



Public Health Assessment for

**EASTERN MICHAUD FLATS CONTAMINATION
POCATELLO, BANNOCK COUNTY AND POWER COUNTY, IDAHO
EPA FACILITY ID: IDD984666610
MARCH 21, 2005**

**U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
PUBLIC HEALTH SERVICE**
Agency for Toxic Substances and Disease Registry

THE ATSDR PUBLIC HEALTH ASSESSMENT: A NOTE OF EXPLANATION

This Public Health Assessment was prepared by ATSDR pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund) section 104 (i)(6) (42 U.S.C. 9604 (i)(6)), and in accordance with our implementing regulations (42 C.F.R. Part 90). In preparing this document, ATSDR has collected relevant health data, environmental data, and community health concerns from the Environmental Protection Agency (EPA), state and local health and environmental agencies, the community, and potentially responsible parties, where appropriate.

In addition, this document has previously been provided to EPA and the affected states in an initial release, as required by CERCLA section 104 (i)(6)(H) for their information and review. The revised document was released for a 30-day public comment period. Subsequent to the public comment period, ATSDR addressed all public comments and revised or appended the document as appropriate. The public health assessment has now been reissued. This concludes the public health assessment process for this site, unless additional information is obtained by ATSDR which, in the agency's opinion, indicates a need to revise or append the conclusions previously issued.

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Public Health Assessment

**Eastern Michaud Flats Contamination
Pocatello, Bannock County and Power County, Idaho**

EPA Facility ID: IDD98466610

Prepared by

Bureau of Community and Environmental Health
Division of Health
Idaho Department of Health and Welfare
Under Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry

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Abbreviations

AOC	Administrative Order on Consent
AOEC	Association of Occupational and Environmental Clinics
ATSDR	Agency for Toxic Substances and Disease Registry
BAPCO	Bannock Paving Company
BCEH	Bureau of Community and Environmental Health
BLM	Bureau of Land Management
CAA	Clean Air Act
CBG	census block group
CDRI	Cancer Data Registry of Idaho
COC	contaminants of concern
CV	comparison value
EMEG	environmental media evaluation guide
EMF	Eastern Michaud Flats
EPA	U.S. Environmental Protection Agency
ERA	ecological risk assessment
FMC	FMC Corporation
FSP	field sampling plan
HHE	Health Hazard Evaluation
HHRA	human health risk assessment
HOD	health outcome data
ICRP	International Commission on Radiological Protection
IDEQ	Idaho Department of Environmental Quality
IDFG	Idaho Department of Fish and Game
IDHW	Idaho Department of Health and Welfare
MCL	maximum contaminant level
mg/L	milligrams per liter
mrem	millirem
MRL	minimal risk level
NAAQS	National Ambient Air Quality Standards
NIOSH	National Institute for Occupational Safety and Health
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
OSHA	Occupational Health and Safety Administration
OU	operable unit
PCBs	polychlorinated biphenyls
pCi/m ³	picocuries per cubic meter
PM	particulate matter
PM ₁₀	particulate matter smaller than 10 microns
PM _{2.5}	particulate matter smaller than 2.5 microns
ppb	parts per billion
ppm	parts per million
PRP	potentially responsible party
PVA	Portneuf Valley Airshed
RI/FS	remedial investigation/feasibility study
RCRA	Resource Conservation and Recovery Act
ROD	record of decision

Simplot
SIP
 $\mu\text{g}/\text{m}^3$

J.R. Simplot Company
State Implementation Plan
micrograms per cubic meter

Summary

The Eastern Michaud Flats (EMF) Contamination site covers 2,530 acres near Pocatello, Idaho. Within the site boundaries are two adjacent phosphate ore processing facilities, the FMC Corporation (FMC) and the J.R. Simplot Company (Simplot). The disposal of by-product waste material at and around the facilities and air emissions (fugitive and direct discharges) from the facilities have contributed to environmental contamination associated with the EMF site. The site was listed on the U.S. Environmental Protection Agency's (EPA) National Priorities List (NPL) on August 30, 1990. Since 1990, the Agency for Toxic Substances and Disease Registry (ATSDR) has evaluated potential exposure to site-related contaminants and released a preliminary public health assessment and several health consultations for the site. The Bureau of Community and Environmental Health (BCEH), Division of Health, Idaho Department of Health and Welfare (IDHW) has a cooperative agreement with ATSDR to conduct public health assessments and consultations for hazardous waste sites in Idaho.

As part of this cooperative agreement, BCEH conducted this comprehensive public health assessment. In this public health assessment, BCEH revisited the conclusions and recommendations made in past health consultations for groundwater, surface soil, surface water and sediment, and air contamination (ATSDR 1998a, 1998b, 1998c, 2001a), and reviewed new environmental data, information regarding site operations (i.e. closure of the FMC facility), health data, and community health concerns. In addition, BCEH conducted a cancer incidence analysis for the Pocatello and Fort Hall area in conjunction with the Cancer Data Registry of Idaho (CDRI). This public health assessment recommends actions to prevent, reduce, or further identify the possibility for site-related adverse health effects, as appropriate.

On the basis of the data and information reviewed, BCEH has drawn the following conclusions and recommendations:

Conclusions

1. **The current** completed exposure pathways include surface soil, surface water and sediment, air, and residential exposure to radiation from slag. A potential exposure pathway exists for site-related contaminants for individuals who consume fish from the Portneuf River. The groundwater exposure pathway has been an eliminated exposure pathway since the early 1990s.
2. **In the past**, the EMF site was classified as a *public health hazard* according to ATSDR's interim public health hazard categories (Appendix C), based on past exposure: 1) of people to groundwater from the Old Pilot Café well, the Frontier well, and Batiste Spring; 2) of FMC workers to cadmium in surface soils; 3) of slag and gypsum workers at both facilities to alpha, beta, and gamma radiation; and 4) of the general public to air contamination.
Determinations included:
 - Because of elevated arsenic concentrations in the drinking water, long term employees (those working more than 1 year) at the Old Pilot Café (from the early 1950s through 1976) and the Frontier Building (from 1943 to the late 1980s) may be at higher risk for developing skin, liver, bladder, and kidney cancers if they drank a significant amount of

water at work because of elevated arsenic concentrations in the drinking water. These same people may also have lower production of red and white blood cells, abnormal heart rhythm, and blood-vessel damage (e.g., Raynaud's disease and cyanosis of fingers and toes).

- If an infant less than 4 months of age was fed formula made with water from the Old Pilot Café well (prior to 1976) or the Batiste Spring (before early 1990s) for several days, the infant would have had an increased risk for developing acute acquired methemoglobinemia ("blue baby syndrome") because of elevated nitrate/nitrite concentrations in the drinking water. Symptoms of methemoglobinemia would be apparent within a few days of exposure.
 - Workers at the FMC facility (before FMC ceased production of elemental phosphorous in December 2001) may have been exposed to cadmium contaminated surface soil. These exposures may have increased the potential for the workers who smoke to develop proteinuria (excess proteins found in the urine because of damage to the kidneys).
 - Depending upon work practices (e.g., amount of dust generated and personal protective devices used) and personal hygiene habits (e.g., how often hands are washed), slag or gypsum pile workers at both facilities may have been exposed to gross alpha, beta, and gamma radiation. These exposures may have increased the cancer risk for slag or gypsum pile workers. However, good occupational practices (e.g., shielding provided by vehicles and dust control) could have substantially reduced these past exposures, thereby significantly reducing the workers' risk for developing cancer.
 - Before 2000, levels of particulate matter in air throughout Chubbuck and Pocatello, as well as part of the Fort Hall Indian Reservation between FMC and Interstate 86, periodically exceeded EPA's health-based comparison values (CVs) for PM₁₀ and PM_{2.5}, reaching unhealthy air pollution levels as a result of emissions from FMC, Simplot, and other sources.
3. **At present**, BCEH classifies the EMF site as a *no apparent public health hazard* because 1) no one is drinking site-contaminated groundwater; 2) the FMC facility no longer employs production workers at the site; 3) the annual average concentrations of PM₁₀ and PM_{2.5} steadily decreased between 2000 and 2003, and PM₁₀ levels exceeded EPA's health-based CVs only once (April 23, 2002) since 2001.
4. **In the future**, the public health hazard associated with air contamination from the EMF site and other PM sources in the Portneuf Valley Airshed (PVA) is uncertain. Although PM₁₀ and PM_{2.5} in the EMF area have seldom exceeded EPA's health-based CVs since 2001, BCEH is not certain that unhealthy PM levels (such as those that occurred during a severe winter inversion in December 1999) will not happen again in severe inversion-producing conditions. Therefore, BCEH recommends that measures to control air pollution remain in place and classifies the exposures to air from the EMF site and from other sources as an *indeterminate public health hazard*.

5. Gypsum pile workers at the Simplot facility may presently be exposed to elevated levels of alpha, beta, and gamma radiation. These exposures may increase the risk for a worker developing cancer. However, following good occupational practices (e.g., shielding provided by vehicles and dust control) could substantially reduce these exposures. Superfund site-related workers have short durations of exposure to the gypsum and are, therefore, unlikely to have any adverse health effects.
6. On the basis of available data from the slag study, the highest estimated annual radiation dose from slag used in the community was not high enough to cause apparent adverse health effects. However, this assumption is based on very limited data because most of the residences which were recommended for further evaluation did not complete the follow-up surveys. In addition, there may be other homes in the community built with slag in which the occupants did not participate in the study.
7. On the basis of the available surface water and sediment data, BCEH believes that site-related contaminants in fish from the Portneuf River are unlikely to pose a health risk to people who consume these fish infrequently.
8. The health outcome data analysis for the cities of Pocatello and Chubbuck and for the Fort Hall Reservation does not indicate any increased cancer incidence for cancers known to be associated with site-related contaminants, except for female bladder cancer. However, this association may be due to a potential underestimation of state-wide cancer rates for cancer cases geocoded at fine levels of geographic detail.
9. The health concerns expressed by community members in the EMF area (e.g., health effects of air pollution, fugitive emissions from the gypsum stack, odor complaints) were reviewed and are reasonably consistent with the contamination on the EMF site. ATSDR, Simplot, and the Idaho Department of Environmental Quality (IDEQ) are addressing these health concerns (e.g., ATSDR's health study, Simplot's fugitive emission control from permanent roads on the gypsum stack, and odor reduction and odor management plans).
10. The conclusions in this report only apply to the current site conditions. If land uses change, these conclusions may no longer be applicable.

Recommendations

1. Appropriate remedial actions, worker protection activities, and worker safety procedures, such as a worker protection plan to protect gypsum workers of Simplot from radiation exposures, should be instituted or continued to prevent workers from exposures to site-related contaminants in surface soil, surface water and sediment.
2. Appropriate remedial actions and monitoring should be instituted or continued to prevent future migration of site-related groundwater contaminants into any drinking water sources.
3. The land deed restrictions instituted and planned for the property presently owned by FMC and Simplot should remain in effect so that the land will not be developed into residential or agricultural areas, and the shallow groundwater will not be used for drinking water.

4. FMC and Simplot should continue to monitor the groundwater to assure that site-related contaminants do not impact drinking water sources.
5. IDEQ and the Shoshone-Bannock Tribes should continue to monitor air contamination, including PM₁₀ and PM_{2.5}, to further characterize air quality trends. Analysis of PM₁₀ filters for metals and inorganics (chemical mass balance) should be done regularly to address chronic exposure to metals.
6. IDEQ should continue to issue warnings on days when levels of air pollution are expected to reach potentially unhealthy levels and to communicate these warnings to the local public and media.
7. EPA, IDEQ, the Shoshone-Bannock Tribes, and the cities of Chubbuck and Pocatello should continue to develop, implement, and enforce air pollution control initiatives to minimize the amount of particulate matter released to the air in the EMF area.
8. Concerned homeowners and other building owners in the Pocatello area and on the Fort Hall Reservation area should contact the Southeast Idaho District Health Department to participate in the voluntary Slag Exposure Study, which is still ongoing.
9. The voluntary suspension by FMC and Monsanto of the sale of slag for all construction uses should remain in place.
10. IDEQ should continue to work with Simplot to address site odor issues. IDEQ should also continue to track odor complaints (in particular, in residential or industrial areas where complaints originate) and health effects associated with these odors and follow up with exposure point monitoring as appropriate.
11. In response to community health concerns, cancer surveillance in the EMF area should continue including an analysis of cancer incidence for Shoshone-Bannock tribal members.

Public Health Action Plan

1. BCEH has assembled the Eastern Michaud Flats Work Group, which consists of state, federal, and tribal environmental and health agency staff and community members, to assist and advise in the implementation of community health education activities. BCEH will continue to conduct health education and outreach activities as needed.
2. FMC and EPA are working on a supplemental remedial investigation and feasibility study for the FMC operable unit based on potential future industrial or commercial redevelopment of the FMC facility.
3. IDEQ has completed the *Portneuf Valley PM₁₀ Nonattainment Area (PVNAA) State Implementation Plan (SIP), Maintenance Plan, and Redesignation Request*. This plan outlines that Pocatello, Chubbuck, Inkom and a portion of the Fort Hall Reservation will

ensure continued attainment of the Clean Air Act National Ambient Air Quality Standards (NAAQS) for annual and 24-hour PM₁₀.

4. EPA, Southeastern District Health Department, and FMC are conducting the ongoing Idaho Slag Exposure Study, a voluntary program to help residents find out if phosphorus slag in their homes and business properties is causing unacceptably high exposure to radiation.
5. BCEH will further evaluate slag exposure data generated by the Slag Exposure Study when it becomes available.
6. BCEH will work with Idaho Department of Fish and Game (IDFG) and IDHW Bureau of Laboratories to analyze edible fish harvested from the Portneuf River for non-site related polychlorinated biphenyls (PCBs). At the same time, BCEH will analyze heavy metals in the edible fish to verify that site-related contaminants in fish from the Portneuf River do not pose a health risk.
7. BCEH and CDRI will periodically monitor cancer incidence.
8. ATSDR is conducting a health study to determine if an association exists between past particulate matter air pollution exposures and hospital admissions and other visits (including emergency room, urgent care, and family practice) for heart and lung conditions. Because of the availability of quality exposure data, this study is limited to the residents of Chubbuck and Pocatello.
9. The Shoshone-Bannock Tribes, FMC, and independent experts will conduct a tribal health study for the Shoshone-Bannock Tribes using existing data provided by the Fort Hall Clinic and the . FMC funds this study under the Resource Conservation and Recovery Act (RCRA) Consent Decree as part of a Special Environmental Project (SEP #14).
10. Simplot is in the process of enacting cleanup and monitoring requirements of its Consent Decree that addresses identified sources of threats to public and worker health.
11. BCEH will review new environmental sampling data and studies relevant to the public health of communities near the EMF site as they become available.

1. Purpose and Health Issues

The Bureau of Community and Environmental Health (BCEH), Division of Health, Idaho Department of Health and Welfare (IDHW), has a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR) to conduct public health assessments and consultations for hazardous waste sites in Idaho. BCEH completed this public health assessment of the Eastern Michaud Flats (EMF) Contamination National Priorities List (NPL) site under this cooperative agreement.

A public health assessment is a tool used to determine if contamination at a hazardous waste site poses a public health risk and if actions are needed to protect the health of community members residing or working at or near a hazardous waste site. For this public health assessment, BCEH revisited the conclusions and recommendations made in past health consultations for groundwater, surface soil, surface water and sediment, and air contamination (ATSDR 1998a, 1998b, 1998c, 2001). BCEH also reviewed new environmental data, information regarding site operations (i.e. closure of the FMC facility), health data, and community health concerns. In addition, BCEH conducted a cancer incidence analysis for the Pocatello and Fort Hall area in conjunction with the Cancer Data Registry of Idaho (CDRI). This public health assessment recommends actions to prevent, reduce, or further identify the possibility for site-related adverse health effects, as appropriate.

2. Background

2.1 Site Description

The EMF site covers 2,530 acres near Pocatello, Idaho. Within the site boundaries are two adjacent phosphate ore processing facilities, the FMC Corporation (FMC) and the J.R. Simplot Company (Simplot) (Appendix A, Figure A-1).

The FMC facility, the FMC Elemental Phosphorus Plant, covers an estimated 1,189 acres, almost all of which lie within the Fort Hall Indian Reservation (Appendix A, Figure A-2). The FMC facility adjoins the western boundary of the Simplot facility. Approximately 560 people were employed at the FMC Elemental Phosphorus Plant before FMC ceased production of elemental phosphorous from phosphate ore at the facility in December 2001. The FMC facility began producing phosphorous in 1949. Some of the facility's processes changed little during the time FMC was in operation. Phosphate-bearing shale was shipped to FMC by the Union Pacific Railroad during the summer months and stored on site in large stockpiles. Ore could not be shipped during the winter months because the ore tended to freeze in the rail cars. After passing through several mechanical processes (e.g., crushing), the phosphate rock was fed to calciners, which removed moisture from the feed. One of the facility's four electric arc furnaces then processed a mixture of this intermediate phosphate rock, coke, and silica. Outputs from the furnaces included gaseous elemental phosphorus, various gaseous by-products (some of which contain radiological components), and solid wastes called "slag" and "ferrophos" (Bechtel 1996). The elemental phosphorus was subsequently condensed to a liquid state and eventually shipped off-site, and the solid wastes were disposed of at various on-site and off-site locations (IDEQ 2004a).

FMC's elemental phosphorus production process included calcining, electric arc furnaces and product handling and shipment. Primary waste products associated with the process were slurried (water conveyed) solids, formerly deposited in numerous unlined and lined ponds, and furnace slag. Approximately 1.5 million tons of ore were processed at the plant annually. The historic disposal of by-product waste material at and around the facility resulted in slag piles covering large areas of land. In addition, former air emissions (fugitive and direct discharges) from the facility contributed to the environmental contamination associated with the EMF site.

The Simplot facility is an active phosphate processing plant. It covers about 745 acres, none of which are on Fort Hall Indian Reservation property, and adjoins the eastern property boundary of the FMC facility. Approximately 460 people work at the Simplot facility. The plant began production of single superphosphate fertilizer in 1944. In 1954, the facility began producing phosphoric acid by using sulfuric acid. Phosphoric acid is presently produced by using a wet (aqueous) process. Formerly, trains transported phosphate ore from the mines to the facility. As of September 1991, the Simplot facility began receiving phosphate ore through a slurry pipeline direct from mines. The phosphate ore slurry is processed at the Simplot facility in phosphoric acid reactors and then further processed into a variety of solid and liquid fertilizers. The facility produces 12 principal products, including phosphoric acid, five grades of solid fertilizers, and four grades of liquid fertilizers (Bechtel 1996).

Simplot primarily produces phosphogypsum as waste product, initially placed as a slurry in ponds and then redeposited in extensive "stacks". Phosphogypsum is primarily gypsum but includes numerous impurities resulting from the ore processing. Other contaminants associated with sources include arsenic, selenium, zinc, cadmium, vanadium, fluoride, sodium, potassium, chloride, nitrates, ammonia, and sulfate (IDEQ 2004a). The disposal of by-product waste material (e.g., gypsum) at and around the facility and air emissions (fugitive and direct discharges) from the facility have contributed to the environmental contamination associated with the EMF site.

The Eastern Michaud Flats are on the Snake River Plain and are bordered by the American Falls Reservoir, the Portneuf River, Rock Creek, and on the south by the foothills of the Deep Creek Mountains and Bannock Range. The Portneuf River, which is adjacent to the northeast corner of the Simplot facility, is used for fishing, recreation, and irrigation downstream from the site. According to the Idaho Department of Environmental Quality (IDEQ), groundwater from beneath the site discharges into the river at Batiste and Swanson Road Springs (Personal communication: B. Wicherski, IDEQ, email, July 2004).

2.2 Regulatory and Non-regulatory History

Since 1972, the State of Idaho, the U.S. Geological Survey, the U.S. Environmental Protection Agency (EPA), and the owners of the FMC and Simplot facilities have conducted various investigations at and around the EMF site (Bechtel 1996). The results of these investigations indicated that the activities at the two facilities have resulted in the contamination of the surrounding environment. Because of the environmental contamination and the potential for human exposure to the contaminants, EPA placed the site on the NPL on August 30, 1990.

In accordance with ATSDR's Congressional Mandate to conduct a public health assessment at all newly proposed NPL sites, ATSDR completed a Preliminary Public Health Assessment in August 1990, which evaluated potential exposure to site-related contaminants. At the time of the preliminary public health assessment, ATSDR determined the EMF site to be a potential public health concern due to potential past, present, and future human exposures to site-related contaminants.

Since 1990, ATSDR has performed several public health evaluations of exposures to contaminants associated with the EMF site. In response to a request from the Shoshone-Bannock Tribes in 1992, ATSDR conducted a study of Fort Hall Reservation residents to determine if site emissions were impacting their health. The resulting 1995 Fort Hall Air Emissions Study found an increase in respiratory disease and symptoms in the study population. Changes in lung function (spirometric changes) consistent with increased particulates were also demonstrated, although the changes were not statistically significant. The study found no evidence of increased exposure to metals or of kidney problems associated with contaminants from the phosphate plants (ATSDR 1995).

Between 1991 and 1997, EPA conducted a remedial investigation and feasibility study (RI/FS) to determine the nature and extent of site contamination at EMF. Groundwater, surface water and sediment, and soil samples were collected. The RI/FS was completed and a proposed plan for cleanup was released in April 1997. The record of decision (ROD) was issued on June 8, 1998, requiring capping of contaminated soils, environmental monitoring, and institutional controls.

In March 1997, ATSDR completed a site-review and update, outlining its intended activities at the site. These activities included a re-evaluation of human exposure pathways associated with the site (specifically the development of health consultations that address the potential for past, present, and future human exposure to site-related contaminants in groundwater, surface water and sediment, surface soil, biota, and ambient air). As outlined in the site-review and update, ATSDR released health consultations for surface soil, surface water and sediments, and groundwater (ATSDR 1998a, 1998b, 1998c) in October 1998, on the basis of data generated by the RI/FS.

During the development of these health consultations, ATSDR, EPA, BCEH, the Idaho Southeastern District Health Department (SDHD), tribal officials, and local officials worked with community members to identify site-related health concerns and health education needs. ATSDR conducted an environmental health information needs assessment among affected community members and the health professionals serving them. ATSDR and BCEH then developed and implemented health education activities designed to address the needs and concerns identified by the community. Results of the health consultations were presented by ATSDR and BCEH at public meetings in Fort Hall and Pocatello.

In response to concerns from members of the Shoshone-Bannock Tribes and the non-tribal community, ATSDR finalized a health consultation in March 2001 which evaluated current and historical exposures to air pollutants. This health consultation concluded that the release of air contaminants from the site and other sources posed a public health hazard to residents of Chubbuck, Pocatello, and the Fort Hall Indian Reservation (ATSDR 2001). ATSDR

recommended continued air monitoring in the EMF area and a reduction in air pollution emissions.

As a result of the evaluation of air exposures, ATSDR agreed to conduct a study on the effects of air pollution on the cardiopulmonary and respiratory health of people who reside in Pocatello and Chubbuck. To this end, ATSDR developed a peer-reviewed protocol for the health study and has begun evaluating hospital admission and medical visit data from the Portneuf Regional Medical Center and the former Pocatello Regional Medical Center (owned by Intermountain Hospital Corporation). The Shoshone-Bannock Tribes are also conducting a health study in conjunction with FMC and independent experts at Oregon Health Sciences University to investigate the effects of air pollution on the health of Native Americans on the Fort Hall Reservation. Both studies are currently underway.

Since the previous health consultations were released, a number of substantial changes have occurred at the EMF site. In December 2001, FMC ended production and initiated activities to decommission the facility. As a result, air emissions related to the FMC facility operations ceased, with the exception of minor sources related to decommissioning activities (EPA 2003) and fugitive dust. In August 2002, FMC terminated its industrial wastewater discharge to the Portneuf River and EPA subsequently terminated FMC's National Pollutant Discharge Elimination System (NPDES) work permit. A number of active surface impoundment ponds have been closed since 1998, which should result in a reduction of migration of contaminants to the aquifers. All of the Resource Conservation and Recovery Act (RCRA)-regulated ponds at FMC are currently closed or in closure.

According to the J.R. Simplot Company, improvements made at its facility in 2001 resulted in a decrease in sulfur dioxide emissions. The shutdown of the nitric acid and ammonia plants in 2002 reduced emissions of nitrogen oxides by about 263 tons per year and ammonia emissions by almost 188 tons per year.

In October 2003, the EPA and FMC entered into an Administrative Order on Consent (AOC) for a supplemental remedial investigation and feasibility study (Supplemental RI/FS) at the FMC plant operable unit. The AOC outlines the process and schedule for conducting an investigation of the former operating areas. The Supplemental RI/FS will include constituents, such as elemental phosphorus and radium 226, that did not have toxicity data at the time the original RI was conducted. The additional investigation is expected to be completed by summer of 2006.

In conjunction with ATSDR, BCEH conducted this comprehensive public health assessment for the EMF site. This public health assessment was prepared in light of changes in site operations, and new environmental data, health information and community health concerns. BCEH reviewed past ATSDR health consultations (ATSDR 1998a, 1998b, 1998c, 2001) and revisited the conclusions and recommendations made in these health consultations in the context of this new data and information. In addition, in response to community concerns, BCEH and CDRI conducted a cancer incidence analysis for residents of Chubbuck, Pocatello and Fort Hall.

2.3 Land Use

According to the RI/FS Report (Bechtel 1996), the EMF site includes land belonging to the FMC, Simplot, Fort Hall Indian Reservation, the Bureau of Land Management (BLM), Bannock and Power counties, and portions of the cities of Pocatello and Chubbuck. Land use on the Fort Hall Indian Reservation in the area surrounding the EMF site is mainly agricultural with scattered residences. BLM land in the area is designated for multiple uses. Unincorporated land in Bannock and Power counties is mostly agricultural, also with scattered residences, and land within the cities of Pocatello and Chubbuck in the EMF area is primarily zoned for residential use.

In addition to owning the land on which the facilities operate, FMC and Simplot also own all land (with the exception of road rights-of-way) between the facilities and Interstate 86, as well as substantial property immediately north of Interstate 86 and east of the facilities. Other land uses in the area included a drag racing strip (which has closed) located across the access road from FMC and a park across the street from Simplot. Until March 12, 1995, the Bannock Paving Company (BAPCO) operated a paving and aggregate handling facility on land leased from, and adjacent to, the FMC facility. BAPCO periodically conducted many industrial operations, such as processing asphalt, drying coke, and crushing slag and ferrophosphate, at this site (Bechtel 1996). The land owned by FMC to the north of the facility reportedly is deed restricted, prohibiting current or potential future residential use. All of the FMC property to the north of Interstate 86 is fenced with locked gates and posted with no trespassing signs. The number of people who access the land immediately north of FMC is believed to be limited (ATSDR 2001).

2.4 Demographics

The area within a 1-mile radius of the FMC and Simplot facilities is sparsely populated with approximately 220 residents, as is typical of areas with primarily agricultural and industrial land uses (Appendix A, Figure A-3-Demographics map). Several residences and businesses have been observed within 1 mile of the site, including a trailer park located 1 mile to the east (Appendix A, Figure A-3). The nearest major population areas, the cities of Pocatello and Chubbuck, are located east-southeast and east-northeast, respectively, of the FMC and Simplot facilities (Appendix A, Figure A-1). Based on the 2000 U.S. Census, the combined populations of these two cities was 61,166 residents. The area within a 5-mile radius of the facilities includes much of the cities of Chubbuck and Pocatello, as well as a large part of the Fort Hall Indian Reservation. As a result, the area within 5 miles of the facilities is considerably more populated than the area within just 1 mile of the facilities. The nearest populated area on the Fort Hall Indian Reservation, the Fort Hall Agency, is about 8 miles north-northeast of the facilities. However, the majority of the population on the Fort Hall Indian Reservation lives in rural areas, including some within 1 mile of FMC and Simplot.

3. Discussion

3.1 Data and Information Used

The data evaluated in this document came from the following sources: EPA Report for the EMF Site (Bechtel 1993, 1994, 1995, 1996), RCRA Pond Emission Study (Bechtel 1998), OP-FTIR Air Monitoring System Quarterly Report (FMC 1999a, 1999b, 1999c, 1999d, 2000), Portneuf Valley Particulate Matter Air Quality Improvement Plan (IDEQ 1999), the Fort Hall Source Apportionment Study (EPA 1999a) and air monitoring data for the Pocatello area from IDEQ (IDEQ 2003, 2004b). This document's data also came from the Quarterly Report of the Shoshone-Bannock/EPA Particulate Monitoring Program (Sho-Ban 2004), Supplemental Remedial Investigation and Feasibility Study (RI/FS) Statement of Work (EPA 2003); Evaluation of Water Quality Impacts Associated with FMC and Simplot Phosphate Ore Processing Facilities (IDEQ 2004a), groundwater monitoring data for EMF area from EPA (Personal communication: L. Meyer, site manager, EPA, email, June 2004), the NPDES Discharge Monitoring Report (FMC 2002), and the Elemental Phosphorus Slag Exposure Study—Phase I Final Report (FMC et al. 1999).

The conclusions reached in this document are based on the data available at this time, a review of previous ATSDR health consultations, information obtained from site visits, community concerns, and public and agency input. Conclusions may be modified on the basis of additional data and information.

3.2 Evaluation Process

3.2.1. Past Health Consultations and New Information

The general process by which ATSDR (in previous health consultations) and BCEH (in this public health assessment) evaluate the possible health effects of environmental contaminants is summarized here and described in more detail in Appendix D. The first step involves screening the available data for contaminants of concern (COCs). BCEH uses conservative comparison values (CVs) to determine which chemicals to examine more closely. CVs are concentrations of chemicals in the environment (air, water, or soil) below which no adverse human health effects should occur. Exceeding a CV does not mean that health effects will occur, just that more evaluation is needed. BCEH then examines environmental and human components that might constitute a human exposure pathway and lead to contact with COCs in the past, present, or future. It is important to note that a complete exposure pathway does not necessarily imply that negative health effects will occur. BCEH also reviews site history, information on site activities, and the available sampling data to identify exposure pathways that warrant consideration. The next step is to take those contaminants that are above the CVs and further identify which chemicals and exposure situations are likely to be a health hazard. The public health implications of contamination in air, surface soil, surface water and sediments, groundwater, and biota are discussed in a later section of this public health assessment.

For a detailed account of the COCs identified in past health consultations, see Appendices F, G, H, and I. Additional information regarding the exposure pathways identified for the EMF site is provided in Appendix E of this public health assessment.

For this public health assessment, BCEH reviewed the past health consultations for surface soil, surface water and sediment, groundwater, and air health consultations (Appendices F- I.), summarized the major findings and, when available, reviewed and discussed new information or environmental data which were not previously addressed. On the basis of the new information or environmental data, BCEH will discuss any changes in previously identified exposure pathways and public health implications.

3.2.2 Radiological Contamination in Air

For radiological contamination in the air, BCEH first reviewed available radiological data to identify the contaminants of concern and completed exposure pathways. BCEH reviewed radiological air data collected in and around the EMF area. The contaminants considered in this section are the radioisotopes released by FMC and Simplot. When radioisotopes decay, they can release ionizing radiation which is a type of electromagnetic or particulate energy. This energy determines the health effects associated with radioisotope contamination. Using the most conservative parameters, BCEH then calculated the estimated radiological doses to targeted organs. Doses are calculated for the site-specific exposure scenarios using assumptions regarding who comes in contact with the COCs, how often they are exposed, and how much contaminant they encounter. The public health implications of radiological contamination in air are discussed in a later section of this public health assessment.

3.3 Exposure Pathways and Public Health Implications

3.3.1 Surface Soil Ingestion Pathway

In 1998, ATSDR released a health consultation for surface soil contamination at the EMF site which evaluated soil data generated during the RI/FS (Bechtel 1996). Tables in Appendix F present the maximum contaminant concentrations measured during the RI. Since the health consultation was released, FMC collected additional surface soil data at the site, which was obtained to characterize background levels and was not for the purpose of assessing risks.

In the previous health consultation for soil contamination, cadmium was the contaminant of concern for both FMC workers and the general public. ATSDR concluded that it was very unlikely that children or the general public would come in contact with site-related surface soil contamination for a sufficient amount of time to result in adverse health effects. However, after the release of the health consultation, ATSDR's environmental media evaluation guide (EMEG) for cadmium in surface soil was re-evaluated and lowered from 500 mg/kg to 100 mg/kg. Despite the reduction in the EMEG, ATSDR's conclusion that exposure to contaminants in soil is unlikely to pose a health risk to the general public and children still remains viable.

While evaluating the health risks posed to community members in previous health consultations, ATSDR also looked at health risks posed to workers at both the FMC and Simplot facilities. At

the time, the site was classified as a public health hazard given the potential for workers to be exposed to site-related contaminants in surface soil and the potential for adverse health effects to occur in exposed workers. The main findings of the previous health consultation were that 1) workers at the FMC facility may be exposed to cadmium contaminated surface soil; 2) these exposures may increase the potential for the workers who smoke to develop proteinuria (proteins found in urine because of damage to the kidneys); and 3) slag and gypsum pile workers at both facilities may be exposed to elevated levels of alpha, beta, and gamma radiation, which could increase their risk for developing cancer (ATSDR 1998a, Appendix F).

Since the release of the health consultation in December 2001, FMC ceased production of elemental phosphorous from phosphate ore at its facility and began decommissioning activities (EPA 2003). As a result, workers are no longer employed at the FMC site, with the exception of some contractors engaged in decommissioning, dismantling, and remediation work. All workers at the plant site must comply with FMC's health and safety procedures and task specific health and safety plans, which are in compliance with Occupational Health and Safety Administration (OSHA) standards. Therefore, worker exposure to contaminants in soil and slag is no longer occurring. However, gypsum stack workers in the Simplot facility may presently be exposed to elevated levels of alpha, beta, and gamma radiation, as well as possible radon emissions from the phosphogypsum stack.

According to ATSDR (1998a), depending on work practices, the amount of dust generated, personal protective devices used, and personal hygiene habits, some workers may inhale or ingest surface soil containing elevated gross alpha, beta, and gamma radiation. Work practices at the Simplot facility have not changed significantly since 1998; therefore, as concluded in the prior health consultation, radiation exposure may be occurring for gypsum stack workers and may increase their cancer risk. Because phosphogypsum waste materials at the Simplot facility are handled by mechanical means (i.e., slurry pipeline and front-end loaders with enclosed cabs), radiation exposure for a few workers near the gypsum stack is significantly reduced. Current worker exposures could be reduced further by the implementation and continuation of good occupational practices (e.g., shielding provided by vehicles and dust control), thereby significantly reducing the workers' risk for developing cancer. The Simplot Consent Decree Scope of Work requires Simplot to implement institutional controls and monitor gypsum stack worker exposure to radiation. The controls outlined in the Consent Decree include 1) training to inform workers of potential health hazards associated with the site; 2) measures to mitigate radiation exposure; 3) identification of areas with elevated gross alpha levels in soil; and 4) implementation of radon controls and monitoring. Simplot has submitted an institutional controls program plan which is currently under review by EPA, IDEQ, and the Shoshone-Bannock Tribes.

3.3.2 Surface Water and Sediment Exposure Pathway

ATSDR released a health consultation for surface water and sediment contamination at the EMF contamination site in 1998 on the basis of data generated during the RI/FS (Bechtel 1996). Tables in Appendix G present maximum contaminant concentrations found during initial surface water and sediment sampling and analysis. The previous health consultation classified surface water and sediment as posing no apparent public health hazard. The health consultation It

concluded that it is unlikely that FMC or Simplot workers, the general public, including children, have been, are currently, or will be exposed to significant levels of site-related surface water or sediments (ATSDR 1998b, Appendix G).

Since the health consultation, no additional sediment sampling has occurred. However, in 2003, IDEQ released a report containing limited water quality data taken at various transects in the Portneuf River near the EMF site. None of the site-related contaminants (phosphorus and nitrate) that were measured exceeded health-based CVs. In addition, wastewater discharges from the FMC facility to the Portneuf River permanently ceased in 2002, likely resulting in a reduction of site-related contaminants in surface water and sediments near the site. Therefore, the previous health consultation's conclusion of no apparent public health hazard is still applicable.

3.3.3 Groundwater Exposure Pathway

Various investigations have determined that two separate aquifers (shallow and deep) underlie the EMF site (Bechtel 1996). The shallow aquifer is a 10- to 20-foot thick gravel and sand aquifer that is locally overlain by a silt aquitard. The deep aquifer is the gravel unit of the Sunbeam Formation and the underlying basalt and rhyolite. These two aquifers are separated by the American Falls Lake Beds aquitard. According to IDEQ, groundwater from the shallow and deep aquifers beneath the site discharge into the Portneuf River at the Batiste and Swanson Road Springs (Personal communication: B. Wicherski, IDEQ, email, July 2004).

Analysis of groundwater samples taken from the deep aquifer during the RI/FS indicates that no site-related contamination has entered the deep aquifer at levels of health concern (Bechtel 1996). However, analysis of groundwater samples taken from the shallow aquifer indicates that the activities at the two facilities have resulted in significant contamination of the shallow aquifer (Bechtel 1996).

On the basis of groundwater data generated during the RI/FS, ATSDR released a health consultation for groundwater contamination at the EMF contamination site in 1998 (ATSDR 1998c). On the basis of the past exposures to site-related contaminants (such as arsenic and nitrate/nitrite) in groundwater, the health consultation concluded that a public health hazard existed. However, the only locations at or near the EMF site that ever used contaminated shallow groundwater for human consumption are the Old Pilot Café well, the Frontier well, and the Batiste Spring. While these wells and the spring are no longer used for drinking water, people may have been exposed to contaminated drinking water from these sources in the past.

