit right-of-way clearing for utility corridors to the extent necessary for safe and efficient use. (Siuslaw NF, Land & Resource Management Plan (USDA/FS, 1990d, pg.IV-55))

- Cooperate with utilities' representatives to develop strategies that will minimize the potential for a single- or multiple-line power outages that could result from catastrophic events such as wildfire. (Guideline) (Modoc NF, Land & Resource Management Plan (USDA/FS, 1991b, pg.4-17)

- In managing Forest activities near the utility corridor, coordinate with respective Federal or private utility managers to ensure that forest activities will not conflict with the intended permitted use and management of the utility corridor. (Standard) (Modoc NF, Land & Resource Management Plan (USDA/FS, 1991b, pg.4-17))

Visual – Visual resources, often a concern of the local Forest, become standards and guidelines in the Forest Plans. It is possible that leaving screens of vegetation, as described below, could conflict with keeping vegetation safely away from transmission lines or other facilities.

- . . . . the impacts of management activities will be visually assessed from the nearest viewpoints contained in the sensitivity level maps on file. Vegetative and topographic screening will be used where possible to minimize visual impacts. cases. (Lolo NF, Forest Plan (USDA/FS, 1986c, pg. III-15))

- Meet assigned Visual Quality Objectives when activities are planned within the foreground zone of state Highway 139 and 299. Specific objectives are to:

  - ✶ Blend treated vegetation with adjacent untreated areas for a natural appearance.
  - ✶ No distinct edge between treated and untreated areas should be evident. *(Modoc NF, Land & Resource Management Plan (USDA/FS, 1991b, pg.4-24))*

Vegetation management standards and guidelines vary for each Forest. Some examples of standards and guidelines are as follows:

- *For vegetation management and/or manipulation*, follow the Record of Decision, Managing Competing and Unwanted Vegetation, Final EIS, Pacific NW Region, December l988 (or as amended), the Mediated Agreement, and implementation direction.

(Mt. Baker-Snoqualmie NF, Land & Resource Management Plan (USDA/USFA,1990g, pg. 4-135))

- Control noxious weeds to the extent practical. The following methods for control shall be used: mechanical, biological, access restrictions to prevent spread, seeding disturbed soil, and use of herbicides. Small infestations of new noxious weeds (e.g. tansy ragwort) should be eradicated as quickly as possible. (Mt. Baker-Snoqualmie NF, Land & Resource Management Plan (USDA/USFA,1990g))

- Where appropriate, use methods of vegetation treatment that emulate natural ecological processes to maintain or restore properly functioning ecosystems. (Targhee NF Forest Plan (USDA/FS, 1997b, pg. III-12))

- Preserve unique formations within a landscape (such as cliffs, bogs, seeps, talus slopes, warm or alkaline springs, pot holes, and rock outcroppings) that provide habitat to plant species not common to the overall landscape and contribute to the species diversity within the landscape. (Targhee NF Forest Plan (USDA/FS, 1997b, pg. III-14)

Wildlife and Fish – The FS and BLM have species other than threatened and endangered species that require special attention or protection.

"Indicator species" have been identified for those species groups whose habitat is most likely to be changed by Forest management activities. The tree-dependent group indicator species is the marten; the old growth dependent group is represented by the pileated woodpecker; and the riparian tree-dependent group indicator species is the barred owl. These species will be monitored to determine population changes resulting from forest management activities. Other indicator species include the threatened or endangered species (grizzly bear, gray wolf, bald eagle and peregrine falcon); commonly hunted species (mule deer, elk, and white-tailed deer); and fish species (bull trout and cutthroat trout*). (Flathead NF, Forest Plan (USDA/FS,1985, pg. II-21))*

- Management Direction:

  - ✶ *Under the selected alternative, the Inland Native Fish Strategy will apply the following management direction to all 22 Forests except where PACFISH or the President's Plan apply. (Kootenai NF, Forest Plan (USDA/FS 1987d, Attachment pg. A-1))*

✶ General Riparian Area Management: Apply herbicides, pesticides, and other toxicants, and other chemicals in a manner that does not retard or prevent attainment of riparian management objectives and avoids adverse effects on inland native fish. (Kootenai NF, Forest Plan (USDA/FS 1987d, Attachment pg. A-12))

- . . .Fish habitat and riparian management activities will be coordinated in order to provide suitable riparian vegetation to aquatic habitats. . . . (Flathead NF, Forest Plan (USDA/FS 1985, pg. II-21))

- *Biological evaluations shall be prepared on all significant projects and activities that have a probability of affecting gray wolves and their habitat. Project, activities, or land uses might proceed if a "No Effect" determination is made. If a "Might Adversely Affect" determination results, the project, activity, or land use will be either modified for compatibility, eliminated, terminated, or appropriate consultation procedures with the USFWS will be initiated. (Flathead NF, Forest Plan (USDA/FS ,1985, pg. II-37 f(1)))*
- Provide necessary protection and management to conserve listed threatened, endangered and sensitive plant species. (Targhee NF Forest Plan (USDA/FS, 1997b,pg. III-14))
- Information on the presence of listed threatened, endangered or sensitive plant species will be included in all assessments for vegetation and/or ground disturbing management activities. Appropriate protection and mitigation measures will be applied to the management activities. (Standard) (Targhee NF Forest Plan, (USDA/FS, 1997b. pg. III-14))

- Site specific analysis is needed for all projects. This includes addressing threatened endangered, and sensitive species of plants and animals as contained on the FS, R-1 list. Roads for access should be consistent with direction for MA23 and consider surrounding MAs and grizzly bear habitat needs.

- *In Riparian Area Management*: Apply herbicides, pesticides, and other toxicants, and other chemicals in a manner that does not retard or prevent attainment of riparian management objectives and avoids adverse effects on inland native fish. (Kootenai NF, Forest Plan (USDA/FS, 1987d, Attachment pg. A-12))

Cultural Resources -

- Inventory to identify cultural resource properties prior to any project, activity or license that might affect significant cultural resources consistent with the national Historic Preservation Act of 1966 (as amended) and other pertinent laws and regulations. Adjustments will be made to projects to comply with cultural resource laws. (standard) (Modoc NF, Land & Resource Management Plan (USDA/FS, 1991b, pg.4-14))

Soil and Water – Forest Plans have special requirements when operating around water.

- Stream Shading - Leave enough vegetation intact along perennial streams to limit solar heating of streams and maintain water temperatures within State water quality standards. (Siuslaw NF, Land & Resource Management Plan (USDA/FS, 1990d, pg. IV-53))

- Standards are designed to protect or improve the quality of the water resource. These practices, known as BMPs (Best Management Practices) use the best technology available. These practices are a result of laws, regulations, and good land stewardship. (Flathead NF Forest Plan (USDA/FS, 1985, pg. II-40))

- The forest has designated riparian management areas (Management Areas 12 and 17) and non-timber-producing areas where riparian ecosystems are protected. (Flathead NF Forest Plan (USDA/FS,1985, pg. II-40))

- A watershed cumulative-effects feasibility analysis for projects involving significant vegetation removal is required prior to project implementation. This is to ensure that the project, considered with other activities, will not increase water yields or sediment beyond acceptable limits. Such analysis should identify opportunities, if any exist, for mitigating adverse effects on water related beneficial uses. (Flathead NF Forest Plan (USDA/FS, 1985, pg. II-41))

Soil and water requirements can be quite extensive, The requirements shown below are all from the same Forest Plan. One area can trigger many management plans.

- *Streamside management zones (SMZs) are determined by stream class, channel stability, and side-slope stability. Included in the SMZ are the channel (waterway and upper banks) and side slopes. The SMZ exceeds the area dominated by riparian vegetation. Although managing an SMZ width that includes 50 feet on either*

side of the channel is typical, managing SMZs of variable width affords more direct protection of riparian-dependent resources. (Modoc NF, Land & Resource Management Plan (USDA/FS 1991b, Appendix M pg. M-1))

Side-slope distances are determined by stream class and percent of side slope. The stream class is based on the relative importance or significance of a stream or segment, based on resource values and beneficial uses. The percent of side slope is inversely related to side slope stability (i.e. the higher the percent of side slope, the less the stability of the side slope). Streams that are more important or are less stable are assigned longer slide slope distances and thus wider SMZs. (Modoc NF, Land & Resource Management Plan USDA/FS, 1991b, Appendix M pg. M-1))

At the project level, management standards are flexible so that widths might vary as additional information is learned about channel and side slope stability. Stream classes might also change as more information is collected about the stream. (Modoc NF, Land & Resource Management Plan (USDA/FS, 1991b, Appendix M pg. M-1)

The Modoc NF identifies **Water Quality Best Management Practices** (BMPs) to be used within resource categories. The following resource categories could potentially be affected by Bonneville's vegetation management program. Depending on the particular activity planned within the resource category, any of the listed BMPs could be appropriate practices and should be considered for use.

Resource category: Timber

BMP: Protection of Unstable Areas
Streamside Management Zone Designation
Special Erosion Prevention Measures on Disturbed Land
Revegetation of Areas Disturbed by Harvest Activities
Streamcourse Protection
Erosion Control Structure Maintenance
Slash Treatment in Sensitive Areas

Resource category: Road and Building Site Construction

BMP: Erosion Control Plan
Disposal of Right-of-way and Roadside Debris
Maintenance of Roads
Road Surface Treatment to Prevent Loss of Materials
Traffic Control during Wet Periods

Resource category: Vegetative Manipulation pg. N-3

BMP: Seed Drilling on the Contour
Slope Limitations for Tractor Operation
Tractor Operation Excluded from Wetlands and Meadows
Revegetation of Surface Disturbed Areas
Tractor Windrowing on the Contour
Soil Moisture Limitations for Tractor Operation
Contour Disking
Pesticide Use Planning Process
Apply Pesticide According to label and EPA Registration Directions
Pesticide Application Monitoring and Evaluation
Pesticide Spill Contingency Planning
Cleaning and Disposal of Pesticide Containers and Equipment
Untreated Buffer Strips for riparian area and Streamside Management Zone (SMZ) Protection during Pesticide Spraying
Controlling Pesticide Drift during Spray Application

Resource category: Watershed Management pg. N-4

BMP: Protection of Wetlands
Oil and Hazardous Substance Spill Contingency Plan
Control of Activities under Special Use Permit
Water Quality Monitoring

(This concludes the section on samples of FS standards and guidelines.)

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APPENDIX G

BLM MITIGATION MEASURES AND BACKGROUND

Appendix G
BLM Mitigation Measures and Background

This appendix provides additional information regarding the Bureau of Land Management. First, mitigation measures specific to the BLM lands are listed. Second, background information is provided, including a list of documents that guides BLM land management that may affect Bonneville's vegetation management on those lands.

Mitigation Measures Specific to BLM

This section lists examples of additional mitigation measures specific to managing vegetation on rights-of-way or other Bonneville electrical facilities on BLM-managed lands. These mitigation measures are in addition to those listed in **Chapter III, Planning Step 2.)** ***Identify surrounding land use and landowners/mangers***.

These mitigation measures are to be used as a tool to anticipate issues that may need to be addressed and documents that may need to be consulted when developing or revising site-specific vegetation management plans. These measures do not replace the need to coordinate with the FS for development of the plans and for measures appropriate to any given Forest. Vegetation management plans should be developed or revised to be consistent with the Record of Decision of this EIS.

The measures were developed based on current BLM land and resource management planning documents. However, since these planning documents are revised and supplemented over time, the following mitigation measures are also subject to revisions.

For BLM-managed lands, project managers would apply the following measures as appropriate.

- **If using herbicide, use only those herbicides that are approved for both BLM use and Bonneville use.**

Those herbicides presently approved for both Bonneville and BLM—Washington, eastern Oregon*, Idaho, and Montana Districts—are as follows:

Bromacil	Glyphosate+ 2,4-D
Bromacil+	Hexazinone
Diuron	Imazapyr
Chlorsulfuron	Mefluidide
Clopyralid	Metsulfuron methyl
2,4-D	Picloram
Dicamba	Picloram+ 2,4-D
Dicamba + 2,4-D	Sulfomturon methyl
Diuron	Tebuthiuron
Glyphosate	Triclopyr

* Oregon continues under herbicide injunction except for control of noxious weeds. This herbicide list would then apply only for the use on noxious weeds.

In *western* Oregon only those herbicides presently approved for both Bonneville and BLM-Oregon (for the control of noxious weeds) are used, as follows:

2,4-D	Glyphosate
Dicamba	Picloram
Dicamba + 2,4-D	Picloram + 2,4-D

Table G-1: BLM Buffer Zones Adjacent to Dwellings, Domestic Water Sources, Agricultural Land, Streams, Lakes, and Ponds

(Washington, eastern Oregon, Idaho, and Montana Districts)

Method	Buffer Width (from waters edge)
***No* Ground-disturbing Mechanical** (Tractor operations will be limited to periods of low soil moisture to reduce the chance of soil compaction.)	"so far as practical on the contour to reduce the chance of soil erosion"
***No* Spot-herbicide Applications** (Herbicides will be wiped on individual plants within 3 m or 10 ft. of water where application is critical.) (For noxious weed control, herbicides may be wiped on individual plants to the high water line where application is critical.)	Within 3 m or 10 ft.
***No* Broadcast Herbicide**	Within 7.6 m or 25 ft.
***No* Aerial Herbicide**	Within 30.5 m or 100 ft.

* Any buffer deviations must be in accordance with herbicide label.

Table F-2: BLM Buffer Zones (Western Oregon)

Method	Buffer Width
***No* Ground-disturbing Mechanical** (Tractor operations may be limited to periods of minimum soil moisture levels)	Within 7.6 m or 25 ft. of streams
***No* Spot Herbicide Applications** (Herbicides will be wiped on individual plants within 10 feet of water where application is critical.)	Within high water mark of waterways
***No* Localized Herbicide Applications** (manual backpack)	Within 6 m or 20 ft. of waterways
***No* Broadcast Herbicide**	Within 15.2 m or 50 ft. of waterways
***No* Aerial Herbicide**	Within 30.5 m or 100 ft. of flowing streams; within 61 m (200 ft.) of lakes and ponds
***No* Herbicide Applications**	Within 30.5m (100 ft.) of residences

* Follow the outlined buffer zones or zones in the resource management plan, whichever is greater.

- *In western Oregon*, consider recommending buffer strips for wildlife habitat, scenic corridors, and other concerns as identified in land use plans.
- *In western Oregon*, conduct any ground-disturbing mechanical operation in municipal watersheds in accordance with BLM memorandum of understanding with local municipalities.
- *In Oregon*, submit herbicide proposal for reporting to BLM's Oregon/Washington state office.
- *In western Oregon*, post project description signs at points of common public access to areas where herbicides are used; leave the signing in place during the potency period. Provide the posted information in both English and Spanish, and at least 24 hours before treatment.
- *In Oregon*, submit any proposals to use picloram treatment to a hydrologist and/or soil scientist to be evaluated for potential leaching and long-term non-target phytotoxic (toxic to plants) impacts on water contamination both on and off-site before a decision on such a treatment.

BLM Guidance Documents

Following is a list of selected documents that guide the BLM.

- **Resource Management Plans (RMP) for the respective Districts:** Each BLM District has an RMP or Management Framework Plan (MFP) that gives direction for land management for that district. Similar to FS Forest Plans, RMPs identify standards and guidelines for how the land will be managed and what special areas are to be protected.
- *For Washington, eastern Oregon, Idaho, and Montana Districts* - **EIS on Vegetation Treatment on BLM Lands in Thirteen Western States (USDOI/BLM 1991b).** This document governs the BLM's integrated management treatment program for undesirable plants and noxious weeds on BLM-administered public lands within the Washington, Oregon, Idaho, and Montana Districts. The plan focuses on a mix of methods, including prescribed burning, biological, mechanical, manual, and chemical

treatments, with a high priority placed on prevention, followed by non-chemical methods.

Although Washington and Oregon districts are covered in this EIS, these districts are under an herbicide injunction except as authorized under the Northwest Area Noxious Weed Control Program EIS, listed below.

- **Western Oregon - EIS on Western Oregon Program-Management of Competing Vegetation (USDOI/BLM, 1992c).** BLM has a separate EIS for vegetation management covering the Salem, Eugene, Roseburg, Coos Bay, Medford, and part of Lakeview districts. This plan also focuses on a mix of methods, including the following: manual (pulling, cutting, bashing and covering vegetation), mechanical, biological (plant pathogens, grass seeding to prevent alder, insects), prescribed fire, and herbicide treatments.

  Although western Oregon is covered in this EIS, Oregon is under an herbicide injunction except as authorized under the Northwest Area Noxious Weed Control Program EIS, listed below.

- *Washington, Oregon, Idaho, and Montana Districts –* **Supplemental EIS on Northwest Area Noxious Weed Control Program** (USDOI/BLM,1987a). This document continues to govern the BLM's noxious weed control program in Oregon. The State of Oregon and counties list those species that are noxious weeds by county, and place responsibility for noxious weed control on Federal land with the Federal government. This EIS allows BLM use of four herbicides for noxious weed control.

- *Parts of BLM Oregon and Washington Districts* **- Standards & Guidelines for Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl (Forest Plan)** (USDA/FS and USDOI/BLM, 1994a). These documents provide standards and guidelines and land-use designations for all BLM and FS lands within the range of the northern spotted owl. When located within this range, the FS and BLM must follow Forest Plan standards and guidelines if they are more restrictive or provide greater benefits to late-successional forest related species than do the district or forest specific plans.

  The Northwest Forest Plan also designates Adaptive Management Areas (AMAs). Of the ten managed AMAs, BLM land is within two in Oregon that have Bonneville facilities in or near them:

- **Northern Coast Range AMA** in Polk, Yamhill, Tillamook and Washington Counties, Oregon;
- **Central Cascades AMA** in Lane and Linn Counties, Oregon.

Please see **Appendix F: FS Mitigation Measures and Background** for more information on how the Northwest Forest Plan may affect Bonneville vegetation control.

- **The Interior Columbia River Basin Draft EISs and Appendices** (USDA/FS and USDOI/BLM, 1997a and 1997b) – These two planning documents include the Eastside EIS (covering eastern Oregon and Washington) and the Upper Columbia River Basin EIS (Idaho and western Montana). These plans have yet to be adopted.

APPENDIX H
HERBICIDE FACT SHEETS

2,4-D

HERBICIDE FACT SHEET

U.S. DEPARTMENT OF ENERGY
BONNEVILLE POWER ADMINISTRATION

This fact sheet is one of a series issued by the Bonneville Power Administration for their workers and the general public. It provides information on forest and land management uses, environmental and human health effects, and safety precautions. A list of definitions is included in Section VIII of this fact sheet.

I. BASIC INFORMATION

COMMON NAME: 2,4-D

CHEMICAL NAME: 2,4-dichlorophenoxyacetic acid, including, but not limited to:

Acids and Salts

Cas No. 2008-39-1 and 1928-43-4

Esters

Cas No. 25168-26-7

CHEMICAL TYPE: chlorinated phenoxy compound

PESTICIDE CLASSIFICATION: herbicide

REGISTERED USE STATUS: General Use Pesticide. Restricted Use in Washington for Some Locations. Date and Elevation Restrictions for Aerial Applications in Idaho.

FORMULATIONS: Commercial herbicide products generally contain one or more ingredients. An inert ingredient is anything added to the product other than an active ingredient. Because of concern for human health and the environment, EPA announced its policy on toxic inert ingredients in the Federal Register on April 22, 1987 (52FR13305). This policy focuses on the regulation of inert ingredients. EPA's strategy for implementing this policy included the development of four lists of inerts, based on toxicological concerns. Inerts of toxicological concern were placed on List 1. Potentially toxic inerts/high priority for testing were placed on List 2. Inerts of unknown toxicity were placed on List 3, and inerts of minimal concern were placed on List 4.

The inert ingredients of the 2,4-D formulations are not classified by the USEPA as inert ingredients of toxicological concerns to humans or the environment.

RESIDUE ANALYTICAL METHODS: EPA Method 600/4-88-039 515.1; 515.2; 555.

II. HERBICIDE USES

REGISTERED FORESTRY, RANGELAND AND RIGHT-OF-WAY USES: 2,4-D is registered for use in crop and non-crop sites for selective and total weed control. For terrestrial and aquatic uses.

OPERATIONAL DETAILS:

TARGET PLANTS: 2,4-D is used for control of grasses, broadleaf weeds, and woody plants.

MODE OF ACTION: Plant growth regulator.

METHOD OF APPLICATION AND RATES: Aerial and ground broadcast, spot and localized applications. Rates depend on formulation.

SPECIAL PRECAUTIONS:

TIMING OF APPLICATION: Timing is dependent on the target plant.

DRIFT CONTROL: Care should be exercised not to overspray or apply the herbicide to adjacent non-target areas. Drift control is achieved by observing weather conditions and following label and sprayer instructions. Spray droplet size should be 150 microns or larger.

RESTRICTIONS/WARNINGS/LIMITATIONS: Do not apply through any type of irrigation system. Groundwater advisory. Various state use restrictions.

III. ENVIRONMENTAL EFFECTS/FATE

SOIL:

RESIDUAL SOIL ACTIVITY: The half-life of 2,4-D is from less than one day to several weeks.

ADSORPTION: The K(oc) of 2,4-D is 19.6 to 109.1.

PERSISTENCE AND AGENTS OF DEGRADATION: 2,4-D is can be moderately persistent in the plant and soils. The primary route of degradation is microbial activity.

METABOLITES/DEGRADATION PRODUCTS AND POTENTIAL ENVIRONMENTAL EFFECTS: 2,4-D degrades to many less toxic chemicals.

WATER:

SOLUBILITY: 3.39×10^{4} mg/l in water (pH 7 at 25° C).

POTENTIAL FOR LEACHING INTO SURFACE AND GROUND WATER: 2,4-D is moderately persistent with a low soil adsorption coefficient. There is a moderate potential for 2,4-D to leach into groundwater.

AIR:

VOLATILIZATION: 1.4×10^{-7} mm Hg at 25° C.

POTENTIAL FOR BYPRODUCTS FROM BURNING OF TREATED VEGETATION: Not known.

IV. ECOLOGICAL TOXICITY EFFECTS ON NON-TARGET SPECIES

MICROORGANISMS:

ACUTE CONTACT TOXICITY*:* LD_{50} (honey bee contact) >100 µg/bee

OVERALL TOXICITY: Practically Non-Toxic

PLANTS: Contact will injure or kill target and non-target plants.

AQUATIC VERTEBRATES:

ACUTE TOXICITY*:* LC_{50} (rainbow trout 96-hour) 1.1 - >240 mg/l

ACUTE TOXICITY: LC_{50} (bluegill sunfish 96-hour) 0.9 - >524 mg/l

OVERALL TOXICITY: Highly Toxic - Practically Non-Toxic (Depending on Formulation)

AQUATIC FRESHWATER INVERTEBRATES:

ACUTE TOXICITY*:* LC_{50} (*Daphnia magna* 48-hour) 5.8 - >184 mg/l

OVERALL TOXICITY: Moderately Toxic - Practically Non-Toxic (Depending on Formulation)

AQUATIC ESTUARINE/MARINE INVERTEBRATES:

ACUTE TOXICITY*:* LC_{50} (Dungeness crab 96-hour) >10.0 mg/l
ACUTE TOXICITY*:* LC_{50} (brown shrimp 96-hour) >2.0 mg/l

OVERALL TOXICITY: Moderately Toxic - Slightly Toxic (Depending on Formulation)

TERRESTRIAL ANIMALS:

AVIAN ACUTE ORAL TOXICITY*:* LD_{50} (various birds) 472 - >2000 mg/kg

AVIAN SUBACUTE DIETARY TOXICITY: LC_{50} (various birds) >1000 mg/kg

MAMMAL ACUTE ORAL TOXICITY: LD_{50} (various mammals) >100 - >5000 mg/kg

OVERALL TOXICITY: Moderately Toxic to Practically Non-Toxic (Depending on Formulation)

BIOACCUMULATION POTENTIAL: Low Potential

THREATENED AND ENDANGERED SPECIES: All federally listed terrestrial and aquatic species may be adversely affected if certain formulated products are applied directly or indirectly to the species or habitat.

V. TOXICOLOGICAL DATA

ACUTE TOXICITY:

ACUTE ORAL TOXICITY*:* LD_{50} (rat) >50 - >5000 mg/kg

ACUTE DERMAL TOXICITY: LD_{50} (rabbit) >2000 -20,000 mg/kg

PRIMARY SKIN IRRITATION: Rabbit - Slight - Non-Irritant

PRIMARY EYE IRRITATION: Rabbit – Severe Irritant - Slight Irritant

ACUTE INHALATION: LC_{50} (rat) >1.0 - >100.0 mg/l

OVERALL TOXICITY: Category 1 – Highly Toxic to Practically Non-Toxic (Depending on Formulation)

CHRONIC TOXICITY:

CARCINOGENICITY: IARC Group 2B - Possible human carcinogen.

DEVELOPMENTAL/REPRODUCTIVE: Animal studies indicate limited ability to cause birth defects. Evidence suggests adverse reproductive effects at moderate doses.

MUTAGENICITY: Evidence suggests adverse effects on human chromosomes.

HAZARD: The end-use product labels for the 2,4-D formulations vary considerably between the *Caution* and *Danger* signal words due to various effects.

VI. HUMAN HEALTH EFFECTS

ACUTE TOXICITY (POISONING):

REPORTED EFFECTS: Nervous system from skin absorption. Dizziness, irritation and coughing from inhalation. Ingestion of large amounts of 2,4-D has caused death within 1 to 2 days. Ingestion of lower doses has resulted in neuromuscular problems. Existing medical conditions may be aggravated by exposure to 2,4-D.

CHRONIC TOXICITY:

REPORTED EFFECTS: Liver, kidney, digestive, muscular and nervous system damage.

POTENTIAL FOR ADVERSE HEALTH EFFECTS FROM CONTACTING OR CONSUMING TREATED VEGETATION, WATER OR ANIMALS: See above.

POTENTIAL FOR ADVERSE HEALTH EFFECTS FROM INERT INGREDIENTS CONTAINED IN THE FORMULATED PRODUCTS: None reported.

HEALTH EFFECTS OF EXPOSURE TO FORMULATED PRODUCTS: See above.

HEALTH EFFECTS ASSOCIATED WITH CONTAMINANTS: Past reports of dioxin contamination. Recent testing has shown 2,4-D manufactured in the U.S. to be relatively free of dioxin. Minor traces found do not have biological significance.

HEALTH EFFECTS ASSOCIATED WITH OTHER FORMULATIONS: None reported.

VII. SAFETY PRECAUTIONS

SIGNAL WORD AND DEFINITION:

Most Acid and Salt Formulations:

2,4-D - **DANGER** - CAUSES IRREVERSIBLE EYE DAMAGE. HARMFUL IF SWALLOWED OR ABSORBED THROUGH SKIN. AVOID BREATHING SPRAY MIST. DO NOT GET IN EYES, ON SKIN OR CLOTHING.

Most Esters:

2,4-D - **CAUTION** – HARMFUL IF SWALLOWED, ABSORBED THROUGH THE SKIN OR INHALED. AVOID BREATHING VAPORS AND SPRAY MIST. AVOID CONTACT WITH EYES, SKIN OR CLOTHING.

PROTECTIVE PRECAUTIONS FOR WORKERS: Applicators and other handlers must wear long-sleeved shirt and long pants, shoes plus socks, and protective eyewear where appropriate.

MEDICAL TREATMENT PROCEDURES (ANTIDOTES):

EYES: Imperative to flush eyes with water for a minimum of 15 minutes. Call physician immediately.

SKIN: Wash all exposed areas with soap and water. Call physician if irritation persists.

INGESTION: Rinse mouth thoroughly with water. Promptly drink a large quantity of milk, egg whites, gelatin or water. Do not induce vomiting. Call physician immediately.

INHALATION: Remove to fresh air. Call a physician if breathing difficulty persists.

HANDLING, STORAGE AND DISPOSAL: Store at room temperature or cooler. Do not reuse container. Rinse container and dispose accordingly.

EMERGENCY SPILL PROCEDURES AND HAZARDS: Contain and sweep up material of small spills and dispose as waste. Do not contaminate water, food, or feed by storage or disposal.

VIII. DEFINITIONS

adsorption – the process of attaching to a surface

avian – of, or related to, birds

CAEPA – California Environmental Protection Agency

carcinogenicity – ability to cause cancer

CHEMTREC – Chemical Transportation Emergency Center

dermal – of, or related to, the skin

EC_{50} - median effective concentration during a bioassay

ecotoxicological – related to the effects of environmental toxicants on populations of organisms originating, being produced, growing or living naturally in a particular region or environment

FIFRA – Federal Insecticide, Fungicide and Rodenticide Act

formulation – the form in which the pesticide is supplied by the manufacturer for use

half-life – the time required for half the amount of a substance to be reduced by natural processes

herbicide – a substance used to destroy plants or to slow down their growth

Hg – chemical symbol for mercury

IARC – International Agency for Research on Cancer

K(oc) – the tendency of a chemical to be adsorbed by soil, expressed as: K(oc) = conc. adsorbed/conc. dissolved/% organic carbon in soil

LC_{50} – the concentration in air, water, or food that will kill approximately 50% of the subjects

LD_{50} – the dose that will kill approximately 50% of the subjects

leach – to dissolve out by the action of water

mg/kg – weight ratio expressed as milligrams per kilogram

mg/l – weight-to-liquid ratio expressed as milligrams per liter

microorganisms – living things too small to be seen without a microscope

mPa – milli-Pascal (unit of pressure)

mutagenicity – ability to cause genetic changes

NFPA – National Fire Protection Association

NIOSH - National Institute for Occupational Safety and Health

NOEL - no observable effect level

non-target – animals or plants other than the ones that the pesticide is intended to kill or control

OSHA - Occupational Safety and Health Administration

Pa – Pascal (unit of pressure)

persistence – tendency of a pesticide to remain to remain in the environment after it is applied

pesticides – substances including herbicides, insecticides, rodenticides, fumigants, repellents, growth regulators, etc., regulated under FIFRA

PPE – personal protective equipment

ppm – weight ratio expressed as parts per million

residual activity – the remaining amount of activity as a pesticide

T&E – Threatened and Endangered Species (from the Endangered Species Act)

µg – micrograms

volatility – the tendency to become a vapor at standard temperatures and pressures

IX. INFORMATION SOURCES

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X. TOXICITY CATEGORY TABLES

TABLE I: HUMAN HAZARDS

Category	Signal Word	Route of Administration			Hazard	
		Acute Oral LD_{50} (mg/kg)	Acute Dermal LD_{50} (mg/kg)	Acute Inhalation LC_{50} (mg/l)	Eye irritation	Skin irritation
I (Highly Toxic)	**DANGER (poison)**	0–50	0-200	0-0.2	corrosive: corneal opacity not reversible within 7 days	corrosive
II (Moderately Toxic)	**WARNING**	>50–500	>200-2000	>0.2-2	corneal opacity reversible within 7 days; irritation persisting for 7 days	severe irritation at 72 hours
III (Slightly Toxic)	**CAUTION**	>500-5000	>2000-20.000	>2-20	no corneal opacity; irritation reversible within 7 days	moderate irritation at 72 hours
IV (Practically Non-toxic)	**NONE**	>5000	>20,000	>20	no irritation	moderate irritation at 72 hours

After *Pesticide User's Guide*, Ohio State University, Extension Bull. No. 745, 1998.

TABLE II: ECOTOXICOLOGICAL RISKS TO WILDLIFE (TERRESTRIAL AND AQUATIC)

Risk Category	Mammals Acute Oral LD_{50} mg/kg)	Avian Acute Oral LD_{50} (mg/kg)	Avian Acute Dietary LC_{50} (mg/kg)	Fish or Aquatic Invertebrates Acute Concentration LC_{50} (mg/l)
Very Highly Toxic	<10	<10	<50	<0.1
Highly Toxic	10-50	10-50	50-500	0.1 – 1
Moderately Toxic	51-500	51-500	501-1,000	>1 – 10
Slightly Toxic	501-2,000	501-2,000	1,001-5,000	>10 – 100
Practically Non-toxic	>2,000	>2,000	>5,000	>100

Table II created from information contained in *Pesticides and Wildlife*, Whitford, Fred, et al., Purdue University Cooperative Extension Service PPP-30, 1998.

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This fact sheet was prepared by USDOE-Bonneville Power Administration, March 2000.

Azafenidin

HERBICIDE FACT SHEET

U.S. DEPARTMENT OF ENERGY
BONNEVILLE POWER ADMINISTRATION

This fact sheet is one of a series issued by the Bonneville Power Administration for their workers and the general public. It provides information on forest and land management uses, environmental and human health effects, and safety precautions. A list of definitions is included in Section VIII of this fact sheet.

I. BASIC INFORMATION

COMMON NAME: azafenidin

CHEMICAL NAME: 2-[2,4-dichloro-5-(2-propynyloxy)phenyl]-5,6,7,8-tetrahydro-1,2,4-triazolo[4,3-a]pyridin-3(2H)-one

CAS No. 68049-83-2

CHEMICAL TYPE*:* triazolone class of herbicides

PESTICIDE CLASSIFICATION*:* selective pre- and postemergent herbicide for broad leaf weeds and grasses.

REGISTERED USE STATUS: ”Registration Pending.”

FORMULATIONS: Commercial herbicide products generally contain one or more ingredients. An inert ingredient is anything added to the product other than an active ingredient. Because of concern for human health and the environment, EPA announced its policy on toxic inert ingredients in the Federal Register on April 22, 1987 (52FR13305). This policy focuses on the regulation of inert ingredients. EPA’s strategy for implementing this policy included the development of four lists of inerts, based on toxicological concerns. Inerts of toxicological concern were placed on List 1. Potentially toxic inerts/high priority for testing were placed on List 2. Inerts of unknown toxicity were placed on List 3, and inerts of minimal concern were placed on List 4.

The inert ingredients of the azafenidin formulation are not classified by EPA as inert ingredients of toxicological concern to humans or the environment.

The contents of the azafenidin formulation is listed below:

Azafenidin	80 %
Inert	20 %

RESIDUE ANALYTICAL METHODS:

II. HERBICIDE USES

REGISTERED FORESTRY, RANGELAND AND RIGHT-OF-WAY USES: Azafenidin as Milestone™ is registered for use in non-agricultural and agricultural areas for the control of selective broadleaf weeds and grasses and as a total vegetation management tool for bareground treatment. For terrestrial use only.

OPERATIONAL DETAILS:

TARGET PLANTS: Azafenidin is a selective pre- and post-emergent herbicide for control of broadleaf weeds and grasses, including, but not limited to the following: bluegrass, bermudagrass, crabgrass, chickweed, knotweed, milkweed, nettle, nutsedges, ragweed, and Russian thistle.

MODE OF ACTION: Inhibits the porphyrin biosynthetic pathway at a site that causes the accumulation of a photodynamic porphyrin intermediate, protoporphyrin IX, resulting in cell membrane disruption.

METHOD OF APPLICATION AND RATES: Pre- or post-treatment by a variety of spray application methods, with application rates of 8 to 16 ounces of active ingredient per acre.

SPECIAL PRECAUTIONS:

TIMING OF APPLICATION: Approximately one-half inch of rain is necessary for activation. The Milestone formulation is applied any time but is most effective for pre-emergent treatment. The timing will depend on the target plants.

DRIFT CONTROL: Care should be exercised not to overspray or apply the herbicide to adjacent non-target areas. Drift control is achieved by observing weather conditions and following label and sprayer instructions. Spray droplet size should be 150 microns or larger.

Restrictions/Warnings/Limitations: Do not apply directly to water or areas where surface water is present, or to intertidal areas below the mean high water mark. May harm non-target plants.

III. ENVIRONMENTAL EFFECTS/FATE

SOIL:

RESIDUAL SOIL ACTIVITY: The half-life of azafenidin is 4 to 129 days.

ADSORPTION: The K(oc) of azafenidin is 186 to 579 depending on soil pH and soil types.

PERSISTENCE AND AGENTS OF DEGRADATION: Not known.

METABOLITES/DEGRADATION PRODUCTS AND POTENTIAL ENVIRONMENTAL EFFECTS: Not known.

WATER:

SOLUBILITY: 18 mg/kg in water.

POTENTIAL FOR LEACHING INTO SURFACE AND GROUND WATER: The product has low potential to leach into surface and ground water due to low solubility, high K(oc) and relatively rapid field and soil dissipation.

AIR:

VOLATILIZATION: 2.1×10^{-10} mm Hg at 25° C

POTENTIAL FOR BYPRODUCTS FROM BURNING OF TREATED VEGETATION: Not known.

IV. ECOLOGICAL TOXICITY EFFECTS ON NON-TARGET SPECIES

MICROORGANISMS:

ACUTE ORAL TOXICITY*:* LD_{50} (honey bee 48-hour) >20 µg/bee

ACUTE CONTACT TOXICITY*:* LD_{50} (honey bee 48-hour) >100 µg/bee

OVERALL TOXICITY: Practically Non-Toxic

PLANTS: Contact will injure or kill target and non-target brush/woody plants.

AQUATIC VERTEBRATES:

ACUTE TOXICITY*:* LC_{50} (rainbow trout 96-hour) 33 mg/l

ACUTE TOXICITY: LC_{50} (bluegill sunfish 96-hour) 48 mg/l

ACUTE TOXICITY: LC_{50} (sheepshead minnow 96-hour) >25 mg/l

OVERALL TOXICITY: Slightly Toxic

AQUATIC INVERTEBRATES:

ACUTE TOXICITY*:* LC_{50} (*Daphnia magna* 48-hour) 38 mg/l
OVERALL TOXICITY: Slightly Toxic

TERRESTRIAL ANIMALS:

AVIAN ACUTE ORAL TOXICITY*:* LD_{50} (bobwhite quail) >2250 mg/kg

AVIAN ACUTE ORAL TOXICITY: LD_{50} (mallard duck) >2250 mg/kg

MAMMAL ACUTE ORAL TOXICITY: LD_{50} (rat) >5000 mg/kg

AVIAN SUBACUTE DIETARY TOXICITY: LC_{50} (bobwhite quail) >5620 mg/kg

AVIAN SUBACUTE DIETARY TOXICITY: LC_{50} (mallard duck) >5620 mg/kg

OVERALL TOXICITY: Practically Non-Toxic

BIOACCUMULATION POTENTIAL: Slight Potential

THREATENED AND ENDANGERED SPECIES: Federally listed plants may be adversely affected if the product is applied directly to the plants.

V. TOXICOLOGICAL DATA

ACUTE TOXICITY:

ACUTE ORAL TOXICITY: LD_{50} (rat) >5000 mg/kg

LD_{50} (rat) >5000 mg/kg (Milestone™)

ACUTE DERMAL TOXICITY: LD_{50} (rabbit) >2000 mg/kg

LD_{50} (rabbit) >5000 mg/kg (Milestone™)

PRIMARY SKIN IRRITATION: Rabbit - Not an Irritant (Technical and Milestone™)

PRIMARY EYE IRRITATION: Rabbit – Not an Irritant (Technical and Milestone™)

ACUTE INHALATION: LC_{50} (rat) >5.3 mg/l

LC_{50} (rat) >5.5 mg/l (Milestone™)

OVERALL TOXICITY: Awaiting final registration by EPA.

CHRONIC TOXICITY:

CARCINOGENICITY: Not listed or classified by EPA or CAEPA as a carcinogen.

DEVELOPMENTAL/REPRODUCTIVE: No effects reported.

MUTAGENICITY: No effects reported.

HAZARD: Awaiting final registration by EPA.

VI. HUMAN HEALTH EFFECTS

ACUTE TOXICITY (POISONING):

REPORTED EFFECTS: Ingestion may cause liver toxicity and anemia.

CHRONIC TOXICITY:

REPORTED EFFECTS: None reported.

POTENTIAL FOR ADVERSE HEALTH EFFECTS FROM CONTACTING OR CONSUMING TREATED VEGETATION, WATER OR ANIMALS: None reported.

POTENTIAL FOR ADVERSE HEALTH EFFECTS FROM INERT INGREDIENTS CONTAINED IN THE FORMULATED PRODUCTS: Information not available.

HEALTH EFFECTS OF EXPOSURE TO FORMULATED PRODUCTS: Mild, temporary skin and eye irritation.

HEALTH EFFECTS ASSOCIATED WITH CONTAMINANTS: None reported.

HEALTH EFFECTS ASSOCIATED WITH OTHER FORMULATIONS: None reported.

VII. SAFETY PRECAUTIONS

SIGNAL WORD AND DEFINITION:

AZAFENIDIN **- CAUTION** – CAUSES MODERATE EYE IRRITATION. AVOID CONTACT WITH EYES OR CLOTHING. WASH THOROUGHLY WITH SOAP AND WATER AFTER HANDLING.

PROTECTIVE PRECAUTIONS FOR WORKERS: None.

MEDICAL TREATMENT PROCEDURES (ANTIDOTES):

EYES: Flush eyes with water; call physician if irritation persists.

SKIN: Wash all exposed areas with soap and water.

INGESTION: None.

INHALATION: None.

HANDLING, STORAGE AND DISPOSAL: Store at room temperature or cooler. Do not reuse container. Rinse container and dispose accordingly.

EMERGENCY SPILL PROCEDURES AND HAZARDS: Contain and sweep up material of small spills and dispose as waste. Do not contaminate water, food or feed by storage or disposal.

