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

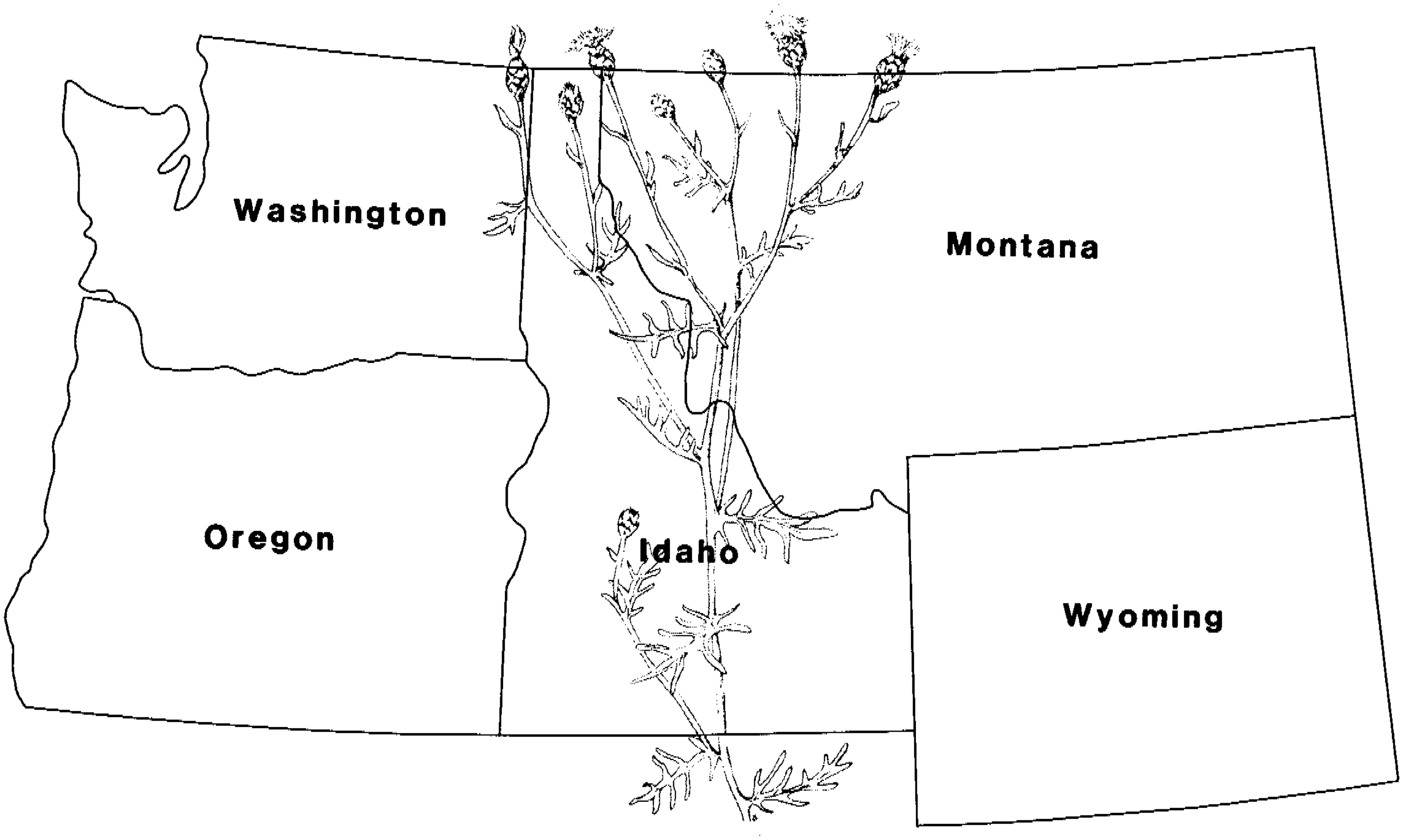
Final

Oregon State Office

March 1987

Supplement to the Northwest Area Noxious Weed Control Program

Final Environmental Impact Statement



United States Department of the Interior

BUREAU OF LAND MANAGEMENT

OREGON STATE OFFICE
P.O. Box 2965 (825 NE Multnomah Street)
Portland, Oregon 97208

IN REPLY
REFER TO:

Enclosed for your review is the Final Supplement to the Environmental Impact Statement (FSEIS) for noxious weed control in five northwestern states--Idaho, Montana, Oregon, Washington, and Wyoming.

The FSEIS was prepared to provide more discussion on possible impacts to the human environment from the chemical treatment portion of the program. The reader should keep in mind that the FSEIS is not a decision document. BLM will prepare Records of Decision as a follow-up to the Final Supplement. Records of Decision will be prepared and issued on or after April 27, 1987.

All of the documents listed in the References Cited section of the FSEIS are on file and may be reviewed during office hours (7:30 a.m. - 4:15 p.m.) at the BLM Oregon State Office (Lloyd Center Tower, 16th floor, 825 NE Multnomah Street, Portland, Oregon). Please call Philip Hamilton (503-231-6256) for an appointment to review any of this material. Copies of material without copyright protection may be acquired at standard copying fees of $0.25 per page.

Please send your comments on the FSEIS to

Oregon State Director
Bureau of Land Management (935)
P.O. Box 2965
Portland, Oregon 97208

Thank you for your interest in the management of public lands. We look forward to your comments.

Sincerely,

Charles W. Luscher

Charles W. Luscher
State Director, Oregon and Washington

Final

Supplement to the Northwest Area Noxious Weed Control Program

Final Environmental Impact Statement

Prepared by

U.S. Department of the Interior
Bureau of Land Management
March 1987

State Director, Oregon and Washington

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Preface

Authorities and Background

The Bureau of Land Management (BLM) has the statutory duty to control and eradicate noxious weeds on public lands. Section 302(b) of the Federal Land Policy and Management Act of 1976 directs BLM to "take any action necessary to prevent unnecessary or undue degradation of the [public] lands" 43 U.S.C. 1782(b)(1982).

Supplementing this mandate in Section 2(b)(2) of the Public Rangelands Improvement Act of 1978, Congress declared as policy that BLM will "manage, maintain and improve the condition of the public rangelands so that they become as productive as feasible...." 43 U.S.C. 1901(b)(2).

Expanding the Federal Government's commitment to control and eradicate noxious weeds, Congress stated in Section 2 of the Federal Noxious Weed Act of 1974, "the growth and spread of weeds...interfere with navigation, cause disease, or have other adverse effects upon man or his environment..." 7 U.S.C. 2801 (1982). Moreover, the Carlson-Foley Act of 1968 directed BLM "to permit the commissioner of agriculture or other proper agency head of any state in which there is in effect a program for the control of noxious plants to enter upon any lands under [the federal agency's] control or jurisdiction and destroy noxious plants growing on such land..."

Noxious weeds have become thoroughly established on public lands administered by BLM in Idaho, Montana, Oregon, Washington, and Wyoming. Fourteen weed species have been mandated for control and, where possible, eradication. These 14 weeds are commonly known as Canada thistle, hoary cress (white top), leafy spurge, Russian knapweed, spotted knapweed, diffuse knapweed, dalmatian toadflax, common toadflax, common tansy, tansy ragwort, Dyers woad, yellow starthistle, musk thistle, and Scotch thistle. Also in the northwest United States are 33 other noxious, troublesome, or poisonous plants on BLM public lands.

Noxious weeds reduce and eliminate desirable vegetation from public lands by competing with native plants for water, sunlight, and soil nutrients. The secondary effects of this competition include lower soil quality, increased erosion, and reduced livestock and wildlife yields through the presence of less desirable forage.

Noxious weeds also result in less efficient use of both public and private lands and incur costs. Governmental agencies and private landowners must spend money to control and eradicate the undesired plants. Noxious weeds decrease public and private property values. Lands infested by noxious weeds cost more to manage, and noxious weeds may limit crop choices.

On April 8, 1986, BLM announced a program for controlling noxious weeds infesting public lands it administered in Idaho, Montana, Oregon, Washington and Wyoming. The program involved the integrated use of four methods to control noxious weeds: biological, chemical, manual, and mechanical. BLM had evaluated the program in its *Final Northwest Area Noxious Weed Control Program Environmental Impact Statement* (FEIS) (December 1985).

On June 26, 1986, the Department of the Interior announced that it was suspending the earlier decision's provisions to use chemicals to control noxious weeds on public lands in the Northwest. The announcement also stated that chemicals would not be used until the FEIS's discussion on the subject was supplemented and a new record of decision issued. This document provides the requisite supplementation.

This FSEIS discusses the environmental consequences of BLM's proposal to resume chemical treatment of noxious weeds in conjunction with the other methods decided upon in April 1986. BLM's intended use of chemicals is nearly identical to the proposal described in the FEIS's Alternative 1–Proposed Action.

To assist the reader in understanding the environmental consequences of BLM's proposal to resume chemical treatment, a summary of the proposal follows. The following is only a summary of the FEIS's provisions governing the proposed use of chemicals. For a complete description of the Proposed Action's intended use of chemicals and its mitigative design features, see the FEIS, Chapter 1 and Appendix I, and all BLM policies and manual sections referenced in that document.

The Proposed Action is to resume using six herbicide formulations to control noxious weeds: Banvel, Rodeo, Tordon 22K, Tordon 2K, Esteron 99 and DMA-4. These herbicides contain different active ingredients designed to kill or retard the growth of noxious weeds. Banvel's active ingredient is dicamba, Rodeo's is glyphosate, Tordon 22K's and Tordon 2K's is picloram, and Esteron 99's and DMA-4's is 2,4-D. Each of the herbicides may also contain emulsifiers, solvents, preservatives, anti-volatility agents, and other substances commonly referred to as inerts.

The proposal to use the six herbicides is somewhat limited in scope. BLM plans to use them on less than half the estimated acres of public lands to be treated annually for noxious weed control. The proposal assumes that an estimated 21,243 acres of public lands infested with noxious weeds would be subject to chemical treatment annually. Three means of application are proposed. The BLM projects that herbicides would be applied aerially on 5,900 acres annually, by ground vehicle on 13,665 acres annually, and by hand on 1,678 acres annually. The maximum amount of each herbicide's active ingredient to be applied aerially, by ground vehicle, or by hand is shown in the FEIS's Table 1-3. Chapter 1 of the FEIS details the typical chemical treatment of an area by each means of application and the governing restrictions.

BLM also proposes a set of priorities governing when to eradicate or control noxious weeds and how best to do so. See the Text Revisions section of this FSEIS. Generally, herbicides are proposed for use if they are more effective than other available means. The proposal also includes requirements for pretreatment surveying of public lands identified for treatment to assure that environmental degradation is minimized. See the Text Revisions section.

Finally, BLM previously has looked at three alternatives to the Proposed Action in the FEIS. The first alternative is to forgo applying herbicides aerially. The second is to forgo using all herbicides, relying instead on biological, manual, and mechanical methods. The third alternative is to forgo using all methods controlling noxious weeds. The FEIS describes and analyzes the three alternatives.

Issues

The public raised several concerns in its comment letters on the *Final Northwest Area Noxious Weed Control Program Environmental Impact Statement* (FEIS) and later responses to the Department of the Interior's motion of partial dissolution of the injunction (Civil No. 83-6272-E). In addition, new data relating to human health has increased the need to supplement the FEIS arising from BLM's proposal for managing public lands infested with or threatened by invading noxious weeds.

The issue of most controversy then and now concerns the appropriateness of using herbicides containing dicamba, glyphosate, picloram, and 2,4-D to control or eradicate noxious weeds. The following questions were manifold: What are the short- and long-term effects of these herbicides on human health? What are the worst-case effects on human health of exposure to these herbicides? Will the herbicides drift to nontarget species? Will the herbicides injure or destroy nontarget species in amounts that harm wildlife? What are direct and indirect effects to wildlife from being exposed to herbicides? What are the effects of the herbicides on ground water, streams, and soils? What is the persistence of herbicides in the environment? The issue was also raised that the inert ingredients of the chemicals may be of toxicological concern.

In this FSEIS, BLM has endeavored to fully consider and address the important questions raised by the public. Changes made include the following: replacing some studies concerning human health that were judged to be invalid; further analyzing the impacts on the environment from the use of dicamba, glyphosate, picloram, and 2,4-D to control or eradicate noxious weeds; improving the technical explanation of procedures, and introducing new test data that has been obtained since publication of the FEIS.

BLM has focused its attention on the environmental consequences that might arise from using herbicides containing as their active ingredients dicamba, glyphosate, picloram, or 2,4-D. This document also draws attention to the outstanding question of whether the inert ingredients in the herbicides proposed for use are of environmental concern.

Requirements for Further Environmental Analysis

Funding will determine how many acres infested or threatened with noxious weeds would be treated in any year. Assuming that adequate funding exists, BLM would treat an estimated annual average of 44,414 acres using all control methods. The BLM state directors in the Northwest would decide through consensus, the specific acreage to be treated in each state. BLM state and district offices that would treat noxious weeds would decide where, when, and how to treat them.

The FEIS and this supplement constitute a regional programmatic statement for controlling noxious weeds on BLM-administered lands in Idaho, Montana, Oregon, Washington, and Wyoming and is intended to guide this program for the next 15 years. Site-specific environmental analysis and documentation (including application of categorical exclusions where appropriate) will be accomplished at the state or district level on proposed weed control plans. During site-specific analysis and documentation, BLM will invite the public to participate in accordance with the CEQ regulations for implementing the National Environmental Policy Act. Interdisciplinary impact analyses will be based upon this and other related EISs, such as EISs for resource management plans, timber management plans, and grazing management plans.

Chapter 3 *Supplement*

Environmental Consequences of Chemical Treatment

Chapter 3 supplements the FEIS by providing more discussion on possible impacts to the natural and human environment from the use of chemicals in noxious weed control.

Impacts on Air Quality

Chemicals may move through the air either from spray drift or from volatization. The movement of chemical particles through the air is of concern if they remain there for an appreciable time and in detectible levels significant enough to pose undue and unnecessary hazards. This concern, however, is not expected to manifest itself under the proposed action.

Spray drift is commonly defined as the movement of airborne spray particles from the target area. The amount of a chemical's spray drift largely depends upon the size of the droplets and the wind speed. Liquid spray droplets most prone to drift are ordinarily smaller than 100 microns in diameter (Klingman and Ashton 1982). The spray equipment to be used under the Proposed Action will be calibrated to produce liquid spray droplets twice that size, thereby reducing the possibility of spray drift. When herbicides are applied aerially in a 5 mph wind, the spray that will drift 100 feet downwind is less than 1 percent of the concentration found on the target area (USDI, BLM 1983). Aerial spraying will be prohibited when wind speeds exceed 5 mph.

The reports and studies on the spray drift of the active ingredients of the herbicides proposed for use by BLM are relatively meager, with the exception of 2,4-D. Research shows that 2,4-D's potential for spray drift depends on the formulation. Two researchers at Washington State University have observed that under certain meteorological conditions, highly volatile formulations of 2,4-D have the potential to drift for long distances (Robinson and Fox 1978). A study of 2,4-D butyl ester also arrived at a similar conclusion (Maybank et al 1978).

In contrast, when inspecting many areas within 100 feet of Oregon and Washington transmission power line rights-of-way sprayed with 2,4-D low volatile ester formulations and nonvolatile amine formulations, Norris (1983b) found little or no herbicide effects of offsite drift on nontarget vegetation. He concluded, therefore, that spray did not drift to a major degree. And in two field operations in the Northwest, only 1 of 36 air monitors attached to ground observers (who were used to represent anyone who might be in the area of the spray operation) collected a detectable level of similar 2,4-D formulations in the "breathing zone" of a site where the chemical was applied from a helicopter. The detectable level (0.05ug) was considered negligible in relation to any possible human health hazard (Lavy and others 1981).

In estimating 2,4-D amine salt and ester drift and vapor loss in the field, Grover (1972, as cited in Hartley and Graham-Bryce 1980) could not detect amine spray droplets for more than 3 minutes after application. He detected the ester for up to 30 minutes after application. Grover suggested that the ester transport resulted from vapor loss rather than from the drift of the droplets.

Given the nature of the two 2,4-D formulations proposed for use and the results of the above-mentioned studies, little or no spray drift is likely. The herbicide DMA-4 contains a dimethylamine salt of 2,4-D. As Grover has stated, formulations of this type will remain in the air for a negligible time. Esteron 99 contains a low volatile isooctyl ester of 2,4-D. As Norris (1983b), Lavy and others (1981), and Grover (1972, as cited in Hartley and Graham-Bryce 1980) have observed, these types of formulations, when they drift, pose a negligible risk. In focusing on other formulations of 2,4-D, the other studies do not apply to the Proposed Action.

The reports on the spray drift from herbicides containing picloram are less certain. EPA (1985b) acknowledged that it could not determine if nontarget plants are being damaged by picloram's drift and that the damage might result from other factors, including applicator error, misuse, leaching, runoff, or persistence.

In examining areas treated with herbicides containing picloram, however, Norris (1983b) observed little or no herbicide effects of offsite drift on nontarget vegetation. He concluded, therefore, that spray drift largely did not occur.

Because provisions governing the application of all herbicides, including dicamba, are designed to produce large spray droplets and to avoid climate conditions that might cause drift, spray drift is not expected to be notably different regardless of the herbicide used. As to glyphosate, this is largely irrelevant because the proposed action prohibits it being aerially applied.

Volatility is the tendency of a chemical to vaporize or give off fumes. The amount of vapor emitted or fumes given off is directly related to the chemical's vapor pressure.

The volatility of 2,4-D has received much attention. The amine and sodium salts of 2,4-D have little or no volatility hazard, while the ester formulations vary from low to high volatility, depending on the vapor pressure (Klingman and Ashton 1982). Norris (1983b) reported that 2,4-D esters may volatilize, but only briefly because the ester hydrolizes to nonvolatile forms within a few hours or days after application. Grover (1972, as cited in Hartley and Graham-Bryce 1980) also noted that ester vapors were detected up to at least 30 minutes after certain types of 2,4-D were applied. Because both DMA-4 and Esteron 99 contain 2,4-D formulations with low vapor pressures, the reports' findings suggest little or no hazard to the air from volatility.

Norris (1983b) stated that glyphosate and picloram are unlikely to volatize because they have a low vapor pressure. The Weed Science Society of America (1983) also reported loss from volatilization to be negligible. Dicamba may volatize from soil surfaces, but because it is less volatile than most 2,4-D formulations, it is also expected to pose little hazard of volatility.

In addition, because most project areas are extremely small, widely scattered, and far from urban centers, overall effects on local or regional air quality are unlikely from the spray drift or volatility of herbicides proposed for use by BLM.

Impacts on Soils

Removal of solid stands of noxious weeds by chemical treatment may result in short-term insignificant increases in surface erosion,which would be mitigated as vegetation reoccupies the treated site.

The behavior of a chemical substance in soil is determined by several properties relating both to the chemical and to the soil environment. Two of the more important properties are persistence and mobility. Persistence refers to the length of time a herbicide remains active in the soils. Persistence is important in one sense because for some herbicides, such as picloram beads, it influences the length of time that weed control can be expected. Persistence is also important because, if a herbicide is present in the soil in high enough quantities, its residual toxicity can have unintended after-effects that may injure succeeding plants for a period of time after application. Mobility refers to the ability of a herbicide to move within the soil profile. Mobility is important because if a herbicide is present in the soil in high enough quantities and moves throughout the profile, its residual toxicity can have unintended after effects that may injure plants.

Many factors affect a herbicide's persistence and mobility in the soils. To aid the reader in understanding the two properties under consideration, the factors are briefly outlined. Soils contain a number of microorganisms that use all types of organic matter, including herbicides, for energy and growth. If a herbicide reaches the soil, these microorganisms immediately attack it. The rate at which microorganisms decompose a herbicide in the soil depends on their type and quantity, which is determined by soil factors such as soil temperature, moisture content, aeration, and the amount of organic matter. This process of microorganisms attacking herbicides is known as microbial decomposition. A related process is known as chemical decomposition. Different soils contain different chemicals that may interact with a herbicide to either destroy it or activate it.

Colloid refers to the microscopic inorganic and organic particles in the soils. These particles have unusual adsorptive, glue-like capacities. Observations in research work shows that soils high in organic matter and clay content have a tendency to hold herbicides for a longer time than sandy soils, which are more porous and allow things to move more readily through them. In contrast, leaching refers to the movement of a substance by water through the soil. The movement of a herbicide by leaching may determine its effectiveness or selectivity, or may account for its leaving the soil. The degree to which a herbicide may leach depends upon its adsorptive relationship with the soil, its solubility in water, and the amount of water passing through the soil. Volatility may also affect soils. Some herbicides that are highly volatile

Table 3-1 Behavior of Herbicides in Soils

Ingredient/Common Name	Behavior in Soil
2,4-D/Esteron 99 and DMA-4	Degradability in soil depends on microbial activity but is fast in organic and moist soils. Persistence is short, and mobility is relatively high.
Dicamba/Banvel	Moderately persistent, does not adsorb readily to soil particles, and is highly mobile. Mainly lost from soil by microbial decomposition.
Glyphosate/Rodeo	Strongly adsorbed by soil. Adsorption is higher with organic soils and lowest in sandy soils. Decomposed rapidly and completely by microorganisms.
Picloram/Tordon 22K and 2K	Highly stable in plants, can be leached, relatively nonvolatile. Moderately to highly persistent in soil. Relatively mobile. Degradation results from sunlight and microbial action.

may move into porous soils as a gas. Finally, some herbicides may decompose if exposed to light, whereas others may not be susceptible to it. The process is known as photodecomposition.

The behavior in the soil environment of herbicides proposed for use is summarized in Table 3-1 and discussed below.

The soil and its surface make up an extremely dynamic biological system that provides processes by which herbicides can be destroyed, thus preventing accumulation and redistribution. The mobility of herbicides in soil depends on solubility, adsorption, and persistence. Degradation is usually biological, but chemical and light degradation also have a role.

The persistence of herbicide formulations containing 2,4-D has been studied in a variety of soil types and under a wide range of environmental and laboratory conditions. 2,4-D persists only briefly in most soils, generally less than 1 month (Ashton 1982). Norris (1983a) found the half-life of 2,4-D in soil to be 1 to 4 weeks with little potential for bioaccumulation. In general, 2,4-D is relatively mobile in soil compared with other herbicides. 2,4-D thus moves more readily through the soil profile, especially if a soil is low in organic matter. This mobility is less in soils higher in organic matter, such as those in northern Idaho, western Montana, and western Oregon (Ghassemi and others 1981). Microbial degradation (see Glossary) is the major mechanism by which 2,4-D is lost from the soil, especially under warm moist conditions with high soil organic matter—conditions that stimulate the growth of microorganisms. Only minor losses of 2,4-D activity occur due to photodecomposition and, for most formulations, due to volatilization.

The fate of formulations containing picloram in soil is determined by several factors, including volatilization, photodecomposition, adsorption and leaching, runoff, and chemical and microbial degradation. Volatilization is not considered a major determinant of environmental fate because of the low vapor pressure of picloram. Picloram is degraded by natural sunlight and ultraviolet light, although the extent of photodecomposition under field conditions has not been measured. It is generally considered to be a mobile herbicide because its adsorption to soil particles is low. Picloram's mobility is governed by net water flow and the amount of organic matter, with mobility being less in soils high in organic matter.

Preliminary studies with various soil types found that picloram is usually confined to the upper 1 foot of the soil profile when application rates are low (less than 1 pound/acre) but that picloram can readily move to depths greater than 3 feet, even in relatively dry areas, when the application rate is high (3 to 9 pounds/acre) (NRCC 1974). BLM application rates will not exceed 1 pound/acre.

The persistence of picloram in soils is considered to be moderate to high and is related to both treatment rate and climate. The half-life of the compound has been reported to range from more than 4 years in arid regions to 1 month under highly favorable conditions of moisture, temperature, and organic content of the soil (NRCC 1974). Mitchell (1969) indicated that picloram residues may occasionally damage arable crops. NRCC (1974) stated that picloram is relatively persistent in soil, particularly under dry, cold Canadian conditions.

On the other hand, two studies of picloram persistence in arid and semiarid soils suggest that application rates not exceeding 1 pound/acre/year significantly reduce the potential for accumulation in the soil. Scifres and others (1971) reported that studies on semiarid rangeland in northwest Texas found dissipation of 0.25 pound/acre of picloram from the soil profile within a year and usually within 90 days under warm, dry conditions. Residues usually were restricted to the top 12 inches, at least for 60 days. Five ppb or less were detected below 12 inches, 120 to 180 days after application. NRCC (1974) also states that at low rates of application, picloram rarely moves downward beyond the top 30 cm of the profile, especially in semi-arid regions.

Vore and Alley (1982) reported that studies on different soil types in Wyoming showed that the highest concentration of picloram was in the top 8 inches of soil.

At applications of 1 pound/acre, concentrations ranged from 0.991 to 0.062 ppm after 117 days. As a comparison, the acceptable picloram tolerance level for forage grasses is 80 ppm (40 CFR 180.29). Picloram application rates will not exceed 1 pound/acre/year to reduce the potential for accumulation in arid soils of the EIS area.

Bovey and Scifres (1971) reported that picloram was not detected in a Texas soil after 1 year regardless of application rate or sampling depth. They also mentioned that 2 pounds of picloram per acre disappeared from the top 2 feet of soil at 6 and 12 weeks after treatment, respectively.

Dicamba has a moderate (3 to 12 months) persistence in soil compared to other herbicides (Ashton 1982). Dicamba does not adsorb readily to soil particles and colloids (see Glossary) and thus has a high degree of mobility in most soils. The major route for loss of dicamba in soil appears to be microbial degradation rather than chemical degradation or photodecomposition.

Glyphosate is rapidly and strongly adsorbed to soil particles and accounts for its observed lack of mobility, its tendency not to leach in soil, and its unavailability for root uptake. Adsorption to soil is believed to be through the phosphonic acid component. The phosphate level in the soil influences the amount of glyphosate adsorbed, and glyphosate adsorption is greater in soils with high concentrations of trivalent metals such as aluminum and iron, rather than high concentrations of sodium and calcium (Dost 1983).

Dissipation of glyphosate in soil is fairly rapid (half-life of about 2 months) and results mainly from microbial degradation. The main soil metabolite of glyphosate is aminomethylphosphonic acid (AMPA), which itself is also highly biodegradable. (USDA, FS 1984).

An estimated annual total of only 147 acres (out of approximately 51.5 million acres of public land in the EIS area), made up of small, widely dispersed blocks, will be treated with glyphosate under the proposed program.

Since the persistence of 2,4-D and glyphosate in most soils is short (Ashton 1982; USDA, FS 1984), and they break down rapidly and completely in most soils, they will not be present in sufficient amounts or long enough to reduce the productivity potential of those soils. There has been at least one study that suggests glyphosate may effect soil productivity for a period of time after application in soils containing more than 80 percent sand (Eberbach, 1983). However, the average sand content of rangeland soils in the EIS area is closer to 30 percent, which is far below this figure. Considering the low application rates, number of applications (primarily only once a year), and physical characteristics of the soils in the EIS area, glyphosate application should not substantially affect soil productivity under the proposed program.

Dicamba, because it is mobile and persists longer than glyphosate or 2,4-D in most soils, will have more of a possibility for effecting soil productivity. The possibility, though, is lessened by the low application rates, number of applications proposed (primarily only once a year), and physical characteristics of the soils in the EIS area.

Some of the literature reviewed (Mitchell 1969; NRCC 1974) indicates the persistance of picloram in some soils may detrimentally affect residual plant growth for a period of time. However, other literature strongly suggests that at BLM's proposed low rate of application, soil quality and productivity potential should not be substantially affected.

Impacts on Water Resources

Chemical treatment would have varying impacts on water resources from the introduction of herbicides into the water. The degree of impact would depend on the size of the treated area, closeness to water, existing water quality, and type of treatment.

Impacts on Surface Water

The likelihood of a herbicide entering surface water depends upon the herbicide's persistence and mobility (see Glossary). Herbicides would most likely enter streams through drift. Some herbicides could also enter streams in surface runoff or through erosion of previously treated soils.

Where large streamflows occur, as in western Oregon and Washington, herbicides entering streams are heavily diluted so that little if any herbicide is detected.

In arid or semiarid areas, the normal streamflow is low or ephemeral. Where streamflow results from thunderstorms, surface runoff may flush herbicide residuals into streams in detectable levels. Amounts would depend on the length of time since spraying in which microbial action has been degrading the herbicide. The longer the interval, the less chance of residuals being present.

A study with 2,4-D applied for brush control on hill pastures in southern Oregon (Norris and others 1982) found that during 7 months following application, 4 to 5 grams of 2,4-D were discharged into streams, representing 0.014 percent of the total amount applied. They concluded that most of the herbicide discharged into streams in this study were deposited in dry stream channels or streambanks.

Frank and Sirons (1980) reported an analysis of 949 samples from 11 agricultural watersheds in Ontario, Canada, in which 66 samples (7 percent) had 2,4-D residues ranging from 0.1 to 320 parts per billion (ppb). The two highest residues, 320 and 15.9 ppb, involved sample collections during the applying of 2,4-D to ditches and streambanks.

Ghassemi and others (1981) have determined that 2,4-D may remain stable for many months in cool, nutrient-poor, natural surface waters. This time would decrease as more microorganisms become present to biodegrade the 2,4-D. 2,4-D photodecomposes, but photodecomposition is not considered a major mechanism for removal of 2,4-D from water. Studies have shown that

2,4-D does not adsorb readily to particles and sediment in water (USDA, FS 1984) and that the maximum residues of 2,4-D in aquatic environments, when found, are in the parts-per-billion rather than parts-per-million range (Ghassemi and others 1981).

From 1977 to 1982, BLM collected water samples from aerial application of 2,4-D in western Oregon, analyzing 337 samples but finding only 69 testing positive for 2,4-D residue. All of the positive samples contained less than 30 ppb (USDI, BLM 1983), less than the 1976 EPA water quality criteria recommended limit of 100 ppb for drinking water. These sites were sprayed aerially on relatively steep forest land, whereas the proposed treatment areas consist mainly of rangeland, which generally has gentler slopes. Approximately 2,200 acres are proposed for aerial application of 2,4-D.

On the basis of the previously cited studies on the environmental fate of 2,4-D in the environment and with the use of such design features (listed in the FEIS) as buffer strips, wind restrictions, temperature restrictions, and pretreatment surveys to highlight potential problems and derive solutions, the use of 2,4-D is not expected to have any significant adverse impact to surface water.

Ghassemi and others (1981) reviewed the persistence and fate of dicamba in aquatic systems. Because dicamba salts are highly water soluble and rapidly enter the soil, sufficient residues are unlikely to remain for transport via precipitation runoff into nearby water bodies. Frank and Sirons (1980) found dicamba residues (0.7 ppb) in only 1 of 949 stream samples after dicamba was applied to watershed soils.

Norris and Montgomery (1975) sampled a stream following treatment of 165.5 acres of a total 602.7-acre forest watershed in the Pacific Northwest sprayed aerially with dicamba at a rate of 1 pound/acre. Samples taken where the stream flowed out of the watershed contained dicamba residues within 2 hours after the start of spraying. These residues rose to a high of 37 ppb at 5.2 hours and then dropped to background levels (less than 1 ppb) 37.5 hours after the start of spraying. The authors attributed these residues to drift and to direct application of dicamba to water surfaces.

In sampling water and bottom sediments in an area of intense agricultural use of dicamba, Butler (1980) found residues in only 2 of 57 water samples with a maximum concentration of 0.01 ppb. Residues were detected in 5 out of 55 bottom samples with a maximum concentration of 2.6 ppb.

These studies show that dicamba generally enters the soil rapidly and is not available for transport into surface waters. The studies also show that when dicamba enters surface waters through drift or direct application, it dilutes or disperses to an undectable concentration in a relatively short time. With the use of buffer strips and controls on allowable wind speed for aerial application of herbicides, dicamba has little chance of reaching surface water in measurable amounts.

Because of its mobility, picloram may be carried by surface runoff to nontarget areas, including streams and ponds. Runoff, however, removes less than 3 percent of the total picloram applied to soil, and the concentration of picloram in runoff generally decreases with time as well as with the time between application and the first rainfall (Trichell and others 1968 in National Research Council of Canada 1974). Other factors that decrease the concentration of picloram in runoff include decreases in the slope of the terrain, the use of slow-release granular formulations rather than liquids, and the distance over which the runoff flows.

Aerial application of a mixture of picloram at 2.5 pounds active ingredient (ai) per acre and 2,4-D at 5 pounds ai/acre resulted in detectable levels of picloram in runoff for 30.5 months from a semiarid watershed in Arizona (Johnsen 1980). The highest concentration of picloram detected was 320 ppb in the first storm after treatment. Of the total picloram applied, 1.1 percent eventually left the area in runoff.

Butler (1980) sampled stream water and bottom sediments in an area of Wyoming where picloram was intensely used in agriculture and found residues in 19 of 57 water samples with a maximum concentration of 0.7 ppb.

BLM's water sampling conducted with the aerial application of picloram on forest land in western Oregon from 1977 to 1982 found residues in 2 out of 21 samples collected. Concentrations were less than 10 ppb in both positive samples (USDI, BLM 1983).

An average annual acreage of 3,700 acres would be treated aerially with formulations containing picloram. Treatment areas would be widely dispersed and generally smaller than 100 acres. The maximum proposed picloram application rate and use of the required design features would prevent formulations containing picloram from entering the surface water in significant amounts. All of the determined toxic levels of picloram to plants and animals are shown in parts per million (ppm), but the studies showing picloram in surface water have detected it at parts-per-billion levels. The use of picloram is not expected to have significant adverse effects on surface water quality.

Glyphosate has a low tendency to run off because it strongly adsorbs to both organic and mineral matter and is subject to biodegradation in natural waters, mainly by microorganisms. Glyphosate has been found to have a half-life of from 7 to 10 weeks in natural surface water (USDA, FS 1984).

The strong adsorbtion of glyphosate to soil particles greatly reduces its mobility through leaching and surface washout. Rueppel and others (1977) tested the mobility of glyphosate in three different soils by means of soil thin-layer plates spotted with radiolabelled glyphosate. These plates were washed twice with water, and the final distribution of radiolabelled glyphosate was determined by beta camera analysis after each washing. On all three soils tested, even after the second washing, glyphosate moved only a short distance, indicating that it is an immobile herbicide.

Comes and others (1976) investigated the leaching of residues from irrigation canal banks treated with glyphosate in the Yakima Valley of Washington. They detected neither glyphosate nor its metabolite, aminomethyl phosphonic acid, in the first flow of water through canals that had been dry for 23 weeks after glyphosate had been sprayed on the ditch banks at a rate of 5 pounds/acre.

Annually, an average of 147 acres are proposed for treatment with herbicide formulation containing glyphosate, of which 42 acres would be treated by hand and the rest treated with a vehicle-mounted hand gun. Little potential exists for drift, and therefore the herbicide will be almost entirely bound up immediately in the treated vegetation or by soil particles. The insignificant amount of glyphosate that might enter the water would quickly come into contact with water-borne sediment or organic matter and bind to the medium. The use of glyphosate is not expected to significantly affect surface water quality.

The proposed application of herbicides would involve relatively small, widely dispersed areas whose sizes would rarely exceed 100 acres and most would be smaller than 10 acres. Aerial spraying at the upper reaches of a watershed often does not attempt to exclude ephemeral stream channels, which range from a couple of feet to several yards wide. In these channels, one of two situations usually apply to preclude the flushing of herbicides downstream in amounts likely to cause impacts: (1) enough rain falls to induce runoff but not enough for the streamflow to reach the next order stream, or (2) if the streamflow is great enough to reach the next order stream, enough water flows to dilute the herbicide. Larger ephemeral stream channels, typically near or in valley bottoms, would be protected by restrictions similar to those that apply to other areas such as riparian zones or wetlands.

With the use of buffer strips and restrictions on equipment, windspeed, and application rates, significant impacts to surface water quality are unlikely to occur from the normal use of herbicides. In herbicide spraying operations that have not applied these restrictions, the amount of herbicide entering the water has been in the parts-per-billion range and not in the parts-per-million range that appears to be the level for most adverse effects. Since most treatments would be applied not more than one time per year, little potential exists for herbicides to accumulate in harmful amounts.

Alternative 1 is expected to have slight or nonexistent cumulative effects on water quality. With the design features proposed, such as buffer strips, restrictions on allowable wind speed for spraying, restrictions on air temperatures, and others, little or no herbicide is expected to enter the water, and any herbicides entering the water would be dispersed and degraded before the next application with little or no chance of accumulation.

In Wyoming, the U.S. Geological Survey, in cooperation with the Wyoming Department of Agriculture, conducted a study (Butler 1980) to assess herbicide impacts on water quality. They selected an area of intensive herbicide use along rivers and found that only 13 of the 55 bottom-material samples contained detectable levels of herbicides. The highest concentration was 8.0 mg/kg of 2,4-D. The report concluded, "...the herbicide concentrations in Wyoming streams in areas of intense herbicide use do not seem to be significant" (Butler 1980).

In most instances, treatment areas on BLM-administered lands are small and dispersed and do not undergo intense herbicide use. If areas of intense herbicide use along rivers show little or no detectable levels of herbicides, then BLM spray operations, which are dispersed, normally small, and require buffer strips, are not expected to contribute to long-term measurable levels.

Impacts on Ground Water

The likelihood of a herbicide entering ground water depends on its ability to move vertically through the soil profile. Its ability to move depends on factors such as its ability to adsorb to soil particles, its solubility in water, and its time period of existence. Physical factors such as soil type, organic content, soil porosity, and available soil water are also important for herbicide movement potential. A highly mobile herbicide is readily soluble in water, has a low ability to attach itself to soil particles, and persists for several months. Since picloram, dicamba, and 2,4-D are mobile herbicides under the above criteria, the potential exists for detectable traces to enter the ground water. Glyphosate readily attaches itself to soil particles and is considered to be a relatively nonmobile herbicide. (See Soil Impacts section and Appendix K in the FEIS for more herbicide characteristics.)

The degradability of picloram, 2,4-D, and dicamba highly depends on the presence of microbes in the soil and water. Microbes abound in areas of high precipitation, as in western Oregon, and in areas of high ground water retention such as flood plains and wetlands. Microbes are less abundant in the semiarid environment of much of the BLM-administered grazing land.

The drier grazing land has fewer microbes to degrade herbicides but also has deeper aquifers and less rainfall to leach herbicides into the soil profile. The potential for herbicides to percolate depends on several factors, such as soil type, organic content, porosity, available soil water, and chemical composition of the soil. Studies have shown that herbicides applied at the proper rates do not concentrate residues below the first foot of the soil profile. Existing information reveals that herbicides are rarely leached below the top 10 inches of soil found on the proposed treatment areas (Ghassemi and others 1981; USDA, FS 1984).

BLM does not know of any existing studies in the EIS area that have analyzed ground water samples collected in conjunction with herbicide application on BLM land. Two known instances of ground water contamination in Montana and Wyoming have no relationship to BLM operations. In the Montana situation, Missoula County had a special area for washing and rinsing its herbicide applicator trucks. The resultant rinse water flowed into a

Table 3-2 Terrestrial Plant Susceptibility to Picloram, Dicamba, and 2,4-D[1]

	Susceptibility[2]		
	Picloram	Dicamba	2,4-D Ester
Douglas-Fir (*Pseudotsuga menziesii*)	SI	S	I-R
Lodgepole Pine (*Pinus contorta*)	MS	-	-
Spruce (*Picea spp.*)	I	I-R	I-R
Juniper (*Juniperus spp.*)	MS-S	S-I	R
Willow (*Salix spp.*)	S	S-I	S
Cottonwood (*Populus spp.*)	S	S	S-I
Alder (*Alnus spp.*)	S	S	S-I
Quaking Aspen (*Populus tremuloides*)	S	S	S-I
Big Sagebrush (*Artemisia tridentata*)	R	S	S-I[5]
Fringed Sagebrush (*Artemisia frigida*)	S	S[3]	S
True Mountain Mahogany (*Cercocarpus montanus*)	S	S[3]	I
Rubber Rabbitbrush (*Chrysothamnus nauseousus*)	S	S-I[4]	S
Black Greasewood (*Sarcobatus vermiculatus*)	S	S	S
Serviceberry (*Amelanchier spp.*)	-	-	S-I
Shrubby Cinquefoil (*Potentilla fruticosa*)	MS-S[4]	S[3]	S-I[4]
Antelope Bitterbrush (*Purshia tridentata*)	S[3]	S[3]	S[3]
Snowberry (*Symplocarpus occidentalis*)	MS	S[3]	S-I
Lupine (*Lupinus spp.*)	S[3]	S[3]	S-I
Geranium (*Geranium spp.*)	S	S	S-I
Clover (*Trifolium spp.*)	S	-	S
Alfalfa (*Medicogo sativa*)	S	S[3]	S[3]
Indian Ricegrass (*Oryzopsis hymenoides*)	R[3]	R[3]	R
Bluegrass (*Poa spp.*)	R	R[3]	R
Thickspike Wheatgrass (*Agropyron dasystachym*)	R[3]	R[3]	R[4]
Western Wheatgrass (*Agropyron smithii*)	R[3]	R[3]	R[4]
Idaho Fescue (*Festuca idahoensis*)	R[3]	R[3]	R[4]
Spike Fescue (*Festuca kingii*)	R[3]	R[3]	R[4]

[1]Taken from USDI, BLM 1982, this table is a compilation of data from the following sources: Dow Chemical Co. 1979; Klingman 1961; Bovey 1977; Alley 1978.

[2]R-resistant, MS-moderately susceptible, S-susceptible, I-severely injured or partially controlled by 1 lb/acre or less of 2,4-D. S-I - Control of plant falls between the susceptible and intermediate class.

[3]Source: Alley 1978

[4]Studies by the authors shown above found the susceptibilty of different species within a given genus. Generally members within the same genus respond similarly to the same herbicide.

[5]The ester formulations are effective on big sagebrush, but the amine formulations little affect this species.

depression that served as a recharge area for the local ground water aquifer, from which water was used for drinking. This practice has been discontinued.

The incident in Wyoming resulted from Tordon beads being applied on frozen ground on a steep slope directly above an irrigation canal. The overland flow flushed the pellets into the canal, which flowed across a sandstone formation, and half of the flow was lost to the ground water aquifer. The pellets at that time used borate as the carrier, whereas such pellets are now made with a more soluble ammonium sulfate carrier. This application was made by a private party on his own land.

In contrast, two EPA-funded studies in the EIS area have looked at ground water in relation to farmland use of herbicides and do provide a basis for drawing some inferences. One study (Bruck 1986) was conducted in the vegetable-producing farmland around Ontario, Oregon. These fields were intensely irrigated, had high water tables, and annually received relatively high amounts of herbicides. Of the 13 pesticides tested, only one of the four chemicals analyzed in this EIS (2,4-D) was included. The report includes only the analysis results for Dacthal, which was detected at a maximum level of 290 ppb. EPA established a health advisory of 500 ppb for dacthal. Dacthal is not approved for application on rangeland and would not be used by BLM. Through personal communication with Bruck on January 14, 1987, it was learned that no detectable amounts of 2,4-D were found in the study sample analysis.

The other study (Montana Dept. of Agriculture 1984) was conducted in three areas of Montana where farm crops—potatoes, grains, hay—were grown. Selected were sites that had "the greatest potential for ground water contamination in Montana." With this direction, the "Field investigators selected sites with permeable soils, high water tables, irrigation, and a history of pesticide use." The maximum level of 2,4-D detected was 0.00039 ppm, and the maximum level of dicamba was 0.00074 ppm.

Both of these studies were conducted in situations unlike those at sites to be treated on BLM land. The sites on BLM land would not be irrigated, would normally not have a high water table, and would not receive a high annual rate of herbicide aplication over a relative long period.

From the two previously mentioned EPA studies of herbicide application on irrigated farmland in the EIS area (which have detected levels below any suggested limits or EPA water quality criteria), one can assume that 2,4-D and dicamba, with the required design features (listed in the FEIS), would not adversely affect ground water on BLM-administered land. These design features might include buffer strips on areas with high water tables, or timing herbicide application during the drier period of the year.

Along streams and wetlands, ground water is often close to the surface. Depending on the hydraulic head of the aquifer, these areas can be gaining or losing water. If they are losing water to the aquifer, a potential exists for herbicides that are flushed into these areas from over surface flow to be introduced into the ground water. As addressed in the surface water section, studies have shown the concentration of herbicides in surface flow to be in parts-per-billion, and with the further dilution from entering into the stream or wetland, the concentration would be even lower. Streams and wetlands are normally high in micro-organisms, the main agents for biodegradation of herbicides.

If herbicides do enter the ground water, they might persist for relatively long periods. Colder water temperatures and lack of microbiological activity would slow the action needed to degrade the herbicides. Ground water pumping could purge the acquifer in some cases, but it is a slow and expensive process.

BLM has found no studies dealing strictly with herbicide application on rangeland and its effect on ground water in the semiarid EIS area. On the basis of studies conducted on farmland in the EIS area, some conclusions can be reached. These studies have shown that detectable levels of 2,4-D and dicamba reached the ground water but under conditions favorable for movement of them into the ground water. Picloram was not included in the studies, but under identical favorable conditions, it is assumed that picloram may also be detectable in the ground water. Notable among these conditions are the following: heavy to intense irrigation, permeable soils, high water tables, and heavy use of herbicides. Most of these conditions, however, are not present on BLM land proposed for noxious weeds spraying.

Most of the BLM herbicide applications will occur on small, widely dispersed areas, and with low application rates. Using studies showing that herbicides are rarely leached below the top 10 inches of soil, examining studies where heavy use of herbicides occurred on farmland with little detectable amounts in the ground water, and applying design features such as buffer strips and low application rates, BLM does not believe its Proposed Action would adversely affect ground water.

Impacts on Vegetation

Terrestrial vegetation is the environmental component that would be most affected by the proposed weed control program. Treatment of noxious weeds could affect both target and nontarget vegetation. The susceptibility of the noxious weeds to the proposed herbicides is summarized in Appendix E of the FEIS. Herbicide use may kill some nontarget vegetation. The adverse effects on nontarget plants would depend upon their susceptibility to the herbicide, residual effects of the herbicide, the rate of application, and the number of herbicide applications over the 15-year period of treatment.

Alternative 1 would have the greatest effect on noxious weeds (target vegetation) in the EIS area by providing the best possible total cooperative weed control effort. Alternative 2 would have a somewhat smaller impact than Alternative 1. The effectiveness of each herbicide on individual weed species is presented in Appendix E of the FEIS. Appendix E also shows the susceptibility of many nontarget plants to 2,4-D, dicamba, picloram, and glyphosate. Table 3-2 shows terrestrial plant susceptibility to picloram, dicamba, and 2,4-D. In general, the largest area of treatment will not exceed 100 acres at one site, and most often will be less than 10 acres. The publication *Relative Plant Susceptibility to Picloram* (Dow Chemical Company 1983) also shows the susceptibility of many nontarget plants to picloram.

Except for glyphosate, the proposed herbicides are selective, affecting broadleaf plants but not grasses. Glyphosate is a broad spectrum, nonselective herbicide that affects most perennial plants, annual and biennial grasses, sedges, and broadleaf plants. Under chemical techniques, some chemical residue may be left for varying periods, depending upon soil and climatic conditions.

Dicamba is phytotoxic to a variety of plants, including conifers. Plant susceptibility depends on differences in the distribution of dicamba within a plant and differences in the range of adsorption, translocation, and metabolism. 2,4-D is phytotoxic to many nontarget plants and is highly toxic to young pine seedlings. Impacts to nontarget species, however, would be localized and site-specific because of the few acres treated with herbicides and the methods of controlled application used. Dicamba and picloram would not be applied by broadcast methods where conifers grow but would be specifically applied to target species. Potential loss of nontarget species will be analyzed in site-specific environmental analyses prepared before any control measures are implemented.

Aerial application of herbicides, rather than ground application methods, presents the greater risks for effects on nontarget vegetation because of the broadcast application. (Note: glyphosate would not be aerially applied.)

Because chemical drift could injure or kill nontarget vegetation, herbicides would not be applied when weather conditions would defeat their effectiveness or when controlling the treatment would be a problem (Appendix I of the FEIS).

Impacts to off-site, nontarget species would be controlled by method of application and weather conditions at the time of application. Spray drift would be 1 percent or less of full concentration at 100 feet downwind, assuming a 5 mph wind during helicopter application. With ground vehicle application, off-site nontarget species should be much less affected.

Several incidents of damage to nontarget plants from picloram spray drift have been reported (see Appendix K), but the opportunity for spray drift of picloram would be much reduced because the granular form would be applied to 2,800 acres of the estimated 3,700 acres to be treated.

Table 3-2 presents the susceptibility of terrestrial vegetation to herbicidal active ingredients. Glyphosate, the least selective of the herbicides to be used under Alternatives 1 and 2, would result in the greatest loss of nontarget vegetation. An estimated 105 acres are proposed for glyphosate treatment by ground application, and 42 more acres are proposed for hand wiping of glyphosate to individual plants. Because these methods are more successful at exclusively treating target species than is nonspecific broadcast application, impacts to nontarget species should be slight. For dicamba, picloram, and 2,4-D, broadleaf plants would be the main nontarget group affected. Plants such as rabbitbrush, greasewood, mountain mahogany, sagebrush, willow, aspen, and many forbs in or near treatment sites could be weakened or destroyed.

The extent of any nontarget vegetation loss would depend on closeness of desirable species to treated weeds, method and rate of herbicide application, formulation of the herbicide, and herbicide used. Because herbicide application rates would be reduced in riparian areas, injury to nontarget plants in these areas would be minimized.

Most grasses resist applications of the expected use rates of picloram, dicamba, and 2,4-D. Grasses should become more abundant as plant competition is reduced after weed control is implemented.

The impacts of chemicals would be greatest under Alternative 1 and less under Alternative 2, since more non-target vegetation would be subjected to direct application of the herbicide due to the nondiscriminate nature of applying chemicals aerially.

Although some nontarget plants would be harmed in the immediate treatment area, only a relatively small area would be treated. Treatment areas have an average size of 5-10 acres and rarely exceed 100 acres. Only about 44,000 acres are proposed for all forms of weed control annually under the Proposed Action, and less than half of this area would be treated by chemical methods. BLM-administered land in the EIS area totals 51.5 million acres, whereas the area proposed for chemical treatment under the Proposed Action amounts to 0.87 percent of the total. In addition, only 147 acres would be treated annually by a nonselective herbicide (glyphosate), of which 42 acres would be treated by hand application to specific plants. No areas treated would be denuded of vegetation.

Potential loss of nontarget species will be analyzed in specific environmental analyses to be prepared before any control measures are implemented.

Impacts on Animals

Impacts on Livestock and Wild Horses

2,4-D is partially metabolized by the liver and rendered more polar, which later facilitates its excretion via the kidney (EPA Seattle, Region X comment letter dated January 12, 1987). Dicamba does not tend to accumulate in the bodies of animals, but is carried in the blood and digestive systems until animals excrete it from their bodies or it is metabolized to 3,6-dichloro-2-hydroxybenzoic acid (USDA, FS 1984). The same is true for glyphosate (Monsanto Company 1982) and picloram (Fisher and others 1965).

Most treatments under the proposed alternatives would be applied when livestock are not in treated pastures, but a few spot treatments could be applied at any time, regardless of the presence of livestock. Herbicide treatments would follow all label directions for livestock grazing and management (see Appendix O in the FEIS).

Studies of force-feeding of herbicides to cattle and sheep show some detectable levels of residue, but no study found livestock to be harmed by ingesting amounts of chemical equal to or less than the no observed effect level (NOEL) (USDA, FS 1984).

Levels of ingestion of forage treated with herbicides proposed for use under Alternatives 1 and 2 fall well below the NOEL, and thus livestock and wild horses would not be harmed.

Impacts on Wildlife and Fish

Chemical control of noxious weeds would improve selected habitat areas, cause the loss of some habitat diversity, destroy a few small animals, and temporarily displace a minimal number of large animals. The most important impact would be to improve habitat used as food and cover by removing undesirable vegetation. Projects that prevent further degradation of important habitat would benefit fish and wildlife over the long term (National Academy of Sciences 1968; Morris and Bedunah 1984).

The loss of habitat diversity would be localized and reduce some wildlife numbers for only a short period. Most short-term impacts would be low over the entire area because of the small areas treated (usually less than 100 acres and most often less than 10 acres) as compared to the land base that is spread over five states. Some chemical control treatments that remove too much nontarget vegetation on small, unique, or crucial habitat areas could harm selected wildlife populations. To prevent unacceptable adverse impacts to those sensitive wildlife populations, key habitat areas would be avoided. Site-specific plans would weigh the losses and gains of each project to ensure that wildlife and fish populations and habitat diversity would be maintained. Mitigation measures such as seasonal restrictions, partial treatment, buffer zones, or replanting would be used to minimize impacts to wildlife and fish. Few acute or chronic toxic impacts are expected to occur from chemical treatments.

Noxious weeds that invade small unique habitat areas or dominate wide expanses of important habitat areas are usually detrimental to wildlife and fish. Noxious weeds usually reduce habitat diversity or eliminate key plants used for food or cover by animals. Although noxious weeds provide some food or cover for a few wildlife species (goldfinches eat Canada thistle seeds, leafy spurge provides some ground cover for horned larks), most native communities have greater vegetation diversity and better forage and cover for wildlife and fish (Yoakum, 1979). In most cases, control of noxious weeds that degrade such wildlife habitat would actually be more of an overall benefit to wildlife and fish.

Native forbs and shrubs are usually susceptible to herbicide treatments, and the loss of these important food or cover plants could harm wildlife and fish on small or unique habitat areas (e.g., riparian, wet meadows, wetlands). Wildlife or fish species that are restricted to isolated habitat areas or that are not mobile are highly susceptible to large changes in their habitat. In the short term, these wildlife and fish could be harmed by major losses of nontarget vegetation.

A risk assessment for wildlife and fish was made to determine the potential impact to wildlife from the use of herbicides for BLM's weed control program. A summary of the risk assessment follows.

Wildlife risk is a function of the inherent toxicity (hazard) and the amount of the chemical (exposure) that animals may take in from the herbicides. Doses are determined by using a series of highly conservative, simplifying assumptions concerning spraying operations for likely (routine) dose estimates or highly unlikely (extreme dose estimates.

2,4-D is only moderately toxic to most wildlife species but is toxic to highly toxic to aquatic species. Some small mammals, amphibians, and reptiles may experience minor to moderate acute toxic effects (routine dose exceeds the EPA risk criterion of 1/5 the LD_{50}). Amphipods and aquatic snails are the most sensitive species. Exposure estimates for all terrestrial species are well below the LD_{50}. Adverse effects are unlikely to occur in aquatic animals from exposure to 2,4-D.

Glyphosate (Rodeo formulation) is generally of low toxicity for most wildlife species. LD_{50}'s for wildlife from glyphosate are well below the 1/5 LD_{50} criterion for routine and extreme doses. No adverse effects to aquatic species are expected. It is practically nontoxic to aquatic organisms.

Picloram is of low toxicity to most wildlife. Tordon 2K and Tordon 22K are slightly toxic to aquatic organisms. Bluegill are the most sensitive species tested. Doses for both routine and extreme cases are well below the 1/5 LD_{50} level for wildlife and domestic animals. No adverse effects to these animals are expected.

Dicamba is of low toxicity to most birds and mammals. It is slightly toxic to most aquatic organisms. Amphipods have the greatest sensitivity to dicamba. Exposures for most species are below the LD_{50}. Several species will be exposed to levels exceeding 1/5 LD_{50}. Some species, particularily small animals, could be harmed by exposure to dicamba. Aquatic species are not expected to be harmed by exposure to dicamba.

These herbicides are generally low to moderately toxic to terrestrial wildlife. Aquatic species are more sensitive to most of the herbicides. Dicamba and picloram are usually less toxic than 2,4-D and glyphosate. In routine cases, most animals are unlikely to be exposed to fatal doses of the herbicides. In extreme cases, individual animals could receive acute doses.

The order of risk to wildlife from proposed noxious weed control programs in decreasing order is dicamba, 2,4-D, glyphosate, and picloram. Risks depend on application rates, exposure rates, and inherent toxicity of the compounds. Use of lower rates for 2,4-D and dicamba could reduce the risk to wildlife.

A more thorough summary of impacts on wildlife and fish from exposure to 2,4-D, glyphosate, picloram, and dicamba may be found in the Wildlife Health Effects section of Appendix K.

Chronic (long-term) effects of herbicides on wildlife and fish are not expected. Fish and wildlife excrete herbicide residues, which tend not to be concentrated in body tissues (USDA, FS 1984).

Controlling exotic noxious plants and encouraging native plant growth would ensure future productivity and use of the land for livestock grazing and wildlife. Implementing the proposed weed control program, however, would cause a temporary loss of habitat diversity of treated sites, where treated vegetation serves as food and cover for wildlife.

In the short term, the loss of target and nontarget vegetation would cause temporary loss of food and cover for wildlife in the treatment areas. Over the long term, increased vegetation diversity of grasses and forbs would increase the productivity of the land for wildlife. Failure to control or limit the spread of such noxious weeds as knapweed and leafy spurge could reduce as much as 60 percent the long-term productivity of palatable native plants (Bucher 1984; Baker 1983).

Under Alternatives 1 and 2, habitat diversity would improve over the long term and benefit most animal species. A few wildlife and fish populations on isolated or small unique habitat areas could be temporarily harmed.

Impacts on Human Health

Introduction

The analysis of the potential human health effects of the use of chemical herbicides to control noxious weeds was accomplished using the methodology of risk assessment generally accepted by the scientific community. (The reader is referred to the Glossary for definition of scientific terms.) In essence, the risk assessment consists of comparing doses people may get from applying the herbicides (worker doses) or from being near an application site (public doses) with doses estimated to be safe based on animal laboratory studies.

The analysis in this SEIS is aimed at answering the following questions relating to the human health effects of BLM's noxious weed control program.

1. Will people die if they are exposed to the herbicides?

2. Will people experience toxic effects that are not fatal, such as appetite loss, changes in body weight, nausea, irritated eyes or skin, decreased enzyme levels, or kidney or liver damage, if they are exposed to the herbicides?

3. Will a woman's reproductive success, as indicated by either fertility, toxicity to a fetus, or the survival and weight of her offspring change if she is exposed to the herbicides?

4. Will a pregnant woman's embryo or developing fetus be malformed if she is exposed to the herbicides?

5. Will people develop cancer if they are exposed to the herbicides?

6. Will the genetic information in a person's reproductive cells be damaged, e.g., mutate, if he or she is exposed to the herbicides?

A number of problems contribute to the uncertainty in this process of judging risks to human health from laboratory animal studies. First, the estimated safe levels established in the laboratory are the result of tests on laboratory animals, particularly rats and mice, where dose levels produce no observed effects. To allow for the uncertainty in extrapolating from these no-observed-effect levels (NOEL's) in laboratory animals to safe levels for humans, additional safety factors are used. The generally accepted factors (Thomas 1986) are 10 for moving from animals to humans (between species variation) and another 10 to account for possible variation in human responses (within species variation). This 10 times 10 or 100-fold safety factor means the laboratory NOEL dose reduced one hundred fold would be considered a safe dose. In this risk assessment a margin-of-safety (MOS) has been calculated for each estimated dose by dividing the animal NOEL by the estimated dose. The computed MOS is then compared to the 100-fold safety factor to judge the risks of toxic effects.

A second area of uncertainty lies in comparing human doses received only once or over a period of less than a week to doses received by animals over a period of months or years. (All public and accidental doses are generally one-time events.) This risk assessment uses the MOS approach discussed above in comparing one-time human doses to lifetime animal doses in all of these cases even though this leads to an exaggeration of the risks.

A different approach is used to assess the risks to humans of chemicals that may cause cancer since they are assumed to have no comparable margin of safety so that there is some risk even at extremely low doses. In this case a cancer potency value, expressing the probability of developing tumors at increasing dose levels, is taken from lab animal studies and adjusted for the differences in body weight and lifetime duration between the lab animals and humans. This potency times an estimated human lifetime dose provides an estimate of human cancer risk.

A third area of uncertainty involves the estimation of the human doses liable to occur in herbicide use. This risk assessment has been designed to overestimate doses to err on the side of safety. All exposures were calculated on the basis of application rates 20 to 30 percent higher than actually proposed. In reality, workers are likely to receive some low level doses because they work with the chemicals routinely. However, standard safety practices and the use of protective clothing will normally reduce their actual dose levels far below those estimated in this analysis. The same is true of the doses from any spraying or spill accidents that might occur, since the normal procedure would be to wash immediately. In addition, no member of the public is likely to receive as high a dose as estimated in this risk assessment; again because normal safety practices, and the remoteness of most treated areas limit the possibility of the public receiving any dose at all. Furthermore, the public doses estimated here exaggerate the amount they could receive. No herbicide degradation is assumed to occur, the public is not assumed to wash themselves or their food items after a spraying, and they are assumed to consume water that has received herbicide from drift or a spill immediately after the event. Thus, the way in which exposures are estimated in this risk assessment and the way the risks are judged both tend to exaggerate the real risks, to err on the side of protecting human health.

Finally, attention must be drawn to the fact that the herbicides proposed for use, Banvel, Rodeo, Tordon 22K and Tordon 2K, and Esteron 99 and DMA-4, have not in themselves as formulated products been subject to extensive toxicological testing. Rather, the active or technical ingredients in each of those herbicides, respectively, dicamba, glyphosate, picloram and 2,4-D, are what have been in varying degrees tested. Each herbicide proposed for use, though, contains in its formulation other ingredients commonly known as inerts. EPA has recently expressed a general concern about the toxicity and risks of some inerts in some formulations of some herbicides. Accordingly, one segment of the public has offered the opinion that unless and until herbicides are evaluated as formulated products, taking into consideration their active and inert ingredients, no complete evaluation of the herbicides, toxicity and risks can be presumed. The opinion, though, is largely beside the point here. EPA has determined that the herbicides proposed for use here, with one lone exception, contain inerts that do not support a specific concern for toxicity or risk. (EPA 1987b). The one exception is a petroleum distillate in Esteron 99. The risk posed by that inert is assessed. But otherwise, in light of the EPA report, the analysis here focuses on the active ingredients of Banvel, Rodeo, Tordon 22K and Tordon 2K, and Esteron 99 and DMA-4. Since each herbicide's inerts are neither of toxicological concern nor suggestive of concern, with the one noted exception, and because a number of assumptions overestimate the exposure from each herbicide's active ingredient, an analysis of each herbicide's active ingredient should subsume each herbicide's risk as a formulated product.

Worst-Case Analysis

Recently, the Council on Environmental Quality amended its regulation (40 C.F.R. 1502.22), which addresses incomplete or unavailable information in an environmental impact statement. The new regulation provides that in instances where relevant information concerning adverse impacts is not known and the overall costs of obtaining it are exorbitant or because the means to obtain it are not known, the agency must undertake four steps in its environmental impact statement. Specificially, the new regulation provides that the agency must include within the document:

(1) a statement that [the] information is incomplete or unavailable;

(2) a statement of the relevance of the incomplete or unavailable information to evaluating reasonably foreseeable significant adverse impacts on the human environment;

(3) a summary of existing credible scientific evidence that is relevant to evaluating the reasonably foreseeable significant adverse impact on the human environment; and

(4) the agency's evaluation of such impacts based upon theoretical approaches on research methods generally accepted in the scientific community.

The new regulation also rescinded the old requirement that the agency prepare a worst-case analysis on the risk of proceeding in the face of uncertainty about a proposed action's environmental effects. The Council on Environmental Quality has stated that "[if] on environmental impact statements in progress, agencies may choose to comply with the requirements of either the original or amended regulation."

While this SEIS was prepared after the Council on Environmental Quality amended the original regulations, it nonetheless also includes a worst-case analysis. It is included because this document supplements an EIS prepared under the original regulation. The approach maintains consistency between the FEIS and SEIS.

Glyphosate. Information gaps include lack of exposure studies for workers and the public and for animals in the spray area. EPA's preliminary analysis of a study in August 1985 showed that there may have been a weak oncogenic effect. More recently, EPA's FIFRA Scientific Advisory Panel found the data to be inconclusive. Therefore, BLM has prepared worst-case analyses.

2,4-D. Information gaps include the lack of exposure studies for the public. A number of studies have assessed the carcinogenicity of 2,4-D, and thus far, there are no conclusive data demonstrating the carcinogenicity of 2,4-D (IARC 1977; Mullison 1981). However, there is also general agreement that none of these studies was adequate (EPA 1982; WHO 1984). A long-term oncogenicity study has been received and is under review. Preliminary findings by EPA indicate that it is positive for cancer. There are also some questions regarding the ability of 2,4-D to cause heritable mutations. Therefore, BLM has prepared worst-case analyses.

Dicamba. No field data exists for exposure studies for the public and for animals in the spray area. Therefore, BLM has prepared a risk analysis on threshold effects.

EPA has requested more studies for cancer and chronic effects, but because existing chronic feeding studies do not show chronic effects or provide tumor data, cancer potency curves cannot be calculated. Without a base of information from which to calculate cancer potency curves, a cancer risk analysis on dicamba can not be meaningfully conducted. The worst case, however, is hypothesized.

Picloram. Information gaps include lack of exposure studies for the public and for animals in the spray area.

The issue of carcinogenicity has also been raised in the case of picloram. A carcinogenesis bioassay of picloram in rats and mice was conducted by Gulf Research Institute for the National Cancer Institute (1978). Picloram was not found to cause cancer in mice or male rats. However, the study concluded that under the bioassay conditions, the findings suggested the ability of picloram to induce benign tumors in the livers of female Osborne-Mendel rats. According to a classification scheme devised by the National Cancer Institute (NCI), however, picloram was listed among chemicals where evidence for carcinogenicity in animals was equivocal at best (Griesmer and Cueto 1980). EPA has requested additional data and both rat and mouse cancer studies should be completed this year. Because there is scientific uncertainty regarding the ability of picloram to cause cancer, a worst-case analysis was conducted.

BLM does not have the staff, expertise, or funds to fill the existing data gaps, and the time required to perform these studies would seriously delay the execution of state-mandated noxious weed control programs. To fill all the data gaps pertaining to the carcinogenicity potential of picloram, 2,4-D, and glyphosate would require a total investment of between $3.5 million and $4.2 million and 5 years (see Appendix M in the FEIS).

Most, if not all, of the research to fill these data gaps for 2,4-D is being conducted by a task force of manufacturers. Research on picloram is being conducted by Dow Chemical Company (1984). Therefore, BLM's conducting such studies would constitute unneeded duplication. Additionally, the Courts, citing the requirements of NEPA *(Southern Oregon Citizens Against Toxic Sprays, Inc. vs. James Watt et al.,* 1982), ruled that BLM must perform a worst-case analysis evaluating the risks of using herbicides and assessing the probability of the worst case actually happening. Therefore, the worst-case analysis for 2,4-D, glyphosate, and picloram is included in this SEIS as Appendix N. A risk analysis for dicamba is also included.

Structure of the Risk Assessment

The risk assessment methodology that was used in this SEIS consisted of three principal steps: a hazard analysis, an exposure analysis, and a risk analysis. Appendix N presents a complete description of the assumptions, calculations, and results of these analyses.

In the hazard analysis, a review was made of relevant public literature and publicly available summaries of proprietary data to determine the hazard that each herbicide may present. The hazard analysis included a review of relevant laboratory animal studies on acute (single dose), subchronic (short term dosing), and chronic (long-term or lifetime dosing) exposures via dermal, inhalation, and ingestion routes. Appendix K presents reviews of the relevant toxicological literature for dicamba, 2,4-D, picloram, and glyphosate.

The second step of the analysis consisted of determining the highest exposures workers and the public are likely to receive under the proposed program. Because no analysis of this kind could consider all the combinations of circumstances under which a herbicide might be sprayed, a generic exposure analysis, which investigators conducted represents a conservative, simplified description of both operational parameters and potential routes of exposure for humans. Appendix N presents the assumptions and results of the exposure analysis.

The analysis of risk was conducted once exposures were determined in this generic analysis. The human exposure levels were compared with the animal hazard levels detailed in the first step. These comparisons were used to determine the risk to humans under the specified circumstances of exposure. Appendix N presents the quantitative results of the risk analysis. The following sections summarize the results in layman's terms.

Hazard Analysis

Types of Toxicity Studies

Acute Toxicity Studies. Acute toxicity studies are used to determine the median lethal dose (LD_{50}), which is the dose that kills 50 percent of the test animals. The lower the LD_{50}, the greater the toxicity of the chemical. The LD_{50} ranges and toxicity categories used in this risk assessment are those of the EPA classification system using rat LD_{50}'s, as shown in Table 3-6 (adapted from Maxwell 1982, as cited in Walstad and Dost 1984). Because lethality is the intended toxic endpoint, dose levels usually are set relatively high in acute studies. The animal most commonly used for oral LD_{50}'s is the rat. Rabbits are used most often to determine dermal LD_{50}'s.

Because death represents the extreme toxic consequence for judging possible effects from the use of herbicides, the policies of regulating agencies regarding acceptable intake levels of these chemical compounds are most often based not on acute studies, but rather on longer term toxicity tests designed to find the dose level that produces no effects in the animal species tested.

Subchronic Toxicity Studies. Subchronic studies of up to 90 days duration are designed to determine the toxicity reference level called the no-observed-effect level (NOEL), which is the highest dose level at which no toxic effects are observed. If a chemical produces effects at the lowest dose tested (LDT) in a study, the NOEL must be at some lower dose. If the chemical produces no effects, even at the highest dose tested (HDT), the NOEL is equal to or greater than the HDT. Subchronic studies, normally employing lower dose levels than acute studies, provide information on systemic effects, cumulative toxicity, the latency period (the time between exposure and the manifestation of a toxic effect), the reversibility of toxic effects, and appropriate dose ranges to be used in chronic tests. The adverse effects may include death; decreased rate of food consumption; change in body weight; decreased enzyme levels; changes in blood constituents, such as red blood cells (RBC's) or white blood cells (WBC's); undesirable constituents in the urine; or microscopic changes in tissues.

Teratogenicity tests (teratology studies) determine the potential of a chemical to cause malformations in an embryo or a developing fetus between the time of conception and birth. These studies, generally using rats or rabbits, may be conducted over several generations. The animals are monitored for functional as well as structural deformities.

Chronic Toxicity Studies. Chronic studies, like subchronic studies, are used to determine systemic NOEL's. All other things being equal, the longer the study from which the NOEL is derived, the more reliable the resulting value. Chronic studies, are also important in determining doses that are hazardous to reproductive success or in determining whether the chemical causes cancer. Tests for systemic effects, teratogenicity, reproduction effects, and carcinogenicity provide the bulk of chronic data on laboratory animals.

Feeding experiments of more than 90 days are considered to be chronic studies. These tests can determine systemic NOEL's and define organ sites where long-term exposure can cause deleterious effects. Blood chemistry, hematology, microscopic, and gross pathology of the laboratory animals can provide detailed information on the effect of the herbicide during the animal's lifetime.

Reproduction studies are conducted to determine the effect of the chemical on reproductive success as indicated by fertility (production of reproductive cells), fetotoxicity (direct toxicity to the developing fetus), and survival and weight of offspring. These tests are performed at doses similar to those used in teratogenicity studies and generally use rats. Both male and female rats are exposed to the chemical for a number of weeks before mating. The number of resulting pregnancies, stillbirths, and live births are recorded. Tests are usually conducted over two or three generations.

Carcinogenicity tests (cancer studies or oncogenicity studies) examine the potential for a chemical to cause cancerous (malignant) or nonmalignant tumors when fed in the diet over the animal's lifetime. Testing is normally conducted with rats or mice for a 2-year period.

Mutagenicity Assays. Mutagenicity assays are used to determine the ability of a chemical to cause physical changes (mutations) in an organism's basic genetic material (DNA) that could be passed on from one generation to the next. The species used in these tests range from primitive organisms, such as the bacteria Salmonella, Escherichia, and Streptomyces; the mold Aspergillus; the yeast Saccharomyces; and the fruit fly Drosophila, to the more advanced organisms that include mammalian species. Tests may be conducted in vivo (within the body of the living organism) or in vitro (on cells cultured outside the body in a petri dish or test tube).

Mutagenicity assays may be divided into three categories: 1) tests for detecting gene mutations, 2) tests for detecting chromosomal aberrations, and 3) tests for detecting primary DNA damage. Included within the first group are microbial assays, involving prokaryotic (bacteria) and eukaryotic microorganisms, developed to detect reverse mutations and to a limited extent, forward mutations. Examples of tests for detecting chromosomal effects include mammalian cytogenetic assays in Chinese hamster ovary cells in vitro, and mice bone marrow micronucleus in vivo. The existence of DNA damage caused by mutagens is detected by biologic processes such as DNA repair and recombination, which occur after DNA damage. Tests to determine such processes utilize bacteria, yeast, and mammalian cells in vitro, with or without metabolic activation.

A detailed discussion (with complete citations) of the toxicity of the four active ingredients in the herbicide formulations proposed for use is presented in Appendix K. This information includes the most recent studies available from EPA. The following section summarizes the toxicity for each.

Dicamba. In experimental studies with mammals, dicamba was a mild skin irritant, a moderate skin sensitizer, and a severe eye irritant, although the effects were transient. Acute oral doses of dicamba in laboratory animals resulted in slight toxicity. A subchronic rat study that found slight liver cell alterations at the highest dose tested produced a NOEL of 25 mg/kg/day. Chronic consumption by dogs and rats showed no adverse health effects, but chronic consumption by mice caused decreased body weight and increased liver weight. No carcinogenic effects were noted in these chronic feeding studies. EPA does not consider these chronic studies adequate for the registration guidelines under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) and has requested additional studies for both chronic effects and cancer. A recent cancer study that EPA considered adequate showed no carcinogenic effect (Taylor 1986).

Although EPA now has valid data to determine that dicamba is not a carcinogen, the guidelines require negative data on three species. Data to complete the guidelines package has been requested by EPA.

Dicamba caused no reproductive or teratogenic effects in rats. In rabbits, dicamba caused post-implantation losses, decreased number of live fetuses, and decreased fetal weights. The NOEL for this study was 3 mg/kg based on maternal toxicity. EPA has requested additional information on the mutagenic potential of dicamba. On the basis of a number of bacterial and in vitro test systems not reviewed by EPA, dicamba has not been shown to produce mutagenic effects.

2,4-D. Based on acute toxicity, 2,4-D is moderately toxic to humans. Acute and chronic toxicity studies in mammals revealed general systemic toxic effects following ingestion of large doses of 2,4-D. Similar clinical symptoms have been observed in human cases. Even though dermal absorption of 2,4-D is limited, the herbicide has produced peripheral neuropathy (nervous system damage in the limbs) in a few individuals after accidental exposure. In a limited number of cases, the recovery has not been complete. A recent chronic rat feeding study resulted in a NOEL of 1 mg/kg/day based on kidney effects.

In reproduction and teratogenesis studies, decreases in birth weight, litter size, and fertility were observed; however, these adverse effects were caused by high doses that also caused maternal toxicity (WHO 1984). The lowest NOEL from a rat teratology study was 25 mg/kg/day. The lowest NOEL from a recent multigeneration reproductive study is 5 mg/kg/day.

2,4-D has shown weak mutagenic activity in some assays, but generally has been found to be non-mutagenic in most of the microbial systems investigated. 2,4-D may be a weak mutagen but probably is without significance as an environmental mutagenic hazard.

Previous chronic studies were not regarded as positive for cancer by the majority of the scientific community, although there was a concensus that more data were needed. Epidemiology studies conducted for farmworkers in Kansas have suggested an increased risk of a certain type of cancer (non-Hodgkins lymphoma) in humans exposed to phenoxy acids and chlorophenols. EPA has recently received and is in the process of completing their review of a new cancer study. The Agency considers the new study to show 2,4-D as positive for cancer. However, EPA has stated that the cancer potency values based on a previous study that are used in this risk analysis would not underestimate the risk of cancer for 2,4-D (EPA 1986c).

Picloram. Acute LD_{50}'s of greater than 3,000 mg/kg classify picloram as slightly toxic. Although picloram alone does not cause skin sensitization, in combination with 2,4-D it is capable of producing sensitizing reactions in humans. No birth defects have been shown in laboratory animals, but in a 3-generation reproduction study, reduced fertility was observed at the highest dose tested (NOEL = 50 mg/kg/day). A six-month dog study resulted in a NOEL of 7 mg/kg/day based on increased liver weights. Cancer studies conducted by the National Cancer Institute indicate that picloram was not carcinogenic in mice or male rats and that at high sustained doses could produce benign liver tumors in female rats. EPA considers this study of questionable value and has requested additional data.

Glyphosate. Glyphosate generally has low toxicity to mammals, as reflected by its acute LD_{50} value of 5,400 mg/kg in rats. It is only slightly irritating to the skin and eyes. A 2-year chronic feeding study did not indicate any oncogenic or other chronic effects at the highest dose tested (31 mg/kg/day). Studies have shown that glyphosate is neither teratogenic nor mutagenic, and a recent 3-generation reproductive study reviewed by EPA set a NOEL of 10 mg/kg/day.

In a review of preliminary data from recent glyphosate cancer studies using mice and rats, EPA found one study to be positive for cancer. However, in these cancer studies on both sexes of two species of test animals, the incidence of only one

Table 3-3. Summary of Acute and Chronic Toxicity Thresholds Based on Results From the Most Sensitive Species

Herbicide	Acute Oral[1] LD_{50} in mg/kg	Systemic Toxicity[2] NOEL in mg/kg/day	Reproductive[3] Toxicity NOEL in mg/kg/day	Provisional[4] Allowable Daily Intake Set by EPA in mg/kg/day
2,4-D	100	1	5	0.01
Picloram	2,000	7	50	0.007
Glyphosate	4,320	30	10	0.1
Dicamba	75	25	3	0.0125

[1]Based on review by Sassman and others 1984.
[2]Lowest NOEL found in the literature (see Appendix K) for general systemic effects such as changes in kidneys, liver, or decreased food consumption.
[3]Lowest NOEL found in the literature (see Appendix K) for reproductive effects such as birth defects, fertility, fetotoxicity, or maternal toxicity.
[4]EPA used the lowest NOEL and reduced it by a safety factor (100, 1,000, 100, and 2,000 for 2,4-D, picloram, glyphosate, and dicamba respectively).