The health consultation (ATSDR 1998c) determined that, because of elevated arsenic concentrations in the drinking water, long term employees (those working more than 1 year) at the Old Pilot Café (prior to 1976) and the Frontier Building (prior to the late 1980s) may be at higher risk for developing skin, liver, bladder, and kidney cancers if they drank a significant amount of water at work. These same people may also have lower production of red and white blood cells, abnormal heart rhythm, and blood-vessel damage (e.g., Raynaud's disease and cyanosis of fingers and toes). The consultation also concluded that if an infant less than 4 months of age was fed formula made with water from the Old Pilot Café well (prior to 1976) or the Batiste Spring for several days, the infant would have had an increased risk for developing acute

acquired methemoglobinemia (“blue baby syndrome”) because of elevated nitrate/nitrite concentrations in the drinking water (ATSDR 1998c, Appendix H).

In the previous health consultation, the Meadow Gold Dairy spring was identified as a drinking water source. Until May 2004, the Dairy bottled the spring water, which was regulated by the Food and Drug Administration, and sold it in local grocery stores. (For testing requirements for bottled water, see the Code of Federal Register, 21 CFR 165.110 Subpart B). At the time of the health consultation, water from the Meadow Gold Dairy spring did not exceed health-based CVs for any site-related contaminants. Since then, the spring water has not exceeded the maximum contaminant levels (MCLs) for site-related contaminants, including nitrate most recently sampled in 2003.

As a result of the past groundwater health consultation, ATSDR recommended that appropriate monitoring of the groundwater (e.g., quarterly monitoring of wells 524 and 525 between Batiste Spring and Meadow Gold Dairy Spring) should be conducted to assure that site-related contaminants do not affect drinking water sources. ATSDR also recommended that appropriate remedial actions be instituted or continued to prevent future migration of site-related groundwater contaminants into additional drinking water sources (e.g., the Meadow Gold Dairy spring) (ATSDR 1998c, Appendix H). Since the release of the health consultation, wells 524 and 525 have been monitored on at least a yearly basis. The maximum concentrations of site-related groundwater contaminants (arsenic, nitrate, selenium, and sulfate) found in monitoring wells 524 and 525 between 1994 and 2003 are summarized in Appendix B, Table B-1. None of these site-related contaminants exceeded the health-based CVs.

While conducting this health assessment, BCEH was informed that Simplot has three production wells (Well 4, Well 5, and Well 7) on its property which are identified as public drinking water wells and are subject to monitoring requirements for public drinking water wells. Sample results of one of these wells showed arsenic concentrations in 1993 and 2003 of 0.03 milligrams per liter (mg/L) and 0.054 mg/L, respectively (both above the MCL of 0.01 mg/L). However, no one is currently drinking water from these wells, which has been confirmed by both the Southeastern District Health Department and the J.R. Simplot Company. Simplot supplies bottled drinking water for its on-site employees. The majority of the water from these wells is used for processing water and the remainder supplies safety showers, eye washes, hand washing sinks, and toilets.

Currently no one is being exposed to site-related contaminated drinking water. Therefore, at present, the groundwater exposure pathway is an eliminated exposure pathway, and likely will not result in any adverse health effects.

3.3.4 Air Exposure Pathway

3.3.4.1 Non-radiological Contamination in Air

In 2001, ATSDR released a health consultation which evaluated air exposures to particulate matter smaller than 10 microns in diameter (PM₁₀) and particulate matter smaller than 2.5 microns in diameter (PM_{2.5}) at the EMF site (ATSDR 2001, Appendix I). Using ambient air monitoring data collected between 1975 and 1999, ATSDR concluded that a public health hazard

had existed since at least 1975 and would continue to exist in the future unless particulate matter emissions from the two phosphate processing plants, FMC and Simplot, and from other sources (e.g., paved roads, windblown dust, fires, and residential heating) were reduced. The primary finding of the report was that between 1975 and 1999, people in the cities of Chubbuck and Pocatello were exposed to short- and long-term levels of PM₁₀ and PM_{2.5} that may result in adverse cardiopulmonary health effects. The health consultation also noted that long-term average concentrations and the frequency of 24-hour concentrations of PM_{2.5} and PM₁₀ in excess of the health-based comparison value (CV) had dropped appreciably since 1993 (ATSDR 2001, Appendix I).

Since the release of the health consultation, FMC stopped production and initiated activities to decommission the facility. As a result, in December 2001 air emissions related to facility operations ceased with the exception of minor sources related to decommissioning activities and fugitive dust. EPA estimated FMC's PM₁₀ emissions inventory to be 1,532 tons per year before control technologies were employed at the plant in 1998 and 424 tons per year after controls were in place (EPA 2000). Implementing control technologies resulted in a continuous reduction in PM₁₀ emissions from the facility until closure in 2001. After the closure of FMC, total emissions of particulate matter from the site and resulting PM concentrations decreased even more appreciably. It is estimated that Simplot emits 135 tons of particulate matter to the air per year (IDEQ 1999).

At the time the previous health consultation was released, available data was limited to air monitoring that occurred before 2000. Since then, IDEQ and the Shoshone-Bannock Tribes have collected additional air monitoring data in the EMF area.

New air monitoring data from IDEQ: The IDEQ air monitoring network consists of four stations: Garret and Gould, Pocatello Sewage Treatment Plant, Chubbuck School, and Idaho State University (Appendix A, Figure A-1). From 2000 through 2003, IDEQ monitored PM₁₀ and PM_{2.5} at the Garret and Gould station, PM₁₀ at the Pocatello Sewage Treatment Plant station, and PM_{2.5} at the Chubbuck School station. The Idaho State University PM₁₀ monitor stopped operating in May 1999, the Chubbuck School PM₁₀ station in June 1999 and the Pocatello Sewage Treatment Plant PM₁₀ station in June 2002. The Chubbuck School PM_{2.5} monitor was shut down in July 2003. Currently, the Garret and Gould station maintains the only active PM₁₀ and PM_{2.5} monitors. Tables B-2 and B-3 (Appendix B) summarize the PM₁₀ and PM_{2.5} data collected by IDEQ from 2000 to 2004 (IDEQ 2004b).

Annual average PM₁₀ concentrations measured at the Pocatello Sewage Treatment Plant station between 2000 and 2001 and at the Garret and Gould station between 2000 and 2003 did not exceed EPA's health-based CV of 50 micrograms per cubic meter (µg/m³). Annual average PM₁₀ concentrations from 2000 and 2003 are similar to those between 1995 and 1999. The 24-hour average PM₁₀ concentrations measured at the Pocatello Sewage Treatment Plant and Garret and Gould stations have not exceeded the health-based CV of 150 µg/m³ since 2000.

Since 2000, 24-hour average PM_{2.5} concentrations exceeded EPA's health-based CV of 65 µg/m³ only once, on February 6, 2000 (72.7 µg/m³) (Table B-3, Appendix B). From 2000 to 2004, the

annual average PM_{2.5} levels have not exceeded EPA's health-based comparison value (15 µg/m³).

Between January 2001 and August 2002, IDEQ analyzed 11 samples with high PM values for selected metals and other inorganic substances, including ammonium ions, nitrate ions, fluoride ions, chloride ions, and sulfate ions (IDEQ 2003). These samples were collected at the Garrett and Gould Site in Pocatello. During this period, arsenic, cadmium, and chromium (total) were measured at levels exceeding their corresponding health-based comparison values (CVs) on at least one occasion. The maximum 24-hour air concentrations of arsenic, cadmium, and chromium were 0.0015 µg/m³, 0.0077 µg/m³, and 0.0017 µg/m³, respectively. All those concentrations are lower than the levels reported in the health consultation, *Air Contamination at the Eastern Michaud Flats* (ATSDR 2001, Appendix I). As discussed in that health consultation, adverse health effects are not expected from exposure to metals in the air at these concentrations.

IDEQ has also continued to measure ambient air concentrations of sulfur dioxide at the Pocatello Sewage Treatment Plant. The data from 1999 through 2003 (Appendix B, Table B-4) shows that the annual average concentrations are all below EPA's health-based CV of 0.03 parts per million (ppm). Since 1999, the maximum 24-hour average sulfur dioxide concentration remained below EPA's health-based CV of 0.14 ppm. Therefore, sulfur dioxide in ambient air is unlikely to result in any adverse health effects.

New air monitoring data from Shoshone-Bannock Tribes: The Shoshone-Bannock Tribes have four ambient air monitoring stations: the Primary, Sho-Ban, Ballard, and Fort Hall stations (Appendix A, Figure A-1 and A-4). From 2000 through part of 2003, the tribes monitored PM₁₀ at the Primary and Sho-Ban stations. In addition, the tribes began monitoring PM₁₀ at the Fort Hall station in March 2000 and at the Ballard station in December 2001. PM_{2.5} monitoring at the Primary Station started in April 2000. The Sho-Ban and Ballard stations discontinued PM₁₀ monitoring in March 2003. Currently the Fort Hall PM₁₀ monitor and the Primary station PM₁₀ and PM_{2.5} monitors are active. Air monitoring data for PM₁₀ and PM_{2.5} collected by Shoshone-Bannock Tribes between 2000 and 2003 (Sho-Ban 2004) are listed in Appendix B, Table B-5 and Table B-6.

In 2000, annual average PM₁₀ concentrations at Primary Station (57.8 µg/m³) and Sho-Ban Station (49.5 µg/m³) were either above or close to EPA's health-based CV of 50 µg/m³. Since 2000, annual average PM₁₀ concentrations have been decreasing steadily and have not exceeded EPA's health-based CV. The 24-hour average PM₁₀ concentrations exceeded EPA's health-based CV of 150 µg/m³ three times at each of two stations in 2000 (187.5 µg/m³, 183 µg/m³, and 167.6 µg/m³ at the Primary Station; 250.7 µg/m³, 220.8 µg/m³, and 179 µg/m³ at the Sho-Ban Station) and once in 2002 at the Primary and Sho-Ban stations (214.1 µg/m³ and 202.9 µg/m³, respectively). No concentrations exceeded EPA's health-based CVs in 2001 and 2003.

At the Fort Hall Station, the 24-hour average PM₁₀ concentration exceeded EPA's health-based CV of 150 µg/m³ only one time, on August 11, 2001, when it reached 168.9 µg/m³. No exceedance occurred at the Ballard Station.

How do ATSDR's and EPA's roles differ in evaluating air quality criteria?

When reading this health assessment document, it is important to note that the roles of BCEH and ATSDR as public health agencies at the EMF site are considerably different from the roles of other agencies, particularly those charged with addressing environmental issues. In this document, BCEH evaluates the public health implications of the levels of air pollution in the EMF area. These evaluations are not meant to address the region's compliance, or lack thereof, with state and federal environmental standards, such as EPA's National Ambient Air Quality Standards (NAAQS). This health assessment, though, uses the NAAQS as a means for evaluating air monitoring data collected at the EMF site.

Throughout this report, BCEH uses EPA's current health-based national ambient air quality standards (NAAQS) to evaluate the public health implications of measured concentrations of particulate matter. BCEH compares the measured levels of air pollution to EPA's health-based standards as a first step in evaluating public health implications of the levels of air pollution. Additionally, BCEH considers the potential for human exposure to air of poor quality and, in this report, does not consider EPA's criteria for compliance or attainment. Therefore, this report's findings must not be confused with EPA's evaluation of attainment for the region.

No PM_{2.5} exceedances have occurred at the Primary Station. In 2003, annual average and maximum 24-hour PM_{2.5} concentrations were as low as 7.6 µg/m³ and 22.7 µg/m³, respectively (Appendix B, Table B-6). However, during occasional winter inversion conditions, 24-hour average PM_{2.5} concentrations may still possibly come close to EPA's comparison value of 65 µg/m³, such as on January 16, 2004, when the 24-hour average PM_{2.5} concentration reached 49.0 µg/m³ (Personal communication: R. Turner, CERCLA/RCRA program manager, Shoshone-Bannock, email, March 2004).

Air Quality in Chubbuck and Pocatello: Between 2000 and 2003, 24-hour average concentrations of PM_{2.5} exceeded the health-based CV of 65 µg/m³ only once, on February 6, 2000, when the concentration reached 72.7 µg/m³. Twenty-four hour and annual average concentrations of PM₁₀, as well as the annual average concentrations of PM_{2.5}, are all below their respective health-based comparison values. These data suggest that PM₁₀ and PM_{2.5} are ***no longer a public health hazard*** in the Chubbuck and Pocatello area. However, this does not guarantee that unhealthy levels of PM₁₀ and PM_{2.5} (those exceeding their respective 24-hour average health-based CVs of 150 µg/m³ and 65 µg/m³) will not occur in severe inversion-producing conditions in the future.

The maximum 24-hour air concentrations of arsenic, cadmium, and chromium between 2001 and 2002 were at levels exceeding their corresponding health-based CVs on at least one occasion. However, the concentrations were all lower than those reported in the previous health consultation for air. As discussed in the health consultation (Appendix I), the concentrations of individual metals were well below levels in the scientific literature that showed non-carcinogenic health effects in humans and animals. Therefore, the conclusion that it is unlikely that adverse

non-carcinogenic health effects would result from short-term exposure to the individual metal is still applicable.

What is a nonattainment area?

In 1970, the Clean Air Act established requirements for the attainment and maintenance of National Ambient Air Quality Standards (NAAQS). These standards, which are set by the EPA, cover six criteria air pollutants: ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, lead, and particulate matter. EPA calls these pollutants criteria air pollutants because it regulates them by first developing health-based criteria as the basis for setting allowable levels. A geographic area that meets or does better than the NAAQS is called an “attainment” area. Areas that do not meet air quality standards are called “nonattainment” areas.

An area is given nonattainment status when a NAAQS is violated. A violation occurs when air pollution levels exceed the average 24-hour standard more than three times in any 3- year period. Therefore, a region can have up to 3 days of poor air quality in a row and still remain in attainment status, if no other exceedances occurred in the previous 3 years.

Why was the Portneuf Valley designated a nonattainment area?

In 1990, the Clean Air Act was amended to require the EPA to designate all areas exceeding or having potential to exceed the PM_{10} standards prior to January 1, 1989, as Nonattainment Areas (NAAs). As a result, the cities of Pocatello, Chubbuck, and Inkom, as well as a part of the Fort Hall Indian Reservation, were designated as the Portneuf Valley PM_{10} Nonattainment Area (PVNAA).

The Portneuf Valley has been in attainment of the PM_{10} NAAQS since December 31, 1996, and with the exception of 3 days during a severe winter inversion in December 1999, the PM_{10} 24-hour standard has not been exceeded since 1994. Exceedance of the PM_{10} standard during the 1999 inversion did not register as a violation of the standard since no other exceedances occurred prior to December 31, 2001.

In 2004, IDEQ completed the Portneuf Valley PM_{10} Nonattainment Area (PVNAA) State Implementation Plan (SIP), Maintenance Plan, and Redesignation Request. This document demonstrates all Clean Air Act requirements for attainment have been met, summarizes the progress of the area in attaining the annual and 24-hour PM_{10} standards, and includes a maintenance plan to ensure continued attainment.

BCEH evaluates carcinogenic health effects based on long-term exposures to cancer-causing agents. Because of the limited number of samples analyzed for metals between 2001 and 2002 (n=11), annual averages could not be calculated. For this reason, BCEH was not able to evaluate the potential for carcinogenic health effects to occur on the basis of the new metals data. As mentioned previously, maximum 24-hour metal concentrations in air were below those reported

in the past health consultation. With this in mind, BCEH believes that the conclusion for the carcinogenic health effects in the previous health consultation (ATSDR 2001) is still applicable, and that the concentration of metals is not likely to result in an appreciable increased risk for cancer in the exposed population.

Air Quality on the Fort Hall Indian Reservation: Air monitoring data collected by the Shoshone-Bannock Tribes at Sho-Ban and Primary stations (which are the closest stations to the FMC facility) consistently showed the highest levels of PM₁₀ in the entire EMF area before FMC ceased air emission in December 2001. Since then, 24-hour PM₁₀ concentrations exceeded the health-based comparison value of 150 µg/m³ only once, on April 23, 2002 (214.1 µg/m³ at Primary Station and 202.9 µg/m³ at Sho-Ban Station). Furthermore, annual average PM₁₀ and PM_{2.5} concentrations and 24-hour PM_{2.5} concentrations have not exceeded EPA's health-based CVs since 2000. PM₁₀ data collected at the Ballard Station have never exceeded EPA's health-based CVs. As with Chubbuck and Pocatello, these data suggest that PM₁₀ and PM_{2.5} are *no longer a public health hazard* on the Fort Hall Indian Reservation. However, unhealthy levels of PM₁₀ and PM_{2.5} may occur in severe inversion-producing conditions in the future.

3.3.4.2 Radiological Contamination in Air

This section reviews and discusses the radiological implications of air releases from both the FMC and Simplot operations.

The Simplot facility currently uses a wet process to produce phosphoric acid and, prior to decommissioning, the FMC facility used a thermal process to produce elemental phosphorus. These processes release radiological materials as by-products to the environment through air emissions and fugitive release from slag and gypsum piles. Radionuclide emissions from FMC and radon emissions from Simplot's phosphogypsum stack are regulated by the National Emission Standards for Hazardous Air Pollutants (40 CFR 61). These regulations, in place since 1989, limit emissions to levels that correspond to an excess cancer risk of less than 1 in 10,000 over a lifetime. Radiological materials released from the site include thorium 232 (Th 232), radium 226 (Ra 226), uranium isotopes (U 238, U 235, and U 234), polonium 210 (Po 210), lead 210 (Pb 210), radon 222 (Rn 222), and other components of the natural decay scheme for which the uranium or Th 232 is the initial source.

The radiological data used in this section were derived from a seven-station air monitoring network running from October 1993 through December 1993 (Bechtel 1994). This network measured both PM₁₀ and radionuclide concentrations. Air filters used to measure particulates in the air (PM₁₀) were also analyzed for radionuclides. Radionuclide levels measured in air are given in Appendix B, Table B-7. Background values in Table B-7 were collected near the Pocatello airport.

Public health implications: Human health risks associated with exposure to airborne contaminants are dependent on the contaminant concentration, duration of exposure, and inhalation rate. The radiological dose delivered to target organs, including the lungs, is also dependent on the chemical form, solubility and the resulting internal dose. BCEH believes the organs most likely affected by the radionuclides released at the EMF site are the lungs, bone red

marrow, where the majority of the blood cell production occurs, or perhaps bone surfaces. For the purposes of calculating radiation dose to the bone, some radionuclides concentrate along the surface of the bone and other radionuclides are distributed throughout the entire bone irradiating the red marrow.

BCEH calculated estimated radiological doses to the lung and either bone surfaces or the bone red marrow. To estimate the radiological dose, BCEH used the maximum concentrations of contaminants found in air samples, inhalation rates supplied in the EPA Exposure Factors Handbook (EPA 1999b), and radiological dose conversion factors set by the International Commission on Radiological Protection (ICRP 1995; ICRP 1996). The results of these calculations are supplied in Appendix B, Table B-8 (Personal communication: P. Charp, senior health physicist, ATSDR, email, April 2004).

Results in Appendix B, Table B-8 show that the estimated radiological doses to organs of concern are similar to doses one might receive from background radiation levels throughout the country. In addition, based on estimates from the National Research Council (NRC) (NRC 1990), the radiological dose to the bone surface resulting from air emissions at EMF is not expected to result in any adverse bone cancers.

Past studies have shown that a radiation dose delivered to the bone marrow could result in several blood-related illnesses such as myeloid and lymphatic leukemia (NRC 1990), which may also be age-related (NCRP 1993). However, little information exists to show how much radiation exposure is needed to cause leukemia. The only comparative studies available show that leukemia appeared shortly after ingestion of radium by radium dial painters. However, a review of U.S. studies of radium exposures in humans deemed this study inconclusive (Rowland 1994). Based on radionuclide concentrations in air, the estimated radiological dose to the bone red marrow around EMF (7 millirem) is about 5,800 times lower than the lowest dose estimated in the entire group of radium dial painters (40 rem). Therefore, it is unlikely that any adverse health effects related to blood-related illness would be expected in individuals living around the EMF site.

Inhaled radioactive materials can also affect the lungs. However, the estimated radiation dose to the lungs of residents around the EMF facility (around 100 millirem per year) is similar to the dose from the inhalation of radon gas for a typical individual anywhere in the country. In comparison, the average whole body dose from radon exposure in the U.S. population is 200 millirem per year with the majority of this dose being delivered directly to the lung and its structures (NCRP 1987). Therefore, it is unlikely that any adverse health outcomes related to lung cancer would be expected in individuals living around the EMF site.

BCEH does not believe that any adverse health effects exist as a result of radiological emissions to the atmosphere during the period of time covered by the available data. BCEH is uncertain about the exposures that could have resulted during those periods of time when air emissions were much different from the period for which the data exist.

3.3.5 Residential Exposures to Radiation from Slag

Elemental phosphorus slag is a by-product of elemental phosphorus production. Phosphorus slag contains natural radioactive material at levels higher than found in most ordinary rock and soil. This radioactive material emits gamma radiation, a type of radiation similar to medical x-rays.

Until 1990, the slag generated by the FMC and Monsanto process was used for construction purposes as aggregate in concrete and asphalt, roadbed fill, backfill, streets, sidewalks, and railroad ballast. From the 1950s until 1976, the slag was also used in concrete poured for some basements and building foundations. In 1976, the State of Idaho prohibited the use of slag for residential construction. Immediately thereafter, FMC and Monsanto voluntarily suspended the use of slag in the construction of all inhabited buildings.

In May 1990, the EPA issued a report on the Idaho Radionuclide Study (EPA 1990). The study concluded that some people in southeast Idaho (including Pocatello) could be at increased risk for contracting cancer because of long-term exposure to low-level radiation from slag in building foundations, streets, and sidewalks. Following the release of the Idaho Radionuclide Study (EPA 1990), FMC and Monsanto voluntarily suspended the sale of slag for all construction uses.

The primary public health concern from elemental phosphorus slag is gamma radiation emitted from the radionuclides present in the waste. This radiation can exceed ordinary background levels, particularly when slag is used in bulk, such as in construction. Radiation surveys in the southeast Idaho communities have demonstrated that the use of slag has resulted in increased levels of radiation in public areas as well as residences. The exposure pathway of concern is direct exposure, which means that exposure is related to a person's proximity to the material.

Since 1996, FMC and Monsanto have been conducting a radiation exposure study to assess doses to people from exposure to gamma radiation from phosphorus slag. This exposure study is being conducted according to an Administrative Order on Consent (AOC) between EPA, FMC and Monsanto. The guidelines, methods, and action levels for this study were developed by a technical work group consisting of representatives of the Shoshone-Bannock Tribes, FMC, Monsanto, State of Idaho, the communities of Pocatello and Soda Springs, and ATSDR. The exposure study offers people exposed to radiation from slag in the environment the opportunity to evaluate the extent of their individual exposure levels.

The most recent available data are from Elemental Phosphorus Slag Exposure Study-Phase I Final Report (FMC et al, 1999). More than 1,300 residences participated in the study; 1,133 were in Pocatello and 204 were on the Fort Hall Reservation. No houses in Pocatello or Fort Hall were found to have slag in the construction and the Slag Exposure Study estimated that less than 0.5% of residences in these two communities might contain slag. Twenty-one residences in Pocatello and Fort Hall with maximum direct radiation equal to or exceeding the action level of 20 microrem per hour, or individual annual doses in excess of 100 millirem (mrem), as determined by thermoluminescent dosimeters, were identified and recommended for a follow-up evaluation after an initial screening. Only two households (eight individuals) completed the follow-up surveys by November 1, 1998. All other participating households were either no longer interested or withdrew from the study. Dose estimates based on measured radiation levels and

time logs provided by residents were performed during follow-up. The highest estimated annual dose from the follow-up surveys for Pocatello and Fort Hall was 20.4 mrem above background levels, which is not high enough to cause apparent adverse health effects. However, because most of the residences which were recommended for further evaluation did not complete the follow-up surveys, BCEH cannot accurately evaluate the health effects of exposure to the radiation from slag use in the communities at this time. The Slag Exposure Study is ongoing; therefore, BCEH will further evaluate slag exposure data when and if the data become available. More information on the Slag Exposure Study is available on the EPA Region 10 Web site.

3.3.6 Fish Consumption Exposure Pathway

According to the Idaho Department of Fish and Game (IDFG), people harvest fish from the lower Portneuf River near the Meadow Gold Dairy at the inflow of several groundwater springs (including Batiste Springs). A completed exposure pathway exists for non-site related contaminants and a potential exposure pathway exists for site-related contaminants for people who consume fish from the Portneuf River. Those people could include sports fishers and their families and friends who share the caught fish.

Descriptive surveys of the river have been conducted over the years, but do not provide useful human exposure data. How much fish is caught for human consumption is unknown and no information on site-related contaminant concentrations in edible fish near the site is available.

BCEH acknowledges that some contaminants of concern (COCs) found in the Portneuf River, such as arsenic and selenium, may bioaccumulate in fish tissue. Available surface water and sediment data show that the maximum concentrations of arsenic are well below EPA's human health criteria for allowable arsenic concentrations in surface water 50 parts per billion (ppb). (EPA recommends pollutant concentrations in water that are considered to ensure the safe consumption of fish living in that water. EPA's water quality criteria are based on data and scientific judgments on the relations between pollutant concentrations and human health effects.) No human health criteria for allowable selenium concentrations in surface water have been established. Available surface water and sediment data suggest, however, that maximum concentrations of selenium are well below health-based CVs for surface water (based on ingestion exposure pathways). BCEH believes, therefore, that site-related contaminants in fish from the Portneuf River are unlikely to pose a health risk to people who consume these fish infrequently.

The only fish tissue data available for the Portneuf River are for non-site related contaminants. In 1992 and 1994, the U.S. Geological Survey analyzed polychlorinated biphenyls (PCBs) in Utah sucker and common carp (Maret and Ott, 1997). Although PCBs are not site-related contaminants and Utah suckers are not eaten by the general public, average PCBs concentration in Utah suckers is high enough (690 microgram per kilogram wet weight) to justify further sampling of edible fish from the Portneuf River.

Because of the elevated PCB levels, and to confirm that site-related contaminants in fish will not pose a health risk to the general public, BCEH will work with Idaho Department of Fish and Game (IDFG) and the Idaho Department of Health and Welfare (IDHW) Bureau of Laboratories

to analyze edible fish harvested from the Portneuf River for PCBs and heavy metals. BCEH will then evaluate possible health effects associated with fish consumed from the Portneuf River.

3.4 ATSDR Child Health Considerations

ATSDR recognizes that infants and children may be more vulnerable to exposures than adults in communities faced with contamination of their air, water, soil, or food. This vulnerability is a result of the following factors:

- Children are more likely to play outdoors and bring food into contaminated areas.
- Children are shorter, resulting in a greater likelihood of breathing dust, soil, and heavy vapors close to the ground.
- Children are smaller, have a faster breathing rate, and eat and drink more food and water per body weight than do adults, which results in higher doses of chemical exposure per body weight.
- The developing body systems of children can sustain permanent damage if toxic exposures occur during critical growth stages.
- Young children are more prone to put foreign objects (including soil) into their mouths and have frequent hand-to-mouth contact.

Because children depend completely on adults for risk identification and management decisions, BCEH and ATSDR are committed to evaluating their special interests at the site as part of the ATSDR Child Health Considerations.

As delineated in the discussions of different exposure pathways, the surface soil contamination, surface water and sediment contamination and the radiation exposure from air contamination are highly unlikely to result in any adverse health effects to local residents, including children. However, in the past, if an infant less than 4 months of age was fed formula made with water from the Old Pilot Café well (prior to 1976) or the Batiste Spring for several days, the infant would have had an increased risk for developing acute acquired methemoglobinemia (“blue baby syndrome”) because of elevated nitrate/nitrite concentrations in the drinking water. Children, especially those with pre-existing heart or lung disease or asthma, are one of the groups that probably have the greatest risk for suffering adverse health effects from the air contamination (ATSDR 2001).

3.5 Health Outcome Data (HOD) Evaluation

Because proteinuria (excess proteins found in the urine because of damage to the kidneys) and acute acquired methemoglobinemia (“blue baby syndrome”) are not reportable diseases in Idaho, only the cancer incidence is discussed in this section.

3.5.1 Data Review

The health outcome data evaluation from the EMF site is based on an analysis of available cancer data from the Cancer Data Registry of Idaho (CDRI). CDRI is an Idaho Hospital Association program that contracts with IDHW to provide a statewide cancer surveillance

system. The Registry is a population-based cancer registry that collects incidence and survival data on all cancer patients who reside in the State of Idaho or are treated for cancer in the State of Idaho. Through collaborative efforts with Idaho's neighboring states, CDRI is able to obtain data on cancer cases of Idaho residents diagnosed or treated for cancer in adjacent states. CDRI, in operation since 1969, became population-based in 1971. Each Idaho hospital, outpatient surgery center, and pathology laboratory is responsible for reporting cancer diagnoses and treatments within 6 months after services are provided. CDRI has a 99.6% case completeness rate and a 98.6% accuracy rate.

The period selected for each evaluation of the cancer incidence data was 1990–2001, the period of the most recent data available for analysis. Cancer incidence, instead of cancer mortality, was reviewed for this public health assessment because cancer death rates are affected by how advanced the cancer is at the time of diagnosis, access to health care, and other factors not related to exposure.

3.5.2 Data Analysis

The cancer incidence analysis was conducted for the EMF study area (Appendix I, Figure 4). Because census block group (CBG) population data do not correspond exactly to the boundary of the EMF site impact area, CBGs were aggregated to form an analysis area (Appendix J, Figure J-1). Cancer incidence for the analysis area was calculated by comparing the observed number of cases to the expected number of cases (also known as standardized incidence ratio) (Appendix J, tables J-1 and J-2). The expected number was calculated by multiplying rates for the remainder of Idaho by the population of the study area. Rates for the remainder of Idaho were calculated by dividing observed cases by the person-years for the remainder of Idaho. Person-years describe the length of time a group of people have been exposed, observed, or at risk.

To help interpret the difference between cancer incidence in the study area population and the remainder of Idaho, the “statistical significance” of the difference is calculated. “Statistical significance” for this public health assessment means that the chance that the observed difference is due to random chance alone is less than 5% ($p < 0.05$). In other words, if the difference was found to be statistically significant, then the difference between the expected and observed cases is probably due to some set of factors that influences the rate of that disease. The factors could be environmental, lifestyle, or family histories. In the public health assessment, only statistically significant differences are discussed.

Cancer is not a single disease, but a group of more than 200 different diseases. Because cancer is, unfortunately, a common disease (one in two men, or one in three women will develop cancer in the lifetime), every community will experience a certain number of cancer cases. Different types of cancer have different causes and are likely to be linked to different risk factors. As discussed previously, in the past, the high levels of arsenic in the Old Pilot Café well and the Frontier well may cause high risk for developing skin, liver, bladder, and kidney cancers. Also, the air contamination in the past may cause higher risk for developing lung cancer. Therefore, BCEH selected the specific cancer types (skin, liver, bladder, kidney, and lung) which, according to scientific studies, are biologically plausible as a result of exposure to site-related contaminants.

3.5.3 Results of Cancer Incidence Analysis

The EMF Cancer Analysis Area (Appendix J, Figure J-1)

Geocoded cancer cases diagnosed from 1990–2001 were queried from within the EMF cancer analysis area (Appendix J, Figure J-1), and the remainder of geocoded cases in the State of Idaho comprised the comparison group. An estimate of person-years (the denominator for the cancer incidence rates) was obtained by taking the April 1, 1990 census population count for the EMF cancer analysis area and for Bannock County and calculating the proportion of the Bannock County population that is in the EMF cancer analysis area. This proportion was then applied to the estimated person-years for 1990–2001 by 5-year age groups and sex. Person-years for the study area were estimated by summing population estimates for the study area over the time period of the study. The person-years for the remainder of Idaho were calculated by subtracting the person-years for the EMF cancer analysis area from the State of Idaho (Personal communication: C.J. Johnson, epidemiologist, CDRI, email, March 2004).

Comparing small area cancer incidence rates in Idaho involves an inherent problem because not all cancer cases can be geocoded at the same level of accuracy. Thus, cancer case-patients who may have resided in the EMF cancer analysis area, but whose address did not allow for accurate geocoding, may have been assigned a geocode for the ZIP Code or county centroid and may inadvertently have been misclassified. At the same time, cancer rates for the remainder of the state include case-patients geocoded to any level of accuracy (address, zip code, or county level). This is because delineation of the state cases requires less precision than that of smaller areas within the state. Therefore, when geocoded case-patients within the EMF cancer analysis area are compared to geocoded case-patients in the remainder of the state, some case-patients who truly reside within the analysis area may not be counted, resulting in an understatement of cancer incidence rates for the analysis area.

Overall, about 90% of case-patients in Bannock County were able to be geocoded to the census block group level or better (which would be included in a census block group analysis). Therefore, an additional analysis was run using only cancer case-patients geocoded to the census block group level or better for both the EMF cancer analysis area and the remainder of the State of Idaho. However, in most of the remainder of Idaho, case-patients are not geocoded as well as in Bannock County. Therefore, in contrast to the first analysis, the cancer incidence rates may be understated for the remainder of Idaho and comparisons may show falsely elevated rates in the EMF cancer analysis area (Personal communication: C.J. Johnson, epidemiologist, CDRI, email, March 2004).

The two tables (Appendix J, tables J-1 and J-2) show very different results. Table J-1, *Comparison of cancer incidence rates between the Eastern Michaud Flats cancer analysis area and the remainder of the State of Idaho using all geocoded cases*, shows the EMF cancer analysis area has statistically significantly lower rates of cancer than the remainder of Idaho for several sites and overall. Table J-2, *Comparison of cancer incidence rates between the Eastern Michaud Flats cancer analysis area and the remainder of the state of Idaho using cases geocoded to the census block group quality or better*, shows mixed results with several elevated rates of cancer incidence for the EMF cancer analysis area. For the selected cancers that might be

associated with the contaminants in the EMF area (skin, liver, kidney, lung, and bladder cancers), only the number of female bladder cancer cases increased significantly compared to the remainder of the State (Appendix J, Table J-2). Because this analysis likely understates rates for the comparison area (Personal communication: C.J. Johnson, epidemiologist, CDRI, email, March 2004), we can conservatively state that no elevation in skin, liver, kidney, and lung cancers exists. On the basis of this analysis, determining whether significantly more female bladder cancer cases exist is not possible. Tobacco consumption has been associated with a six-fold higher incidence of bladder tumor (Silverman et al. 1999). Therefore, BCEH cannot determine at this time if the contamination in the EMF area is associated with the increased female bladder cancer incidence in the area of analysis, even if significantly more female bladder cancer cases do exist.

Fort Hall Indian Reservation Area

Because specific information regarding tribal membership is not part of the information in the CDRI, CDRI did not calculate the cancer rates specific to the Fort Hall Indian Reservation for this public health assessment. Instead CDRI calculated cancer rates for Native Americans in general (American Indian/Alaska Native) in the three counties that contain the Fort Hall Indian Reservation (Bingham, Bannock and Power counties). The cancer rates for American Indian/Alaska Native (Appendix J, Table J-3) were compared to those found in the report *Cancer in Idaho by Race and Ethnicity* (Johnson and Carson 2003).

In Bingham County, where most of the Fort Hall Indian Reservation is located, the cancer rates of the selected cancers (skin, liver, kidney, lung, and bladder cancers) for American Indians/Alaska Natives are all lower than those found in the report *Cancer in Idaho by Race and Ethnicity* (Johnson and Carson 2003). In the three counties combined, among the selected cancers, only one more liver and two more skin cancers were observed compared to those expected based on rates found in *Cancer in Idaho by Race and Ethnicity*. Therefore, according to this analysis, it is unlikely that the contamination in the EMF area resulted in any increased cancer incidence to the Native Americans in the three counties that contain the Fort Hall Indian Reservation.

3.6 Community Health Concerns

As a result of past health consultations and while conducting this public health assessment, BCEH was made aware of some community health concerns by residents of Pocatello, Chubbuck and Fort Hall. EPA also provided information regarding community members' health concerns.

In addition, BCEH made this public health assessment available for public review and comment, starting on July 28, 2004. We distributed this public health assessment to 35 persons or organizations. We also made copies available on the IDHW Web site and at the Idaho State University Library, Marshall Public Library, Portneuf District Library, Pocatello DEQ, American Falls Library and the Shoshone-Bannock Library. Further, we held public meetings at the Fort Hall Indian Reservation and in Pocatello to present our findings and discuss them with the public. Upon distribution of the public health assessment, we requested that comments be provided by August 26, 2004—a schedule that was announced in the Idaho State Journal, Power County News, Idaho Unido, and the Sho-Ban News. All references to page numbers in the

following response to public comments are from the July 28, 2004 version of the public health assessment.

3.6.1 Health Effects of Air Pollution

When ATSDR conducted the health consultation for air contamination in the EMF study area (ATSDR 2001), community members in the area expressed their concerns about a potential increase in the incidence of asthma, upper respiratory illness, and heart disease. During the course of this public health assessment, community members again expressed their concerns regarding a perceived elevated incidence of respiratory disease in the EMF area. ATSDR is currently conducting a health study to assess health impacts of particulate matter exposures on residents of Chubbuck and Pocatello.

3.6.2 Fugitive Emissions from the Simplot Gypsum Stack

During the course of this public health assessment, concerns were expressed regarding potential exposures to the fugitive dust from Simplot's gypsum stack. Residents have noted that on windy days a visible cloud of dust can be seen blowing off of roads and the sides of the gypsum stack.

As discussed in the air exposure pathway section (Section 3.3.4.1), PM₁₀ and PM_{2.5} are no longer a public health hazard in Chubbuck and Pocatello or on the Fort Hall Indian Reservation. Monitoring data from the Primary and Sho-Ban stations, which are nearest the site, show that 24-hour health-based CVs for PM₁₀ were exceeded only once (at both stations) since FMC shut down operations in December 2001. PM_{2.5} concentrations (24-hour average) have not exceeded EPA's health-based CVs since 2000. The effect of high-level, short-term (hourly) exposures to particulate matter (PM) on human health is uncertain. Because of a lack of studies that examine these health effects, determining whether the health risks associated with high-level, hourly PM exposures may occur on days when 24-hour average standards are not exceeded is difficult for BCEH.