VIII. DEFINITIONS

adsorption – the process of attaching to a surface

avian – of, or related to, birds

CAEPA – California Environmental Protection Agency

carcinogenicity – ability to cause cancer

CHEMTREC – Chemical Transportation Emergency Center

dermal – of, or related to, the skin

EC_{50} - median effective concentration during a bioassay

ecotoxicological – related to the effects of environmental toxicants on populations of organisms originating, being produced, growing or living naturally in a particular region or environment

FIFRA – Federal Insecticide, Fungicide and Rodenticide Act

formulation – the form in which the pesticide is supplied by the manufacturer for use

half-life – the time required for half the amount of a substance to be reduced by natural processes

herbicide – a substance used to destroy plants or to slow down their growth

Hg – chemical symbol for mercury

IARC – International Agency for Research on Cancer

K(oc) – the tendency of a chemical to be adsorbed by soil, expressed as: K(oc) = conc. adsorbed/conc. dissolved/% organic carbon in soil

LC_{50} – the concentration in air, water, or food that will kill approximately 50% of the subjects

LD_{50} – the dose that will kill approximately 50% of the subjects

leach – to dissolve out by the action of water

mg/kg – weight ratio expressed as milligrams per kilogram
mg/l – weight-to-liquid ratio expressed as milligrams per liter
microorganisms – living things too small to be seen without a microscope
mPa – milli-Pascal (unit of pressure)
mutagenicity – ability to cause genetic changes
NFPA – National Fire Protection Association
NIOSH - National Institute for Occupational Safety and Health
NOEL - no observable effect level
non-target – animals or plants other than the ones that the pesticide is intended to kill or control
OSHA - Occupational Safety and Health Administration
Pa – Pascal (unit of pressure)
persistence – tendency of a pesticide to remain to remain in the environment after it is applied
pesticides – substances including herbicides, insecticides, rodenticides, fumigants, repellents, growth regulators, etc., regulated under FIFRA
PPE – personal protective equipment
ppm – weight ratio expressed as parts per million
residual activity – the remaining amount of activity as a pesticide
T&E – Threatened and Endangered Species (from the Endangered Species Act)
µg – micrograms
volatility – the tendency to become a vapor at standard temperatures and pressures

IX. INFORMATION SOURCES

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Spray Drift Task Force, A Summary of Ground Application Studies, 1997 http://www.agdrift.com/publications/Body.htm

X. TOXICITY CATEGORY TABLES

TABLE I: HUMAN HAZARDS

Category	Signal Word	Route of Administration			Hazard	
		Acute Oral LD_{50} (mg/kg)	Acute Dermal LD_{50} (mg/kg)	Acute Inhalation LC_{50} (mg/l)	Eye irritation	Skin irritation
I (Highly Toxic)	**DANGER (poison)**	0–50	0-200	0-0.2	corrosive: corneal opacity not reversible within 7 days	corrosive
II (Moderately Toxic)	**WARNING**	>50–500	>200-2000	>0.2-2	corneal opacity reversible within 7 days; irritation persisting for 7 days	severe irritation at 72 hours
III (Slightly Toxic)	**CAUTION**	>500-5000	>2000-20.000	>2-20	no corneal opacity; irritation reversible within 7 days	moderate irritation at 72 hours
IV (Practically Non-toxic)	**NONE**	>5000	>20,000	>20	no irritation	moderate irritation at 72 hours

After *Pesticide User's Guide*, Ohio State University, Extension Bull. No. 745, 1998.

TABLE II: ECOTOXICOLOGICAL RISKS TO WILDLIFE (TERRESTRIAL AND AQUATIC)

Risk Category	Mammals	Avian	Avian	Fish or Aquatic Invertebrates
	Acute Oral LD_{50} mg/kg)	Acute Oral LD_{50} (mg/kg)	Acute Dietary LC_{50} (mg/kg)	Acute Concentration LC_{50} (mg/l)
Very Highly Toxic	<10	<10	<50	<0.1
Highly Toxic	10-50	10-50	50-500	0.1 – 1
Moderately Toxic	51-500	51-500	501-1,000	>1 – 10
Slightly Toxic	501-2,000	501-2,000	1,001-5,000	>10 – 100
Practically Non-toxic	>2,000	>2,000	>5,000	>100

Table II created from information contained in *Pesticides and Wildlife*, Whitford, Fred, et al., Purdue University Cooperative Extension Service PPP-30, 1998.

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This fact sheet was prepared by USDOE-Bonneville Power Administration, March 2000.

Bromacil

HERBICIDE FACT SHEET

U.S. DEPARTMENT OF ENERGY
BONNEVILLE POWER ADMINISTRATION

This fact sheet is one of a series issued by the Bonneville Power Administration for their workers and the general public. It provides information on forest and land management uses, environmental and human health effects, and safety precautions. A list of definitions is included in Section VIII of this fact sheet.

I. BASIC INFORMATION

COMMON NAME: bromacil*

CHEMICAL NAME: 5-bromo-3-sec-butyl-6-methyluracil, CAS No. 314-40-9
5-bromo-3-sec-butyl-6-methyluracil, lithium salt, CAS No. 53404-19-6

* According to EPA, bromacil and bromacil lithium salt are toxicologically similar. This Fact Sheet applies to both active ingredients.

CHEMICAL TYPE: uracil class of herbicide

PESTICIDE CLASSIFICATION: systemic, broad-spectrum herbicide to controls weeds and brush

REGISTERED USE STATUS: General Use Pesticide. Restricted Use Pesticide in Washington.

FORMULATIONS: Commercial herbicide products generally contain one or more ingredients. An inert ingredient is anything added to the product other than an active ingredient. Because of concern for human health and the environment, EPA announced its policy on toxic inert ingredients in the Federal Register on April 22, 1987 (52FR13305). This policy focuses on the regulation of inert ingredients. EPA's strategy for implementing this policy included the development of four lists of inerts, based on toxicological concerns. Inerts of toxicological concern were placed on List 1. Potentially toxic inerts/high priority for testing were placed on List 2. Inerts of unknown toxicity were placed on List 3, and inerts of minimal concern were placed on List 4.

The inert ingredients of the dicamba formulations are not classified by the USEPA as inert ingredients of toxicological concerns to humans or the environment.

The contents of the bromacil formulation is listed below:

Hyvar™ X (Wettable Powder)

Bromacil	80 %
Inert	20 %

Hyvar™ X-L (Water Soluble Liquid)

Bromacil Lithium Salt	21.9 %
Inert	78.1 %

RESIDUE ANALYTICAL METHODS: EPA METHOD 632

II. HERBICIDE USES

REGISTERED FORESTRY, RANGELAND AND RIGHT-OF-WAY USES: Bromacil as Hyvar™ is registered for use in non-agricultural and agricultural areas for the control of weeds, grasses, and as a total vegetation management tool for bare-ground treatment. For terrestrial use only.

OPERATIONAL DETAILS:

TARGET PLANTS: Bromacil is a non-selective herbicide for annual and perennial weeds and brush, woody plants and, vines.

MODE OF ACTION: Bromacil enters the plant through the root zone and moves throughout the plant inhibiting photosynthesis.

METHOD OF APPLICATION AND RATES: Broadcast, band and basal application at 2 to 12 pounds of formulated product per acre. Aerial application is prohibited.

SPECIAL PRECAUTIONS:

TIMING OF APPLICATION: For woody plants and brush, Bromacil is applied in the spring and summer. Weeds are controlled by applying Bromacil prior to or after emergence. As bromacil must move to the root zone to be effective, adequate soil moisture is necessary.

DRIFT CONTROL: Care should be exercised not to overspray or apply the herbicide to adjacent non-target areas. Drift control is achieved by observing weather conditions and following label and sprayer instructions. Spray droplet size should be 150 microns or larger.

Restrictions/Warnings/Limitations: Do not enter or allow others to enter the treated area until sprays have dried. Not for use in recreation or residential areas. Do not apply through any type of irrigation system. Do not apply more than 12 pounds/acre/year for any treated site. Do not apply when ground is frozen. Do not apply directly to water or areas where surface water is present, or to intertidal areas below the mean high water mark. Do not apply to irrigation banks or other ditch banks. Do not graze animals in treated areas. Will harm non-target plants.

III. ENVIRONMENTAL EFFECTS/FATE

SOIL:

RESIDUAL SOIL ACTIVITY: The half-life of bromacil is 275 days.

ADSORPTION: The K(oc) of bromacil is 32.

PERSISTENCE AND AGENTS OF DEGRADATION: Bromacil is persistent with no major (>10%) degradates.

METABOLITES/DEGRADATION PRODUCTS AND POTENTIAL ENVIRONMENTAL EFFECTS: The primary metabolites of bromacil are carbon dioxide, 5-bromo-6-methyluracil, 5-bromo-3-(alpha-hydroxymethylpropyl)-6-methyluracil, 5-bromo-3-sec-butyl-6-hydroxymethyluracil, 5-bromo-3-(2-hydroxy-1-methylpropyl)-6-methyluracil, and 3-sec-butyl-6-methyluracil. These metabolites are not of toxicological concern to EPA.

WATER:

SOLUBILITY: 700 mg/kg in water.

POTENTIAL FOR LEACHING INTO SURFACE AND GROUND WATER: Bromacil is persistent and highly mobile. Bromacil is known to leach into ground water and has high potential to enter surface waters.

AIR:

VOLATILIZATION: Very low.

POTENTIAL FOR BYPRODUCTS FROM BURNING OF TREATED VEGETATION: Not known.

IV. ECOLOGICAL TOXICITY EFFECTS ON NON-TARGET SPECIES

MICROORGANISMS:

ACUTE ORAL TOXICITY*:* LD_{50} (honey bee 48-hour) >1 µg/bee

ACUTE CONTACT TOXICITY*:* LD_{50} (honey bee 48-hour) >100 ug/bee

OVERALL TOXICITY: Practically Non-Toxic

PLANTS: Contact will injure or kill target and non-target brush/woody plants.

AQUATIC VERTEBRATES:

ACUTE TOXICITY*:* LC_{50} (rainbow trout 96-hour) 36 mg/l

ACUTE TOXICITY: LC_{50} (bluegill sunfish 96-hour) 127 mg/l

OVERALL TOXICITY: Slightly Toxic

AQUATIC FRESHWATER INVERTEBRATES:

ACUTE TOXICITY*:* EC_{50} (*Daphnia magna* 48-hour) 121 mg/l

OVERALL TOXICITY: Practically Non-Toxic

AQUATIC ESTUARINE/MARINE INVERTEBRATES:

ACUTE TOXICITY*:* LC_{50} (Eastern oyster larvae 48-hour) 130 mg/l

ACUTE TOXICITY*:* LC_{50} (mysid 48-hour) 12.9 mg/l

ACUTE TOXICITY*:* LC_{50} (sheepshead minnow 48-hour) 1620 mg/l

OVERALL TOXICITY: Practically Non-Toxic

TERRESTRIAL ANIMALS:

AVIAN ACUTE ORAL TOXICITY*:* LD_{50} (bobwhite quail) >2250 mg/kg

MAMMAL ACUTE ORAL TOXICITY: LD_{50} (rat) 3998 mg/kg

AVIAN SUBACUTE DIETARY TOXICITY: LC_{50} (bobwhite quail) >10,000 mg/kg

AVIAN SUBACUTE DIETARY TOXICITY: LC_{50} (mallard duck) >10,000 mg/kg

OVERALL TOXICITY: Practically Non-Toxic

BIOACCUMULATION POTENTIAL: Low potential

THREATENED AND ENDANGERED SPECIES: Federally listed plants may be adversely affected if the product is applied directly to the plants.

V. TOXICOLOGICAL DATA

ACUTE TOXICITY:

ACUTE ORAL TOXICITY*:* LD_{50} (rat) 5126 mg/kg

ACUTE DERMAL TOXICITY: LD_{50} (rabbit) >5000 mg/kg

PRIMARY SKIN IRRITATION: Rabbit - Not an Irritant

PRIMARY EYE IRRITATION: Rabbit – Slight Irritant

ACUTE INHALATION: LC_{50} (rat) >14.4 mg/l

OVERALL TOXICITY: Category III – Caution

CHRONIC TOXICITY:

CARCINOGENICITY: Classified by EPA as Group C - possible human carcinogen.

DEVELOPMENTAL/REPRODUCTIVE: No effects reported.

MUTAGENICITY: Not a mutagenic.

HAZARD: The end-use product label for Hyvar™ carries the *Caution* signal word due to eye irritation, potential exposure to mixers/applicators, and PPE requirements.

VI. HUMAN HEALTH EFFECTS

ACUTE TOXICITY (POISONING):

REPORTED EFFECTS: Low Risk.

CHRONIC TOXICITY:

REPORTED EFFECTS: None reported.

POTENTIAL FOR ADVERSE HEALTH EFFECTS FROM CONTACTING OR CONSUMING TREATED VEGETATION, WATER OR ANIMALS: None reported.

POTENTIAL FOR ADVERSE HEALTH EFFECTS FROM INERT INGREDIENTS CONTAINED IN THE FORMULATED PRODUCTS: Information not available.

HEALTH EFFECTS OF EXPOSURE TO FORMULATED PRODUCTS: Mild, temporary skin and eye irritation.

HEALTH EFFECTS ASSOCIATED WITH CONTAMINANTS: None reported.

HEALTH EFFECTS ASSOCIATED WITH OTHER FORMULATIONS: None reported.

VII. SAFETY PRECAUTIONS

SIGNAL WORD AND DEFINITION:

BROMACIL **- CAUTION** – HARMFUL IF SWALLOWED. CAUSES MODERATE EYE IRRITATION. AVOID CONTACT WITH EYES OR CLOTHING

PROTECTIVE PRECAUTIONS FOR WORKERS: Applicators and other handlers must wear long-sleeved shirt and long pants, shoes plus socks, and waterproof gloves.

MEDICAL TREATMENT PROCEDURES (ANTIDOTES):

EYES: Flush eyes with water; call physician if irritation persists.

SKIN: Wash all exposed areas with soap and water; call physician if irritation persists.

INGESTION: Induce vomiting and call physician or Poison Control Center.

INHALATION: None.

HANDLING, STORAGE AND DISPOSAL: Store at room temperature or cooler. Do not reuse container. Rinse container and dispose accordingly. Liquid formulation is combustible. Do not use or store near heat or open flame. Keep container closed when not in use.

EMERGENCY SPILL PROCEDURES AND HAZARDS: Contain and sweep up material of small spills and dispose as waste. Do not contaminate water, food or feed by storage or disposal.

VIII. DEFINITIONS

adsorption – the process of attaching to a surface

avian – of, or related to, birds

CAEPA – California Environmental Protection Agency

carcinogenicity – ability to cause cancer

CHEMTREC – Chemical Transportation Emergency Center

dermal – of, or related to, the skin

EC_{50} - median effective concentration during a bioassay

ecotoxicological – related to the effects of environmental toxicants on populations of organisms originating, being produced, growing or living naturally in a particular region or environment

FIFRA – Federal Insecticide, Fungicide and Rodenticide Act

formulation – the form in which the pesticide is supplied by the manufacturer for use

half-life – the time required for half the amount of a substance to be reduced by natural processes

herbicide – a substance used to destroy plants or to slow down their growth

Hg – chemical symbol for mercury

IARC – International Agency for Research on Cancer

K(oc) – the tendency of a chemical to be adsorbed by soil, expressed as: K(oc) = conc. adsorbed/conc. dissolved/% organic carbon in soil

LC_{50} – the concentration in air, water, or food that will kill approximately 50% of the subjects

LD_{50} – the dose that will kill approximately 50% of the subjects

leach – to dissolve out by the action of water

mg/kg – weight ratio expressed as milligrams per kilogram

mg/l – weight-to-liquid ratio expressed as milligrams per liter

microorganisms – living things too small to be seen without a microscope

mPa – milli-Pascal (unit of pressure)

mutagenicity – ability to cause genetic changes

NFPA – National Fire Protection Association

NIOSH - National Institute for Occupational Safety and Health

NOEL - no observable effect level

non-target – animals or plants other than the ones that the pesticide is intended to kill or control

OSHA - Occupational Safety and Health Administration

Pa – Pascal (unit of pressure)

persistence – tendency of a pesticide to remain to remain in the environment after it is applied

pesticides – substances including herbicides, insecticides, rodenticides, fumigants, repellents, growth regulators, etc., regulated under FIFRA

PPE – personal protective equipment

ppm – weight ratio expressed as parts per million

residual activity – the remaining amount of activity as a pesticide

T&E – Threatened and Endangered Species (from the Endangered Species Act)

µg – micrograms

volatility – the tendency to become a vapor at standard temperatures and pressures

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http://www.epa.gov/oppsrrd1/REDs/

X. TOXICITY CATEGORY TABLES

TABLE I: HUMAN HAZARDS

Category	Signal Word	Route of Administration			Hazard	
		Acute Oral LD_{50} (mg/kg)	Acute Dermal LD_{50} (mg/kg)	Acute Inhalation LC_{50} (mg/l)	Eye irritation	Skin irritation
I (Highly Toxic)	**DANGER (poison)**	0–50	0-200	0-0.2	corrosive: corneal opacity not reversible within 7 days	corrosive
II (Moderately Toxic)	**WARNING**	>50–500	>200-2000	>0.2-2	corneal opacity reversible within 7 days; irritation persisting for 7 days	severe irritation at 72 hours
III (Slightly Toxic)	**CAUTION**	>500-5000	>2000-20.000	>2-20	no corneal opacity; irritation reversible within 7 days	moderate irritation at 72 hours
IV (Practically Non-toxic)	**NONE**	>5000	>20,000	>20	no irritation	moderate irritation at 72 hours

After *Pesticide User's Guide*, Ohio State University, Extension Bull. No. 745, 1998.

TABLE II: ECOTOXICOLOGICAL RISKS TO WILDLIFE (TERRESTRIAL AND AQUATIC)

Risk Category	Mammals Acute Oral LD_{50} mg/kg)	Avian Acute Oral LD_{50} (mg/kg)	Avian Acute Dietary LC_{50} (mg/kg)	Fish or Aquatic Invertebrates Acute Concentration LC_{50} (mg/l)
Very Highly Toxic	<10	<10	<50	<0.1
Highly Toxic	10-50	10-50	50-500	0.1 – 1
Moderately Toxic	51-500	51-500	501-1,000	>1 – 10
Slightly Toxic	501-2,000	501-2,000	1,001-5,000	>10 – 100
Practically Non-toxic	>2,000	>2,000	>5,000	>100

Table II created from information contained in *Pesticides and Wildlife*, Whitford, Fred, et al., Purdue University Cooperative Extension Service PPP-30, 1998.

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Chlorsulfuron

HERBICIDE FACT SHEET

U.S. DEPARTMENT OF ENERGY
BONNEVILLE POWER ADMINISTRATION

This fact sheet is one of a series issued by the Bonneville Power Administration for their workers and the general public. It provides information on forest and land management uses, environmental and human health effects, and safety precautions. A list of definitions is included in Section VIII of this fact sheet.

I. BASIC INFORMATION

COMMON NAME: chlorsulfuron

CHEMICAL NAME: 2-Chloro-N-[(4-methoxy-6-methyl-1,3,5-triazin-2-yl)aminocarbonyl] benzenesulfonamide

Cas No. 64902-72-3

CHEMICAL TYPE: sulfonylurea herbicide

PESTICIDE CLASSIFICATION: systemic, selective pre- and post-emergent herbicide

REGISTERED USE STATUS: "General Use Pesticide."

FORMULATIONS: Commercial herbicide products generally contain one or more ingredients. An inert ingredient is anything added to the product other than an active ingredient. Because of concern for human health and the environment, EPA announced its policy on toxic inert ingredients in the Federal Register on April 22, 1987 (52FR13305). This policy focuses on the regulation of inert ingredients. EPA's strategy for implementing this policy included the development of four lists of inerts, based on toxicological concerns. Inerts of toxicological concern were placed on List 1. Potentially toxic inerts/high priority for testing were placed on List 2. Inerts of unknown toxicity were placed on List 3, and inerts of minimal concern were placed on List 4.

The inert ingredients of these formulations are not classified by the USEPA as inert ingredients of toxicological concerns to humans or the environment.

The contents of the chlorsulfuron formulation are listed below:

Telar® DF

Chlorsulfuron	75 %
Inert	25 %

RESIDUE ANALYTICAL METHODS: EPA METHOD 632

II. HERBICIDE USES

REGISTERED FORESTRY, RANGELAND AND RIGHT-OF-WAY USES: Chlorsulfuron as Telar® is registered for use in non-agricultural areas for the control of weeds, grasses, and as a total vegetation management tool for bareground treatment. For terrestrial use only.

OPERATIONAL DETAILS:

TARGET PLANTS: Chlorsulfuron is a selective herbicide for pre- and post-emergent control of annual, biennial, and perennial broadleaf weeds.

MODE OF ACTION: Chlorsulfuron enters the plant through the root zone and foliage inhibiting the synthesis of key amino acids.

METHOD OF APPLICATION AND RATES: Broadcast and spot spray applications a t1/4 to 3 ounces of formulated product per acre. Ground application only.

SPECIAL PRECAUTIONS:

TIMING OF APPLICATION: Weeds are controlled by applying Chlorsulfuron prior to or after emergence. As chlorsulfuron must move to the root zone to be effective for pre-emergent control, adequate soil moisture is necessary.

DRIFT CONTROL: Care should be exercised not to overspray or apply the herbicide to adjacent non-target areas. Drift control is achieved by observing weather conditions and following label and sprayer instructions. Spray droplet size should be 150 microns or larger.

Restrictions/Warnings/Limitations Do not enter or allow others to enter the treated area until sprays have dried. Do not apply through any type of irrigation system. Do not apply directly to water or areas where surface water is present, or to intertidal areas below the mean high water mark. Do not apply to irrigation banks or other ditch banks. Do not use on lawns. Do not use on walks, driveways, tennis courts, or other impermeable areas. Do not apply to frozen ground. Treated soil should remain undisturbed. Will harm non-target plants.

III. ENVIRONMENTAL EFFECTS/FATE

SOIL:

RESIDUAL SOIL ACTIVITY: The half-life of chlorsulfuron is 28 to 42 days.

ADSORPTION: The K(oc) of chlorsulfuron is 33.

PERSISTENCE AND AGENTS OF DEGRADATION: Chlorsulfuron is persistent with no major (>10%) degradates.

METABOLITES/DEGRADATION PRODUCTS AND POTENTIAL ENVIRONMENTAL EFFECTS: Chlorsulfuron degrades to nonphytotoxic, low-molecular-weight compounds.

WATER:

SOLUBILITY: 31,800 mg/l in water (pH 7).

POTENTIAL FOR LEACHING INTO SURFACE AND GROUND WATER: Chlorsulfuron is moderately persistent and highly mobile and has potential to enter surface waters from runoff. The very low application rate and microbial breakdown suggest that chlorsulfuron has little potential to enter ground water.

AIR:

VOLATILIZATION: Nonvolatile

POTENTIAL FOR BYPRODUCTS FROM BURNING OF TREATED VEGETATION: Not known.

IV. ECOLOGICAL TOXICITY EFFECTS ON NON-TARGET SPECIES

MICROORGANISMS:

ACUTE CONTACT TOXICITY*:* LD_{50} (honey bee contact) >2 µg/bee

OVERALL TOXICITY: Practically Non-Toxic

PLANTS: Contact will injure or kill target and non-target plants.

AQUATIC VERTEBRATES:

ACUTE TOXICITY*:* LC_{50} (rainbow trout 96-hour) >250 mg/l

ACUTE TOXICITY: LC_{50} (bluegill sunfish 96-hour) >300 mg/l

OVERALL TOXICITY: Practically Non-Toxic

AQUATIC FRESHWATER INVERTEBRATES:

ACUTE TOXICITY*:* LC_{50} (*Daphnia magna* 48-hour) 370.9 mg/l

OVERALL TOXICITY: Practically Non-Toxic

AQUATIC ESTUARINE/MARINE INVERTEBRATES:

ACUTE TOXICITY*:* EC_{50} (Eastern oyster larvae 48-hour) 385 mg/l

ACUTE TOXICITY*:* LC_{50} (sheepshead minnow 96-hour) >980

OVERALL TOXICITY: Practically Non-Toxic

TERRESTRIAL ANIMALS:

AVIAN ACUTE ORAL TOXICITY*:* LD_{50} (bobwhite quail) >5000 mg/kg

AVIAN ACUTE ORAL TOXICITY*:* LD_{50} (mallard duck) >5000 mg/kg

AVIAN SUBACUTE DIETARY TOXICITY: LC_{50} (bobwhite quail) >5620 mg/kg

AVIAN SUBACUTE DIETARY TOXICITY: LC_{50} (mallard duck) >5000 mg/kg

MAMMAL ACUTE ORAL TOXICITY: LD_{50} (rat) >5000 mg/kg

OVERALL TOXICITY: Practically Non-Toxic

BIOACCUMULATION POTENTIAL: No Potential

THREATENED AND ENDANGERED SPECIES: Federally listed plants may be adversely affected if the product is applied directly to the plants.

V. TOXICOLOGICAL DATA

ACUTE TOXICITY:

ACUTE ORAL TOXICITY*:* LD_{50} (rat) >5000 mg/kg

ACUTE DERMAL TOXICITY: LD_{50} (rabbit) >2000 mg/kg

PRIMARY SKIN IRRITATION: Rabbit - Not an Irritant

PRIMARY EYE IRRITATION: Rabbit – Moderate Irritant

ACUTE INHALATION: LC_{50} (rat) >5.9 mg/l

OVERALL TOXICITY: Category III – Caution

CHRONIC TOXICITY:

CARCINOGENICITY: No effects reported.

DEVELOPMENTAL/REPRODUCTIVE: No effects reported.

MUTAGENICITY: Not a mutagenic.

HAZARD: The end-use product label for Telar® carries the *Caution* signal word due to eye, nose, throat or skin irritation.

VI. HUMAN HEALTH EFFECTS

ACUTE TOXICITY (POISONING):

REPORTED EFFECTS: None.

CHRONIC TOXICITY:

REPORTED EFFECTS: None reported.

POTENTIAL FOR ADVERSE HEALTH EFFECTS FROM CONTACTING OR CONSUMING TREATED VEGETATION, WATER OR ANIMALS: None reported.

POTENTIAL FOR ADVERSE HEALTH EFFECTS FROM INERT INGREDIENTS CONTAINED IN THE FORMULATED PRODUCTS: None reported.

HEALTH EFFECTS OF EXPOSURE TO FORMULATED PRODUCTS: Mild, temporary skin and eye irritation.

HEALTH EFFECTS ASSOCIATED WITH CONTAMINANTS: None reported.

HEALTH EFFECTS ASSOCIATED WITH OTHER FORMULATIONS: None reported.

VII. SAFETY PRECAUTIONS

SIGNAL WORD AND DEFINITION:

CHLORSULFURON **- CAUTION** – MAY IRRITATE EYES, NOSE, THROAT OR SKIN

PROTECTIVE PRECAUTIONS FOR WORKERS: Applicators and other handlers must wear long-sleeved shirt and long pants, shoes plus socks.

MEDICAL TREATMENT PROCEDURES (ANTIDOTES):

EYES: Flush eyes with water; call physician if irritation persists.

SKIN: Wash all exposed areas with soap and water; call physician if irritation persists.

INGESTION: Induce vomiting and call physician or Poison Control Center.

INHALATION: Remove to fresh air.

HANDLING, STORAGE AND DISPOSAL: Store at room temperature or cooler. Do not reuse container. Rinse container and dispose accordingly.

EMERGENCY SPILL PROCEDURES AND HAZARDS: Contain and sweep up material of small spills and dispose as waste. Do not contaminate water, food, or feed by storage or disposal.

VIII. DEFINITIONS

adsorption – the process of attaching to a surface

avian – of, or related to, birds

CAEPA – California Environmental Protection Agency

carcinogenicity – ability to cause cancer

CHEMTREC – Chemical Transportation Emergency Center

dermal – of, or related to, the skin

EC_{50} - median effective concentration during a bioassay

ecotoxicological – related to the effects of environmental toxicants on populations of organisms originating, being produced, growing or living naturally in a particular region or environment

FIFRA – Federal Insecticide, Fungicide and Rodenticide Act

formulation – the form in which the pesticide is supplied by the manufacturer for use

half-life – the time required for half the amount of a substance to be reduced by natural processes

herbicide – a substance used to destroy plants or to slow down their growth

Hg – chemical symbol for mercury

IARC – International Agency for Research on Cancer

K(oc) – the tendency of a chemical to be adsorbed by soil, expressed as: K(oc) = conc. adsorbed/conc. dissolved/% organic carbon in soil

LC_{50} – the concentration in air, water, or food that will kill approximately 50% of the subjects

LD_{50} – the dose that will kill approximately 50% of the subjects
leach – to dissolve out by the action of water
mg/kg – weight ratio expressed as milligrams per kilogram
mg/l – weight-to-liquid ratio expressed as milligrams per liter
microorganisms – living things too small to be seen without a microscope
mPa – milli-Pascal (unit of pressure)
mutagenicity – ability to cause genetic changes
NFPA – National Fire Protection Association
NIOSH - National Institute for Occupational Safety and Health
NOEL - no observable effect level
non-target – animals or plants other than the ones that the pesticide is intended to kill or control
OSHA - Occupational Safety and Health Administration
Pa – Pascal (unit of pressure)
persistence – tendency of a pesticide to remain to remain in the environment after it is applied
pesticides – substances including herbicides, insecticides, rodenticides, fumigants, repellents, growth regulators, etc., regulated under FIFRA
PPE – personal protective equipment
ppm – weight ratio expressed as parts per million
residual activity – the remaining amount of activity as a pesticide
T&E – Threatened and Endangered Species (from the Endangered Species Act)
µg – micrograms
volatility – the tendency to become a vapor at standard temperatures and pressures

IX. INFORMATION SOURCES

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X. TOXICITY CATEGORY TABLES

TABLE I: HUMAN HAZARDS

Category	Signal Word	Route of Administration			Hazard	
		Acute Oral LD_{50} (mg/kg)	Acute Dermal LD_{50} (mg/kg)	Acute Inhalation LC_{50} (mg/l)	Eye irritation	Skin irritation
I (Highly Toxic)	**DANGER (poison)**	0–50	0-200	0-0.2	corrosive: corneal opacity not reversible within 7 days	corrosive
II (Moderately Toxic)	**WARNING**	>50–500	>200-2000	>0.2-2	corneal opacity reversible within 7 days; irritation persisting for 7 days	severe irritation at 72 hours
III (Slightly Toxic)	**CAUTION**	>500-5000	>2000-20.000	>2-20	no corneal opacity; irritation reversible within 7 days	moderate irritation at 72 hours
IV (Practically Non-toxic)	**NONE**	>5000	>20,000	>20	no irritation	moderate irritation at 72 hours

After *Pesticide User's Guide*, Ohio State University, Extension Bull. No. 745, 1998.

TABLE II: ECOTOXICOLOGICAL RISKS TO WILDLIFE (TERRESTRIAL AND AQUATIC)

Risk Category	Mammals Acute Oral LD_{50} mg/kg)	Avian Acute Oral LD_{50} (mg/kg)	Avian Acute Dietary LC_{50} (mg/kg)	Fish or Aquatic Invertebrates Acute Concentration LC_{50} (mg/l)
Very Highly Toxic	<10	<10	<50	<0.1
Highly Toxic	10-50	10-50	50-500	0.1 – 1
Moderately Toxic	51-500	51-500	501-1,000	>1 – 10
Slightly Toxic	501-2,000	501-2,000	1,001-5,000	>10 – 100
Practically Non-toxic	>2,000	>2,000	>5,000	>100

Table II created from information contained in *Pesticides and Wildlife*, Whitford, Fred, et al., Purdue University Cooperative Extension Service PPP-30, 1998.

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Clopyralid

HERBICIDE FACT SHEET

U.S. DEPARTMENT OF ENERGY
BONNEVILLE POWER ADMINISTRATION

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I. BASIC INFORMATION

COMMON NAME: clopyralid

CHEMICAL NAME: 3,6-dichloro-2-pyridinecarboxylic acid, monoethanolamine salt

Cas No. 1702-17-6

CHEMICAL TYPE: pyridine-carboxylic acid

PESTICIDE CLASSIFICATION: herbicide

REGISTERED USE STATUS: "General Use."

FORMULATIONS: Commercial herbicide products generally contain one or more ingredients. An inert ingredient is anything added to the product other than an active ingredient. Because of concern for human health and the environment, EPA announced its policy on toxic inert ingredients in the Federal Register on April 22, 1987 (52FR13305). This policy focuses on the regulation of inert ingredients. EPA's strategy for implementing this policy included the development of four lists of inerts, based on toxicological concerns. Inerts of toxicological concern were placed on List 1. Potentially toxic inerts/high priority for testing were placed on List 2. Inerts of unknown toxicity were placed on List 3, and inerts of minimal concern were placed on List 4.

The inert ingredients of the clopyralid formulations are not classified by the USEPA as inert ingredients of toxicological concerns to humans or the environment.

The contents of the clopyralid formulation are listed below:

Transline® Specialty Herbicide

Clopyralid	40.9 %
Inert	59.1 %

RESIDUE ANALYTICAL METHODS: Gas/liquid chromatography.

II. HERBICIDE USES

REGISTERED FORESTRY, RANGELAND AND RIGHT-OF-WAY USES: Clopyralid is registered for use in crop and non-crop sites for selective post-emergent weed control. For terrestrial use only.

OPERATIONAL DETAILS:

TARGET PLANTS: Selective, broad leaf weeds.

MODE OF ACTION: Clopyralid is an auxin growth regulator absorbed by the leaves.

METHOD OF APPLICATION AND RATES: Aerial (helicopter only) and ground broadcast, spot and localized applications. One-third to 1 /1/3 pints per acre.

SPECIAL PRECAUTIONS:

TIMING OF APPLICATION: Timing is dependent on emergence of the target plant. As clopyralid must be absorbed through the leaves, timing is limited to emerged plants.

DRIFT CONTROL: Care should be exercised not to overspray or apply the herbicide to adjacent non-target areas. Drift control is achieved by observing weather conditions and following label and sprayer instructions. Spray droplet size should be 150 microns or larger.

Restrictions/Warnings/Limitations: Groundwater advisory. Do not contaminate irrigation ditches or water used for irrigation or domestic purposes. T&E warning for plants.

III. ENVIRONMENTAL EFFECTS/FATE

SOIL:

RESIDUAL SOIL ACTIVITY: The half-life of clopyralid is 40 days.

ADSORPTION: The K(oc) of clopyralid is 6.

PERSISTENCE AND AGENTS OF DEGRADATION: Clopyralid is moderately persistent in the plant and soils. The primary route of degradation is microbial activity.

METABOLITES/DEGRADATION PRODUCTS AND POTENTIAL ENVIRONMENTAL EFFECTS: Clopyralid degrades to carbon dioxide and other unidentified products.

WATER:

SOLUBILITY: 300,000 mg/l in water (pH 7 at 25° C).

POTENTIAL FOR LEACHING INTO SURFACE AND GROUND WATER: Clopyralid is moderately persistent with a very low soil adsorption coefficient. There is a high potential for clopyralid to leach into groundwater when applied over shallow aquifers or to soils having high permeability.

AIR:

VOLATILIZATION: Not volatile.

POTENTIAL FOR BYPRODUCTS FROM BURNING OF TREATED VEGETATION: Not known.

IV. ECOLOGICAL TOXICITY EFFECTS ON NON-TARGET SPECIES

MICROORGANISMS:

ACUTE CONTACT TOXICITY*:* LD_{50} (honey bee contact) >100 µg/bee

OVERALL TOXICITY: Practically Non-Toxic

PLANTS: Contact will injure or kill target and non-target plants.

AQUATIC VERTEBRATES:

ACUTE TOXICITY*:* LC_{50} (rainbow trout 96-hour) >100 mg/l

ACUTE TOXICITY: LC_{50} (bluegill sunfish 96-hour) >100 mg/l

OVERALL TOXICITY: Practically Non-Toxic

AQUATIC FRESHWATER INVERTEBRATES:

ACUTE TOXICITY*:* LC_{50} (*Daphnia magna* 48-hour) >100 mg/l

OVERALL TOXICITY: Practically Non-Toxic

AQUATIC ESTUARINE/MARINE INVERTEBRATES:

ACUTE TOXICITY*:* LC_{50} (fiddler crab 96-hour) No information

ACUTE TOXICITY*:* LC_{50} (grass shrimp 96-hour) No information

OVERALL TOXICITY: Practically Non-Toxic

TERRESTRIAL ANIMALS:

AVIAN ACUTE ORAL TOXICITY*:* LD_{50} (bobwhite quail) <2000 mg/kg

AVIAN ACUTE ORAL TOXICITY*:* LD_{50} (mallard duck) <2000 mg/kg

AVIAN SUBACUTE DIETARY TOXICITY: LC_{50} (bobwhite quail) <5000 mg/kg

AVIAN SUBACUTE DIETARY TOXICITY: LC_{50} (mallard duck) <5000 mg/kg

MAMMAL ACUTE ORAL TOXICITY: LD_{50} (rat) >4000 mg/kg

OVERALL TOXICITY: Slightly Toxic

BIOACCUMULATION POTENTIAL: Little or No Potential

THREATENED AND ENDANGERED SPECIES: Federally listed terrestrial and aquatic plants may be adversely affected if the product is applied directly to the plants, or indirectly as the result of drift or leaching.

V. TOXICOLOGICAL DATA

ACUTE TOXICITY:

ACUTE ORAL TOXICITY*:* LD_{50} (rat) >5000 mg/kg

ACUTE DERMAL TOXICITY: LD_{50} (rabbit) >5000 mg/kg

PRIMARY SKIN IRRITATION: Rabbit - Moderate Irritant

PRIMARY EYE IRRITATION: Rabbit – Slight Irritant

ACUTE INHALATION: LC_{50} (rat) >3.0 mg/l

OVERALL TOXICITY: Category III – Slightly Toxic

CHRONIC TOXICITY:

CARCINOGENICITY: No evidence of carcinogenicity in test animals.

DEVELOPMENTAL/REPRODUCTIVE: Some effects at highest dose levels.

MUTAGENICITY: No effects.

HAZARD: The end-use product labels for clopyralid formulations carry the *Caution* signal word due to potential eye, skin and inhalation hazards.

VI. HUMAN HEALTH EFFECTS

ACUTE TOXICITY (POISONING):

REPORTED EFFECTS: None reported.

CHRONIC TOXICITY:

REPORTED EFFECTS: None reported.

POTENTIAL FOR ADVERSE HEALTH EFFECTS FROM CONTACTING OR CONSUMING TREATED VEGETATION, WATER OR ANIMALS: EPA reports no toxicological endpoints of concern..

POTENTIAL FOR ADVERSE HEALTH EFFECTS FROM INERT INGREDIENTS CONTAINED IN THE FORMULATED PRODUCTS: None reported.

HEALTH EFFECTS OF EXPOSURE TO FORMULATED PRODUCTS: None reported.

HEALTH EFFECTS ASSOCIATED WITH CONTAMINANTS: None reported.

HEALTH EFFECTS ASSOCIATED WITH OTHER FORMULATIONS: None reported.

VII. SAFETY PRECAUTIONS

SIGNAL WORD AND DEFINITION:

CLOPYRALID - **CAUTION** – CAUSES EYE INJURY. HARMFUL IF INHALED OR ABSORBED THROUGH THE SKIN

PROTECTIVE PRECAUTIONS FOR WORKERS: Applicators and other handlers must wear long-sleeved shirt and long pants, shoes plus socks.

MEDICAL TREATMENT PROCEDURES (ANTIDOTES):

EYES: Flush eyes with water.

SKIN: Wash all exposed areas with soap and water; call physician if irritation persists.

INGESTION: Rinse mouth thoroughly with water. Do not induce vomiting. Call physician.

INHALATION: Remove to fresh air. Call a physician if breathing difficulty persists.

HANDLING, STORAGE AND DISPOSAL: Store at room temperature or cooler. Do not reuse container. Rinse container and dispose accordingly.

EMERGENCY SPILL PROCEDURES AND HAZARDS: Contain and sweep up material of small spills and dispose as waste. Do not contaminate water, food, or feed by storage or disposal.

VIII. DEFINITIONS

adsorption – the process of attaching to a surface

avian – of, or related to, birds

CAEPA – California Environmental Protection Agency

carcinogenicity – ability to cause cancer

CHEMTREC – Chemical Transportation Emergency Center

dermal – of, or related to, the skin

EC_{50} - median effective concentration during a bioassay

ecotoxicological – related to the effects of environmental toxicants on populations of organisms originating, being produced, growing or living naturally in a particular region or environment

FIFRA – Federal Insecticide, Fungicide and Rodenticide Act

formulation – the form in which the pesticide is supplied by the manufacturer for use

half-life – the time required for half the amount of a substance to be reduced by natural processes

herbicide – a substance used to destroy plants or to slow down their growth

Hg – chemical symbol for mercury

IARC – International Agency for Research on Cancer

K(oc) – the tendency of a chemical to be adsorbed by soil, expressed as: K(oc) = conc. adsorbed/conc. dissolved/% organic carbon in soil

LC_{50} – the concentration in air, water, or food that will kill approximately 50% of the subjects

LD_{50} – the dose that will kill approximately 50% of the subjects

leach – to dissolve out by the action of water

mg/kg – weight ratio expressed as milligrams per kilogram
mg/l – weight-to-liquid ratio expressed as milligrams per liter
microorganisms – living things too small to be seen without a microscope
mPa – milli-Pascal (unit of pressure)
mutagenicity – ability to cause genetic changes
NFPA – National Fire Protection Association
NIOSH - National Institute for Occupational Safety and Health
NOEL - no observable effect level
non-target – animals or plants other than the ones that the pesticide is intended to kill or control
OSHA - Occupational Safety and Health Administration
Pa – Pascal (unit of pressure)
persistence – tendency of a pesticide to remain to remain in the environment after it is applied
pesticides – substances including herbicides, insecticides, rodenticides, fumigants, repellents, growth regulators, etc., regulated under FIFRA
PPE – personal protective equipment
ppm – weight ratio expressed as parts per million
residual activity – the remaining amount of activity as a pesticide
T&E – Threatened and Endangered Species (from the Endangered Species Act)
µg – micrograms
volatility – the tendency to become a vapor at standard temperatures and pressures

IX. INFORMATION SOURCES

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X. TOXICITY CATEGORY TABLES

TABLE I: HUMAN HAZARDS

Category	Signal Word	Route of Administration			Hazard	
		Acute Oral LD_{50} (mg/kg)	Acute Dermal LD_{50} (mg/kg)	Acute Inhalation LC_{50} (mg/l)	Eye irritation	Skin irritation
I (Highly Toxic)	**DANGER (poison)**	0–50	0-200	0-0.2	corrosive: corneal opacity not reversible within 7 days	corrosive
II (Moderately Toxic)	**WARNING**	>50–500	>200-2000	>0.2-2	corneal opacity reversible within 7 days; irritation persisting for 7 days	severe irritation at 72 hours
III (Slightly Toxic)	**CAUTION**	>500-5000	>2000-20.000	>2-20	no corneal opacity; irritation reversible within 7 days	moderate irritation at 72 hours
IV (Practically Non-toxic)	**NONE**	>5000	>20,000	>20	no irritation	moderate irritation at 72 hours

After *Pesticide User's Guide*, Ohio State University, Extension Bull. No. 745, 1998.