Table 3-4. Comparison of Acute Toxicity of Technical Active Indgredients (a.i.) Versus the Formulated Products

Herbicide	Technical LD_{50} (mg/kg)	Formulation LD_{50} (mg/kg)
2,4-D[2]	375	Estron 99 = 2100 DMA-4 =1000
Dicamba[3]	757	Banvel D =2629 Banvel CST = >5000
Glyphosate[1]	4,320	Rodeo = >5000 mg/kg
Picloram[2]	2,000	Tordon 22K = 10,330 mg/kg Tordon 2K = >5000 mg/kg

Source:
[1]Tom Hooganhem, Monsanto Company, St. Louis, Missouri, Personal Communication, February 1987.
[2]Alice Organ, Dow Chemical Co., Midland, Michigan, Personal Communication, February 1987.
[3]Weed Science of America, 1983.

tumor type in one sex of one species was found to increase with increasing doses of glyphosate. This increase in tumors occurred only at very high exposure levels (much higher dosing than normally used in long-term studies of pesticides) and the positive findings depended upon the presence of tumors in only 4 of 149 treated animals. To the extent that it is actually an oncogen, EPA has stated that these results indicate that glyphosate is likely to have only a weak oncogenic effect. More recently, EPA's FIFRA Scientific Advisory Panel found that the data on glyphosate's oncogenic potential are inconclusive. The Panel proposed that glyphosate not be classified until a data call-in for further studies in rats, mice, or both provides clarification of unresolved questions. Based on the information currently available, EPA has indicated that it does not expect any significant risk from the use of glyphosate in accordance with label directions.

The State of California Department of Food and Agriculture has undertaken an ongoing review of studies submitted to it for registration of glyphosate. Some of those studies were also submitted to EPA for the federal registration process. The State's preliminary findings as they relate to EPA's review summarily are as follows:

Chronic rat, onco rat, and repro rat studies had a data gap, were inadequate studies with no adverse effect indicated; chronic dog, terato rat, terato rabbit, gene mutation and chromosome studies had no data gap, had no adverse effect indicated; onco mouse study had no data gap with possible adverse effect indicated; and DNA damage study had a data gap, was an inadequate study with possible adverse effect indicated. The neurotox study was not required (CDFA 1986).

The results of the hazard analysis for each herbicide, including the LD_{50} and the lowest no observable effect levels (NOELs) for systemic and reproductive effects found in the literature, are summarized in Table 3-3.

Inert Ingredients

Inert ingredients are chemicals used with the active ingredient in preparing a formulation of a herbicide. Inert ingredients are used to provide a carrier for the active ingredient that facilitates the effective application of the herbicide. Inerts are not intended to supplement the herbicide's toxic properties.

Table 3-5. Lowest Margins of Safety for Occupational and Public Exposures

	2,4-D (NOEL = 1)	Picloram (NOEL = 7)	Glyphosate (NOEL = 10)	Dicamba (NOEL = 3)
Lowest Margins of Safety for Major Mixing Errors				
Workers				
Aerial				
Pilot	9	180	—	77
Mixer-loader	2	41	—	18
Supervisor	23	500	—	214
Observer	6	135	—	58
Ground Vehicle				
Driver	10	212	102	45
Mixer-loader	2	41	20	9
Driver-mixer-loader	2	35	17	7
Ground Hand				
Mixer-loader-applicator	4	90	43	19
Public				
Dermal (drift)				
500 feet	>5,000	>10,000	>10,000	>10,000
1/4 mile	>10,000	>10,000	>10,000	>10,000
1/2 mile	>10,000	>10,000	>10,000	>10,000
Oral Ingestion				
Water	213	>5,000	>2,000	349
Meat	714	>10,000	>5,000	>1,000
Berries	909	>10,000	>10,000	>1,000
Lowest Margins of Safety for Extraordinary Exposures				
Dermal and Oral Exposure (Public)	118	>2,000	>1,000	150
Dermal Exposure Aerial Spray (Public)	10	>10,000	83	100
Ground Hand Applicator with Oral Exposure (Occupational)	4	87	41	18
Lowest Margins of Safety for Doses Due to Spills				
Spills onto skin (0.5 liter)				
Concentrate	-94	1.5	- 7.2	-31
Spray Mix (Aerial)	-14	15	—	-9
Spray Mix (Ground)	-1.4	175	7.1	1
Spills into Water (1 liter consumed)				
Pond, Helo	13	280	—	120
Reservoir, Helo	1,000	>1,000	—	882
Pond, Truck	9	194	91	14
Reservoir, Truck	667	>1,000	>1,000	1,000

EPA's Office of Pesticide Programs (EPA 1986h) has identified about 1,200 inert ingredients that are now used in approved pesticides and has reviewed the existing evidence concerning the toxicity of these inerts, including laboratory toxicity data, epidemiological data, and structure/activity relationships. Of particular concern in reviewing the inerts was their potential for causing chronic human health effects. The EPA review resulted in categorizing the 1,200 inerts into four lists.

List 1 contains about 55 inerts that have been shown to be carcinogens, developmental toxicants. neurotoxins, or potential ecological hazards and that merit the highest priority for regulatory action.

List 2 contains approximately 50 chemicals that have been given high priority for testing because toxicity data is suggestive, but not conclusive, of possible chronic health effects or because they have structures similar to chemicals on List 1.

List 3 contains about 800 chemicals that are of lower priority because no evidence from toxicity data or from a review of their chemical structure would now support a concern for toxicity or risk.

List 4 of about 300 chemicals contains those inerts generally recognized as safe.

Because EPA normally classifies inert ingredients as "Confidential Business Information", information on them does not have to be released by EPA to the public under the Freedom of Information Act (see also 40 CFR 1506.(a)). Nonetheless, the BLM requested that the EPA review the herbicides proposed for use, specifically, Esteron 99, DMA-4, Tordon 22K and Tordon 2K, Banvel and Rodeo, and disclose whether any of them contained inert ingredients of or suggesting toxicological concern. EPA has so informed the BLM. (EPA 1987b).

The EPA has reported to the BLM that none of the herbicides proposed for use, with one exception, contain any inert ingredients appearing on either list 1 or list 2. The exception is that Esteron 99 contains a petroleum distillate of high priority for testing. Accordingly, a risk analysis has been conducted on the human health risk from exposure to the petroleum distillate in Esteron 99. Otherwise, the six herbicides proposed for use contain inerts that EPA generally recognizes as safe or that do not support a specific concern for toxicity or risk. EPA's report to BLM is that "[a]lthough an exhaustive literature and data search was not carried out and it is possible that new information could be uncovered that would trigger concerns for these chemicals, the Agency is reasonably confident, within the limits of this analysis, that these inert ingredients do not support a specific concern for toxicity or risk at this time."

EPA also noted in its report that concerns regarding the acute toxicity of inert ingredients are usually addressed through tests of the herbicides as formulated products. In this regard, another indication of the toxicity of the formulated product (which includes the inert ingredients) can be shown by comparing its acute LD_{50}'s to the active ingredients'. As shown in Table 3-4, the formulations of the herbicides proposed for use by BLM are less acutely toxic than their respective active inqredients. Of course, the main difference shown is the effect of dilution of the active ingredients. However, it does indicate that given the same volume of material, active ingredients are generally more acutely toxic than the products they are formulated in, i.e., the herbicides proposed for use.

While the herbicides as formulated products have undergone acute toxicity testing, they generally have not undergone extensive chronic toxicity testing, or cancer, reproductive, developmental or mutagencity tests. The gap in the testing of the herbicides as formulated products, according to one viewpoint, gives rise to one inference that the environmental consequences, including hazards to human health, from using them are largely unknown. The theory holds that regardess of what is known about each herbicide formulations' two components, that is, the active ingredients and inerts, the possibility obtained that the formulated product may pose greater risk than separate consideration of each component may suggest. Given the little information that is available on each herbicide's formulation, the possibility can not be discounted entirely. Neither can it be presumed as true. The possibility that the herbicides' formulations may pose greater risk than their components is largely an untested hypothesis, and as to the herbicides' formulations acute toxicity, as Table 3-4 shows, the possibility should not follow. Turning to the competing viewpoint, and the one adopted in this SEIS, the data gaps about the herbicides as formulated products is largely beside the point since the risks posed by the herbicides's active ingredient are over stated. Any risk posed by the herbicides as formulated products is considered to be subsumed by the analysis of the active ingredients. Moreover, it must be recalled that each herbicide as a formulated product contains two types of ingerdients: active and inert. Each type of ingredient has known and suspected properties. The herbicides' active ingredients have undergone cancer, reproductive, developmental and mutagencity tests of varying degrees. The herbicides' inerts have undergone categorization according to their toxicity and risks, if any. With only one lone exception, no specific concern exists with the herbicides' inerts. Thus, because the herbicides' active ingredients here, not their inerts, pose the risks, it logically follows that an analysis drawing attention to the former as opposed to the later is properly focused.

And, as to Esteron 99's inert ingredient of toxicological concern, an analysis of that risk now follows.

One of the 2,4-D formulations proposed for use, Esteron 99, contains a petroleum distillate of toxicological concern, whose toxicity can be estimated from the toxicity of diesel oil. Diesel oil is classified as a slightly toxic mixture on the basis of its acute oral toxicity of 7,380 mg/kg (about 20 times higher than 2,4-D). Diesel oil is not irritating to the eyes, but it is a skin irritant. Diesel oil does not cause teratogenic effects, but it has been shown to cause chromosomal abnormalities in the bone marrow cells of rats. Although diesel oil has not been shown to cause cancer, it is likely to have slight carcinogenic potency because it contains small amounts of chemicals known or suspected to cause cancer. Among these chemicals are benzene and benzo(a)pyrene. A cancer potency for diesel oil was calculated in Appendix K. Because it is about 1,000 times less likely to cause cancer than 2,4-D and assuming the petroleum distillate is of the relative same toxicity as diesel oil, Esteron 99's inert of toxicological concern would not add significantly to the potency of the 2,4-D formulation.

Exposure Analysis

The exposure analysis estimates doses for the categories of people shown in Table 3-5. The analysis exaggerates the doses that humans are likely to receive because all exposures were calculated based on minor and major mixing errors that would cause a 20- to 30-percent increase in the concentration of the active ingredient above that actually expected in BLM's program. In addition, no protective clothing is assumed to be worn by workers and herbicide residues were not assumed to degrade before they are ingested.

All worker doses were based on field studies of workers using herbicides while doses to members of the public were calculated using data from field studies that monitored deposition of sprayed chemicals on different surfaces. Three categories of exposure are shown, including maximum exposed individuals and accidental spills. No member of the public is likely to be exposed to doses that exceed those analyzed here.

Risk Analysis for Threshold Effects

The impacts on human health of a given chemical depend upon the toxicity of the chemical and the level of the exposure. It is clearly established that most chemical effects on biological systems follow a dose-response relationship—that is, as the dose increases, so do the effects. For most toxic responses (but not cancer or mutations) chemicals are assumed to have a threshold of toxicity below which no ill effects occur. For chemicals evaluated in this document, it has been possible to establish a no observed effect level (NOEL) in laboratory studies, which is the highest dose (below the effects threshold) to which animals have been exposed without causing an observable toxicological response.

Chemical exposure may be brief (acute) or prolonged (chronic). The chemical's toxic effects on an organism depend on the way the organism takes in the chemical (that is, orally, dermally, or through inhalation) and its frequency of exposure, coupled with the chemical's specific mechanisms of toxicity. Some chemicals may affect the nervous system; others may cause damage to organs such as the liver or kidneys. A highly toxic chemical may cause limited or no effects if the dose is low and the exposure time is short, just as a chemical of limited toxicity may be quite hazardous if the dose is high and the exposure time is extended.

The principal reason for routine laboratory toxicity testing is to assess the risks associated with human exposure to chemical substances. Most experimental toxicological studies are carried out in the laboratory using specially bred species of test animals, and these results are extrapolated to humans. This method has certain limitations because of the variation of responses between and within species. For animal studies, small numbers of animals are fed relatively high doses of a toxicant, and the resulting data are extrapolated to a possible situation where large numbers of people may be exposed to much lower levels.

There are two basic approaches for extrapolating from laboratory animal NOEL's to the general human population: the acceptable daily intake approach and the margin-of-safety approach. Under the acceptable daily intake (ADI) approach, "safety factors" based on the quality of the data are applied to either the highest (Thomas 1986; Doull and others 1980) or lowest (EPA 1986g) NOEL found in animal studies. These safety factors have been used for the estimation of acceptable human exposures based on experimental human and animal studies where noncarcinogenic effects were observed following exposure to a toxic chemical substance (Thomas 1986). For example, an uncertainty factor of 10 has been used in the estimation of safe levels in humans from experimental studies when there are valid human studies available and no indication of carcinogenicity. An uncertainty factor of 100 is used when there are few or no human studies available but there are valid long-term animal studies; when there are very limited toxicological data 1,000 or greater could be used to estimate acceptable human exposure.

Safety factors and the "ADI approach" are used by Federal regulatory agencies such as the FDA and EPA to set ADI's for chemicals that a broad segment of the general public are liable to be exposed to for an indeterminate period of time. Thus, the ADI is a lifetime safe dose for threshold toxic effects based on the best available toxicity information on a particular chemical. Cancer and mutation effects are not dealt with in this way since they are not assumed to have a predictable threshold of reversible toxic effects.

The second approach called the margin-of-safety (MOS) approach is used in this risk assessment and is based on the same concepts of a threshold of toxicity (approximated by animal NOEL's in long-term studies) and of the safety of a dose. However, it differs from the ADI approach in several important ways. First, the MOS approach is not being used here to establish a regulatory standard safe level for the general public against which samples of possibly contaminated products, for example, marketed vegetables or drinking water, would be tested. The margins-of-safety computed here are dose ratios that are direct comparisons of the doses estimated in this risk assessment with the NOEL's from animal studies. For example, an MOS of 100 means the laboratory-determined level is 100 times higher than the estimated dose. Although they correspond with the safety factors used to determine the ADI's, they are applicable only to this risk assessment. It should also be pointed out that a margin-of-safety does not always mean that the dose is safe. A MOS of 3, for example, could represent a high risk of toxic effects for repeated exposures.

Second, the ADI as a standard level for comparison of tested samples should remain relatively stable over the years, modified only when the results of new toxicity tests produce a new NOEL or make a change in the ADI safety factor appropriate. The MOS, however, vary with the estimated doses in a particular exposure scenario and are thus used to indicate the potential toxic effects of the proposed chemical under differing conditions or routes of exposure or in comparison with alternative chemicals that may be used for the same purpose.

For most systemic effects in this risk analysis, uncertainty factors of 100 have been used, unless otherwise indicated by the experimental data. Thus, an estimated exposure producing an MOS of 100 or greater shows a small risk of most toxic effects other than cancer.

The larger the MOS (the smaller the estimated human dose compared to the animal NOEL), the lower the risk to human health. As the estimated dose to humans approaches the animal NOEL (as the MOS approaches 1), the risk to humans increases. When an estimated dose exceeds a NOEL (giving an MOS of less than 1), the ratio is reversed (the dose is divided by the NOEL) to indicate how high the estimated dose is above the laboratory level; a minus sign is attached to indicate that the dose exceeded the NOEL; and the result is no longer termed a margin of safety but is simply called a negative ratio. A ratio of -3, for example, means that the estimated dose is 3 times the laboratory-determined level. A negative ratio implies that the estimated dose (given all assumptions of the scenario) represents a clear risk of possible acute or chronic effects.

When repeated doses to humans are higher than the animal NOEL (the MOS is less than 1), there is a distinct probability of harmful effects. Conversely, when the human dose is small compared with the animal NOEL (giving an MOS greater than 100), the risk to humans can be judged small. Comparing one-time or once-a-year doses (such as those experienced by the public) to NOEL's derived from lifetime studies tends to greatly overestimate the risk from those rare events. The lowest margins of safety are shown in Table 3-5.

In this risk analysis, the risks to humans potentially exposed to the herbicides 2,4-D, picloram, glyphosate, and dicamba were quantified by comparing the dose shown in Tables N-5 and N-6 (see Appendix N for N tables) with the laboratory-derived NOEL's determined in the most sensitive test animal shown in Table N-7.

Risk to Workers.

To answer the questions posed at the beginning of this section, one must interpret the MOS's shown in Appendix N and summarized in Table 3-5.

To answer the question of whether non-cancer related deaths are expected among workers, one must examine the margins-of-safety and ratios between the exposures and LD_{50}'s. Under routine scenarios, the smallest ratio between the rat LD_{50} and the highest occupational exposure is greater than 700, indicating that no worker fatalities are expected to occur from general systemic effects.

Because the highest doses occur under the accidental scenarios, one must examine the ratios shown in Table N-19 through N-22 to determine the potential for fatalities. Under the accident scenarios, both spills of herbicide concentrate on workers and truck and aircraft crashes were analyzed. These scenarios are not designed to show what will happen as a result of a given treatment operation, but rather what could happen when all of the conditions specified in the scenario are met in the actual operation. For instance, worker doses are based on no protective clothing, which is contrary to BLM policy.

The lowest MOS (and therefore greatest risk) is from the accidental spill of approximately a pint of spray mix of 2,4-D. If an individual did not wash the herbicide off, there is a clear risk of severe effects, such as nausea, dizziness, and neurological effects (i.e. neuropathy).

The ratio between the 2,4-D rat LD_{50} and human dose from a spill of about a pint of 2,4-D concentrate also shows the potential for fatal effects. However, no deaths from short-term exposure to 2,4-D have been reported in the literature.

To deterimine whether workers could experience adverse health effects such as appetite loss, decreased enzyme levels, or kidney or liver damage, margins of safety less than 100 for systemic effects were identified.

There is also a risk of general systemic effects for workers, including sensitive individuals, as shown in Table N-8. The risks are greatest for 2,4-D, followed by the mixture of 2,4-D/picloram, picloram, glyphosate, and dicamba. The margins of safety indicate that ground vehicle mixer-loader-applicators are at greatest risk, followed by aerial mixer-loaders, and backpack applicators. All MOS's for worker occupational exposures for 2,4-D are less than 15 with the exception of supervisors, which are less than 25. These low MOS's show that applicators using 2,4-D have the greatest chance of experiencing adverse health effects. If they repeatedly receive these worst case doses, there is a clear risk of kidney effects as shown in the studies cited in Appendix K. 2,4-D has also been reported to produce peripheral neuropathy in some individuals following high acute exposures.

Likewise, individuals exposed to the 2,4-D/picloram mixture could experience similar, although lesser, effects. The most likely effect from the 2,4-D/picloram mixture is skin irritation. However, the margins of safety indicate the possibility of adverse health effects, especially among sensitive individuals. Ground vehicle mixer-loaders of dicamba could possibly experience liver damage (reduced glycogen storage) if they repeatedly received doses as high as shown here, although the risk of chronic health effects is less than 2,4-D.

It is unlikely that BLM employees will experience these effects for a number of reasons:

1. The number of days they are expected to be exposed per year is relatively small (except for ground-vehicle applicators using 2,4-D).
2. The projected doses shown in Table N-5 greatly overestimate average exposures.
3. All doses are based on workers not wearing protective clothing. The use of protective clothing would reduce the exposures and thus increase the MOS by 30 to 90 percent.

To examine whether the fertility of male or female workers or a pregnant woman's offspring would be affected by the herbicides proposed for use, margins of safety of less than 100 for reproductive effects were identified (see Table N-8B). None of the chemicals proposed for use have been shown to interfere with male reproductive success in laboratory animals. The MOS's, however, indicate a possibility of maternal and fetotoxic effects of pregnant women mixer-loaders using dicamba, glyphosate, and 2,4-D. The MOS for workers using picloram and the 2,4-D/picloram mixture are all greater than 100 and thus indicate a negligible risk of reproductive effects.

Table N-8B in Appendix N presents the margins-of-safety for reproductive effects. Pregnant female ground vehicle operators using glyphosate and dicamba are at greatest risk. It is important to note that neither of these chemicals has been shown to cause birth defects in laboratory animals. However, a conservative assumption is that any developing fetus would be at high risk in women who repeatedly receive doses as high as a ground vehicle mixer-loader. The MOS's for aerial and ground mixer-loaders of 2,4-D indicate the potential for maternal and fetotoxic effects in pregnant sensitive individuals. An operator's frequency of exposure as shown in Table N-1, however, is small. Contract employees who are exposed throughout the spray season are at greater risk.

Risk to the Public

Table 3-5 shows that large margins of safety (MOS's) (greater than 200) exist for every category of routine exposure for 2,4-D, dicamba, glyphosate, and picloram. Although the public should not be chronically exposed to these herbicides (indeed, given the remote location of most spray areas, the public will not be exposed at all in most spray operations), these large margins of safety mean the public could be repeatedly exposed to these levels and suffer no adverse effects. This is true for pregnant women and most sensitive individuals.

Because all of the doses shown in Table N-6 are below the provisional acceptable daily intakes (ADIs) (see Table 3-3) set by EPA, EPA considers all of the estimated doses to the public safe for lifetime exposure.

Tables N-9A and N-9B present the MOS's for children, who are generally considered to be sensitive individuals. The MOS's for a 10 kg child drinking a liter of water contaminated at about 120 ppm show the potential for effects on the kidneys if exposure at this level continues. However, this worst-case estimate is about six times higher than has been found in water monitoring studies. Most forest field studies have found nondetectable levels of herbicide in streams, even immediately after spraying. (Drifting modeling studies show that 1 percent of the onsite concentration would be deposited at 100 feet; with a 6-inch stream, the concentration would be only 30 ppm under a 4 lb/acre 2,4-D application rate.) In addition, the exposure to the child would be one-time, rather than repeat or chronic, further decreasing the probability of harmful effects.

In conclusion, this analysis shows that under routine operations the public should not suffer adverse health effects as a result of BLM's using any of the four herbicide formulations.

- No member of the public is likely to die.

- No general systemic effects are likely to occur, except in the unlikely event of a small child repeatedly drank water contaminated with high levels of 2,4-D.

- No reproductive effects, including birth defects, are likely.

- A negligible chance exists of the public getting cancer or producing heritable mutations as discussed in Appendix N and summarized in the next section.

There is always the possibility that some very sensitive or high risk individual will experience adverse health effects. However, the MOS's indicate that the vast majority of even sensitive individuals should not be affected.

Risk to Maximum Exposed Individuals

Doses and MOS's calculated for extraordinary situations are shown in Table N-10. The first situation involves a member of the public who is directly under an aerial application. The doses were calculated on the application basis of the rates shown in Table N-3 and under the assumption of 2 square feet of exposed skin. The MOS's show only negligible chance of adverse health effects resulting from direct spraying with the herbicides glyphosate, picloram, or dicamba other than skin or eye irritation. For 2,4-D there is greater risk. However, although the MOS is relatively low, the risk of irreversible effects is not considered to be high because the NOEL is based on chronic rather than one-time exposure.

MOS values for the public are for days of maximum exposure, which is generally the day of spraying. Since the dermal dose will only occur on the day of exposure, the MOS values for subsequent days involving only oral doses would be higher. MOS values for public dermal exposures are typically high, often 500,000, particularly for picloram and 2,4-D/picloram mixture. Dose comparisons show that the public (through all age classes) would receive a dose that even remotely approaches the NOEL level only when directly sprayed by an aircraft or when collecting and consuming relatively large amounts of sprayed berries, water, or deer meat containing herbicide residues. For many reasons, these are low probability events. Sprayed areas would not logically attract visitors seeking wild foods. Nonetheless, the calculated extraordinary situation MOS values show that even when improbable events occur, health impacts would be highly unlikely with such a transient dose.

Again, the low MOS's for ground applications of 2,4-D show the risk of toxic effects if these doses are sustained. The risk would be reduced if workers wear protective clothing.

Summary of the Worst-Case Cancer Analysis

The highest risk of cancer under operational conditions would be to the worker exposed for 40 years at the maximum exposure from ground application. The probability of these carcinogenic exposures was on the order of magnitude of 2 out of 10,000 workers exposed.

The type of exposure with the highest probability of causing cancer would be on the order of magnitude of 2 out of 100 million from drinking water from a stream just sprayed with no dilution and being exposed for 20 days in this manner.

The probability of cancer is lower than the cancer probability from eating 0.5 pounds of broiled steak per week (3 out of 10 million) or drinking one pint of milk per day (2 out of 1 million).

Chronic carcinogenic probability was greatest also to the worker splashed with concentrate. This was on the order of magnitude of 2 out of 100,000 and similar to taking contraceptive pills (2 out of 100,000) (Goldman 1984).

The highest probability of getting cancer by the public through drinking 1 liter of water containing herbicide residue after a major spill was on the order of magnitude of 2 in 100 million. This probability of cancer is much lower than the probability of death by storms in the U.S. (8 out of 10 million), bites of venomous creatures (2 out of 10 million), or earthquake in California (16 out of 10 million).

The preceding summary of the worst-case cancer analysis refers to the active ingredients glyphosate, picloram, and 2,4-D; it has no relevance to dicamba. No traditional cancer analysis can be conducted for dicamba, worst-case or otherwise because the existing evidence has not produced the tumor data needed to calculate cancer protency curves. Indeed, all existing information leads to the inference that dicamba does not have a carcinogenic effect. Nonetheless, because the data is not conclusive when measured against current protocols and because a cancer risk analysis cannot be performed, the worst case of proceeding with the use of dicamba in the context of cancer must be hypothesized. The worst case is that the hypothesis that dicamba may have a carcinogenic effect of some unkown magnitude at any dose-exposure may prove true at some time. This is the risk of proceeding with the use of dicamba. The scenario, though, is a hypothesis, and as such, no probability of its occurrence or nonoccurrence can be assigned. The worst case regarding dicamba rests on speculation squared.

Synergistic and Cumulative Effects

Synergistic Effects

Synergistic effects of herbicides are those that occur because of simultaneous exposure to more than one herbicide and that cannot be predicted based on the effects of the individual chemicals. A synergistic effect occurs when the combined effect of two chemicals is much greater than the sum of the effects of each agent given alone. Based on the limited amount of data available on pesticide combinations, it is possible but unlikely that synergistic effects could occur as a result of exposure to two or more of the herbicides considered in this analysis. One known synergistic effect is that the combination of 2,4-D and picloram produces skin sensitization, whereas neither herbicide alone has this effect (EPA 1985b).

The effects of many of the possible herbicide combinations have not been studied. This is not surprising because the first priority must be to study the effects of the herbicides individually, and this type of information is not yet sufficient in some cases. Moreover, the combinations that could be studied are too numerous to be listed. The combinations of interest include not only combinations of two or more of the four herbicides, but also combinations of the herbicides with other chemicals, such as inerts in the formulated product or insecticides that exist in the environment.

Moreover, for several reasons synergistic adverse effects are highly unlikely to result from exposure to more than one herbicide applied in separate projects. First, unlike the situation in conventional agriculture, herbicide residues in plants and soil are not expected to persist from one application to another, even for the more persistent herbicides.

Second, none of the herbicides accumulates in human tissues, so exposure of an individual to two herbicides at different times would be unlikely to cause simultaneous residues within the body.

Third, exposures to the herbicides, especially for the public, are normally small. The exposures considered would occur only infrequently, and the probability of the accidental exposures is extremely low. Because the probability of a large exposure is small for any one chemical, the probability of large exposures simultaneously to multiple chemicals is negligible. The probability of two independent events occurring simultaneously is the product of the probabilities of the individual events. For example, if the probability of a person receiving a given exposure is 1 in 1,000 for two herbicides, then the probability of receiving that exposure to both herbicides would be 1 in 1 million.

Simultaneous exposure to more than one chemical is likely in cases where those chemicals are combined in a single spray mixture. Although most vegetation control projects in the EIS area would involve only a single herbicide, some areas would be treated with mixtures of herbicides, but only mixtures that have been approved for use by EPA.

The EPA guidelines for assessing the risk from exposures to chemical mixtures recommend using additivity models when little information exists on the toxicity of the mixture and when parts of the mixture appear to induce the same effect by similar modes of action. Separate margins of safety are computed in the risk assessment for the mixture of 2,4-D and picloram used in ground vehicle and ground hand applications. The EPA guidelines suggest a hazard index, HI, based on the dose on toxicity reference level for each chemical as follows:

$$HI = \frac{D_1}{L_1} + \frac{D_2}{L_2}$$

where

D_i is the dose of the i^{th} component

L_i is the level of safety (NOEL, ADI, etc.)

As the HI approaches 1, the risk from the mixture becomes greater and greater. On the basis of the highest exposures for adult members of the public in this risk assessment for systemic effects (drinking water - major mixing error), the HI is 0.00133. This amount shows little possibility of toxic efforts from the mixture.

Although the herbicides used for vegetation control are unlikely to have synergistic toxic effects, other substances occurring in the diets of exposed people may have some influence on the toxicity of the herbicides. This is one of several factors that may influence the sensitivity of individuals.

Factors Affecting the Sensitivity of Individuals

Individuals typically display a range of susceptibilities to toxic effects of chemicals. Factors that may affect susceptibility include diet, age, heredity, preexisting diseases, and life style (Calabrese 1978). These factors have been studied in detail for very few cases, and their significance in controlling toxicity of the proposed herbicides is not known. However, enough data has been collected on other chemicals to show that these factors can be important.

Elements of the diet known to affect toxicity include vitamins and minerals (Calabrese and Dorsey 1984). For example, the mineral selenium can prevent the destruction of blood-forming tissues by chronic heavy exposure to benzene. Large doses of vitamin C have also been shown to protect animals and humans from toxic effects of chronic benzene exposure. Vitamin A seems to have a preventative effect on cancer induced by chemicals such as benzo(a)pyrene (found in cigarette and wood smoke) and DMBA. This effect has been seen in laboratory animals and human epidemiological studies. The food additives BHT and BHA may also be active in preventing the carcinogenicity of benzo(a)pyrene. Various levels of the B vitamin riboflavin have also been tested with mixed results. Vitamin C has been shown to prevent nitrites from combining with amines to form nitrosamines, and vitamin E seems to be at least as effective. These vitamins would be likely to prevent formation of N-nitrosoatrazine and N-nitrosoglyphosate if conditions are otherwise favorable for their formation in the human stomach. (Calabrese and Dorsey 1984)

Genetic factors are also known in some cases to be important determinants of susceptibility to toxic environmental agents (Calabrese 1984). Susceptibility to irritants and allergic sensitivity vary widely among individuals and are known to largely depend on genetic factors. Race has been shown to be a significant factor influencing sensitivity to irritants, and some investigations have indicated that women may be more sensitive than men (Calabrese 1984).

A variety of human genetic conditions have been identified as possibly enhancing susceptibility to environmental agents. For example, persons with beta thalassenia may be at increased risk when exposed chronically to benzene. But only one condition, G-6-PD deficiency, has conclusively been shown to cause enhanced susceptibility to industrial pollutants. Several other genetic conditions have been shown to involve defects in the cellular mechanisms for repair of damage to DNA. Persons with these diseases share an increased sensitivity to the effects of UV light, which can cause cancer. Cells from individuals with at least one of these diseases, xeroderma pigmentosum, are also sensitive to a variety of chemical substances implicated as causative agents of human cancers. (Calabrese 1984)

Persons with other types of preexisting medical conditions may also be at increased risk of toxic effects. For example, sensitivity to chemical skin irritants can be expected to be greater for people with a variety of chronic skin ailments. Patients with these conditions may be advised to avoid occupational exposure to irritating chemicals (Calabrese 1984).

On the basis of the current state of knowledge, individual susceptibility to toxic effects of the four herbicides cannot be specifically predicted. The use of safety factors have traditionally been used to account for variations in susceptibility among people. As described in the introduction to this risk assessment, a safety factor of 10 is used for interspecies variation, an additional safety factor of 10 is used for within-species variation. Thus, the normal margin of safety of 100 for both types of variation is generally sufficient to ensure that even sensitive individuals should experience no ill effects. Where chronic data is lacking, an additional safety factor of 10 is sometimes used, possibly increasing to 1,000 the margin of safety at which a certainty exists that no adverse effects would occur.

Chapter 4
Supplement
Consultation and Coordination

Public Participation

In July 1986, BLM announced in the Federal Register and to the news media its intent to prepare a supplement to the Northwest Area Noxious Weed Control Program Final EIS. The notice provided the reasons for issuing the supplement. This supplemental environmental impact statement (SEIS) was prepared by an interdisciplinary team of specialists from the five-state EIS area and a private contracting firm, Labat-Anderson, Inc. BLM began writing the SEIS in August 1986 and consulted and coordinated with agencies, organizations, and individuals throughout the preparation of the draft and final documents. In addition, a peer review was conducted on the material prepared by Labat-Anderson, Inc. The draft SEIS was released to the public on November 3, 1986. The public comment period ended on January 5, 1987.

Written Comments

The following list provides the names of organizations and individuals that submitted written comments on the draft SEIS. Each person, organization, or agency that commented in writing was assigned an index (letter) number. Apendix material was enclosed with letters 11, 35, 42, and 45, and may be reviewed at BLM's Oregon State Office.

Letter No.	Agency, Organization, or Individual
1.	Idaho County Weed Control and Livestock Programs, Grangeville, Idaho
2.	Idaho Weed Control Superintendent's Association, Inc., Grangeville, Idaho
3.	Roosevelt County Weed District, Culbertson, Montana
4.	USDA, Soil Conservation Service, Boise, Idaho
5.	Diane M. Schrack
6.	Professor James W. Cox, University of Montana
7.	Idaho Weed Control Association, Twin Falls, Idaho
8.	Curry County Weed Control, Gold Beach, Oregon
9.	Gem County Weed Department, Emmett, Idaho
10.	Southwest Idaho Weed Control Association, Southwest Idaho
11.	Coos-Curry Council of Governments, Coos Bay, Oregon
12.	Idaho County Farm Bureau, Riggins, Idaho
13.	Darrell Granbois
14.	Clatsop-Tillamook Intergovernmental Council, Cannon Beach, Oregon
15.	Elliott Bernshaw
16.	Coos-Curry Council of Governments, Coos Bay, Oregon
17.	Morrow County Weed Control, Heppner, Oregon
18.	Oregon Executive Department, Intergovernmental Relations Division, Salem, Oregon
19.	Montana Public Lands Council, Helena, Montana
20.	Curry County Soil and Water Conservation District, Gold Beach, Oregon
21.	Wyoming Department of Agriculture, Cheyenne, Wyoming

22. Monsanto Agricultural Company, St. Louis, Missouri
23. Montana Stockgrowers Association, Inc., Helena, Montana
24. Wood River Resource Conservation and Development Area, Gooding, Idaho
25. Montana Association of State Grazing Districts, Helena, Montana
26. Richland County Weed Board, Sidney, Montana
27. C. W. (Bill) Pogue
28. Idaho Department of Agriculture, Weed Control Coordinator, Boise, Idaho
29. USDI, National Park Service, Seattle, Washington
30. Ada County Weed and Pest Control, Meridian, Idaho
31. Province of British Columbia-Ministry of Agriculture and Food, Creston, B.C.
32. Idaho Cattle Association, Boise, Idaho
33. Wyoming Office of the Governor, Cheyenne, Wyoming
34. Bingham County Noxious Weed Control, Blackfoot, Idaho
35. Fred H. Mass
36. Caribou County Weed Control, Soda Springs, Idaho
37. Northwest Coalition for Alternatives to Pesticides, Eugene, Oregon
38. Bonneville County Weed Control, Idaho Falls, Idaho
39. Georgia E. Hoglund
40. George Wooten
41. Portland Audubon Society, Portland, Oregon
42. USDI, Fish and Wildlife Service, Boise, Idaho
43. USDA, Forest Service, Portland, Oregon
44. Southern Oregon Northwest Coalition for Alternatives to Pesticides, Grants Pass, Oregon
45. US Environmental Protection Agency, Seattle, Washington
46. Department of the Army, Corps of Engineers, Portland, Oregon
47. Prairie County Weed Board, Terry, Montana

1

IDAHO COUNTY WEED CONTROL and LIVESTOCK PROGRAMS

Carl Crabtree, Supervisor
Room 3 - Courthouse
Grangeville, Idaho 83530
Phone: (208) 983-2667

November 13, 1986

Oregon State Director
Bureau of Land Management
P.O. Box 2965
Portland, Ore. 97208

Dear Sir:

I am writing in response to the draft of the Supplement to the Northwest Area Noxious Weed control program, Final Environmental Impact Statement (Oct. 1986).

It is our opinion that the assessment in the document, more than adequately covers the environmental impact.

It is further our opinion that continued delays in implementation are costing the taxpayers millions of dollars. This cost is occuring, not just in paperwork and labor cost, but in the resulting logarithmic increase in noxious weed population.

We urge you to move foreward with on-site weed control. Your environmental impact statement addresses the issues raised, beyond any reasonable doubt.

Sincerely,

Carl Crabtree

Carl Crabtree
Supervisor

CC/cm

cc: Idaho County Commissioners

2

IDAHO WEED CONTROL SUPERINTENDENT'S ASSOCIATION INC

November 17, 1986

Oregon State Director
Bureau of Land Management
P.O. Box 2965
Portland, OR 97208

Dear Sir:

I am writing in response to the draft of the Supplement to the Northwest Area Noxious Weed control program, Final Environmental Impact Statement (Oct. 1986).

It is our opinion that the assessment in the document, more than adequately covers the enviornmental impact.

It is further our opinion that continued delays in implementation are costing the taxpayers millions of dollars. This cost is occuring, not just in paperwork and labor cost, but in the resulting logarithmic increase in noxious weed population.

We urge you to move foreward with on-site weed control. Your enviornmental impact statement addresses the issues raised, beyond any reasonable doubt.

Sincerely

Carl Crabtree

Carl Crabtree
President

tw

SYSTEMATIC PROTECTION FOR PLANT RESOURCES

3

Roosevelt County Weed District

P.O. Box 416
Culbertson, MT 59218

November 18, 1986

Charles W. Luscher
Oregon State Director
Bureau of Land Management (935)
P.O. Box 2965
Portland, Oregon 97208

Dear Mr. Luscher,

As Supervisor of the Roosevelt County Weed District, I would like to comment on the draft supplement to the final environmental impact statement (DSEIS) for noxious weed control in five northwestern states - Idaho, Montana, Oregon, Washington, and Wyoming. In our area of Eastern Montana, all of the spraying would be done as not to coincide with the tourist, or outdoors season of June, July, August, and September. We would spray either very early spring (April, May) or late fall (October).

All of the BLM land in this area is out of range of the general public. There is very remote chance of hikers or other persons outside of land leaseholder being in the area when spraying takes place. Because of the remoteness of this area, there are no residences located close to the BLM land.

The targeted land in this area will require pellet work only, so we will have less worry about drift to off target vegetation. According to the DSEIS the greatest chance of exposure would be to persons mixing and loading the sprayers. This is significant because I as a Weed District Supervisor, and people working for the Weed District as mixers, are specially trained to handle chemicals and dress properly to minimize risk of chemical exposure. We are also trained to handle accidental spills and leaks, to prevent further environmental damages.

By using buffer zones, well trained applicators, and ground crew, chemicals as discussed in the DSEIS, good quality control programs can be implemented with little hazard to the public and the environment. We feel a good control program will have less damage on the environment than the spread of noxious weeds.

Sincerely,

Henry L. Lannen

Henry L. Lannen
Weed Supervisor

HLL:cds

4

United States Department of Agriculture — Soil Conservation Service

Room 345, 304 North 8th Street
Boise, Idaho 83702

November 19, 1986

Oregon State Director
Bureau of Land Management
P.O. Box 2965
Portland, Oregon 97208

Dear Sir:

We have reviewed the draft supplement to the Northwest Area Noxious Weed Control Program Final Environmental Impact Statement (DSEIS).

We support the Idaho Noxious Weed Control Workshop recommendations for public lands submitted to Idaho Bureau of Land Management State Office earlier this year. You should have received a copy early this spring.

We have no additional comments.

Sincerely,

Rod Ault (Acting)

STANLEY N. HOBSON
State Conservationist

cc:
Mike Somerville, SRC, SCS, Boise

The Soil Conservation Service is an agency of the Department of Agriculture

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WYOMING

December 30, 1986

Wyoming State Director (930)

To whom it may concern,

In regards to the supplemental draft environmental impact statement - I would like to register my opposition to the noxious weed control project on public lands in Wyoming, Washington, Oregon, Idaho and Montana. I am fundamentally opposed to the use of herbicides. The possibility of public health hazards and unforseen environmental damage far outweighs the benefits associated with the use of herbicides.

I appreciate the opportunity to register my comments.

Thankyou -
Diane M. Schrader
2009 Autumn Ct.
Gillette, Wyoming
82716

6

University of Montana

Department of Chemistry • Missoula, Montana 59812 • (406) 243-4022

21 November 1986

BLM
Portland

Gentlemen:

I understand you are seeking comment on chemical control of weeds in the Northwest.

I wish only to say that our principal noxious weed in Montana, knapweed - Centaurea maculosa - can be much more effectively controlled by spring grazing by sheep than it can be by Tordon application. I have been doing it for several years & am prepared to document my thesis to your satisfaction. 6-1

Sincerely,
[illegible], Professor

Equal Opportunity in Education and Employment

RESPONSE TO COMMENT LETTER 6

6-1 BLM is aware of ongoing research involving the use of livestock for controlling certain noxious weeds. To date, use of livestock has not proven adequate for eradicating noxious weeds. BLM is cooperating in this type of research.

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Idaho Weed Control Association

1330 FILER AVENUE EAST
TWIN FALLS, ID 83301
PHONE 734-6600

November 24, 1986

Oregon State Director
Bureau of Land Management
P.O. Box 2965
Portland, Oregon 97208

To Whom It May Concern:

Recently the Idaho Weed Control Association Board of Directors met and discussed the impending decision to be reached on the issue of herbicide application on federally owned lands by the Bureau of Land Management for control of noxious weeds. The following comments represents the feeling that 17 member Board as well as the hundreds of members of the Idaho Weeed Control Association.

It is quite distrubing to us to advocate control of noxious weeds throughout the State of Idaho by way of seminars and publications and then learn that the land owned by the government is going unchecked for spread of noxious weeds. Even more distressing is to think that the reason for such lack of control stems from special interest groups involved in protecting all of mankind.

It is estimated by the University of Idaho College of Agriculture in 1980 that annual losses to weeds in six major crops, potatoes, wheat, barley, beans, corn and sugarbeets, of $135 million annually. If added losses to livestock, seed and minor crops, waterways, highways and right-of-ways are considered the total loss exceeded $500 million.

Since the Environmental Impact Draft Supplement continues to dispell concerns of special interest groups it seems logical to conclude that a continuation of restrictions on control of noxious weeds on federal lands would work to the detriment of all concerned. Noxious weed problems where ever they occur effect all of us either directly or indirectly. Please then consider it the wish of this Association that a program of noxious weed control by means of biological, mechanical and chemical means be reinstated on BLM land.

Sincerely,

Greg Lowry
Greg Lowry
President, IWCA

GL/ms

8

Curry County Weed Control

P. O. Box 746
GOLD BEACH, ORE. 97444

Bill Keil
Orogon-Washington State Director
Bureau of Land Management
P.O. Box 2965
Portland, Oregon 97208

Dear Bill;

Curry County Weed Control fully supports the BLM effort to once again resume the use of herbicides in the fight against noxious weeds.

Weed Control feels that both the final and supplemental enviromental impact statements are adequately written and provides a complete intergrated weed control program.

Sincerely,

James E. Penland
Weed Control Supervisor
P.O. Box 746
28425 Hunter Creek Complex
Gold Beach, Oregon 97444

phone; (503) 247-7097

9

OFFICE OF
GEM COUNTY WEED DEPARTMENT
402 N. Hays
EMMETT, IDAHO 83617
(208)[illegible]

December 3, 1986

Oregon State Director
Bureau of Land Management (935)
P.O. Box 2965
Portland, Oregon 97208

In regards to the DSEIS, I think it represents all of the areas of concern. It is a well researched and well written document, that shows the spirit of cooperation on behalf of the BLM. It deals with specific areas of concern in a comprehensive manner. I feel that the BLM plan is a realistic one as shown in this DSEIS.

The greatest problem in weed control is that weeds know no boundaries. The infestations are capable of moving, sometimes many miles away. Many of the weeds we are worried about are not native species, and they can out compete our native vegitation. They also reduce the grazing capacity of the ground. This hurts both the land users and the wildlife. These weeds also move to private ground where they cause economic damage to farmers and ranchers. Weeds have got to be managed no matter where they are. I feel that if chemical control is not allowed that our management efforts will be reduced to a no effect level in many of our management areas. This will lead to areas that have constant sources of seed that can be spread to new places. This will only increase our problems.

Biological control plays a major role on our Rush Skeloton Weed infestation in Gem County, but it has limitations. Even in optimum conditions it doesn't seem that our biological control agents establish as rapidly as the host spreads. We would like to be able to hold the infestations where they are until the biological agents have multiplied to a number that can help us. The regions where I am talking about are rugged areas that only biological or chemical control can be used. It is my opinion that either form of control without the help of the other is not effective. However together they form an effective arsenal for the management of this potentially threatening weed.

It is my opinion that some of these environmental groups are not for proper weed control methods, and proper use of pesticides. They are rallying to stop all use of pesticides. If the conflicting parties cannot openly communicate and cooperate with one another, a realistic weed management effort cannot be found. I believe that for the economic and ecological goog of the State of Idaho, extreme measures must be taken. It is my opinion that the majority of Idahoans would be in favor of this proposed plan presented by the BLM. I believe it would be in the interest of both parties to pass this DSEIS and get on with a good Weed Management Program.

Brian Wilbur, Supervisor
Gem County Weed Control

10

SOUTWEST IDAHO WEED CONTROL ASSOCITATION
ADA, ADAMS, BOISE, CANYON, ELMORE, GEM, OWYHEE,
PAYETTE, VALLEY & WASHINGTON COUNTIES

December 3,1986

Oregon State Director
Bureau of Land Management (935)
P.O. Box 2965
Portland, Oregon 97208

Comments of the
Southwest Idaho Weed Control Association

After reviewing the DSEIS for noxious weed control on BLM grounds in the five Norhtwestern States. I find that the document has been thoroughly researched, and is well thought out, informative, and portrays an overall anaylsis of specific problems and concerns, with a realistic approach.

Cooperation and communication are the needed ingredients to come to a realistic method of Weed Management on BLM grounds throughout the five states. We feel that on some BLM ground in S.W. Idaho weed management can only be accomplished by chemical control, due to the remoteness of the infestations. Not being allowed to use chemical methods of weed managenent has already allowed the spread of noxious weeds, and valuable time has been lost. The spread of noxious weeds from BLM ground to private ground has caused serious economical damage to many farmers and ranchers in this area. I feel that if this ban on chemical control methods is not lifted very soon any progress that has been made will be lost. This delay is costing everyone in loss of money already put into weed management efforts, by now letting the weeds multiply unchecked to larger infestation than they were before the ban. In economic pressure to farmers and ranchers affected by spread of noxious weeds adjecent to BLM ground. By having to start over again with our programs to initiate control to infestations, that could have been at manageable levels if chemical control could have been used. In decreased prices for agricultural goods caused by spread of these noxious weeds at a time when our farmets and ranchers are in a depressed state anyway. In the repetitious collection of already valid data into official EIS documents.

I believe that if an agreement cannot be reached between the conflicting parties that there will have to be extreme measures taken for the economic and ecological good of the State of Idaho. I feel that it is in the best interest of both parties to pass this DSEIS and get on with a beneficial Weed Management program.

Again I would like to state that Cooperation and Communication is the only way to come up with a realistic weed management program for BLM lands.

Brian K. Wilbur
Chairman

11

COOS-CURRY COUNCIL OF GOVERNMENTS
170 S. SECOND STREET, SUITE 204
COOS BAY, OREGON 97420
267-6500

TIMM SLATER, Chairman
PHIL MATSON, Vice-Chairman
JOE JAKOVAC, Treasurer
SANDRA DIEDRICH, Director

December 8, 1986

USDI, Bureau of Land Management
Oregon State Office
P.O. Box 2965
Portland, OR 97208
Attn: Philip Hamilton

Dear Mr. Hamilton:

SUBJECT: Draft Final Environmental Impact Statement
Northwest Area Noxious Weed Control Program

Enclosed is a copy of the staff report prepared on your proposed project from materials submitted to our office for review. Please be advised that this project will be considered by the Coos-Curry Council of Governments at their meeting on Thursday, December 11, 1986 at McFarland's Restaurant in Bandon. The meeting will begin at 6:30 P.M.

An agenda is enclosed for your information. Please contact our office if you or your representative would like to attend the meeting. If you are unable to attend, you will receive a letter advising you of the Council's action.

Sincerely,

Jana Doerr

Jana Doerr,
Support Services Manager

jrd

Enclosures

REPRESENTING MEMBERSHIP OF GENERAL PURPOSE AND SPECIAL PURPOSE UNITS OF GOVERNMENT IN COOS AND CURRY COUNTIES.

6.1 **U.S.D.I. - BLM State Office**
Northwest Noxious Weed Control Program - Final EIS

PROJECT: Review of DRAFT Final Environmental Impact Statement (DFEIS): Supplement to the Northwest Area Noxious Weed Control Program-Washington, Oregon, Montana, Idaho, and Wyoming states.

PROJECT DESCRIPTION: The proposed Action is the use of chemical treatments (i.e. dicamba, glyphosate, picloram, and 2,4D) to control or eradicate noxious weeds on public lands controlled by the Department of Interior Bureau of Land Management in the Northwest.

PROJECT PURPOSE: Noxious weeds have become thoroughly established on public lands administered by BLM in Idaho, Montana, Oregon, Washington, and Wyoming. Fourteen weed species have been mandated for control and where possible, eradication. These 14 weeds are commonly known as Canada thistle, hoary cress (white top), leafy spurge, Russian Knapweed, spotted Knapweed, diffuse knapweed, dalmatian toadflax, common toadflax, common tansy, tansy ragworth, Dyers woad, yellow starthistle, musk thistle, and Scotch thistle. Also in the northwest United States are 33 other noxious, troublesome, or poisonous plants on BLM public lands. The Bureau of Land Management has the statutory duty to control and eradicate noxious weeds on public lands and in so doing is proposing to use chemical treatments for this control.

STAFF COMMENTS: The general public raised several concerns in its common letters on the Final Northwest Area Noxious Weed Control Program Environmental Impact Statement (FEIS) and later responses to the Department of Interior's motion of partial dissolution of the injunction (Civil No. 83-6272-E). In addition, new data relating to human health has increased the need to supplement the FEIS arising from BLM's proposal for managing public lands infested with or threatened by invading noxious weeds.

Assuming that adequate funding exists, BLM proposes to treat an estimated annual average of 44,414 acres. The BLM state directors in the Northwest would decide through consensus, the specific acreage to be treated in each state. BLM state and district offices that would treat noxious weeds would decide where, when, and how to treat them.

The final EIS (1985) and this supplement constitute a regional programmatic statement for controlling noxious weeds on BLM-administered lands in the states shown above and is intended to guide this program for the nest 15 years. Site-specific environmental analysis and documentation (including application of categorical exclusions where appropriate) will be accomplished at the state or district level on proposed weed control plans. During site-specific analysis and documentation, BLM will invite the public to participate in accordance with the Council On Environmental Quality (CEQ) regulations for implementing the National Environmental Policy Act. BLM has attempted to answer the public's concerns with this supplemental documentation.

RECOMMENDED ACTION: Favorable review.

6.1

12

Box 239
Riggins, ID 83549
December 9, 1986

Oregon-Washington State Director (935)
Bureau of Land Management
P.O. Box 2965
Portland, OR 97208

Dear Sir:

Following are comments on the draft supplement for the environmental impact statement concerning noxious weed control on public lands in Washington, Oregon, Idaho, Montana and Wyoming. Noxious weeds are an increasing threat to private and public lands, to domestic cropland and pasture land, and to public lands and wildlife habitat. Every effort must be made to control noxious weeds. In our area knapweed and yellow star thistle are particular-ly troublesome. Control measures must be undertaken by all land owning entities. This includes private, county, state and federal lands. For this reason it is particularly important that federal agencies such as the BLM launch control efforts on the federal lands they administer. Private, county and state groups must do the same.

Additionally, federal agencies should be permitted to use any and all herbicides that are registered for applicable uses. Federal agencies should not be required to enter into extensive technical testing and analysis nor be expected to make a worst case analysis. The EPA and the manufacturer make exhaustive tests and analyses before a product is registered and approved for use. Federal agencies should not be required to "reinvent the wheel" so to speak before they can use approved herbicides.

BLM should pursue a vigorous program of chemical weed control to avoid adverse impacts to wildlife habitat and to surrounding private and state lands. Thank you for the opportunity to comment on the draft supplement.

Sincerely,

Bill DeVeny

Bill DeVeny
President,
Idaho County Farm Bureau

13

December 10, 1986

Oregon State Director
Bureau of Land Management (935)
P.O. Box 2965
Portland, OR 97201

Mr. Luscher,

I have reviewed the Draft EIS and the Draft Supplement to the Final EIS. As a former Pesticide Specialist with the Montana Department of Agriculture, I feel qualified to comment. I appreciate the concerns of the special interest groups who had the foresight to require the documentation of the human health aspects of herbicide use on federal land. It is obvious that your review of presently available research is thorough and well rounded.

The importance of controlling the spread of noxious weeds on federal, as well as on private land cannot be understated. However difficult to document, it is not hard to visualize the enormous economic impact weeds have on resource values in the EIS area.

I support Alternative 1 as the preferred alternative in your plan to mitigate the spread of noxious weeds. I feel it is the most realistic approach considering existing technology. I fully support the use of biological means to control pests of all kinds but at present their widespread use is not viable, economically or ecologically.

Alternative 1 is also in line with present legislation, which requires private property owners to control noxious weeds. In that regard, you should realize the additional benefit of an ease in tension between BLM and neighboring private property owners. After all, is it fair to require farmers and ranchers to control weeds on private ground that have origins on property owned by the federal government? That is a double standard we can all live without.

Although evidence is clear that aerial pesticide applications result in more off-site drift than ground applications, it goes without saying that the job you have at hand does not come without risk. The risk in this case may easily be buffered by the judicious use of pesticides in the hands of competent applicators. Wind speed and high temperatures have more to do with the drift of volatile chemicals than application technique. I trust the federal government to

Page 2

keep a watchful eye on weather patterns in order to alleviate the annoying consequences of off-target drift. I would also fully expect the BLM to be financially responsible for remuneration of costs incurred by neighboring private property owners for the contamination or destruction of farm commodities damaged as a result of the improper use of pesticides on federal land.

I believe that everyone involved in the management of our natural resources should commit themselves to the control or eradication of noxious weeds. However, the use of pesticides should be considered one of many options to evaluate in a systematic approach to integrated pest management. It is still extremely important to give biological pesticides a chance to prove themselves as an economical alternative to synthetic pesticides.

Thank you,

Darrell Granbois
1103 Knight
Miles City, MT 59301

14

CLATSOP-TILLAMOOK
INTERGOVERNMENTAL COUNCIL

Box 488 • Cannon Beach, Oregon 97110 • Phone 436-1156

Donald M. Fields, Director

Rainmar Bartl, Planner
Mike Morgan, Planner

December 10, 1986

USDI, Bureau of Land Management
Oregon State Office
PO Box 2965
Portland, Oregon 97208

Attention: Philip Hamilton

Dear Philip:

Thank you for submitting your application for the Draft Supplement to the Northwest Area Noxious Weed Control Program.

This was brought before the CTIC Board on November 25, 1986, and was approved.

Sincerely,

Don Fields
Director

MEMBERS: Astoria, Bay City, Cannon Beach, Clatsop County, Garibaldi, Gearhart, Hammond, Port of Astoria, Rockaway, Tillamook County, and Wheeler. ASSOC. MEMBER: North Tillamook County Sanitary Authority.

15

Elliott Bernshaw
P.O. Box 6235
Salt Lake City, Utah 84106

December 10, 1986

B.L.M.
Oregon State Director
P.O. Box 2965
Portland, Ore. 97208

Dear Sir:

RE: COMMENTS ON "N.W. NOXIOUS WEED CONTROL PROGRAM"

I still object to your lack of discussion of the role of livestock grazing as a suspected primary factor for the unnatural concentration of the weeds on lands, both public and private. 15-1

Until more attention is given to the cause of the presence of increased weeds on land, we will be treating only the symptoms of "something-going-wrong."

Your control program, thus, could be an ever-repeating waste of tax-payer money for the express benefit of the public-land livestock grazing industry (which I submit is an economically insignificant minority nationally).

Yours truly,

Elliott Bernshaw

P.S.: Please update your mailing list to include my new address as per the above letterhead.

RESPONSE TO COMMENT LETTER 15

15-1 Heavy grazing by either livestock or big game can contribute to the noxious weed problem by reducing desirable vegetation, allowing noxious weeds to better compete. One cannot say that noxious weeds occur as a result of heavy livestock grazing or only in areas that are heavily grazed by livestock. Noxious weeds grow in forest land, national parks, good condition rangeland, and in areas ungrazed by livestock.

Noxious weeds have become a problem in Yellowstone National Park, where the infestation could spread to 200,000 acres and cut the northern Yellowstone elk herd in half. Dalmatian toadflax infests another 4,000 acres of the park. Although prevention remains a major thrust of weed control in the park, Tordon 22K (picloram) is being used in accordance with a written noxious weed control plan. A park official said, "We need to use herbicides--carefully--wherever they fit and only when necessary. But we would be derelict in protecting these natural resources if we didn't use them" (Sweaney 1986).

As discussed in Common Issue 7 in the Northwest Area Noxious Weed Control Program FEIS (December 1985), weed species are spread by several methods. Humans are the most important agents of this spread.

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COOS-CURRY COUNCIL OF GOVERNMENTS
170 S. SECOND STREET, SUITE 204
COOS BAY, OREGON 97420
267-6500

TIMM SLATER, Chairman
PHIL MATSON, Vice-Chairman
JOE JAKOVAC, Treasurer
SANDRA DIEDRICH, Director

December 12, 1986

USDI, Bureau of Land Management
Oregon State Office
P.O. Box 2965
Portland, OR 97208
Attn: Phillip Hamilton

Dear Mr. Hamilton:

SUBJECT: Draft Final Environmental Impact Statement
Northwest Area Noxious Weed Control Program

As part of Oregon's Intergovernmental Project Review, the Coos-Curry Council of Governments, on December 11, 1986, reviewed the above noted project.

The action of the Council was for favorable review.

Should you have any questions regarding this action by the Council, please do not hesitate to contact us.

Sincerely,

Sandra Diedrich,
Director

jrd

REPRESENTING MEMBERSHIP OF GENERAL PURPOSE AND SPECIAL PURPOSE UNITS OF GOVERNMENT IN COOS AND CURRY COUNTIES

17

MORROW COUNTY WEED CONTROL
P.O. Box 127
Heppner, OR 97836
Phone (503) 676-5452

December 12, 1986

Oregon State Director
Bureau of Land Management (935)
PO Box 2965
Portland, OR 97208

Dear Sir:

I have reviewed the draft supplement to the final environmental impact statement (DSEIS) for noxious weed control in five northwestern states. This document is very well written and advises adequately the possible impacts to the human environment from the chemical application portion of the statement.

Thank you for the opportunity to review this document. Please let us know if we can be of further assistance.

Sincerely,

Jim Van Winkle
Morrow County Weed Supervisor

18

Executive Department
155 COTTAGE STREET NE., SALEM, OREGON 97310

VICTOR ATIYEH
Governor

December 16, 1986

OREGON STATE DIRECTOR
Bureau of Land Management (935)
P.O. Box 2965
Portland, OR 97208

SUBJECT: Noxious Weed Control Program
PNRS #: OR861105-005-4

Thank you for submitting your Draft Supplement to the Final Environmental Impact Statement for State of Oregon review and comment.

Your draft was referred to the appropriate state agencies for review. The Department of Agriculture offered the enclosed comments.

Sincerely,

INTERGOVERNMENTAL RELATIONS DIVISION

Dolores Streeter
Clearinghouse Coordinator

DS:lh:0578t

Enclosure

Supplement to the Northwest Area Noxious Weed Control Program - Final EIS
BLM

OREGON INTERGOVERNMENTAL PROJECT REVIEW

State Clearinghouse
Intergovernmental Relations Division
155 Cottage Street N. E.
Salem, Oregon 97310

Phone (503)378-3732 or Toll Free in Oregon 1-800-422-3600

STATE AGENCY REVIEW

Project Number: OR 86 1105-005-4 Return Date: DEC 12 1986

ENVIRONMENTAL IMPACT REVIEW PROCEDURES

If you cannot respond by the above return date, please call to arrange an extension at least one week prior to the return date.

ENVIRONMENTAL IMPACT REVIEW
DRAFT STATEMENT

( ) This project has no significant environmental impact.

(✓) The environmental impact is adequately described.

( ) We suggest that the following points be considered in the preparation of a Final Environmental Impact Statement.

( ) No comment.

Remarks

Soil & Water Conservation Districts can be helpful and should be contacted when chemical treatment is to be used that may have an impact on soils, water, vegetation and livestock.

There is a soil & water conservation district located in all counties of the state that have jurisdiction over certain areas and are responsible for various programs as described by ORS Chapter 568, Soil & Water Conservation District Law.

Districts are available to serve the general public and work with all agencies to develop the best solution for soil and water related matters.

This USDI BLM final EIS covers the issue of a noxious weed control program in the northwest area of Washington, Montana, Oregon, Idaho and Wyoming very well, and the districts would help you in your implementation, and advice of how best to utilize such a program.

Agency Agriculture By

IPR #5

MONTANA PUBLIC LANDS COUNCIL

19

P. O. BOX 1679 — HELENA, MONTANA 59624

Phone (406) 442-3420

December 16, 1986

Oregon State Director
Bureau of Land Management (935)
P.O. Box 2965
Portland, Oregon 97208

Dear Sir:

The Montana Public Lands Council would like to offer the following comments in regard to the Supplement to the Northwest Area Noxious Weed Control Program.

The Montana Public Lands Council is comprised of approximately 550 paying members throughout the State of Montana. We understand this supplement deals with human health impacts resulting from herbicide use and may affect the availability of noxious weed control in the State of Montana.

Noxious weeds have been and are becoming a real problem on the rangeland of Montana. The citizens of Montana need to control the growing problem of noxious weeds. The control of noxious weeds is a responsibility of all landowners, whether public or private, and long-term management plans need to be implemented. Without some type of control, noxious weeds will reduce desirable forage for livestock and wildlife. In the long run, the people who use these lands will be greatly affected by the spread of noxious weeds.

This brings us around to discuss the effects of control to the human environment. If used properly, the effect on the human environment should be minimal. Most individuals who use the chemicals for control must have a license to do so. This license is not just given out, a person must pass a test in order to receive the license. Thus all impacts on the human environment should be few when the licensed operators practice weed control.

Frequency of treatment will also affect the human environment. On page 4 of the supplement in regard to water quality, it is stated that most treatments would not be applied more than one time per year, therefore accumulation in harmful amounts should not take place.

Location of treatment areas will also affect the human environment. In Montana most of the control is remote from the general population so it

-more-

therefore should not be harmful as stated on pages 9 and 17 in the supplement.

With regard to the person who uses these chemicals becoming affected, the risk is minimal as they are trained in the proper use of the chemicals. See page 17.

Ingesting the chemicals through the consumption of wild foods is a very low event. Areas sprayed are usually far removed from human traffic and edible berry bushes and prime food habitat usually do not occupy noxious weed infested areas as stated on page 46.

Accumulation of herbicides due to exposure to more than one herbicide is unlikely because none of the herbicides accumulates in human tissue. Exposure to the herbicides is small and herbicide residues in plants and soils are not expected to persis from one application to another as stated on page 21.

Factors such as diet, age, heredity, pre-existing diseases and life style also govern the way a human will react to toxic environmental agents. Therefore chemical control cannot be the scapegoat for human reaction to noxious weed control.

After reading the draft supplement to the Northwest Area Noxious Weed Control Program, the Montana Public Land Council Directors have determined the effect to the human environment to be minimal and recommends that noxious weed control be continued in the State of Montana. Approximately $334,000 has already been spent during the past two years in weed control in Montana and the results have been encouraging. If control is stopped now, all of this money and hard work will have been in vain. During a time when consumers are worrying about wasted money involved in many programs, this program need not be one of them. Another item to point out is that for every year noxious weeds aren't controlled, they spread over 16 percent more of Montana. Furthermore, we feel the State of Montana should not be included in this area where control of noxious weeds is stopped. Agriculture makes up most of our state's industry and when the land we produce our products on is taken over by weeds, there goes the economy. The State of Montana did not have any problems with the control of noxious weeds in the first place and are anxious to continue to control them.

Thank you for the opportunity to comment on this draft supplement.

Sincerely yours,

Jim Courtney

Jim Courtney, Chairman
Montana Public Lands Council

JC:ejr

Curry Soil and Water Conservation District

20

POST OFFICE BOX 666 GOLD BEACH, OREGON 97444

December 16, 1986

Bill Keil
Oregon-Washington State Director
Bureau of Land Management
P.O. Box 2964
Portland, Oregon 97208

Dear Mr. Keil:

Curry County Soil and Water Conservation District supports the Bureau of Land Management in their efforts to control noxious weeds by using herbicides.

We have reviewed the final and supplemental environmental impact statement. We concur that the statements adequately address the safe use of herbicides.

Yours truly,

Robert M. Rommarane

Robert Rommarane
Chairman
Curry County SWCD

CONSERVATION · DEVELOPMENT · SELF GOVERNMENT

21

THE STATE OF WYOMING

ED HERSCHLER
GOVERNOR

Wyoming Department of Agriculture

TELEPHONE: (307) 777-7321 CHEYENNE, WYOMING 82002-0100

JOHN ORTON, COMMISSIONER

December 17, 1986

Mr. Charles W. Luscher
Oregon State BLM Director
P. O. Box 2965
Portland, Oregon 97208-2965

Dear Mr. Luscher:

Re: Supplement to the Northwest Area Noxious Weed Control Program (EIS)

We have no additional comments to make at this time. One would almost have to be a Toxicologist to comment on the supplemental draft. Our main concern is that we get through with the paper work and get on with the control program.

Sincerely,

George F. Hittle

George F. Hittle
Weed & Pest Coordinator

GFH:sw

Files: USDI/BLM, NANWCP

"AGRICULTURE—the backbone of Wyoming"

22

Monsanto

MONSANTO AGRICULTURAL COMPANY
800 N. Lindbergh Boulevard
St. Louis, Missouri 63167
Phone. (314) 694-1000

December 17, 1986

Oregon State Director
Bureau of Land Management (935)
P. O. Box 2965
Portland, Oregon 97208

Dear Sir:

Monsanto Agricultural Company is pleased to provide comments on the document entitled "Supplement to the Northwest Area Noxious Weed Control Program, Final Environmental Impact Statement". Monsanto manufactures and markets the chemical ingredient glyphosate, whose environmental impact is discussed in this document.

After review of this document, it is my belief that the authors have done a more than adequate job in accurately assessing the environmental impact of using glyphosate to control noxious weeds. More importantly, the results of the worst case analysis, which purposely overestimates exposure and considers toxicological properties in the most conservative sense, clearly show risks to the general public to be insignificant, regardless of what scientific measure is utilized. In addition, issues previously challenged in court as being inadequately addressed, have also in my opinion, now been sufficiently investigated.

I urge the Bureau of Land Management to vigorously defend this document as is necessary and aggressively move to implement the proposed noxious weed control program.

Sincerely yours,

Thomas J. Hoogheem
Environmental Issues Manager

TJH:rk

A unit of Monsanto Company

MONTANA STOCKGROWERS ASSOCIATION, INC. 23

P. O. BOX 1679 — 420 NO. CALIFORNIA ST. — PHONE (406) 442-3420 — HELENA, MONTANA 59624

December 16, 1986

Oregon State Director
Bureau of Land Management (935)
P.O. Box 2965
Portland, Oregon 97208

Dear Sir:

The Montana Stockgrowers Association would like to offer the following comments in regard to the Supplement to the Northwest Area Noxious Weed Control Program.

The Montana Stockgrowers Association is comprised of approximately 2600 members throughout the State of Montana. We understand this supplement deals with human health impacts resulting from herbicide use and may affect the availability of noxious weed control in the State of Montana.

Noxious weeds have been and are becoming a real problem on the rangeland of Montana. The citizens of Montana need to control the growing problem of noxious weeds. The control of noxious weeds is a responsibility of all landowners, whether public or private, and long-term management plans need to be implemented. Without some type of control, noxious weeds will reduce desirable forage for livestock and wildlife. In the long run, the people who use these lands will be greatly affected by the spread of noxious weeds.

This brings us around to discuss the effects of control to the human environment. If used properly, the effect on the human environment should be minimal. Most individuals who use the chemicals for control must have a license to do so. This license is not just given out, a person must pass a test in order to receive the license. Thus all impacts on the human environment should be few when the licensed operators practice weed control.

Frequency of treatment will also affect the human environment. On page 4 of the supplement in regard to water quality, it is stated that most treatments would not be applied more than one time per year, therefore accumulation in harmful amounts should not take place.

Location of treatment areas will also affect the human environment. In Montana most of the control is remote from the general population so it

-more-

SERVING MONTANA'S CATTLE INDUSTRY SINCE 1884

Page 2
Oregon State Director BLM
December 16, 1986

therefore should not be harmful as stated on pages 9 and 17 in the supplement.

With regard to the person who uses these chemicals becoming affected, the risk is minimal as they are trained in the proper use of the chemicals. See page 17.

Ingesting the chemicals through the consumption of wild foods is a very low event. Areas sprayed are usually far removed from human traffic and edible berry bushes and prime food habitat usually do not occupy noxious weed infested areas as stated on page 46.

Accumulation of herbicides due to exposure to more than one herbicide is unlikely because none of the herbicides accumulates in human tissue. Exposure to the herbicides is small and herbicide residues in plants and soils are not expected to persis from one application to another as stated on page 21.

Factors such as diet, age, heredity, pre-existing diseases and life style also govern the way a human will react to toxic environmental agents. Therefore chemical control cannot be the scapegoat for human reaction to noxious weed control.

After reading the draft supplement to the Northwest Area Noxious Weed Control Program, the Montana Stockgrowers Association Directors have determined the effect to the human environment to be minimal and recommends that noxious weed control be continued in the State of Montana. Approximately $334,000 has already been spent during the past two years in weed control in Montana and the results have been encouraging. If control is stopped now, all of this money and hard work will have been in vain. During a time when consumers are worrying about wasted money involved in many programs, this program need not be one of them. Another item to point out is that for every year noxious weeds aren't controlled, they spread over 16 percent more of Montana. Furthermore, we feel the State of Montana should not be included in this area where control of noxious weeds is stopped. Agriculture makes up most of our state's industry and when the land we produce our products on is taken over by weeds, there goes the economy. The State of Montana did not have any problems with the control of noxious weeds in the first place and are anxious to continue to control them.

Thank you for the opportunity to comment on this draft supplement.

Sincerely yours,

Jack Eidel, President
Montana Stockgrowers Association

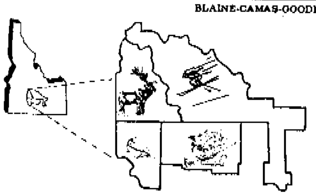
JE:ejr

WOOD RIVER

RESOURCE CONSERVATION and DEVELOPMENT AREA

24

BLAINE-CAMAS-GOODING-LINCOLN Counties, Idaho



131 3rd Avenue East
Gooding, Idaho 83330
(208) 934-4149

December 19, 1986

Oregon State Director
Bureau of Land Management (935)
PO Box 2965
Portland, OR. 97208

The Wood River Resource Area feels that since both the Northwest Area Noxious Weed Control Program EIS and supplement to it shows that herbicide use to control noxious weeds is a safe and sound management practice, we should start using them to help control weeds before more of our public lands are ruined for their various values such as; wildlife, recreation, watersheds, wilderness and forage production.

Sincerely,

EVERETT WARD
WRRA Chairman

cc: Senator James McClure
Senator Steve Symms

25

MONTANA ASSOCIATION OF STATE GRAZING DISTRICTS

(406) 442-3420

420 North California St.

Helena, Montana 59601

December 16, 1986

Oregon State Director
Bureau of Land Management (935)
P.O. Box 2965
Portland, Oregon 97208

Dear Sir:

The Montana Association of State Grazing Districts would like to offer the following comments in regard to the Supplement to the Northwest Area Noxious Weed Control Program.

The Montana Association of State Grazing Districts is comprised of 30 grazing districts which cover most of the eastern area of Montana. We understand this supplement deals with human health impacts resulting from herbicide use and may affect the availability of noxious weed control in the State of Montana.

Noxious weeds have been and are becoming a real problem on the rangeland of Montana. The citizens of Montana need to control the growing problem of noxious weeds. The control of noxious weeds is a responsibility of all landowners, whether public or private, and long-term management plans need to be implemented. Without some type of control, noxious weeds will reduce desirable forage for livestock and wildlife. In the long run, the people who use these lands will be greatly affected by the spread of noxious weeds.

This brings us around to discuss the effects of control to the human environment. If used properly, the effect on the human environment should be minimal. Most individuals who use the chemicals for control must have a license to do so. This license is not just given out, a person must pass a test in order to receive the license. Thus all impacts on the human environment should be few when the licensed operators practice weed control.

Frequency of treatment will also affect the human environment. On page 4 of the supplement in regard to water quality, it is stated that most treatments would not be applied more than one time per year, therefore accumulation in harmful amounts should not take place.

Location of treatment areas will also affect the human environment. In Montana most of the control is remote from the general population so it

-more-

Page 2
Oregon State Director BLM
December 16, 1986

therefore should not be harmful as stated on pages 9 and 17 in the supplement.

With regard to the person who uses these chemicals becoming affected, the risk is minimal as they are trained in the proper use of the chemicals. See page 17.

Ingesting the chemicals through the consumption of wild foods is a very low event. Areas sprayed are usually far removed from human traffic and edible berry bushes and prime food habitat usually do not occupy noxious weed infested areas as stated on page 46.

Accumulation of herbicides due to exposure to more than one herbicide is unlikely because none of the herbicides accumulates in human tissue. Exposure to the herbicides is small and herbicide residues in plants and soils are not expected to persis from one application to another as stated on page 21.

Factors such as diet, age, heredity, pre-existing diseases and life style also govern the way a human will react to toxic environmental agents. Therefore chemical control cannot be the scapegoat for human reaction to noxious weed control.

After reading the draft supplement to the Northwest Area Noxious Weed Control Program, the Montana Association of State Grazing Districts has determined the effect to the human environment to be minimal and recommends that noxious weed control be continued in the State of Montana. Approximately $334,000 has already been spent during the past two years in weed control in Montana and the results have been encouraging. If control is stopped now, all of this money and hard work will have been in vain. During a time when consumers are worrying about wasted money involved in many programs, this program need not be one of them. Another item to point out is that for every year noxious weeds aren't controlled, they spread over 16 percent more of Montana. Furthermore, we feel the State of Montana should not be included in this area where control of noxious weeds is stopped. Agriculture makes up most of our state's industry and when the land we produce our products on is taken over by weeds, there goes the economy. The State of Montana did not have any problems with the control of noxious weeds in the first place and are anxious to continue to control them.

Thank you for the opportunity to comment on this draft supplement.

Sincerely yours,

John Pfaff

John Pfaff, President
Montana Association of State
Grazing Districts

JP:ejr

26

Richland County Weed Board

Con Donvan, Weed Supervisor
County Extension Office
P.O. Box 1028
Sidney, Montana 59270

December 23, 1986

Charles Luscher, State Director
Oregon State University
Bureau of Land Management
P.O. Box 2965
Portland, OR 97208

Dear Mr. Luscher,

The Richland County Weed Control Board has been following this herbicide review process for several years now, and we are pleased to have the opportunity to respond.

In reviewing the Draft Final Environmental Impact Statement, we have just two comments:

1. We feel that the committee has assembled a fine reference book for those of us who need to know more complete information on the chemicals that we use regularly in our business. Further, you have addressed the human health hazard in the Draft Final Environmental Impact Statement.
2. One possible addition would be this: Require a blood base line analysis for workers. In this way, a history could be developed for each chemical to be used for each individual worker over the project time frame. **26-1**

Thank you for your consideration and continued support of noxious weed control in the Northwest Area.

Respectfully,

Cornelius T. Donvan

Cornelius T. Donvan
Richland County Weed Supervisor

CTD/cc

cc: Director, BLM, Miles City District Office, P.O. Box 940, Miles City, Mt. 59301

RESPONSE TO COMMENT LETTER 26

26-1 BLM will look into the possibility of this suggestion on a voluntary basis for BLM employees. Most of this work, however, is done in cooperation with state and county weed boards, and BLM thus has no authority for such a program.

27

C.W. (Bill) Pogue
P.O. Box 1470
Oldtown, Idaho, 83822

January 3, 1987

Charles W. Luscher
Oregon -Washington State Director
Bureau of Land Management
Dept. of the Interior
P.O. Box 2965
Portland, Oregon 97208

Dear Mr. Luscher,

After reading the final Environmental Impact Statement of December 1985 and the supplement draft to Northwest Area Noxious Weed Control Program I wish to make the following comments.

The amount of time and money that was spent to research and develop the documentation in these reports must have been enormous indeed, all paid for by the taxpayer. It is ridiculous that a few can be so blind as to not see the magnitude of problems that noxious weed cost the U.S. taxpayer.

If we would have started a real sound program 20 years ago we would'nt have such a gigantic problem today and it can in no way be corrected by wasting funds to write lengthy reports as to correct the problem. It does appear that just jobs are created and held unto by just doing that while the problem still remains.

For instance knapweed in the Washington, the Panhandle of Idaho and Montana has reached epidemic proportions basically because of a few that say the BLM and the U.S. Forestry can't spray so the State and Counties don't want to spray as they are afraid of lawsuits. I think the time has come to take the monkey of our backs and put the lawsuits unto the "Do Gooders" that say we can't spray this or that. They are causing with the continued spread of weed seeds the following:

1. Damaged over 2 million acres of quality environment timber and forage production in Montana for wild game (deer and elk).
2. Spotted napweed produces a toxin that weakens most native grasses, forage and shrubs and nothing will then grow.
3. Loss to the sportsmen is devastating to big game. In the next 10 years Montana alone will lose close to 200 elk each year just from spotted knapweed.
4. Loss of grazing land. Spotted knapweed will reduce cattle grazing capacity by 60 to 70 %, costing the Northwest in excess of 10 million dollars annual.
5. Loss of quality wilderness and reserves. There is not a single place that knapweed is not found or deeply entranched. In Montana alone, Cabinet, Mission Mountain, Bob Marshell, Scapegoat, Bitterroot, Selway, Glacier National Park, National Bison Range and so many more here in Idaho and in Washington.