Simplot is in the process of enacting cleanup and monitoring requirements of the Consent Decree that address identified sources of threats to public health, including the control of fugitive emissions from permanent roads on the gypsum stack.

3.6.3 Odor Complaints and Associated Health Effects

Community members have expressed concern to IDEQ about odors coming from the EMF site and health effects associated with these odors. IDEQ logged odor complaints from community members from 1999 through 2003. According to IDEQ's complaint log, community members began noting health effects associated with these odors in 2001. These health effects include burning sensations in the eyes, nose, and throat and on the skin; nausea; headache; difficulty in breathing; nose bleeds; asthma; and respiratory effects. The odors are described as acidic, burnt almond, methane, and sulfur smells.

According to the EPA Toxic Release Inventory, the Simplot facility releases ammonia, nitrogen oxides, hydrogen fluoride, and acid aerosols to the environment through both fugitive and direct

emissions. The symptoms reported to IDEQ by community members are consistent with those that may result from exposures to Simplot's reported TRI emissions. Short-term exposures to ammonia at concentrations of 50 ppm have resulted in irritation to the eyes, nose, and throat in humans. Low levels of nitrogen oxides in the air can irritate the eyes, nose, throat, and lungs, possibly causing the exposed person to cough and experience shortness of breath, tiredness, and nausea. Long term exposure to hydrogen fluoride can result in irritation and congestion of the nose, throat, and lungs at low levels.

ATSDR and BCEH obtained and reviewed ambient air monitoring data for several ionic species. As discussed in the air exposure pathway section (Section 3.3.4.1) as well as in the past health consultation (Appendix I), the chemical concentrations in air (including ammonium ion, nitrate ion, fluoride ion, chloride ion, sulfate ion) measured at Garrett and Gould and other IDEQ monitoring stations (Appendix I) were unlikely to cause adverse non-carcinogenic health effects or result in an appreciable increased risk of cancer in the exposed population. In addition, the measured ambient air concentrations of sulfur dioxide at the Pocatello Sewage Treatment Plant from 1999 through 2003 were also below EPA's health-based CV of 0.03 ppm.

To address community complaints, Simplot has been working with GE Betz Company on odor reductions. IDEQ is working with Simplot to establish an odor management plan to control odor intensities (Personal communication: T. Floyd, air quality regional manager, IDEQ, email, May 2004). EPA has also set maximum achievable control technology standards for Simplot's stack emissions of acids. Simplot is currently in the first year of monitoring to comply with these standards (Personal communication: T. Edward, IDEQ, email, July 2004).

Because studies have linked exposure of acid aerosols to an increased incidence of adverse health effects among sensitive populations and some people may be more sensitive to odors than others, BCEH encourages community members to continue to report odors and associated symptoms to IDEQ. BCEH recommends that IDEQ continue to work with Simplot to address site odor issues and that IDEQ continue to track odor complaints (in particular, in residential or industrial areas where complaints originate). BCEH also recommends that IDEQ continue to track health effects associated with these odors and follow up with exposure point monitoring as appropriate.

3.6.4 Occupational Exposures to Former Workers

Former workers have expressed their concerns regarding past occupational exposures to contaminants at the two facilities and consequent exposures to their families. ATSDR's official mandate under the 1980 Superfund law, and as amended in 1986, focuses primarily on health issues related to the uncontrolled release of hazardous substances into the environment as it relates to community exposures. Except for very limited authority to examine health issues of workers' exposure to Superfund waste and exposure to those who perform remediation tasks, ATSDR's mandate does not include the health of workers—an issue that is mainly the responsibility of OSHA and the National Institute for Occupational Safety and Health (NIOSH). These agencies can evaluate in much greater detail worker health issues at the EMF site.

Through its Health Hazard Evaluation (HHE) Program, NIOSH evaluates whether health hazards occur as a result of workers being exposed to hazardous substances while on the job. NIOSH conducts HHEs only after receiving a written request to do so. These requests must come from three or more current employees, or the employer. Employees who request that an HHE be performed will remain anonymous, if requested. Further information about the NIOSH HHE Program can be found on the Web (at <http://www.cdc.gov/niosh/hhe/>) or by calling NIOSH at 1-800-356-4674.

In addition, former workers who are concerned about work-related illness can contact the Association of Occupational and Environmental Clinics (AOEC). The AOEC is a network of more than 60 clinics and more than 250 individuals trained in occupation and environmental medicine. The AOEC received funding through multi-year cooperative agreements with ATSDR and NIOSH.

The nearest AOEC clinic to the Pocatello area is in Salt Lake City. For more information on work-related illness and occupational medicine, contact:

Kurt Hegmann, MD, MPH
Rocky Mountain Center for Occupational and Environmental Health
75 South 2000 East
University of Utah
Salt Lake City, Utah 84112-0512
PHONE (801) 581-5056
FAX (801) 581-3756

4. Conclusions

On the basis of the data and information reviewed, the Bureau of Community and Environmental Health (BCEH) has drawn the following conclusions:

1. **The current** completed exposure pathways include surface soil, surface water and sediment, air, and residential exposure to radiation from slag. A potential exposure pathway exists for site-related contaminants for people who consume fish from the Portneuf River. The groundwater exposure pathway has been an eliminated exposure pathway since the early 1990s.
2. **In the past**, the EMF site was classified as a *public health hazard* according to ATSDR's interim public health hazard categories (Appendix C), based on past exposure: 1) of people to groundwater from the Old Pilot Café well, the Frontier well, and Batiste Spring; 2) of FMC workers to cadmium in surface soils; 3) of slag and gypsum workers at both facilities to alpha, beta, and gamma radiation; and 4) of the general public to air contamination. Determinations included:
 - Because of elevated arsenic concentrations in the drinking water, long term (more than 1 year) employees at the Old Pilot Café (from the early 1950s through 1976) and the Frontier Building (from 1943 to the late 1980s) may be at higher risk of developing skin,

liver, bladder, and kidney cancers if they drank a significant amount of water at work. These same people may also have lower production of red and white blood cells, abnormal heart rhythm, and blood-vessel damage (e.g., Raynaud's disease and cyanosis of fingers and toes).

- If an infant less than 4 months of age was fed formula made with water from the Old Pilot Café well (prior to 1976) or the Batiste Spring (before early 1990s) for several days, the infant would have had an increased risk of developing acute acquired methemoglobinemia (“blue baby syndrome”) because of elevated nitrate/nitrite concentrations in the drinking water. Symptoms of methemoglobinemia would be apparent within a few days of exposure.
 - Workers at the FMC facility (before FMC ceased production of elemental phosphorous in December 2001) may have been exposed to cadmium contaminated surface soil. These exposures may have increased the potential for the workers who smoke to develop proteinuria (excess proteins found in the urine because of damage to the kidneys).
 - Depending upon work practices (e.g., amount of dust generated and personal protective devices used) and personal hygiene habits (e.g., how often hands are washed), slag or gypsum pile workers at both facilities may have been exposed to gross alpha, beta, and gamma radiation. These exposures may have increased the cancer risk for slag or gypsum pile workers. However, good occupational practices (e.g., shielding provided by vehicles and dust control), could have substantially reduced these past exposures, thereby substantially reducing the workers’ risk of developing cancer.
 - Before 2000, levels of particulate matter in air throughout Chubbuck and Pocatello, as well as part of the Fort Hall Indian Reservation between FMC and Interstate 86, periodically exceeded EPA’s health-based comparison values (CVs) for PM₁₀ and PM_{2.5}, reaching unhealthy air pollution levels as a result of emissions from FMC, Simplot, and other sources.
3. **At present**, BCEH classifies the EMF site as a *no apparent public health hazard* because 1) no one is drinking site-contaminated groundwater; 2) the FMC facility no longer employs production workers at the site; 3) the annual average concentrations of PM₁₀ and PM_{2.5} steadily decreased between 2000 and 2003, and PM₁₀ levels exceeded EPA’s health-based CV only once (April 23, 2002) since 2001.
 4. **In the future**, the public health hazard associated with air contamination from the EMF site and other PM sources in the Portneuf Valley Airshed (PVA) is uncertain. Although PM₁₀ and PM_{2.5} in the EMF area have seldom exceeded EPA’s health-based CVs since 2001, BCEH is not certain that unhealthy PM levels (such as those that occurred during a severe winter inversion in December 1999) will not happen again in severe inversion-producing conditions. Therefore, BCEH recommends that measures to control air pollution remain in place and classifies the exposures to air from the EMF site and other sources as an *indeterminate public health hazard* in the future.

5. Gypsum pile workers at the Simplot facility may presently be exposed to elevated levels of alpha, beta, and gamma radiation. These exposures may increase the risk of a worker developing cancer. However, following good occupational practices (e.g., shielding provided by vehicles and dust control) could substantially reduce these exposures. Superfund site-related workers are likely to have short durations of exposure to the gypsum and are, therefore, unlikely to have any adverse health effects.
6. On the basis of available data from the slag study, the highest estimated annual radiation dose from slag used in the community was not high enough to cause apparent adverse health effects. However, this assumption is based on very limited data because most of the residences which were recommended for further evaluation did not complete the follow-up surveys. In addition, there may be other homes in the community built with slag in which the occupants did not participate in the study.
7. On the basis of the available surface water and sediment data, BCEH believes that site-related contaminants in fish from the Portneuf River are unlikely to pose a health risk to people who consume these fish infrequently.
8. Because of a lack of data regarding site-related contaminants in the fish tissue, BCEH cannot evaluate the possible health effects of consumption of fish from the Portneuf River at this time.
9. The health outcome data analysis for the cities of Pocatello and Chubbuck and for the Fort Hall Reservation does not indicate any increased cancer incidence for cancers known to be associated with site-related contaminants except for female bladder cancer. However, this association may be due to a potential underestimation of state-wide cancer rates for cancer cases geocoded at fine levels of geographic detail.
10. The health concerns expressed by community members in the EMF area (e.g., health effects of air pollution, fugitive emissions from the gypsum stack, odor complaints) were reviewed and are reasonably consistent with the contamination on the EMF site. ATSDR, Simplot, and the Idaho Department of Environmental Quality (IDEQ) are addressing these health concerns (e.g., ATSDR's health study, Simplot's fugitive emission control from permanent roads on the gypsum stack, and odor reduction and odor management plans).
11. The conclusions in this report only apply to the current site conditions. If land uses change, these conclusions may no longer be applicable.

5. Recommendations

On the basis of the data and information reviewed, the Bureau of Community and Environmental Health (BCEH) has made the following recommendations:

1. Appropriate remedial actions, worker protection activities, and worker safety procedures, such as a worker protection plan to protect gypsum workers of Simplot from radiation

exposures, should be instituted or continued to prevent workers from exposures to site-related contaminants in surface soil, surface water, and sediment.

2. Appropriate remedial actions and monitoring should be instituted or continued to prevent future migration of site-related groundwater contaminants into any drinking water sources.
3. The land deed restrictions instituted and planned for the property presently owned by FMC and Simplot should remain in effect so that the land will not be developed into residential or agricultural areas, and the shallow groundwater will not be used for drinking water.
4. FMC and Simplot should continue to monitor the groundwater to assure that site-related contaminants do not affect drinking water sources.
5. The Idaho Department of Environmental Quality (IDEQ) and the Shoshone-Bannock Tribes should continue to monitor air contamination, including PM₁₀ and PM_{2.5}, to further characterize air quality trends. Analysis of PM₁₀ filters for metals and inorganics (chemical mass balance) should be done regularly to address chronic exposure to metals.
6. IDEQ should continue to issue warnings on days when levels of air pollution are expected to reach potentially unhealthy levels and to communicate these warnings to the local public and media.
7. EPA, IDEQ, the Shoshone-Bannock Tribes, and the cities of Chubbuck and Pocatello should continue to develop, implement, and enforce air pollution control initiatives to minimize the amount of particulate matter released to the air in the EMF area.
8. Concerned homeowners and other building owners in the Pocatello area and on the Fort Hall Reservation area should contact the Southeast Idaho District Health Department to participate in the voluntary Slag Exposure Study, which is ongoing.
9. The voluntary suspension by FMC and Monsanto of the sale of slag for all construction uses should remain in place.
10. IDEQ should continue to work with Simplot to address site odor issues. IDEQ should also continue to track odor complaints (in particular, residential or industrial areas where complaints originate) and health effects associated with these odors and follow up with exposure point monitoring as appropriate.
11. In response to community health concerns, cancer surveillance in the EMF area should continue including an analysis of cancer incidence for Shoshone-Bannock Tribal members.

6. Public Health Action Plan

The purpose of the public health action plan is to ensure this public health assessment not only identifies any current and potential exposure pathways and related health hazards, but also to provide a plan of action to mitigate and prevent adverse human health effects resulting from

exposures to hazardous substances in the environment. The following lists the ongoing or planned actions by the Bureau of Community and Environmental Health (BCEH), ATSDR, Shoshone-Bannock Tribes, EPA, and other agencies, as well as FMC and Simplot.

1. BCEH has assembled the Eastern Michaud Flats Work Group, which consists of state, federal, and tribal environmental and health agency staff and community members, to assist and advise in the implementation of community health education activities. BCEH will continue to conduct health education and outreach activities as needed.
2. FMC and EPA are working on a supplemental remedial investigation and feasibility study for the FMC operable unit based on potential future industrial or commercial redevelopment of the FMC facility.
3. IDEQ has completed the *Portneuf Valley PM₁₀ Nonattainment Area (PVNAA) State Implementation Plan, Maintenance Plan, and Redesignation Request*. This plan outlines that Pocatello, Chubbuck, Inkom and a portion of the Fort Hall Reservation will ensure continued attainment of the Clean Air Act National Ambient Air Quality Standards (NAAQS) for annual and 24-hour PM₁₀.
4. EPA, Southeastern District Health Department, and FMC are conducting the ongoing Idaho Slag Exposure Study, a voluntary program to help residents find out if phosphorus slag in their homes and business properties is causing unacceptably high exposure to radiation.
5. BCEH will further evaluate slag exposure data generated by the Slag Exposure Study when the data become available.
6. BCEH will work with the Idaho Department of Fish and Game (IDFG) and the Idaho Department of Health and Welfare (IDHW) Bureau of Laboratories to analyze edible fish harvested from the Portneuf River for non-site related polychlorinated biphenyls (PCBs). At the same time, BCEH will analyze heavy metals in the edible fish to verify that site-related contaminants in fish from the Portneuf River do not pose a health risk.
7. BCEH and the Cancer Data Registry of Idaho (CDRI) will periodically monitor cancer incidence.
8. ATSDR is conducting a health study to determine if an association exists between past particulate matter air pollution exposures and hospital admissions and other visits (including emergency room, urgent care, and family practice) for heart and lung conditions. Because of the availability of quality exposure data, this study is limited to the residents of Chubbuck and Pocatello.
9. The Shoshone-Bannock Tribes, FMC, and independent experts will conduct a Tribal Health Study for the Shoshone-Bannock Tribes using existing data provided by the Fort Hall Clinic and the CDRI. FMC funds this study under the Resource Conservation and Recovery Act (RCRA) Consent Decree as part of a Special Environmental Project (SEP #14).

10. Simplot is in the process of enacting cleanup and monitoring requirements of its Consent Decree that address identified sources of threats to public and worker health.
11. BCEH will review new environmental sampling data and studies relevant to the public health of communities near the EMF site as they become available.

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8. Certifications

The Idaho Bureau of Community and Environmental Health prepared this public health assessment under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures existing at the time the public health assessment was initiated. Editorial review was completed by the Cooperative Agreement partner.

Technical Project Officer, SSAB, DHAC

The Superfund Site Assessment Branch (SSAB), Division of Health Assessment and Consultation (DHAC), ATSDR has reviewed this health assessment and concurs with its findings.

Team Leader, CAT, SSAB, DHAC, ATSDR

9. References

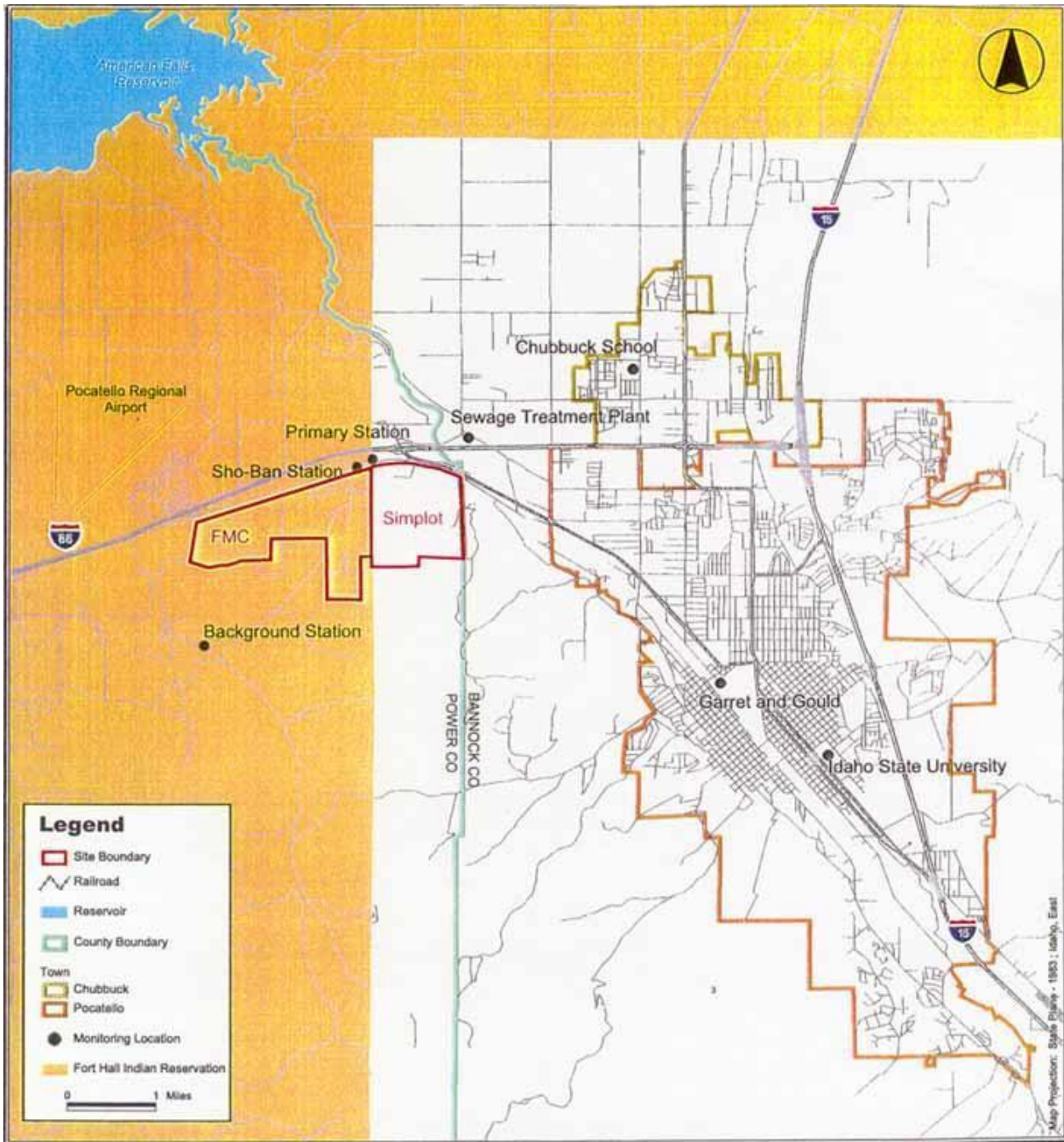
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Appendix A

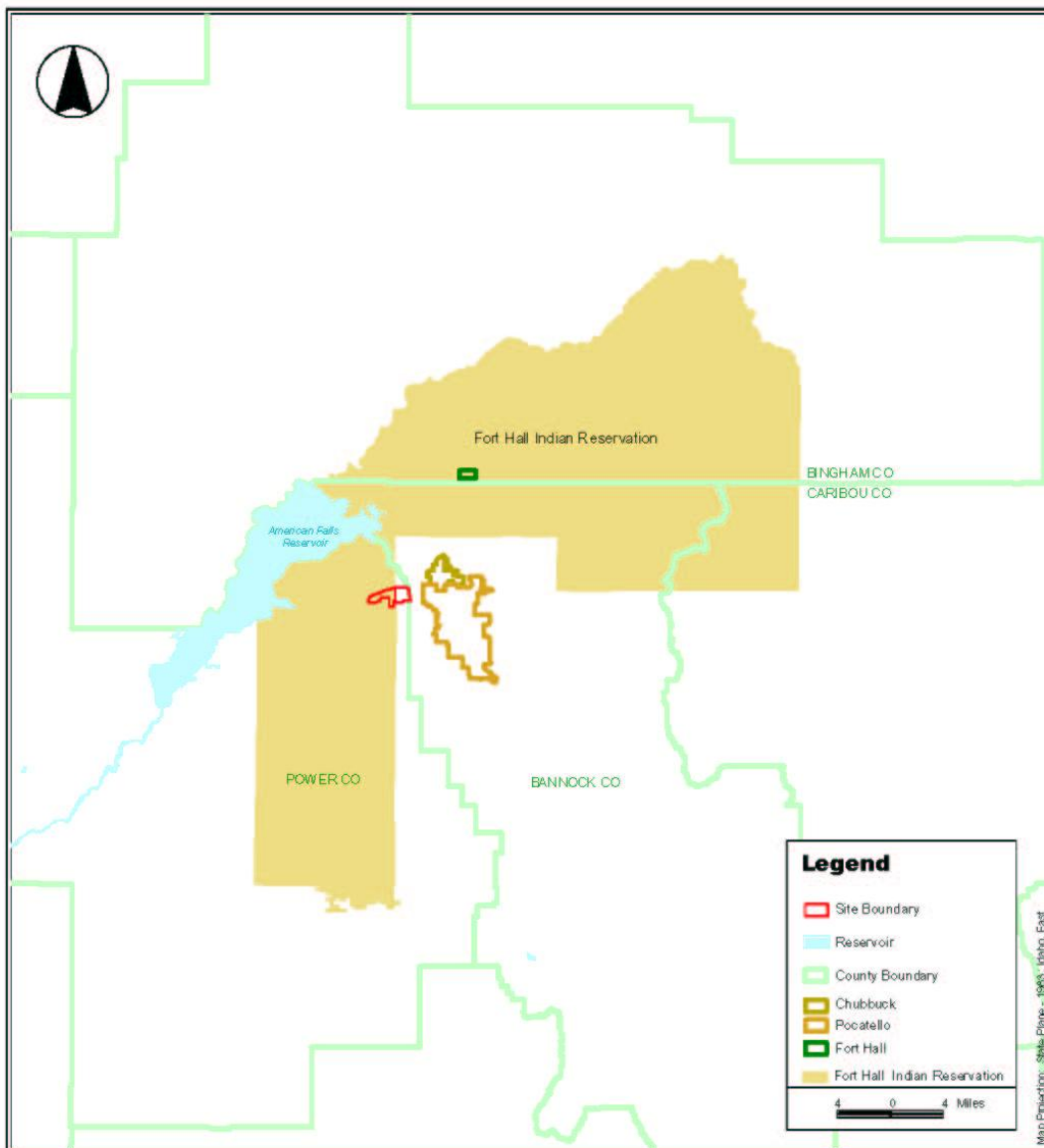
The Maps of Eastern Michaud Flats Contamination Site



Eastern Michaud Flats

Pocatello, Idaho
 CERCLIS No. IDD984666610

Figure A-1 Air Monitoring Locations



Eastern Michaud Flats

Pocatello, Idaho
 CERCLIS No. IDD98466610

Figure A-2 General Area around Eastern Michaud Flats Contamination Site



Power County, Idaho

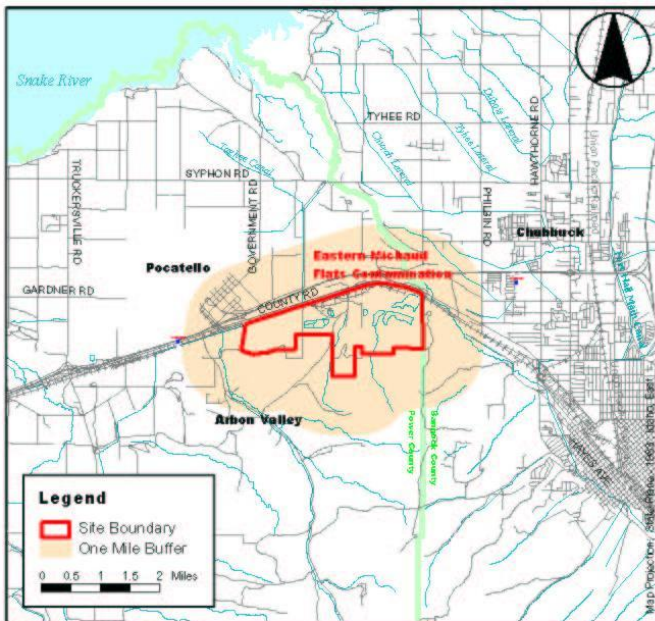


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Eastern Michaud Flats Contamination

INTRO MAP

Pocatello, Idaho
EPA Facility ID IDD984666610

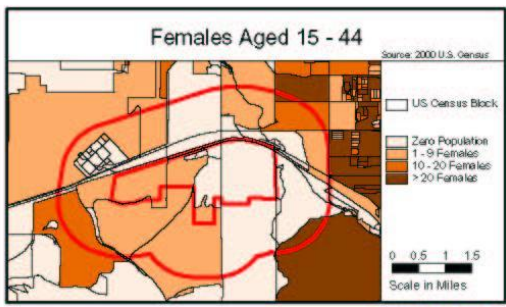
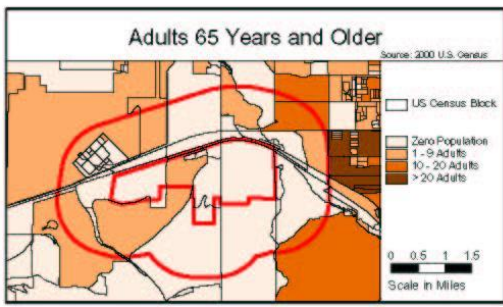
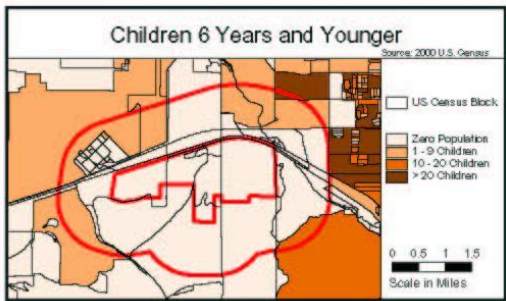
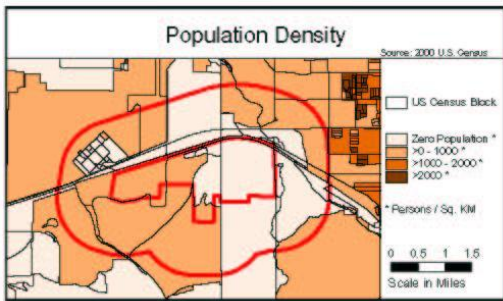


Power, Bannock County, Idaho

Demographic Statistics Within One Mile of Site*	
Total Population	220
White alone	210
Black alone	2
Am. Indian and Alaska Native alone	4
Asian alone	2
Native Hawaiian and Other Pacific Islander alone	0
Some other race alone	2
Two or More races	1
Hispanic or Latino	10
Children Aged 6 and Younger	17
Adults Aged 65 and Older	26
Females Aged 15 - 44	42
Total Housing Units	97

Base Map Source: 1995 TIGER/Line Files

Demographic Statistics Source: 2000 US Census
 *Calculated using an area-proportion spatial analysis technique



JVA01404



Figure A-3 Demographic Map

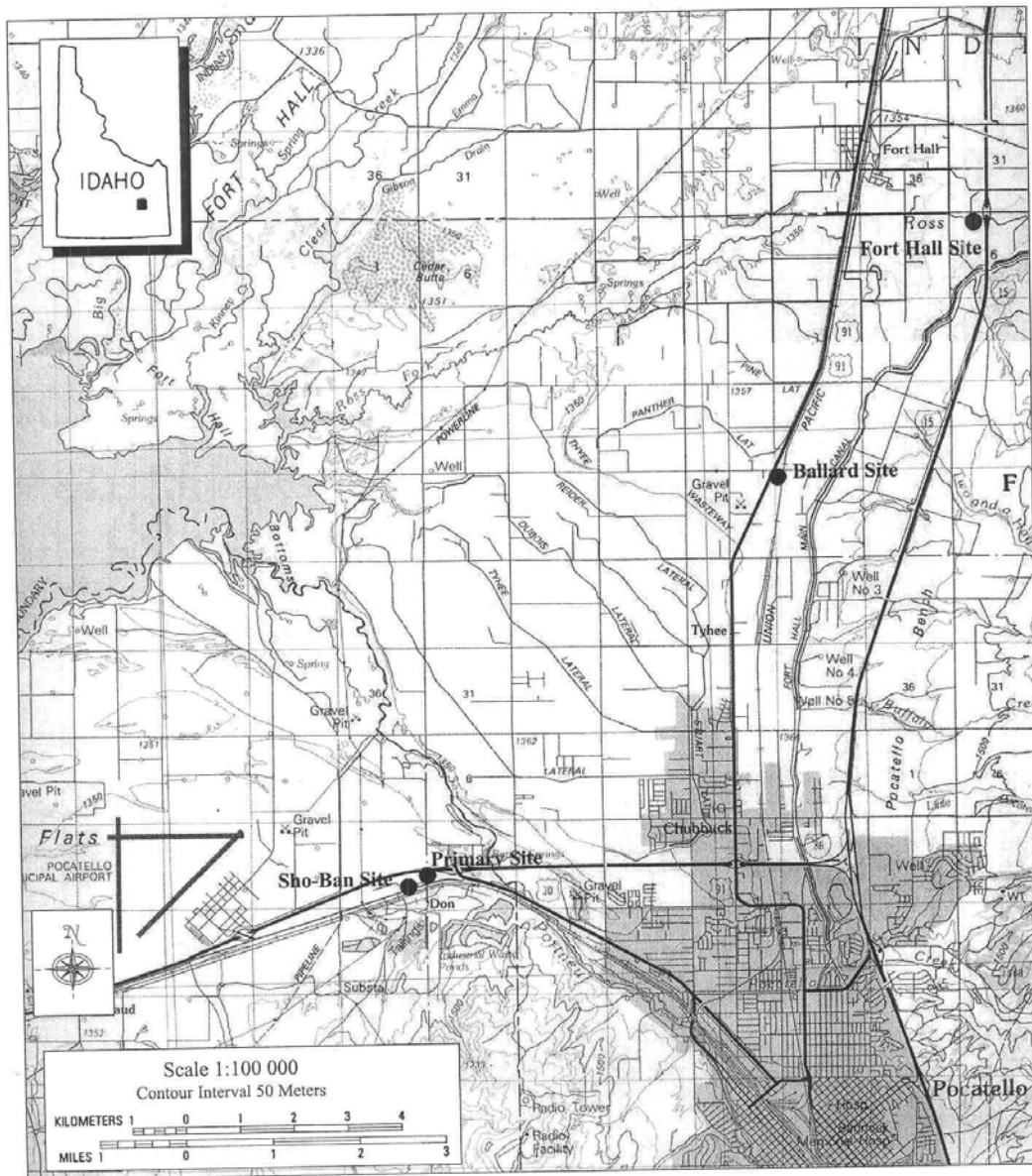


Figure A-4 Sho-Ban/EPA Particulate Monitoring Program Sites, Pocatello, Idaho

Appendix B

Data Tables

Table B-1 Maximum Concentration (milligrams per liter) of Site-Related Groundwater Contaminants Found in Monitoring Wells 524 and 525

Monitoring Well	Calendar Year	Arsenic (Total) (mg/L)	Nitrate (mg/L)	Selenium (mg/L)	Sulfate (mg/L)
Well 524	1994	0.0034	2.66	0.0035	51.0
	1995	0.0038	1.57	0.0021	96.4
	1996	0.0054	3.41	0.0050	90.0
	1997	0.0050	2.90	0.0050	53.0
	1998	0.0050	1.60	0.0050	55.8
	1999	0.0039	1.70	0.0050	47.4
	2000	0.0050	1.50	0.0050	43.9
	2001	0.0050	2.10	0.0050	42.7
	2002	0.0050	2.00	0.0050	41.6
	2003	0.0050	1.90	0.0050	43.9
Well 525	1994	0.0033	2.29	0.0035	55.0
	1995	0.0038	2.51	0.0021	55.8
	1996	0.0076	3.65	0.0050	94.0
	1997	0.0090	4.30	0.0050	100.0
	1998	0.0050	2.00	0.0050	84.0
	1999	0.0050	2.60	0.0050	61.9
	2000	0.0050	1.60	0.0050	46.6
	2001	0.0042	2.20	0.0050	43.8
	2002	0.0050	2.10	0.0050	42.7
	2003	0.0050	2.00	0.0050	45.8
Comparison Values and Source		0.01 EMEG	10 MCL	0.2 EMEG	250 SMCL

EMEG: Environmental media evaluation guide
MCL: Maximum contaminant level
mg/L: milligrams per liter
SMCL: Secondary maximum contaminant level

Table B-2 Summary of Ambient Air Monitoring Data (PM₁₀) Collected by IDEQ Air Monitoring Network (2000–2003)

Station	Maximum 24-Hour Average Concentration (µg/m ³)			
	2000	2001	2002	2003
Sewage Treatment Plant	141 (April 6)	85 (Sept. 25)	74 (May 14)	N/A*
Garrett and Gould	112 (Feb. 6)	81 (Feb. 28)	66 (Feb. 4)	88 (July 8)

Station	Annual Weighted Average Concentration (µg/m ³)			
	2000	2001	2002	2003
Sewage Treatment Plant	31	27	N/A*	N/A*
Garrett and Gould	25	26	25	22

Source of data: Idaho Department of Environmental Quality (IDEQ) 2004a

Chubbuck School PM₁₀ monitor was shut down on June 29, 1999.

Idaho State University PM₁₀ monitor was shut down on May 30, 1999.

EPA's National Ambient Air Quality Standards (NAAQS) for 24-hour and annual average PM₁₀ concentrations are 150 µg/m³ and 50 µg/m³, respectively.

N/A*: Not available; the Pocatello Sewage Treatment Plant PM₁₀ monitor was shut down on June 28, 2002.

µg/m³: micrograms per cubic meter

Table B-3 Summary of Ambient Air Monitoring Data (PM_{2.5}) Collected by IDEQ Air Monitoring Network (2000–2003)

Station	Maximum 24-Hour Average Concentration (µg/m ³)			
	2000	2001	2002	2003

Chubbuck School	61 (Dec. 8)	41 (Jan. 7)	42.4 (Feb. 4)	19.7 (Jan. 9)
Garrett and Gould	72.7 (Feb. 6)	51.2 (Jan. 6)	43.8 (Feb. 4)	21.9 (Jan. 9)

Station	Annual Weighted Average Concentration ($\mu\text{g}/\text{m}^3$)			
	2000	2001	2002	2003
Chubbuck School	10.4	8.7	8.5	N/A*
Garrett and Gould	10.5	9.9	8.8	5.9

Source of data: Idaho Department of Environmental Quality (IDEQ) 2004a

EPA's National Ambient Air Quality Standards (NAAQS) for 24-hour and annual average $\text{PM}_{2.5}$ concentrations are $65 \mu\text{g}/\text{m}^3$ and $15 \mu\text{g}/\text{m}^3$, respectively. Bold concentrations exceed NAAQS.

N/A*: Not available; the Chubbuck School $\text{PM}_{2.5}$ monitor was shut down on July 8, 2003.
 $\mu\text{g}/\text{m}^3$: micrograms per cubic meter.

**Table B-4 Annual Arithmetic Average Concentrations of Sulfur Dioxide (parts per million)
From the Monitor Located at the Pocatello Sewage Treatment Plant**

Calendar Year	Annual Average Concentration of Sulfur Dioxide (ppm)
1999	0.0073
2000	0.0084
2001	0.0073
2002	0.0050
2003	0.0047

Source of data: Idaho Department of Environmental Quality (IDEQ) 2004a

EPA's National Ambient Air Quality Standards (NAAQS) for sulfur dioxide concentrations is 0.03 ppm.

ppm: parts per million

Table B-5 Summary of Ambient Air Monitoring Data (PM₁₀) Collected by the Shoshone-Bannock Tribes (2000–2003)

Station	Maximum 24-Hour Average Concentration (µg/m ³)			
	2000*	2001	2002	2003
Primary	187.5 (April 6)	145.1 (Sept. 25)	214.1 (April 23)	103.3 (July 8)
Sho-Ban	250.7 (June 8)	108.6 (Sept 25)	202.9 (April 23)	41.5 (Jan. 18)
Ballard		34.2 (Dec.27)	86.1 (Oct. 17)	14.8 (Feb. 2)
Fort Hall	135.5 (April 6)	168.9 (Aug. 11)	135.7 (May 20)	134.8 (Sept. 30)
	Annual Weighted Average Concentration (µg/m ³)			

Station	2000	2001	2002	2003
Primary	57.8	38.3	27.1	24.0
Sho-Ban	49.5	31.9	28.9	N/A†
Ballard		N/A‡	25.5	N/A‡
Fort Hall	N/A§	30.3	36.4	36.8

Source of data: Sho-Ban 2004

EPA's National Ambient Air Quality Standards (NAAQS) for 24-hour and annual average PM₁₀ concentrations are 150 µg/m³ and 50 µg/m³, respectively. Bold concentrations exceed NAAQS.

* In 2000, the 24-hour average concentrations of PM₁₀ exceeded EPA's NAAQS (150 µg/m³) three times at both Primary and Sho-Ban stations.

N/A†: Not available; the Sho-Ban PM₁₀ monitor was shut down on March 31, 2003.

NA‡: Not available; the Ballard PM₁₀ monitor started on November 15, 2001, and was shut down on March 28, 2003.

N/A§: Not available; the Fort Hall PM₁₀ monitor started on March 25, 2000.

