United States Department of Energy

Environmental Assessment of Remedial Action at the Lowman Uranium Mill Tailings Site Near Lowman, Idaho

JUN 03 1992

Final

January 1991

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Uranium Mill Tailings Remedial Action Project

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ENVIRONMENTAL ASSESSMENT
OF
REMEDIAL ACTION AT THE LOWMAN
URANIUM MILL TAILINGS SITE NEAR
LOWMAN, IDAHO

FINAL

JANUARY 1991

U.S. DEPARTMENT OF ENERGY
UMTRA PROJECT OFFICE
ALBUQUERQUE, NEW MEXICO

MASTER

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LOWMAN, IDAHO

U.S. DEPARTMENT OF ENERGY

ABSTRACT

This document assesses the environmental impacts of stabilization on site of the contaminated materials at the Lowman uranium mill tailings site. The Uranium Mill Tailings Radiation Control Act of 1978, Public Law 95-604, authorized the U.S. Department of Energy to clean up the site to reduce the potential health impacts associated with the residual radioactive materials. The U.S. Environmental Protection Agency (EPA) promulgated health and environmental protection standards for uranium mill tailings (40 CFR 192). Remedial action must be performed in accordance with these standards and with the concurrence of the U.S. Nuclear Regulatory Commission and the state of Idaho.

The Lowman site is 0.5 road mile northeast of the unincorporated village of Lowman, Idaho, and 73 road miles from Boise, Idaho. The Lowman site consists of piles of radioactive sands, an ore storage area, abandoned mill buildings, and windblown/waterborne contaminated areas. A total of 29.5 acres of land are contaminated and most of this land occurs within the 35-acre designated site boundary. The proposed action is to stabilize the tailings and other contaminated materials on the site. A radon barrier would be constructed over the consolidated residual radioactive materials and various erosion control measures would be implemented to ensure the long-term stability of the disposal cell. Radioactive constituents and other hazardous constituents were not detected in the groundwater beneath the Lowman site. The groundwater beneath the disposal cell would not become contaminated during or after remedial action so the maximum concentration limits or background concentrations for the contaminants listed in the draft EPA groundwater protection standards would be met at the point of compliance. No significant impacts were identified as a result of the proposed remedial action at the Lowman site.

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1.0 INTRODUCTION

1.1 PROJECT SUMMARY

The Uranium Mill Tailings Radiation Control Act of 1978 (UMTRCA), Public Law 95-604, authorized the U.S. Department of Energy (DOE) to perform remedial action at the Lowman tailings site near Lowman, Idaho, (as well as at many other sites) to reduce the potential public health impacts from the residual radioactivity at the site. The remedial actions at inactive uranium mill sites are performed by the Uranium Mill Tailings Remedial Action (UMTRA) Project. The U.S. Environmental Protection Agency (EPA) promulgated standards (40 CFR 192) in March 1983 for the remedial actions.

The Lowman site is 0.5 road mile northeast of the village of Lowman in Boise County, Idaho (Figure 1.1). The site is in the northern Rocky Mountains, is characterized by steep, heavily wooded terrain, and is within the Boise National Forest. The elevation at the site is approximately 3800 feet above mean sea level (MSL) and the surrounding mountains rise to over 6000 feet above MSL. Land uses in the surrounding area include recreation, grazing, logging, and mining.

A total 29.5 acres of land are contaminated within the 35-acre designated site (Figure 1.2). The radioactive sand piles cover 10.1 acres and contain 50,000 cubic yards (cy) of contaminated materials; these piles are comprised of white, gray, black, and red sands. The mill yard, ore storage, and pond areas cover 5.0 acres and 19,100 cy of contaminated materials occur in these areas. The windblown and waterborne contaminated areas cover 14.4 acres and contain 19,700 cy of contaminated materials. The total amount of contaminated materials at the site is 88,800 cy. An additional 38,700 cy of contaminated materials exist off-site at the vicinity properties.

The principal potential hazard associated with the contaminated materials at the Lowman site results from the production of radon, a decay product of the radium contained in the sand piles. Radon, a radioactive gas, can diffuse through the piles and be released into the atmosphere, where it and its radioactive decay products (radon daughters) may be inhaled by humans. Exposure to radon and its decay products over a long period of time will increase the probability that cancer deaths (i.e., cancers) may develop in persons living and working near the piles. Exposure to gamma radiation, the inhalation of airborne radioactive particulates, the ingestion of contaminated food produced in the area around the sands, and the ingestion of surface water contaminated by the sands also pose potential hazards. If the sands are not properly stabilized, erosion or human removal of contaminated materials could spread the contamination over a much wider area and increase the potential for public health hazards.

The proposed remedial action for the Lowman site is a consolidation of all of the sands and other contaminated materials into one pile on the site. The disposal cell would be placed against the steep slope on the east side of the designated site and have 20 percent slopes on the lower

- LEGEND**
- DIRT ROAD
 - (21) STATE ROAD
 - BUILDINGS

■ SUPPLEMENTAL STANDARDS APPLIED AND
NO EXCAVATION REQUIRED EXCEPT
IN POSSIBLE ISOLATED AREAS

100 0 100 300
SCALE IN FEET

FIGURE 1.2
PRESENT CONDITION OF THE LOWMAN SITE
NEAR LOWMAN, IDAHO

part and 10 percent slopes on the upper part. The cell would be covered with a layer of compacted soil to inhibit radon emanation. The cell would then be covered with a layer of sand and rock to protect it against erosion, penetration by animals, and inadvertent human intrusion. The disposal cell would average 22.5 feet above the surrounding terrain and would cover 8.2 acres. Twenty-nine and one-half acres of land are contaminated. However, only 13.1 acres would be cleaned up; 10.2 acres are in a wooded area and riparian area along Clear Creek with low contamination levels consisting of windblown and waterborne materials, and supplemental standards would be applied (see Figure 1.2 for limits of excavation if supplemental standards are applied); 6.2 acres of contaminated land would be covered by the disposal cell and would not be cleaned up. An additional two acres of uncontaminated land outside the current designated site boundary would be used for the disposal cell, resulting in 15.1 acres being affected by remedial action. Areas disturbed around the disposal cell during remedial action would be restored in accordance with applicable permits or approvals and released for unrestricted use.

A limited amount of remedial action construction activities may take place in the floodplain and wetlands of Clear Creek. An analysis of these activities is presented in Attachment 1, Floodplain/Wetlands Assessment, attached to this document.

Supplemental information providing further details on the conceptual remedial action design, surface water and groundwater hydrology, flora and fauna, radiation doses and cancer deaths, and permits, licenses, and approvals can be found in the Environmental Analysis and Data Report (EADR) for the Lowman remedial action (DOE, 1990a).

1.2 IMPACT SUMMARY

The environmental impacts of the proposed action are listed in Table 1.1. The impacts presented in this document are based on conservative impact assessment methods and are intended to represent a realistic upper limit on the severity of the potential impacts for stabilization on the site.

Table 1.1 Impacts of the proposed action

Component	Impacts
Remedial action worker health	6.7×10^{-6} radon daughter additional cancer deaths; 6.9×10^{-5} gamma exposure additional cancer deaths; 1.5×10^{-4} radioactive particulate additional cancer deaths; 2.3×10^{-4} total additional cancer deaths.
Public health ^a	5.3×10^{-5} radon daughter excess cancer deaths; 4.3×10^{-5} radioactive particulate excess cancer deaths during remedial action; 9.6×10^{-5} total excess cancer deaths. The estimated annual health risk for no action at the tailings site would be 1.2×10^{-4} , while the estimated annual health risk for no action at the vicinity properties would range from 0.8×10^{-1} to 1.1×10^{-1} .
Air quality (nonradiological, 24-hour maximum)	Total suspended particulate (TSP) concentrations at the disposal site (192 micrograms per cubic meter) would exceed the secondary EPA and Idaho standards; TSP concentrations at the Mores Creek borrow site would not exceed standards.
Mineral resources	25,000 cy of rock would be extracted from the Mores Creek borrow site.
Soils	Soil exists on 11.2 acres of land that would be disturbed. The remaining acres represent the sand piles, which contain no soil (10.1 acres) or land that would not be cleaned up due to supplemental standards (10.2 acres). The estimated amount of soil lost would be 38,800 cy.

Table 1.1 Impacts of the proposed action (Continued)

Component	Impacts
Water resources	Groundwater beneath the residual radioactive materials is not contaminated and the groundwater beneath the disposal cell would not be contaminated. Therefore, the maximum concentration limits and background concentrations of hazardous constituents listed in the draft EPA groundwater protection standards would not be exceeded at the point of compliance.
Water consumption	An estimated 648,200 gallons of water would be needed for such activities as compaction and dust control. The water would likely be obtained from Clear Creek.
Wildlife	21.3 acres of wildlife habitat would be cleared; permanent loss of 8.2 acres; remaining area would be recontoured and revegetated.
Vegetation	11.2 acres of vegetation cleared (10.1 acres of bare sands not included in this total); 8.2 acres permanently lost; 13.1 acres recontoured and revegetated, which includes some areas previously covered with radioactive sands.
Threatened and endangered species	None
Land use	Restricted use of the 18-acre disposal site, which includes the 8.2-acre disposal cell; no limitations on land use for remainder of designated site.
Noise	Noise levels slightly above 70 dBA ^b at nearest residence to the Lowman site. Noise levels in the village of Lowman much lower.

Table 1.1 Impacts of the proposed action (Concluded)

Component	Impacts
Historic and cultural resources	None
Population	Short-term increase of 19 people.
Employment	Average work force of 21; peak of 35.
Social services	None
Transportation networks	Short-term (3 weeks) 78 percent increase in traffic on State Highway 21 associated with the movement of rock erosion protection materials from the Mores Creek borrow site; total projected accidents may result in 0.565 injury and 0.019 fatal accident along the transportation routes and at the Lowman site.
Construction costs (\$) ^c	\$ 2.2 million

^aHealth impacts are calculated for a constant population (see Section 4.1).

^bdBA=decibels on the A-weighted scale.

^cDoes not include the cost of construction management, field supervision, and engineering.

2.0 REMEDIAL ACTION ALTERNATIVES

2.1 THE NEED FOR REMEDIAL ACTION

2.1.1 Background

In response to concern about the potential public health hazards related to uranium mill tailings and the associated contaminated materials left abandoned or otherwise uncontrolled at inactive processing sites throughout the United States, Congress passed the UMTRCA, Public Law 95-604 (PL95-604), which was enacted into law on November 8, 1978. In Title I of the UMTRCA, Congress acknowledged the potential health hazards associated with uranium mill tailings and identified 24 sites that were in need of remedial action. The Lowman, Idaho, site is one of these sites.

Title I of the UMTRCA required the Secretary of the DOE to designate sites to be remediated and authorized the DOE to enter into cooperative agreements with affected states or Indian tribes. Title I also required the EPA to promulgate standards for the inactive sites and defined the role of the U.S. Nuclear Regulatory Commission (NRC).

Effective March 11, 1985, the DOE and the State of Idaho entered into a cooperative agreement under the UMTRCA. The cooperative agreement set forth the terms and conditions for the DOE and state's cooperative remedial action efforts including the DOE's development of a remedial action plan (RAP) (in conjunction with the state of Idaho), the DOE's preparation of an appropriate environmental document (reviewed and commented on by the state), real estate responsibilities, and other concerns.

The EPA published an Environmental Impact Statement (EIS) (EPA, 1982) on the development and impacts of its standards (40 CFR 192) and issued final standards (48 FR 590-604) that became effective on March 7, 1983 (Table 2.1). In developing these standards, the EPA determined "that the primary objective for control of tailings should be isolation and stabilization to prevent their misuse by man and dispersal by natural forces" and that "a secondary objective should be to reduce the radon emissions from the piles." A third objective should be "the elimination of significant exposure to gamma radiation from tailings piles."

On September 3, 1985, the U.S. Tenth Circuit Court of Appeals remanded the EPA Title I groundwater standards, 40 CFR 192.2(a)(2)-(3). The EPA issued proposed groundwater standards for comment on September 24, 1987. Under the UMTRCA, the DOE must comply with the proposed standards until final standards are promulgated. The design for the disposal of the Lowman contaminated materials has been formulated to achieve compliance with the requirements of the proposed standards. When the final EPA standards are promulgated,

PART 192 - HEALTH AND ENVIRONMENTAL PROTECTION STANDARDS FOR URANIUM MILL TAILINGS

SUBPART A - Standards for the Control of Residual Radioactive Materials from Inactive Processing Sites

192.02 Standards

Control shall be designed to:

- (a) Be effective for up to one thousand years, to the extent reasonably achievable, and, in any case, for at least 200 years, and,
- (b) Provide reasonable assurance that releases of radon-222 from residual radioactive material to the atmosphere will not:
 - (1) Exceed an average release rate of 20 picocuries per square meter per second, or
 - (2) Increase the annual average concentration of radon-222 in air at or above any location outside the disposal site by more than one-half picocurie per liter.

SUBPART B - Standards for Cleanup of Land and Buildings Contaminated with Residual Radioactive Materials from Inactive Uranium Processing Sites

192.12 Standards

Remedial actions shall be conducted so as to provide reasonable assurance that, as a result of residual radioactive materials from any designated processing site:

- (a) The concentration of radium-226 in land averaged over any area of 100 square meters shall not exceed the background level by more than -
 - (1) 5 pCi/g, averaged over the first 15 cm of soil below the surface, and
 - (2) 15 pCi/g, averaged over 15 cm thick layers of soil more than 15 cm below the surface.
- (b) In any occupied or habitable building -
 - (1) The objective of remedial action shall be, and reasonable effort shall be made to achieve, an annual average (or equivalent) radon decay product concentration (including background) not to exceed 0.02 WL. In any case, the radon decay product concentration (including background) shall not exceed 0.03 WL, and
 - (2) The level of gamma radiation shall not exceed the background level by more than 20 microroentgens per hour.

SUBPART C - Implementation (condensed)

192.20 Guidance for Implementation

Remedial action will be performed with the "concurrence of the Nuclear Regulatory Commission and the full participation of any state that pays part of the cost" and in consultation as appropriate with other government agencies.

192.21 Criteria for Applying Supplemental Standards

The implementing agencies may apply standards in lieu of the standards of Subparts A or B if certain circumstances exist, as defined in 192.21.

192.22 Supplemental Standards

"Federal agencies implementing Subparts A and B may in lieu thereof proceed pursuant to this section with respect to generic or individual situations meeting the eligibility requirements of 192.21."

- (a) "...the implementing agencies shall select and perform remedial actions that come as close to meeting the otherwise applicable standards as is reasonable under the circumstances."
- (b) "...remedial actions shall, in addition to satisfying the standards of Subparts A and B, reduce other residual radioactivity to levels that are as low as is reasonably achievable."
- (c) "The implementing agencies may make general determinations concerning remedial actions under this Section that will apply to all locations with specified characteristics, or they may make a determination for a specific location. When remedial actions are proposed under this Section for a specific location, the Department of Energy shall inform any private owners and occupants of the affected location and solicit their comments. The Department of Energy shall provide any such comments to the other implementing agencies [and] shall also periodically inform the Environmental Protection Agency of both general and individual determinations under the provisions of this section."

Ref: Federal Register, Volume 48, No. 3, January 5, 1983, 40 CFR Part 192.

TABLE 2.1
EPA STANDARDS

the DOE will reevaluate its groundwater protection plan for the Lowman disposal site and undertake such action as is necessary to ensure that the final standards are met. The EPA standards will be addressed in the RAP, which is scheduled for publication in the spring of 1991.

The Lowman site is within the Boise National Forest and part of the proposed disposal cell and project site would be on land purchased from the U.S. Forest Service. The U.S. Forest Service is fully aware and has been involved in all aspects of the Lowman UMTRA Project. This has included UMTRA Project personnel giving presentations regarding the Lowman project at the U.S. Forest Service's annual meeting in Lowman. There have been frequent discussions with the U.S. Forest Service regarding purchase of U.S. Forest Service land for the disposal cell, as well as communication on many other topics relative to remedial action at the Lowman site.

2.1.2 The purpose of this document

This Environmental Assessment (EA) is prepared pursuant to the National Environmental Policy Act (NEPA), which requires Federal agencies to assess the effects of their actions on the environment. This EA examines the short- and long-term effects of the DOE's proposed remedial action for the Lowman site.

The DOE will use the information and analyses presented here to determine whether the proposed action would have a significant impact on the environment. If the impacts are determined to be significant, an environmental impact statement will be prepared. If the impacts are not judged to be significant, the DOE may issue a Finding of No Significant Impact and implement the proposed action. These procedures are defined in regulations issued by the Council on Environmental Quality in Title 40, Code of Federal Regulations (CFR), Parts 1500 through 1508 (40 CFR 1500 through 1508).