-2-

5. Loss of Tourism and Outfitting. Motels, hotels and restaurants and most everybody is effected by the losses.

This monumental task can not be done by the Federal Government alone. The property owners are now paying the bill. What we need is a motor fuel tax for Federal, State and County level to fight this noxious weed problem.

The weed seed are spread 99% by motor vehicles so lets stop playing games and make anyone that drives a car, truck or train pay the bill. I mean you and I, interstate trucks or private transportation, tourist , hunter , fishermen etc. Lets take the burden off the property owner. I strongly support Proposal # 1 , lets get to it.

Sincerely,

Bill Pogue

Bill Pogue

28

STATE OF IDAHO
DEPARTMENT OF AGRICULTURE

JOHN V. EVANS, Governor
RICHARD R. RUSH, Director

2270 OLD PENITENTIARY ROAD
P.O. BOX 790
BOISE, IDAHO 83712

(208) 334-3240

December 31, 1986

Mr. Charles Luscher
Oregon State Director
Bureau of Land Management
P.O. Box 2965
Portland, OR 97208

Dear Mr. Luscher:

Idaho is vitally concerned about the damage being caused to the state by noxious weeds. We appreciate this opportunity to offer our comments.

1. Weeds devastate fisheries, destroy wildlife habitat, ruin our shrinking rangelands, reduce tourist attraction, and increase the cost of food. Threatened and endangered plants - as well as the irreplaceable native flora - are completely obliterated by the stronger, more competitive exotic vegetation. Worry about product harm that is less likely to happen than being struck by a meteorite suggests that we can lose perspective; we have more serious things to think about. The alternatives are clear: Judicial use of chemicals in an IPM program, or unrestrained environmental destruction from noxious weeds.

2. We are not apprehensive about ground water hazards from these herbicides. We do not have any information showing valid instances of ground water contamination in Idaho from use of the planned chemicals.

3. There is adequate documental analysis. Any document, we suppose, will have shortcomings. However, anyone who has the background and interest to read this one should not find it difficult to understand, and it is as readable as it is necessary to be. Our concern is not with the immaculacy of the EIS, but with halting the environmentally destructive noxious weeds.

4. The laws of the State of Idaho demand attention to noxious weeds by the citizens and entities of the state. We should expect the same attention to weeds from the federal sectors. Intelligent, directed IPM programs must be re-instituted and sustained on federal lands in Idaho.

5. We live in a chemical society - gasoline, plastics, medicines, water purification, ad infinitum. No one wants health hazards, but after so much testing, further impediments become harrassments. The end result has not changed; there has been much tax money spent on litigation and paper which should have gone for weeds; herbicides have been identified which are far less potentially damaging than the weeds they control; and noxious weeds in untreated areas are flourishing.

EQUAL OPPORTUNITY EMPLOYER

Mr. Charles Luscher
December 31, 1986
Page Two

6. It would seem that a statement of the Sierra Club is appropriate: "Not blind opposition to progress, but opposition to blind progress". It is the belief of the Idaho Department of Agriculture that the Bureau's IPM plan is not "Blind Progress", but that further impediment is "Blind Opposition". Any unknown elements of this proposed Integrated Pest Management program are of inconsequential significance compared to further rampant, uninhibited destruction of the environment by noxious weeds. These ecosystem predators must be controlled. Any weaknesses of the BLM proposal are surmounted by the urgency for on-the-ground action.

There has been enough assessment. Rapid implementation of the EIS is essential. Further delay will only cause unnecessary harm to our wildlife, recreation areas, watersheds, and our productive lands.

Sincerely,

Loal A. Vance
Idaho State Weed Control

LAV/sme

29

United States Department of the Interior

NATIONAL PARK SERVICE

Pacific Northwest Region
83 South King Street, Suite 212
Seattle, Washington 98104

IN REPLY REFER TO:
K7617(PNR-RE)
DES86/141

DEC 30 1986

Memorandum

To: State Director, Bureau of Land Management, Portland, Oregon

From: Acting Regional Director, Pacific Northwest Region

Subject: Comments on the Draft Supplement to the Northwest Area Noxious Weed Control Program: Final Environmental Impact Statement. (DES-86/41)

We found the subject draft Supplement to be well prepared, and reflective of the current literature, in most regards. In particular, we noted the reference on page 27 to the recent publication by Hoar, et al. (1986), on the risks for certain cancers related to the use of herbicides for agricultural purposes.

While we agree that some use of chemical herbicides will be necessary to control weeds on lands administered by the Bureau of Land Management, we continue to support Integrated Pest Management approaches whenever possible. All means of replacing chemical applications with biological and cultural methods should be explored.

William J. Briggle

30

ADA COUNTY

WEED AND PEST CONTROL
517 N. Meridian St.
Meridian, Idaho 83642
(208) 888-2316

EUGENE ROSS
Manager

January 2,1987

Oregon State Director
Bureau of Land Management
P.O. Box 2965
Portland,Oregon 97208

Dear Sir:

After reviewing both the Final EIS and associated DSEIS to the Northwest Area Noxious Weed Control Program on BLM lands. I wish to offer the following comments.

Noxious weed eradication,containment and control on public lands is extremely critical when implementing and conducting extensive noxious weed control measures on the county and state level.failure on the part of Federal Land Management Agencies to control and manage noxious weeds on their lands can only lead to heavy economic and unnecessary cost to adjacent landowners and managers.

The DSEIS provides adequate information on the impacts and environmental consequences of chemical treatment of noxious weeds,especially those impacts on human health.With the adoption of the interated noxious weed management program (Page 61 DSEIS) that is designed to set noxious weed treatment priorities,the stage is now set for the discriminate and intelligent use of herbicides as a management tool.The integrated noxious weed management program now gives total meaning to the entire EIS on BLM lands.

I recommend adoption of Alternative 1. The Proposed Action and full acceptance of the final EIS and DSEIS for noxious weed control on BLM lands in the Nothwest area.

Respectfully Submitted

Eugene Ross,Manager

31

Province of British Columbia

Ministry of Agriculture and Food

District Office
Box 1980,
Creston, B. C.
V0B 1G0

December 31, 1986.

Oregon State Director,
Bureau of Land Management (935),
Box 2965,
PORTLAND, OR. 97208

Dear Sir:

Over the past few years we have enjoyed a very cooperative relationship with Boundary County weed control personnel working out of Bonners Ferry, Idaho. There are a number of noxious weeds especially spotted and diffuse Knapweed that are a major concern to us in British Columbia and the ability to work with United States weed control crews to ensure these weeds are chemically controlled along both sides of the international border is very important to both programs.

We are shocked to learn that your department is seriously considering the banning of chemical control on Bureau of Land Management and Forestry Lands. We understand the kind of pressure that environmentalists can bring to bear, as we have similar problems here. However, we hope that the impact of weeds on agriculture, forestry, and wildlife concerns will be taken into account in your decision. A decision to ban pesticides, especially herbicides, would cause serious problems for us in the Creston area and, in fact, in the East Kootenay Region of British Columbia.

Yours very truly,

Brian T. Laing, P. Ag.,
District Agriculturist.

32

PRESIDENT
Jim Little, Emmett

PRESIDENT-ELECT
Bill Schroeder, American Falls

EXECUTIVE VICE PRESIDENT
Tom Hovenden, Boise

NATIONAL CATTLEMEN'S ASSOCIATION

Idaho Cattle Association

ICA

2120 AIRPORT WAY January 2, 1987

Charles W. Luscher,
Oregon State Director,
Bureau of Land Management (935)
Post Office Box 2965,
Portland, Oregon 97208.

RE: NOXIOUS WEED CONTROL PROGRAM, NORTHWEST AREA

Dear Sirs:

I have spent part of my holiday season reviewing the Final Environmental Impact Statement for the five northwest states.

Please accept my compliments for a document that is an excellent presentation of the technical data required to answer certain critics of any environmental program.

We are in the process of creating a new organization in Idaho that will be patterned after the Oregonians for Food and Shelter (OFS). Paulette Payle of OFS has been most helpful in our organizational efforts.

We are working very closely with Delmar Vail and the Idaho Noxious Weed Study Group.

This brings me to one of the main points in this letter. Do you have additional copies of the October 1986 Supplement to the Northwest Area Noxious Weed Control Program? If so, we would be interest in purchasing up to 10 copies of this document.

I think the document would be an excellent text for our library for this new broad based organization.

Yours for a successful New Year.

TOM HOVENDEN
Executive Vice President

P.O. BOX 15397 • BOISE, IDAHO 83715 • 208 / 343-1615 or 344-9482

STATE OF WYOMING
OFFICE OF THE GOVERNOR
CHEYENNE 82002

ED HERSCHLER
GOVERNOR

December 31, 1986

Mr. Charles W. Luscher
Oregon State Director
Bureau of Land Management (935)
P.O. Box 2965
Portland, Oregon 97208

Dear Mr. Luscher:

The Supplement to the Northwest Area Noxious Weed Control Program final environmental impact statement has been circulated for state agency review. Copies of agency comments are enclosed for your consideration and use.

Thank you for the opportunity to review and comment on this document. Please keep us informed of the progress in this effort.

Sincerely,

Warren White
State Planning Coordinator

WW:pcl

Enclosures

cc: Hillary Oden w/enc.

THE STATE OF WYOMING

ED HERSCHLER
GOVERNOR

Department of Environmental Quality

Water Quality Division

HERSCHLER BUILDING CHEYENNE, WYOMING 82002 TELEPHONE 307 777-7781

MEMORANDUM

TO: Randolph Wood, Director, DEQ

FROM: Beth Wessel, Water Quality State Program Planning Coordinator

DATE: December 31, 1986

SUBJECT: Review and Comments on the Draft Supplement to the Northwest Area Noxious Weed Control Program

E. J. Fanning and Michael Carnevale have reviewed the above referenced document and have the following comments:

1. Page 3, Impacts on Surface Water, Column 2, Paragraph 2 ---

   The 1976 (rather than 1977) EPA "Quality Criteria for Water" recommended level of 2-4-D for drinking water was 100 ppb rather than 50 ppb. The May 1, 1986 EPA "Quality Criteria for Water" recommends a much more liberal 3.09 mg/l for protection of public health, although it recommends a taste and odor threshold of 0.3 ppb. U.S.G.S. water quality monitoring data for the water year 1985 indicate a seasonal peak (July 30) concentration of 0.22 ppb in Bitter Creek at Garland, Wyoming. Bitter Creek is a small collection drainage for irrigation return flows. Thus, the probability of elevated concentrations of herbicides would be the greatest. Information on local usage of 2-4-D and other herbicides is probably available through the Cooperative Extension Service and/or the Wyoming Department of Agriculture, but has not been utilized for these comments. 33-1

2. Page 3, Column 2, Paragraphs 5-6 and Page 4, Column 1, Paragraph 1 ---

   At U.S.G.S. station #06284500 (Bitter Creek near Garland, Wyoming) the seasonal high (June 18) concentration of Dicamba for Water Year 1985 was 0.280 ppb. The 1986 EPA "Quality Criteria for Water" recommended level for dichlorobenzenes is 400 ppb for drinking water.

3. Page 4, Column 1, Paragraphs 4-7 ---

   The highest concentration of picloran measured at U.S.G.S. station #06284500 on July 30 (1985 Water Year) was 0.010.

Memoradum to Randolph Wood
December 31, 1986
Page 2

4. Page 4, Column 2, Paragraphs 1-3 ---

   No monitoring data is available for glyphosate.

5. Historic use of pesticides in the northwest part of Wyoming does not appear to have resulted in exceedences of EPA recommended concentrations. Implementation of the noxious weed program as outlined in this document will probably have no significant impact on water quality in Wyoming.

nc

RESPONSE TO COMMENT LETTER 33

33-1 Thank you for noting our errors. The "Quality Criteria for Water" was the 1976 edition, and the 2,4-D recommended limit is 100 ppb rather than 50 ppb. These changes have been made in the text.

THE STATE OF WYOMING

ED HERSCHLER GOVERNOR

State Engineer's Office

NOV 21 1986

HERSCHLER BUILDING CHEYENNE, WYOMING 82002

November 17, 1986

Charles W. Luscher
State Director
U.S. Bureau of Land Management
Oregon State Office
P.O. Box 2965 (825 NE Multnomah St.)
Portland, Oregon 97208

Re: Draft Supplement to the Northwest Area Noxious Weed Control Program Final Environmental Impact Statement.

Dear Mr. Luscher:

We have briefly reviewed the subject draft supplement and have no particular comments at this time.

We do, however, have a comment on the Final EIS itself. By memorandum of July 9, 1985, from this office (No. 34-9, page 82 of the Final EIS), we questioned the listing in Table 2-1, page 29 of three endangered species as occurring in Wyoming. These include the Bonytail chub, Humpback chub, and the Colorado Squawfish. The Final EIS did not remove these fish, not found in Wyoming, from Table 2-1, or was there any comment about our questioning the list.

We request that Table 2-1 in the Final EIS be clarified, regarding the inclusion of species in Wyoming, in the Supplement as an addenda to the Final EIS. **33-2**

Sincerely,

George L. Christopulos

GEORGE L. CHRISTOPULOS
State Engineer

GLC/ht

cc: Paul Cleary
Natural Resources Analyst
State Planning Coordinator's Office
Herschler Building
Cheyenne, Wyoming 82002

33-2 Bonytail chub, humpback chub, and the Colorado squawfish are listed in the Federal Register (50 CFR 17.11 and 17.12, Endangered and Threatened Wildlife and Plants, January 1, 1986) as endangered in Colorado and Wyoming. Therefore, these fish are included in Table 2-1 as listed.

34

BINGHAM COUNTY NOXIOUS WEED CONTROL

P.O. Box 583
Blackfoot, Idaho 83221
Phone: 785-5005, Ext. 270

Marlyn J. Nelson
Bingham County
Weed Supervisor

January 2, 1987

Oregon State Director
Bureau of Land Management
P.O. Box 2965
Portland, OR 97208

Dear Sir:

I have reviewed the Draft Supplement Environmental Impact Statement for the Northwest Area Noxious Weed Control Program.

I feel that it is very adequate concerning any potential problems that may arise. The margins of safety and risk analysis are discussed very well and show that there is very little risk to human health involved in using herbicides as part of an integrated Pest Management Program. We do need to keep those individuals who handle these products well trained and equipped so as to minimize what little risk there is.

I appreciate the opportunity to comment on the supplement and would strongly urge its adoption.

Thank you.

Sincerely,

Marlyn Nelson

Marlyn Nelson, Superintendent
Bingham County Weed Control

MN:mm

35

W 214 - 6TH AVE, #201
Spokane, WA. 99204 12/31/86

STATE DIRECTOR BUREAU OF LAND MANAGEMENT
OREGON + WASHINGTON

BUREAU OF LAND MANAGEMENT
P.O. BOX 2985, PORTLAND, OR. 97208

GENTLEMEN,

REFERENCE IS MADE TO DRAFT SUPPLEMENTAL IMPACT STATEMENT CONCERNING NOXIOUS WEED CONTROL ON PUBLIC LANDS IN WASHINGTON, OREGON, IDAHO, MONTANA AND WYOMING AND TO PREVIOUS STATEMENTS I HAVE MADE REGARDING THE PRELIMINARY AND FINAL DRAFT EIS.

PLEASE INCLUDE THE FOLLOWING FOR CONSIDERATION IN DRAFTING YOUR FINAL DRAFT SUPPLEMENTAL STATEMENT. **35-1** CONGRATULATIONS FOR YOUR CONTINUING AGGRESSIVE EFFORT TO CARRY OUT YOUR RESPONSIBILITIES FOR PREV. + CONTROL OF TARGET NOXIOUS WEEDS ON THE PUBLIC LANDS.

YOURS VERY SINCERELY

Fred H. Mass

FRED H. MASS

RESPONSE TO COMMENT LETTER 35

35-1 Thank you for the material. It will be reviewed and considered in preparing the final supplement. Anyone wishing to review the material should contact the BLM Oregon State Office (Lloyd Center Tower, 16th floor, 825 NE Multnomah Street, Portland, Oregon, (503) 231-6268.

36

Caribou County Weed Control
Reao Mickelson Sup't.
159 So. Main
Soda Springs, Idaho 83276

January 2, 1987

Oregon State Director
Bureau of Land Management (935)
P.O. Box 2965
Portland, OR 97208

Re: The Supplement to the Final Environmental Impact Statement (DSEIS)

Dear Sir:

Congratulations on your willingness to go the second mile with your (DSEIS).

In the final EIS, December 1985, many letters breathed appreciation for the extensive coverage by the Bureau of Land Management on the safety of herbicide usage on Public Lands.

Thousands of acres in the Pacific Northwest have been rendered useless by the on going take over by noxious and undesirable plants.

Page 29 (Draft 1986) Paragraph six (6)	Disagreement of Experts Toxicity
Page 45 (Draft 1986) Paragraph five (5)	Risk Analysis
Page 46 (Draft 1986) Paragraph one (1)	Risk to Members of the Public
Page 51 (Draft 1986) Paragraph two (2)	Accidental Spill Scenario #1
Page 57-58 (Draft 1986) Paragraph one (1)	Incidence Levels of Cancer H.S.

I have used herbicides for 44 years by hand-gun, back-pack, helicopter and trucks. I am glad that you noted the realism of herbicides usage by denoting the fact that herbicides are diluted 100x's prior to usage, that only the targeted weeds are to be sprayed and the unrealistic chance and remote possibility of ingestion by human or any endangered specie.

There needs to be on going efforts in poison plants and noxious weed control, whether on public or private lands. Over 300 sheep were lost to "death camus" on Caribou County's public lands. Many cattle have died from "tall larkspur" and "poison hemlock". Fifty cattle died at one time on Brockman Creek drainage in Gray's Lake outlet area by eating "water hemlock"(the most toxic plant in North America; reference Poison Plant Center of Logan Utah.)

Oregon State Director
Page two (2)

Your (DSEIS) coverage is concise and adequate for any person or organization with a will to be reasonable and realistic.

Sincerely yours,

Reao H. Mickelson

Reao Mickelson, Sup't
Caribou County Weed Control

37

NCAP

NORTHWEST COALITION for ALTERNATIVES to PESTICIDES
P.O. BOX 1393 EUGENE, OREGON 97440 (503) 344-5044

Charles W. Luscher
Oregon State Director
Bureau of Land Management (935)
P.O. Box 2965
Portland, OR 97208

January 4, 1987

Comments of the Northwest Coalition
for Alternatives to Pesticides
on the
Draft Supplement to the Northwest Area Noxious Weed Control Program Final Environmental Impact Statement

Table of Contents

JAN 05 REC'D

NORTHWEST COALITION for ALTERNATIVES to PESTICIDES
P.O. BOX 1393 EUGENE, OREGON 97440 (503) 344-5044

Charles W. Luscher
Oregon State Director
Bureau of Land Management (935)
P.O. Box 2965
Portland, Oregon 97208

January 4, 1986

Comments on the
Draft Supplement to the Northwest Area Noxious Weed Control Program Final Environmental Impact Statement

The following comments are submitted on behalf of the Northwest Coalition for Alternatives to Pesticides (NCAP).

I. Introduction

This Draft Supplement fails to remedy the severe deficiencies of the Final Environmental Impact Statement (FEIS) that was withdrawn on June 23, 1986.

NCAP has now commented on the deficiencies of the Draft EIS and Final EIS (FEIS), and has submitted legal affidavits documenting the deficiencies of the FEIS.

In the preface to the Supplement, BLM claims that public concerns raised in the response to the FEIS and in the responses to the Department of Interior's motion for partial dissolution of the injuction spurred the agency to issue a document that takes "the opportunity to correct technical errors of merit that appeared in the FEIS.... These changes, however, are not expected to change the overall analysis." (p. i)

The NEPA regulation on preparing a Supplement to an EIS identifies two occasions when a Supplement needs to be issued: when the agency makes substantial changes in the proposed action that are relevant to environmental concerns; or when there are significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts (40 CFR 1502.9).

Apparently, the BLM has issued a Supplement that is supposed to trigger changes in the EIS, yet the BLM denies that any changes in the overall analysis occur. What is the point of issuing the Supplement? The BLM is admitting that its decision to issue a Supplement does not comply with NEPA requirements that substantial changes in the proposed action are being made or significant new circumstances bearing on the action or its impacts are present. 37-1

NCAP agrees that the BLM has not made any changes in its analysis. The same deficiencies remain in this Supplement as were present in the FEIS that was withdrawn, for the BLM has chosen to dig in its heels and window-dress rather than honor the regulations of the National Environmental Policy Act (NEPA) (40 CFR 1500-1508):

1) The BLM does not state or make clear the extent of incomplete and unavailable information on the human toxicology, wildlife effects, or environmental fate of the five herbicide formulations proposed for spraying (40 CFR 1502.22).

2) The BLM does not insure the scientific integrity of its analyses of the potential environmental and health impacts of its proposed program (40 CFR 1502.24).

3) The BLM does not evaluate the potential range of adverse impacts of its proposed program as indicated by credible scientific evidence (40 CFR 1502.16).

4) The BLM does not include the major reasonable alternative of grazing management and classical integrated pest management, although this deficiency has been noted by numerous commenters since the first Draft EIS. Since, as noted in the NEPA regulations, "This section is the heart of the environmental impact statement" (40 CFR 1502.14), the heart is still missing.

5) The BLM does not insure the scientific integrity of its risk analysis or discussion of the acceptability of risk (40 CFR 1502.24).

The BLM has before it an example, here in the Northwest, of a federal land management agency that is attempting to follow the mandates of NEPA for its vegetation management EIS. As it writes the EIS, Region 6 of the Forest Service is including all suggested, reasonable alternatives and is, as of this date, undefensively considering all evidence of adverse impacts of herbicides.

If the BLM produces its FEIS out of the Supplement that is here being commented upon, the contrast between the Forest Service EIS and the BLM EIS will be the contrast between a NEPA document and a document that ignores NEPA. 37-2

The following comments document examples of each of the five major deficiencies of the Supplement. NCAP recommends that the BLM also reread or read earlier comments of NCAP (July 31, 1985 comments on the Draft EIS; February 3, 1986 and February 6, 1986 comments of NCAP on the FEIS); Narrative Statements of Mary O'Brien, Ruth Shearer, and Norma Grier and the Response to Department of Interior Motion for Partial Dissolution of Injunction submitted by Ralph Bradley in the 1986 NCAP v. Block challenge of the Final EIS. Most of those comments remain applicable to the FEIS and its Draft Supplement.

II. The Supplement Does Not State or Make Clear The Extent of Incomplete and Unavailable Information

Example #1: Secret Ingredients

The Supplement attempts various quantitative risk analyses of the following four publically revealed herbicide ingredients: dicamba, glyphosate, picloram, and 2,4-D. No analyses are given of the environmental and chronic health effects of Esteron 99, Tordon 2K (granular), Tordon 22K (Liquid), Banvel, or Rodeo. The BLM does not propose to spray dicamba, however; it proposes to spray Banvel. It does not propose spraying glyphosate; it proposes spraying Rodeo (FEIS, Appendix O).

The quantitative risk analyses are computed assuming that humans, other animals, and plants will be exposed only to the revealed ingredients dicamba, glyphosate, picloram, and 2,4-D. All other secret, but potentially biologically active ingredients in Esteron 99, Tordon 2K, Tordon 22K, Banvel, and Rodeo are entirely ignored in the risk analyses, either in terms of volume or toxicity, alone or in the formulated mixtures.

In the case of Tordon 22K (liquid), for instance, this means the risk analyses consider 24.4% of the volume of chemical ingredients to which the environment and its humans will be exposed. The BLM indefensibly ignores the various types of potential toxicity of 75.6% of the chemicals in Tordon 22K.

The BLM blithely assigns two paragraphs to this enormous data gap in the risk analysis (Supplement, p. 13): **37-3**

Inert Ingredients

In addition to active ingredients, pesticide formulations may contain a number of other chemical compounds to increase penetration, reduce drift, etc. A { EPA recently has undertaken a study of inert ingredients and identified chemicals of toxicological concern. None of the formulations proposed for use by BLM has any inerts of toxicological concern according to EPA (1986). }

Another indication of the toxicity of the formulated product (which includes inerts) and the technical grade material can be demonstrated by comparing D { their acute LD_{50} 's. As shown in Table 3-4, the formulations proposed for use by BLM are not more acutely toxic than their active ingredients. } Of course, the main difference shown is the effect of dilution of the active ingredient. However, it does in- B { dicate that given the same volume of material, active ingredients are generally more acutely toxic than their formulated products. Therefore, the risk analysis should not underestimate effects due to the formulated product. } C { For additional information see the section on synergistic and cumulative effects. }

Several comments are in order, corresponding to the letters I have marked on the two paragraphs:

BLM ["A" "EPA recently has undertaken a study of inert ingredients and identified chemicals of toxicological concern. None of the formulations proposed for use by BLM has any inerts of toxicological concern according to EPA (1986)."

These two sentences are misleading. The U.S. Environmental Protection Agency, which has registered 1200 "inert" (secret) ingredients for use in pesticides, indicates that it knows nothing about the toxicity of approximately 800 of the ingredients, knows 55 "have been shown to be carcinogens, developmental toxicants, neurotoxins, etc.," knows that the chemical structures of an additional 51 ingredients are suggestive of these same problems,[1] and is "concerned about petroleum distillates which occur in about 80% of all pesticide formulations...and pose signficant regulatory problems."[2] These petroleum distillates are of highly variable chemical composition and "The polynuclear aromatic components of petroleum distillates have a high potential for carcinogenicity and the aliphatic content may pose problems as well."[2]

The EPA (1986) reference is a letter from Therese Murtagh, Chief of the Information Services Section of the Program Management and Support Division of EPA's Office of Pesticide Programs to Guy Baier, Acting Assistant Director of the Bureau of Land Management. In this letter, Murtagh states that (a) none of the 55 inerts known to pose toxicological hazards are present in Esteron 99, Tordon 2K, Tordon 22K, Banvel, or Rodeo, and (b) Esteron 99 contains petroleum distillates.

Three comments are in order:

(1) Citizens are equally concerned about the 800 ingredients about which the EPA knows nothing and the other 51 that are likely to be similarly and may be more dangerous than the 55 known "bad actors." **37-4**

(2) The EIS fails to mention the comment by Therese Murtagh that Esteron 99 contains petroleum distillates and that the EPA has noted that these have a high potential for carcinogenicity. **37-5**

(3) Murtagh does not indicate how she arrived at her conclusions regarding the 55 ingredients that are known to pose toxicological hazards. If she has looked at evidence, it is proprietary data unavailable for public review. ("Material based on proprietary data which is itself not available for review and comment shall not be incorporated by reference." 40 CFR 1502.21) **37-6**

BLM ["B" "[G]iven the same volume of material, active ingredients are generally more acutely toxic than their

formulated products. Therefore, the risk analysis should not underestimate effects due to the formulated product."

(1) Even if the formulations are not "generally more acutely toxic" than the active ingredients, the risk analysis treats the secret ingredients as if they are not toxic at all and as if their volume does not exist. This means the risk analysis does underestimate effects due to the formulated product.

(2) Acute toxicity is not the only or even the major area of concern. What of the secret ingredients' potential to cause birth defects, cancer, nerve damage, chronic damage, etc.? What of their environmental fate? What of their effects on wildlife? **37-7**

BLM ["C" "For additional information see the section on synergistic and cumulative effects."

The EIS "section on synergistic and cumulative effects" (pp. 20-22) speaks only of synergism and not at all of cumulative effects. The discussion of synergism speaks only of combinations of revealed ingredients of herbicides, and not at all of combinations of an herbicide's revealed ingredient(s) and its secret ingredients.

The section on synergism indicates that (a) there are too many combinations of herbicides to feasibly test, (b) people are unlikely to encounter two herbicides in separate projects, and (c) residues of any of the two herbicides would not be likely to be simultaneously present in the body.

Clearly, none of these assurances applies to the problem of synergism of the various ingredients in one formulated product sprayed by the BLM: (a) the BLM is apparently proposing only five formulations (based on the five labels given in Appendix O of the FEIS), (b) people and other animals will encounter both active and secret ingredients if they are exposed to the herbicides, and (c) the residues of all of the formulation's ingredients will be simultaneously present in the body.

Neither the synergism nor cumulative effects of the secret and revealed ingredients of the five proposed herbicides have been considered in this EIS. This is a violation of 40 CFR 1502.16. **37-8**

BLM ["D" "As shown in Table 3-4, the formulations proposed for use by BLM are not more acutely toxic than their active ingredients."

Table 3-4 is as follows, and comments correspond to the numbers marked on the table:

Chapter 3, Supplement, p. 14

Table 3-4. Comparison of Acute Toxicity of Technical Active Indgedients (a.i.) Versus the Formulated Products

Herbicide	Technical LD_{50} (mg/kg) a	Formulation LD_{50} (mg/kg) b
2,4-D	375	21% formaulation LD_{50} = 2,830 0.6% formulation LD_{50} =20,000
Dicamba	757	85.8% a.i. LD_{50} = 2,900
Glyphosate	4,320 d	5,400 c
Picloram	8,200 e	Picloram 17%. f triclopyr 32.5% LD_{50} = 2,991[1]
Triclopyr	630	43.8% a.i., LD_{50} = 2,140 8.0% a.i., LD_{50} = 5,000

[1]This is an indication of the higher toxicity of triclopyr as shown below.

Six comments are in order regarding Table 3-4: 37-9

(a) No references are given for these LD_{50}s, the species of experimental animals are not indicated, and the routes of exposure are not listed.

(b) What formulations are these?

(c) An LD_{50} of 5,400 mg/kg (oral, rat) for Roundup is listed in the Herbicide Background Statements (USDA FS, 1984 as listed in this Supplement), but presumably the BLM is not proposing to use Roundup, if it is only proposing to use those herbicides for which labels are provided in Appendix O of the EIS. (The EIS fails to clearly state which formulations will be used for which situations. It must state this.)

The only glyphosate formulation listed in Appendix O (Herbicide Labels) is Rodeo. The LD_{50} for Rodeo is not given in the EIS.

Are any of the Table 3-4 formulations those that the BLM is intending to use? What are the LD_{50}s of the formulations BLM is intending to use?

(d) On p. 31 of the Supplement, the BLM notes that glyphosate has an LD_{50} of 5,500 mg/kg (rats). If the LD_{50} of glyphosate is 5,500 mg/kg and that of Roundup is 5,400 mg/kg as listed in Table 3-4, then the secret ingredients, which make up 59% of the formulation, have an LD_{50} of about 5,300 mg/kg. This means they are more acutely toxic than glyphosate, the environment will be exposed to a greater volume of secret ingredients than glyphosate, and the risk analysis is calculated on the basis that the toxicity and volume of secret ingredients will be zero!

(e) Although no reference is given for this picloram LD_{50} of 8,200 mg/kg, the EPA's Science Chapters on picloram indicate the picloram test that yielded an acute oral LD_{50} of 8,200 mg/kg (oral, rat, Dow Chemical Co. Tox. Res. Lab., Jan. 15, 1963, MRID# 0068961) is invalid.[3] What is the BLM reference for the 8,200 mg/kg LD_{50}, and what is BLM's evidence that the LD_{50} is valid?

The only picloram LD_{50} (oral, rats) listed as valid in the Science Chapters is for male rats and it is 3,250 mg/kg, which is 2.5 times as acutely toxic as indicated in Table 3-4.

f. Why is a picloram and triclopyr formulation LD_{50} given? Is the BLM intending to use that mixture? If so, it hasn't stated this.

The following conclusions must be clearly stated in the Final EIS, because they are true and they are of significance:

1. The BLM does not know what chemicals it is proposing to spray.

2. None of the herbicide formulations proposed for spraying has been tested for cancer, birth defects, mutagenicity, reproductive effects, nerve damage, or chronic effects.

3. The secret ingredients in the herbicide formulations may cause cancer, birth defects, mutagenicity, reproductive effects, nerve damage, or chronic effects.

4. At least one of the formulations BLM is proposing to use (Esteron 99) contains petroleum distillates, whose polynuclear aromatic hydrocarbons have a high potential for carcinogenicity. 37-10

5. The risk analyses in the EIS are based on only one revealed ingredient in the herbicide formulation, not on the full formulation that is being proposed for spraying by the BLM.

6. The BLM is unable to claim that it knows anything about the chronic effects of spraying the full formulations of the herbicides.

7. The BLM is unable to assume, with any scientific integrity, that the effects of the secret ingredients are likely to be less, comparably, or more hazardous than the revealed ingredients, alone or in combination with other ingredients in the formulation.

Therefore the BLM must state that it does not know the risk at which it places the environment and its humans by spraying herbicide formulations (except in the case of cancer and 2,4-D formulations for which there exist epidemiological data).

Example #2: Dicamba Missing Information

Although the BLM quotes extensively from the EPA dicamba registration standard for its discussion of dicamba's toxicity in humans and other animals (Supplement, p. 25), the Supplement never clearly lays out the data that are missing for dicamba and the relevance of this missing information to its risk analysis of dicamba.

As of 1983, when the dicamba registration standard was established, the following data were available:

DICAMBA – revealed ingredient of Banvel

Note: A solid box indicates no acceptable data are known to the EPA:

LD_{50}	Chronic Effects (2 species)	Oncogenicity (2species)	Reproductive Effects	Teratogenicity	Mutagenicity
757 mg/kg (oral, rat)	■ ■	■ ■	25 mg/kg (rat)	Fetal toxicity: 10 mg/kg (rabbit) Maternal toxicity: 3 mg/kg (rabbit)	Gene mutations: ■ Chromosome aberrations: ■ Other mechanisms of mutagenicity ■

The BLM needs to graphically indicate the fact that there are no valid dicamba chronic toxicity, oncogenicity, or mutagenicity (gene mutation, chromosome aberration, or other mechanisms of mutagenicity) data on file with the EPA. 37-11

Moreover, since Banvel is the chemical that is being proposed for spraying, the BLM needs to indicate what information the BLM has for Banvel (and likewise for the other formulations it proposes to spray): 37-12

BANVEL – dicamba + secret ingredients

LD_{50}	Chronic Effects	Oncogenicity	Reproductive Effects	Teratogenicity	Mutagenicity
None is listed in the EIS	■	■	■	■	■

The BLM proceeds to calculate a NOEL for "chronic toxicity" of dicamba (Table N-7, p. 45), although there is no valid chronic effects study to cite. The only study available is a subchronic effects (90-day) rat study. Because of this, the EPA states in the dicamba registration standard that "The available toxicity data are insufficient to fully assess the chronic human risk of dicamba."

The EPA toxicological conclusion notwithstanding, the BLM is undaunted. The BLM proceeds to develop "margins of safety" for systemic effects of dicamba (Tables N-8A, N-9A, pp. 47-48) and to state that any "margin of safety" over 100 means "the risk to humans can be judged negligible" (p. 45) and can be "considered a safe dose" (p. 9). (NCAP will not here repeat the scientific objection to the use of the term "margins of safety" when referring to any exposure below a non-human NOEL. The objection is contained in Ruth Shearer's Narrative Statement in the 1986 NCAP v. Block challenge of the FEIS. As BLM uses "margin of safety," the plain English meanings of "margins" and "safety" are violated.)

The BLM does note that EPA reduces the dicamba subchronic effects study NOEL by a factor of 2,000, rather than the factor of 100 used for chemicals with an adequate chronic effects data base, but the BLM makes no such allowance for missing information and scientific uncertainty (Supplement, p. 25, and Table N-7, footnote 4, p. 45).

In other words, in contrast to the EPA's consideration of the relevance of missing information to the tune of a factor of 2,000, the BLM pronouncement of the adequacy of a "margin of safety" of 100 for dicamba denies the significance of missing dicamba information (40 CFR 1502.22). Other than public dermal exposure estimates, all public and occupational exposures to dicamba estimated by BLM and found in Table 3-5 (p. 15) are greater than would be considered "safe" by the EPA. 37-13

III. The BLM Does Not Insure the Scientific Integrity of its Analyses

Example #1: Glyphosate Toxicology

By looking closely at just one column of text, it is clear that the BLM has abdicated its responsibility to insure the scientific integrity of its analyses.

Reproduced on the next page is a column on glyphosate from p. 31, Appendix K, the Chemical Hazard Assessment. Comments refer to the letters that have been marked on the column:

"A" This paragraph speaks of Roundup and glyphosate, but presumably the BLM is intending to spray Rodeo, not Roundup? **37-14**

The BLM makes no mention of the most disturbing implication of this paragraph: the secret ingredients in Roundup are more acutely toxic than glyphosate (i.e., the LD_{50} of Roundup is lower than the LD_{50} of glyphosate). Do the secret ingredients also cause more cancer? Do they pose risk of birth defects, liver damage, nerve damage? Is there any evidence that they do not?

A 21-day subacute dermal toxicity study found the Roundup formulation, its surfactant, and an alternate surfactant caused severe testicular skin reaction and atrophy in rabbits.[4] The test was in part a repetition of an earlier study that found use level dilutions of Roundup caused severe local skin reactions, atrophy of the testes, and death in some of the rabbits. The repeat study determined that the surfactants, and not glyphosate, were causing the severe reaction. Whether these same surfactants are still being used in glyphosate formulations is not clear. If different surfactants have been added, NCAP has seen no studies of the effects of the current formulations of Roundup on animals. This concern was raised by Ruth Shearer in her Narrative Statement for NCAP v. Block in 1983. The BLM has never acknowledge the problem.

If the surfactants in Roundup can cause severe skin reactions and testicular atrophy, what else can they cause? No chronic feeding, birth defects, reproductive effects, or oncogenicity studies have been performed on Roundup (or Rodeo, Banvel, Tordon 22K, Tordon 2K, or Esteron 99). **37-15**

The BLM must discuss the potential problems associated with incomplete information on the full formulations of the herbicides they propose to spray.

Appendix K (Chemical Hazard Assessment - Glyphosate), Supplement, p.31

A **Acute Oral Toxicity**. Roundup (41-percent glyphosate by weight) is ranked as moderately to slightly toxic (Doull and others 1980), based on an LD_{50} of 5,400 mg/kg in rats and an LD_{50} of 3,800 mg/kg in rabbits. Pure glyphosate has a slightly higher LD_{50} in rats, 5,500 mg/kg body weight (EPA 1984d).

B **Dermal and Eye Toxicity**. The dermal LD_{50} in rabbits for both the Roundup formulation and pure glyphosate is greater than 5,000 mg/kg body weight (Monsanto 1982).

C Roundup is ranked as moderately irritating when instilled in the rabbit eye and moderately irritating on rabbit skin in skin irritation tests (Newton and Dost 1981).

D **Reproductive Toxicity**. Teratology studies of glyphosate conducted with rats and rabbits also have been reviewed by EPA. These studies were negative for teratogenic effects. In these studies, teratogenic effects were not observed at the highest dose tested (3,500 mg/kg/day) in the rat or at the highest dose tested (350 mg/kg/day) in the rabbit. Maternal effects such as inactivity, stomach hemorrhage, reduced body weight gain, and death were observed in the rat at the highest dose tested. In the rabbit, soft stools, diarrhea, nasal discharge, and death were observed at the highest dose tested. The maternal NOEL for the rat was 1,000 mg/kg/day. The maternal NOEL for the rabbit was 175 mg/kg/day. In addition, mutagenicity studies on glyphosate have been reviewed and determined to be negative (EPA 1984d).

E **Chronic Toxicity**. A 2-year rat feeding study using technical glyphosate has replaced invalidated chronic feeding studies conducted by IBT. This replacement study has been reviewed by EPA, which reports no oncogenicity at the highest dose tested and a systemic NOEL greater than 31 mg/kg/day (EPA 1984d). Based on these study results, EPA has established a systemic NOEL of 30 mg/kg/day.

A replacement 3-generation reproductive study of glyphosate in rats has been reviewed by EPA. The NOEL established from these replacement data is 10 mg/kg/day (EPA 1984d). EPA has established an acceptable daily intake (ADI) of 0.1 mg/kg/day. The ADI is based on the NOEL of 10 mg/kg/day in the 3-generation reproduction study and utilizes a hundredfold safety factor. The ADI provides a yardstick for determining safe levels of chronic exposure.

F **Mutagenicity**. Glyphosate was nonmutagenic in microbial assays and mammalian cell assay systems both in vitro and in vivo (EPA, 1984d). There is no evidence to indicate that it is mutagenic or presents any mutagenic risk to humans.

Oncogenicity. Based on results from a 2-year chronic feeding mouse study that used technical glyphosate, EPA determined in August 1985 that glyphosate may be a weak oncogen (EPA 1985c). A treatment-related increase in the incidence of renal tumors was found in glyphosate-treated male mice.

"B" The Monsanto (1982) reference cited in the paragraph marked "B" gives a dermal LD_{50} only for technical glyphosate, not Roundup. Presumably Roundup isn't even being considered for use by the BLM, however, and the BLM gives no dermal LD_{50} for Rodeo. **37-16**

"C" The Newton and Dost (1981) reference does not mention rabbit eye or rabbit skin tests for Roundup.

"D" California Department of Food and Agriculture (CDFA) toxicologists are independently reviewing the tests Monsanto has submitted to California for registration of glyphosate (as well as data submitted for other pesticides registered in California). It is possible to match tests described by the EPA with tests described by the CDFA. The CDFA has found both of the teratology studies cited in the BLM EIS to be unacceptable, due to major variances from EPA study guidelines.[5] The rat study, for instance, did not present necropsy/histopathology data, did not present an analysis of the dose solution, did not justify the dosage selection, and did not present observations, individual animal data, and litter data, among other problems. **37-17**

Different problems plagued the rabbit teratology study: The health status of the dams was poor, the cause of death was not determined for most females, too few animals were included in the high dose group, and no necropsy findings were presented, among other problems.

"E" The 2-year rat chronic feeding/oncogenicity study has been judged unacceptable by CDFA for a variety of reasons including the fact that the highest doses were too low. A statistically significant number of testicular tumors were noted in the high dose males when compared to concurrent controls. "Conclusion: need more info on the testicular tumor."[5] **37-18**

In the glyphosate registration standard, the EPA also notes the testes tumors in this rat study as well as the fact that the doses were too low for the study to qualify as an oncogenicity study. Since the testes tumors were observed even at the doses that were 100 times too low, the Toxicology Branch Oncogenicity Review Committee speculated that at higher doses, "tumors might have been induced." The BLM does not mention this oncogenicity information.

"F" The CDFA indicates that three of the seven mutagenicity assays acceptable to EPA (EPA, 1984d) are unacceptable, including the rat DNA repair study, the dominant lethal mouse study, and the B. subtilis mutagenicity study.[5] **37-19**

Going from a data base missing all chronic effects data on dicamba (let alone Banvel) to exposure estimates and "margins of safety" for dicamba ranging from -31 (Table N-22, p 58) to a precise 595,238 (Table N-9A, p. 48), the BLM summarizes that "No adverse impacts [are] expected from use of herbicides" (e.g., Banvel) in its program (Table 1-4, p. 62). **37-20**

Aside from the fact that the "margins of safety" are calculated only for the revealed ingredient dicamba and not the herbicide BLM intends to spray (Banvel), they are calculated without sufficient data and interpreted without scientific integrity.

The same denial of the relevance of missing information occurs with respect to cancer. No valid oncogenicity study exists for dicamba, so the BLM considers dicamba to pose no cancer risk. The BLM states that "existing chronic feeding studies do not indicate that dicamba is a carcinogen, therefore no cancer risk analysis was conducted" (Supplement, p. 10). (One needs to recall that no adequate chronic feeding studies exist, either, see Supplement p. 25.) **37-21**

Although the BLM claims on p. 10 that it is performing a worst case analysis for all four known ingredients in its herbicide formulations, it is not. Clearly, if dicamba has not been tested for oncogenicity, the possibility exists that it may be carcinogenic.

The BLM must state that dicamba and/or Banvel may cause cancer, because that is the logical relevance of missing oncogenicity information (40 CFR 1502.22).

It is appalling enough that dicamba (Banvel) is even being allowed to be sold in the U.S. with no acceptable chronic effects, mutagenicity, or oncogenicity studies. It is totally unacceptable for the BLM to then calculate "margins of safety" for dicamba, and act as if there is no cancer risk. It is unsupportable scientifically.

The BLM must search its EIS for places where it assumes "no risk" on the basis of "no information" or incomplete information. All such statements lack scientific integrity and must be replaced with statements that the BLM "does not know," and these statements must not be accompanied by such ridiculous qualifiers as, "But there is no evidence that the herbicide causes (some) problem." This includes all references to full formulations and "herbicides," unless the BLM has documented studies on the full formulations.

The BLM must consider CDFA reviews of industry studies of their proposed four revealed ingredients as well as EPA reviews, because the studies are not published, are not peer-reviewed, and are not readily available for public review. If the BLM considers only EPA reviews of these studies and ignores contradictory CDFA reviews while not themselves independently reviewing the study data, the BLM is abdicating to the EPA.

The BLM needs to obtain all available CDFA reviews of the studies discussed in the EIS, for it will help the BLM judge the adequacy of the data base for making conclusions. **37-22**

Example #2: "2,4-D Contaminants"

Regarding 2,4-D contaminants, the BLM makes several statements that are unsupportable scientifically.

BLM (1) "...2,3,7,8 TCDD has never been found in any sample of 2,4-D." (Supplement, p. 26.)

Response: A 1984 EPA document on dioxins writes, "Though 2,4-D is not expected to contain 2,3,7,8-TCDD and does not in general, production trains are often used for production of chemicals whose manufacture necessitates the use of similar process equipment. In the manufacture of chemicals on a production train previously contaminated with PCDDs [polychlorinated dibenzo dioxins], both the products and waste generated can be contaminated with PCDDs. Thus, 2,4-D, which otherwise was not expected to be contaminated with 2,3,7,8-TCDD, did indeed contain some 2,3,7,8-TCDD because the equipment used in its manufacture had been employed previously to produce 2,4,5-T (45 FR 32677)."[7] (Emphasis added.) **37-23**

The BLM must note that 2,3,7,8-TCDD has been found in 2,4-D and that 2,4-D produced by Vertac Chemical company may still be producing 2,4-D contaminated with 2,3,7,8-TCDD.

As noted in a September 24, 1981 EPA Dioxin Task Force meeting summary, "Vertac has in storage approximately 3,200 drums of TCDD wastes resulting from the production of 2,4-D (Dichlorophonoxyacetic Acid) between September 1979 and May 12, 1980. These wastes contain TCDD because the equipment used to produce 2,4-D had been used previously to produce 2,4,5-T, and the equipment remained contaminated with TCDD after production shifted from 2,4,5-T to 2,4-D."[28]

Six months later, a meeting summary of the EPA Chlorinated Dioxin Work Group noted that Vertac's "existing stores of [TCDD-contaminated] 2,4-D wastes will be recycled into the manufacturing stream; Vertac anticipates that the existing inventory of 2,4-D wastes will be thus depleted by late 1985."[29]

In other words, Vertac was allowed to add the TCDD-contaminated wastes into the 2,4-D it was producing.

BLM (2) "Special attention" need be paid to only two 2,4-D contaminants: 2,4-dichlorophenol (2,4-DCP), and 2,7-dichlorodibenzo-p-dioxin (DCDD). (Supplement, pp. 27-28)

Response: At least one tri- and one tetrachlorodibenzo-p-dioxin have also been found in 2,4-D, as well as "unidentified" chlorinated compounds and nitrosamines (see (5) below for a discussion of nitrosamines).

Surveys have found 1,3,6,8-TCDD in 2,4-D.[8-9] As an EPA memo entitled 'Analyses for Di and Tetra Chlorinated Dibenzo-p-dioxins in 2,4,-D," notes, "The presence of 1,3,6,8-TCDD in 2,4-D is not surprising. This laboratory reported the presence of 1,3,6,8-TCDD in a 2,4-D process water to EPA Region 5, in early 1979."[9]

To quote from Ruth Shearer's 1983 NCAP v. Block first Narrative Statement, "...[I]n 1980, Canadian scientists reported that 12 out of 26 commercial samples of 2,4-D analyzed for dioxin content were positive at 80 to 8000 ppb (parts per billion) for three types of dioxin: 2,7-dichlorodibenzo-p-dioxin (DCDD), 1,3,7-trichlorodibenzo-p-dioxin, and 1,3,6,8-tetrachlorodibenzo-p-dioxin (1,3,6,8-TCDD). After receiving this information, the EPA still put no restrictions on 2,4-D, but did begin a sampling program to determine whether dioxin contaminants are present in U.S. products. During the first phase of this program, 3 out of 30 samples were found to contain DCDD in concentrations below 100 ppb, and no TCDD was detected. However, when the three positive samples were sent to another laboratory for higher resolution confirmatin, DCDD was detected at concentrations up to 184 ppb, and 2 of the 3 samples showed 1,3,6,8-TCDD at 6 to 11 ppb. The other 27 samples were not assayed by the more sensitive procedure, and none of the 30 samples was tested for the trichloro-dioxin found in the Canadian analyses. In addition, the higher resolution laboratory reported that extremely high concentrations of unidentified chlorinated contaminants were also present in the U.S. samples." (Cites "EPA (December 22, 1980) Dioxins in 2,4-D - Interim Progress Report".) (Emphases added.) **37-24**

What does all this mean? That the BLM must acknowledge the presence and potential presence of 1,3,6,8-TCDD and 1,3,7-trichlorodibenzo-p-dioxin and other, unidentified chlorinated compounds in 2,4-D formulations. This was pointed out to the BLM in court in 1983 and the evidence presented in court was a repeat of evidence that had been presented to the BLM for years before that. It gets old (not to mention illegal), this denial of problems with the herbicide formulations.

BLM (3) What of the risk posed by the dioxin contaminants? The BLM writes, without reference, that "...2,7-dichlorodibenzo-p-dioxin (DCDD), which differs only slightly in structure from the well-known 2,3,7,8-TCCDD [sic],...differs by about a million-fold in toxicity.... DCDD has been found in 3 of 30 samples of U.S.-produced 2,4-D along with traces of other relatively nontoxic chlorodioxins with three and four chlorines." (P. 28)

Response: In fact, dioxins are poorly tested, and the BLM must either document its conclusions about the low toxicity of these dioxins or state that they do not have toxicological information on the dioxins. **37-25**

In what is one of the more amazing admissions of the voodoo of risk assessment in the absence of adequate data, a position document of the U.S. EPA Chlorinated Dioxins Workgroup entitled "Interim Risk Assessment Procedures for Mixtures of Chlorinated Dibenzodioxins and -Dibenzofurans (CDDs and CDFs)" notes the following:[10]

"Given the high potency and strong structure-activity relationships exhibited in in vivo and in vitro studies of CDDs [chlorinated dibenzodioxins] and CDFs [chlorinated dibenzofurans], the CDWG [Chlorinated Dioxins Working Group] recognizes that the potential risks posed by the congeners other than 2,3,7,8-TCDD need to be addressed. Detailed consideration of the toxicity of the vast majority of the CDDs/CDFs is limited by the lack of toxicology studies on most of the congeners.... [T]the CDWG believes that it would be unwise, uneconomical and unnecessary to conduct...extensive testing on each of the CDD/CDF congeners prior to conducting an assessment of their risks." (Emphasis added.)

This in spite of the CDWG's admission that "limited data suggest that some of the 74 other CDDs [dioxins] may have toxic effects similar to those of 2,3,7,8-TCDD, again at very low doses."[10]

The BLM must admit that it does not know the risks that may be posed by 1,3,6,8-TCDD and 1,3,7-trichlorodibenzo-p-dioxin and other chlorinated compounds in 2,4-D. The BLM cannot assume, in the absence of information, that these compounds pose minimal risk.

Obviously, the literature on contaminants of Banvel, Rodeo, Tordon 2K, and Tordon 22K needs to be searched more closely by the BLM.

BLM (4) "The conclusion...is that neither 2,4-DCP nor 2,7-DCDD, at maximum occupational or environmental exposures to 2,4-D, represents a human hazard." (Supplement, p. 28)

Response: This conclusion has no scientific integrity given the preceding evidence cited by the BLM that (a) "The effects of 2,4-DCP on human health have not been well studied," that it is a weak tumor promotor, and that it is extraordinarily volatile; and (b) 2,7-DCDD is fetotoxic and a possible carcinogen. (P.28.) **37-26**

BLM (5) The BLM does not mention the presence of nitrosamines in 2,4-D. To quote from NCAP's June 12, 1986 comments on the BLM Supplement to the Western Oregon Program - Management of Competing Vegetation Draft Environmental Impact Statement, "The BLM does not discuss the fact that four 2,4-D amine salts have been found to contain 120-150 ppb of one or both of two N-nitroso compounds: N-nitrosodimethylamine and N-nitrosodiethylamine.[11] **37-27**

Diethylnitrosoamine has been tested in 20 species, including primates, and has been a potent carcinogen in all of them.[12]

N-nitroso-dimethylamine and N-nitroso-diethylamine are believed to generate alkylating intermediates believed to be responsible for the mutagenic, toxic, and carcinogenic effects of the parent compounds in vivo and in vitro.[13]

The BLM must discuss the potential for 2,4-D formulations to contain carcinogenic nitrosamines.

IV. The BLM Does Not Evaluate the Potential Range of Adverse Impacts of Its Proposed Program

Example #1: Impacts on Wildlife and Fish

The discussion of impacts on wildlife in this five-state, fifteen-year, five-pesticide EIS is wholly inadequate. Numerous sweeping statements are made without documentation, the 14-paragraph section, "Impacts on Wildlife and Fish" (pp. 7-8) basically incorporates by reference a lengthy Cannabis eradication EIS, and no attempt is made to discuss the effects of killing broadleaf plants and or pesticides on wildlife communities of rangeland, the main type of land addressed in this EIS.

Unreferenced statements: The following statements must either be documented or removed from the EIS:

BLM (a) "Noxious weeds that invade small unique habitat areas or dominate wide expanses of important habitat areas are usually detrimental to wildlife and fish." (p. 8.)

Response: Are introduced rangeland grasses any less detrimental?

BLM (b) "Noxious weeds usually reduce habitat diversity or eliminate key plants used for food or cover by animals."

Response: Do the foraging animals or the introduced rangeland grasses do less of this? More?

BLM (c) "Although noxious weeds provide some food or cover for a few wildlife species...most native communities have greater vegetation diversity and better forage and cover for wildlife and fish. In most cases, control of noxious weed [sic] that degrade such wildlife habitat would actually be more of an overall benefit to wildlife and fish." (p. 8) **37-28**

Response: Aside from being unreferenced, what do "native communities" have to do with grazed rangeland? Millions and millions of acres of rangeland are being seeded with crested wheatgrass. The efforts of the BLM to maintain "native communities" under the pressure of grazing and "production" need to be documented. They are not well known.

Note the contradiction stated in the sentence that follows the two sentences quoted above: "Native forbs and shrubs are usually susceptible to herbicide treatments." If taking out **37-29**

noxious weeds also takes out native forbs and shrubs, and the BLM is supposedly trying to save the diversity of "native communities," what has been gained?

BLM (d) "Over the long-term, increased vegetation diversity of grasses and forbs [from this BLM program] would increase the productivity of the land for wildlife" (p. 8).

Response: Why would forbs be increased? Most of the proposed herbicides kill forbs. What evidence has been gathered from years of BLM spraying on rangeland for the conclusion that the productivity of the land for wildlife has been increased? If there is no documentation, no monitoring, no evidence, remove the sentence as wishful thinking.

BLM (e) "Failure to control or limit the spread of such noxious weeds as knapweed and leafy spurge, would reduce by 60 percent the long-term productivity of palatable native plants. (Bucher 1983; Baker 1984)" (p. 8.)

Response: NCAP has not yet reviewed the Bucher reference on spotted knapweed. The Baker reference is totally undocumented and does not lead to the conclusion of the sentence. If numbers like 60% are going to be associated with "noxious weeds" in general, there had better be evidence.

The 14-paragraph treatment of "Impacts on Wildlife and Fish" on pp. 7-8 is wholly inadequate. It is replete with undocumented, sweeping statements. It is haphazard. It refers the reader to the Cannabis eradication EIS for a full discussion. This is unacceptable. **37-30**

When the city of Seattle wanted to assess the effects on aquatic organisms of using four herbicides in lakes to control aquatic vegetation, the potential effects of 2,4-D were reviewed on 93 pages, and those of the other three herbicides on 62 pages.[14] This was for effects on aquatic organisms alone.

The point is not that the BLM should print 155 pages on wildlife effects of their use of five herbicides. The point is that BLM must indicate that it has done a thorough review of the potential impacts of using these five herbicides on the types of communities that are proposed for spraying in the five states under this program. This has not been done.

BLM (f) "The aquatic extreme case for glyphosate [in the Cannabis eradication EIS] shows that a temporary exposure dose to bluegill could reach 61 percent of the lowest LC_{50} reported for that species, but concentrations would decline rapidly and exposures would be brief. Therefire, [sic] no aquatic organism should receive a dose of glyphosate large enough to result in adverse effects." (p. 32.)

Response: This is a non-sequitur. Cite some responsible source for such a ridiculous statement or take it out. This kind of statement is why the public doesn't trust that the BLM is even attempting to face the problems their pesticide spraying may pose. **37-30a**

Example #2: Cancer Risk Analysis and 2,4-D

The supposed "worst case" worker risk of cancer from exposure to 2,4-D is based on one 1971 laboratory experiment with dogs (Hansen, et al., 1971, cited in Supplement, p. 26) and an extensive series of exposure estimates regarding drift, absorption, inhalation, amount of exposed skin, ingestion, consumption, etc.

Nowhere does the BLM apply the rate of non-Hodgkins' lymphoma observed among human farmers who were exposed to 2,4-D twenty or more days a year (Hoar, et al., 1986, cited in the Supplement on p. 27).

The incidence of non-Hodgkins' lymphoma in the general population is 11/100,000 (personal communication, Shelia Hoar Zaum, researcher of Hoar, et al, 1986), so the yearly incidence rate among those exposed 20 days or more a year would be 66-88/100,000 (i.e., 6 or 8 times 11), an increase of 55-77/100,000 for only one cancer for each year!

This is 2 1/2 to 3 1/2 times higher than the BLM's "worst case" lifetime (as opposed to yearly) cancer risk from "extraordinary dosages to wrokers [sic] exposed [up to 44 days a year (Table N-1)] for a 40-year working lifetime" with major mix errors for 40 years (Table N-13, p. 53). The highest of 16 lifetime worker risks thus calculated by the BLM for all 2,4-D caused cancer is 21/100,000. So much for "worst case analysis!"

Obviously, the Hansen dog study cancer potency based on the revealed ingredient only, combined with numerous selected "worst case" estimates of exposure parameters, has greatly underestimated what has actually been happening among humans here in the U.S. (and Sweden, according to the study that found, five years ago, a similar risk increase for non-Hodgkins' lymphoma among workers exposed to phenoxy herbicides and chlorophenols.[15] **37-31**

The BLM must use human data from exposure to full herbicide formulations in preference to a 15-year old laboratory dog study involving exposure to the revealed ingredient alone, particularly when the risk to humans from the formulation appears much higher than has been calculated on the basis of the revealed ingredient and dog data.

In addition, the Hoar, et al. (1986) study, by showing that the BLM 2,4,-D worst case analysis underestimates cancer, raises

questions about whether the other BLM "worst case" analyses of non-cancer and cancer risks are also gross underestimates.

An aside: On p. 27, The BLM refers to another laboratory study that has recently found brain tumors in rats exposed to 2,4-D (active ingredient only) and states that the EPA has informed the BLM that the cancer potency is similar to that found in the Hansen study. The reference given for this is "EPA 1986." There is no such reference in the bibliography. When NCAP mentioned this problem to the BLM in a Freedom of Information Act request of December 11, 1986, the BLM responded on December 22, 1986 that "The reference to EPA 1986 on page 27 of the draft Supplement is an error. Thank you for pointing it out; it will be corrected in the final." The BLM did not supply NCAP with a correct reference or documentation that could be reviewed before the Final Supplement is issued.) **37-32**

Example #3: Environmental impacts:

There are serious errors in the discussions of drift, volatilization, soil impacts, and water contamination in the EIS. The following exemplary comments should convince the BLM to rewrite the environmental impacts section on the herbicides:

BLM (a) "Preliminary studies with various soil types found that picloram is usually confined to the upper 1 foot of the soil profile when application rates are low (less than 1 pound/acre) but that picloram can readily move to depths greater than 3 feet, even in realtivley [sic] dry areas, when the application rate is high (3 to 9 pounds/acre) (NRCC 1974). BLM application rates will not exceed 1 pound/acre." (p. 2.)

"Scifres and others (1971) reported that studies on semiarid rangeland in northwest Texas found ... residues [of 0.25 pound/acre of picloram] usually were restricted to the top 12 inches, at least for 60 days. Five ppb or less were detected below 12 inches 120 to 180 days after application." (p. 2.)

"Picloram application rates will not exceed 1 pound/acre/year to reduce the potential for accumulation in arid soils of the EIS area." (p. 2.)

Response: NCAP has not reviewed the Scifres, et al. (1971) reference cited in the EIS, but NCAP has a 1971 Bovey and Scifres publication[16] on picloram residues in grassland ecosystems. It notes that picloram, applied at 1 pound/acre did not remain within the "upper one foot" of soil in three of three soil types near Mayaguez, Puerto Rico: Nipe and Fraternidad clay, and Catano sand. Three months after treatment at one pound per acre, picloram had moved to (and beyond?) the lowest depth monitored (45-51 inches). Up to 259 ppb were found below 12 inches.[16] **37-33**

BLM (b) "Herbicides in surface water will disperse and degrade rapidly with no long-term impacts. If herbicides enter ground water it can have relatively long-term impact, but it is not expected the [sic] occur under proposed action." (Table 1-4, Summary of Impacts by Alternative, Long-Term and Cummulative [sic] Effects (Proposed Action), p. 62.)

Response: This blithe assurance of "no problem" is supposedly the summary of the BLM text that has written, "Since picloram, dicamba, and 2,4-D are relatively mobile herbicides, the potential exists for detectable traces to enter the ground water," (p. 5); "Dicamba is considered a highly mobile herbicide. Studies have shown that salts of dicamba readily leach in soil..." (p. 24); and "Because of the water solubility of picloram and its salts and its leaching tendencies, runoff from treated areas can contain relatively high concentrations of picloram" (p. 29). **37-33a**

What does it take for the BLM to summarize that their use of picloram may have adverse impacts on water quality?

BLM (c) "Existing information reveals that herbicides are rarely leached below the top 10 inches of soil." (p. 5)

"Studies have shown that herbicides applied at the proper rates do not concentrate residues below the first foot of the soil profile." (p. 5.)

Response: In his introduction to the 1984 EPA "List of Potential Ground-Water Contaminants," Ground-Water Team Leader Stuart Cohen, writes, "Some interesting observations can be drawn from the tables [on the 45 "leachers"]. Seventy per cent are herbicides..."[17] Both picloram and dicamba are on the list.

In the EPA's 1985 "Revised List of [90] Analytes for the National Pesticides Survey," both picloram and dicamba are in the category of highest priority for monitoring because of their characteristics and known mobility.[18] **37-33b**

BLM (d) The drier grazing land has few microbes to degrade herbicides but also has deeper aquifers and less rainfall to leach herbicides into the soil profile." (P. 5.)

Response: Document this. In both years (1983 and 1985) in which monitoring has been undertaken, in eastern Oregon near Ontario, the herbicide dacthal has been found in groundwater. The ground water is only 9 to 11 feet from the surface.[19] **37-34**

BLM (e) "Herbicides are not known to have contaminated ground water on BLM-administered lands in the EIS area." (p. 5.)

Response: This is getting old. In reviewing the Final EIS for this BLM Noxious Weed program, I sent a Freedom of Information Act request (January 27, 1986) to Oregon BLM stating, "On page 106 of the FEIS in response #44-24, there appears the statement that 'there are no data revealing that BLM-applied herbicides have been detected in groundwater.' ... We request documentation of all BLM testing for pesticides in groundwater: the sites tested and their history of pesticide application (pesticides used, rate of application, and dates of application), the methods used (including dates of testing), level of sensitivity of detection, pesticides and metabolites tested for, and results of the tests."

On February 13, 1986, BLM Acting State Director Edward Lewis replied, "Very little data exist on the subject of ground water contamination by herbicide use. BLM does not have a detailed monitoring program for ground water."

For the BLM to say herbicides are not known to have contaminated groundwater on BLM land when they have never looked is fraudulent. Knock it off.

BLM (f) "A small amount of herbicide may move (via spray drift or volatization) from the treated area during or shortly after aerial application." (p. 1.)

"Norris (1983b) reported that 2,4-D esters may volatilize, but only briefly because the ester hydrolizes [sic] to nonvolatile forms within a few hours or days after application." (p. 1.)

Response: In a review of pesticide delivery success, Pimentel notes, "Maybank et al.[20] reported that as much as 35% of the butyl ester of 2,4-D volatilized after being applied to Canadian prairie soils during the summer. This high level of vapor drift compares with only a 3% droplet drift resulting from ground applications of 2,4-D. In Austria, 75% of spray damage from herbicides may be caused by vapor rather than droplet drift.[21] [22] **37-35**

The BLM needs to calculate the potential volatilization loss (and resultant drift) of 35% of 2,4-D into the air.

BLM (g) "When inspecting many areas within 100 feet of Oregon and Washington transmission power line rights-of-ways sprayed with 2,4-D and picloram, Norris (1983b) saw little or no herbicide effects of off-site drift on nontarget vegetation."

Response: Come on. The reference is an NCAP v. Block affidavit in which Norris merely states that he didn't see many herbicide effects. If that's the kind of reference you're going to cite, then let us submit similar statements by citizens who

have seen off-site drift on nontarget vegetation following use of 2,4-D.

The picloram registration standard (EPA, 1985) writes: "The Agency [i.e., EPA] is requiring data on technical picloram for nontarget area phytotoxicity.

"Rationale: Picloram is highly phytotoxic, easily absorbed by roots and foliage.... The Agency has determined that damage to nontarget plants is occurring. Phytotoxicity data will be required because the Agency is unable to ascertain whether this damage is a result of applicator error, misuse, drift, leaching, runoff or persistence." (Emphasis added.)

Maybe Norris didn't find off target phytoxicity walking around before the NCAP v. Block trial, but EPA has.

BLM (h) "In two actual field operations in the Northwest, only 1 of 36 air monitors attached to ground observers (who were used to represent anyone who might be in the area of the spray operation) collected a detectable level of 2,4-D in the 'breathing zone' of a site where the chemical was applied from a helicopter. The detectable level (0.05 ug) was considered negligible in relation to any possible human health hazard (Lavy and other 1981)." (p. 1.)

Response: On the other hand, there are contradictory data not cited by BLM. Summarizing a number of years of 2,4-D air monitoring in the Yakima Valley of central Washington, Washington State University researchers Elmer Robinson and Lawrence Fox write, "Correlations between atmospheric monitoring data, observed vineyard damage, and weather patterns indicate that long distance transport - 10 to 50 miles - is an important factor in the 2,4-D concentration pattern."[23]

The average 2,4-D concentrations by volatility type for eight Yakima Valley monitoring stations for the month of May, 1973 was 310 ug/m^3.[23] **37-36**

BLM (i) "Since the persistence of 2,4-D and glyphosate in most soils is short (Ashton 1982; USDA, FS 1984), they will probably not be present in sufficient amounts or long enough to reduce the productivity potential of the soil."

Response: A sandy loam treated with glyphosate at recommended application rates (e.g., 2, 5, and 10 ug/g soil) was found to drastically reduce nitrogen fixation, growth, and nodulation of subterranean clover (Rhizobium trifolium planted 120 days after glyphosate treatment.[24]

This is documented reduction of productivity potential. What documentation does the BLM have for its assumption that glyphosate will "probably not" reduce the productivity potential? **37-37**

The examples go on and on. The BLM has cited those references it wishes to cite and ignored relevant literature. The result is that the BLM is not evaluating the potential range of adverse impacts of its proposed program as indicated by credible scientific evidence (40 CFR 1502.16).

You get what you pay for. The BLM must rewrite the EIS following consultation with experts who are aware of the literature of concern about pesticides as opposed to only being aware of the literature of optimism regarding pesticides. Just as with groundwater contamination on BLM lands (see "e" above), you won't find it if you don't look.

V. The BLM Does Not Include the Major Reasonable Alternative of Grazing Management and Classical Integrated Pest Management

As noted in the NEPA regulations, presentation of alternatives is the "heart of the environmental impact statement" (40 CFR 1502.14), but the heart is still missing from this noxious weed EIS. As explained by the Council on Environmental Quality, "This section [on alternatives] rigorously explores and objectively evaluates all reasonable alternatives including the proposed action." (Question 7, Forty Most Asked Questions, emphais added.) The BLM EIS as Supplemented fails to consider the major reasonable alternative of grazing management and classical integrated pest management (IPM), even though this alternative has been requested by numerous commenters in response to the Draft EIS (summer 1985), Final EIS (winter 1986) and NCAP court documents (spring 1986). **37-38**

As is currently being demonstrated by Region 6 Forest Service, it is feasible for a federal agency to develop a classical IPM alternative. The program proposed in the BLM Supplement does not describe a classical IPM program.

1) A classical IPM program is reasonable and presents a strong alternative for managing noxious weeds. NCAP has repeatedly noted the need for a well-conceived alternative developed that is based on the classical definition of IPM as put forth by pest management specialists such as Robert van den Bosch and Mary Louise Flint, authors of Introduction to Integrated Pest Management.[23]

This alternative is not merely one of an infinity of "possible" alternatives. It is the major alternative that has been repeatedly called for by commenters on the various drafts of this EIS.

The IPM approach to vegetation management considers a plant as it relates to the other plants, insects, animals and resources in the ecosystem that surrounds it. This is in contrast to the BLM proposed action that isolates a problem plant from the ecosystem and considers only techniques to identify, classify, eliminate, or control the plant. IPM puts primary emphasis on preventing noxious weeds problems. It is a specific decisionmaking process in which managers understand the biology of the natural systems in which they work, assess on a site specific basis the "problem vegetation" in relation to other

organisms on the site, consider the potential impacts of their decisions, select techniques that work in the best long-term interest of society, and assess, on a continuing basis, the results of their actions.

There are five steps in an IPM program:

(a) The first step and the program's primary commitment must be monitoring. Specific records must be kept of important factors in the ecosystem including information on associated plant species, environmental factors that influence plant species presence, survival, and growth, and various indicators in the ecosystem that may be important to maintaining the long-term health and productivity of the ecosystem.

For example, rangeland monitoring would identify measurable factors that would be used in making a decision on the need for action (i.e., soil type and conditions, signs of erosion, plant species and plant associations, signs of animals or insects, and habitat). Rights-of-way monitoring would include factors such as road use patterns, various plant species' growth and association, and insect and animal signs. Monitoring would point to whether use patterns are degrading the condition of the site.

(b) The second step is to determine the injury level of specific plant species on specific sites. What level of occupancy by associated plant species is tolerable? What level of occupancy will permit yields, safety, or longterm site health without action? The economic or environmental injury of the plant species must be documented. Such documentation by the BLM has often been shoddy or nonexistent in the past. **37-39**

(c) The third step is to determine the action level, that level of plant occupancy that will trigger action to prevent reaching the injury level. It is critical that injury projections be accurate and independently verifiable so that citizens can be certain that money is not spent on wasted efforts.

(d) The fourth step is to select effective pest management treatments that are least disruptive of the environment and pose the least harm to human health. Treatments are chosen that are directed at the weak links in the ecosystem (e.g., disturbance or stress) that allow a site to be occupied by a "problem" plant, or at the weak links in the problem plant's life cycle. Treatments that are disruptive must be accompanied by rehabilitation of the site.

(e) The fifth step is evaluation of the program. Managers must know what effect their decisions have on plant and animal associations and on the site. This step feeds back into the first monitoring step.

2) A grazing alternative and integrated pest management program have been requested by numerous parties.

In public comment on the DEIS, twelve commenters mentioned the need to include an alternative that strives to prevent noxious weed problems, looks to changes in management practices that strengthen the ecosystem so that problem vegetation can be resisted, and/or implements a classical IPM program. In the comments on the Final EIS, NCAP documented all of these requests and noted the inadequate BLM response to these concerns. NCAP wrote:

> The BLM refuses to include an integrated pest management alternative in the FEIS as requested by the commenters, choosing instead to label the BLM Proposed Action an integrated pest management alternative. Calling the MX a Peacemaker does not alter the fact that it is a nuclear war weapon, and calling the Proposed Action an IPM alternative does not alter the fact that it is a program that, in opposition to an IPM approach, treats noxious weeds symptomatically and almost entirely chemically. (NCAP Comments on FEIS, p. 11) **37-40**

Further, Norma Grier's Narrative Statement and Ralph Bradley's Response to the Department of Interior's Motion for Partial Dissolution of the Injuction in NCAP v Block describe how a preventive IPM alternative that assesses grazing management as a solution to noxious weeds is reasonable and should be described in the EIS.

BLM's disregard for development of this alternative despite numerous requests to include such a program is a violation of NEPA (40 CFR 1503.4).

3) The IPM alternative requested by NCAP is qualitatively different from the "integrated" approach proposed in the EIS as supplemented.

The EIS emphasizes methods in defining the integrated approach. "Under this integrated approach, managers would use herbicide, manual, and biological methods to treat an estimated 44,014 acres of noxious weeds annually in the EIS area." (FEIS p. 6) In other words, the program is integrated because it uses a mix of methods.

The Supplement revises the FEIS and describes how the BLM will set priorities for weed treatments. The emphasis is still on treatment and methods, with some elaboration on funding designations. There is nothing in the EIS that describes incorporation of assessment of problem vegetation in the context of the ecosystem, management of the ecosystem for prevention of "problem" vegetation, setting of injury and action levels, site -specific assessment of desirable action, or systematic

post-action monitoring. All of these steps are central to a classical IPM program.

A classical IPM program would strive to achieve goals that are set for the land (wildlife habitat, fisheries resources, water quality values, livestock grazing, recreation, etc.) without isolating one species of plant from the ecosystem in which it survives and targeting that one plant for control. IPM works to achieve ecosystem and resource goals without the need for action. When action is warranted, it is done with the least alteration of the natural ecosystem and by posing the least risk to human health.

While failing to describe the site-specific criteria that will trigger specific actions, the Supplement blocks the public from participating in the development of site specific programs: "[S]pecific species assignments [to priority categories] are left to each BLM district in cooperation with county weed control authorities." (p. 61).

The BLM "integrated" program basically involves simply categorizing which weeds will be singled out for treatment: **37-41**

BLM A) Priority I weeds are potential new invaders and the BLM will be emphasizing education and awareness for these weeds. In addition to displays of weeds, BLM managers will share information about weed treatments on an annual basis. Identification and recognition of specific weeds appear to be the goal of this priority.

Where is the systems approach to management in this priority? How will BLM be monitoring their management of the land to ensure that BLM is not encouraging noxious weed establishment? How can BLM build on a data base that is ongoing to identify the weak links in the ecosystem that permit noxious weeds to establish at levels that are injurious? This priority as it is written merely encourages managers to know which plants to pick off when they are found on location.

BLM B) Priority II weeds are the new invaders, the weeds that will receive the most attention and funding. Eradication, or total elimination of the species, is the goal of this priority.

No standards are indicated in the Supplement to identify when eradication is feasible or economical. What is the potential for reintroduction? Is the infestation surrounded by areas on which the plant is established? Does the lifecycle of the plant lend itself to control? Can infestations be accurately delimited?

BLM Supposedly, "A key [BLM] factor in treating Priority II weeds is to prevent the conditions that allow noxious weeds to become established" (p. 61).

Of what this "prevention" consists is not identified. Does it involve alterations of grazing patterns? If so, what kinds of alterations? Does it involve seeding with native species? Obviously, for the public to be convinced that prevention will in fact be "a key factor in treating Priority II weeds," that prevention needs to operationalized and explained in the EIS. To the contrary, the BLM does not elaborate at all on what it plans for its "key factor."

It seems a little late to first think about preventing conditions favorable for a weed after the weed species has been found in an area. A classical IPM program would monitor for site conditions on an ongoing basis, certainly before an unwanted plant is discovered in an area.

BLM When a new invader is identified, the BLM is directed to take "immediate, effective noxious weed control measures to prevent the species from going to seed" (p. 61).

What does this mean? Will BLM be evaluating the potential impacts of a treatment method and using methods that are least disruptive of the ecosystem and pose the least harm to human health? Will herbicides be used only as a last resort? Or as a first choice? How will the "effectiveness" of methods be determined? In terms of dead "problem plants"? Succeeding vegetation? Increased diversity?

BLM The BLM will "survey lands next to infested areas to ensure that all new infestations have been identified" (p. 61).

How will this be done? What about lands not immediately adjacent? What about lands upstream? What standards will be used? How will action be changed when inadequate surveying is all that is available? (The literature on "eradication" is strewn with failures due to inadequate surveying.)

BLM BLM will "identify and treat the causes of [priority II] noxious weed infestations to reduce the possibility of re-entry" (p. 61).

How will this translate into field operations for BLM managers? Without clear elaboration in the EIS, the public has no assurance that a preventive, systems approach to weed management will be implemented. Without this elaboration, the EIS gives a license to open the nozzle and spray with minimal consideration of the consequences.

BLM C) Priority III weeds are the established infestations for which eradication is unlikely. The treatments will "emphasize containing and preventing the further spread of the infestation", and "give highest treatment priority to 'breakouts' from the main infestation and infestations along rights-of-way...and next to private land. Apply acceptable but immediately effective control measures in such areas" (p. 61).

Will weed species be controlled adjacent to private lands and along rights-of-way regardless of the level of infestation on surrounding lands? Will herbicides be relied on as the only "immediately effective control measure" for these types of treatments? What about longterm effectiveness of control? How does this proposed program avoid being an herbicide treadmill?

BLM Under Priority III (c), BLM will "consider the practicality/cost-effectiveness of the method [of treatment] compared to the likelihood of success" (p. 61).

BLM should also consider the environmental and health costs of the method, and indicate how these will be considered..

BLM Under III (d), BLM claims that it will use biological control on main infestations where successful agents exist. Research and development efforts will concentrate on priority III weeds.

This is an extremely limited view of biological control potential. Biological control need not be a technique that is used only after chemical and eradication efforts have failed.