TABLE II: ECOTOXICOLOGICAL RISKS TO WILDLIFE (TERRESTRIAL AND AQUATIC)

Risk Category	Mammals Acute Oral LD_{50} mg/kg)	Avian Acute Oral LD_{50} (mg/kg)	Avian Acute Dietary LC_{50} (mg/kg)	Fish or Aquatic Invertebrates Acute Concentration LC_{50} (mg/l)
Very Highly Toxic	<10	<10	<50	<0.1
Highly Toxic	10-50	10-50	50-500	0.1 – 1
Moderately Toxic	51-500	51-500	501-1,000	>1 – 10
Slightly Toxic	501-2,000	501-2,000	1,001-5,000	>10 – 100
Practically Non-toxic	>2,000	>2,000	>5,000	>100

Table II created from information contained in *Pesticides and Wildlife*, Whitford, Fred, et al., Purdue University Cooperative Extension Service PPP-30, 1998.

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This fact sheet was prepared by USDOE-Bonneville Power Administration, March 2000.

Dicamba

HERBICIDE FACT SHEET

U.S. DEPARTMENT OF ENERGY
BONNEVILLE POWER ADMINISTRATION

This fact sheet is one of a series issued by the Bonneville Power Administration for their workers and the general public. It provides information on forest and land management uses, environmental and human health effects, and safety precautions. A list of definitions is included in Section VIII of this fact sheet.

I. BASIC INFORMATION

COMMON NAME: dicamba

CHEMICAL NAME: 3,6-dichloro-o-anisic acid

Cas No. 1918-00-9

CHEMICAL TYPE: benzoic acid compound

PESTICIDE CLASSIFICATION: herbicide

REGISTERED USE STATUS: General Use Pesticide. Date and Elevation Restrictions for Aerial Applications in Idaho.

FORMULATIONS: Commercial herbicide products generally contain one or more ingredients. An inert ingredient is anything added to the product other than an active ingredient. Because of concern for human health and the environment, EPA announced its policy on toxic inert ingredients in the Federal Register on April 22, 1987 (52FR13305). This policy focuses on the regulation of inert ingredients. EPA's strategy for implementing this policy included the development of four lists of inerts, based on toxicological concerns. Inerts of toxicological concern were placed on List 1. Potentially toxic inerts/high priority for testing were placed on List 2. Inerts of unknown toxicity were placed on List 3, and inerts of minimal concern were placed on List 4.

The inert ingredients of the dicamba formulations are not classified by the USEPA as inert ingredients of toxicological concerns to humans or the environment.

The contents of the dicamba formulation are listed below:

Banvel® Herbicide

Dicamba	48.2 %
Inert	51.8 %

Vanquish®

Dicamba	56.8 %
Inert	43.2 %

RESIDUE ANALYTICAL METHODS: Gas/liquid chromatography.

II. HERBICIDE USES

REGISTERED FORESTRY, RANGELAND AND RIGHT-OF-WAY USES: Dicamba is registered for use in crop and non-crop sites for selective pre- and post-emergent weed and brush control. For terrestrial use only.

OPERATIONAL DETAILS:

TARGET PLANTS: Selective, pre- and post-emergent herbicide for control of annual and perennial broadleaf weeds and brush.

MODE OF ACTION: Absorbed by root and shoot tissue causing rapid, abnormal cell growth leading to disruption of the phloem system and normal auxin balance.

METHOD OF APPLICATION AND RATES: Aerial and ground broadcast, spot and localized applications. One-half to four pints per acre.

SPECIAL PRECAUTIONS:

TIMING OF APPLICATION: Timing is dependent on the target plant.

DRIFT CONTROL: Care should be exercised not to overspray or apply the herbicide to adjacent non-target areas. Drift control is achieved by observing weather conditions and following label and sprayer instructions. Spray droplet size should be 150 microns or larger.

Restrictions/Warnings/Limitations: Do not exceed 4 pints per/acre/year. Groundwater advisory. Do not apply within 50 feet of wells or other waters. Do not apply in situations favorable to runoff. Do not apply to impervious surfaces. Do not contaminate irrigation ditches or water used for irrigation or domestic purposes. T&E warning for plants.

III. ENVIRONMENTAL EFFECTS/FATE

SOIL:

RESIDUAL SOIL ACTIVITY: The half-life of dicamba is 90 days.

ADSORPTION: The K(oc) of dicamba is 2.

PERSISTENCE AND AGENTS OF DEGRADATION: Dicamba is moderately persistent in the plant and soils. The primary route of degradation is microbial activity.

METABOLITES/DEGRADATION PRODUCTS AND POTENTIAL ENVIRONMENTAL EFFECTS: Dicamba degrades to carbon dioxide and other unidentified products.

WATER:

SOLUBILITY: 400,000 mg/l in water (pH 7 at 25° C).

POTENTIAL FOR LEACHING INTO SURFACE AND GROUND WATER: Dicamba is moderately persistent with a very low soil adsorption coefficient. There is a high potential for dicamba to leach into groundwater or surface water when applied over shallow aquifers or to soils having high permeability, and to impervious surfaces

AIR:

VOLATILIZATION: Moderately volatile.

POTENTIAL FOR BYPRODUCTS FROM BURNING OF TREATED VEGETATION: Not known.

IV. ECOLOGICAL TOXICITY EFFECTS ON NON-TARGET SPECIES

MICROORGANISMS:

ACUTE CONTACT TOXICITY*:* LD_{50} (honey bee contact) >100 µg/bee

OVERALL TOXICITY: Practically Non-Toxic

PLANTS: Contact will injure or kill target and non-target plants.

AQUATIC VERTEBRATES:

ACUTE TOXICITY*:* LC_{50} (rainbow trout 96-hour) >100 mg/l

ACUTE TOXICITY: LC_{50} (bluegill sunfish 96-hour) >100 mg/l

OVERALL TOXICITY: Practically Non-Toxic

AQUATIC FRESHWATER INVERTEBRATES:

ACUTE TOXICITY*:* LC_{50} (*Daphnia magna* 48-hour) 38 mg/l

OVERALL TOXICITY: Slightly Toxic

AQUATIC ESTUARINE/MARINE INVERTEBRATES:

ACUTE TOXICITY*:* LC_{50} (fiddler crab 96-hour) >180 mg/l

ACUTE TOXICITY*:* LC_{50} (grass shrimp 96-hour) >100 mg/l

OVERALL TOXICITY: Practically Non-Toxic

TERRESTRIAL ANIMALS:

AVIAN ACUTE ORAL TOXICITY*:* LD_{50} (mallard duck) >2000 mg/kg

AVIAN SUBACUTE DIETARY TOXICITY: LC_{50} (bobwhite quail) >10,000 mg/kg

AVIAN SUBACUTE DIETARY TOXICITY: LC_{50} (mallard duck) >10,000 mg/kg

MAMMAL ACUTE ORAL TOXICITY: LD_{50} (rat) >500 mg/kg

OVERALL TOXICITY: Slightly Toxic

BIOACCUMULATION POTENTIAL: Slight Potential

THREATENED AND ENDANGERED SPECIES: Federally listed terrestrial and aquatic plants may be adversely affected if the product is applied directly to the plants, or indirectly as the result of drift or leaching.

V. TOXICOLOGICAL DATA

ACUTE TOXICITY:

ACUTE ORAL TOXICITY*:* LD_{50} (rat) 3512 mg/kg

ACUTE DERMAL TOXICITY: LD_{50} (rabbit) >2000 mg/kg

PRIMARY SKIN IRRITATION: Rabbit - Non-Irritant

PRIMARY EYE IRRITATION: Rabbit – Moderate Irritant

ACUTE INHALATION: LC_{50} (rat) >5.3 mg/l

OVERALL TOXICITY: Category III – Slightly Toxic

CHRONIC TOXICITY:

CARCINOGENICITY: No evidence of carcinogenicity in test animals.

DEVELOPMENTAL/REPRODUCTIVE: Some effects at highest dose levels.

MUTAGENICITY: No effects.

HAZARD: The end-use product labels for the dicamba formulation Vanquish® carries the *Caution* signal word due to potential eye and skin hazards.

The end-use product labels for the dicamba formulation Banvel® carries the *Warning* signal word due to potential eye hazards.

VI. HUMAN HEALTH EFFECTS

ACUTE TOXICITY (POISONING):

REPORTED EFFECTS: None reported.

CHRONIC TOXICITY:

REPORTED EFFECTS: None reported.

POTENTIAL FOR ADVERSE HEALTH EFFECTS FROM CONTACTING OR CONSUMING TREATED VEGETATION, WATER OR ANIMALS: EPA reports no toxicological endpoints of concern..

POTENTIAL FOR ADVERSE HEALTH EFFECTS FROM INERT INGREDIENTS CONTAINED IN THE FORMULATED PRODUCTS: None reported.

HEALTH EFFECTS OF EXPOSURE TO FORMULATED PRODUCTS: None reported.

HEALTH EFFECTS ASSOCIATED WITH CONTAMINANTS: None reported.

HEALTH EFFECTS ASSOCIATED WITH OTHER FORMULATIONS: None reported.

VII. SAFETY PRECAUTIONS

SIGNAL WORD AND DEFINITION:

DICAMBA *(Vanquish®)* - **CAUTION** – AVOID CONTACT WITH SKIN, EYES OR CLOTHING. HARMFUL IF SWALLOWED.

DICAMBA (*Banvel®*) - **WARNING** – CAUSES EYE IRRITATION. DO NOT GET IN EYES, ON SKIN OR ON CLOTHING. HARMFUL IF SWALLOWED.

PROTECTIVE PRECAUTIONS FOR WORKERS: Applicators and other handlers must wear long-sleeved shirt and long pants, shoes plus socks.

MEDICAL TREATMENT PROCEDURES (ANTIDOTES):

EYES: Flush eyes with water.

SKIN: Wash all exposed areas with soap and water, call physician if irritation persists.

INGESTION: Rinse mouth thoroughly with water. Do not induce vomiting. Call physician.

INHALATION: Remove to fresh air. Call a physician if breathing difficulty persists.

HANDLING, STORAGE AND DISPOSAL: Store at room temperature or cooler. Do not reuse container. Rinse container and dispose accordingly.

EMERGENCY SPILL PROCEDURES AND HAZARDS: Contain and sweep up material of small spills and dispose as waste. Do not contaminate water, food, or feed by storage or disposal.

VIII. DEFINITIONS

adsorption – the process of attaching to a surface
avian – of, or related to, birds
CAEPA – California Environmental Protection Agency
carcinogenicity – ability to cause cancer

CHEMTREC – Chemical Transportation Emergency Center

dermal – of, or related to, the skin

EC_{50} - median effective concentration during a bioassay

ecotoxicological – related to the effects of environmental toxicants on populations of organisms originating, being produced, growing or living naturally in a particular region or environment

FIFRA – Federal Insecticide, Fungicide and Rodenticide Act

formulation – the form in which the pesticide is supplied by the manufacturer for use

half-life – the time required for half the amount of a substance to be reduced by natural processes

herbicide – a substance used to destroy plants or to slow down their growth

Hg – chemical symbol for mercury

IARC – International Agency for Research on Cancer

K(oc) – the tendency of a chemical to be adsorbed by soil, expressed as: K(oc) = conc. adsorbed/conc. dissolved/% organic carbon in soil

LC_{50} – the concentration in air, water, or food that will kill approximately 50% of the subjects

LD_{50} – the dose that will kill approximately 50% of the subjects

leach – to dissolve out by the action of water

mg/kg – weight ratio expressed as milligrams per kilogram

mg/l – weight-to-liquid ratio expressed as milligrams per liter

microorganisms – living things too small to be seen without a microscope

mPa – milli-Pascal (unit of pressure)

mutagenicity – ability to cause genetic changes

NFPA – National Fire Protection Association

NIOSH - National Institute for Occupational Safety and Health

NOEL - no observable effect level

non-target – animals or plants other than the ones that the pesticide is intended to kill or control

OSHA - Occupational Safety and Health Administration

Pa – Pascal (unit of pressure)

persistence – tendency of a pesticide to remain to remain in the environment after it is applied

pesticides – substances including herbicides, insecticides, rodenticides, fumigants, repellents, growth regulators, etc., regulated under FIFRA

PPE – personal protective equipment

ppm – weight ratio expressed as parts per million

residual activity – the remaining amount of activity as a pesticide

T&E – Threatened and Endangered Species (from the Endangered Species Act)

µg – micrograms

volatility – the tendency to become a vapor at standard temperatures and pressures

IX. INFORMATION SOURCES

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X. TOXICITY CATEGORY TABLES

TABLE I: HUMAN HAZARDS

Category	Signal Word	Route of Administration			Hazard	
		Acute Oral LD_{50} (mg/kg)	Acute Dermal LD_{50} (mg/kg)	Acute Inhalation LC_{50} (mg/l)	Eye irritation	Skin irritation
I (Highly Toxic)	**DANGER (poison)**	0–50	0-200	0-0.2	corrosive: corneal opacity not reversible within 7 days	corrosive
II (Moderately Toxic)	**WARNING**	>50–500	>200-2000	>0.2-2	corneal opacity reversible within 7 days; irritation persisting for 7 days	severe irritation at 72 hours
III (Slightly Toxic)	**CAUTION**	>500-5000	>2000-20.000	>2-20	no corneal opacity; irritation reversible within 7 days	moderate irritation at 72 hours
IV (Practically Non-toxic)	**NONE**	>5000	>20,000	>20	no irritation	moderate irritation at 72 hours

After *Pesticide User's Guide*, Ohio State University, Extension Bull. No. 745, 1998.

TABLE II: ECOTOXICOLOGICAL RISKS TO WILDLIFE (TERRESTRIAL AND AQUATIC)

Risk Category	Mammals Acute Oral LD_{50} mg/kg)	Avian Acute Oral LD_{50} (mg/kg)	Avian Acute Dietary LC_{50} (mg/kg)	Fish or Aquatic Invertebrates Acute Concentration LC_{50} (mg/l)
Very Highly Toxic	<10	<10	<50	<0.1
Highly Toxic	10-50	10-50	50-500	0.1 – 1
Moderately Toxic	51-500	51-500	501-1,000	>1 – 10
Slightly Toxic	501-2,000	501-2,000	1,001-5,000	>10 – 100
Practically Non-toxic	>2,000	>2,000	>5,000	>100

Table II created from information contained in *Pesticides and Wildlife*, Whitford, Fred, et al., Purdue University Cooperative Extension Service PPP-30, 1998.

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This fact sheet was prepared by USDOE-Bonneville Power Administration, March 2000.

Dichlobenil

HERBICIDE FACT SHEET

U.S. DEPARTMENT OF ENERGY
BONNEVILLE POWER ADMINISTRATION

This fact sheet is one of a series issued by the Bonneville Power Administration for their workers and the general public. It provides information on forest and land management uses, environmental and human health effects, and safety precautions. A list of definitions is included in Section VIII of this fact sheet.

I. BASIC INFORMATION

COMMON NAME: dichlobenil

CHEMICAL NAME: 2,6-dichlorobenzonitrile

Cas No. 1194-65-6

CHEMICAL TYPE: benzonitrile

PESTICIDE CLASSIFICATION: herbicide

REGISTERED USE STATUS: "General Use."

FORMULATIONS: Commercial herbicide products generally contain one or more ingredients. An inert ingredient is anything added to the product other than an active ingredient. Because of concern for human health and the environment, EPA announced its policy on toxic inert ingredients in the Federal Register on April 22, 1987 (52FR13305). This policy focuses on the regulation of inert ingredients. EPA's strategy for implementing this policy included the development of four lists of inerts, based on toxicological concerns. Inerts of toxicological concern were placed on List 1. Potentially toxic inerts/high priority for testing were placed on List 2. Inerts of unknown toxicity were placed on List 3, and inerts of minimal concern were placed on List 4.

The inert ingredients of the dichlobenil formulations are not classified by the USEPA as inert ingredients of toxicological concerns to humans or the environment.

The contents of the dichlobenil formulation are listed below:

Casoron® Herbicide

Dichlobenil	4.0 %
Inert	96.0 %

RESIDUE ANALYTICAL METHODS: Gas chromatography with electron capture.

II. HERBICIDE USES

REGISTERED FORESTRY, RANGELAND AND RIGHT-OF-WAY USES: Dichlobenil is registered for use in crop and non-crop sites for selective and total weed control. For terrestrial use only.

OPERATIONAL DETAILS:

TARGET PLANTS: Dichlobenil is used for control of annual and perennial grasses, broadleaf weeds, and woody plants.

MODE OF ACTION: Acts on growing points and root tips, dichlobenil inhibits germination of actively dividing meristems.

METHOD OF APPLICATION AND RATES: Ground broadcast, spot and localized applications. One hundred to five hundred pounds per acre depending on target species.

SPECIAL PRECAUTIONS:

TIMING OF APPLICATION: Timing is dependent on the target plant.

DRIFT CONTROL: Care should be exercised not to overspray or apply the herbicide to adjacent non-target areas. Drift control is achieved by observing weather conditions and following label and sprayer instructions. Spray droplet size should be 150 microns or larger.

Restrictions/Warnings/Limitations: Do not plant or transplant into treated soil. Do not graze livestock in treated areas.

III. ENVIRONMENTAL EFFECTS/FATE

SOIL:

RESIDUAL SOIL ACTIVITY: The half-life of dichlobenil is 60 days.

ADSORPTION: The K(oc) of dichlobenil is 400.

PERSISTENCE AND AGENTS OF DEGRADATION: Dichlobenil is moderately persistent in the plant and soils. The primary route of degradation is microbial activity.

METABOLITES/DEGRADATION PRODUCTS AND POTENTIAL ENVIRONMENTAL EFFECTS: Dichlobenil degrades to 2,6-dichlorobenzamide (BAM) and 2,6-dichlorobenzoic acid. BAM is the primary metabolite produced by soil microbes.

WATER:

SOLUBILITY: 21.2 mg/l in water (pH 7 at 25° C).

POTENTIAL FOR LEACHING INTO SURFACE AND GROUND WATER: Dichlobenil is moderately persistent with a very high soil adsorption coefficient. There is a moderate potential for dichlobenil to leach into groundwater and a high potential for surface water runoff.

AIR:

VOLATILIZATION: 0.088 Pa at 20° C.

POTENTIAL FOR BYPRODUCTS FROM BURNING OF TREATED VEGETATION: Not known.

V. ECOLOGICAL TOXICITY EFFECTS ON NON-TARGET SPECIES

MICROORGANISMS:

ACUTE CONTACT TOXICITY*:* LD_{50} (honey bee contact) >120 µg/bee

OVERALL TOXICITY: Practically Non-Toxic

PLANTS: Contact will injure or kill target and non-target plants.

AQUATIC VERTEBRATES:

ACUTE TOXICITY*:* LC_{50} (rainbow trout 96-hour) 6.26 mg/l

ACUTE TOXICITY: LC_{50} (bluegill sunfish 96-hour) 6.72 mg/l

OVERALL TOXICITY: Moderately Toxic

AQUATIC FRESHWATER INVERTEBRATES:

ACUTE TOXICITY*:* LC_{50} (*Daphnia magna* 48-hour) 5.8 mg/l

OVERALL TOXICITY: Moderately Toxic

AQUATIC ESTUARINE/MARINE INVERTEBRATES:

ACUTE TOXICITY*:* LC_{50} (sheepshead minnow 96-hour) >12.7 mg/l

ACUTE TOXICITY*:* LC_{50} (grass shrimp 96-hour) >1.0 mg/l

ACUTE TOXICITY*:* LC_{50} (eastern oyster 96-hour) >1.63 mg/l

OVERALL TOXICITY: Moderately Toxic

TERRESTRIAL ANIMALS:

AVIAN ACUTE ORAL TOXICITY*:* LD_{50} (bobwhite quail) 683 mg/kg

AVIAN ACUTE ORAL TOXICITY*:* LD_{50} (mallard duck) >2000 mg/kg

AVIAN SUBACUTE DIETARY TOXICITY: LC_{50} (bobwhite quail) 5200 mg/kg

AVIAN SUBACUTE DIETARY TOXICITY: LC_{50} (mallard duck) >5200 mg/kg

MAMMAL ACUTE ORAL TOXICITY: LD_{50} (rat) 4250 mg/kg

OVERALL TOXICITY: Slightly Toxic

BIOACCUMULATION POTENTIAL: Slight Potential

THREATENED AND ENDANGERED SPECIES: Federally listed terrestrial and aquatic plants may be adversely affected if the product is applied directly to the plants, or indirectly as the result of drift or leaching.

V. TOXICOLOGICAL DATA

ACUTE TOXICITY:

ACUTE ORAL TOXICITY*:* LD_{50} (rat) 4250 mg/kg

ACUTE DERMAL TOXICITY: LD_{50} (rabbit) >2000 mg/kg

PRIMARY SKIN IRRITATION: Rabbit - Non-Irritant

PRIMARY EYE IRRITATION: Rabbit – Non-Irritant

ACUTE INHALATION: LC_{50} (rat) >3.3 mg/l

OVERALL TOXICITY: Category III – Slightly Toxic

CHRONIC TOXICITY:

CARCINOGENICITY: EPA Group C - possible human carcinogen.

DEVELOPMENTAL/REPRODUCTIVE: No adverse effects.

MUTAGENICITY: No adverse effects.

HAZARD: The end-use product labels for the dichlobenil formulation Casoron® carries the *Caution* signal word due to potential eye and skin irritation.

VI. HUMAN HEALTH EFFECTS

ACUTE TOXICITY (POISONING):

REPORTED EFFECTS: None reported.

CHRONIC TOXICITY:

REPORTED EFFECTS: None reported.

POTENTIAL FOR ADVERSE HEALTH EFFECTS FROM CONTACTING OR CONSUMING TREATED VEGETATION, WATER OR ANIMALS: None reported.

POTENTIAL FOR ADVERSE HEALTH EFFECTS FROM INERT INGREDIENTS CONTAINED IN THE FORMULATED PRODUCTS: None reported.

HEALTH EFFECTS OF EXPOSURE TO FORMULATED PRODUCTS: None reported.

HEALTH EFFECTS ASSOCIATED WITH CONTAMINANTS: None reported.

HEALTH EFFECTS ASSOCIATED WITH OTHER FORMULATIONS: None reported.

VII. SAFETY PRECAUTIONS

SIGNAL WORD AND DEFINITION:

DICHLOBENIL - **CAUTION** – HARMFUL IF SWALLOWED. AVOID BREATHING DUST. AVOID CONTACT WITH SKIN AND EYES.

PROTECTIVE PRECAUTIONS FOR WORKERS: Applicators and other handlers must wear long-sleeved shirt and long pants, shoes plus socks.

MEDICAL TREATMENT PROCEDURES (ANTIDOTES):

EYES: Flush eyes with water.

SKIN: Wash all exposed areas with soap and water; call physician if irritation persists.

INGESTION: Rinse mouth thoroughly with water. Do not induce vomiting. Call physician.

INHALATION: Remove to fresh air. Call a physician if breathing difficulty persists.

HANDLING, STORAGE AND DISPOSAL: Store at room temperature or cooler. Do not reuse container. Rinse container and dispose accordingly.

EMERGENCY SPILL PROCEDURES AND HAZARDS: Contain and sweep up material of small spills and dispose as waste. Do not contaminate water, food or feed by storage or disposal.

VIII. DEFINITIONS

adsorption – the process of attaching to a surface

avian – of, or related to, birds

CAEPA – California Environmental Protection Agency

carcinogenicity – ability to cause cancer

CHEMTREC – Chemical Transportation Emergency Center

dermal – of, or related to, the skin

EC_{50} - median effective concentration during a bioassay

ecotoxicological – related to the effects of environmental toxicants on populations of organisms originating, being produced, growing or living naturally in a particular region or environment

FIFRA – Federal Insecticide, Fungicide and Rodenticide Act

formulation – the form in which the pesticide is supplied by the manufacturer for use

half-life – the time required for half the amount of a substance to be reduced by natural processes

herbicide – a substance used to destroy plants or to slow down their growth

Hg – chemical symbol for mercury

IARC – International Agency for Research on Cancer

K(oc) – the tendency of a chemical to be adsorbed by soil, expressed as: K(oc) = conc. adsorbed/conc. dissolved/% organic carbon in soil

LC_{50} – the concentration in air, water, or food that will kill approximately 50% of the subjects

LD_{50} – the dose that will kill approximately 50% of the subjects

leach – to dissolve out by the action of water

mg/kg – weight ratio expressed as milligrams per kilogram
mg/l – weight-to-liquid ratio expressed as milligrams per liter
microorganisms – living things too small to be seen without a microscope
mPa – milli-Pascal (unit of pressure)
mutagenicity – ability to cause genetic changes
NFPA – National Fire Protection Association
NIOSH - National Institute for Occupational Safety and Health
NOEL - no observable effect level
non-target – animals or plants other than the ones that the pesticide is intended to kill or control
OSHA - Occupational Safety and Health Administration
Pa – Pascal (unit of pressure)
persistence – tendency of a pesticide to remain to remain in the environment after it is applied
pesticides – substances including herbicides, insecticides, rodenticides, fumigants, repellents, growth regulators, etc., regulated under FIFRA
PPE – personal protective equipment
ppm – weight ratio expressed as parts per million
residual activity – the remaining amount of activity as a pesticide
T&E – Threatened and Endangered Species (from the Endangered Species Act)
µg – micrograms
volatility – the tendency to become a vapor at standard temperatures and pressures

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X. Toxicity Category Tables

Table I: Human Hazards

Category	Signal Word	Route of Administration			Hazard	
		Acute Oral LD_{50} (mg/kg)	Acute Dermal LD_{50} (mg/kg)	Acute Inhalation LC_{50} (mg/l)	Eye irritation	Skin irritation
I (Highly Toxic)	**DANGER (poison)**	0–50	0-200	0-0.2	corrosive: corneal opacity not reversible within 7 days	corrosive
II (Moderately Toxic)	**WARNING**	>50–500	>200-2000	>0.2-2	corneal opacity reversible within 7 days; irritation persisting for 7 days	severe irritation at 72 hours
III (Slightly Toxic)	**CAUTION**	>500-5000	>2000-20.000	>2-20	no corneal opacity; irritation reversible within 7 days	moderate irritation at 72 hours
IV (Practically Non-toxic)	**NONE**	>5000	>20,000	>20	no irritation	moderate irritation at 72 hours

After *Pesticide User's Guide*, Ohio State University, Extension Bull. No. 745, 1998.

Table II: Ecotoxicological Risks to Wildlife (Terrestrial and Aquatic)

Risk Category	Mammals	Avian	Avian	Fish or Aquatic Invertebrates
	Acute Oral LD_{50} mg/kg)	Acute Oral LD_{50} (mg/kg)	Acute Dietary LC_{50} (mg/kg)	Acute Concentration LC_{50} (mg/l)
Very Highly Toxic	<10	<10	<50	<0.1
Highly Toxic	10-50	10-50	50-500	0.1 – 1
Moderately Toxic	51-500	51-500	501-1,000	>1 – 10
Slightly Toxic	501-2,000	501-2,000	1,001-5,000	>10 – 100
Practically Non-toxic	>2,000	>2,000	>5,000	>100

Table II created from information contained in *Pesticides and Wildlife*, Whitford, Fred, et al., Purdue University Cooperative Extension Service PPP-30, 1998.

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This fact sheet was prepared by USDOE-Bonneville Power Administration, March 2000.

Diuron

HERBICIDE FACT SHEET

U.S. DEPARTMENT OF ENERGY
BONNEVILLE POWER ADMINISTRATION

This fact sheet is one of a series issued by the Bonneville Power Administration for their workers and the general public. It provides information on forest and land management uses, environmental and human health effects, and safety precautions. A list of definitions is included in Section VIII of this fact sheet.

I. BASIC INFORMATION

COMMON NAME: diuron

CHEMICAL NAME: N-(3,4-dichlorophenyl)-N,N-dimethyl urea

Cas No. 330-54-1

CHEMICAL TYPE: substituted urea

PESTICIDE CLASSIFICATION: herbicide

REGISTERED USE STATUS: General Use Pesticide. Restricted Use Pesticide in Washington.

FORMULATIONS: Commercial herbicide products generally contain one or more ingredients. An inert ingredient is anything added to the product other than an active ingredient. Because of concern for human health and the environment, EPA announced its policy on toxic inert ingredients in the Federal Register on April 22, 1987 (52FR13305). This policy focuses on the regulation of inert ingredients. EPA's strategy for implementing this policy included the development of four lists of inerts, based on toxicological concerns. Inerts of toxicological concern were placed on List 1. Potentially toxic inerts/high priority for testing were placed on List 2. Inerts of unknown toxicity were placed on List 3, and inerts of minimal concern were placed on List 4.

The inert ingredients of the diuron formulations are not classified by the USEPA as inert ingredients of toxicological concerns to humans or the environment.

The contents of the diuron formulation are listed below:

Diuron® 4L Herbicide

Diuron	40.0 %
Inert	60.0 %

Diuron® 80 DF Herbicide

Diuron	80.0 %
Inert	20.0 %

Karmex® DF Herbicide

Diuron	80.0 %
Inert	20.0 %

RESIDUE ANALYTICAL METHODS: EPA Method 632.

II. HERBICIDE USES

REGISTERED FORESTRY, RANGELAND AND RIGHT-OF-WAY USES: Diuron is registered for use in crop and non-crop sites for selective and total weed control. For terrestrial use only.

OPERATIONAL DETAILS:

TARGET PLANTS: Diuron is used for pre- and post-emergent control of annual and perennial grasses and broadleaf weeds.

MODE OF ACTION: Diuron is absorbed through the root system, inhibiting photosynthesis.

METHOD OF APPLICATION AND RATES: Aerial and ground broadcast, spot, and localized applications. Fifteen to forty-eight pounds per acre on non-crop target species.

SPECIAL PRECAUTIONS:

TIMING OF APPLICATION: Timing is dependent on the target plant. Rainfall is required to activate migration to root zone.

DRIFT CONTROL: Care should be exercised not to overspray or apply the herbicide to adjacent non-target areas. Drift control is achieved by observing weather conditions and following label and sprayer instructions. Spray droplet size should be 150 microns or larger.

Restrictions/Warnings/Limitations: Do not plant or transplant into treated soil. Do not graze livestock in treated areas. Do not apply to impervious surfaces.

III. ENVIRONMENTAL EFFECTS/FATE

SOIL:

RESIDUAL SOIL ACTIVITY: The half-life of diuron is 90 days.

ADSORPTION: The K(oc) of diuron is 480.

PERSISTENCE AND AGENTS OF DEGRADATION: Diuron is moderately persistent in the plant and soils. The primary route of degradation is microbial activity.

METABOLITES/DEGRADATION PRODUCTS AND POTENTIAL ENVIRONMENTAL EFFECTS: No information.

WATER:

SOLUBILITY: 42.0 mg/l in water (pH 7 at 25° C).

POTENTIAL FOR LEACHING INTO SURFACE AND GROUND WATER: Diuron is moderately persistent, with a very high soil adsorption coefficient. There is a moderate potential for diuron to leach into groundwater and a high potential for surface water runoff.

AIR:

VOLATILIZATION: 0.41 mPa at 50° C.

POTENTIAL FOR BYPRODUCTS FROM BURNING OF TREATED VEGETATION: Not known.

IV. ECOLOGICAL TOXICITY EFFECTS ON NON-TARGET SPECIES

MICROORGANISMS:

ACUTE CONTACT TOXICITY*:* LD_{50} (honey bee contact) >100 µg/bee

OVERALL TOXICITY: Practically Non-Toxic

PLANTS: Contact will injure or kill target and non-target plants.

AQUATIC VERTEBRATES:

ACUTE TOXICITY*:* LC_{50} (rainbow trout 96-hour) 3.5 mg/l

ACUTE TOXICITY: LC_{50} (bluegill sunfish 96-hour) 42 mg/l

OVERALL TOXICITY: Moderately Toxic

AQUATIC FRESHWATER INVERTEBRATES:

ACUTE TOXICITY*:* LC_{50} (*Daphnia magna* 48-hour) 1.0 mg/l

OVERALL TOXICITY: Highly Toxic

AQUATIC ESTUARINE/MARINE INVERTEBRATES:

ACUTE TOXICITY*:* LC_{50} (sheepshead minnow 96-hour)

ACUTE TOXICITY*:* LC_{50} (grass shrimp 96-hour)

ACUTE TOXICITY*:* LC_{50} (eastern oyster 96-hour)

OVERALL TOXICITY: Moderately Toxic

TERRESTRIAL ANIMALS:

AVIAN ACUTE ORAL TOXICITY*:* LD_{50} (bobwhite quail) >2000 mg/kg

AVIAN ACUTE ORAL TOXICITY*:* LD_{50} (mallard duck) >2000 mg/kg

AVIAN SUBACUTE DIETARY TOXICITY: LC_{50} (bobwhite quail) >1730 mg/kg

AVIAN SUBACUTE DIETARY TOXICITY: LC_{50} (mallard duck) >1730 mg/kg

MAMMAL ACUTE ORAL TOXICITY: LD_{50} (rat) 3400 mg/kg

OVERALL TOXICITY: Slightly Toxic

BIOACCUMULATION POTENTIAL: Slight Potential

THREATENED AND ENDANGERED SPECIES: Federally listed terrestrial and aquatic plants may be adversely affected if the product is applied directly to the plants, or indirectly as the result of drift or leaching.

V. TOXICOLOGICAL DATA

ACUTE TOXICITY:

ACUTE ORAL TOXICITY*:* LD_{50} (rat) 3500 mg/kg

ACUTE DERMAL TOXICITY: LD_{50} (rabbit) >2000 mg/kg

PRIMARY SKIN IRRITATION: Rabbit - Mild Irritant

PRIMARY EYE IRRITATION: Rabbit – Mild Irritant

ACUTE INHALATION: LC_{50} (rat) <2.5 mg/l

OVERALL TOXICITY: Category III – Slightly Toxic

CHRONIC TOXICITY:

CARCINOGENICITY: Proposed revised EPA guidelines as a Known/Likely Carcinogen..

DEVELOPMENTAL/REPRODUCTIVE: Teratogenic in mice at high dose levels. Significant decrease in offspring weights at highest dose levels.

MUTAGENICITY: No adverse effects.

HAZARD: The end-use product labels for the diuron formulation Casoron® carries the *Caution* signal word due to potential eye and skin irritation.

VI. HUMAN HEALTH EFFECTS

ACUTE TOXICITY (POISONING):

REPORTED EFFECTS: May cause cyanosis, depression, watering eyes, liver enlargement.

CHRONIC TOXICITY:

REPORTED EFFECTS: Skin and eye irritant. Short exposure may cause blood effects, spleen effects, thyroid effects, and other nonspecific effects.

POTENTIAL FOR ADVERSE HEALTH EFFECTS FROM CONTACTING OR CONSUMING TREATED VEGETATION, WATER OR ANIMALS: None reported.

POTENTIAL FOR ADVERSE HEALTH EFFECTS FROM INERT INGREDIENTS CONTAINED IN THE FORMULATED PRODUCTS: Dust from granular product may be an irritant.

HEALTH EFFECTS OF EXPOSURE TO FORMULATED PRODUCTS: None reported.

HEALTH EFFECTS ASSOCIATED WITH CONTAMINANTS: None reported.

HEALTH EFFECTS ASSOCIATED WITH OTHER FORMULATIONS: None reported.

VII. SAFETY PRECAUTIONS

SIGNAL WORD AND DEFINITION:

DIURON - **CAUTION** – CAUSES EYE IRRITATION. MAY IRRITATE NOSE, THROAT AND SKIN. AVOID BREATHING DUST OR SPRAY MIST. AVOID CONTACT WITH SKIN, EYES AND CLOTHING.

PROTECTIVE PRECAUTIONS FOR WORKERS: Applicators and other handlers must wear long-sleeved shirt and long pants, shoes plus socks.

MEDICAL TREATMENT PROCEDURES (ANTIDOTES):

EYES: Flush eyes with water.

SKIN: Wash all exposed areas with soap and water; call physician if irritation persists.

INGESTION: Drink 1 to 2 glasses of water and induce vomiting. Call physician.

INHALATION: Remove to fresh air. Call a physician if breathing difficulty persists.

HANDLING, STORAGE AND DISPOSAL: Store at room temperature or cooler. Do not reuse container. Rinse container and dispose accordingly.

EMERGENCY SPILL PROCEDURES AND HAZARDS: Contain and sweep up material of small spills and dispose as waste. Do not contaminate water, food or feed by storage or disposal.

VIII. DEFINITIONS

adsorption – the process of attaching to a surface

avian – of, or related to, birds

CAEPA – California Environmental Protection Agency

carcinogenicity – ability to cause cancer

CHEMTREC – Chemical Transportation Emergency Center

dermal – of, or related to, the skin

EC_{50} - median effective concentration during a bioassay

ecotoxicological – related to the effects of environmental toxicants on populations of organisms originating, being produced, growing or living naturally in a particular region or environment

FIFRA – Federal Insecticide, Fungicide and Rodenticide Act

formulation – the form in which the pesticide is supplied by the manufacturer for use

half-life – the time required for half the amount of a substance to be reduced by natural processes

herbicide – a substance used to destroy plants or to slow down their growth

Hg – chemical symbol for mercury

IARC – International Agency for Research on Cancer

K(oc) – the tendency of a chemical to be adsorbed by soil, expressed as: K(oc) = conc. adsorbed/conc. dissolved/% organic carbon in soil

LC_{50} – the concentration in air, water, or food that will kill approximately 50% of the subjects

LD_{50} – the dose that will kill approximately 50% of the subjects

leach – to dissolve out by the action of water

mg/kg – weight ratio expressed as milligrams per kilogram

mg/l – weight-to-liquid ratio expressed as milligrams per liter

microorganisms – living things too small to be seen without a microscope

mPa – milli-Pascal (unit of pressure)

mutagenicity – ability to cause genetic changes

NFPA – National Fire Protection Association

NIOSH - National Institute for Occupational Safety and Health

NOEL - no observable effect level

non-target – animals or plants other than the ones that the pesticide is intended to kill or control

OSHA - Occupational Safety and Health Administration

Pa – Pascal (unit of pressure)

persistence – tendency of a pesticide to remain to remain in the environment after it is applied

pesticides – substances including herbicides, insecticides, rodenticides, fumigants, repellents, growth regulators, etc., regulated under FIFRA

PPE – personal protective equipment

ppm – weight ratio expressed as parts per million

residual activity – the remaining amount of activity as a pesticide

T&E – Threatened and Endangered Species (from the Endangered Species Act)

µg – micrograms

volatility – the tendency to become a vapor at standard temperatures and pressures

IX. INFORMATION SOURCES

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X. TOXICITY CATEGORY TABLES

TABLE I: HUMAN HAZARDS

Category	Signal Word	Route of Administration			Hazard	
		Acute Oral LD_{50} (mg/kg)	Acute Dermal LD_{50} (mg/kg)	Acute Inhalation LC_{50} (mg/l)	Eye irritation	Skin irritation
I (Highly Toxic)	**DANGER (poison)**	0–50	0-200	0-0.2	corrosive: corneal opacity not reversible within 7 days	corrosive
II (Moderately Toxic)	**WARNING**	>50–500	>200-2000	>0.2-2	corneal opacity reversible within 7 days; irritation persisting for 7 days	severe irritation at 72 hours
III (Slightly Toxic)	**CAUTION**	>500-5000	>2000-20.000	>2-20	no corneal opacity; irritation reversible within 7 days	moderate irritation at 72 hours
IV (Practically Non-toxic)	**NONE**	>5000	>20,000	>20	no irritation	moderate irritation at 72 hours

After *Pesticide User's Guide*, Ohio State University, Extension Bull. No. 745, 1998.

TABLE II: ECOTOXICOLOGICAL RISKS TO WILDLIFE (TERRESTRIAL AND AQUATIC)

Risk Category	Mammals Acute Oral LD_{50} mg/kg)	Avian Acute Oral LD_{50} (mg/kg)	Avian Acute Dietary LC_{50} (mg/kg)	Fish or Aquatic Invertebrates Acute Concentration LC_{50} (mg/l)
Very Highly Toxic	<10	<10	<50	<0.1
Highly Toxic	10-50	10-50	50-500	0.1 – 1
Moderately Toxic	51-500	51-500	501-1,000	>1 – 10
Slightly Toxic	501-2,000	501-2,000	1,001-5,000	>10 – 100
Practically Non-toxic	>2,000	>2,000	>5,000	>100

Table II created from information contained in *Pesticides and Wildlife*, Whitford, Fred, et al., Purdue University Cooperative Extension Service PPP-30, 1998.

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This fact sheet was prepared by USDOE-Bonneville Power Administration, March 2000.

Fosamine Ammonium

HERBICIDE FACT SHEET

U.S. DEPARTMENT OF ENERGY
BONNEVILLE POWER ADMINISTRATION

This fact sheet is one of a series issued by the Bonneville Power Administration for their workers and the general public. It provides information on forest and land management uses, environmental and human health effects, and safety precautions. A list of definitions is included in Section VIII of this fact sheet.

I. BASIC INFORMATION

COMMON NAME: fosamine ammonium

CHEMICAL NAME: ammonium salt of fosamine; [ethyl hydrogen (aminocarbonyl) phosphonate]

CAS No. 25954-13-6

CHEMICAL TYPE*:* organophosphonate subclass of organophosphate

PESTICIDE CLASSIFICATION*:* herbicidal brush control agent; plant growth regulator

REGISTERED USE STATUS: ”General Use.”