Remedial action at the Lowman site would include the cleanup of contaminated vicinity properties associated with the site. Vicinity properties are properties outside the Lowman designated processing site boundary that were contaminated by materials that were removed from the site before the potential hazards of these materials were known. Radiological surveys in the Lowman site area indicated that there are 30 vicinity properties associated with the Lowman site; this number may increase slightly because vicinity property surveys are still in progress. The potential environmental impacts of remedial action at vicinity properties at UMTRA Project sites were previously assessed in a programmatic environmental report (DOE, 1985a). With the exception of radiological impacts, impacts to vicinity properties associated with the Lowman site are expected to be similar to those assessed in the programmatic environmental report and, therefore, are not addressed in this EA. The radiological impacts for no action and for the proposed action at the vicinity properties are addressed in this EA.

2.2 THE PROPOSED ACTION--STABILIZATION ON SITE

The proposed action is to stabilize the contaminated materials on the Lowman site. The design for stabilization on site was developed to comply with the EPA standards. Consistent with the EPA standards, it is proposed that supplemental standards be applied to portions of the windblown area at the north end of the site and waterborne contaminated areas along Clear Creek (see Figure 1.2). The rationale for application of supplemental standards to these areas is based on radiological, ecological, geomorphological, and engineering information. Application of supplemental standards under Subpart C, paragraph 192.21 (see Table 2.1), is recommended for the following reasons:

- o Areas proposed to be excluded from excavation have low average radium-226 soil concentrations, ranging from below five picocuries per gram (pCi/g) to 15 pCi/g and the health impacts from leaving the contaminated material in place would be minimal.
- o Application of supplemental standards would ensure that there would be no impacts in the 100-year floodplain and in U.S. Army Corp of Engineers regulated wetlands along Clear Creek.
- o Application of supplemental standards at the windblown contaminated areas on the steep forested slopes north of the site would prevent environmental harm that is excessive compared to health benefits resulting from cleanup.
- o Supplemental standards would be applied to steeply sloped areas between the Lowman site and Clear Creek that are contaminated. Excavation of these slopes would result in unreasonably high environmental and engineering costs compared to long-term benefits. In addition, excavation of these areas would necessitate use of hand excavation techniques and present a risk of injury to remedial action workers not justified by the reduction in long-term risks.
- o Application of supplemental standards to the slope between the site and Clear Creek would also result in leaving vegetation and soil in place and would thereby maintain the stability of the slope. This in turn would prevent destabilization of the slope and the upper terrace on which the disposal cell would be placed.

The major design features are summarized below.

2.2.1 Description of final conditions

The disposal cell would be entirely above grade, and would have a maximum length of 500 feet and a maximum width of 800 feet (Figure 2.1). The cell would have slopes of 20 percent on the lower part and 10 percent on the upper part and its average height would be 22.5 feet above the existing grade (Figure 2.2).

LEGEND

- BOUNDARY OF AREA TO BE PROTECTED
- DIRT ROAD
- ②1 STATE ROAD
- BUILDINGS

100 0 100 300
SCALE IN FEET

FIGURE 2.1

PROPOSED PILE CONFIGURATION AND AREA AROUND THE DISPOSAL CELL
TO BE PROTECTED FROM HUMAN DISTURBANCE AT THE
LOWMAN SITE NEAR LOWMAN, IDAHO

SECTION A

SECTION B

FIGURE 2.2
TYPICAL CROSS SECTIONS FOR THE DISPOSAL CELL
AT THE LOWMAN SITE NEAR LOWMAN, IDAHO

Material from the windblown/waterborne areas, which is less contaminated than the other contaminated materials, would be placed on top of the cell to partially attenuate the emanation of radon gas and thus reduce the required thickness of the radon barrier. The contaminated materials would then be covered with a layer of compacted soil to inhibit radon emanation, and a layer of sand and rock for erosion protection.

The disposal cell would occupy 8.2 acres, mostly within the current designated site boundary. After remedial action, disturbed areas surrounding the disposal cell would be restored in accordance with applicable regulations.

This design is conceptual in nature and may change during the design review process. However, it is anticipated that the final design will be similar to the conceptual design presented in this EA and any changes in the final design will not alter the impacts analysis in this EA.

2.2.2 Major construction activities

The remedial action would be performed using conventional construction practices and technologies that comply with applicable regulations to ensure the safe and environmentally sound stabilization of the contaminated materials. The major construction activities for stabilization on the site would be site preparation, demolition of existing mill building foundations, construction of drainage control features, consolidation of all contaminated materials into the disposal cell, placement of cover and erosion protection materials onto the cell, and restoration of the land surrounding the disposal cell. In addition, a 9.8-acre forested area upslope of the cell would be protected from human disturbance such as logging and road and/or trail construction up to the top of the ridge (Figure 2.1). The forest on this slope was minimally affected by the 1989 forest fire, and most of the trees on the slope are still alive up to the top of the ridge. This area is currently U.S. Forest Service land; it would be purchased from the U.S. Forest Service and become part of the final disposal site. As such, access to this area would be restricted. The boundary would be posted with "No Trespassing" signs and evidence of human intrusion or other disturbances would be assessed during annual surveillance and maintenance inspections.

2.2.3 Borrow sites

Construction of the disposal cell would require the use of earth, gravel, and rock materials to stabilize the cell. Radon barrier materials would be obtained on the site after removal of all radioactive topsoil from the borrow area. The radon barrier material would then be obtained from a 10-foot-deep excavation. This material varies from low-plasticity silty sand to clayey sand. Its remolded saturated hydraulic conductivity is approximately 10^{-5} .

centimeters per second. Because the radon barrier would not be used as an infiltration barrier, this material would be a suitable source.

A potential source for large diameter rock (Mores Creek borrow site) is south of Idaho City, which is approximately 40 road miles south of the Lowman site (see Figure 1.1). Durability tests and petrographic analyses were performed on samples of this rock and indicate it would be suitable for use as erosion protection.

During the final design process, the location of the rock borrow site may change. However, the environmental impacts associated with the use of the Mores Creek borrow site represent a realistic upper limit of environmental impacts that would occur and changing the location of the borrow site would not require a reanalysis of impacts.

2.3 OTHER ALTERNATIVES

2.3.1 No action

The no action alternative consists of taking no steps toward remedial action at the Lowman tailings site or at the vicinity properties. The contaminated materials would remain in their present condition and would continue to be subject to dispersion by wind and water erosion, use by wildlife, and unauthorized removal by humans. The selection of this alternative would not be consistent with the intent of the UMTRCA (PL95-604) and would not result in compliance with the EPA standards.

2.3.2 Disposal at Bear Valley

The material that was processed at the Lowman site was dredged from along Bear Valley Creek, 18 road miles north of the Lowman site. The feasibility of returning the sands and other contaminated materials to Bear Valley was assessed. Although returning the contaminated materials to the dredged draws in Bear Valley may be technically feasible, it was eliminated from further consideration because the Bear Valley area has a high scenic and recreational value. In addition, a project was recently completed that reclaimed the dredge draws and spoil piles along Bear Valley Creek to enhance the anadromous fish breeding potential along the creek.

2.3.3 Reprocessing the sands

Reprocessing the radioactive sands to recover the residual minerals is not practical given the small amount of material on the site, the fact that the materials would have to be shipped elsewhere, and the current market price of the recoverable material (FBDU, 1981).

3.0 AFFECTED ENVIRONMENT

3.1 WEATHER AND AIR QUALITY

The Lowman site is characterized by a dry continental climate with dry, hot summers and cold winters. The varied topography of the region can create considerable differences in weather parameters from site to site. Temperature and precipitation vary mostly with elevation, while wind flow is significantly influenced by local topographic relief.

The average annual maximum and minimum temperatures in Lowman for the period 1941 through 1970 were 60°F and 28°F, respectively. The average monthly maximum temperature varied from 33°F in January to 89°F in July while the average monthly minimum ranged from 13°F in January to 42° in July. The temperature extremes for the period ranged from -28°F to 108°F. Temperatures below freezing have been recorded every month of the year (NOAA, 1970).

Data for the period 1941 through 1970 indicate that the average annual precipitation in Lowman is 27 inches. July and August are the driest months with about 0.5 inch of rain each month. The late fall and winter months (November through February) are the wettest months with an average of over 3.62 inches of precipitation falling each month, mostly in the form of snow. The average snowfall for Lowman is almost 95 inches per year (NOAA, 1970).

Surface wind flow data from the Lowman Ranger District for the period 1964 through 1973 were for the months of May through October only. The predominant wind direction is from the west, followed by the southwest and south. Winds from the west were the most common for each of the six months for which records are available. The average daily wind speed for this period was 5.7 miles per hour. Wind speed data for the winter in Boise, Idaho, indicate that winds blow most frequently out of the southeast (NOAA, 1979). However, it is expected that wind direction at the Lowman site during the winter would be similar to the direction during the summer due to the channelling of winds along the South Fork Payette River Valley.

The State of Idaho does not maintain an air quality monitoring station at or near the Lowman site. The Lowman air quality is in attainment for all priority air pollutants monitored by the EPA. The closest Class I air quality region to the site is 18 miles to the east in the Sawtooth Mountains; Lowman is in a Class II air quality region (Delany, 1988). Ambient air pollutant levels are expected to be well below the EPA air quality standards (Table 3.1).

3.2 SURFACE AND SUBSURFACE FEATURES

The slopes of the ridge partially encircling the site are covered by ponderosa pine forest and have a soil cover that ranges from less than one foot at the ridge crest to three to six feet just above the line of the highest alluvial terrace. The thickness of alluvium and colluvium under the Lowman site varies from one to 70 feet..

Table 3.1 National and Idaho standards for ambient air quality^a

Pollutant	Averaging time	Primary standard ^b	Secondary standard ^b
Sulfur dioxide	Annual arithmetic mean	80	---
	24-hour ^c	365	---
	3-hour ^c	---	1,300
Total suspended particulates	Annual geometric mean	75	60
	24-hour ^c	260	150
Carbon monoxide	8-hour ^c	10,000	10,000
	1-hour ^c	40,000	40,000
Ozone	1-hour	235	235
	1-hour	160	---
Nitrogen dioxide	Annual arithmetic mean	100	100
Lead	Calendar quarter arithmetic	1.5	1.5

^aNational and state standards are the same.

^bAll concentrations are in micrograms per cubic meter.

^cNot to be exceeded more than once per year.

Ref. 40 CFR 50.

Soils within the alluvial terrace include colluvial deposits in the upper slopes overlying a thin zone of fine-grained ancient floodplain deposits. Below this are thick stream deposits of gravelly sand with cobbles and large boulders.

Bedrock directly below the alluvial soils at the site is highly weathered, Cretaceous-age biotite granodiorite of the Idaho Batholith. Less-weathered bedrock forms a resistant rock terrace below the mill building in the northern half of the mill site. Depth to bedrock here is six to 11 feet. The ridge that bounds the south end of the site terrace is a distinctly more resistant granitic rock than that below the disposal site.

Drainage on the site is controlled by grading established during mill site operation. A partially lined ditch carries intercepted runoff from the upper site perimeter to the lower terrace along Clear Creek. A natural drainage, which had dissected the central part of the site, was filled in

during the original grading of the site. The sandy nature of the soil at the site and the scattered deposits of radioactive sands across the site and on the prominent lower slopes have essentially eliminated runoff.

Borrow site

The rock borrow source along Mores Creek consists of dissected lava flow and talus. The lava flow once filled the channel of Mores Creek and flooded its tributaries. The creek has incised below its original channel, leaving the basalt lava as a resistant rock ledge 50 to 100 feet above the creek and State Highway 21 (SH-21). Steep slopes covered with blocks of basalt line the valley for about seven miles from a point about 8.5 miles south of Idaho City. The talus lies on the slopes below the rock ledge. It is expected that the talus deposits can be worked by coarse screening of the appropriate sizes without quarrying the rock ledge.

Seismicity

The design earthquake for the Lowman site was determined to be a magnitude 7.0 event occurring at a distance of 15 kilometers (km) (9.3 miles) from the site as a floating earthquake not associated with a known fault. The resulting peak horizontal acceleration on bedrock at the site is estimated to be 0.34 g (Campbell, 1981).

Seismicity for the site region, based upon credible locations of historical earthquakes and instrumentally located epicenters, is essentially confined to the westward-trending Idaho Seismic Zone, 22 km north of the site. The largest events recorded within the 65-km (40-mile) site region are two historic events of Modified Mercalli Intensity VII, approximately equivalent to a Richter magnitude of 5.7. The closest of these events was 47 km from the site. The largest instrumentally located event was of $m_b = 4.3$ (equivalent to Richter magnitude 4.7) located at a distance of 46 km from the site. The largest earthquake in the United States since 1959 occurred in eastern Idaho (Borah Peak) in 1983 with a magnitude of 7.3; this earthquake was 140 km (87 miles) from the Lowman site. The estimated acceleration at the site from that event was 0.05 g based on the distance/attenuation relationship of Campbell (1981).

There are five faults within the site region that are conservatively considered to be capable faults based on possible disturbance of quaternary deposits. There are also numerous faults and lineaments. The closest approach to the site of any of the faults considered capable is the Cat Creek Fault at a distance of 17 km (10.5 miles) from the Lowman site.

The most prominent fault system in the site region, the Trans-Challis, has mapped fault segments trending to the northeast that spread five miles on either side of the site, crossing the entire site region, and extending beyond the Idaho Batholith. This system offsets older north-south systems and in turn is offset by younger fractures. It is not considered to be a capable fault system. One fault segment of the Trans-Challis system was located by LaForge and Hawkins (1987) about 0.25 mile north of the disposal

site. A photo-lineament suggests another fault of this same system bounds the south end of the site.

3.3 HYDROLOGY

Surface water

The Lowman tailings site is located in the South Fork Payette River basin along Clear Creek (Figure 3.1). The South Fork Payette River originates in the Sawtooth Mountain Range near Snowyside Peak. Elevations in the basin vary from 4000 feet above MSL at the site to over 10,000 feet above MSL near Snowyside Peak.

The confluence of Clear Creek with the South Fork Payette River is located near the village of Lowman. Elevations in the Clear Creek watershed vary from 3800 feet above MSL at Lowman to over 8000 feet above MSL at its headwaters. Clear Creek is incised into the granite of the Idaho Batholith and is prevented from meandering by the bedrock. There has been very little alluvial deposition along the creek except in narrow and intermittent floodplain areas.

The Lowman site is on an alluvial terrace 80 feet above Clear Creek and 1200 feet from the confluence of Clear Creek with the South Fork Payette River. Surface water flow across the Lowman site occurs during snowmelt or rain storms (Figure 3.2). A granite ridge south of the site provides a natural obstruction to floodwaters from the South Fork Payette River.

Most major flow events on the South Fork Payette River occur during the spring or early summer as a result of snowmelt or a combination of snowmelt and rainfall. The largest recorded discharge from the South Fork Payette River was 8980 cubic feet per second (cfs) recorded June 16, 1974, at a gaging station one-half mile downstream of the confluence with Clear Creek.

The Lowman site is above the probable maximum flood levels of both the South Fork Payette River and Clear Creek and, therefore, is not susceptible to flooding from either body of water. Additional details regarding flood analyses are presented in Section 3.1 of the Lowman EADR (DOE, 1990a).

Analysis of surface water quality from Clear Creek upstream, adjacent to, and downstream of the site indicate that water quality is excellent and no contaminants from the Lowman site are present.

Groundwater

Groundwater beneath the Lowman site occurs in the alluvium/weathered granodiorite (the uppermost aquifer) and in the fractured zone of the deeper, nonweathered granodiorite. Depth to groundwater ranges from 27 to 78 feet in the area of the radioactive sands and six feet adjacent to Clear Creek. Groundwater flows west by southwest, along the alluvium/weathered

FIGURE 3.1
REGIONAL SURFACE WATER CHARACTERISTICS NEAR LOWMAN, IDAHO

LEGEND

- ←--- SURFACE WATER FLOW PATTERNS
- DIRT ROAD
- (21) STATE ROAD
- BUILDINGS

100 0 100 300
SCALE IN FEET

FIGURE 3.2
SURFACE WATER CHARACTERISTICS AT THE
LOWMAN SITE NEAR LOWMAN, IDAHO

granodiorite bedrock contact, and discharges into Clear Creek. There is a downward hydraulic gradient between the alluvium/weathered granodiorite and the deeper, fractured, nonweathered granodiorite.

Groundwater beneath the site is recharged from rain and snowmelt through the coarse alluvium at the site and from the steep, forested ridge east of the site.

The hydraulic conductivity of the alluvium is 0.37 foot per day (ft/day), based on a slug injection test in a monitor well completed near Clear Creek. Slug test data indicate the average (geometric mean) hydraulic conductivity of the weathered granodiorite is 0.78 ft/day and the average (geometric mean) hydraulic conductivity of the nonweathered granodiorite is 0.021 ft/day. The average linear groundwater velocities in the bedrock were calculated using Darcy's Law and an average hydraulic gradient of 0.11, determined from the potentiometric surface of the groundwater beneath the site. The average linear groundwater velocity in the weathered granodiorite is 0.72 ft/day, and in the nonweathered granodiorite is 0.23 ft/day, based on effective porosities of 12 percent and one percent, respectively. Calculations of the average linear velocity in the nonweathered granodiorite assume that primary porosity is negligible and that groundwater velocities are dependent upon the bulk fracture porosity.