µg/m³: micrograms per cubic meter

Table B-6 Summary of Ambient Air Monitoring Data (PM_{2.5}) Collected by the Shoshone-Bannock Tribes (2000–2003)

Calendar Year	PM _{2.5} Monitoring Data at Primary Station	
	Annual Average Concentration (µg/m ³)	Maximum 24-Hour Average Concentration (µg/m ³)
2000	N/A*	57.2 (April 12)
2001	14.5	39.1 (March 8)
2002	10.5	38.4 (March 3)
2003	7.6	22.7 (Jan. 21)

Source of data: Sho-Ban 2004

EPA's National Ambient Air Quality Standards (NAAQS) for 24-hour and annual average PM_{2.5} concentrations are 65 µg/m³ and 15 µg/m³, respectively.

N/A*: Not available; the Primary PM_{2.5} monitor started on March 31, 2000.

µg/m³: micrograms per cubic meter

Table B-7 Radionuclides Detected in Air Samples Collected in the Vicinity of EMF (October–December 1993)

Radioisotope	Site-Related Background Concentration* (pCi/m ³)	Range of detected contaminants related to Eastern Michaud Flats (pCi/m ³)
Uranium 238	8.7×10^{-6}	1×10^{-5} to 3.8×10^{-4}
Uranium 235	4.1×10^{-7}	5×10^{-7} to 1.9×10^{-5}
Uranium 234	9.3×10^{-6}	1.1×10^{-5} to 4.0×10^{-4}
Thorium 230	3.5×10^{-5} (DL) †	ND‡ to 2.85×10^{-4}
Radium 226	5.31×10^{-4} (DL)	ND‡ to 5.9×10^{-4}
Polonium 210	4.4×10^{-3}	6.7×10^{-3} to 6.9×10^{-2}
Lead 210	1.7×10^{-2}	2.1 to 2.5×10^{-2}
Thorium 232	4.1×10^{-5}	ND‡
Radium 228	1.97×10^{-3}	ND‡

*Data from Bechtel 1996. *Remedial Investigation and Feasibility Study Report for the Eastern Michaud Flats Site. Part III. Air Quality Characterization. Air Monitoring Report. Volume II*, sections 1–6. August 1996.

DL†: The instrument detection limit is the lowest value the monitoring equipment could detect.

ND‡: Not detectable, below the detection limit.

pCi/m³: picocuries per cubic meter

Table B-8 Estimated Radiological Doses to Organs of Concern*

Organ	10-year-old Child†	Adult
Bone Surface	22 millirem	48 millirem
Bone Red Marrow	7	5
Lungs	109	75

* The calculated dose, expressed in millirem and rounded to the next whole number, is the total from all radionuclides listed in Table B-7. The dose was derived by converting the values given in Table B-7 to millirem per year. Breathing patterns used are those derived from the EPA *Exposure Factors Handbook* (EPA 1999b). The dose conversion factors were derived from the International Commission on Radiological Protection (ICRP) 1996.

† Age at Intake

Appendix C

ATSDR Interim Public Health Hazard Categories

Table C-1 Interim Public Health Hazard Categories

CATEGORY/DEFINITION	DATA SUFFICIENCY	CRITERIA
<p>Urgent Public Health Hazard This category is used for sites where short-term exposures (<1yr) to hazardous substances or conditions that could result in adverse health effects that require rapid intervention.</p>	<p>This determination represents a professional judgment based on critical data, which ATSDR has judged sufficient to support a decision. This does not necessarily imply that the available data are complete; in some cases additional data may be required to confirm or further support the decision made.</p>	<p>Evaluation of available relevant information* indicated that site-specific conditions or likely exposures have had, are having, or are likely to have in the future, an adverse impact on human health that requires immediate action or intervention. Such site-specific conditions or exposures may include the presence of serious physical or safety hazards.</p>
<p>Public Health Hazard This category is used for sites that pose a public health hazard due to the existence of long-term exposure (>1yr) to hazardous substances or conditions that could result in adverse health effects.</p>	<p>This determination represents a professional judgment based on critical data, which ATSDR has judged sufficient to support a decision. This does not necessarily imply that the available data are complete; in some cases additional data may be required to confirm or further support the decision made.</p>	<p>Evaluation of available relevant information* suggests that, under site-specific conditions of exposure, long-term exposures to site-specific contaminants (including radionuclides) have had, are having, or are likely to have in the future, an adverse impact on human health that requires one of more public health interventions. Such site-specific exposures may include the presence of serious physical or safety hazards.</p>
<p>Indeterminate Public Health Hazard This category is used for sites in which “critical” data are insufficient with regard to extent of exposure or toxicological properties at estimated exposure levels.</p>	<p>This determination represents a professional judgment that critical data are missing and ATSDR has judged the data insufficient to support a decision. This does not necessarily imply all data are incomplete; but that some additional data are required to support a decision.</p>	<p>The health assessor must determine, using professional judgment, the “criticality” of such data and the likelihood that the data can be obtained and will be obtained in a timely manner. Where some data are available, even limited data, the health assessor is encouraged to the extent possible to select other hazard categories and to support the decision with clear narrative that explains the limits of the data and the rationale for the decision.</p>
<p>No Apparent Public Health Hazard This category is used for sites where human exposure to contaminated media may be occurring, may have occurred in the past, or may occur in the future, but the exposure is not expected to cause any adverse health effects.</p>	<p>This determination represents a professional judgment based on critical data, which ATSDR considers sufficient to support a decision. This does not necessarily imply that the available data are complete; in some cases additional data may be required to confirm or further support the decision made.</p>	<p>Evaluation of available relevant information* indicates that, under site-specific conditions of exposure, exposures to site-specific contaminants in the past, present, or future are not likely to result in any adverse impact on human health.</p>
<p>No Public Health Hazard This category is used for sites that, because of the absence of exposure, do not pose a public health hazard.</p>	<p>Sufficient evidence indicates that no human exposures to contaminant media have occurred, are now occurring, or are likely to occur in the future.</p>	

*Such as environmental and demographic data; health outcome data; community health concerns information; toxicological, medical, and epidemiologic data; monitoring and management plans

Appendix D

Explanation of Evaluation Process

Explanation of Evaluation Process

Screening Process

In evaluating available data, the Bureau of Community and Environmental Health (BCEH) uses comparison values (CVs) to determine which chemicals to examine more closely. CVs are contaminant concentrations found in a specific media (air, soil, or water) and are used to select contaminants for further evaluation. Comparison values are designed to be conservative and non-site specific, and therefore protective for all probable exposures. Their intended use is only to screen out contaminants which do not need further evaluation. CVs are not intended as cleanup levels or as indicators of public health effects. CVs, derived from toxicological information, incorporate assumptions of daily exposure to the chemical and a standard amount of air, water, and soil that a person may inhale or ingest each day. Generally, the assumptions are very conservative (i.e., worst case).

As health-based thresholds, CVs are set at a concentration below which no known or anticipated adverse human health effects are expected to occur. Different CVs are developed for cancer and non-cancer health effects. Non-cancer levels are based on valid toxicological studies for a chemical, with appropriate safety factors included, and the assumption that small children (22 pounds or less) and adults are exposed every day. Cancer levels are the media concentrations at which there could be a one in a million excess cancer risk for an adult eating contaminated soil or drinking contaminated water every day for 70 years. For chemicals for which both cancer and non-cancer numbers exist, the lower level is used to be protective. Exceeding a CV does not mean that adverse health effects will occur, just that more evaluation is needed.

If a chemical contaminant is selected for further evaluation, the next step is to identify which chemicals and exposure situations could be a health hazard. Child and adult exposure doses are calculated for contaminants of concern (COCs) in site media (e.g., soil, groundwater, surface water, sediment, and biota). Exposure doses are the estimated amounts of a contaminant that people come in contact with under specified exposure situations. These exposure doses are compared to appropriate health guidelines for that chemical. Health guideline values are considered safe doses; that is, health effects are unlikely below this level. If the exposure dose for a chemical is greater than the health guideline, then the exposure dose is compared to known health effect levels identified in ATSDR's toxicological profiles and other scientific references. If the chemical of concern is a carcinogen, the cancer risk is also estimated. These comparisons are the basis for stating whether the exposure is a health hazard.

CVs used in this document and previous health consultations are listed below:

Environmental media evaluation guides (EMEGs) are estimated contaminant concentrations in a media where non-carcinogenic health effects are unlikely. The EMEG is derived from the Agency for Toxic Substances and Disease Registry's (ATSDR) minimal risk level.

Cancer risk evaluation guides (CREGs) are estimated contaminant concentrations that would be expected to cause no more than one additional excess cancer in one million people exposed over

a lifetime. CREGs are calculated from the U.S. Environmental Protection Agency's (EPA) cancer slope factors.

Lifetime health advisories (LTHAs) are derived by EPA from a drinking water equivalent level below which no adverse noncancer health effects are expected to occur over a 70-year lifetime.

Lowest-observed-adverse-effect level (LOAEL) is defined as the lowest dose of chemical in a study, or group of studies, that produces statistically or biologically significant increases in the frequency or severity of adverse effects between the exposed population and its appropriate control.

National Ambient Air Quality Standards (NAAQS) are developed by EPA to protect people and the environment from unhealthy and undesirable levels of air pollution. NAAQS have been developed specifically to protect the health and welfare of humans. To be conservative, these standards were designed to be protective of exposed persons, including the most "sensitive" populations (e.g., persons with asthma).

No-observed-adverse-effect level (NOAEL) is defined as the lowest dose of chemical at which no statistically or biologically significant increases occurred in the frequency or severity of adverse effects seen between the exposed population and its appropriate control. Effects may be produced at this dose, but they are not considered to be adverse.

Minimal risk levels (MRLs) are defined as an estimate of daily human exposure to a substance that is likely to be without an appreciable risk of adverse effects (non-carcinogenic) over a specified duration of exposure. MRLs are derived when reliable and sufficient data exist to identify the target organ(s) of effect or the most sensitive health effect(s) for a specified duration within a given route of exposure. MRLs are based only on non-cancerous health effects, and do not consider carcinogenic effects. MRLs can be derived for acute, intermediate, and chronic durations of exposure.

Maximum contaminant levels (MCLs) are enforceable drinking water regulations, established by EPA under the Safe Drinking Water Act, that are protective of human health to the extent feasible both technologically and economically. The MCL assumes exposure over a 70-year lifetime and ingestion of 2 liters of water per day.

Risk-Based concentrations (RBCs) are the estimated contaminant concentrations in which no chance exists for carcinogenic or non-carcinogenic health effects.

Secondary maximum contaminant levels (SMCLs) are non-enforceable guidelines regulating contaminants that may cause cosmetic effects (such as skin or tooth discoloration) or aesthetic effects (such as taste, odor, or color) in drinking water. EPA recommends secondary standards to water systems but does not require systems to comply.

For radiological contaminants, BCEH uses information on radiation exposure and its effects related to environmental levels prepared by federal agencies, including EPA, the U.S. Department of Energy (DOE), and the Nuclear Regulatory Commission. BCEH and ATSDR also

use other publicly available data sources and recommendations on radiation dose limits. The National Council on Radiation Protection and Measurements (NCRP), the International Commission on Radiological Protection (ICRP), the United Nations Scientific Committee on the Effects of Atomic Radiation, and others develop these sources.

Determination of Exposure Pathways

BCEH identifies human exposure pathways by examining environmental and human components that might lead to contact with contaminants of concern. A pathway analysis considers five principal elements: a source of contamination, transport through an environmental medium, a point of exposure, a route of human exposure, and an exposed population. Completed exposure pathways are those for which the five elements are evident, and indicate that exposure to a contaminant has occurred in the past, is currently occurring, or will occur in the future. Potential exposure pathways are those for which exposure seems possible, but one or more of the elements is not clearly defined. Potential pathways indicate that exposure to a contaminant could have occurred in the past, could be occurring now, or could occur in the future. It should be noted that the identification of an exposure pathway does not imply that health effects will occur. Exposures may, or may not be, substantive. Therefore, even if exposure has occurred, is occurring currently, or is likely to occur in the future, human health effects may not result.

BCEH reviews site history, information on site activities, and the available sampling data. On the basis of this review, BCEH identifies exposure pathways that warrant consideration. Additional information regarding the exposure pathways identified for the EMF site is provided in Appendix E of this public health assessment. If people are unlikely to be exposed to contaminants in a given pathway, then that pathway will not be evaluated further for human health risks.

Evaluation of Public Health Implications

The next step is to take those contaminants that are above the CVs and further identify which chemicals and exposure situations are likely to be a health hazard. Child and adult exposure doses are calculated for the site-specific exposure scenario, using our assumptions of who goes on the site and how often they contact the site contaminants. The exposure dose is the amount of a contaminant that gets into a person's body.

Appendix E

Exposure Pathways for Eastern Michaud Flats Contamination Site

Table E-1. Exposure Pathways for Eastern Michaud Flats Contamination Site

PATHWAY NAME	ENVIRONMENTAL MEDIA & TRANSPORT MECHANISMS	POINT OF EXPOSURE	ROUTE OF EXPOSURE	EXPOSURE POPULATION	TIME	NOTES	STATUS
Soil	Spillage onto soil; erosion of waste to surface soils; deposition of fugitive dust	Site soil Off-site soil	Incidental ingestion, inhalation, dermal exposure	Workers Nearby residents	Past, present, future	Population may include children.	Complete
Surface water	Surface water runoff over contaminated soil to river; dissolution of contaminants from sediment	On-site Ponds Portneuf River	Incidental ingestion, inhalation, dermal exposure	Workers Nearby residents	Past, present, future	Population may include children.	Complete
Sediments	Spillage; deposition from surface water runoff into river	On-site Ponds Portneuf River	Incidental ingestion, dermal exposure	Workers Nearby residents	Past, present, future	Population may include children.	Complete
Groundwater	Infiltration to groundwater	Groundwater wells supplying drinking water taps	Ingestion, inhalation, dermal exposure	Nearby residents	Past, present, future	Population may include young children.	Complete (past) Incomplete (present) Potential (future)
Air	Volatilization of contaminants; fugitive dust	On or near site soil	Inhalation, dermal exposure	Residents near the site	Past, present, future	Population may include young children.	Complete
Slag	Radiation from the slag used in the community	In close proximity to slag	Radiation	Residents with slag in their homes and communities	Past, present, future	Population may include young children.	Complete
Fish	Bioaccumulation of contaminants from surface water and sediments in fish	Meals prepared using fish from the Portneuf River	Ingestion	Sport fishers and their families	Past, present, future	Population may include young children.	Potential

Appendix F

Health Consultation: Surface Soil Contamination at the Eastern Michaud Flats Contamination Site

HEALTH CONSULTATION

SURFACE SOIL CONTAMINATION

at the

**EASTERN MICHAUD FLATS CONTAMINATION
POCATELLO, BANNOCK COUNTY, IDAHO
CERCLIS NO. IDD984666610**

October 9, 1998

**U.S. Department of Health & Human Services
Public Health Service
Agency for Toxic Substances and Disease Registry**

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I. Purpose

As recommended in the March 11, 1997, Site Review and Up-Date for the Eastern Michaud Flats Contamination National Priorities List (NPL) site (1), the Agency for Toxic Substances and Disease Registry (ATSDR) committed to reviewing recently released environmental data generated by the Remedial Investigation conducted at this site. The Remedial Investigation (2) provides most of the data and information needed by ATSDR to re-evaluate human exposure pathways associated with the Eastern Michaud Flats Contamination NPL site. ATSDR had previously evaluated the potential for human exposures to site-related contaminants in the 1990 Preliminary Public Health Assessment (3). Specifically, ATSDR will develop health consultations that address the potential for human exposures (past, present, and future) to site-related contaminants in the groundwater, surface water and sediment, surface soil, biota, and ambient air. This health consultation will evaluate the potential for human exposures to site-related contaminants in surface soils.

This health consultation will focus on characterizing the surface soil contamination at and off the two facilities that are a part of the Eastern Michaud Flats NPL site. It does not attempt to characterize any contamination that may exist inside the facility buildings or the exposures the workers may experience within those buildings. Exposures that may occur to workers inside the buildings are regulated by the Occupational Safety and Health Administration (OSHA) and can be evaluated, if so requested, by the National Institute of Occupational Safety and Health (NIOSH), Centers for Disease Control and Prevention (CDC).

In the past, the slag generated by the FMC process was used as road bedding and fill material (1). This slag has some associated radioactivity. To address concerns about the human health effects from exposure to radioactive slag, a technical workgroup (Phosphorus Slag Technical Working group -- members include EPA, ATSDR, other federal officials, state officials, local officials, the affected Tribes, citizens, and industry representatives) was formed. As an outcome of the group's recommendations, a study is presently underway to address this issue. Therefore, this health consultation will not discuss the possible health effects of contaminated slag.

II. Background and Statement of Issues

The Eastern Michaud Flats Contamination NPL site is located west of Pocatello, Idaho (1-3). Two manufacturing facilities, FMC Elemental Phosphorus Plant and Simplot Don Plant, are located on the NPL site (see Appendix A, Figure 1 for location map).

The FMC facility, FMC Elemental Phosphorus Plant, covers an estimated 1,189 acres and adjoins the western boundary of the Simplot Don Plant (2). Approximately 560 people are employed at the FMC Elemental Phosphorus Plant. Elemental phosphorus production at the

facility has changed little since the plant operations began in 1949. Phosphate-bearing shale is shipped to FMC via the Union Pacific Railroad during the summer months. Ore cannot be shipped during the winter months because the ore tends to freeze in the rail cars. Therefore, the ore is stockpiled at the facility. Ore from the stockpiles is processed in four electric arc furnaces. The furnace reaction yields gaseous elemental phosphorus in addition to by-products, some of which contain radiological components. The elemental phosphorus is subsequently condensed to a liquid state and eventually shipped off-site. Approximately 1.5 million tons of ore are processed at the plant annually. The disposal of by-product waste material at and around the facility has resulted in slag piles covering large areas of land. In addition, air emissions (fugitive and direct discharges) from the facility have contributed to the environmental contamination associated with the Eastern Michaud Flats Contamination NPL site (1).

The Simplot Don Plant covers approximately 745 acres and adjoins the eastern property boundary of the FMC facility (2). Around 460 people work at the Simplot Don Plant. The plant began production of single superphosphate fertilizer in 1944. In 1954, the facility began producing phosphoric acid. The phosphoric acid is presently produced by using a wet (aqueous) process. Formerly phosphate ore was transported from the mines to the facility via rail. As of September 1991, the Simplot plant receives phosphate ore through a slurry pipeline. The phosphate ore slurry is processed at the Simplot Don Plant in phosphoric acid reactors and then further processed into a variety of solid and liquid fertilizers. The plant produces 12 principal products, including five grades of solid fertilizers and four grades of liquid fertilizers. The disposal of by-product waste material (e.g., gypsum) at and around the facility and air emissions (fugitive and direct discharges) from the facility have contributed to the environmental contamination associated with the Eastern Michaud Flats Contamination NPL site (1).

Neither facility is located near any large populations centers. The nearest residence is approximately one mile north of the facilities (1-3). The plant boundaries are fenced. Representatives of FMC and Simplot have told ATSDR that trespassers are rarely found on their facilities. In addition, the land directly across US 30 from the plants is predominantly owned by either FMC or Simplot (see Appendix A, Figure 2). Deed restrictions to prevent future residential development have or will be placed on the properties across from the plants. Currently some of the land across US 30 is used for a drag racing strip (the old airport runway) and for a softball/baseball field (on Simplot property).

During the Remedial Investigation (RI) for this NPL site, an extensive surface soil sampling and analysis program was undertaken (2). Composite samples of the raw materials and major waste products were taken. Surface soil samples were taken at various locations throughout the facilities. In addition, surface soil samples were taken off the facility properties (16 equally spaced transects with samples collected at regular intervals within a three mile radius). Supplemental samples of surface soil north of the facilities were also collected.

Tables 1, 2, and 3 present the maximum results of the RI. As indicated in Appendix B, comparing the maximum results of the surface soil sampling and analysis program to comparison values is conducted to select contaminants for further evaluation.

The highest surface soil contamination was found at the two plants. The highest surface soil contamination found beyond the FMC or Simplot facility fence lines was on the land directly across US 30 from the plants (the land is presently owned by either FMC or Simplot) (2). The pattern of surface soil contamination found beyond the FMC or Simplot facility fence lines is coincident with the prevailing wind patterns (i.e., the highest contamination was found northeast and northwest of the facilities). In addition, the surface soil contamination decreases with distance from the facilities (2). Analytical results of samples taken from residential areas are either at or below background levels or comparison values (i.e., there is no site-related contamination at levels of health concern within residential areas).

Since the RI, FMC and Simplot have taken actions to limit human exposures to site-related surface soil contaminants. Roads at the FMC facility have been paved and specific areas have been capped to prevent both direct contact and fugitive emissions releases. In addition, deed restrictions to prevent future residential development have or will be placed on the properties across from the plants.

III. Discussion

There are two separate groups of people who may come in contact with site-related contaminants (the general public including children and workers at the FMC and Simplot facilities). Each of these groups' potential for exposure to site-related contaminants and potential for adverse health effects will be discussed separately.

A. Children and the General Public

For the following reasons, it is very unlikely that children or the general public would come in contact with site-related surface soil contamination for a sufficient amount of time (a significant portion of a lifetime continuously -- 20 years) to result in any adverse health effects: no residences are located next to the two facilities, people rarely trespass onto the facilities, those people who do trespass are at the facilities for only short periods of time, and the analytical results of surface soil samples taken at some distance from the facilities indicate that there is no surface soil contamination at levels of health concern within residential areas. In addition, people who attend or participate in the drag racing and softball/baseball activities directly across the street from the two facilities are unlikely to come in contact with a significant amount of surface soil contaminants. None of the contaminants found at or near the drag strip or the ball field are high enough to cause acute health effects (health effects that may occur after only a brief contact with contaminated surface soil).

B. Workers at the FMC and Simplot Facilities

Workers at the two facilities are the only people who may come in contact with a significant amount of surface soil contamination. There is very little vegetation covering the soil at the facilities (this is not an uncommon situation for these type of facilities). Therefore, the surface soil contamination is mobile and available for people to inhale or ingest (wind blown dust and direct transfer to clothes and hands).

Although arsenic, beryllium, and lead were found above comparison values, it is unlikely that adverse health effects would occur because the highest levels of contamination were found at discrete areas (e.g., lead was only found in one sample above comparison values). It is unlikely that workers would ingest enough contaminated soil or inhale enough contaminated dust over the amount of time required to result in any adverse health effects (e.g., 50 grams of contaminated soil per day for several years) (4-6). It is important to note that the comparison values used to develop Tables 1, 2, and 3 assume that upon ingesting contaminated soil or inhaling contaminated dust, 100% of the contaminant is absorbed into the body. However, scientific literature clearly demonstrates that less than 50% of the ingested metal contaminants associated with soil (i.e., arsenic, beryllium, and lead) are absorbed into the body (4,5,6). In addition, comparison values have built-in safety factors which lower the values by 100 to 10,000 times below concentrations known to cause adverse health effects in animals or humans. The actual amount (dose) of site-related arsenic, beryllium, and lead (excluding any exposures directly related to job duties) that a worker may ingest or inhale is below that which has been observed to cause adverse health effects in humans or animals.

Fluoride was detected above the comparison value for surface soil (35,000 milligrams of fluoride per kilogram of soil [mg/kg]) at both facilities. The maximum concentration found at the FMC and Simplot facilities is 221,000 mg/kg and 123,000 mg/kg, respectively (2). According to the EPA Risk Assessment for this NPL site, the average fluoride surface soil concentration at the two facilities is 16,868 mg/kg (7). Assuming that a 70 kilogram (kg) adult ingests 50 milligrams (mg) of soil per day (incidental ingestion by hand to mouth activities and the clearing of contaminated dust particles from the respiratory tract) and that 100 percent of the fluoride is bio-available, the exposure dose to a worker ranges from 0.16 milligrams of fluoride per kilogram of body weight per day (mg/kg/day), worse case situation, to 0.012 mg/kg/day, an average situation. These doses are below the levels of exposure shown to have resulted in adverse human health effects (0.48 mg/kg/day -- increased non-vertebral fracture rate in osteoporotic women) (8). Therefore, it is unlikely that any adverse human health effects would occur because of exposure to site-related fluoride.

Cadmium was detected at very high levels at the facilities (particularly at the FMC facility -- upwards of 5,110 mg/kg with an average of approximately 740 mg/kg) (2). Although EPA has

designated cadmium as a probable human carcinogen via inhalation (Group B1 --occupational and animal studies indicate that inhaling cadmium *fumes* or *aerosols* could result in an increased risk of lung cancer [9]), it is doubtful that workers exposed to cadmium contaminated surface soil would inhale a sufficient amount of cadmium into their lungs that would result in an increased risk of lung cancer. The particle sizes of surface soil are probably too large to be deposited into the lung (the inhaled soil dust would either not enter the lungs in the first place or would be removed from the lungs by the various filtering and clearing mechanisms that function in the human body).

However, workers may ingest a significant amount of cadmium contaminated surface soil (either by hand to mouth habits or via the clearing of inhaled soil dust from the respiratory tract). The worst case theoretical dose (assuming a 70 kg person ingests 50 mg of contaminated soil per day, 50% bio-availability, and 5,110 mg/kg of cadmium in the surface soil) indicates that a worker could receive as much as of 0.0018 mg/kg/day of cadmium. A worker exposure of 0.0003 mg/kg/day could occur if the average concentration of cadmium found at FMC is used. These theoretical doses are near the minimum risk level (MRL) of 0.0007 mg/kg/day established by ATSDR (9). The ATSDR MRL is based on a lifetime (greater than 20 years) threshold for proteinuria (proteins found in the urine because of damage to the kidneys) caused by dietary cadmium intake in residents of cadmium-polluted areas of Japan. The current average cadmium dietary intake of adult Americans is approximately 0.0004 mg/kg/day and smokers receive an additional 0.0004 mg/kg/day from cigarettes (9). Based upon these facts, workers who smoke may already exceed the threshold for chronic cadmium-related kidney damage without any environmental or occupational exposures. Therefore, smoking workers employed at FMC for 20 years or more and who ingest cadmium contaminated surface soil may be at increased risk. The workers of particular concern are those that perform most of their duties outside (i.e., slag and maintenance workers -- <50 workers) (2,7).

Elevated levels of radiation (gross alpha, beta, and gamma) have been detected in surface soil at both facilities (2). The highest levels of radiation are associated with the slag and gypsum. Usually only a few workers may come in contact with or near the slag and gypsum. These waste materials are generally handled via mechanical means (i.e., slurry pipeline and frontend loaders with enclosed cabs at Simplot, frontend loaders and haul trucks with enclosed cabs at FMC) (2,7). These material handling procedures tend to shield the worker from radiation and reduce the amount of radioisotopes that the worker may ingest or inhale. Gamma radiation exposure studies conducted at both facilities indicate that the workers are not being exposed to an excessive amount of gamma radiation (2). Depending upon work practices (e.g., amount of dust generated and personal protection devices used) and personal hygiene habits (e.g., how often hands are washed), slag or gypsum pile workers may inhale or ingest surface soil containing elevated gross alpha and beta radiation. This may increase the cancer risk of slag or gypsum pile workers (<50 workers) (10,11).

The surface soil contamination at the facilities is a potential reservoir of contaminants that could migrate into groundwater or surface water. Therefore, it may be prudent to remediate surface soil contamination in order to protect groundwater and surface water resources even though the surface soil contamination may not be at levels that pose a public health concern.

IV. Conclusions

Based upon the data and information reviewed, the Agency for Toxic Substances and Disease Registry has drawn the following conclusions:

1. It is unlikely that the general public, including children, has been, is currently, or will be exposed to significant levels of site-related surface soil contamination. Therefore, it is unlikely that any adverse human health effects have or will occur because of site-related surface soil contamination. The nearest residence to the FMC and Simplot facilities is over one mile away. Analytical results of surface soil samples indicate that there is not any site-related surface soil contamination at levels of health concern within the nearest residential areas. In addition, very few people trespass onto the facilities. The deed restriction on the land near and on the facilities should prevent any of the contaminated land from being used for residential areas.
2. Workers at the FMC facility may be exposed (ingestion and inhalation) to cadmium contaminated surface soil. The highest concentrations of cadmium in surface soil was found at the FMC facility. These exposures may increase the potential for the workers who smoke to develop proteinuria (proteins found in the urine because of damage to the kidneys). Good occupational practices (e.g., the use of respirators, where appropriate, and frequent hand washing, particularly before eating) can significantly reduce the worker's potential to be exposed to cadmium.
3. Slag and gypsum pile workers may be exposed to elevated levels of alpha, beta, and gamma radiation. These exposures may increase the risk of a worker to develop cancer. However these exposures can and are significantly reduced by good occupational practices (e.g., shielding provided by vehicles and dust control), thereby significantly reducing the workers' risk of developing cancer.
4. Given the potential for worker exposures to site-related contaminants in surface soil and the potential for adverse health effects to occur in exposed workers, ATSDR has classified the Eastern Michaud Flats Contamination NPL site as a Public Health Hazard in regards to surface soil.

V. Recommendations

ATSDR makes the following recommendations:

1. Appropriate remedial actions and worker protection activities should be instituted or continued to prevent worker exposures to site-related contaminants.
2. Appropriate remedial actions should be taken to prevent the surface soil contaminants from migrating into the local groundwater and surface water.
3. The land deed restrictions instituted and planned for the property presently owned by FMC and Simplot should remain in effect so that those lands will not be developed into residential or agricultural areas.

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Table 1 - Maximum Concentration of Various Site-Related Contaminants in Ore, Slag, and Gypsum at the Eastern Michaud Flats Contamination National Priorities List Site, Pocatello, Bannock County, Idaho					
Contaminant and Units	Maximum Concentration at FMC		Maximum Concentration at Simplot Gypsum	Background Levels According to EPA	ATSDR Comparison Value for Ingestion and Source*
	Ore	Slag			
Arsenic mg/kg	14.6	0.6	0.9	7.5	0.5 CREG
Beryllium mg/kg	1.9	2	2.8	1	0.2 CREG
Cadmium mg/kg	77.8	103	37	1.9	500 Adult EMEG
Fluoride mg/kg	13,200	7,800	7,650	600	35,000 Adult EMEG
Gross Alpha pCi/g	~200	240	~200	25**	15
Gross Beta pCi/g	400	1,100	46	31**	50
Gross Gamma µrem/h	50	52	30	15**	None
<p>* - A description of the various comparison values is presented in Appendix B. Unless indicated otherwise, the comparison values listed are for chronic exposures (greater than 365 days).</p> <p>** - EPA did not select a background level for gross alpha, gross beta, and gross gamma. The background levels report for these three contaminants were developed by the consultant for the companies.</p> <p>EPA is the U.S. Environmental Protection Agency mg/kg is milligrams of contaminant per kilogram of soil. pCi/g picocurie per gram of soil. µrem/h is microrems per hour.</p>					

Table 2 - Maximum Surface Soil Contamination Found at the FMC or J.R. Simplot Facilities, Eastern Michaud Flats Contamination National Priorities List Site, Pocatello, Bannock County, Idaho

Contaminant and Units	Maximum Concentration at FMC	Maximum Concentration at Simplot	Background Levels According to EPA	Comparison Value and Source*
Arsenic mg/kg	27.1	55	7.5	0.5 CREG
Beryllium mg/kg	2.9	5.2	1	0.2 CREG
Cadmium mg/kg	5,110	131	1.9	500 Adult EMEG
Fluoride mg/kg	221,000	123,000	600	35,000 Adult EMEG
Lead mg/kg	<500	2,370	29.1	400 EPA Screen
Gross Alpha pCi/g	216	406	25**	15
Gross Beta pCi/g	133	13.8	31**	50
Gross Gamma μ rem/h	45	25	15**	None

* - A description of the various comparison values is presented in Appendix B. Unless indicated otherwise, the comparison values listed are for chronic exposures (greater than 365 days).

** - EPA did not select a background level for gross alpha, gross beta, and gross gamma. The background levels report for these three contaminants were developed by the consultant for the companies.

EPA is the U.S. Environmental Protection Agency
mg/kg is milligrams of contaminant per kilogram of soil.

pCi/g picocurie per gram of soil.
 µrem/h is microrems per hour.

Table 3 - Maximum Surface Soil Contamination Found Beyond the FMC or J.R. Simplot Facility Fence Lines, Eastern Michaud Flats Contamination National Priorities List Site, Pocatello, Bannock County, Idaho

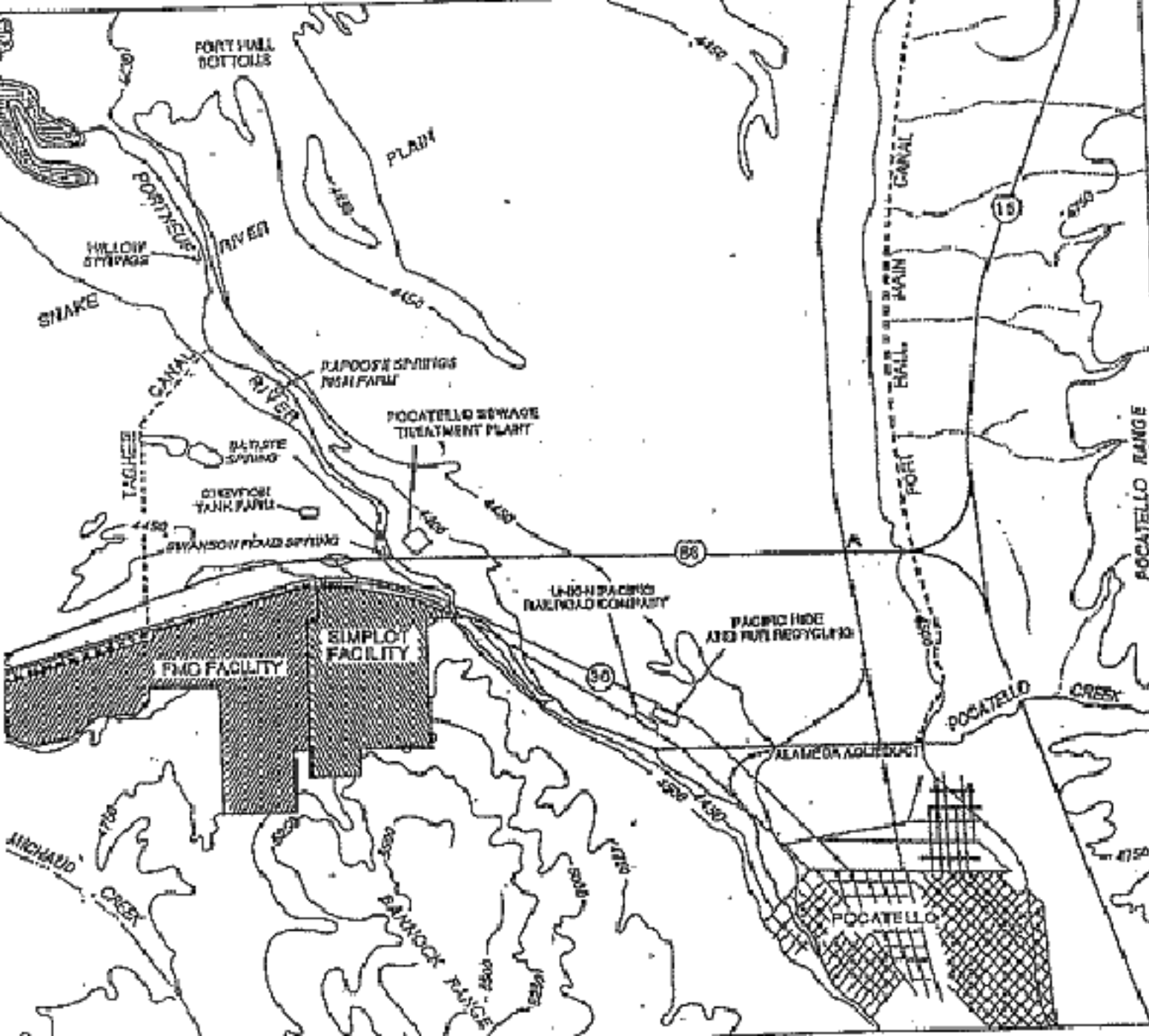
Contaminant and Units	Maximum Concentration Detected	Maximum Mean Concentration Detected within a Sector	Background Levels According to EPA	Comparison Value and Source*
Arsenic mg/kg	18.4	8.28	7.7	0.5 CREG
Cadmium mg/kg	189	62.2	1.9	500 Adult EMEG
Fluoride mg/kg	27,200	7,532	600	35,000 Adult EMEG

* - A description of the various comparison values is presented in Appendix B. Unless indicated otherwise, the comparison values listed are for chronic exposures (greater than 365 days).

EPA is the U.S. Environmental Protection Agency
 mg/kg is milligrams of contaminant per kilogram of soil.
 pCi/g picocurie per gram of soil.
 mrem/h is millirems per hour.