FORMULATIONS: Commercial herbicide products generally contain one or more ingredients. An inert ingredient is anything added to the product other than an active ingredient. Because of concern for human health and the environment, EPA announced its policy on toxic inert ingredients in the Federal Register on April 22, 1987 (52FR13305). This policy focuses on the regulation of inert ingredients. EPA’s strategy for implementing this policy included the development of four lists of inerts, based on toxicological concerns. Inerts of toxicological concern were placed on List 1. Potentially toxic inerts/high priority for testing were placed on List 2. Inerts of unknown toxicity were placed on List 3, and inerts of minimal concern were placed on List 4.

The inert ingredients of the fosamine ammonium formulation, Krenite™, are not classified by the USEPA as inert ingredients of toxicological concerns to humans or the environment.

The contents of the fosamine ammonium formulation is listed below:

Fosamine ammonium	41.5 %
Inert	58.5 %

RESIDUE ANALYTICAL METHODS: EPA 614, 8141A.

II. HERBICIDE USES

REGISTERED FORESTRY, RANGELAND AND RIGHT-OF-WAY USES: Fosamine ammonium as Krenite™ is registered for use in non-agricultural, uncultivated areas and non-agricultural rights-of-ways for the control of woody plants. For terrestrial use only.

OPERATIONAL DETAILS:

TARGET PLANTS: Fosamine ammonium is a selective, post-emergent herbicide for control of woody/brush and herbaceous plants, including, but not limited to: maple, birch, alder, blackberry, hawthorn, vine maple, ash, and oak.

MODE OF ACTION: Inhibits bud and leaf formation.

METHOD OF APPLICATION AND RATES: Foliar application by open pour, mix/load, high pressure hand wand, backpack, aerial and ultra low-volume equipment at rates of 6 to 24 pounds of active ingredient per acre.

SPECIAL PRECAUTIONS:

TIMING OF APPLICATION: The Krenite formulation is applied any time from full leaf in the spring to first fall coloration.

DRIFT CONTROL: Care should be exercised not to overspray or apply the herbicide to adjacent non-target areas. Drift control is achieved by observing weather conditions and following label and sprayer instructions.

Restrictions/Warnings/Limitations: Do not apply directly to water or areas where surface water is present, or to intertidal areas below the mean high water mark. May harm non-target plants. Not for use on crops. Do not plant crops or graze livestock within one year of application. Do not apply through irrigation systems. Do not cut treated brush until stems are dead, or sprouting may occur. Not registered for use in California or Arizona.

III. ENVIRONMENTAL EFFECTS/FATE

SOIL:

RESIDUAL SOIL ACTIVITY: The half-life of fosamine ammonium is 8 days.

ADSORPTION: The K(oc) of fosamine ammonium is 8 to 150 depending on soil pH and soil types.

PERSISTENCE AND AGENTS OF DEGRADATION: The field half-life of fosamine ammonium is 0.5 to 5 days and is dependent on rapid-microbial mediated dissipation.

METABOLITES/DEGRADATION PRODUCTS AND POTENTIAL ENVIRONMENTAL EFFECTS: Fosamine ammonium degrades to carbamoylphosphonic acid (CPA), carboxylphosphonic acid (ING-3003), and carbon dioxide. No fate data is available for CPA and ING-3003.

WATER:

SOLUBILITY: Completely miscible in water.

POTENTIAL FOR LEACHING INTO SURFACE AND GROUND WATER: The product has low potential to leach into surface and ground water due to rapid field and soil dissipation.

AIR:

VOLATILIZATION: 4×10^{-6} mm Hg at 25° C.

POTENTIAL FOR BYPRODUCTS FROM BURNING OF TREATED VEGETATION: Carbon dioxide may be formed.

IV. ECOLOGICAL TOXICITY EFFECTS ON NON-TARGET SPECIES

MICROORGANISMS:

ACUTE CONTACT TOXICITY*:* LD_{50} (honey bee 48-hour) >200 µg/bee

OVERALL TOXICITY: Practically Non-Toxic

PLANTS: Contact will injure or kill target and non-target brush/woody plants.

AQUATIC VERTEBRATES:

ACUTE TOXICITY*:* LC_{50} (rainbow trout 96-hour) 377 mg/l

ACUTE TOXICITY: LC_{50} (bluegill sunfish 96-hour) 590 mg/l

ACUTE TOXICITY: LC_{50} (coho salmon 96-hour) >200 mg/l

OVERALL TOXICITY: Practically Non-Toxic

AQUATIC INVERTEBRATES:

ACUTE TOXICITY*:* LC_{50} (*Daphnia magna* 48-hour) 1524 mg/l

OVERALL TOXICITY: Practically Non-Toxic

TERRESTRIAL ANIMALS:

AVIAN ACUTE ORAL TOXICITY*:* LD_{50} (bobwhite quail) >5000 mg/kg

AVIAN ACUTE ORAL TOXICITY: LD_{50} (mallard duck) >5000 mg/kg

MAMMAL ACUTE ORAL TOXICITY: LD_{50} (rat) >24,400 mg/kg

AVIAN SUBACUTE DIETARY TOXICITY: LC_{50} (bobwhite quail) >5620 mg/kg

AVIAN SUBACUTE DIETARY TOXICITY: LC_{50} (mallard duck) >5620 mg/kg

OVERALL TOXICITY: Practically Non-Toxic

BIOACCUMULATION POTENTIAL: Slight Potential

THREATENED AND ENDANGERED SPECIES: Federally listed plants may be adversely affected if the product is applied directly to the plants during budding and leafing until fall coloration.

V. TOXICOLOGICAL DATA

ACUTE TOXICITY:

ACUTE ORAL TOXICITY: LD_{50} (rat) 24,400 mg/kg

ACUTE DERMAL TOXICITY: LD_{50} (rabbit) >1682 mg/kg

LD_{50} (rabbit) >5000 mg/kg (Krenite™)

PRIMARY SKIN IRRITATION: Rabbit - Low Potential

PRIMARY EYE IRRITATION: Rabbit – Low to Moderate Potential

ACUTE INHALATION: LC_{50} (rat) >56.6 mg/l (male)

LC_{50} (rat) >42 mg/l (female)

OVERALL TOXICITY: Category III – Caution – Causes Moderate Eye Irritation

CHRONIC TOXICITY:

CARCINOGENICITY: Not listed or classified by EPA or CAEPA as a carcinogen.

DEVELOPMENTAL/REPRODUCTIVE: No effects reported.

MUTAGENICITY: Krenite™ was clastogenic both with and without metabolic activation. Chromosome breakage was observed at final concentrations.

HAZARD: The end-use product label for Krenite™ carries the *Caution* signal word due to moderate eye irritation.

VI. HUMAN HEALTH EFFECTS

ACUTE TOXICITY (POISONING):

REPORTED EFFECTS: None reported.

CHRONIC TOXICITY:

REPORTED EFFECTS: None reported.

POTENTIAL FOR ADVERSE HEALTH EFFECTS FROM CONTACTING OR CONSUMING TREATED VEGETATION, WATER OR ANIMALS: None reported.

POTENTIAL FOR ADVERSE HEALTH EFFECTS FROM INERT INGREDIENTS CONTAINED IN THE FORMULATED PRODUCTS: Information not available.

HEALTH EFFECTS OF EXPOSURE TO FORMULATED PRODUCTS: Mild, temporary skin and eye irritation.

HEALTH EFFECTS ASSOCIATED WITH CONTAMINANTS: None reported.

HEALTH EFFECTS ASSOCIATED WITH OTHER FORMULATIONS: None reported.

VII. SAFETY PRECAUTIONS

SIGNAL WORD AND DEFINITION:

FOSAMINE AMMONIUM **- CAUTION** – CAUSES MODERATE EYE IRRITATION. AVIOD CONTACT WITH EYES OR CLOTHING. WASH THOROUGHLY WITH SOAP AND WATER AFTER HANDLING.

PROTECTIVE PRECAUTIONS FOR WORKERS: None.

MEDICAL TREATMENT PROCEDURES (ANTIDOTES):

EYES: Flush eyes with water; call physician if irritation persists.

SKIN: Wash all exposed areas with soap and water.

INGESTION: None.

INHALATION: None.

HANDLING, STORAGE AND DISPOSAL: Store at room temperature or cooler. Do not reuse container. Rinse container and dispose accordingly.

EMERGENCY SPILL PROCEDURES AND HAZARDS: Contain and sweep up material of small spills and dispose as waste. Do not contaminate water, food or feed by storage or disposal.

VIII. DEFINITIONS

adsorption – the process of attaching to a surface

avian – of, or related to, birds

CAEPA – California Environmental Protection Agency

carcinogenicity – ability to cause cancer

CHEMTREC – Chemical Transportation Emergency Center

dermal – of, or related to, the skin

EC_{50} - median effective concentration during a bioassay

ecotoxicological – related to the effects of environmental toxicants on populations of organisms originating, being produced, growing or living naturally in a particular region or environment

FIFRA – Federal Insecticide, Fungicide and Rodenticide Act

formulation – the form in which the pesticide is supplied by the manufacturer for use

half-life – the time required for half the amount of a substance to be reduced by natural processes

herbicide – a substance used to destroy plants or to slow down their growth

Hg – chemical symbol for mercury

IARC – International Agency for Research on Cancer

K(oc) – the tendency of a chemical to be adsorbed by soil, expressed as: K(oc) = conc. adsorbed/conc. dissolved/% organic carbon in soil

LC_{50} – the concentration in air, water, or food that will kill approximately 50% of the subjects

LD_{50} – the dose that will kill approximately 50% of the subjects

leach – to dissolve out by the action of water

mg/kg – weight ratio expressed as milligrams per kilogram
mg/l – weight-to-liquid ratio expressed as milligrams per liter
microorganisms – living things too small to be seen without a microscope
mPa – milli-Pascal (unit of pressure)
mutagenicity – ability to cause genetic changes
NFPA – National Fire Protection Association
NIOSH - National Institute for Occupational Safety and Health
NOEL - no observable effect level
non-target – animals or plants other than the ones that the pesticide is intended to kill or control
OSHA - Occupational Safety and Health Administration
Pa – Pascal (unit of pressure)
persistence – tendency of a pesticide to remain to remain in the environment after it is applied
pesticides – substances including herbicides, insecticides, rodenticides, fumigants, repellents, growth regulators, etc., regulated under FIFRA
PPE – personal protective equipment
ppm – weight ratio expressed as parts per million
residual activity – the remaining amount of activity as a pesticide
T&E – Threatened and Endangered Species (from the Endangered Species Act)
µg – micrograms
volatility – the tendency to become a vapor at standard temperatures and pressures

IX. INFORMATION SOURCES

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X. TOXICITY CATEGORY TABLES

TABLE I: HUMAN HAZARDS

Category	Signal Word	Route of Administration			Hazard	
		Acute Oral LD_{50} (mg/kg)	Acute Dermal LD_{50} (mg/kg)	Acute Inhalation LC_{50} (mg/l)	Eye irritation	Skin irritation
I (Highly Toxic)	**DANGER (poison)**	0–50	0-200	0-0.2	corrosive: corneal opacity not reversible within 7 days	corrosive
II (Moderately Toxic)	**WARNING**	>50–500	>200-2000	>0.2-2	corneal opacity reversible within 7 days; irritation persisting for 7 days	severe irritation at 72 hours
III (Slightly Toxic)	**CAUTION**	>500-5000	>2000-20.000	>2-20	no corneal opacity; irritation reversible within 7 days	moderate irritation at 72 hours
IV (Practically Non-toxic)	**NONE**	>5000	>20,000	>20	no irritation	moderate irritation at 72 hours

After *Pesticide User's Guide*, Ohio State University, Extension Bull. No. 745, 1998.

TABLE II: ECOTOXICOLOGICAL RISKS TO WILDLIFE (TERRESTRIAL AND AQUATIC)

Risk Category	Mammals	Avian	Avian	Fish or Aquatic Invertebrates
	Acute Oral LD_{50} mg/kg)	Acute Oral LD_{50} (mg/kg)	Acute Dietary LC_{50} (mg/kg)	Acute Concentration LC_{50} (mg/l)
Very Highly Toxic	<10	<10	<50	<0.1
Highly Toxic	10-50	10-50	50-500	0.1 – 1
Moderately Toxic	51-500	51-500	501-1,000	>1 – 10
Slightly Toxic	501-2,000	501-2,000	1,001-5,000	>10 – 100
Practically Non-toxic	>2,000	>2,000	>5,000	>100

Table II created from information contained in *Pesticides and Wildlife*, Whitford, Fred, et al., Purdue University Cooperative Extension Service PPP-30, 1998.

Disclaimers and Other Legal Information:

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Glyphosate

HERBICIDE FACT SHEET

U.S. DEPARTMENT OF ENERGY
BONNEVILLE POWER ADMINISTRATION

This fact sheet is one of a series issued by the Bonneville Power Administration for their workers and the general public. It provides information on forest and land management uses, environmental and human health effects, and safety precautions. A list of definitions is included in Section VIII of this fact sheet.

I. BASIC INFORMATION

COMMON NAME: glyphosate

CHEMICAL NAME: N-(phosphonomethyl)glycine

Cas No. 38641-94-0

CHEMICAL TYPE: phosphanoglycine

PESTICIDE CLASSIFICATION: herbicide

REGISTERED USE STATUS: "General Use."

FORMULATIONS: Commercial herbicide products generally contain one or more ingredients. An inert ingredient is anything added to the product other than an active ingredient. Because of concern for human health and the environment, EPA announced its policy on toxic inert ingredients in the Federal Register on April 22, 1987 (52FR13305). This policy focuses on the regulation of inert ingredients. EPA's strategy for implementing this policy included the development of four lists of inerts, based on toxicological concerns. Inerts of toxicological concern were placed on List 1. Potentially toxic inerts/high priority for testing were placed on List 2. Inerts of unknown toxicity were placed on List 3, and inerts of minimal concern were placed on List 4.

The inert ingredients of the glyphosate formulations are not classified by the USEPA as inert ingredients of toxicological concerns to humans or the environment.

There are many formulations of glyphosate, including:

Accord® Herbicide (Terrestrial/Aquatic Uses)

Glyphosate	41.5 %
Inert	58.5 %

Accord® Site Prep (Terrestrial Uses)

Glyphosate	41 %
Inert	59 %

Glypro® Specialty Herbicide (Terrestrial/Aquatic Uses)

Glyphosate	53.8 %
Inert	46.2 %

Glypro® Plus (Terrestrial Uses)

Glyphosate	41 %
Inert	59 %

Glyphomax® Herbicide (Terrestrial Uses)

Glyphosate	41 %
Inert	59 %

Glyphos® Herbicide (Terrestrial Uses)

Glyphosate	41 %
Inert	59 % (Ethoxylated Tallowamines)

Glypro® Plus (Terrestrial Uses)

Glyphosate	41 %
Inert	59 %

Honcho® Herbicide (Terrestrial Uses)

Glyphosate	41 %
Inert	59 % (Ethoxylated Tallowamines)

Rodeo® Emerged Aquatic Weed and Brush Herbicide (Terrestrial/Aquatic Uses)

Glyphosate	53.8 %
Inert	46.2 %

Roundup Ultra® Herbicide (Terrestrial Uses)

Glyphosate	41 %
Inert	59 %

RESIDUE ANALYTICAL METHODS: EPA Method 547.

II. HERBICIDE USES

REGISTERED FORESTRY, RANGELAND AND RIGHT-OF-WAY USES: Glyphosate is registered for use in crop and non-crop sites, including aquatic sites, for post-emergent weed and woody plant control. For terrestrial and aquatic use.

OPERATIONAL DETAILS:

TARGET PLANTS: Broad spectrum, non-selective for grasses, weeds and woody plants.

MODE OF ACTION: Glyphosate is absorbed by the leaves preventing the plant from producing an essential amino acid.

METHOD OF APPLICATION AND RATES: Aerial and ground broadcast, spot and localized applications. Application rates vary.

SPECIAL PRECAUTIONS:

TIMING OF APPLICATION: Timing is dependent on the target plant. As glyphosate must be absorbed through the leaves, timing is limited to emerged plants.

DRIFT CONTROL: Care should be exercised not to overspray or apply the herbicide to adjacent non-target areas. Drift control is achieved by observing weather conditions and following label and sprayer instructions. Spray droplet size should be 150 microns or larger.

Restrictions/Warnings/Limitations: Non-selective herbicide—apply to target plants only. Unless labeled for aquatic use, do not apply directly to water or to areas where surface water is present. Corrosive to unlined and galvanized steel. T&E warning for plants.

III. ENVIRONMENTAL EFFECTS/FATE

SOIL:

RESIDUAL SOIL ACTIVITY: The half-life of glyphosate is 47 days.

ADSORPTION: The K(oc) of glyphosate is 24,000.

PERSISTENCE AND AGENTS OF DEGRADATION: Glyphosate is moderately persistent in the plant. The primary route of degradation is microbial activity.

METABOLITES/DEGRADATION PRODUCTS AND POTENTIAL ENVIRONMENTAL EFFECTS: The primary metabolite of glyphosate is aminomethylphosphonic acid. Environmental effects similar to parent chemical.

WATER:

SOLUBILITY: 11,600 mg/l in water (pH 7 at 25° C).

POTENTIAL FOR LEACHING INTO SURFACE AND GROUND WATER: Glyphosate is moderately persistent with a very high soil adsorption coefficient. It is not expected to leach or otherwise migrate from the site of application.

AIR:

VOLATILIZATION: Very low.

POTENTIAL FOR BYPRODUCTS FROM BURNING OF TREATED VEGETATION: None.

IV. ECOLOGICAL TOXICITY EFFECTS ON NON-TARGET SPECIES

For Glyphosate Formulations Labeled for Terrestrial Uses

MICROORGANISMS:

ACUTE CONTACT TOXICITY*:* LD_{50} (honey bee contact) >100 µg/bee

OVERALL TOXICITY: Practically Non-Toxic

PLANTS: Contact will injure or kill target and non-target plants.

AQUATIC VERTEBRATES:

ACUTE TOXICITY*:* LC_{50} (rainbow trout 96-hour) 8.2 mg/l

ACUTE TOXICITY: LC_{50} (bluegill sunfish 96-hour) 5.8 mg/l

ACUTE TOXICITY*:* LC_{50} (chinook salmon 96-hour) 20 mg/l

ACUTE TOXICITY: LC_{50} (coho salmon 96-hour) 22 mg/l

OVERALL TOXICITY: Moderately Toxic

AQUATIC FRESHWATER INVERTEBRATES:

ACUTE TOXICITY*:* LC_{50} (*Daphnia magna* 48-hour) 24 mg/l

OVERALL TOXICITY: Slightly Toxic

AQUATIC ESTUARINE/MARINE INVERTEBRATES:

ACUTE TOXICITY*:* LC_{50} (fiddler crab 96-hour) 934 mg/l

ACUTE TOXICITY*:* LC_{50} (grass shrimp 96-hour) 281 mg/l

OVERALL TOXICITY: Practically Non-Toxic

TERRESTRIAL ANIMALS:

AVIAN ACUTE ORAL TOXICITY*:* LD_{50} (bobwhite quail) >2000 mg/kg

AVIAN ACUTE ORAL TOXICITY*:* LD_{50} (mallard duck) >2251 mg/kg

AVIAN SUBACUTE DIETARY TOXICITY: LC_{50} (bobwhite quail) >6300 mg/kg

AVIAN SUBACUTE DIETARY TOXICITY: LC_{50} (mallard duck) >6300 mg/kg

MAMMAL ACUTE ORAL TOXICITY: LD_{50} (goat) >5000 mg/kg

OVERALL TOXICITY: Practically Non-Toxic

BIOACCUMULATION POTENTIAL: Little or No Potential

For Glyphosate Formulations Labeled for Aquatic/Terrestrial Uses

MICROORGANISMS:

ACUTE CONTACT TOXICITY*:* LD_{50} (honey bee contact) >100 µg/bee

OVERALL TOXICITY: Practically Non-Toxic

PLANTS: Contact will injure or kill target and non-target plants.

AQUATIC VERTEBRATES:

ACUTE TOXICITY*:* LC_{50} (rainbow trout 96-hour) >1000 mg/l

ACUTE TOXICITY: LC_{50} (bluegill sunfish 96-hour) >1000 mg/l

OVERALL TOXICITY: Practically Non-Toxic

AQUATIC FRESHWATER INVERTEBRATES:

ACUTE TOXICITY*:* LC_{50} (*Daphnia magna* 48-hour) 930 mg/l

OVERALL TOXICITY: Practically Non-Toxic

AQUATIC ESTUARINE/MARINE INVERTEBRATES:

ACUTE TOXICITY*:* LC_{50} (Eastern oyster larvae 48-hour) >10 mg/l

ACUTE TOXICITY : LC_{50} (fiddler crab 96-hour) 934 mg/l

ACUTE TOXICITY*:* TL_{50} (grass shrimp 96-hour) >281 mg/l

OVERALL TOXICITY: Slightly Toxic

TERRESTRIAL ANIMALS:

AVIAN ACUTE ORAL TOXICITY*:* LD_{50} (bobwhite quail) >2000 mg/kg

AVIAN SUBACUTE DIETARY TOXICITY: LC_{50} (bobwhite quail) >4640 mg/kg

AVIAN SUBACUTE DIETARY TOXICITY: LC_{50} (mallard duck) >4640 mg/kg

MAMMAL ACUTE ORAL TOXICITY: LD_{50} (goat) >5000 mg/kg

OVERALL TOXICITY: Practically Non-Toxic

BIOACCUMULATION POTENTIAL: Little or No Potential

THREATENED AND ENDANGERED SPECIES: Federally listed terrestrial and aquatic plants may be adversely affected if the product is applied directly to the plants, or indirectly as the result of drift or leaching.

V. TOXICOLOGICAL DATA

ACUTE TOXICITY:

ACUTE ORAL TOXICITY*:* LD_{50} (rat) >4320 mg/kg

ACUTE DERMAL TOXICITY: LD_{50} (rabbit) >2000 mg/kg

PRIMARY SKIN IRRITATION: Rabbit - Slight Irritant

PRIMARY EYE IRRITATION: Rabbit – Mild Irritant

ACUTE INHALATION: Not required by EPA.

OVERALL TOXICITY: Category III – Slightly Toxic

CHRONIC TOXICITY:

CARCINOGENICITY: Classified as a Group E chemical: Evidence of non-carcinogenicity for humans.

DEVELOPMENTAL/REPRODUCTIVE: Some effects at highest dose levels.

MUTAGENICITY: No effects.

HAZARD: The end-use product labels for glyphosate formulations without ethoxylated tallowamines carry the *Caution* signal word due to potential eye irritation.

The end-use product labels for glyphosate formulations with ethoxylated tallowamines carry the *Warning* signal word by causing substantial but temporary eye injury.

VI. HUMAN HEALTH EFFECTS

ACUTE TOXICITY (POISONING):

REPORTED EFFECTS: Glyphosate formulations will cause reversible eye injury. Will cause hypotension and lung edema if ingested in large quantities.

CHRONIC TOXICITY:

REPORTED EFFECTS: Decreased body weight, decreased food consumption, increased white blood cells, decreased liver weight and increased relative brain weights were observed in test animals.

POTENTIAL FOR ADVERSE HEALTH EFFECTS FROM CONTACTING OR CONSUMING TREATED VEGETATION, WATER OR ANIMALS: EPA reports no toxicological endpoints of concern..

POTENTIAL FOR ADVERSE HEALTH EFFECTS FROM INERT INGREDIENTS CONTAINED IN THE FORMULATED PRODUCTS: None reported.

HEALTH EFFECTS OF EXPOSURE TO FORMULATED PRODUCTS: The results of a single exposure (acute) toxicity studies conducted on formulations containing ethoxylated tallowamines indicate that these materials are no more than moderately toxic in rats after ingestion or in rabbits after skin application. The formulation is severely irritating to corrosive to rabbit eyes and can be irritating to rabbit skin.

HEALTH EFFECTS ASSOCIATED WITH CONTAMINANTS: None reported.

HEALTH EFFECTS ASSOCIATED WITH OTHER FORMULATIONS: None reported.

VII. SAFETY PRECAUTIONS

SIGNAL WORD AND DEFINITION:

GLYPHOSATE - **CAUTION** – CAUSES EYE IRRITATION

GLYPHOSATE WITH ETHOXYLATED TALLOWAMINES - **WARNING** - CAUSES SUBSTANTIAL BUT TEMPORARY EYE INJURY

PROTECTIVE PRECAUTIONS FOR WORKERS: Applicators and other handlers must wear long-sleeved shirt and long pants, shoes plus socks; for the ehtoxylated tallowamine formulations, the user must also wear protective eyewear.

MEDICAL TREATMENT PROCEDURES (ANTIDOTES):

EYES: Flush eyes with water for 15 minutes and call physician.

SKIN: Wash all exposed areas with soap and water, call physician if irritation persists.

INGESTION: Rinse mouth thoroughly with water. Do not induce vomiting. Call physician.

INHALATION: None normally needed.

HANDLING, STORAGE AND DISPOSAL: Store at room temperature or cooler. Do not reuse container. Rinse container and dispose accordingly.

EMERGENCY SPILL PROCEDURES AND HAZARDS: Contain and sweep up material of small spills and dispose as waste. Do not contaminate water, food, or feed by storage or disposal.

VIII. DEFINITIONS

adsorption – the process of attaching to a surface
avian – of, or related to, birds
CAEPA – California Environmental Protection Agency
carcinogenicity – ability to cause cancer
CHEMTREC – Chemical Transportation Emergency Center
dermal – of, or related to, the skin
EC_{50} - median effective concentration during a bioassay
ecotoxicological – related to the effects of environmental toxicants on populations of organisms originating, being produced, growing or living naturally in a particular region or environment
FIFRA – Federal Insecticide, Fungicide and Rodenticide Act
formulation – the form in which the pesticide is supplied by the manufacturer for use
half-life – the time required for half the amount of a substance to be reduced by natural processes
herbicide – a substance used to destroy plants or to slow down their growth

Hg – chemical symbol for mercury

IARC – International Agency for Research on Cancer

K(oc) – the tendency of a chemical to be adsorbed by soil, expressed as: K(oc) = conc. adsorbed/conc. dissolved/% organic carbon in soil

LC_{50} – the concentration in air, water, or food that will kill approximately 50% of the subjects

LD_{50} – the dose that will kill approximately 50% of the subjects

leach – to dissolve out by the action of water

mg/kg – weight ratio expressed as milligrams per kilogram

mg/l – weight-to-liquid ratio expressed as milligrams per liter

microorganisms – living things too small to be seen without a microscope

mPa – milli-Pascal (unit of pressure)

mutagenicity – ability to cause genetic changes

NFPA – National Fire Protection Association

NIOSH - National Institute for Occupational Safety and Health

NOEL - no observable effect level

non-target – animals or plants other than the ones that the pesticide is intended to kill or control

OSHA - Occupational Safety and Health Administration

Pa – Pascal (unit of pressure)

persistence – tendency of a pesticide to remain to remain in the environment after it is applied

pesticides – substances including herbicides, insecticides, rodenticides, fumigants, repellents, growth regulators, etc., regulated under FIFRA

PPE – personal protective equipment

ppm – weight ratio expressed as parts per million

residual activity – the remaining amount of activity as a pesticide

T&E – Threatened and Endangered Species (from the Endangered Species Act)

µg – micrograms

volatility – the tendency to become a vapor at standard temperatures and pressures

IX. INFORMATION SOURCES

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X. TOXICITY CATEGORY TABLES

TABLE I: HUMAN HAZARDS

Category	Signal Word	Route of Administration			Hazard	
		Acute Oral LD_{50} (mg/kg)	Acute Dermal LD_{50} (mg/kg)	Acute Inhalation LC_{50} (mg/l)	Eye irritation	Skin irritation
I (Highly Toxic)	**DANGER (poison)**	0–50	0-200	0-0.2	corrosive: corneal opacity not reversible within 7 days	corrosive
II (Moderately Toxic)	**WARNING**	>50–500	>200-2000	>0.2-2	corneal opacity reversible within 7 days; irritation persisting for 7 days	severe irritation at 72 hours
III (Slightly Toxic)	**CAUTION**	>500-5000	>2000-20.000	>2-20	no corneal opacity; irritation reversible within 7 days	moderate irritation at 72 hours
IV (Practically Non-toxic)	**NONE**	>5000	>20,000	>20	no irritation	moderate irritation at 72 hours

After *Pesticide User's Guide*, Ohio State University, Extension Bull. No. 745, 1998.

TABLE II: ECOTOXICOLOGICAL RISKS TO WILDLIFE (TERRESTRIAL AND AQUATIC)

Risk Category	Mammals	Avian	Avian	Fish or Aquatic Invertebrates
	Acute Oral LD_{50} mg/kg)	Acute Oral LD_{50} (mg/kg)	Acute Dietary LC_{50} (mg/kg)	Acute Concentration LC_{50} (mg/l)
Very Highly Toxic	<10	<10	<50	<0.1
Highly Toxic	10-50	10-50	50-500	0.1 – 1
Moderately Toxic	51-500	51-500	501-1,000	>1 – 10
Slightly Toxic	501-2,000	501-2,000	1,001-5,000	>10 – 100
Practically Non-toxic	>2,000	>2,000	>5,000	>100

Table II created from information contained in *Pesticides and Wildlife*, Whitford, Fred, et al., Purdue University Cooperative Extension Service PPP-30, 1998.

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This fact sheet was prepared by USDOE-Bonneville Power Administration, March 2000.

Halosulfuron-methyl

HERBICIDE FACT SHEET

U.S. DEPARTMENT OF ENERGY
BONNEVILLE POWER ADMINISTRATION

This fact sheet is one of a series issued by the Bonneville Power Administration for their workers and the general public. It provides information on forest and land management uses, environmental and human health effects, and safety precautions. A list of definitions is included in Section VIII of this fact sheet.

I. BASIC INFORMATION

COMMON NAME: halosulfuron-methyl

CHEMICAL NAME: Methyl 5-[((4,6-dimethoxy-2pyrimidinyl)amino)carbonylaminosulfonyl]-3-chloro-1-methyl-1H-pyrazole-4-carboxylate

CAS No. 100784-20-1

CHEMICAL TYPE*:* Sulfonyl Urea

PESTICIDE CLASSIFICATION*:* Herbicide

REGISTERED USE STATUS: ”General Use.”

FORMULATIONS: Commercial herbicide products generally contain one or more ingredients. An inert ingredient is anything added to the product other than an active ingredient. Because of concern for human health and the environment, EPA announced its policy on toxic inert ingredients in the Federal Register on April 22, 1987 (52FR13305). This policy focuses on the regulation of inert ingredients. EPA’s strategy for implementing this policy included the development of four lists of inerts, based on toxicological concerns. Inerts of toxicological concern were placed on List 1. Potentially toxic inerts/high priority for testing were placed on List 2. Inerts of unknown toxicity were placed on List 3, and inerts of minimal concern were placed on List 4.

The inert ingredients of the Manage® formulation are not classified by the USEPA as inert ingredients of toxicological concerns to humans or the environment.

The contents of the halosulfuron-methyl formulation is listed below:

Manage® Turf Herbicide	
Halosulfuron-methyl	75%
Inert	25%

RESIDUE ANALYTICAL METHODS: Analytical Method AG-500B

II. HERBICIDE USES

REGISTERED FORESTRY, RANGELAND AND RIGHT-OF-WAY USES: Manage® is registered for commercial and non-commercial application to established lawns, ornamental turfgrass, and established woody ornamentals in numerous places, including public areas.

OPERATIONAL DETAILS:

TARGET PLANTS: Halosulfuron-methyl is a selective herbicide for post-emergence control of sedges and other weeds in turf.

MODE OF ACTION: Halosulfuron-methyl interferes with acetolactate synthase enzyme, resulting in a rapid cessation of cell division and plant growth in both roots and shoots.

METHOD OF APPLICATION: Halosulfuron-methyl (as Manage®) is applied (ground methods only) to established turf grasses, etc., at an application rate of 0.66 to 1.66 ounces per acre. A second treatment may be necessary.

SPECIAL PRECAUTIONS:

TIMING OF APPLICATION: Halosulfuron-methyl is a post-emergence weed herbicide and is applied after emergence of target weeds.

DRIFT CONTROL: Halosulfuron-methyl is applied mixed with water/surfactant. Care should be exercised not to overspray or apply the herbicide to adjacent non-target areas. Drift control is achieved by following label and sprayer instructions.

RESTRICTIONS/WARNINGS/LIMITATIONS: Groundwater advisory. Do not apply within 4 hours of precipitation. Do not apply through any irrigation system. Do not apply by air.

III. ENVIRONMENTAL EFFECTS/FATE

SOIL:

RESIDUAL SOIL ACTIVITY: The half-life of halosulfuron-methyl is 55 days.

ADSORPTION: The K(oc) of halosulfuron-methyl is 75.

PERSISTENCE AND AGENTS OF DEGRADATION: The manufacturer has not conducted environmental toxicity studies with this product.

METABOLITES/DEGRADATION PRODUCTS AND POTENTIAL ENVIRONMENTAL EFFECTS: The manufacturer has not conducted environmental toxicity studies with this product.

WATER:

SOLUBILITY: 15 ppm at pH 5; 1630 ppm at pH 7

POTENTIAL FOR LEACHING INTO SURFACE AND GROUND WATER: The product has high potential to leach into surface and ground water when applied to normal to basic soils (greater than pH 7).

AIR:

VOLATILIZATION: Halosulfuron-methyl is slightly volatile.

POTENTIAL FOR BYPRODUCTS FROM BURNING OF TREATED VEGETATION: No information is available.

IV. ECOLOGICAL TOXICITY EFFECTS ON NON-TARGET SPECIES

MICROORGANISMS:

ACUTE CONTACT TOXICITY*:* LD_{50} (honey bee contact) >100 µg/bee

OVERALL TOXICITY: Practically Non-Toxic

PLANTS: Contact will injure or kill target and non-target plants.

AQUATIC VERTEBRATES:

ACUTE TOXICITY*:* LC_{50} (rainbow trout 96-hour) >131 mg/l

ACUTE TOXICITY: LC_{50} (bluegill sunfish 96-hour) >118 mg/l

OVERALL TOXICITY: Practically Non-Toxic

AQUATIC FRESHWATER INVERTEBRATES:

ACUTE TOXICITY*:* LC_{50} (*Daphnia magna* 48-hour) >107 mg/l

OVERALL TOXICITY: Practically Non-Toxic

AQUATIC ESTUARINE/MARINE INVERTEBRATES:

ACUTE TOXICITY*:* EC_{50} (Eastern oyster larvae 48-hour)

ACUTE TOXICITY*:* LC_{50} (grass shrimp 96-hour)

OVERALL TOXICITY:

TERRESTRIAL ANIMALS:

AVIAN ACUTE ORAL TOXICITY*:* LD_{50} (bobwhite quail)

AVIAN ACUTE ORAL TOXICITY*:* LD_{50} (mallard duck)

AVIAN SUBACUTE DIETARY TOXICITY: LC_{50} (bobwhite quail)

AVIAN SUBACUTE DIETARY TOXICITY: LC_{50} (mallard duck)

MAMMAL ACUTE ORAL TOXICITY: LD_{50} (rat) 1287 mg/kg

OVERALL TOXICITY: Slightly Toxic

BIOACCUMULATION POTENTIAL: Slight Potential

THREATENED AND ENDANGERED SPECIES: Federally listed terrestrial and aquatic plants may be adversely affected if the product is applied directly to the plants, or indirectly as the result of drift or leaching.

V. TOXICOLOGICAL DATA

ACUTE TOXICITY:

ACUTE ORAL TOXICITY*:* LD_{50} (rat) >1287 mg/kg

ACUTE DERMAL TOXICITY: LD_{50} (rat) >5000 mg/kg

PRIMARY SKIN IRRITATION: Rabbit – Slightly Irritating

PRIMARY EYE IRRITATION: Rabbit – Moderately Irritating

ACUTE INHALATION: LC_{50} (rat 4 hour) >5.7 mg/l.

OVERALL TOXICITY: Category III – Caution – Slightly Toxic

CHRONIC TOXICITY:

CARCINOGENICITY: No effects.

DEVELOPMENTAL: Slight developmental toxicity.

REPRODUCTIVE: No effects.

MUTAGENICITY: No effects.

HAZARD: EPA has concluded that potential levels of halosulfuron-methyl or metabolites in soil and water do not appear to have significant toxicological effects on humans or animals and presents a negligible risk [63FR29401].

VI. HUMAN HEALTH EFFECTS

ACUTE TOXICITY (POISONING):

REPORTED EFFECTS: In sulfite-sensitive individuals, skin reactions have been reported following dermal exposure.

CHRONIC TOXICITY:

REPORTED EFFECTS: None reported.

POTENTIAL FOR ADVERSE HEALTH EFFECTS FROM CONTACTING OR CONSUMING TREATED VEGETATION, WATER OR ANIMALS: None reported.

POTENTIAL FOR ADVERSE HEALTH EFFECTS FROM INERT INGREDIENTS CONTAINED IN THE FORMULATED PRODUCTS: Inhalation of both silica gel and kaolin dust may cause coughing, sneezing and nasal irritation.

HEALTH EFFECTS OF EXPOSURE TO FORMULATED PRODUCTS: There have been no reported effects on workers manufacturing the products.

HEALTH EFFECTS ASSOCIATED WITH CONTAMINANTS: None reported.

HEALTH EFFECTS ASSOCIATED WITH OTHER FORMULATIONS: None reported.

HEALTH RISK MANAGEMENT PROCEDURES: See Section VII.

VII. SAFETY PRECAUTIONS

SIGNAL WORD AND DEFINITION:

HALOSULFURON-METHYL **- CAUTION** – AVOID CONTACT WITH EYES AND CLOTHING. HARMFUL IF SWALLOWED.

PROTECTIVE PRECAUTIONS FOR WORKERS: Wear eye protection. Wear long-sleeved shirt, long pants, shoes and socks.

MEDICAL TREATMENT PROCEDURES (ANTIDOTES):

EYES: Flush eyes with water; call physician.

SKIN: Wash all exposed areas with soap and water. Wash all contaminated clothing prior to reuse. Call a physician if irritation develops.

INGESTION: Remove visible particles from mouth and rinse with water. Swallow water to dilute. Immediately transport to a medical care facility.

INHALATION: Remove individual to fresh air. If breathing difficulty occurs, provide CPR assistance and seek immediate medical attention.

HANDLING, STORAGE AND DISPOSAL: Keep dry (below 120° F) and store away from food, feed or other material to be used or consumed by humans or animals. Do not contaminate water. Dispose of only in accordance with local, state, and federal regulations.

EMERGENCY SPILL PROCEDURES AND HAZARDS: Contain and sweep up material of small spills and dispose as waste. Large spills should be reported to CHEMTREC (800-424-9300) for assistance. Prevent runoff. Do not contaminate water, food, or feed by storage or disposal.

VIII. DEFINITIONS

adsorption – the process of attaching to a surface

avian – of, or related to, birds

CAEPA – California Environmental Protection Agency

carcinogenicity – ability to cause cancer

CHEMTREC – Chemical Transportation Emergency Center

dermal – of, or related to, the skin

EC_{50} - median effective concentration during a bioassay

ecotoxicological – related to the effects of environmental toxicants on populations of organisms originating, being produced, growing or living naturally in a particular region or environment

FIFRA – Federal Insecticide, Fungicide and Rodenticide Act

formulation – the form in which the pesticide is supplied by the manufacturer for use

half-life – the time required for half the amount of a substance to be reduced by natural processes

herbicide – a substance used to destroy plants or to slow down their growth

Hg – chemical symbol for mercury

IARC – International Agency for Research on Cancer

K(oc) – the tendency of a chemical to be adsorbed by soil, expressed as: K(oc) = conc. adsorbed/conc. dissolved/% organic carbon in soil

LC_{50} – the concentration in air, water, or food that will kill approximately 50% of the subjects

LD_{50} – the dose that will kill approximately 50% of the subjects

leach – to dissolve out by the action of water

mg/kg – weight ratio expressed as milligrams per kilogram

mg/l – weight-to-liquid ratio expressed as milligrams per liter

microorganisms – living things too small to be seen without a microscope

mPa – milli-Pascal (unit of pressure)

mutagenicity – ability to cause genetic changes

NFPA – National Fire Protection Association

NIOSH - National Institute for Occupational Safety and Health

NOEL - no observable effect level

non-target – animals or plants other than the ones that the pesticide is intended to kill or control

OSHA - Occupational Safety and Health Administration

Pa – Pascal (unit of pressure)

persistence – tendency of a pesticide to remain to remain in the environment after it is applied

pesticides – substances including herbicides, insecticides, rodenticides, fumigants, repellents, growth regulators, etc., regulated under FIFRA

PPE – personal protective equipment

ppm – weight ratio expressed as parts per million

residual activity – the remaining amount of activity as a pesticide

T&E – Threatened and Endangered Species (from the Endangered Species Act)

µg – micrograms

volatility – the tendency to become a vapor at standard temperatures and pressures

IX. INFORMATION SOURCES

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X. TOXICITY CATEGORY TABLES

TABLE I: HUMAN HAZARDS

Category	Signal Word	Route of Administration			Hazard	
		Acute Oral LD_{50} (mg/kg)	Acute Dermal LD_{50} (mg/kg)	Acute Inhalation LC_{50} (mg/l)	Eye irritation	Skin irritation
I (Highly Toxic)	**DANGER (poison)**	0–50	0-200	0-0.2	corrosive: corneal opacity not reversible within 7 days	corrosive
II (Moderately Toxic)	**WARNING**	>50–500	>200-2000	>0.2-2	corneal opacity reversible within 7 days; irritation persisting for 7 days	severe irritation at 72 hours
III (Slightly Toxic)	**CAUTION**	>500-5000	>2000-20.000	>2-20	no corneal opacity; irritation reversible within 7 days	moderate irritation at 72 hours
IV (Practically Non-toxic)	**NONE**	>5000	>20,000	>20	no irritation	moderate irritation at 72 hours

After *Pesticide User's Guide*, Ohio State University, Extension Bull. No. 745, 1998.