The groundwater in the alluvium/weathered granodiorite is characterized as neutral and oxidizing. The groundwater in most of the monitor wells is dominated by calcium bicarbonate. Background groundwater quality data indicates that none of the hazardous constituents observed exceed EPA maximum concentration limits (MCLs). None of the mean concentrations of hazardous constituents which were detected in the radioactive sand pore fluids exceed MCLs. Four potentially hazardous constituents (antimony, copper, vanadium, and zinc) in the pore fluids that do not have MCLs exceed the background groundwater quality. An evaluation of batch leach testing concludes that leaching of hazardous constituents from the radioactive sands under neutral pH conditions will not occur at the Lowman site. In addition, chemical analyses of pore fluids collected in natural soils upgradient from the radioactive sands indicate concentrations of antimony, copper, vanadium, and zinc are higher in natural soils than in the radioactive sands. Water quality analyses of samples collected from on-site/downgradient monitor wells show no significant variation from background groundwater quality.

A priority pollutant scan of samples from two on-site monitor wells determined that no volatile, semi-volatile, or other organic compounds are present in groundwater. This is expected as the placer dredge product was concentrated mechanically without the use of organic chemicals at the Lowman site.

Ongoing geochemical processes occurring in the Lowman site subsoils attenuate soluble metals in the native soils and residual radioactive sands as groundwater moves downward through the unsaturated zone. These geochemical processes result in decreased concentrations of soluble metals within groundwater in the uppermost aquifer. Concentrations of soluble

metals are observed at levels considerably lower than concentrations in near-surface native soils and residual radioactive sand pore fluids.

Residents of the town of Lowman obtain their water from private wells in the granodiorite bedrock or from the South Fork Payette River. There is no potential for these wells to be contaminated since there is no contamination of the groundwater currently at the site and groundwater from the uppermost aquifer at the site discharges into Clear Creek.

3.4 FLORA AND FAUNA

The Lowman site is in a ponderosa pine vegetation community within the Northern Rocky Mountain Zone (Kuchler, 1975). The abandoned mill and radioactive sands are on a terrace above Clear Creek where the vegetation is dominated by grass and herbaceous species indicative of a previously disturbed site. The site is bordered by a ponderosa pine forest on the north, south, and east sides. Mature ponderosa pine and, to a lesser extent, Douglas fir are the dominant tree species in this forest. Shrub species dominate the understory and the ground cover is sparse. Clear Creek forms the western boundary of the site and the vegetation between the creek and the abandoned mill terrace is more open than in the forest. Ponderosa pine and Douglas fir are more scattered, shrub species form large clumps in the open areas, and ground cover dominated by grass and herbs is much more common than in the surrounding forest. The small areas of riparian shrub vegetation that occur next to Clear Creek and willow, along with other shrub species, form a dense growth in these areas (Hilliard, 1988; TAC, 1987a,b; DOE, 1983) (see Attachment 1, Floodplain/Wetlands Assessment for more details.)

Clear Creek is a cold, clear stream that has an average width of 35 feet, an average depth of 0.8 foot, and seven percent pools with the remainder being riffle areas. The substrate typically ranges from gravel to boulders and the water quality is good. The rainbow trout is the most frequently observed species within the creek and other species such as brook trout and white fish are also common (Corley and Burmeister, 1977).

No reptiles or amphibians were observed at or near the site during brief reconnaissance surveys; 13 species may occur in the area. Twenty-three species of nesting birds were observed at or near the site. Common nesting species observed within the ponderosa pine forest were MacGillivray's warbler, yellow-rumped warbler, western tanager, and Cassin's finch. Common species in the riparian shrub habitat were the yellow warbler, song sparrow, and common yellow-throat. The common species noted in the disturbed habitat at the mill site were the robin and chipping sparrow. The red-tailed hawk and osprey were the only birds of prey observed in the area. Nests for the red-tailed hawk or other woodland nesting raptors were not observed at or near the site so it is assumed that no nesting raptors occur in the site area (TAC, 1987a,b; DOE, 1983). The closest known nest site for the osprey is a possible site three miles to the west at the confluence of the Deadwood River and the South Fork Payette River (Moroz, 1988).

A total of 33 species of mammals may occur at or near the site. Eight species were recorded from the site area including the mule deer (sighting and sign) and elk (sign only). The Lowman site is within the summer range of the mule deer and elk and is also within the migration path of these species as they move back and forth between summer and winter range (TAC, 1987a,b; DOE, 1983).

Threatened and endangered species

Consultations with the U.S. Fish and Wildlife Service (USFWS) and the state of Idaho indicate that the only endangered species that may occur near the site is the gray wolf (Lobdell, 1989; Groves, 1987; Wolflin, 1987). The gray wolf has been observed near Lowman on occasion. However, its summer habitat occurs in areas such as Bear Valley 18 miles north of the site, while its winter habitat range coincides with ungulate winter range. This winter range occurs along the South Fork Payette River and is not in the area of the Lowman site. The gray wolf may occur very sporadically in the Lowman site area as it migrates with ungulates through the area (Kaminski and Hansen, 1984).

The bald eagle winters in small numbers along the South Fork Payette River between Lowman and Banks; the number of wintering birds has varied from three to 10 from 1980 through 1987 (Steenhof, 1988). Use is very sporadic since the river does not form optimal bald eagle winter habitat in this area (Moroz, 1988).

3.5 RADIATION

Background radiation

The natural background gamma exposure rates at the Lowman site ranged from 10 to 15 microR/hr as measured by a 1983 aerial survey (EG&G, 1983). Approximately five microR/hr were from the cosmic component of natural background radiation (EG&G, 1983). The range of natural background values for the same area, as measured by hand-held scintillometers, was between 10 and 12 microR/hr, with an average of 11 microR/hr (FBDU, 1981). An Oak Ridge National Laboratory survey indicated gamma exposure rates between 11 and 16 microR/hr, with an average of 13 microR/hr (ORNL, 1980).

Baseline outdoor radon concentrations averaged 1.2 picocuries per liter (pCi/l) for the Lowman area, ranging from 1.1 to 1.3 pCi/l. These concentrations were measured at four locations by obtaining 24-hour samples with continuous radon monitors (FBDU, 1981). Background radon concentrations typically range from less than 1.0 to 1.4 pCi/l at other UMTRA Project sites.

Filtered surface water samples in the Lowman area were obtained from three locations along Clear Creek upstream from, adjacent to, and downstream from the site. There was little difference in concentrations of

gross alpha and radionuclides from the three locations. Filtered groundwater samples were collected from six wells on the site and from five off-site background wells. All gross alpha, uranium (U), radium 226 (Ra-226), and radium 228 (Ra-228) concentrations from both the surface water and groundwater samples were well below the EPA standards. Due to the low levels of activity in the filtered water there is a large amount of uncertainty associated with the measurements made in these analyses.

A total of six unfiltered water samples were collected at two locations in the town of Lowman during 1988 to assess potential impacts resulting from ingestion of radionuclides from the tailings site. Average concentrations (in pCi/l) of natural uranium (0.6), thorium-230 (Th-230) (0.9), Ra-228 (0.0), Ra-226 (0.1), lead-210 (Pb-210) (0.2), and polonium-210 (Po-210) (0.4) were well below applicable EPA standards. In addition, all gross alpha and gross beta concentrations were well below standards, with averages (in pCi/l) of 0.9 and 2.1, respectively. Total water sample analyses also did not indicate the presence of any uranium tailings site contaminants.

Six background surface soil samples were collected at locations one to two miles from the Lowman site. Results of the analyses of these samples indicated mean concentrations of 1.1 ± 0.8 pCi/g for Ra-226; <1.3 pCi/g for Th-230; 1.9 milligrams per gram (mg/g) for U; 11.1 ± 4.6 parts per million (ppm) for thorium-232 (Th-232); and 3.6 ± 0.5 percent for potassium (K) (UNC, 1986).

Radiation levels

An aerial survey at the Lowman site revealed gamma exposure rates of 175 to 330 microR/hr over the former mill area. Exposure rates over the rest of the site ranged from 90 to 175 microR/hr. Background gamma exposure rates were reached within 0.2 mile to the north of the site and 0.1 mile in other directions (EG&G, 1983).

Measurements were made to establish a boundary around the site indicating the limits of windblown and waterborne contamination at or above five pCi/g for Ra-226. The total area contaminated by windblown or waterborne tailings (14.4 acres) is shown in Figure 3.3. Approximately 6.9 acres of the windblown area will require limited excavation for isolated contamination.

Radon flux measurements on the tailings piles were made in 1977 using the charcoal canister technique (FBDU, 1981). The fluxes ranged from 50 to 150 picocuries per square meter per second (pCi/m²s). A 24-hour sample taken with a continuous radon monitor indicated an outdoor radon concentration of 1.8 pCi/l at the former mill site area. The average Ra-226 concentrations ranged from nine to 430 pCi/g in soil samples from various areas around the site.

Direct gamma exposure and limited radon measurements have been completed for contamination at Lowman vicinity properties. The average

LEGEND

SUPPLEMENTAL STANDARDS APPLIED AND NO EXCAVATION REQUIRED EXCEPT IN POSSIBLE ISOLATED AREAS

== DIRT ROADS

(21) STATE ROAD

BUILDINGS

FIGURE 3.3

AREAL EXTENT OF Ra-226 SOIL CONCENTRATIONS EXCEEDING 5 pCi/g AT THE LOWMAN SITE NEAR LOWMAN, IDAHO

area-weighted outdoor and indoor gamma exposure rates were 50 and 19 microR/hr, respectively. The average radon concentration for three Lowman residences was 7.4 pCi/l. The data from the measurements are available through the DOE UMTRA Project Office, Albuquerque Operations Office, Albuquerque, New Mexico.

3.6 LAND USE

The Lowman processing site is in Boise County; more than 75 percent of the land in Boise County is Federally owned, with the majority belonging to the U.S. Forest Service. Approximately 80 percent of the land is forested (Porter, 1982); most of this land is subject to the U.S. Forest Service's multiple-use policy that includes logging, recreation, wildlife management, and livestock grazing. Approximately 19 percent of the land is rangeland (Porter, 1982), and much of this is managed by the Bureau of Land Management, with an emphasis on livestock production. Less than one percent of the land in Boise County is dedicated to agriculture (Idaho Division of Economic and Community Affairs, 1981).

The Lowman processing site is near the confluence of Clear Creek and the South Fork Payette River. The site is bordered by Clear Creek on the west, Forest Service land on the north and east, and Highway 21 on the south. The land within the site is currently owned by the State of Idaho, and has been subjected to no recent land uses other than milling and tailings disposal.

The principal land uses near the site are housing and recreation. More than 50 homes (many seasonal) are within two miles of the Lowman processing site (Mesa, 1982), and a number of small subdivisions are growing in the area. The nearby watercourses are used for fishing, the forests for hunting, and the entire area for sightseeing.

3.7 AMBIENT NOISE LEVELS

The Lowman tailings site is in a forested area in the Boise National Forest. Noise levels in the site area have not been measured. Noise levels typical of partially developed rural areas (40 decibels, or dBA) (NAS, 1977) would be expected at the Lowman site, while higher levels would be expected in the village of Lowman (NAS, 1977; EPA, 1972).

3.8 HISTORIC AND CULTURAL RESOURCES

The pre-historic inhabitants of southwestern Idaho, including the Lowman area, have not been well characterized. The area has had continuous occupation for the past 12,000 years, beginning with the Paleo-Indians. The Archaic hunters and gatherers followed (2250 BC to 1700 AD) and included the Fremont and Plains Indians between 600 to 1500 AD. The last prehistoric people of the area were the Numic speaking ancestors of the historic Paiutes and Shoshoni (Mesa, 1982).

The discovery of gold in the Boise Basin and Salmon River areas in the early 1860s initiated the first modern settlement of the area. The gold and silver mining boom was followed by the cattle and sheep grazing industries that are still evident in the area today (Mesa, 1982).

A Class III cultural resource survey of approximately 65 acres at and around the Lowman site was conducted. No historic or prehistoric cultural resources were identified (BRR, 1987).

3.9 SOCIOECONOMIC CHARACTERISTICS

Towns in Boise County are small (less than 1000 people) and are separated from each other by mountains cut by river valleys. Access to many of the towns is via unpaved county roads that may be periodically closed during winter months. Idaho City, the Boise County seat, had an estimated population of 300 in 1988, and is considered as a service center for approximately 1500 residents from area towns including Lowman, Centerville, and Placerville (Wilson, 1988).

The population of Lowman varies from 130 to 400 depending on the season. Boise County had an estimated 1986 population of 3100 (Friel, 1988). Garden Valley and Horseshoe Bend are the other service centers for Boise County residents.

In 1986, the annual average civilian work force in Boise County consisted of 1349 workers. Unemployment tends to be seasonal; there were 140 persons unemployed (10.4 percent) in 1986. Approximately 62 percent of the employed workers (1209) were in nonagricultural positions. The majority of county employment occurred in the government (34 percent), lumber (26 percent), and services (22 percent) job sectors. In 1987, unemployment levels were around 10 percent (Friel, 1988).

Lowman is not actually a town but refers to those residents living along a 12-mile corridor paralleling the South Fork Payette River. The center of Lowman is the South Fork Lodge, which contains the post office, service station, restaurant, bar, grocery store, United Parcel Service office, laundromat, cabins and motel units, and trailer hook-ups with a total capacity for 65 persons (Shaw, 1988). There is also a one-room schoolhouse and Forest Service Ranger District Station that has housing for its 20 permanent employees and several temporary summer workers (Giles, 1988). Three miles northeast on State Highway 21 (SH-21) was another resort (Haven Lodge). This lodge was burned to the ground during a 1989 forest fire.

Within a 10-mile radius of the South Fork Lodge there are two hot springs, nine campgrounds (with a total capacity for 570 visitors), and another resort (Sourdough Lodge); additionally, summer rafting occurs on the South Fork Payette River. Lowman is 58 miles from Stanley, which is one of the main entrances to the Sawtooth National Recreation area; Sun Valley is 60 miles further southeast. During summer months, recreational areas attract visitors that use all available lodge and camp space.

Lowman has no elected officials but can bring local issues to one of three county commissioners based in Idaho City. There are few law enforcement personnel in the area. Lowman has a resident deputy who spends most of his time in Idaho City; the state police patrol the area. During the summer, fire protection is available through the Lowman Ranger District. The Ranger District has two fire trucks (Shue, 1988). Medical emergencies are coordinated through the County Sheriff's Office. Lowman has its own ambulance and several Emergency Medical Technician-qualified residents. Minor medical problems are taken to a clinic in Stanley, Idaho. Boise has a hospital and "life flight" capability to Lowman (Shue, 1988).

3.10 TRANSPORTATION

The Lowman site is accessible via SH-21, a paved, two-lane, all-weather road. Known locally as the Ponderosa Pine Scenic Corridor, this route originates at Interstate 84 in Boise, Idaho, and terminates in Stanley, Idaho, at State Highway 25, 129 miles to the northeast of Boise (Giles, 1988). Summer traffic in the Lowman area typically consists of logging trucks passing through Lowman and recreational traffic from Boise and other points south to reach recreational areas along SH-21, the Stanley area, Deadwood Reservoir, or the Sawtooth National Recreational Area. The peak use of this highway occurs between Memorial Day and Labor Day when traffic may increase to between 700 and 1000 vehicles per day, while in the winter, traffic counts are between 300 and 400 in the general Lowman area (Fuller, 1988; Manubay, 1988).

The Lowman-Banks road is currently a two-lane dirt road for the majority of its length and receives light traffic use; this road is being widened and will eventually be paved (Robeson, 1988). The majority of use on this road occurs during the summer by logging trucks and recreationists.

Based on the most recent three-year period of record, there were 42 accidents of all kinds (property, injury, fatal) on a 40-mile stretch of SH-21 centered in Lowman. The 1986 injury accident rate was calculated to be 0.60 injury per 1,000,000 miles of vehicle travel, and the fatal accident rate was calculated to be 0.07 fatality per 1,000,000 miles. These rates were calculated by the Idaho Department of Highways and were based on roads that are 24 to 30 feet wide, have two lanes, have no access control (e.g., stop signs, traffic signals), and have an average daily traffic volume of less than 400 vehicles of all kinds (Amick, 1988).

4.0 ENVIRONMENTAL IMPACTS

4.1 INTRODUCTION

Remedial action would consist of stabilizing the existing contaminated materials on the site during a six-month period; this period would include 1.5 months of site preparation, 3.5 months of work on the tailings pile and radon cover, and one month of work on erosion protection and site restoration.