Appendices

Appendix A - Figures



EXPLANATION

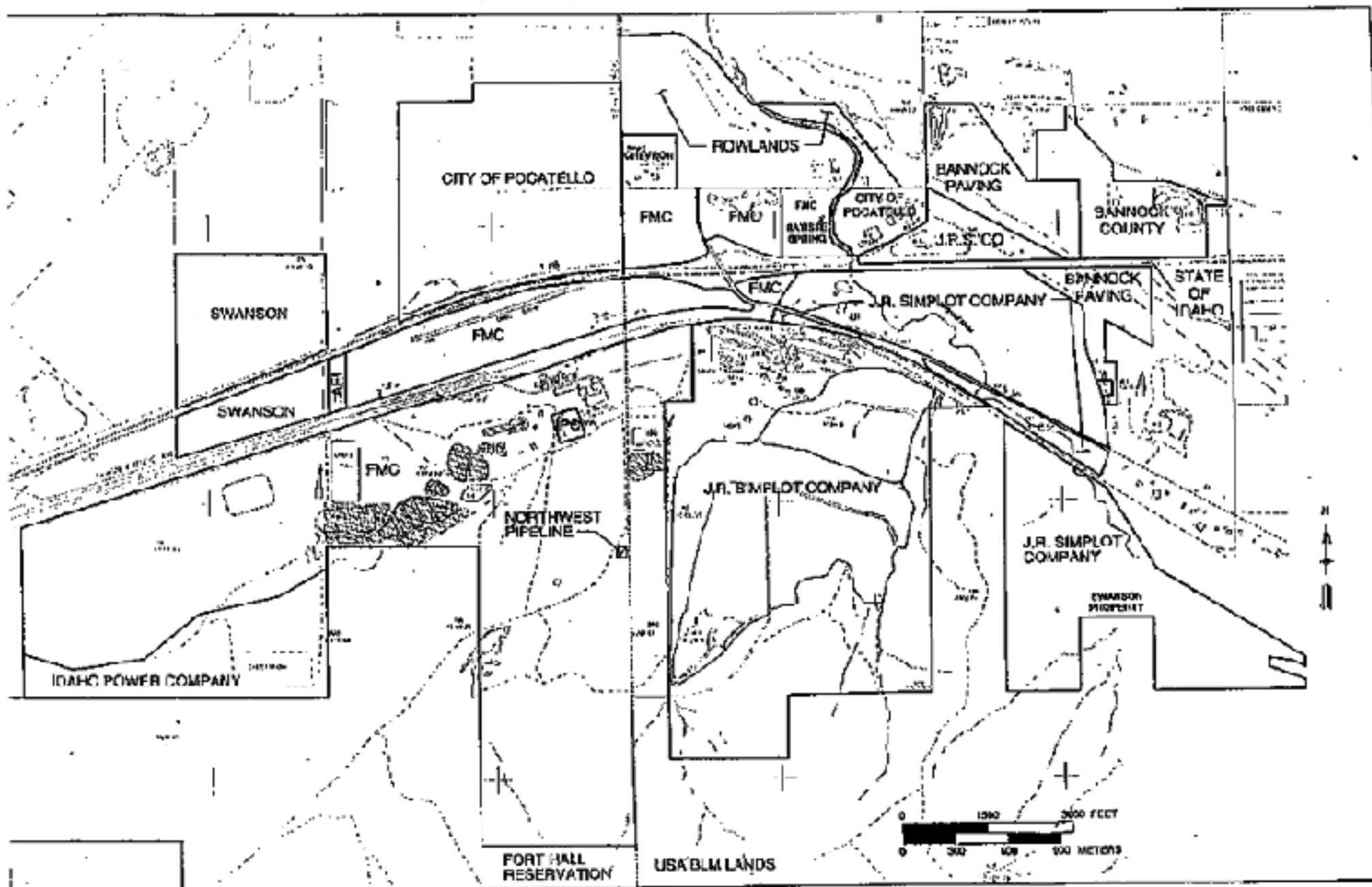
- RIVER
- INTERMITTENT STREAM
- SPRING
- TOPOGRAPHIC CONTOUR
- UNION PACIFIC RAILROAD
- CANAL

Contour Intervals
 Above 4500 ft. elevation: 250 ft.
 Below 4500 ft. elevation: 50 ft.

Note:
 Base map adapted from Trimble, 1975,
 and from USGS Michaud (1971) and
 Pocatello North (1971) 7.5 minute
 topographic quadrangles.

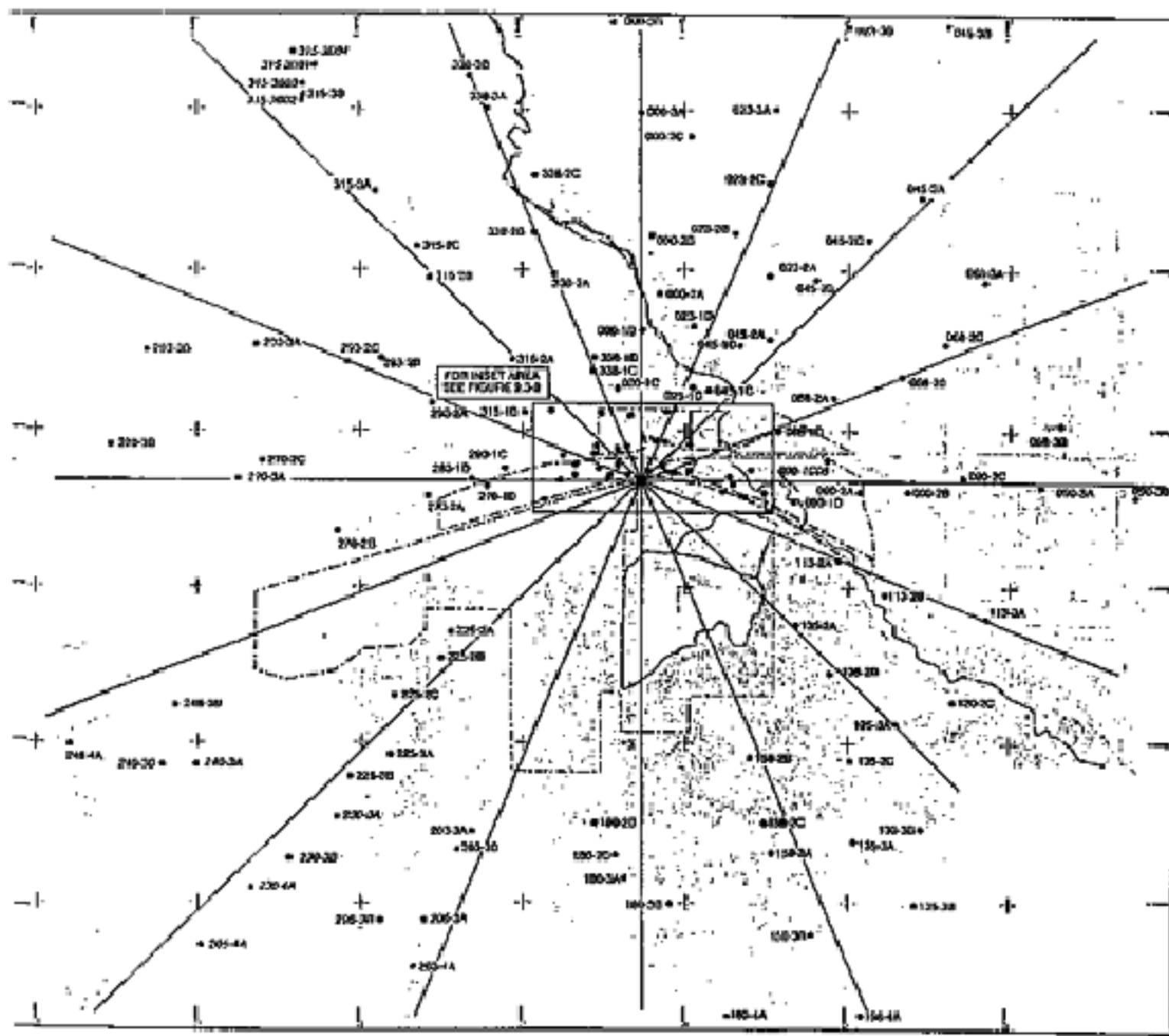


Appendix A, Figure I - Location
 Map for the Eastern Michaud
 Flats Contamination National
 Priorities List Site, Pocatello,
 Bannock County, Idaho



Appendix A, Figure 2 - Map Delineating Land Ownership near the FMC and J.R. Simplot Company Facilities, Eastern Michaud Flats Contamination National Priorities List Site, Pocatello, Bannock County, Idaho

Appendix A, Figure 3 - Location Map of the Surface Soil Sampling Sites not at the FMC or J.R. Simplot Facilities, Eastern Michaud Flats Contamination National Priorities List Site, Pocatello, Bannock County, Idaho



- Legend
- 315-30B ● Phase I soil sample location and designation
 - 215-30B1 ▲ Phase II soil sample location and designation
 - GUP Property Lines



Appendix B - Description of Comparison Values

Appendix B - Comparison Values

Comparison values for the Agency for Toxic Substances and Disease Registry (ATSDR) public health assessments and health consultations are contaminant concentrations that are found in specific media (air, soil, and water) and that are used to select contaminants for further evaluation. Comparison values are designed to be conservative and non-site specific, and therefore protective for all probable exposures. Their intended use is only to screen out contaminants which do not need further evaluation. **They are not intended to be used as clean-up levels or to be indicators of public health effects.** They are derived from toxicological information, using assumptions regarding body weights, ingestion rates, and exposure frequency and duration. Generally, the assumption used are very conservative (i.e., worst case). For example, soil health comparison values are developed for children who exhibit pica behavior. Soil ingestion in pica children (5 to 10 grams per day) greatly exceeds the soil ingestion rate for the normal population (0.1 grams per day).

There are two different types of comparison values, those based on carcinogenic (cancer-causing) effects, and those based on non-carcinogenic effects. Cancer-based comparison values are calculated from the U.S. Environmental Protection Agency's (EPA's) oral cancer slope factor or inhalation unit risk. They are calculated for a lifetime exposure (70 years), with an unacceptable excess lifetime cancer risk of one case per million persons exposed. Non-cancer comparison values are calculated from ATSDR's Minimal Risk Levels, or EPA's Reference Doses or Reference Concentrations. These values are calculated for adults, children, and small children who may eat large amounts of soil.

The comparison values used in the health consultation are listed and described below.

Cancer Risk Evaluation Guides (CREGs) are estimated concentrations that would be expected to cause no more than one excess cancer in a million persons exposed over a lifetime. CREGs are calculated from EPA's cancer slope factors.

Environmental Media Evaluation Guides (EMEGs) are based on ATSDR's minimal risk levels (MRLs) and factor in body weight and ingestion or inhalation rates. Separate EMEGs are developed for specific durations of exposure (acute, 1-14 days; intermediate, 15-364 days, and chronic, 365 days and longer).

EPA Screen are developed by EPA Superfund Office to be used to determine if any soil contamination at or near Superfund sites warrant further investigation.

Maximum Contaminant Levels (MCLs) are enforceable drinking water regulations that are protective of public health to the "extent feasible." National primary drinking water regulations

apply to all public water systems including community water systems and transient and non-transient noncommunity water systems. EPA promulgates MCLs.

For radiological contaminants, ATSDR uses information on radiation exposure and its effects related to environmental levels prepared by federal agencies, including EPA, DOE, and the Nuclear Regulatory Commission. The agency also uses other publicly available data sources and recommendations on radiation dose limits. The National Council on Radiation Protection and Measurements (NCRP), the International Commission on Radiological Protection (ICRP), and the United Nations Scientific Committee on the Effects of Atomic Radiation and others develop these sources.

Appendix C - Public Comments and ATSDR's Responses

Response to Comments Received during the Public Comment Period for the Eastern Michaud Flats Surface Soil Health Consultation

The Surface Soil Health Consultation for the Eastern Michaud Flats site was available for public review and comment from November 12 through December 19, 1997. We announced the Public Comment Period in The Idaho State Journal and the Sho-Ban News. ATSDR made copies of the health consult available at the Idaho State University Library and the Shoshone-Bannock Tribal Business Center. In addition, we sent the health consultation to 10 persons or organizations.

The comments and ATSDR's responses are summarized below.

Comment:

The health consultation provides only a cursory review of the wealth of knowledge developed for the Eastern Michaud Flats (EMF) site and the characterization of potential exposure which might impact human health. Greater detail and analyses have been incorporated in previously prepared documents and presentations in conjunction with the Remedial Investigation and Feasibility Studies under EPA's oversight.

Response:

ATSDR agrees that the health consultation does not provide an in-depth review of all the data and information available. The purpose of the health consultation is not to give a complete history of how and when the various environmental samples were taken. The health consultation is ATSDR's public health review of the available environmental data and information regarding the information and data concerning the Eastern Michaud Flats Contamination site. People requiring more detailed information about the environmental sampling results should review the referenced documents.

Comment:

The text of the health consultation indicates that the tables are a "summary" of the available sampling data. However, only maximum levels are reported in the table. In addition, the emphasis on maximum exposures overstates the possible risks.

Response:

The purpose of the tables are to select which contaminants may be at levels of health concern. The selected contaminants are then evaluated further in the document. The text of the health consultation has been modified to clarify this issue.

An explanation of comparison values is included in the appendices of the health consultation. This explanation clearly states that comparison values are not intended to be used as clean-up levels or to be indicators of public health effects.

In the discussion section of the health consultation, ATSDR discusses the range of possible exposures that may have occurred. Mean concentrations of exposure were used to determine if people were chronically exposed to contaminants at levels of health concern. Maximum concentrations of exposure were not used to determine if people were exposed chronically to contaminants at levels of health concern.

Comment:

ATSDR should have used the same cadmium bioavailability factor used by the U.S. Environmental Protection Agency (50% instead of 100%). In addition, the U.S. Environmental Protection Agency used a soil ingestion rate of 50 mg/day (ATSDR used 100 mg/day).

Response:

ATSDR has recalculated the soil ingestion exposure evaluation using a cadmium bioavailability factor of 50% and a soil ingestion rate of 50 mg/day.

However, the important public health message is that smokers may already be exposed to levels of cadmium above that which may result in proteinuria, not including any exposures to environmental contaminants. Therefore, any additional exposures to cadmium may increase a smoker's risk of proteinuria. ATSDR has modified the discussion section and the conclusions to clarify this issue.

Comment:

The consultation fails to note that extensive actions have already been implemented by FMC to reduce worker exposures (i.e., roads have been paved and specific areas have been capped to prevent both direct contact and fugitive emission releases).

Response:

ATSDR has added this information to the consultation.

Comment:

The health consultation does not adequately explain the source of environmental data gathered.

Response:

A brief description of when and how the surface soil samples were collected is presented on page 2 of the health consultation. We reference all of the data sources in the health consultation. The purpose of the health consultation is not to give a complete history of how and when the various environmental samples were taken. The health consultation is ATSDR's public health review of the available environmental data and information regarding the surface soil contamination at and near the Eastern Michaud Flats Contamination site.

People requiring more detailed information about the environmental sampling results should review the referenced documents.

Comment:

The health consultation does not address the potential for Tribal members to be exposed to contaminants through the food chain.

Response:

ATSDR has discussed this concern with the Tribal Business Council. ATSDR has agreed to evaluate the potential for Tribal members to be exposed to contaminants through the food chain in a separate health consultation. To conduct this evaluation, ATSDR has requested that the Tribes give ATSDR specific information concerning the particular plants and animals Tribal members may consume.

Comment:

Because years have passed since the Remedial Investigation was conducted at the Eastern Michaud Flats Contamination site, ATSDR should sample the soil in and near the site to ensure that the soil contamination has not increased in concentration.

Response:

The surface soil contamination found near the Eastern Michaud Flats Contamination site occurred primarily because of the air discharges (1949 to present) from the two facilities.

These discharges have been significantly reduced in the last 10 years. Therefore, it is doubtful that the surface soil contamination has significantly increased since the surface soil samples were taken in 1992-5.

Comment:

ATSDR should gather more information about community concerns.

Response:

To date, ATSDR has conducted four community availability/public meetings regarding the Eastern Michaud Flats Contamination site. During those meetings, ATSDR has been available so that the public could present their concerns. In addition, ATSDR staff is available to talk with the community via telephone or letter. Various members of the community have contacted ATSDR and we will continue to be available to talk with the community. The public will have other opportunities to discuss their concerns at future ATSDR meetings.

Comment:

ATSDR should use health data during their evaluation of the Eastern Michaud Flats Contamination site.

Response:

As promised, ATSDR is collecting the available health data from the State of Idaho and the Indian Health Service. We will evaluate and present this data to the community in a separate health consult.

Comment:

In the Discussion section on cadmium, the report states: "The particle sizes of surface soil are probably too large to be deposited into the lung..." The data available from the air monitoring stations near the site do not support this finding.

Response:

The referenced section only discusses surface soil contamination. ATSDR agrees that particulates discharged to the air from the facilities are within the range that could be deposited into the lung. We will evaluate and discuss these discharges in the air health consultation that ATSDR is presently preparing.

Comment:

ATSDR should evaluate the maximally exposed individuals (rail road workers, highway crews, and the public that uses the frontage road). Also, the public participation at the drag-races on FMC property should be considered.

Response:

On page 3 of the health consultation, ATSDR states that the public, which includes all of the individuals discussed above, is unlikely to come in contact with site-related surface soil contamination for a sufficient amount of time (a significant portion of a lifetime continuously). ATSDR further states that people attending or participating in the drag races or softball/baseball games directly across the street from the two facilities are unlikely to come in contact with a significant amount of surface soil contaminants.

Comment:

ATSDR should evaluate the additional radiation information available from the Tribes.

Response:

The additional radiation information is from air sampling activities conducted by the Tribes and the U.S. Environmental Protection Agency. ATSDR will evaluate this information along with all of the other air sampling information in the air health consultation presently being developed.

Comment:

The health consultation concludes that deed restrictions have been placed on the property across from the plants. The Land Use Policy Commissioners of the Tribes is not aware of any deed restrictions on the property.

Response:

Information provided by FMC indicates that actions have been or are being taken to assure that any area which might pose health risks are restricted from future residential land use. FMC has already deed restricted FMC-owned properties. FMC has also indicated that other off-site areas of potential concern will also be precluded from residential use as a part of the Record of Decision with the U.S. Environmental Protection Agency.

Comment:

ATSDR should recommend that appropriate remedial actions be taken to prevent the surface soil contaminants from becoming airborne and accessible to the public.

Response:

The health consultation states in the conclusion section that it is unlikely that the public has been, is currently or will be exposed to significant levels of site-related surface soil contamination. Therefore, it would not be appropriate for ATSDR to make a recommendation similar to what is stated in the comment.

Comment:

ATSDR should issue a "Summary" report that combines all of the risks the site may present through multiple pathways of exposure.

Response:

ATSDR will issue of "Summary" report. The report will be a public health assessment. Each of the health consultations developed by ATSDR will be included in the appendix of the public health assessment.

Review and Approval Page

Review and Approval of Health Consultation for Eastern Michaud Flats Contamination National Priorities List Site, Pocatello, Bannock County, Idaho.

Concurrence:

Branch Chief, SSAB, DHAC

Date

Appendix G

Health Consultation: Surface Water and Sediment Contamination at the Eastern Michaud Flats Contamination Site

HEALTH CONSULTATION

SURFACE WATER AND SEDIMENT CONTAMINATION

at the

**EASTERN MICHAUD FLATS CONTAMINATION
POCATELLO, BANNOCK COUNTY, IDAHO
CERCLIS NO. IDD984666610**

October 9 , 1998

**U.S. Department of Health & Human Services
Public Health Service
Agency for Toxic Substances and Disease Registry**

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I. Purpose

As recommended in the March 11, 1997, Site Review and Up-Date for the Eastern Michaud Flats Contamination National Priorities List (NPL) site (1), the Agency for Toxic Substances and Disease Registry (ATSDR) committed to reviewing recently released environmental data generated by the Remedial Investigation conducted at this site. The Remedial Investigation (2) provides most of the data and information needed by ATSDR to re-evaluate human exposure pathways associated with the Eastern Michaud Flats Contamination NPL site. ATSDR had previously evaluated the potential for human exposures to site-related contaminants in the 1990 Preliminary Public Health Assessment (3). Specifically, ATSDR will develop health consultations that address the potential for human exposures (past, present, and future) to site-related contaminants in the groundwater, surface water and sediment, surface soil, biota, and ambient air. This health consultation will evaluate the potential for human exposures to site-related contaminants in surface water and sediment.

This health consultation will focus on characterizing the surface water and sediment contamination at and off the two facilities that are a part of the Eastern Michaud Flats NPL site. It does not attempt to characterize any contamination that may exist inside the facility buildings or the exposures the workers may experience within those buildings. Exposures that may occur to workers inside the buildings are regulated by the Occupational Safety and Health Administration (OSHA) and can be evaluated, if so requested, by the National Institute of Occupational Safety and Health (NIOSH), Centers for Disease Control and Prevention (CDC).

II. Background and Statement of Issues

The Eastern Michaud Flats Contamination NPL site is located west of Pocatello, Idaho (1-3). Two manufacturing facilities, FMC Elemental Phosphorus Plant and Simplot Don Plant, are located on the NPL site (see Appendix A, Figure 1 for location map).

The FMC facility, FMC Elemental Phosphorus Plant, covers an estimated 1,189 acres and adjoins the western boundary of the Simplot Don Plant (2). Approximately 560 people are employed at the FMC Elemental Phosphorus Plant. Elemental phosphorus production at the facility has changed little since the plant operations began in 1949. Phosphate-bearing shale is shipped to FMC via the Union Pacific Railroad during the summer months. Ore cannot be shipped during the winter months because the ore tends to freeze in the rail cars. Therefore, the ore is stockpiled at the facility. Ore from the stockpiles is processed in four electric arc furnaces. The furnace reaction yields gaseous elemental phosphorus in addition to by-products, some of which contain radiological components. The elemental phosphorus is subsequently condensed to a liquid state and eventually shipped off-site. Approximately 1.5 million tons of ore are processed at the plant annually. The disposal of by-product waste material at and around the

facility has resulted in slag piles covering large areas of land. In addition, air emissions (fugitive and direct discharges) from the facility have contributed to the environmental contamination associated with the Eastern Michaud Flats Contamination NPL site.

Wastewater generated by the FMC manufacturing processes can be categorized as phosphy water, precipitator slurry, scrubber blowdown, or noncontact cooling water (2). Phosphy water, precipitator slurry, and scrubber blowdown are discharged into various treatment ponds at the FMC facility. The treatment ponds facilitate the settling of solids from the wastewaters and provide for evaporation of water. Some of the water discharged to the phosphy water, precipitator slurry and scrubber blowdown treatment ponds is recycled back to the manufacturing processes. In contrast, noncontact cooling water (i.e., secondary cooling loops, furnace cooling, and calciner water beams) from the FMC facility is sent to the on-site industrial wastewater basin for cooling and then discharged into the Portneuf River (see Appendix A, Figure 2).

The Simplot Don Plant covers approximately 745 acres and adjoins the eastern property boundary of the FMC facility (2). Around 460 people work at the Simplot Don Plant. The plant began production of single superphosphate fertilizer in 1944. In 1954, the facility began producing phosphoric acid. The phosphoric acid is presently produced by using a wet (aqueous) process. Formerly phosphate ore was transported from the mines to the facility via rail. As of September 1991, the Simplot plant receives phosphate ore through a slurry pipeline. The phosphate ore slurry is processed at the Simplot Don Plant in phosphoric acid reactors and then further processed into a variety of solid and liquid fertilizers. The plant produces 12 principal products, including five grades of solid fertilizers and four grades of liquid fertilizers. The disposal of by-product waste material (e.g., gypsum) at and around the facility and air emissions (fugitive and direct discharges) from the facility have contributed to the environmental contamination associated with the Eastern Michaud Flats Contamination NPL site.

The Simplot Don Plant recycles industrial wastewater back into the manufacturing processes (2). Noncontact wastewater (e.g., cooling tower blow down) from the J.R. Simplot facility is spray irrigated along with the City of Pocatello wastewater. Prior to July 1980, the J.R. Simplot facility discharged the noncontact wastewater into the Portneuf River.

Neither facility is not located near any large population centers. The nearest residence is approximately one mile north of the facilities (1-3). The plant boundaries are fenced. Representatives of FMC and Simplot have told ATSDR that trespassers are rarely found on their facilities. In addition, the land directly across US 30 from the plants is predominantly owned by either FMC or Simplot (see Appendix A, Figure 3). Deed restrictions to prevent future residential development have or will be placed on the properties across from the plants. Currently some of the land across US 30 is used for a drag racing strip (the old airport runway) and for a softball/baseball field (on Simplot property).

During the Remedial Investigation (RI) for this NPL site, an extensive surface water and sediment sampling and analysis program was undertaken (2). Tables 1 through 4 present the maximum results of the surface water and sediment sampling and analysis program. Samples (surface water and sediment) were taken from each of the treatment ponds and the ditches at both facilities as well as upstream and downstream of the FMC Corporation discharge point into the Portneuf River (sampling station number 17). As indicated in Appendix B, comparing the maximum results of the surface water and sediment sampling and analysis program to comparison values is conducted to select contaminants for further evaluation.

III. Discussion

The highest surface water and sediment contamination is located in the wastewater ponds found at the two facilities (see Tables 1 and 2). Analytical results of samples taken in the Portneuf River have demonstrated that the FMC discharge has not resulted in any significant contamination of the river (i.e., no contamination was found at levels of health concern) (see Tables 3 and 4).

Because of the location of the ponds and the operational procedures used (e.g., site restrictions), it is doubtful that the general public would come in contact with the contaminated surface water and sediment contained in the ponds. In addition, no contamination at levels of health concern was found in the Portneuf River. Therefore, it is very unlikely that the general public's health has been or will be impacted by any of the surface water or sediment contamination found at the Eastern Michaud Flats Contamination NPL site.

The only people who may come in contact with contaminated surface water and sediment are workers at the FMC and Simplot facilities (specifically workers responsible for the operation of the wastewater ponds). However, the length and frequency of contact with contaminated surface water and sediment is probably very short and infrequent. The wastewater operating procedures used at the facilities do not require frequent or intensive human involvement. Normal occupational safety procedures (e.g., wearing of safety gear -- gloves and eye protection) would further reduce the possibility of workers ingesting contaminated surface water and sediment. In addition, the level of contamination found in the on-site ponds are not at levels that could result in health impacts after a one time exposure (i.e., accidental ingestion). Therefore, it is doubtful that FMC or Simplot workers have been or will be exposed to any significant amounts of contaminated surface water or sediment that could impact their health.

IV. Conclusions

Based upon the data and information reviewed, the Agency for Toxic Substances and Disease Registry has drawn the following conclusions:

1. It is unlikely that the general public, including children, has been, is currently, or will be exposed to significant levels of site-related surface water or sediment contamination. Therefore, it is unlikely that any adverse human health effects have or will occur because of site-related surface water or sediment contamination. The nearest residence to the FMC and Simplot facilities is over one mile away. Analytical results of surface water and sediment samples indicate that there is not any site-related contamination at levels of public health concern in the Portneuf River. In addition, very few people trespass onto the facilities.
2. It is unlikely that FMC or Simplot workers have been, are currently, or will be exposed to significant levels of site-related surface water or sediment contamination. Therefore, it is unlikely that any adverse human health effects have or will occur because of site-related surface water or sediment contamination. The wastewater operational procedures used at the facilities do not require frequent or intensive human involvement. Therefore, frequent human contact (chronic exposures) with contaminated surface water or sediment is unlikely. In addition, normal occupational safety procedures (e.g., wearing of safety gear -- gloves and eye protection) would further reduce the possibility of workers ingesting contaminated surface water and sediment. Also, the levels of contamination found in the wastewater ponds are not high enough to be considered acute health hazards (one time exposures).
3. Given the unlikelihood of worker or general public exposures to site-related contaminants in surface water or sediment, ATSDR has classified the Eastern Michaud Flats Contamination NPL site as a No Apparent Public Health Hazard as it relates to surface water and sediment.

V. Recommendations

ATSDR makes the following recommendation:

Appropriate worker safety procedures should continue to prevent workers from accidentally ingesting contaminated surface water and sediment.

VI. Prepared By

Sven E. Rodenbeck, Sc.D., P.E., DEE
Environmental Engineer Consultant
Section A, Superfund Site Assessment Branch
Division of Health Assessment and Consultation
Agency for Toxic Substances and Disease Registry

VII. References

1. Agency for Toxic Substances and Disease Registry (ATSDR). Site Review and Up-Date for Eastern Michaud Flats Contamination, Pocatello, Bannock County, Idaho. Atlanta, Georgia: U.S. Department of Health and Human Services, Public Health Service; March 11, 1997.
2. Bechtel Environmental, Inc. Remedial Investigation Report for the Eastern Michaud Flats Site. San Francisco: Bechtel Environmental, Inc.; August 1996.
3. ATSDR. Preliminary Public Health Assessment for Eastern Michaud Flats Contamination, Pocatello, Bannock County, Idaho. Atlanta, Georgia: U.S. Department of Health and Human Services, Public Health Service; August 24, 1990.

Table 1 - Maximum Site-Related Surface Water Contamination Found at the FMC or J.R. Simplot Facilities, Eastern Michaud Flats Contamination National Priorities List Site, Pocatello, Bannock County, Idaho

Contaminant	Maximum Concentration at the FMC Facility	Maximum Concentration at the J.R. Simplot Facility	Comparison Value for Ingestion and Source*
Metals, Nutrients, and Fluoride (milligrams per liter)			
Arsenic (Total)	6.0	0.04	0.01 EMEG
Boron (Total)	6.8	0.51	0.4 Intermediate EMEG
Cadmium (Total)	5,268	0.54	0.007 EMEG
Chromium (Total)	3.0	0.42	0.1 LTHA
Fluoride	1,250	26.6	4 MCLG
Nitrate as Nitrogen	18.4	4.2	10 MCL
Selenium (Total)	6.3	0.12	0.02 EMEG
Sulfate	19,800	2,590	500 MCLG
Radiological Parameters (picocuries per liter)			
Gross Alpha	232	360	15 MCL
Gross Beta	9,720	272	50 MCL
* - A description of the various comparison values is presented in Appendix B. Unless indicated otherwise, the comparison values listed are for chronic exposures (greater than 365 days).			
Note: The concentrations reported for the FMC facility have been adjusted (increased 150%) because the facility now uses a richer ore than previously.			

Table 2 - Maximum Site-Related Sediment Contamination Found at the FMC or J.R. Simplot Facilities, Eastern Michaud Flats Contamination National Priorities List Site, Pocatello, Bannock County, Idaho

Contaminant	Maximum Concentration at FMC Facility	Maximum Concentration at J.R. Simplot Facility	Comparison Value for Ingestion and Source*
Metals, Nutrients, and Fluoride (milligrams per kilogram)			
Arsenic	256	13.0	0.5 CREG
Boron	2,640	193	7,000 Adult Intermediate EMEG
Cadmium	2,410	108	500 Adult EMEG
Chromium	677	2,350	4,000 Adult EMEG
Fluoride	191,000	25,900	35,000 Adult EMEG
Selenium	49.6	61.2	1,000 Adult EMEG
Radiological Parameters (picocuries per gram)			
Gross Alpha	299	131	15
Gross Beta	783	64	50
* = A description of the various comparison values is presented in Appendix B. Unless indicated otherwise, the comparison values listed are for chronic exposures (greater than 365 days).			

Table 3 - Maximum Surface Water Contamination Found in the Portneuf River Beyond the FMC or J.R. Simplot Facility Fence Lines, Eastern Michaud Flats National Priorities List Site, Pocatello, Bannock County, Idaho

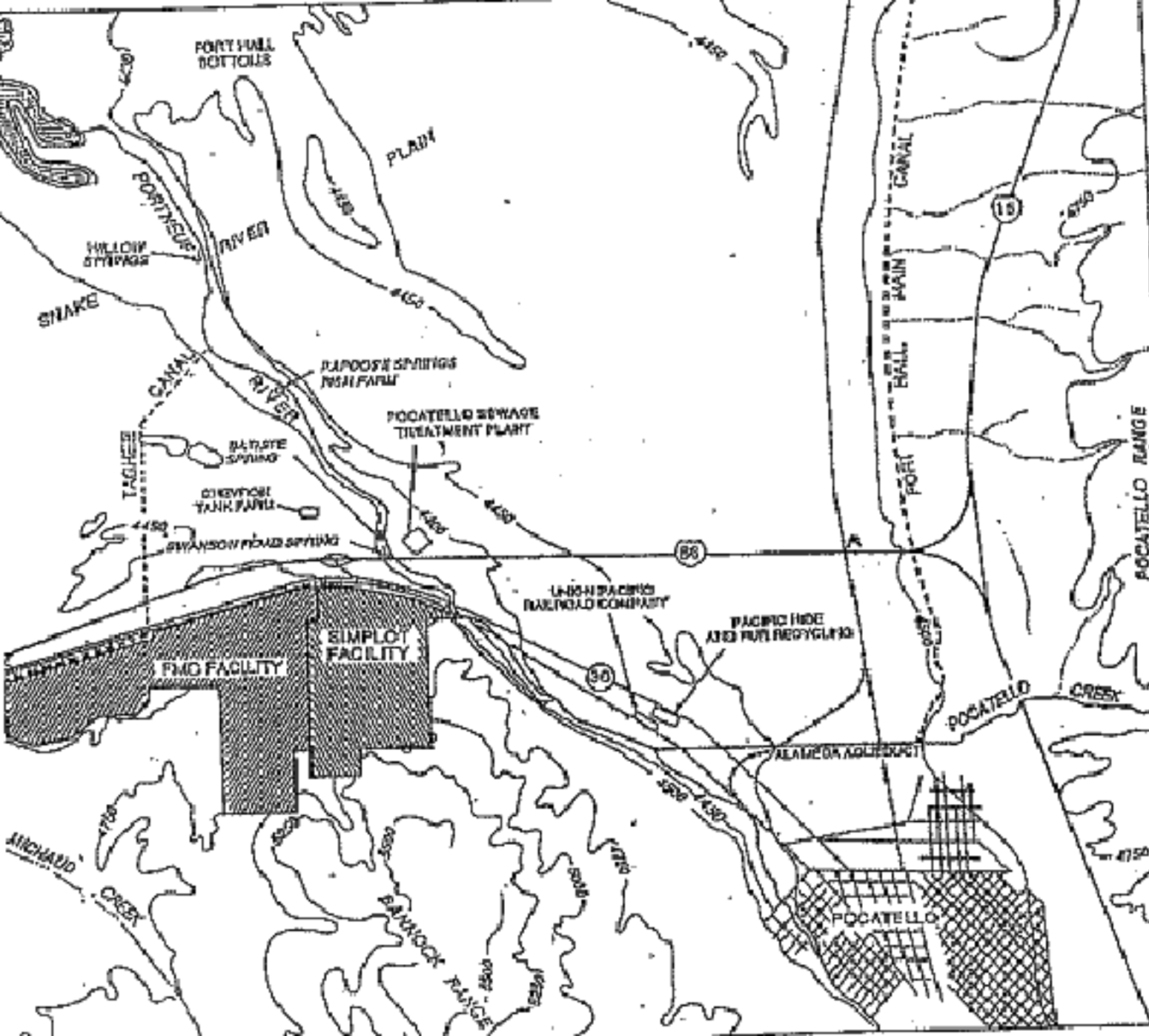
Contaminant	Maximum Concentration in the Portneuf River near the Facilities	Maximum Concentration in the Portneuf River Up-Stream from the Facilities	Comparison Value for Ingestion and Source*
Metals, Nutrients, and Fluoride (milligrams per liter)			
Arsenic (Total)	0.006	0.014	0.01 EMEG
Boron (Total)	0.38	0.33	0.4 Intermediate EMEG
Cadmium (Total)	0.0003	0.001	0.007 EMEG
Chromium (Total)	0.002	0.001	0.1 LTHA
Fluoride	0.65	0.39	4 MCLG
Nitrate as Nitrogen	1.3	1.2	10 MCL
Selenium (Total)	0.005	0.013	0.02 EMEG
Sulfate	65	50	500 MCLG
Radiological Parameters (picocuries per liter)			
Gross Alpha	5.8	4.9	15 MCL
Gross Beta	4.9	9.8	50 MCL
* - A description of the various comparison values is presented in Appendix B. Unless indicated otherwise, the comparison values listed are for chronic exposures (greater than 365 days).			

Table 4 - Maximum Sediment Contamination Found in the Portneuf River Beyond the FMC or J.R. Simplot Facility Fence Lines, Eastern Michaud Flats National Priorities List Site, Pocatello, Bannock County, Idaho

Contaminant	Maximum Concentration in the Portneuf River near the Facilities	Maximum Concentration in the Portneuf River Up-Stream from the Facilities	Comparison Value for Ingestion and Source*
Metals, Nutrients, and Fluoride (milligrams per kilogram)			
Arsenic	3.7	9.9	0.5 CREG
Boron	10.3	13.2	7,000 Adult Intermediate EMEG
Cadmium	22.2	0.82	500 Adult EMEG
Chromium	10.6	5.1	4,000 Adult EMEG
Fluoride	3,080	550	35,000 Adult EMEG
Selenium	0.88	0.72	1,000 Adult EMEG
Radiological Parameters (picocuries per gram)			
Gross Alpha	29.2	13.6	15
Gross Beta	30	25.3	50
* - A description of the various comparison values is presented in Appendix B. Unless indicated otherwise, the comparison values listed are for chronic exposures (greater than 365 days).			