For example, effective control (populations below levels of economic harm) can be achieved when the biological control agent is introduced at a point when the target organism is at low populations. In whitefly control in greenhouses, for example, "[t]he most successful control resulted from the 'classical' method in which whitefly is deliberately introduced into the greenhouse, and two weeks later the (Encarsia formosa) parasite is released."[26] BLM should explore and explain the strengths and weaknesses of various control methods in this EIS. Biological control may be the most effective method to consider for Priority II situations that meet certain conditions (e.g., a new infestation such as Oregon's skeleton weed which is surrounded by established infestations of skeleton weed in all adjacent states).

BLM Subcategory III(e) directs BLM to use management practices in conjunction with control activities such as introducing vigorous vegetation, moving and/or using livestock, and moving and/or using vehicles.

This is the first mention of livestock as a factor in vegetation management. It must be considered with Priority II and even Priority I weeds. The offhand, unelaborated mention of this tool (i.e., grazing management) illustrates BLM non-responsiveness to public comments.

In a classical IPM program, management would be a consideration throughout, regardless of the priority designations. The overall health of the ecosystem would be a primary objective of the program, and not just of concern when sites are occupied by unwanted vegetation.

Moreover, the methods of "moving and/or using livestock" would be operationalized. Ranchers have been "moving and/or using livestock" for quite a few decades now, with varying degrees of degradation of public rangeland ecosystems. How do the BLM's plans for "moving and/or using livestock" differ from degrading practices?

4) BLM must initiate a process to fully develop a classical IPM alternative for consideration in the Noxious Weed EIS. **37-42**

When Region 6 Forest Service decided to write a new EIS for their vegetation management programs, the agency approached NCAP and asked us to explain what the IPM alternative would look like. NCAP has repeatedly indicated the need for EIS integrated pest management alternatives that are recognizable to the environmental community as IPM. The public participation that Region 6 Forest Service has fostered will result in an alternative being presented in their vegetation management EIS that embodies classical IPM principles of resource management. BLM needs to follow the example of the Forest Service and establish a process to develop an IPM alternative. Without better communication with the interested parties for this program, BLM will only continue failing in its course that develops an inadequate, bandaid document that BLM hopes to push through the courts.

The risks associated with BLM's proposed program are not "acceptable" because the BLM has not considered all reasonable alternatives. By now citizens are too familiar with classical IPM to countenance the BLM's failure to include IPM as an alternative in this EIS.

Numerous Northwest BLM staff have attended Holistic Resource Management workshops on rangeland management presented by Alan Savory of Albuquerque, NM. That is one form of IPM. The BLM is aware of alternatives to its proposed vegetaion management program, rangeland scientists are aware of alternatives, NCAP and other public commenters are aware of alternatives, and, finally, BLM has been warned that such alternatives must appear in this EIS. Such alternatives are not present. They are reasonable, they are feasible, and they are operational.

VI. The BLM Does Not Insure the Scientific Integrity of the Risk Analysis or Discussion of the Acceptability of Risks

The presentation of risk inappropriately relies on quantification from unquantified or missing data and does not consider the public's perception of risk.

A. The level of quantification is unsupported by the data base.

In Tables N-8 through N-10 and N-19 through N-22, 604 different "margins of safety" are given for public and worker risk of threshold (non-genetic) adverse effects. In Tables N-11 through N-14 and N-23, 402 different estimates of cancer risk are given for the public and workers for three "herbicides" and one mixture of two "herbicides" (with no indication of how the margins of safety were calculated for the mixture). **37-43**

These are all based on the revealed ingredient only, on no chronic toxicity tests for three of the five revealed ingredients (dicamba, picloram, and "2,4-D/picloram"), no cancer test for two of the revealed ingredients (dicamba, "2,4-D/picloram"), and other major categories of test data missing. They are based on no nerve damage or immune suppression studies, no consideration of the particular physiological susceptibility of children, infants, ill, or elderly people, and no testing (other than minimal acute toxicity testing) of any of the herbicide full formulations. **37-44**

B. The discussion of acceptability of risks does not utilize a range of scientific opinion.

The BLM writes, "When cancer probability estimates are compared to everyday events, one can more easily assess the risk that may be found acceptable." (p. 51, emphasis added.) In Tables N-15 and N-16, the supposed cancer risks to the public and workers are compared to hazards from rare and everyday occurrences.

Using these tables, the BLM makes such comparisons as "[T]he probability of an individual contacting [sic] cancer from a 5-year oral exposure to 2,4-D would be 4.3 chances in a billion. The probability of contacting [sic] leukemia from eating 1 egg per day for the same period of time is much higher at 50 chances in 1 billion."

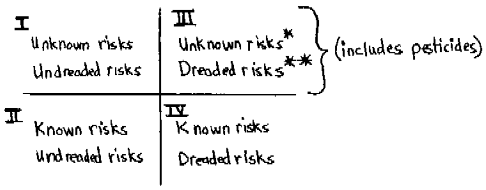
These Tables (N-15 and N-16) are referenced to Goldman (1984) and Crouch and Wilson (1982). In a November 20, 1986 Freedom of Information Act (FOIA) request, NCAP requested the Goldman reference because it is an unpublished paper on "Health

Effects" presented at the Risk Assessment and Briefing Session, of the American Mining Congress, July 10, 1984, Washington D.C.

In their letter of December 9, BLM informed NCAP that they could view the documents requested through FOIA at the Eugene District BLM office. The requested Goldman reference[27] had not been sent, but, interestingly, a Paul Slovic paper presented at the same session at the same American Mining Congress on the same day had instead been sent. THe Slovic paper, although obviously in BLM's possession, has not been cited in the EIS or used in the discussion of "acceptable risk."

The Slovic paper is interesting, because it indicates that (a) comparing quantified risks of different dimensions (such as risk from voluntarily eating eggs vs. involuntary exposure to herbicides) is inappropriate; (b) risk perception research indicates that "riskiness" means more to people than "expected number of fatalities" (the basis of BLM Tables N-15 and N-16); (c) it is not risks, but alternatives with some degree of risk that are or are not "acceptable" (and the BLM has not presented all reasonable alternatives, see Section V of these comments); (d) the public must be allowed to participate at a very early stage in specifying options (see Section V); and, (e) unless the public is convinced the decisionmaking process in intelligent, open, and fair, "even the best efforts at communicating risk will be ineffective."[27]

Slovic's paper graphically displays the results of several research studies on perception of risk, and two are of particular interest. In one, a quadrant is drawn and various risks are placed in the various quadrants:



*unknown: not observable, unknown to those exposed, effect delayed, new risk, risks unknown to science.

**dreaded: uncontrollable, consequences fatal, not equitable, catastophic, high risk to future generations, not

easily reduced, risk increasing, involuntary, affects me.

Pesticides are placed by people in quadrant III (dreaded and unknown risks) among such other risks as nuclear power, lasers, DNA research, and radiation therapy. According to Slovic, risks in quadrant III should not be compared to risks (such as eating an egg a day) that are in other quadrants.

Another table shows the gap between the public's perceived benefit and perceived risk for thirty activities and technologies. Pesticides rank fourth of the thirty (behind nuclear power, handguns, and smoking) in having a large risk to benefit ratio. In other words, people perceive pesticides as posing a high risk and bringing only moderate benefit. (Slovic, Table 1, page 3)

Other passages in this paper are in direct contrast to BLM's presentation of risk:

"There is not just error in public perceptions, there is also wisdom. The public has a much richer conception of risk than the experts. Experts focus narrowly on actual or expected mortality and morbidity. The public goes beyond these quantitative factors to include such considerations as voluntariness of exposure, dread, catastrophic potential, uncertainty in the estimates, transfer of risks to future generations, and other equity issues."[27] (Slovic, page 2, emphasis added.)

The BLM EIS includes no factors but actual or expected mortality and morbidity in their consideration of risk.

"Wilson (1979) [the other author beside Goldman cited for the BLM Tables N-15 and N-16] argued that we should 'try to measure our risks quantitatively . . . . Then we could compare risks and decide which to accept or reject' (p. 43). Likewise, Sowby (1965) observed that we need to pay more attention to 'some of the other risks of life' when deciding whether or not we are regulating radiation hazards properly, and Lord Rothschild (1978) added, 'There is no point in getting into a panic about the risks of life until you have compared the risks which worry you with those that don't, but perhaps should.'

"Risk perception research suggests that these comparisons will often not be very satisfactory. People's perceptions are determined not only by expected value statistics but also by a variety of quantitative and qualitative characteristics--including a hazard's degree of controllability, the dread it evokes, its catastrophic potential, the equity of its distribution of risks and benefits. In short, 'riskiness' means more to people than 'expected number of fatalities.' Attempts to characterize, compare, and regulate risks must be sensitive to the broader conception of risk that underlies people's concerns."[27] (Slovic, page 6, emphasis added.)

The BLM EIS entirely ignores citizens' "broader conception of risk" as researched by scientists.

"All too often, comparative risk estimates are rejected by the public for ignoring uncertainties and attempting to compare qualitatively different kinds of risks (apples vs. oranges)."[27] (Slovic, page 7)

"The susceptibility of perceptions to 'manipulation' indicates that the presentation of risk information is an ethically and politically significant act, and should be treated accordingly."[27] (Slovic, page 7, emphasis added.)

"An acceptable risk is the risk associated with the most acceptable alternative . . . . We never accept risks. We accept an alternative that has some level of risk." (Slovic, page 7, emphasis added.)

"A critical aspect of risk management is framing the decision problem (i.e., specifying the options). Whenever possible, the public should participate in this. If they do not feel comfortable with the way the problem is framed, they may reject even the best assessments of risk and the most appropriate decisions made within that frame. This implies that the public must be allowed to participate at a very early stage in the risk management process.

"Process is the key. The overall process of structuring public communication and participation is the key to gaining respect and acceptance for risk management decisions. The public must be convinced that the process is intelligent, open, and fair. If people have this confidence, they will cooperate with institutions and agencies in a much more constructive manner. Without this, even the best efforts at assessing and communicating risk will be ineffective."[27] (Slovic, page 8, emphasis added.)

These lengthy quotations are cited to help the BLM understand that their quantified presentation of risk is not only scientifically incorrect, but that their comparisons of quantified risks are inappropriate in terms of current risk research. It is important to note that the BLM has not presented the major reasonable alternative to its preferred alternative (see Section V) and cannot therefore decide that the risk of its preferred alternative is acceptable.

If it wishes, the BLM can certainly cite Goldman and Wilson, who pronounce for society that a risk is "acceptable" if it is estimated to be similar to risks of activities voluntarily undertaken. The BLM needs, however, also to discuss the risk research of Slovic, which it gathered, but has failed to use. Slovic is a past president of the American Society of Risk Analysts and a preeminent researcher in the field.

If the BLM fails to discuss the research of Slovic, it is failing to discuss responsible scientific opinion that contradicts the BLM claim that the pesticide risks its program poses are "acceptable" to the public. 37-45

VII. What the BLM Must Do

In order to meet the requirements of the National Environmental Policy Act, the BLM must alter its Final EIS and Draft Supplement in four major ways. Correcting the EIS in this manner will require a new Draft Supplement because, unlike the changes made for this Supplement, it will significantly alter the presentation of the range of alternatives and their relative impacts.

1. The EIS must present the major reasonable alternative the public has repeatedly urged the BLM to include in the EIS.

While the BLM may have long-established habits of killing weeds as if weeds are the problem, the public is clearly aware of the major alternative: alteration of land management practices to prevent the establishment of problem plants and the strengthening of the ecosystem's ability to control problem plants. In a classical integrated pest management alternative (IPM), herbicides may occasionally be used as a last resort, but only in conjunction with a program of treating the ecosystem and in conjunction with non-chemical methods.

The BLM cannot avoid presenting classical integrated pest management as an alternative to its proposed weed-killing plan. If the BLM feels that development of such an alternative is beyond their skill, it should contact the Interdisciplinary Team currently preparing the Region 6 Forest Service vegetation management EIS. In particular, the BLM could speak with Tom Atzet, the Region 6 ID Team member responsible for preparing the IPM alternative.

Region 6 Forest Service is relying heavily on input from NCAP, the environmental community, and the public as it prepares the IPM alternative. While NCAP and the Oregon District BLM have talked about the possibility of developing an IPM alternative for the Oregon BLM Decision of Record regarding the Final EIS as Supplemented, the BLM has never contacted NCAP with any question as to how to develop the IPM alternative for the EIS. Regarding the process of public involvement, the BLM could speak with Gary Larsen, responsible for overseeing the writing of the Region 6 Forest Service Vegetation Management EIS. 37-46

2. The BLM must make clear the extent of incomplete and unavailable information and the relevance of this uncertainty to an analysis of adverse impacts of their program.

The BLM does not know what chemicals it is spraying, the herbicide formulations have never been tested for anything but acute toxicity (if that), and major gaps exist for testing of even the revealed ingredients. This is never clearly stated in the EIS.

The BLM must graphically present these gaps so that decisionmakers and the public readily understand what information is missing, as illustrated for dicamba and Banvel in NCAP's comments (Section II, Example #2). In addition, the relevance of this missing information to the inability to predict risks and the possibility of significant risks must be explained.

3. The BLM must insure the scientific integrity of its analyses of impacts and risk, and its discussion of the acceptability of risks.

The BLM cannot rely on risk estimates of the revealed ingredients as a stand-in for risk estimates of the secret ingredients or full formulations. Although it is a common practice of hired risk assesors to assume that the revealed ingredient somehow is the full formulation and inadequate testing somehow suffices for adequate testing, it is scientifically untenable.

NCAP appreciates the fact that the current pesticide law in our country does not require that full pesticide formulations be tested for their risk or that the revealed ingredients be fully tested before they are sold and used. That does not allow the BLM to rely on legally-sanctioned inadequate testing to unscientifically conclude that it knows the "margins of safety" for the herbicides it is spraying when the data are not there.

It makes no sense to claim that a 50-50 mixture of gasoline and water is safe to drink based on the fact that half of it is water. Likewise, it makes no sense to claim that the margin of safety for chronic effects for the public exposed to BLM's use of dicamba (in the form of Banvel) will be 104,167 based on dicamba data and that there will be no cancer risk when (a) dicamba is only some small proportion of Banvel (the label included in the EIS does not state the proportion), and (b) dicamba (let alone Banvel) has not been tested for either chronic toxicity or carcinogenicity.

The flaws in the Federal Insecticide, Fungicide and Rodenticide Act and the willingness of some hired risk assessors to quantify anything notwithstanding, the BLM has to face up to its responsibility to state EIS conclusions with a modicum of scientific integrity.

The BLM must state the range of adverse impacts it may unknowingly be causing by spraying unknown mixtures of untested chemicals into public land, water, and air.

Likewise, the BLM must discuss the range of scientific evidence relating to the acceptability of risk to the public.

In Table 1-4 (page 62), the BLM concludes that their proposed alternative is "Likely to generate more constructive social responses and concerns" compared to the other alternatives which are "Likely to generate polarized reactions."

Aside from the fact that the BLM hasn't even considered the major alternative to their preferred alternative, the statement is scientifically untenable.

As long as the BLM only listens to such experts as Richard Wilson, who basically figures if voluntarily eating eggs is acceptable, then involuntarily drinking water contaminated with pesticides will be acceptable, the BLM is likely to dream up their absurd Table 1-4 summary of expected public reactions to their proposal to inject toxic chemicals into the environment. Richard Wilson's mathematical world (he is a physicist) isn't how society works, however.

The BLM must use the Slovic paper that is in their possession to extend their discussion of the acceptability of risk. It is based on studies of the public's perception of risk, rather than on a physicist's calculator.

4. The BLM must evaluate the potential range of adverse impacts of its proposed program.

In its comments on the Draft EIS, FEIS, and Supplement, NCAP has cited several studies that contradict the BLM presentation of adverse impacts. These citations are only examples, and if the BLM intends to release a new Supplement that makes a serious attempt at facing the range of adverse impacts their proposed pesticide use may have, NCAP will assist in locating crucial literature and experts who can help them.

The Draft FEIS as Supplemented is so basically flawed that a Final EIS as Supplemented cannot include corrections before another Draft Supplement is issued that actually "makes substantial changes in the proposed action that are relevant to environmental concerns" and presents "significant new circumstances" and "information relevant to environmental concerns and bearing on the proposed action" and "its impacts" (40 CFR 1502.9).

The Region 6 Forest Service process of writing a vegetation management EIS stands as a model of the process intended by NEPA regulations. The BLM will not be able to claim that the BLM is currently doing everything feasible to observe NEPA. The Region 6 Forest Service process stands as testimony to the fact that the BLM has not begun.

Norma Grier
Norma Grier
NCAP Director

Mary H. O'Brien
Mary H. O'Brien
NCAP Information Coordinator

RESPONSE TO COMMENT LETTER 37

37-1 The BLM prepared this supplement because it "determined that the purposes of the Act [NEPA] will be furthered by doing so." See 40 CFR 1502.9(c)(2). The supplement, when contrasted with the FEIS's discussion on the subject, plainly evidences numerous changes in analysis on the environmental consequences from using chemicals to control noxious weeds.

37-2 BLM believes that its responses and the substantive changes it has made in the FSEIS reflect the Bureau's intent to fully comply with NEPA.

37-3 In response to your concerns, BLM has expanded the section on inert ingredients in the FSEIS.

37-4 To answer the concerns raised in your letter, the BLM asked EPA for a more thorough discussion on the inert ingredients contained in the herbicides proposed for use. EPA has reported to the BLM that none of the herbicides proposed for use contain any inert ingredients of toxicological concern or suggestive of concern, with one lone exception. The report further evidences, based on EPA's review of available literature and analysis of chemical structures, that the inert ingredients in the herbicides proposed for use, with the one noted exception, do not support a specific concern for toxicity or risk. The exception, a petroleum distillate in Esteron 99, has been acknowledged in the SEIS. An analysis of the risk posed by that substance has been undertaken.

The EPA report referred to, because it is important to understanding the BLM's approach to the question of inerts, follows comment 37-6.

Note: the exception the EPA is referring to is a petroleum distillate in Esteron 99.

37-5 The SEIS fully acknowledges that EPA has reported that Esteron 99 contains a petroleum distillate that merits toxicological concern. The document also analyzes the risk posed by that substance.

37-6 In reporting to the BLM, EPA set forth how and on what basis inert ingredients are placed into the categories of (1) toxicological concern (2) suggesting toxicological concern (3) not supporting a specific concern for toxicity or risk and (4) generally recognized as safe. The report also sets forth that EPA then identified the inert ingredients in the herbicides proposed for use and compared them against the substances in each category. EPA's report also notes that the inert ingredients in the herbicides proposed for use were identified from the confidential statements of formula submitted by the companies that manufacture and sell the herbicides. The SEIS fully sets forth how the EPA arrived at its conclusions. One final note. The BLM is merely reporting EPA's conclusions; in no way does the SEIS purport to incorporate the proprietary data relied on by EPA in deciding what inert ingredients are found in the herbicides proposed for use. Since NCAP's concerns about inert ingredients found their genesis in EPA's statement on the subject last year, the BLM decided to go to EPA to ascertain whether NCAP's concern was with merit in the specific context of the herbicides proposed for use here. The EPA has answered in the negative.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

FEB 19 1987

OFFICE OF PESTICIDES AND TOXIC SUBSTANCES

Guy Baier
Assistant Deputy Director
Bureau of Land Management
U.S Department of the Interior
18th and C St., N.W.
Washington, D.C. 20240

Dear Mr. Baier:

I am writing in response to the request from the Bureau of Land Management that the Office of Pesticide Programs review the herbicides proposed for use in BLM's draft Environmental Impact Statement for the Northwest Area Noxious Weed Control Program to determine whether they contain inert ingredients of toxicological concern. The specific herbicides proposed for use are Esteron 99, DMA 4, Tordon 2K, Tordon 22K, Banvel and Rodeo.

EPA has divided the approximately 1,200 intentionally-added inert ingredients currently contained in pesticide products into four toxicity categories as follows:

1) Inerts of toxicological concern (List 1)
2) Potentially toxic inerts/ High priority for testing (List 2)
3) Inerts of unknown toxicity (List 3)
4) Inerts of minimal concern (List 4)

EPA has identified about fifty inert ingredients as being of significant toxicological concern (List 1). This list was assembled on the basis of known toxicity of the chemical. No consideration was given to the potential for exposure. The criteria used to place chemicals on List 1 were known carcinogenicity, adverse reproductive effects, neurotoxicity or other chronic effects, or developmental toxicity (birth defects). These effects must have been demonstrated in laboratory or human studies and the data must have been peer reviewed. The criteria also include documented ecological effects and the potential for bioaccumulation. These criteria and the list itself were reviewed by the FIFRA Scientific Advisory Panel.

EPA has further identified about fifty inert ingredients which the Agency believes are potentially toxic and should be assessed for effects of concern (List 2). Many of these inerts are structurally similar to chemicals known to be toxic. For some of them there are data suggesting a basis for concern about the toxicity of the chemical. Most of the chemicals on List 2 have been designated for testing through the National Toxicology Program, the Office of Toxic Substances, or other regulatory or governmental bodies. The FIFRA Scientific Advisory Panel has also reviewed this list.

Inert ingredients were placed on List 4 (minimal hazard or risk) if they were generally regarded as innocuous. These inert ingredients include substances such as cookie crumbs, corn cobs, and substances "generally recognized as safe (GRAS)" by the FDA (21 CFR Part 182). There are approximately 300 inert ingredients in this category.

The list of 1200 inert ingredients was circulated through several Agency offices and toxicologists were asked to provide any information they had in their files that would support a concern for the toxicity of any of the inert ingredients. An inert ingredient was placed on List 3 if this review provided no basis for placing it on any of the other three lists. There are approximately 800 inert ingredients on List 3. Although an exhaustive literature and data search was not carried out and it is possible that new information could be uncovered that would trigger concerns for these chemicals, the Agency is reasonably confident, within the limits of this analysis, that these inert ingredients do not support a specific concern for toxicity or risk at this time. It should be noted that concerns regarding the acute toxicity of inert ingredients are generally addressed through testing of the formulated product. Such acute data are required by the Agency before a product can be conditionally registered under FIFRA.

In regard to the specific herbicides proposed for use by BLM for noxious weed control, the Agency has determined that, with one exception, none of the inert ingredients listed in the Confidential Statements of Formula are contained on Lists 1 or 2. This exception was addressed elsewhere.

If I can be of further assistance do not hesitate to contact me.

Sincerely,

Amy S. Rispin

Amy S. Rispin, Director
Science Integration Staff
Hazard Evaluation Division (TS-769C)

37-7 The SEIS discloses that none of the herbicides, as formulated products, have undergone extensive testing for chronic, carcinogenic, teratongenic or mutagenic effects. The document also explains the limited significance of these data gaps since much is known about the herbicides' active ingredients and because the EPA has concluded that the herbicides' inert ingredients do not support a specific concern for toxicity or risk. The document also acknowledges the competing point of view.

37-8 The DSEIS's statement that more information about the herbicides' inert ingredients could be found in the section on synergistic and cumulative effects was in error. The supplement's discussion on inerts is contained wholly in the section labeled Inert Ingredients. The discussion on the herbicides' synergistic and cumulative effects goes to the different question of how the herbicides may interact with each other.

37-9 The critique of Table 3-4, as it appeared in the DSEIS, is well-taken. BLM has revised it. The table is provided merely as an example of the acute toxicity of technical active ingredients versus the formulated products.

37-10 BLM has reviewed the chemicals it is proposing to use, including the inert ingredients; has clarified among other items that the formulated products generally have not undergone subchronic or chronic testing; and has added information on petroleum distillates. Please note that EPA does not consider these formulations' inerts, with one exception, to be of any specific concern. Also see response to comments 37-3 to 37-7.

37-11 BLM has stated in Appendix K where EPA considers that it has adequate data and where it has requested more information. The text summarizes those conclusions. Please note that EPA does have valid chronic toxicity studies on dicamba.

37-12 See responses to comments 37-3 to 37-7.

37-13 Please note that EPA has reviewed and validated two chronic studies. Although these studies do not meet the current FIFRA chronic study guidelines, they do provide some information on chronic effects.

The term margin of safety (MOS) is used in a standard scientific manner. (See "Guidelines for the Health Assessment of Suspect Developmental Toxicants" published in the Federal Register Vol. 51 No. 185, Sept. 24, 1986.)

The use of MOSs in this risk assessment versus EPA's use of safety factors to establish ADIs is discussed in the Risk Analysis for Threshold Effects section of Chapter 3.

Because EPA's ADI for dicamba is 0.00125 per day, all public exposures (see Table N-6 in this FSEIS) are below this level that EPA considers "safe," except for a child drinking 1 liter of water. Table 3-5 uses the reproductive NOEL of 3 mg/kg/day (for which EPA believes the study meets current guidelines) rather than the systemic NOEL of 25 mg/kg/day used to set the ADI.

37-14 BLM has added information about Rodeo, the formulation proposed for use. The references to Roundup were inadvertant. The BLM does not propose to use Roundup.

37-15 BLM has clarified that it does not propose to use Roundup. Rodeo has not been shown to cause severe skin reactions. Also see response to comment 37-7.

37-16 See response to comment 37-14.

37-17 The SEIS has been revised and acknowledges that the State of California's Department of Food and Agriculture is engaged in an on-going review of toxicological data on glyphosate. BLM has obtained working papers from the State of California, including a document entitled "Summary of Toxicology Data Glyphosate," dated December 2, 1986. As disclosed in that summary statement, the State of California's preliminary findings about the toxicological data on glyphosate are disclosed in the SEIS's text and appendix K in appropriate places.

37-18 See response to comment 37-17

37-19 See response to comment 37-17.

37-20 BLM has rounded these numbers to the nearest hundred to show the limits of their precision. Table 1-4 has been revised.

37-21 The SEIS has been revised and acknowledges that available studies do not conclusively disprove the hypothesis that dicamba is carcinogenic. The studies, though, in particular, a recent cancer study, provide a strong basis for concluding that dicamba is not carcinogenic. Nonetheless, since the studies are not conclusive, the SEIS now posits that the worst case of proceeding with the use of dicamba is that the hypothesis that it is carcinogenic may prove true. The worst case is described qualitatively, not quantitatively.

37-22 In light of the comment, BLM obtained and reviewed the CDFA reviews to which you refer. They are disclosed in the SEIS's text and appendix K. In addition, BLM used literature searches conducted through the USDA Forest Service's WESTFORNET and the USDA Agricultural Research Service to gain information on topics addressed in this EIS. BLM also obtained publications from its state and district office libraries within the EIS area. BLM specialists contacted their counterparts in the academic world and in state and other federal agencies to determine the availability of unknown publications or unpublished studies. The BLM also consulted with EPA. Although it could not review everything written on the subjects addressed in this EIS, BLM did conduct a thorough search on the topics.

37-23 As you know, 2,4,5-T is no longer being manufactured. EPA has been carefully monitoring the contaminants of 2,4-D and has found no 2,3,7,8, TCDD in recent years.

37-24 BLM has revised the SEIS to acknowledge that there may be other less toxic dioxin contaminants in 2,4-D, but EPA's Chlorinated Dioxins Working Group does not consider these other dioxins as being of the same level of toxicological concern as 2,3,7,8 TCDD.

37-25 BLM has clarified that other dioxins have not been well studied.

37-26 BLM stands by the statement since the environmental exposure to either contaminant, even at maximum exposures to 2,4-D, is so low when compared to the studies observing effects.

37-27 Because the formulations proposed for use are not amines, they would not be contaminated with N-nitrosoamines.

37-28 Each statement in the DSEIS is about the adverse consequences posed by noxious weeds was unaccompanied by citation because each one was considered self-evident. To the extent citation is required, attention is drawn to the following sources, all referenced in the earlier FEIS: Chase, 1985; Bucher, 1984; Kelsey, 1984; Morris and Bedenah 1984; and Penhallegon, 1983. The adverse effect noxious weeds have on native plant communities is of concern since many acres of public lands in the northwest contain vegetation of that type. The fact that other acres have been seeded with new plant species, like crested wheatgrass, is beside the point. Similarily, the BLM's efforts to maintain native communities, and the concurrent effort to introduce new species, are being addressed in resource management plans and EISs accompanying these.

37-29 That many noxious weeds invade and outcompete native shrubs and forbs has been documented. Long-term detrimental effects of noxious weeds on native plant diversity outweigh the short-term effects of temporary loss of a few native plants, including forbs and shrubs.

37-30 The section on impacts to fish and wildlife has been revised substantially. It is accompanied by a detailed risk assessment appearing in Appendix K. The changes were a response to your criticism of the DSEIS's discussion on the subject.

37-30a A complete risk assessment for fish and wildlife has been added to this FSEIS.

37-31 The Hoar and others (1986) study and earlier epidemiological studies on 2,4-D are described on page 27 of the DSEIS and in this SEIS also. They were not used to predict 2,4-D cancer risk because uncontrolled confounding factors made it difficult to assess exposure-disease relationships. Therefore, an animal study, applying established scientific methods, was used to predict human cancer risk.

37-32 BLM has included more information, including an accurate citation, on the most recent rat cancer study in this FSEIS.

37-33 Nipe clay is a subtropical series of the Oxisol order. Oxisols are mineral soils that have relatively rapid permeability, allowing herbicides to more readily move down through the soil profile than do the range soils of the EIS area. Catano sand is of the Entisol order and occurs only along the sandy beaches of Puerto Rico. None of these subtropical Puerto Rican soil series occur in the EIS area. Many of our rangeland soils have duripans, which impede and often restrict the downward movement of chemicals through the soil profile.

In addition, BLM would like to draw your attention to the magnitude of picloram detected below 12 inches--259 ppb (parts per billion). As a comparison, the acceptable picloram tolerance level for forage grasses is 80 ppm (parts per million), an amount significantly higher than what you state the authors found in the profiles of the three soils. It is important to distinguish between simply detecting the presence of a herbicide in the soil and a whether a herbicide is present in amounts high enough to pose a threat to the environment.

We noticed that your comment did not mention that the application rate at which this level (259 ppb) was detected was 9 pounds per acre, nine times higher than our proposed rate of application. At our proposed rate (1 pound per acre), picloram was barely detectable in the soil profile of all three of these Puerto Rican soils 6 months after treatment and, with the exception of 1 ppb at the 45- to 51-inch depth in Fraternidad clay, was totally nondetectable after 12 months (page 15, Table 7 of the document to which you refer).

In reviewing the reference you cited (Bovey and Scifres 1971), we noted some more comments by the authors regarding studies of picloram in the soil profile in Texas, including rangeland areas:

> Two pounds of picloram per acre disappeared from the top 2 feet of soil at 6 and 12 weeks after treatment (page 12).
>
> Picloram was not detected in soil from Victoria and Carlos (Texas) after 1 year, regardless of application rate or sampling depth (page 12).
>
> Twenty-five samples from a plot sprayed with 8 pounds per acre of picloram were taken to a depth of 2 feet. Picloram residue was not detectable in any sample (page 12).
>
> Picloram at 1 pound per acre disappeared from the sandy soil after 3 months (page 12).
>
> Picloram was not detected 18 months after application of 1 and 3 pounds per acre to sand and 1 pound per acre to clay surfaces bare of vegetation (page 14).

Bovey and Scifres (1971) also mentioned the following statements:

> Picloram has a low order of toxicity to wildlife and fish (page 6).
>
> Treatment of rangelands [with picloram] would not result in levels of residue in food or feed toxic to humans or livestock (page 6).
>
> It is generally concluded that the use of picloram presents no hazard to humans, livestock, or wildlife (page 6).

37-33a Table 1-4 has been changed to state that herbicide detection is possible but that levels of detection would be in all probability so low that adverse impact should not occur as measured by EPA criteria.

37-33b BLM is aware of the potential mobility of picloram and dicamba. For two major reasons, however, BLM's analysis has concluded that the use of these herbicides is unlikely to substantially contaminate ground water. First, BLM's Proposed Action has been related to studies of herbicide use with little if any detection in the ground water. Second, BLM would apply design features to further mitigate the possibility of contamination.

37-34 The study you refer to was completed in eastern Oregon on intensely used farmland where the main crop consisted of vegetables. The herbicide used--Dacthal--is registered by EPA for vegetable crops and ornamental turf but not for rangeland use and would not be used by BLM. The soil in the study area was well drained and received intensive irrigation. The report states that "...approximately 80 percent of the water available for ground water recharge is from diverted surface waters." Thus, this area of relatively low precipitation derives most of its soil moisture from irrigation. This condition is not typical of BLM land.

According to the Dacthal label, application rates may very from 6 to 14 pounds/acre. This rate is higher than the rates BLM proposes for applying the herbicides analyzed in the FEIS. For crops such as onions, herbicides are usually applied annually with similar high application rates. Even under all the conditions favorable for contaminating ground water, the study found concentrations with the maximum detection level only slightly higher than half the EPA 1982

Health Advisory Limit. Because the conditions of herbicide use proposed by BLM are almost opposite of those cited in this study, detection levels are expected to be lower or nonexistent in ground water associated with noxious weed control sites.

37-35 Some 1,400 different formulations of 2,4-D exist, ranging from high volatile forms to low volatile forms. BLM has reviewed studies on the volatility of 2,4-D presented in your comment letter in addition to other studies.

In his study, Maybank stated that vapor drift depends on vapor pressure, soil surface temperature, wind speed, and atmospheric turbulence. He mentioned that most of the chemical picked up on monitors consisted of the butyl ester formulation of 2,4-D. Although he did find that for 2,4-D butyl ester, 35 percent of the applied chemical evaporated from the ground and migrated downwind, for the less volatile octyl formulation the figure was 12 percent. For the low volatile esters and nonvolatile amine formulations, this figure dropped to from 3 to 5 percent.

Maybank advocated that the problem could be eliminated by phasing out the high volatile esters, certainly the butyl one that BLM is not proposing to use. DMA-4 is a dimethylamine salt of 2,4-D. Esteron 99 is a low volatile, isoctyl ester of 2,4-D.

The air quality impact analysis in this FSEIS is based on BLM's proposal to use only a low volatile formulation and to adhere to climatic restrictions built into the design of the proposal. BLM's mitigative approach is based upon a knowledge of the potential for adverse effects and a desire to protect the environment. The impact analysis is accurate as presented and is supported by studies. Also see response to comment 37-36.

37-36 BLM is aware of the Robinson and Fox (1978) study but has found it not to apply to the impact analysis of the Proposed Action. BLM has reviewed another study by Robinson and Reisinger (1976) dealing with long-distance, aerially applied, high volatile 2,4-D transport in the south-central Washington grape growing region. The authors correlated the long-distance transport of these high volatile formulations with a specific set of "poor spraying" synoptic conditions for a specific geographic area, which (1) included Pacific prefrontal backing surface transport winds and (2) limited surface heating to produce vertical mixing. The surface transport winds were blowing from the south toward the nearby grape-growing regions to the north. BLM does not propose aerial application in Oregon or Washington. Nor does it intend to aerially apply herbicides if such synoptic conditions were to occur in the other three states.

37-37 BLM has reviewed this reference. In this Australian study, glyphosate was added directly to samples and concentrated in an extremely thin 2 cm layer of a sandy loam mixture lying in shallow, plastic-lined trays. After 120 days, the soil mixture was transferred to 200g pots, which were later planted with clover. The soil samples consisted of 82 percent sand.

Although the authors noted a decrease in nitrogen fixation 120 days after treatment in the pots, they also advocated that a review of other literature suggests that their observed glyphosate-nitrogen fixation correlation may not hold true in soils with a sand content of less than 80 percent, probably because glyphosate is rapidly inactivated by strong adsorption to soil particles. The authors cited another study where 90 percent of the glyphosate dissipated in a soil 14 days after application. The sand content of this soil was 6 percent.

We know of no soils in the area proposed for treating with glyphosate that contain profiles with sand percentages as high as the authors of this study used in their pot mixture. If fine sands are also considered, the mean sand content of rangeland soils in the EIS area is 30 to 35 percent. If fine sands are not included, the sand content would be about 25 to 28 percent.

One should also consider that the authors applied the herbicide directly to an extremely thin and restrictive 2 cm layer of soil. This condition would not occur in the field. They also used a glass rod to thoroughly mix the formulation into the soils, which is not a common practice in field application. As a result, all the roots of the clover growing in the pots were restricted to the glyphosate-mixed soil. In the field, vegetation and litter intercept much of the herbicide before it reaches the soil. Therefore, the amount of formulation actually reaching the soil surface under normal field application would no doubt be less than in this study.

The potential is extremely remote for the mixing of a plant's entire root-growing zone with the levels of glyphosate under the conditions simulated in this study. In the field, plant roots extend beyond the surface layer. In a soil containing 82 percent sand, roots of perennials extend far beyond the control depth of this study. Therefore, plant roots would not be restricted to only that portion of a growing medium containing glyphosate. One must assess the methods used in this study, the results and conclusions obtained under these methods, and how the methods relate to what is actually being proposed under field conditions.

37-38 Several commenters on the Final Northwest Area Noxious Weed Control Program EIS (December 1985) suggested that BLM forgo proceeding with any alternative for controlling or eradicating noxious weeds until it evaluates reducing livestock grazing and pursuing other forms of intensive livestock grazing management. The inference of this suggested alternative is that overgrazing by livestock contributes to or is a cause of noxious weeds. This alternative ignores that, given the magnitude of noxious weed infestations, BLM defined the program as mainly performing control and eradication. The program focuses on ameliorating the symptoms given the magnitude of the problem.

The suggested alternative is beyond the scope of the program that BLM is considering. Other BLM planning efforts address the question of livestock grazing management. The public knows and BLM acknowledges that it has an ongoing program to prepare plans and EISs on how to best manage livestock grazing on public lands. To consider an alternative here focusing on livestock grazing would be duplicative. Heavy grazing and its influence on noxious weeds are properly addressed elsewhere.

This is the first time during this lengthy 2-year process that the idea of analyzing a "classical" integrated pest management (IMP) alternative has been suggested. Nevertheless, the five-step process presented on page 29 of this comment letter is in concept, the very IPM Alternative (Proposed Action--Alternative 1) BLM analyzed in the draft EIS (May 1985) and final EIS (December 1985) and is reflected in the Project Design Features (Appendix I) and the Herbicide Application Monitoring Plan.

37-39 This five-step process is basically the concept BLM is using in its IPM program (see Appendix I of the FEIS--pages 183-185 and text revisions, page 61 of the DSEIS). In regards to your fourth step, item (d), BLM is also concerned about using an effective and cost-efficient pest management technique. If a successful biological control agent exists, such as the Cinnebar moth for tansy ragwort in Oregon, BLM will use it first. If a successful biological control agent does not exist and our other nonchemical control options will not contain or control (whatever the objective) an infestation, BLM may use a herbicide. Also see response to comment 44-45 in the FEIS.

37-40 See response to comment 37-38.

37-41 A representative from NCAP participated fully with the Idaho Noxious Weed Workgroups in developing this program. NCAP's representative approved this plan, and BLM understands that it was agreed with by the officers of NCAP.

37-42 See response to comment 37-38.

37-43 Both the margins of safety and cancer potency for the mixture were based on averages. BLM has clarified this issue in the FSEIS.

37-44 BLM has clearly stated the status of various chronic studies. The SEIS deals with sensitive individuals in a separate section. Also see response to comment 37-7.

37-45 The information in the DSEIS and repeated in this supplement concerning acceptable risk was only included to provide some perspective on the risks. A determination of what constitutes an acceptable risk will be made by the decisionmaker and documented in the Record of Decision. Slovic's paper, among others, will be reviewed at that time.

37-46 BLM received no comments from NCAP during the scoping period for the draft EIS. Also see response to comments 37-38 and 37-41.

38

Bonneville County Weed Control

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January 2, 1987

Charles W. Luscher
Oregon State Director
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Portland, Oregon 97205

Dear Mr Luscher:

I find the draft supplement to the final environmental impact statement very thoroughly documented in all areas, leaving very little room for further challenges.

The 1986 season was the fourth consecutive year of no noxious weed control in our area on lands administered by the Bureau of Land Management. The resultant increase in infestation of noxious weeds have reached the point of irreversibility and is a contributing factor in the spread of noxious weeds on to privately owned lands.

Those not involved in Weed Control inforcement or food production seem to be unaware and or indifferent to the seriousness of the problems caused by weeds.

Unless there is a resumption of a realistic, effective approach towards noxious weed control, including herbicide usage in 1987 on Federal lands, strict regulation in the use of Federal lands for all purposes may be the solution to curtail the spread of noxious weeds.

Thank you for the opportunity for comments.

Sud Morishita

Sud Morishita
Superintendent
Bonneville County Weed Control

39

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January 3, 1987

Charles W. Luscher
State Director
Bureau of Land Management
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RE: DRAFT SUPPLEMENT TO THE NORTHWEST AREA NOXIOUS WEED CONTROL PROGRAM EIS.

Dear Mr. Luscher,

These comments on the above mentioned draft supplement are submitted on behalf of the Idaho Natural Resources Legal Foundation and Citizens for Environmental Quality.

The document is seriously flawed and has not complied with the National Environmental Policy Act (NEPA) and its implementing regulations because of its failure to: (1) make documents incorporated by reference reasonably available to the Idaho public; (2) consider serious questions which have been raised concerning inert ingredients; (3) provide meaningful risk assessments.

(1) Documents incorporated by reference not made reasonably available to Idaho public: Although the draft covers five states, including Idaho, the BLM has only made the documents incorporated by reference available for review in the Portland office. Referenced documents were not made available for review in any BLM office in the state of Idaho. **39-1**

Additionally, Oregon BLM has refused to exercise their authority under the Freedom of Information Act (FOIA) (5 USC 552) and CEQ regulations (40 CFR 1502.21, 40 CFR 1505.3(d) and 40 CRF 1506.6(f)) to waive copying fees and provide Citizens for Environmental Quality and the public they represent with materials incorporated by reference during the period for comment. The Oregon office of BLM has taken the position that if Citizens for Environmental Quality or other members of the Idaho public wish to review the referenced documents, they can travel to Portland to do so and/or pay copying fees. Since the majority of its members are low-income, Citizens for Environmental Quality can not afford travel expenses or copying fees. Consequently, by placing an unreasonable burden on the affected public in northern Idaho, the BLM has deliberately failed to insure that environmental information is available to Idaho citizens before decisions are made and action taken(40 CFR 1500.1(b)). Public scrutiny is essential to implementing NEPA (40 CFR 1500.1(b)). NEPA procedures do not allow federal agencies to create roadblocks to public involvement which the Oregon BLM has done.

Consequently, the agency's actions on this issue are so gross, the BLM is in substantial violation of CEQ regulations as cited above. Therefore, the agency has invalidated the draft supplement.

In addition to NEPA violations, the failure to insure that information be made available is detrimental to the Idaho noxious weed control program. For over a year, we have bargained in good faith with the Idaho Noxious Weed Workgroup and struggled to build up public trust in the BLM and Forest Service noxious weed programs. We have succeeded in getting broadbase support for both BLM and Forest Service programs. Our success has been due in a large part to the willingness of federal agency workgroup members to share information and other resources with the public which has enabled the public to take part in a truly meaningful way in the development of federal noxious weed programs. Oregon BLM has shown a callous disregard for the Idaho public and caused some citizens to question whether or not the Idaho BLM is still sincere about their desire to continue negotiations through the workgroup. This is a serious matter.

Moreover, the invalidation of the draft supplement could mean another delay in getting the Idaho BLM noxious weed plan implemented. Thus the Oregon BLM has succeeded in disrupting successful negotiations and undermining the workgroup's progress. Since continuity during implementation is a key factor to the success of the Idaho noxious weed plan, this may jeopardize the entire program. It is clear these problems could have been avoided had the Oregon BLM simply acted according to the letter and spirit of NEPA. **39-2**

(2) Draft fails to consider serious questions which have been raised concerning inert ingredients: The draft supplement's treatment of inert ingredients is misleading and gives the impression that inert ingredients are not a significant issue. Page 13 of the draft states: "None of the formulations proposed for use by BLM has any inerts of toxicological concern according to EPA." **39-3**

The document does not mention that inert ingredients are considered trade secret. Therefore, the preparers of the draft supplement to not know what inert ingredients are contained in the herbicides proposed for use.[1] In other words, the complete chemical make up of the herbicides proposed for use are not known.

Of the 1200 chemicals registered as inert ingredients, EPA does not know the toxicity of 700 - 800 of these chemicals. Of these, at least 50 are structually similar to "chemicals with demonstrated health or ecological effects."[2]

Additionally, testing of herbicides for chronic toxicity (e.g. birth defects, mutations, cancer) is required only for active ingredients. Therefore, the chronic effects are not known for inert ingredients in combination with the active ingredients.

Thus, the agency does not know what inert ingredients it proposes to use, the EPA does not know the toxicity of many of these inerts, and the chronic and/or combined effects of inerts with active ingredients has not been tested. Failure of the draft to consider these serious questions is a further violation of NEPA (40 CFR 1502.21 & 40 CFR 1502.24).

(3) No meaningful risk assessments are presented in the draft supplement: Since the complete chemical makeup of the herbicides proposed for use are not known, as discussed above, the quantitative risk assessments (e.g. "the margin of safety is 26, "The risk of cncer is 3 in a million.") presented in the draft are inadequate. As Mary O'Brien puts it, "(q)uantification of the risk of an active ingredient which having next to no information on the secret ingredients or on the interaction of the active ingredient with the secret ingredients (e.g., for cancer, birth defects, chronic toxicity, reproductive effects, nerve damage, genetic toxicity) does not put the risk "in perspective." It is misleading under the plain language of risk."[3] (For discussions on how the supplement should discuss risk in the face of missing information refer to: 1) Appendix 1 (Mary O'Brien letter to Nick Heyer, US Forest Service, Region 6, November 18, 1986 with attached memorandum Risk analysis in the face of missing health and environmental data, November 19, 1986) and 2) Appendix 2 (EIS's, PESTICIDES, and TOXICOLOGY. Prepared by Mary O'Brien for the workshop sponsored by NCAP for the Forest Service, Eugene, Oregon, July 9, 1986.).) **39-4**

Therefore, in order to demonstrate scientific integrity and comply with NEPA, the supplement should describe the risks of each herbicide in qualitative terms and avoid quantitative risk assessments. Failure to do so flys in the face of NEPA (40 CFR 1502.22).

As explained above, the draft is so inadequate as to preclude meaningful analysis. Consequently, in order to comply with NEPA, a new draft should be prepared and circulated.

Although the Idaho Natural Resources Legal Foundation and Citizens for Environmental Quality do not intend to appeal this document, we reserve our right to appeal future environmental impact statements and/or supplements if these violations are not corrected.

Respectfully submitted,

Georgia E. Hoglund

Georgia E. Hoglund
for the Idaho Natural Resources Legal Foundation & Citizens for Environmental Quality

cc: Edwin Stockly, INRLF
Janice Masterjohn, CEQ
Steve Ellis, INWWG
Norma Grier, NCAP

RESPONSE TO COMMENT LETTER 39

39-1 Neither BLM's Oregon nor Idaho State Offices has ever received a request from any Idaho resident to make available for review in any BLM office in Idaho any one or all four of the documents incorporated by reference in the DSEIS. Please note that only four of the documents listed in the References Cited section of the DSEIS are actually incorporated by reference in accordance with 40 CFR 1502.21. These four documents may be reviewed in BLM's Idaho State Office in Boise.

39-2 BLM is complying fully with NEPA guidelines. Also see responses to comments 37-1 and 37-2.

39-3 See response to comments 37-4 and 37-10.

39-4 BLM has clarified the text to put the use of margins of safety into perspective. Also see response to comment 37-7.

40

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January 4, 1986

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<u>Comments on the
Draft Supplement to the Northwest Area Noxious Weed
Control Program Final Environmental Impact Statement</u>

<u>Introduction</u>

Upon review of the Draft Supplement, the following issues need clarification:

1. Where does the document state or make clear the extent of incomplete and unavailable information pertaining to the herbicide spray program, as required by the National Environmental Policy Act (NEPA) in 40 CFR 1502.22? **40-1**

2. Why is the potential range of adverse impacts quantified as to specific risks, when in fact the lack of available scientific information on the environmental and toxicological fate of the proposed herbicide formulations invalidates such silly figures (40 CFR 1502.24)? **40-2**

3. As in the first document, where are the reasonable alternatives to the spray program (40 CFR 1502.14)? **40-3**

4. How does this document include justification that the proposed actions will indeed fulfill the mandate in Section 2(b)(2) of the Public Rangelands Improvement Act of 1978, that the BLM will "manage, maintain and improve the condition of the public rangelands so they become as productive as feasible" (43 U.S.C. 1901(b)(2))? What gaurentee does the public have that the BLM is not just trying to favor the interests of its own grazing investments by converting the natural diversity of these lands to a terrain unsuitable for multiple use, despoiled by the one industry it seeks to favor (grazing)?

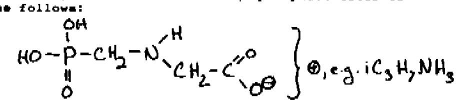
5. As in Section 302(b) of the Federal Land Policy and Management Act of 1976, when has the BLM ever taken "any action necessary to prevent unnecessary or undue degradation of the [public] lands" (43 U.S.C. 1782(b)(1982))? As everyone who lives west of the Mississippi knows, the BLM is usually the cause of such degradation in the first place. BLM land is an example of what happens when a group from private industry (cattle) gains control of a branch of the government and runs their operation for their own interests rather than for any general good. Wherever one crosses the boundary into BLM land, the effect of poor stewardship of the land becomes obvious; the management of the BLM has left its land overgrazed, weed-choked, and thirsty for relief from "management". The continued support of an EIS riddled with scientific bestiality makes me recoil from contact with such a corrupt agency [cult].

<u>Examples of Inadequacies in the Draft Supplement</u>

In the following comment section I have addressed my questions to you on certain problem areas in the order they appear in the Supplement, and have indicated their page number and placement on the pages by numbering each page's paragraphed indentations from the top of the page disregarding title headings or figures or tables. So, from the beginning. . .

p.1, indentation 3: Is there a known reference, Norris (1983b) or is this a typo of the Supplement? **40-4**

p.3, ind. 2: An organic chemist would appreciate inclusion of the structures of the molecules representing the active ingredients. No common name or trade name is as clear as a simple "ball and stick" model would be in representing the structure of glyphosate. For your information, the structure of this phosphate ester of methyl glycine follows:



Knowledge of the structure of a compound helps toxicologists and biochemists assess the rationale for the design of such an agent (if any); it helps manufacturing chemists to design the synthesis of such molecules, and thus aids in the search for possible as yet unencountered toxic contaminants; and it aids in the discovery of the mode of action of such a compound. For instance, a substantial amount of work has been performed to elucidate the mode of action of glyphosate, and a review of such work might lead to an understanding of its potential hazards. Suggestions have been made that it acts via the inhibition or suppression of chorismate mutase and/or prephenate dehydratase or, perhaps that it acts at the earlier stage of shikimate to chorismate conversion, specifically the inhibition of the enzyme 5 - enolpyruvyl - shikimate - 3 - phosphate synthetase (ref. 1, 2), and since these are enzymes present in animal as well as plant tissues, a closer look at their direct effect on these enzymes would yield safety information on glyphosate. Unfortunately, studies of the effect of glyphosate on corn (refs. 3, 4) and soybeans (refs. 5, 6) indicated elevated levels on the enzyme phenylalanine ammonia-lyase accompanied by reduced levels of phenylalanine, an essential amino acid in both plants and animals. Interference with the enzymes concerned with such crucial metabolic transformations had better be very specific to plant enzymes only for an herbicide to pass safety tests with humans. An indication that glyphosate is not very specific at all and may indeed be a much more general poison is indicated by the above effects and the following further effects. Glyphosate inhibits transpiration in bean leaves (ref. 7). This process indicates that it may act as a mitochondrial poison, affecting the conversion of oxygen to carbon dioxide. All higher plants and animals possess mitochondria; just how many of them are effected in this way by glyphosate remains to be tested. In barley and corn, glyphosate induced a significant decrease in the content of 8 - amino - levulinic acid, a precursor of chlorophyll, cytochromes, peroxidases and other vital plant constituents (ref. 8). Such nonspecificity of action really leads me to doubt the exacting calculations of safety given by the BLM in view of their ignorance of this data and similar data on all their proposed herbicides.

Do you have information on the nature of microbial soil metabolites of Dicamba, glyphosate, or Picloram? Have any data appeared on the products of photochemical or chemical decompositions of 2,4-D, Dicamba, glyphosate, or Picloram? Any data to suggest higher toxicity? Does the BLM (or anybody else, for that matter) know how these chemicals are manufactured and what side products are to be expected in pure formulations of the active ingredient? Clearly, information of this sort is useful in any risk assessment such as the one the BLM is trying to produce; as stated in my introduction, point number one, the the extent of the lack of information on herbicides has not been stated by the BLM in the Draft Supplement, and it is easy to see why. Because of the potential damage to mammals as well as plants resulting from the BLM's proposed use of "safe" chemicals such as glyphosate, widespread use on public lands would do untold damage to the credibility of the BLM, not to mention any valuable assets that might be permanently obliterated from earth as a result of its brash program. **40-5**

p.5. ind. 12: Since the BLM has not performed testing for groundwater, the Draft EIS then assumes that "herbicides are not expected to be introduced into the ground water in detectable amounts". Yet in both years that monitoring of groundwater has been done in eastern Oregon (1983 and 1985), the herbicide dacthal has been found (ref. 9). The BLM need not have made such a presumption regarding groundwater contamination. If not outright dishonest in its appraisal of the effects of herbicides on the environment, the BLM is at least downright ignorant. **40-6**

p.7, ind. 5: For years, our company has been coaxing rare and unusual plants to flower and grow in their arid habitats. Such diversity in the flora of a region means that future generations will be able to enjoy the righ wealth of natural products, both economic and esthetic, that are available from a rich bounty of natural grasses and plants that is the heritage of the west.. For years the BLM has degraded those qualities that brought the frontiersmen west, replacing natural fauna with cattle and natural grasses with created wheatgrass. Then, when the land began to fail under this totalitarianism of the soil, and cheat grass and other weeds took advantage of the poor practices of the BLM land managers and others who were shortening the life of the lands. converting what they saw as useless scrub to more useless Eurasian imports, this EIS appears with the proposition that chemicals be brought to the aid of the cattle in converting their land to a vast stretch of wind blown sand. Herbicides kill all native plants would be an appropriate comment to desalinize the BLM's alkaline reassurance that grasses should become more abundant after spraying. There are native grasses in urgent need of protection from the BLM. Perhaps a spray program could be initiated to eliminate the agency.

p.7, ind. 13: Any information on contaminated fish, wildlife populations (particularly trout)? Loss of habitat (other than goldfinches, larks)? 40-7

p.9, ind. 9: There are few enough studies on chronic risk to exposure to these chemicals as the BLM states here. Thus it is educational to review all the references to such studies that one can find. On page 27 of the Draft Supplement, a reference to Hoar, et al reveals that the preparers of the document are aware of an observed 6- to 8-fold increase in non-Hodgkin's lymphoma among human farm workers exposed to 2,4-D for 20 or more days a year. These figures are several times higher that the BLM's "worst case" lifetime cancer risk, and an accurate representation of the integrity of BLM "managers" in protecting the public from their spray program results. The use of minimal data to extrapolate to worst case human effects is clearly inadequate to the task of this EIS. 40-8 As I detailed in point 2 of my introduction, misleading data such as the Hanson dog study (when other more relevant data is available) violates the NEPA. 40-9

p. 10, ind. 9: The data on the weak oncogenic effect of glyphosate concern one of two required tests done. A mouse study, at 1/100 of the dose of the rat study, showed suggestions of testes humors. This study has to be redone. I would like to recomment that it be performed on BLM's honcho Burford. 40-10

p. 10, ind. 11: What are the authors and title of the long term oncogenicity study on 2,4-D? 40-11

p. 11, ind. 8 (and Table 3-6): Is any data in the table directly comparable with LD-50's found for the pure ingredients? What use is a table of mixtures only; where is the control? Where is the reference to Maxwell (1982)? How is it that the LD-50's for 2,4-D in mixtures are the same for some very different mixtures and different for others? 40-12

p.11,ind. 10: Other toxicological parameters may have been viable indicators for risk assessment; in view of the fact that the NOEL misses toxic effects on other organs, manifest in other, perhaps more malignant ways, at higher than NOEL dosages, why is no mention made in the Draft Supplement of the consideration of such alternatives? Particularly, studies on suppression of the immune system, nervous tissue, or even the "Ames" tests for pharmacological safety by environmental pollutants might be applicable. 40-13

p. 13, ind. 9: Why, in the summary of acute oral toxicity of Roundup given on page 31, does pure glyphosate have a higher LD-50 than Roundup with only 41% glyphosate? 40-14 Obviously, the "inert ingredients" are not inert, are they? What inerts does BLM propose to use, since these seem to be so potent, are they listed somewhere? 40-15

p. 13, ind. 10 (and Table 3-4): Do you have any intelligent data on the inerts? What are they? How was the test done? Why is the LD-50 data for the different concentrations of 2,4-D curved? 40-16

p. 14, Table 3-3: Have you found any lower, valid LD-50's or NOEL's in your studies? 40-17

p. 14, Table 3-4: Does the NOEL best represent a method of quantifying the toxicological data? Perhaps not; it is quantitative, trying to give a number answer in an area where nothing is clearly black and white. Managers should be aware that quantified data is often simpler to assess, and in the case of this document, easier for the preparers to write (they are in way over their heads anyway), and easier for the reviewers to believe (particularly in this sleazy document).

p. 16, ind. 2: The NOEL's are a method of estimating possible toxic hazards when no real human data is available. The BLM has shown that it would rather ignore such valid data and rely on such estimates. Such ignorance in the face of bliss reminds me of the Space Shuttle Challenger. . .

p. 21, ind. 1 (and Table 3-6): Why list these particular combinations? Is BLM just trying to pad the Supplement? 40-18

p. 21, ind. 10: On the face of it, the very fact that one genetic deficiency disease predisposes some people to toxicological hazards would seem to indicate that myriad other unknown or untested deficiencies might similarly put those individuals at risk to various forms of pollution. Do you have any data on the pollution risks for any other genetic variants in the human population? 40-19

p. 27, ind. 4: Gad! What other tumors are linked with 2,4 D that we haven't found yet?

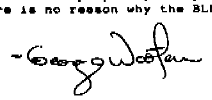
p. 32, ind. 10: Right here in Washington, the Department of Ecology is now handling the case of a fellow who knowingly, willfully dumped pesticides in a major River system, the Okanogan. The fines are in excess of one million dollars. The man involved has disappeared. When the BLM work crew gets fed up with the boss and craches the helicopter into a canyon, is BLM going to stick around for the clean-up like that man did?

p. 36, ind. 7: Need data on the length of feeding in the study involving renal pathology. 40-20

p. 43, ind. 1: Aside from the obvious boo-boo of multiplying by the number of kilograms in an adult human instead of dividing, the result is still 8.7E-5 mg/kg (uncorrected for major or minor mix error) which when corrected for mix errors is about 20% lower that the result in Table N-6. Have you gone through recalculating any other major errors in the table or the others in the Supplement? 40-21

Summary

In the past, public involvement in the decision making process was minimal, leaving corrupt agencies like the BLM carte blanche in their little mini-land cartel. Today, with increased awareness of the role played by the public in the decision making process, there is no reason why the BLM should continue its existence.



RESPONSE TO COMMENT LETTER 40

40-1 BLM has acknowledged missing or incomplete information throughout the DSEIS under the appropriate sections that are addressed.

40-2 BLM attempted to measure human health risks in the absence of specific data, using an accepted scientific model.

40-3 BLM analyzed the alternatives in both the draft EIS (May 1985) and the final EIS (December 1985) and has not changed the Proposed Action in this supplement. Also see response to comment 37-1.

40-4 See References Cited, page 83, right column of the DSEIS.

40-5 The requested information is summarized under each chemical in the Environmental Fates sections of Appendix K, Chemical Hazard Assessment.)

40-6 See response to comment 37-34 concerning the ground water study in eastern Oregon.

40-7 Appendix K of the DSEIS addresses the health effects to wildlife. General habitat losses are addressed in the Impacts on Wildlife section (pages 7-8). Specific habitat losses will be addressed in environmental analyses on site-specific plans.

40-8 See response to comment 37-31.

40-9 See response to comment 37-33.

40-10 The EPA Scientific Advisory Panel has stated that the mouse study was inconclusive for cancer. Both the mouse and rat studies are being repeated.

40-11 Another mouse study was conducted by Hazelton Laboratories and is entitled "Oncogenicity Study in Mice with 2,4-Dichlorophenoxyacetic Acid." EPA has information on the author and exact title of the rat study.

40-12 Table 3-6 shows the LD_{50} of mixtures of various herbicides and the LD_{50} of their components. Table 3-6 shows that, without account for the effect of dilution, no LD_{50} for a mixture was lower than any component of the herbicide. BLM has deleted this table because, from the data presented for the studies, it was unable to account for dilution.

40-13 The use of animal NOELs to estimate risk to humans is a well documented practice. See Thomas (1986).

40-14 The LD_{50} for Rodeo is given as greater than 5,000 mg/kg because no rats died at that level. Also see response to comment 37-7.

40-15 EPA has a list of inert ingredients for each formulation proposed for use. Also see responses to comments 37-4 and 37-10.

40-16 As stated on page 13 of the DSEIS, the main difference shown is the effect of dilution. Also see response to comment 37-7.

40-17 A new, lower NOEL for glyphosate systemic toxicity has been added to Appendix K in this FSEIS. It is not used in the risk analysis because questions regarding the effects still need to be answered.

40-18 These particular combinations were used as examples to show the potential of synergistic effects. Also see response to comment 40-12.

40-19 BLM has discussed certain types of high-risk individuals in the Sensitive Individuals section.

40-20 This was a 2-year study.

40-21 You are correct that the example calculations on page 43 of the DSEIS should have divided by the weight of an adult male. The calculation, however, is correct. BLM has rechecked the margin of safety tables and corrected any errors.

Furthermore with the exception of those states affected by an aerial herbicide ban, it is highly unlikely that any of the alternatives other than Alternative 1 will be chosen, because, "The objectives of the Proposed Action and federal and state laws would not be met," FEIS, p.7. Therefore, an adequate range of alternatives that would incorporate an IPM alternative that may include chemical treatment but not hinge upon a chemical program is needed.

ENVIRONMENTAL CONSEQUENCES OF CHEMICAL TREATMENT

Table 1-4

Note: new Table 1-4, p. 62 , replaces table in the FEIS on p. 12-13. Although, this table appears in Chapter 1, it is a summary of impacts by alternative dealt with by topic in the Chapter 3 supplement.

A criticism of this presentation is the overall optimism concerning adverse impacts and recovery of non-target species that may be affected by a chemical program. The following comments deal primarily with Alternatives 1 (Proposed Action) and 2 (non-aerial herbicide application).

Vegetation -- (Alt. 1 and 2), "Non-target species will become reestablished after treatment." This is optimistic considering planned treatment over 15 years. One assumes that the targeted species could also become reestablished and that if the program goal is eradication non-target species would be injured or destroyed. (Alt. 2,) "Degree of effects would be less than under the Proposed Action (fewer acres treated with herbicides)." We oppose aerial herbicide application due to unavoidable impacts on non-target species.

Animals, Livestock, Wild Horses, Wildlife -- A rather all inclusive category. "Adverse short-term impacts would be temporary and localized. However, over the short and long term, animal habitat would improve benefiting all species populations. --- Long-term animal habitat would improve benefiting all species." What are the cumulative impacts on non-target animals species from a 15-year treatment program? **41-3**

Livestock grazing is currently one of the primary uses of BLM lands in the EIS area, (PRIA, 1978). This may be a contributing factor to the noxious weed overabundance in the "affected areas." Native range in good or excellent condition is not susceptible to invasion by most weeds. Cost effectiveness of a noxious weed program is highly questionable considering the Bureau's questionable mandate concerning the use of the public lands as rangelands. **41-4**

Fish -- "Long term animal habitat would improve benefiting all species."

Wilderness and Special Areas -- "Non-target broadleaf plant species may be injured or destroyed in areas of treatment over the 15-year period of treatment." These areas are of great concern to us. Chemical tampering could result in the injury or decimation of wildlife and plant communities for which these areas have been set aside. Minimal assurance is given in the document concerning protection for these areas from chemical treatment. Revised Chapter 3 under "Impacts on Wildlife and Fish" does state on p. 7, "To prevent unacceptable adverse impacts to those

TO: Charles W. Luscher, Oregon State Director
Bureau of Land Management
P.O. Box 2965
Portland, Oregon 97208

FROM: Lynn Herring, Conservation Committee
Portland Audubon Society
5151 N.W. Cornell Road
Portland, Oregon 97210

SUBJECT: NORTHWEST AREA NOXIOUS WEED CONTROL PROGRAM, DSEIS

DATE: January 5, 1987

These comments constitute a response from the Conservation Committee of the Portland Audubon Society to the Northwest Area Noxious Weed Control Program, Draft Supplement to the Final Environmental Impact Statement (DSEIS). The Portland Audubon Society, a 5000 member chapter of the National Audubon Society, shares its parent organization's long-standing concern about the impacts of pesticides on our wildlife, native plant, and overall habitat base. You may also refer to our response listed as letter 52 in the FEIS, December 1985, which addresses our original concerns with this program and remains applicable to the DSEIS.

INTRODUCTION

With regard to issues that have been raised by the public, we are disappointed to read in the Preface, p. i, that although the "BLM has taken the opportunity to correct technical errors of merit that appeared in the FEIS - - - (t)hese changes, however, are not expected to change the overall analysis." In terms of new information and major changes that have necessitated the need to produce this supplement, the legal acceptance of this product becomes moot.

As for requirements for further environmental analysis, if the FEIS and this supplement constitute a regional programmatic statement, site-specific environmental analysis and documentation must be accomplished at a state or district level in a timely fashion (not two weeks before or after treatment has begun) to allow public participation in accordance with CEQ regulations for implementing NEPA. It is obviously important to accomplish an inventory of those non-target plants and animals that may be especially susceptible to a proposed control measure before it takes place. **41-1**

ALTERNATIVES

Still there is no adequate range of alternatives. For instance, an alternative such as non-grazing that incorporates preventive measures and examines a likely contributor to the noxious weed problem has not been included. Moreover, Alternative 1 (the agency's Preferred Alternative and Proposed Action) is not a true IPM alternative. We reiterate that Alternative 1 and the current array of alternatives as a package are heavily biased toward chemical treatment for noxious weeds. (See FEIS, Table 1-2, p.6.) In fact, Common Issue #1 response on p. 58 states, "A high proportion of the expected control acreage is proposed for spraying with herbicides." **41-2**

sensitive wildlife populations, key habitat areas would be avoided. Site-specific plans would weigh the losses and gains of each project to ensure that wildlife and fish population and habitat diversity would be maintained." The section "Impacts on Vegetation" should contain similar language. **41-5**

Water Quality -- "Herbicides in surface water will disperse and degrade rapidly with no long-term impacts. If herbicides enter ground water it can have relatively long-term impact, but it is not expected (the) occur under proposed action." All the more reason to have a site specific analysis and adequate public involvement. Accidents can also occur. Need we remind you of the incredible accident-frought spruce budworm spray program in NE Oregon in June 1983. We are concerned about this overly optimistic assessment.

Human Health -- (Alt. 1), "No adverse impacts expected from use of herbicides. Human health would benefit from control of those noxious weeds that adversely affect humans. No long term adverse impacts. Some long term beneficial effects on human health." We are highly suspicious of this assessment. We will defer to the Northwest Coalition for Alternatives to Pesticides to address the human health impacts. (Alt. 2), "Herbicide related impacts similar to those under Alt. 1. More workers would be exposed to herbicides. Hazards of manual control methods would increase." You have not made a case on this score against a non-aerial spray alternative. Again, please review the ill-fated spruce budworm spray program in NE Oregon in June 1983.

Chapter 3 Supplement

"Impacts on Vegetation," p. 5,6,7

The need for site specific analysis of each proposed treatment unit is critical. We are concerned about the potential loss of nontarget species.

From the revised text of this section and an analysis of Table 3-2 on p. 6 and Appendix E in the FEIS, one can draw the following conclusions:

1) Susceptibility to a herbicide or herbicide combination must be determined and considered for non-target species in a treatment unit. Avoidance of some herbicides will be necessary as a result.

"The adverse effects on nontarget plants would depend upon their susceptibility to the herbicide, residual effects of the herbicide, the rate of application, and the number of herbicide applications over the 15-year period of treatment.", p.5.

2) Glyphosate will affect both broadleaf plants and grasses. Due to its non-selectivity and proposed limited application, there may be little reason to use it.

"Except for glyphosate, the proposed herbicides are selective, affecting broadleaf plants but not grasses. Glyphosate is a broad spectrum, nonselective herbicide that affects most perennial plants, annual and biennial grasses, sedges, and broadleaf plants. Under chemical techniques, some chemical residue may be left for varying periods, depending upon soil and climatic conditions. --- Glyphosate, the least selective of the herbicides to be used under Alt. 1 and 2, would result in the greatest loss of nontarget vegetation."

"Impacts on Wildlife and Fish, " pp. 7,8

Again, site-specific analysis for a proposed treatment is critical to avoid injury and loss of nontarget species.

From an examination of the revised text for this section and an analysis of Appendix K, the following conclusions have been drawn:

1) Due to the susceptibility of specific animal species to certain herbicides and herbicide combinations, it may be necessary to avoid the use of some herbicides on a site-specific basis.

"The risk of wildlife and fish health effects from exposure to dicamba and picloram would, in general, be less than that arising from the use of 2,4-D and glyphosate" (USDA, FS 1984).

"Wildlife or fish species that are restricted to isolated habitat areas or that are not mobile are highly susceptible to large changes in their habitat. In the short term, these wildlife and fish could be harmed by major losses of nontarget vegetation."

2) The hazard assessment and worst case analysis for the DEA's FEIS on the Eradication of Cannabis on Federal lands should not merely be incorporated by reference. More complete data is needed. Moreover, this study evaluates only 2,4-D and glyphosate.

3) The FEIS and supplement make a case for not using 2,4-D due to its impacts on wildlife.

"Because 2,4-D is the higher risk chemical proposed for use in the noxious weed program for both acute and chronic effects, the dose levels to wildlife have been included in Table K-2.", p. 32.

"Dicamba and picloram are generally nontoxic to most wildlife" (USDA,FS,1984), p.32. No such statement is made about 2,4-D. **41-6**

"Scientific uncertainty exists about the carcinogenicity potential of the herbicides 2,4-D, picloram, and glyphosate." Appendix N, p. 35.

4) More information is needed on adverse impacts on insects from the proposed application of these four herbicides and combinations. After all, insects form a feeding base for a number of animals, participate in some cases as predators for so-called pest species and/or in pollination, and have an intrinsic worth or their own. **41-7**

END

RESPONSE TO COMMENT LETTER 41

41-1 Pretreatment surveys, as discussed in Appendix I, Project Design Features, of the FEIS, would include the needed wildlife inventories.

41-2 See response to comment 15-1. The FEIS (December 1985) does present an analysis of an adequate range of alternatives. The inclusion of chemicals as one of four treatment methods under the Proposed Action in no way means that the Proposed Action is not an IPM alternative. In fact, less than 50 percent of the proposed annual acreage would be treated with chemicals, and more than 50 percent would be treated by manual, mechanical, and biological methods.

41-3 Cumulative (long-term) impacts on wildlife are addressed in the last three paragraphs on page 8, Chapter 3 of the DSEIS.

41-4 Native range in good or excellent condition is not immune to invasion by noxious weeds. Any soil disturbance, including that done naturally by rodents, can open up a niche that becomes a seedbed for noxious weed seed (personal communication with Dr. Robert Callahan, University of Idaho, January 13, 1987).

41-5 The required site-specific analyses are discussed in Requirements for Further Environmental Analysis, on page 14, Chapter 1 of the FEIS and restated in the Preface of the SEIS.

41-6 The toxicity of 2,4-D is discussed in depth in Appendix K of the DSEIS under 2,4-D (page 25) and Wildlife Health Effects (page 31).

41-7 Impacts to nontarget species were assessed in Appendix K of the DSEIS, and measures to protect aquatic insects are found in Appendix I, Project Design Features, of the FEIS.

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United States Department of the Interior

FISH AND WILDLIFE SERVICE

BOISE FIELD OFFICE
4696 Overland Road, Room 576
Boise, Idaho 83705

January 5, 1987

To: State Director, BLM, Oregon State Office, Portland, OR

From: Field Supervisor, USFWS, Boise Field Office, Boise, ID

Subject: Draft Supplement to Northwest Area Noxious Weed Control Program FEIS (FWS comments on EC-86/38)

These are the Fish and Wildlife Service's consolidated comments on the subject draft from our field offices in Boise, Idaho; Billings and Helena, Montana; Cheyenne, Wyoming; Olympia, Washington; and Portland, Oregon.

On July 26, 1985, the Portland Regional Office of the Fish and Wildlife Service provided comments to you on the draft EIS on Northwest noxious weed control. Those Service comments were not addressed in the final EIS. We are pleased that the draft supplement offers the opportunity again to express our views. **42-1**

General Comments

The document should expand the preferred alternative discussion concerning impacts to anadromous and resident fish, especially regarding the likely death of some fish food organisms. Also, the draft supplement notes that chemical treatment of weeds will occur in riparian areas. Riparian areas are vital to many fish and wildlife species. In those areas, BLM should take extra efforts to protect non-target plants by using back-pack sprayers or mechanical control measures. Aerial herbicide application to riparian areas should not be done. Wetlands are unique habitats on which many wild animals depend. The treatment of noxious weeds in wetlands, like riparian areas, should be done with back-pack sprayers or mechanical methods. Wetlands should not be sprayed aerially. **42-2**

Noxious weeds frequently grow in disclimax environments. Disclimax conditions result when fire, erosion, construction activities, pesticides, or livestock (overgrazing) destroy the permanent native vegetation and provide conditions necessary for the noxious weeds to establish and flourish. Thus, a good way to reduce the need for noxious weed control is to minimize disclimax environments by improving range conditions. Livestock grazing is widespread and a factor over which your agency has considerable control. The document should discuss in detail how livestock grazing will be managed by BLM to minimize noxious weed establishment, spread, and re-establishment after plant control. **42-3**

We are pleased that BLM will prepare site specific environmental analyses before plant control measures are implemented on the ground. The Fish and Wildlife Service offices of Ecological Services and Endangered Species in the cities listed in the first paragraph of this memo should be invited to comment on each site analysis in their respective area of jurisdiction.

Using full disclosure as a guideline, the document should include an estimate of specific habitat acreages (critical deer and antelope winter range, upland habitats, wetlands, and riparian habitats) expected to be affected by herbicide spraying on an annual basis. Based on this information, the type and magnitude of impact(s) expected on these habitats should be identified and presented. This analysis could be limited to the primary noxious weeds targeted for control.

Specific Comments for Supplement

1. Page 8 paragraph 3. Simply citing the Cannabis report is not adequate. Instead you should summarize from the Cannabis report the 2,4-D and glyphosate risks, similarly to what you did on pages 31-32 of the supplement. **42-4**

2. Specific comments in our July 26, 1985, letter that are not addressed in the Supplement.

a. Page 6, Alternative 1. It is stated in the draft EIS that an estimated 24,564 acres of noxious weeds would be treated annually in the EIS area. However, it is unclear how many acres of land will be treated over the 10-year period, if retreatment of some areas is required. We recommend that Table 1-2, Page 6 of the draft EIS, be expanded to project total acreage treated over a 10-year period, including any estimate of acreage that may need to be retreated. **42-5**

b. Pages 12-13, Table 1-4, Summary of Impacts by Alternative. We do not agree with the conclusion that fish habitat conditions and population levels would remain unchanged. Removal of stream-side vegetation and the drift of herbicides into water courses is possible. A more complete analysis is needed in the EIS document. **42-6**

c. Page 21, Vegetation--Wetlands and Riparian. There is no indication what portion of the existing riparian habitat or wetland areas could be affected, especially in western Oregon. This should be addressed in the final document and could be listed in a table. **42-7**

2

d. Page 24. E. Northern Great Plains Spring Wheat Region. Prairie rose and buffaloberry are species mentioned as being common in draws and narrow valleys. Often these species, in association with snowberry, comprise the only woody shrubs in such areas. These woody species are important to many species of wildlife inhabiting this region. The susceptibility of rose and buffaloberry to Tordon, Banvel, and 2,4-D should be included in Appendix G of the EIS. Based on our limited experience, Rosa species are highly susceptible to damage from Tordon. 42-8

e. Pages 24-26 and 28. Threatened and Endangered Plants and Animals. The Service has determined that Federally-listed threatened or endangered species are present within the project area and may be present in the immediate area of specific herbicide application sites. When detailed spray plans are prepared at your district level, the Service should be consulted informally to determine if listed, proposed, or candidate species may be present. 42-9

Two species should be added to the listed or proposed threatened and endangered species list for Montana shown in Table 2-1 on page 29 of the draft EIS. They are listed below and shown in Attachment A. 42-10

Listed Species

Least tern (*Sterna antillarum*)	Endangered Species - Montana

Proposed Species

Piping Plover (*Charadrius melodus*)	Threatened - Northeast Montana

Endangered species responsibilities are outlined in Attachment B. Should your biological assessment determine that a listed species is likely to be affected adversely by the project, you should request formal Section 7 consultation through the appropriate Service field office.

f. Page 37. Impacts on Water Resources. The draft EIS states that a buffer strip between live water and the area sprayed would be provided. In this regard, you refer to Appendix I. In Appendix I it is implied that the width of the buffer strip would be whatever is required by state regulation or guidelines for streams, lakes, or ponds. Apparently, this refers only to aerial applications, since on page 9 of the draft EIS, handheld spray guns could be used for treating weeds up to the high water line. The width and applicability of the buffer needs to be clarified. 42-11

g. Appendix G. The document states that big sagebrush, a plant important to wildlife, has "S-1" susceptibility to 2,4-D ester. The amine formulations of 2,4-D have little effect on big sagebrush. Since big sagebrush is not shown as a noxious weed or poisonous plant in Appendix C, the final EIS should explain why the ester, rather than the amine formulation of 2,4-D, would be used on some sites. You should clarify whether the ester would only be used where big sagebrush is absent. Further, Johnson and Finley* show that the dimethyl amine salt of 2,4-D is much less toxic to fish than any of the ten other formulations they tested. The ester formulations they tested were all more toxic to fish and aquatic insects. You should discuss whether the dimethyl amine salt would be used, if so where, and if not, why. 42-12

h. Appendix N. It is noted that a worst-case analysis of impacts on human health has been presented. In our opinion, a similar analysis should be performed for fish and wildlife, since these resources are quite likely to be affected by the noxious weed control and eradication program. In this regard, the worst-case analysis could be limited to the chemical control aspects of the program as this relates to critical wildlife habitats. These include winter range, upland bird nesting habitats and winter cover, riparian habitats, and wetlands (including isolated wetlands). The worst-case analysis should include a cumulative impact assessment for a 10-year period. 42-13

John F. Wolflin

Attachments

cc: FWS, ES/BEC, Washington, D.C.
FWS, R-1, HR, Portland (Campbell)
FWS, R-6, HR, Denver
FWS, ES, Billings, Cheyenne, Olympia, and Portland
FWS, SE, Helena

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*Johnson, W. and M. Finley. 1980. Handbook of Acute Toxicity of Chemicals to Fish and Aquatic Invertebrates. USFWS, Resource Pub. 137. Pages 59-60.