The radiological impacts associated with no action are also assessed in this section. Remedial action would result in the cleanup of radioactive materials at the processing site and vicinity properties, while no action would result in the continued exposure of the public to and dispersion of radioactive materials. The additional cancer deaths as a result of no action are quantified in Section 4.2. The impacts from no action for the other environmental components considered in Section 4.0 are not included in each Section. This is because the existing conditions would prevail if no action were taken and these existing conditions have already been presented in Section 3.0.

4.2 RADIATION

4.2.1 Exposure pathways

There are five principal pathways by which individuals could be exposed to radiation during remedial action. These are 1) inhalation of radon and radon daughters; 2) direct exposure to gamma radiation; 3) inhalation and ingestion of airborne radioactive particulates; 4) ingestion of contaminated foods produced in areas contaminated by tailings; and 5) ingestion of ground and surface waters contaminated with radioactive materials.

The ingestion of contaminated water and food are not of concern at the Lowman site since no water supply wells or agricultural areas have been adversely affected. Therefore, additional cancer deaths were only calculated for the inhalation of radon and radon daughters, direct exposure to gamma radiation, and inhalation of airborne radioactive particulates.

Radon is an inert gas produced from the radioactive decay of Ra-226 in the uranium-238 (U-238) decay series. Because radon is inert, it does not react chemically with other elements and can diffuse through the tailings pile into the atmosphere where it is transported by prevailing winds. Radon decays into radioactive daughter products, which when in the atmosphere, may be inhaled directly or be inhaled after attaching to airborne dust particles. Since radon daughters are charged ions rather than gases, they will adhere to the lining of the upper respiratory tract and release alpha radiation to the surrounding tissues.

Gamma radiation is also emitted by members of the U-238 decay series, but behaves independently of atmospheric conditions and travels in a straight line until it interacts with matter. Gamma radiation emitted from radionuclides in the tailings delivers an external exposure to the whole body of exposed individuals. However, gamma radiation becomes negligible at 0.3 mile from the perimeter of the Lowman site due to the interaction of gamma rays with air.

The general public is presently being exposed to radon daughters and airborne particulates from the unstabilized tailings piles, mill yard, ore storage, and surrounding contaminated areas. No exposures to the general public from direct gamma radiation occur, since the surrounding population is 0.3 mile or more from the tailings site. However, the general public is exposed to direct gamma radiation and radon daughters from contamination at vicinity properties. Following remedial action, there would be no exposure to airborne particulates since stabilization on site includes the construction of an earthen radon barrier. However, there would continue to be exposure of the general population to radon and radon daughters following remedial action since the radon barrier would substantially reduce, but not eliminate, the release of radon into the atmosphere. The rate of radon emanation would be no greater than the allowable levels specified by the EPA standards. Remedial action would also reduce exposure to direct gamma radiation and radon daughters at vicinity properties to levels specified by the EPA.

4.2.2 Health impacts

Exposure to radiation may cause somatic cancer deaths, which are manifested in the exposed individual, and genetic cancer deaths, which are manifested in the descendants of the exposed individual. The genetic risk is approximately two-thirds of the somatic risk for gamma radiation. Measures taken to reduce the somatic cancer deaths would also reduce the genetic effects. Therefore, the following discussion will address only pertinent cancer deaths (i.e., premature death from cancer).

Additional cancer deaths are reported in this section as the probability of occurrence, e.g., 1.0×10^{-6} effect per person per year of exposure. This risk is equivalent to one chance in a million of an individual incurring an excess health effect. If an individual is exposed for a 70-year period, the corresponding lifetime risk would be 70 times greater, or one chance in 14,000. Similarly, if the entire population of 289 individuals near the Lowman site were exposed, then the inverse of 1.0×10^{-6} (289 individuals) would correspond to one chance in 3500 of incurring an excess health effect in the exposed population. A risk coefficient of 100×10^{-6} per rem was used to estimate risks following exposures to gamma radiation and inhalation of radioactive particulates (ICRP,

1977a,b). A risk coefficient of 300×10^{-6} per working-level month (WLM) was selected to estimate risk from inhalation of radon daughters since this value was close to an average of all risk coefficients reported in the literature. A detailed description of health effect calculations can be found in Section 5.0 of the Lowman EADR (DOE, 1990a).

Subsequent to these calculations having been performed, more recent estimates of risk from exposure to radiation have been reported in the literature. The BEIR IV Report (NAS, 1988) reported a risk coefficient of 350×10^{-6} per WLM for radon daughter inhalation. The BEIR V Report (NAS, 1990) was evaluated by the DOE (1990b) and a risk coefficient of 400×10^{-6} per rem was recommended for effective whole body exposures to ionizing radiation. The draft Environmental Impact Statement for Proposed National Emission Standards for Hazardous Air Pollutants (NESHAPS) for Radionuclides (EPA, 1989) reported a risk coefficient of 360×10^{-6} per WLM for radon daughters.

Cancer deaths during remedial action

During remedial action, radiation exposures to the general population from airborne particulates would increase as the tailings are disturbed. Exposures from radon daughters would also increase initially, but would decrease progressively as cover materials are placed on the stabilized pile. For the purposes of this analysis, the one-month of erosion protection work and site restoration was not included in the calculation of cancer deaths since particulate and gamma exposures would be eliminated following construction of the radon barrier.

As can be seen in Table 4.1, total cancer deaths following five months of exposure to the general population increase from 4.7×10^{-5} for no action to 9.6×10^{-5} during remedial action. This increase is due, primarily, to cancer deaths from inhalation of airborne particulates, which contribute 45 percent of the total cancer deaths to the general population during remedial action. The annual total risk of 1.2×10^{-4} to an exposed population of 289 persons for no action would correspond to a one in 2.4 million chance of an individual contracting a fatal cancer per year of exposure, or one chance per 34,000 over a 70-year lifetime. Without remedial action, the increased risk of cancer deaths would continue to exist for thousands of years.

Due to their proximity to the site, remedial action workers would be exposed to gamma radiation in addition to radon daughters and airborne particulates. An individual worker would receive an average of six millirems (mrem) to the whole body during the 1.5-month site preparation period and 27 mrem during 3.5 months of work on the tailings pile and radon cover. Excess worker cancer deaths

Table 4.1 Additional cancer deaths for the general population and workers during remedial action and for the no action alternative at the Lowman site near Lowman, Idaho

Exposed group	Radon daughter exposure	Gamma exposure	Airborne particulates	Total excess health effects
<u>General population</u>				
No action ^a	4.4×10^{-5} ($1.1 \times 10^{-4}/\text{yr}$)	0	2.6×10^{-6} ($6.3 \times 10^{-6}/\text{yr}$)	4.7×10^{-5} ($1.2 \times 10^{-4}/\text{yr}$)
Stabilization on site	5.3×10^{-5}	0	4.3×10^{-5}	9.6×10^{-5}
<u>Remedial action workers</u>				
No action	0	0	0	0
Stabilization on site	6.7×10^{-6}	6.9×10^{-5}	1.5×10^{-4}	2.3×10^{-4}

^aCancer deaths for the no action alternative are calculated for a five-month period to allow direct comparison with cancer deaths from the five-month remedial action alternative. Health effects per year of exposure during no action are shown in parentheses. Health effects for no action at vicinity properties are not included.

Ref: DOE, 1990a.

are 6.9×10^{-5} from gamma exposure, or one chance in 15,000 of a health effect resulting from exposure during remedial action.

Remedial action workers would also receive radiation doses from the inhalation of airborne particulates. An individual worker would receive a 50-year effective dose commitment of 71 mrem to the whole body. Additional cancer deaths to workers from exposure to airborne particulates during remedial action are 1.5×10^{-4} , or one chance in 7000. The combined dose of 33 mrem from gamma exposure and 71 mrem from particulates would be two percent of the 5000 mrem standard established by the NRC for radiation workers (10 CFR 20).

Airborne particulates would contribute 65 percent of the total 2.3×10^{-4} cancer deaths to remedial action workers. Workers would be exposed to an average radon concentration of only 0.1 pCi/l during the entire remedial action period of five months due primarily to very low radon emanation from the tailings. This concentration of radon is less than one percent of the annual occupational radon standard of 30 pCi/l for a restricted area (10 CFR 20). The total risk for workers from all exposure pathways corresponds to a one in 4300 chance of an excess health effect, or about one chance in 91,000 for an individual worker. The lifetime risk for a remedial action worker would be less than the risk incurred by a member of the general population under no action conditions, since the worker would only be exposed for five months of a 70-year lifetime.

Cancer deaths following remedial action

Implementation of the no action alternative at the tailings site would result in total cancer deaths to the general population that are a factor of six higher than cancer deaths following the proposed remedial action (Table 4.2). Impacts due to no action would primarily result from the release of radon from the tailings pile and contaminated soils into the atmosphere, with consequent off-site dispersion of radon daughters. Airborne particulates would contribute insignificant cancer deaths of 6.3×10^{-6} per year and no cancer deaths from gamma exposure would occur due to the distance of the general population from the Lowman site.

Under no action, additional cancer deaths would continue for persons at vicinity properties and the estimated effects would range from eight to 11 deaths per 100 years of exposure. This estimated upper range was obtained using a DOE document on vicinity property remedial actions (DOE, 1985a); a lower estimate was calculated using inclusion survey data for Lowman properties. Data for the Lowman area consisted of direct gamma exposure and radon daughter concentrations. A population of 135 people was estimated to be presently exposed at Lowman vicinity properties.

Table 4.2 Additional cancer deaths per year for the general population following remedial action at the Lowman site near Lowman, Idaho^a

Remedial action alternative	Radon daughter exposure	Gamma exposure	Airborne particulates	Total health effects/year
No action	1.1×10^{-4}	0	6.3×10^{-6}	1.2×10^{-4}
Stabilization on site	1.8×10^{-5}	0	0	1.8×10^{-5}

^aAdditional cancer deaths for no action at vicinity properties are not included.

Ref: DOE, 1990a.

Excess health effect calculations for the no action alternative assumed that the tailings would not be dispersed by natural erosion or removal by humans in the future, since there is no way to predict these rates of dispersion accurately. However, some level of dispersion will occur over time and therefore the actual additional cancer deaths from the no action alternative could be greater than 1.2×10^{-4} per year. In addition, the erosion of contaminants into Clear Creek, increases in population of the area, and cancer deaths from contamination at vicinity properties would all increase the no action estimate of additional cancer deaths for the general population.

Following remedial action, radon releases from the tailings pile, contaminated soils, and vicinity properties would be reduced because the contaminated materials would be consolidated and covered with a compacted radon barrier. The radon barrier would reduce cancer deaths to the general population from gamma exposures and airborne particulates to background levels. A discussion of background radiation can be found in Section 3.5. Total additional cancer deaths to the general population following stabilization in place would be 1.8×10^{-5} per year.

The total additional cancer deaths to the general population and remedial action workers that would occur five, 10, 100, 200, and 1000 years after the initiation of remedial action are listed by alternative in Table 4.3. It should be noted that the cancer deaths shown in Table 4.3 were calculated assuming that the population in the vicinity of the site remained constant throughout the 1000-year period. If the population increases, additional cancer deaths would increase proportionally. In addition, additional cancer deaths for no action at vicinity properties were not included. As can be seen in Table 4.3, total additional cancer deaths at the tailings site

Table 4.3 Total additional cancer deaths for the general population and remedial action workers for five, 10, 100, 200, and 1000 years after the initiation of remedial action and for no action at the Lowman site near Lowman, Idaho^a

Alternative	Years after initiation of remedial action				
	5	10	100	200	1000
No action ^b	0.0006	0.0012	0.012	0.024	0.12
Stabilization on site	0.0004	0.00049	0.0021	0.0039	0.018

^aThese estimates assume a constant population in the vicinity of the site.

^bThe calculations for no action assume that the tailings are not dispersed by natural forces or humans. Additional cancer deaths for no action at vicinity properties are not included.

Ref: DOE, 1990a.

from the no action alternative exceed cancer deaths from stabilization on site before five years. Cancer deaths for these two alternatives are approximately equal in three years.

4.3 AIR QUALITY

The air quality impacts of the proposed action were estimated by developing a detailed emissions inventory and modeling resultant air pollution concentrations.

The emissions inventory includes estimated combustion emissions from construction equipment and fugitive dust emissions from wind erosion and the movement of contaminated materials and cover materials. Combustion emissions include hydrocarbons (HC), nitrogen oxides (NO_x), sulphur oxides (SO_x), carbon monoxide (CO), and total suspended particulates (TSP). The combustion and fugitive dust emissions were calculated using air pollutant emission factors for construction equipment and associated operations (EPA, 1985; CDH, 1981). Fugitive dust emissions from wind erosion were calculated using an adaptation of the universal soil loss equation, which includes components for soil erodibility, the local climate, the size of the exposed area, and vegetation (CDH, 1981). The emissions calculations were based on fuel consumption, vehicle-miles travelled, vehicle speed, compositions of materials, sizes of affected areas, and volumes of materials moved.

Table 4.4 presents the estimated total tonnages of uncontrolled air pollutants that would be emitted during the proposed action. Fugitive dust would be the major air pollutant and most of the fugitive dust would be generated on the Lowman site during remedial action. The total combustion emissions are relatively small and would be generated on the site by the construction equipment.

Table 4.4 Estimated total air pollutant emissions during the proposed action at the Lowman site near Lowman, Idaho, and Mores Creek borrow site near Idaho City, Idaho

Site	Fugitive dust emissions (tons)	Combustion emissions (tons)				
		HC	NO _x	SO _x	CO	TSP
Lowman site	53.00	0.59	11.85	0.78	2.29	0.75
Mores Creek borrow site	3.96	0.07	1.11	0.08	0.23	0.07
Totals	56.96	0.66	12.96	0.86	2.52	0.82

Ref: EPA, 1985; CDH, 1981.

Ambient air pollution concentrations were estimated using the Industrial Source Complex Short Term (ISCST) dispersion model (EPA, 1986). Given information concerning emission rates, source location, and meteorology, this computer model predicts air pollutant concentrations downwind from the source. The ISCST model is particularly appropriate for this analysis because it considers gravitational settling of particulates and can accommodate both large-area emissions sources and line emissions sources such as haul roads. For the proposed action, only fugitive dust concentrations were estimated with the ISCST model. Emissions of combustion air pollutants would be much lower than fugitive dust (Table 4.4), and the resulting concentrations would be expected to be well below the applicable air quality standards.

Modeling for the proposed action was performed for the activities at the disposal site and Mores Creek borrow site. Fugitive dust emissions along the haul road between Mores Creek borrow site and the disposal site were not modeled because the road is paved. For wind erosion, the average monthly rate of fugitive dust emissions for the remedial action was used. The short-term fugitive dust emission rates used in the modeling represent those that would occur during the month of maximum activity, and it was conservatively assumed that all equipment used during this peak period would be operating concurrently. Dust control measures at the disposal and borrow sites (water spraying) were assumed to be 50 percent effective (CDH, 1981).

The estimated maximum 24-hour increase in TSP concentrations for the proposed action at the processing site is 192 micrograms per cubic meter (microg/m^3). This estimate exceeds the applicable secondary TSP standard of 150 microg/m^3 . However, this analysis of air quality impacts was based on very conservative assumptions that would tend to overpredict impacts.

Factors in the air quality analysis that lead to an overprediction are the assumptions that light winds would blow persistently from a single direction for six consecutive hours, that stable meteorological conditions would persist throughout this six hours, and that all equipment would be in use at the same time. Maximum 24-hour TSP concentrations at the Mores Creek borrow site (85 microg/m³) would not exceed the secondary TSP standard.

4.4 MINERAL RESOURCES AND SOILS

The riprap and rock cover materials would be obtained from the Mores Creek borrow site (see Figure 1.1). A total of 6900 cy of gravel, 13,900 cy of small rock, and 4200 cy of large rock would be obtained from this borrow site. The radon barrier materials (16,500 cy) would be obtained on the Lowman site.

Soils

The primary surficial materials that would be disturbed by the remedial action would be previously disturbed surfaces within the mill site. A total of 21.3 acres of land would be disturbed during remedial action; all but 10.1 acres (radioactive sand piles) have an existing soil layer that supports vegetation. Much of the soil on the remaining 11.2 acres of land is contaminated and would be consolidated into the stabilized pile. The estimated amount of soil that would be lost (38,800 cy) is the total amount of contaminated material (88,800 cy) minus the radioactive sands (50,000 cy). The disturbed areas would be recontoured and revegetated consistent with applicable permits.

Natural resources

There are no known mineral deposits of economic importance within the disposal site boundaries. Timber production on the adjacent lands of the Boise National Forest would not be affected, except for approximately five acres of land upslope from the stabilized pile that would be protected from human disturbance (see Figure 2.1). A natural cold-water spring that was developed by a previous occupant of the Lowman site is well below the area of disturbance and the outlet would not be disturbed by surface activity. However, improved drainage on the surface of the alluvial terrace would restrict surface water infiltration and could reduce the flow of the spring.