Appendices

Appendix A - Figures



EXPLANATION

	RIVER
	INTERMITTENT STREAM
	SPRING
	TOPOGRAPHIC CONTOUR
	UNION PACIFIC RAILROAD
	CANAL

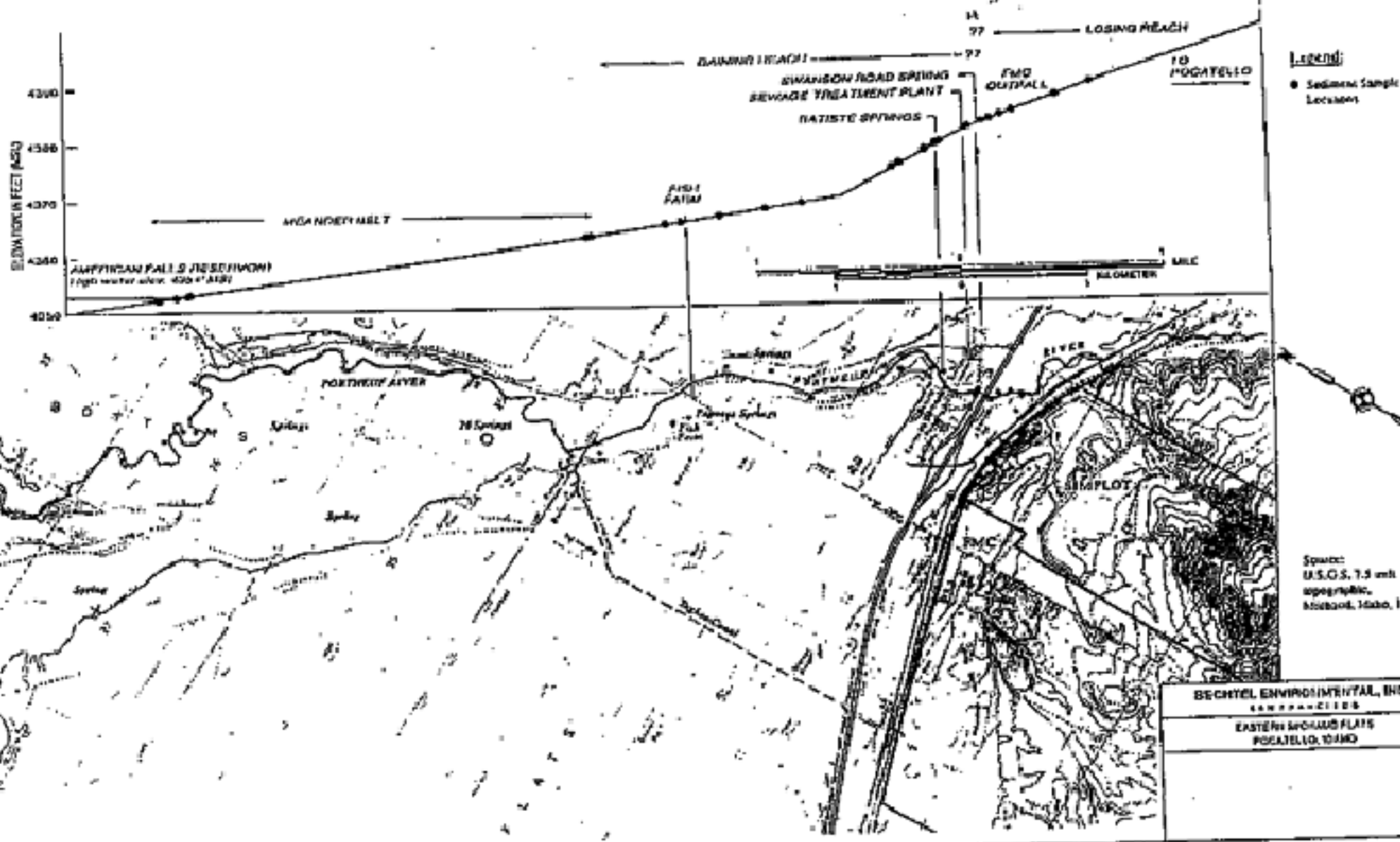
Contour Intervals
 Above 4500 ft. elevation: 250 ft.
 Below 4500 ft. elevation: 50 ft.

Note:
 Base map adapted from Trimble, 1975,
 and from USGS Michaud (1971) and
 Pocatello North (1971) 7.5 minute
 topographic quadrangles.

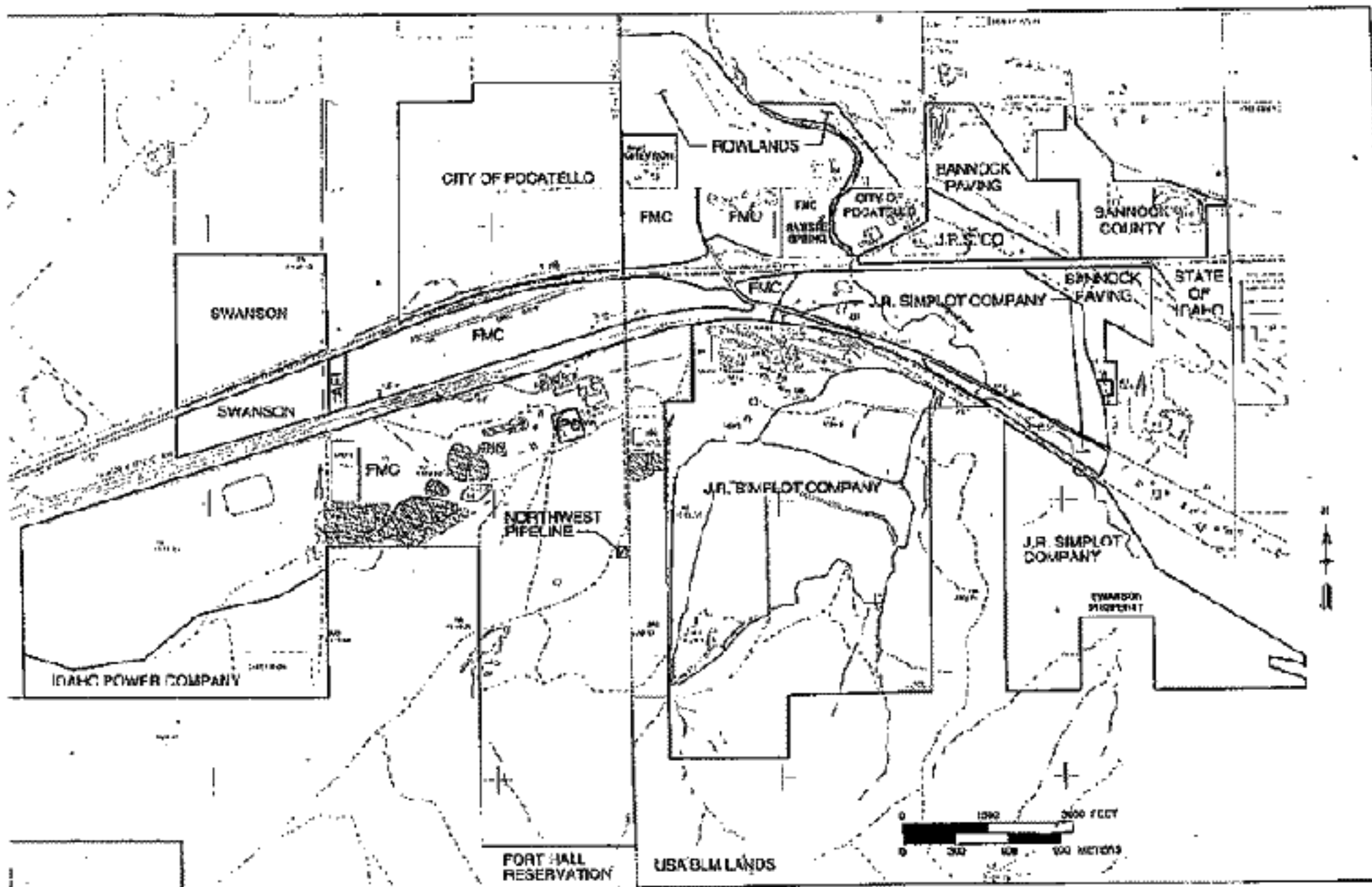


Appendix A, Figure I - Location
 Map for the Eastern Michaud
 Flats Contamination National
 Priorities List Site, Pocatello,
 Bannock County, Idaho

PORTNEUF RIVER PROFILE



Appendix A, Figure 2 - Map Delineating the FMC Waste Water Discharge Point (Outfall) into the Portneuf River and the Areas Sample in the Portneuf River for Site-Related Contaminants, Eastern Michigand Flats Contamination National Priority List Site, Pocatello, Bannock County, Idaho



Appendix A, Figure 3 - Map Delineating Land Ownership near the FMC and J.R. Simplot Company Facilities, Eastern Michaud Flats Contamination National Priorities List Site, Pocatello, Bannock County, Idaho

Appendix B - Description of Comparison Values

Appendix B - Comparison Values

Comparison values for the Agency for Toxic Substances and Disease Registry (ATSDR) public health assessments and health consultations are contaminant concentrations that are found in specific media (air, soil, and water) and that are used to select contaminants for further evaluation. Comparison values are designed to be conservative and non-site specific, and therefore protective for all probable exposures. Their intended use is only to screen out contaminants which do not need further evaluation. **They are not intended to be used as clean-up levels or to be indicators of public health effects.** They are derived from toxicological information, using assumptions regarding body weights, ingestion rates, and exposure frequency and duration. Generally, the assumption used are very conservative (i.e., worst case). For example, soil health comparison values are developed for children who exhibit pica behavior. Soil ingestion in pica children (5 to 10 grams per day) greatly exceeds the soil ingestion rate for the normal population (0.1 grams per day).

There are two different types of comparison values, those based on carcinogenic (cancer-causing) effects, and those based on non-carcinogenic effects. Cancer-based comparison values are calculated from the U.S. Environmental Protection Agency's (EPA's) oral cancer slope factor or inhalation unit risk. They are calculated for a lifetime (70 years) exposure, with an excess lifetime cancer risk of one case per million persons exposed. Non-cancer comparison values are calculated from ATSDR's Minimal Risk Levels, or EPA's Reference Doses or Reference Concentrations. These values are calculated for adults, children, and small children who may eat large amounts of soil.

The comparison values used in the health consultation are listed and described below.

Cancer Risk Evaluation Guides (CREGs) are estimated concentrations that would be expected to cause no more than one excess cancer in a million persons exposed over a lifetime. CREGs are calculated from EPA's cancer slope factors.

Environmental Media Evaluation Guides (EMEGs) are based on ATSDR's minimal risk levels (MRLs) and factor in body weight and ingestion or inhalation rates. Separate EMEGs are developed for specific durations of exposure (acute, 1-14 days; intermediate, 15-364 days, and chronic, 365 days and longer).

Maximum Contaminant Levels (MCLs) are enforceable drinking water regulations that are protective of public health to the "extent feasible." National primary drinking water regulations apply to all public water systems including community water systems and transient and non-transient noncommunity water systems. EPA promulgates MCLs.

Life Time Health Advisories (LTHAs) are developed by the EPA. LTHAs are lifetime exposure levels specific for drinking water (assuming 20 percent of an individual's exposure comes from drinking water) at which adverse, non-carcinogenic health effects would not be expected to occur.

Maximum Contaminant Level Goals (MCLGs) are drinking water health goals. MCLGs are set at a level at which, in the EPA Administrator's judgement, "no known or anticipated adverse effect on human health occurs and which allows an adequate margin of safety."

For radiological contaminants, ATSDR uses information on radiation exposure and its effects related to environmental levels prepared by federal agencies, including EPA, DOE, and the Nuclear Regulatory Commission. The agency also uses other publicly available data sources and recommendations on radiation dose limits. The National Council on Radiation Protection and Measurements (NCRP), the International Commission on Radiological Protection (ICRP), and the United Nations Scientific Committee on the Effects of Atomic Radiation and others develop these sources.

Appendix C - Public Comments and ATSDR's Responses

Response to Comments Received during the Public Comment Period for the Eastern Michaud Flats Surface Water and Sediment Health Consultation

The Surface Water and Sediment Health Consultation for the Eastern Michaud Flats site was available for public review and comment from November 12 through December 19, 1997. We announced the Public Comment Period in The Idaho State Journal and the Sho-Ban News. ATSDR made copies of the health consult available at the Idaho State University Library and the Shoshone-Bannock Tribal Business Center. In addition, we sent the health consultation to 10 persons or organizations.

The comments and ATSDR's responses are summarized below.

Comment:

The health consultation provides only a cursory review of the wealth of knowledge developed for the Eastern Michaud Flats (EMF) site and the characterization of potential exposure which might impact human health. Greater detail and analyses have been incorporated in previously prepared documents and presentations in conjunction with the Remedial Investigation and Feasibility Studies under EPA's oversight.

Response:

ATSDR agrees that the health consultation does not provide an in-depth review of all the data and information available. The purpose of the health consultation is not to give a complete history of how and when the various environmental samples were taken. The health consultation is ATSDR's public health review of the available environmental data and information regarding the information and data concerning the Eastern Michaud Flats Contamination site. People requiring more detailed information about the environmental sampling results should review the referenced documents.

Comment:

The text of the health consultation indicates that the tables are a "summary" of the available sampling data. However, only maximum levels are reported in the table. In addition, the emphasis on maximum exposures overstates the possible risks.

Response:

The purpose of the tables are to select which contaminants may be at levels of health concern. The selected contaminants are then evaluated further in the document. The text of the health consultation has been modified to clarify this issue.

An explanation of comparison values is included in the appendices of the health consultation. This explanation clearly states that comparison values are not intended to be used as clean-up levels or to be indicators of public health effects.

In the discussion section of the health consultation, ATSDR discusses the range of possible exposures that may have occurred. Mean concentrations of exposure were used to determine if people were chronically exposed to contaminants at levels of health concern. Maximum concentrations of exposure were not used to determine if people were exposed chronically to contaminants at levels of health concern.

Review and Approval Page

Review and Approval of Health Consultation for Eastern Michaud Flats Contamination National Priorities List Site, Pocatello, Bannock County, Idaho.

Concurrence:

Branch Chief, SSAB, DHAC

Date

Appendix H

Health Consultation: Groundwater Contamination at the Eastern Michaud Flats Contamination Site

HEALTH CONSULTATION

GROUNDWATER CONTAMINATION

at the

**EASTERN MICHAUD FLATS CONTAMINATION
POCATELLO, BANNOCK COUNTY, IDAHO
CERCLIS NO. IDD984666610**

October 9, 1998

**U.S. Department of Health & Human Services
Public Health Service
Agency for Toxic Substances and Disease Registry**

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I. Purpose

As recommended in the March 11, 1997, Site Review and Up-Date for the Eastern Michaud Flats Contamination National Priorities List (NPL) site (1), the Agency for Toxic Substances and Disease Registry (ATSDR) committed to reviewing recently released environmental data generated by the Remedial Investigation conducted at this site. The Remedial Investigation (2) provides most of the data and information needed by ATSDR to re-evaluate human exposure pathways associated with the Eastern Michaud Flats Contamination NPL site. ATSDR had previously evaluated the potential for human exposures to site-related contaminants in the 1990 Preliminary Public Health Assessment (3). Specifically, ATSDR will develop health consultations that address the potential for human exposures (past, present, and future) to site-related contaminants in the groundwater, surface water and sediment, surface soil, biota, and ambient air. This health consultation will evaluate the potential for human exposures to site-related contaminants in groundwater.

II. Background and Statement of Issues

The Eastern Michaud Flats Contamination NPL site is located west of Pocatello, Idaho (1-3). Two manufacturing facilities, FMC Corporation and J.R. Simplot Company, are located on the NPL site (see Appendix A, Figure 1 for location map).

The FMC facility, FMC Elemental Phosphorus Plant, covers an estimated 1,189 acres and adjoins the western boundary of the Simplot Don Plant (2). Elemental phosphorus production at the facility has changed little since the plant operations began in 1949. Phosphate-bearing shale is shipped to FMC via the Union Pacific Railroad during the summer months. Ore cannot be shipped during the winter months because the ore tends to freeze in the rail cars. Therefore, the ore is stockpiled at the facility. Ore from the stockpiles is processed in four electric arc furnaces. The furnace reaction yields gaseous elemental phosphorus in addition to by-products, some of which contain radiological components. The elemental phosphorus is subsequently condensed to a liquid state and eventually shipped off-site. Approximately 1.5 million tons of ore are processed at the plant annually. The disposal of by-product waste material at and around the facility has resulted in slag piles covering large areas of land. In addition, air emissions (fugitive and direct discharges) from the facility have contributed to the environmental contamination associated with the Eastern Michaud Flats Contamination NPL site.

The Simplot Don Plant covers approximately 745 acres and adjoins the eastern property boundary of the FMC facility (2). The plant began production of single superphosphate fertilizer in 1944. In 1954, the facility began producing phosphoric acid. The phosphoric acid is presently produced by using a wet (aqueous) process. Formerly phosphate ore was transported from the mines to the facility via rail. As of September 1991, the Simplot plant receives

phosphate ore through a slurry pipeline. The phosphate ore slurry is processed at the Simplot Don Plant in phosphoric acid reactors and then further processed into a variety of solid and liquid fertilizers. The plant produces 12 principal products, including five grades of solid fertilizers and four grades of liquid fertilizers. The disposal of by-product waste material at and around the facility and air emissions (fugitive and direct discharges) from the facility have contributed to the environmental contamination associated with the Eastern Michaud Flats Contamination NPL site.

Since 1972, the State of Idaho, the U.S. Geological Survey, the U.S. Environmental Protection Agency (EPA), and the owners of the two facilities have conducted various investigations at and around the two facilities that make up the Eastern Michaud Flats Contamination NPL site (2,4). The results of these investigations indicated that the activities at the two facilities have resulted in the contamination of the surrounding environment. Because of the environmental contamination and the potential for human exposure to the contaminants, the EPA placed the site on the NPL.

Based upon the various investigations, it has been determined that there are two separate aquifers (shallow and deeper) underlying the Eastern Michaud Flats Contamination NPL site (2). The shallow aquifer is a 10 to 20-foot thick gravel and sand aquifer that is locally overlain by a silt aquitard. The deeper aquifer is the gravel unit of the Sunbeam Formation and the underlying basalt and rhyolite. These two aquifers are separated by an aquitard, American Falls Lake Beds.

Analysis of groundwater samples taken from the deeper aquifer indicate that no site-related contamination has entered the deeper aquifer at levels of health concern (2). However, analysis of groundwater samples taken from the shallow aquifer indicate that the activities at the two facilities have resulted in significant contamination of the shallow aquifer (2). Table 1 presents the maximum results of the shallow groundwater contamination investigation. Only those contaminants found above comparison values are presented in Table 1 (see Appendix B for an explanation of the comparison values and their purpose). As indicated in Appendix B, comparing the maximum results of the groundwater sampling and analysis program to comparison values is conducted to select contaminants for further evaluation.

Under the two facilities, the groundwater within the shallow aquifer tends to flow towards the Batiste Spring, the Swanson Road Spring, and the Portneuf River (2). The Batiste and Swanson Road Springs are major discharge points of the shallow groundwater that flows under the two facilities. It is there that the shallow groundwater discharges to the Portneuf River (via the Batiste and Swanson springs and direct groundwater migration through the river bed). The location of the springs is delineated on Appendix A, Figure 2.

Table 2 presents the maximum analytical results for samples taken from the Batiste and Swanson Road springs. As indicated in Appendix B, comparing the maximum results of the groundwater

sampling and analysis program to comparison values is conducted to select contaminants for further evaluation. These springs could have been impacted by the groundwater contamination that originates from the Eastern Michaud Flats Contamination NPL site (2).

In the past, water withdrawn from the Batiste Spring was used by the Union Pacific Railroad as process water and drinking water for the railroad workers and 30 residences of Pocatello (3). Presently, the spring is not being used by the Union Pacific Railroad. In the future, the Simplot Don plant is planning to withdraw water from the Batiste Spring and use the water in its manufacturing processes (non-drinking water). Analytical results of samples taken from the Batiste Spring indicate that only arsenic and nitrate/nitrites have been detected above comparison values. (Note: The maximum concentrations of radium-226 and radium-228 detected in the Batiste Spring were found in different samples. The summation of radium-226 and Radium-228 for any one sample never exceeded the comparison value.)

The Swanson Road Spring has never been used as a drinking water source for human consumption. Analytical results of samples taken from the Swanson Road Spring indicate only arsenic has been detected above comparison values.

The Meadow Gold Dairy, located just north of Batiste Spring (near the Rowlands well shown on Appendix A, Figure 2), bottles water which is sold in local grocery stores (Tenton Spring Water). The Dairy obtains the water from a spring located within the Dairy building. This spring is not the Batiste Spring. However, a majority of water for this spring probably comes from the shallow aquifer. Analytical results of groundwater samples taken from the monitoring wells (524 and 525) between Batiste Spring and the Dairy indicate that no site-related contaminants have moved towards the Dairy Spring (2). In addition, recent analytical results of a sample taken from the spring located within the Dairy building did not find any site-related contaminants (5). However, it may be possible for site-related contaminants to move towards this spring in the future if no remedial actions are taken (e.g., pumping and treatment of the groundwater contamination before it reaches this spring).

There are several drinking water wells located on the properties currently owned by FMC or Simplot or near the Eastern Michaud Flats NPL site (2,3,4). Of these wells, only the Old Pilot House Cafe well and the Frontier well have been contaminated with site-related contaminants. All of the other drinking water wells (i.e., Williamsen well, Lindley well, Tank Farm well, Rowlands well, Indian Springs Trout Farm well, or Idaho Power well) at or near the Eastern Michaud Flats Contamination NPL site are not contaminated with any site-related metals, nutrients, or radiological parameters above comparison levels.

Analytical results of samples taken from the Old Pilot House Cafe well indicate that this well is contaminated with site-related metals (i.e., arsenic and boron), nutrients (i.e., nitrates), and radiological parameters (i.e., gross alpha and gross beta) at levels above comparison levels (2,4).

Analysis of samples taken by the State of Idaho indicate that arsenic contamination in the Old Pilot House Cafe well was present above comparison values as early as 1972. This well obtained water from the shallow aquifer. From the early 1950's to 1976, the Old Pilot House Cafe well was the only source of drinking water for the Pilot House Cafe. In 1976, this well was replaced with a well that withdraws water from the deeper aquifer. Analytical results of samples taken from the New Pilot House Cafe well demonstrate that this well is not contaminated. In the spring of 1994, the Pilot Cafe moved to a different location in Pocatello.

Prior to the late 1980's, drinking water for the Frontier Building (Research and Development Department for the Simplot Company) and the Simplot softball/baseball field was obtained from the Frontier Well (6). It is believed that the well was constructed in 1943. Analysis of samples taken by the State of Idaho indicate that arsenic contamination was present above comparison values as early as 1972. Since the late 1980's, the well was removed from service and clean drinking water has been provided to the Frontier Building (e.g., bottled water).

FMC and Simplot currently own all of the land that overlays the area of groundwater contamination. Deed restrictions have either been placed or will be placed upon this land so that the contaminated shallow aquifer will not be used as a drinking water source.

III. Discussion

The only locations at or near the Eastern Michaud Flats NPL site that used contaminated shallow groundwater for human consumption (i.e., drinking water) are the Old Pilot Cafe well, the Frontier well, and the Batiste Spring. Currently, no one is drinking water containing any site-related contaminants. The public health implication of the past exposures to contaminated drinking water from these three locations will be discussed separately.

A. The Pilot Cafe

From the early 1950's through 1994, the Pilot Cafe was a family run restaurant which could serve about 25 people at a time. The only source of water for the Cafe was either the Old Pilot Cafe well (early 1950's through 1976) or the New Pilot Cafe well (1977 until the Cafe moved in 1994) (2,4). Analysis of samples from the New Pilot Cafe well found no contaminants in the water above comparison values (the New Pilot Cafe well was not contaminated).

Historical (1972 forward) analytical results of samples taken from the Old Pilot Cafe well indicate that arsenic, boron, and nitrate/nitrite have been found in the well consistently above comparison values (4). In addition, recent sampling results indicate that radiological parameters (gross alpha and gross beta) were at levels above comparison levels (2). It is not known when these contaminants entered the Old Pilot Cafe well. No sampling data are available prior to 1972. However, the levels of contamination were not high enough in the Old Pilot Cafe well to

cause any adverse health effects to the patrons of the Cafe. This is because the occasional glass of water or cup of coffee at the Cafe would not provide enough of the contaminants (dose) to result in any adverse health effects (the contaminants were not present at levels where acute exposures would lead to adverse health effects).

Long-term (greater than a year) employees of the Pilot Cafe may have been exposed to enough contaminants such that adverse health effects could have occurred. This is assuming that the employees drank a significant amount of their daily water at the Cafe (2 liters per day). At the levels detected, arsenic (0 - 7.48 milligrams of arsenic per liter of water [mg/L] with an average of about 0.7 mg/L) has been shown in humans to cause changes in the skin (darkening of the skin and the appearance of small "corns" or "warts" on the palms, soles, and torso) (7). While these skin changes are not considered to be a health concern in their own right, a small number of the corns may ultimately develop into skin cancer (arsenic is a known human carcinogen). In addition, a number of human studies indicate that people who drink water containing arsenic, as low as 0.6 to 0.8 mg/L over a significant portion of a lifetime (>20 years), may develop decreased production of red and white blood cells, abnormal heart rhythm, and blood-vessel damage (e.g., Raynaud's disease and cyanosis of fingers and toes) (7). There is also some evidence that longer term (a significant portion of a lifetime, > 20 years) ingestion of arsenic contaminated water may increase a person's risk of developing liver, bladder, and kidney cancer (7).

Although boron was detected at levels above comparison values, it is unlikely that any boron-related adverse health effects would occur in people who ingested the water from the Old Pilot Cafe well (even long term employees of the Cafe). The actual amount (dose) of site-related boron that a person may have ingested from the Old Pilot Cafe well is below that which has been observed to cause adverse health effects in humans or animals (0.91 mg/L is a dose of 0.026 milligrams of boron per kilogram body weight per day [mg/kg/day -- assuming a 70 kilogram person drank 2 liters of water per day] vs. the 0.6 mg/kg/day observed level that did not result in any adverse health effects in laboratory animals [No Observed Adverse Effect Level {NOAEL}]) (8).

The nitrate/nitrite levels detected in the Old Pilot Cafe well were sometimes found at levels above the comparison value of 10 mg/L. At that level, scientific literature indicates that adverse health effects could occur in infants even after a short period of exposure (several days) (9,10). Infants less than four months of age who are fed formula diluted with nitrate/nitrite contaminated water are prone to develop acute acquired methemoglobinemia ("blue babies"). The gut pH of infants less than four months of age is normally higher than that in older children and adults. The higher pH permits a greater abundance of certain bacteria that convert nitrate to nitrite in infants, resulting in increased toxicity from oral nitrate exposure (9,10). There is little evidence that breast-fed infants develop methemoglobinemia from exposure to nitrate/nitrite ingested by the nursing mother. Pregnant women may be more sensitive to the toxic effects of

nitrate/nitrite levels above 10 mg/L should not be used to make baby formula or as the primary drinking water supply for pregnant women.

Elevated levels of radiation (gross alpha and beta) have been detected in the Old Pilot Cafe well. Depending upon how much water the long term employees drank at the Pilot Cafe (prior to 1976), they may have an increased risk of developing cancer (11,12).

B. Frontier Well

From 1943 to the late 1980's, the Frontier Well provided drinking water to the Frontier Building and the Simplot softball/baseball field (6). Analytical results of samples taken from this well indicate that arsenic (maximum of 3.01 mg/L with an average of about 1 mg/L) was detected above comparison values (2). It is not known when arsenic entered the Frontier well. No sampling data is available prior to 1970. However, the levels of arsenic were not high enough in the well to cause any adverse health effects to any visitors to the Frontier Building or the Simplot softball/baseball field. This is because the occasional glass of water or cup of coffee would not provide enough of the contaminant (dose) to result in any adverse health effects (the contaminant was not present levels where acute exposures would lead to adverse health effects).

Long-term (greater than a year) employees at the Frontier Building may have been exposed to enough arsenic that could have resulted in adverse health effects. This is assuming that the employees drank a significant amount of their daily water at the Frontier Building and the Simplot softball/baseball field (2 liters per day). At the levels detected, arsenic has been shown to cause changes in the skin (darkening of the skin and the appearance of small "corns" or "warts" on the palms, soles, and torso) in humans (7). While these skin changes are not considered to be a health concern in their own right, a small number of the "corns" may ultimately develop into skin cancer (arsenic is a known human carcinogen). In addition, a number of human studies indicate that people who drink water containing arsenic, as low as 0.6 to 0.8 mg/L over a significant portion of a lifetime (>20 years), may develop decreased production of red and white blood cells, abnormal heart rhythm, and blood-vessel damage (e.g., Raynaud's disease and cyanosis of fingers and toes) (7). There is also some evidence that longer term (a significant portion of a lifetime, > 20 years) ingestion of arsenic contaminated water may increase a person's risk of developing liver, bladder, and kidney cancer (7).

C. Batiste Spring

The Batiste Spring was used by the Union Pacific Railroad as process waters and drinking water for the railroad workers (3). In addition, 30 residences of Pocatello were also provided water from the spring (approximately 120 people) (3).

Analytical results of samples taken from the Batiste Spring by the U.S. Geological Survey, 1982-7, indicate that arsenic (maximum of 0.094 mg/L and a mean of 0.036 mg/L) and nitrates/nitrites (maximum of 15 mg/L and a mean of 7.9 mg/L) were detected above comparison values (4). However, the average amount of arsenic detected in the Batiste Spring is not at levels that have been shown to cause adverse health effects in humans (please see the discussion above concerning the Old Pilot Cafe well).

The nitrate/nitrite levels detected in the Batiste Spring were sometimes found at levels above the comparison value of 10 mg/L (4). At that level, the scientific literature indicates that adverse health effects could occur in infants even after a short period of exposure (several days) (9,10). Infants less than four months of age who are fed formula diluted with nitrate/nitrite contaminated water are prone to develop acute acquired methemoglobinemia ("blue babies"). The gut pH of infants less than four months of age is normally higher than that in older children and adults. The higher pH permits a greater abundance of certain bacteria that convert nitrate to nitrite in infants, resulting in increased toxicity from oral nitrate exposure (9,10). There is little evidence that breast-fed infants develop methemoglobinemia from exposure to nitrate/nitrite ingested by the nursing mother. Pregnant women may be more sensitive to the toxic effects of nitrates/nitrites. Therefore, water from wells with nitrate/nitrite levels above 10 mg/L should not be used to make baby formula or as the primary drinking water supply for pregnant women (9,10).

D. Children

As part of the ATSDR Child Health Initiative, ATSDR Public Health Assessment and Health Consultations must indicate whether any site-related exposures are of particular concern for children. As discussed above, the nitrate/nitrite levels detected in the Old Pilot Cafe well and the Batiste Spring were at levels that could result in adverse health effects in infants less than four months of age and possibly pregnant women (acute acquired methemoglobinemia) (9,10). These adverse health effects may have occurred in the past if nitrate/nitrite contaminated water from either the Old Pilot Cafe well or the Batiste Spring was used for several days to make baby formula or as the primary drinking water supply for pregnant women.

IV. Conclusions

Based upon the data and information reviewed, the Agency for Toxic Substances and Disease Registry (ATSDR) has drawn the following conclusions:

1. Currently, no one is being exposed to site-related contaminated drinking water. In addition, the deed restrictions already placed or soon to be placed upon the land that overlays the current area of contaminated shallow groundwater should help prevent future exposures to contaminated groundwater at those locations.

2. If appropriate remedial activities are not conducted, it may be possible for site-related contaminants to enter the spring being used by the Meadow Gold Dairy. The Dairy bottles the spring water and sells it in local grocery stores.
3. In the past, long term employees at the Pilot Cafe may have been exposed to site-related arsenic and nitrate/nitrite at levels that could result in adverse health effects. If the employees drank a significant amount of water at work, they may have a higher risk of developing skin, liver, bladder, and kidney cancers. These exposures may also result in lower production of red and white blood cells, abnormal heart rhythm, and blood-vessel damage (e.g., Raynaud's disease and cyanosis of fingers and toes). If an infant, less than 4 months of age, was fed formula made with water from the Old Pilot Cafe well for several days, the infant would have had an increased risk of developing acute acquired methemoglobinemia ("blue babies").
4. In the past, long term employees at the Frontier Building may have been exposed to site-related arsenic at levels that could result in adverse health effects. If the employees drank a significant amount of water at work, they may have a higher risk of developing skin, liver, bladder, and kidney cancers. These exposures may also result in lower production of red and white blood cells, abnormal heart rhythm, and blood-vessel damage (e.g., Raynaud's disease and cyanosis of fingers and toes).
5. In the past, infants less than four months old who resided in the homes that obtained drinking water from the Batiste Spring may have been exposed to significant nitrate/nitrite levels in their formula. Those exposures could have resulted in the infant developing acute acquired methemoglobinemia ("blue babies"). This is assuming that the formula was made with Batiste Spring water for several days.
6. Patrons of the Pilot Cafe and visitors to the Frontier building or the Simplot softball/baseball field did not drink enough contaminated water at these locations that could have resulted in any adverse health effects.
7. Because of past exposures to site-related contaminants, ATSDR has classified the Eastern Michaud Flats Contamination site as a Public Health Hazard in regards to groundwater.

V. Recommendations

ATSDR makes the following recommendations:

1. Appropriate remedial actions should be instituted or continued to prevent future migration of site-related groundwater contaminants into any drinking water sources (e.g., the Meadow Gold Dairy spring). Appropriate monitoring of the groundwater should be

conducted to assure that site-related contaminants do not impact drinking water sources (e.g., quarterly monitoring of monitoring wells 524 and 525).

2. The land deed restrictions instituted and planned for the property presently owned by FMC and Simplot should remain in force so that the shallow groundwater will not be used for drinking water.

VI. Prepared By

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Agency for Toxic Substances and Disease Registry

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11. National Research Council. Health Risks of Radon and other Internally deposited Alpha-Emitters BEIR IV. Washington, D.C.: National Academy Press; 1988.
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Table 1 - Maximum Site-Related Shallow Groundwater Contamination Found at the FMC or Simplot Facilities and in the Old Pilot House Cafe Well and the Frontier Well, Eastern Michaud Flats Contamination National Priorities List Site, Pocatello, Bannock County, Idaho				
Contaminant	Maximum Mean Concentration at FMC or Simplot Facilities	Maximum Concentration in the Old Pilot House Cafe Well	Maximum Concentration in the Frontier Well	Comparison Value for Ingestion and Source*
Metals, Nutrients, and Fluoride (milligrams per liter)				
Arsenic (Total)	0.658	7.48	3.08	0.01 EMEG
Boron (Total)	17.103	0.91	0.21	0.4 Intermediate EMEG
Cadmium (Total)	2.62	<0.005	<0.005	0.007 EMEG
Chromium (Total)	3.81	<0.003	0.002	0.1 LTHA
Cobalt (Total)	0.106	0.02	0.01	0.04 EMEG
Fluoride	1,061	<0.2	0.6	4 MCLG
Nitrate/Nitrite as Nitrogen	74.3	16.3	2.36	10 MCL
Selenium (Total)	0.192	0.006	0.006	0.02 EMEG
Sulfate	2,506	240	221	500 MCLG
Radiological Parameters (picocuries per liter)				
Gross Alpha	1,690	20.7	2.12	15 MCL
Gross Beta	1,163.2	96.5	9.24	50 MCL
Potassium-40	1,210	112	NM	-
Radium-226	2.83	1.56	<1	5 MCL (Summation)
Radium 228	12.9	7.1	<1	
Uranium-233/234	29.4	<1	<1	30 MCL** (Summation)
Uranium-238 (alpha)	11.2	<1	<1	
* - A description of the various comparison values is presented in Appendix B. Unless indicated otherwise, the comparison values listed are for chronic exposures (greater than 365 days).				
** - The MCL was developed by assuming that the Uranium is naturally occurring.				

NM means not measured.

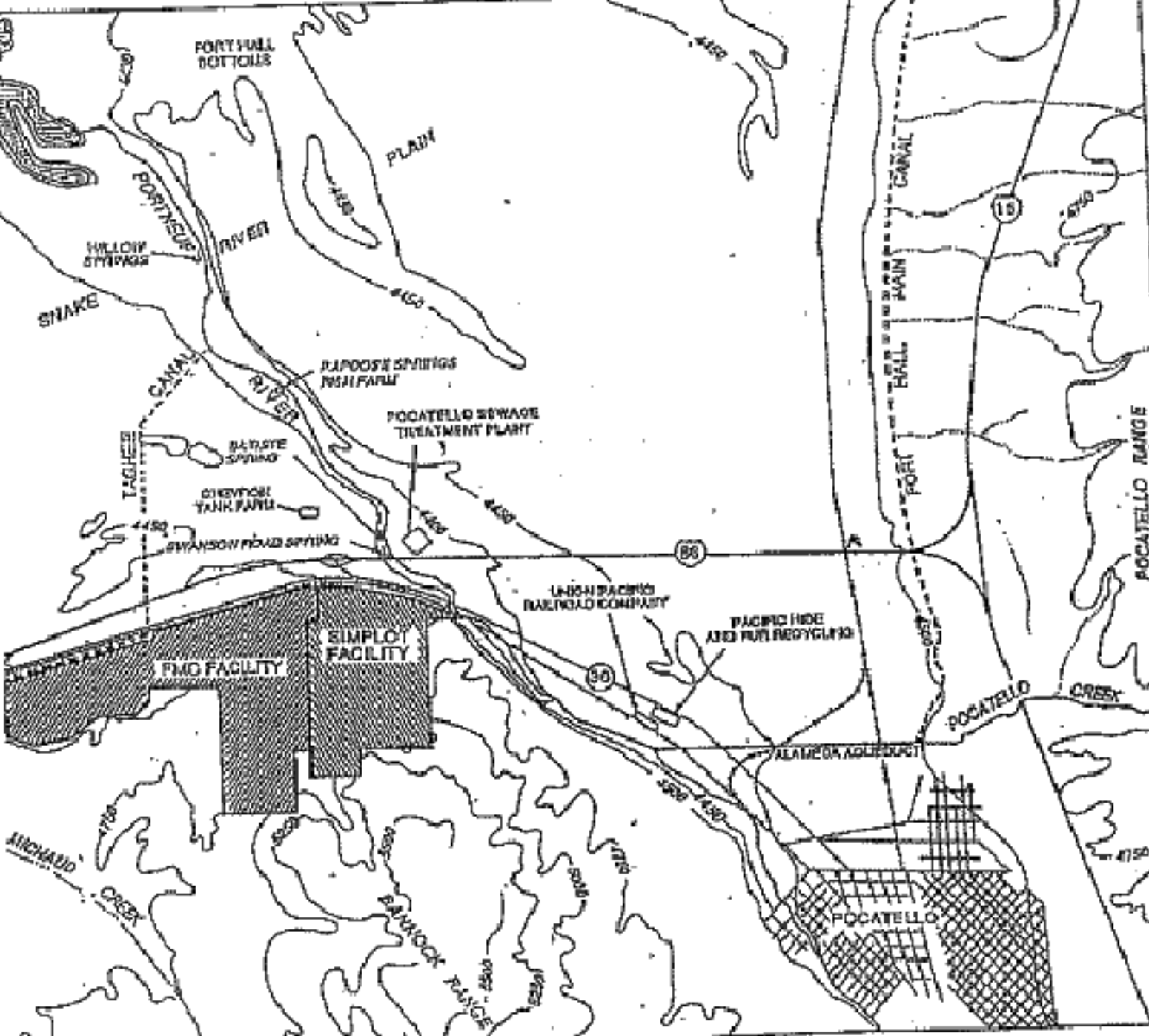
Table 2 - Maximum Site-Related Contaminant Concentrations Found in the Batiste and Swanson Road Springs, Eastern Michaud Flats contamination National Priorities List Site, Pocatello, Bannock County, Idaho

Contaminant	Maximum Concentration in the Batiste Spring	Maximum Concentration in the Swanson Road Spring	Comparison Value for Ingestion and Source*
Metals, Nutrients, and Fluoride (milligrams per liter)			
Arsenic (Total)	0.094	0.013	0.01 EMEG
Boron (Total)	0.167	0.43	0.4 Intermediate EMEG
Cadmium (Total)	0.005	0.0003	0.007 EMEG
Chromium (Total)	0.002	0.002	0.1 LTHA
Cobalt (Total)	0.01	0.0089	0.04 EMEG
Fluoride	0.63	0.5	4 MCLG
Nitrate/Nitrite as Nitrogen	16	2.92	10 MCL
Selenium (Total)	0.01	0.0036	0.02 EMEG
Sulfate	192	116	500 MCLG
Radiological Parameters (picocuries per liter)			
Gross Alpha	<1	3.51	15 MCL
Gross Beta	10.4	8.0	50 MCL
Potassium-40	<1	8.0	-
Radium-226	4.6	1.82	5 MCL (Summation)
Radium-228	7.4	2.2	
Uranium-233/234	1.52	NM	30 MCL** (Summation)
Uranium-238 (alpha)	1.1	NM	
<p>* - A description of the various comparison values is presented in Appendix B. Unless indicated otherwise, the comparison values listed are for chronic exposures (greater than 365 days).</p> <p>** - The MCL was developed by assuming that the Uranium is naturally occurring.</p>			

NM means the contaminant was not measured.