RESPONSE TO COMMENT LETTER 42

42-1 BLM never received such a letter. On at least two previous occasions, BLM has requested copies of the July 26, 1985 letter from your files and has never received it.

42-2 Riparian and wetland areas would not be sprayed aerially. See text revisions in this FSEIS and Chemical Methods, pages 9-11 of the FEIS.

42-3 See response to comment 15-1.

42-4 As stated in paragraph 9 on page 8 of the DSEIS, a thorough summary of all the herbicides used, including the Cannabis report, is included in Appendix K of the DSEIS.

42-5 The total of 24,564 estimated acres that would be treated annually as listed in Table 1-2 of the draft EIS has been increased to 44,014 acres. This increase is mainly a result of the increase of biological control by insects from 2,140 acres to 21,590 acres. Usually, fewer acres would be treated than are listed because the treatment estimates provide for retreatment of some areas.

42-6 A more thorough discussion of impacts to riparian vegetation and drift of herbicides into water courses is included in the Impacts on Surface Water and Impacts on Terrestrial Vegetation sections of Chapter 3 of the DSEIS.

42-7 The Chemical Methods section of Chapter 1 on page 8 of the FEIS lists glyphosate as the herbicide that would be used along waterways. Table 1-3 in the FEIS shows 105 acres proposed for treatment with glyphosate from ground vehicles and 42 acres proposed for treatment on the ground by hand. These 147 acres occur in small patches spread over 51.5 million acres in five states. This small area seems insignificant from this viewpoint.

42-8 Appendix G of the FEIS lists a representative sample of plants and their susceptibility to certain herbicides. BLM will include a more site-specific plant list in the pesticide use proposal and narrative justification that it will prepare after on-the-ground investigations of areas to be treated.

42-9 BLM's requirement for consultation with the Fish and Wildlife Service on threatened and endangered species is listed on pages 7 and 14 of Chapter 1 of the FEIS.

42-10 The least tern (E-Montana) and piping plover (T-Montana) have been added to Table 2-1 in the Text Revision section of this FSEIS.

42-11 The subject of buffer strips was addressed in the FEIS (Appendix I, page 183) and in the Text Revisions section of the DSEIS on page 64. Buffer strips must be addressed as part of the site-specific analysis required before application. Width and applicability of buffer strips are a function of many factors such as land slope, proposed chemical, target weed species, associated vegetation, soil type, herbicide label restrictions, and application method. Some states also have buffer strip restrictions that must be complied with. All these factors suggest that the final determination of the need for buffer strips and the necessary width are a function of the site-specific analysis.

42-12 BLM has investigated the inert substances in the amine formulation of 2,4-D that it proposes to use and has found that no inert substances of toxicological concern are present. Therefore, BLM has included a label for an amine salt form of 2,4-D, which will be considered for use when important fish streams are near the project site and where significant amounts of big sagebrush grow on the project site.

42-13 Impacts to wildlife health were included on pages 201-204 of the FEIS.

United States Department of Agriculture | Forest Service | Pacific Northwest Region | 319 S.W. Pine P.O. Box 3623 Portland, OR 97208

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File: 1950

Date: JAN 6 1987

Mr. Charles Luscher, State Director
Bureau of Land Management
PO Box 2965
Portland, OR 97208

Dear Mr. Luscher:

We appreciate the opportunity to review the Draft Supplement to the Final Environmental Impact Statement for Noxious Weed Control in Five Western States. Review has been completed by my Range and Watershed, and Forest Pest Management staff groups. We feel that the document effectively supplements the FEIS and meets the intent of the CEQ amendments to Regulation 40 CFR 1502.22 (Incomplete or Unavailable Information).

A major concern for the Pacific Northwest Region is the relationship of Worst-Case Analysis in the Noxious Weed Control Program Document and the recent joint Forest Service--Bureau of Land Management effort through Labat-Anderson, Inc. The methodology, logic, and findings of the two assessments appear to be consistent. We feel that the DSEIS satisfactorily addresses the issue of inert ingredients (pg. 13) and incorporates new available information on the herbicide 2,4-D (pg. 27). The Herbicide Application Monitoring Plan elements (pg. 64) display the operational controls and restraints used in project-level implementation and follow up.

Information in the DSEIS will be a useful reference for the development of our Vegetation Management Draft Environmental Impact Statement. If there are comments or questions, please contact Gary Larsen of my staff.--Phone: 221-2727.

Sincerely,

JAMES F. TORRENCE
Regional Forester

cc:
PLAN (Kent Churchill)
FPM (Jim Hadfield)
WO-FPM (Max Ollieu)

44

Southern Oregon Northwest Coalition for Alternatives to Pesticides

P.O. Box 402, Grants Pass, Oregon, 97526
503-474-6034

January 5, 1987

Charles W. Luscher, State Director
BLM - Oregon
PO Box 2965
Portland, OR 97208

Dear Mr. Luscher,

Thank you for this additional opportunity to comment on the BLM's Noxious Weed Control Program. SONCAP has been an active participant in the development of this EIS, and we wish to express our dedication to producing a sound document.

I apologize for submitting this comment letter 2 days late. However, I have been assured by Ms. Alice Johnson in your office that this comment letter will be considered in preparing the final supplement if postmarked by January 6, 1987. Thank you.

SONCAP is a non-profit educational organization of grass-roots volunteers and families living in Southwest Oregon. We are the regional office for the Northwest Coalition for Alternatives to Pesticides centered in Eugene. Our goals are to educate the public and work with governmental agencies to improve the standard practices for handling pesticides, herbicides, fungicides, and other toxic materials here on Earth.

Good luck in your future efforts,

Julie Kay Norman
for SONCAP

COMMENTS ON THE SUPPLEMENT TO THE NORTHWEST AREA NOXIOUS WEED CONTROL PROGRAM

1. SONCAP's original comment letter on the EIS has not been incorporated into this Draft Supplement. This Draft Supplement ignores the mandate in NEPA 1502.9 by not acknowledging or incorporating substantive changes, as suggested by SONCAP and others, into this Supplement. **44-1**

Please reread and respond to original SONCAP comments in full.

2. There is no stated Alternative which represents an Integrated Pest Management Alternative, as requested by SONCAP and others. The incorporation of the text revisions cited on page 61 which would add Priorities to the weed management program do not constitute an Integrated Pest Management (IPM) process as outlined by SONCAP and NCAP. **44-2**

3. There is not an adequate range of alternatives nor an adequate comparison of alternatives as specified in NEPA.

4. The discussion of the health and environmental effects from INERT ingredients of pesticides is inadequate. The two paragraphs do not fully cover the potential impacts from full formulations of pesticides. **44-3**

5. The BLM has not sufficiently dealt with data gaps, as cited previously by SONCAP and NCAP. Registration standards, for example, are incomplete. **44-4**

6. The experts employed to make scientific risk assessments were not well balanced in terms of bias and perspective. The use of an "egg-a-day vs pesticide exposure" risk assessment technique has been found to be faulty, because it compares known risks to unknown risks. Other risk assessment experts should be consulted, and other techniques of assessing these unknown pesticide risks should be explored. **44-5**

7. Finally, the Preface states that "In this DSEIS, BLM has taken the opportunity to correct technical errors of merit that appeared in the FEIS...These changes, however, are not expected to change the overall analysis."

This statement illustrates that this document does not meet the intent of NEPA under which it was initiated, and it indicates that the agency is not acting in good faith.

In conclusion, no substantive changes or additions were made. Undocumented scientific claims remain undocumented. Data gaps are being ignored. The assumption that "the agency knows all" continues to bog it down in bad science.

You still don't understand what you're supporting when you advocate the use of these poisons.

- - end of comments - -

RESPONSE TO COMMENT LETTER 44

44-1 SONCAP's original comment letter on the EIS was included in the FEIS (December 1985) along with BLM's response to those comments. See pages 91 to 95 of the FEIS.

44-2 See response to comments 37-38 and 37-41.

44-3 BLM has expanded the section on inert substances. Also see response to comment 37-7.

44-4 See responses to comment letter 37. All of the herbicides except for 2,4-D have registration standards.

44-5 The risk assessment methodology chosen is well documented and generally accepted in the scientific community.

3. On page 17 under Public Risk the point is made that "the public could be repeatedly exposed to these levels and suffer NO adverse effects. This is true for ALL individuals including children, infants, pregnant women, and the majority of sensitive individuals." The logic and concepts discussed here are probably valid for non-carcinogens when considered merely as whether or not a no observed effect level (NOEL) is exceeded, and whether the margin of safety is large or small. However, if the substances are assumed to be CARCINOGENS as the document later assumes they are in its risk assessment - then the statements on page 17 are not logical. This is because under the conservative assumptions of the document, ANY dose of a carcinogen can conceivably be harmful. 45-20

4. On page 59 the supplement makes the statement in paragraph 2 that "NO epidemiologic studies are available that associate ANY of the herbicides with heritable mutations". This is questionable.

GRAZING

The document states that "Grasses should become more abundant as plant competition is reduced after weed control is implemented" (page 7). Such an assumption should be supported by EIS documentation of commitments for adequate grazing controls (the final EIS appears to move the responsibility for making such commitments to the district office level). Furthermore, the document appears to make the assumption that weed control projects would "prevent further degradation of important habitat" and "would benefit fish and wildlife over the long term." Such an assumption is not necessarily accurate unless the EIS is revised to contain the commitments for accomplishing all the integrated land management actions (of which weed control would be a part) that may be required to achieve the above benefits. Also, the goal should include improvement of habitat where needed (not just to "prevent further degradation"). 45-21

BIOLOGICAL EFFECTS

There is limited discussion on the long-term vegetation impacts of chemical controls. We suggest that more effort be directed toward the biological and ecological consequences of vegetation control. For example, spraying herbicides may be the best and most cost effective means of controlling the weeds, but what about the effect of continually eradicating undesirable plants as an artificial practice of essentially "farming" the environment? When new niches are created by eradicating the present weeds, more noxious weeds can then invade the newly available niche. 45-22

SPECIFIC COMMENTS

3 Photodegradation doesn't appear to be discussed as a depletion mechanism for herbicides in surface water. 45-23

7 Under Impacts on Livestock and Wild Horses, the statement that 2,4-D is "carried in the blood and digestive systems until animals excrete it from their bodies" is somewhat incorrect. Actually, (as stated correctly later in the document), 2,4-D is partially metabolized by the liver and rendered more polar, which subsequently facilitates its excretion via the kidney. The statement needs to be re-worded, although the intent is well taken. 45-24

10 The Final EIS should include a statement of the relevance of the incomplete or unavailable information to evaluating reasonably foreseeable significant adverse impact on the human environment. 45-25

10 The two paragraphs beginning on the end of page 10 and the beginning of page 11 on data gaps should be reworded or deleted.

13 Sometimes the document does not adequately reference its statements on toxicity. For instance, page 13 and page 29 both state that picloram in combination with 2,4-D is capable of producing sensitizing reactions in humans. Neither of these statements is referenced, as far as can be determined. The same is occasionally true for selected other portions of the document, although most key toxicologic statements are referenced adequately. 45-26

15 Table 3-5 is unclear. Without examining the table in close detail, we are unable to determine whether the NOEL for 2,4-D is in fact 1 mg/kg (per day?), or whether the NOEL for 2,4-D is merely assigned a value of 1, and then used as a basis for comparison with the other (less toxic and generally less risky) three herbicides. Units are needed in the table. 45-27

18 (Table 3-6) What is "Comp 1, Comp 2" and so forth? The table cannot be followed logically. Also, why include Paraquat (a much more toxic and pharmacologically unique substance than any of the four herbicides being considered by the EIS) in combination with the others in the table? Also, how can the LD_{50} for paraquat possibly be 20,000 mg/kg? This must be an error. The table should be omitted if it cannot be greatly clarified as to what was intended. 45-28

45 (Table N-7) If the LD_{50} and both the systemic and reproductive toxicity NOELS for 2,4-D are significantly lower than those for picloram, why is the provisional ADI for picloram (0.007) lower than that for 2,4-D (0.01)? 45-29

51 Other factors can also affect absorption. These include which herbicide is involved, the carrier it is dissolved in, the K_{ow} of the material, whether or not the skin is abraded, and so forth. 45-30

55 (Table N-15) Why is benzene a risk from eating eggs? 45-31

67 The list of groups and agencies to whom copies of the EIS were sent does not appear to include even a single state or local health department. This would appear to be a serious omission, since many of the questions of exposure and health risk from the citizenry at large are directed at these agencies, rather than to the various other state and local groups indicated in the distribution list. For that matter, other environmental interest groups such as Trout Unlimited, Ducks Unlimited, and so forth could also be included on the list. 45-32

5276E

RESPONSE TO COMMENT LETTER 45

45-1 BLM has included all the latest information provided it by EPA.

45-2 The stream classes you referred to in the glossary were included as an example of a classification system and were not meant to be all inclusive. This example is used by the State of Wyoming. It was mentioned in the text on page 184 of the FEIS and intended to be an example of things to consider when addressing the need and scope of water monitoring or studies. Because the stream classification systems of all states differ, the state system where the treatment site is located will be used. As noted in the Interrelationships section of the FEIS, BLM works closely with the state agency responsible for water quality requirements.

45-3 See response to comment 42 11.

45-4 Thank you for providing a copy of this report. It has been included in our analysis of ground water effects. See Chapter 3 of the FSEIS, Impacts on Ground Water.

45-5 BLM does not expect that the ground water will be contaminated under its Proposed Action, nor do the cited studies show any contamination. Some detectable levels of herbicide have been found, but these do not exceed recommended limits, and the ground water is not considered contaminated. If an aquifer should become contaminated, several actions are possible, including pumping, injecting chemicals or microbes to change or degrade the herbicide, or using alternative water sources. The action to be taken would depend upon such aquifer characteristics as porosity, depth, direction of flow, and transmissivity. In the unlikely event of contamination, the needed corrective action would be selected. These characteristics can only be determined at individual sites.

45-6 Studies conducted on farmland within the EIS area have shown low or no detectable amounts of herbicides. Applying the contrast between favorable conditions for affecting ground water on farmland and unfavorable conditions present on rangeland, one can assume that the potential risk from the Proposed Action would be low. With the use of design features listed in the FEIS, the risks for affecting ground water appear even lower. Also see response to comment 45-5.

45-7 The pretreatment surveys will highlight the wildlife and fish values potentially affected, and the resultant site-specific project plan will direct the needed wildlife and habitat monitoring program.

45-8 All potable water supplies are considered high priority, but potability is not the only criterion for monitoring water quality. See Water Monitoring and Studies on pages 184 and 185 of the FEIS for more guidance. The pretreatment survey will highlight potential problems, and the resultant plan will direct the needed monitoring.

45-9 All our water quality monitoring is directed to compare the measured parameter against the established standard, but EPA has not developed water quality standards for herbicides. The established EPA Water Quality Criteria for particular herbicides will be the figures to which the detected amounts will be compared.

45-10 Contingency plans for spills are covered in several ways. As you know, EPA has a National Contingency Plan for spills of oil and hazardous materials. In addition, each EPA region has a contingency plan for oil spills and hazardous materials. Also, each state government has developed a contingency plan for oil spills and hazardous materials under the guidance and authorization of EPA. Pesticides, which include herbicides, are listed and treated as a hazardous material and will be responded to in that respect. BLM Manual 9222 states that a spill contingency plan will be developed before a herbicide is applied on BLM land. Manual 9222 also gives guidance on contingency plan development.

45-11 The herbicide monitoring plan you referred to on page 64 of the DSEIS does not, nor was it intended to, refer only to surface water. As in determining the need for and the type of water quality monitoring for surface water, these decisions can be applied only site-specifically for ground water.

You are correct in stating that ground water monitoring is expensive and requires detailed planning to ensure that quality data is obtained. Factors such as water depth, direction of flow, and aquifer transmissivity are important, but probably more important is having a source to sample. Obtaining a source often requires drilling a well at great expense. If a potential exists for introducing herbicides into an important aquifer and monitoring capabilities do not exist, treating noxious weeds by herbicides may have to be precluded in that area. This determination will be made on a site-by-site basis as needed.

45-12 See response to comment 45-10.

45-13 This FEIS and FSEIS will serve as the guides for the noxious weed control program for the next 15 years. Site-specific environmental analysis will be conducted at the state or district level on the proposed weed control plans, and the public will be invited to participate. See Requirements for Further Environmental Analysis on page i of the DSEIS, which states that "Interdisciplinary impact analyses will be based upon this and other EISs, such as EISs for resource management plans, timber management plans, and grazing management plans." All the EISs and management plans are used to thoroughly analyze the impacts on the environment and when possible to prevent degradation of natural resources.

45-14 BLM is revising this table with information provided by its consultant, LAI. The assumption made from this information will probably not change the outcome.

45-15 These items are discussed in USDA, FS (1984), which has been incorporated by reference into this EIS. This matter has been clarified in Appendix K of the FSEIS.

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 SIXTH AVENUE
SEATTLE, WASHINGTON 98101

JAN 9 1987

REPLY TO ATTN OF: M/S 443

Mr. Charles W. Luscher
Oregon State Director
Bureau of Land Managment (935)
P.O. Box 2965
Portland, Oregon 97208

Dear Mr. Luscher:

In accordance with our responsibilities under Section 309 of the Clean Air Act and the National Environmental Policy Act we have reviewed the Draft Supplement to the Northwest Area Noxious Weed Control Program Final Environmental Impact Statement (EIS). This document provides more discussion on the possible impacts to the natural and human environment from the chemical treatment portion of the proposed program than was included in the December 1985 Final EIS.

Based on our review, we have rated this Draft Supplemental EIS EC-2 (Environmental Concerns-Insufficient Information). We have concerns because ground-water monitoring was not included and the supplement somewhat understates the ground-water contamination potential. We have enclosed a copy for your review of a ground-water study undertaken by the Montana Department of Agriculture in 1984. We noted also that pertinent toxicity information for 2,4-D and Picloram and chronic effects for pesticides were not included in this supplement. The enclosed review report details our comments. **45-1**

If you have any questions about our review, please contact Wayne Elson at (FTS) 399-1463.

Sincerely,

Robert S. Burd
Director, Water Division

Enclosures

cc: U.S. Forest Service, Region 6

Review Report For Supplemental Draft DEIS
Northwest Noxious Weed Control Program

WATER QUALITY

The definition of "STREAM CLASSES" used on pages 75-76 needs to be revised. The definition should incorporate stream classifications as a component of state water quality standards (WQS), and make the distinction between state WQS classifications and the classification system described by BLM. **45-2**

Some standards are now included for buffer zones along water bodies (page 64). We question the use of only a 25 foot width buffer zone when a boom sprayer is used. The buffer zone requirement for aerial applications should be included. The adequacy of proposed buffer zone standards needs to be documented. **45-3**

As we indicated in our comments on the DEIS, the buffer zone standards need to be established for all wetlands (as defined by the Cowardin system). This should be included in the Final EIS.

The supplement does not mention the pesticides in ground-water study undertaken by the Montana Department of Agriculture in 1984. Routine use of herbicides resulted in detectable concentrations of ground-water contaminants. We have enclosed a copy of this report for review and inclusion into the Final EIS. **45-4**

No mitigation measures are mentioned for the situation where herbicides contaminate an aquifer. Such mitigation should be discussed in the Final EIS. **45-5**

The supplement does address the impact of specific pesticides on ground-water. However it tends to understate the potential contamination risks. **45-6**

MONITORING

The inclusion of a monitoring plan (page 64) is commendable. However, the supplement states that the plan's "methods and frequency...would be used if monitoring is begun." The Final EIS should include specific commitments to initiate and carry out the plan.

The monitoring plan should be revised to:

1. assure that the effects of herbicide treatment on terrestrial and aquatic ecosystems are measured; **45-7**

2. include water monitoring for non-potable water (protection of chemical, physical, and biological integrity under the Clean Water Act does not apply to just potable sources); **45-8**

3. include water quality standards compliance as a "Characteristic Evaluated" for water monitoring; **45-9**

4. and to include contingency plans for spills, excessive application, or accidental misapplication. **45-10**

The possibility of ground-water monitoring is mentioned in comments in the final EIS (page 131). Also, the Herbicide Application Monitoring Plan (p. 64) contains no provision for ground-water monitoring. The "Water Monitoring Samples" referred to in the chart appear to be specific to surface water. The supplement should address ground-water monitoring and the process surrounding a monitoring decision. Monitoring that is incorrectly done provides false information at considerable expense. **45-11**

The Final EIS should include a commitment that BLM will consult with all affected agencies and organizations in designing the monitoring program. The monitoring plan only recognizes reviews by the "authorized certified applicator" and the BLM Washington Office. The "Interrelationships" section of the supplement also lacks this specificity on monitoring program reviews.

Although the supplement addresses several accidental spill scenarios (page 51), it only discussed the potential impact on human health. There is no discussion of the plan needed to deal with these spills should they occur. This aspect will have to be included in each site-specific plan. **45-12**

The degree to which the resource management plan (RMP/EIS) establishes resource management requirements and describes environmental impacts, in general, has been extensively debated. The noxious weed control EIS should establish the role of the RMP/EIS in providing such information, e.g., identification of sensitive areas and associated management requirements, and the monitoring program for the specific resource area. **45-13**

TOXIC EFFECTS

In general no data are included for chronic effects of these pesticides on aquatic life coupled with concentrations expected during runoff (frequency and duration).

LC50s of species that are available in the open literature were not considered in the supplement. For example, the following are data from Johnson and Finley (1980) pertaining to 2,4-D and picloram (which are lower than those in Table K-3): **45-14**

2,4-D

Organism	48/96 hr. LC50
Lake trout	0.9 parts per million (ppm)
Cutthroat trout	0.9 ppm
Bluegill	0.5-0.6 ppm
Cypridopsis (ostracod)	0.4 ppm
Channel catfish	0.3 ppm

Picloram

Organism	48/96 hr. LC50
Cutthroat trout	1.4 ppm
Pteronarcys (stonefly)	0.048 ppm
Gammarus fasciatus (amphipod)	0.027 ppm

These data change the margin of safety of 2,4-D (page 32) from 19 percent to as much as 28 percent of the median lethal concentration. The Final EIS should also compute the extreme case scenario in which the organisms could be exposed to 230 and 700 percent of the median lethal concentration.

A review of the literature suggests that the alkanolamine salt and the dimethylamine formulations are the least toxic to fish, whereas the isopropyl ester and butyl ester were the most toxic. These aspects were not discussed in the supplement nor the differences in LC50 values for 2,4-D or other herbicides when waters from two different sources were used in toxicity tests. **45-15**

Related to statements on page 10 on carcinogenicity of 2,4-D, EPA is reviewing the Hoar study (Journal of the American Medical Association, September 9, 1986), which indicates a correlation between exposure to phenoxy herbicides, especially 2,4-D, and non-Hodgkins lymphoma in humans. This study should be considered in Final EIS. **45-16**

For picloram, the supplement did not include any aquatic LC50s and stated that "picloram was only slightly toxic (defined as having an LC50 exceeding 10 ppm) to most fish and moderately toxic (LC50 of 4.0 ppm) to rainbow trout" (page 32). The fish-food organisms included in the above data showed the invertebrates to be very sensitive [LC50s of 27 and 48 parts-per-billion (ppb)] to picloram. A more complete presentation of effects on aquatic life (including invertebrates) is needed. **45-17**

Page 10 states that "EPA has requested additional studies for cancer and chronic effects. However, existing chronic feeding studies do not indicate that dicamba is a carcinogen." The way these two statements are juxtaposed infers that negative data concerning dicamba's carcinogenicity indicates that this pesticide is not carcinogenic. This is in contrast to EPA's efforts to obtain further information on both carcinogenicity and chronic effects of this chemical. If this is the point that is being made the Final EIS should explain why the negative data are sufficient to conclude that dicamba is not carcinogenic. **45-18**

The supplement used absolute terms at inappropriate times. For example:

1. On page 8, paragraph 8 states that the alternatives would eliminate ANY adverse impacts from applying picloram. Such descriptors as ALL and ANY are too absolute and should be modified accordingly.

2. On page 13 under Inert Ingredients, the absolute terms NONE and ANY are used inappropriately. **45-19**

45-16 This study was considered in the DSEIS. Please see page 27 of this document.

45-17 The definition of slightly toxic as having an LC_{50} exceeding 10 ppm is found on pages 12 and 15 of Pesticide Background Statements (USDA, FS 1984). The word "moderate" has been deleted from page 32 of Appendix K of the DSEIS.

45-18 See response to comment 37-13.

45-19 Please note that these terms come from a direct quote from the Office of Pesticide Programs's letter to BLM, dated (October) 1986.

45-20 This discussion appears under the subheading Risk Analysis for Threshold Effects on page 14 of the DSEIS. Carcinogenic risks are dealt with in the next section.

45-21 See response to comment 42-3.

45-22 This statement would be true only if a seed source now exists. The site-specific analysis and narrative statement will contain information on the probability of noxious weeds reinvading a treated area. Range conditions differ from crop conditions. When noxious weeds are brought to a controlled level or eradicated, the desirable native forage species tend to come back and can then compete with noxious weeds. Biological and ecological controls of noxious weeds are not now universally available or effective. Some means of control must be used in the interim until other methods are developed.

45-23 Photodegradation has been noted by chemical in Appendix K, Chemical Hazard Assessment, of the DSEIS. Photodegradation is a process for degrading herbicides in the sunlight environment and should be considered as part of the reason for low detectable levels of herbicides reaching surface waters as cited in the studies. The DSEIS (page 3) recognizes that photodecomposition is not a major mechanism for removal of 2,4-D from water. Consequently, photodegradation has not been highlighted as a major factor in this analysis of herbicide use, nor will it be added to the final report.

45-24 BLM has revised the text in response to your comment.

45-25 In addition to page 10, BLM discussed the relevance of the incomplete or unavailable information in Appendix N of the DSEIS.

45-26 The information was taken from the picloram registration standard published by EPA.

45-27 As shown in Table 3-3 of the DSEIS, 1 mg/kg/day is the NOEL for 2,4-D. BLM has added units to Table 3-5.

45-28 BLM has revised this table.

45-29 The EPA, Office of Pesticide Programs set the ADI for picloram and 2,4-D. Your questions should be directed to them. BLM's understanding is that different safety factors were used.

45-30 As noted in Table 1-3 of the FEIS, the only liquids used as carriers are water.

45-31 BLM cannot verify the reasoning behind this statement and has therefore deleted it from Table N-15.

45-32 As noted, pages 67 and 68 of the DSEIS consist of only a partial listing because a complete listing of every federal, state, and local organization (national and local levels), and individuals receiving copies of this EIS would involve some 2,500 names. This list is compiled from the master mailing lists in each BLM office in the EIS area, scoping respondents, commenters on all documents published thus far, and anyone else requesting to be placed on the mailing list. In addition, as a standard practice, EPA receives a complete copy of the mailing list along with the EIS filing package.

46

DEPARTMENT OF THE ARMY
NORTH PACIFIC DIVISION, CORPS OF ENGINEERS
P.O. BOX 2870
PORTLAND, OREGON 97208-2870

REPLY TO ATTENTION OF:

January 6, 1987

Environmental Resources Branch

Charles W. Luscher
Oregon State Director
Bureau of Land Management
PO Box 2965
Portland, OR 97208

Dear Mr. Luscher:

We have reviewed your Supplement to the Northwest Area Noxious Weed Control Program, final EIS and have no comments.

We appreciate the opportunity to review and comment on this document.

Sincerely

D. E. Olson
Chief, Planning Division

47

PRAIRIE COUNTY WEED BOARD
P. O. Box 7
☆
Terry, Montana 59349

January 7, 1987

Dear Sirs:

RE: Final Environmental Impact Statement to Supplement the Northwest Area Noxious Weed Control Program

Our county is roughly one-half BLM land. With this huge acreage it is imperative that the Federal Government take an active stand in noxious weed control and eventual eradication.

As a local grass roots organization we heartily support the concept of intergraded control using cultural, biological and chemical control of noxious weeds to protect our grassland and henceforth our livelihood.

We urge that control measures are adopted as soon as possible and heartily thank the BLM for past efforts in weed control.

Sincerely,

James H. Lindstrom
Prairie County Weed Board Secretary

JHL/kw

Appendix K
Chemical Hazard Assessment

Detailed information of the fate and behavior of dicamba, 2,4-D, picloram, and glyphosate in the environment and toxicity to humans and wildlife may be found in the following source documents: Ghassemi and others 1981; USDA, FS 1984; and DOE, BPA 1983. In accordance with 40 CFR 1502.21, these documents are incorporated into this FSEIS by reference. Toxicity data was always checked against the EPA tox-oneliners to ensure that no invalidated Industrial Bio-Test Laboratories (IBT) studies were cited.

Common Name: Dicamba

Chemical Name: 3,6-dichloro-o-anisic acid

Proposed Formulation: Banvel

Major Applications in Noxious Weed Control:
Dicamba is used to control or cause growth suppression of a broad spectrum of woody plants and certain annual, biennial, and perennial broadleaf weeds in crop sites, pasture, rangeland, and noncropland areas.

Environmental Fate
Dicamba degrades best in soils with high organic matter and high moisture content and at higher temperatures (USDA, FS 1984). Degradation mainly results from microbial action. Under aerobic conditions in soil, dicamba degrades with half-lives ranging from 1 to 6 weeks depending on soil texture (EPA 1983b). It may be leached out of the zone of activity in humid regions in 3 to 12 weeks. Dicamba may persist longer under conditions of low soil moisture and rainfall. However, under field conditions, dicamba will probably not persist more than several months in most soils.

Dicamba has been shown to volatilize from soil and leaf surfaces, but the extent and significance of losses due to volatilization have not been determined. Dicamba is considered a highly mobile herbicide. Studies have shown that salts of dicamba readily leach in soil and that dicamba only slightly adsorbs onto nonpeaty soil types. Photodecomposition probably is not a major route of degradation (EPA 1983a).

Few studies, however, have been conducted on the fate and persistence of dicamba in water. EPA has requested additional studies in this area (EPA 1983a). Model ecosystem studies show that, in water, dicamba and its metabolites persist in conjugated or anionic forms. Dicamba slowly transforms to 5-OH dicamba in water (about 10 percent after 32 days) and is slowly decarboxylated. Phytotoxic dicamba (free acid) residues are photodegraded in water to nonphytotoxic levels (EPA 1983b).

Norris and Montgomery (1975) studied a watershed in western Oregon treated with dicamba-2,4-D. This treatment area was next to, and at some points crossed, small tributaries of a creek that discharged from the area at 57 liters/second. A 1-pound/acre treatment resulted in a peak concentration at the feeder outlet of 37 parts per billion (ppb) about 5 hours after application and then dropped to background levels (less than 1 ppb) 37.5 hours after the start of spraying.

Toxicity to Nontarget Organisms

Dicamba is phytotoxic to a variety of plants, including conifers. Plant susceptibility depends on differences in the distribution of dicamba within a plant and differences in the rate of adsorption, translocation, and metabolism.

Existing data shows that dicamba is practically nontoxic to fish and wildlife and is unlikely to directly affect organisms. Use patterns of the chemical do not present any problem to endangered species. (EPA 1983b)

Dicamba has a low level of acute toxicity to mammals and birds. The oral LD_{50} of technical dicamba to rats is 1,707-2,900 milligrams per kilogram (mg/kg); to mallard ducks, 2,009 mg/kg. Dicamba is more toxic to fish; the 96-hour LD_{50} is 135 milligrams per liter (mg/l) for bluegills and rainbow trout. Dicamba has been shown to be relatively nontoxic to bees. It does not bioaccumulate (USDA, FS 1984).

The following source documents present detailed information on the fate and behavior of dicamba in the environment and potential impacts: Ghassemi and others 1981; USDA, FS 1984; DOE, BPA 1983. In accordance with 40 CFR 1502.21, these source documents are incorporated into this DSEIS by reference. The following discussions on toxicity and hazard assessment were extracted from "Pesticide Background Statements" (USDA, FS 1984) and "Guidance for the Reregistration of Pesticide Products Containing Dicamba as the Active Ingredient" (EPA 1983a). All studies were checked against the most recent (1984) EPA tox one-liners to ensure that no invalidated studies were used.

Toxicity in Animals and Humans

The following discussion on toxicity is taken from the 1983 EPA Reregistration Standard (EPA, 1983a):

Existing data show that technical dicamba is a severe eye irritant but has low oral and primary skin irritation toxicities. Supplementary data shows low dermal and inhalation toxicities. Technical dicamba is classified under Toxicity Category I based on eye irritation.

Data to support the establishment of reentry protection standards are not required because the Agency has determined, based on the use patterns and available toxicity data for dicamba, that the criteria in 40 CFR 158.14 are not met. Categories for acute toxicity are shown in Table K-0.

A three-generation reproduction study (Case No. 00028249) in male and female rats showed no evidence of toxicity among the rats from any of the generations utilized in the study. No test-article related effects were evident for any of the reproduction indices examined during the course of the study. This study found a NOEL of 25 mg/kg/day.

The teratology study (Case No. 00028236) in female rabbits was done at levels of 0, 1.0, 3.0, and 10.0 mg/kg/day. The 10 mg/kg/day dose caused slightly reduced fetal body weights and increased post-implantation loss. Dicamba was not found to be teratogenic in this study. The no-observed effect level was 3.0 mg/kg/day for maternal toxicity.

A 90-day subchronic feeding study (Case No. 00128093) with male and female rats at dosages of 0, 1,000, 5,000 and 10,000 ppm found no compound related changes in general behavior and appearance. The high dose groups showed a slight decrease in comparative body weight gains and food consumptions. No gross lesions or organ weight gains variations were found in treated groups. An absence or reduction of cytoplasmic vacuolation of hepatocytes indicating reduced glycogen storage in high-dose groups. The NOEL was 250 mg/kg/day (systemic).

Table K-0 Categories of Acute Toxicity[a]

Toxicity Category[b]	Signal Word	Oral LD_{50} (mg/kg)	Dermal LD_{50} (mg/kg)	Inhalation LC_{50} Dust or Mist (mg/liter)	Inhalation LC_{50} Gas or Vapor (ppm)	Eye Effect	Skin Irritation
I-	Severe	50 or less	200 or less	2 or less	200 or less	Irreversible corneal opacity at 7 days.	Severe irritation or damage at 72 hours.
II-	Moderate	50 through 500	200 through 2,000	2 through 20	200 through 2,000	Corneal opacity reversible within 7 days, or irritation persisting for 7 days.	Moderate irritation at 72 hours.
III-	Slight	500 through 5,000	2,000 through 20,000	20 through 200	2,000 through 20,000	No corneal opacity, irritation reversible within 7 days.	Mild or slight irritation at 72 hours.
IV-	Very slight	5,000 or greater	20,000 or greater	200 or greater	20,000 or greater	No irritation.	No irritation at 72 hours.

[a]Adapted from U.S. Environmental Protection Agency toxicology guidelines, summarized in Ashton 1982 in USDA, FS 1984

[b]Adapted from EPA by Maxwell 1982, as cited in Walstad and Dost 1984.

More recent information now follows:

A chronic rat study with dicamba was conducted by IBT. At present this study cannot be used to satisfy a data requirement. EPA has requested chronic and cancer studies for dicamba. A new rat study that does meet the new FIFRA guidelines also does not show any evidence of cancer (Taylor 1986).

The manufacturing process for dicamba has the potential of resulting in traces of 2,7-dichlorodibenzo-p-dioxin as a contaminant. 2,7-dichlorodibenzo-p-dioxin is present at levels to 50 (ppb). The more toxic dioxin isomer 2,3,7,8-tetrachlorodibenzo-p-dioxin has not been found at the limit of detection (2 ppb) of the method and is not expected as an impurity in dicamba. Dicamba products formulated with dimethylamine have the potential of adding dimethyl-nitrosoamine (DMNA) contaminant. Nitrosoamine levels in the diethylamine formulations are expected to be less than 1 ppm. The risk levels for the dicamba products with the nitrosoamine contaminant are in the 1×10^{-7} - 1×10^{-8} range. EPA considers the benefits to outweigh the risks associated with the nitrosoamines.

No birth defects were found in a number of rat and rabbit teratology studies, although fetotoxic and maternal toxic effects have been observed. No reproductive effects were observed in two 3-generation rat studies (EPA 1984b).

EPA has reviewed and validated two other studies (a 2-year rat feeding study and a 2-year dog feeding study). Although these studies do not meet the current FIFRA registration guidelines, they do provide information on the chronic effects of dicamba. Likewise, although none of these studies was conducted as a cancer study (nor would they meet today's strict guidelines for cancer studies), the pathologic analysis and other results showed no oncogenic effects. A recent 2-year rat study, accepted by EPA, showed no oncogenic or systemic effects at the highest dose tested (2,500 ppm) (Taylor 1986).

Although EPA now has valid data to determine that dicamba is not a carcinogen, the guidelines require negative data on three species. Data to complete the guidelines package has been requested by EPA.

In a 1962 2-year rat feeding study (5, 50, 100, 250, 500 ppm), no systemic or oncogenic effects were seen at the highest dose tested (500 ppm) (EPA 1984b). In a 1962 2-year dog feeding study (0.5, 25, and 50 ppm), the only effect seen was decreased body weight (EPA 1984b). Both of these studies were conducted by Kettering Laboratories.

Dicamba has been tested for mutagenicity and for its effect on unscheduled DNA synthesis. EPA has no validated mutagenic studies for dicamba and has requested additional information on dicamba's mutagenic potential. The following studies are cited in USDA FS, 1984, and have not been reviewed by EPA. The results were negative for *Salmonella typhimurium* (Poole and others 1977; Eisenbeis and others 1981; and Anderson and others 1972), *Escherichia coli* (Poole and others 1972), and *Saccharomyces cerevisiae* (Poole and others 1977). Unscheduled DNA synthesis was assayed in human fibroblast line W1-38 and was negative for dicamba (Poole and others 1977). Dicamba was positive in relative toxicity assays in E. coli (Poole and others 1977). Dicamba has been negative in in-vitro test systems, except those measuring relative toxicity. On the basis of these results, dicamba is not considered to be mutagenic.

The lowest NOEL found in the literature is from a 90-day rat study. The systemic NOEL is given as 500 ppm (25 mg/kg/day) based on slight liver cell alterations at the 800-ppm dose. EPA (1983) has set a provisional allowable daily intake (PADI) of 0.0125 mg/kg/day and a maximum permissible intake (MPI) of 0.7500 mg/day based on the subchronic rat study NOEL of 25 mg/kg (500 ppm) and a 2,000-fold safety factor, and a maximum permissible intake (MPI) of 0.7500 mg/day.

Common Name: 2,4-D

Chemical Name: 2,4-dichlorophenoxyacetic acid

Proposed Formulation: Esteron 99, DMA-4

Major Applications in Noxious Weed Control: 2,4-D is used as a selective annual, biennial and perennial broadleaf weedkiller in grass pastures, rangelands, and noncropland areas.

Environmental Fate

Plants readily absorb, translocate, and metabolize 2,4-D. The formulation influences the degree of absorption. Once absorbed, 2,4-D may be chemically altered by a variety of mechanisms. Residues at phytotoxic levels are believed not to persist in dead vegetation.

2,4-D is considered a relatively nonpersistent herbicide. The 2,4-D acid is degraded mainly by microorganisms. Esters and amines of 2,4-D hydrolyze to acid form within a few days after deposition in the soil. In warm, moist soils with a high organic content, 2,4-D can degrade within days, but in cold, dry soil conditions 2,4-D can persist for many months. Leaching of 2,4-D is more extensive in soils with less organic matter and a lower pH. Leaching and adsorption are inversely related. 2,4-D generally remains within the top foot of the soil profile (Ashton 1982; Ghassemi and others 1981; Mullison 1981).

In water, esters of 2,4-D are also rapidly hydrolyzed to the acid form. The persistence of the acid depends on the presence of microorganisms adapted to 2,4-D degradation. In cool, nutrient-poor, natural surface waters, 2,4-D may remain stable for many months. Photodecomposition has been shown in the laboratory, but the degree of 2,4-D degradation in the field with natural sunlight is unknown. Volatilization is usually not a major mechanism for removal of 2,4-D from water (Ghassemi and others 1981).

Toxicity to Nontarget Organisms

2,4-D is phytotoxic to many nontarget plants, including some crops and ornamentals. The toxicity of 2,4-D to fish varies highly, depending on the species, water quality, and 2,4-D formulation. Most ester formulations are rated as toxic to highly toxic to aquatic invertebrates and fish, while salt and acid formulations are generally only slightly toxic to those organisms. In general, 2,4-D has a low toxicity to birds with LD_{50}'s ranging from 300 to 5,000 mg/kg. The toxicity of 2,4-D to honey bees is low. In mammals, 2,4-D is moderately toxic with acute oral LD_{50}'s in the range of 300 to 1,000 mg/kg. Chronic effects are described in the next section. 2,4-D does not tend to bioaccumulate in fish or in mammals (USDA, FS 1984).

Detailed information, summarized above, concerning the fate and behavior of 2,4-D in the environment and potential impacts may be found in the following source documents: Ghassemi and others 1981; USDA, FS 1984; and DOE, BPA 1983. In accordance with 40 CFR 1502.21, these documents are incorporated into this DSEIS by reference.

Toxicity in Animals and Humans

After a review of the existing toxicology data base supporting 2,4-D registrations, EPA (1982) concluded that the scientifically valid toxicology studies on 2,4-D did not indicate that the continued use of 2,4-D posed a significant health hazard when used in accordance with label directions and precautions. EPA did conclude, however, that more information on 2,4-D's toxicological properties was necessary. EPA has requested data on the following areas of potential health concern: acute toxicity, tumor formation, reproduction, birth defects, neurotoxicity, and metabolism (EPA 1982). With the exception of reproductive effects, these additional studies have been completed and are undergoing review by EPA.

There was particular concern that 2,4-D could be contaminated with 2,3,7,8 tetrachlorodibenzo-p-dioxin (TCDD), as was 2,4,5-T. This dioxin has been linked with potential fetotoxic and carcinogenic effects. While as of 1982, 2,3,7,8 TCDD had not been found in any sample of 2,4-D (EPA 1982), EPA has since then noted the possibility of the contaminant being found in some formulations of 2,4-D manufactured sometime ago. Since 2,3,7,8 TCDD is no longer manufactured, the likelihood of finding it in formulations of 2,4-D today is highly remote (EPA 1987a).

Acute Oral Toxicity. 2,4-D has been tested in several different animal species, including mice, rats, guinea pigs, rabbits, swine, sheep, cattle, and monkeys, for acute toxicity. The acute oral LD_{50} in these animals ranged from 300 to 1,000 mg/kg body weight. Female rats given dietary 2,4-D at a concentration of 100 mg/kg for 113 days showed no adverse effects. An additional group of rats given 1,000 ppm in the diet for the same period had depressed weight gain, increased liver weight, and increased mortality (Rowe and Hymas 1954). It is therefore classified as moderately toxic (Gehring and Betso 1978).

Dermal Toxicity. Skin absorption of 2,4-D is limited. The acute dermal LD_{50} of 2,4-D in the rabbit is greater than 10,000 mg/kg. Feldman and Maibach (1974) found that approximately 5 to 6 percent of the 2,4-D dermally applied to humans was recovered in the urine. When dermal contact continues, nausea, vomiting, muscular weakness, and diarrhea have been reported, indicating absorption (Poland and others 1971). Acute eye irritation can result from occupational exposures (WHO 1984).

Neurotoxicity. Four groups of male and female Fischer CDF 344 rats (15 rats/group) were used in a study to determine whether repeated dermal exposure to 2,4-dimethylamine on the peripheral nervous system of rats would result in pharmacological or toxicological effects. The skin of the animals in the three treatment groups was painted with a 12 percent 2,4-D amine solution for 2 hours per day, 5 days per week, for 3 weeks. Control animals were treated with tap water.

Dermal exposure to 2,4-D resulted in two systemic effects: (1) treated rats weighed less than control rats, and (2) the kidneys of treated rats weighed more than those of the control rats. Even though the rats had clear systemic effects of exposure to 2,4-D, there were no treatment-related changes in the function or structure of the nervous system (EPA 1986d).

Peripheral neuropathy also has been reported to result from dermal exposure to 2,4-D. In one study, Goldstein and others (1959) reported three cases in agricultural workers following dermal exposure to 2,4-D. The neuropathy was characterized by progressive numbness, aching of the extremities, muscular fasciculations, denervation of muscles, and decreased conduction velocity in the ulnar nerve. The condition may be partially or totally reversible, depending on the dose level and the individual exposed (Goldstein and Brown, 1960; Todd 1962; Berkley and Magee 1963; Wallis and others 1970). In one patient, only partial recovery was reported, even after 3 years of treatment (Goldstein and others 1959). His estimated exposure was 60 cc of a 10-percent ester solution, approximately 60 mg/kg.

Reproductive and Developmental Toxicity.

Schwetz and others (1971) examined the effects of 2,4-D and two esters of 2,4-D on fetal development and neonatal growth and survival in rats. Dose levels up to the maximum tolerated dose of 87.5 mg/kg/day were administered to the laboratory animals on days 6 through 15 of gestation. The fetuses then were delivered by cesarean section on day 20 of gestation and examined for anomalies. The anomalies observed include decreased fetal body weight, subcutaneous edema, delayed ossification of bone, lumbar ribs, and wavy ribs. Since none of these anomalies interferes with fetal or neonatal development and survival, they were classified in this study as neither embryotoxic nor fetotoxic. There were no treatment- related teratogenic responses observed. From this study, a reproductive NOEL of 25 mg/kg/day was established.

EPA has recently reviewed a teratology study on rats that used an acid form of 2,4-D (EPA 1985a). Based on fetotoxicity and delayed ossification, a NOEL of 25 mg/kg/day was established; the lowest effect level was found to be 75 mg/kg/day.

A recent multigeneration rat study was conducted at dose levels of 0, 5, 20 and 80 mg/kg/day. During gestation and lactation of the original parents, the female high dose group was actually receiving about 120 mg/kg/day.

Adverse effects on the original parents in this high dose group and their offspring were excessive, and the 80 mg/kg/day dosage level was terminated (Mullison 1986). According to EPA, the results found no effects a 5 mg/kg/day. At the next higher dose tested (20 mg/kg/day), however, maternal body weights and pup weights decreased (EPA 1986d).

Chronic Toxicity. Based on a 2-year feeding study with dogs (described fully under the section on oncogenicity that follows), a systemic NOEL of 500 ppm (12.5 mg/kg/day) was determined (Hansen and others 1971). Results from the first year of a chronic feeding study on rats have been reviewed by EPA (1985a). Based on renal effects, a NOEL of 1 mg/kg/day was established; the lowest effect level was 5 mg/kg/day. Based on this study and utilizing a hundredfold safety factor, EPA has established a provisional ADI of 0.01 mg/kg/day.

Oncogenicity. Several chronic studies have been reported in the literature using various esters of 2,4-D. Innes and others (1969) reported that the maximum tolerated dose of butyl, isopropyl, or isooctyl esters of 2,4-D was fed to two strains of mice for up to 78 weeks with no significant increase in the tumor incidences observed at a 95-percent confidence level. A study was reported by Hansen and others (1971) in which, over a period of more than 2 years, rats were fed 2,4-D at 0, 5, 25, 125, 625, and 1,250 ppm, and dogs were fed 2,4-D at 0, 10, 50, 100, and 500 ppm. In the dogs, no increased tumor incidence was observed, and no other lesions were attributed to 2,4-D. The rats showed a high incidence of tumors (30 percent) in both the treated and untreated (control) groups. The male rats had a significantly higher incidence of malignant tumors in the high-dose group (1,250 ppm), and the female rats showed a trend toward increased tumor formation with the logarithm of dose. However, Hansen and others (1971) concluded that, since the tumors were not target organ types but were randomly distributed types normally found in aging Osborne-Mendel rats and survival rates were not affected, the data "support the pathological interpretation that a carcinogenic effect of 2,4-D has not been shown."

A later review of this study by the National Cancer Institute (as cited in USDA, FS 1984) agreed that a carcinogenic effect was not demonstrated for 2,4-D. However, one expert, Dr. M. Reuber, has reexamined the data and challenged the conclusion that no carcinogenic effect was demonstrated (Reuber 1979). Because some uncertainty exists regarding 2,4-D carcinogenicity, an upper limit value for cancer potency has been calculated based on the tumor data from the Hansen study in Appendix N.

According to the World Health Organization (WHO) (1984), "the carcinogenic potential of 2,4-D and its derivatives such as the amine salts and esters has not been adequately tested. The reports on animal bioassays carried out so far are either too brief for proper evaluation or have been the subject of scientific controversy."

EPA has recently reviewed a long-term study on the oncogenic potential of 2,4-D (Adalbert Kostner, Histological Evaluation of Brain Sections obtained from F. 344 rats exposed to various doses of 2,4-D in a 2-year chronic oral toxicity study, 1986). Preliminary findings indicate an increased incidence of brain tumors in rats. But EPA's review of the recent cancer study is not yet complete. EPA has requested an independent expert to review the brain tissue slides from this study. EPA may also request a review of this study by the Scientific Advisory Panel. Thus, a thorough review of this study may take months to complete. Therefore, EPA does not believe it is now appropriate to derive a specific numerical estimate of cancer potency based on the new data, but has stated, that from its preliminary review the level of cancer potency indicated by the reported results would be of about the same order of magnitude as the potency value based on the Hansen study which has been used in previous risk analyses (EPA 1986c).

At 106 weeks, a preliminary pathology report from a recent mouse study found that 2,4-D was not oncogenic at dosages of 1, 15, and 45 mg/kg/day. (Hazelton Laboratories 1986.)

2,4-D Mutagenicity. Several studies have been performed to examine the mutagenic potential of 2,4-D. These studies, reviewed by Newton and Dost (1981) have shown negative, weakly positive, and positive results, depending upon the test systems used and the purity of the test substances. Eight strains of histidine-requiring mutants of bacteria (*Salmonella typhimurium*) exposed to 2,4-D failed to show point mutations (Anderson and others 1972). Styles (1973) failed to show increases in mutations with serum from rats treated with 2,4-D in a host-mediated assay with histidine-requiring S. *typhimurium* mutants. The sex-linked lethality assay of 2,4-D using *Drosophila* was negative (Vogel and Chandler 1974), weakly positive (Magnusson and others 1977), and positive (Rasmussen and Svahlin 1978) in three different studies. According to WHO (1984), "studies available at present are not adequate for the quantitative evaluation of the mutagenic effects of 2,4-D and evidence does not suggest that 2,4-D derivatives are potent mutagens." Newton and Dost (1981), in their review, concluded that 2,4-D may be a weak mutagen "but is without significance as an environmental mutagenic hazard."

Epidemiology. Several epidemiological investigations have been conducted to examine the link between human phenoxyacid herbicide exposure and cancer. In the mid and late 1970s, Hardell and colleagues (Hardell and Sandstrom 1979; Eriksson and others 1981; Hardell and others 1981) conducted a series of case-control studies in rural Sweden. These studies found a significant increase of five- to sixfold in the relative risk of soft-tissue carcomas, Hodgkin's disease, and non-Hodgkin's lymphoma among farmers using various herbicides. However, because of selection bias, observation bias, and uncontrolled confounding variables, many have questioned the validity of the results of these studies (Colton 1986). In addition, a case-control study conducted in New Zealand by Smith and others (1984) was negative for soft-tissue carcomas showing an estimated relative risk of 1.3.

Recently, Hoar and others (1986) completed a case control study in Kansas examining the risk of lymphoma and soft-tissue sarcoma in men from agricultural herbicide exposure. The study found no association between exposure and soft-tissue sarcoma or Hodgkin's disease, but observed a significant association for non-Hodgkin's lymphoma and phenoxyacetic acid herbicide exposure, especially 2,4-dichlorophenoxyacetic acid exposure. In addition, individuals exposed to herbicides for more than 20 days per year had a sixfold increase in non-Hodgkin's lymphoma.

This study, however, suffers from the same inherent limitations as other case-control studies, mainly that it relies on the subject's and the next of kin's recall of exposure status. If recall is faulty, then misclassification occurs. Assessing exposure-disease relationships in these types of epidemiological studies is especially difficult (Thomas 1986). For example, common exposures to other carcinogenic agents or other factors may result in disease but be undiscovered in the interview and confound the results. Thus, uncontrolled confounding factors in observational epidemiological studies can be particularly troublesome in interpreting the results. The apparent dose-response relationship observed in the Hoar and others (1986) study for non-Hodgkin's lymphoma (NHL) is of public health concern and needs further examination. Now under way are at least two more studies that should be helpful in assessing risk to humans from the use of 2,4-D and other phenoxy herbicides (Colton 1986).

A recent review of the Hoar and others (1986) study conducted by Brian MacMahon, M.D., Ph.D. of the Harvard School of Public Health for EPA concluded:

"In my opinion the weight of evidence does not support the conclusion that there is an association between exposure to 2,4-D and NHL. It is axiomatic that, except when relative risks are very high - and sometimes even then - no single study will establish an association between an exposure and an outcome. The acceptance of an association depends on a number of studies showing consistent results across populations and across different epidemiologic methods. The study of Hoar et al (1986) is a strong study - stong enough on its own to establish a hypothesis of relationship of exposure to 2,4-D with some small proportion of cases of NHL - a hypothesis that clearly deserves attempts at refutation or support in other populations. When one attempts to place the results of this study among the results of those published previously, the picture becomes very confusing - much more so than if Hoar et al. had been the only study published. Taken as a whole, I believe that the weight of evidence indicates that an association between 2,4-D and NHL remains a hypothesis that is still to be tested. I am unwilling to speculate as to whether 2,4-D causes NHL (or some cases of NHL) until the evidence is clear that there is an association between them."

Esteron 99 contains petroleum distillates as inert ingredients. The toxicity of the petroleum distillates can be estimated from the toxicity of petroleum oil.

Petroleum oil is a complex variable mixture of hydrocarbons with a boiling point range of from 350° to 700° F and an aromatic content ranging up to 35 percent (DOE 1983). Petroleum fuel is usually a straight-run distillation product that boils below 650° F, contains few polycyclic aromatics, and has not been shown to be carcinogenic. A 2-year oncogenic skin-painting study (terminated after 62 weeks), during which Swiss Epley mice were exposed to 0.05 mL (41 mg) of petroleum fuel products, resulted in skin carcinomas in 2 of 50 animals. These results were not statistically significant by chi-square analysis. The study was prematurely terminated because of the presence of extensive skin lesions in test animals (American Petroleum Institute 1983). Higher boiling point (greater than 700° F) petroleum products subjected to more refinement processes, such as cracking or hydrogenation, and that contain polycyclic aromatics may be carcinogenic to experimental animals (Bingham and others 1979).

Beck and others (1982) conducted a short-term exposure study examining the acute toxicity of 19 petroleum hydrocarbons in acute oral, acute dermal, subacute dermal, and eye irritation studies. On the basis of an acute oral LD_{50} of 9.0 µ/l/kg (7,380 mg/kg), diesel oil can be classified as a very slightly toxic compound. The LD_{50} is about 20 times greater than that of 2,4-D. The most marked acute toxic effect observed after the administration of petroleum oil to test animals occurred during primary dermal irritation studies. A single petroleum oil exposure to rabbits resulted in a rating of "extremely irritating" based on a score of 6.82 (on a scale of 1 to 10). Irritation may have been caused by chemical additives used to make petroleum oil burn more efficiently in internal combustion engines. Petroleum oil was nonirritating in primary eye irritation studies. A subacute 3-week dermal study of eight rabbits resulted in an average weight loss of 0.38 kg at a dose level of 4.0 µ/l/kg (3,280 mg/kg) and an average weight loss of 0.55 kg with a 67-percent mortality rate at a dose level of 8.0 µ/l/kg (6,560 mg/kg).

An inhalation teratology study in which rats were exposed to 101.8 ppm or 401.5 ppm (5.09 or 20.075 µ/l/kg) of petroleum fuel on days 6 through 15 of gestation resulted in no significant teratogenic effects (Mecler and Beliles 1979 as cited in American Petroleum Institute 1983). Petroleum fuel was nonmutagenic when tested in the Ames assay and the mouse lymphoma assay, but it was found to be clastogenic (causing chromosomal breaks) in rat bone marrow cells (Conaway and others 1982). Because petroleum oil contains polycyclic aromatic hydrocarbons and other constituents that are known or suspected mutagens, this risk assessment considered it a mutagen as a worst-case assumption.

Petroleum oil has not been shown to be carcinogenic, but it is a complex mixture that typically contains small amounts of substances known or suspected of being carcinogenic. For the purposes of this risk assessment, petroleum oil is assumed to be carcinogenic because of its benzene content and its content of polycyclic aromatic hydrocarbons, typified by the potent carcinogen benzo(a)pyrene. But these carcinogens occur in such small amounts that they do not contribute significantly to the potency calculated for 2,4-D. Consequently, cancer risk was not calculated separately for petroleum oil but only for the total mixture with 2,4-D.

The oncogenic potential of petroleum fuels is directly related to refinery processing methods used to obtain the petroleum product and the crude oil composition from which the fuel was derived. An evaluation of the composition of petroleum fuels has revealed a positive correlation between polycyclic aromatic hydrocarbon (PAH) content and carcinogenicity in human epidemiology studies or experimental laboratory studies (Bingham and others 1979).

Substances known or suspected of being carcinogenic and contained in petroleum oil in small amounts include benzo(a)pyrene and benzene. Benzo(a)pyrene (BaP), a potent carcinogen, is a PAH that also occurs at low levels in foods and in products of combustion, including cigarette smoke. Bioassays have found that the concentration of this single carcinogen can often serve as a guide in predicting carcinogenic potency, although other substances are also known to be involved (Bingham and others 1979).

There is sufficient evidence for the carcinogenicity of BaP in experimental animals: BaP has produced tumors in all of the nine species for which data have been reported following various methods of administration (DHHS 1985). It has both a local and systemic carcinogenic effect. EPA (1986e) has estimated the carcinogenic potency of BaP as 11.5 per mg/kg/day.

For benzene, another aromatic known to be present in petroleum fuels, sufficient evidence exists for its carcinogenicity in experimental animals and in humans (DHHS 1985). Benzene has been shown to cause leukemia in workers with chronic exposure. The carcinogenic potency of benzene, however, is much less than that of BaP. EPA (1986f) has estimated the carcinogenic potency of benzene as 0.0445 per mg/kg/day. But benzene can occur at greater concentrations (about 29 ppm in No. 2 fuel oil) than BaP occurs in petroleum oil. Consequently, the carcinogenic potencies of petroleum oil have been estimated for this FSEIS on the basis of the potencies of both benzene and BaP.

The cancer potency of the petroleum distillates in Esteron 99 was estimated from the potencies of both benzene and benzo(a)pyrene. Samples of petroleum oil and fuel oil have been found to have a BaP content of only 26 ppb, but No. 2 heating oil (which may be subjected to cracking rather than straight-run distillation) can contain 600 ppb (Bingham and others 1979). The midpoint of this concentration range--313 ppb--has been used to calculate the carcinogenic potency of the petroleum distillates although most petroleum fuels can be expected to have fewer BaP contents. The content of benzene was assumed to be 28.5 ppm on the basis of an analysis of water extracts of No. 2 fuel oil by Anderson (1975), with corrections for solubility relationships. The resulting estimate of carcinogenic potency of the petroleum distilltes is 4.9×10^{-6} $(mg/kg/day)^{-1}$. Seventy-four percent of this potency is due to the BaP component. Because this potency is about one thousandth of that of 2,4-D, it would not add significantly to the potency of the 2,4-D mixture.

2,4-D Contaminants

In the case of 2,4-D, special attention must be paid to two contaminants, one of which is also a metabolic product in microorganisms.

In the manufacture of 2,4-D, 2-4-dichlorophenol (2,4-DCP) is an intermediate, a minute fraction of which may remain in the final product. It is also an environmental metabolite of 2,4-D. Because of its relatively low toxicity (the LD_{50} is approximately 1,300 mg/kg), 2,4-DCP has not been judged sufficiently toxic to be eliminated from 2,4-D formulations.

The effects of 2,4-DCP on human health have not been well studied. Boutwell and Bosch (1959) examined the carcinogenicity of 2,4-DCP and found it to be a weak tumor promoter. It was also found to inhibit oxidative phosphorylation in rat liver and brain mitochondria (Mitsuda and others 1963).

Somani and Khalique (1982) found that after intravenous administration of 2,4-DCP in rats, the chemical was rapidly metabolized to glucuronide and other conjugates and was eliminated from the body. They showed that half-lives in the kidney and liver are longer than in other tissues, indicating that the liver is a major organ for metabolism, and that the higher levels in the kidneys correlate with that being the route of elimination.

Seyler and others (1984) performed some preliminary reproductive screening procedures and found that 2,4-DCP did not depress sperm penetration of ova and sperm motility in vitro when compared with controls. A 2,4-DCP teratology study recently reviewed by EPA found a NOEL of 350 mg/kg/day; the lowest effect level was found to be 750 mg/kg/day with the effect being delayed ossification (EPA 1985d).

In conclusion, 2,4-DCP appears to be less toxic than the parent herbicide 2,4-D. 2,4-DCP is the immediate microbial breakdown product of 2,4-D, and is in turn further oxidized by the same organisms. The rate function for each of the steps in this long series of oxidations is higher than the preceding step. Breakdown thus becomes easier with each step. The products are mostly not liberated but remain captive in the microorganims.

2,4-DCP is so volatile that if it were to escape it would immediately dissipate. It also has an exceedingly low olfactory threshold; extremely small amounts are detectable by smell. The result of these factors is that only applicators or others working directly with the material before it is applied have any significant opportunity for contact.

The eight manufacturers of 2,4-D in the United States have subjected their products to analysis for 2,4-DCP. Total chlorophenols, of which 2,4-DCP is predominant, were about 0.3 percent in the most contaminated sample. Therefore, at worst, such immediate contact is something less than 0.3 percent of the corresponding exposure to 2,4-D. Many contained no detectable chlorophenols. Other chlorophenols include 2,6-DCP and the 2-chloro- and 4-

chlorophenols, all of which are minor contributors (Warren 1983).

Environmental exposures will not correspond to the amount of 2,4-D applied, either as a fixed fraction of impurity or as a fraction of applied and degraded 2,4-D. As an impurity, 2,4-DCP has a high vapor pressure, so it evaporates and disappears quickly. As a metabolite of soil organisms, 2,4-D is almost entirely entrained in those organisms, although at high levels of 2,4-D in water some DCP can be found. Environmental exposure to 2,4-DCP is so low that it cannot be measured.

The other impurity is 2,7-dichloro dibenzo-p-dioxin (DCDD), which differs only slightly in structure from the well-known 2,3,7,8 TCDD, but differs significantly in toxicity. Two concerns of DCCD's toxicity have been expressed: DCDD is alleged to be a teratogen and to be carcinogenic.

DCDD has been found in 3 of 30 samples of U.S.-produced 2,4-D, along with traces of other relatively nontoxic chlorodioxins with three and four chlorines. Most chlorodioxins have not been well studied. The concentrations in the three positive samples ranged from 25 to 60 ppb. If the maximum expected human dose of 2,4-D is 0.1 mg/kg, and for convenience all 2,4-D is assumed to contain 100 ppb of DCDD, the dose of DCDD to the exposed human would be 0.00000001 mg/kg.

The toxicologic studies from which these concerns arise are reported by Khera and Ruddick (1973), who discussed fetotoxic effects of DCDD, and the National Cancer Institute (1979), which conducted carcinogenesis studies in two species. Khera and Ruddick fed DCDD at dosages of 1 and 2 mg/kg daily to determine whether DCDD could cause birth defects. The observed effect at 1 mg/kg was a modest degeneration of heart muscle fibers and some fluid accumulation around the heart in a few of the animals. A somewhat greater number of animals were affected at 2 mg/kg. Both effects are in the category of general fetal toxicity. No teratogenic effect was found.

The National Cancer Institute (1979) work was carried out by feeding DCDD as 0.5 and 1 percent of the total diet for 2 years. The data indicated a "suggested" carcinogenic effect in male mice that was not strong enough to support a conclusion that DCDD is a carcinogen. Male mice and rats of both sexes did not significantly respond.

Comparing the extremely low amounts of 2,4-DCP and 2,7 DCDD that have been detected in 2,4-D, with the amounts showing an effect from exposure to either contaminant, the conclusion, follows that neither 2,4-DCP nor 2,7-DCDD, at maximum occupational or environmental exposures to 2,4-D, represents a human hazard.

2-4,D may have other less toxic dioxin contaminents. Although these other contaminents have not been well studied, current scientific thinking as explained by EPA's Chlorinated Dioxins Working Group does not find that these other dioxins are of the same degree of toxicological concern as 2,3,7,8 TCDD.

EPA (1987c) reported on the potencies of dioxins (mono, di, and tri CDD's), some of which may be present as contaminants in 2,4-D, relative to 2,3,7,8-TCDD. The LD_{50} of guinea pigs for mono through tri CDDs is 10,000 times less than that of 2,3,7,8-TCDD. Receptor binding of mono through tri CDDs is 100 to 1,000 times less than that of 2,3,7,8-TCDD (Knutson and Poland 1980, as cited in EPA 1987c). The enzyme induction in animal cells of mono, di, and tri CDDs is 1,000 times less than that of 2,3,7,8-TCDD (Bradlaw and others 1985b, as cited in EPA 1987c). The immuno toxicity (in vitro) of the mono through tri CDDs is 5,000 times less than that of 2,3,7,8-TCDD (Greenlee and others 1985b as cited in EPA 1987c).

Common Name: Picloram

Chemical Name: 4-amino 3,5,6-trichloropicolinic acid

Major Trade Names: Tordon 22K, and Tordon 2K

Major Applications In Noxious Weed Control:
Picloram is used for the control of broadleaf weeds on rangeland and permanent grass pastures.

Environmental Fate
Most information on the fate of picloram in soil and water is the result of laboratory and field studies with agricultural systems.

Picloram is rapidly absorbed by plant roots and less rapidly by foliage. Once absorbed, it is readily translocated throughout the plant and tends to accumulate in new growth. It is highly stable and remains largely intact within the plant.

Picloram is considered moderately to highly persistent in soils under conditions of normal application. Reported half-lives vary from 1 month to over 13 months. Persistence is generally shorter in soils with high organic matter and adequate moisture such as in forest soils and in warm temperatures. Picloram degrades in soil via microbial rather than chemical routes, but amounts of picloram decomposed are small. Picloram photodecomposes on soil surfaces to the greatest extent under intense sunlight (USDA, FS 1984).

Picloram is considered a mobile herbicide and is reversibly adsorbed on soil particles. Adsorption is greatest in soils high in organic matter and increases with decreasing pH, particularly in clay soils. Leaching occurs to the greatest extent in sandy, light-textured soils and in soils poor in organic matter. Because of the water solubility of picloram and its salts and its leaching tendencies, runoff from treated areas can contain relatively high concentrations of picloram (USDA, FS 1984).

Toxicity to Nontarget Organisms
Picloram is phytotoxic to many nontarget plants and is highly toxic to young pine seedlings. Several incidents of damage to nontarget plants from picloram spray drift have been reported. Certain plant species have been injured as long as 5 years after application because of picloram's persistence.

Honey bees showed no-observable effect and no increase in mortality when sprayed with or fed picloram at 1,000 ppm in a 60-percent sucrose syrup. Most aquatic arthropods exposed for 24 hours to picloram had LC_{50}'s ranging from 50 to 120 ppm. *Daphnia* sp., the water flea, showed no-observable effect at 380 ppm during a 24-hour exposure period. Picloram is considered to be relatively nontoxic to soil microorganisms. Fungi appear to be able to tolerate concentrations of picloram as high as 1,000 ppm. At moderate concentrations (up to 10 ppm), some species exhibited stimulated growth rates. Picloram is relatively nontoxic to birds. Single dose tests with male mallard ducks and pheasants resulted in LD_{50}'s of greater than 2,000 mg/kg. No studies have been conducted on warm-blooded wildlife to date. Studies on mammals show low toxicity in a number of species. The acute oral LD_{50} in the rat is 8,200 mg/kg. In the mouse, rabbit, and guinea pig, the acute oral LD_{50} is 2,000-4,000; 2,000; and 3,000 mg/kg, respectively. Sheep showed no ill effects when given one dose of picloram up to 650 mg/kg, and cattle showed no ill effects on one oral treatment of up to 448 mg/kg picloram (USDA, FS 1984).

Studies have found picloram to appear to be moderately toxic to cold water fish (trout) and slightly toxic to warm water fish (catfish, bluegill) (EPA 1985b). But, chronic studies on lake trout suggest that low concentrations of picloram will adversely affect the rate of yolk sac absorption and growth of fry.

The following source documents present detailed information on the fate and behavior of picloram in the environment and potential impacts: Ghassemi and others 1981; USDA, FS 1984; and DOE, BPA 1983. In accordance with 40 CFR 1502.21, these documents are incorporated into this DSEIS by reference.

Toxicity

On the basis of the acute oral LD_{50} of greater than 3,000 in rats, mice, and guinea pigs (EPA, 1984a), picloram can be classified as slightly toxic. Human sensitization studies have shown that the combination of 2,4-D and picloram is capable of producing sensitizing reactions.

The lowest reproductive NOEL reported for picloram is 1,000 ppm (50 mg/kg/day in rats, with reduced fertility at the lowest effect level of 3,000 ppm (150 mg/kg/day) (EPA 1984a). Teratogenic effect was absent in rats at doses up to 1,000 mg/kg/day given through the period of organ formation. The doses were high enough that several maternal deaths occurred at the upper levels. Even at such intake, no fetal wastage or postnatal effects occurred among survivors. Skeletal development was slowed at the highest dose (USDA, FS 1984).

A 6-month dog feeding study, during which test animals were exposed to picloram at the dietary levels of 0, 7, 35, and 175 mg/kg/day, resulted in a chronic NOEL of 7 mg/kg/day. Increased liver weights were reported at 35 mg/kg/day (EPA 1985b).

Two chronic feeding studies performed by Industrial Bio-Test Laboratories have been invalidated by EPA (1984a). EPA has asked for additional data on chronic rodent and nonrodent studies.

EPA has established a provisional allowable daily intake (PADI) of 0.007 mg/kg/day based on the 6-month dog study using a safety factor of 1,000.

Experts disagree on the interpretation of studies on the potential of picloram to cause cancer. The early studies were not designed as carcinogenicity assays but were lifetime general toxicity evaluations in which observation of tumor formation was incidental. More recently, the National Cancer Institute (1978) carried out a study in rats and mice in which the animal work was contracted to a private laboratory, but the project was jointly designed and assessed. Rats were maintained at average dietary concentrations of about 0.75 percent and 1.5 percent (7,437 ppm and 14,875 ppm) picloram in the diet for 80 weeks. The rats were then observed for 33 weeks and killed. Mice were given a diet containing about 0.25 percent and 0.5 percent (2,531 ppm and 5,062 ppm) for 80 weeks and observed for 10 weeks. (These doses are about 500 and 1,000 mg/kg/day in the respective species.) Lifespan is somewhat over 2 years for both species.

The observations of these studies showed a nonsignificant increase in thyroid tumors in rats but not in mice and a significant increase in benign liver tumors in female rats.

EPA has determined that some studies on long-term effects performed by IBT were invalid due to improper laboratory practices. In addition, an NCI oncogenicity study on rats and mice fed picloram was negative for oncogenic effects except in the female rats treated at 743 mg/kg/day. The effects observed were increased incidences of liver neoplastic nodules. However, the study has drawn criticism because it was conducted in the same room as other tested chemicals which have been shown capable of producing the same lesions. A new replacement study in rats is close to completion. Other chronic and subchronic studies do not exhibit oncogenic effects.

The data does not support a contention of carcinogencity, but an open and valid scientific question exists about the meaning of the nodules or benign tumors of the liver. Therefore, a worst-case assumption is made that picloram is carcinogenic and a cancer risk assessment is provided in Appendix N.

Studies have shown that hexachlorobenzene (HCB), a contaminant of picloram, is a carcinogen in several rodent species. Based on this information, EPA conducted a risk assessment and has estimated the dietary cancer risk to the public of HCB in the fat and milk of cattle fed picloram-treated grass to be 4.6×10^{-8} to a 70-kg adult and 1.4×10^{-7} to a 10-kg child. These risk estimates are based on 200 ppm of HCB in currently registered technical picloram. EPA has concluded that this risk is acceptable. EPA will impose a maximum limitation of 200 ppm of HCB in technical picloram and is requiring the registrant to submit a revised confidential statement of formula to reflect this required limit (EPA 1985b).

Nitrosamine may be a potential contaminant of the various amines used to produce the amine salts of picloram. This chemical is regulated under that rule which requires testing to show that a level of 1 ppm of nitrosamine contamination is not exceeded [45 FR 42854].

Picloram was mutagenic to *strep. coelicolor* sp. test strain but not to four strains of *S. typhimurium*. Other studies were determined to be insensitive tests not capable of determining mutagenicity in the test system (EPA 1984b). No evidence leads to the conclusion that picloram presents a mutagenic risk to humans. EPA has requested more picloram mutagenicity studies. The worst-case assumption is that picloram is a mutagen.

Common Name: Glyphosate

Chemical Name: N-(phosphonomethyl) glycine

Major Trade Names: Rodeo

Major applications in Noxious Weed Control: Glyphosate is used to control many annual, biennial, and perennial broadleaf weeds and grasses in noncropland areas.

Environmental Fate

Because glyphosate is a relatively new pesticide, its environmental fate and potential ecological effects of its use have not yet been extensively studied. The small amount of existing data was obtained almost entirely from greenhouse and laboratory studies with agricultural systems and laboratory animals, studies largely generated by the manufacturer. This data shows glyphosate's high effectiveness, short persistence in soil and water, and low toxicity to animals.

Glyphosate is absorbed almost exclusively via plant foliage and is translocated throughout the plant. Less than 1 percent of the glyphosate in the soil is absorbed via the roots. Glyphosate is apparently not metabolized to a significant degree in plants, and its mode of action is believed to involve inhibition of aromatic amino acid syntheses (USDA, FS 1984).

That glyphosate is rapidly and strongly adsorbed to soil particles accounts for its observed lack of mobility, its lack of leaching tendency in soil, and its unavailability for root uptake. Adsorption to soil is believed to be through the phosphonic acid component. The phosphate level in the soil influences the amount of glyphosate adsorbed, and glyphosate adsorption is greater in soils with high concentrations of trivalent metals such as aluminum and iron, rather than high concentrations of sodium and calcium (Dost 1983).

Glyphosate dissipates fairly rapidly in soil (half-life of about 2 months). This dissipation mainly results from microbial degradation. The main soil metabolite of glyphosate is aminomethylphosphonic acid (AMPA), which itself is also highly biodegradable. Glyphosate is subject to biodegradation in natural waters and has an estimated half-life of 7 to 10 weeks (USDA, FS 1984).

Toxicity to Nontarget Organisms

Glyphosate generally has low toxicity to mammals, having LD_{50}'s ranging from 2,836 mg/kg in rabbits to 4,750 mg/kg in rats. Bioassays on several aquatic invertebrates and fishes have found 96-hr LC_{50} values ranging from 2.3 mg/1 to fathead minnows to 43 mg/1 to mature scuds. The surfactant in Roundup is highly toxic to fish and is not proposed for use by BLM. Animal feeding studies with glyphosate have found low toxicity to rat, mallard duck, and quail and little or no potential for bioaccumulation. Teratogenicity was not detected in test dosages (USDA, FS 1984).

The following source documents present detailed information on the fate and behavior of glyphosate in the environment and potential impacts: Ghassemi and others 1981; USDA, FS 1984; DOE, BPA 1983. In accordance with 40 CFR 1502.21, these documents are incorporated by reference into this SEIS. The following information was obtained from these reviews and from the publicly available data from EPA.

Toxicity to Animals and Humans

Known Toxic Effects in Humans. EPA's Pesticide Incident Monitoring System, which is a voluntary reporting system, contains 91 reports of incidents in which humans were exposed to glyphosate. Of those, 49 reports involved humans who had a history of exposure and 39 reports documented some kind of diagnosis being made by a physician or through a poison control center. The primary and most frequent diagnosis is contact dermatitis and conjunctivitis. No fatal cases of human poisoning have been reported (WSSA, 1983).

Acute Toxicity. Acute oral and dermal toxicity data place technical glyphosate in Toxicity Category III. Primary eye and skin irritation data show that technical glyphosate is not a primary skin irritant (Toxicity Category IV), and is only minimally irritating to the eye (Toxicity Category III). Acute inhalation or dermal sensitization studies have not been submitted but are required EPA 1986b). Rodeo has an LD_{50} of greater than 5,000 mg/kg (no rats died at that level) but is nonirritating in skin and eye tests (Monsanto 1983).

Reproductive Toxicity. Teratology studies of glyphosate conducted with rats and rabbits also have been reviewed by EPA. These studies were negative for teratogenic effects. In these studies, teratogenic effects were not observed at the highest dose tested (3,500 mg/kg/day) in the rat or at the highest dose tested (350 mg/kg/day) in the rabbit. Maternal effects such as inactivity, stomach hemorrhage, reduced body weight gain, and death were observed in the rat at the highest dose tested. In the rabbit, soft stools, diarrhea, nasal discharge, and death were observed at the highest dose tested. The maternal NOEL for the rat was 1,000 mg/kg/day. The maternal NOEL for the rabbit was 175 mg/kg/day. In addition, mutagenicity studies on glyphosate have been reviewed and determined to be negative (EPA 1984c).