4.5 HYDROLOGY

Surface water

The proposed disposal site is in the southeastern corner of the alluvial terrace above Clear Creek. Several control features were incorporated into the remedial action design to prevent erosion of the

disposal cell. Along the upland perimeter of the pile is a riprap apron of large rock. The apron would be designed to withstand the erosive forces of runoff resulting from a probable maximum precipitation (PMP) event. Also, erosion protection placed on the sideslopes would be designed to resist the PMP event. A riprap apron along the west toe of the cell would prevent gully intrusion into the disposal cell.

Groundwater

The proposed concentration limits for potential hazardous constituents detected in the uppermost aquifer at the Lowman site were selected based on the proposed EPA groundwater MCLs (for barium, molybdenum, nitrate, radium-226 and -228, and uranium); maximum background concentrations (for aluminum, antimony, strontium, and vanadium); and the EPA/State of Idaho secondary MCLs for drinking water (for copper and zinc). The groundwater protection strategy for these potentially hazardous constituents would be compliance with the proposed EPA groundwater MCLs or background concentrations and the EPA/State of Idaho secondary drinking water MCLs at the point of compliance (POC) (downgradient western edge of the disposal cell) in the uppermost aquifer. A detailed description of the groundwater protection strategy appears in the EADR (DOE, 1990a) and will appear in the RAP, which will be released in the spring of 1991. The following is a brief summary of these more detailed reports.

The proposed disposal cell design, characteristics of the radioactive sands, and the hydrogeologic system will minimize and control releases of hazardous constituents to groundwater and surface water and radon emanations to the atmosphere to the extent necessary to protect human health and the environment. Natural, stable materials have been proposed for use in construction of the Lowman disposal cell so that long-term performance is ensured. The following are the hydrogeologic characteristics important to the performance assessment of the proposed disposal cell:

- o Presently, groundwater beneath the site is not contaminated with hazardous constituents moving downward from the processed or unprocessed radioactive sand piles.
- o Both the processed and unprocessed radioactive sands are physically and chemically inactive.
- o Pore fluids in upgradient native soils contain higher concentrations of soluble metals, including antimony and vanadium, than pore fluids in the radioactive sands.
- o Geochemical processes in the native soils attenuate soluble metals in the unsaturated zone.
- o The proposed disposal cell design will limit infiltration through the radioactive sands to a rate approximately equal to or less than the current infiltration rate.

A groundwater monitoring program will be carried out during and after the remedial action period to demonstrate that the initial performance of the disposal cell is in accordance with the design requirements, and to ensure compliance of the disposal cell with the EPA groundwater protection standards. Groundwater in the uppermost aquifer will be monitored downgradient from the disposal cell at the POC, using existing monitor wells, where applicable, and installing new monitor wells as necessary. Background groundwater quality will also continue to be monitored upgradient/crossgradient from the disposal cell.

4.6 FLORA AND FAUNA

Remedial action activities would result in direct and indirect impacts on the flora and fauna associated with the Lowman site. Direct impacts would be the destruction of habitat during the cleanup of contaminated land, while indirect impacts associated with noise and human activities may reduce wildlife use of habitat adjacent to the direct impact zone.

Implementation of the proposed action would result in the clearing of approximately 21 acres of land at the Lowman site; 16 acres would be previously disturbed lands at the mill site/radioactive sands area, two acres would be ponderosa pine forest, and three acres would be open ponderosa pine forest. One acre of wetlands occurs along Clear Creek and would not be impacted if supplemental standards are applied. This wetland area is regulated by the U.S. Army Corps of Engineers (Hilliard, 1988) (see Attachment 1, Floodplain/Wetlands Assessment, for more details regarding wetlands). Overall, the impacts to vegetation would be minimal because of the small area to be cleared and because most of the area (15 acres or 76 percent of 21 acres) is disturbed land presently covered with early successional plant species. Revegetation of the field habitat and riparian shrub plant communities would be possible within one to three years; the loss of the mature ponderosa pines would be long-term in that it would take many years for mature trees to become reestablished.

Remedial action activities would not be expected to impact the fishery in Clear Creek since erosion control measures designed to protect the creek would be implemented. Removal of the contaminated material from areas of potential erosion into Clear Creek would be a positive benefit of the proposed action in that the source of potential contamination of the creek would be removed.

Impacts of the proposed action on terrestrial wildlife would be minimal due to the small area to be cleared and because most of the area has been previously disturbed. Species that presently use this previously disturbed habitat would be expected to return to the site after the area has been revegetated. Principal game species' use of the area is by unregulates migrating to and from their wintering grounds. Remedial action activities would not be expected to affect migrating ungulates, especially if construction does not occur during the migratory periods (May and December).

Remedial action activities would not affect bald eagles wintering along the South Fork Payette River since they occur in very small numbers, the river is 0.5 mile from the site at its nearest point, and construction activities would not occur during most of the winter period. The gray wolf occurs near the Lowman site very sporadically and probably only during the periods of time that ungulates migrate through the Lowman site area. For these reasons, remedial action activities at the Lowman site would not be expected to have an impact on the gray wolf.

An estimated 15 acres of land would be disturbed at the Mores Creek borrow site. Most of this area is rock talus slopes and is not very productive in terms of flora and fauna. The ponderosa pine forest surrounding the borrow site would be expected to have the same plant and animal species as are found at the Lowman tailings site. The land at the base of the talus slope had been disturbed during previous borrow activities. The site is far enough from Mores Creek so that borrow site activities would not affect it. Erosion control measures would be implemented, if necessary, to prevent runoff into Grimes Creek. If the Mores Creek borrow site is determined to be the final site to be used for rock erosion protection material, consultation with the U.S. Fish and Wildlife Service for endangered species would be initiated and a permit from the U.S. Forest Service would be obtained.

4.7 LAND USE

During remedial action, approximately 21 acres of the 35-acre designated site would be cleared. All contaminated materials would be consolidated into a disposal cell that would occupy 8.2 acres.

Warning signs would be posted around the disposal site boundary. The 8.2 acres covered by the cell and the additional land upslope from the cell (9.8 acres) (see Figure 2.3) would be permanently restricted from productive land uses and would be under the direct control of the Federal government.

The remaining disturbed areas would be restored. Fill would be applied as necessary to restore positive drainage and support revegetation. Native grasses and browse shrubs would be used in the seed mix, and the area could be reforested if desired. Future land uses would be at the disposition of the land owner.

The proposed Mores Creek borrow site is on U.S. Forest Service land and use of this land as a borrow site would be subject to Forest Service permits. Rock has been extracted from this area in the past.

4.8 NOISE

A noise prediction model (Kessler et al., 1978) was used to estimate the maximum A-weighted noise level in decibels (dBA) emitted from the site

area during the remedial action. The model is based on the numbers and types of equipment operating at the site, usage factors for operation of the noisiest models, and the distance from the activity to the nearest noise-sensitive receptors (i.e., residences). The model assumes a clustering of equipment (e.g., a point source). However, in reality, the equipment would be in operation over the entire 24.5-acre area subject to remedial action. Also, for this analysis, it is assumed that each piece of equipment would be in operation continuously over the eight- to 10-hour work day, five to six days per week. The elevated noise levels from the remedial action activities at the tailings site would occur over a maximum of 24 construction weeks (six months) and only during daytime working hours; each piece of equipment would not necessarily be in use at the same time. No attenuation for air absorption, berms, topography, or foliage is considered in the model. Therefore, the model tends to overpredict noise levels.

The EPA (1978) has determined that continuous exposure to noise of 70 dBA or greater over a 24-hour time period can cause permanent hearing damage and that outdoor noise levels should not exceed 55 dBA to guarantee the ability to hear without difficulty (often referred to as the "annoyance level"). A level of 45 dBA has been established as the recommended limit for indoor noise (EPA, 1978). A typical home reduces outdoor noise by 15 dBA; therefore, outdoor sound levels should not exceed 60 dBA for extended periods of time.

The Occupational Safety and Health Administration (OSHA) noise protection standards require that hearing protection devices be worn by workers when the eight-hour time-weighted average sound level reaches 85 dBA or greater (29 CFR 1910.95). All remedial action workers would be provided with hearing protection devices and instructed in their proper use in accordance with the OSHA standards.

Noise levels were estimated for the six-month remedial action period. Based on the most conservative analysis, the average maximum noise level was estimated to be 92 dBA at the disposal site. This exceeds the EPA-recommended 55-dBA annoyance level for outdoor noise. At the nearest residence, 0.125 mile from the south boundary of the designated site, outdoor noise levels would be reduced to 73.3 dBA. Indoor noise levels would be reduced to about 58 dBA, which exceeds the EPA-recommended limit by three dBA. This noise model tends to overpredict the amount of noise generated by the equipment. Noise produced by the South Fork Payette River and absorption of noise by the forest and topography will likely mask most construction activity noise. At distances of 0.5 and one mile, outdoor noise levels were estimated to be 61.2 and 55.2 dBA, respectively. At these distances, particularly in the town of Lowman along SH-21, which sustains significant summer traffic, the noise generated by the remedial action activity would be below the annoyance level.

The estimated maximum noise level at the Mores Creek borrow site would be 94 dBA. This would have a minimal impact on local residents as the nearest residences are over one mile away.

Trucks hauling the erosion protection material would be traveling along a 40-mile stretch of SH-21. One haul truck can be expected to produce noise levels of 85 to 79 dBA at distances of 50 feet and 100 feet, respectively, from the source (Kessler et al., 1978). Residents living within 50 to 100 feet of the road would experience elevated indoor noise levels between 64 and 70 dBA. Again, the trees and topography would absorb some of the sound, further reducing the noise levels. In addition, traffic along the highway is common in the summer, including logging trucks and recreational vehicles. Therefore, it is likely that the noise generated by trucks hauling erosion protection material would be indistinguishable from the regular summer traffic. These noise levels would be of short duration, would occur only during normal working hours, and would occur only during the last month of construction.

4.9 HISTORIC AND CULTURAL RESOURCES

No historic or cultural resources were identified in the Class III survey of the tailings area. However, due to the thick vegetation on the site, historic and/or cultural resources may have been overlooked during the survey. Therefore, it is recommended that the site be monitored for these resources during remedial action by the construction personnel (BRR, 1987; Green, 1987). The Mores Creek borrow site area has not been surveyed for historic and cultural resources. A Class III survey would be conducted at this site prior to any surface disturbance in previously undisturbed areas.

4.10 SOCIOECONOMICS

An average work force of 21 and a peak of 35 would be employed during the six-month remedial action. An estimated eight remedial action workers are anticipated to be supervisory or technical (e.g., radiation technician, field engineer, construction management) and would likely be recruited from outside the Lowman-Boise area. The remainder of the average work force (13 workers) would be made up of truck drivers, heavy equipment (e.g., grader, compactor, front-end loader) operators, mechanics, and general laborers that would likely be hired locally. According to a Boise area labor market analyst (Koppes, 1988), skilled and experienced workers in these job categories should be readily available; there are no known proposed projects for southwestern Idaho that would deplete area labor availability.

It is unlikely that secondary or indirect employment would be generated by this remedial action because of the small work force, the short employment duration, the remoteness of Lowman, and the normal transient summer populations in the Lowman area. As discussed in Section 3.9, Socioeconomics, the Lowman area has high recreational values and attracts visitors as well as summer workers for the U.S. Forest Service, highway department, and logging industry. The combination of visitors, workers, and summer home residents more than doubles the permanent population. The addition of eight new workers (supervisors and technical specialists)

would have a negligible effect (two percent increase) on the summer population of 400 in the area. Even if the entire remedial action work force (average of 21) were hired from outside the area, the average summer population would increase by only five percent.

Since the two lodges in the Lowman area provide the only source of visitor and summer worker accommodations (although the U.S. Forest Service does provide housing at the Ranger District Office for their summer crews) (Giles, 1988), reservation of space for project-related employment would need to be done in advance. The two lodges in the Lowman area contain a variety of accommodations (i.e., cabins, motel units, trailer hook-ups), for an estimated 130 visitors (Holcomb, 1988; Shaw, 1988; Shue, 1988). Additionally, it may be possible to rent trailer space on private land. Since the area is accustomed to providing a basic level of service to the influx of summer workers, residents, and tourists, the area should be able to accommodate the addition of a small number of remedial action workers.

The above analysis has included only the workers and not spouses or families that might accompany workers. Studies done by Mountain West Research (1979) suggest that 60 percent of a construction workforce may be accompanied by spouses and families. Since it is likely that the majority of the workers would be available locally, only those projected eight supervisory or technical positions would possibly bring spouses or families. The addition of 11 persons (the spouses and children of five of the eight supervisory or technical personnel) would create a negligible impact on the local area.

The cost of the remedial action is estimated at \$2.2 million. This figure represents the cost for construction activities and does not include the cost for remediation of vicinity properties or construction management. Monies that would be spent within Idaho (primarily in the Boise area) would be from wages and salaries (\$700,000); purchases of equipment and supplies (\$700,000); and miscellaneous items such as bond monies would amount to \$800,000. Research on the impacts on rural areas in the western United States from energy projects similar to the proposed action suggests that an indirect income multiplier of 1.23 (every dollar in wages, salaries, supplies, and materials would generate an additional \$0.23 in direct expenditures) (Mountain West Research, Inc., 1979) is appropriate. Applying this multiplier to local wages, salaries, supplies, and equipment results in an additional income of \$506,000.

4.11 TRANSPORTATION

Use of area highways related to remedial action activities would include workers commuting from area residences, miscellaneous contractor trips between the Lowman disposal site, the Mores Creek borrow site, and possibly Boise or Idaho City, and trucks transporting rock borrow materials from the Mores Creek borrow site on SH-21, 40 miles south of Lowman. Project-related traffic on most area roads would be negligible and would consist primarily of workers commuting by private vehicle to the disposal

site and the previously mentioned miscellaneous contractor trips. However, SH-21 between Lowman and Idaho City would be heavily used over a three-week period by project trucks to transport the rock erosion protection materials. It was estimated that traffic would increase 78 percent due to the additional 282 trucks per day hauling these materials. The average daily traffic on SH-21 just south of Lowman was 360 vehicles of all types in 1986. Since rock borrow materials would be transported during the final phase of the remedial action, this traffic should not disrupt the normal heavier summer traffic on SH-21.

4.12 ACCIDENTS NOT INVOLVING RADIATION

Off-site traffic related to the remedial action would consist primarily of workers commuting to the Lowman site from area residences and trucks hauling rock erosion protection materials. Miscellaneous trips related to contractor needs are expected to be limited due to the distance to Boise, Idaho, or to other cities. For that reason, such miscellaneous trips were considered negligible and were not considered further. A worst-case analysis of potential injury and fatal accidents occurring on SH-21 was based on an average commute distance of five miles and an average borrow haulage distance of 40 miles. It was assumed that the average work force of 21 would commute to the Lowman site in separate vehicles, five days a week, for six months. It is possible that all workers would reside at the South Fork Lodge in Lowman and that these mileages are overstated; however, it is also possible that workers may be housed in trailers on private property along SH-21 at varying distances from the site. An estimated 196,600 miles of highway travel would be associated with the remedial action.

Based on state of Idaho injury and fatal accident rates presented in Section 3.11, it is estimated that 0.118 injury and 0.014 fatal accident may occur on area highways as a result of the remedial action. These potential accidents may be overstated since the state of Idaho rates were based on travel occurring over a one-year period of time, whereas the remedial action would take six months. Additionally, the rates were developed from accidents occurring on state highways, while a portion of the remedial action-related traffic would occur on a county road.

The remedial action would require the extensive use of heavy equipment (e.g., bulldozers, compactors) on the site. Accidents associated with the operation of construction equipment and materials handling activities could occur during the remedial action. These hazards would be similar to those encountered in any large earthmoving project such as surface mining or heavy construction. Based on 1981 accident data for the mining and construction industries, approximately 0.0422 injury accident and 0.00045 fatal accident could occur per person-year of labor (DOC, 1983). Based on the number of person-months of labor over the six-month remedial action, an estimated 10.58 person-years of labor would be associated with the remedial action. Using the above national statistics, 0.447 injury and 0.005 fatal accident may occur on the Lowman site due to the activities associated with the movement of equipment, people, earth, and rock materials.

The total projected accidents that may occur as a result of the remedial action are estimated conservatively at 0.565 injury and 0.019 fatal accident.

4.13 MITIGATIVE MEASURES

The following mitigative measures were incorporated into the design and approach for the remedial action alternative in order to reduce the environmental impacts:

- o Applying water or chemical dust suppressants to disturbed areas and the gravel haul road to inhibit dust emissions.
- o Backfilling, grading, and revegetating the areas disturbed after the remedial action.
- o Implementing an equipment maintenance program to assure proper functioning of combustion emissions and noise control devices.
- o Firmly securing tailgates and any other metal noise source during transportation to avoid unnecessary noises.
- o Cleaning any equipment used before release from the site to prevent the spread of contaminated materials.
- o Using local labor whenever possible to reduce the sociological impacts to the local communities and to provide economic benefits.
- o Maintaining close communication with the local population through an established public information task force.
- o Purchasing land upslope from the disposal cell to ensure long-term stability.