Appendices

Appendix A - Figures



EXPLANATION

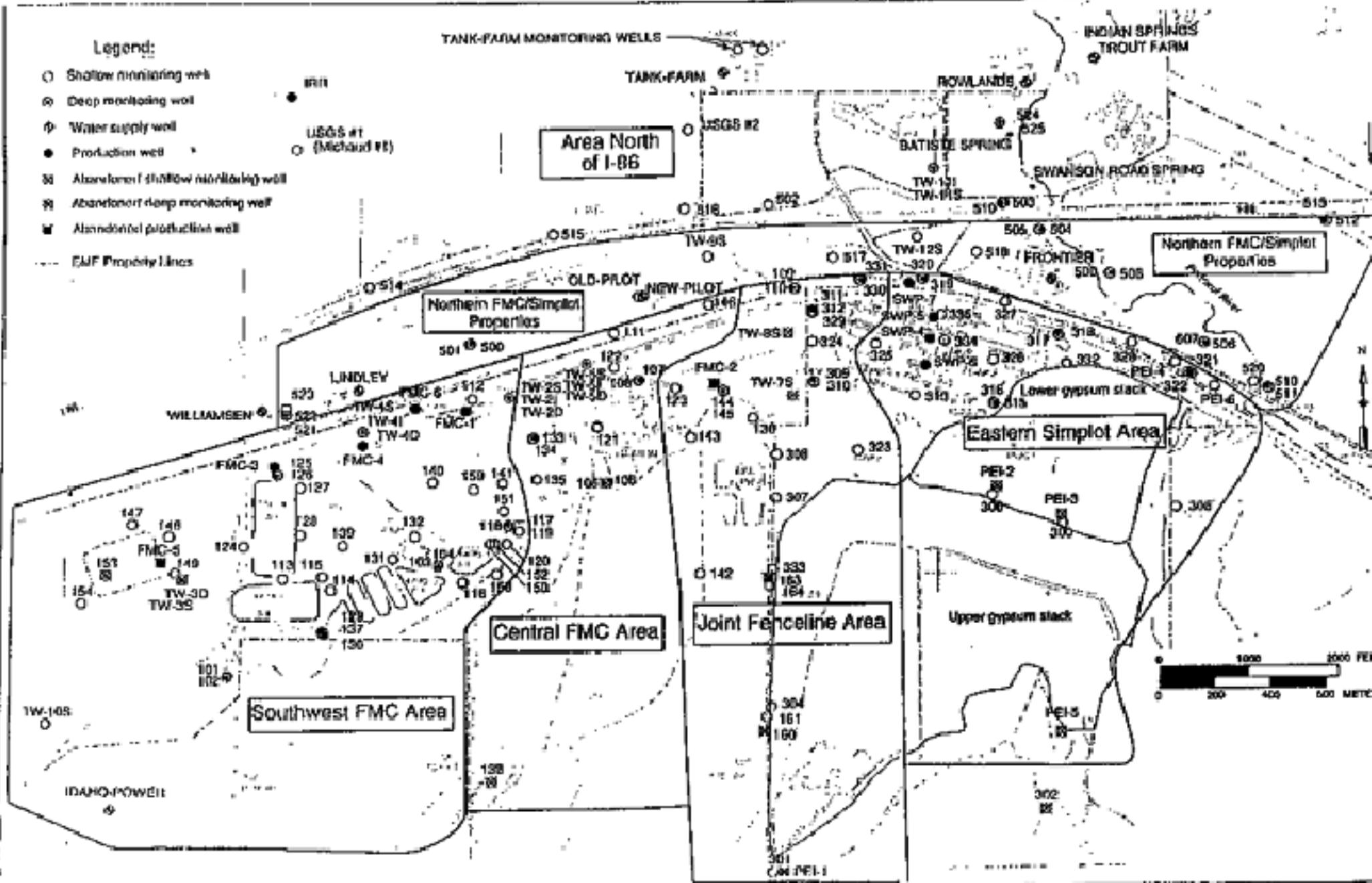
- RIVER
- INTERMITTENT STREAM
- SPRING
- TOPOGRAPHIC CONTOUR
- UNION PACIFIC RAILROAD
- CANAL

Contour Intervals
 Above 4500 ft. elevation: 250 ft.
 Below 4500 ft. elevation: 50 ft.

Note:
 Base map adapted from Trimble, 1975,
 and from USGS Michaud (1971) and
 Pocatello North (1971) 7.5 minute
 topographic quadrangles.



Appendix A, Figure I - Location
 Map for the Eastern Michaud
 Flats Contamination National
 Priorities List Site, Pocatello,
 Bannock County, Idaho



Appendix A, Figure 2 - Map Delineating the Locations of the Monitoring Wells, the Drinking Water Wells, the Production Wells, and the Springs at and near the Eastern Michaud Flats Contamination National Priorities List Site, Pocatello, Blaine County, Idaho.

Appendix B - Description of Comparison Values

Appendix B - Comparison Values

Comparison values for the Agency for Toxic Substances and Disease Registry (ATSDR) public health assessments and health consultations are contaminant concentrations that are found in specific media (air, soil, and water) and that are used to select contaminants for further evaluation. Comparison values are designed to be conservative and non-site specific, and therefore protective for all probable exposures. Their intended use is only to screen out contaminants which do not need further evaluation. **They are not intended to be used as clean-up levels or to be indicators of public health effects.** They are derived from toxicological information, using assumptions regarding body weights, ingestion rates, and exposure frequency and duration. Generally, the assumption used are very conservative (i.e., worst case). For example, soil health comparison values are developed for children who exhibit pica behavior. Soil ingestion in pica children (5 to 10 grams per day) greatly exceeds the soil ingestion rate for the normal population (0.05 grams per day).

There are two different types of comparison values, those based on carcinogenic (cancer-causing) effects, and those based on non-carcinogenic effects. Cancer-based comparison values are calculated from the U.S. Environmental Protection Agency's (EPA's) oral cancer slope factor or inhalation unit risk. They are calculated for a lifetime (70 years) exposure with an unacceptable excess lifetime cancer risk of one case per one million exposed people. Non-cancer comparison values are calculated from ATSDR's Minimal Risk Levels, or EPA's Reference Doses or Reference Concentrations. These values are calculated for adults, children, and small children who may eat large amounts of soil.

The comparison values used in the health consultation are listed and described below.

Environmental Media Evaluation Guides (EMEGs) are based on ATSDR's minimal risk levels (MRLs) and factor in body weight and ingestion or inhalation rates. Separate EMEGs are developed for specific durations of exposure (acute, 1-14 days; intermediate, 15-364 days, and chronic, 365 days and longer).

Life Time Health Advisories (LTHAs) are developed by the EPA. LTHAs are lifetime exposure levels specific for drinking water (assuming 20 percent of an individual's exposure comes from drinking water) at which adverse, non-carcinogenic health effects would not be expected to occur.

Maximum Contaminant Level Goals (MCLGs) are drinking water health goals. MCLGs are set at a level at which, in the EPA Administrator's judgement, "no known or anticipated adverse effect on human health occurs and which allows an adequate margin of safety."

Maximum Contaminant Levels (MCLs) are enforceable drinking water regulations that are protective of public health to the “extent feasible.” National primary drinking water regulations apply to all public water systems including community water systems and transient and nontransient noncommunity water systems. EPA promulgates MCLs.

For radiological contaminants, ATSDR uses information on radiation exposure and its effects related to environmental levels prepared by federal agencies, including EPA, DOE, and the Nuclear Regulatory Commission. The agency also uses other publicly available data sources and recommendations on radiation dose limits. The National Council on Radiation Protection and Measurements (NCRP), the International Commission on Radiological Protection (ICRP), and the United Nations Scientific Committee on the Effects of Atomic Radiation and others develop these sources.

Appendix C - Public Comments and ATSDR's Responses

Response to Comments Received during the Public Comment Period for the Eastern Michaud Flats Groundwater Health Consultation

The Groundwater Health Consultation for the Eastern Michaud Flats site was available for public review and comment from November 12 through December 19, 1997. We announced the Public Comment Period in The Idaho State Journal and the Sho-Ban News. ATSDR made copies of the health consult available at the Idaho State University Library and the Shoshone-Bannock Tribal Business Center. In addition, we sent the health consultation to 10 persons or organizations.

The comments and ATSDR's responses are summarized below.

Comment:

The health consultation provides only a cursory review of the wealth of knowledge developed for the Eastern Michaud Flats (EMF) site and the characterization of potential exposure which might impact human health. Greater detail and analyses have been incorporated in previously prepared documents and presentations in conjunction with the Remedial Investigation and Feasibility Studies under EPA's oversight.

Response:

ATSDR agrees that the health consultation does not provide an in-depth review of all the data and information available. The purpose of the health consultation is not to give a complete history of how and when the various environmental samples were taken. The health consultation is ATSDR's public health review of the available environmental data and information regarding the information and data concerning the Eastern Michaud Flats Contamination site. People requiring more detailed information about the environmental sampling results should review the referenced documents.

Comment:

The text of the health consultation indicates that the tables are a "summary" of the available sampling data. However, only maximum levels are reported in the table. In addition, the emphasis on maximum exposures overstates the possible risks.

Response:

The purpose of the tables are to select which contaminants may be at levels of health concern. The selected contaminants are then evaluated further in the document. The text of the health consultation has been modified to clarify this issue.

An explanation of comparison values is included in the appendices of the health consultation. This explanation clearly states that comparison values are not intended to be used as clean-up levels or to be indicators of public health effects.

In the discussion section of the health consultation, ATSDR discusses the range of possible exposures that may have occurred. Mean concentrations of exposure were used to determine if people were chronically exposed to contaminants at levels of health concern. Maximum concentrations of exposure were not used to determine if people were exposed chronically to contaminants at levels of health concern.

Comment:

The consultation mistakenly refers to the dairy near the site as Gold Medal. The correct name of the dairy is Meadow Gold.

Response:

The name of the dairy has been corrected in the consultation.

Comment:

Recently the spring used by the Meadow Gold Dairy was sampled and checked for site-related contaminants. The analytical results of this sampling event indicate that the spring water has not been impacted by the site.

Response:

ATSDR appreciates the quick response taken to collect this important piece of information. It has been incorporated into this health consultation.

Comment:

The consultation fails to provide any adequate description of the knowledge of the regional groundwater flow. Analysis of conducted for the responsible parties and reviewed by the U.S. Environmental Protection Agency indicates that site-related contaminants can not migrate towards the spring used by the Meadow Gold Dairy.

Response:

Although the information developed during the Remedial Investigation indicates that it is unlikely that site-related contaminants would migrate towards the spring used by the Meadow Gold Dairy, the computer simulations can not predict all possible situations (i.e., the models will always have a degree of error associated with them). Therefore, ATSDR believes that it is appropriate to conclude that “it may be possible for site-related contaminants to enter the spring being used by the Meadow Gold Dairy.” Given that the spring used by the dairy is near the contaminant plume and the spring water is sold to the public, it is in the best interest of public health to, at a minimum, monitor the movement of the plume to assure that the spring is not impacted by the migration of the site-related contaminant plume. For these reasons, ATSDR recommends:

“Appropriate remedial actions should be instituted or continued to prevent future migration of site-related groundwater contaminants into any drinking water sources (e.g., the Meadow Gold Dairy spring). Appropriate monitoring of the groundwater should be conducted to assure that site-related contaminants do not impact drinking water sources (e.g., quarterly monitoring of monitoring wells 524 and 525).”

Comment:

In evaluating the hazards, the consultation fails to place the potential risks in proper perspective. The consultation presents only the maximum concentrations as a summary of the years of site characterization and does not report the natural regional background concentrations. Specifically, the consultation does not indicate that the arsenic levels detected in the Batiste and Swanson Road Springs reflect only natural arsenic concentrations.

Response:

In the discussion of the Batiste Spring, the average concentration of arsenic is used. That discussion clearly indicates that the average amount of arsenic detected in the Batiste Spring is not at levels that have been shown to cause adverse health effects in humans. In the conclusions, ATSDR states that the only possible health concerns associated with the Batiste Spring is nitrate/nitrite exposures and the possible development of acute acquired methemoglobinemia.

As stated on page 3 of the health consultation, the Swanson Road Spring has never been used as a drinking water source for human consumption. Therefore, no human health risk exists.

Comment:

The presentation of the historical exposures from the Old Pilot House Well and potential health concerns overstate the risks and should be so noted with greater clarity. The consultation assumes that people used the well for their primary water supply, which is highly unlikely.

Response:

In the Discussion Section, "A. The Pilot Cafe", of the Health Consultation, the potential for exposure to site-related contaminants are clearly discussed. Maximum concentrations were not used to determine whether people were exposed chronically to contaminants at levels of health concern. The average concentration of arsenic was used in ATSDR's evaluation of the potential chronic exposures. In addition, ATSDR clearly states its assumptions. To conclude that it is "highly unlikely" that the Old Pilot House Well was the primary water supply for this family run business is debatable. In order to err on the side of public health, ATSDR assumed that the well could have been used as the primary drinking water source. This assumption is clearly stated in the discussion section and is also stated in the conclusion section of the health consultation: "If the employees drank a significant amount of water at work, they may have a higher risk of developing skin, liver, bladder, and kidney cancers."

Comment:

The risk with respect to nitrates are overstated in that the risk are no longer current.

Response:

The very first conclusion of the health consultation states the no one is currently exposed to site-related contaminants.

In conclusion number three, ATSDR clearly indicates that people were exposed in the past and that the past exposures would have increased an *infants* risk of developing acute acquired methemoglobinemia. ATSDR's health consultation provides information not only about current and future health risks, but also health risks that may have occurred in the past.

Comment:

The health consultation should point out that the population upon which the health-based value was derived was a non-U.S. population who were generally poor and not well

nourished. The nutritional status of the population used to derive the health-based arsenic value has been a major issue; the relationship between nutritional status and health effects is undergoing great scrutiny.

Response:

As this comment indicates, there is some debate as whether the nutritional status of an individual has an impact on the ability of arsenic to produce adverse human health impacts. However, it is important to realize that the Old Pilot House Well has been shown to contain arsenic at levels that could have resulted in exposure doses as high as 0.25 milligrams of arsenic per kilogram body weight per day (mg/kg/day) with an average exposure dose of 0.02 mg/kg/day. The toxic effects of arsenic have been observed in humans starting at 0.009 mg/kg/day (this is not a theoretical cancer risk calculation but actual observations of a human population). Therefore, the known exposures as a result of the arsenic contamination in the Old Pilot House Well are above those levels observed to cause adverse health effects (two to 27 times higher). This is only for the time period that analytical sampling results are available (1972 forward). The concentration of arsenic in the Old Pilot House Well may have been even higher in the past. Therefore, ATSDR believes that it is appropriate to conclude that:

“If the employees drank a significant amount of water at work, they may have a higher risk of developing skin, liver, bladder, and kidney cancers.”

Review and Approval Page

Review and Approval of Health Consultation for Eastern Michaud Flats Contamination National Priorities List Site, Pocatello, Bannock County, Idaho.

Concurrence:

Branch Chief, SA, SSAB, DHAC

Date

Appendix I

Health Consultation: Air Contamination at the Eastern Michaud Flats Contamination Site

Health Consultation

Air Contamination
at the

**Eastern Michaud Flats Contamination
Bannock County, Idaho; Power County, Idaho;
Fort Hall Indian Reservation**

CERCLIS NO. IDD98466610

Prepared by:

Superfund Site Assessment Branch
Division of Health Assessment and Consultation
Agency for Toxic Substances and Disease Registry

ABOUT THIS REPORT

This health consultation addresses concerns raised by members of the Shoshone-Bannock Tribes and residents of Chubbuck and Pocatello, Idaho, that operations at two phosphate processing facilities might lead to unhealthy levels of air pollution. To address these concerns, this document identifies specific pollutants released to the air from these facilities, summarizes air sampling studies conducted in the vicinity of the facilities, and evaluates whether the air sampling results indicate a public health hazard. Readers can find these analyses organized into the following sections of this health consultation:

Summary	This section provides a non-technical overview of the key findings of this consultation.
Purpose	This section reviews concerns raised by community members and describes past and current operations at the phosphate processing plants.
Discussion	This section reviews air sampling data that have been collected near the phosphate processing plants and evaluates whether the sampling data indicate a public health hazard.
Conclusions	This section provides an overview of the findings of this health consultation. The conclusions in this section are more detailed and technical than the overview provided in the summary section.
Recommendations	This section offers several recommendations for addressing site-specific public health issues.
Public Health Action Plan	This section describes actions taken or planned in relation to the site.

Because ATSDR prepares its reports for a diverse audience of readers, this health consultation includes both non-technical discussions of site-related public health issues as well as selected technical analyses of air sampling results. To orient readers to terminology used in this report, this document includes a list of abbreviations and a glossary to explain selected acronyms and define certain terms. All figures and tables cited in the text of this report appear at the end of the health consultation (figures first, followed by tables).

For more information on ATSDR or this report, you may call the agency toll free at:
1-800-447-1544

or you may visit the agency's Home Page at:
<http://www.atsdr.cdc.gov>

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LIST OF ACRONYMS

ACS	American Cancer Society
AIRS	Aerometric Information Retrieval System
AQI	air quality index
ATSDR	Agency for Toxic Substances and Disease Registry
BAPCO	Bannock Paving Company
BEHS	Bureau of Environmental Health and Safety
BLM	Bureau of Land Management
COPD	chronic obstructive pulmonary disease
CREG	Cancer Risk Evaluation Guide
EMEG	Environmental Media Evaluation Guide
EMF	Eastern Michaud Flats
EPA	U.S. Environmental Protection Agency
FMC	FMC Corporation
HEI	Health Effects Institute
HHE	health hazard evaluation
IDEQ	Idaho Division of Environmental Quality
IDH	Idaho Division of Health
INEEL	Idaho National Engineering and Environmental Laboratory
ISU	Idaho State University
LOAEL	lowest-observed-adverse-effect level
MRL	minimal risk level
NAAQS	National Ambient Air Quality Standard
NIOSH	National Institute for Occupational Safety and Health
NMMAPS	National Morbidity and Mortality Air Pollution Study
NOAEL	no-observed-adverse-effect level
NPL	National Priorities List
OSHA	Occupational Safety and Health Administration
PM	particulate matter
PM10	particulate matter smaller than 10 microns
PM2.5	particulate matter smaller than 2.5 microns
ppm	parts per million
REL	NIOSH recommended exposure limit
RI	remedial investigation
Simplot	J.R. Simplot Company
STEL	NIOSH short-term exposure limit
TRI	Toxic Release Inventory
TSP	total suspended particulates
ug/m ³	micrograms per cubic meter

NOTE

This document focuses largely on air emissions from two industrial facilities in Idaho. During the time that ATSDR evaluated these air emissions, the name of one of the facilities changed. Specifically, when ATSDR began this health consultation, FMC Corporation owned and operated one of the facilities of concern. Now, that facility is owned and operated by Astaris. All references to “FMC” and the “FMC facility” in this health consultation, therefore, refer to what is currently the Astaris facility.

I. SUMMARY

Based on its review of numerous air quality studies, the Agency for Toxic Substances and Disease Registry (ATSDR) concludes that releases of air contaminants from the Eastern Michaud Flats (EMF) Superfund site near Pocatello, Idaho, poses a **public health hazard**. This hazard has existed since at least 1975 and will continue to exist in the future unless emissions from the two phosphate processing plants on the site—FMC Corporation and J.R. Simplot Company— and from other sources are reduced. Important information on the nature and extent of this public health hazard follows:

- ***What pollutants have reached hazardous levels?*** Many agencies and researchers have measured the levels of air pollution in the area near the EMF Superfund site. These studies have measured air concentrations of the pollutants that FMC and Simplot emit in the greatest quantities. Of these pollutants, only airborne particulate matter—or particles and aerosols in the air—and sulfates have reached levels that are known to be associated with adverse health effects among exposed populations. Whether considering total suspended particulates (TSP), fine and coarse particulates combined (PM10), or fine particulates (PM2.5), air concentrations of particulate matter near the site have reached, and continue to reach, elevated and potentially unhealthy levels, as described below; and short-term levels of sulfates have periodically reached concentrations of health concern. Emissions from FMC and Simplot account for a very large quantity of the airborne particulate matter and sulfates in the area, but other sources undoubtedly contribute to this problem as well.

ATSDR thoroughly reviewed the available data for acids, metals, and other pollutants released from FMC and Simplot, but none appear individually to have reached levels of health concern; however, there is uncertainty in this conclusion. Current science provides little evidence as to whether the mix of these air contaminants may increase or decrease their toxicological effects because of cumulative exposures. However, the epidemiological evidence does indicate that PM, a measure of a mix of contaminants present in air, including many of the acids and metals detected in the EMF study area, is a good surrogate measure for estimating the short-term and long-term adverse cardiopulmonary health effects from exposure. From this standpoint, ATSDR evaluated and made definitive public health statements regarding the cumulative health effects of the exposure to the mix of acid aerosols and particulate metal contaminants present in the EMF study area as measured by PM. To confirm the above finding for acids and metals, ATSDR recommends ongoing air sampling for these pollutants.

Phosphine may have reached levels of health concern at the FMC fence line. However, these levels of health concerns were obtained using unreliable methods. ATSDR recommends that more monitoring be performed to confirm these data.

- ***How are airborne particulate matter and sulfates harmful?*** High levels of airborne particulate matter and sulfates, like those observed near the EMF site, are known to be associated with various health problems, such as asthma attacks, upper respiratory illnesses, and chronic bronchitis. Certain people are known to suffer from these pollution-related respiratory problems more so than others. These people include children, the elderly, smokers, people with heart disease, and people with asthma or other forms of lung disease.

It is impossible to predict, however, exactly how many people will develop these problems after being exposed to airborne particulate matter, because people are exposed to many respiratory irritants every day, such as cigarette smoke and indoor air contaminants. Though it is difficult to prove that air pollution is the main cause of any one health problem, ATSDR notes that the elevated incidence of certain respiratory problems among residents living in the EMF study area is reasonably consistent with exposures to unhealthy levels of airborne particulate matter and sulfates.

Though exposure to particulate matter has not been shown conclusively to cause cancer, individual components of particulate matter may be carcinogenic. Based on a review of the limited data available on these components, ATSDR concludes that exposure to potentially carcinogenic heavy metals found in particulate matter in the EMF study area are not likely to result in an appreciable increased risk of carcinogenic health effects in the exposed population. However, this conclusion is limited by the fact that data on annual average concentrations for metals are not available for time periods before 1994, when levels of PM, and hence heavy metals, were notably higher. For some metals, the paucity of toxicological data and the lack of data on the exact chemical species found in the ambient air prevents a complete assessment of the public health implications of exposure.

- ***Is air quality in the area generally getting better or worse?*** There is no single measurement that characterizes overall “air quality” for a region. A relevant indicator of air quality for the EMF study area, however, is levels of airborne particulate matter, the main contaminant of concern for this site. Based on a review of nearly 25 years of air sampling data in the Pocatello area, ATSDR has found that levels of particulate matter since 1994 (when averaged over the long term) are more than 30% lower than levels measured prior to that time. This decrease is most likely the effect of emissions controls that have been implemented on a wide range of sources throughout the EMF study area. Though this trend is certainly encouraging and suggests improving air quality, ATSDR also notes that potentially unhealthy levels of particulate matter continue to be frequently observed in some parts of the Fort Hall Indian Reservation and periodically observed in the cities of Chubbuck and Pocatello. The next two questions address this topic further. Note, the available sampling data are insufficient to determine whether levels of metals and inorganic aerosols in the area are increasing or decreasing.

- ***In what parts of the Fort Hall Indian Reservation are air pollution levels hazardous?*** Air monitors have been operated on the Fort Hall Indian Reservation at locations directly across from the FMC facility for the last 3 years. These monitors consistently measure the highest concentrations of particulate matter in the entire area surrounding the EMF site—a trend suggesting that potentially hazardous levels of air pollution frequently occur on the Fort Hall Indian Reservation at locations between FMC and Interstate 86. Because levels of particulate matter are known to vary over short distances in this area, however, ATSDR is not certain whether unhealthy levels of air pollution occur at locations north of Interstate 86. ATSDR believes this is a critical data gap for this site and highly recommends that air monitors be placed at additional locations on the Fort Hall Indian Reservation, and near where people live, to determine the areas where unhealthy levels of air pollution occur.
- ***In what parts of Chubbuck and Pocatello are air pollution levels hazardous?*** The air quality data indicate that episodes of potentially unhealthy air pollution have affected the entire cities of Chubbuck and Pocatello. These episodes are infrequent and are typically associated with inversions or stagnation conditions, which trap air pollution in the lowest levels of the atmosphere. The fact that the two cities are located in or at the mouth of a valley makes this situation worse, since the mountains prevent pollutants from dispersing. During past pollution episodes, which most often occur in the winter, airborne particulate matter has been measured at potentially unhealthy levels throughout the entire Portneuf Valley—from Idaho State University to Chubbuck School. Though no pollution episodes occurred between 1994 and 1998, the recent and severe episode in December 1999 shows that unhealthy levels of air pollution can still occur throughout Chubbuck and Pocatello. ATSDR believes these episodes will continue to occur in the future unless emissions sources of particulate matter at FMC and Simplot and elsewhere in the area are reduced.

Moreover, the ambient air monitoring data indicate that long-term average levels of particulate matter in much of Chubbuck and Pocatello reached potentially unhealthy levels between 1975 and 1993. These long-term levels were highest in areas closest to FMC and Simplot, and decreased with distance from the facilities.

- ***What is being done about the air pollution in the area?*** State and federal environmental agencies, the Shoshone-Bannock Tribes, the Cities of Chubbuck and Pocatello, FMC, and Simplot have all made efforts to improve air quality near the EMF site and have plans to continue to improve air quality in the future. Most noteworthy are the efforts to control or eliminate the known sources of pollution, thus helping to prevent air quality problems from occurring in the first place. Additionally, state environmental officials have implemented a program that warns residents of potentially unhealthy levels of air pollution before they occur. ATSDR encourages residents to heed these warnings, which

are typically broadcast by the media and recommend residents, especially persons with respiratory conditions, to remain indoors and to avoid moderate levels of exercise as much as possible when air quality is expected to be poor.

The remainder of this health consultation clarifies, defends, and expands upon, the general findings listed above. Moreover, the health consultation presents additional information (e.g., site descriptions, a list of community concerns, a review of air pollution studies) that ATSDR considered when evaluating health concerns for this site. As noted throughout this document, this health consultation does not consider potential exposures to airborne radionuclides—a topic that will be addressed in a future ATSDR health consultation. ATSDR also plans to conduct other public health actions at the EMF site. These actions include: evaluating cancer incidence; preparing a comprehensive public health assessment; continuing to implement health education and outreach activities, as needed; and, evaluating the feasibility of conducting an additional health study in the EMF study area.

II. PURPOSE

The Agency for Toxic Substances and Disease Registry (ATSDR) prepared this health consultation to address community concerns regarding inhalation exposures to potentially unhealthy levels of air pollution near the Eastern Michaud Flats Contamination (EMF) National Priorities List (NPL) site. ATSDR previously evaluated potential exposures to site-related contaminants in its 1990 Preliminary Public Health Assessment (ATSDR 1990). Since then, a Remedial Investigation (RI) was conducted at the site, during which a large volume of environmental monitoring data was generated (Bechtel 1996). In 1997, ATSDR prepared a Site Review and Update, in which the Agency committed to reviewing the data released during the RI. This health consultation, therefore, presents ATSDR's re-evaluation of the inhalation exposure pathway, considering the most recent information available.

In preparing this health consultation, ATSDR is also responding to concerns that members of the Shoshone-Bannock Tribes have raised regarding the impacts of releases from the EMF site on air quality at the Fort Hall Indian Reservation. Among these concerns, the Shoshone-Bannock Tribes have specifically requested that ATSDR enhance the 1995 Fort Hall Air Emissions Study to determine the health effects of radionuclide emissions and to consider a broader geographic area than had been considered in the 1995 study (Sho-Ban 1996). In response to this request, ATSDR indicated that the air exposure pathways and the populations-at-risk need to be better defined in order to address the concerns of the tribe (ATSDR 1996). This health consultation begins the process of addressing the concerns of the Shoshone-Bannock Tribes by attempting to better define the past, current, and future air exposure pathways for nearby communities.

The Shoshone-Bannock Tribes have also expressed concerns regarding air exposures to workers at FMC, Simplot, an adjacent railroad area, and other contract workers at and near these facilities. ATSDR's official mandate, however, under the 1980 Superfund law, and as amended in 1986, focuses primarily on health issues related to the uncontrolled release of hazardous

How ATSDR's Role at the EMF Site Differs from the Roles of Other Agencies

When reading this document, it is important to note that ATSDR's role at the EMF site as a *public health* agency is considerably different from the roles of other agencies, particularly those charged with addressing *environmental* issues. In this document, ATSDR evaluates the public health implications of the levels of air pollution in the EMF study area. These evaluations are not meant to address the region's compliance, or lack thereof, with state and federal environmental standards, such as EPA's National Ambient Air Quality Standards (NAAQS), even though this health consultation uses the NAAQS as a means for evaluating air monitoring data collected at the EMF site. State, tribal, and federal environmental agencies are responsible for evaluating a region's attainment status with the NAAQS and other environmental standards.

substances into the environment as it relates to community exposures. Except for very limited authority to examine health issues of workers who perform remediation tasks, ATSDR's mandate does not include the health of workers—an issue that is mainly the responsibility of the Occupational Safety and Health Administration (OSHA) and the National Institute for Occupational Safety and Health (NIOSH). These agencies can evaluate in much greater detail worker health issues at the EMF site (e.g., see sidebar).

This health consultation is one of many documents that ATSDR has prepared, or has committed to prepare, for the EMF site. In October, 1998, ATSDR released health consultations that addressed the potential for past, present, and future human exposures to site-related contaminants in the groundwater, surface water and sediment, and surface soil (ATSDR 1998a; 1998b; 1998c).

This health consultation supplements the previous documents by focusing strictly on site-related contaminants in

ambient air. ATSDR currently plans to address the inhalation exposure pathway in two separate health consultations: the first health consultation (i.e., this health consultation) addresses all site-related contaminants other than radionuclides, and a later health consultation will address only radionuclides. ATSDR also plans to evaluate the incidence of cancer in the Pocatello area and in Fort Hall in a later health consultation. Combined, the 1998 health consultations, this health consultation, and the future health consultations on radionuclides and cancer incidence, will provide the basis for a comprehensive assessment of public health issues associated with the EMF site.

Overall, therefore, the purpose of this health consultation is to obtain and review existing data relevant to air quality issues for the EMF site and to comment on the public health implications of these data. Moreover, the health consultation recommends specific actions that need to be taken to fill notable data gaps and also provides a description of the public health actions taken or planned in relation to the site.

NIOSH'S Health Hazard Evaluation (HHE) Program

Through its Health Hazard Evaluation (HHE) program, NIOSH evaluates whether health hazards occur as a result of workers being exposed to hazardous substances while on the job. NIOSH conducts HHEs only after receiving a written request to do so. These requests must come from three or more current employees, an official of the union representing current employees, or the employer. Employees who request that an HHE be performed will remain anonymous, if requested. Further information about the NIOSH HHE program can be found on the Web (at <http://www.cdc/niosh/hhe.html>) or by contacting NIOSH at 1-800-356-4674.

III. BACKGROUND

Before reading ATSDR's analyses of public health issues for the EMF site, it is important to understand the specific health concerns raised by community members, the operating histories of the FMC and Simplot phosphate processing plants, and the land use and demographics in the EMF study area. The following discussion reviews these topics.

A. Statement of Issues

The FMC Corporation (FMC) and J.R. Simplot Company (Simplot) operate phosphate processing plants that are located on what the U.S. Environmental Protection Agency (EPA) has designated the EMF NPL site. Members of the Shoshone-Bannock Tribes and residents of Chubbuck and Pocatello have expressed concern regarding the occurrence of asthma and upper respiratory infections in their communities. Some community members believe these health effects are related to exposure to air pollutants emanating from FMC and Simplot. The Shoshone-Bannock Tribes have expressed additional health concerns, including concerns regarding congenital heart problems, heart problems among the elderly, and cancer.

To investigate concerns related to the number of respiratory and renal disorders being treated in a local clinic, ATSDR conducted a health study in 1995 of persons living on the Fort Hall Indian Reservation (ATSDR 1995). This study concluded that the prevalence of pneumonia and chronic bronchitis was statistically significantly elevated among participants living on the Fort Hall Indian Reservation, as compared to participants living at another reservation in a remote part of Nevada. Results of pulmonary function tests showed that participants living on the Fort Hall Indian Reservation had decreased pulmonary function when compared to participants in the control group, but the difference was not statistically significant. Biological monitoring found that levels of cadmium, chromium, and fluoride in the urine samples of all participants were within normally defined values, and no statistically significant difference between the two reservations was observed. The study recognized, however, that this type of biological monitoring would neither identify historically exposed persons nor quantify the exact extent of their past exposures. As indicated in the 1995 ATSDR health study, a major limitation of the study was the uncertainty in attributing exposure to site-related contaminants (i.e., emissions from the two phosphate processing plants) (ATSDR 1995).

It should be noted, however, that attributing exposures to individual sources is often an extremely difficult task, especially in areas with many different sources of environmental contaminants, like the EMF study area. Although it has been well established that FMC and Simplot have historically been major sources of emissions of various air contaminants, many other sources of air pollution are found on the Fort Hall Indian Reservation and in the cities of Chubbuck and Pocatello. These sources include, but are not limited to, other industries, wood stoves, residential fireplaces, automobiles, and agricultural operations. Due to the uncertainty in determining the extent to which each individual source contributes to inhalation exposures, this

health consultation does not provide quantitative estimates of each source's impact on levels of air pollution. Rather, this health consultation attempts to delineate areas where persons have been, and are being, exposed to various contaminants at levels that might be associated with adverse health effects.

B. Site Description

As noted above, phosphorous processing facilities owned and operated by FMC and Simplot are located on the EMF NPL site. The nearest major population areas—the cities of Pocatello and Chubbuck, Idaho—are located east-southeast and east-northeast, respectively, of the FMC and Simplot facilities (see Figure 1). The facilities are about 2.5 miles from populated areas of these cities, but some residences are located closer to the facilities. No residences were observed within approximately 0.5 miles of either facility. As Figure 1 shows, the nearest populated area on the Fort Hall Indian Reservation—the Fort Hall Agency—is located about 8 miles north-northeast of the facilities. ATSDR notes, however, that the majority of the population on the Fort Hall Indian Reservation lives in rural areas, including some in proximity to FMC and Simplot.

The FMC phosphorous production facility covers an estimated 1,189 acres, almost all of which lie within the Fort Hall Indian Reservation. The Simplot facility (described below) is located directly east of the FMC facility. The FMC facility has produced phosphorous since 1949; some of the facility's processes have changed little since then. FMC has always produced phosphorous from phosphorous-bearing shale, which is shipped to the facility via rail car during the summer months and stored on site in large stockpiles. After passing through several mechanical processes (e.g., crushing), the phosphate rock is fed to calciners, which remove moisture from the feed. A mixture of this intermediate product, coke, and silica are then further processed in one of the facility's four electric arc furnaces. Outputs from the furnaces include gaseous elemental phosphorus, various gaseous by-products (some of which contain radiological components), and solid wastes called "slag" and "ferrophos" (Bechtel 1993). The elemental phosphorus is subsequently condensed and eventually shipped off site, and the solid wastes are disposed of at various on-site and off-site locations. Though effluents from the calciners and electric arc furnaces pass through air pollution control devices, these operations emit a wide range of air pollutants, as do numerous other sources throughout the facility. Section IV.C of this health consultation describes these emissions in greater detail.

The Simplot Don Plant covers about 745 acres, none of which are on reservation property. As noted above, the Simplot facility adjoins the eastern property boundary of the FMC facility (Bechtel 1996). Since 1944, the Simplot facility has produced various phosphorous-containing products; currently, the facility produces 12 principal products, including phosphoric acid, five grades of solid fertilizers, and four grades of liquid fertilizers (Bechtel 1996). Phosphate ore is one of the principal feeds to Simplot's processes. Prior to September, 1991, the Simplot facility received its ore from mines via rail car. Since then, however, the facility has received its ore

through a slurry pipeline. The incoming slurry then passes through various processes, depending on the product being made. Many of the products also use sulfuric acid as a feed, which Simplot manufactures on site. Like the processes at FMC, the processes at Simplot emit contaminants to the air and generate many forms of solid and liquid waste. Air pollution control devices at the Simplot facility help minimize adverse impacts on local air quality, but the facility has emitted, and continues to emit, a wide range of contaminants to the air. Section IV.C revisits this issue.