Chronic Toxicity. Existing chronic feeding/oncogenicity data includes chronic feeding/oncogenicity studies in mice and rats and a 1-year chronic feeding study in dogs. See also a discussion of these studies under the oncogenicity section. A 2-year rat feeding study using technical glyphosate has replaced invalidated chronic feeding studies conducted by IBT. This replacement study has been reviewed by EPA, which reports no oncogenicity at the highest dose tested and a systemic NOEL greater than 31 mg/kg/day (EPA 1984c). Based on these study results, EPA has established a systemic NOEL of 30 mg/kg/day.

A 2-year chronic/cancer mouse feeding study (see discussion next section) noted effects on the liver and kidneys in the females at 30,000 ppm. The NOEL for non-neoplastic chronic effects was 5,000 ppm (750 mg/kg/day) (EPA 1986b).

A 1-year chronic feeding study in dogs tested doses of 0, 20, 100, and 500 mg/kg/day, administered by capsule. The only effect of treatment was an apparent decrease in the absolute and relative weights of pituitaries from mid- and high-dose dogs. More data has been requested to better assess this apparent effect. The tentative NOEL is 20 mg/kg/day pending submission of requested data(EPA 1986b). This NOEL was not used in the risk assessment because of unanswered questions regarding this study.

A replacement three-generation reproductive study of glyphosate in rats has been reviewed by EPA. The NOEL established from these replacement data is 10 mg/kg/day (EPA 1984c). EPA has established an acceptable daily intake (ADI) of 0.1 mg/kg/day. The ADI is based on the NOEL of 10 mg/kg/day in the three-generation reproduction study and utilizes a hundredfold safety factor. The ADI provides a yardstick for determining safe levels of chronic exposure.

Mutagenicity. Glyphosate was nonmutagenic in microbial assays and mammalian cell assay systems both in vitro and in vivo (EPA, 1984c). There is no evidence to indicate that it is mutagenic or presents any mutagenic risk to humans.

The chronic feeding/oncogenicity study in mice tested dosages of 1,000, 5,000, and 30,000 ppm. Glyphosate produced an equivocal oncogenic response in the mouse, causing a slight increase in the incidence of renal tabular adenomas (benign kidney tumors) in males at the highest dose tested of 30,000 ppm. The EPA toxicology Branch Ad Hoc Oncogenicity Committee tentatively classified glyphosate as a "Class C" oncogen. The studies were reexamined by a consulting pathologist, and data was submitted showing that another kidney tumor had been found in control males. (No renal tumors were found in controls in the original examination.)

EPA then requested that more kidney sections from the mouse study be prepared and examined. The resultant microslides were examined by several pathologists, who found no more tumors but confirmed the presence of the tumors found in the original study. The apparent lesion in the control kidney was not present in any of the additional sections. After examination of the slides, EPA (1986b) concluded that this lesion did not "represent a pathophysiologically significant change."

The apparent oncogenic response, however, was a marginal response at best. The doses tested were high–3 percent of the diet–and the target tissue had no corresponding increase in the incidence of preneoplastic changes, such as hyperplasia or dysplasia. Moreover, because glyphosate was found to be negative in acceptable mutagenicity studies, the compound is not known to be genotoxic (EPA 1986b).

Because of the equivocal nature of the findings, the Toxicology Ad Hoc Oncogenicity Committee asked the expert assistance of the FIFRA Science Advisory Panel (SAP) in determining the proper Weight-of-the-Evidence classification for the study. After reviewing all the existing evidence, the SAP proposed that glyphosate be classified as "Class D", or having "inadequate animal evidence of oncogenicity." The main reason for the SAP's assessment was their determination that, after adjusting for the greater survival in the high-dose mice compared to concurrent controls, no statistically significant difference existed. The SAP further noted that, although comparison of these findings to historical control incidences yielded a statistically significant result, this finding did not override the lack of significance of comparisons to concurrent controls. The SAP determined that the oncogenic potential of glyphosate could not be determined from existing data and proposed that the study be repeated to clarify these equivocal findings (EPA 1986b).

After considering the expert opinion of the SAP and reconsidering all relevant data for this compound, in particular the statistical assessment provided by the SAP, EPA agreed that not enough data exists to adequately address the question of whether the apparent effects noted in the mouse study are biologicaly relevant. Therefore, to fully address this question, the EPA is requiring that this study be repeated with more animals in each test group to increase the statistical power of the study (EPA 1986b).

Other non-neoplastic changes noted in high dose male mice included centrilobular hypertrophy and necrosis of hepatocytes, chronic interstitial nephritis, and proximal tubule epithelial cell basophilia and hypertrophy in females. The NOEL for non-neoplastic chronic effects was mid-dose level, 5,000 ppm. This study is acceptable as a chronic feeding study (EPA 1986b).

The lifetime feeding study in rats tested dietary concentrations of glyphosate of 0, 30, 100, and 300 ppm. These concentrations were adjusted during the study to maintain actual doses of 0, 3, 10, and 31 mg/kg/day in males and 0, 3, 11, and 34 mg/kg/day in female rats. Thus, the doses tested in the rat chronic study were about 1/100 of those tested in the mouse study. Although no effect of treatment on the incidence of non-neoplastic lesions was noted, a marginal apparent increase in the incidence of interstitial cell tumors of the testes was observed in the rats.

Historical controls were used in the weight-of-the-evidence analysis to show the range of variability in the background spontaneous incidence of any lesion. Historical controls were also used to supplement the data provided by a concurrent control group. Because of the absence of a dose-dependent effect, the lack of preneoplastic changes, the wide variability in the spontaneous incidence of this tumor, the similarity in incidences between the high dose group and the historical controls, and lack of any evidence of genotoxicity, the analysis concluded that the observed incidence did not show an oncogenic response.

An independent review of the data raised a question of possible thyroid carcinoma in high-dose females. After a review of the slides by a consulting pathologist and a reassessment of all relevant data, including the fact that no effect of treatment on tumor latency or the combined incidences of adenoma and carcinoma was apparent, EPA (1986b) concluded that the data did not show a carcinogenic response in the thyroid.

In view of the large difference in doses between the rat and mouse studies, the Toxicology Branch Oncogenicity Review Committee speculated that "a toxic, or MTD (Maximally Tolerated Dose), was not reached in [the rat] study," and that at doses "close to an MTD, tumors might have been induced." The rat study was re-reviewed for evidence that the highest dose tested was an MTD. Because no effect of treatment was noted on survival, body weight gain, clinical pathology, or findings of necropsy, no evidence exists that the highest dose tested is an MTD. A repeat rat study is required in which the highest dose tested is an MTD. This study is acceptable as a chronic feeding study, since an MTD is not required to satisfy EPA guidelines for chronic toxicity studies. Because an MTD was apparently not reached in this study, it does not fulfill the EPA Guidelines for a rat oncogenicity study (EPA 1986b).

The State of California's Department of Food and Agriculture has undertaken an ongoing review of studies submitted to it for registration of glyphosate. Some of those studies were also submitted to EPA for the federal registeration process. The State's preliminary findings as they relate to EPA's review summarily are as follows:

Chronic rat, onco rat, and repro rat studies had a data gap, were inadequate studies with no adverse effect indicated; chronic dog, terato rat, terato rabbit, gene mutation and chromosome studies had not data gap with no adverse effect indicated; onco mouse study had no data gap with possible adverse effect indicated; and DNA damage study had a data gap, was an inadequate study with possible adverse effect indicated. The neurotox study was not required (CDFA 1986).

For the purposes of this risk analysis, a worst-case assumption is made that glyphosate is a carcinogen, and a risk assessment was conducted. Glyphosate's cancer potency is discussed in Appendix N.

Wildlife Health Effects

It has been suggested that BLM consider the impacts of its proposed chemical weed control program on the health of fish and wildlife because of the dose levels for animals portrayed in the worst-case analysis (Appendix N). The dose levels depicted are a direct result of feeding studies. Duplication of these conditions in the field would require applying herbicides in extremely large amounts, which would far exceed label recommendations.

A risk analysis on fish and wildlife exposure to herbicides is presented in the Final Environmental Impact Statement on the Eradication of Cannabis on Federal Lands in the Continental United States. A similiar analysis has been made for the herbicides used in this control program. A summary of this analysis follows.

A review of BLM monitoring data concluded that concentration levels as high as those for the routine case scenario in the referenced analysis are unlikely. BLM monitoring data for picloram (Chapter 2, Water Resource FEIS) shows that less than 35 percent of the samples taken contained a detectable level of residue, and that the maximum concentration was 0.18 micrograms/liter (0.00018 ppm). Thus, acute and chronic toxic effects would occur only from extreme case accidental spill exposures in localized areas.

In the extremely unlikely event that small animal or aquatic species should receive a lethal dose from the weed control program, individual fatalities would result. Such fatalities, however, would have no significant impact on the overall population of the species.

A risk assessment was conducted to determine the potential wildlife impacts of the use of herbicides to control noxious weeds. A general description of the assessment is given here; details of the wildlife exposure analysis are given at the end of this section. Table K-1 shows the representative wildlife species and parameters considered.

Wildlife risk from noxious weed control with herbicides is a function of the inherent toxicity (hazard) of each of the herbicides to different animals and of the amount of each chemical (exposure) that wildlife may take in during a control operation.

The toxicity of herbicides to wildlife varies among individuals of the same species (intraspecific), between different species (interspecific), and, often most markedly, between different classes of animals. Thus, a chemical may be more toxic to birds than to mammals, or more toxic to fish than to birds. Toxicity testing, however, has been conducted on relatively few wildlife species, particularly for dicamba and glyphosate. Most laboratory testing has been conducted on rats and mice to estimate human toxicity. Thus, to determine the potential impacts of estimated doses on wildlife, one must compare those estimates with laboratory results on the few species that have been tested. The following sections present a review of the toxic hazard to wildlife of each of the herbicides proposed for use.

Wildlife Hazard Analysis

The toxicity of the four herbicides to mammalian laboratory species was discussed in the human health section of this risk analysis.

2,4-D

2,4-D is recognized as being moderately toxic to vertebrates (USDA, FS 1984). Much data exists on the toxicity of various formulations of 2,4-D to vertebrates, and the toxicity of differing forms of 2,4-D (amines, butyl esters, isooctyl esters, and propylene glycol butyl ether) appears to differ significantly. In many instances, toxic response to 2,4-D formulations appears to be species specific. In birds, acute oral LD_{50}'s range from 472 mg/kg in young pheasants to greater than 2,025 mg/kg in mallards.

Table K-1. Representative Wildlife and Domestic Species and Associated Biological Parameters

Representative Niche	Representative Species	Body Weight (Grams)	Daily Food Intake (Grams)	Percent of Food Contaminated in Routine Case	Body Surface Area (cm 2)	Body Surface Contacting Vegetation (Percent)	Percent of Body Groomed	Inhalation Volume (L/min)
Insectivorous Birds	Flicker	75	15	42	178	57	49	0.038
Granivorous Birds	Dove	100	11	40	216	51	45	0.048
Ominvorous Birds	Jay	70	14	43	170	58	50	0.037
Piscivorous Birds	Kingfisher	250	50	33	398	36	35	0.098
Carnivorous Birds	Owl	100	20	40	216	51	45	0.048
Small Omnivorous Mammals	Mouse	20	6	55	74	93	72	0.017
Medium Herbivorous Mammals	0.480	Rabbit	1,350	130	24	1,224	19	21
Large Herbivorous Mammals	Deer	68,000	2,500	11	16,722	4	7	11.100
Carnivorous Mammals	Fox	5,670	475	18	3,189	11	14	1.520
Insectivorous Amphibians	Toad	22	5	54	79	90	0	0.007
Carnivorous Reptiles	Snake	40	22	48	117	72	0	.00334
Domestic Animals	Cattle	453,590	12,000	7	59,292	2	4	50.6
	Chicken	2,000	300	22	1,591	1	19	.484
	Dog	13,000	NA	NA	5,715	8	11	3.06

NA = Not applicable or not available

Animals do not bioaccumulate 2,4-D to any great extent. The 2,4-D that is absorbed is usually eliminated rapidly in unmetabolized form. Reviews of animal metabolism and bioaccumulation of 2,4-D and its formulations include Mullison (1981), Loos (1975), Hayes (1982), Lommen (1980), and the State of Minnesota (1978).

Little monitoring data exists on 2,4-D levels in wildlife. But studies by Erne(1974, 1975) that samples 2,4-D levels in liver and kidney tissue of 250 animals taken by hunters or found dead in Sweden from 1968 to 1972 showed residues ranging from 0.05 to 6 mg/kg. Newton and Norris (1968, cited in USDA, FS 1984) sampled blacktail deer from sites that had been treated with 2,4,5-T and atrazine but did not detect residues in most tissues.

Picloram

A review of the toxicological properties of picloram indicates this herbicide is slightly toxic to be of low toxicity to most organisms (USDA, FS 1984). The acute oral LD_{50} for birds ranges from greater than 2,000 mg/kg in male mallards and pheasants (Tucker and Crabtree 1970) to 6,000 mg/kg in chickens (Lynn 1965).

No field studies have been conducted to determine the effects of picloram on wildlife. Five-day feeding studies reported LC_{50}'s of greater than 5,000 ppm in gamebirds (Tucker and Crabtree, 1970; Heath and others 1972). A 2-week dietary study on Japanese quail showed reduced egg fertility and hatchability at 1,000 ppm, but no effects were seen at 100 ppm (Kenaga, 1969). A three generation study with Japanese quail at 100, 500, and 1,000 ppm showed no effects on food consumption, egg production, hatchability and fertility, survival, and body weight (Kenaga, 1969). Chicken eggs exposed to application rates comparable to 9.98 lb/acre for 3 days were not adversely affected, and adult chickens from the sprayed eggs revealed no reproductive effects (Somers and others 1978a, 1978b).

Honeybees showed no observable effects and no increase in mortality when sprayed with or fed picloram at 1,000 ppm in a 60 percent sucrose syrup (Morton and others 1972). Likewise, caged honeybees sprayed with 4 lb active ingredient/acre showed no increased mortality rates after 14 days (Moffett and others 1972)

Glyphosate
Although relatively little data exists on the toxicity of glyphosate to wildlife species, glyphosate is considered to be slightly toxic to mammals in the environment (USDA, FS 1984). Acute oral LD_{50}'s in birds range above 4,640 mg/kg for mallards and quail. No monitoring data exist, however, on levels of glyphosate in wildlife or other environmental components.

Residue and metabolism studies have shown that glyphosate is only slowly absorbed across the gastrointestinal membranes and that tested vertebrates retained only minimal amounts in their tissues and rapidly eliminated residues (Monsanto 1982).

Dicamba
A review of laboratory studies of dicamba on mammals and birds suggests that dicamba is slightly toxic to wildlife (USDA, FS 1984). The avian acute oral LD_{50} ranges from 673 mg/kg in female pheasants to 2,000 mg/kg in mallards (USDA, FS 1984). Dicamba is moderately toxic to amphibians (LD_{50} = 106 mg/kg, tadpoles).

No field studies have been conducted to determine the effects of dicamba on wildlife, but existing laboratory studies (EPA 1983) characterize dicamba as slightly toxic to birds. Eight-day feeding studies of dicamba in bobwhite quail and mallards showed no effects at 10,000 ppm, the highest dose tested (Ghassemi and others 1981). Chicken eggs injected with 400 ppm dicamba showed decreased hatching rates, while no effects were observed at 300 ppm (Dunachie and Fletcher 1970). No teratogenic effects were apparent at either dose.

Studies of the effects of dicamba on honeybees show varying results, but generally a low toxicity (USDA, FS 1984). Oral LD_{50}'s range from 3.6 ug/bee (Pimentel 1971) to more than 100 ug/bee (Ghassemi and others 1981). Because an application rate of 1 lb/acre would result in 1.25 ug/bee (Ghassemi and others 1981), these LD_{50}'s far exceed what would normally be experienced in the field.

Dicamba does not bioaccumulate appreciably in animals and is rapidly excreted in the urine as a metabolite or in its original form (USDA, FS 1984).

Aquatic Hazard Analysis

2,4-D
The aquatic toxicity of the butoxyethanol ester of 2,4-D ranges from highly toxic to moderately toxic (USDA, FS 1984). (Classifications for relative toxicity are based on Clarke and others (1970), where 96-hr LC_{50} values are described as follows: < 1 ppm, dangerous or highly toxic, 1-10 ppm, harmful or toxic, and > 10 ppm, slightly toxic. In this analysis the classification of "harmful or toxic" will be referred to as moderately toxic.) Acute LC_{50} values range from about 0.5 ppm to 10 ppm for most species (Table K-2). Amphipods (*Gammarus*) and snails (*lymnea*) are among the most sensitive groups. The acids, to which esters hydrolyze, are not nearly as toxic. Esters are typically 100 times more toxic than their corresponding acids (Ghassemi and others 1981).

Field studies show that 2,4-D does not bioconcentrate or persist in fish (Halter 1980). Several studies with bluegill have reported bioconcentration factors of less than 1 (Sigman 1979b; Sikka and others 1977, both in USDA, FS 1984). Rodgers and Stalling (1972, in Ghassemi and others 1981) reported 2,4-D bioconcentration factors of 7 to 55 for fish. Concentrations, however, peaked within 1 to 8 hours after exposure, and residues were rapidly eliminated.

The esters of 2,4-D rapidly hydrolyze to the acid. In cool, nutrient-poor natural surface waters 2,4-D may remain stable for many months. Volatilization loss from water is of low potential (Ghassemi and others 1981).

Dicamba
Dicamba is only slightly toxic to most aquatic organisms (USDA, FS 1984). Dicamba salts and the free acid are considered toxicologically equivalent because the salt hydrolyzes to the free acid in an aqueous environment (EPA 1983). Short-term LC_{50} values are greater than 10 ppm for fish, amphibia, and most invertebrates (Table K-3). The amphipod *Gammarus lacustris* with a 96-hr LC_{50} of 3.9 ppm, has shown a greater sensitivity to dicamba than any other aquatic animal tested (Sanders 1969, in Pimentel 1977, as cited in USDA, FS 1984). A 48-hr EC_{50} of 11 ppm was determined for *Daphnia pulex* (Sanders and Cope 1966, in Hulbert 1975, as cited in USDA, FS 1984). *Daphnia magna*, with a 48-hr EC_{50} of greater than 100 ppm (Johnson and Finley 1980) does not appear to be as sensitive as *D. pulex*. No long-term aquatic toxicity studies have been reported.

Studies with a model aquatic ecosystem have shown no evidence of bioconcentration of dicamba or its metabolites. After application at 1 lb/acre, 0.02 ppm was detected in fish (Sanborn 1974; Yu and others 1975, both as cited in USDA, FS 1984).

Field studies have shown rapid dissipation of dicamba residues in a stream flowing from a watershed treated at 1 lb/acre (USDA, FS 1984). Maximum residues of 37 ppb accrued at 5.2 hours and decreased to less than 1 ppb (background level) within 37.5 hours after spraying (Norris and Montgomery 1975). Slower dissipation was observed in a pond treated at 4 lb/acre (Scifres and others 1973, as cited in USDA, FS 1984). Maximum dicamba concentrations of 11 ppb were completely dissipated within about 40 days.

Glyphosate
The Rodeo formulation (53.5 percent isopropylamine salt of the active ingredient N-phosphonomethyl glycine) of

Table K-2. Toxicity of 2,4-D Butoxyethanol Ester to Aquatic Organisms

Organism	Concentration (ppm)	Effect	Source
Bluegill	1.2	96-hr LC_{50}	Johnson and Finley 1980
Rainbow Trout			
Fingerlings	1.42 to 1.55	96-hr LC_{50}	Halter 1980
Yearlings	9.0	96-hr LC50	Dodson and Mayfield 1979[a]
Fathead Minnow	3.3	96-hr LC_{50}	Johnson and Finley 1980
	5.6	96-hr LC_{50}	Halter 1980
Black Bullhead	7.1 to 7.7	96-hr LC_{50}	Halter 1980
Cladocerans			
Daphnia pulex	3.0	8 days, no effects	Sigmon 1979[a]
D. magna	5.6	48-hr LC_{50}	Sanders 1970
D. magna (1st instar)	6.4	96-hr LC_{50}	Johnson and Finley 1980
Amphipods			
Gammarus lacustris	0.44	96-hr LC_{50}	Sanders 1969[a]
Gammarus fasciatus	5.9	96-hr LC_{50}	Sanders 1970
	6.1	96-hr LC_{50}	Johnson and Finley 1980
Stonefly (*Pteronarcys californica*)			
Adult	> 1000	96-hr LC_{50}	FWPCA 1968[a]
Nymphs	1.6	96-hr LC_{50}	Sanders and Cope 1968[a]
Isopod (sowbug) *Asellus brevicaudis*			
	2.6	96-hr LC_{50}	Johnson and Finley 1980
	3.2	48-hr LC_{50}	Sanders 1970
Copepod *Nitocra spinipes*	3.1	96-hr LC_{50}	Linden and others 1979[a]
Crayfish *Orconectes nais*	> 100	48-hr LC_{50}	Sanders 1970
Seed Shrimp *Cypridopsis vidua*	2.2	48-hr EC_{50}	Johnson and Finley 1980
	1.8	48-hr LC_{50}	Sanders 1970
Glass Shrimp *Palaemonetes kadiakensis*	1.4	48-hr LC_{50}	Sanders 1970
Shrimp	1.0	48-hrs, no effect	Ghassemi and others 1981
Eastern Oyster *Crassostrea virginica*	3.75	96-hr EC_{50}, decrease in shell growth	Butler 1965, in USDA, FS 1984
Snail *Lymnea sp.*	0.32	6 wks LC_{42}	Halter 1980
Phytoplankton	1.0	4 hrs 16% decline in carbon fixation	Butler 1965[a]
Phytoplankton *Euglena gracilis*	100.0	7 days, growth inhibited	USDOI, 1982[a]
Planktonic algae	4.0	14 days–in 10% of cultures, some inhibition of growth response	Butler 1965[a]
Lake plankton	0.36	no effect	USDOI, 1982[a]

[a]as cited in DEA 1986

Table K-3. Toxicity of Dicamba (88% technical) to Aquatic Organisms

Organism	Concentration 96-hour LC 50 (ppm)	Source
Rainbow Trout (fingerlings 0.8g)	28 135	Johnson and Finley 1980 Velsicol Chem. Corp. in Ghassemi and others 1981
Cutthroat trout	> 50	Woodward 1982, in USDA, FS 1984
Coho Salmon (juveniles)	120a	Lorz and others 1979, in USDA, FS 1984
Bluegill (fingerlings 0.9g)	> 50 135	Johnson and Finley 1980 Velsicol Chem. Corp., in Ghassemi and others 1981
Amphipod Gammarus fasciatus	> 100	Johnson and Finley 1980
Isopod Asellus brevicaudus	> 100	Johnson and Finley 1980
Glass Shrimp Palaemonetes kadiakensis	> 56	Johnson and Finley 1980
Cladoceran Daphnia sp.	11 b	Sanders and Cape 1966, in Hurlbert 1975, in USDA, FS 1984
Daphnia magna (1st instar)	> 100 b	Mayer and Ellersieck 1986
Frog, tadpole (1-2 wks old) Adelotus brevis	185	Johnson 1976, in USDA, FS 1984
Frog, tadpole (1-2 wks old) Limnodynastes peroni	106	Johnson 1976, in USDA, FS 1984

a 48-hr LC 50
b 48-hr EC 50

Table K-4. Acute Toxicity of Glyphosate to Aquatic Organisms

Organism	Concentration (ppm)	Effect	Source
Rodeo:			
Trout	> 1,000	96-hr LC_{50}	Monsanto 1983
Bluegill	> 1,000	96-hr LC_{50}	Monsanto 1983
Carp	> 10,000	96-hr LC_{50}	Monsanto 1983
Daphnia magna	930	48-hr LC_{50}	Monsanto 1983
Glyphosate[b]:			
Rainbow Trout	140 (120-170)	96-hr LC_{50}	Folmar and others 1977[a]
	38	96-hr LC_{50}	USDA 1981[c]
Bluegill	140 (110-160)	96-hr LC_{50} (static test)	Folmar and others 1977[a]
	24	96-hr LC_{50} (flow-through test)	USDA 1981[c]
Carp	115	96-hr LC_{50}	USDA 1981[c]
Fathead Minnow	97 (79-120)	96-hr LC_{50}	Folmar and others 1977[a]
Channel Catfish	130 (110-160)	96-hr LC_{50}	Folmar and others 1977[a]
Daphnia sp	780	40-hr LC_{50}	Monsanto 1982[c]
Chironomus plumosus	55	48-hr EC_{50}	Folmar and others 1979[c]

[a]In Ghassemi and others 1981
[b]Technical glyphosate (95% or more of active ingredient) is assumed to be the formulation used.
[c]In USDA, FS 1984

glyphosate is practically nontoxic to aquatic organisms (Monsanto 1983b). The 96-hr LC_{50}'s for fish are all greater than 1,000 ppm, and the 48-hr LC_{50} for *Daphnia magna* is 930 ppm (Table K-4) (Monsanto 1983b). No long-term aquatic toxicity studies have been reported.

Glyphosate has a very low octanol/water partition coefficient (0.0006 - 0.0017) showing that it has little tendency to bioconcentrate in aquatic organisms. Sacher (1978, in USDA, FS 1984) has reported bioconcentration factors of less than 1 for channel catfish, rainbow trout, and largemouth bass. USDA (1981, in USDA, FS 1984) reported a bioconcentration factor of 1.6 in a study with bluegill.

Glyphosate has an estimated half-life of 7 to 10 weeks in natural waters (USDA, FS 1984).

Picloram
Picloram and Tordon 22K (24.4 percent picloram-potassium salt) are generally only slightly toxic to aquatic organisms (USDA, FS 1984). For Tordon 22K, the bluegill was the most sensitive species tested; LC_{50} = 5.4 to 8.2 ppm for 24 to 96 hours (in Kenaga, 1969). All other reported LC_{50}'s for Picloram and Tordon 22K are greater than 10 ppm (Table K-5). LC50's have not been reported for aquatic invertebrates for Tordon 22K. Tordon 2K, which is only 2.3 percent picloram-potassium salt, is expected to be less toxic than Tordon 22K. Chronic or partial life cycle studies have not been reported for Tordon 22K.

Aquatic insects and crustaceans have 24-hr LC_{50}'s of 50 to 120 ppm for picloram. *Daphnia* showed no effect during a 24-hour exposure to 380 ppm (USDA, FS 1984). For lake trout and cutthroat trout, technical grade picloram (90 percent a.i.) is more toxic than the other formulations with 96-hr LC_{50}'s of 4.25 and 5.0 ppm, respectively.

Some aquatic invertebrates (*Gammarus fasciatus* and *Pteronarcys californica*) have also shown a high sensitivity to technical grade picloram (see Table K-5). Woodward (1979, in Ghassemi and others 1981) reported increased fry mortality in cutthroat trout at concentrations of technical grade picloram greater than 1,300 ug/l and reduced fry growth above 610 µg/l (flow-through tests). No adverse effects to fry occurred at below 290 ug/l. Similar findings have been reported by Scott and others (1977, in Mullison 1985). EPA (1985b) has also reported chronic studies on lake trout, where low concentrations of picloram adversely affected the rate of yolk sac absorption and growth of fry. Johnson and Finley (1980) have reported a chronic NOEL for lake trout fry of less than 35 ug/l.

No adverse effects on growth were reported for algae, *Daphnia*, goldfish, and guppies exposed to 1 ppm picloram for 10 weeks. Guppies exhibited no adverse effects at this same concentration after 6 months of exposure (Lynn 1965, as cited in Ghassemi and others 1981).

Picloram did not bioconcentrate in bluegill or channel catfish in studies by Bidlack (1981a; 1980b as cited in Mullison 1985). Mosquito fish (*Gambusia sp.*) had concentrations of 1.12 ppb picloram after 567 days of exposure to a concentration in water of 5 ppb (Youngson and Meikle 1972, as cited in Mullison 1985).

Picloram apparently does not degrade quickly in aquatic environments. Concentrations of 1 ppm were detected in farm ponds next to plots treated at 1 lb/acre. Residues declined to less than 10 ppb within 100 days (Haas and others 1971, in National Research Council of Canada 1974, as cited in USDA, FS 1984). The microbial degradation rate of picloram in soils is low and is expected to be low in aquatic environments (Youngson and others 1967, as cited in USDA, FS 1984).

2,4-D and Picloram Mixture
No synergistic effects have been reported for aquatic organisms exposed to mixtures of 2,4-D and picloram. The toxicity of the mixture can be described by the toxic effects of each of its components (see the discussions on 2,4-D and picloram).

Wildlife Exposure Analysis

An analysis of the herbicides' risk to wildlife compared estimated acute exposures for representative wildlife species with existing hazard information on closely related species. Because the herbicides examined in this SEIS show no tendency to bioaccumulate, long-term persistence in food chains and later toxic effects, such as those that result from the use of persistent organochlorides, were not considered a problem and were not examined in the risk analysis.

Doses were estimated for a selected group of species that normally inhabit areas supporting noxious weed growth and that, because of their relatively high populations and broad habitat requirements, are most likely to be exposed. The species were as follows:

Birds		
	Flicker	Kingfisher
	Mourning Dove	Screech Owl
	Jay	
Mammals		
	Mouse	Deer
	Rabbit	Fox
Amphibian		Reptile
	Toad	Snake
Domestic Animals		
	Cow	Dog
	Chicken	

Herbicide doses for these representative species were calculated using a series of highly conservative, simplifying assumptions concerning routine spraying operations giving routine dose estimates and highly unlikely (extreme) dose estimates in which most animals are directly sprayed with herbicide.

For routine doses, dermal exposures were based on the levels likely to be found on vegetation leaf surfaces because the animals are assumed to seek cover during a

Table K-5. Toxicity of Picloram to Aquatic Organisms

Organism	Exposure Time	Effects	Source
Tordon 22K:			
Rainbow Trout	96 hours	LC_{50} 58 ppm; No mortality, 22 ppm	In Kenaga 1969
	10 days	LC_{50} 22.2 ppm (flow through test)	Fogels and Sprague 1977
Brook Trout	96 hours	LC_{50} 91 ppm; No mortality, 69 ppm	In Kenaga 1969
Brown Trout	96 hours	LC_{50} 52 ppm; No mortality, 22 ppm	In Kenaga 1969
Coho Salmon	24 hours	LC_{50} 17.5 ppm	Spehar and others 1981
Bluegill	96 hours	LC_{50} 5.4 ppm	In Kenaga 1969
Green Sunfish	96 hours	LC_{50} 91 ppm; No mortality, 39 ppm	In Kenaga 1969
Fathead Minnow	96 hours	LC_{50} 29 ppm; No mortality, 22 ppm	In Kenaga 1969
Black Bullhead	96 hours	LC_{50} 91 ppm; No mortality, 69 ppm	In Kenaga 1969
Emerald Shiner	96 hours	LC_{50} 30 ppm	In Kenaga 1969
Picloram:			
Rainbow Trout	24 to 96 hours	LC_{50} 24 - 34 ppm a.e.*	U.S. DOI, 1965, in Kenaga 1969
Coho Salmon	96 hours	LC_{50} 21 - 29 ppm a.e.*	Bond and others 1967, in Kenaga 1969
Bluegill	96 hours	LC_{50} 21 - 26.5 ppm a.e.*	Bond and others 1967, in Kenaga 1969
Largemouth Bass	24 to 48 hours	LC_{50} 13.1 - 19.7 ppm a.e.*	USDOI 1964, in Kenaga 1969
Goldfish	24 to 96 hours	LC_{50} 14 - 36 ppm a.e.*	USDOI 1964, in Kenaga 1969
Mosquito Fish	24 to 96 hours	LC_{50} 120 - 133 ppm	Johnson 1978 a
Stonefly nymphs, *Pteronarcys californica*	24 hours	LC_{50} 120 ppm	Sanders and Cope 1968 a
Amphipod *Gammarus lacustris*	24 hours	LC_{50} 50ppm	Sanders 1969 a
	48 hours	LC_{50} 48 ppm	USDOI 1968, in Pimentel 1971 a
Cladoceran *Daphnia sp.*	24 hours	95 percent mortality at	Lynn 1965 a 530 ppm concentration NOEL at 380 ppm
	10 weeks	NOEL at 1 ppm (No observed effect on growth and reproduction)	Hardy 1966 a
Brown Shrimp	48 hours	NOEL at 1 ppm	USDOI 1966 a

Table K-5. Toxicity of Picloram to Aquatic Organisms (continued)

Organism	Exposure Time	Effects	Source
Eastern Oyster	48 hours	NOEL at 1 ppm (no observed effect on shell growth)	Butler 1965 a
Technical Grade (90% a.i.):			
Rainbow Trout	96 hours	LC_{50} 12.5 ppm	Johnson and Finley 1980
Lake Trout	96 hours chronic	LC_{50} 4.25 ppm Decreased rate of yolk sac adsorption and growth in fry at < 0.035 ppm	Woodward 1976 a Johnson and Finley 1980
Cutthroat Trout	96 hours	LC_{50} 5.0 ppm	Woodward 1976 a
	22 days	Increased fry mortality at > 1.3 ppm; reduced growth of fry at > 0.610 ppm; and no adverse effects at < 0.29 ppm	Woodward 1979, in USDA, FS 1984 and in Ghassemi and others 1981
Channel Catfish	96 hours	LC_{50} 6.3-15.5 ppm	Johnson and Finley 1980
Bluegill	96 hours	LC_{50} 23.0 ppm	Johnson and Finley 1980
Amphipod *Gammarus fasciatus*	96 hours	LC_{50} 0.027 ppm	Johnson and Finley 1980
Stonefly *Pteronarcella badia*	96 hours	LC_{50} >10.0 ppm	Johnson and Finley 1980
Pteronarcys californica	96 hours	LC_{50} 0.048 ppm	Johnson and Finley 1980

a cited in USDA, FS 1984
*a.e. = acid equivalent

spraying operation. Specific penetration rates for each chemical were used to determine what portion of their dermal exposure actually penetrated their skin. In both routine and extreme exposures, mammals and birds are assumed to receive an additional indirect dermal dose from grooming their fur or preening their feathers. Ingestion doses were assumed to come from eating contaminated items as a specified percentage of their daily food intake. The percentage depends on their body size. Inhalation exposures were assumed to come from a hypothetical amount of herbicide droplets forming a cloud that moves slowly offsite. As shown in the exposure details at the end of this section, inhalation exposure constitutes a negligible fraction of any animal's total herbicide dose.

Extreme dose levels were estimated by assuming that animals do not seek cover and thus receive the full herbicide application rate on their entire body surface. In the extreme case, animals are also assumed to feed entirely on contaminated food items. Inhalation exposure was assumed to be the same as in the routine case.

The total systemic dose to each animal was calculated as the sum of the estimated doses received via dermal, ingestion, and inhalation routes. The details of the exposure calculations are given at the end of this section.

Wildlife Risk Analysis

This wildlife risk assessment uses the criteria that EPA (1986) used in its ecological risk assessment to judge the absolute risks to organisms and the relative risks among the noxious weed herbicides. The EPA criteria call for comparing an estimated environmental concentration (EEC) with a laboratory-determined LD_{50} or LC_{50} for the most closely related laboratory test species.

Table K-6. 2,4-D--Wildlife and Domestic Animal Doses (mg/kg) Compared With Lab Acute Toxicity

Species	Routine Dose Estimate	Extreme Dose Estimate	1/5 LD_{50}	LD_{50}	Laboratory Species
Flicker	51.10	153.0	94.4	472	Pheasant
Morning Dove	33.40	109.0	94.4	472	Pheasant
Jay	44.20	138.0	94.4	472	Pheasant
Kingfisher	9.96	31.8	94.4	472	Pheasant
Screech Owl	33.60	116.0	94.4	472	Pheasant
Mouse	118.00	329.0	76.0	380	Mouse
Rabbit	14.40	62.3	84.4	424	Rabbit
Deer	2.41	21.1	80.0	400	Deer
Fox	5.99	18.3	20.0	100	Dog
Toad	72.60	186.0	40.0	200	Toad
Snake	51.90	162.0	40.0	200	Toad
Cow	1.17	14.8	10.0	50	Cow
Chicken	18.90	87.3	76.0	380	Chicken
Dog	0.61	3.03	20.0	100	Dog

Where the EEC exceeds one-fifth the LD_{50} or LC_{50}, EPA deems it a significant risk that may be mitigated by restricting the use of the pesticide. EPA judges EECs that exceed the LD_{50} or LC_{50} as unacceptable risk levels. In this risk assessment, an organism's total estimated dose (rather than an EEC) is compared with the laboratory toxicity level because the dose comes from all exposure routes, not just feeding.

2,4-D Wildlife Risk

As shown in Table K-6, none of the estimated wildlife doses in either the routine or extreme exposure cases exceeds the laboratory species LD_{50}. Realistic doses of 2,4-D for the mouse, toad, and snake do exceed the EPA risk criterion of 1/5 the LD_{50}. All other species routine 2,4-D doses are well below the EPA risk level. Extreme case 2,4-D doses for the flicker, mourning dove, jay, screech owl, mouse, toad, snake, cow, and chicken all exceed 1/5 the LD_{50}. Most animals are not likely to experience severe toxic effects and thus are at low risk from the use of 2,4-D for noxious weed control. Some small mammals, amphibians, and reptiles may experience minor to moderate acute toxic effects from 2,4-D applications. These smaller animals are at greater risk because they feed more heavily on sprayed food items on site and because they have a higher dietary intake to body size ratio. Individual smaller animals may be killed or may be debilitated enough by their dose to be more susceptible to predation or death by exposure. Risk at the population level would depend on the size of the treated area.

Local populations of small mammals, small birds, amphibians, and reptiles may be harmed if a large area is treated, but the reproductive capacity of these species is generally high enough to replace the few lost individuals within the next breeding cycle. Populations of larger mammals and birds and any domestic animals present are not likely to be affected at all.

Picloram Wildlife Risk

Wildlife and domestic animal doses of picloram shown in Table K-7 are well below the EPA risk level of 1/5 the LD_{50} for both routine and extreme-case exposures. Although a few individual animals may experience minor toxic effects, most should not be adversely affected by the use of picloram. Data is insufficient data to determine whether amphibians or reptiles might be at greater risk than birds and mammals.

Glyphosate Wildlife Risk

Glyphosate wildlife and domestic animal doses, as shown in Table K-8, are well below the EPA 1/5 the LD_{50} risk level for both routine and extreme exposure cases. No birds or mammals are likely to die or experience more than slight acute toxic effects from glyphosate. Data is not sufficient to assess the risk of glyphosate effects in amphibians and reptiles.

Dicamba Wildlife Risk

Wildlife and domestic animal doses of dicamba are shown in table K-9. The routine dose estimate for the toad exceeds the LD_{50}. The routine dose of dicamba for the mouse nearly equals the EPA 1/5 the LD_{50} level. Realistic doses for the other wildlife species and for domestic animals are below the EPA level, although extreme dose estimates for the flicker, mourning dove, jay, screech owl, rabbit, and chicken do exceed 1/5 the LD_{50}. Larger animals are not likely to be affected by the use of dicamba in noxious weed control, but individual smaller animals seem likely to experience minor to moderate acute toxic effects from the use of dicamba. Some animals, particularly small mammals, amphibians, and reptiles, may die as a result of a dicamba application.

The effects of dicamba on populations of these animals would depend on the extent of the treated area. Local populations of smaller animals may experience some decline if a large area is treated, although the reproductive capacity of most of these animals is sufficient to replace lost individuals during the next breeding cycle. Populations of larger mammals and birds should not be affected by dicamba treatments.

Table K-7. Picloram--Wildlife and Domestic Animal Doses (mg/kg) Compared With Lab Acute Toxicity

Species	Routine Dose Estimate	Extreme Dose Estimate	1/5 LD_{50}	LD_{50}	Laboratory Species
Flicker	16.800	49.800	400	2000	Pheasant
Morning Dove	10.900	35.000	400	2000	Pheasant
Jay	14.500	44.600	400	2000	Pheasant
Kingfisher	3.120	9.580	400	2000	Pheasant
Screech Owl	10.900	37.000	400	2000	Pheasant
Mouse	38.800	108.000	400	2000	Mouse
Rabbit	4.610	19.900	400	2000	Rabbit
Deer	0.756	6.800	200	1000	Sheep
Fox	1.880	5.490	400	2000	Mouse
Toad	19.300	37.600	N/A		
Snake	11.000	22.600	N/A		
Cow	0.365	4.810	200	1000	Sheep
Chicken	6.210	28.500	400	2000	Pheasant
Dog	0.122	0.601	400	2000	Mouse

N/A : data not available

Table K-8. Glyphosate--Wildlife and Domestic Animal Doses (mg/kg) Compared With Lab Acute Toxicity

Species	Routine Dose Estimate	Extreme Dose Estimate	1/5 LD_{50}	LD_{50}	Laboratory Species
Flicker	51.10	153.00	928	4640	Quail
Morning Dove	33.40	109.00	928	4640	Quail
Jay	44.20	138.00	928	4640	Quail
Kingfisher	9.96	31.80	928	4640	Quail
Screech Owl	33.60	116.00	928	4640	Quail
Mouse	118.00	329.00	800	4000	Rat
Rabbit	14.40	62.30	760	3800	Rabbit
Deer	2.41	21.10	760	3800	Rabbit
Fox	5.99	18.30	760	3800	Rabbit
Toad	72.60	186.00	N/A		
Snake	51.90	162.00	N/A		
Cow	1.17	14.80	760	3800	Rabbit
Chicken	18.9	87.30	928	4640	Quail
Dog	0.61	3.03	760	3800	Rabbit

N/A : data not available

Table K-9. Dicamba--Wildlife and Domestic Animal Doses (mg/kg) Compared With Lab Acute Toxicity

Species	Routine Dose Estimate	Extreme Dose Estimate	1/5 LD_{50}	LD_{50}	Laboratory Species
Flicker	102.00	307.00	132.6	673	Pheasant
Morning Dove	66.70	218.00	132.6	673	Pheasant
Jay	88.40	275.00	132.6	673	Pheasant
Kingfisher	19.90	63.50	132.6	673	Pheasant
Screech Owl	67.30	232.00	132.6	673	Pheasant
Mouse	235.00	657.00	132.6	1189	Mouse
Rabbit	28.70	125.00	237.8	566	Rabbit
Deer	4.83	42.30	113.2	566	Guinea Pig
Fox	12.00	36.60	113.2	566	Guinea Pig
Toad	145.00	372.00	21.2	106	Tadpole
Snake	104.00	324.00	21.2	106	Tadpole
Cow	2.35	29.60	113.2	566	Guinea Pig
Chicken	37.90	175.00	132.6	673	Pheasant
Dog	1.22	6.05	113.2	566	Guinea Pig

Wildlife Risk Overview

In order of decreasing risk to wildlife and domestic animals, the herbicides that BLM proposes for noxious weed control are dicamba, 2,4-D, glyphosate, and picloram. The risks depend on application rates, dermal penetration rates, and the inherent toxicity of the compounds. Use of lower rates in the case of 2,4-D and dicamba would reduce the risks to wildlife.

The analysis tends to overstate the risks because many of the assumptions are conservative. For example, no degradation of the herbicides is assumed to occur; all herbicide sprayed is assumed to be biologically available. In the extreme exposure case, the entire diet of an animal is assumed to consist of contaminated items, whereas in the routine case a significant percentage (7 to 55 percent depending onbody size) of the diet is assumed to be contaminated. Birds and mammals are assumed to receive dermal doses through their skin and from grooming. Dermal exposures are assumed to come both directly from herbicide spray and indirectly from brushing up against treated vegetation. This accumulation of doses from every conceivable route undoubtedly overestimates doses, even in the routine case. Nevertheless, when these dose estimates do exceed the EPA risk criterion, and more so when they exceed the LD_{50} for the most closely related laboratory species, a clear risk exists for adverse effects or individual animals.

When a large area is treated, there is a clear risk of adverse effects on local populations.

In addition to any possible direct toxic effects of the herbicides on animals, individual animals or local populations, particularly small mammals and ground-nesting birds, could be significantly though temporarily affected by the removal of most of the vegetative cover. Larger birds and mammals and domestic species should not be affected.

Aquatic Risk Analysis

Concentrations of the herbicides in water were estimated for each application method, including nominal application rates and minor and major mixing errors. The EEC's (estimated environmental concentrations) are given in Table K-10. These values assume that 1 percent of the applied herbicide is deposited 100 feet from the application site (Yates and others 1978), but for granular formulations, such as Tordon 22K, much less drift is likely. The calculation for 1 lb/acre is as follows:

$$\frac{453{,}590 \text{ mg/lb}}{1 \text{ lb/acre} \times 4{,}047 \text{ m}^2\text{/acre}} = 112 \text{ mg/m}^2$$

1 percent deposition at 100 feet offsite:
$112 \text{ mg/m}^2 \times .01 = 1.12 \text{ mg/m}^2$

In 6 inches (0.15m) of water:

$$\frac{1.12 \text{ mg}}{\text{m}^2 \times 0.15\text{m}} = \frac{1.12 \text{ mg}}{0.15\text{m}^3}$$

$$\frac{1.12 \text{ mg}}{0.15 \text{ m}^3 \times \left(\frac{1000 \text{ liters}}{\text{m}^3}\right)} = \frac{1.12 \text{ mg}}{150 \text{ l}} = 0.0075 \text{ mg/l}$$

or 7.5 µg/l (ppb)

Table K-10. Estimated Herbicide Concentrations in Water (ppb in 6-inch deep water body at 100 feet from spray area)

Application Method	At Nominal Application Rate	With Minor Mixing Error (20%)	With Major Mixing Error (30%)
Aerial:			
2,4-D	22.5	27.0	29.3
Picloram	7.5	9.0	9.8
Dicamba	7.5	9.0	9.8
Ground Vehicle:			
2,4-D	22.5	27.0	29.30
Picloram	7.5	9.0	9.80
2,4-D/Picloram Mix	3.8	4.5	5.25
Glyphosate	22.5	27.0	29.30
Dicamba	45.0	54.0	58.50
Ground Hand:			
2,4-D	22.5	27.0	29.30
Picloram	7.5	9.0	9.80
2,4-D/Picloram Mix	3.8	4.5	5.25
Glyphosate	22.5	27.0	29.30
Dicamba	45.0	54.0	58.50

To determine the risk to aquatic species the toxicity values for each herbicide (Tables K-2 through K-5) were compared to the expected herbicide concentrations in water (Table K-10). The Q (quotient)-value described by EPA-HED (1986i) is used to estimate the potential for adverse effects: where Q = EEC/LC_{50} (or other toxic effect level). A Q-value of $\leq$ 0.1 reveals that no adverse effects are likely.

2,4-D
The estimated aquatic concentrations of 2,4-D range from 22.5 to 29.3 ppb (about 0.02 to 0.03 ppm) at an application rate of 3 lbs/acre (Table K-10). The maximum expected environmental concentration is about 0.03 ppm.

Q-values for 2,4-D were calculated using the EEC of 0.03 ppm and LC_{50}'s and EC_{50}'s in Table K-2. The Q-values were less than 0.1 for all species listed, showing that no adverse effects to aquatic species are expected from 2,4-D butoxyethanol ester (BEE).

Dicamba
The estimated concentrations of dicamba are 7.5 to 58.5 ppb (about 0.008 to 0.06 ppm) (see Table K-10). Q-values were calculated using a maximum EEC of 0.06 ppm and the LC_{50}'s and EC_{50}'s in Table K-3. The lowest toxicity value reported is a 48-hr EC_{50} for *Daphnia* of 11 ppm. For *Daphnia*, the Q-value is 0.005. Therefore, all Q values are far less than 0.1, and no adverse effects to aquatic organisms are expected.

Glyphosate
The EECs for glyphosate range from 22.5 to 29.3 ppb (about 0.02 to 0.03 ppm) (Table K-10). Because the maximum EEC of 0.03 ppm is at least 30,000 times less than any of the LC_{50}'s reported for Rodeo (Table K-4), no adverse effects to aquatic life are expected.

Picloram
The estimated concentrations for picloram range from 7.5 to 9.8 ppb (about 0.008 to 0.01 ppm) at 1 lb/acre. No adverse effects are expected from the use of Tordon 22K; the largest Q-value is 0.002 (for bluegill, LC_{50} = 5.4 ppm) (Table K-5). Because Tordon 2K is most likely to be less toxic, it would result in even lower Q-values than Tordon 22K.

Life cycle or partial life cycle studies with fish have not been reported for Tordon 22K. Partial life cycle studies with technical grade picloram have found lake trout and cutthroat trout fry to be highly sensitive. An exposure of 0.01 ppm divided by a NOEL for cutthroat trout fry of 0.29 ppm gives a Q-value of 0.034, which is well within the safe range. But the NOEL of less than 0.035 ppm for lake trout fry yields a Q-value of 0.29. EPA considers Q-values in the range of 0.1 to 10 to have possible adverse effects. Technical picloram could harm the reproduction of sensitive salmonids at these exposure levels, particularly if its residues do not dissipate quickly. Under a worst-case assumption Tordon 22K may also be harmful to the reproduction of sensitive salmonids.

Acute LC_{50}'s for *Gammarus fasciatus* (0.027 ppm) and *Pteronarcys californica* (0.048 ppm) also show a high sensitivity to technical picloram. The Q-values for these species would be 0.37 and 0.21, respectively. Technical picloram might therefore directly kill some of these species and increase their occurrence in stream drift (due to a loss of their ability to hold to the substrate). Under a worst-case assumption Tordon 22K may have similiar adverse effects.

2,4-D and Picloram Mixture
The aquatic concentration for 2,4-D (at 1 lb/acre in the mixture) is 7.5 to 9.8 ppb (Table K-10). The concentration for picloram (at 0.5 lb/acre in the mixture) is 3.8 to 5.25 ppb (Table K-10). No adverse effects are expected from the use of 2,4-D. Concentrations of picloram are about half of those from using picloram alone, and impacts should be proportionately less (see the previous discussions for each of the herbicides).

Details of the Wildlife Exposure Calculations

Wildlife exposures were calculated for a series of representative wildlife species. The species are typical of areas supporting noxious weed growth in the Northwest and represent a range of phylogenetic classes, body sizes, and feeding niches. Table K-11 lists the representative wildlife species with various biological parameters used in the exposure analysis. References used in the selection and in deriving the physical parameters of each species were Schmidt and Gilbert (1978), Scott and others (1977), and Burt and Grossenheider (1966) and Robbins and others (1983).

Routine and extreme exposure estimates were made for each representative species for each of the three major exposure routes: inhalation, dermal, and ingestion. Exposures were based on the recommended application rates in pounds of active ingredient per acre: 2,4-D, 3 lb/acre; for picloram, 1 lb/acre; for glyphosate, 3 lb/acre; and dicamba, 6 lb/acre.

Inhalation Exposures. Wildlife inhalation exposures were based on air sampling data from pesticide field applications, adjusted to give a dose at a breathing rate of 1 l/min for an exposure of 10 minutes. The dose was weighted by each animal's breathing rate on the basis of the following equations:

Birds:

$$LPM = \frac{284 \times (BWT/1000)^{0.77}}{1000}$$

Mammals:

$$LPM = \frac{379 \times (BWT/1000)^{0.80}}{1000}$$

Reptiles:

LPM = 0.00334

Amphibians:

LPM = 0.007

Table K-11. Representative Wildlife Species Diet Items

Representative Species	Water	Vegetation	Seeds	Insects	Berries	Mouse	Toad	Fish
Birds								
Flicker	0.02	0	0	15	0	0	0	0
Mourning Dove	0.05	0	11	0	0	0	0	0
Jay	0.05	0	5	5	4	0	0	0
Kingfisher	0.08	0	0	0	0	0	0	50
Screech Owl	0.05	0	0	0	0	20	0	0
Mammals								
Mouse	0.05	1	2	3	0	0	0	0
Rabbit	0.05	130	0	0	0	0	0	0
Deer	1.50	2,500	0	0	0	0	0	0
Fox	0.80	0	0	0	175	300	0	0
Amphibian								
Toad	0.05	0	0	5	0	0	0	0
Reptile								
Snake	0.01	0	0	0	0	0	22	0
Domestic Animals								
Cow	58.00	12,000	0	0	0	0	0	0
Chicken	0.10	0	300	0	0	0	0	0
Dog	0.50	0	0	0	0	0	0	0

[1]Consumption in in liters for water and in grams for all other items.

where:

LPM is the animal's breathing rate in liters per minute.

BWT is the animal's body weight in grams.

The equations for birds and mammals were taken from Lasiewski and Calder. (1971). The reptile value is from Gordon and others (1968), who report a study on the collared lizard. The breathing rate for amphibians was taken from Hutchinson and others (1968). As expected, the animal modeling results showed inhalation exposures to be only a small fraction of each species total dose.

Dermal Exposures. Dermal exposures were assumed to come from two sources: (1) directly from herbicide spray at the deposition rate that should occur on vegetation leaf surfaces in the routine case and at the herbicide application rate in the extreme case and (2) indirectly by contact with contaminated vegetation. Fur, feathers, and scales afford varying degrees of protection against dermal exposure; by preventing the chemical from reaching the animal's skin, they may instead allow the chemical to dry or to be rubbed off in their movements. For this reason, the dermal penetration value set for each herbicide for mammals was adjusted for the three other classes. The dermal penetration factors are as follows: (1) birds, 9.75; (2) reptiles, 0.15; and (3) amphibians, 5.0. The amphibian factor is high because the moist, glandular skin of the amphibian serves largely as a respiratory organ and is many times more permeable than the skin of other animal classes.

The mammalian dermal penetration rates for the four herbicides were assumed to be 10 percent for 2,4-D, glyphosate, and dicamba and 1 percent for picloram.

Wildlife may receive indirect dermal exposure in moving through contaminated vegetation by transferring pesticide from the vegetation to their body surfaces. The transfer would depend on (1) the density of the vegetation, (2) the animal's body size in relation to the height of the vegetation, and (3) the amount of movement of the animal.

To simplify the analysis, it was assumed that a certain percentage of the animal's total body surface received herbicide at the same level as in direct dermal exposure (either the level on leaf surfaces in the routine case or at the application rate in the extreme case). That percentage was based on the animal's body size and a movement factor (MVF) to adjust for the taxonomic class. (Mammals, for example, are expected to move more than amphibians.) The animal's total body surface area was assumed to be a function of its weight according to the following formula (Kendeigh 1970; Schmidt-Nielsen, 1972):

$$BSA = 10 \times (BWT)\ 0.667$$

where:

BSA is the animal's body surface area in cm^2
BWT is the animal's body weight in grams

The animal's vegetation contact percent (VCP) is based on its body weight in grams (BWT) according to the following formula:

VCP = 2.89 (BWT) -.3775

The class adjustment factors (MVF's) for differing movement are as follows: (1) birds, 0.8; (2) mammals, 1; (3) reptiles, 0.3; and (4) amphibians, 0.4. The indirect dermal dose (IND) is then calculated using the direct dermal dose (DDD):

IND = DDD + (DDD x VCP x MVF)

Mammals and birds regularly groom themselves and may receive an ingestion dose if their fur or feathers are contaminated. The percent of their body surface groomed (PBG) was assumed to be a decreasing function of their body size according to the following formula:

PBG = 1.72 (BWT) - 0.29

No grooming was assumed for reptiles and amphibians. The oral dose for mammals and birds from grooming was subtracted from the amount of herbicide that would contribute to the animal's dermal dose.

Ingestion Exposures. Each representative species was assumed to drink a specified amount of water and to feed on contaminated food items according to a specified diet. These dietary amounts are listed in Table K-11. The diet items--seeds, insects, and berries--are assumed to have the following weights and surface areas:

	weight (g)	surface area (cm 2)	contamination level in ppm based on a 1 lb/acre application
seeds	0.002	0.158	885
insects	0.00322	0.22	766
berries	0.5	3.1416	070

These items are assumed to be contaminated over their entire surface area at the level on vegetation leaf surfaces in both routine and extreme cases. Grass was assumed to be contaminated at the level of 178.9 mg/kg per pound of herbicide applied per acre on site. Water is assumed to be drunk from a stream 6 inches deep 100 feet offsite that reaches a concentration of 7.5 ppb per pound of insecticide applied per acre. Predators that feed on mice, toads, or quail are assumed to receive the total body burden each of these prey species has received through the three exposure routes described above as a result of the herbicide spraying. In the routine exposures, each species is assumed to consume a percentage of its daily intake in contaminated food items, depending on its body size. The percentages are listed in Table K-1 and are based on the following formula:

% = 100 x (1/(BWT) 0.2

In the extreme case, each species entire daily food intake is assumed to consist of herbicide-contaminated items.

The results of the exposure analysis for each species for each exposure route are listed in Tables K-12 through K-19.

Table K-12. 2,4-D Routine Exposure Estimates

Species	Direct Dermal Dose	Oral Dose Via Grooming	Inhalation Dose	Dose From Food	Total Dose	Dose in mg/kg
Flicker	6.63E-02 *	8.56E-01	9.74E-04	2.91E+00	3.83E+00	5.11E+01
Mourning Dove	8.38E-02	9.23E-01	1.22E-03	2.33E+00	3.34E+00	3.34E+01
Jay	6.26E-02	8.41E-01	9.24E-04	2.19E+00	3.09E+00	4.42E+01
Kingfisher	1.69E-01	1.19E+00	2.46E-03	1.13E+00	2.49E+00	9.96E+00
Screech Owl	8.38E-02	9.23E-01	1.22E-03	2.36E+00	3.36E+00	3.36E+01
Mouse	2.67E-02	6.92E-01	4.18E-04	1.64E+00	2.35E+00	1.18E+02
Rabbit	7.72E-01	2.08E+00	1.21E-02	1.65E+01	1.94E+01	1.44E+01
Deer	1.09E+01	8.01E+00	2.79E-01	1.45E+02	1.64E+02	2.41E+00
Fox	2.05E+00	3.34E+00	3.83E-02	2.86E+01	3.40E+01	5.99E+00
Toad	3.59E-01	0.00E+00	1.76E-04	1.24E+00	1.60E+00	7.26E+01
Snake	4.79E-01	0.00E+00	8.42E-05	1.60E+00	2.08E+00	5.19E+01
Cow	3.91E+01	1.60E+01	1.27E+00	4.76E+02	5.32E+02	1.17E+00
Chicken	7.36E-01	2.30E+00	1.22E-02	3.49E+01	3.79E+01	1.89E+01
Dog	3.70E+00	4.52E+00	7.71E-02	1.68E-03	8.29E+00	6.10E-01

Table K-13--Picloram Routine Exposure Estimates

Species	Direct Dermal Dose	Oral Dose Via Grooming	Inhalation Dose	Dose From Food	Total Dose	Dose in mg/kg
Flicker	2.21E-03	2.85E-01	3.25E-04	9.69E-01	1.26E+00	1.68E+01
Mourning Dove	2.79E-03	3.08E-01	4.05E-04	7.76E-01	1.09E+00	1.09E+01
Jay	2.09E-03	2.80E-01	3.08E-04	7.30E-01	1.01E+00	1.45E+01
Kingfisher	5.62E-03	3.98E-01	8.20E-04	3.75E-01	7.80E-01	3.12E+00
Screech Owl	2.79E-03	3.08E-01	4.05E-04	7.77E-01	1.09E+00	1.09E+01
Mouse	8.90E-04	2.31E-01	1.39E-04	5.45E-01	7.77E-01	3.88E+01
Rabbit	2.57E-02	6.95E-01	4.05E-03	5.50E+00	6.20E+00	4.61E+00
Deer	3.64E-01	2.67E+00	9.31E-02	4.83E+01	5.14E+01	7.56E-01
Fox	6.83E-02	1.11E+00	1.28E-02	9.44E+00	1.06E+01	1.88E+00
Toad	1.20E-02	0.00E+00	5.88E-05	4.13E-01	4.25E-01	1.93E+01
Snake	1.60E-02	0.00E+00	2.81E-05	4.25E-01	4.41E-01	1.10E+01
Cow	1.30E+00	5.34E+00	4.25E-01	1.59E+02	1.66E+02	3.65E-01
Chicken	2.45E-02	7.66E-01	4.07E-03	1.16E+01	1.24E+01	6.21E+00
Dog	1.23E-01	1.51E+00	2.57E-02	5.59E-04	1.66E+00	1.22E-01

Table K-14. Glyphosate Routine Exposure Estimates

Species	Direct Dermal Dose	Oral Dose Via Grooming	Inhalation Dose	Dose From Food	Total Dose	Dose in mg/kg
Flicker	6.63E-02	8.56E-01	9.74E-04	2.91E+00	3.83E+00	5.11E+01
Mourning Dove	8.38E-02	9.23E-01	1.22E-03	2.33E+00	3.34E+00	3.34E+01
Jay	6.26E-02	8.41E-01	9.24E-04	2.19E+00	3.09E+00	4.42E+01
Kingfisher	1.69E-01	1.19E+00	2.46E-03	1.13E+00	2.49E+00	9.96E+00
Screech Owl	8.38E-02	9.23E-01	1.22E-03	2.36E+00	3.36E+00	3.36E+01
Mouse	2.67E-02	6.92E-01	4.18E-04	1.64E+00	2.35E+00	1.18E+02
Rabbit	7.72E-01	2.08E+00	1.21E-02	1.65E+01	1.94E+01	1.44E+01
Deer	1.09E+01	8.01E+00	2.79E-01	1.45E+02	1.64E+02	2.41E+00
Fox	2.05E+00	3.34E+00	3.83E-02	2.86E+01	3.40E+01	5.99E+00
Toad	3.59E-01	0.00E+00	1.76E-04	1.24E+00	1.60E+00	7.26E+01
Snake	4.79E-01	0.00E+00	8.42E-05	1.60E+00	2.08E+00	5.19E+01
Cow	3.91E+01	1.60E+01	1.27E+00	4.76E+02	5.32E+02	1.17E+00
Chicken	7.36E-01	2.30E+00	1.22E-02	3.49E+01	3.79E+01	1.89E+01
Dog	3.70E+00	4.52E+00	7.71E-02	1.68E-03	8.29E+00	6.10E-01

*E + or - the numbers means scientific notation and should be read as 6.63×10^{-2}

Table K-15--Dicamba Routine Exposure Estimates

Species	Direct Dermal Dose	Oral Dose Via Grooming	Inhalation Dose	Dose From Food	Total Dose	Dose in mg/kg
Flicker	1.33E-01 *	1.71E+00	1.95E-03	5.81E+00	7.66E+00	1.02E+02
Mourning Dove	1.68E-01	1.85E+00	2.43E-03	4.65E+00	6.67E+00	6.67E+01
Jay	1.25E-01	1.68E+00	1.85E-03	4.38E+00	6.19E+00	8.84E+01
Kingfisher	3.37E-01	2.39E+00	4.92E-03	2.25E+00	4.98E+00	1.99E+01
Screech Owl	1.68E-01	1.85E+00	2.43E-03	4.71E+00	6.73E+00	6.73E+01
Mouse	5.34E-02	1.38E+00	8.35E-04	3.27E+00	4.71E+00	2.35E+02
Rabbit	1.54E+00	4.17E+00	2.43E-02	3.30E+01	3.87E+01	2.87E+01
Deer	2.19E+01	1.60E+01	5.59E-01	2.90E+02	3.28E+02	4.83E+00
Fox	4.10E+00	6.68E+00	7.65E-02	5.71E+01	6.80E+01	1.20E+01
Toad	7.19E-01	0.00E+00	3.53E-04	2.48E+00	3.20E+00	1.45E+02
Snake	9.57E-01	0.00E+00	1.68E-04	3.20E+00	4.15E+00	1.04E+02
Cow	7.82E+01	3.21E+01	2.55E+00	9.52E+02	1.06E+03	2.35E+00
Chicken	1.47E+00	4.59E+00	2.44E-02	6.97E+01	7.58E+01	3.79E+01
Dog	7.40E+00	9.03E+00	1.54E-01	3.35E-03	1.66E+01	1.22E+00

Table K-16. 2,4-D Routine Exposure Estimates

Species	Direct Dermal Dose	Oral Dose Via Grooming	Inhalation Dose	Dose From Food	Total Dose	Dose in mg/kg
Flicker	3.32E-01	4.28E+00	9.74E-04	6.89E+00	1.15E+01	1.53E+02
Mourning Dove	4.19E-01	4.62E+00	1.22E-03	5.85E+00	1.09E+01	1.09E+02
Jay	3.13E-01	4.20E+00	9.24E-04	5.12E+00	9.64E+00	1.38E+02
Kingfisher	8.43E-01	5.97E+00	2.46E-03	1.13E+00	7.94E+00	3.18E+01
Screech Owl	4.19E-01	4.62E+00	1.22E-03	6.57E+00	1.16E+01	1.16E+02
Mouse	1.33E-01	3.46E+00	4.18E-04	2.98E+00	6.57E+00	3.29E+02
Rabbit	3.86E+00	1.04E+01	1.21E-02	6.98E+01	8.41E+01	6.23E+01
Deer	5.47E+01	4.00E+01	2.79E-01	1.34E+03	1.44E+03	2.11E+01
Fox	1.02E+01	1.67E+01	3.83E-02	7.68E+01	1.04E+02	1.83E+01
Toad	1.80E+00	0.00E+00	1.76E-04	2.30E+00	4.10E+00	1.86E+02
Snake	2.39E+00	0.00E+00	8.42E-05	4.10E+00	6.49E+00	1.62E+02
Cow	1.96E+02	8.01E+01	1.27E+00	6.44E+03	6.72E+03	1.48E+01
Chicken	3.68E+00	1.15E+01	1.22E-02	1.59E+02	1.75E+02	8.73E+01
Dog	1.85E+01	2.26E+01	7.71E-02	1.13E-02	4.12E+01	3.03E+00

Table K-17. Picloram Extreme Exposure Estimates

Species	Direct Dermal Dose	Oral Dose Via Grooming	Inhalation Dose	Dose From Food	Total Dose	Dose in mg/kg
Flicker	1.11E-02	1.43E+00	3.25E-04	2.30E+00	3.74E+00	4.98E+01
Mourning Dove	1.40E-02	1.54E+00	4.05E-04	1.95E+00	3.50E+00	3.50E+01
Jay	1.04E-02	1.40E+00	3.08E-04	1.71E+00	3.12E+00	4.46E+01
Kingfisher	2.81E-02	1.99E+00	8.20E-04	3.76E-01	2.39E+00	9.58E+00
Screech Owl	1.40E-02	1.54E+00	4.05E-04	2.15E+00	3.70E+00	3.70E+01
Mouse	4.45E-03	1.15E+00	1.39E-04	9.93E-01	2.15E+00	1.08E+02
Rabbit	1.29E-01	3.47E+00	4.05E-03	2.33E+01	2.69E+01	1.99E+01
Deer	1.82E+00	1.33E+01	9.31E-02	4.47E+02	4.63E+02	6.80E+00
Fox	3.41E-01	5.57E+00	1.28E-02	2.52E+01	3.11E+01	5.49E+00
Toad	5.99E-02	0.00E+00	5.88E-05	7.66E-01	8.26E-01	3.76E+01
Snake	7.98E-02	0.00E+00	2.81E-05	8.26E-01	9.06E-01	2.26E+01
Cow	6.52E+00	2.67E+01	4.25E-01	2.15E+03	2.18E+03	4.81E+00
Chicken	1.23E-01	3.83E+00	4.07E-03	5.31E+01	5.71E+01	2.85E+01
Dog	6.16E-01	7.53E+00	2.57E-02	3.75E-03	8.17E+00	6.01E-01

*E + or - the numbers means scientific notation and should be read as 1.33×10^{-1}

Table K-18. Glyphosate Extreme Exposure Estimates

Species	Direct Dermal Dose	Oral Dose Via Grooming	Inhalation Dose	Dose From Food	Total Dose	Dose In mg/kg
Flicker	3.32E-01 *	4.28E+00	9.74E-04	6.89E+00	1.15E+01	1.53E+02
Mourning Dove	4.19E-01	4.62E+00	1.22E-03	5.85E+00	1.09E+01	1.09E+02
Jay	3.13E-01	4.20E+00	9.24E-04	5.12E+00	9.64E+00	1.38E+02
Kingfisher	8.43E-01	5.97E+00	2.46E-03	1.13E+00	7.94E+00	3.18E+01
Screech Owl	4.19E-01	4.62E+00	1.22E-03	6.57E+00	1.16E+01	1.16E+02
Mouse	1.33E-01	3.46E+00	4.18E-04	2.98E+00	6.57E+00	3.29E+02
Rabbit	3.86E+00	1.04E+01	1.21E-02	6.98E+01	8.41E+01	6.23E+01
Deer	5.47E+01	4.00E+01	2.79E-01	1.34E+03	1.44E+03	2.11E+01
Fox	1.02E+01	1.67E+01	3.83E-02	7.68E+01	1.04E+02	1.83E+01
Toad	1.80E+00	0.00E+00	1.76E-04	2.30E+00	4.10E+00	1.86E+02
Snake	2.39E+00	0.0E+00	8.42E-05	4.10E+00	6.49E+00	1.62E+02
Cow	1.96E+02	8.01E+01	1.27E+00	6.44E+03	6.72E+03	1.48E+01
Chicken	3.68E+00	1.15E+01	1.22E-02	1.59E+02	1.75E+02	8.73E+01
Dog	1.85E+01	2.26E+01	7.71E-02	1.13E-02	4.12E+01	3.03E+00

Table K-19. Dicamba Extreme Exposure Estimates

Species	Direct Dermal Dose	Oral Dose Via Grooming	Inhalation Dose	Dose From Food	Total Dose	Dose in mg/kg
Flicker	6.63E-01	8.56E+00	1.95E-03	1.38E+01	2.30E+01	3.07E+02
Mourning Dove	8.38E-01	9.23E+00	2.43E-03	1.17E+01	2.18E+01	2.18E+02
Jay	6.26E-01	8.41E+00	1.85E-03	1.02E+01	1.93E+01	2.75E+02
Kingfisher	1.69E+00	1.19E+01	4.92E-03	2.25E+00	1.59E+01	6.35E+01
Screech Owl	8.38E-01	9.23E+00	2.43E-03	1.31E+01	2.32E+01	2.32E+02
Mouse	2.67E-01	6.92E+00	8.35E-04	5.96E+00	1.31E+01	6.57E+02
Rabbit	7.72E+00	2.08E+01	2.43E-02	1.40E+02	1.68E+02	1.25E+02
Deer	1.09E+02	8.01E+01	5.59E-01	2.68E+03	2.87E+03	4.23E+01
Fox	2.05E+01	3.34E+01	7.65E-02	1.54E+02	2.08E+02	3.66E+01
Toad	3.59E+00	0.00E+00	3.53E-04	4.60E+00	8.19E+00	3.72E+02
Snake	4.79E+00	0.00E+00	1.68E-04	8.19E+00	1.30E+01	3.24E+02
Cow	3.91E+02	1.60E+02	2.55E+00	1.29E+04	1.34E+04	2.96E+01
Chicken	7.36E+00	2.30E+01	2.44E-02	3.19E+02	3.49E+02	1.75E+02
Dog	3.70E+01	4.52E+01	1.54E-01	2.25E-02	8.23E+01	6.05E+00

*E + or - the numbers means scientific notation and should be read as 3.32×10^{-1}

Appendix N
Worst-Case Analysis Impacts on Human Health From Using 2,4-D, Picloram, Glyphosate, and Dicamba

This appendix presents information on the potential risks to the health of workers and members of the public from the proposed use of 2,4-D, picloram, glyphosate, and dicamba in BLM's noxious weed control program. The first section evaluates the risks of chronic systemic effects, reproductive effects, and teratogenic effects. The last section discusses the risks of herbicides causing cancer or mutagenic effects in the population at risk. The analysis uses worst-case assumptions that overestimate the actual risk of human health effects occurring under BLM's proposed program.

Scientific uncertainty exists about the carcinogenicity potential of the herbicides 2,4-D, picloram, and glyphosate. This appendix analyzes the risks to human health of proceeding with the Proposed Action in the face of that uncertainty; for example, the hypothesis is valid that 2,4-D, picloram, and glyphosate are carcinogenic. The analysis presented may best be labeled as the worst case to human health from using 2,4-D, picloram, 2,4-D/picloram mixture, and glyphosate to control and eradicate noxious weeds on public lands. The analysis also indicates the probability of the worst case occurring.

The worst-case analysis addresses the following:

Necessity of a Worst-Case Analysis
- Nature of the scientific uncertainty
- Cost of additional research
- The worst-case analysis requirement

Worst-Case Analysis
- Overview
- Exposure Analysis including summary of project description, expected and unintended events, and exposure levels for affected populations
- Review of herbicide toxicity and comparisons risk to workers and the public of general systemic and reproductive effects
- Risk of cancer for affected populations
- Comparisons of cancer risks to death from involuntary occurrence
- Likelihood of the worst case occurring
- Exposure and risk from accidental spill scenarios
- Risk of heritable mutations

Necessity Of A Worst-Case Analysis

Nature of the Scientific Uncertainty

Because a scientific uncertainty regarding the potential of 2,4-D, picloram, and glyphosate to cause cancer, this analysis makes the worst-case assumption that these herbicides are human carcinogens. For dicamba, no evidence exists of oncogenicity in laboratory studies. Although EPA has requested more information on the potential of dicamba to cause cancer, no tumor data exist with which to calculate cancer potency and, no cancer risk analysis was conducted. A qualitative statement about dicamba, cancer and the worst case is found in the text.

Scientific studies on whether 2,4-D causes cancer have evoked disagreement among experts. As stated in Appendix K, the most recent 2-year cancer study is under review by EPA and appears positive. However, the two previous studies considered most acceptable are considered negative for cancer by most of the scientific community. In the first study, which involved many chemicals, Innes and others (1969) orally exposed two strains of mice to two different formulations of 2,4-D for 18 months. Eighteen mice of each sex and each strain were exposed to each formulation. Exposure to 2,4-D did not significantly increase tumors in this experiment. In the second study, Hansen and others (1971) exposed Osborne-Mendel rats to 0, 5, 25, 125, 625, or 1,250 parts per million (ppm) 2,4-D in the diet for 2 years. There were 25 male and 25 female rats in each dosage group. No significant effect of dosage on survival was noted. The total number of rats with tumors in the control group was 15, and the tumors in the treated groups, by increasing dose, were 14, 18, 20, 23, and 22. Because the tumors were typical of those normally found in aging Osborne-Mendel rats, the authors did not attribute these lesions to the feeding of 2,4-D. The data from the Hansen study were used to compute 2,4-D's cancer potency of 5.03×10^{-3}. EPA has stated that the new cancer data are unlikely to exceed this value (EPA 1986c).

The issue of carcinogenicity has also been raised in the case of picloram. A carcinogenesis bioassay of picloram in rats and mice was conducted by Gulf Research Institute for the National Cancer Institute (1978). This study found a relatively high incidence of foliar hyperplasia, C-cell hyperplasia, and C-cell adenoma of the thyroid in both sexes of rats. The statistical tests for adenoma did not show sufficient evidence of association of the tumor with picloram administration, but there was evidence that picloram affected the livers of rats of both sexes.

No tumors were found in male or female mice or male rats at incidences that could be significantly associated with treatment, and the study concluded that picloram was not carcinogenic for mice or male rats. In female rats, however, incidence of neoplastic nodules (benign tumors) was associated with picloram treatment. The study concluded that under the bioassay conditions, the findings were suggestive of the ability of picloram to induce benign tumors in the livers of female Osborne-Mendel rats. According to a classification scheme devised by the National Cancer Institute (NCI), however, picloram was listed among chemicals where evidence for carcinogenicity in animals was equivocal at best (Griesemer and Cueto 1980).

From his examination of the histological sections, Rueber (1981) interpreted the results of the NCI bioassay differently when he concluded that picloram was carcinogenic for all test animals except mice tested at the lowest dose. This interpretation differs from that of the panel of experts (the former NCI Data Evaluation/Risk Assessment Subgroup of the Clearinghouse on Environmental Carcinogens), who evaluated and interpreted the bioassay experiment.

More research has yet to be completed on picloram's carcinogenicity. Research on picloram is being conducted by Dow Chemical Company (1984). EPA is expected to complete its review of the new study in 1987.

A new replacement cancer study for glyphosate provided inconclusive evidence of oncogenicity according to the EPA's FIFRA Scientific Advisory Panel (EPA 1986h). EPA indicates this feeding study showed a treatment-related increase in the incidence of renal tumors in male mice. The tumors (renal tubule adenomas) occurred in three out of 50 male mice fed a diet containing 30,000 parts per million (ppm) or 3 percent glyphosate. The same type of tumor also was found in one of 50 animals fed 5,000 ppm (0.5 percent) glyphosate. The original pathology report indicated no renal tubule adenomas among 49 animals fed 1,000 ppm (0.1 percent) glyphosate or among the control animals. The registrant has recently submitted information indicating that one animal in the concurrent control group was found to have a renal tubule adenoma.

EPA has concluded that these tumor results are not statistically significant when each treated group is compared to the concurrent control. However, the tumor has rarely been found among untreated (control) mice and there is a statistically significant tumor increase in the glyphosate-treated male mice when compared to appropriate historical control findings. There is also a statistically significant dose-related trend. Therefore, EPA initially considered the study to be positive for oncogenicity.

No statistically or biologically significant increases in tumors were found among female mice from the same study. In addition, the result of a long-term oncogenic study conducted with rats was negative for oncogenicity. Several appropriately conducted and scientifically acceptable mutagenicity tests also were negative.

Thus, in well-conducted oncogenicity studies on both sexes of two species, the incidence of only one tumor type in one sex of one species was found to have a tumor increase related to treatment with glyphosate. This increase in tumors, however, occurred only at very high dose levels (much higher than usual for long-term studies of pesticides). Furthermore, the positive finding is based upon the presence of tumors in only four treated animals. As stated previously, EPA now regards this study as inconclusive and has requested additional studies.

Cost of Additonal Research

BLM does not have the staff, expertise, or funds to fill the existing data gaps, and the time required to perform these studies would seriously delay the execution of noxious weed control programs. To fill all the data gaps pertaining to the carcinogenicity potential of picloram, glyphosate, and 2,4-D could require a total investment of between $3.5 million and $4.2 million, and at least 5 years of study per chemical. These figures are derived from cost estimates submitted to EPA by Centaur Associates, Inc. (1982), which are summarized in Table M-1 (Appendix M) of FEIS. The time estimates are based on historical data for toxicological research. EPA (1980) highlighted 2,4-D data gaps in the areas of oncogenicity, reproductive effects, and metabolism in animals. These studies would require expenditures within the lower cost estimate range. More research on chronic toxicity and teratogenicity could also be required, further adding to the costs. These costs are considered exorbitant.