Mitigative measures necessary to ensure the protection of remedial action workers and the long-term stability of the tailings are described in the UMTRA Project Environmental, Health, and Safety Plan (DOE, 1985b) and Guidance for UMTRA Project Surveillance and Maintenance (DOE, 1986).

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REFERENCES

- Amick, D., 1988. Highway Safety Division, Idaho Department of Highways, Boise, Idaho, personal communication with Sandra Beranich, Environmental Services, Jacobs Engineering Group Inc., Albuquerque, New Mexico, dated January 26, 1988.
- BRR (Basin and Range Research), 1987. "Class III Cultural Resources Survey, Lowman, Idaho," prepared by BRR, Boise, Idaho, for Jacobs Engineering Group Inc., Albuquerque, New Mexico.
- CDH (Colorado Department of Health), 1981. Fugitive Dust Emissions, Air Pollution Control Division, Denver, Colorado.
- Campbell, K. W., 1981. "Near Source Attenuation of Peak Horizontal Source Acceleration," in Bulletin of the Seismological Society of America, Vol. 71, pp. 2039-2070.
- Corley, D. R., and L. A. Burmeister, 1977. "Stream Inventory Survey of Clear Creek Near Lowman," U.S. Forest Service, Boise National Forest, Boise, Idaho.
- DOC (U.S. Department of Commerce), 1983. Statistical Abstracts of the United States, 1981 to 1982, Bureau of the Census, Washington, D.C.
- DOE (U.S. Department of Energy), 1990a. "Environmental Analysis and Data Report for the Lowman Uranium Mill Tailings Remedial Action, Lowman, Idaho," UMTRA-DOE/AL-150312.0000, DOE UMTRA Project Office, Albuquerque Operations Office, Albuquerque, New Mexico.
- DOE (U.S. Department of Energy), 1990b. "Final Report to the Secretary of Energy--Implications of the BEIR V Report to the Department of Energy," DOE/EH-0158T, DOE, Assistant Secretary for Environment, Safety, and Health, Office of Health, Washington, D.C.
- DOE (U.S. Department of Energy), 1986. Guidance for the UMTRA Project Surveillance and Maintenance, UMTRA-DOE/AL-350124.0000, DOE UMTRA Project Office, Albuquerque Operations Office, Albuquerque, New Mexico.
- DOE (U.S. Department of Energy), 1985a. Programmatic Environmental Report for Remedial Actions at UMTRA Project Vicinity Properties, UMTRA-DOE/AL-150327.0000, DOE UMTRA Project Office, Albuquerque Operations Office, Albuquerque, New Mexico.
- DOE (U.S. Department of Energy), 1985b. The UMTRA Project Environmental, Health, and Safety Plan, UMTRA-DOE/AL-150224.0006, DOE UMTRA Project Office, Albuquerque Operations Office, Albuquerque, New Mexico.
- DOE (U.S. Department of Energy), 1983. "Environmental Assessment of Remedial Actions on the Radioactive Sands at the Lowman Site, Lowman, Idaho," DOE UMTRA Project Office, Albuquerque Operations Office, Albuquerque, New Mexico.

- Delany, D., 1988. Bureau of Air Quality, Boise, Idaho, personal communication with Chuck Burt, Environmental Services, Jacobs Engineering Group Inc., Albuquerque, New Mexico, dated February 2, 1988.
- EG&G (Edgerton, Germerhausen & Grier; Energy Measurements, Inc.), 1983. "An Aerial Radiological Survey of the Area Surrounding the Lowman Mill Site and Porter Brothers Mine, Lowman, Idaho," EG&G Survey Report, NE-U-019, prepared for the U.S. Department of Energy, Albuquerque Operations Office, UMTRA Project Office, Albuquerque, New Mexico.
- EPA (U.S. Environmental Protection Agency), 1989. "Draft Environmental Impact Statement for Proposed NESHAPS For Radionuclides," EPA 520/1-89-007, EPA Office of Radiation Programs, Washington, D.C.
- EPA (U.S. Environmental Protection Agency), 1986. Industrial Source Complex (ISC) Dispersion Model User's Guide, Second Edition, Research Triangle Park, North Carolina.
- EPA (U.S. Environmental Protection Agency), 1985. Compilation of Air Pollutant Emission Factors AP-42, Fourth Edition, Research Triangle Park, North Carolina.
- EPA (U.S. Environmental Protection Agency), 1982. Final Environmental Impact Statement for Remedial Action Standards for Inactive Uranium Processing Sites (40 CFR Part 192), EPA 520/4-82-013-1, Washington, D.C.
- EPA (U.S. Environmental Protection Agency), 1978. "Protective Noise Levels," EPA-550/9-79-100, November, 1978.
- EPA (U.S. Environmental Protection Agency), 1972. Report to the President and Congress on Noise, Senate Document No. 92-63, Stock No. 5500-0040, U.S. Government Printing Office, Washington, D.C.
- FBDU (Ford, Bacon & Davis Utah Inc.), 1981. Engineering Assessment of Inactive Uranium Mill Tailings, Lowman site, Lowman, Idaho, UMTRA-DOE/UMT-0118, FBDU 360-17, UC-70, prepared by FBDU, Salt Lake City, Utah, for the U.S. Department of Energy, UMTRA Project Office, Albuquerque Operations Office, Albuquerque, New Mexico.
- Friel, F., 1988. Research and Analysis, Job Service, Department of Employment, Boise, Idaho, personal communication with Sandra Beranich, Environmental Services, Jacobs Engineering Group Inc., Albuquerque, New Mexico, dated February 16, 1988.
- Fuller, G., 1988. Planning Division, Idaho Department of Highways, Boise, Idaho, personal communication with Sandra Beranich, Environmental Services, Jacobs Engineering Group Inc., Albuquerque, New Mexico, dated January 26, 1988.
- Giles, B., 1988. Timber Management Assistant, Lowman Ranger District, Lowman, Idaho, personal communication with Sandra Beranich, Environmental Services, Jacobs Engineering Group Inc., Albuquerque, New Mexico, dated February, 1988.

- Green, T., 1987. Idaho Deputy State Historic Preservation Officer, Idaho State Historical Society, Boise, Idaho, personal communication with James Anderson, UMTRA Project Manager, Department of Energy, Albuquerque Operations Office, Albuquerque, New Mexico, dated August 5, 1988.
- Groves, C., 1987. Idaho Natural Heritage Program, Boise, Idaho, personal communication with Charles J. Burt, Environmental Services, Jacobs Engineering Group Inc., Albuquerque, New Mexico, 87108, dated March 30, 1987.
- Hilliard, G. D., 1988. Chief, Regulatory Branch, U.S. Army Corps of Engineers, Walla Walla, Washington, personal communication with Charles J. Burt, Environmental Services, Jacobs Engineering Group Inc., Albuquerque, New Mexico, 87108, dated May 3, 1988.
- Holcomb, K., 1988. Manager of the Haven Lodge, Lowman, Idaho, personal communication with Sandra Beranich, Environmental Services, Jacobs Engineering Group Inc., Albuquerque, New Mexico, dated February 15, 1988.
- IDHW (Idaho Department of Health and Welfare), 1985. "Idaho Regulations for Public Drinking Water Supplies," IDAPA 16.01.8900, Boise, Idaho.
- Idaho Division of Economic and Community Affairs, 1981. County Profiles of Idaho, Idaho State House Library, Boise, Idaho.
- ICRP (International Commission on Radiological Protection), 1977a. Recommendations of the International Commission on Radiological Protection, ICRP Publication 27, Pergamon Press, Elmsford, New York.
- ICRP (International Commission on Radiological Protection), 1977b. Recommendations of the International Commission on Radiological Protection, ICRP Publication 26, Pergamon Press, Elmsford, New York.
- Kaminski, T., and J. Hansen, 1984. "Wolves of Central Idaho," Montana Cooperative Wildlife Research Unit, University of Montana, Missoula, Montana.
- Kessler et al. (F. M. Kessler, P. D. Schomar, P. C. Schanau, and E. Rosendahl), 1978. Construction Site Noise Control Cost-Benefit Estimation Technical Background, prepared by the U.S. Army Corps of Engineers, Construction Engineering Research Laboratory Technical Report N-37, Champaign, Illinois.
- Koppes, B., 1988. Area labor market analyst, Boise Job Service Office, Department of Employment, Boise, Idaho, personal communication with Sandra Beranich, Environmental Services, Jacobs Engineering Group Inc., Albuquerque, New Mexico, dated February 24, 1988.
- Kuchler, A. W., 1975. "Potential Natural Vegetation of the Conterminous United States," American Geographic Society Special Publication No. 36, New York, New York (Map).
- LaForge, F. C., and F. F. Hawkins, 1987. "Seismotectonic Study for Arrowrock Dam, Boise Project, Idaho," Seismotectonic Report 87-4, U.S. Bureau of Reclamation, Denver, Colorado.

- Lobdell, C. H., 1989. Field Supervisor, U.S. Fish and Wildlife Service, Boise, Idaho, personal communication with Bill Glover, Environmental Services, Jacobs Engineering Group Inc., Albuquerque, New Mexico, dated April 27, 1989.
- Manubay, R., 1988. Transportation Services Bureau, Idaho, Department of Highways, Boise, Idaho, personal communication with Sandra Beranich, Environmental Services, Jacobs Engineering Group Inc., Albuquerque, New Mexico, dated January 27, 1988.
- Mesa (Mesa Corporation), 1982. "Backup to the Socioeconomic Parts of the Lowman Environmental Assessment for the Uranium Mill Tailings Remedial Action Project," prepared by Mesa Corporation, Salt Lake City, Utah, for Ford, Bacon, & Davis, Salt Lake City, Utah.
- Moroz, P., 1988. U.S. Forest Service, Emmett Ranger District, Emmett, Idaho, personal communication with Charles J. Burt, Environmental Services, Jacobs Engineering Group Inc., Albuquerque, New Mexico, dated February 9, 1988.
- Mountain West Research, Inc., 1979. A Guide to Methods for Impact Assessment of Western Coal/Energy Development, Billings, Montana.
- NAS (National Academy of Sciences), 1990. Cancer deaths of Exposure to Low Levels of Ionizing Radiation: BEIR V, Committee on the Biological Effects of Ionizing Radiations, National Academy Press, Washington, D.C.
- NAS (National Academy of Sciences), 1988. Health Risks of Radon and Other Internally Deposited Alpha-Emitters. BEIR IV, Committee on the Biological Effects of Ionizing Radiations, National Academy Press, Washington, D.C.
- NAS (National Academy of Sciences), 1980. BEIR-III report, The Effects on Population Exposure to Low Levels of Ionizing Radiation, Advisory Committee on Biological Effects of Ionizing Radiation, National Research Council, Washington, D.C.
- NAS (National Academy of Sciences), 1977. Guidelines for Preparing Environmental Impact Statements on Noise, Committee on Hearing Bioacoustics and Biomechanics, Working Group No. 69, Washington, D.C.
- NOAA (National Oceanic and Atmospheric Administration), 1979. "Climatology of the United States No. 90 (1965-1974), Boise, Idaho, Boise Air Terminal-Gowey Field," NOAA, National Climatic Center, Ashville, South Carolina.
- NOAA (National Oceanic and Atmospheric Administration), 1970. "Climotological Summary, Lowman, Idaho, 1941-1970," NOAA, National Climate Center, Ashville, South Carolina.
- ORNL (Oak Ridge National Laboratory), 1980. "Radiological Survey of the Radioactive Sands and Residues at Lowman, Idaho," ORNL-5465, Dist. Category UC-41, prepared for the U.S. Department of Energy, Albuquerque Operations Office, UMTRA Project Office, Albuquerque, New Mexico.

- Porter, A., 1982. "County Profiles of Idaho," Idaho Division of Economic and Community Affairs, Boise, Idaho.
- Robeson, D., 1988. County Road Superintendent for the Boise Road Department, Garden Valley, Idaho, personal communication with Sandra Beranich, Environmental Services, Jacobs Engineering Group Inc., Albuquerque, New Mexico, dated January 27, 1988.
- Shaw, E., 1988. Manager of South Fork Lodge, Lowman, Idaho, personal communication with Sandra Beranich, Environmental Services, Jacobs Engineering Group Inc., Albuquerque, New Mexico, dated February 15, 1988.
- Shue, I., 1988. Resident, Lowman, Idaho, personal communication with Sandra Beranich, Environmental Services, Jacobs Engineering Group Inc., Albuquerque, New Mexico, dated February 25, 1988.
- Steenhof, K., 1988. U.S. Bureau of Land Management, Boise, Idaho, personal communication with Charles J. Burt, Environmental Services, Jacobs Engineering Group Inc., Albuquerque, New Mexico, dated February 3, 1988.
- TAC (Technical Assistance Contractor; Jacobs-Weston Team), 1987a. "Unpublished Field Notes, Lowman, Idaho Radioactive Sands Site," unpublished report prepared by the TAC, Albuquerque, New Mexico, for the U.S. Department of Energy, UMTRA Project Office, Albuquerque Operations Office, Albuquerque, New Mexico.
- TAC (Technical Assistance Contractor; Jacobs-Weston Team), 1987b. "Unpublished Field Notes, Lowman, Idaho Radioactive Sands Site," unpublished report prepared by the TAC, Albuquerque, New Mexico, for the U.S. Department of Energy, UMTRA Project Office, Albuquerque Operations Office, Albuquerque, New Mexico.
- UNC (United Nuclear Corporation, Technical Services, Inc.), 1986. "Radiological Characterization of the Lowman, Idaho, Uranium Mill Tailings Remedial Action Site, GJ-53," prepared for the U.S. Department of Energy, Albuquerque Operations Office, UMTRA Project Office, Albuquerque, New Mexico.
- Wilson, B., 1988. Boise County Assessors Office, Idaho City, Idaho, personal communication with Sandra Beranich, Environmental Services, Jacobs Engineering Group Inc., Albuquerque, New Mexico, dated February 24, 1988.
- Wolflin, J. P., 1987. Field Supervisor, U.S. Fish and Wildlife Service, Boise, Idaho, personal communication to Dave Lechel, Environmental Services, Jacobs Engineering Group Inc., Albuquerque, New Mexico, dated March 11, 1987

GLOSSARY

absorbed dose, radiation	The amount of energy imparted to matter by ionizing radiation per unit mass of irradiated material at the point of interest; usually given in units of "rads."
alluvium	Sediment deposited by a stream.
alpha particle	A positively charged particle emitted from certain radio-nuclides; it is composed of two protons and two neutrons and is identical to the helium nucleus.
aquifer	A geologic unit that transmits usable quantities of water. It is a relative term. A unit that is considered an aquifer in one area may be considered an aquitard in another.
attenuate	To reduce in strength, force, value, or amount.
A-weighted scale	Sound pressure level scale that most closely matches the response of the human ear; this scale is most commonly used to measure environmental noise and is often supplemented by the time and duration of the noise to determine the total quantity of sound affecting people.
background radiation	Background radiation due to cosmic rays and natural radioactivity is always present. Background radiation may also be present due to the presence of radioactive substances in building materials and the like.
batholith	A large intrusive body greater than 40 square miles with steep sided contact with crustal rocks. Formed from a pluton.
beta particle	Charged particle emitted from the nucleus of an atom during radioactive decay, with mass and charge equal to those of an electron.
Class III archaeological surveys	A Class III survey is an in-depth inspection of an area to determine the presence of archaeological materials where the likelihood of their occurrence is high, based on the history of the area.
colluvium	General term for loose, uncompacted deposits at the foot of a slope transported chiefly by gravity and sheet flow runoff.
combustion emissions	Emissions such as hydrocarbons, nitrogen oxides, sulfur oxides, and carbon monoxide emitted during the operation of construction equipment.

concentration, maximum permissible	The maximum concentration of a radionuclide that a remedial action worker may be exposed to which, if accumulated during a set time interval, would be within Federal safety standards.
contamination	In this report, the presence of radioactive material in concentrations above natural levels.
cosmic rays, radiation	High energy particulate and electromagnetic radiations that originate outside the earth's atmosphere.
Cretaceous	Final period of the Mesozoic era spanning 136 to 66 million years ago.
curie (Ci)	The unit of radioactivity defined as precisely equal to 3.7×10^{10} disintegrations per second.
daughter product(s)	A nuclide resulting from radioactive disintegration of a radionuclide, formed either directly or as a result of successive transformations in a radioactive series; it may be either radioactive or stable.
decay, radioactive	Disintegration of the nucleus of an unstable nuclide usually by spontaneous emission particles, photons, or both.
decay chain, radioactive	A succession of nuclides, each of which transforms by radioactive disintegration into the next until a stable nuclide results.
decibel	A measure, on a logarithmic scale, of the magnitude of a particular quantity (such as sound pressure, sound power, intensity) with respect to a standard reference value (0.0002 microbars for sound pressure and 10 to 12 watts for sound power).
decontamination	The reduction of radioactive contamination in an area to a predetermined level set by a standards-setting body, such as the EPA.
air dispersion model	A mathematical model designed to measure the concentrations of air pollutants dispersed into the atmosphere.
dose	A general term denoting the quantity of radiation or energy absorbed, usually by a person: for special purposes, it must be qualified; if unqualified, it refers to absorbed dose.
dose equivalent	The quantity that expresses all kinds of radiation on a common scale for calculating the effective absorbed dose and defined as the product of the absorbed dose in rads and modifying factors, especially the quality factor: usually given in units of rems; often abbreviated "dose."