TABLE II: ECOTOXICOLOGICAL RISKS TO WILDLIFE (TERRESTRIAL AND AQUATIC)

Risk Category	Mammals (Acute Oral LD_{50} mg/kg)	Avian (Acute Oral LD_{50} mg/kg)	Avian LC_{50} (mg/kg)	Fish or Aquatic Invertebrates LC_{50} (mg/l)
Very Highly Toxic	<10	<10	<50	<0.1
Highly Toxic	10-50	10-50	50-500	0.1 – 1
Moderately Toxic	51-500	51-500	501-1,000	>1 – 10
Slightly Toxic	501-2,000	501-2,000	1,001-5,000	>10 – 100
Practically Non-toxic	>2,000	>2,000	>5,000	>100

Table II created from information contained in *Pesticides and Wildlife*, Whitford, Fred, et al., Purdue University Cooperative Extension Service PPP-30, 1998.

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Hexazinone

HERBICIDE FACT SHEET

U.S. DEPARTMENT OF ENERGY
BONNEVILLE POWER ADMINISTRATION

This fact sheet is one of a series issued by the Bonneville Power Administration for their workers and the general public. It provides information on forest and land management uses, environmental and human health effects, and safety precautions. A list of definitions is included in Section VIII of this fact sheet.

I. BASIC INFORMATION

COMMON NAME: hexazinone

CHEMICAL NAME: [3-cyclohexyl-6-(dimethylamino)-1-methyl-S-triazine-2,4-(1H,3H)-dione]

Cas No. 51235-04-2

CHEMICAL TYPE: triazine-dione herbicide

PESTICIDE CLASSIFICATION: herbicide

REGISTERED USE STATUS: General Use Pesticide. Restricted Use Pesticide in Washington.

FORMULATIONS: Commercial herbicide products generally contain one or more ingredients. An inert ingredient is anything added to the product other than an active ingredient. Because of concern for human health and the environment, EPA announced its policy on toxic inert ingredients in the Federal Register on April 22, 1987 (52FR13305). This policy focuses on the regulation of inert ingredients. EPA's strategy for implementing this policy included the development of four lists of inerts, based on toxicological concerns. Inerts of toxicological concern were placed on List 1. Potentially toxic inerts/high priority for testing were placed on List 2. Inerts of unknown toxicity were placed on List 3, and inerts of minimal concern were placed on List 4.

The inert ingredients of the Velpar® formulation are not classified by the USEPA as inert ingredients of toxicological concerns to humans or the environment.

The contents of the hexazinone formulation are listed below:

Velpar® Herbicide (soluble powder)

Hexazinone	90 %
Inert	10 %

Velpar® DF (dispersible granules)

Hexazinone	75 %
Inert	25 %

Velpar® L (water dispersible liquid)

Hexazinone	25 %
Inert	75 % (includes 45% ethanol - CAS 64-17-5)

Velpar® ULW (soluble granules)

Hexazinone	75 %
Inert	25 %

Velpar® ULW DF (soluble granules)

Hexazinone	75 %
Inert	25 %

RESIDUE ANALYTICAL METHODS: EPA Method 633.

II. HERBICIDE USES

REGISTERED FORESTRY, RANGELAND AND RIGHT-OF-WAY USES: Hexazinone as Velpar® is registered for use in agriculture and forestry for selective weed control, and in non-agricultural areas as a non-selective general weed and woody plants control herbicide. For terrestrial use only.

OPERATIONAL DETAILS:

TARGET PLANTS: Broad-spectrum annual, biennial, and perennial weeds including woody plants.

MODE OF ACTION: Hexazinone inhibits photosynthesis.

METHOD OF APPLICATION AND RATES: Broadcast and spot spray applications at 1/4 ounce to 8 ounces of formulated product per acre. Ground or aerial (helicopter only) application. Do not apply more than 8 ounces/acre/year.

SPECIAL PRECAUTIONS:

TIMING OF APPLICATION: Timing is dependent on the target plant. Application may be made at any time the ground is not frozen. As hexazinone must move to the root zone to be effective for pre-emergent control, adequate soil moisture is necessary.

DRIFT CONTROL: Care should be exercised not to overspray or apply the herbicide to adjacent non-target areas. Drift control is achieved by observing weather conditions and following label and sprayer instructions. Spray droplet size should be 150 microns or larger.

Restrictions/Warnings/Limitations: Do not apply through any type of irrigation system. Do not apply to frozen ground. Do not apply 30 to 60 days before grazing, harvest, or feeding. Non-target plants may be adversely effected from drift and run-off.

III. ENVIRONMENTAL EFFECTS/FATE

SOIL:

RESIDUAL SOIL ACTIVITY: The half-life of hexazinone is 175 days.

ADSORPTION: The K(oc) of hexazinone is 40.

PERSISTENCE AND AGENTS OF DEGRADATION: Hexazinone is persistent and is known to leach into groundwater. Hexazinone is degraded by soil microorganisms and sunlight.

METABOLITES/DEGRADATION PRODUCTS AND POTENTIAL ENVIRONMENTAL EFFECTS: Hexazinone degrades to carbon dioxide; many degradates have similar or identical characteristics to the parent material.

WATER:

SOLUBILITY: 33,000 mg/l in water (pH 7).

POTENTIAL FOR LEACHING INTO SURFACE AND GROUND WATER: Hexazinone is persistent and is known to leach into groundwater under favorable soil conditions and high water tables.

AIR:

VOLATILIZATION: 0.03 Pa at 25° C.

POTENTIAL FOR BYPRODUCTS FROM BURNING OF TREATED VEGETATION: None.

IV. ECOLOGICAL TOXICITY EFFECTS ON NON-TARGET SPECIES

MICROORGANISMS:

ACUTE CONTACT TOXICITY*:* LD_{50} (honey bee contact) >100 µg/bee

OVERALL TOXICITY: Practically Non-Toxic

PLANTS: Contact will injure or kill target and non-target plants.

AQUATIC VERTEBRATES:

ACUTE TOXICITY*:* LC_{50} (rainbow trout 96-hour) >320 mg/l

ACUTE TOXICITY: LC_{50} (bluegill sunfish 96-hour) >370 mg/l

OVERALL TOXICITY: Practically Non-Toxic

AQUATIC FRESHWATER INVERTEBRATES:

ACUTE TOXICITY*:* LC_{50} (*Daphnia magna* 48-hour) 151.6 mg/l

OVERALL TOXICITY: Practically Non-Toxic

AQUATIC ESTUARINE/MARINE INVERTEBRATES:

ACUTE TOXICITY*:* EC_{50} (Eastern oyster larvae 48-hour) >320 mg/l

ACUTE TOXICITY*:* LC_{50} (grass shrimp 96-hour) >78 mg/l

OVERALL TOXICITY: Slightly Toxic

TERRESTRIAL ANIMALS:

AVIAN ACUTE ORAL TOXICITY*:* LD_{50} (bobwhite quail) >2251 mg/kg

AVIAN ACUTE ORAL TOXICITY*:* LD_{50} (mallard duck) >2251 mg/kg

AVIAN SUBACUTE DIETARY TOXICITY: LC_{50} (bobwhite quail) >5000 mg/kg

AVIAN SUBACUTE DIETARY TOXICITY: LC_{50} (mallard duck) >10,000 mg/kg

MAMMAL ACUTE ORAL TOXICITY: LD_{50} (rat) >1100 mg/kg

OVERALL TOXICITY: Slightly Toxic

BIOACCUMULATION POTENTIAL: Slight Potential

THREATENED AND ENDANGERED SPECIES: Federally listed terrestrial and aquatic plants may be adversely affected if the product is applied directly to the plants, or indirectly as the result of drift or leaching.

V. TOXICOLOGICAL DATA

ACUTE TOXICITY:

ACUTE ORAL TOXICITY*:* LD_{50} (rat) >1200 mg/kg

ACUTE DERMAL TOXICITY: LD_{50} (rabbit) >5278 mg/kg

PRIMARY SKIN IRRITATION: Rabbit - Slight Irritant

PRIMARY EYE IRRITATION: Rabbit – Severe Irritant

ACUTE INHALATION: LC_{50} (rat) >3.94 mg/l

OVERALL TOXICITY: Category I – Danger

CHRONIC TOXICITY:

CARCINOGENICITY: Classified as a Group D chemical: Not classifiable as a human carcinogen.

DEVELOPMENTAL/REPRODUCTIVE: Some effects at mid- to high dose levels.

MUTAGENICITY: Positive in one study and negative in another. Suggests slight to no mutagenic effects.

HAZARD: The end-use product label for Velpar® carries the *Danger* signal word due to irreversible eye damage.

VI. HUMAN HEALTH EFFECTS

ACUTE TOXICITY (POISONING):

REPORTED EFFECTS: Hexazinone formulations will cause irreversible eye damage.

CHRONIC TOXICITY:

REPORTED EFFECTS: Decreased body weight, decreased food consumption, increased white blood cells, decreased liver weight and increased relative brain weights were observed in test animals..

POTENTIAL FOR ADVERSE HEALTH EFFECTS FROM CONTACTING OR CONSUMING TREATED VEGETATION, WATER OR ANIMALS: EPA reports no toxicological endpoints of concern.

POTENTIAL FOR ADVERSE HEALTH EFFECTS FROM INERT INGREDIENTS CONTAINED IN THE FORMULATED PRODUCTS: None reported.

HEALTH EFFECTS OF EXPOSURE TO FORMULATED PRODUCTS: Severe eye irritation.

HEALTH EFFECTS ASSOCIATED WITH CONTAMINANTS: None reported.

HEALTH EFFECTS ASSOCIATED WITH OTHER FORMULATIONS: None reported.

VII. SAFETY PRECAUTIONS

SIGNAL WORD AND DEFINITION:

HEXAZINONE **- DANGER** – CORROSIVE, CAUSES IRREVERSIBLE EYE DAMAGE

PROTECTIVE PRECAUTIONS FOR WORKERS: Applicators and other handlers must wear long-sleeved shirt and long pants, shoes plus socks, and protective eyewear.

MEDICAL TREATMENT PROCEDURES (ANTIDOTES):

EYES: Flush eyes with water for 15 minutes and call physician.

SKIN: Wash all exposed areas with soap and water; call physician if irritation persists.

INGESTION: Do not induce vomiting. Promptly drink a large quantity of milk, egg whites, gelatin solution, or if these are not available, drink large quantities of water. Avoid alcohol. Call a physician.

INHALATION: Remove to fresh air.

HANDLING, STORAGE AND DISPOSAL: Store at room temperature or cooler. Do not reuse container. Rinse container and dispose accordingly.

EMERGENCY SPILL PROCEDURES AND HAZARDS: Contain and sweep up material of small spills and dispose as waste. Do not contaminate water, food, or feed by storage or disposal.

VIII. DEFINITIONS

adsorption – the process of attaching to a surface

avian – of, or related to, birds

CAEPA – California Environmental Protection Agency

carcinogenicity – ability to cause cancer

CHEMTREC – Chemical Transportation Emergency Center

dermal – of, or related to, the skin

EC_{50} - median effective concentration during a bioassay

ecotoxicological – related to the effects of environmental toxicants on populations of organisms originating, being produced, growing or living naturally in a particular region or environment

FIFRA – Federal Insecticide, Fungicide and Rodenticide Act

formulation – the form in which the pesticide is supplied by the manufacturer for use

half-life – the time required for half the amount of a substance to be reduced by natural processes

herbicide – a substance used to destroy plants or to slow down their growth

Hg – chemical symbol for mercury

IARC – International Agency for Research on Cancer

K(oc) – the tendency of a chemical to be adsorbed by soil, expressed as: K(oc) = conc. adsorbed/conc. dissolved/% organic carbon in soil

LC_{50} – the concentration in air, water, or food that will kill approximately 50% of the subjects

LD_{50} – the dose that will kill approximately 50% of the subjects

leach – to dissolve out by the action of water

mg/kg – weight ratio expressed as milligrams per kilogram

mg/l – weight-to-liquid ratio expressed as milligrams per liter

microorganisms – living things too small to be seen without a microscope

mPa – milli-Pascal (unit of pressure)

mutagenicity – ability to cause genetic changes

NFPA – National Fire Protection Association

NIOSH - National Institute for Occupational Safety and Health

NOEL - no observable effect level

non-target – animals or plants other than the ones that the pesticide is intended to kill or control

OSHA - Occupational Safety and Health Administration

Pa – Pascal (unit of pressure)

persistence – tendency of a pesticide to remain to remain in the environment after it is applied

pesticides – substances including herbicides, insecticides, rodenticides, fumigants, repellents, growth regulators, etc., regulated under FIFRA

PPE – personal protective equipment

ppm – weight ratio expressed as parts per million

residual activity – the remaining amount of activity as a pesticide

T&E – Threatened and Endangered Species (from the Endangered Species Act)
µg – micrograms
volatility – the tendency to become a vapor at standard temperatures and pressures

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X. TOXICITY CATEGORY TABLES

TABLE I: HUMAN HAZARDS

Category	Signal Word	Route of Administration			Hazard	
		Acute Oral LD_{50} (mg/kg)	Acute Dermal LD_{50} (mg/kg)	Acute Inhalation LC_{50} (mg/l)	Eye irritation	Skin irritation
I (Highly Toxic)	**DANGER (poison)**	0–50	0-200	0-0.2	corrosive: corneal opacity not reversible within 7 days	corrosive
II (Moderately Toxic)	**WARNING**	>50–500	>200-2000	>0.2-2	corneal opacity reversible within 7 days; irritation persisting for 7 days	severe irritation at 72 hours
III (Slightly Toxic)	**CAUTION**	>500-5000	>2000-20.000	>2-20	no corneal opacity; irritation reversible within 7 days	Moderate irritation at 72 hours
IV (Practically Non-toxic)	**NONE**	>5000	>20,000	>20	no irritation	Moderate irritation at 72 hours

After *Pesticide User's Guide*, Ohio State University, Extension Bull. No. 745, 1998.

TABLE II: ECOTOXICOLOGICAL RISKS TO WILDLIFE (TERRESTRIAL AND AQUATIC)

Risk Category	Mammals Acute Oral LD_{50} mg/kg)	Avian Acute Oral LD_{50} (mg/kg)	Avian Acute Dietary LC_{50} (mg/kg)	Fish or Aquatic Invertebrates Acute Concentration LC_{50} (mg/l)
Very Highly Toxic	<10	<10	<50	<0.1
Highly Toxic	10-50	10-50	50-500	0.1 – 1
Moderately Toxic	51-500	51-500	501-1,000	>1 – 10
Slightly Toxic	501-2,000	501-2,000	1,001-5,000	>10 – 100
Practically Non-toxic	>2,000	>2,000	>5,000	>100

Table II created from information contained in *Pesticides and Wildlife*, Whitford, Fred, et al., Purdue University Cooperative Extension Service PPP-30, 1998.

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This fact sheet was prepared by USDOE-Bonneville Power Administration, March 2000.

Imazapyr

HERBICIDE FACT SHEET

U.S. DEPARTMENT OF ENERGY
BONNEVILLE POWER ADMINISTRATION

This fact sheet is one of a series issued by the Bonneville Power Administration for their workers and the general public. It provides information on forest and land management uses, environmental and human health effects, and safety precautions. A list of definitions is included in Section VIII of this fact sheet.

I. BASIC INFORMATION

COMMON NAME: imazapyr

CHEMICAL NAME: 2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1-H-imidazol-2-yl]-3-pyridinecarboxylic acid

Cas No. 81334-34-1

CHEMICAL TYPE: imidazolinone

PESTICIDE CLASSIFICATION: herbicide

REGISTERED USE STATUS: "General Use."

FORMULATIONS: Commercial herbicide products generally contain one or more ingredients. An inert ingredient is anything added to the product other than an active ingredient. Because of concern for human health and the environment, EPA announced its policy on toxic inert ingredients in the Federal Register on April 22, 1987 (52FR13305). This policy focuses on the regulation of inert ingredients. EPA's strategy for implementing this policy included the development of four lists of inerts, based on toxicological concerns. Inerts of toxicological concern were placed on List 1. Potentially toxic inerts/high priority for testing were placed on List 2. Inerts of unknown toxicity were placed on List 3, and inerts of minimal concern were placed on List 4.

The inert ingredients of the imazapyr formulations are not classified by the USEPA as inert ingredients of toxicological concerns to humans or the environment.

The contents of the imazapyr formulation are listed below:

Arsenal® Herbicide

Imazapyr	28.7 %
Inert	71.3 %

Arsenal® Applicators Concentrate Herbicide

Imazapyr	53.1 %
Inert	46.9 %

Arsenal® Railroad Herbicide

Imazapyr	27.6 %
Inert	72.4 %

Chopper® Herbicide

Imazapyr	27.6 %
Inert	72.4 %

RESIDUE ANALYTICAL METHODS: Capillary Electrophoresis Method 2657.

II. HERBICIDE USES

REGISTERED FORESTRY, RANGELAND AND RIGHT-OF-WAY USES: Imazapyr is registered for use in non-crop sites for selective and total weed control. For terrestrial use only.

OPERATIONAL DETAILS:

TARGET PLANTS: Imazapyr is used for pre- and post-emergent control of annual and perennial grasses and broadleaf weeds, brush, vines, and many deciduous trees.

MODE OF ACTION: Imazapyr is absorbed by the leaves and through the root system, disrupting protein synthesis.

METHOD OF APPLICATION AND RATES Aerial and ground broadcast, spot and localized applications at 2 to 6 pints per acre.

SPECIAL PRECAUTIONS:

TIMING OF APPLICATION: Timing is dependent on the target plant.

DRIFT CONTROL: Care should be exercised not to overspray or apply the herbicide to adjacent non-target areas. Drift control is achieved by observing weather conditions and following label and sprayer instructions. Spray droplet size should be 150 microns or larger.

RESTRICTIONS/WARNINGS/LIMITATIONS: Do not use on food or feed crops. Do not treat irrigation ditches or water used for irrigating crops.

III. ENVIRONMENTAL EFFECTS/FATE

SOIL:

RESIDUAL SOIL ACTIVITY: The half-life of imazapyr is 90 days.

ADSORPTION: The K(oc) of imazapyr is 100.

PERSISTENCE AND AGENTS OF DEGRADATION: Imazapyr is moderately persistent in the plant and soils. The primary route of degradation is microbial activity.

METABOLITES/DEGRADATION PRODUCTS AND POTENTIAL ENVIRONMENTAL EFFECTS: No information.

WATER:

SOLUBILITY: 1.0 mg/l in water (pH 7 at 25° C).

POTENTIAL FOR LEACHING INTO SURFACE AND GROUND WATER: Imazapyr is moderately persistent with a moderate soil adsorption coefficient. There is a moderate potential for imazapyr to leach into groundwater and a high potential for surface water runoff.

AIR:

VOLATILIZATION: No information.

POTENTIAL FOR BYPRODUCTS FROM BURNING OF TREATED VEGETATION: Not known.

IV. ECOLOGICAL TOXICITY EFFECTS ON NON-TARGET SPECIES

MICROORGANISMS:

ACUTE CONTACT TOXICITY*:* LD_{50} (honey bee contact) >100 µg/bee

OVERALL TOXICITY: Practically Non-Toxic

PLANTS: Contact will injure or kill target and non-target plants.

AQUATIC VERTEBRATES:

ACUTE TOXICITY*:* LC_{50} (rainbow trout 96-hour) >100 mg/l

ACUTE TOXICITY: LC_{50} (bluegill sunfish 96-hour) >100 mg/l

OVERALL TOXICITY: Practically Non-Toxic

AQUATIC FRESHWATER INVERTEBRATES:

ACUTE TOXICITY*:* LC_{50} (*Daphnia magna* 48-hour) >100 mg/l

OVERALL TOXICITY: Practically Non-Toxic

AQUATIC ESTUARINE/MARINE INVERTEBRATES:

ACUTE TOXICITY*:* LC_{50} (sheepshead minnow 96-hour)

ACUTE TOXICITY*:* LC_{50} (grass shrimp 96-hour)

ACUTE TOXICITY*:* LC_{50} (eastern oyster 96-hour)

OVERALL TOXICITY: Practically Non-Toxic (Based on freshwater data, imazapyr is not expected to be toxic to estuarine invertebrates.)

TERRESTRIAL ANIMALS:

AVIAN ACUTE ORAL TOXICITY*:* LD_{50} (bobwhite quail) >2150 mg/kg

AVIAN ACUTE ORAL TOXICITY*:* LD_{50} (mallard duck) >2150 mg/kg

AVIAN SUBACUTE DIETARY TOXICITY: LC_{50} (bobwhite quail) >5000 mg/kg

AVIAN SUBACUTE DIETARY TOXICITY: LC_{50} (mallard duck) >5000 mg/kg

MAMMAL ACUTE ORAL TOXICITY: LD_{50} (rat) >5000 mg/kg

OVERALL TOXICITY: Practically Non-Toxic

BIOACCUMULATION POTENTIAL: Little Potential

THREATENED AND ENDANGERED SPECIES: Federally listed terrestrial and aquatic plants may be adversely affected if the product is applied directly to the plants, or indirectly as the result of drift or leaching.

V. TOXICOLOGICAL DATA

ACUTE TOXICITY:

ACUTE ORAL TOXICITY*:* LD_{50} (rat) >5000 mg/kg

ACUTE DERMAL TOXICITY: LD_{50} (rabbit) >2000 mg/kg

PRIMARY SKIN IRRITATION: Rabbit - Slight Irritant

PRIMARY EYE IRRITATION: Rabbit – Moderate Irritant

ACUTE INHALATION: LC_{50} (rat) >1.3 mg/l

OVERALL TOXICITY: Category III – Slightly Toxic

CHRONIC TOXICITY:

CARCINOGENICITY: EPA Group E - No evidence of human carcinogenicity.

DEVELOPMENTAL/REPRODUCTIVE: No adverse effects.

MUTAGENICITY: No adverse effects.

HAZARD: The end-use product labels for the imazapyr formulations carry the *Caution* signal word due to potential eye and skin irritation.

VI. HUMAN HEALTH EFFECTS

ACUTE TOXICITY (POISONING):

REPORTED EFFECTS: None.

CHRONIC TOXICITY:

REPORTED EFFECTS: None.

POTENTIAL FOR ADVERSE HEALTH EFFECTS FROM CONTACTING OR CONSUMING TREATED VEGETATION, WATER OR ANIMALS: None reported.

POTENTIAL FOR ADVERSE HEALTH EFFECTS FROM INERT INGREDIENTS CONTAINED IN THE FORMULATED PRODUCTS: None.

HEALTH EFFECTS OF EXPOSURE TO FORMULATED PRODUCTS: Dermal sensitizer in some applicators after prolonged and repeated contact with formulated products.

HEALTH EFFECTS ASSOCIATED WITH CONTAMINANTS: None reported.

HEALTH EFFECTS ASSOCIATED WITH OTHER FORMULATIONS: None reported.

VII. SAFETY PRECAUTIONS

SIGNAL WORD AND DEFINITION:

IMAZAPYR - **CAUTION** – HARMFUL IF INHALED OR ABSORBED THROUGH SKIN. AVOID BREATHING SPRAY MIST. AVOID CONTACT WITH SKIN, EYES OR CLOTHING. PROLONGED OR FREQUENT EXPOSURE TO SKIN MAY CAUSE ALLERGIC REACTIONS IN SOME INDIVIDUALS.

PROTECTIVE PRECAUTIONS FOR WORKERS: Applicators and other handlers must wear long-sleeved shirt and long pants, shoes plus socks.

MEDICAL TREATMENT PROCEDURES (ANTIDOTES):

EYES: Flush eyes with water.

SKIN: Wash all exposed areas with soap and water, call physician if irritation persists.

INGESTION: Drink 1 to 2 glasses of water and induce vomiting. Call physician.

INHALATION: Remove to fresh air. Call a physician if breathing difficulty persists.

HANDLING, STORAGE AND DISPOSAL: Store at room temperature or cooler. Do not reuse container. Rinse container and dispose accordingly.

EMERGENCY SPILL PROCEDURES AND HAZARDS: Contain and sweep up material of small spills and dispose as waste. Do not contaminate water, food, or feed by storage or disposal.

VIII. DEFINITIONS

adsorption – the process of attaching to a surface

avian – of, or related to, birds

CAEPA – California Environmental Protection Agency

carcinogenicity – ability to cause cancer

CHEMTREC – Chemical Transportation Emergency Center

dermal – of, or related to, the skin

EC_{50} - median effective concentration during a bioassay

ecotoxicological – related to the effects of environmental toxicants on populations of organisms originating, being produced, growing or living naturally in a particular region or environment

FIFRA – Federal Insecticide, Fungicide and Rodenticide Act

formulation – the form in which the pesticide is supplied by the manufacturer for use

half-life – the time required for half the amount of a substance to be reduced by natural processes

herbicide – a substance used to destroy plants or to slow down their growth

Hg – chemical symbol for mercury

IARC – International Agency for Research on Cancer

K(oc) – the tendency of a chemical to be adsorbed by soil, expressed as: K(oc) = conc. adsorbed/conc. dissolved/% organic carbon in soil

LC_{50} – the concentration in air, water, or food that will kill approximately 50% of the subjects

LD_{50} – the dose that will kill approximately 50% of the subjects

leach – to dissolve out by the action of water

mg/kg – weight ratio expressed as milligrams per kilogram

mg/l – weight-to-liquid ratio expressed as milligrams per liter

microorganisms – living things too small to be seen without a microscope

mPa – milli-Pascal (unit of pressure)

mutagenicity – ability to cause genetic changes

NFPA – National Fire Protection Association

NIOSH - National Institute for Occupational Safety and Health

NOEL - no observable effect level

non-target – animals or plants other than the ones that the pesticide is intended to kill or control

OSHA - Occupational Safety and Health Administration

Pa – Pascal (unit of pressure)

persistence – tendency of a pesticide to remain to remain in the environment after it is applied

pesticides – substances including herbicides, insecticides, rodenticides, fumigants, repellents, growth regulators, etc., regulated under FIFRA

PPE – personal protective equipment

ppm – weight ratio expressed as parts per million

residual activity – the remaining amount of activity as a pesticide

T&E – Threatened and Endangered Species (from the Endangered Species Act)

µg – micrograms

volatility – the tendency to become a vapor at standard temperatures and pressures

IX. INFORMATION SOURCES

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X. TOXICITY CATEGORY TABLES

TABLE I: HUMAN HAZARDS

Category	Signal Word	Route of Administration			Hazard	
		Acute Oral LD_{50} (mg/kg)	Acute Dermal LD_{50} (mg/kg)	Acute Inhalation LC_{50} (mg/l)	Eye irritation	Skin irritation
I (Highly Toxic)	**DANGER (poison)**	0–50	0-200	0-0.2	corrosive: corneal opacity not reversible within 7 days	corrosive
II (Moderately Toxic)	**WARNING**	>50–500	>200-2000	>0.2-2	corneal opacity reversible within 7 days; irritation persisting for 7 days	severe irritation at 72 hours
III (Slightly Toxic)	**CAUTION**	>500-5000	>2000-20.000	>2-20	no corneal opacity; irritation reversible within 7 days	moderate irritation at 72 hours
IV (Practically Non-toxic)	**NONE**	>5000	>20,000	>20	no irritation	Moderate irritation at 72 hours

After *Pesticide User's Guide*, Ohio State University, Extension Bull. No. 745, 1998.

TABLE II: ECOTOXICOLOGICAL RISKS TO WILDLIFE (TERRESTRIAL AND AQUATIC)

Risk Category	Mammals Acute Oral LD_{50} mg/kg)	Avian Acute Oral LD_{50} (mg/kg)	Avian Acute Dietary LC_{50} (mg/kg)	Fish or Aquatic Invertebrates Acute Concentration LC_{50} (mg/l)
Very Highly Toxic	<10	<10	<50	<0.1
Highly Toxic	10-50	10-50	50-500	0.1 – 1
Moderately Toxic	51-500	51-500	501-1,000	>1 – 10
Slightly Toxic	501-2,000	501-2,000	1,001-5,000	>10 – 100
Practically Non-toxic	>2,000	>2,000	>5,000	>100

Table II created from information contained in *Pesticides and Wildlife*, Whitford, Fred, et al., Purdue University Cooperative Extension Service PPP-30, 1998.

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This fact sheet was prepared by USDOE-Bonneville Power Administration, March 2000.

Isoxaben

HERBICIDE FACT SHEET

U.S. DEPARTMENT OF ENERGY

BONNEVILLE POWER ADMINISTRATION

This fact sheet is one of a series issued by the Bonneville Power Administration for their workers and the general public. It provides information on forest and land management uses, environmental and human health effects, and safety precautions. A list of definitions is included in Section VIII of this fact sheet.

I. BASIC INFORMATION

COMMON NAME: isoxaben

CHEMICAL NAME: N-[3-(1-ethyl-1-methylpropyl)-5-isoxazoly]-2,6dimethoxybenzamide and isomers

CAS No. 82558-50-7

CHEMICAL TYPE: benzamide family

PESTICIDE CLASSIFICATION: herbicide

REGISTERED USE STATUS: "General Use."

FORMULATIONS: Commercial herbicide products generally contain one or more ingredients. An inert ingredient is anything added to the product other than an active ingredient. Because of concern for human health and the environment, EPA announced its policy on toxic inert ingredients in the *Federal Register* on April 22, 1987 (52FR13305). This policy focuses on the regulation of inert ingredients. EPA's strategy for implementing this policy included the development of four lists of inerts, based on toxicological concerns. Inerts of toxicological concern were placed on List 1. Potentially toxic inerts/high priority for testing were placed on List 2. Inerts of unknown toxicity were placed on List 3, and inerts of minimal concern were placed on List 4.

The inert ingredients of the imazapyr formulations are not classified by the USEPA as inert ingredients of toxicological concerns to humans or the environment.

The contents of the isoxaben formulation are listed below:

Gallery 75 DF®	Isoxaben	75%
	Inert	25%

RESIDUE ANALYTICAL METHODS: Information not available.

II. HERBICIDE USES

REGISTERED FORESTRY, RANGELAND AND RIGHT-OF-WAY USES*:* Industrial sites, utility substations, highways.

OPERATIONAL DETAILS:

TARGET PLANTS: Isoxaben is used for pre-emergence control of certain broadleaf weeds in non-cropland areas. Does not control established weeds.

MODE OF ACTION: Isoxaben inhibits cell wall biosynthesis. Susceptible plants are killed prior to emergence.

METHOD OF APPLICATION: Isoxaben, a pre-emergence herbicide, is applied during planting and in established turf grasses/ open areas at an application rate of 0.66 to 1.66 pounds per acre.

SPECIAL PRECAUTIONS:

TIMING OF APPLICATION: Isoxaben, a pre-emergent weed herbicide, is applied during germination of the target plant. Isoxaben is also registered for use in established turf grasses to prevent growth of unwanted weeds.

DRIFT CONTROL: Isoxaben is mixed with water and applied using low-pressure sprayers. Isoxaben can be applied to dry soil, as water does not affect the effectiveness of the herbicide. Care should be exercised not to overspray or apply the herbicide to adjacent non-target areas.

III. ENVIRONMENTAL EFFECTS/FATE

SOIL:

RESIDUAL SOIL ACTIVITY: Isoxaben residual activity is reported not to exceed 6 months under normal application rates.

ADSORPTION: Isoxaben has a K(oc) of 1400 and is moderately adsorbed onto soils.

PERSISTENCE AND AGENTS OF DEGRADATION: The half-life of isoxaben in the soil is 100 days.

METABOLITES/DEGRADATION PRODUCTS AND POTENTIAL ENVIRONMENTAL EFFECTS: Information not available.

WATER:

SOLUBILITY: Less than 1.0 mg/l water.

POTENTIAL FOR LEACHING INTO SURFACE OR GROUND WATER: There is a low potential for leaching into surface and groundwater.

AIR:

VOLATILIZATION: Isoxaben is slightly volatile at $<3.9 \times 10^{-7}$ mm Hg at 77° F.

POTENTIAL FOR BYPRODUCTS FROM BURNING OF TREATED VEGETATION: Information is not available; however, the formulated product will emit toxic vapors as it burns.

IV. ECOLOGICAL TOXICITY EFFECTS ON NON-TARGET SPECIES

MICROORGANISMS:

ACUTE CONTACT TOXICITY*:* LD_{50} (honey bee contact) >100 µg/bee

OVERALL TOXICITY: Practically Non-Toxic

PLANTS: Contact will injure or kill target and non-target plants.

AQUATIC VERTEBRATES:

ACUTE TOXICITY*:* LC_{50} (rainbow trout 96-hour) 1.1 mg/l

ACUTE TOXICITY: LC_{50} (bluegill sunfish 96-hour) 1.1 mg/l

OVERALL TOXICITY: Moderately Toxic

AQUATIC FRESHWATER INVERTEBRATES:

ACUTE TOXICITY*:* LC_{50} (*Daphnia magna* 48-hour) >100 mg/l

OVERALL TOXICITY: Practically Non-Toxic

AQUATIC ESTUARINE/MARINE INVERTEBRATES:

ACUTE TOXICITY*:* LC_{50} (sheepshead minnow 96-hour)

ACUTE TOXICITY*:* LC_{50} (grass shrimp 96-hour)

ACUTE TOXICITY*:* LC_{50} (eastern oyster 96-hour)

OVERALL TOXICITY: Practically Non-Toxic (Based on freshwater data, imazapyr is not expected to be toxic to estuarine invertebrates.)

TERRESTRIAL ANIMALS:

AVIAN ACUTE ORAL TOXICITY*:* LD_{50} (bobwhite quail)

AVIAN ACUTE ORAL TOXICITY*:* LD_{50} (mallard duck)

AVIAN SUBACUTE DIETARY TOXICITY: LC_{50} (bobwhite quail) >5000 mg/kg

AVIAN SUBACUTE DIETARY TOXICITY: LC_{50} (mallard duck) >5000 mg/kg

MAMMAL ACUTE ORAL TOXICITY: LD_{50} (rat) >5000 mg/kg

OVERALL TOXICITY: Practically Non-Toxic

BIOACCUMULATION POTENTIAL: Little Potential

THREATENED AND ENDANGERED SPECIES: Isoxaben may be a hazard if applied to pre-emerging endangered plants and if applied directly to waters containing endangered aquatic plant life. There is an indication that isoxaben may interfere with reproduction and may cause birth defects in animals.

V. TOXICOLOGICAL DATA

ACUTE TOXICITY:

ACUTE ORAL TOXICITY: LD_{50} (rat) >5000 mg/kg

ACUTE DERMAL TOXICITY: LD_{50} (rabbit) >2000 mg/kg

PRIMARY IRRITATION SCORE: Slight

PRIMARY EYE IRRITATION: Moderate. The formulated product may cause moderate eye irritation, which may be slow to heal. May cause slight temporary corneal injury.

ACUTE INHALATION: LC_{50} (rat) >2.68 mg/l

OVERALL TOXICITY: Category III – Caution – Slightly Toxic

CHRONIC TOXICITY:

CARCINOGENICITY: Isoxaben is considered slightly oncogenic. In addition, the formulated product contains crystalline silica (in kaolin), which is listed as a known carcinogen.

DEVELOPMENTAL: Unknown effects.

REPRODUCTIVE: Has been shown to interfere with reproduction in animals.

MUTAGENICITY: Isoxaben has caused birth defects in laboratory animals at doses toxic to the mother.

HAZARD: Based on the results of animal studies, isoxaben causes genetic damage and birth defects. There are data that support the finding that isoxaben has potential to have cancer-causing effects on animals.

VI. HUMAN HEALTH EFFECTS

ACUTE TOXICITY (POISONING):

REPORTED EFFECTS: None reported.

CHRONIC TOXICITY:

REPORTED EFFECTS: None reported.

POTENTIAL FOR ADVERSE HEALTH EFFECTS FROM CONTACTING OR CONSUMING TREATED VEGETATION, WATER OR ANIMALS: None reported.

POTENTIAL FOR ADVERSE HEALTH EFFECTS FROM INERT INGREDIENTS CONTAINED IN THE FORMULATED PRODUCTS: Slight skin and eye irritation caused by clay (Kaolin) binding agents. Crystalline silica (in Kaolin) is listed as a carcinogen for hazard communication purposes under 29 CFR 1910.1200.

HEALTH EFFECTS OF EXPOSURE TO FORMULATED PRODUCTS: There have been no reported effects on workers manufacturing the products.

HEALTH EFFECTS ASSOCIATED WITH CONTAMINANTS: None reported.

HEALTH EFFECTS ASSOCIATED WITH OTHER FORMULATIONS: None reported.

HEALTH RISK MANAGEMENT PROCEDURES: See Section VII.

VII. SAFETY PRECAUTIONS

SIGNAL WORD AND DEFINITION:

ISOXABEN - **CAUTION** – CAUSES EYE IRRITATION AND HARMFUL IF INHALED.

PROTECTIVE PRECAUTIONS FOR WORKERS: Use safety glasses. Use impervious gloves when prolonged or frequently repeated contact could occur. In enclosed spaces, use NIOSH-approved dust respirator. Long-sleeved shirt, long pants, shoes, and socks are required for workers.

MEDICAL TREATMENT PROCEDURES (ANTIDOTES):

EYES: Flush eyes with water; call physician if irritation develops.

SKIN: Wash all exposed areas with soap and water. Wash all contaminated clothing prior to reuse. Call a physician if irritation develops.

INGESTION: Call a physician or Poison Control Center. Immediately transport to a medical care facility.

INHALATION: Remove individual to fresh air. If breathing difficulty occurs, provide CPR assistance and seek immediate medical attention.

HANDLING, STORAGE AND DISPOSAL: Keep dry (below 120° F) and store away from food, feed, or other material to be used or consumed by humans or animals. Do not contaminate water. Dispose only in accordance with local, state and federal regulations.

EMERGENCY SPILL PROCEDURES AND HAZARDS: Contain and sweep up material of small spills and dispose as waste. Large spills should be reported to CHEMTREC (800-424-9300) for assistance. Prevent runoff. Do not contaminate water, food or feed by storage or disposal.

VIII. DEFINITIONS

adsorption – the process of attaching to a surface

avian – of, or related to, birds

CAEPA – California Environmental Protection Agency

carcinogenicity – ability to cause cancer

CHEMTREC – Chemical Transportation Emergency Center

dermal – of, or related to, the skin

EC_{50} - median effective concentration during a bioassay

ecotoxicological – related to the effects of environmental toxicants on populations of organisms originating, being produced, growing or living naturally in a particular region or environment

FIFRA – Federal Insecticide, Fungicide and Rodenticide Act

formulation – the form in which the pesticide is supplied by the manufacturer for use

half-life – the time required for half the amount of a substance to be reduced by natural processes

herbicide – a substance used to destroy plants or to slow down their growth

Hg – chemical symbol for mercury

IARC – International Agency for Research on Cancer

K(oc) – the tendency of a chemical to be adsorbed by soil, expressed as: K(oc) = conc. adsorbed/conc. dissolved/% organic carbon in soil

LC_{50} – the concentration in air, water, or food that will kill approximately 50% of the subjects

LD_{50} – the dose that will kill approximately 50% of the subjects

leach – to dissolve out by the action of water

mg/kg – weight ratio expressed as milligrams per kilogram

mg/l – weight-to-liquid ratio expressed as milligrams per liter

microorganisms – living things too small to be seen without a microscope

mPa – milli-Pascal (unit of pressure)

mutagenicity – ability to cause genetic changes

NFPA – National Fire Protection Association

NIOSH - National Institute for Occupational Safety and Health

NOEL - no observable effect level

non-target – animals or plants other than the ones that the pesticide is intended to kill or control

OSHA - Occupational Safety and Health Administration

Pa – Pascal (unit of pressure)

persistence – tendency of a pesticide to remain to remain in the environment after it is applied

pesticides – substances including herbicides, insecticides, rodenticides, fumigants, repellents, growth regulators, etc., regulated under FIFRA

PPE – personal protective equipment

ppm – weight ratio expressed as parts per million

residual activity – the remaining amount of activity as a pesticide

T&E – Threatened and Endangered Species (from the Endangered Species Act)

µg – micrograms

volatility – the tendency to become a vapor at standard temperatures and pressures

IX. INFORMATION SOURCES

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X. TOXICITY CATEGORY TABLES

TABLE I: HUMAN HAZARDS

Category	Signal Word	Route of Administration			Hazard	
		Acute Oral LD_{50} (mg/kg)	Acute Dermal LD_{50} (mg/kg)	Acute Inhalation LC_{50} (mg/l)	Eye irritation	Skin irritation
I (Highly Toxic)	**DANGER (poison)**	0–50	0-200	0-0.2	corrosive: corneal opacity not reversible within 7 days	corrosive
II (Moderately Toxic)	**WARNING**	>50–500	>200-2000	>0.2-2	corneal opacity reversible within 7 days; irritation persisting for 7 days	severe irritation at 72 hours
III (Slightly Toxic)	**CAUTION**	>500-5000	>2000-20.000	>2-20	no corneal opacity; irritation reversible within 7 days	moderate irritation at 72 hours
IV (Practically Non-toxic)	**NONE**	>5000	>20,000	>20	no irritation	moderate irritation at 72 hours

After *Pesticide User's Guide*, Ohio State University, Extension Bull. No. 745, 1998.

TABLE II: ECOTOXICOLOGICAL RISKS TO WILDLIFE (TERRESTRIAL AND AQUATIC)

Risk Category	Mammals (Acute Oral LD_{50} mg/kg)	Avian (Acute Oral LD_{50} mg/kg)	Avian LC_{50} (mg/kg)	Fish or Aquatic Invertebrates LC_{50} (mg/l)
Very Highly Toxic	<10	<10	<50	<0.1
Highly Toxic	10-50	10-50	50-500	0.1 – 1
Moderately Toxic	51-500	51-500	501-1,000	>1 – 10
Slightly Toxic	501-2,000	501-2,000	1,001-5,000	>10 – 100
Practically Non-toxic	>2,000	>2,000	>5,000	>100

Table II created from information contained in *Pesticides and Wildlife*, Whitford, Fred, et al., Purdue University Cooperative Extension Service PPP-30, 1998.