The Worst-Case Analysis Requirement

As stated in the text, the BLM has decided to comply with the recently rescinded worst-case analysis regulation (40

CFR 1502.22). It was promulgated in 1979 by the Council on Environmental Quality (Council or CEQ). The regulation was one of many implementing the National Environmental Policy Act of 1969 (NEPA), 42 U.S.C. 4321 et seq. (1976), and it set forth the formal procedure an agency had to follow when confronted with gaps in relevant information or scientific uncertainty; about significant, adverse effects on the environment from a major federal action. The regulation required an agency to make known when it was confronted with gaps in relevant information or scientific uncertainty (40 CFR 1502.22). An agency then had to determine if the missing information was essential to a reasoned choice among the alternatives. When the missing information was material to the decision, an agency ordinarily had to obtain the information and include it is an environmental impact statement (EIS) (40 CFR 1502.22(a)). If the means for obtaining the missing information were "beyond the state of the art," or alternatively, if the costs of obtaining it were "exorbitant," an agency then had to prepare a worst-case analysis. (40 CFR 1502.22(b)). In this analysis, an agency had to "weigh the need for the action against the risk and severity of possible adverse impacts where the action to proceed in the face of uncertainty." An agency also had to indicate "the probability or improbability of its (the worst-case's) occurrence."

On the basis of the discord surrounding the Hansen study and EPA's decision to undertake additional studies, the courts have concluded that scientific uncertainty exists about 2,4-D's carcinogenic effect. See *Save Our EcoSystems* v. *Clark*, (9th Cir. 1983). The disagreement among experts about picloram's and glyphosate's carcinogenic effect is essentially the same as that surrounding 2,4-D. Hence given existing judicial opinions, the agency is constrained to find that there also is scientific uncertainty about picloram's and glyphosate's carcinogenic effect. Regarding resolution of the scientific uncertainty surrounding 2,4-D's, picloram's, and glyphosate's carcinogencity, as indicated earlier, the costs of obtaining additional information to resolve that dispute are exorbitant (Appendix M). Accordingly, BLM has decided to prepare a worst-case analysis before proceeding with the use of 2,4-D, picloram, and glyphosate.

Worst-Case Analysis

Overview

This risk assessment examines the potential health effects on workers and the public who might be exposed to 2,4-D, picloram, glyphosate, or dicamba as a result of BLM's noxious weed control program. This risk assessment employs the three principal analytical elements described by the National Research Council (1983) as necessary to characterize the potential adverse health effects of human exposures to existing or introduced hazards in the environment: hazard analysis, exposure analysis, and risk analysis.

1. The hazard analysis requires gathering information on the toxic properties of each chemical, including:

- Identifying what kinds of health effects have been observed in laboratory animals and at what levels of exposure
- Identifying any health effects that have been observed in humans
- Determining median lethal dose (LD_{50}) for acute effects from laboratory rat study
- Determining lowest NOEL's, if possible, for general chronic effects, reproductive effects, and birth defects
- Determining if the herbicide potentially causes cancer or mutations
- Identifying data gaps in toxicity information

2. The exposure analysis requires gathering information on the type of people exposed, their duration and frequency of exposure, and dose. Summarily, the analysis is broken down by the following steps:

a. Identification of important elements in the herbicide application program including sizes of spray areas, locations of spray areas, herbicide application rates, and application methods

b. Identification of the problems and misapplications that are possible with the herbicide spraying projects and a determination of the likelihood of these events

c. Identification of the population potentially affected by using all four herbicides (population at risk)

d. Estimation of the possible exposure and dosage of the affected populations taking into account various possible errors as well as unavoidable exposure intrinsic to the application process

e. In addition, at the end of this appendix, a discussion of potential worker and public exposure to accidental spill scenarios

3. The risk analysis requires comparing the hazard information with the dose estimates and discusses the probability of acute, systemic, reproductive, carcinogenic, or mutagenic effects occurring under the worst-case assumptions.

The risk of cancer to workers and the public of proceeding with the use of 2,4-D, picloram, or glyphosate to control noxious weeds in light of scientific uncertainty surrounding them is that the hypotheses about their carcinogenicity are valid. Indeed, to accept the hypotheses' validity is the worst-case to human health in the event that BLM proceeds with the proposed use of the three herbicides.

In analyzing the worst case, BLM has attempted to establish incidence levels of cancer for different groups of persons who can be expected to be exposed to 2,4-D, picloram, and glyphosate. The incidence levels are expressed mathematically. The analysis also posits several different amounts (doses) and durations of 2,4-D, picloram, and glyphosate dosages to which persons will be exposed. In each scenario posited, the analysis focuses on amounts and durations of exposure in excess of what is foreseeable from the Proposed Action. Consequently, the incidence levels of cancer for persons exposed to 2,4-D, picloram, and glyphosate under this analysis also will relate the projected incidence levels of other risks to human health, both voluntary and involuntary, that persons confront in their daily lives.

Two populations are considered in analyzing the worst case: the public residing in the areas where 2,4-D, picloram, and glyphosate are used and the occupational group of workers applying the substances. The analysis differentiates the public by age; that is, incidence levels of cancer are projected for infants, adolescents, and adults. For these members of the public, incidence levels also are projected for each group according to whether they reside within 500 feet, 1/4 mile, or 1/2 mile of the area treated with the three herbicides. As for infants, adolescents, and adults, incidence levels are also projected according to whether they are exposed to 2,4-D, picloram, or glyphosate as a result of either dermal exposure from herbicide drift or oral ingestion by consumption of water, meat, or vegetation containing herbicide residues. Occupational exposure to 2,4-D, picloram, and glyphosate and incidence levels of cancer from it are projected for pilots, mixer-loaders, supervisors, and observers where the herbicides are applied aerially. Where the three herbicides are applied by ground vehicle, incidence levels are projected for the drivers, mixer-loaders, and driver-mixer-loaders. Where the herbicides are applied on the ground by hand, incidence levels are projected for the applicator, who also mixes and loads.

The estimated doses of 2,4-D, picloram, and glyphosate to which persons are exposed are based on assumed errors in mixing, in formulations, and in applications.

Incidence levels of cancer resulting from exposure to 2,4-D, picloram, and glyphosate were analyzed from the basis of a one-hit model. The one-hit model assumes that any single dose of a carcinogen in a lifetime, no matter how minute, has some finite chance of causing cancer. The model is one of the most conservative in that it projects the greatest risks of any model used to project carcinogenicity of a substance.

Exposure Analysis

The Herbicide Background Statement (USDA, FS 1984) and Dost (1983) provide detailed information on actual residue levels in plants, water, and meat found in field studies. These documents also present the results of field exposure studies for workers. Both of these documents contain exposure assessments for workers and members of the public. The categories of exposure and methods chosen for this risk analysis greatly overestimate actual exposures that would be expected under BLM's proposed program and thus can be labelled as worst case.

Summary Descriptions of Project Application Scenarios

Although 4,416 acres of the Proposed Action herbicide applications would use granular herbicide, for this analysis it is assumed that all herbicides would be a liquid formulation. This assumption is conservative, since exposure risk is greater with liquid spray applications.

Under the Proposed Action, 5,900 acres are expected to be treated annually with 2,4-D, picloram, glyphosate, and dicamba by helicopter. In an extraordinary situation, 1.5

Table N-1 Expected and Extraordinary Crew Exposure Days

	Expected		Extraordinary	
Project Type/Chemical	Anticipated Acres	Crew Exposure Days	Extraordinary Acres[4]	Crew Exposure Days
Aerial[1]				
2,4-D	2,170	3.0	3,255	4.0
Picloram	3,730	4.0	5,595	6.0
Dicamba	1,520	2.0	2,280	3.0
Ground Vehicle[2]				
2,4-D	8,750	29.0	13,125	44.0
Picloram	3,866	13.0	5,799	19.5
2,4-D/Picloram	694	2.5	1,041	3.5
Glyphosate	105	1.0	158	1.0
Dicamba	8,379	28.0	12,569	42.0
Ground Hand[3]				
2,4-D	879	5.5	1,318	8.5
Picloram	657	4.5	986	6.5
2,4-D/Picloram	80	1.0	120	1.0
Glyphosate	42	1.0	63	1.0
Dicamba	782	5.0	1,173	8.0

[1]Based on one crew per state - 195 acres per day/per crew.
[2]Based on four crews per state - 15 acres per day/per crew.
[3]Based on four crews per state - 8 acres per day/per crew.
[4]Extraordinary acres (anticipated acres) x 1.5).

times as many acres (8,850) could be treated. Although this many acres could possibly be treated by a single crew, a conservative assumption of one crew in each of five states is used. In a typical year, relatively few areas with continuous extensive infestation of noxious weeds would be treated. Closeness of these large aerial spraying projects to residences would be highly unusual. This analysis assumes five crews treating 1,180 acres each under the expected situation and 1,770 acres each under the extraordinary situation. It is assumed that all treatment areas over 200 acres would be treated by aerial application, although smaller acreage would be treated under rare circumstances.

An estimated 195 acres per day would be treated per crew, and an average helicopter load of 70 gallons would cover 14 acres (at a 5 gallon/acre application rate). Each helicopter would therefore apply 14 batches per day. Under the Proposed Action, 6 crew-exposure days (number of days for a crew to treat allocated acreage) would be needed to treat 1,180 acres (expected), and 9 crew exposure days to treat 1,770 acres under the extraordinary situation. Expected and extraordinary crew exposure days are presented by chemical and method of application in Table N-1.

Ground Vehicle - Under the Proposed Action, an estimated 13,415 acres (expected) would be treated annually with 2,4-D, picloram, and glyphosate by ground vehicle. Depending on the size of individual infested areas, the average-size treatment area is approximately 5 acres. It is assumed that ground vehicles could treat an average of 15 acres per day. Normally, application of herbicide by BLM occurs in sparsely populated or unpopulated areas. With adjacent landowner permission, applications are often made up to property boundaries.

The ground vehicles normally carry 200 gallons of spray mixture, which will cover approximately 15 acres. Accessibility and safety limits vehicle applications to flat or gently rolling terrain.

In the extraordinary situation, 1.5 times as many acres would increase the total acreage to 20,123 acres. Other factors such as average plot size would not change.

Based on a 15 acres per day treatment rate and an assumed 4 crews per state, there would be 45 crew exposure days for the expected situation. This would increase to 67 crew exposure days under the extraordinary situation (see Table N-1).

Ground Hand - Under the Proposed Action, estimated 1,658 acres (expected) would be treated by hand application of 2,4-D, picloram, and glyphosate. In the extraordinary situation (1.5 times as many acres), 2,487 acres would be treated. Hand application projects are assumed to be approximately 1 acre of noxious weeds spread over a 10-acre area. Hand applications would be utilized in areas that are too small to efficiently use other application methods, which require special protection. These would be areas such as;

- areas close to water
- riparian areas
- recreation areas
- areas not accessible to ground vehicles
- areas adjacent to residences

An estimated 4 acres would be sprayed per day per person, and an average load of 5 gallons would cover an estimated 0.25 acres (at a 20 gallon/acre application rate). An applicator would therefore apply 16 batches per day. Assuming 4 crews per state and an average of 8 acres (actually treated) per day treatment rate per crew, it would take 10.5 crew exposure days for the expected situation. This would increase to 16 crew exposure days for the extraordinary situation (see Table N-1).

Expected and Unintended Events and Outcomes Associated With Herbicide Application and the Likelihood of These Events

Under the ideal circumstances, noxious weed chemical control programs would result in pesticide application at the proper rate to target organisms with little or no impact to nontarget organisms. Unfortunately, this assumption does not apply under all circumstances, and this analysis is based on a presumption that misapplication and off-target impacts could occur during application. Off-target impacts could result from the following:

- Drift of herbicides during application
- Errors of measurement during manufacturing and formulation
- Errors of measurement during field mixing
- Excessive swath overlap during application

Except for the topic of drift, there is no data on the effect or the rate of occurrence of these events during past noxious weed control programs. Therefore, estimates of the rate of occurrence of the other events are made that increase the apparent risk of these projects above what would likely occur. Rates of occurrence for over-strength mixing and misapplication are taken to the point that excessive use of the herbicide concentrate would be noticeable during mixing and corrective actions would be taken to prevent further overuse and wasteful expenditures.

Drift of Herbicide Off-target Was Assumed to Occur During Ground and Aerial Applications

Several investigators (Yates and others 1978; Maybank and others 1977) have studied herbicide drift from ground equipment as well as from aircraft. Yates and his coworkers provide the most complete study of drift from ground-vehicle applications over relatively long distances (up to1,000 meters). Maybank and his coworkers provide more complete data concerning deposition on target and deposition and drift of herbicide within short distances off-target. Both types of data are useful in determining the impacts of spraying under different application scenarios.

In determining rates of drift from ground application, the highest rate of drift found in tests of ground equipment by Yates and his coworkers or by Maybank and his coworkers are assumed to occur at all times during ground application in the EIS area. These drift rates greatly overestimate drift from typical ground application since other tests have shown rates as much as 100 times lower than the rates used here. In addition, the drift rates used here were based on drift from tractor- or truck-mounted spray equipment employing high-pressure spray booms and spraying more than 3 feet off the ground. In addition, BLM uses low pressure boom sprayers nozzled for drift reduction, therefore drift would be less than projected in these projections.

Table N-2 presents data from Yates and others (1978) on deposition of drift onto downwind mylar sheets. Data for 100-meter-wide spray areas are calculated by Yates from 10-meter-wide spray swath data. Also presented are data on deposition of aerial application drift from 100-meter-wide spray areas (Dost 1981). Data are expressed as that fraction of an application rate that could be expected to be deposited at a specified distance (500 feet, one-quarter mile, and one-half mile). Elements from Table N-2 were used to estimate doses for public dermal exposures.

Errors of Measurement During Manufacturing and Formulation

Possible herbicide concentration errors resulting from poor quality-control in the manufacturing and formulation processes are accounted for. It is assumed that all such errors result in higher concentrations of herbicide per gallon than is stated on the label. Allowances for a 4

Table N-2 Drift Deposition at Specified Distances From Spray Projects (in a 5 mph wind)

Ground Vehicle Application - 100-meter-wide spray area

Distance	Mylar Sheet [1]
500 feet	0.00049
1/4 mile	0.00017
1/2 mile	0.00007

Aerial Application [2]

Distance	
500 feet	0.00054
1/4 mile	0.00011
1/2 mile	0.00002

[1]Expressed at the fractional portion of an application rate in mass/acre (e.g., kg/ha, lbs/ac, mg/m²). Taken from Yates and others 1978.

[2]Derived from An Analysis of Human Health Hazards Report (Dost 1981) presented in kg/ha/kg applied/acre.

percent manufacturing and formulation error are included, although errors of such magnitude are considered rare.

Errors of Measurement in the Field

Most pesticide formulations require additional dilution for field applications. Errors could occur due to improper calibration of metering equipment, unskilled use of measuring instruments, etc. Again it is expected that the actual diluted concentration would cluster about the appropriate dilution rate. However, this analysis assumes that all pesticide mixtures for field applications were mixed such that the pesticide concentration is 10 percent higher than called for (minor mixing error).

In addition, major mixing errors were assumed in which the pesticide concentration was 20 percent higher than called for. Both of these rates of mixing error are extremely high and their effects on consumption of the herbicide concentrate would be noticed and improper dilution problems corrected. Table N-3 contains a listing of herbicides, and application rates including rates involving minor and major mixing errors.

Excess Swath Overlap During Application

This analysis assumes that 5 percent of the land sprayed on any individual project is sprayed twice due to swath overlap. A 5 percent overlap is unlikely for basically the same reasons stated in the discussion on mixing errors. Such an overlap would result in a noticeable, excessive use of the herbicide concentrate requiring additional herbicide to complete treatment of a given area.

Exposure Levels for Affected Populations

Exposure to a herbicide refers to contact or potential contact between the chemical compound and the external surface of an organism that may result in the chemical being incorporated into cells or organs. Dose refers to the portion of the substance that is taken into the organism as a result of exposure. This distinction is made for several reasons. Exposure to herbicides during application is often a function of physical variables such as spray equipment, protective apparatus, wind speed, height of application, and concentration of herbicide applied. Thus, the dermal exposure to a worker using a backpack sprayer will be similar whether he is spraying 2,4-D, picloram or glyphosate, as long as all other variables are held constant.

The dose (or amount absorbed) from an exposure will often depend on chemical characteristics of the herbicide. For example, dermal dose is a function of the nature of the chemical and its interaction with cutaneous surfaces. The dose is different for each herbicide, although certain generalities on rate of absorption are possible and will be set forth in this section.

Occupational Exposure and Dosage

Exposure and dose factors for workers involved in applying 2,4-D, picloram, and glyphosate are based on studies by Lavy and others (1982, 1984) and Nash and others (1982). The urine of workers was analyzed as an indication of worker dose from all routes (dermal,

Table N-3 Listing of Herbicides and Application Rates Used for Noxious Weed Control. (Active Ingredient in Pounds per Acre)

Herbicide by Projected Type	Expected Granular (kg/ai/ha)	Expected Liquid (kg/ai/ha)	Minor Mix Errors (kg/ai/ha)	Major Mix Errors (kg/ai/ha)
Aerial				
2,4-D		3.0 (3.36)	3.6 (4.03)	3.9 (4.37)
Picloram	1.0 (1.12)	1.0 (1.2)	1.2 (1.34)	1.3 (1.46)
Dicamba		1.0 (1.2)	1.2 (1.34)	1.3 (1.46)
Ground Vehicle				
2,4-D		3.0 (3.36)	3.6 (4.03)	3.9 (4.37)
Picloram	1.0 (1.12)	1.0 (1.12)	1.2 (1.34)	1.3 (1.46)
Mix - 2,4-D/		1.0 (1.12)	1.2 (1.33)	1.3 (1.42)
Picloram		0.5 (0.56)	0.6 (0.67)	0.7 (0.72)
Glyphosate		3.0 (3.36)	3.6 (4.03)	4.2 (4.37)
Dicamba		6.0 (6.72)	7.2 (8.06)	7.8 (8.74)
Ground Hand				
2,4-D		3.0 (3.36)	3.6 (4.03)	3.9 (4.37)
Picloram	1.0 (1.12)	1.0 (1.12)	1.2 (1.34)	1.3 (1.46)
Mix - 2,4-D/		1.0 (1.12)	1.2 (1.34)	1.3 (1.46)
Picloram		0.5 (0.56)	0.6 (0.67)	0.7 (0.72)
Glyphosate		3.0 (3.36)	3.6 (4.03)	3.9 (4.37)
Dicamba		6.0 (6.72)	7.2 (8.06)	7.8 (8.74)

inhalation, and oral). Data on the amount of herbicide applied during the study period, which allowed normalization of data on a "per kilogram applied or mixed" basis, was provided by these studies. Several other studies of worker exposure and dose are reported in the literature, but these reports do not contain sufficient information to allow normalization of the data.

Table N-4 summarizes results of the Lavy and Nash studies representing "base case dose rates" computed on a 1.0 pound active ingredient per acre (lb ai/acre) (1.12 kg ai/ha) application rate. Listed exposures are the highest dose to any worker in the category and are therefore conservative. Additional conservatism is built in by the fact that all measurements were taken from workers wearing little protective clothing (short sleeve or sleeveless shirts, cotton pants, nonrubberized boots, and baseball caps.) Workers in the projects covered by this EIS, particularly for high-exposure jobs such as mixer-loaders, will be required to wear protective clothing.

Dose levels of 2,4-D, picloram, and glyphosate to workers using various hand application control methods are compared in Lavy and others (1984). Average dosage on a "per kilogram applied" basis was 5 to 10 times greater for 2,4-D than for picloram. The difference in doses between the herbicides is not surprising when the data on dermal absorption of these herbicides is considered. Feldman and Maibach (1974) have shown dermal absorption rates for 2,4-D in the range of 8 percent, whereas Nolan and others (1984) have shown dermal absorption of picloram at less than 1 percent of the exposure amount while the absorption rate of glyphosate is about 6 percent. To be conservative, BLM rounds up

Table N-4 Occupational Exposure Base Case Dose Rates (at 1 lb/acre Application Rate)

Occupation	Dosage (mg/kg/day)
Aerial	
Pilot	0.03
Mixer-loader	0.13
Supervisor	0.011
Observer	0.04
Ground Vehicle	
Driver	0.025
Mixer-loader	0.13
Driver-mixer-loader	0.155
Ground Hand	
Mixer-loader-applicator	0.06

Source: Nash and others 1982; lavy and others 1982, 1984.

the absorption rates to 1 percent for picloram and 10 percent for both 2,4-D and glyphosate. The difference in 2,4-D and picloram doses also supports the finding of inhalation and dermal sampling studies that have shown that inhalation doses for workers are negligible compared to dermally absorbed doses (see Lavy and others 1982 and 1980). For occupational exposures, it is assumed that the absorption of 2,4-D and picloram is the same. These are conservative estimates for absorption from picloram. A list of the herbicides addressed in this analysis and the expected application rates by application method (aerial, ground vehicle, and ground hand) are shown in Table N-3. Each treatment is adjusted for assumed minor and major errors in application and mixing (hereafter called mixing errors).

There are no data to indicate that consistent mixing error is ever experienced. Therefore, under-application and over-application would reasonably balance out. However, for a conservative approach, all assumed mixing errors were for over application.

Assumed minor mixing errors are based on human error factors such as 4 percent formulation error (4 percent more "active ingredient" than is listed on the herbicide label), 5 percent over-application error due to swath overlap, and overmixing of "active ingredient" by 10 percent. The same assumptions apply for major mixing errors except that the over-mixing error is increased from 10 to 20 percent. For example, at a 1.0 lb ai/acre application rate, 19 percent (4 percent + 5 percent + 10 percent) more active ingredient is applied per batch due to minor mixing errors. Therefore, for a desired 1.0 lb ai/acre application rate, it is assumed that 1.2 lb ai/acre would actually be applied (for major mixing errors, 1.3 lb ai/acre).

Summaries of occupational dosages in mg/kg body weight/day are shown in Table N-5. Dosages are the products of application rate (Table N-3) x base case dose (Table N-4). The highest dosages for occupational exposures would occur to mixer-loaders and to those drivers who also mix and load in ground vehicle applications. These dosage estimates err on the high side for reasons described above. In actual practice, these dosages could be halved because of proper attention to protective measures and application detail.

Public Exposure and Dose

Potential doses to the public were developed based on several exposure pathways. These include dermal absorption of drift deposited on the skin, consumption of sprayed wild berries, consumption of wild game having fed on sprayed forage, and consumption of water with herbicide residues.

Off-target drift during herbicide application is one of several ways in which individuals near spray areas could be exposed to herbicides. Estimates of drift at 500 feet or more from a 300-foot-wide spray area were based on the highest exposure determinations reported by Yates and others (1978) for drift from ground vehicle applications and from Dost (1981) for aerial applications. Because of the methods of hand application (backpack sprayers, granular spreaders, wipers), the analysis assumes that insignificant drift results. Using data from Table N-2, one can project drift deposition onto bystanders (adults, adolescents, and infants) downwind of spray projects. These analyses assume that adults weighed 70 kg, adolescents weighed 40 kg, and infants weighed 10 kg. It is assumed that adult exposed skin area is 0.37 m^2 (4 $feet^2$). adolescents exposed skin area is 0.27 m^2 (3 $feet^2$) and infant exposed skin area is 0.15 m^2 (1.6 $feet^2$). All exposed skin is assumed to be directly in the drift pathway and fully exposed to drift (an extreme assumption). In a 5 mph wind, the downwind off-target deposition at 100 feet (edge of usual buffer strip) is expected to be 1 percent of the on-target rate; at 500 feet the deposition is about 0.05 percent (Yates and others 1978; Dost 1983). Deposition on clothing, unless drenched, does not result in significant absorption through the skin (Dost 1981). The dermal absorption rate is assumed to be 1 percent for picloram

Table N-5 Summary of Dosages for Occupational Exposure (in mg/kg/day)

	2,4-D		Picloram		2,4-D in Mix		Picloram in Mix		Glyphosate		Dicamba	
	Minor Mix Errors	Major Mix Errors	Minor Mix Errors	Major Mix Errors	Minor Mix Errors	Major Mix Errors	Minor Mix Errors	Major Mix Errors	Minor Mix Errors	Major Mix Errors	Minor Mix Errors	Major Mix Errors
Aerial[1]												
Pilot	0.108	0.117	0.036	0.039	-	-	-	-	-	-	0.036	0.039
Mixer-loader	0.468	0.507	0.156	0.169	-	-	-	-	-	-	0.156	0.169
Supervisor	0.040	0.043	0.013	0.014	-	-	-	-	-	-	0.013	0.014
Observer	0.144	0.156	0.048	0.052	-	-	-	-	-	-	0.048	0.052
Ground Vehicle[1]												
Driver	0.090	0.098	0.030	0.033	0.030	0.033	0.015	0.017	0.090	0.098	0.060	0.066
Mixer-loader	0.468	0.507	0.156	0.169	0.156	0.169	0.078	0.085	0.468	0.507	0.312	0.338
Driver-mixer-loader	0.558	0.605	0.186	0.202	0.186	0.202	0.093	0.101	0.558	0.605	0.372	0.404
Ground hand[1]												
Mixer-loader-applicator	0.216	0.234	0.072	0.078	0.072	0.078	0.036	0.039	0.216	0.234	0.148	0.156

[1]Computed using the formula - (Application Rate x Base Case Dose). Tables N-3 and N-4 respectively.

and 10 percent for 2,4-D, glyphosate, and dicamba (see Occupational Exposure and Dosage). Drift deposition at 500 feet from a 3.0 lb ai/acre (3.36 kg/ha) ground application of 2,4-D would be 0.165 mg/m 2 (3.36 kg/ha x 1,000,000 mg/kg/10,000 m 2 in a hectare x 0.00049 (from Table N-2)). The 500-foot drift dose to an adult would be 8.7 x 10^{-5} or 0.000087 mg/kg body weight ((0.165 mg/m 2 x 0.37 m 2 exposed skin area x 0.10 absorption rate)/70 kg adult weight).

Computation of all adult, adolescent, and infant exposures by aerial and ground applications revealed that ground applications result in about 8.1 percent higher dermal exposures. Therefore, ground vehicle application dose estimates were used to compute dosages resulting from minor and major mixing errors (Table N-6). The daily dermal dosage from drift 500 feet downwind for dermal exposures due to drift are higher for infants, adolescents, and adults, respectively. With major mixing errors, infant dosages would range from 0.000351 mg/kg at 500 feet to 0.00000076 mg/kg at 0.5 mile for 2,4-D and glyphosate. Such dosages, although low, are unlikely as the analysis assumes that all exposed skin gets hit directly and that no skin is washed.

Estimates of oral dosages from ingestion of sprayed water are based on Dost (1983). At a theoretical expected concentration of 30 ppb in a 6-inch-deep stream based on Dost's theoretical concentrations (less than 2 percent of streams analyzed in western Oregon BLM spray treatments had concentrations from 11-20 ppb; 82 percent showed no detectable levels of herbicide) due to drift at 100 feet from the target area, an adult consuming 2 liters of water would receive a dose of 0.0012 mg/kg of body weight. This estimate assumes that the entire amount of water is consumed at one time and the herbicide is not diluted. Adults are assumed to drink 2 liters, adolescents 1 liter, and infants 1 liter. This dose is assumed to result from 1.0 lb ai/acre, which greatly overestimated estimated doses. A theoretical concentration based on 1 percent drift offsite would be 7 ppb/1.0 lb ai/acre, not 30. A summary of dosage estimates for public exposure, including minor and major mixing errors, is presented in Table N-6. A person drinking 2 liters of water immediately after it was sprayed with 2,4-D applied at 3.6 lb ai/acre (minor mixing error) would receive a dosage of 0.0031 mg/kg of body weight. The dosage for an adolescent would be 0.0027 mg/kg from drinking 1 liter of water. The dosage for an infant drinking 1 liter of water would be 0.011 mg/kg.

Estimates of oral doses from consumption of meat are based on several studies. Fang and Khanna (1966) reported 40 to 60 percent elimination of 60 to 100 mg doses of 2,4-D within 24 hours in rats. Cows and sheep fed up to 2,000 ppm 2,4-D in their diet for 28 days had average residue levels of less than 1.0 ppm in muscle, fat, and liver (Clark and others 1975). Picloram is excreted very rapidly from mammalian systems. Nolan and others (1984) found that more than 70 percent of a human oral dose of 5.0 mg/kg was recovered in urine within 6 hours. Ninety percent of the compound fed to dogs was excreted within 48 hours (Redemann 1963 as reported in National Research Council of Canada 1974; Fisher and others 1965). In two studies (McCollister and Leng 1969, and Kutschinski and Riley 1969) cattle fed from 1 to 1,600 mg/kg of picloram in feed for 4.5 to 8 weeks showed 0.05 to 0.5 mg/kg in muscle and fat, 0.12 to 2.0 mg/kg in liver and 2.0 to 18 mg/kg in kidneys. Kidneys contained less than 0.1 mg/kg when picloram was withdrawn from their diet 3 days before slaughter. The feeding studies reviewed above reveal that little bioaccumulation of 2,4-D, picloram or glyphosate occurs in mammals, particularly in edible muscle tissue.

Estimates of oral dose from consumption of wild game (deer) having fed on sprayed forage are based on estimates derived by Dost (1983) from registering data for triclopyr. Transfer of chemicals through game animals has been the subject of many studies. Triclopyr was given daily to goats for 10 days. Chemical concentrations were found only in the liver (0.004 ppm) and kidneys (0.013 ppm), with none found in muscle tissue. Assuming that a deer daily consumes 3 percent of its body weight in forage and that the maximum herbicide deposition rate is 4.0 lb ai/acre resulting in concentrations of forage of 400 ppm, a deer would ingest a total dose of 12 mg/kg. We assume for this analysis, that the maximum possible concentration of residue to accumulate in muscle would be 0.003 ppm or 0.2 mg/kg, and that an adult eats 0.5 kg (1.1 lbs) daily, an adolescent 0.3 kg daily, and an infant 0.1 kg daily.

The dosage estimates (including mixing errors) with 2,4-D applied at 3.6 lb. ai/acre (4.03 kg ai/ha), that an adult would receive a daily dose of 0.00116 mg/kg of body weight (0.162/mg/kg based on minor mixing error application rate x 0.5 kg meat eaten/70 kg body weight). These estimates are conservative in that they do not consider the effects of cooking on the herbicide residue in meat.

Estimates of oral dose from consumption of wild berries are based on the review by Dost (1983). Studies by Siltanen and Rosenburg (1978) found a 7 ppm residue level of 2,4-D on berries from aerial spraying, whereas other studies have found concentrations from 0 to 6 ppm. Assuming a conservative on-site maximum concentration of 10 ppm from a 4.0 lb ai/acre application, drift 100 feet offsite would result in a maximum concentration of 0.1 ppm. Consumption of 0.25 kg (0.55 lb) a day by a 70 kg adult would result in a dose rate of 0.00036 mg/kg/day.

This analysis assumes that berries are eaten raw and that picloram, dicamba, and glyphosate residue levels are the same as 2,4-D residues. Adults are assumed to eat 0.25 kg per day, adolescent 0.13 kg per day, and infants 0.05 kg per day. The dosage estimates, including minor and major mixing errors, are presented in Table N-6. When 2,4-D is applied (minor mixing errors) at 3.6 lb ai/acre, an adult would receive a daily dose of 0.00032 mg/kg and an adolescent weighing 40 kg would receive a dose of 0.00029 mg/kg (eating 0.13 kg berries/day). In areas where noxious weed control projects are conducted, few berries would be found, except in recreation areas. Visitor exposure to herbicides through eating these foods would be voluntary, as recreational areas would be posted and accidental exposure should not occur. Also, recreation areas would be treated when the areas are least used by recreationists.

Table N-6 Summary of Dosages for Public Exposure (in mg/kg/day).

	Adult (70 Kg)		Adolescent (40 Kg)		Infant (10 Kg)	
	Minor Mixing Errors	Major Mixing Errors	Minor Mixing Errors	Major Mixing Errors	Minor Mixing Errors	Major Mixing Errors
2,4-D						
Dermal (drift)						
500 feet	1.2×10^{-4}	1.3×10^{-4}	1.5×10^{-4}	1.6×10^{-4}	3.2×10^{-4}	3.5×10^{-4}
1/4 mile	3.6×10^{-5}	3.9×10^{-5}	4.8×10^{-5}	5.2×10^{-5}	1.0×10^{-4}	1.0×10^{-4}
1/2 mile	1.5×10^{-5}	1.6×10^{-5}	2.0×10^{-5}	2.1×10^{-5}	4.2×10^{-5}	4.5×10^{-5}
Oral Ingestion						
Water[1]	3.1×10^{-3}	3.3×10^{-3}	2.7×10^{-3}	2.9×10^{-3}	1.1×10^{-2}	1.2×10^{-2}
Meat	1.2×10^{-3}	1.3×10^{-3}	1.2×10^{-3}	1.3×10^{-3}	1.6×10^{-3}	1.8×10^{-3}
Berries[2]	3.2×10^{-4}	3.5×10^{-4}	2.9×10^{-4}	3.2×10^{-4}	4.5×10^{-4}	4.9×10^{-4}
Picloram						
Dermal (drift)						
500 feet	3.9×10^{-6}	4.2×10^{-6}	5.1×10^{-6}	5.5×10^{-6}	1.1×10^{-5}	1.2×10^{-5}
1/4 mile	1.2×10^{-6}	1.3×10^{-6}	1.6×10^{-6}	1.7×10^{-6}	3.4×10^{-6}	3.7×10^{-6}
1/2 mile	5.0×10^{-7}	5.4×10^{-7}	6.6×10^{-7}	7.1×10^{-7}	1.4×10^{-6}	1.5×10^{-6}
Oral Ingestion						
Water[1]	1.0×10^{-3}	1.1×10^{-3}	9.0×10^{-4}	9.7×10^{-4}	3.6×10^{-3}	3.9×10^{-3}
Meat	3.9×10^{-4}	4.2×10^{-4}	4.1×10^{-4}	4.4×10^{-4}	5.4×10^{-4}	5.8×10^{-4}
Berries[2]	1.1×10^{-4}	1.2×10^{-4}	9.7×10^{-5}	1.1×10^{-4}	1.5×10^{-4}	1.6×10^{-4}
2,4-D in mix						
Dermal (drift)						
500 feet	3.9×10^{-5}	4.2×10^{-5}	5.1×10^{-5}	5.5×10^{-5}	1.1×10^{-4}	1.2×10^{-4}
1/4 mile	1.2×10^{-5}	1.3×10^{-5}	1.6×10^{-5}	1.7×10^{-5}	3.4×10^{-5}	3.7×10^{-5}
1/2 mile	5.0×10^{-6}	5.4×10^{-6}	6.6×10^{-6}	7.1×10^{-6}	1.4×10^{-5}	1.5×10^{-5}
Oral Ingestion						
Water[1]	1.0×10^{-3}	1.1×10^{-3}	9.0×10^{-4}	9.7×10^{-4}	3.6×10^{-3}	3.9×10^{-3}
Meat	3.9×10^{-4}	4.2×10^{-4}	4.1×10^{-4}	4.4×10^{-4}	5.4×10^{-4}	5.8×10^{-4}
Berries[2]	1.1×10^{-4}	1.2×10^{-4}	9.7×10^{-5}	1.1×10^{-4}	1.5×10^{-4}	1.6×10^{-4}
Picloram in mix						
Dermal (drift)						
500 feet	1.9×10^{-6}	2.1×10^{-6}	2.5×10^{-6}	2.7×10^{-6}	5.4×10^{-6}	5.8×10^{-6}
1/4 mile	6.1×10^{-7}	6.6×10^{-7}	8.0×10^{-7}	8.6×10^{-7}	1.7×10^{-6}	1.8×10^{-6}
1/2 mile	2.5×10^{-7}	2.7×10^{-7}	3.3×10^{-7}	3.6×10^{-7}	7.0×10^{-7}	7.6×10^{-7}
Oral Ingestion						
Water[1]	5.1×10^{-4}	5.6×10^{-4}	4.5×10^{-4}	4.9×10^{-4}	1.8×10^{-3}	2.0×10^{-3}
Meat	1.9×10^{-4}	2.1×10^{-4}	2.0×10^{-4}	2.2×10^{-4}	2.7×10^{-4}	2.9×10^{-4}
Berries[2]	5.4×10^{-5}	5.8×10^{-5}	4.9×10^{-5}	5.3×10^{-5}	7.5×10^{-5}	8.1×10^{-5}
Glyphosate						
Dermal (drift)						
500 feet	1.2×10^{-4}	1.3×10^{-4}	1.5×10^{-4}	1.6×10^{-4}	3.2×10^{-4}	3.5×10^{-4}
1/4 mile	3.6×10^{-5}	3.9×10^{-5}	4.8×10^{-5}	5.2×10^{-5}	1.0×10^{-4}	1.1×10^{-4}
1/2 mile	1.5×10^{-5}	1.6×10^{-5}	2.0×10^{-5}	2.1×10^{-5}	4.2×10^{-5}	4.5×10^{-5}
Oral Ingestion						
Water[1]	3.1×10^{-3}	3.3×10^{-3}	2.7×10^{-3}	2.9×10^{-3}	1.1×10^{-2}	1.2×10^{-2}
Meat	1.2×10^{-3}	1.3×10^{-3}	1.2×10^{-3}	1.3×10^{-3}	1.6×10^{-3}	1.8×10^{-3}
Berries[2]	3.2×10^{-4}	3.5×10^{-4}	2.9×10^{-4}	3.2×10^{-4}	4.5×10^{-4}	4.9×10^{-4}
Dicamba						
Dermal (drift)						
500 feet	2.3×10^{-4}	2.5×10^{-4}	3.0×10^{-4}	3.3×10^{-4}	6.5×10^{-4}	7.0×10^{-4}
1/4 mile	7.3×10^{-5}	7.9×10^{-5}	9.6×10^{-5}	1.0×10^{-4}	2.0×10^{-4}	2.2×10^{-4}
1/2 mile	3.0×10^{-5}	3.3×10^{-5}	3.9×10^{-5}	4.3×10^{-5}	8.4×10^{-5}	9.1×10^{-5}
Oral Ingestion						
Water[1]	6.2×10^{-3}	6.9×10^{-3}	5.4×10^{-3}	5.8×10^{-3}	2.2×10^{-2}	2.3×10^{-2}
Meat	2.3×10^{-3}	2.5×10^{-3}	2.4×10^{-3}	2.6×10^{-3}	3.2×10^{-3}	3.5×10^{-3}
Berries[2]	6.4×10^{-4}	7.0×10^{-4}	5.8×10^{-4}	6.3×10^{-4}	9.0×10^{-4}	9.7×10^{-4}

[1]Based on deposition rates 500 feet downwind of treated area.
[2]Based on deposition rates 100 feet downwind of treated area.

Several studies of herbicide residue in spray areas reveal that the herbicide dose to persons reentering a spray area is likely to be small. Lavy and others (1980) reported that individuals who walked through an acre sprayed 2 hours earlier with 2,4,5-T had no detectable dislodgable residue levels on patches that represented dermal exposure to skin and clothing. Also, Thompson and others (1983) found that only 5 percent of 2,4-D applied to grasses could be removed by physically wiping immediately after spraying 1 to 2 lb ai/acre. These residues dropped to less than 1 percent within 5 days after application. These data show that the exposure to herbicides from contacting treated foliage would be extremely small.

Hazard Analysis

A detailed discussion of the toxicity of the four herbicides is presented in Appendix K. Table N-7 presents the toxicity yardsticks used in this risk analysis.

The toxic effects of a compound can be measured on any number of animal species using a variety of specific experimental protocol needed to provide a comprehensive picture of toxicity. The acute toxicity of a chemical compound is often indicated by the one-time or short-term dose that is lethal to 50 percent of a group of treated animals (LD_{50}). Because there is no universally accepted method for determining which animal species would provide the most suitable model for effects on man, the LD_{50} value for the species most sensitive to a particular herbicide (Table N-7) has been used. These values are based on a review of herbicide toxicological data provided by Sassman and others (1984).

All of the systemic NOEL's take into account validated 2-year chronic feeding studies. For dicamba and picloram, subchronic study NOEL's were used because they are the lowest NOEL's found in the literature. EPA has requested additional chronic data on these two herbicides and has reflected uncertainty by the use of higher safety factors in setting the allowable daily intake (ADI). Also, 2,4-D is the only herbicide of the four that has been shown to cause birth defects and only at high doses. No NOEL was estimated for the dicamba/2,4-D mixture. Any MOS's for this mixture should approximate the lowest MOS for either constituent.

Table N-7 Summary of Acute and Chronic Toxicity Thresholds Based on Results From the Most Sensitive Species

Herbicide	Acute Oral[1] LD_{50} in mg/kg	Systemic Toxicity NOEL in mg/kg/day	Reproductive[3] Toxicity NOEL in mg/kg/day	Provisional[4] Allowable Daily Intake Set by EPA in mg/kg/day
2,4-D	100	1	5	0.01
Picloram	2,000	7	50	0.007
Glyphosate	4,320	30	10	0.1
Dicamba	757	25	3	0.0125

[1]Based on review by Sassman and others (1984).
[2]Lowest NOEL found in the literature (see Appendix K) for general systemic effects such as changes in kidneys, liver, or decreased food consumption.
[3]Lowest NOEL found in the literature (see Appendix K) for reproductive effects such as birth defects, fertility, fetotoxicity, or maternal toxicity.
[4]EPA utilizes the lowest NOEL and reduces it by a safety factor (100, 1,000, 100, and 2,000 for 2,4-D, picloram, glyphosate, and dicamba respectively).

Risk Analysis

Risk For Threshold Effects

In this risk analysis, the risks to humans potentially exposed to 2,4-D, picloram, glyphosate, and dicamba were quantified by comparing the dose shown in Tables N-5 and N-6 with the laboratory-derived NOEL's determined in the most sensitive test animal shown in Table N-7.

The ratio between the animal NOEL and the estimated human dose, referred to in this analysis as the margin of safety (MOS), is used to account for the uncertainty inherent in relating doses and effects seen in animals to doses and effects seen in humans. For example, an MOS of 100 means the laboratory-determined level is 100 times higher than the estimated dose.

The larger the margin of safety (the smaller the estimated human dose compared to the animal NOEL), the lower the risk to human health. As the estimated dose to humans approaches the animal NOEL (as the MOS approaches 1), the risk to humans increases. When an estimated dose exceeds a NOEL (giving an MOS of less than 1), the ratio is reversed (the dose is divided by the NOEL) to indicate how high the estimated dose is above the laboratory level; a minus sign is attached to indicate that the dose exceeded the NOEL; and the result is no longer termed a margin of safety but is simply called a negative ratio.

A ratio of -3, for example, means that the estimated dose is 3 times the laboratory-determined level. A negative ratio implies that the estimated dose (given all assumptions of the scenario) represents a clear risk of possible acute or chronic effects.

When repeated doses to humans are higher than the animal NOEL (the MOS is less than 1), there is some possibility of harmful effects. Conversely, when the human dose is small compared with the animal NOEL (giving an MOS greater than 100), the risk to humans can be judged very small. Comparing one-time or once-a-year doses (such as those experienced by the public) to NOEL's derived from lifetime studies tends to greatly overestimate the risk from those rare events.

Risk to Workers

Table N-8A presents the margins of safety for workers for general systemic effects. The margins of safety indicate that ground vehicle mixer-loader-applicators are at greatest risk, followed by aerial mixer-loaders and backpack applicators. Except for supervisors, all occupational exposures for 2,4-D are less than 15. This indicates that applicators using 2,4-D have the greatest chance of experiencing adverse health effects. If they repeatedly receive these worst-case doses, there is a clear risk of kidney effects. 2,4-D has also been reported to produce peripheral neuropathy in sensitive individuals.

Likewise, individuals exposed to the 2,4-D/picloram mixture could experience similar although lesser effects. The most likely effect from the mixture 2,4-D/picloram is skin irritation. However, the margins of safety indicate the possibility of adverse health effects, especially among sensitive individuals. Ground vehicle mixer-loaders of dicamba could potentially have liver damage (reduced glycogen storage) if they repeatedly received doses as high as shown here, although the risk of chronic health effects is less than 2,4-D.

BLM workers would be unlikely to experience these effects for a number of reasons:

1. The number of days they are expected to be exposed per year is relatively small (less than 20), except for ground vehicle applicators using 2,4-D.

2. The projected doses shown in Table N-5 greatly overestimate average exposures.

3. All doses are based on workers not wearing protective clothing. The use of protective clothing could reduce the exposures and thus increase the MOS by 30 to 90 percent (Lavy et al. 1982; Libich et al. 1984; Waldron 1985).

Table N-8B presents the margins of safety for reproductive effects. Female ground vehicle operators using glyphosate and dicamba are at greatest risk. A conservative assumption is that any developing fetus would be at high risk in women who repeatedly receive doses as high as a ground vehicle mixer-loader. Neither of these chemicals has been shown to cause birth defects in laboratory animals. The MOS for aerial and ground vehicle mixer-loaders of picloram and the 2,4-D/picloram mixture indicate the potential of maternal toxic effects on sensitive individuals. An operator's frequency of exposure as shown in Table N-1, however, is quite small. Contract employees, who are exposed throughout the spray season, are at greater risk.

Risk to the Public

Tables N-9, N-9A, and N-9B show that large margins of safety (MOSs) (greater than 200) exist for every category of routine public exposures to 2,4-D, dicamba, glyphosate, and picloram. Although the public should not be chronically exposed to these herbicides (indeed, given the remote location of most spray areas, the public will not be exposed at all in most spray operations), these large margins of safety mean the public could be repeatedly exposed to these levels and suffer no adverse effects. This is true for pregnant women and most sensitive individuals.

Because all of the doses shown in Table N-6 are below the provisional acceptable daily intakes (ADIs) (see Table 3-3) set by EPA, EPA considers all of the estimated doses to the public safe for lifetime exposure.

Table N-9A and N-9B present the MOSs of children, who are generally considered to be sensitive individuals. The MOSs for a 10 kg child drinking a liter of water contaminated at about 120 ppm show the potential for effects on the kidneys if exposure at this level continues. However, this worst-case estimate is about six times higher than has been found in water monitoring studies. Most forest field studies have found nondetectable levels of herbicide in streams, even immediately after spraying. (Drift modeling studies show that 1 percent of the onsite concentration would be deposited at 100 feet, with a 6-inch stream the concentration would be only 30 ppm under a 4 lb/acre 2,4-D application rate.) In addition, the exposure to the child would be one-time, rather than repeat or chronic, further decreasing the probability of harmful effects.

Risk to Maximum Exposed Individuals

Doses and margins of safety calculated for extraordinary situations are shown in Table N-10. The first situation involves a member of the public who is directly under an aerial application. The doses were calculated based on the application rates shown in Table N-3 assuming two square feet of exposed skin. The MOS's indicate that there is a negligible chance of adverse health effects occurring from being directly sprayed with glyphosate, picloram, or dicamba other than skin or eye irritation. For 2,4-D, although the MOS is relatively low, the risk of kidney damage is not considered to be high because the NOEL is based on chronic rather than one-time exposure.

The entry in each matrix element is the NOEL divided by the sum of doses for hypothetical exposures of one individual. For example, the MOS of 1,412 for an adult receiving direct dermal exposure for 2,4-D drift at 500 feet downwind of application and additional doses from oral ingestion was calculated by dividing the NOEL value for 2,4-D by the cumulative major mixing error dosages (1 mg/kg/day)/(0.00013 + 0.0047 + 0.0014 + 0.0011 mg/kg/day). MOS values for the public are for days of maximum exposure, which are generally days of spraying. Since the dermal dose will only occur on the day of exposure, the MOS values for subsequent days involving only oral doses would be higher. MOS values for public dermal exposures are typically very high, often in excess of 500,000, particularly for picloram and 2,4-D/picloram mixture. Dose comparisions show that the public would receive a dose that remotely approaches the NOEL level only when they are directly sprayed by an aircraft or collect and consume relatively large amounts of sprayed berries, water, or deer meat containing herbicide residues. For numerous reasons, these are very low probability events. Sprayed areas are not in locations that naturally attract visitors seeking wild foods. The target noxious weeds (knapweed, leafy spurge, thistle) are not in edible berry bushes and prime food habitats, and edible berries generally do not occupy noxious-weed-infested areas. Nonetheless, the calculated extraordinary situation MOS values show that even when improbable events occur, health impacts would be highly unlikely with such a transient dose.

Table N-8A Margins of Safety[1] for Systemic Effects Based on Doses to Workers on Aerial and Ground Application Projects

	2,4-D		Picloram		2,4-D & Picloram Mix		Glyphosate		Dicamba	
	Minor Mix Errors	Major Mix Errors	Minor Mix Errors	Major Mix Errors	Minor Mix Errors	Major Mix Errors	Minor Mix Errors	Major Mix Errors	Minor Mix Errors	Major Mix Errors
Aerial										
Pilot	9	9	194	180	--	--	--	--	694	641
Mixer-loader	2	2	45	41	--	--	--	--	160	148
Supervisor	25	23	539	500	--	--	--	--	1,923	1,786
Observer	7	6	146	135	--	--	--	--	521	481
Ground Vehicle										
Driver	11	10	233	212	89	80	333	306	417	379
Mixer-loader	2	2	45	41	17	15	64	59	80	74
Driver-mixer-loader	2	2	38	35	14	13	54	50	67	62
Ground hand										
Mixer-loader-applicator	5	4	97	90	37	33	139	128	169	160

[1]MOS = NOEL from Table N-7 divided by exposure dose from Table N-5

Table N-8B Estimated Margins of Safety[1] for Reproductive Effects Based on Doses to Workers on Aerial and Ground Application Projects

	2,4-D		Picloram		2,4-D in Mix		Picloram in Mix		Glyphosate		Dicamba	
	Minor Mix Errors	Major Mix Errors	Minor Mix Errors	Major Mix Errors	Minor Mix Errors	Major Mix Errors	Minor Mix Errors	Major Mix Errors	Minor Mix Errors	Major Mix Errors	Minor Mix Errors	Major Mix Errors
Aerial[1]												
Pilot	225	225	1,386	1,286	-	-	-	-	-	-	83	77
Mixer-loader	50	50	321	293	-	-	-	-	-	-	19	18
Supervisor	625	575	3,850	3,571	-	-	-	-	-	-	231	214
Observer	175	150	1,043	964	-	-	-	-	-	-	63	58
Ground Vehicle[1]												
Driver	275	250	1,664	1,514	834	765	3,334	3,030	111	102	50	45
Mixer-loader	50	50	321	293	159	147	642	592	21	20	10	9
Driver-mixer-loader	50	50	271	250	147	123	538	496	18	17	8	7
Ground hand[1]												
Mixer-loader-applicator	125	100	693	643	348	321	1,388	1,282	46	43	20	19

[1]MOS = NOEL from Table N-7 divided by exposure dose from Table N-5.

Table N-9A Margins of Safety for Chronic Effects Based on Doses to the Public in the Vicinity of Aerial and Ground Application Projects

	Adult		Adolescent		Infant	
	Minor Mix Errors	Major Mix Errors	Minor Mix Errors	Major Mix Errors	Minor Mix Errors	Major Mix Errors
2,4-D						
Dermal (drift)						
500 feet	8,333	7,692	6,667	6,250	3,571	3,333
1/4 mile	25,000	23,256	19,231	17,857	10,417	10,000
1/2 mile	62,500	55,556	47,619	43,478	25,641	23,810
Oral Ingestion [1]						
Water	233	213	455	417	909	833
Meat	769	714	714	667	667	588
Berries	1,020	909	1,124	1,031	909	833
Picloram						
Dermal (drift)						
500 feet	1,842,105	1,707,317	1,428,571	1,346,154	777,778	729,167
1/4 mile	5,384,615	5,000,000	4,666,667	4,119,647	2,333,383	2,187,500
1/2 mile	38,888,889	14,000,000	11,666,667	10,000,000	6,363,636	5,833,333
Oral Ingestion [1]						
Water	4,667	4,667	9,333	8,750	18,421	17,500
Meat	16,279	14,894	15,550	14,000	14,000	12,963
Berries	21,212	20,000	23,333	21,875	194,444	184,211
2,4-D/Picloram						
Dermal (drift)						
500 feet	166,667	62,500	51,948	104,878	2,667	2,500
1/4 mile	20,000	18,182	14,296	13,333	176,923	71,486
1/2 mile	434,478	500,000	18,182	33,333	18,182	61,667
Oral Ingestion [1]						
Water	1,818	1,667	3,636	3,333	7,272	6,557
Meat	7,143	6,897	5,970	5,333	5,333	5,128
Berries	8,000	7,547	8,889	8,333	7,407	7,018
Glyphosate						
Dermal (drift)						
500 feet	250,000	230,769	200,000	187,500	107,143	100,000
1/4 mile	750,000	697,674	576,923	535,714	312,500	300,000
1/2 mile	1,875,000	1,666,667	1,428,571	1,304,348	769,230	714,286
Oral Ingestion [1]						
Water	6,977	6,383	13,636	12,500	27,273	25,000
Meat [2]	23,077	21,429	21,429	20,000	20,000	17,647
Berries [3]	30,612	27,273	33,708	30,928	27,273	25,000
Dicamba						
Dermal (drift)						
500 feet	104,167	96,154	83,333	78,125	69,444	41,667
1/4 mile	312,500	290,698	250,000	250,000	131,579	125,000
1/2 mile	781,250	694,444	1,595,238	543,478	641,026	595,238
Oral Ingestion [1]						
Water	2,907	2,660	5,682	5,208	11,364	10,417
Meat	15,625	8,929	8,929	8,333	8,333	7,353
Berries	13,158	11,364	13,889	13,158	11,364	10,417

[1]MOS = NOEL from Table N-7 divided by exposure dose from Table N-6
[2]Based on deposition rates 500 feet downwind of treated area
[3]Based on deposition rates 100 feet downwind of treated area

Table N-9B Estimated Margins of Safety for Reproductive Effects Based on Doses to the Public in the Vicinity of Aerial and Ground Applications Projects

	Adult		Adolescent		Infant	
	Minor Mix Errors	Major Mix Errors	Minor Mix Errors	Major Mix Errors	Minor Mix Errors	Major Mix Errors
2,4-D						
Dermal (drift)						
500 feet	208,333	192,308	166,667	156,250	89,286	83,333
1/4 mile	626,000	581,395	480,769	446,429	26,042,517	250,000
1/2 mile	1,562,500	1,388,889	1,190,476	1,086,956	641,025	595,238
Oral Ingestion [1]						
Water	5,814	5,319	11,363	10,417	22,727	20,833
Meat	19,231	17,857	17,857	16,667	16,667	14,706
Berries	25,510	22,727	28,090	25,773	22,727	20,833
Picloram						
Dermal (drift)						
500 feet	13,157,895	12,195,122	10,204,082	9,615,385	5,555,556	5,208,333
1/4 mile	38,461,538	35,714,286	33,333,333	29,411,765	16,666,667	15,625,000
1/2 mile	277,777,777	100,000,000	83,333,333	71,428,571	4,554,545	41,666,667
Oral Ingestion [1]						
Water	33,333	33,333	66,667	62,500	131,579	124,500
Meat	116,279	106,383	11,111	100,000	100,000	92,593
Berries	151,515	142,857	116,667	156,250	1,388,889	131,579
2,4-D/Picloram						
Dermal (drift)						
500 feet	625,000	585,938	487,013	457,317	250,000	234,375
1/4 mile	1,875,000	1,704,545	1,339,285	1,250,000	721,154	669,643
1/2 mile	4,076,087	4,687,500	1,704,545	3,125,000	1,704,545	1,562,500
Oral Ingestion [1]						
Water	17,045	15,625	34,091	31,250	68,182	61,475
Meat	66,964	64,655	55,970	50,000	50,000	48,077
Berries	75,000	70,755	83,333	78,125	69,444	65,789
Glyphosate						
Dermal (drift)						
500 feet	83,333	76,923	66,667	62,500	35,714	33,333
1/4 mile	250,000	232,558	192,308	178,571	104,167	100,000
1/2 mile	625,000	555,556	476,190	434,783	256,410	238,095
Oral Ingestion [1]						
Water	2,326	2,128	4,545	4,167	9,091	8,333
Meat	7,692	7,143	7,143	6,667	6,667	5,882
Berries	10,204	9,091	11,236	10,309	9,091	8,333
Dicamba						
Dermal (drift)						
500 feet	125,000	11,538	10,000	9,375	8,333	5,000
1/4 mile	37,500	34,884	30,000	30,000	15,789	15,000
1/2 mile	193,750	83,333	71,429	65,217	76,923	71,429
Oral Ingestion [1]						
Water	349	319	682	725	1,364	1,250
Meat	1,875	1,071	1,071	1,000	1,000	882
Berries	1,579	1,364	1,667	1,579	1,364	1,250

[1] Based on deposition rates 500 feet downwind of treated area. MOS = NOEL from Table N-7 divided by exposure dose from Table N-6.

Table N-10 Extraordinary Dose Margins of Safety[1] from Selected Exposures

	Dermal and Oral Exposure[2] (Public)	Dermal Exposure Aerial Spray[3] (Public)	Ground Hand Applicator With Oral Exposure[4] (Occupational)
2,4-D			
Adult	118	10	4
Picloram			
Adult	2,741	10,000	87
2,4-D in Mix			
Adult	354	30	12
Picloram in Mix			
Adult	5,482	20,000	174
Glyphosate			
Adult	1,176	83	41
Dicamba			
Adult	150	100	18

[1]MOS=lowest NOEL/exposure dose.
[2]Dermal exposures at 500 feet from application. Oral exposure is ingestion of berries, water, and meat.
[3]Assumes person receives full per-acre application rate.
[4]Assumes major mixing errors.

Again, the low MOS's for ground applications of 2,4-D indicate the risk of toxic effects if these doses are sustained. The risk would be reduced if workers wear protective clothing.

Incidence Levels of Cancer for Affected Populations from Differing Doses and Durations of Exposure

It is possible to calculate statistical upper limits on the carcinogenic potential of 2,4-D, utilizing multiple dosage data from Hansen and others (1971). The one-hit model was fit separately to male and female rat oncogenic data on total animals with tumors using the computer program GLOBAL82 (Howe and Crump 1982). The 2,4-D data on females gave the highest measure of cancer potency (the upper limit on the linear term in the one-hit model of cancer) based on 95 percent probability of occurrence. This upper limit was 3.01×10^{-4} ppm of 5.03×10^{-3} $(mg/kg/day)^{-1}$. Likewise, liver tumor data from picloram studies (National Cancer Institute 1978) were applied and the calculated upper limit for picloram is 3.40×10^{-5} ppm or 5.68×10^{-4} $(mg/kg/day)^{-1}$. This value is approximately one-tenth of the 2,4-D value. The value used for cancer potency of glyphosate is $2.4 \times 10^{-5,}$ which was derived from the most recent mouse study.

With these cancer potency estimates, the probability of cancer over a life time as a result of differing lengths of exposure was determined using the following equation: $Pc = q^* \times D \times (De/L)$, where;

Pc = estimate of the probability of cancer

q^* = the upper limit of carcinogenic potency (ie., 2,4-D = 5.03×10^{-3}, picloram = 5.68×10^{-4}, and glyphosate = 2.4×10^{-5})

D = daily dose in mg/kg/day

De = number of days during which the daily dose occurs

L = number of days in a lifetime (25,550) for 70 years

Table N-11 Probability of Carcinogenic Effects from Extraordinary Dosages to Workers Exposed for a Single Season

	Occupational Exposure									
	2,4-D		Picloram		2,4-D in Mix		Picloram in Mix		Glyphosate	
	Minor Mix Errors	Major Mix Errors	Minor Mix Errors	Major Mix Errors	Minor Mix Errors	Major Mix Errors	Minor Mix Errors	Major Mix Errors	Minor Mix Errors	Major Mix Errors
Aerial										
Pilot	8.5×10^{-8}	9.2×10^{-8}	4.8×10^{-9}	5.2×10^{-9}	—	—	—	—	—	—
Mixer-loader	3.7×10^{-7}	4.0×10^{-7}	2.1×10^{-8}	2.3×10^{-8}	—	—	—	—	—	—
Supervisor	3.1×10^{-8}	3.4×10^{-8}	1.7×10^{-9}	1.9×10^{-9}	—	—	—	—	—	—
Observer	1.1×10^{-7}	1.2×10^{-7}	6.4×10^{-9}	6.9×10^{-9}	—	—	—	—	—	—
Ground Vehicle										
Driver	7.8×10^{-7}	8.5×10^{-7}	1.3×10^{-8}	1.4×10^{-8}	2.6×10^{-7}	2.8×10^{-7}	6.5×10^{-9}	7.0×10^{-9}	8.5×10^{-11}	9.2×10^{-11}
Mixer-loader	4.1×10^{-6}	4.4×10^{-6}	6.8×10^{-8}	7.3×10^{-8}	1.4×10^{-6}	1.5×10^{-6}	3.4×10^{-8}	3.7×10^{-8}	4.4×10^{-10}	4.8×10^{-10}
Driver-mixer-loader	4.8×10^{-6}	5.2×10^{-6}	8.1×10^{-8}	8.8×10^{-8}	1.6×10^{-6}	1.7×10^{-6}	4.1×10^{-8}	4.4×10^{-8}	5.2×10^{-10}	5.7×10^{-10}
Ground Hand										
Mixer-loader-applicator	3.6×10^{-7}	3.9×10^{-7}	1.0×10^{-8}	1.1×10^{-8}	1.2×10^{-7}	1.3×10^{-7}	5.0×10^{-9}	5.1×10^{-9}	2.0×10^{-10}	2.2×10^{-10}

Using the equation, the incremental chance of contracting cancer in a lifetime from each exposure pathway was calculated on the affected populations by varying the daily exposure dose and the number of days of dosing as appropriate for each scenario. The incidence levels are stated as mathematical probabilities.

Cancer probabilities for workers exposed during 1 year on the job are presented in Table N-11. This table shows that the lifetime chance of cancer occurring in a pilot spraying 2,4-D with major mixing errors would be 9.2 $\times 10^{-8}$. This probabily of cancer incidence was derived from: Pc = 5.03 $\times 10^{-3}$ upper limit of carcinogenic potency x .117 mg/kg daily dose from Table N-5 x (4 days exposure from Table N-1/25,550 days in a lifetime).

Cancer probabilities for individuals of the public exposed to 1 day of spraying are presented in Table N-12. Cancer probabilities for workers exposed over multiple years on the job are presented in Table N-13. In determining the number of exposure days, it was assumed that a worker stayed on the job performing the same type of project annually for 40 years.

Cancer probabilities for multiple public exposures (20 days) are presented in Table N-14. In determining the number of exposure days, it was assumed that a residence would receive drift from each side of a dwelling annually for 5 years (4 exposures annually for 5 years), resulting in 20 total exposure days to dermal exposure and also to ingestion of berries, water, and meat.

The cancer incidence levels posited exponentially may be difficult to understand. From the example above, the chance of a pilot spraying 2,4-D contacting cancer is 9.2 x 10^{-8}. This figure means that 9.2 pilots out of 100 million spraying 2,4-D for an annual program could contact cancer due to occupational exposure to 2,4-D. Similarly, 3.7 pilots out of one million spraying 2,4-D for 40 years could contact cancer.

Comparisons of Cancer Risks to Death From Involuntary Occurrence of Every Day Events

To put the probabilities of getting cancer into prospective, Tables N-15 and N-16 relate them to probabilities of death from everyday events. These comparisons are not made to determine what is acceptable but to relate the small exponential numbers in Tables N-11 through N-14 to events that lay persons can understand. Risks are related to voluntary and unavoidable occurrences because worker exposure is assumed to be voluntary whereas public exposure is not.

Table N-15 displays the probabilities of cancer occurring in members of the public from maximum exposure to 2,4-D, picloram, and glyphosate related to risks of natural, involuntary occurences. For example, the probability of an individual contacting cancer from a 5-year oral exposure to 2,4-D would be 4.3 chances in 1 billion (4.3 x 10^{-9}). The probability of contacting leukemia from eating 1 egg per day for the same period of time is much higher at 50 chances in 1 billion (50 x 10^{-9}). Similarly, there is a greater chance of being killed by meteorite (6 chances in 100 billion) than of getting cancer from 5-year drift exposure to picloram (1.8 chances in 1 trillion).

Table N-16 shows comparisons of selected voluntary exposures to workers and the occurrence of common events. For example, the cancer probability of a maximum exposed ground application crewmember working for 40 years with 2,4-D is 3.4 chances in 100,000 (3.4 x 10^{-5}). The chance of the same individual dying as a result of being run over by a vehicle is essentially the same at 5 chances in 100,000 (5.0 x 10^{-5}). Similarly, a maximum exposed pilot has a greater chance of being killed by firearms (2 chances in 1 million) than of getting cancer from working with picloram for 40 years (2.1 chances in 10 million).

Likelihood of the Worst-Case Occurring

This analysis has overstated the possible effects throughout in estimating the extent of occupational and public exposure to 2,4-D and picloram as proposed under the Proposed Action. The analysis has overstated actual practices and conditions, assumed that simultaneous occurrence of these values would happen, and furthermore has used the one-hit theory of carcinogencity. The situations presented for public exposures are hypothetical and are highly unlikely to occur in actual practice. The margins of safety based on NOEL's, are extremely high for public exposure. Even with built-in conservatism, the doses and resulting cancer probabilities would be extremely rare events. Comparisons to cancer-causing potential of commonplace events based on actual statistics emphasize this fact.

Accidental Spill Scenarios

In the event of an accident, workers or members of the general public could be exposed to much greater amounts of herbicide than they would under routine operational conditions. Accident scenarios were used to estimate the extreme doses that would result from these exposures. The scenarios are not intended to show what necessarily will happen as a result of a given treatment operation, but what could happen when all of the conditions specified in the scenario are met in the actual operation. For example, worker doses are based on dose levels found in field exposure studies in which no protective clothing or equipment was worn. Doses would be significantly lower than those estimated here since workers are required to wear protective clothing and equipment during actual operations. There is no question that workers would be present and would be subjected to some level of exposure in treatment operations.

The two scenarios used in this analysis are:

Scenario No. 1--Workers spilling concentrate or prepared spray mixture on their skin during mixing, loading, or backpack spraying operations; or being doused when a transfer hose breaks.

Table N-12 Lifetime Cancer Risk for the Public for a Single Lifetime Exposure

	Adult (70 Kg)		Adolescent (40 Kg)		Infant (10 Kg)	
	Minor Mixing Errors	Major Mixing Errors	Minor Mixing Errors	Major Mixing Errors	Minor Mixing Errors	Major Mixing Errors
2,4-D						
Dermal (drift)						
500 feet	2.3×10^{-11}	2.5×10^{-11}	3.0×10^{-11}	3.2×10^{-11}	6.4×10^{-11}	6.9×10^{-11}
1/4 mile	7.2×10^{-12}	7.8×10^{-12}	9.4×10^{-12}	1.0×10^{-11}	2.0×10^{-11}	2.2×10^{-11}
1/2 mile	3.0×10^{-12}	3.2×10^{-12}	3.9×10^{-12}	4.2×10^{-12}	8.3×10^{-12}	9.0×10^{-12}
Oral Ingestion						
Water	6.1×10^{-10}	6.6×10^{-10}	5.3×10^{-10}	5.8×10^{-10}	2.1×10^{-9}	2.3×10^{-9}
Meat	2.3×10^{-10}	2.5×10^{-10}	2.4×10^{-10}	2.6×10^{-10}	3.2×10^{-10}	3.5×10^{-10}
Berries	6.3×10^{-11}	6.9×10^{-11}	5.8×10^{-11}	6.2×10^{-11}	8.9×10^{-11}	9.6×10^{-11}
Picloram						
Dermal (drift)						
500 feet	8.6×10^{-14}	9.3×10^{-14}	1.1×10^{-13}	1.2×10^{-13}	2.4×10^{-13}	2.6×10^{-13}
1/4 mile	2.7×10^{-14}	2.9×10^{-14}	3.5×10^{-14}	3.8×10^{-14}	7.6×10^{-14}	8.2×10^{-14}
1/2 mile	1.1×10^{-14}	1.2×10^{-14}	1.5×10^{-14}	1.6×10^{-14}	3.1×10^{-14}	3.4×10^{-14}
Oral Ingestion						
Water	2.3×10^{-11}	2.5×10^{-11}	2.0×10^{-11}	2.2×10^{-11}	8.0×10^{-11}	8.7×10^{-11}
Meat	8.6×10^{-12}	9.3×10^{-12}	9.0×10^{-12}	9.7×10^{-12}	1.2×10^{-11}	1.3×10^{-11}
Berries	2.4×10^{-12}	2.6×10^{-12}	2.2×10^{-12}	2.4×10^{-12}	3.3×10^{-12}	3.6×10^{-12}
2,4-D in Mixture						
Dermal (drift)						
500 feet	7.6×10^{-12}	8.2×10^{-12}	10.0×10^{-12}	1.1×10^{-11}	2.1×10^{-11}	2.3×10^{-11}
1/4 mile	2.4×10^{-12}	2.6×10^{-12}	3.1×10^{-12}	3.4×10^{-12}	6.7×10^{-12}	7.2×10^{-12}
1/2 mile	9.8×10^{-13}	1.1×10^{-12}	1.3×10^{-12}	1.4×10^{-12}	2.8×10^{-12}	3.0×10^{-12}
Oral Ingestion						
Water	2.0×10^{-10}	2.2×10^{-10}	1.8×10^{-10}	1.9×10^{-10}	7.1×10^{-10}	7.7×10^{-10}
Meat	7.6×10^{-11}	8.2×10^{-11}	8.0×10^{-11}	8.6×10^{-11}	1.1×10^{-10}	1.2×10^{-10}
Berries	2.1×10^{-11}	2.3×10^{-11}	1.9×10^{-11}	2.1×10^{-11}	3.0×10^{-11}	3.2×10^{-11}
Picloram in Mix						
Dermal (drift)						
500 feet	4.3×10^{-14}	4.6×10^{-14}	5.6×10^{-14}	6.1×10^{-14}	1.2×10^{-13}	1.3×10^{-13}
1/4 mile	1.4×10^{-14}	1.5×10^{-14}	1.8×10^{-14}	1.9×10^{-14}	3.8×10^{-14}	4.1×10^{-14}
1/2 mile	5.6×10^{-15}	6.0×10^{-15}	7.3×10^{-15}	7.9×10^{-15}	1.6×10^{-14}	1.7×10^{-14}
Oral Ingestion						
Water	1.1×10^{-11}	1.2×10^{-11}	10.0×10^{-12}	1.1×10^{-11}	4.0×10^{-11}	4.3×10^{-11}
Meat	4.3×10^{-12}	4.6×10^{-12}	4.5×10^{-12}	4.9×10^{-12}	6.0×10^{-12}	6.5×10^{-12}
Berries	1.2×10^{-12}	1.3×10^{-12}	1.1×10^{-12}	1.2×10^{-12}	1.7×10^{-12}	1.8×10^{-12}
Glyphosate						
Dermal (drift)						
500 feet	1.1×10^{-13}	1.2×10^{-13}	1.4×10^{-13}	1.5×10^{-13}	3.0×10^{-13}	3.3×10^{-13}
1/4 mile	3.4×10^{-14}	3.7×10^{-14}	4.5×10^{-14}	4.9×10^{-14}	9.6×10^{-14}	1.0×10^{-13}
1/2 mile	1.4×10^{-14}	1.5×10^{-14}	1.9×10^{-14}	2.0×10^{-14}	3.9×10^{-14}	4.3×10^{-14}
Oral Ingestion						
Water	2.9×10^{-12}	3.1×10^{-12}	2.5×10^{-12}	2.7×10^{-12}	1.0×10^{-11}	1.1×10^{-11}
Meat	1.1×10^{-12}	1.2×10^{-12}	1.1×10^{-12}	1.2×10^{-12}	1.5×10^{-12}	1.7×10^{-12}
Berries	3.0×10^{-13}	3.3×10^{-13}	2.7×10^{-13}	3.0×10^{-13}	4.2×10^{-13}	4.6×10^{-13}

Table N-13 Probability of Carcinogenic Effects from Extraordinary Dosages to Workers Exposed for a 40-year Working Lifetime

	Occupational Exposure									
	2,4-D		Picloram		2,4-D in Mix		Picloram in Mix		Glyphosate	
	Minor Mix Errors	Major Mix Errors	Minor Mix Errors	Major Mix Errors	Minor Mix Errors	Major Mix Errors	Minor Mix Errors	Major Mix Errors	Minor Mix Errors	Major Mix Errors
Aerial										
Pilot	3.4×10^{-6}	3.7×10^{-6}	1.9×10^{-7}	2.1×10^{-7}	—	—	—	—	—	—
Mixer-loader	1.5×10^{-5}	1.6×10^{-5}	8.3×10^{-7}	9.0×10^{-7}	—	—	—	—	—	—
Supervisor	1.3×10^{-6}	1.4×10^{-6}	6.9×10^{-8}	7.5×10^{-8}	—	—	—	—	—	—
Observer	4.5×10^{-6}	4.9×10^{-6}	2.6×10^{-7}	2.8×10^{-7}	—	—	—	—	—	—
Ground Vehicle										
Driver	3.1×10^{-5}	3.4×10^{-5}	5.2×10^{-7}	5.7×10^{-7}	1.0×10^{-5}	1.1×10^{-5}	2.6×10^{-7}	2.8×10^{-7}	3.4×10^{-9}	3.7×10^{-9}
Mixer-loader	1.6×10^{-4}	1.8×10^{-4}	2.7×10^{-6}	2.9×10^{-6}	5.0×10^{-5}	6.0×10^{-5}	1.4×10^{-6}	1.5×10^{-6}	1.8×10^{-8}	1.9×10^{-8}
Driver-mixer-loader	1.9×10^{-4}	2.1×10^{-4}	3.2×10^{-6}	3.5×10^{-6}	6.0×10^{-5}	7.0×10^{-5}	1.6×10^{-6}	1.8×10^{-6}	2.1×10^{-8}	2.3×10^{-8}
Ground Hand										
Mixer-loader-applicator	1.4×10^{-5}	1.6×10^{-5}	4.2×10^{-7}	4.5×10^{-7}	4.7×10^{-6}	5.3×10^{-6}	2.1×10^{-7}	2.2×10^{-7}	8.1×10^{-9}	8.8×10^{-9}

A person's dermally absorbed dose would depend on the concentration of herbicide in the spray mix, the area of exposed skin, the extent to which the person's clothing absorbed herbicide (that would either dry in place or penetrate to the skin), and the length of time between accidental exposure and the person's washing up. Indirect dermal exposure could occur when workers or members of the general public brush up against wet vegetation in the sprayed site, but this exposure would be less than that of the applicator drenched when a hose breaks. As a conservative approach, indirect dermal exposure will be considered the same as direct dermal exposure.

Scenario No. 2--Members of the public could be exposed from a herbicide load being jettisoned or from a container of herbicide mixture being ruptured and spilled into a drinking water supply. For example, a helicopter could jettison its load of herbicide for safety reasons (to maintain aircraft stability) or accidentally through pilot error.

Such a spill would, in most instances, result in localized damaged to the environment, causing a small area of plant kill, but with no toxic effects to humans. However, in the extremely unlikely event that a person was standing where the jettisoned load fell, there could be toxic effects, depending on the inherent toxicity of the herbicide and the concentration of herbicide in the spray mix, in addition to the effects of the physical impact of such a dump of liquid on the person.

All doses estimated in this accidental exposure analysis were calculated for a representative 50-kg person. This weight was chosen to represent an adult of less than average weight, so that doses to adults would be calculated in a conservative manner. (Doses for a larger person would be less in terms of mg per kg of body weight.)

Herbicides are packaged and sold by the manufacturer in liquid form as a concentrate with a specified number of pounds of active ingredient, usually between 1 and 4 pounds per gallon of concentrate.

A 1,000-gallon tank on a truck for ground vehicle application is used for analysis; this exceeds the maximum size normally used in the noxious weed control program. Also, the impact of a helicopter crash into a reservoir is calculated assuming a 70-gallon tank which is the normal size tank for a small agricultural helicopter ordinarily involved in this type program.

The maximum herbicide concentrations in helicopters and batch trucks are summarized in Table N-17.

Before herbicides are applied they would be mixed with water (the carrier), according to the manufacturer's label instructions for the particular treatment purpose and the desired application rate in pounds of active ingredient per acre. The concentrate is normally mixed with 5 to 15 gallons of water for every acre to be treated in aerial applications and with 50 to 100 gallons of water for every acre to be treated in ground applications. To obtain the highest concentration in doses, the lowest figures in gallons per acre is used. Herbicide stored in 30- to 55-gallon drums as concentrate is prepared for application and transferred to application equipment by a mixer-loader who uses a batch truck that has separate storage tanks for the carrier and for the herbicide mixture.

