

APPENDIX D

Methodology for Assessing Health Risk to Humans

The methodology for the FS 1992 Risk Assessment employed three principal analytical elements -- hazard analysis, exposure analysis, and risk analysis -- to characterize the potential adverse health effects of human exposure to herbicides.

Human Health Hazard Analysis

The human health hazards associated with using each herbicide were determined from extensive literature searches and relevant data submitted to the Environmental Protection Agency in support of each of the pesticide's registration. This information was reviewed in particular to identify toxicity reference levels determined in laboratory animal studies for comparison with estimated program doses.

Human Health Exposure Analysis

For the Noxious Weed Management Plan for the ARNF & PNG, herbicides are to be applied by backpack, horse-pack, ground mechanical, and hand application. For each application method, two human populations were evaluated in terms of their potential to be exposed to the herbicides proposed for use -- members of the public who live or work nearby, or who visit an area where the herbicides are being applied, and workers participating in application operations.

Exposure scenarios were developed for each application type to estimate doses to the public and to workers. The scenarios took into account the potential route of exposure, the relevant characteristics of the individual exposed, the time of inception and the duration of the exposure, the distance from the treated area, and the level of protection against receiving a dose from such an exposure that the person might possess. For the ARNF & PNG, the chances that any member of the public will actually be exposed in these operations are expected to be extremely low because of the small acreages involved, the remoteness of most application sites, and the mitigation measures requiring signing of treated areas and public notification of treatment schedules.

In most cases, three levels of exposure were analyzed for members of the public and workers: routine-typical, routine-extreme, and accidental. The risk assessment did not quantify the probability or likelihood that any single member of the public will be exposed, but rather estimated public health risk assuming an individual is exposed under a given set of circumstances. The routine-typical public exposure scenarios were designed to estimate the most likely level of exposure that would occur assuming a person is exposed under the prescribed set of circumstances. The routine-extreme scenarios were designed to estimate what could be the highest exposure levels likely to occur, again assuming a person is exposed under the same set of circumstances. The accidental exposure scenarios were designed to estimate the level of exposure that could occur to a member of the public only in the event of an emergency situation, such as a spill.

Exposures to members of the public were determined by evaluating the transport and fate of the herbicide in the environment and estimating the amount to which a person might be exposed by each potential exposure route. Exposures to members of the public near the treatment area during or just after

an application were evaluated for a variety of scenarios representing the range of activities persons might be engaged in near these sites. Exposures to workers were determined by extrapolating from doses found in field studies of similar types of herbicide applications. Scenarios developed for accidental exposures of both members of the public and workers included direct spray of a person, direct spray of vegetation or water, immediate reentry into a treated area, and spills of concentrated herbicides or mixtures.

Human Health Risk Analysis

Evaluation of human health risks were based on risk of systemic and reproductive/developmental health effects from chronic exposure, as well as the risk of cancer from repeated exposure to those substances considered possible carcinogens by EPA. Human health risks were evaluated for exposures to the herbicides used in broadcast applications and in spot treatments. Human health risks from the herbicides and carriers were evaluated for both acute and chronic effects and for cancer risk.

Systemic risks from the herbicides and carriers used in broadcast and spot applications were evaluated by comparing the estimated doses for each herbicide in each scenario to the laboratory-determined toxicity levels noted in the hazard analysis. The risks of threshold effects were evaluated in terms of a margin-of-safety (MOS), which is the ratio of dose estimated in the Human Health Exposure Analysis to the systemic or reproductive/developmental no-observed-effect-level (NOEL). Risk increases as the estimated dose approaches the laboratory toxicity level -- that is, as the MOS decreases. In general, where the MOS for a given estimated dose was calculated to be 100 or greater, the dose is described as posing a low risk of health effects. An MOS of between 100 and 10 is described as posing a moderate risk of health effects. MOS's less than 10 pose a high risk of health effects.

The risk of an herbicide causing cancer was evaluated differently because it is assumed that an herbicide that may cause cancer has some chance of causing it at any dose level. Cancer risks were calculated only for chemicals for which EPA has established a cancer potency value.

Source: USDA Forest Service, Risk Assessment for Herbicide Use in Forest Service Regions 1, 2, 3, 4, and 10 and On Bonneville Power Administration Sites, September 1992: Section III-E, Human Health Risk Analysis, and pp. III-E-42 to III-E-44, Potential for Effects on Sensitive Individuals.