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This fact sheet was prepared by USDOE-Bonneville Power Administration, March 2000.

Mefluidide

HERBICIDE FACT SHEET

U.S. DEPARTMENT OF ENERGY
BONNEVILLE POWER ADMINISTRATION

This fact sheet is one of a series issued by the Bonneville Power Administration for their workers and the general public. It provides information on forest and land management uses, environmental and human health effects, and safety precautions. A list of definitions is included in Section VIII of this fact sheet.

I. BASIC INFORMATION

COMMON NAME: mefluidide

CHEMICAL NAME: N-[2,4-dimethyl-5-[[(trifluoromethyl)sulfonyl]amino]phenyl] acetamide

CAS No. 53780-34-0

CHEMICAL TYPE*:* acetamide compound

PESTICIDE CLASSIFICATION: plant growth regulator

REGISTERED USE STATUS: "General Use."

FORMULATIONS: Commercial herbicide products generally contain one or more ingredients. An inert ingredient is anything added to the product other than an active ingredient. Because of concern for human health and the environment, EPA announced its policy on toxic inert ingredients in the *Federal Register* on April 22, 1987 (52FR13305). This policy focuses on the regulation of inert ingredients. EPA's strategy for implementing this policy included the development of four lists of inerts, based on toxicological concerns. Inerts of toxicological concern were placed on List 1. Potentially toxic inerts/high priority for testing were placed on List 2. Inerts of unknown toxicity were placed on List 3, and inerts of minimal concern were placed on List 4.

The inert ingredients of the Embark® formulation are not classified by the USEPA as inert ingredients of toxicological concerns to humans or the environment.

The contents of the mefluidide formulations are listed below:

Embark®	Mefluidide	3.20%
	Inert	96.80%

RESIDUE ANALYTICAL METHODS: Following extraction, mefluidide is derivatized with diazomethane and analyzed by gas chromatography using flame ionization detection.

II. HERBICIDE USES

REGISTERED FORESTRY, RANGELAND AND RIGHT-OF-WAY USES: Embark® is registered as a plant growth regulator to suppress seedhead formation and to regulate the vegetative growth of various turfgrass species and woody ornamentals in commercial, residential, public, and non-cropland areas.

OPERATIONAL DETAILS:

TARGET PLANTS: Many, mainly turfgrasses and weeds such as Johnsongrass, shattercane, volunteer corn, and volunteer sorghum.

MODE OF ACTION: Mefluidide inhibits the growth and development of the meristematic regions of the affected plants.

METHOD OF APPLICATION: Conventional power spray equipment using a non-ionic surfactant. Manufacturer recommends use of colorant to control even application.

SPECIAL PRECAUTIONS:

TIMING OF APPLICATION: Mefluidide must be applied before emergence of seedheads.

DRIFT CONTROL: Apply only when conditions will prevent drift to non-target areas and surface waters.

RESTRICTIONS/WARNINGS/LIMITATIONS: Do not apply through any type of irrigation system. Do not allow animals to graze treated areas.

III. ENVIRONMENTAL EFFECTS/FATE

SOIL:

RESIDUAL SOIL ACTIVITY: Mefluidide residual activity is reported not to exceed 3 hours after application.

ADSORPTION: Mefluidide has a K(oc) of 200. Adsorption of mefluidide after 3 hours, however, is insignificant.

PERSISTENCE AND AGENTS OF DEGRADATION: The half-life of mefluidide is 4 days.

METABOLITES/DEGRADATION PRODUCTS AND POTENTIAL ENVIRONMENTAL EFFECTS: Information not available.

WATER:

SOLUBILITY: 180 mg/l water at 23° C (Pure Compound)

POTENTIAL FOR LEACHING INTO SURFACE AND GROUND WATER*:* Mefluidide is weakly adsorbed onto soil and organic particles but is not persistent in soils or plants. Leaching into groundwater should be minimal or nonexistent if application methods are followed.

SURFACE WATERS: See above.

AIR:

VOLATILIZATION: <13 mPa at 25° C (Pure Compound).

POTENTIAL FOR BYPRODUCTS FROM BURNING OF TREATED VEGETATION: Information not available.

IV. ECOLOGICAL TOXICITY EFFECTS TO NON-TARGET SPECIES

MICROORGANISMS:

ACUTE CONTACT TOXICITY*:* LD_{50} (honey bee contact) >2 µg/bee

OVERALL TOXICITY: Practically Non-Toxic

PLANTS: Contact may injure or kill target and non-target plants.

AQUATIC VERTEBRATES:

ACUTE TOXICITY*:* LC_{50} (rainbow trout 96-hour) <100 mg/l

ACUTE TOXICITY: LC_{50} (bluegill sunfish 96-hour) <100 mg/l

OVERALL TOXICITY: Slightly Toxic

AQUATIC FRESHWATER INVERTEBRATES:

ACUTE TOXICITY*:* LC_{50} (*Daphnia magna* 48-hour) No information.

OVERALL TOXICITY: [Not available.]

AQUATIC ESTUARINE/MARINE INVERTEBRATES:

ACUTE TOXICITY*:* EC_{50} (Eastern oyster larvae 48-hour) No information.

ACUTE TOXICITY*:* LC_{50} (sheepshead minnow 96-hour) No information.

OVERALL TOXICITY: [Not available.]

TERRESTRIAL ANIMALS:

AVIAN ACUTE ORAL TOXICITY*:* LD_{50} (mallard duck) >4640 mg/kg

AVIAN SUBACUTE DIETARY TOXICITY: LC_{50} (bobwhite quail) >10,000 mg/kg

AVIAN SUBACUTE DIETARY TOXICITY: LC_{50} (mallard duck) >10,000 mg/kg

MAMMAL ACUTE ORAL TOXICITY: LD_{50} (rat) >4000 mg/kg

OVERALL TOXICITY: Practically Non-Toxic

BIOACCUMULATION POTENTIAL: No Potential

THREATENED AND ENDANGERED SPECIES: Mefluidide may be a hazard if applied to pre-emerging endangered plants and if applied directly to waters containing endangered aquatic life. It probably would not be a hazard to most endangered terrestrial animals, due to its low toxicity.

V. TOXICOLOGICAL DATA

ACUTE TOXICITY:

ACUTE ORAL TOXICITY

LD_{50} (rat) >4000 mg/kg
LD_{50} (mice) >1920 mg/kg

ACUTE DERMAL TOXICITY:

Rabbit LD_{50} >4,000 mg/kg

PRIMARY IRRITATION SCORE: none

PRIMARY EYE IRRITATION: Mild irritation to rabbits

ACUTE INHALATION: LC_{50} (rat, 4-hour) >8.5 mg/l.

OVERALL TOXICITY: Category III – Caution – Slightly Toxic

CHRONIC TOXICITY:

CARCINOGENICITY: No data.

DEVELOPMENTAL: No effects.

REPRODUCTIVE: No effects.

MUTAGENICITY: No effects.

HAZARD: Based on the results of animal studies, mefluidide does not cause genetic damage or birth defects and has little or no effect on fertility, reproduction or development of offspring. There are no data on the potential cancer-causing effects of mefluidide.

VI. HUMAN HEALTH EFFECTS

ACUTE TOXICITY (POISONING):

REPORTED EFFECTS: None reported.

CHRONIC TOXICITY:

REPORTED EFFECTS: None reported.

POTENTIAL FOR ADVERSE HEALTH EFFECTS FROM CONTACTING OR CONSUMING TREATED VEGETATION, WATER OR ANIMALS: None reported.

POTENTIAL FOR ADVERSE HEALTH EFFECTS FROM INERT INGREDIENTS CONTAINED IN THE FORMULATED PRODUCTS: No information available.

HEALTH EFFECTS OF EXPOSURE TO FORMULATED PRODUCTS: There have been no reported effects on workers manufacturing the products.

HEALTH EFFECTS ASSOCIATED WITH CONTAMINANTS: None reported.

HEALTH EFFECTS ASSOCIATED WITH OTHER FORMULATIONS: None reported.

HEALTH RISK MANAGEMENT PROCEDURES: See Section VII.

VII. SAFETY PRECAUTIONS

SIGNAL WORD AND DEFINITION:

MEFLUIDIDE - **CAUTION** – HARMFUL IF SWALLOWED OR ABSORBED THROUGH THE SKIN. AVOID BREATHING SPRAY MIST. AVOID CONTACT WITH SKIN, EYES, OR CLOTHING. WEAR PROTECTIVE CLOTHING INCLUDING RUBBER GLOVES WHEN HANDLING.

PROTECTIVE PRECAUTIONS FOR WORKERS: Use safety glasses. Use impervious gloves when prolonged or frequently repeated contact could occur. Long-sleeved shirt, long pants, shoes, and socks are recommended.

MEDICAL TREATMENT PROCEDURES (ANTIDOTES):

EYES: Flush eyes with water; call physician if irritation develops.

SKIN: Wash all exposed areas with soap and water. Wash all contaminated clothing prior to reuse. Call a physician if irritation develops.

INGESTION: Do not induce vomiting. Call a physician or Poison Control Center. Do not wait for symptoms to appear. Immediately transport to a medical care facility.

INHALATION: Remove individual to fresh air. If breathing difficulty occurs, provide CPR assistance and seek immediate medical attention.

HANDLING, STORAGE AND DISPOSAL: Keep dry and store away from food, feed, or other material to be used or consumed by humans or animals. Do not contaminate water. Dispose only in accordance with local, state and federal regulations.

EMERGENCY SPILL PROCEDURES AND HAZARDS: Contain and sweep up material of small spills and dispose as waste. Large spills should be reported to CHEMTREC (800-424-9300) for assistance. Prevent runoff. Do not contaminate water, food or feed by storage or disposal.

VIII. DEFINITIONS

adsorption – the process of attaching to a surface

avian – of, or related to, birds

CAEPA – California Environmental Protection Agency

carcinogenicity – ability to cause cancer

CHEMTREC – Chemical Transportation Emergency Center

dermal – of, or related to, the skin

EC_{50} - median effective concentration during a bioassay

ecotoxicological – related to the effects of environmental toxicants on populations of organisms originating, being produced, growing or living naturally in a particular region or environment

FIFRA – Federal Insecticide, Fungicide and Rodenticide Act

formulation – the form in which the pesticide is supplied by the manufacturer for use

half-life – the time required for half the amount of a substance to be reduced by natural processes

herbicide – a substance used to destroy plants or to slow down their growth

Hg – chemical symbol for mercury

IARC – International Agency for Research on Cancer

K(oc) – the tendency of a chemical to be adsorbed by soil, expressed as: K(oc) = conc. adsorbed/conc. dissolved/% organic carbon in soil

LC_{50} – the concentration in air, water, or food that will kill approximately 50% of the subjects

LD_{50} – the dose that will kill approximately 50% of the subjects

leach – to dissolve out by the action of water

mg/kg – weight ratio expressed as milligrams per kilogram

mg/l – weight-to-liquid ratio expressed as milligrams per liter

microorganisms – living things too small to be seen without a microscope

mPa – milli-Pascal (unit of pressure)

mutagenicity – ability to cause genetic changes

NFPA – National Fire Protection Association

NIOSH - National Institute for Occupational Safety and Health

NOEL - no observable effect level

non-target – animals or plants other than the ones that the pesticide is intended to kill or control

OSHA - Occupational Safety and Health Administration

Pa – Pascal (unit of pressure)

persistence – tendency of a pesticide to remain to remain in the environment after it is applied

pesticides – substances including herbicides, insecticides, rodenticides, fumigants, repellents, growth regulators, etc., regulated under FIFRA

PPE – personal protective equipment

ppm – weight ratio expressed as parts per million

residual activity – the remaining amount of activity as a pesticide

T&E – Threatened and Endangered Species (from the Endangered Species Act)

µg – micrograms

volatility – the tendency to become a vapor at standard temperatures and pressures

IX. INFORMATION SOURCES

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X. TOXICITY CATEGORY TABLES

TABLE I: HUMAN HAZARDS

Category	Signal Word	Route of Administration			Hazard	
		Acute Oral LD_{50} (mg/kg)	Acute Dermal LD_{50} (mg/kg)	Acute Inhalation LC_{50} (mg/l)	Eye irritation	Skin irritation
I (Highly Toxic)	**DANGER (poison)**	0–50	0-200	0-0.2	corrosive: corneal opacity not reversible within 7 days	corrosive
II (Moderately Toxic)	**WARNING**	>50–500	>200-2000	>0.2-2	corneal opacity reversible within 7 days; irritation persisting for 7 days	severe irritation at 72 hours
III (Slightly Toxic)	**CAUTION**	>500-5000	>2000-20.000	>2-20	no corneal opacity; irritation reversible within 7 days	moderate irritation at 72 hours
IV (Practically Non-toxic)	**NONE**	>5000	>20,000	>20	no irritation	moderate irritation at 72 hours

After *Pesticide User's Guide*, Ohio State University, Extension Bull. No. 745, 1998.

TABLE II: ECOTOXICOLOGICAL RISKS TO WILDLIFE (TERRESTRIAL AND AQUATIC)

Risk Category	Mammals (Acute Oral LD_{50} mg/kg)	Avian (Acute Oral LD_{50} mg/kg)	Avian LC_{50} (mg/kg)	Fish or Aquatic Invertebrates LC_{50} (mg/l)
Very Highly Toxic	<10	<10	<50	<0.1
Highly Toxic	10-50	10-50	50-500	0.1 – 1
Moderately Toxic	51-500	51-500	501-1,000	>1 – 10
Slightly Toxic	501-2,000	501-2,000	1,001-5,000	>10 – 100
Practically Non-toxic	>2,000	>2,000	>5,000	>100

Table II created from information contained in *Pesticides and Wildlife*, Whitford, Fred, et al., Purdue University Cooperative Extension Service PPP-30, 1998.

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This fact sheet was prepared by USDOE-Bonneville Power Administration, March 2000.

Metsulfuron-methyl

HERBICIDE FACT SHEET

U.S. DEPARTMENT OF ENERGY
BONNEVILLE POWER ADMINISTRATION

This fact sheet is one of a series issued by the Bonneville Power Administration for their workers and the general public. It provides information on forest and land management uses, environmental and human health effects, and safety precautions. A list of definitions is included in Section VIII of this fact sheet.

I. BASIC INFORMATION

COMMON NAME: metsulfuron-methyl

CHEMICAL NAME: methyl 2-[[[[(4-methoxy-6-methyl-1,3,5-triazin-2-yl)amino]-carbonyl]amino]sulfonyl]benzoate

Cas No. 74223-64-6

CHEMICAL TYPE: sulfonylurea herbicide

PESTICIDE CLASSIFICATION: systemic, selective pre- and post-emergent herbicide

REGISTERED USE STATUS: "General Use."

FORMULATIONS: Commercial herbicide products generally contain one or more ingredients. An inert ingredient is anything added to the product other than an active ingredient. Because of concern for human health and the environment, EPA announced its policy on toxic inert ingredients in the Federal Register on April 22, 1987 (52FR13305). This policy focuses on the regulation of inert ingredients. EPA's strategy for implementing this policy included the development of four lists of inerts, based on toxicological concerns. Inerts of toxicological concern were placed on List 1. Potentially toxic inerts/high priority for testing were placed on List 2. Inerts of unknown toxicity were placed on List 3, and inerts of minimal concern were placed on List 4.

The inert ingredients of the Escort® formulation are not classified by the USEPA as inert ingredients of toxicological concerns to humans or the environment.

The contents of the metsulfuron-methyl formulation are listed below:

Escort®

Metsulfuron-methyl	60 %
Inert	40 %

RESIDUE ANALYTICAL METHODS: EPA Method 632.

II. HERBICIDE USES

REGISTERED FORESTRY, RANGELAND AND RIGHT-OF-WAY USES: Metsulfuron-methyl as Escort® is registered for use in non-agricultural areas as a general weed and brush control herbicide. For terrestrial use only, however, Escort® is registered for use in floodplains where surface water is not present and in terrestrial areas of deltas and low-lying areas.

OPERATIONAL DETAILS:

TARGET PLANTS: Metsulfuron-methyl is a selective herbicide primarily for post-emergent control of annual, biennial, and perennial broadleaf weeds and brush. Escort® does have pre-emergent activity.

MODE OF ACTION: Metsulfuron-methyl enters the plant through the root zone and foliage, inhibiting the synthesis of key amino acids.

METHOD OF APPLICATION AND RATES: Broadcast and spot spray applications at 1/4 to 4 ounces of formulated product per acre. Ground and aerial application. Do not apply more than 4 ounces/acre/ year.

SPECIAL PRECAUTIONS:

TIMING OF APPLICATION: Timing is dependent on the target plant; however, application may be made at any time the ground is not frozen. As metsulfuron-methyl must move to the root zone to be effective for pre-emergent control, adequate soil moisture is necessary.

DRIFT CONTROL: Care should be exercised not to overspray or apply the herbicide to adjacent non-target areas. Drift control is achieved by observing weather conditions and following label and sprayer instructions. Spray droplet size should be 150 microns or larger.

RESTRICTIONS/WARNINGS/LIMITATIONS: Do not enter or allow others to enter the treated area until sprays have dried. Do not apply through any type of irrigation system. Do not apply directly to water or areas where surface water is present, or to intertidal areas below the mean high water mark. Do not apply to irrigation banks or other ditch banks. Do not use on lawns. Do not use on walks, driveways, tennis courts, or other impermeable areas. Do not apply to frozen ground. Treated soil should remain undisturbed. Grazing and cut forage restrictions of 3 days post-application at rates of 1-2/3 to 3-1/3 ounces per acre. This herbicide is injurious to plants at extremely low concentrations. Non-target plants may be adversely affected from drift and run-off. Not for use in California.

III. ENVIRONMENTAL EFFECTS/FATE

SOIL:

RESIDUAL SOIL ACTIVITY: The half-life of metsulfuron-methyl is 120 days.

ADSORPTION: The K(oc) of metsulfuron-methyl is 35.

PERSISTENCE AND AGENTS OF DEGRADATION: Metsulfuron-methyl is persistent with no major (>10%) degradates.

METABOLITES/DEGRADATION PRODUCTS AND POTENTIAL ENVIRONMENTAL EFFECTS: Metsulfuron-methyl degrades to nonphytotoxic, low-molecular-weight compounds.

WATER:

SOLUBILITY: 2790 mg/l in water (pH 7).

POTENTIAL FOR LEACHING INTO SURFACE AND GROUND WATER: Metsulfuron-methyl is moderately persistent and highly mobile and has potential to enter surface waters from runoff. The very low application rate and microbial breakdown suggest that metsulfuron-methyl has little potential to enter or ground water.

AIR:

VOLATILIZATION: Nonvolatile

POTENTIAL FOR BYPRODUCTS FROM BURNING OF TREATED VEGETATION: Not known.

IV. ECOLOGICAL TOXICITY EFFECTS ON NON-TARGET SPECIES

MICROORGANISMS:

ACUTE CONTACT TOXICITY*:* LD_{50} (honey bee contact) >2 µg/bee

OVERALL TOXICITY: Practically Non-Toxic

PLANTS: Contact will injure or kill target and non-target plants.

AQUATIC VERTEBRATES:

ACUTE TOXICITY*:* LC_{50} (rainbow trout 96-hour) >150 mg/l

ACUTE TOXICITY: LC_{50} (bluegill sunfish 96-hour) >150 mg/l

OVERALL TOXICITY: Practically Non-Toxic

AQUATIC FRESHWATER INVERTEBRATES:

ACUTE TOXICITY*:* LC_{50} (*Daphnia magna* 48-hour) >150 mg/l

OVERALL TOXICITY: Practically Non-Toxic

AQUATIC ESTUARINE/MARINE INVERTEBRATES:

ACUTE TOXICITY*:* EC_{50} (Eastern oyster larvae 48-hour)

ACUTE TOXICITY*:* LC_{50} (sheepshead minnow 96-hour)

OVERALL TOXICITY: Practically Non-Toxic

TERRESTRIAL ANIMALS:

AVIAN ACUTE ORAL TOXICITY*:* LD_{50} (bobwhite quail)

AVIAN ACUTE ORAL TOXICITY*:* LD_{50} (mallard duck) >2510 mg/kg

AVIAN SUBACUTE DIETARY TOXICITY: LC_{50} (bobwhite quail) >5620 mg/kg

AVIAN SUBACUTE DIETARY TOXICITY: LC_{50} (mallard duck) >5620 mg/kg

MAMMAL ACUTE ORAL TOXICITY: LD_{50} (rat) >5000 mg/kg

OVERALL TOXICITY: Practically Non-Toxic

BIOACCUMULATION POTENTIAL: No Potential

THREATENED AND ENDANGERED SPECIES: Federally listed plants may be adversely affected if the product is applied directly to the plants.

V. TOXICOLOGICAL DATA

ACUTE TOXICITY:

ACUTE ORAL TOXICITY*:* LD_{50} (rat) >5000 mg/kg

ACUTE DERMAL TOXICITY: LD_{50} (rabbit) >5000 mg/kg

PRIMARY SKIN IRRITATION: Rabbit - Mild Irritant

PRIMARY EYE IRRITATION: Rabbit – Moderate Irritant

ACUTE INHALATION: LC_{50} (rat) >5.3 mg/l

OVERALL TOXICITY: Category III – Caution

CHRONIC TOXICITY:

CARCINOGENICITY: No effects reported.

DEVELOPMENTAL/REPRODUCTIVE: No effects reported.

MUTAGENICITY: Not a mutagenic.

HAZARD: The end-use product label for Escort® carries the *Caution* signal word due to eye irritation.

VI. HUMAN HEALTH EFFECTS

ACUTE TOXICITY (POISONING):

REPORTED EFFECTS: None.

CHRONIC TOXICITY:

REPORTED EFFECTS: None reported.

POTENTIAL FOR ADVERSE HEALTH EFFECTS FROM CONTACTING OR CONSUMING TREATED VEGETATION, WATER OR ANIMALS: None reported.

POTENTIAL FOR ADVERSE HEALTH EFFECTS FROM INERT INGREDIENTS CONTAINED IN THE FORMULATED PRODUCTS: None reported..

HEALTH EFFECTS OF EXPOSURE TO FORMULATED PRODUCTS: Mild, temporary skin and eye irritation.

HEALTH EFFECTS ASSOCIATED WITH CONTAMINANTS: None reported.

HEALTH EFFECTS ASSOCIATED WITH OTHER FORMULATIONS: None reported.

VII. SAFETY PRECAUTIONS

SIGNAL WORD AND DEFINITION:

METSULFURON-METHYL **- CAUTION** – CAUSES EYE IRRITATION

PROTECTIVE PRECAUTIONS FOR WORKERS: Applicators and other handlers must wear long-sleeved shirt and long pants, and shoes plus socks.

MEDICAL TREATMENT PROCEDURES (ANTIDOTES):

EYES: Flush eyes with water; call physician if irritation persists.

SKIN: Wash all exposed areas with soap and water; call physician if irritation persists.

INGESTION: No specific intervention is indicated as compound is not likely to be hazardous by ingestion. Consult a physician if necessary.

INHALATION: Remove to fresh air.

HANDLING, STORAGE AND DISPOSAL: Store at room temperature or cooler. Do not reuse container. Rinse container and dispose accordingly.

EMERGENCY SPILL PROCEDURES AND HAZARDS: Contain and sweep up material of small spills and dispose as waste. Do not contaminate water, food, or feed by storage or disposal.

VIII. DEFINITIONS

adsorption – the process of attaching to a surface

avian – of, or related to, birds

CAEPA – California Environmental Protection Agency

carcinogenicity – ability to cause cancer

CHEMTREC – Chemical Transportation Emergency Center

dermal – of, or related to, the skin

EC_{50} - median effective concentration during a bioassay

ecotoxicological – related to the effects of environmental toxicants on populations of organisms originating, being produced, growing or living naturally in a particular region or environment

FIFRA – Federal Insecticide, Fungicide and Rodenticide Act

formulation – the form in which the pesticide is supplied by the manufacturer for use

half-life – the time required for half the amount of a substance to be reduced by natural processes

herbicide – a substance used to destroy plants or to slow down their growth

Hg – chemical symbol for mercury

IARC – International Agency for Research on Cancer

K(oc) – the tendency of a chemical to be adsorbed by soil, expressed as: K(oc) = conc. adsorbed/conc. dissolved/% organic carbon in soil

LC_{50} – the concentration in air, water, or food that will kill approximately 50% of the subjects

LD_{50} – the dose that will kill approximately 50% of the subjects

leach – to dissolve out by the action of water

mg/kg – weight ratio expressed as milligrams per kilogram

mg/l – weight-to-liquid ratio expressed as milligrams per liter

microorganisms – living things too small to be seen without a microscope

mPa – milli-Pascal (unit of pressure)

mutagenicity – ability to cause genetic changes

NFPA – National Fire Protection Association

NIOSH - National Institute for Occupational Safety and Health

NOEL - no observable effect level

non-target – animals or plants other than the ones that the pesticide is intended to kill or control

OSHA - Occupational Safety and Health Administration

Pa – Pascal (unit of pressure)

persistence – tendency of a pesticide to remain to remain in the environment after it is applied

pesticides – substances including herbicides, insecticides, rodenticides, fumigants, repellents, growth regulators, etc., regulated under FIFRA

PPE – personal protective equipment

ppm – weight ratio expressed as parts per million

residual activity – the remaining amount of activity as a pesticide

T&E – Threatened and Endangered Species (from the Endangered Species Act)

µg – micrograms

volatility – the tendency to become a vapor at standard temperatures and pressures

IX. INFORMATION SOURCES

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X. TOXICITY CATEGORY TABLES

TABLE I: HUMAN HAZARDS

Category	Signal Word	Route of Administration			Hazard	
		Acute Oral LD_{50} (mg/kg)	Acute Dermal LD_{50} (mg/kg)	Acute Inhalation LC_{50} (mg/l)	Eye irritation	Skin irritation
I (Highly Toxic)	**DANGER (poison)**	0–50	0-200	0-0.2	corrosive: corneal opacity not reversible within 7 days	corrosive
II (Moderately Toxic)	**WARNING**	>50–500	>200-2000	>0.2-2	corneal opacity reversible within 7 days; irritation persisting for 7 days	severe irritation at 72 hours
III (Slightly Toxic)	**CAUTION**	>500-5000	>2000-20.000	>2-20	no corneal opacity; irritation reversible within 7 days	moderate irritation at 72 hours
IV (Practically Non-toxic)	**NONE**	>5000	>20,000	>20	no irritation	moderate irritation at 72 hours

After *Pesticide User's Guide*, Ohio State University, Extension Bull. No. 745, 1998.

TABLE II: ECOTOXICOLOGICAL RISKS TO WILDLIFE (TERRESTRIAL AND AQUATIC)

Risk Category	Mammals Acute Oral LD_{50} mg/kg)	Avian Acute Oral LD_{50} (mg/kg)	Avian Acute Dietary LC_{50} (mg/kg)	Fish or Aquatic Invertebrates Acute Concentration LC_{50} (mg/l)
Very Highly Toxic	<10	<10	<50	<0.1
Highly Toxic	10-50	10-50	50-500	0.1 – 1
Moderately Toxic	51-500	51-500	501-1,000	>1 – 10
Slightly Toxic	501-2,000	501-2,000	1,001-5,000	>10 – 100
Practically Non-toxic	>2,000	>2,000	>5,000	>100

Table II created from information contained in *Pesticides and Wildlife*, Whitford, Fred, et al., Purdue University Cooperative Extension Service PPP-30, 1998.

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This fact sheet was prepared by USDOE-Bonneville Power Administration, March 2000.

Oryzalin

HERBICIDE FACT SHEET

U.S. DEPARTMENT OF ENERGY
BONNEVILLE POWER ADMINISTRATION

This fact sheet is one of a series issued by the Bonneville Power Administration for their workers and the general public. It provides information on forest and land management uses, environmental and human health effects, and safety precautions. A list of definitions is included in Section VIII of this fact sheet.

I. BASIC INFORMATION

COMMON NAME: oryzalin

CHEMICAL NAME: 3,5-dinitro-N4,N4-dipropylsulfanilamide

CAS No. 019044-88-3

CHEMICAL TYPE*:* 2,6-dinitroanline

PESTICIDE CLASSIFICATION: herbicide

REGISTERED USE STATUS: ”General Use.”

FORMULATIONS: Commercial herbicide products generally contain one or more ingredients. An inert ingredient is anything added to the product other than an active ingredient. Because of concern for human health and the environment, EPA announced its policy on toxic inert ingredients in the Federal Register on April 22, 1987 (52FR13305). This policy focuses on the regulation of inert ingredients. EPA’s strategy for implementing this policy included the development of four lists of inerts, based on toxicological concerns. Inerts of toxicological concern were placed on List 1. Potentially toxic inerts/high priority for testing were placed on List 2. Inerts of unknown toxicity were placed on List 3, and inerts of minimal concern were placed on List 4.

The inert ingredients of the oryzalin formulations are not classified by the USEPA as inert ingredients of toxicological concerns to humans or the environment.
The contents of the oryzalin formulation is listed below:

Surflan Herbicide (both formulations)

Oryzalin	40.4%
Inert	59.6%

RESIDUE ANALYTICAL METHODS: Pesticide Analytical Method Volume I FDA Multiresidue Protocols D and E.

II. HERBICIDE USES

REGISTERED FORESTRY, RANGELAND AND RIGHT-OF-WAY USES: Oryzalin is registered for commercial and non-commercial application to established lawns, ornamental/shade trees, nonagricultural rights-of-way, power stations, and industrial and paved areas.

OPERATIONAL DETAILS:

TARGET PLANTS: Oryzalin is a non-selective, post-emergent herbicide for control of annual grasses, broadleaf weeds, herbaceous plants, woody shrubs and vines.

MODE OF ACTION: Oryzalin inhibits cell division.

METHOD OF APPLICATION: Oryzalin is applied at an application rate of 0.75 to 6.0 pounds per acre depending on use, formulation and application method.

SPECIAL PRECAUTIONS:

TIMING OF APPLICATION: Oryzalin is a post-emergence herbicide and is applied anytime after emergence of target plants.

DRIFT CONTROL: Care should be exercised not to overspray or apply the herbicide to adjacent non-target areas. Drift control is achieved by observing weather conditions and following label and sprayer instructions. Aerial application is not allowed (see below).

RESTRICTIONS/WARNINGS: Oryzalin is NOT registered for use on residential lawns. Aerial application is RESTRICTED throughout the U.S., except for agricultural use in California. This herbicide is TOXIC to fish. DO NOT graze or feed forage to livestock in treated areas.

III. ENVIRONMENTAL EFFECTS/FATE

SOIL:

RESIDUAL SOIL ACTIVITY: The half-life of oryzalin is 20 days.

ADSORPTION: The K(oc) of oryzalin is 75.

PERSISTENCE AND AGENTS OF DEGRADATION: Degradates of oryzalin have not been monitored.

METABOLITES/DEGRADATION PRODUCTS AND POTENTIAL ENVIRONMENTAL EFFECTS: The manufacturer has not conducted environmental toxicity studies with the degradates of this product.

WATER:

SOLUBILITY: 2.5 mg/kg at 25 C.

POTENTIAL FOR LEACHING INTO SURFACE AND GROUND WATER: The product has low potential to leach into surface and ground water.

AIR:

VOLATILIZATION: Oryzalin is not volatile.

POTENTIAL FOR BYPRODUCTS FROM BURNING OF TREATED VEGETATION: Nitrogen oxides and other toxic gasses may be formed.

IV. ECOLOGICAL TOXICITY EFFECTS ON NON-TARGET SPECIES

MICROORGANISMS:

ACUTE CONTACT TOXICITY*:* LD_{50} (honey bee 48-hour) >11 µg/bee

OVERALL TOXICITY: Practically Non-Toxic

PLANTS: Contact will injure or kill target and non-target plants.

AQUATIC VERTEBRATES:

ACUTE TOXICITY*:* LC_{50} (rainbow trout 96-hour) 3.26 mg/l

ACUTE TOXICITY: LC_{50} (bluegill sunfish 96-hour) 2.88 mg/l

OVERALL TOXICITY: Moderately Toxic

AQUATIC INVERTEBRATES:

ACUTE TOXICITY: LC_{50} (*Daphnia Magna* 48-hour) 1.4 mg/l

OVERALL TOXICITY: Moderately Toxic

AQUATIC ESTUARINE/MARINE INVERTEBRATES: Studies not required by EPA. EPA calculates toxicity will be similar to freshwater invertebrates.

TERRESTRIAL ANIMALS:

AVIAN ACUTE ORAL TOXICITY*:* LD_{50} (bobwhite quail) 506.7 mg/kg

AVIAN DIETARY TOXICITY: LC_{50} (mallard duck) >5000 mg/kg

SMALL MAMMAL ACUTE ORAL TOXICITY: LD_{50} >10,000 mg/kg

OVERALL TOXICITY: Slightly to Practically Non-Toxic

BIOACCUMULATION POTENTIAL: LOW POTENTIAL

THREATENED AND ENDANGERED SPECIES: Federally listed aquatic organisms may be at risk in shallow water adjacent to treated areas. In addition, oryzalin may adversely affect federally listed plants.

V. TOXICOLOGICAL DATA

ACUTE TOXICITY:

ACUTE ORAL TOXICITY*:* LD_{50} (rat) >10,000 mg/kg

ACUTE DERMAL TOXICITY: LD_{50} (rabbit) >2000 mg/kg

PRIMARY SKIN IRRITATION: No information available

PRIMARY EYE IRRITATION: Rabbit – Slightly Irritating

ACUTE INHALATION: LC_{50} (rat 4-hour) >3.17 mg/l.

OVERALL TOXICITY: Category III – Caution – Slightly Toxic

CHRONIC TOXICITY:

CARCINOGENICITY: Classified by EPA as a Group C possible human carcinogen based on mammary gland tumors.

DEVELOPMENTAL: Reduced maternal and fetal body weight and increased runts and bone development effects at high dose levels.

REPRODUCTIVE: Increase in liver and kidney weights and decreased food consumption and body weight gain at high dose levels.

MUTAGENICITY: No adverse effects.

HAZARD: Sufficient cancer risk is present to require PPE in all application methods, and extended reentry intervals.

VI. HUMAN HEALTH EFFECTS

ACUTE TOXICITY (POISONING):

REPORTED EFFECTS: None reported.

CHRONIC TOXICITY:

REPORTED EFFECTS: None reported.

POTENTIAL FOR ADVERSE HEALTH EFFECTS FROM CONTACTING OR CONSUMING TREATED VEGETATION, WATER OR ANIMALS: None reported.

POTENTIAL FOR ADVERSE HEALTH EFFECTS FROM INERT INGREDIENTS CONTAINED IN THE FORMULATED PRODUCTS: Repeated excessive ingestion of propylene glycol may cause central nervous system effects.

HEALTH EFFECTS OF EXPOSURE TO FORMULATED PRODUCTS: Temporary eye irritation. Prolonged or repeated exposure may cause allergic skin reactions.

HEALTH EFFECTS ASSOCIATED WITH CONTAMINANTS: None reported.

HEALTH EFFECTS ASSOCIATED WITH OTHER FORMULATIONS: None reported.

HEALTH RISK MANAGEMENT PROCEDURES: See Section VII.

VII. SAFETY PRECAUTIONS

SIGNAL WORD AND DEFINITION:

ORYZALIN **- CAUTION** – AVOID CONTACT WITH EYES SKIN AND CLOTHING. HARMFUL IF SWALLOWED, INHALE, OR ABSORBED THROUGH THE SKIN

PROTECTIVE PRECAUTIONS FOR WORKERS: Wear eye protection. Wear long-sleeved shirt, long pants, shoes and socks, and waterproof gloves.

MEDICAL TREATMENT PROCEDURES (ANTIDOTES):

EYES: Flush eyes with water; call physician.

SKIN: Wash all exposed areas with soap and water. Wash all contaminated clothing prior to reuse. Call a physician if irritation develops.

INGESTION: Do not induce vomiting. Call a physician or Poison Control Center. If available, administer activated charcoal (6-8 heaping teaspoonfuls) with a large quantity of water. Do not give by mouth to an unconscious person. Immediately transport to a medical care facility.

INHALATION: Remove individual to fresh air. If breathing difficulty occurs, provide CPR assistance and seek immediate medical attention.

HANDLING, STORAGE AND DISPOSAL: Keep dry (below 120° F) and store away from food, feed, or other material to be used or consumed by humans or animals. Do not contaminate water. Dispose of only in accordance with local, state and federal regulations.

EMERGENCY SPILL PROCEDURES AND HAZARDS: Contain and sweep up material of small spills and dispose as waste. Large spills should be reported to CHEMTREC (800-424-9300) for assistance. Prevent runoff. Do not contaminate water, food, or feed by storage or disposal.

VIII. DEFINITIONS

adsorption – the process of attaching to a surface

avian – of, or related to, birds

CAEPA – California Environmental Protection Agency

carcinogenicity – ability to cause cancer

CHEMTREC – Chemical Transportation Emergency Center

dermal – of, or related to, the skin

EC_{50} - median effective concentration during a bioassay

ecotoxicological – related to the effects of environmental toxicants on populations of organisms originating, being produced, growing or living naturally in a particular region or environment

FIFRA – Federal Insecticide, Fungicide and Rodenticide Act

formulation – the form in which the pesticide is supplied by the manufacturer for use

half-life – the time required for half the amount of a substance to be reduced by natural processes

herbicide – a substance used to destroy plants or to slow down their growth

Hg – chemical symbol for mercury

IARC – International Agency for Research on Cancer

K(oc) – the tendency of a chemical to be adsorbed by soil, expressed as: K(oc) = conc. adsorbed/conc. dissolved/% organic carbon in soil

LC_{50} – the concentration in air, water, or food that will kill approximately 50% of the subjects

LD_{50} – the dose that will kill approximately 50% of the subjects

leach – to dissolve out by the action of water

mg/kg – weight ratio expressed as milligrams per kilogram

mg/l – weight-to-liquid ratio expressed as milligrams per liter

microorganisms – living things too small to be seen without a microscope

mPa – milli-Pascal (unit of pressure)

mutagenicity – ability to cause genetic changes

NFPA – National Fire Protection Association

NIOSH - National Institute for Occupational Safety and Health

NOEL - no observable effect level

non-target – animals or plants other than the ones that the pesticide is intended to kill or control

OSHA - Occupational Safety and Health Administration

Pa – Pascal (unit of pressure)

persistence – tendency of a pesticide to remain to remain in the environment after it is applied

pesticides – substances including herbicides, insecticides, rodenticides, fumigants, repellents, growth regulators, etc., regulated under FIFRA

PPE – personal protective equipment

ppm – weight ratio expressed as parts per million

residual activity – the remaining amount of activity as a pesticide

T&E – Threatened and Endangered Species (from the Endangered Species Act)

µg – micrograms

volatility – the tendency to become a vapor at standard temperatures and pressures

IX. INFORMATION SOURCES

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X. TOXICITY CATEGORY TABLES

TABLE I: HUMAN HAZARDS

Category	Signal Word	Route of Administration			Hazard	
		Acute Oral LD_{50} (mg/kg)	Acute Dermal LD_{50} (mg/kg)	Acute Inhalation LC_{50} (mg/l)	Eye irritation	Skin irritation
I (Highly Toxic)	**DANGER (poison)**	0–50	0-200	0-0.2	corrosive: corneal opacity not reversible within 7 days	corrosive
II (Moderately Toxic)	**WARNING**	>50–500	>200-2000	>0.2-2	corneal opacity reversible within 7 days; irritation persisting for 7 days	severe irritation at 72 hours
III (Slightly Toxic)	**CAUTION**	>500-5000	>2000-20.000	>2-20	no corneal opacity; irritation reversible within 7 days	moderate irritation at 72 hours
IV (Practically Non-toxic)	**NONE**	>5000	>20,000	>20	no irritation	moderate irritation at 72 hours

After *Pesticide User's Guide*, Ohio State University, Extension Bull. No. 745, 1998.

TABLE II: ECOTOXICOLOGICAL RISKS TO WILDLIFE (TERRESTRIAL AND AQUATIC)

Risk Category	Mammals (Acute Oral LD_{50} mg/kg)	Avian (Acute Oral LD_{50} mg/kg)	Avian LC_{50} (mg/kg)	Fish or Aquatic Invertebrates LC_{50} (mg/l)
Very Highly Toxic	<10	<10	<50	<0.1
Highly Toxic	10-50	10-50	50-500	0.1 – 1
Moderately Toxic	51-500	51-500	501-1,000	>1 – 10
Slightly Toxic	501-2,000	501-2,000	1,001-5,000	>10 – 100
Practically Non-toxic	>2,000	>2,000	>5,000	>100

Table II created from information contained in *Pesticides and Wildlife*, Whitford, Fred, et al., Purdue University Cooperative Extension Service PPP-30, 1998.

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This fact sheet was prepared by USDOE-Bonneville Power Administration, March 2000.

Paclobutrazol

HERBICIDE FACT SHEET

U.S. DEPARTMENT OF ENERGY
BONNEVILLE POWER ADMINISTRATION

This fact sheet is one of a series issued by the Bonneville Power Administration for their workers and the general public. It provides information on forest and land management uses, environmental and human health effects, and safety precautions. A list of definitions is included in Section VIII of this fact sheet.

I. BASIC INFORMATION

COMMON NAME: paclobutrazol

CHEMICAL NAME: (R*,R*)-(±)-β-[(4-chlorophenyl)methyl]-α-(1,1-dimethylethyl)-1H-1,2,4-triazole-1-ethanol

CAS No. 76738-62-2

CHEMICAL TYPE: Information not available.

PESTICIDE CLASSIFICATION*:* Plant Growth Regulator

REGISTERED USE STATUS: ”General Use.”

FORMULATIONS: Commercial herbicide products generally contain one or more ingredients. An inert ingredient is anything added to the product other than an active ingredient. Because of concern for human health and the environment, EPA announced its policy on toxic inert ingredients in the Federal Register on April 22, 1987 (52FR13305). This policy focuses on the regulation of inert ingredients. EPA’s strategy for implementing this policy included the development of four lists of inerts, based on toxicological concerns. Inerts of toxicological concern were placed on List 1. Potentially toxic inerts/high priority for testing were placed on List 2. Inerts of unknown toxicity were placed on List 3, and inerts of minimal concern were placed on List 4.