Table N-14 Lifetime Cancer Risk for the Public for 20 Lifetime Exposures

	Adult (70 Kg)		Adolescent (40 Kg)		Infant (10 Kg)	
	Minor Mixing Errors	Major Mixing Errors	Minor Mixing Errors	Major Mixing Errors	Minor Mixing Errors	Major Mixing Errors
2,4-D						
Dermal (drift)						
500 feet	4.6×10^{-10}	4.9×10^{-10}	6.0×10^{-10}	6.5×10^{-10}	1.3×10^{-9}	1.4×10^{-9}
1/4 mile	1.4×10^{-10}	1.6×10^{-10}	1.9×10^{-10}	2.0×10^{-10}	4.0×10^{-10}	4.4×10^{-10}
1/2 mile	5.9×10^{-11}	6.4×10^{-11}	7.7×10^{-11}	8.4×10^{-11}	1.7×10^{-10}	1.8×10^{-10}
Oral Ingestion						
Water	1.2×10^{-8}	1.3×10^{-8}	1.1×10^{-8}	1.2×10^{-8}	4.3×10^{-8}	4.6×10^{-8}
Meat	4.6×10^{-9}	4.9×10^{-9}	4.8×10^{-9}	5.2×10^{-9}	6.4×10^{-9}	6.9×10^{-9}
Berries	1.3×10^{-9}	1.4×10^{-9}	1.2×10^{-9}	1.3×10^{-9}	1.8×10^{-9}	1.9×10^{-9}
Picloram						
Dermal (drift)						
500 feet	1.7×10^{-12}	1.9×10^{-12}	2.3×10^{-12}	2.4×10^{-12}	4.8×10^{-12}	5.2×10^{-12}
1/4 mile	5.4×10^{-13}	5.8×10^{-13}	7.1×10^{-13}	7.7×10^{-13}	1.5×10^{-12}	1.6×10^{-12}
1/2 mile	2.2×10^{-13}	2.4×10^{-13}	2.9×10^{-13}	3.2×10^{-13}	6.2×10^{-13}	6.7×10^{-13}
Oral Ingestion						
Water	4.6×10^{-10}	5.0×10^{-10}	4.0×10^{-10}	4.3×10^{-10}	1.6×10^{-9}	1.7×10^{-9}
Meat	1.7×10^{-10}	1.9×10^{-10}	1.8×10^{-10}	2.0×10^{-10}	2.4×10^{-10}	2.6×10^{-10}
Berries	4.8×10^{-11}	5.2×10^{-11}	4.3×10^{-11}	4.7×10^{-11}	6.7×10^{-11}	7.2×10^{-11}
2,4-D in Mixture						
Dermal (drift)						
500 feet	1.5×10^{-10}	1.6×10^{-10}	2.0×10^{-10}	2.2×10^{-10}	4.3×10^{-10}	4.6×10^{-10}
1/4 mile	4.8×10^{-11}	5.2×10^{-11}	6.3×10^{-11}	6.8×10^{-11}	1.3×10^{-10}	1.5×10^{-10}
1/2 mile	2.0×10^{-11}	2.1×10^{-11}	2.6×10^{-11}	2.8×10^{-11}	5.5×10^{-11}	6.0×10^{-11}
Oral Ingestion						
Water	4.1×10^{-9}	4.4×10^{-9}	3.5×10^{-9}	3.8×10^{-9}	1.4×10^{-8}	1.5×10^{-8}
Meat	1.5×10^{-9}	1.6×10^{-9}	1.6×10^{-9}	1.7×10^{-9}	2.1×10^{-9}	2.3×10^{-9}
Berries	4.2×10^{-10}	4.6×10^{-10}	3.8×10^{-10}	4.2×10^{-10}	5.9×10^{-10}	6.4×10^{-10}
Picloram in Mixture						
Dermal (drift)						
500 feet	8.6×10^{-13}	9.3×10^{-13}	1.1×10^{-12}	1.2×10^{-12}	2.4×10^{-12}	2.6×10^{-12}
1/4 mile	2.7×10^{-13}	2.9×10^{-13}	3.5×10^{-13}	3.8×10^{-13}	7.6×10^{-13}	8.2×10^{-13}
1/2 mile	1.1×10^{-13}	1.2×10^{-13}	1.5×10^{-13}	1.6×10^{-13}	3.1×10^{-13}	3.4×10^{-13}
Oral Ingestion						
Water	2.3×10^{-10}	2.5×10^{-10}	2.0×10^{-10}	2.2×10^{-10}	8.0×10^{-10}	8.7×10^{-10}
Meat	8.6×10^{-11}	9.3×10^{-11}	9.0×10^{-11}	9.7×10^{-11}	1.2×10^{-10}	1.3×10^{-10}
Berries	2.4×10^{-11}	2.6×10^{-11}	2.2×10^{-11}	2.4×10^{-11}	3.3×10^{-11}	3.6×10^{-11}
Glyphosate						
Dermal (drift)						
500 feet	2.2×10^{-12}	2.4×10^{-12}	2.9×10^{-12}	3.1×10^{-12}	6.1×10^{-12}	6.6×10^{-12}
1/4 mile	6.8×10^{-13}	7.4×10^{-13}	9.0×10^{-13}	9.7×10^{-13}	1.9×10^{-12}	2.1×10^{-12}
1/2 mile	2.8×10^{-13}	3.1×10^{-13}	3.7×10^{-13}	4.0×10^{-13}	7.9×10^{-13}	8.5×10^{-13}
Oral Ingestion						
Water	5.8×10^{-11}	6.3×10^{-11}	5.1×10^{-11}	5.5×10^{-11}	2.0×10^{-10}	2.2×10^{-10}
Meat	2.2×10^{-11}	2.4×10^{-11}	2.3×10^{-11}	2.5×10^{-11}	3.0×10^{-11}	3.3×10^{-11}
Berries	6.0×10^{-12}	6.5×10^{-12}	5.5×10^{-12}	6.0×10^{-12}	8.5×10^{-12}	9.2×10^{-12}

Table N-15 Selected High Probabilities of Cancer in the Adult Population from Involuntary Occurrences Compared to Hazards from Rare Occurrences

Occurrences	Involuntary Probability	Probability from Major Error/5-year Exposure	
		2,4-D	
-Death from living in a brick house (radon)	40×10^{-9}	5.1×10^{-10}	Drift
-Leukemia from eating 1 egg/day (Benzene)	50×10^{-9}	4.3×10^{-9}	Oral
		Picloram	
-Probability of death from being killed by a meterorite (none yet recorded)	6×10^{-11}	1.8×10^{-12} 1.6×10^{-10}	Drift Oral
		Glyphosate	
-Death from lightning strike	1×10^{-7}	8.8×10^{-11}	Oral

Sources: Goldman (1984) and Crouch and Wilson (1982).

Table N-16 Selected High Probabilities of Adult Cancer in Workers Compared to Probabilities of Death from Everyday Occurrences

Everyday Activities Resulting in Mortality	Probability of Occurrence	Voluntary Applicator Probability Major Error - 40 Year Exposure
		2,4-D
-Drinking water in New York City or Miami	1.3×10^{-6}	
-Falls in public places	1.9×10^{-6}	Aerial 1.6×10^{-5}
-Electrocution	5.3×10^{-6}	
-Fires in Home	2.1×10^{-6}	Ground 3.4×10^{-5}
-Run over by a Vehicle	5.0×10^{-5}	
		Picloram
-Eating a half pound broiled steak per week	3.0×10^{-7}	
-Firearms (accidental)	2.0×10^{-6}	Aerial 2.1×10^{-7}
-Bladder cancer from sacchrin (1 soft drink/day)	1.7×10^{-6}	Ground 2.9×10^{-6}
		Glyphosate
-Drinking 1 pt. milk/day	2.0×10^{-6}	Ground 1.8×10^{-8}

Sources: Crouch and Wilson (1982) and Goldman (1984).

Table N-17 Maximum Herbicide Concentrations in Helicopters and Batch Trucks

Chemical	Pounds [1] Applied PerAcre	Pounds [1] Per Gallon of Concentrate	Pounds [1] Per 70 Gal Helicopter	Pounds [1] 1000 Gallon Ground Vehicle
2,4-D	3	4	42	60
Picloram	1	2	14	20
Glyphosate [2]	3	3	-	60
Dicamba	1-6	4	14	120

[1]Pounds of active ingredient (a.i.)
[2]Not proposed for aerial

Direct dermal exposures were calculated for spills of 0.5 liter of herbicide concentrate (if liquid concentrates are used) or 0.5 liter of the most concentrated spray mixture. It was assumed that the person exposed during the spill weighs 50 kg and most of their surface area (0.8 m^2 or 8.6 ft^2) is thoroughly wetted by the solution. Denim fabric commonly used in clothing retains about 57.5 ml of solution per square foot (Weeks 1985). However, to be conservative it was assumed that 20 percent of the solution would wet bare skin. A spill resulting in this much exposure could result from broken hoses, spilled containers, or emergency and accidental dumps by helicopters. It was also assumed that no additional washing occurred. The dermal penetration rates used in this study were 10 percent for 2,4-D, 1 percent for picloram, and 10 percent for glyphosate, as discussed earlier.

To analyze the impacts of major spills into ponds and reservoirs, the size of the water body must be assumed. Small ponds and reservoirs are used for a conservative approach since the herbicide concentration would be greater than in a larger water body. The pond is assumed to be 1 acre in size by 4 feet deep which converts to approximately 1,306,000 gallons total. The reservoir is assumed to be 30 acres with an average depth of 10 feet. Total mixing of the spill in the waters and that someone would drink 1 liter before being alerted to the spill, are assumed. The herbicide is also assumed to remain at full strength, not allowing for chemical degradation or absorption by either sediment or organic matter in the water.

An individual could receive an accidental ingestion exposure by drinking water contaminated by a jettison of 70 gallons of herbicide mix as from a helicopter, or 1,000 gallons of herbicide mix spilled from a batch truck accident.

Doses from accidental spills, both dermal and via drinking water, are presented in Table N-18. By far, the highest doses would be received by a worker spilling a sufficient amount of herbicide concentrate on the skin.

Table N-18 Workers and Public Doses from Exposure to Herbicide Spills

	Exposures Per Lifetime	Herbicide Dose in mg/kg			
		2,4-D	Picloram	Glyphosate	Dicamba
Spills onto Skin (0.5 liter)					
Concentrate	1	94	4.8	72	94
Spray Mix (Aerial)	1	14	0.48	--	28
Spray Mix (Ground)	1	1.4	0.04	1.4	2.8
Spills into Water (1 liter consumed)					
Pond, Helo	1	0.076	0.025	--	0.025
Reservoir, Helo	1	0.001	0.00034	--	0.0003
Pond, Truck	1	0.11	0.036	0.11	0.22
Reservoir, Truck	1	0.0015	0.00048	0.0015	0.003

[1]Based on BLM's (not including Forest Service data) past ratio of such accidents to total acres treated, it is highly unlikely that any worker or member of the public would be exposed more than once in a lifetime to an accident as described in this section.
[2]Herbicide concentrate spills onto the skin should occur only to a worker.

Risks to Workers and the Public from Accidental Exposure

To qualify these risks of threshold effects, the doses estimated for exposed individuals are compared to laboratory derived no-observed-effect levels (NOEL's) determined in the most sensitive animal test species. For doses that are not likely to occur more than once (such as those received by workers spilling 0.5 liter of spray mix over their entire upper body), a dose estimate that exceeds the laboratory test animal NOEL does not necessarily lead to the conclusion that there would be chronic toxic effects because all NOEL's are based on (or take into account) long-term multiple exposures. As evidenced by the probabilities of chronic effects shown in Tables N-11 through N-14, the greater number of exposures resulting in doses leads to a higher probability of effects. An estimated dose that exceeds the test animal NOEL is compared to the herbicide's LD_{50} value that provides information on the risk of acute effects.

Tables N-19 through N-22 present the margin of safety values for worker and public accidental exposure to the herbicides 2,4-D, picloram, glyphosate, and dicamba.

Incidence Levels of Cancer for Accidental Exposure to Herbicide Spills

Cancer risks calculated for exposures to accidental herbicide spills are shown in Table N-23. The greatest risks among the three chemicals are for a spill of 2,4-D concentrate onto the skin. The greatest risks are for spills of herbicide concentrate directly onto clothing and skin. Workers are at the greatest risk for this type of accident. The tabled values assume that at least 20 percent of a person's skin has been contacted by the solution and cleanup does not occur for several hours. This is certainly contrary to standard practice. A concentrate spill of 2,4-D onto a person gives a cancer risk of about 2 in 100,000 such incidents, and a spill of spray mixture (aerial) gives a risk of about 3 in 1,000,000. A spill of picloram

Table N-19 Margins of Safety for Doses to Spills of 2,4-D

		Margin of Safety Relative to		
	Exposure (mg/kg/day)	Acute LD_{50} (375)	Systemic NOEL (1)	Reproductive NOEL (5)
Spills onto Skin (0.5 liter)				
Concentrate	94	4	-94	-19
Spray Mix (Aerial)	14	27	-14	2.8
Spray Mix (Ground)	1.4	268	-1.4	3.6
Spills into Water (1 liter consumed)				
Pond, Helo	0.076	4,934	13	65.8
Reservoir, Helo	0.001	10,000+	1,000	5,000+
Pond, Truck	0.11	3,409	9	45.45
Reservoir, Truck	0.0015	10,000+	667	3,333+

Table N-20 Margins of Safety for Doses Due to Spills of Picloram

		Margin of Safety Relative to		
	Exposure (mg/kg/day)	Acute LD_{50} (8200)	Systemic NOEL (7)	Reproductive NOEL (50)
Spills onto Skin (0.5 liter)				
Concentrate	4.8	1,708	1.5	10
Spray Mix (Aerial)	0.48	10,000+	15	104
Spray Mix (Ground)	0.04	10,000+	175	1,250
Spills into Water (1 liter consumed)				
Pond, Helo.	0.025	10,000+	280	2,000
Reservoir, Helo	0.00034	10,000+	10,000+	10,000+
Pond, Truck	0.036	10,000+	194	1,389
Reservoir, Truck	0.00048	10,000+	10,000+	10,000+

Table N-21 Margins of Safety for Doses Due to Spills of Glyphosate [1]

	Exposure (mg/kg/day)	Margin of Safety Relative to Acute LD_{50} (4320)	Systemic NOEL (30)	Reproductive NOEL (10)
Spills onto Skin (0.5 liter)				
Concentrate	72	60	-2.4	-7.2
Spray Mix (Aerial)	--	--	--	--
Spray Mix (Ground)	1.4	3,086	21	7.1
Spills into Water (1 Liter Consumed)				
Pond, Helo	--	--	--	--
Reservoir, Helo	--	--	--	--
Pond, Truck	0.11	10,000+	273	91
Reservoir, Truck	0.0015	10,000+	10,000+	6,667

[1] The herbicide glyphosate is not proposed for aerial application.

Table N-22 Margins of Safety for Doses Due to Spills of Dicamba

	Exposure (mg/kg/day)	Margin of Safety Relative to Acute LD50 (757)	Systemic NOEL (25)	Reproductive NOEL (3)
Spills onto Skin (0.5 liter)				
Concentrate	94	8	-4	-31
Spray Mix (Aerial)	28	27	-1	-9
Spray Mix (Ground)	2.8	270	9	1
Spills into Water (1 liter consumed)				
Pond, Helo	0.025	10,000	1,000	120
Reservoir, Helo	0.0034	10,000	7,353	882
Pond, Truck	0.22	3,441	114	14
Reservoir, Truck	0.0030	10,000	8,333	1,000

concentrate gives a risk of about 1 in 10 million, and for picloram mixture (aerial) about 1 in 100 million. Cancer risks arising from major spills into drinking water supplies are significantly less. A 70-gallon helicopter load of 2,4-D spray mixture dumped into a pond would lead to a risk of cancer of less than 2 in 100 million for a spill of 1,000-gallon tank truck of spray mixture into a small pond.

Probability of Accidental Exposure

Herbicide spill accidents recorded by BLM and the Forest Service were classified by location, date, and quantity spilled. Also included was information specifying the occurrence of accidents on ground or in the air, and if the spill was near a waterway. Over an 11-year period from 1973 through 1983, there were 24 recorded spills averaging 44.4 gallons per accident. Herbicide use rates ranged from 1.5 lb. active ingredient (a.i.) to 7 lb. a.i. per acre for normal use rates. For a total of 302,085 acres sprayed during the 11-year period there was one accident for every 12,589 acres and 54 of the spills involved 30 gallons or less. Applying this past accident ratio to the proposed herbicide use level for noxious weed control, as many as 1.7 accidents (on the average) could occur per year (22,000 acres-13,000 acres).

Comparison of Cancer Risks with Other Common Risks

Comparison of cancer risks from accidental exposure (Table N-23) to familiar hazards and occupational risks listed in Table N-16 provides a good perspective of the risk. According to Crouch and Wilson (1982), motor vehicle accidents have a fatality risk that averages 2 in

10,000 persons each year. Over a person's 30-year period of vehicular travel the cumulative fatality risk is 6 in 1,000 from car accidents. A variety of hazards are listed in the table that have a fatality risk of about 1 in 1 million. These include smoking two cigarettes, eating 6 pounds of peanut butter, drinking 40 sodas sweetened with saccharin, or taking one transcontinental round trip by air. The cancer risk from having a single x-ray taken is 7 in 1 million people. Many occupational risks are greater. Working for 30 years in agriculture or construction has a fatality risk of about 2 in 100 and in mining and quarrying the risk is even greater, estimated to be 3 in 100.

Risk of Heritable Mutations

No epidemiologic studies are available that associate any of the herbicides with heritable mutations. Furthermore, no risk assessments that quantify the probability of mutations are available in the literature or from EPA. Laboratory studies constitute the best available information on mutagenic potential. Results of the mutagenicity assays conducted on the four herbicides are discussed in Appendix K.

For 2,4-D and picloram, there is some uncertainty about the potential to cause mutations. For these herbicides, a worst-case assumption is made that they have the potential to cause mutations in humans. Because mutagenicity and carcinogenicity both follow similar mechanistic steps (at least those that involve genetic toxicity), the risk of cancer can be used to approximate the quantitative risk of heritable mutations. The basis for this assumption is that both mutagens and at least primary carcinogens react with DNA to form a mutation or DNA lesion affecting a particular gene or set of genes. The genetic lesions then require specific metabolic processes to occur, or the cell must divide, to insert the lesion into the cell's genetic code. For these reasons, the quantitative risk of cancer provides a worst-case approximation to heritable mutations because cancer involves many types of cells, whereas heritable mutations involve only germinal (reproductive) cells.

Glyphosate and dicamba tested negative for mutagenicity in all assays conducted, and thus can be considered to pose no mutagenic risk.

For 2,4-D, there have been only a few studies performed and these have indicated both positive and negative mutagenic potential. EPA has requested more mutagenicity test information. A number of comprehensive reviews of the 2,4-D mutagenic data have indicated that it does not pose significant risk of human gene mutations (USDA, FS 1984). Based on a worst-case estimate, the risk of heritable mutations from 2,4-D and picloram would be no greater than the estimates of cancer risk shown in Tables N-11 through N-14.

Table N-23 Probability of Carcinogenic Effects from Exposure to Herbicide Spills for Workers and Public

	2,4-D	Picloram	Glyphosate [1]
Spills onto Skin (0.5 liter)			
Concentrate [2]	1.8×10^{-5}	1.1×10^{-7}	6.7×10^{-8}
Spray Mix (Aerial)	2.7×10^{-6}	1.1×10^{-8}	--
Spray Mix (Ground)	2.7×10^{-7}	9.0×10^{-10}	1.3×10^{-9}
Spills into Water (1 liter consumed)			
Pond, Helo	1.5×10^{-8}	6.0×10^{-10}	--
Reservoir, Helo	2.0×10^{-10}	7.5×10^{-12}	--
Pond, Truck	2.2×10^{-8}	8.0×10^{-10}	1.0×10^{-10}
Reservoir, Truck	3.0×10^{-10}	1.1×10^{-11}	1.4×10^{-12}

[1] Glyphosate is not proposed for aerial application.
[2] Herbicide concentrate spills onto the skin should occur only to a worker.

Text Revisions

This section includes revisions to the text of the final environmental impact statement (FEIS). The location cited in bold type before the revision shows where in the FEIS the text has been revised.

Add to page Iv, left column, after 1st (incomplete) paragraph:

Some nontarget plants would be harmed in the immediate treatment areas. Treatment areas would average 5-10 acres and would rarely exceed 100 acres. Less than 1 percent of the BLM-administered lands in the EIS area is proposed for chemical treatment, of which only 147 acres are proposed for treatment by nonselective chemicals. No areas treated would be denuded of vegetation.

Add to page iv, left column, after 2nd complete paragraph:

Chemical application rates for the treatment of noxious weeds on BLM-administered lands would be at or below the no observable effect level (NOEL).

Add to page 8, left column at the bottom:

The integrated noxious weed management approach is designed to set treatment priorities for noxious weed infestations on BLM lands. The different priorities do not list specific weed species but simply assign goals and components of control. The approach recognizes that a Priority II species in one area may not be a Priority II species in another. Therefore, specific species assignments are left to each BLM district in cooperation with county weed control authorities.

The different priorities reflect BLM's position that action should be directed first at education or making land managers aware of noxious weed species that do not yet occur in their specific management jurisdiction (potential new invaders), second at halting the spread of noxious weeds by eradicating new invaders, and third at managing and reducing larger and well-established infestations.

Priority I - Potential New Invaders: Emphasizes education and awareness of noxious weed species that do not yet occur in a specific management jurisdiction (BLM district). Components of this category may include the following:

(a) Initiate a continuing education and awareness program to help BLM employees and public land users recognize Prioriy I noxious weeds. Options may include establishing noxious weed herbarium specimens, displaying photographs or color prints of noxious weed, and setting up other displays.

(b) Have management jurisdictions share, at least annually, information on their weed treatment programs and established priorities.

(c) Once a Priority I noxious weed is identified, give it a Priority II rating and take action as described for Priority II.

Priority II - Eradication of New Invaders: Gives the highest priority in treatment to new invading noxious weeds within an area. A key factor in treating Priority II weeds is to prevent conditions that allow noxious weeds to become established. Eradication is the goal for noxious weeds in the priority. Components of this treatment category include the following:

(a) Give Priority II noxious weeds the highest priority in funding.

(b) Take isolation and eradication measures as soon as a new invader is officially identified. Apply immediate, effective noxious weed control measures to prevent the species from going to seed.

(c) Survey lands next to infested areas to ensure that all new infestations have been identified.

(d) Identify and treat the causes of noxious weed infestations to reduce the possibility of re-entry.

Priority III - Established Infestations: Weed species in this priority have become so well established and widespread that eradication would be unlikely. Components of this treatment category include the following:

(a) Emphasize containing and preventing the further spread of the infestation.

(b) Give the highest treatment priority to "breakouts" from the main infestation and infestations along rights-of-way (riparian areas, canals, waterways, trails, roads) and next to private lands. Apply acceptable but immediately effective control measures in such areas.

(c) Use any acceptable control measure (herbicide, manual, biological) on the main infestations. But in determining methods, consider the practicality/cost-effectiveness of the method compared to the likelihood of success.

(d) Emphasize biological control on main infestations where successful agents exist. Concentrate research and development efforts on biological control agents on Priority III species.

(e) Use management practices in conjunction with control activities. These management practices may include the following:

1. Promoting the introduction/growth of both native and nonnative plants that would better compete with noxious weeds.
2. Moving and/or using livestock.
3. Moving and/or using vehicles.

Replace "Roundup" with "Rodeo" on Table 1-3 on page 9.

Replace Table 1-4 on pages 12-13 with revised Table 1-4.

Table 1-4 Summary of Impacts by Alternative

	Existing Situation	Alternative 1 (Proposed Action)	Long-Term and Cumulative Effects (Proposed Action)
Air Quality	Smoke intrusions from wood stoves sometimes results in particulate levels exceeding EPA standards in urban areas during periods of atmospheric stability.	Moderate, short-term increases in intrusions expected, but EPA standards would not be exceeded.	None
Soils	There is a great variation in soils across the EIS area due to differences in climate, parent material, and topography.	Short-term increases in erosion, long-term stabilization. Herbicides more persistent in arid area soils.	No long-term accumulation of 2,4-D, dicamba or glyphosate in the soil. Slight potential for accumulation of picloram in arid soils. The proposed low application rates for picloram (not to exceed 1 lb/ac/yr) will significantly reduce the possibility.
Water Quality	No detectable levels of herbicides on west coast but some detectable in Wyoming. Water quality good in west coast streams. Varying water quality on streams in rest of EIS area.	Some detectable levels of herbicides will enter streams from drift; short-term impact may result from spraying in ephemeral stream channels.	If herbicides enter ground water in large amounts it can have relatively long-term impacts, but under the proposed action, if detectable, the amounts will be less than EPA drinking water criteria.
Vegetation	Noxious weeds are spreading on BLM lands within EIS area. Reduced productivity of desirable range vegetation due to competition from noxious weeds. Weeds invading adjacent private land.	Production of grass species would increase. Some injury or loss of nontarget vegetation may occur from using herbicides. Non-target species will become reestablished after treatment.	Non-target grass species will tend to increase. Non-target broadleaf plant species may be injured or destroyed in areas of treatment over the 15 year period of treatment.
Animals **Livestock** **Wild Horses** **Wildlife**	Livestock grazing is one of the primary uses of BLM lands in the EIS area. Wildlife diversity abundance and habitat values are high.	Adverse short-term impacts would be temporary and localized. However, over the short and long term, animal habitat would improve benefiting all species populations.	Livestock forage would improve over the 15 year period of treatment. Wild horse forage would improve over the 15 year period of treatment. Long-term animal habitat would improve benefiting all species.
Fish	Most habitat is in fair to good condition.	Habitat conditions and population levels would remain largely unchanged. Under some scenarios, principally worst case, some adverse impact to fish and wildlife may occur from use of herbicides.	Long-term animal habitat would improve benefiting all species.
Cultural Resources		Low probability of site damage.	If a site is missed in a pre-work survey and disturbed by mechanical treatment it would be a long-term impact.
Visual Resources and Recreation	Outdoor recreation occurs throughout EIS area. Camping and picnicking occur in designated recreation sites that have noxious weeds.	Low probability of scenic degradation. Recreation areas infested with noxious weeds would benefit by decreased visitor exposure to adverse effects from weeds. Visitor use would increase.	No impact on visual resources. Recreation would have long-term beneficial impact from controlling or eliminating noxious weeds from campground areas.
Wilderness and Special Areas	The EIS area contains five designated wilderness areas and 224 wilderness study areas.	Noxious weeds in wilderness areas and WSAs may be controlled. Suppression of noxious weeds would allow native plants in the natural ecosystem to better compete.	Non-target grass species will tend to increase. Non-target broadleaf plant species may be injured or destroyed in areas of treatment over the 15 year period of treatment.
Economic Conditions	Little economic production on weed-infested land. Ingestion of poisonous plants by livestock causes deaths and production decreases. Weeds spreading from BLM land are contributing to economic losses on adjacent nonpublic land.	Beneficial economic impacts to the region: increased livestock production, fewer livestock deaths, and potential decrease in economic losses. Local expenditures on equipment and materials for weed control would benefit local economy.	Increase in livestock production would be a long-term cumulative effect.
Social Environment		Likely to generate more constructive social responses and concerns.	Likely to generate more constructive social responses and concerns.
Human Health		No adverse impacts expected from use of herbicides, although a remote possibility exists under worst case scenarios. Human health would benefit from control of those noxious weeds that adversely affect humans.	No long-term adverse impacts. Some long-term beneficial effects on human health.

Alternative 2 (No Aerial Herbicide Application)	Alternative 3 (No Herbicide Use)	Alternative 4 (No Action)
About the same impacts as under Alternative 1.	Slightly higher impacts than Alt. 1. EPA standards not exceeded.	No smoke intrusions would occur.
About the same impacts as under Alternative 1.	Short-term increases in erosion where burning and tilling take place. Long-term stabilization.	No change from existing environment.
Less spray drift.	Slightly increased suspended sediments and dissolved solids from mechanical and grazing controls.	No change from existing environment.
Production of grass species would increase. Some injury or loss of non-target vegetation may occur from the use of herbicides. Degree of effects would be less than under the Proposed Action (fewer acres treated with herbicides). Non-target species will become reestablished after treatment.	Some degree of weed control would be achieved, but noxious weeds would spread due to ineffective weed control efforts. Desirable vegetation would decline.	Spread of noxious weeds, thus reduction in desirable vegetation.
About the same impacts as under Alternative 1.	Where nonchemical measures fail to control weeds, weeds would continue to crowd out and reduce desirable forage and habitat for animals, reducing wildlife diversity and leading to livestock herd reductions. Toxic plants would harm animals where not controlled with nonmechanical methods.	Noxious weeds would spread unchecked and reduce desirable forage and habitat for wildlife diversity. Toxic weeds would harm animals, leading to livestock herd reductions.
About the same impacts as under Alternative 1.	About the same impacts as under Alternative 1.	About the same impacts as under Alternative 1.
Low probability of site damage.	Low probability of site damage.	No probability of site damage.
About the same impacts as under Alternative 1.	Spread of noxious weeds would increase exposure of recreationalists to detrimental effects when nonchemical measures fail to control these weeds. Visitor use reduced in such areas.	Increased exposure of recreationalists to detrimental effects of noxious weeds. Visitor use would be reduced.
About the same impacts as Alternative 1.	Impacts would be the same as under Alternative 1 only when nonchemical measures sufficiently control noxious weeds. Otherwise, impacts would be the same as under Alternative 4.	Noxious weeds, including exotics, in wilderness and WSAs would spread unchecked and compete with native plants, decreasing naturalness.
Beneficial economic impacts to the region: increase in livestock production and fewer livestock deaths. Some weeds would spread to noninfested land, causing economic losses. Local expenditures on equipment and materials for weed control would benefit the economy.	Beneficial and adverse impacts to the local economy. Slight increase in livestock production where weeds are controlled, but potential further economic losses, livestock deaths, and lower livestock production over time where weeds are not controlled. Weeds spreading to noninfested land would cause additional economic losses.	Economic losses, livestock deaths, and lower livestock production would continue over time. Weeds would spread to nonpublic land contributing to a decline in productivity and economic loss.
Likely to generate polarized reactions.	Likely to generate a polarized reaction.	About the same impacts as under Alternative 3.
Higher risk to unprotected workers because of greater exposure to ground applicators. Public should not suffer adverse health effects. Public cancer risk is very small.	More adverse impacts from more manual control methods and less control of weeds hazardous to human health.	Greatest adverse effects from a lack of control of weeds hazardous to human health. This can be caused by allergies, poisoning or physical harm depending upon the individual weed species.

Add to page 14, left column, after 3rd paragraph:

The following Herbicide Application Monitoring Plan table summarizes the methods and frequency of monitoring that would be used.The contracting officer's representative would monitor the following contract requirements to ensure compliance.

1. In aerial applications, a 500-foot-wide buffer strip will be left next to inhabited dwellings unless this requirement is waived in writing by the resident. A 100-foot-wide buffer strip will be left next to cropland and barns.

2. Boom sprayers will not be used within 25 feet of water bodies.

3. Granular formulations will be applied no closer than 10 feet from the high water line of streams and other water bodies.

4. Contact systemic herbicides wiped on individual plants may be used up to the existing high water line.

5. When herbicides are being applied, wind speeds must not exceed 10 miles per hour (mph) in all instances. Where liquid herbicides are applied from the air, the wind speed must not exceed 5 mph. Where herbicides are applied by vehicle or hand, the wind speed must not exceed 8 mph except in riparian areas, where the wind speed must not exceed 5 mph. Granular formulations will be applied through the use of broadcast spreaders from about 3.5 feet above the ground.

6. Spray nozzles are designed for aerial and ground vehicle spray equipment to produce droplets large enough (200 microns or larger) to limit the amount of drift. Aerial application equipment will normally operate with a boom pressure of 20 to 35 pounds per square inch unless the product label specifies a different pressure. Liquid

Herbicide Application Monitoring Plan

Monitoring Element	Method	Frequency	Characteristic Evaluated
Pretreatment Survey	onsite visual inspection	each treatment area	species present, density, endangered species present, control options, method chosen
Post-Treatment Survey	onsite visual inspection	each treatment area	effectiveness, need for retreatment, corrective measures or mitigation
Pesticide Use Proposal	review of proposal and EPA registration by authorized certified applicator	before any herbicide application	proposal compared to EPA registration requirements and record of decision compliance
Water Monitoring * Samples	pre- and post-treatment water samples when treatment is near potable sources and herbicide could get into water	as needed	potential water contamination
Coordination Monitoring	weed management plans submitted to Washington, D.C.	yearly	coordination of plan
Biological Establishment	Survey of bio-control agents release and establishment	state/district yearly	establishment, effectiveness, and rate of spread of biological control agents
Surveys of Threatened and Endangered (T&E) Species	Survey for T&E species before action	each project	presence of T&E species
Cultural Resource Surveys	Survey for archaeological and historical resources	each project involving surface disturbance	presence of cultural resources
Contract	contractor contacts	continually	contract requirements

*Also see Appendix I, FEIS.

herbicides will be applied by backpack with low nozzle pressure and within 2.5 feet of the ground. Granular formulations will be applied through the use of broadcast spreaders from about 3.5 feet above the ground.

7. All chemicals will be applied only in accordance with Environmental Protection Agency standards specified on the herbicide's label.

Add to page 15, left column, bottom of page:

Additionally, the Sikes Act (PL 93-452), as amended, provides the main guidance for coordination between BLM and state wildlife agencies.

Add to page 10, right column, bottom of first complete paragraph:

Riparian and wetland areas will not be sprayed aerially.

Replace Table 2-1 on page 29 with revised Table 2-1.

Add DMA-4 herbicide label to the end of Appendix O.

Table 2-1. Threatened and Endangered Animals in the EIS Area

Species	Federal Status	State Status/Occurrence: Idaho Status	Montana Status	Oregon Status	Washington Status	Wyoming Status
Mammals						
Grizzly bear, *Ursus arctos horribilis*	T	T	T	—	T	T
Woodland caribou, *Rangifer tarandus caribou*	E	E	E	—	E	—
Black-footed ferret, *Mustela nigripes*	E	—	E	—	—	E
Wolverine, *Gulo gulo*	—	—	—	T	—	—
Columbia white-tailed deer, *Odocoileus virginianus leucurus*	E	—	—	E	E	—
Southern sea otter, *Enhydra lutris nereis*	T	—	—	T	E	—
Gray wolf, *Canis lupus*	E	E	E	—	E	E
Pygmy rabbit, *Sylvilagus idahoensis*	—	—	—	—	T	—
Birds						
Peregrine falcon, *Falco peregrinus tundrius*	T	—	—	E	E	—
Peregrine falcon, *Falco peregrinus anatum*	E	E	E	E	E	E
Bald eagle, *Haliaeetus leucocephalus anascanus*	E/T	E	E	T	T	E
Whooping crane, *Grus americana*	E	E	E	—	—	E
Northern spotted owl, *Strix occidentalis caurina*	—	—	—	T	T	—
Short-tailed albatross, *Diomedea albatrus*	E	—	—	—	—	—
California condor, *Gymnogyps californianus*	E	—	—	—	—	—
Brown pelican, *Pelecanus occidentalis*	E	—	—	E	E	—
Aleutian Canada Geese, *Branta canadensis leucopareia*	E	—	—	E	E	—
Sandhill crane, *Crus Canadensis*	—	—	—	—	E	—
Western Snowy Plover, *Charadrius alexandrinus nivosos*	—	—	—	T	E	E
Upland sandpiper, *Bartramia longicauda*	—	—	—	—	E	—
Ferruginous hawk, *Buteo regalis*	—	—	—	—	—	E
Least tern, *Sterna antillarum*	E	—	E	—	—	—
Piping plover, *Charadrius melodus*	T	—	T	—	—	—
Amphibians						
Western spotted frog, *Rana pretiosa*	—	—	—	T	—	—
Wyoming toad, *Bufo hemniophrys baxteri*	E	—	—	—	—	E
Western pond turtle, *Clemmys marmorata*	—	—	—	—	T	E
Fish						
Bonytail chub, *Gila elegans*	E	—	—	—	—	E
Borax Lake chub, *Gila boraxobius*	E	—	—	E	—	—
Humpback chub, *Gila cypha*	E	—	—	—	—	E
Kendall warm springs dace, *Rhinichthys osculus thermalis*	E	—	—	—	—	E
Colorado squawfish, *Ptychocheilus lucius*	E	—	—	—	—	E
Hutton Tui chub, *Gila bicolor*	T	—	—	—	—	—
Foskett speckled dace, *Rhinichthys osculus*	T	—	—	—	—	—
Warner sucker, *Catostomus warnernesis*	T	—	—	—	—	—
Insects						
Oregon silverspot butterfly, *Speyeria zerene hippolyta*	T	—	—	—	T	—

T = Threatened
E = Endangered

VERTAC*

DMA* 4

herbicide

Contains Dimethylamine Salt‡ of 2,4-D

For Selective Control of Many Broadleaf Weeds in Non-Crop Areas, Grass Pastures, Rangelands, and in Certain Crops • Also for Control of Trees by Injection

ACTIVE INGREDIENT:
Dimethylamine Salt of 2,4-Dichlorophenoxyacetic Acid †† 46.3%
INERT INGREDIENTS: 53.7%
2,4-Dichlorophenoxyacetic Acid††
Equivalent: 38.4% — 3.8 lb/gal
†† Isomer Specific by AOAC Method No. 6.275-6.279 (13th Ed.)
EPA Registration No. 464-196-39511 EPA Est. 464-MI-1
‡ Salts are the least volatile forms of 2,4-D and do not release enough vapors from treated areas to reduce yield of adjacent susceptible crops.

PRECAUCION AL USUARIO: Si usted no lee inglés, no use este producto hasta que la etiqueta le haya sido explicada ampliamente.
TRANSLATION: (TO THE USER: If you cannot read English, do not use this product until the label has been fully explained to you.)

18.93 L/5 gal

KEEP OUT OF REACH OF CHILDREN

WARNING

PRECAUTIONARY STATEMENTS
Hazards to Humans and Domestic Animals
INJURIOUS TO EYES • HARMFUL IF SWALLOWED
MAY CAUSE SKIN IRRITATION
Do Not Get In Eyes Or On Clothing • Wear Goggles Or Face Shield When Handling • Avoid Contact With Skin • Wash Thoroughly After Handling

Statements of Practical Treatment
In case of eye contact, immediately flush eyes with plenty of water for 15 minutes. Call a physician. **In case of skin contact,** wash with soap and plenty of water. Remove and wash contaminated clothing before reuse. Discard contaminated shoes. If swallowed, induce vomiting immediately by giving two glasses of water and sticking finger down throat. Call a physician. Do not induce vomiting or give anything by mouth to an unconscious person.

Physical or Chemical Hazards
Do Not Cut or Weld Container

Environmental Hazards
Do not contaminate water by cleaning of equipment or disposal of wastes. Do not contaminate water used for irrigation or domestic purposes.

For chemical spill, leak, fire or exposure call toll free 1-800-424-9300

AGRICULTURAL CHEMICAL
Do Not Ship or Store with Foods, Feeds, Drugs or Clothing

WEED LIST

- bitterweed
- broomweed
- burdock
- carpetweed
- wild carrot
- chicory
- cocklebur
- coffeeweed
- croton
- dandelion
- dock
- flixweed
- galinsoga
- wild hemp
- jewelweed
- jimsonweed
- kochia
- lambsquarters
- bigbend loco
- lupines
- Venice mallow
- marshelder
- annual morningglory
- mustards
- pennycress
- pennwort
- pepperweed
- pigweed
- plantains
- poorjoe
- Florida pusley
- wild radish
- common ragweed
- wild rape
- yellow rocket
- shepherdspurse
- sicklepod
- smartweed
- bitter sneezeweed
- annual sowthistle
- spanishneedles
- sunflower
- sweetclover
- tansymustard
- bull thistle
- musk thistle
- Russian thistle
- tumbleweed
- velvetleaf
- vetch
- waterplantain
- witchweed
- wormwood

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

Generally, the lower dosages given will be satisfactory for young, succulent growth of sensitive weed species. For less sensitive species and under conditions where control is more difficult, the higher dosages will be needed. Apply **DMA 4** during warm weather when weeds are young and growing actively. Use enough spray volume for uniform coverage by ground or air application. If only bands or rows are treated, leaving middles unsprayed, the dosage per crop acre is reduced proportionately. **Do not apply where drift may be a problem due to proximity of susceptible crops or other desirable plants. Read and follow all Use Precautions given on this label.**

To Prepare the Spray, mix **DMA 4** only with water, unless otherwise directed on this label. Add about half the water to the mixing tank, then add the **DMA 4** Herbicide with agitation, and finally the rest of the water with continuing agitation. **Note:** Adding oil, wetting agent, or other surfactant to the spray may increase effectiveness on weeds, but also may reduce selectivity to crops resulting in crop damage.

WEED CONTROL IN SMALL GRAINS NOT UNDERSEEDED WITH A LEGUME (Barley, Oats, Rye, Wheat): See Table for recommended use rates. Spray after grain begins tillering and before the boot stage (usually 4 to 8 inches tall) and weeds are small. **Do not apply before the tiller stage nor from early boot through the milk stage.** To control large weeds that will interfere with harvest or to suppress perennial weeds, preharvest treatment can be applied when the grain is in the dough stage. Best results will be obtained when soil moisture is adequate for plant growth and weeds are growing well. **Note:** Do not permit dairy animals or meat animals being finished for slaughter to forage or graze treated grain fields within 2 weeks after treatment. Do not feed treated straw to livestock.

WEED CONTROL IN CORN: See Table for recommended use rates. **Pre-emergence** —Apply to soil anytime after planting but before corn emerges. Do not use on very light, sandy soil. **Emergence** —Apply just as corn plants are breaking ground. **Post-emergence** —Apply to emerged corn. When corn is over 8 inches tall, use drop nozzles to keep spray off corn foliage. Do not apply from tasseling to dough stage. Injury to corn is most likely to occur if **DMA 4** is applied when corn is growing rapidly under high temperature and high soil moisture conditions. In such situations, use the low rate of ½ pint per acre. After application, delay cultivation for 8 to 10 days to allow the corn to overcome any temporary brittleness. **NOTE:** Hybrids vary in tolerance to 2,4-D. Some are easily injured. Spray only varieties known to be tolerant to 2,4-D. Consult the seed company or your Agricultural Experiment Station or Extension Service Weed Specialist for this information.

WEED CONTROL IN SORGHUM (MILO): See Table for recommended use rates. Treat only after the sorghum is 6 inches high and preferably before it is 15 inches high. Do not treat during the boot, tasseling, or early dough stages. Reduce spray drift by keeping the boom and spray nozzles as low as possible. If crop is taller than 8 inches, use drop nozzles to keep the spray off the leaves. Temporary crop injury can be expected under conditions of high soil moisture and high air temperatures. If it is necessary to apply **DMA 4** under these conditions, use no more than ⅔ pint per acre.

NOTE: Hybrids vary in tolerance to 2,4-D. Some are easily injured. Spray only varieties known to be tolerant to 2,4-D. Consult the seed company or your Agricultural Experiment Station or Extension Service Weed Specialist for this information.

WEED CONTROL IN RICE: See Table for recommended use rates. Apply in the late tillering stage of rice development, at the time of first joint development (first to second green ring), usually 6 to 9 weeks after emergence. Do not apply after panicle initiation, after rice internodes exceed ½ inch, at early seedling, early panicle, boot, flowering, or early heading growth stages. **NOTE:** Some rice varieties under certain conditions can be injured by 2,4-D. Therefore, before spraying consult local Extension Service or University specialists for appropriate rates and timing of 2,4-D sprays.

WEED CONTROL IN SUGARCANE: See table for recommended use rates. Apply as a pre-emergence or post-emergence spray in accordance with State recommendations. For grass control, use DOWPON M grass herbicide in addition to **DMA 4**. Always read the label directions and precautions for the use of these products before using them with **DMA 4.**

AMOUNT OF DMA 4 HERBICIDE TO USE IN CROPS

By Air or Ground Application

NOTE: Do not apply when weather conditions favor drift from treated areas. Read complete directions and precautions before using.

CROP	DOSAGE PER ACRE	
	Normal rates (usually safe to crops	**Higher rates for special situations[2] (more likely to injure crop)**
SMALL GRAINS		
Spring postemergence		
wheat, barley, rye	⅔ to 1⅓ pints	2 to 3 pints
oats	½ to 1 pint	1½ to 2 pints
Preharvest (dough stage)		
wheat, barley, oats	1 to 2 pints	2 to 3 pints
CORN[1]		
Preemergence	2 to 4 pints	
Emergence[1]	1 pint	1½ pints
Postemergence[1]		
up to 8 inches tall	½ to 1 pint	
8 inches to tasseling (use only directed spray)	1 pint	1½ to 2½ pints
SORGHUM (Milo)[1]		
Postemergence		
6 to 8 inches tall	⅔ to 1 pint	
8 to 15 inches tall (use only directed spray)	1 pint	1½ to 2 pints
RICE	1 to 2½ pints	2 to 3 pints
SUGARCANE	2 to 4 pints	

[1]Corn and sorghum varieties vary in tolerance to 2,4-D, some are easily injured. Before spraying, get information on 2,4-D tolerance of specific varieties and spray only those known to be resistant to 2,4-D injury. If plants are more than 8 inches tall, use directed spray and keep spray off corn and sorghum foliage.

[2]These higher rates may be needed to handle difficult weed problems in certain areas such as under dry conditions especially in western areas. However, do not use unless possible crop injury will be acceptable. Consult State Agricultural Experiment Station or Extension Service weed specialists for recommendations or suggestions to fit local conditions.

WEED CONTROL ON FALLOW LAND: Use 1 to 2 quarts of **DMA 4** per acre on annual broadleaf weeds and up to 3 quarts per acre on established perennial species, such as Canada thistle and field bindweed. Apply to weeds actively growing. Do not plant any crop for 3 months after treatment or until chemical has disappeared from soil.

WEED CONTROL IN ESTABLISHED GRASS PASTURES AND RANGELANDS: Use at 2 to 4 pints per acre. Apply preferably when weeds are small and growing actively before the bud stage. Do not use on bentgrass, alfalfa, clover, or other legumes. Do not use on newly seeded areas until grass is well established. Do not use from early boot to milk stage where grass seed production is desired. Do not graze dairy animals on treated areas within 7 days after application.

CONTROL OF SOUTHERN WILD ROSE: On rangelands, roadsides, and fencerows, use 1 gallon of **DMA 4** plus 4 to 8 fluid ounces of an agricultural surfactant per 100 gallons of water and spray thoroughly as soon as foliage is well developed. Two or more treatments may be required. On rangeland, apply a maximum of 6 quarts of **DMA 4** per acre per application. Do not graze dairy animals on treated areas within 7 days after application.

GRASS SEED CROPS: Use 1 to 4 pints per acre in spring or fall to control broadleaf weeds in grass being grown for seed. **Do not apply from early boot to the milk stage.** Spray seedling grass only after the five-leaf stage, using ¾ to 1 pint per acre to control small seedling weeds. After the grass is well established, higher rates of up to 4 pints can be used to control hard-to-kill annual or perennial weeds. For best results, apply when soil moisture is adequate for good growth.

NOTE: Do not use on bentgrass unless grass injury can be tolerated. Do not graze dairy animals nor cut forage for hay within 7 days after application.

BROADLEAF WEED CONTROL IN NON-CROPLAND GRASS AREAS SUCH AS LAWNS, GOLF COURSES, CEMETERIES AND PARKS, AIRFIELDS, ROADSIDES, VACANT LOTS, DRAINAGE DITCH BANKS: Use 1 to 3 quarts of **DMA 4** per acre in the amount of water needed for uniform application. Treat when weeds are young and growing well. Usually 2 quarts per acre will provide adequate weed control. Do not use on dichondra or other herbaceous ground covers. Do not use on creeping grasses such as bent except for spot treating nor on freshly seeded turf until grass is well established. Reseeding of lawns should be delayed following treatment. With spring application, reseed in the fall, with fall application, reseed in the spring. Legumes are usually damaged or killed. Deeprooted perennial weeds such as bindweed and Canada thistle may require repeated applications.

SPOT TREATMENT IN NON-CROP AREAS: To control broadleaf weeds in small areas with a hand sprayer, use ¼ pint of **DMA 4** in 3 gallons of water and spray to thoroughly wet all foliage.

TREE INJECTION TREATMENT: To control unwanted hardwood trees such as elm, hickory, oak, and sweetgum in forest and other non-crop areas, apply **DMA 4** by injecting 1 ml of the undiluted product through the bark around the trunk at intervals of 1 to 3 inches between edges of the injector wounds. For harder to control species such as ash, maple, and dogwood use 2 ml of undiluted **DMA 4** per injection site. Continuous cuts around the trunk often provide improved control. Also, cuts near the ground level may be more effective than at higher levels. Treatments can be made at any season; however, effectiveness may be less during winter months. Maples should not be treated during the spring sap flow.

FOR RIGHTS-OF-WAY: For perennial broadleaf weeds and susceptible woody species, use up to 2 gal **DMA 4** per acre. For difficult to control perennial broadleaf weeds and woody species, use up to 2 gal **DMA 4** and 1 to 4 qts. GARLON 3A herbicide per acre. **For ground application:** (High volume) apply a total of 100 to 400 gal per acre; (low volume) apply a total of 20 to 100 gal per acre. **For helicopter:** Apply a total of 10 to 30 gal per acre spray volume.

STORAGE AND DISPOSAL

Do not contaminate water, food or feed by storage or disposal

STORAGE: Keep container tightly closed when not in use. If exposed to subfreezing temperatures, the product should be warmed to at least 40F and mixed thoroughly before using.

PESTICIDE DISPOSAL: Pesticide wastes are acutely hazardous. Improper disposal of excess pesticide, spray mixture, or rinsate is a violation of Federal Law. If these wastes cannot be disposed of by use according to label instructions, contact your State Pesticide or Environmental Control Agency, or the Hazardous Waste representative at the nearest EPA Regional Office for guidance.

CONTAINER DISPOSAL: Triple rinse (or equivalent). Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or by other procedures approved by state and local authorities

USE PRECAUTIONS

Do not apply **DMA 4** directly to, or otherwise permit it to come into contact with cotton, flowers, fruit trees, grapes, ornamentals, vegetables, or other desirable plants which are sensitive to 2,4-D herbicides and do not use in a greenhouse. Do not permit spray mist containing it to drift onto them, since even very small quantities of the spray, which may not be visible, can cause severe injury during both growing and dormant periods. Use coarse sprays to minimize drift. With ground equipment, spray drift can also be minimized by keeping the spray boom as low as possible, by applying 20 gallons or more of spray per acre, by using no more than 20 pounds per square inch spraying pressure, by using flat fan or flood fan nozzle tips, and by stopping all spraying when wind velocity exceeds 8 miles per hour. Do not apply using cone-type insecticide or other nozzles that produce a fine-droplet spray. With aircraft application, drift can be lessened by using no more than 20 pounds spray pressure at the nozzles, by using nozzles which produce a coarse spray pattern and by spraying only when the wind velocity is less than 5 miles per hour. **Applications by airplane, ground rigs, and hand dispensers should be carried out only when there is no hazard from drift. Do not apply in the vicinity of cotton, grapes, tomatoes, or other desirable vegetation susceptible to 2,4-D. Do not spray when the wind is blowing across the area to be sprayed towards susceptible crops or ornamental plants.** Violent windstorms may move soil particles. If 2,4-D is on these particles and they are blown onto susceptible plants, visible symptoms may appear. Serious injury is unlikely. The hazard of movement of 2,4-D on dust during violent windstorms is reduced if treated fields are irrigated or if rain occurs shortly after application. Do not contaminate irrigation ditches or water used for irrigation or domestic purposes.

To avoid injury to desirable plants, do not store, handle, or apply other agricultural chemicals with the same containers or equipment used for **DMA 4** except as specified on this label. Excessive amounts of 2,4-D in the soil may temporarily inhibit seed germination or plant growth

Consult your State Agricultural Experiment Stations or Extension Service weed specialists in many states for recommendations from this label that best fit local conditions. Be sure that use of this product conforms to all applicable regulations. **Apply this product only as specified on this label.**

CONDITIONS OF SALE AND WARRANTY

VERTAC AND SELLER OFFER THIS PRODUCT AND THE BUYER AND USER ACCEPTS THIS PRODUCT ONLY UNDER THE FOLLOWING AGREED CONDITIONS OF SALE AND WARRANTY

The directions for use of this product are believed to be reliable and should be followed carefully. However, it is impossible to take into account all variables and to eliminate all risks associated with its use. Injury or damage may result because of conditions which are beyond the control of Vertac or the Seller. Vertac warrants only that this product conforms to the chemical description on the label and is believed to be reasonably fit for the purposes referred to in the Directions for Use when used as directed under normal conditions. VERTAC MAKES NO OTHER EXPRESS OR IMPLIED WARRANTY OF FITNESS OR MERCHANTABILITY OR ANY OTHER EXPRESS OR IMPLIED WARRANTY. In no case shall Vertac or the Seller be liable for consequential, special or indirect damages resulting from the use or handling of this product. Any variation or exception from this warranty must be in writing and signed by an authorized Vertac representative

10580-012-1 983

Manufactured for

VERTAC CHEMICAL CORPORATION

Memphis, Tennessee 38137, USA

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List of Agencies and Organizations to Whom Copies of the Draft Supplement to the FEIS are Sent

BLM requested comments on the DSEIS from the following agencies and organizations:

Federal Agencies

Advisory Council on Historic Preservation
Department of Agriculture
- Forest Service
- Soil Conservation Service

Department of Commerce
- National Marine Fisheries Service

Department of Defense
- U.S. Army Corps of Engineers

Department of Energy
- Bonneville Power Administration

Department of the Interior
- Fish and Wildlife Service
- Bureau of Indian Affairs
- Geological Survey
- Bureau of Mines
- Bureau of Reclamation
- National Park Service

Environmental Protection Agency
Small Business Administration

State and Local Government

Idaho

Governor's Office
Department of Agriculture
- County Weed Control Superintendents
- State Seed Laboratory

Department of Fish and Game
Department of Lands
Department of Transportation
County Weed Control Officials

Montana

Department of Agriculture
- County Weed Control Supervisors

Department of Fish, Wildlife and Parks
Department of State Land
Department of Commerce
Department of Natural Resources and Conservation
Department of Health and Environmental Sciences
Department of Livestock
Environmental Quality Council
Montana Highway Commission

Oregon

State Clearinghouse
Areawide Clearinghouses
Lane Regional Pollution Authority
Department of Environmental Quality
Department of Fish & Wildlife
Department of Forestry
State Historic Preservation Office
Department of Agriculture
Weed Control Districts

Washington

Office of the Governor
Office of the Secretary of State
Washington State Library
State Conservation Commission
Department of Natural Resources
Parks and Recreation Commission
Department of Ecology
Department of Agriculture
Weed Control Boards
Department of Game
Department of Fisheries
Farm Bureau
Division of Geology and Earth Resources
Department of Transportation
Commissioner of Public Lands

Wyoming

Governor's Office
Department of Agriculture
- County Weed Control Officials

Department of Forestry
State Game and Fish
State Highway Department
Department of Environmental Quality

Interest Groups (partial listing)

Audubon Society
FIR
Friends of the Earth
Izaak Walton League
Menasha Corp.
National Wildlife Federation
Northwest Coalition for Alternatives to Pesticides
Economic Development Commissions
Environmental Councils
Wheat Growers Leagues
Wilderness Coalitions
Wildlife Federations
Oregonians for Food and Shelter
Sierra Club
Stockmen's Associations
Southern Oregon Citizens Against Toxic Sprays
State Universities
Western Environmental Trade Association
Indian Tribes
Friends of the Earth
League of Women Voters

Natural Resources Defense Council
Nature Conservancy
Society for Range Management
Society of American Foresters
Wildlife Management Institute
Wilderness Society
Cattlemen's Association
Idaho Natural Resources Legal Foundation
Citizens for Environmental Quality

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Though individuals have primary responsibility for preparing sections of an EIS, the document is an interdisciplinary team effort. In addition, internal review of the document occurs throughout preparation. Specialists at the BLM's district, state and Washington Office levels both review the analysis and supply information. Contributions by individual preparers may be subject to revision by other BLM specialists and by management during internal review.

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Glossary

ACTIVE INGREDIENT: This is the technical herbicide itself such as dicamba, 2,4-D, glyphosate or picloram.

ADSORPTION: Adhesion of substances to the surfaces of solids or liquids; technically, the attraction of ions of compounds to the surfaces of solids or liquids.

ADVANCING HEADCUT: An erosional process in which the vertical erosion face (headcut) moves upslope or up a drainage.

ALLEOPATHIC: Pertaining to the suppression of growth of one plant species by another through the release of toxic substances.

ALLUVIAL DEPOSITS: Deposits of sand, gravels, and cobbles resulting from the reduction in carrying capacity of flowing water. As flowing water slows, its carrying capacity drops, allowing material to settle out.

AMINE: Any of a group of chemical substances derived from ammonia in which one, two, or three hydrogen atoms have been replaced by one, two, or three hydrocarbon groups.

ANIMAL UNIT MONTH (AUM): the amount of forage needed to sustain one cow and a calf (6 months old or younger) or their equivalent for 1 month.

ANNUAL PLANT: A plant that completes its life cycle within a year.

AREA OF CRITICAL ENVIRONMENTAL CONCERN (ACEC): An area within the public lands where special management attention is required (when such areas are developed or used, or where no development is required) to protect and prevent irreparable damage to important historic, cultural, or scenic values; fish and wildlife resources; or other natural systems or processes; or to protect life and safety from natural hazards.

AROMATIC: Relating to the presence of at least one benzene ring in cyclic hydrocarbons and their derivitives.

AUTHORIZED OFFICER: A designated federal regulatory agency employee responsible for activities involving the use of public lands or delegated to exercise authority over grants for use of these lands.

BATHOLITH: A great mass of intruded igneous rock that for the most part stopped in its rise a great distance below the surface.

BETA CAMERA ANALYSIS: A method of analyzing movement of a radioactive isotope by recording on film the emittance of beta rays over a time interval.

BIENNIAL PLANT: A plant that completes its life cycle in 2 years.

BIOACCUMULATION: The accumulation of a substance in an ecoysystem. A chemical that does not bioaccumulate, decomposes rapidly in the environment.

BIOASSAY: The testing of the effects of chemical substances on live organisms under controlled conditions.

BIOLOGICAL CONTROL: The use of natural enemies to attack a target plant, retard growth, prevent regrowth, or prevent seed formation.

BOOM (HERBICIDE SPRAY): A tubular metal device that conducts a herbicide mixture from a tank to a series of spray nozzles. A boom may be mounted beneath an aircraft or behind a tractor.

BROADCAST APPLICATION: The applying of pesticide over an entire area or field rather than only to rows, beds, or individual plants. See SPOT TREATMENT.

BROWSE: That part of leaf and twig growth of shrubs, woody vines, and trees on which browsing animals can feed; to consume browse.

BUFFER (STRIP OR ZONE): A zone left untreated with herbicide (at the outer edge of a treated area or along streams) as protection against the effects of treatment.

CARBON 14 DATING: A method of dating archaeological and geological materials through the measurement of carbon 14--a heavy isotope of carbon of mass number 14.

CARCINOGENIC: A substance producing or inciting cancer.

CATEGORICAL EXCLUSION: A category of actions that do not individually or cumulatively have significant effects on the human environment and for which neither an environmental assessment nor an environmental impact statement is required.

CHEMICAL DEGRADATION: The breakdown of a chemical substance into simpler components through chemical reactions.

COLIFORM: A group of bacteria that normally abound in the intestines of humans and other warm-blooded animals and are used as an indicator of sanitary quality in water.

COLLOID: See SOIL COLLOID.

CONTACT SYSTEMIC HERBICIDE: A herbicide applied directly to a plant, which is absorbed in its leaves and then translocated throughout the plant.

CONTROL: Reduction of a pest problem to a point where it causes no significant economic damage.

CREEPING PERENNIALS: Perennial plants that spread by means of specialized modified aboveground stems (stolons) or belowground stems (rhizomes) as well as by seeds. Because of their method of spread, creeping perennial noxious weeds are the most difficult to control.

CRITICAL HABITAT: (1) Specific areas within the habitat occupied by a species at the time it is listed under the Endangered Species Act where there are physical or biological features (i) essential to the conservation of the species and (ii) that may require special management considerations or protection, and (2) specific areas outside the habitat occupied by the species at the time it is listed upon the determination by the Secretary of the Interior that such areas are essential for the conservation of the species.

CRUCIAL WILDLIFE HABITAT: An area of habitat essential to the survival of any wildlife species sometime during its life cycle.

CULTURAL RESOURCES: Remains of human activity, occupation, or endeavor, reflected in districts, sites, structures, building, objects, artifacts, ruins, works of art, architecture, and natural features that were of importance in past human events. Cultural resources consist of (1) physical remains, (2) areas where significant human events occurred, even though evidence of the events no longer remains, and (3) the environment immediately surrounding the actual resource.

DERMATITIS: Inflamation of the skin.

DNA (DEOXYRIBONUCLEIC ACID): Any of the nucleic acids that are the molecular basis of heredity in many organisms.

DOSAGE: The regulation of doses: how often and for how long.

DOSE: The amount of chemical administered at one time.

DRIFT: The movement of airborne herbicide particles by air motion or wind away from an intended target area.

DRIP TORCH: A container of slash-burning fuel equipped with a wick to ignite the fuel mixture as it drips from the container onto the slash. Hand-held torches have a 1.5-gallon capacity and are ignited by a fiber-filled, fuel-soaked wick. The torch used by a helicopter has a 30- to 55-gallon capacity and is equipped with an electrically activated fuel pump and ignition.

ECOLOGICAL NICHE: The physical space in a habitat occupied by an organism; its functional role in a community; and its position in environmental gradients of temperature, moisture, pH, soil, and other conditions of existence.

EIS AREA: In this EIS, the five northwest states of Idaho, Montana, Oregon, Washington, and Wyoming.

ENDANGERED SPECIES: Plant or animal species that are in danger of extinction throughout all or a significant part of their range. See THREATENED SPECIES.

ENVIRONMENTAL ASSESSMENT (EA): A systematic environmental analysis of site-specific activities used to determine whether such activities would significantly affect the human environment and whether an environmental impact statement is required.

ENVIRONMENTAL IMPACT STATEMENT (EIS): An analytical document developed for use by decisionmakers to weigh the environmental consequences of a potential action.

EPHEMERAL STREAM: A stream that flows only in direct response to precipitation and whose channel is at all times above the water table.

ESTER: A substance formed by the reaction between an acid and an alcohol, usually with the elimination of water.

EXCHANGE: A transaction in which the Federal Government receives land or interests in lands in exchange for other land or interests in land.

EXOTIC PLANTS: Plants that are not native to the region in which they occur.

FATE (HERBICIDE): What happens to a herbicide after it is applied, including leaching, photodecomposition, and microbial degradation.

FETOTOXIC: Toxic to a fetus.

FOOD CHAIN: A series of plant or animals species in a community, each of which is related to the next as a source of food.

FORAGE: All browse and herbaceous foods available to grazing animals. Forage may be grazed or harvested for feeding.

FORB: A low-growing herbaceous plant that is not a grass, sedge, or rush.

FOSSORIAL ANIMALS: Animals that have adapted to existing underground in burrows.

GELLED GASOLINE: A slash-burning fuel mixture containing an aluminum soap of fatty acid (alumagel) and gasoline. This gelling additive is mixed with gasoline at the rate of 7 pounds per 35 gallons.

GLYCOGEN: A white, sweet powder occurring as the chief animal storage carbohydrate, mainly in the liver.

GROUND COVER: Grasses or other plants that keep soil from being blown away or washed away.

HABITAT: The environment in which an organism occurs.

HALF-LIFE: The time required for half the amount of a herbicide introduced into a living system to be eliminated or disintegrated by natural processes.

HECTARE: 10,000 square meters or about 2.47 acres.

HERBACEOUS: Having little or no woody tissue and usually persisting for a single season.

HERBICIDE: A substance used to inhibit or destroy plant growth; the active ingredient such as glyphosate. If its effectiveness is restricted to a specific plant or type of plant, it is called a selective herbicide. If it is effective for a broad range of plants, it is called nonselective.

HERBICIDE FORMULATION: A combination of the active ingredient and the inert ingredient which may be an emulsifier, a solvent, a preservative, an anti-volatility agent or other substance.

HERBIVORE: An animal that exclusively eats plants.

HISTOPATHOLOGIC: Pertaining to tissue changes characteristic of diseases.

INFILTRATION: The downward entry of water into the soil.

INSULT: Injury to the body or one of its parts or something that causes or has a potential for causing such injury.

INTEGRATED PEST MANAGEMENT: Use of several techniques (for example, burning, grazing and mechanical, manual, or chemical methods) as one system to control animals or plants where they are unwanted (see BLM Manual 9220).

INTERMITTENT STREAM: A stream that flows only at certain times of the year when it receives water from springs or from some surface source such as melting snow.

IN VITRO: Outside the living body and in an artificial environment.

LABEL: All written, printed, or graphic matter on or attached to pesticide containers as required by law.

LC_{50}: A lethal pesticide concentration rate at which 50 percent of test animals will be killed. It is usually used in testing of fish or other aquatic animals.

LD_{50}: The dosage of toxicant (expressed in milligrams of toxicant per kilogram of animal body weight) required to kill 50 percent of the animals in a test population when given orally.

LEACHING: The movement of chemicals through soil by water or the movement of herbicides out of leaves, stems, or roots into the air or soil.

LIVESTOCK PERFORMANCE: The gaining of weight by livestock.

LOESS: Soil material carried and deposited by the wind, consisting predominantly of silt-sized particles.

LONG TERM: Beyond the 10-year program following the initial implementation of a noxious weed control program.

MARGIN OF SAFETY (MOS): The ratio between the animal no observed effect level (NOEL) and the estimated human dose. The larger the MOS, the smaller the estimated human dose and the lower the risk to human health.

METABOLISM: The chemical processes in living cells by which new material is assimilated and energy is provided for vital processes.

METABOLITE: Any substance taking part in or produced by metabolism.

MICROBIAL DEGRADATION: The breakdown by bacteria of chemical substances into simpler components.

MICROCLIMATE: Climatic conditions characteristic of a small area. Microclimates are influenced by local geography and vegetation and may differ from regional climate in temperature, wind, length of growing season, and precipitation.

MICROGRAM: One millionth of a gram.

MICRON: One millionth of a meter

MOBILITY (HERBICIDE): The capability of a herbicide to be moved easily within soil, vertically or laterally, with the normal movement of water.

MULTIPLE USE: The harmonious use of land for more than one purpose, not necessarily the combination of uses that will yield the highest economic return.

MUTAGEN: A substance that tends to increase the frequency or extent of genetic mutations (changes in hereditary material).

MYONEURAL: Of or relating to both muscle and nerve.

MYOTONIA: Tonic spasm of one or more muscles or a condition characterized by such spasms.

NATIONAL AMBIENT AIR QUALITY STANDARDS (NAAQS): The allowable concentrations of air pollutants in the air specified by the Federal Government in Title 40, Code of Federal Regulations, Part 50. The air quality standards are divided into primary standards (based on the air quality criteria and allowing an adequate margin of safety requisite to protect public health) and secondary standards (based on the air quality criteria and allowing an adequate margin of safety requisite to protect the public welfare from any unknown or expected adverse effects of air pollutants). Welfare includes effects on soils, water, crops, vegetation, manufactured materials, animals, wildlife, weather, visibility, and climate; damage to and deterioration of property; hazards to transportation; and effects on economic values and on personal comfort and well being.

NATIONAL REGISTER OF HISTORIC PLACES: The official list, established by the Historic Preservation Act of 1966, of the nation's cultural resources worthy of preservation. The Register lists archaeological, historic, and architectural properties (districts, sites, buildings, structures, and objects) nominated for their local, state, or national significance by state and federal agencies and approved by the National Register Staff. The Register is maintained by the National Park Service.

NATIONAL TRAILS SYSTEM: A network of nationally significant trails consisting of (1) scenic, extended trails that provide outdoor recreation opportunities and conserve nationally significant scenic, historic, natural, or cultural qualities of areas through which they pass, and (2) recreation trails that provide a variety of outdoor recreation uses in or reasonably near urban areas.

NATIONAL WILD AND SCENIC RIVERS SYSTEM: A system of nationally designated rivers and their immediate environments that have outstanding scenic, recreational, geologic, fish and wildlife, historic, cultural, and other similar values and are preserved in a free-flowing condition. This system consists of three types (1) Recreation--rivers or sections of rivers readily accessible by road or railroad that may have some development along their shorelines and that may have undergone some impoundment or diversion in the past; (2) Scenic--rivers or sections of rivers free of impoundments, with shorelines or watersheds still largely undeveloped but accessible in places by roads; and (3) Wild--rivers or sections of rivers free of impoundments and generally inaccessible except by trails, with watersheds or shorelines essentially primitive and waters unpolluted.

NEUROPATHY: An abnormal and usually degenerative state of the nervous system or nerves.

NONTARGET VEGETATION: Vegetation that is neither expected nor planned to be affected by herbicide treatment.

NO OBSERVED EFFECT LEVEL (NOEL): (1) the lowest dose of a substance by any route other than inhalation that has been found by experiment with animals to have no toxic effect on the animals or (2) the lowest concentration of a substance in air that has been found by experiment with animals to have no toxic effect on the animals exposed for a defined time.

NOXIOUS WEED: According to the Federal Noxious Weed Act (PL 93-629), a weed that causes disease or has other adverse effects on man or his environment and therefore is detrimental to the agriculture and commerce of the United States and to the public health.

ONCOGENIC: Causing tumors, whether benign or malignant.

ORGANOGENESIS: The formation of organs in animals.

OUTSTANDING NATURAL AREA: A natural area established to preserve scenic values and areas of natural wonder.

PALEONTOLOGY: A science dealing with life of past geological periods as known from fossils.

PARTICULATES: Finely divided solid or liquid particles in the air or in an emission, including dust, smoke fumes, mist, spray, and fog.

PATHOGEN: A specific causative agent of disease, such as a bacterium or virus.

PERENNIAL PLANT: A plant that completes its life cycle in more than 2 years.

PERENNIAL STREAM: A stream that flows continuously year round.

PERSISTENCE: The resistance of a herbicide to metabolism and environmental degradation and thus a herbicide's retention of its ability to kill plants for prolonged periods.

PESTICIDE: Any substance or mixture of substances intended for controlling insects, rodents, fungi, weeds, or other plants and animals that are considered pests.

PETIOLE: A slender stem that supports the blade of a foliage leaf.

pH: A numeric value that gives the relative acidity or alkalinity of a substance on a 0 to 14 scale with the neutral point at 7.0. Values lower than 7.0 show the presence of acids, and values greater than 7.0 show the presence of alkalis.

PHOTODECOMPOSITION (PHOTODEGRADATION): The breakdown of a substance, especially a chemical compound, into simpler components by the action of sunlight.

PHOTOSYNTHESIS: Formation of carbohydrates in the tissues of plants exposed to light.

PHYTOTOXIC: Poisonous to plants.

PRODUCTIVITY POTENTIAL: The potential of a particular soil to support and maintain plant growth.

PRESCRIBED BURNING: The scientific, intentional burning of wildland fuels in either their natural or modified states under conditions to allow the fire to continue to a predetermined area and to produce the intensity of heat and rate of spread needed to meet certain objectives.

RADIOLABELLING: A method of creating a radioactive isotope by bombarding a particle with beta or gamma rays. This method is used to trace the movement of particles in fluids.

RAPTORS: Birds of prey, such as owls, hawks, or eagles.

RESEARCH NATURAL AREA: A physical or biological unit in which current natural conditions are maintained insofar as possible. In such areas, activities such as grazing and vegetation manipulation are prohibited unless they replace natural processes and contribute to the protection and preservation of an area. Such recreation activities as camping and gathering plants are discouraged.

RHIZOME: An underground root-like stem, that produces roots and leafy shoots and provides a means for some plants to reproduce.

RIPARIAN: Pertaining to or located along a streambank or other water bodies, such as ponds, lakes, reservoirs, or marshes.

RISK: The probability that a substance will produce harm under specified conditions.

ROSETTE: A cluster of leaves in crowded circles or spirals arising basally from a crown or apically from an axis with greatly shortened internodes.

RUNOFF: The part of the precipitation in a drainage area that is discharged from the area in stream channels, including surface runoff, ground water runoff, and seepage.

SCOPING: The process by which significant issues relating to a proposal are identified for environmental analysis. Scoping includes eliciting public comment on the proposal, evaluating concerns, and developing alternatives for consideration.

SEDIMENTATION: The process or action of depositing sediment.

SENSITIVE SPECIES (PLANTS): Plant species not officially listed as threatened or endangered but that are undergoing a status review or are proposed for listing by either Federal Register notices published by the Secretary of the Interior or the Secretary of Commerce or by comparable state documents.

SOIL COMPACTION: The compression of the soil profile from surface pressure, resulting in reduced air space, lower water-holding capacity, and decreased plant root penetrability.

SOIL COLLOID: An extremely small particle of clay or organic matter that exposes a large surface area on which some herbicides are absorbed.

SOIL PRODUCTIVITY: The capacity of a soil in its normal environment to produce a specified plant or sequence of plants under a specified system of management.

SOIL PROFILE: A vertical section of soil that shows all horizons and parent material.

SORPTION: The process of taking up or holding by either absorption or adsorption.

SPOT TREATMENT: Applying pesticide to a selected individual area as opposed to broadcast application.

STATE HISTORIC PRESERVATION OFFICER (SHPO): The official within each state authorized by the state at the request of the Secretary of the Interior to act as liaison for implementing the National Historic Preservation Act of 1966.

STREAM CLASSES: Four classes of streams defined by present and foreseeable uses made of the water and potential effects of onsite changes on downstream uses. Because importance of use is relative to the general area, size is not necessarily a criterion for classification. Whole streams of parts of streams can be classified, and one stream may have sections in different classes.

Class I - Perennial or intermittent streams or segments that have one or more of the following characteristics: (1) are a direct source of water for domestic use (cities, recreation sites); (2) are used by large numbers of fish for spawning, rearing, or migration; (3) have enough water flow to greatly influence water quality of a Class I stream.

Class II - Perennial or intermittent streams or segments that have one or both of the following characteristics: (1)

are used by moderate though significant numbers of fish for spawning, rearing, or migration; (2) have enough water flow to have only a moderate and not a clearly identifiable influence on downstream quality of a Class I stream or have a major influence on a Class I stream.

Class III - All other perennial streams or segments not meeting higher class criteria.

Class IV - All other intermittent streams or segments not meeting higher class criteria.

SURFACTANT: Any substance that when dissolved in water or in an acqueous solution reduces its surface tension or the interface tension between itself and another liquid.

SUSPENDED SEDIMENT: Very fine soil particles that for long periods of time are maintained in suspension in water by turbulent currents or as colloids.

SUSTAINED YIELD: Achieving and maintaining a permanently high level, annual or regular period production of renewable land resources without impairing the productivity of the land and its environmental values.

TERATOGEN: A substance tending to cause development malformations in unborn human or animal offspring.

TERATOGENESIS: Birth defects.

THREATENED SPECIES: Plant or animal species that are not in danger of extinction but are likely to become so within the foreseeable future throughout all or a significant portion of their range. See ENDANGERED SPECIES.

TISSUE BURDEN: The cumulative effects of a substance on a particular tissue.

TOLERANCE: Acceptable level of pesticide residues.

TOTAL DISSOLVED SOLIDS (TDS): An aggregate of carbonates, bicarbonates, chlorides, sulfates, phosphates, and nitrates of calcium, magnesium, manganese, sodium, potassium, and other cations that form salts. High TDS solutions can change the chemical nature of water, exert varying degrees of osmotic pressures, and often become lethal to life in an aquatic environment.

TRANSLOCATION: The transfer of substances from one location to another in the plant body.

TUMORIGENIC: Causing tumors.

UNDERSTORY VEGETATION: Plants, usually grasses, forbs, and low shrubs, growing beneath the canopy of other plants.

UNGULATES: Hoofed mammals, most of which are herbivores and many of which have horns.

VAPOR PRESSURE: The pressure at which a chemical compound will evaporate.

VASCULAR PLANT: A plant that has a specialized conducting system consisting of xylem and phloem.

VISUAL INTRUSION: A feature (land, vegetation, structure) that is generally considered out of context with the characteristic landscape.

VISUAL RESOURCE MANAGEMENT (VRM): The planning, design, and implementing of management objectives to provide acceptable levels of visual impacts for all resource management activities.

VISUAL RESOURCE MANAGEMENT CLASS (VRM CLASS): The degree of visual change acceptable within the existing characteristic landscape. An area's classification is based upon the physical and sociological characteristics of any given homogeneous area and serves as a management objective. Class I (preservation) provides the highest level of protection for scenic values, and Class IV the lowest level.

VOLATILITY: The ability of a substance to change from a liquid to a vapor state. Volatility is determined by the relative vapor pressures of an individual compound. There are three categories in which the various compounds are grouped for regulatory and analytical purposes: high volatile (HV), low (LV) and nonvolatile (NV).

VOLATIZATION: The change of herbicide droplets from a liquid to a vapor state.

WATER TABLE: The upper limit of the part of the soil or underlying rock material that is wholly saturated with water.

WATSTORE: WATer STOrage and REtrieval--a computer program created and maintained by the U.S. Geological Survey for storing, retrieving, and manipulating water quality data.

WEED: A plant out of place or growing where not desired.

WEED-INFESTED ACRE: Any part of an acre of land that is infested with weeds.

WETLANDS: Those areas that are inumdated by surface or ground water with a frequency sufficient to support and under normal circumstances does or would support a prevalence of vegetative or aquatic life that requires saturated or seasonally saturated soil coditions for growth and reproduction.

WILDERNESS: An area designated by Congress as part of the National Wilderness Preservation System. Wilderness areas are generally undeveloped federal lands that retain their primeval character and influence without improvements or human habitation.

WILDERNESS STUDY AREA (WSA): A roadless area that has been found to have wilderness characteristics and that is being subjected to intensive analysis in the BLM planning system and to public review to determine wilderness suitability.

References Cited

All of the references in the References Cited section of the DSEIS are on file and may be reviewed during office hours (7:30 am - 4:15 pm) at the BLM Oregon State Office (Lloyd Center Tower, 16th floor, 825 NE Multnomah Street, Portland, Oregon). Please call Philip Hamilton (503-231-6258) for an appointment to review any of this material. Copies of material without copyright protection may be acquired at standard copying fees of $0.25 per page.

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Index

Abbreviations

aI:	active ingredient
ADI:	acceptable daily intake
BLM:	U.S. Department of the Interior, Bureau of Land Management
BPA:	U.S. Department of Energy, Bonneville Power Administration
CEQ:	Council on Environmental Quality
CFR:	Code of Federal Regulations
DOE:	U.S. Department of Energy
EIS:	environmental impact statement
EPA:	U.S. Environmental Protection Agency
FIFRA:	Federal Insecticide, Fungicide, and Rodenticide Act
FS:	U.S. Department of Agriculture, Forest Service
ha:	hectare
kg:	kilogram
m:	meter
mg:	milligram
MOS:	margin of safety
mph:	miles per hour
NEPA:	National Environmental Policy Act
NCI:	National Cancer Institute
NOEL:	no observed effect level
NRCC:	National Research Council of Canada
PADI:	Provisional allowable daily intake
ppm:	parts per million
ppb:	parts per billion
SCS:	U.S. Department of Agriculture, Soil Conservation Service
TAP:	Toxicology and Applied Pharmacology
USDA:	U.S. Department of Agriculture
USDI:	U.S. Department of the Interior
VRM:	visual resource management
WSA:	wilderness study area

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