dose equivalent, committed	The dose equivalent to organs or other tissues that will be received following an intake of radioactive material during the 50-year period following that intake.
dose equivalent, committed effective	The weighted sum of committed dose equivalents to organs, using weighting factors based on the susceptibility of each organ to certain cancer deaths.
earthquake, design	The earthquake that produces the largest on-site peak horizontal acceleration; this earthquake could be the floating earthquake or an earthquake whose magnitude is derived from a relationship between fault rupture or fault length and maximum magnitude.
earthquake, floating	An earthquake within a specific seismotectonic province that is not associated with a known tectonic structure; also defined as an earthquake that is moved over an inclusive area because it cannot be pinned down for lack of precise information on where the earthquake may occur.
epicenter	The part of the earth's surface directly above the origin of an earthquake.
equilibrium (radioactive)	In a radioactive decay chain, the state when the ratios between activities of successive members of the decay chain remain constant.
exposure	A measure of the amount of gamma radiation that may deposit energy in an individual; given in units of roentgens. Also used to refer to an individual being subjected to the presence of radiation.
external dose	The absorbed dose that is due to a radioactive source external to the individual as opposed to radiation emitted by inhaled or ingested sources.
fault	A plane or zone of rock fracture along which there has been displacement.
fault, capable	As defined by the Atomic Energy Commission and adopted by the Nuclear Regulatory Commission for the siting of nuclear power plants (10 CFR 100), a capable fault is a fault that has exhibited one or more of the following characteristics: movement at or near the ground surface at least once within the past 35,000 years or movement of a recurring nature within the past 500,000 years; macro-seismicity instrumentally determined with records of sufficient precision to demonstrate a direct relationship with the fault; or structural relationship to a capable fault such that movement on one fault could be reasonably expected to cause movement on the other.

fauna	The animals of a specified region or time.
floodplain	Lowland or relatively flat areas built of sediment from the present stream regime that are subject to flooding.
flora	The plants of a specified region or time.
flux, radon	The rate of emission of radon gas from the earth or other material; usually measured in units of picocuries per square meter per second.
fugitive dust	Dust particles in the atmosphere consisting mainly of coarse soil particles that may be generated during the movement of heavy equipment.
gamma dose	Radiation dose caused by gamma radiation.
gamma logging (or logs)	A technique for determining gamma radiation levels at various depths in a borehole.
gamma ray (or radiation)	High energy electromagnetic radiation emitted from some radiation radionuclides. Different radionuclides have associated specific energies. A deeply penetrating form of radiation; sometimes abbreviated "gamma."
gamma spectral analysis (gamma spectroscopy)	An analytical technique for identifying radionuclides based on their gamma radiation energies.
geochemical attenuation	Any process (through reaction with soil, sediments, or bedrock) by which dissolved groundwater contaminants are removed from solution and thereby made less mobile within an aquifer or soil water system. Mineral precipitation and adsorption onto mineral surfaces are the two main attenuative processes within groundwater.
groundwater	Water below the land surface, generally in a zone of saturation.
head, total	The height to which water will naturally rise in a well or piezometer. Total head is a measure of the energy per unit weight of groundwater. Total head is the sum of elevation head and pressure head. Groundwater flows from regions of higher to regions of lower total head.
health effect	Adverse physiological response to radiation exposure; in this report, one excess health effect is defined as one cancer death from exposure to radioactivity.
hydraulic conductivity	A measure of the capacity of a material to transmit water. The rate at which water driven by a unit hydraulic head will flow through a unit cross-sectional area of material.

hydraulic gradient	The change in total head per unit of distance in a given direction.
inert gas	One of the chemically unreactive gases: helium, neon, argon, krypton, xenon, or radon.
interbedded	Occurring between beds, or lying in a bed parallel to other beds of a different material.
internal dose	The absorbed dose or dose commitment resulting from inhaled or ingested radioactivity.
intrusive	The process of emplacement of magma in pre-existing rock resulting in medium to coarse crystalline rock.
isotopes	Nuclides having the same number of protons in their nuclei but differing in the number of neutrons; the chemical properties of isotopes of a particular element are almost identical.
leachate	The solution generated by the percolation of water through a body of soil, waste rock, or solid waste.
lithologic unit	Unit of rock type based on the physical character of a rock, generally as determined megascopically or with the aid of a low power magnifier.
meander	A sinuous loop or curve in a stream or river (usually part of a series); a deviation of the flow pattern of a current.
micro	A prefix meaning one millionth ($1/1,000,000$ or 10^{-6}).
milli	A prefix meaning one thousandth ($1/1000$ or 10^{-3}).
mitigative measure	A measure implemented to reduce the adverse environmental impacts of remedial action (e.g., the application of water and chemical dust suppressants to dirt and gravelled haul roads to inhibit dust emissions).
monitor	To observe and make measurements to provide data for evaluating the performance and characteristics of disposal site.
nuclide	A general term applicable to all atomic forms of the elements; nuclides comprise all the isotopic forms of all the elements; nuclides are distinguished by their atomic number, atomic mass, and energy state.
outcrop	The exposure of bedrock or strata projecting through the overlying cover of detritus and soil.

Pasquill-Gifford stability categories	A system used to characterize air stability where stability is related to the amount of turbulence, and therefore mixing, in a fluid.
percolate	To pass (a liquid) through a porous substance.
permeability	The ease with which liquids or gases penetrate or pass through a layer of soil; technically, it is the volume of fluid that will flow through a unit area under a unit hydraulic gradient, measured in centimeters per second or equivalent units.
permissible dose	That dose of ionizing radiation that is considered acceptable by standards-setting bodies such as the EPA.
person-rem	Unit of population exposure obtained by summing individual dose-equivalent values for all people in the population; thus, the number of person-rem attributed to one person exposed to 100 rems is equal to that attributed to 100 persons each exposed to one rem.
pico	A prefix meaning one trillionth ($1/1,000,000,000,000$ or 10^{-12}).
picocurie	A measure of radioactivity defined as one trillionth curie; equivalent to 0.037 disintegrations per second.
piezometric surface	In a well or piezometer, the level to which groundwater naturally rises. In an aquitard, the imaginary surface connecting water levels in wells or piezometers throughout the aquifer.
pluton	A body of igneous rock formed beneath the surface of the earth by consolidation from magma.
potentiometric surface	The level to which groundwater rises in a tightly cased well.
porosity	The porosity of a rock or soil is its property of containing interstices or voids and may be expressed quantitatively as the ratio of the volume of its interstices to its total volume; also called total porosity.
porosity, effective	Effective porosity refers to the amount of interconnected pore space available for fluid transmission.
Probable Maximum Flood (PMF)	The hypothetical flood (peak discharge, volume, and hydrograph shape) that is considered to be the most severe reasonably possible, based on the comprehensive hydro-meteorological application of the Probable Maximum Precipitation (PMP) and other hydrologic factors favorable for maximum flood runoff such as sequential storms and snowmelt.

Probable Maximum Precipitation (PMP)	The estimated amount of precipitation for a given duration, drainage area, and time of year for which there is virtually no risk of exceedence.
rad	A unit of measure for the absorbed dose of radiation; it is equivalent to 100 ergs per gram of material.
radioactive decay chain	A succession of radionuclides, each of which transforms by radioactive disintegration into the next until a stable nuclide results.
radioactivity (radioactive decay)	The property of some nuclides to spontaneously emit particles of gamma radiation or of spontaneous fission. This process is referred to as radioactive decay.
radioisotope	A radioactive isotope of an element with which it shares almost identical chemical properties.
radionuclide	A radioactive nuclide.
radium-226 (Ra-226)	A radioactive daughter product of uranium-238. Radium is present in all uranium-bearing ores; it has a half-life of 1620 years.
radon-222 (Rn-222)	The gaseous radioactive daughter product of radium-226; it has a half-life of 3.8 days. It is an inert gas and may escape from the material containing the radium-226.
radon-daughter product	One of several short-lived radioactive daughter products of radon-222; all are solids.
recharge	The process by which water is absorbed by surficial soils or geologic units and is added to the zone of saturation. The process by which water enters the saturated zone of an aquifer.
recharge area	The area of an aquifer over which recharge occurs.
rem	A special unit of dose equivalent which expresses the effective absorbed dose calculated for all radiations on a common scale. It is defined as the product of the absorbed dose in rads and certain modifying factors, e.g., the quality factor.
Richter scale	A measure characteristic of the total energy released by an earthquake, based on a logarithmic scale in terms of local ground motion (M_L) at a distance of 100 km from the epicenter.
riprap	Rock armor used to protect soil and tailings structures from erosion.

roentgen	A unit of exposure of ionizing electromagnetic radiation (gamma or X-ray) in air; for gamma radiation, one roentgen in air is approximately equal to one rad and one rem in tissue.
scintillometer	An instrument used in the field that measures gamma exposure rate levels.
seismic	Pertaining to an earthquake or earth vibration.
soil infiltration rate	The rate at which water enters the soil surface and moves vertically downward toward the water table.
somatic	Radiation cancer deaths to the body of an individual, as opposed to genetic cancer deaths to future generations.
stabilization	The reduction of radioactive contamination in an area to a predetermined level by a standards-setting board, such as the EPA, by encapsulating or covering the contaminated material.
standard deviation	The square root of the arithmetic mean of the sum of the squares of the deviation from the arithmetic mean of a frequency distribution.
Subpart A	That part of the EPA groundwater standards that consists of the requirements for control of potential contaminant releases to the groundwater at disposal sites.
Subpart B	That part of the EPA groundwater standards applicable for remediating contaminated groundwater.
Subpart C	That part of the EPA groundwater standards that addresses supplemental standards applicable to Subparts A and B.
supplemental standards	That part of the EPA groundwater standards that provides for alternative actions that come as close to the standards "as reasonable under the circumstances." Supplemental standards may be applied if protection of human health and the environment is assured and (1) the proposed action would cause more environmental harm than it would prevent, (2) restoration is technically impracticable from an engineering perspective, or (3) the groundwater is Class III.
surveillance	The observation of the disposal site for purposes of visual detection of the need for custodial care, evidence of intrusion, and compliance with other license and regulatory requirements.
tailings, uranium mill	The wastes remaining after most of the uranium has been extracted from uranium ore.

tectonic	Of, pertaining to, or designating the rock structure and external forms resulting from the deformation of the earth's crust.
thorium-230 (Th-230)	A radioactive daughter product of uranium-238; it has a half-life of 80,000 years and is the parent of radium-226.
thorium-232 (Th-232)	A naturally occurring radioisotope with a half-life of 14 billion years.
total suspended particulates (TSP)	Particulates, usually less than 30 microns in diameter, that remain in the atmosphere for extended periods of time.
tributary	A stream which flows into a larger stream.
UMTRA Project	Uranium Mill Tailings Remedial Action Project of the U.S. Department of Energy.
unconfined aquifer	An aquifer without an upper confining layer; also known as phreatic or water-table aquifers.
ungulates	Hoofed mammals such as deer and elk.
uranium-238 (U-238)	A naturally-occurring radioisotope with a half-life of 4.5 billion years; it is the parent of uranium-234, thorium-230, radium-226, radon-222, and others.
vicinity property	A property in the vicinity of a tailings site that is determined by the DOE, in consultation with the NRC, to be contaminated with residual radioactive materials derived from the tailings site and that is determined by the DOE to require remedial action.
visitor use day	One visitor use day is defined as one visitor using the resource for 12 hours, or any equivalent combination such as three visitors using the resource for four hours each, or 12 visitors using the resource for one hour each.
water table	The surface of a body of unconfined groundwater at which pressure is equal to that of the atmosphere.
zone, unsaturated	The unsaturated zone is the zone between the land surface and the uppermost saturated zone.

ABBREVIATIONS AND ACRONYMS

ACL	alternate concentration limit
ALARA	as low as reasonably achievable
BFEC	Bendix Field Engineering Corporation
CFR	Code of Federal Regulations
COE	U.S. Army Corps of Engineers
cfs	cubic feet per second
cfs/ft	cubic feet per second per foot
Ci	curie
cm	centimeter
cm/s	centimeters per second
CO	carbon monoxide
cy	cubic yard
dba	decibels (on the A-weighted scale)
DOC	U.S. Department of Commerce
DOE	U.S. Department of Energy
EA	environmental assessment
EADR	environmental analysis and data report
EIS	environmental impact statement
EMT	emergency medical technician
EPA	U.S. Environmental Protection Agency
°F	degree Fahrenheit
FBDU	Ford, Bacon & Davis Utah Inc.
ft/day	feet per day
fps	feet per second
ft	foot

ft ²	square foot
FONSI	Finding of No Significant Impact
FR	Federal Register
FWS	U.S. Fish and Wildlife Service
g	gram
gpd	gallons per day
gpm	gallons per minute
g/s	grams per second
HC	hydrocarbon
hr	hour
ISCST	Industrial Source Complex Short Term dispersion model
km	kilometer
kw	kilowatt
kwh	kilowatt-hours
l	liter
lb	pound
lb/cy	pounds per cubic yard
lb/hr	pounds per hour
lb/mi	pounds per mile
L _{dn}	day-night sound level measured in decibels
L _{eq}	equivalent sound level measured in decibels
m	meter
m ²	square meter
MCL	maximum concentration limit
mg/l	milligrams per liter
mg/m ³	milligrams per cubic meter
microg	microgram

microg/m ³	micrograms per cubic meter
microR/hr	microroentgens per hour
mg	milligram
mg/g	milligrams per gram
mph	miles per hour
mrem	millirem
mR/hr	milliroentgens per hour
MSL	mean sea level
NAS	National Academy of Sciences
NEPA	National Environmental Policy Act of 1969 (PL91-190)
NO _x	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
OSHA	Occupational Safety and Health Administration
p	pico
Pb-210	lead-210
pCi/g	picocuries per gram
pCi/l	picocuries per liter
pCi/m ² s	picocuries per square meter per second
PL95-604	Public Law 95-604 (Uranium Mill Tailings Radiation Control Act of 1978)
PMF	probable maximum flood
PMP	probable maximum precipitation
Po-210	polonium-210
ppm	parts per million
RAC	Remedial Action Contractor
RAP	remedial action plan
Ra-226	radium-226

RCRA	Resource Conservation and Recovery Act
Ra-228	radon-228
Rn-222	radon-222
s	second
SCS	U.S. Soil Conservation Service
SEM	standard error of the mean
SO _x	sulfur oxide(s)
Th-230	thorium-230
Th-232	thorium-232
TSP	total suspended particulates
U-238	uranium-238
UMTRA Project	Uranium Mill Tailings Remedial Action Project
UMTRCA	Uranium Mill Tailings Radiation Control Act of 1978 (PL95-604)
USGS	U.S. Geological Survey
yr	year(s)

AGENCIES AND PERSONS CONTACTED

Boise County Assessors Office Idaho City, Idaho	Beth Wilson	Population
Boise County Road Department Garden Valley, Idaho	Douglas Robeson	Transportation
Boise National Forest Boise, Idaho	Kay Schiepan Randy Welsh Don Corley James Curtis	Recreation Aquatic resources Mineral resources and dam sites along the South Fork Payette River
Bureau of Air Boise, Idaho	Dean Delany	Air quality
Emmett Ranger District Emmett, Idaho	Paul Moroz Don Dittmer	Bald eagle Socioeconomics
Federal Highway Administration Vancouver, Washington	Lonnie E Moss Daryl Lein Dick Gerhards	Rock erosion pro- tection material and stockpile areas
Haven Lodge Lowman, Idaho	Karen Holcomb	Lodge size and use
Idaho Department of Highways Boise, Idaho	Dave Amick Glenda Fuller Rubin Manubay	Transportation
Idaho Department of Transportation Boise, Idaho	John Sharp	Rock erosion pro- tection material and stockpile areas
Idaho Fish and Game Garden Valley, Idaho	Terry Holubetz	Aquatic resources
Idaho Natural Heritage Program Boise, Idaho	Craig Graves	Threatened and endangered species
Job Service Department of Employment Boise, Idaho	Fred Friel Burel Koppes	Employment

AGENCIES AND PERSONS CONTACTED (Concluded)

Lowman Ranger District Lowman, Idaho	Bob Giles Nadine Hergen-Rider Morris Huffman	General Wildlife Rock erosion pro- tection material and stockpile areas
Resident Lowman, Idaho	Ilo Shue	General about Lowman
South Fork Lodge Lowman, Idaho	Ellen Shaw	Lodge size, facilities, use
Bureau of Land Management Boise, Idaho	Karen Steenhof	Bald eagle
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ATTACHMENT 1
FLOODPLAIN/WETLANDS ASSESSMENT

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2.0 PROJECT DESCRIPTION

The Uranium Mill Tailings Radiation Control Act of 1978 (UMTRCA), Public Law 95-604, authorized the DOE to perform remedial action at the Lowman tailings site near Lowman, Idaho, (as well as at many other sites) to reduce the potential public health impacts from the residual radioactivity at the site. The remedial actions at inactive uranium mill sites are performed by the Uranium Mill Tailings Remedial Action (UMTRA) Project. The U.S. Environmental Protection Agency (EPA) promulgated standards (40 CFR 192) in March 1983 for these remedial actions.