The inert ingredients of the paclobutrazol formulations are not classified by the USEPA as inert ingredients of toxicological concerns to humans or the environment.

The contents of the paclobutrazol formulation is listed below:

Profile® 2SC Tree Growth Regulator

Paclobutrazol	21.8%
Inert	78.2%

RESIDUE ANALYTICAL METHODS: Information not available.

II. HERBICIDE USES

REGISTERED FORESTRY, RANGELAND AND RIGHT-OF-WAY USES: Paclobutrazol is registered for the reduction of terminal growth and pruning volume in trees not used for food production on sites such as utility rights-of-way, urban environments, and residential and non-crop areas.

OPERATIONAL DETAILS:

TARGET PLANTS: Paclobutrazol is a non-selective, post-emergent herbicide for control of annual grasses, broadleaf weeds, herbaceous plants, woody shrubs and vines.

MODE OF ACTION: Paclobutrazol is a xylem plant growth regulator that slows vegetative growth by inhibiting gibberellin biosynthesis.

METHOD OF APPLICATION: Paclobutrazol (as Profile®) is applied as a basal soil drench or by soil injection.

SPECIAL PRECAUTIONS:

TIMING OF APPLICATION: Paclobutrazol is a post-emergence growth regulator and is applied anytime after emergence of target plants. Effects may not be noticeable for up to eighteen months.

DRIFT CONTROL: Care should be exercised not to overspray or apply the herbicide to adjacent non-target areas. Drift control is achieved by observing weather conditions and following label and sprayer instructions.

RESTRICTIONS/WARNINGS: Do not apply this product through any type of irrigation system.

III. ENVIRONMENTAL EFFECTS/FATE

SOIL:

RESIDUAL SOIL ACTIVITY: The half-life of paclobutrazol is 200 days, depending on soil type.

ADSORPTION: The K(oc) of paclobutrazol is 400.

PERSISTENCE AND AGENTS OF DEGRADATION: Information not available.

METABOLITES/DEGRADATION PRODUCTS AND POTENTIAL ENVIRONMENTAL EFFECTS: Information not available.

WATER:

SOLUBILITY: 35 mg/l at 25 C

POTENTIAL FOR LEACHING INTO SURFACE AND GROUND WATER: The product has high potential to leach into surface and ground water.

AIR:

VOLATILIZATION: Paclobutrazol is slightly volatile.

POTENTIAL FOR BYPRODUCTS FROM BURNING OF TREATED VEGETATION: Information not available.

IV. ECOLOGICAL TOXICITY EFFECTS ON NON-TARGET SPECIES

MICROORGANISMS:

ACUTE CONTACT TOXICITY: LD_{50} (honey bee contact) >100 µg/bee

OVERALL TOXICITY: **Practically Non-Toxic**

PLANTS: Contact will slow the growth of target and non-target trees.

AQUATIC VERTEBRATES:

ACUTE TOXICITY*:* LC_{50} (rainbow trout 96-hour) 27.8 mg/l

ACUTE TOXICITY: LC_{50} (bluegill sunfish 96-hour) 23.6 mg/l

OVERALL TOXICITY: Slightly Toxic

AQUATIC INVERTEBRATES:

ACUTE TOXICITY: LC_{50} (*Daphnia Magna* 48-hour) 33.2 mg/l

OVERALL TOXICITY: Slightly Toxic

AQUATIC ESTUARINE/MARINE INVERTEBRATES: Studies not required by EPA. EPA calculates toxicity will be similar to freshwater invertebrates.

TERRESTRIAL ANIMALS:

AVIAN ACUTE ORAL TOXICITY*:* LD_{50} (mallard duck) 7913 mg/kg

AVIAN DIETARY TOXICITY: LC_{50} (mallard duck) >20,000 mg/kg

AVIAN DIETARY TOXICITY: LC_{50} (bobwhite quail) >5000 mg/kg

SMALL MAMMAL ACUTE ORAL TOXICITY: LD_{50} >2140 mg/kg

OVERALL TOXICITY: Practically Non-Toxic

BIOACCUMULATION POTENTIAL: LOW POTENTIAL

THREATENED AND ENDANGERED SPECIES: Due to the low toxicity and method of application, paclobutrazol is not expected to cause adverse effects to federally listed species.

V. TOXICOLOGICAL DATA

ACUTE TOXICITY:

ACUTE ORAL TOXICITY*:* LD_{50} (rat, female) 1330 mg/kg

ACUTE DERMAL TOXICITY: LD_{50} (rabbit) >2000 mg/kg

PRIMARY SKIN IRRITATION: Rabbit - Slightly irritating

PRIMARY EYE IRRITATION: Rabbit - Moderately irritating

ACUTE INHALATION: LC_{50} (rat 4-hour) >250 mg/l.

OVERALL TOXICITY: Category III – Caution – Slightly Toxic

CHRONIC TOXICITY:

CARCINOGENICITY: No adverse effects.

DEVELOPMENTAL: Caused birth defects in lab animals at doses toxic to the mother.

REPRODUCTIVE: No adverse effects.

MUTAGENICITY: No adverse effects.

HAZARD: Harmful if swallowed or absorbed through the skin.

VI. HUMAN HEALTH EFFECTS

ACUTE TOXICITY (POISONING):

REPORTED EFFECTS: None reported.

CHRONIC TOXICITY:

REPORTED EFFECTS: None reported.

POTENTIAL FOR ADVERSE HEALTH EFFECTS FROM CONTACTING OR CONSUMING TREATED VEGETATION, WATER OR ANIMALS: None reported.

POTENTIAL FOR ADVERSE HEALTH EFFECTS FROM INERT INGREDIENTS CONTAINED IN THE FORMULATED PRODUCTS: Repeated excessive ingestion of propylene glycol may cause central nervous system effects. Commercial bentonite may contain silica gel, which is listed as a potential carcinogen by IARC.

HEALTH EFFECTS OF EXPOSURE TO FORMULATED PRODUCTS: Temporary eye irritation. Prolonged or repeated exposure may cause allergic skin reactions and lung effects.

HEALTH EFFECTS ASSOCIATED WITH CONTAMINANTS: None reported.

HEALTH EFFECTS ASSOCIATED WITH OTHER FORMULATIONS: None reported.

HEALTH RISK MANAGEMENT PROCEDURES: See Section VII.

VII. SAFETY PRECAUTIONS

SIGNAL WORD AND DEFINITION:

Paclobutrazol **- CAUTION** – AVOID CONTACT WITH EYES SKIN AND CLOTHING. HARMFUL IF SWALLOWED, INHALED OR ABSORBED THROUGH THE SKIN

PROTECTIVE PRECAUTIONS FOR WORKERS: Wear eye protection. Wear long-sleeved shirt, long pants, shoes, socks, and waterproof gloves.

MEDICAL TREATMENT PROCEDURES (ANTIDOTES):

EYES: Flush eyes with water; call physician.

SKIN: Wash all exposed areas in flowing water or shower. Wash all contaminated clothing prior to reuse. Call a physician if irritation develops.

INGESTION: Do not induce vomiting. Call a physician or Poison Control Center. Immediately transport to a medical care facility.

INHALATION: Remove individual to fresh air. If breathing difficulty occurs, provide CPR assistance and seek immediate medical attention.

HANDLING, STORAGE AND DISPOSAL: Keep dry (below 120° F) and store away from food, feed or other material to be used or consumed by humans or animals. Do not contaminate water. Dispose of only in accordance with local, state and federal regulations.

EMERGENCY SPILL PROCEDURES AND HAZARDS: Contain and sweep up material of small spills and dispose as waste. Large spills should be reported to CHEMTREC (800-424-9300) for assistance. Prevent runoff. Do not contaminate water, food, or feed by storage or disposal.

VIII. DEFINITIONS

adsorption – the process of attaching to a surface

avian – of, or related to, birds

CAEPA – California Environmental Protection Agency

carcinogenicity – ability to cause cancer

CHEMTREC – Chemical Transportation Emergency Center

dermal – of, or related to, the skin

EC_{50} - median effective concentration during a bioassay

ecotoxicological – related to the effects of environmental toxicants on populations of organisms originating, being produced, growing or living naturally in a particular region or environment

FIFRA – Federal Insecticide, Fungicide and Rodenticide Act

formulation – the form in which the pesticide is supplied by the manufacturer for use

half-life – the time required for half the amount of a substance to be reduced by natural processes

herbicide – a substance used to destroy plants or to slow down their growth

Hg – chemical symbol for mercury

IARC – International Agency for Research on Cancer

K(oc) – the tendency of a chemical to be adsorbed by soil, expressed as: K(oc) = conc. adsorbed/conc. dissolved/% organic carbon in soil

LC_{50} – the concentration in air, water, or food that will kill approximately 50% of the subjects

LD_{50} – the dose that will kill approximately 50% of the subjects

leach – to dissolve out by the action of water

mg/kg – weight ratio expressed as milligrams per kilogram

mg/l – weight-to-liquid ratio expressed as milligrams per liter

microorganisms – living things too small to be seen without a microscope

mPa – milli-Pascal (unit of pressure)

mutagenicity – ability to cause genetic changes

NFPA – National Fire Protection Association

NIOSH - National Institute for Occupational Safety and Health

NOEL - no observable effect level

non-target – animals or plants other than the ones that the pesticide is intended to kill or control

OSHA - Occupational Safety and Health Administration

Pa – Pascal (unit of pressure)

persistence – tendency of a pesticide to remain to remain in the environment after it is applied

pesticides – substances including herbicides, insecticides, rodenticides, fumigants, repellents, growth regulators, etc., regulated under FIFRA

PPE – personal protective equipment

ppm – weight ratio expressed as parts per million

residual activity – the remaining amount of activity as a pesticide

T&E – Threatened and Endangered Species (from the Endangered Species Act)

µg – micrograms

volatility – the tendency to become a vapor at standard temperatures and pressures

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X. TOXICITY CATEGORY TABLES

TABLE I: HUMAN HAZARDS

Category	Signal Word	Route of Administration			Hazard	
		Acute Oral LD_{50} (mg/kg)	Acute Dermal LD_{50} (mg/kg)	Acute Inhalation LC_{50} (mg/l)	Eye irritation	Skin irritation
I (Highly Toxic)	**DANGER (poison)**	0–50	0-200	0-0.2	corrosive: corneal opacity not reversible within 7 days	corrosive
II (Moderately Toxic)	**WARNING**	>50–500	>200-2000	>0.2-2	corneal opacity reversible within 7 days; irritation persisting for 7 days	severe irritation at 72 hours
III (Slightly Toxic)	**CAUTION**	>500-5000	>2000-20.000	>2-20	no corneal opacity; irritation reversible within 7 days	moderate irritation at 72 hours
IV (Practically Non-toxic)	**NONE**	>5000	>20,000	>20	no irritation	moderate irritation at 72 hours

After *Pesticide User's Guide*, Ohio State University, Extension Bull. No. 745, 1998.

TABLE II: ECOTOXICOLOGICAL RISKS TO WILDLIFE (TERRESTRIAL AND AQUATIC)

Risk Category	Mammals (Acute Oral LD_{50} mg/kg)	Avian (Acute Oral LD_{50} mg/kg)	Avian LC_{50} (mg/kg)	Fish or Aquatic Invertebrates LC_{50} (mg/l)
Very Highly Toxic	<10	<10	<50	<0.1
Highly Toxic	10-50	10-50	50-500	0.1 – 1
Moderately Toxic	51-500	51-500	501-1,000	>1 – 10
Slightly Toxic	501-2,000	501-2,000	1,001-5,000	>10 – 100
Practically Non-toxic	>2,000	>2,000	>5,000	>100

Table II created from information contained in *Pesticides and Wildlife*, Whitford, Fred, et al., Purdue University Cooperative Extension Service PPP-30, 1998.

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This fact sheet was prepared by USDOE-Bonneville Power Administration, March 2000.

Picloram

HERBICIDE FACT SHEET

U.S. DEPARTMENT OF ENERGY
BONNEVILLE POWER ADMINISTRATION

This fact sheet is one of a series issued by the Bonneville Power Administration for their workers and the general public. It provides information on forest and land management uses, environmental and human health effects, and safety precautions. A list of definitions is included in Section VIII of this fact sheet.

I. BASIC INFORMATION

COMMON NAME: picloram (potassium salt)

CHEMICAL NAME: 2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1-H-imidazol-2-yl]-3-pyridinecarboxylic acid

Cas No. 2545-60-0

CHEMICAL TYPE: pyridinecarboxylic acid

PESTICIDE CLASSIFICATION: herbicide

REGISTERED USE STATUS: Restricted Use Pesticide in All States.

FORMULATIONS: Commercial herbicide products generally contain one or more ingredients. An inert ingredient is anything added to the product other than an active ingredient. Because of concern for human health and the environment, EPA announced its policy on toxic inert ingredients in the Federal Register on April 22, 1987 (52FR13305). This policy focuses on the regulation of inert ingredients. EPA's strategy for implementing this policy included the development of four lists of inerts, based on toxicological concerns. Inerts of toxicological concern were placed on List 1. Potentially toxic inerts/high priority for testing were placed on List 2. Inerts of unknown toxicity were placed on List 3, and inerts of minimal concern were placed on List 4.

The inert ingredients of the picloram formulations are not classified by the USEPA as inert ingredients of toxicological concerns to humans or the environment.
The contents of the picloram formulation are listed below:

Tordon® 22K Herbicide

Picloram	28.7 %
Inert	71.3 %

RESIDUE ANALYTICAL METHODS: EPA Method 600/4-88-039 515.1; 515.2;555.

II. HERBICIDE USES

REGISTERED FORESTRY, RANGELAND AND RIGHT-OF-WAY USES: Picloram is registered for use in non-crop sites for selective and total plant control. For terrestrial use only.

OPERATIONAL DETAILS:

TARGET PLANTS: Picloram is used for control woody plants on rights-of-ways and for the control of noxious weeds on rangeland.

MODE OF ACTION: Picloram is absorbed by the leaves, bark and roots, interfering with the plant's ability to produce proteins and nucleic acids.

METHOD OF APPLICATION AND RATES: Aerial and ground broadcast, spot, and localized applications at 1/4 pint to 1 quart per acre, not to exceed 2 quarts/acre/year (Tordon© 22K).

SPECIAL PRECAUTIONS:

TIMING OF APPLICATION: For weeds, best results are achieved when the plants are small and actively growing.

DRIFT CONTROL: Care should be exercised not to overspray or apply the herbicide to adjacent non-target areas. Drift control is achieved by observing weather conditions and following label and sprayer instructions. Spray droplet size should be 150 microns or larger.

RESTRICTIONS/WARNINGS/LIMITATIONS: Do not enter the treated area until the spray has dried. Do not apply through any type of irrigation system. Do not graze or feed forage from treated areas for 2 weeks after treatment. Groundwater advisory. Surface water and drift advisory. Non-target plant advisory.

III. ENVIRONMENTAL EFFECTS/FATE

SOIL:

RESIDUAL SOIL ACTIVITY: The half-life of picloram is 90 days.

ADSORPTION: The K(oc) of picloram is 16.

PERSISTENCE AND AGENTS OF DEGRADATION: Picloram is moderately persistent in the plant and soils. The primary route of degradation is microbial activity.

METABOLITES/DEGRADATION PRODUCTS AND POTENTIAL ENVIRONMENTAL EFFECTS: Breaks down into carbon dioxide, oxalic acid, 4-amino-2,3,5-trichloropyridine and 4-amino-3,5-dichloro-6-hydroxypicolinic acid.

WATER:

SOLUBILITY: 200,000 mg/l in water (pH 7 at 25° C).

POTENTIAL FOR LEACHING INTO SURFACE AND GROUND WATER: Picloram is moderately persistent with a moderate soil adsorption coefficient. There is a very high potential for picloram to leach into groundwater and a high potential for surface water runoff.

AIR:

VOLATILIZATION: No information.

POTENTIAL FOR BYPRODUCTS FROM BURNING OF TREATED VEGETATION: Not known.

IV. ECOLOGICAL TOXICITY EFFECTS ON NON-TARGET SPECIES

MICROORGANISMS:

ACUTE CONTACT TOXICITY*:* LD_{50} (honey bee contact) >100 µg/bee

OVERALL TOXICITY: Practically Non-Toxic

PLANTS: Contact will injure or kill target and non-target plants.

AQUATIC VERTEBRATES:

ACUTE TOXICITY*:* LC_{50} (rainbow trout 96-hour) 13 mg/l

ACUTE TOXICITY: LC_{50} (bluegill sunfish 96-hour) 24 mg/l

OVERALL TOXICITY: Slightly Toxic

AQUATIC FRESHWATER INVERTEBRATES:

ACUTE TOXICITY*:* LC_{50} (*Daphnia magna* 48-hour) 68.3 mg/l

OVERALL TOXICITY: Slightly Toxic

AQUATIC ESTUARINE/MARINE INVERTEBRATES:

ACUTE TOXICITY*:* EC_{50} (grass shrimp 96-hour) 306 mg/l

ACUTE TOXICITY*:* EC_{50} (eastern oyster 96-hour) 18 mg/l

OVERALL TOXICITY: Slightly Toxic

TERRESTRIAL ANIMALS:

AVIAN ACUTE ORAL TOXICITY*:* LD_{50} (mallard duck) >2250 mg/kg

AVIAN ACUTE ORAL TOXICITY*:* LD_{50} (bobwhite quail) >2250 mg/kg

AVIAN SUBACUTE DIETARY TOXICITY: LC_{50} (bobwhite quail) >10,000 mg/kg

AVIAN SUBACUTE DIETARY TOXICITY: LC_{50} (mallard duck) >10,000 mg/kg

MAMMAL ACUTE ORAL TOXICITY: LD_{50} (rat) >5000 mg/kg

OVERALL TOXICITY: Practically Non-Toxic

BIOACCUMULATION POTENTIAL: Little Potential

THREATENED AND ENDANGERED SPECIES: Federally listed terrestrial and aquatic plants may be adversely affected if the product is applied directly to the plants, or indirectly as the result of drift or leaching.

V. TOXICOLOGICAL DATA

ACUTE TOXICITY:

ACUTE ORAL TOXICITY*:* LD_{50} (rat) >5000 mg/kg

ACUTE DERMAL TOXICITY: LD_{50} (rabbit) >2000 mg/kg

PRIMARY SKIN IRRITATION: Rabbit - Non-Irritant

PRIMARY EYE IRRITATION: Rabbit – Moderate Irritant

ACUTE INHALATION: LC_{50} (rat) >8.11 mg/l

OVERALL TOXICITY: Category III – Slightly Toxic

CHRONIC TOXICITY:

CARCINOGENICITY: EPA Group E - No evidence of human carcinogenicity.

DEVELOPMENTAL/REPRODUCTIVE: Body weight gains/losses, abortions, excess salivation.

MUTAGENICITY: No adverse effects.

HAZARD: The end-use product labels for the picloram formulations carry the *Caution* signal word due to potential eye irritation.

VI. HUMAN HEALTH EFFECTS

ACUTE TOXICITY (POISONING):

REPORTED EFFECTS: Damage to central nervous system, weakness, diarrhea and weight loss.

CHRONIC TOXICITY:

REPORTED EFFECTS: Liver damage.

POTENTIAL FOR ADVERSE HEALTH EFFECTS FROM CONTACTING OR CONSUMING TREATED VEGETATION, WATER OR ANIMALS: See effects reported under acute toxicity.

POTENTIAL FOR ADVERSE HEALTH EFFECTS FROM INERT INGREDIENTS CONTAINED IN THE FORMULATED PRODUCTS: None.

HEALTH EFFECTS OF EXPOSURE TO FORMULATED PRODUCTS: None reported .

HEALTH EFFECTS ASSOCIATED WITH CONTAMINANTS: None reported.

HEALTH EFFECTS ASSOCIATED WITH OTHER FORMULATIONS: None reported.

VII. SAFETY PRECAUTIONS

SIGNAL WORD AND DEFINITION:

PICLORAM - **CAUTION** – CAUSES MODERATE EYE IRRITATION.

PROTECTIVE PRECAUTIONS FOR WORKERS: Applicators and other handlers must wear long-sleeved shirt and long pants, shoes plus socks.

MEDICAL TREATMENT PROCEDURES (ANTIDOTES):

EYES: Flush eyes with water for 15 minutes. Call physician.

SKIN: Wash all exposed areas with soap and water, call physician if irritation persists.

INGESTION: Call physician. Do not induce vomiting.

INHALATION: Remove to fresh air. Call a physician if breathing difficulty persists.

HANDLING, STORAGE AND DISPOSAL: Store at room temperature or cooler. Do not reuse container. Rinse container and dispose accordingly.

EMERGENCY SPILL PROCEDURES AND HAZARDS: Contain and sweep up material of small spills and dispose as waste. Do not contaminate water, food or feed by storage or disposal.

VIII. DEFINITIONS

adsorption – the process of attaching to a surface

avian – of, or related to, birds

CAEPA – California Environmental Protection Agency

carcinogenicity – ability to cause cancer

CHEMTREC – Chemical Transportation Emergency Center

dermal – of, or related to, the skin

EC_{50} - median effective concentration during a bioassay

ecotoxicological – related to the effects of environmental toxicants on populations of organisms originating, being produced, growing or living naturally in a particular region or environment

FIFRA – Federal Insecticide, Fungicide and Rodenticide Act

formulation – the form in which the pesticide is supplied by the manufacturer for use

half-life – the time required for half the amount of a substance to be reduced by natural processes

herbicide – a substance used to destroy plants or to slow down their growth

Hg – chemical symbol for mercury

IARC – International Agency for Research on Cancer

K(oc) – the tendency of a chemical to be adsorbed by soil, expressed as: K(oc) = conc. adsorbed/conc. dissolved/% organic carbon in soil

LC_{50} – the concentration in air, water, or food that will kill approximately 50% of the subjects

LD_{50} – the dose that will kill approximately 50% of the subjects

leach – to dissolve out by the action of water

mg/kg – weight ratio expressed as milligrams per kilogram
mg/l – weight-to-liquid ratio expressed as milligrams per liter
microorganisms – living things too small to be seen without a microscope
mPa – milli-Pascal (unit of pressure)
mutagenicity – ability to cause genetic changes
NFPA – National Fire Protection Association
NIOSH - National Institute for Occupational Safety and Health
NOEL - no observable effect level
non-target – animals or plants other than the ones that the pesticide is intended to kill or control
OSHA - Occupational Safety and Health Administration
Pa – Pascal (unit of pressure)
persistence – tendency of a pesticide to remain to remain in the environment after it is applied
pesticides – substances including herbicides, insecticides, rodenticides, fumigants, repellents, growth regulators, etc., regulated under FIFRA
PPE – personal protective equipment
ppm – weight ratio expressed as parts per million
residual activity – the remaining amount of activity as a pesticide
T&E – Threatened and Endangered Species (from the Endangered Species Act)
µg – micrograms
volatility – the tendency to become a vapor at standard temperatures and pressures

IX. INFORMATION SOURCES

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X. Toxicity Category Tables

Table I: Human Hazards

Category	Signal Word	Route of Administration			Hazard	
		Acute Oral LD_{50} (mg/kg)	Acute Dermal LD_{50} (mg/kg)	Acute Inhalation LC_{50} (mg/l)	Eye irritation	Skin irritation
I (Highly Toxic)	**DANGER (poison)**	0–50	0-200	0-0.2	corrosive: corneal opacity not reversible within 7 days	corrosive
II (Moderately Toxic)	**WARNING**	>50–500	>200-2000	>0.2-2	corneal opacity reversible within 7 days; irritation persisting for 7 days	severe irritation at 72 hours
III (Slightly Toxic)	**CAUTION**	>500-5000	>2000-20.000	>2-20	no corneal opacity; irritation reversible within 7 days	moderate irritation at 72 hours
IV (Practically Non-toxic)	**NONE**	>5000	>20,000	>20	no irritation	moderate irritation at 72 hours

After *Pesticide User's Guide*, Ohio State University, Extension Bull. No. 745, 1998.

Table II: Ecotoxicological Risks to Wildlife (Terrestrial and Aquatic)

Risk Category	Mammals	Avian	Avian	Fish or Aquatic Invertebrates
	Acute Oral LD_{50} mg/kg)	Acute Oral LD_{50} (mg/kg)	Acute Dietary LC_{50} (mg/kg)	Acute Concentration LC_{50} (mg/l)
Very Highly Toxic	<10	<10	<50	<0.1
Highly Toxic	10-50	10-50	50-500	0.1 – 1
Moderately Toxic	51-500	51-500	501-1,000	>1 – 10
Slightly Toxic	501-2,000	501-2,000	1,001-5,000	>10 – 100
Practically Non-toxic	>2,000	>2,000	>5,000	>100

Table II created from information contained in *Pesticides and Wildlife*, Whitford, Fred, et al., Purdue University Cooperative Extension Service PPP-30, 1998.

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This fact sheet was prepared by USDOE-Bonneville Power Administration, March 2000.

Sulfometuron-methyl

HERBICIDE FACT SHEET

U.S. DEPARTMENT OF ENERGY
BONNEVILLE POWER ADMINISTRATION

This fact sheet is one of a series issued by the Bonneville Power Administration for their workers and the general public. It provides information on forest and land management uses, environmental and human health effects, and safety precautions. A list of definitions is included in Section VIII of this fact sheet.

I. BASIC INFORMATION

COMMON NAME: sulfometuron-methyl

CHEMICAL NAME: {Methyl 2-[[[[(4,6-dimethyl-2-pyrimidinyl)amino]-carbonyl]amino]sulfonyl]benzoate}

Cas No. 74222-97-2

CHEMICAL TYPE: sulfonylurea herbicide

PESTICIDE CLASSIFICATION: herbicide

REGISTERED USE STATUS: "General Use."

FORMULATIONS: Commercial herbicide products generally contain one or more ingredients. An inert ingredient is anything added to the product other than an active ingredient. Because of concern for human health and the environment, EPA announced its policy on toxic inert ingredients in the Federal Register on April 22, 1987 (52FR13305). This policy focuses on the regulation of inert ingredients. EPA's strategy for implementing this policy included the development of four lists of inerts, based on toxicological concerns. Inerts of toxicological concern were placed on List 1. Potentially toxic inerts/high priority for testing were placed on List 2. Inerts of unknown toxicity were placed on List 3, and inerts of minimal concern were placed on List 4.

The inert ingredients of the Oust® formulation are not classified by the USEPA as inert ingredients of toxicological concerns to humans or the environment.

The contents of the sulfometuron-methyl formulation are listed below:

Oust®

Sulfometuron-methyl	75 %
Inert	25 %

RESIDUE ANALYTICAL METHODS: EPA METHOD 632

II. HERBICIDE USES

REGISTERED FORESTRY, RANGELAND AND RIGHT-OF-WAY USES: Sulfometuron-methyl as Oust® is registered for use in non-agricultural areas as a general weed and brush control herbicide. For terrestrial use only.

OPERATIONAL DETAILS:

TARGET PLANTS: Sulfometuron-methyl is a selective herbicide primarily for post-emergent control of annual, biennial, and perennial broadleaf weeds and brush. Oust® does have pre-emergent activity.

MODE OF ACTION: Sulfometuron-methyl enters the plant through the root zone and foliage, inhibiting the synthesis of key amino acids.

METHOD OF APPLICATION AND RATES: Broadcast and spot spray applications at 1/4 ounce to 8 ounces of formulated product per acre. Ground or aerial (helicopter only) application. Do not apply more than 8 ounces/acre/year.

SPECIAL PRECAUTIONS:

TIMING OF APPLICATION: Timing is dependent on the target plant. Application may be made at any time the ground is not frozen. As sulfometuron-methyl must move to the root zone to be effective for pre-emergent control, adequate soil moisture is necessary.

DRIFT CONTROL: Care should be exercised not to overspray or apply the herbicide to adjacent non-target areas. Drift control is achieved by observing weather conditions and following label and sprayer instructions. Spray droplet size should be 150 microns or larger.

RESTRICTIONS/WARNINGS/LIMITATIONS: Do not enter or allow others to enter the treated area until sprays have dried. Do not apply through any type of irrigation system. Do not apply directly to water or areas where surface water is present, or to intertidal areas below the mean high water mark. Do not apply to irrigation banks or other ditch banks. Do not use on lawns. Do not use on walks, driveways, tennis courts, or other impermeable areas. Do not apply to frozen ground. Treated soil should remain undisturbed. Grazing and cut forage restrictions of 12 months post-application apply. This herbicide is injurious to plants at extremely low concentrations. Non-target plants may be adversely affected from drift and run-off. Not for use in California.

III. ENVIRONMENTAL EFFECTS/FATE

SOIL:

RESIDUAL SOIL ACTIVITY: The half-life of sulfometuron-methyl is 20 days.

ADSORPTION: The K(oc) of sulfometuron-methyl is 78.

PERSISTENCE AND AGENTS OF DEGRADATION: Sulfometuron-methyl is slightly persistent with no major (>10%) degradates.

METABOLITES/DEGRADATION PRODUCTS AND POTENTIAL ENVIRONMENTAL EFFECTS: Sulfometuron-methyl degrades to nonphytotoxic, low-molecular-weight compounds and carbon dioxide.

WATER:

SOLUBILITY: 244 mg/l in water (pH 7).

POTENTIAL FOR LEACHING INTO SURFACE AND GROUND WATER: Sulfometuron-methyl is slightly persistent and slightly mobile and has low potential to enter surface waters from runoff. The very low application rate and microbial breakdown suggest that sulfometuron-methyl has little potential to enter ground water.

AIR:

VOLATILIZATION: Nonvolatile.

POTENTIAL FOR BYPRODUCTS FROM BURNING OF TREATED VEGETATION: Not known.

IV. ECOLOGICAL TOXICITY EFFECTS ON NON-TARGET SPECIES

MICROORGANISMS:

ACUTE CONTACT TOXICITY*:* LD_{50} (honey bee contact) >100 µg/bee

OVERALL TOXICITY: Practically Non-Toxic

PLANTS: Contact will injure or kill target and non-target plants.

AQUATIC VERTEBRATES:

ACUTE TOXICITY*:* LC_{50} (rainbow trout 96-hour) >148 mg/l

ACUTE TOXICITY: LC_{50} (bluegill sunfish 96-hour) >150 mg/l

OVERALL TOXICITY: Practically Non-Toxic

AQUATIC FRESHWATER INVERTEBRATES:

ACUTE TOXICITY*:* LC_{50} (*Daphnia magna* 48-hour) >150 mg/l

OVERALL TOXICITY: Practically Non-Toxic

AQUATIC ESTUARINE/MARINE INVERTEBRATES:

ACUTE TOXICITY*:* EC_{50} (Eastern oyster larvae 48-hour)

ACUTE TOXICITY*:* LC_{50} (sheepshead minnow 96-hour) >45 mg/l

OVERALL TOXICITY: Practically Non-Toxic

TERRESTRIAL ANIMALS:

AVIAN ACUTE ORAL TOXICITY*:* LD_{50} (bobwhite quail) >5000 mg/kg

AVIAN ACUTE ORAL TOXICITY*:* LD_{50} (mallard duck) >5000 mg/kg

AVIAN SUBACUTE DIETARY TOXICITY: LC_{50} (bobwhite quail) >5620 mg/kg

AVIAN SUBACUTE DIETARY TOXICITY: LC_{50} (mallard duck) >5000 mg/kg

MAMMAL ACUTE ORAL TOXICITY: LD_{50} (rat) >5000 mg/kg

OVERALL TOXICITY: Practically Non-Toxic

BIOACCUMULATION POTENTIAL: No Potential

THREATENED AND ENDANGERED SPECIES: Federally listed plants may be adversely affected if the product is applied directly to the plants.

V. TOXICOLOGICAL DATA

ACUTE TOXICITY:

ACUTE ORAL TOXICITY*:* LD_{50} (rat) >5000 mg/kg

ACUTE DERMAL TOXICITY: LD_{50} (rabbit) >2000 mg/kg

PRIMARY SKIN IRRITATION: Rabbit - Slight Irritant

PRIMARY EYE IRRITATION: Rabbit – Moderate Irritant

ACUTE INHALATION: LC_{50} (rat) >5.1 mg/l

OVERALL TOXICITY: Category III – Caution

CHRONIC TOXICITY:

CARCINOGENICITY: No effects reported.

DEVELOPMENTAL/REPRODUCTIVE: No effects reported.

MUTAGENICITY: Not a mutagenic.

HAZARD: The end-use product label for Oust® carries the *Caution* signal word due to eye irritation.

VI. HUMAN HEALTH EFFECTS

ACUTE TOXICITY (POISONING):

REPORTED EFFECTS: Ingestion of large amounts of sulfometuron may cause red cell destruction.

CHRONIC TOXICITY:

REPORTED EFFECTS: Reduced red cell count, increased liver weights, increased while cell count, and anemia reported in test animals at highest doses.

POTENTIAL FOR ADVERSE HEALTH EFFECTS FROM CONTACTING OR CONSUMING TREATED VEGETATION, WATER OR ANIMALS: None reported and none expected at application rates.

POTENTIAL FOR ADVERSE HEALTH EFFECTS FROM INERT INGREDIENTS CONTAINED IN THE FORMULATED PRODUCTS: None reported.

HEALTH EFFECTS OF EXPOSURE TO FORMULATED PRODUCTS: Mild, temporary skin and eye irritation.

HEALTH EFFECTS ASSOCIATED WITH CONTAMINANTS: None reported.

HEALTH EFFECTS ASSOCIATED WITH OTHER FORMULATIONS: None reported.

VII. SAFETY PRECAUTIONS

SIGNAL WORD AND DEFINITION:

SULFOMETURON-METHYL **- CAUTION** – CAUSES MODERATE EYE IRRITATION

PROTECTIVE PRECAUTIONS FOR WORKERS: Applicators and other handlers must wear long-sleeved shirt and long pants, shoes plus socks.

MEDICAL TREATMENT PROCEDURES (ANTIDOTES):

EYES: Flush eyes with water; call physician if irritation persists.

SKIN: Wash all exposed areas with soap and water; call physician if irritation persists.

INGESTION: Immediately give 2 glasses of water and induce vomiting. Call a physician.

INHALATION: Remove to fresh air.

HANDLING, STORAGE AND DISPOSAL: Store at room temperature or cooler. Do not reuse container. Rinse container and dispose accordingly.

EMERGENCY SPILL PROCEDURES AND HAZARDS: Contain and sweep up material of small spills and dispose as waste. Do not contaminate water, food, or feed by storage or disposal.

VIII. DEFINITIONS

adsorption – the process of attaching to a surface
avian – of, or related to, birds
CAEPA – California Environmental Protection Agency
carcinogenicity – ability to cause cancer
CHEMTREC – Chemical Transportation Emergency Center
dermal – of, or related to, the skin
EC_{50} - median effective concentration during a bioassay
ecotoxicological – related to the effects of environmental toxicants on populations of organisms originating, being produced, growing or living naturally in a particular region or environment
FIFRA – Federal Insecticide, Fungicide and Rodenticide Act
formulation – the form in which the pesticide is supplied by the manufacturer for use
half-life – the time required for half the amount of a substance to be reduced by natural processes
herbicide – a substance used to destroy plants or to slow down their growth
Hg – chemical symbol for mercury

IARC – International Agency for Research on Cancer

K(oc) – the tendency of a chemical to be adsorbed by soil, expressed as: K(oc) = conc. adsorbed/conc. dissolved/% organic carbon in soil

LC_{50} – the concentration in air, water, or food that will kill approximately 50% of the subjects

LD_{50} – the dose that will kill approximately 50% of the subjects

leach – to dissolve out by the action of water

mg/kg – weight ratio expressed as milligrams per kilogram

mg/l – weight-to-liquid ratio expressed as milligrams per liter

microorganisms – living things too small to be seen without a microscope

mPa – milli-Pascal (unit of pressure)

mutagenicity – ability to cause genetic changes

NFPA – National Fire Protection Association

NIOSH - National Institute for Occupational Safety and Health

NOEL - no observable effect level

non-target – animals or plants other than the ones that the pesticide is intended to kill or control

OSHA - Occupational Safety and Health Administration

Pa – Pascal (unit of pressure)

persistence – tendency of a pesticide to remain to remain in the environment after it is applied

pesticides – substances including herbicides, insecticides, rodenticides, fumigants, repellents, growth regulators, etc., regulated under FIFRA

PPE – personal protective equipment

ppm – weight ratio expressed as parts per million

residual activity – the remaining amount of activity as a pesticide

T&E – Threatened and Endangered Species (from the Endangered Species Act)

µg – micrograms

volatility – the tendency to become a vapor at standard temperatures and pressures

IX. INFORMATION SOURCES

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X. Toxicity Category Tables

Table I: Human Hazards

Category	Signal Word	Route of Administration			Hazard	
		Acute Oral LD_{50} (mg/kg)	Acute Dermal LD_{50} (mg/kg)	Acute Inhalation LC_{50} (mg/l)	Eye irritation	Skin irritation
I (Highly Toxic)	**DANGER (poison)**	0–50	0-200	0-0.2	corrosive: corneal opacity not reversible within 7 days	corrosive
II (Moderately Toxic)	**WARNING**	>50–500	>200-2000	>0.2-2	corneal opacity reversible within 7 days; irritation persisting for 7 days	severe irritation at 72 hours
III (Slightly Toxic)	**CAUTION**	>500-5000	>2000-20.000	>2-20	no corneal opacity; irritation reversible within 7 days	moderate irritation at 72 hours
IV (Practically Non-toxic)	**NONE**	>5000	>20,000	>20	no irritation	moderate irritation at 72 hours

After *Pesticide User's Guide*, Ohio State University, Extension Bull. No. 745, 1998.

Table II: Ecotoxicological Risks to Wildlife (Terrestrial and Aquatic)

Risk Category	Mammals	Avian	Avian	Fish or Aquatic Invertebrates
	Acute Oral LD_{50} mg/kg)	Acute Oral LD_{50} (mg/kg)	Acute Dietary LC_{50} (mg/kg)	Acute Concentration LC_{50} (mg/l)
Very Highly Toxic	<10	<10	<50	<0.1
Highly Toxic	10-50	10-50	50-500	0.1 – 1
Moderately Toxic	51-500	51-500	501-1,000	>1 – 10
Slightly Toxic	501-2,000	501-2,000	1,001-5,000	>10 – 100
Practically Non-toxic	>2,000	>2,000	>5,000	>100

Table II created from information contained in *Pesticides and Wildlife*, Whitford, Fred, et al., Purdue University Cooperative Extension Service PPP-30, 1998.

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This fact sheet was prepared by USDOE-Bonneville Power Administration, March 2000.

Tebuthiuron

HERBICIDE FACT SHEET

U.S. DEPARTMENT OF ENERGY
BONNEVILLE POWER ADMINISTRATION

This fact sheet is one of a series issued by the Bonneville Power Administration for their workers and the general public. It provides information on forest and land management uses, environmental and human health effects, and safety precautions. A list of definitions is included in Section VIII of this fact sheet.

I. BASIC INFORMATION

COMMON NAME: tebuthiuron

CHEMICAL NAME: N-[5-(1,1-dimethylethyl)-1,3,4-thiadiazol-2-yl]-N,N'-dimethylurea

Cas No. 34014-18-1

CHEMICAL TYPE: substituted urea

PESTICIDE CLASSIFICATION: herbicide

REGISTERED USE STATUS: General Use Pesticide. Restricted Use Pesticide in Washington.

FORMULATIONS: Commercial herbicide products generally contain one or more ingredients. An inert ingredient is anything added to the product other than an active ingredient. Because of concern for human health and the environment, EPA announced its policy on toxic inert ingredients in the Federal Register on April 22, 1987 (52FR13305). This policy focuses on the regulation of inert ingredients. EPA's strategy for implementing this policy included the development of four lists of inerts, based on toxicological concerns. Inerts of toxicological concern were placed on List 1. Potentially toxic inerts/high priority for testing were placed on List 2. Inerts of unknown toxicity were placed on List 3, and inerts of minimal concern were placed on List 4.

The inert ingredients of the tebuthiuron formulations are not classified by the USEPA as inert ingredients of toxicological concerns to humans or the environment.

The contents of the tebuthiuron formulations are listed below:

Spike® 20 P Herbicide

Tebuthiuron	20 %
Inert	80 %

Spike® 80 DF Herbicide

Tebuthiuron	80 %
Inert	20 %

Spike® 80 W Herbicide

Tebuthiuron	80 %
Inert	20 %

RESIDUE ANALYTICAL METHODS: EPA Method 632.

II. HERBICIDE USES

REGISTERED FORESTRY, RANGELAND AND RIGHT-OF-WAY USES: Tebuthiuron is registered for use in non-crop sites for selective and total plant control. For terrestrial use only.

OPERATIONAL DETAILS:

TARGET PLANTS: Tebuthiuron is a pre- and post-emergent total herbicidal control for weeds and brush.

MODE OF ACTION: Tebuthiuron is absorbed by the roots inhibiting photosynthesis.

METHOD OF APPLICATION AND RATES: Aerial and ground broadcast, spot and localized applications at 0.2 to 2.5 lbs./acre.

SPECIAL PRECAUTIONS:

TIMING OF APPLICATION: Just before or during active plant growth.

DRIFT CONTROL: Care should be exercised not to overspray or apply the herbicide to adjacent non-target areas. Drift control is achieved by observing weather conditions and following label and sprayer instructions. Spray droplet size should be 150 microns or larger.

RESTRICTIONS/WARNINGS/LIMITATIONS: Do not apply more than 1.25 lb./acre of any Spike formulation in areas with less than 20 inches of annual rainfall. Don not apply more than 2.5 lb./acre of any Spike formulation in areas with more than 20 inches of annual rainfall. Do not enter the treated area until the spray has dried. Do not apply through any type of irrigation system. Do not graze or feed forage from treated areas for 2 weeks after treatment. Groundwater advisory. Do not apply within areas identified as groundwater protection zones. Surface water and drift advisory. Non-target plant advisory.

III. ENVIRONMENTAL EFFECTS/FATE

SOIL:

RESIDUAL SOIL ACTIVITY: The half-life of tebuthiuron is 360 days.

ADSORPTION: The K(oc) of tebuthiuron is 80.

PERSISTENCE AND AGENTS OF DEGRADATION: Tebuthiuron is highly persistent in the plant and soils. The primary route of degradation is microbial activity.

METABOLITES/DEGRADATION PRODUCTS AND POTENTIAL ENVIRONMENTAL EFFECTS: Breakdown products are found in very low concentrations and should be relatively non-toxic.

WATER:

SOLUBILITY: 2500 mg/l in water (pH 7 at 25° C).

POTENTIAL FOR LEACHING INTO SURFACE AND GROUND WATER: Tebuthiuron is moderately persistent with a moderate soil adsorption coefficient. There is a very high potential for tebuthiuron to leach into groundwater and a high potential for surface water runoff.

AIR:

VOLATILIZATION: 0.27 mPa at 25° C.

POTENTIAL FOR BYPRODUCTS FROM BURNING OF TREATED VEGETATION: Not known.

IV. ECOLOGICAL TOXICITY EFFECTS ON NON-TARGET SPECIES

MICROORGANISMS:

ACUTE CONTACT TOXICITY*:* LD_{50} (honey bee contact) 30 ug/bee

OVERALL TOXICITY: Slightly Toxic

PLANTS: Contact will injure or kill target and non-target plants.

AQUATIC VERTEBRATES:

ACUTE TOXICITY*:* LC_{50} (rainbow trout 96-hour) 87 mg/l

ACUTE TOXICITY: LC_{50} (bluegill sunfish 96-hour) 87 mg/l

OVERALL TOXICITY: Slightly Toxic

AQUATIC FRESHWATER INVERTEBRATES:

ACUTE TOXICITY*:* LC_{50} (*Daphnia magna* 48-hour) 225 mg/l

OVERALL TOXICITY: Practically Non-Toxic

AQUATIC ESTUARINE/MARINE INVERTEBRATES:

ACUTE TOXICITY*:* EC_{50} (pink shrimp 96-hour) 48 mg/l

ACUTE TOXICITY*:* EC_{50} (fiddler crab 96-hour) 320 mg/l

OVERALL TOXICITY: Slightly Toxic

TERRESTRIAL ANIMALS:

AVIAN ACUTE ORAL TOXICITY*:* LD_{50} (mallard duck) >2500 mg/kg

AVIAN ACUTE ORAL TOXICITY*:* LD_{50} (bobwhite quail) >2500 mg/kg

AVIAN SUBACUTE DIETARY TOXICITY: LC_{50} (bobwhite quail) >5000 mg/kg

AVIAN SUBACUTE DIETARY TOXICITY: LC_{50} (mallard duck) >5000 mg/kg

MAMMAL ACUTE ORAL TOXICITY: LD_{50} (rat) 644 mg/kg

OVERALL TOXICITY: Slightly Toxic

BIOACCUMULATION POTENTIAL: Little Potential

THREATENED AND ENDANGERED SPECIES: Federally listed terrestrial and aquatic plants may be adversely affected if the product is applied directly to the plants, or indirectly as the result of drift or leaching.

V. TOXICOLOGICAL DATA

ACUTE TOXICITY:

ACUTE ORAL TOXICITY*:* LD_{50} (rat) 644 mg/kg

ACUTE DERMAL TOXICITY: LD_{50} (rabbit) >200 mg/kg

PRIMARY SKIN IRRITATION: Rabbit - Slight Irritant

PRIMARY EYE IRRITATION: Rabbit – Slight Irritant

ACUTE INHALATION: LC_{50} (rat) 3.7 mg/l

OVERALL TOXICITY: Category III – Slightly Toxic

CHRONIC TOXICITY:

CARCINOGENICITY: EPA Group E - Not classifiable as a human carcinogen.

DEVELOPMENTAL/REPRODUCTIVE: No adverse effects.

MUTAGENICITY: No adverse effects.

HAZARD: The end-use product labels for the tebuthiuron formulations carry the *Caution* signal word due to potential eye skin and inhalation hazards.

VI. HUMAN HEALTH EFFECTS

ACUTE TOXICITY (POISONING):

REPORTED EFFECTS: Eye irritation, skin irritation, nausea, vomiting, dizziness, sweating, headache and sore throat have been reported.

CHRONIC TOXICITY:

REPORTED EFFECTS: None reported.

POTENTIAL FOR ADVERSE HEALTH EFFECTS FROM CONTACTING OR CONSUMING TREATED VEGETATION, WATER OR ANIMALS: See effects reported under acute toxicity.

POTENTIAL FOR ADVERSE HEALTH EFFECTS FROM INERT INGREDIENTS CONTAINED IN THE FORMULATED PRODUCTS: None.

HEALTH EFFECTS OF EXPOSURE TO FORMULATED PRODUCTS: Both Spike 20P and 80W contain kaolin. Kaolin, or crystalline silica, is listed as a carcinogen.

HEALTH EFFECTS ASSOCIATED WITH CONTAMINANTS: None reported.

HEALTH EFFECTS ASSOCIATED WITH OTHER FORMULATIONS: None reported.

VII. SAFETY PRECAUTIONS

SIGNAL WORD AND DEFINITION:

TEBUTHIURON - **CAUTION** – CAUSES EYE IRRITATION. HARMFUL IF SWALLOWED, INHALED, OR ABSORBED THROUGH THE SKIN.

PROTECTIVE PRECAUTIONS FOR WORKERS: Applicators and other handlers must wear long-sleeved shirt and long pants, shoes plus socks.

MEDICAL TREATMENT PROCEDURES (ANTIDOTES):

EYES: Flush eyes with water for 15 minutes. Call physician.

SKIN: Wash all exposed areas with soap and water, call physician if irritation persists.

INGESTION: Call physician. Do not induce vomiting.

INHALATION: Remove to fresh air. Call a physician if breathing difficulty persists.

HANDLING, STORAGE AND DISPOSAL: Store at room temperature or cooler. Do not reuse container. Rinse container and dispose accordingly.

EMERGENCY SPILL PROCEDURES AND HAZARDS: Contain and sweep up material of small spills and dispose as waste. Do not contaminate water, food, or feed by storage or disposal.

VIII. DEFINITIONS

adsorption – the process of attaching to a surface

avian – of, or related to, birds

CAEPA – California Environmental Protection Agency

carcinogenicity – ability to cause cancer

CHEMTREC – Chemical Transportation Emergency Center

dermal – of, or related to, the skin

EC_{50} - median effective concentration during a bioassay

ecotoxicological – related to the effects of environmental toxicants on populations of organisms originating, being produced, growing or living naturally in a particular region or environment

FIFRA – Federal Insecticide, Fungicide and Rodenticide Act

formulation – the form in which the pesticide is supplied by the manufacturer for use

half-life – the time required for half the amount of a substance to be reduced by natural processes

herbicide – a substance used to destroy plants or to slow down their growth

Hg – chemical symbol for mercury

IARC – International Agency for Research on Cancer

K(oc) – the tendency of a chemical to be adsorbed by soil, expressed as: K(oc) = conc. adsorbed/conc. dissolved/% organic carbon in soil

LC_{50} – the concentration in air, water, or food that will kill approximately 50% of the subjects

LD_{50} – the dose that will kill approximately 50% of the subjects

leach – to dissolve out by the action of water

mg/kg – weight ratio expressed as milligrams per kilogram

mg/l – weight-to-liquid ratio expressed as milligrams per liter

microorganisms – living things too small to be seen without a microscope

mPa – milli-Pascal (unit of pressure)

mutagenicity – ability to cause genetic changes

NFPA – National Fire Protection Association

NIOSH - National Institute for Occupational Safety and Health

NOEL - no observable effect level

non-target – animals or plants other than the ones that the pesticide is intended to kill or control

OSHA - Occupational Safety and Health Administration

Pa – Pascal (unit of pressure)

persistence – tendency of a pesticide to remain to remain in the environment after it is applied

pesticides – substances including herbicides, insecticides, rodenticides, fumigants, repellents, growth regulators, etc., regulated under FIFRA

PPE – personal protective equipment

ppm – weight ratio expressed as parts per million

residual activity – the remaining amount of activity as a pesticide

T&E – Threatened and Endangered Species (from the Endangered Species Act)

µg – micrograms

volatility – the tendency to become a vapor at standard temperatures and pressures

IX. INFORMATION SOURCES

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X. TOXICITY CATEGORY TABLES

TABLE I: HUMAN HAZARDS

Category	Signal Word	Route of Administration			Hazard	
		Acute Oral LD_{50} (mg/kg)	Acute Dermal LD_{50} (mg/kg)	Acute Inhalation LC_{50} (mg/l)	Eye irritation	Skin irritation
I (Highly Toxic)	**DANGER (poison)**	0–50	0-200	0-0.2	corrosive: corneal opacity not reversible within 7 days	corrosive
II (Moderately Toxic)	**WARNING**	>50–500	>200-2000	>0.2-2	corneal opacity reversible within 7 days; irritation persisting for 7 days	severe irritation at 72 hours
III (Slightly Toxic)	**CAUTION**	>500-5000	>2000-20.000	>2-20	no corneal opacity; irritation reversible within 7 days	moderate irritation at 72 hours
IV (Practically Non-toxic)	**NONE**	>5000	>20,000	>20	no irritation	moderate irritation at 72 hours

After *Pesticide User's Guide*, Ohio State University, Extension Bull. No. 745, 1998.

TABLE II: ECOTOXICOLOGICAL RISKS TO WILDLIFE (TERRESTRIAL AND AQUATIC)

Risk Category	Mammals	Avian	Avian	Fish or Aquatic Invertebrates
	Acute Oral LD_{50} mg/kg)	Acute Oral LD_{50} (mg/kg)	Acute Dietary LC_{50} (mg/kg)	Acute Concentration LC_{50} (mg/l)
Very Highly Toxic	<10	<10	<50	<0.1
Highly Toxic	10-50	10-50	50-500	0.1 – 1
Moderately Toxic	51-500	51-500	501-1,000	>1 – 10
Slightly Toxic	501-2,000	501-2,000	1,001-5,000	>10 – 100
Practically Non-toxic	>2,000	>2,000	>5,000	>100

Table II created from information contained in *Pesticides and Wildlife*, Whitford, Fred, et al., Purdue University Cooperative Extension Service PPP-30, 1998.

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This fact sheet was prepared by USDOE-Bonneville Power Administration, March 2000.

Triclopyr

HERBICIDE FACT SHEET

U.S. DEPARTMENT OF ENERGY
BONNEVILLE POWER ADMINISTRATION

This fact sheet is one of a series issued by the Bonneville Power Administration for their workers and the general public. It provides information on forest and land management uses, environmental and human health effects, and safety precautions. A list of definitions is included in Section VIII of this fact sheet.

I. BASIC INFORMATION

COMMON NAME: triclopyr

CHEMICAL NAME: [((3,5,6-trichloro-2-pyridinyl)oxy)acetic acid]

Cas No. 55335-06-3

Of the parent chemical, two sibling forms are used in herbicide formulations:

Triclopyr butoxyethyl ester (BEE), Cas No. 64700-56-7, and

Triclopyr triethylamine salt (TEA), Cas No. 57213-69-1

CHEMICAL TYPE: pyridinyloxyacetic acids

PESTICIDE CLASSIFICATION: herbicide

REGISTERED USE STATUS: "General Use Pesticide."

FORMULATIONS: Commercial herbicide products generally contain one or more ingredients. An inert ingredient is anything added to the product other than an active ingredient. Because of concern for human health and the environment, EPA announced its policy on toxic inert ingredients in the Federal Register on April 22, 1987 (52FR13305). This policy focuses on the regulation of inert ingredients. EPA's strategy for implementing this policy included the development of four lists of inerts, based on toxicological concerns. Inerts of toxicological concern were placed on List 1. Potentially toxic inerts/high priority for testing were placed on List 2. Inerts of unknown toxicity were placed on List 3, and inerts of minimal concern were placed on List 4.

The inert ingredients of the triclopyr formulations are not classified by the USEPA as inert ingredients of toxicological concerns to humans or the environment.

The contents of the triclopyr formulations are listed below:

Forestry Garlon® 4 Herbicide

Triclopyr (BEE)	61.6 %
Inert	38.4 %

Garlon ® 3A Herbicide

Triclopyr (TEA)	44.4 %
Inert	55.6 %

Garlon® 4 Herbicide

Triclopyr (BEE)	61.6 %
Inert	38.4 %

Pathfinder® II Herbicide

Triclopyr (BEE)	13.6 %
Inert	86.4 %

RESIDUE ANALYTICAL METHODS: EPA Method 632.

II. HERBICIDE USES

REGISTERED FORESTRY, RANGELAND AND RIGHT-OF-WAY USES: Triclopyr is registered for use in non-crop sites for selective control of woody plants and weeds. For terrestrial use only.

OPERATIONAL DETAILS:

TARGET PLANTS: Triclopyr is used to control woody plants and weeds.

MODE OF ACTION: Triclopyr is absorbed by the leaves, bark, and roots, disturbing plant growth.

METHOD OF APPLICATION AND RATES: Aerial (helicopter only) and ground broadcast, spot, and localized applications at 0.2 to 2.5 lbs./acre.

SPECIAL PRECAUTIONS:

TIMING OF APPLICATION: Apply foliar treatment anytime plant is growing. Bark treatments can be applied any time. Dormant stem applications are made when the plant is dormant.

DRIFT CONTROL: Care should be exercised not to overspray or apply the herbicide to adjacent non-target areas. Drift control is achieved by observing weather conditions and following label and sprayer instructions. Spray droplet size should be 150 microns or larger.

RESTRICTIONS/WARNINGS/LIMITATIONS: Do not apply through any type of irrigation system. Non-target plant advisory. Grazing, haying, and slaughter restrictions (see individual labels).

III. ENVIRONMENTAL EFFECTS/FATE

SOIL:

RESIDUAL SOIL ACTIVITY: The half-life of triclopyr (BEE) and (TEA) is 46 days.

ADSORPTION: The K(oc) of triclopyr (BEE) is 780. The K(oc) of triclopyr (TEA) is 20.

PERSISTENCE AND AGENTS OF DEGRADATION: Triclopyr (BEE) and (TEA) are moderately persistent in the plant and soils. The primary route of degradation is microbial activity.

METABOLITES/DEGRADATION PRODUCTS AND POTENTIAL ENVIRONMENTAL EFFECTS: Breakdown products are found in very low concentrations and should be relatively non-toxic.

WATER:

SOLUBILITY: Triclopyr (BEE) 23 mg/l in water (pH 7 at 25° C). Triclopyr (TEA) 2,100,000 mg/l in water (pH 7 at 25° C).

POTENTIAL FOR LEACHING INTO SURFACE AND GROUND WATER: Triclopyr (BEE) has a low potential to leach into groundwater and a moderate potential for surface water runoff. Triclopyr (TEA) has a very high potential to leach into groundwater and a low potential for surface water runoff.

AIR:

VOLATILIZATION: Not determined.

POTENTIAL FOR BYPRODUCTS FROM BURNING OF TREATED VEGETATION: Not known.

IV. ECOLOGICAL TOXICITY EFFECTS ON NON-TARGET SPECIES

FOR TRICLOPYR (BEE)

MICROORGANISMS:

ACUTE CONTACT TOXICITY*:* LD_{50} (honey bee contact) >100 µg/bee

OVERALL TOXICITY: Practically Non-Toxic

PLANTS: Contact will injure or kill target and non-target plants.

AQUATIC VERTEBRATES:

ACUTE TOXICITY*:* LC_{50} (rainbow trout 96-hour) 0.65 mg/l

ACUTE TOXICITY: LC_{50} (bluegill sunfish 96-hour) 0.36 mg/l

ACUTE TOXICITY: LC_{50} (coho salmon 96-hour) 0.45 mg/l

OVERALL TOXICITY: Highly Toxic

AQUATIC FRESHWATER INVERTEBRATES:

ACUTE TOXICITY*:* LC_{50} (*Daphnia magna* 48-hour) 1.7 mg/l

OVERALL TOXICITY: Moderately Toxic

AQUATIC ESTUARINE/MARINE INVERTEBRATES:

ACUTE TOXICITY*:* EC_{50} (grass shrimp 96-hour) 1.7 mg/l

ACUTE TOXICITY*:* EC_{50} (eastern oyster 96-hour) 0.32 mg/l

ACUTE TOXICITY*:* EC_{50} (tidewater silverside 96-hour) 0.45 mg/l

OVERALL TOXICITY: Highly Toxic

TERRESTRIAL ANIMALS:

AVIAN ACUTE ORAL TOXICITY*:* LD_{50} (bobwhite quail) 8490 mg/kg

AVIAN SUBACUTE DIETARY TOXICITY: LC_{50} (bobwhite quail) >5000 mg/kg

AVIAN SUBACUTE DIETARY TOXICITY: LC_{50} (mallard duck) >5000 mg/kg

MAMMAL ACUTE ORAL TOXICITY: LD_{50} (rat) 644 mg/kg

OVERALL TOXICITY: Practically Non-Toxic

BIOACCUMULATION POTENTIAL: Little Potential

THREATENED AND ENDANGERED SPECIES: Federally listed terrestrial and aquatic plants, invertebrates and vertebrates may be adversely affected if the product is applied directly to the plants or animals, or indirectly, as the result of drift or leaching.

FOR TRICLOPYR (TEA)

MICROORGANISMS:

ACUTE CONTACT TOXICITY*:* LD_{50} (honey bee contact) >100 ug/bee

OVERALL TOXICITY: Practically Non-Toxic

PLANTS: Contact will injure or kill target and non-target plants.

AQUATIC VERTEBRATES:

ACUTE TOXICITY*:* LC_{50} (rainbow trout 96-hour) 240 mg/l

ACUTE TOXICITY: LC_{50} (bluegill sunfish 96-hour) 471 mg/l

OVERALL TOXICITY: Practically Non-Toxic

AQUATIC FRESHWATER INVERTEBRATES:

ACUTE TOXICITY*:* LC_{50} (*Daphnia magna* 48-hour) 1496 mg/l

OVERALL TOXICITY: Practically Non-Toxic

AQUATIC ESTUARINE/MARINE INVERTEBRATES:

ACUTE TOXICITY*:* EC_{50} (grass shrimp 96-hour) 58 mg/l

ACUTE TOXICITY*:* EC_{50} (fiddler crab 96-hour) >1000 mg/l

ACUTE TOXICITY*:* EC_{50} (eastern oyster 96-hour) >56 mg/l

OVERALL TOXICITY: Slightly Toxic

TERRESTRIAL ANIMALS:

AVIAN ACUTE ORAL TOXICITY*:* LD_{50} (mallard duck) 2055 mg/kg

AVIAN SUBACUTE DIETARY TOXICITY: LC_{50} (bobwhite quail) 11,622 mg/kg

AVIAN SUBACUTE DIETARY TOXICITY: LC_{50} (mallard duck) >10,000 mg/kg

MAMMAL ACUTE ORAL TOXICITY: LD_{50} (rat) 644 mg/kg

OVERALL TOXICITY: Slightly Toxic

BIOACCUMULATION POTENTIAL: Little Potential

THREATENED AND ENDANGERED SPECIES: Federally listed terrestrial and aquatic plants may be adversely affected if the product is applied directly to the plants, or indirectly as the result of drift or leaching.

V. TOXICOLOGICAL DATA

FOR TRICLOPYR (BEE)

ACUTE TOXICITY:

ACUTE ORAL TOXICITY*:* LD_{50} (rat) 803 mg/kg

ACUTE DERMAL TOXICITY: LD_{50} (rabbit) >2000 mg/kg

PRIMARY SKIN IRRITATION: Rabbit - Non-Irritant

PRIMARY EYE IRRITATION: Rabbit – Slight Irritant

ACUTE INHALATION: LC_{50} (rat) >4.8 mg/l

OVERALL TOXICITY: Category III – Slightly Toxic

CHRONIC TOXICITY:

CARCINOGENICITY: EPA Group D - Not classifiable as a human carcinogen.

DEVELOPMENTAL/REPRODUCTIVE: Positive for adverse developmental and reproductive effects.

MUTAGENICITY: No adverse effects.

HAZARD: The end-use product labels for the triclopyr (BEE) formulations carry the *Caution* signal word due to potential eye, skin, ingestion, and inhalation hazards.

FOR TRICLOPYR (TEA)

ACUTE TOXICITY:

ACUTE ORAL TOXICITY*:* LD_{50} (rat) 1847 mg/kg

ACUTE DERMAL TOXICITY: LD_{50} (rabbit) >2000 mg/kg

PRIMARY SKIN IRRITATION: Rabbit - Non-Irritant

PRIMARY EYE IRRITATION: Rabbit – Corrosive

ACUTE INHALATION: LC_{50} (rat) >2.6 mg/l

OVERALL TOXICITY: Category I – Highly Toxic

CHRONIC TOXICITY:

CARCINOGENICITY: EPA Group D - Not classifiable as a human carcinogen.

DEVELOPMENTAL/REPRODUCTIVE: EPA Group D - Not classifiable as a human carcinogen.

MUTAGENICITY: No adverse effects.

HAZARD: The end-use product labels for the triclopyr (TEA) formulations carry the *Danger* signal word due to corrosive potential to the eye.

VI. HUMAN HEALTH EFFECTS

ACUTE TOXICITY (POISONING):

REPORTED EFFECTS: Eye irritation and skin irritation.

CHRONIC TOXICITY:

REPORTED EFFECTS: None reported.

POTENTIAL FOR ADVERSE HEALTH EFFECTS FROM CONTACTING OR CONSUMING TREATED VEGETATION, WATER OR ANIMALS: See effects reported under acute toxicity.

POTENTIAL FOR ADVERSE HEALTH EFFECTS FROM INERT INGREDIENTS CONTAINED IN THE FORMULATED PRODUCTS: None..

HEALTH EFFECTS OF EXPOSURE TO FORMULATED PRODUCTS: Triclopyr (TEA) is a severe eye irritant.

HEALTH EFFECTS ASSOCIATED WITH CONTAMINANTS: None reported.

HEALTH EFFECTS ASSOCIATED WITH OTHER FORMULATIONS: None reported.

VII. SAFETY PRECAUTIONS

SIGNAL WORD AND DEFINITION:

TRICLOPYR (BEE) - **CAUTION** – HARMFUL IF SWALLOWED, INHALED, OR ABSORBED THROUGH THE SKIN.

TRICLOPYR (TEA) - **DANGER** – CORROSIVE. CAUSES IRREVERSIBLE EYE DAMAGE. HARMFUL IF SWALLOWED, INHALED, OR ABSORBED THROUGH THE SKIN. PROLONGED OR REPEATED CONTACT WITH THIS HERBICIDE MAY CAUSE ALLERGIC SKIN REACTIONS

PROTECTIVE PRECAUTIONS FOR WORKERS: Applicators and other handlers must wear protective eyewear (TEA only), and, long-sleeved shirt and long pants, shoes and socks.

MEDICAL TREATMENT PROCEDURES (ANTIDOTES):

EYES: Flush eyes with water for 15 minutes. Call physician.

SKIN: Wash all exposed areas with soap and water; call physician if irritation persists.

INGESTION: Call physician. Do not induce vomiting.

INHALATION: Remove to fresh air. Call a physician if breathing difficulty persists.

HANDLING, STORAGE AND DISPOSAL: Store at room temperature or cooler. Do not reuse container. Rinse container and dispose accordingly.

EMERGENCY SPILL PROCEDURES AND HAZARDS: Contain and sweep up material of small spills and dispose as waste. Do not contaminate water, food or feed by storage or disposal.

VIII. DEFINITIONS

adsorption – the process of attaching to a surface

avian – of, or related to, birds

CAEPA – California Environmental Protection Agency

carcinogenicity – ability to cause cancer

CHEMTREC – Chemical Transportation Emergency Center

dermal – of, or related to, the skin

EC_{50} - median effective concentration during a bioassay

ecotoxicological – related to the effects of environmental toxicants on populations of organisms originating, being produced, growing or living naturally in a particular region or environment

FIFRA – Federal Insecticide, Fungicide and Rodenticide Act

formulation – the form in which the pesticide is supplied by the manufacturer for use

half-life – the time required for half the amount of a substance to be reduced by natural processes

herbicide – a substance used to destroy plants or to slow down their growth

Hg – chemical symbol for mercury

IARC – International Agency for Research on Cancer

K(oc) – the tendency of a chemical to be adsorbed by soil, expressed as: K(oc) = conc. adsorbed/conc. dissolved/% organic carbon in soil

LC_{50} – the concentration in air, water, or food that will kill approximately 50% of the subjects
LD_{50} – the dose that will kill approximately 50% of the subjects
leach – to dissolve out by the action of water
mg/kg – weight ratio expressed as milligrams per kilogram
mg/l – weight-to-liquid ratio expressed as milligrams per liter
microorganisms – living things too small to be seen without a microscope
mPa – milli-Pascal (unit of pressure)
mutagenicity – ability to cause genetic changes
NFPA – National Fire Protection Association
NIOSH - National Institute for Occupational Safety and Health
NOEL - no observable effect level
non-target – animals or plants other than the ones that the pesticide is intended to kill or control
OSHA - Occupational Safety and Health Administration
Pa – Pascal (unit of pressure)
persistence – tendency of a pesticide to remain to remain in the environment after it is applied
pesticides – substances including herbicides, insecticides, rodenticides, fumigants, repellents, growth regulators, etc., regulated under FIFRA
PPE – personal protective equipment
ppm – weight ratio expressed as parts per million
residual activity – the remaining amount of activity as a pesticide
T&E – Threatened and Endangered Species (from the Endangered Species Act)
µg – micrograms
volatility – the tendency to become a vapor at standard temperatures and pressures

IX. INFORMATION SOURCES

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X. TOXICITY CATEGORY TABLES

TABLE I: HUMAN HAZARDS

Category	Signal Word	Route of Administration			Hazard	
		Acute Oral LD_{50} (mg/kg)	Acute Dermal LD_{50} (mg/kg)	Acute Inhalation LC_{50} (mg/l)	Eye irritation	Skin irritation
I (Highly Toxic)	**DANGER (poison)**	0–50	0-200	0-0.2	corrosive: corneal opacity not reversible within 7 days	corrosive
II (Moderately Toxic)	**WARNING**	>50–500	>200-2000	>0.2-2	corneal opacity reversible within 7 days; irritation persisting for 7 days	severe irritation at 72 hours
III (Slightly Toxic)	**CAUTION**	>500-5000	>2000-20.000	>2-20	no corneal opacity; irritation reversible within 7 days	moderate irritation at 72 hours
IV (Practically Non-toxic)	**NONE**	>5000	>20,000	>20	no irritation	moderate irritation at 72 hours

After *Pesticide User's Guide*, Ohio State University, Extension Bull. No. 745, 1998.

TABLE II: ECOTOXICOLOGICAL RISKS TO WILDLIFE (TERRESTRIAL AND AQUATIC)

Risk Category	Mammals Acute Oral LD_{50} mg/kg)	Avian Acute Oral LD_{50} (mg/kg)	Avian Acute Dietary LC_{50} (mg/kg)	Fish or Aquatic Invertebrates Acute Concentration LC_{50} (mg/l)
Very Highly Toxic	<10	<10	<50	<0.1
Highly Toxic	10-50	10-50	50-500	0.1 – 1
Moderately Toxic	51-500	51-500	501-1,000	>1 – 10
Slightly Toxic	501-2,000	501-2,000	1,001-5,000	>10 – 100
Practically Non-toxic	>2,000	>2,000	>5,000	>100

Table II created from information contained in *Pesticides and Wildlife*, Whitford, Fred, et al., Purdue University Cooperative Extension Service PPP-30, 1998.

Disclaimers and Other Legal Information:

Mention of a trademark, vendor, technique, or proprietary product does not imply or constitute an endorsement of the product by the United States Department of Energy - Bonneville Power Administration (USDOE-BPA), its employees, and its contractors, and does not imply or endorse any product to the exclusion of others. In all cases, the user is required by law to follow all pesticide label instructions and restrictions.

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Trinexapac-ethyl

HERBICIDE FACT SHEET

U.S. DEPARTMENT OF ENERGY
BONNEVILLE POWER ADMINISTRATION

This fact sheet is one of a series issued by the Bonneville Power Administration for their workers and the general public. It provides information on forest and land management uses, environmental and human health effects, and safety precautions. A list of definitions is included in Section VIII of this fact sheet.

I. BASIC INFORMATION

COMMON NAME: trinexapac-ethyl

CHEMICAL NAME: 4-(cyclopropyl-a-hydroxymethylene)-3,5-dioxo-cyclohexanecarboxylic acid ethylester

CAS No. 95266-40-3

CHEMICAL TYPE*:* Cyclopropyl Derivative of Cyclohexenone

PESTICIDE CLASSIFICATION*:* Plant Growth Retardant

REGISTERED USE STATUS*:* "General Use."

FORMULATIONS: Commercial herbicide products generally contain one or more ingredients. An inert ingredient is anything added to the product other than an active ingredient. Because of concern for human health and the environment, EPA announced its policy on toxic inert ingredients in the Federal Register on April 22, 1987 (52FR13305). This policy focuses on the regulation of inert ingredients. EPA's strategy for implementing this policy included the development of four lists of inerts, based on toxicological concerns. Inerts of toxicological concern were placed on List 1. Potentially toxic inerts/high priority for testing were placed on List 2. Inerts of unknown toxicity were placed on List 3, and inerts of minimal concern were placed on List 4.

The inert ingredients of the trinexapac-ethyl formulations are not classified by the USEPA as inert ingredients of toxicological concerns to humans or the environment.

The contents of the two trinexapac-ethyl formulations are listed below:

Primo WSB®	Trinexapac-ethyl	25%
	Inert	75%
Primo Liquid®	Trinexapac-ethyl	12%
	Inert	88%

RESIDUE ANALYTICAL METHODS: Information not available.

II. HERBICIDE USES

REGISTERED FORESTRY, RANGELAND AND RIGHT-OF-WAY USES*:* Registered as a growth retardant for grasses.

OPERATIONAL DETAILS:

TARGET PLANTS: Trinexapac-ethyl is used to regulate the growth of many types of grasses.

MODE OF ACTION: Foliar uptake reduces cell growth.

METHOD OF APPLICATION: Low-pressure sprayers at various application rates (see label). Do not apply through any type of irrigation system.

SPECIAL PRECAUTIONS:

TIMING OF APPLICATION: Various (see label), however, as trinexapac-ethyl is a foliar growth retardant, it must be applied to emerged plants to be effective.

DRIFT CONTROL: Trinexapac-ethyl is applied mixed with water/surfactant. Care should be exercised not to overspray or apply the herbicide to adjacent non-target areas.

RESTRICTIONS/WARNINGS/LIMITATIONS: Do not apply through any type of irrigation system. Do not graze area or feed forage after application.

III. ENVIRONMENTAL EFFECTS/FATE

SOIL:

RESIDUAL SOIL ACTIVITY: Information not available.

ADSORPTION: Information not available.

PERSISTENCE AND AGENTS OF DEGRADATION: Information not available.

METABOLITES/DEGRADATION PRODUCTS AND POTENTIAL ENVIRONMENTAL EFFECTS: Information not available.

WATER:

SOLUBILITY: 2.11 mg/l at 20° C.

POTENTIAL FOR LEACHING INTO SURFACE AND GROUND WATER: Information not available.

AIR:

VOLATILIZATION: 0.003 Pa at 20° C.

POTENTIAL FOR BYPRODUCTS FROM BURNING OF TREATED VEGETATION: Information not available; however, Primo Liquid® is a NFPA Class IIIA combustible liquid.

IV. ECOLOGICAL TOXICITY EFFECTS ON NON-TARGET SPECIES

MICROORGANISMS:

ACUTE CONTACT TOXICITY*:* LD_{50} (honey bee contact) >100 µg/bee

OVERALL TOXICITY: Practically Non-Toxic

PLANTS: Contact will injure or kill target and non-target plants.

AQUATIC VERTEBRATES:

ACUTE TOXICITY*:* LC_{50} (rainbow trout 96-hour) 68 mg/l

ACUTE TOXICITY: LC_{50} (bluegill sunfish 96-hour) >130 mg/l

OVERALL TOXICITY: Slightly Toxic

AQUATIC FRESHWATER INVERTEBRATES:

ACUTE TOXICITY*:* EC_{50} (*Daphnia magna* 48-hour) 142.5 mg/l

OVERALL TOXICITY: Practically Non-Toxic

AQUATIC ESTUARINE/MARINE INVERTEBRATES:

ACUTE TOXICITY*:* EC_{50} (grass shrimp 96-hour) No information.

ACUTE TOXICITY*:* EC_{50} (eastern oyster 96-hour) No information.

OVERALL TOXICITY:

TERRESTRIAL ANIMALS:

AVIAN ACUTE ORAL TOXICITY*:* LD_{50} (mallard duck) >2000 mg/kg

AVIAN ACUTE ORAL TOXICITY*:* LD_{50} (bobwhite quail) >2250 mg/kg

AVIAN SUBACUTE DIETARY TOXICITY: LC_{50} (bobwhite quail) >5620 mg/kg

AVIAN SUBACUTE DIETARY TOXICITY: LC_{50} (mallard duck) >5200 mg/kg

MAMMAL ACUTE ORAL TOXICITY: LD_{50} (rat) >5000 mg/kg

OVERALL TOXICITY: Practically Non-Toxic

BIOACCUMULATION POTENTIAL: Little Potential

THREATENED AND ENDANGERED SPECIES: Federally listed terrestrial and aquatic plants may be adversely affected if the product is applied directly to the plants, or indirectly as the result of drift or leaching.

V. TOXICOLOGICAL DATA

ACUTE TOXICITY:

ACUTE ORAL TOXICITY: LD_{50} (rat) >5050 mg/kg

ACUTE DERMAL TOXICITY: LD_{50} (rabbit) >2020 mg/kg

PRIMARY IRRITATION SCORE: Slight

PRIMARY EYE IRRITATION: Moderate

ACUTE INHALATION: LC_{50} (rat) >2.7 mg/l

OVERALL TOXICITY: Category III – Caution – Slightly Toxic (dry formulations)

OVERALL TOXICITY: Category II – Warning – Moderately Toxic (liquid formulations)

CHRONIC TOXICITY:

CARCINOGENICITY: Increase in stomach tumors in male mice at 2000-ppm dose rate.

DEVELOPMENTAL: None observed.

REPRODUCTIVE: None observed.

MUTAGENICITY: None observed.

HAZARD: Based on the results of animal studies, trinexapac-ethyl may cause an increase in carcinogenicity. Tests on dogs show liver, kidney and brain effects (unspecified) at >5000 ppm doses.

VI. HUMAN HEALTH EFFECTS

ACUTE TOXICITY (POISONING):

REPORTED EFFECTS: None reported.

CHRONIC TOXICITY:

REPORTED EFFECTS: None reported.

POTENTIAL FOR ADVERSE HEALTH EFFECTS FROM CONTACTING OR CONSUMING TREATED VEGETATION, WATER OR ANIMALS: None reported.

POTENTIAL FOR ADVERSE HEALTH EFFECTS FROM INERT INGREDIENTS CONTAINED IN THE FORMULATED PRODUCTS: Slight eye irritation caused by clay binding agents.

HEALTH EFFECTS OF EXPOSURE TO FORMULATED PRODUCTS: There have been no reported effects on workers manufacturing the products.

HEALTH EFFECTS ASSOCIATED WITH CONTAMINANTS: None reported.

HEALTH EFFECTS ASSOCIATED WITH OTHER FORMULATIONS: None reported.

HEALTH RISK MANAGEMENT PROCEDURES: See Section VII.

VII. SAFETY PRECAUTIONS

SIGNAL WORD AND DEFINITION:

Dry formulations

TRINEXAPAC-ETHYL - **CAUTION** – HARMFUL IF ABSORBED THROUGH THE SKIN OR INHALED. CAUSES MODERATE EYE IRRITATION. AVOID CONTACT WITH EYES, SKIN OR CLOTHING AND BREATHING DUST OR SPRAY MIST.

Liquid formulations

TRINEXAPAC-ETHYL - **WARNING** – CAUSES EYE IRRITATION. DO NOT GET IN EYES. HARMFUL IF SWALLOWED, INHALED, OR ABSORBED THROUGH SKIN. AVOID CONTACT WITH SKIN OR CLOTHING. AVOID BREATHING VAPOR OR SPRAY MIST.

PROTECTIVE PRECAUTIONS FOR WORKERS: Use safety glasses. Use impervious gloves when prolonged or frequently repeated contact could occur. In enclosed spaces, use NIOSH-approved dust respirator. Long sleeve shirt, long pants, shoes and socks are recommended. Do not enter treated areas without shoes until sprays have dried.

MEDICAL TREATMENT PROCEDURES (ANTIDOTES):

EYES: Flush eyes with water; call physician if irritation develops.

SKIN: Wash all exposed areas with soap and water. Wash all contaminated clothing prior to reuse. Call a physician if irritation develops.

INGESTION: Give large quantity of water and induce vomiting. Call a physician or Poison Control Center. Administer activated charcoal (6-8 teaspoons) with a large amount of water. Immediately transport to a medical care facility.

INHALATION: Move to fresh air. Provide artificial respiration if necessary. Call physician if breathing difficulty continues.

HANDLING, STORAGE AND DISPOSAL: Keep dry and store away from food, feed or other material to be used or consumed by humans or animals. Do not contaminate water. Dispose of only in accordance with local, state and federal regulations. Primo Liquid® is a NFPA Class IIIA combustible liquid.

EMERGENCY SPILL PROCEDURES AND HAZARDS: Contain and sweep up material of small spills and dispose as waste. Large spills should be reported to CHEMTREC (800-424-9300) for assistance. Prevent runoff. Do not contaminate water, food or feed by storage or disposal.

VIII. DEFINITIONS

adsorption – the process of attaching to a surface

avian – of, or related to, birds

CAEPA – California Environmental Protection Agency

carcinogenicity – ability to cause cancer

CHEMTREC – Chemical Transportation Emergency Center

dermal – of, or related to, the skin

EC_{50} - median effective concentration during a bioassay

ecotoxicological – related to the effects of environmental toxicants on populations of organisms originating, being produced, growing or living naturally in a particular region or environment

FIFRA – Federal Insecticide, Fungicide and Rodenticide Act

formulation – the form in which the pesticide is supplied by the manufacturer for use

half-life – the time required for half the amount of a substance to be reduced by natural processes

herbicide – a substance used to destroy plants or to slow down their growth

Hg – chemical symbol for mercury

IARC – International Agency for Research on Cancer

K(oc) – the tendency of a chemical to be adsorbed by soil, expressed as: K(oc) = conc. adsorbed/conc. dissolved/% organic carbon in soil

LC_{50} – the concentration in air, water, or food that will kill approximately 50% of the subjects

LD_{50} – the dose that will kill approximately 50% of the subjects

leach – to dissolve out by the action of water

mg/kg – weight ratio expressed as milligrams per kilogram

mg/l – weight-to-liquid ratio expressed as milligrams per liter

microorganisms – living things too small to be seen without a microscope

mPa – milli-Pascal (unit of pressure)

mutagenicity – ability to cause genetic changes

NFPA – National Fire Protection Association

NIOSH - National Institute for Occupational Safety and Health

NOEL - no observable effect level

non-target – animals or plants other than the ones that the pesticide is intended to kill or control

OSHA - Occupational Safety and Health Administration

Pa – Pascal (unit of pressure)

persistence – tendency of a pesticide to remain to remain in the environment after it is applied

pesticides – substances including herbicides, insecticides, rodenticides, fumigants, repellents, growth regulators, etc., regulated under FIFRA

PPE – personal protective equipment

ppm – weight ratio expressed as parts per million

residual activity – the remaining amount of activity as a pesticide

T&E – Threatened and Endangered Species (from the Endangered Species Act)

µg – micrograms

volatility – the tendency to become a vapor at standard temperatures and pressures

IX. INFORMATION SOURCES

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X. TOXICITY CATEGORY TABLES

TABLE I: HUMAN HAZARDS

Category	Signal Word	Route of Administration			Hazard	
		Acute Oral LD_{50} (mg/kg)	Acute Dermal LD_{50} (mg/kg)	Acute Inhalation LC_{50} (mg/l)	Eye irritation	Skin irritation
I (Highly Toxic)	**DANGER (poison)**	0–50	0-200	0-0.2	corrosive: corneal opacity not reversible within 7 days	corrosive
II (Moderately Toxic)	**WARNING**	>50–500	>200-2000	>0.2-2	corneal opacity reversible within 7 days; irritation persisting for 7 days	severe irritation at 72 hours
III (Slightly Toxic)	**CAUTION**	>500-5000	>2000-20.000	>2-20	no corneal opacity; irritation reversible within 7 days	moderate irritation at 72 hours
IV (Practically Non-toxic)	**NONE**	>5000	>20,000	>20	no irritation	moderate irritation at 72 hours

After *Pesticide User's Guide*, Ohio State University, Extension Bull. No. 745, 1998.

TABLE II: ECOTOXICOLOGICAL RISKS TO WILDLIFE (TERRESTRIAL AND AQUATIC)

Risk Category	Mammals (Acute Oral LD_{50} mg/kg)	Avian (Acute Oral LD_{50} mg/kg)	Avian LC_{50} (mg/kg)	Fish or Aquatic Invertebrates LC_{50} (mg/l)
Very Highly Toxic	<10	<10	<50	<0.1
Highly Toxic	10-50	10-50	50-500	0.1 – 1
Moderately Toxic	51-500	51-500	501-1,000	>1 – 10
Slightly Toxic	501-2,000	501-2,000	1,001-5,000	>10 – 100
Practically Non-toxic	>2,000	>2,000	>5,000	>100

Table II created from information contained in *Pesticides and Wildlife*, Whitford, Fred, et al., Purdue University Cooperative Extension Service PPP-30, 1998.

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