The Lowman site is 0.5 road mile northeast of the village of Lowman in Boise County, Idaho (Figure 2.1). The site is in the northern Rocky Mountains, is characterized by steep, heavily wooded terrain, and is within the Boise National Forest. The elevation at the site is approximately 3800 feet above mean sea level (MSL) and the surrounding mountains rise to over 6000 feet above MSL. Land uses in the surrounding area include recreation, grazing, logging, and mining.

A total 29.5 acres of land are contaminated within the 35-acre designated site. The radioactive sand piles cover 10.1 acres and contain 50,000 cubic yards (cy) of contaminated materials; these piles are comprised of white, gray, black, and red sands. The mill yard, ore storage, and pond areas cover five acres, and 19,100 cy of contaminated materials occur in these areas. The wind-blown and waterborne contaminated areas cover 14.4 acres and contain 19,700 cy of contaminated materials. The total amount of contaminated materials at the site is 88,800 cy. An additional 38,700 cy of contaminated material exists off the site at the vicinity properties.

The proposed remedial action for the Lowman site would consolidate all of the sands and other contaminated materials into one pile on the site. The disposal cell would be placed against the steep slope on the east side of the designated site and have 20-percent slopes on the lower part and 10-percent slopes on the upper part. The cell would be covered with a layer of compacted soil to inhibit radon emanation. The cell would then be covered with a layer of sand and rock to protect it against erosion, penetration by animals, and inadvertent human intrusion. The disposal cell would average 22.5 feet above the surrounding terrain and would cover 8.2 acres. Twenty-nine and one-half acres of land are contaminated. However, only 13.1 acres would be remediated: 10.2 acres are in wooded riparian areas along Clear Creek with low contamination levels created by windblown and waterborne materials, and supplemental standards would be applied; and 6.2 acres of contaminated land would be covered by the stabilized pile and would not be cleaned up. An additional two acres of uncontaminated land outside the current boundary of the designated site would be used for the disposal cell, resulting in 15.1 acres being affected by remedial action. Areas disturbed around the disposal cell during remedial action would be restored in accordance with applicable permits or approvals and released for unrestricted use.

FIGURE 2.1
LOCATION OF THE LOWMAN SITE NEAR LOWMAN, IDAHO

3.0 FLOODPLAIN EFFECTS

3.1 AFFECTED ENVIRONMENT

The Clear Creek watershed upstream from the Lowman tailings site encompasses 56.7 square miles. Clear Creek originates in a mountainous area of the Boise National Forest northeast of the tailings site. Elevations in the watershed vary from 4000 feet above MSL at the tailings site to over 8000 feet above MSL at the headwaters. Clear Creek drains into the South Fork Payette River at Lowman 1200 feet southwest of the Lowman site (Figure 3.1).

Clear Creek is a perennial stream that forms the western border of the Lowman site. It is a cold, clear trout stream with the typical configuration of riffle areas separated by pools. The lower half of the creek, which includes the segment that flows past the Lowman site, has an average width of 10.6 meters (35 feet), an average depth of 0.24 meter (0.79 foot), and is 6.8 percent pools. The substrate ranges from sand to boulders and 70 percent of the lower half is lined with the riparian shrub plant community. The remainder of the shoreline is forest, grass, or exposed land (Corley and Burmeister, 1977).

Clear Creek flows in a southward direction in the vicinity of the tailings site. The creek bends sharply to the west as it approaches the Lowman tailings site and then to the south as it flows past the site. It flows in a southwestward direction as it approaches the Highway 21 bridge and then to the southeast into the South Fork Payette River. Clear Creek is incised in bedrock and is confined from meandering in the vicinity of the tailings site.

3.2 FLOOD CONDITIONS

A flood analysis was performed to determine the extent of the 100-year Clear Creek floodplain and the impacts, if any, that remedial action activities would have on the floodplain.

Estimates for the 100-year floods were determined using the U.S. Army Corps of Engineer's (USACE) HEC-1 hypothetical storm over a subbasin (USACE, 1981). This information was used in the U.S. Soil Conservation Service (SCS) Dimensionless Unitgraph method (SCS, 1982) to compute the runoff hydrograph. Infiltration losses were calculated using the SCS Curve Number method (SCS, 1972). Hydraulic parameters were estimated using Manning's formula (Chow, 1959).

The boundary of the 100-year floodplain is shown in Figure 3.2. A 100-year flow of 25,067 cubic feet per second would occur in Clear Creek next to the Lowman site. The 100-year flood would have a depth of flow of 10 feet, and average velocity of 7.3 feet per second, would reach an elevation of 3835.89 feet above MSL, and would be approximately 220 feet wide. The 100-year flow is an extremely conservative estimate because the HEC-1 analysis assumes essentially zero infiltration losses and, hence, maximum runoff. This value is much greater than the 100-year flood of 9200 cubic feet per second for the South Fork Payette River,

FIGURE 3.1
REGIONAL SURFACE WATER CHARACTERISTICS NEAR LOWMAN, IDAHO

LEGEND

- == DIRT ROAD
- STATE HIGHWAY
- BUILDINGS
- ▨ 100-YEAR FLOODPLAIN

- ▨ SUPPLEMENTAL STANDARDS APPLIED AND NO EXCAVATION REQUIRED EXCEPT IN POSSIBLE ISOLATED AREAS

100 0 100 300

SCALE IN FEET

NOTE: CONTOURS ARE AT 20' INTERVALS

FIGURE 3.2

100-YEAR FLOODPLAIN BOUNDARY AT THE LOWMAN SITE NEAR LOWMAN, IDAHO

which is based on actual flow data. Therefore, the 100-year flood data for the South Fork Payette River is a more realistic estimate of the 100-year flood along Clear Creek. However, the floodplain boundaries shown on Figure 3.2 are based on the conservative HEC-1 analysis.

3.3 IMPACTS

If the U.S. Nuclear Regulatory Commission (NRC) concurs that supplemental standards should be applied, then remedial action construction activities would impact very little of the 100-year floodplain along Clear Creek. See Figure 3.2, which shows the limits of excavation relative to the 100-year floodplain along the creek.

If supplemental standards are not applied, then construction of the disposal cell would have minor impacts in the floodplain of Clear Creek. A few large pine and spruce trees along with shrubs and ground vegetation would be cleared to clean up the contaminated materials. There are no threatened or endangered species or other species of concern in the floodplain. The existing stream channel would undergo minor alterations as a result of construction activities. These minor impacts would not alter the flow patterns in Clear Creek nor would they alter the 100-year floodplain of this creek.

Measures designed to reduce the potential for erosion into Clear Creek following removal of the contaminated materials would include such things as the addition of riprap and mulch.

Land disturbed during remedial action would be revegetated as soon as possible. Riparian species such as willow would be reestablished along the creek. The final revegetation plan for the Clear Creek floodplain would be formulated in consultation with the appropriate state and/or Federal agencies.

4.0 WETLANDS EFFECTS

4.1 DESCRIPTION OF WETLANDS

A USACE survey of wetlands at the Lowman processing site determined that USACE-regulated wetlands occur along Clear Creek (Figure 4.1) (Hilliard, 1988).

Analyses of aquatic invertebrates in Clear Creek indicate that the species diversity is good to excellent and the standing crop is fair. Overall, the water quality is good and the aquatic habitat has experienced little degradation, as indicated by the aquatic invertebrate species composition. A complete survey for fish species was not conducted in Clear Creek. A creel census and snorkeling counts indicate that the rainbow trout (Salmo gairdneri) is the most abundant species, followed by the brook trout (Salvelinus fontinalis) and the white fish (Prosopium williamsoni). In addition, the sculpin (Cottus sp.) and bull trout (Salvelinus confluentus) also occur in Clear Creek (Holubetz, 1987).

The riparian wetland vegetation along Clear Creek is dominated by shrubs, with species such as willow (Salix sp.), dogwood (Cornus stolonifera), Wood's rose (Rosa woodsii), alder (Alnus sp.), raspberry (Rubus idaeus), and spiraea (Spiraea sp.) being common. The dense herbaceous layer is mostly grass, with species such as sedges (Carex sp.), horsetail (Equisetum sp.), goldenrod (Solidago sp.), yarrow (Achillea millefolium), and thistle (Cirsium sp.) also common. This riparian vegetation community occurs along much of a two-mile stretch of Clear Creek upstream from the Lowman site that was surveyed in 1987 (TAC, 1987).

No amphibians or reptiles were observed at or near the Lowman site during the brief reconnaissance surveys. A total of 13 species may occur on the site (Bernard and Brown, 1978); the largest number of species (12) are expected in the riparian plant community.

Twenty-three species of birds were observed at or near the site and all were assumed to be nesting species. This represents a small sample of the bird species likely to occur at or near the site, since 357 species of birds have been recorded in Idaho and 229 are known to nest in the state (Groves and Marks, 1985). Common nesting species in the shrub riparian habitat along Clear Creek were the yellow warbler (Dendroica petechia), song sparrow (Melospiza melodia), and common yellow throat (Geothlypis trichas). Other species observed along the creek included the belted kingfisher (Ceryle alcyon) and spotted sandpiper (Actitis macularia).

A total of 33 species of mammals may occur at or near the Lowman site (Larrison and Johnson, 1981). The beaver (Castor canadensis) was the only strictly riparian species observed; a beaver dam was observed along Clear Creek about one mile upstream from the Lowman site (TAC, 1987).

LEGEND

PLANT COMMUNITY TYPES

PONDEROSA PINE	RIPARIAN-SHRUB
OPEN PONDEROSA PINE-SHRUB	GRASS DOMINATED FIELDS
SITE ACCESS ROAD AND JEEP TRAILS	SUPPLEMENTAL STANDARDS APPLIED AND NO EXCAVATION REQUIRED EXCEPT IN POSSIBLE ISOLATED AREAS
EASTERN BOUNDARY OF PROPOSED STABILIZED PILE	

100 0 100 300
SCALE IN FEET

FIGURE 4.1
PLANT COMMUNITY TYPES AT THE
LOWMAN SITE NEAR LOWMAN, IDAHO

There are no threatened or endangered species or other species of concern in the wetlands along Clear Creek at or near the Lowman site.

4.2 IMPACTS ON WETLANDS

Remedial action would involve cleaning up contaminated lands near Clear Creek. However, the wetlands within the contaminated zone would not be cleared if the NRC concurs that supplemental standards should be applied (see Figure 4.1 for the limits of excavation). The remediation of the Lowman site would have a positive impact because contaminated materials presently eroding into the Clear Creek floodplain and the creek itself would be removed and no longer pose the threat of contaminating this creek. However, remedial action activities would have the potential to promote erosion into Clear Creek and its wetlands. Specific erosion control measures would have to be taken. In addition, the timely revegetation of cleared areas would decrease possible erosion impacts to the Clear Creek wetlands. In summary, remedial action activities would be beneficial to Clear Creek because the source of contamination that presently exists on the site would be eliminated.

4.3 MITIGATION OF IMPACTS ON WETLANDS

If the wetlands along Clear Creek are cleared during remedial action, revegetation would be the major mitigation measure applied at the Lowman site. There is no alternative to clearing this wetland (other than applying supplemental standards) because the land is contaminated above the EPA standards (see Tables 2.1 and 2.2 of this EA for a listing of the standards). Work in the revegetation of riparian habitats with pole plantings has proven successful (Swenson and Mullins, 1985; York, 1985). Willow, the major species growing in the shrub-dominated wetlands along Clear Creek, have been successfully established from pole plantings. If possible, cuttings from vegetation growing near the disturbed land would be obtained. For best results, the following procedures should be followed:

- o Cuttings should be from dormant plants.
- o Pole plantings need to extend into the groundwater. If the groundwater fluctuates on an annual basis, the plantings should be deep enough so that they are in the groundwater at all times.
- o Poles should be cut on an angle at the root end and flat on the top end.
- o Poles should be placed in a barrel of water while being held for planting.
- o All cut surfaces extending above the ground should be sealed.

The following problems have been encountered with this technique:

- o Flooding of pole plantings for greater than three weeks results in high mortality.

- o Beaver cut the living poles at ground level and the subsequent low sprouting growth can be grazed by livestock.
- o Cattle are able to trample down pole plantings if the poles are too small.
- o Cattle also graze new growth so poles need to be tall enough so livestock cannot reach all the new growth.

If beaver and livestock activities are controlled, pole plantings can be very successful. In one study, 95 percent of all the plantings survived the first season and by the second growing season, willows were putting on intense side growth (York, 1985). In another study, survival of pole plantings that were constantly within the water table ranged from 75 to 100 percent (Swenson and Mullins, 1985).

The successful revegetation of the wetland plant communities at the Lowman site would result in plant communities that are similar to the ones that presently exist.

Other mitigative measures that would be taken include:

- o Recontouring excavated areas to create favorable conditions for the reestablishment of riparian wetland vegetation.
- o Selected use of water bars, mulch, riprap, or other soil erosion controls to minimize erosion.

5.0 ALTERNATIVES

The only alternative considered other than cleaning up the floodplain and wetlands or applying supplemental standards was the no action alternative. This alternative consists of taking no steps toward remedial action at the Lowman site. The radioactive sands and other contaminated materials would remain in their present condition and would continue to be subject to dispersal by wind and water erosion and unauthorized removal by humans. The selection of this alternative would not be consistent with the intent of Congress in the UMTRCA (PL95-604) and would not result in compliance with the EPA standards (40 CFR Part 192).

REFERENCES

- Bernard, S. R., and K. F. Brown, 1978. "Distribution of Mammals, Reptiles, and Amphibians by BLM Physiographic Regions and A. W. Kuchlers Associations for the Eleven Western States," U.S. Department of Interior, Bureau of Land Management, Denver, Colorado.
- USACE (U.S. Army Corps of Engineers), 1981. HEC-1, Flood Hydrograph Package, User's Manual, Computer Program 723-X6-L2010, Water Resources Support Center, the Hydrologic Engineering Center, Davis, California.
- Chow, Ven Te, Ph.D., 1959. Open Channel Hydraulics, McGraw-Hill Book Company, New York, New York.
- Corley, D. R., and L. A. Burmeister, 1977. "Stream Inventory Survey of Clear Creek Near Lowman," U.S. Forest Service, Boise National Forest, Boise, Idaho.
- Groves, C. R., and J. S. Marks, 1985. "Annotated Checklist of Idaho Vertebrates," in Tebiwa, Vol. 22, pp. 10-27.
- Hilliard, G. D., 1988. Chief, Regulatory Branch, U.S. Army Corps of Engineers, Walla Walla, Washington, personal communication with Charles J. Burt, Environmental Services, Jacobs Engineering Group Inc., Albuquerque, New Mexico, dated May 3, 1988.
- Holubetz, T., 1987. Idaho Fish and Game Department, Boise, Idaho, personal communication with Chuck Burt, Environmental Services, Jacobs Engineering Group Inc., Albuquerque, New Mexico, dated December 14, 1987.
- Larrison, E. J., and D. R. Johnson, 1981. Mammals of Idaho, The University Press of Idaho, University of Idaho, Moscow, Idaho.
- SCS (U.S. Soil Conservation Service), 1982. TR-20, Project Formulation - Hydrology, Technical Release No. 20, Soil Conservation Service, Lanham, Maryland.
- SCS (U.S. Soil Conservation Service), 1972. SCS National Engineering Handbook, Section 4: Hydrology, Superintendent of Documents, U.S. Government Printing Office, Washington, D.C.
- Swenson, E. A., and C. L. Mullins, 1985. "Revegetating Riparian Trees in Southwestern Floodplains," in Riparian Ecosystems and Their Manageent: Reconciling Conflicting Use, U.S. Forest Service, Rocky Mountain Forest and Range Experiment Station, General Technical Report RM-120, Fort Collins, Colorado.
- TAC (Technical Assistance Contractor; Jacobs-Weston Team), 1987. "Unpublished Field Notes, Lowman, Idaho Radioactive Sands Site," unpublished report prepared by the TAC, Albuquerque, New Mexico, for the DOE, UMTRA Project Office, Albuquerque Operations Office, Albuquerque, New Mexico.

York, J. C., 1985. "Dormant Stub Planting Techniques," in Riparian Ecosystems and their Management: Reconciling Conflicting Uses, U.S. Forest Service, Rocky Mountain Forest and Range Experiment Station, General Technical Report RM-120, Fort Collins, Colorado.