C. Land Use and Demographics

According to the RI (Bechtel 1996), the EMF NPL site (referred to in this document as “the EMF study area”) includes land belonging to the Fort Hall Indian Reservation, the Bureau of Land Management (BLM), Bannock and Power Counties, and portions of the cities of Pocatello and Chubbuck. Land use on the Fort Hall Indian Reservation in the EMF study area is mainly agricultural with scattered residences. BLM land is designated as multiple use. Unincorporated land in Bannock and Power Counties is mostly agricultural, also with scattered residences, and land within the cities of Pocatello and Chubbuck in the EMF study area is primarily zoned for residential use.

In addition to owning the land on which the facilities operate, FMC and Simplot also own all land (with the exception of road rights-of-way) between the facilities and Interstate 86, as well as substantial property located immediately north of Interstate 86 and east of the facilities. Other land uses in the area include a dragstrip located across the access road from FMC, which has recently closed, and a softball field across the street from Simplot. Until March 12, 1995, the Bannock Paving Company (BAPCO) operated a paving and aggregate handling facility on land leased from, and adjacent to, the FMC facility. BAPCO periodically conducted many industrial operations at this site, such as processing asphalt, drying coke, and crushing slag and ferrophos (Bechtel 1996). The land owned by FMC to the north of the facility is reportedly deed restricted, prohibiting current or potential future residential use; however, access to much of this land is not restricted. The number of people who access the land immediately north of FMC is believed to be limited, but passers by and off-site workers clearly use the area.

The area within a 1-mile radius of the FMC and Simplot facilities is sparsely populated, as is typical of areas with primarily agricultural and industrial land uses. However, the area within a 5-mile radius of the facilities includes much of the cities of Chubbuck and Pocatello, as well as a larger portion of the Fort Hall Indian Reservation. As a result, the area within 5 miles of the facilities is considerably more populated than the area within just 1 mile of the facilities. The “Public Health Implications” section of this health consultation describes the demographics of the potentially exposed population in greater detail.

IV. DISCUSSION

ATSDR uses a conservative approach to determine whether levels of air pollution indicate a past, present, or future health hazard. The following discussion describes this methodology, and documents how it was applied to the levels of contamination measured in the EMF study area. The remainder of this section provides an overview of the large volume of data collected in the EMF study area, and appendices to this report present more detailed analyses.

A. Assessment Methodology

ATSDR generally follows a two-step methodology to comment on public health issues related to air pollution. First, ATSDR obtains representative environmental monitoring data for the site of concern and compiles a comprehensive list of site-related contaminants. Second, ATSDR uses health-based comparison values to identify those contaminants that do not have a realistic possibility of causing adverse health effects. For the remaining contaminants, ATSDR reviews recent scientific studies to determine whether the extent of environmental contamination indicates a public health hazard.

The health-based comparison values used in this report are concentrations of contaminants that the current public health literature suggest are “safe” or “harmless.” These comparison values are quite conservative, because they include ample safety factors that account for most sensitive populations. ATSDR typically uses comparison values as follows: If a contaminant is never found at levels greater than its comparison value, ATSDR concludes the levels of corresponding contamination are “safe” or “harmless.” If, however, a contaminant is found at levels greater than its comparison value, ATSDR designates the pollutant as a contaminant of concern and examines potential human exposures in greater detail. Because comparison values are based on extremely conservative assumptions, the presence of concentrations greater than comparison values does not necessarily suggest that adverse health effects will occur among exposed populations. More information on the comparison values used in this report can be found in Appendix B.

In the case of particulate matter, however, some scientists argue that adverse health effects can occur among sensitive populations even when ambient air concentrations are lower than the health-based comparison value used in this report (i.e., EPA’s actual and proposed National Ambient Air Quality Standards). In other words, levels of contamination below the health-based comparison value might, in fact, not be “safe” or “harmless” to certain sensitive populations. The sidebar on the above reviews additional information on the selection of health-based comparison values for particulate matter, and Section IV.E comments on this issue further.

Health-Based Comparison Values for Particulate Matter

Throughout this report, ATSDR uses EPA's former, current, and proposed health-based national ambient air quality standards (NAAQS) to evaluate the public health implications of measured concentrations of particulate matter. As described later in this report, EPA has passed or proposed health-based standards for three different types of particulate matter. Two key points about these standards deserve mention:

First, ATSDR and EPA have different approaches to using the health-based standards for this site. Specifically, EPA uses statistical analyses of air monitoring data to delineate regions of the country that are not in attainment with the health-based standards. For reference, Figure 5 shows what EPA has currently designated as the "nonattainment area" in the vicinity of the EMF study area. ATSDR, on the other hand, compares the measured levels of air pollution to EPA's health-based standards as a *first step* in evaluating the public health implications of the levels of air pollution. Additionally, ATSDR considers the potential for human exposure to air of poor quality and, in this report, does not consider EPA's statistical criteria for attainment. *Therefore, this report's findings must not be confused with EPA's evaluation of attainment for this region!*

Second, though EPA has set health-based standards for different forms of particulate matter, it has also established health-based "air quality indexes" to provide very basic information about public health and air quality. As described later in this report, ATSDR has considered these air quality indexes, especially the index for PM_{2.5}, to comment on the public health implications of the air quality in the EMF study area.

The following analyses identify air pollutants for the EMF study area (Section IV.B), describe how these pollutants disperse throughout the area (Section IV.C), review site-specific studies that have measured levels of air pollution (Section IV.D), and finally comment on the public health implications of inhalation exposures to air pollution in the EMF study area (Section IV.E).

B. Emissions Data: What Pollutants Are Released to the Air?

To identify site-related contaminants for the EMF study area, ATSDR consulted with EPA, IDEQ, the Shoshone-Bannock Tribes, FMC, and Simplot to obtain reports that characterize air emissions from the two phosphorous processing facilities. The reports ATSDR obtained indicate that either FMC or Simplot, or both facilities, are suspected of emitting at least the following pollutants into the air (Bechtel 1996; Bechtel 1998; FMC 1999a, 1999b, 1999c; IDEQ 1999a; USEPA 1999d):

Aluminum	Fluorides	Phosphoric acid
Ammonia	Hydrogen cyanide	Phosphorous
Antimony	Iron	Phosphorous pentoxide
Arsenic	Lead	Selenium
Barium	Manganese	Silver
Beryllium	Mercury	Sulfur dioxide
Cadmium	Nickel	Sulfuric acid
Chromium	Particulate matter	Zinc
Copper	Phosphine	

As an example of emissions data for these facilities, Table 1 presents the air emissions data that FMC and Simplot reported to EPA's Toxic Release Inventory (TRI) for calendar years 1997 and 1998. The TRI database is an important source of "right-to-know" information, or information that people can access about the releases of toxic chemicals in their communities. Because the accuracy of TRI emissions data are not known, ATSDR based its findings of this health consultation on the levels of chemicals that were measured in the ambient air, rather than focusing strictly on the emissions data. It is important to note that a large volume of air quality measurements are available for almost every pollutant listed above and in Table 1, and the evaluations of ambient air monitoring data presented later in this section consider the pollutants that FMC and Simplot emit in greatest quantities.

Also noteworthy is the fact that the TRI data do not show that many different operations at FMC and Simplot emit pollutants to the air. Some pollutants are released from elevated sources, like stacks, and others from ground-level sources, like waste ponds. Several studies have reported estimates of chemical-specific emissions from FMC and Simplot (Bechtel 1996; IDEQ 1999a). Though estimated emission rates are somewhat uncertain, they do provide insight into the relative impacts of various sources on air quality. As Table 2 shows, studies have estimated that, in recent years, FMC and Simplot released 727 and 135 tons of particulate matter to the air in a calendar year, respectively (IDEQ 1999a; USEPA 1999a). The data in Table 2 are interpreted in greater detail below.

It is expected that emission rates from these facilities likely have varied from year to year, as a result of changes in production demands, installation and operation of different pollution controls, use of ores from various sources, and other factors. As examples, particulate emissions from Simplot decreased considerably in 1991, after the facility began to receive ore in a slurry pipeline, instead of by rail car (Bechtel 1996); similarly, particulate emissions from FMC decreased after the facility installed new scrubbers on its calciners in 1992 (Severson 1999), and

FMC is currently implementing controls at many other specific emissions sources. The emissions from these facilities will likely continue to decrease in the future, due to pollution control plans recently adopted by EPA and IDEQ (FR 1999; IDEQ 1999a). In fact, FMC has

informed ATSDR that its ongoing emissions controls projects are expected to result in a 67% reduction in particulate emissions.

In addition to FMC and Simplot, other industrial and non-industrial sources throughout the EMF study area release many of the pollutants listed above. For example, the Bannock Paving Company, which was known to emit particulate matter, metals, and other pollutants, operated on a leased portion of the FMC property. These operations reportedly ceased on March 12, 1995, and Bannock Paving Company moved to another location in Pocatello later in the year (Bechtel 1996). Furthermore, aircraft, trains, automobiles, residential wood burning, and agricultural operations all emit particulate matter to the atmosphere (IDEQ 1999a). These other sources, many of which are found throughout Chubbuck, Pocatello, and the Fort Hall Indian Reservation, undoubtedly contribute to air pollution in the EMF study area.

For perspective on the relative amounts of particulate matter released by FMC, Simplot, and other sources, Table 2 presents selected findings from recent emissions inventories for particulate matter (IDEQ 1999a; USEPA 1999a). The table indicates that particulate emissions from FMC and Simplot account for a considerable portion of the overall emissions for the EMF study area. To a first approximation, therefore, emissions from these facilities also account for a considerable portion of the airborne particulate matter in the EMF study area, but the relative impacts of these facilities on air quality certainly vary from location to location. Also noteworthy is the fact that the emissions inventories suggest that FMC might release more than five times more particulate matter to the air than does Simplot.

Though this health consultation evaluates many different pollutants that FMC and Simplot emit, much of this document focuses on the facilities' emissions of particulate matter—a class of pollutants consisting of solid particles and liquid droplets in the air. The sidebar on the following page provides definitions of, and relevant background information for, particulate matter.

C. Meteorological Data: Where Do the Air Emissions Go?

Although the FMC and Simplot facilities have emitted pollutants in varying quantities over the years, it does not necessarily follow that residents have been continuously exposed to the site-related pollutants. Local meteorological conditions determine whether emissions from the facilities rapidly disperse in the air or gradually accumulate to potentially unhealthy levels. To understand how these local conditions affect levels of air pollution, ATSDR reviewed several

Background Information on Particulate Matter

For nearly 20 years, EPA has closely monitored the levels of solid particles and liquid droplets or aerosols, or “particulate matter,” in the air that people breathe. Many health studies have shown that the size of airborne particles is closely related to potential health effects among exposed populations (see “Public Health Implications” for more details). As a result, EPA and public health agencies focus on the size of airborne particles when evaluating levels of air pollution. This health consultation also classifies the emissions and air concentrations of airborne particles by their size. Particulate matter is generally classified into three categories:

Total suspended particulates (TSP) refers to a wide range of solid particles and liquid droplets found in ambient air, and typically is measured as particles having aerodynamic diameters of 25 to 40 microns or less (USEPA 1996). EPA’s health-based National Ambient Air Quality Standards (NAAQS) regulated ambient air concentrations of TSP up to 1987; they required *annual average* concentrations of TSP to be less than 75 micrograms per cubic meter (ug/m^3) and *24-hour average* concentrations to be less than 260 ug/m^3 (USEPA 1996). Many different industrial, commercial, mobile, and natural sources emit TSP to the air.

Particulate matter smaller than 10 microns (PM10) refers to the subset of TSP comprised of particles smaller than 10 microns in diameter. With research showing that PM10 can penetrate into sensitive regions of the respiratory tract, EPA stopped regulating airborne levels of TSP in 1987, and began regulating ambient air concentrations of PM10. EPA continues to regulate levels of PM10 today, and requires *annual average* concentrations to be less than 50 ug/m^3 and *24-hour average* concentrations to be less than 150 ug/m^3 (USEPA 1996). Typical sources of PM10 include, but are not limited to, windblown dust, grinding operations, and dusts generated by motor vehicles driving on roadways. Additional information on the statistical nature of EPA’s PM10 standard was presented earlier in this report.

Particulate matter smaller than 2.5 microns (PM2.5), or “fine particulates,” refers to the subset of TSP comprised of particles with aerodynamic diameters of 2.5 microns or less. By definition, PM2.5 is also a subset of PM10. With recent studies linking inhalation of fine particles to adverse health effects in children and other sensitive populations, EPA proposed regulating ambient air concentrations of PM2.5 in 1997. These health-based regulations require *annual average* concentrations of PM2.5 to be less than 15 ug/m^3 and *24-hour average* concentrations to be less than 65 ug/m^3 (USEPA 1997). Although many different sources emit PM2.5, the pollutant is primarily emitted by combustion sources (e.g., motor vehicles, power generation, boilers and industrial furnaces, residential heating). Fine particles are also formed in the air from other pollutants. Though EPA’s promulgation of the PM2.5 standard is still under legal review, ATSDR uses the proposed standard, and the scientific evidence that supports this standard, to evaluate inhalation exposures to PM2.5 in the EMF study area. Additional information on the statistical nature of EPA’s proposed PM2.5 standard was presented earlier in this report.

studies that evaluated how emissions from FMC and Simplot disperse in the atmosphere (Bechtel 1993; USEPA 1999d; OMNI 1991a; TRC 1993). These studies identified many meteorological conditions that affect local air pollution, but two factors—surface wind patterns and stagnation episodes (or inversions)—appear to have the strongest impact on air pollution in the EMF study area:

Surface winds. Not surprisingly, the wind direction plays a very important role on air quality issues in the EMF study area: winds blow emissions from the facilities to “downwind” locations, including parts of Chubbuck, Pocatello, and the Fort Hall Indian Reservation. According to wind direction measurements both at the Pocatello Airport (see Figure 2) and near FMC’s main process operations, the prevailing wind direction at locations immediately north of the industrial complex is from the southwest to the northeast (USEPA 1999d; TRC 1993). This wind pattern suggests that emissions from the facilities generally, but not always, blow toward the northeast. Somewhat consistent with this prevailing wind direction is the fact that community members have often reported seeing “a dense brown cloud” extend from near the FMC and Simplot facilities to locations as far as 5 miles to the north (Sho-ban 1989).

Though wind patterns observed at the Pocatello Airport exhibit consistent trends from year to year, prevailing wind patterns are considerably different at other locations in the EMF study area. For instance, a meteorological station operated near the Simplot facility has frequently observed winds blowing from the southeast to the northwest—a wind direction rarely observed at the Pocatello Airport (Bechtel 1996). Moreover, prevailing wind patterns in the Portneuf River valley, where the city of Pocatello is located, are also expected to have a strong southeasterly component, due largely to influences from local terrain (TRC 1993). In fact, IDEQ recently observed a prevailing southeasterly wind pattern at its meteorological monitoring station near downtown Pocatello (IDEQ 1999a).

Two studies have reported noteworthy associations between certain wind conditions and levels of air pollution at locations downwind of the FMC and Simplot facilities. More specifically, roughly 75% of the highest PM₁₀ concentrations measured by IDEQ at locations northeast of the FMC and Simplot facilities have occurred when relatively strong winds (i.e., 24-hour average wind speed greater than 9 miles per hour) blow from the southwest (IDEQ 1999a). Further, an ongoing study at the EMF site indicates that the highest concentrations of PM₁₀ at a location directly across the street from the FMC facility are associated with winds blowing from FMC toward the monitors (USEPA 1999d). Section IV.D comments on these studies further.

Stagnation conditions (inversions). Some of the highest levels of air pollution in the EMF study area have occurred during stagnation conditions (IDEQ 1999a). In fact, a particularly severe stagnation episode occurred in December 1999, as ATSDR was preparing an earlier release of this health consultation. In general, these stagnation

conditions, which are characterized by a calm atmosphere, light and variable winds, little or no precipitation, and near ground-level inversions, are typically observed in the winter, but they are observed infrequently. In fact, in some years, stagnation episodes have not occurred at all in the EMF study area. During the infrequent stagnation periods, however, emissions from FMC, Simplot, and other local sources become trapped in the lowest levels of the atmosphere. When stagnation conditions persist or are severe, air pollution throughout this area can reach potentially unhealthy levels.

Some researchers have characterized the specific meteorological conditions that are associated with the infrequent inversions. For instance, IDEQ has reported that the wintertime inversions generally occur on days with “temperatures near or below freezing; relative humidities above 70 percent; and multi-day meteorologically stagnant conditions” (IDEQ 1998b). Consistent with this observation, EPA has reported that the inversions occur primarily during “very specific and rare meteorological conditions—cold stagnant winter days with relative high humidity” (USEPA 1999a). As discussed in greater detail in Section IV.D, the aforementioned stagnation conditions are a major factor in the infrequent pollution episodes, or days when airborne particulate matter in much of Chubbuck, Pocatello, and the Fort Hall Indian Reservation reach unusually high levels.

It should be noted that ATSDR has reviewed several dispersion modeling studies (studies that simulate the transport of emissions in the atmosphere) for the EMF study area (Bechtel 1993; IDEQ 1991; OMNI 1991b; TRC 1993). Though these studies provide insight into levels of air pollution in locations where monitoring has not been conducted, the dispersion modeling results can be highly uncertain and are limited by the accuracy of critical inputs, particularly the emission rates from the phosphate processing plants. Perhaps the only consistent finding among these studies, however, is that modeled concentrations of PM₁₀ are highest in the immediate vicinity of FMC and Simplot and that trace levels of site-related contaminants are predicted to occur throughout the EMF study area, including at locations in the cities of Chubbuck and Pocatello, at the Fort Hall Agency, and in unincorporated areas between these locations.

Though ATSDR considered conducting its own dispersion modeling analysis for the EMF study area, the Agency eventually decided to abandon such efforts after learning of the difficulties EPA encountered with modeling emissions from FMC. As evidence of this, EPA has recently reported that “. . .despite repeated efforts of EPA, with the assistance of the Tribes, IDEQ, and affected industry, the air quality models initially selected and approved by EPA for use in the Power-Bannock area PM₁₀ non-attainment area, have continued to fail well-established performance criteria in the vicinity of the FMC facility. . .” (USEPA 1999a). For this reason and many other reasons, ATSDR decided that dispersion modeling results for the EMF site would undoubtedly be extremely uncertain and might possibly raise more questions than they would answer. As a result, the conclusions in this health consultation are based entirely on trends and patterns among the large volume of available air monitoring data, which, as mentioned

previously, characterize air concentrations of the pollutants that FMC and Simplot emit in greatest quantities.

D. Ambient Air Monitoring Data: What Are the Levels of Air Pollution?

This section reviews the results of relevant ambient air monitoring studies, or studies of the air that people breathe. Since various organizations have measured levels of air pollution in the EMF study area over the past 25 years, a large volume of ambient air monitoring data are available for review for many locations in the EMF study area. To illustrate this, Figure 3 indicates the locations of the monitoring stations operated by IDEQ and the Shoshone-Bannock Tribes. Further, Appendix A of this report includes ATSDR's review of 12 different air monitoring studies conducted in this area.

Since each study has a limited scope, no single study is sufficient for understanding how levels of air pollution have changed throughout the EMF study area over the years. Combining the results from the many studies, however, provides an extensive and consistent account of air quality in this region. More specifically, the collective weight-of-evidence from these studies indicates the following general trends in air quality:

- The data clearly show that air pollution in the EMF study area, like the air in most urban centers in the United States, contains many different components. However, most studies of the air in the EMF study area have focused on measuring levels of particulate matter, and the chemicals contained in particulate matter. The remainder of this section also focuses on these pollutants.
- Air monitoring data collected from 1975 to the present have consistently shown that concentrations of particulate matter, when averaged over the long term, are highest in the immediate vicinity of the FMC and Simplot facilities and gradually decrease with distance from the facilities. The most plausible explanation for this trend is that emissions from FMC and Simplot largely account for the higher levels of particulate matter in the facilities' vicinity, and this influence decreases with distance from the plants.
- Air monitoring data collected by the Shoshone-Bannock Tribes at a location across the street from FMC has consistently shown the highest levels of certain types of air pollution in the entire EMF study area. Moreover, an extensive source apportionment study has quite clearly identified air emissions from FMC as the source of the elevated levels of air pollution at this location on the Fort Hall Indian Reservation (USEPA 1999d).
- At monitoring stations northeast of FMC and Simplot, concentrations of particulate matter between 1994 and the present were, on average, more than 30% lower than

concentrations measured prior to that time—a concentration trend that was found to be statistically significant. Since the decreasing concentrations were observed at locations that used the same PM10 sampling methods since the mid 1980s, ATSDR has ruled out the possibility that the downward trend is somehow influenced by use of multiple sampling methods with differing sensitivities.¹ Though installation of emission controls at FMC and Simplot, and implementation of a residential wood combustion program have all been credited, to varying degrees, for causing the decreasing PM10 concentrations, the exact reason or reasons for this decline are not fully understood.

- Though long-term average concentrations of PM10 decreased in recent years, inversions can still cause unhealthy levels of air pollution to occur in the EMF study area. As evidence of this, some of the highest levels of air pollution ever measured in the city of Pocatello occurred during a particularly severe 6-day inversion in December 1999. IDEQ has concluded that “industrial sources are significant contributors” to the elevated levels of air pollution during inversions (IDEQ, 2000b).
- Despite the large volume of ambient air monitoring data currently available, important data gaps exist. Most notably, no monitoring has been conducted in areas on the Fort Hall Indian Reservation north of FMC and Interstate 86, and chemical analysis of particulate filters has not been conducted routinely at most monitoring stations.

ATSDR’s more detailed findings regarding the ambient air monitoring data are presented below, classified by pollutant. Selected supporting calculations are documented in appendices, as noted. The findings are based only on ambient air monitoring data collected from 1975 to the present. Without extensive data available for earlier years, ATSDR cannot make firm conclusions about levels of air pollution in the EMF study area prior to 1975.

The following discussion does not comment on whether the ambient air monitoring data trends indicate health hazards. Such analyses can be found in the “Public Health Implications” section, or Section IV.E.

Overview of Exposures to Particulate Matter: The Area of Impact. As a brief summary of the Agency’s findings regarding exposures to particulate matter, Figure 4 indicates the area where ATSDR believes concentrations of PM10 or PM2.5, either over the short term (24-hour average) or the long term (annual average), have exceeded health-based comparison values at least one time between 1975 and the present. ATSDR derived the area of impact in Figure 4 from the following observations:

¹ ATSDR acknowledges that the statistically significant downward trend in PM10 concentrations might simply result from changes in meteorology, or even by chance. However, the fact that annual average PM10 concentrations over the last 5 years have remained lower than their pre-1994 levels suggests that the downward trend is not spurious. Ongoing review of air monitoring data from IDEQ’s network can help confirm this hypothesis.

- Between 1975 and the present, every one of IDEQ's monitoring stations in Pocatello and Chubbuck have had at least one 24-hour average PM10 or PM2.5 concentration greater than EPA's corresponding health-based standards. Since the highest concentrations at these stations appear to be largely caused by prolonged stagnation conditions (IDEQ 1998b; IDEQ 1999a; USEPA 1999a), which tend to trap pollutants in the lowest levels of the atmosphere throughout the Portneuf Valley, ATSDR has reason to believe that airborne particulate matter has reached potentially unhealthy levels throughout the city of Pocatello on isolated occasions in the past and can continue to do so in the future. The area of impact in Figure 4 reflects this determination.
- As Appendices A and C explain, both annual average and 24-hour average concentrations of PM10 at the Pocatello Sewage Treatment Plant have exceeded EPA's corresponding health-based standard periodically between 1975 and the present. Since the short-term elevated levels of PM10 are generally influenced by winds blowing from FMC and Simplot toward the monitor, ATSDR has reason to believe that concentrations of PM10 in the areas between the facilities and the Pocatello Sewage Treatment Plant have also reached potentially unhealthy levels. Moreover, since the concentrations measured at the Pocatello Sewage Treatment Plant are likely representative of air quality for areas surrounding the monitor, ATSDR has reason to believe that levels of particulate matter roughly within 1 mile of this monitoring station also exceeded health-based standards, though this finding is clearly somewhat uncertain (as expanded upon below). The area of impact in Figure 4 reflects this finding.
- Since no air monitoring studies have been conducted in areas more than 1 mile north of FMC and Simplot, north of the Pocatello Sewage Treatment Plant, or north of Chubbuck School, the northern extent of the area of impact in Figure 4 cannot be established with the data currently available and, therefore, is unknown. Figure 4 reflects this finding by using a dashed line to mark the northern extent of the area of impact and a caption to explain the significance of this finding. The lack of monitoring data in this part of the EMF study area is a critical data gap that needs to be filled.

Overall, ATSDR believes the area of impact shown in Figure 4 is a best estimate of the areas where levels of airborne particulate matter (whether PM10 or PM2.5, whether over the short term or the long term) have exceeded health-based standards at some time between 1975 and the present. Given the fact that elevated concentrations of particulate matter have occurred throughout this area as recently as December 1999, ATSDR believes that elevated concentrations will likely occur in the future unless the main emissions sources in the area are reduced. As documented above and in the Appendices to this report, marking the boundaries of the area of impact in Figure 4 involves considerable uncertainty.

Recognizing this, ATSDR emphasizes that the boundaries should be viewed as a defensible estimate of the actual region where concentrations have exceeded health-based standards, and the

boundary shown might understate or overstate the actual area over which concentrations reached potentially unhealthy levels. In other words, some residents who live outside the shaded region in Figure 4 might have been, and continue to be, exposed to levels of particulate matter higher than relevant health-based standards, and some residents who live within the shaded region might not have been exposed to such levels.

Many different emissions sources are believed to contribute to the elevated levels of particulate matter in the EMF study area, but emissions from FMC and Simplot undoubtedly account for a considerable portion of the air pollution in this area, especially in areas immediately downwind of the facilities. A detailed source apportionment study, however, is not included in the scope of this health consultation.

More information on the short-term and long-term concentrations of PM10 and PM2.5 in the EMF study area follows:

PM10. The results of the many air quality studies performed in the EMF study area show that ambient air concentrations of PM10 have varied both with time and with location. The following discussion comments on these temporal and spatial variations by answering two basic questions about airborne levels of PM10 near the EMF site. The questions address *24-hour average* concentrations separate from *annual average* concentrations of PM10, since health-based standards have been developed for both exposure durations. Responses to the following questions are a critical input to the “Public Health Implications” section of this document:

At what locations were 24-hour average PM10 concentrations higher than corresponding health-based comparison values? The weight-of-evidence from the ambient air monitoring studies suggests that *24-hour average* concentrations of PM10 throughout Chubbuck and Pocatello and in parts of the Fort Hall Indian Reservation periodically exceeded health-based standards (i.e., 150 ug/m³) and have the potential to do so in the future. As noted earlier in this report, elevated concentrations near FMC and Simplot are generally associated with strong southwesterly winds that blow emissions toward the monitors, and elevated levels in the Portneuf Valley are generally associated with stagnation conditions, during which emissions from FMC and Simplot and many other sources appear to affect air quality.

The exceedances were clearly most frequent and most severe in the immediate vicinity of the FMC and Simplot facilities. Specifically, EPA has reported that *24-hour average* PM10 concentrations measured at a location on the Fort Hall Indian Reservation north of FMC and south of Interstate 86 exceeded 150 ug/m³ up to 21 days in 1996 and 20 days in 1997 (USEPA 1999a), but the exact spatial extent of this poor air quality is not known. Similarly, according to IDEQ’s monitoring data, the number of days with PM10 concentrations above health-based standards also varied from year to year: in some years, no exceedances were observed in Chubbuck and Pocatello at all; in other years,

however, as many as 6 exceedances likely occurred (IDEQ 1999a). Exceedances of PM10 air quality standards occurred in Pocatello as recently as December 31, 1999—a finding that is based on data that IDEQ recently released to ATSDR (IDEQ 2000).

Appendix C.1 presents the evidence ATSDR considered in reaching its conclusion regarding *24-hour average* concentrations of PM10. Note, ATSDR considers the lack of monitoring data on the Fort Hall Indian Reservation at locations north of Interstate 86 an important data gap that needs to be filled.

At what locations were annual average PM10 concentrations higher than corresponding health-based comparison values? The weight-of-evidence suggests that, in at least one year between 1975 and the present, *annual average* PM10 concentrations exceeded EPA's health-based comparison value (50 ug/m³) in parts of Chubbuck, Pocatello, and the Fort Hall Indian Reservation. The frequency with which *annual average* levels exceeded health-based standards appears to decrease with distance from the EMF site.

Air monitoring studies sponsored by FMC, Simplot, and EPA all indicate that *annual average* PM10 concentrations have exceeded EPA's health-based standard in an area immediately north of FMC (Bechtel 1995; Hartman 1999; USEPA 1999a). ATSDR believes these studies, taken together, suggest that concentrations of PM10 likely exceeded the *annual average* air quality standard in a small area for at least the last 6 years, and probably longer. According to EPA, trends in the ambient air monitoring data “point conclusively to FMC as the source” of the elevated PM10 concentrations in the area between FMC and Interstate 86 (USEPA 1999d). Note, it is not known how far north of the facilities concentrations exceeded health-based standards.

In addition to the data collected in the vicinity of FMC and Simplot, IDEQ's monitoring data suggest (1) that *annual average* PM10 concentrations at the Pocatello Sewage Treatment Plant might have exceeded 50 ug/m³ in as many as 12 years between 1975 and the present, and (2) that *annual average* PM10 levels at Chubbuck School might have exceeded this level in 3 years or fewer during this same time frame. On the other hand, ATSDR does not believe that such elevated *annual average* levels occurred at either Garret and Gould or Idaho State University. As Appendix C.3 explains, these estimates are based, in part, on extrapolations of TSP monitoring data and therefore are somewhat uncertain. Appendix C.2 presents the evidence ATSDR considered in reaching its conclusion.

PM2.5. Though ambient air concentrations of particulate matter have been measured extensively throughout the Pocatello area, few studies have measured concentrations of fine particles, also known as PM2.5. Nonetheless, the available PM2.5 monitoring studies characterize the size distribution of airborne particles typically observed in the EMF study area.

Knowledge of the particle size distribution, coupled with the PM10 and TSP measurements made over the years, provides insight into what PM2.5 concentrations might have been during times when this pollutant was not actually measured.

Responses to the following two questions summarize ATSDR's findings regarding the levels of PM2.5 that likely occurred in the EMF study area between 1975 and the present. Like the questions in the review of PM10 concentrations, the following questions address *24-hour average* and *annual average* concentrations separately. Responses to the following questions are a critical input to the "Public Health Implications" section of this document:

At what locations were 24-hour average PM2.5 concentrations higher than corresponding health-based comparison values? To date, *24-hour average* ambient air concentrations of PM2.5 have been measured at several locations, including across the street from FMC and at the Pocatello Sewage Treatment Plant, Chubbuck School, Idaho State University, and Garret and Gould. The most extensive PM2.5 monitoring effort conducted in the EMF study area to date has shown that *24-hour average* ambient air concentrations of PM2.5 across the street from FMC frequently exceeded health-based comparison values (i.e., 65 ug/m³) between October 1996 and September 1998 (USEPA 1999d). It is reasonable to believe that these exceedances occurred at this location prior to October 1996, even though monitoring was not conducted during this time. It is not known how far north these elevated PM2.5 concentrations occur.

In addition to the data collected across the street from FMC, IDEQ has measured *24-hour average* PM2.5 concentrations above health-based standards at all four of its monitoring stations. Since some of the elevated PM2.5 concentrations occurred as recently as December 1999, ATSDR believes it is possible that elevated PM2.5 levels will continue to occur in the future unless sources of this pollutant are reduced. Unlike the trend observed across the street from FMC, the elevated *24-hour average* concentrations of PM2.5 in Chubbuck and Pocatello appear to occur infrequently, primarily during stagnation episodes or inversions.

Appendix D.1 presents the evidence ATSDR considered in reaching its conclusion regarding *24-hour average* concentrations of PM2.5. The lack of extensive PM2.5 monitoring data on the Fort Hall Indian Reservation at locations north of Interstate 86 is an important data gap that needs to be filled.

At what locations were annual average PM2.5 concentrations higher than corresponding health-based comparison values? The available monitoring data suggests that *annual average* levels of PM2.5 were highest in the immediate vicinity of the EMF study area, with levels gradually decreasing with downwind distance. For instance, the most extensive PM2.5 monitoring study to date has shown that *annual average* concentrations of this pollutant have exceeded, and continue to exceed, 15 ug/m³

at locations immediately north of FMC. Based on a limited set of data collected by IDEQ in 1998 and 1999, *annual average* concentrations of PM_{2.5} currently do not exceed health-based standards throughout Chubbuck and Pocatello.

The weight-of-evidence suggests that, in the years before the PM_{2.5} monitoring studies were conducted, *annual average* PM_{2.5} concentrations likely exceeded EPA's health-based comparison value (15 ug/m³) in much of Chubbuck and Pocatello and in parts of the Fort Hall Indian Reservation. As Appendix D.2 explains, this finding is based primarily on extrapolations of PM₁₀ monitoring data, using defensible estimates of PM_{2.5}/PM₁₀ ratios. In other words, this finding is somewhat uncertain since it is based on estimated—not measured—concentrations of PM_{2.5}.

Appendix D.2 presents the evidence ATSDR considered in reaching its conclusion regarding *annual average* concentrations of PM_{2.5}.

Ionic species in particulate matter. Since studies have linked inhalation exposure of acid aerosols to an increased incidence of adverse health effects among sensitive populations, ATSDR obtained and reviewed ambient air monitoring data for several ionic species. These data were found for ammonium, chloride, fluoride, nitrate, potassium ion, and sulfate (Bechtel 1996; IDEQ 1999b). Of these species, the highest peak concentrations observed to date were for ammonium (42.75 ug/m³), nitrate (27.15 ug/m³), and sulfate (83.9 ug/m³) (IDEQ 1999b). Interestingly, these three peak concentrations all occurred at the Idaho State University monitoring station—the IDEQ station located *furthest* from the FMC and Simplot facilities.

The fact that the highest concentrations of these ions occurred far from FMC and Simplot does not necessarily imply that emissions from these facilities contributed little to the measured levels. To the contrary, the data trends are consistent with the hypothesis that emissions from the two facilities accounted for a considerable portion of the measured concentrations. For example, IDEQ has estimated that emissions of sulfur dioxide from FMC and Simplot account for more than 93% of the total emissions of sulfur dioxide in the EMF study area (IDEQ 1999d). Since sulfur dioxide emissions are a precursor to ambient sulfate ions, and since FMC and Simplot clearly emit more sulfur dioxide to the air than all other sources in the area combined, it is reasonable to assume that the peak concentrations of sulfate at Idaho State University can be attributed, to a large extent, to emissions from the phosphate processing plants. Moreover, given the fact that it takes time for airborne sulfur dioxide to react and form sulfates, it is not surprising that the highest sulfate concentrations have been observed at the monitoring station located furthest from FMC and Simplot. Regardless of the source of these ions, however, Section IV.E evaluates whether these elevated concentrations present a public health hazard.

Though never measured at the levels observed for ammonium, nitrate, and sulfate, fluoride was consistently detected in air samples, particularly those collected in close vicinity to Simplot, a known source of fluoride emissions. For example, the RI reported that the highest

concentrations of fluoride were measured at the three stations located around the perimeter of Simplot. The highest concentrations for these stations were 13.14 ug/m³, 11.29 ug/m³, and 10.92 ug/m³; average concentrations were not reported for these stations (Bechtel 1996). All of the samples from IDEQ's network that were selected for chemical analyses had concentrations lower than those measured during the RI. The "Public Health Implications" section reviews the fluoride concentrations in greater detail.

ATSDR reviewed the available monitoring data for the two remaining ionic species (chloride and potassium ion), but both species were measured at considerably lower levels than the other ionic species discussed above. More specifically, concentrations of chloride and potassium ion in the 72 valid samples collected were all less than 2.0 ug/m³. A brief toxicological evaluation is presented for these ions in the "Public Health Implications" section.

Phosphorous compounds (phosphorous, phosphate, phosphine, phosphorous pentoxide).

Since both FMC and Simplot process vast quantities of phosphorous every year, ATSDR carefully examined the measured ambient air concentrations of various forms of phosphorous. To date, ambient air monitoring studies conducted in the EMF study area have measured levels of total phosphorous in particulate matter as well as levels of phosphate ion (PO₄³⁻). However, no studies have characterized ambient air concentrations of phosphorous pentoxide—a pollutant known to be emitted by FMC (Bechtel 1993). Though ATSDR identified emissions estimates and dispersion modeling results for phosphorous pentoxide, the lack of ambient air monitoring data appears to be due to the lack of approved sampling and analytical methods for this compound. As a result, the actual levels of phosphorous pentoxide that people might have breathed, and might continue to breathe, are not known.

ATSDR does not consider this a critical data gap in the health consultation, however, since phosphorous pentoxide is known to react rapidly in air to form phosphate ion (USEPA 1999b). Due to this reaction, phosphorous pentoxide emitted by FMC will partly, if not entirely, transform to phosphate ion by the time the emissions reach residential areas. Thus, ATSDR believes evaluating ambient air concentrations of total phosphorous and of phosphate ion will adequately address the community concerns regarding emissions of phosphorous pentoxide.

Not surprisingly, concentrations of total phosphorous were consistently found to be highest in areas closest to FMC and Simplot.² For example, according to the RI, average concentrations of total phosphorous at a monitoring location immediately north of FMC were more than five times higher than average concentrations measured at any of the six other monitoring locations (Bechtel 1996). The magnitude of total phosphorous concentrations also varied with time: sometimes phosphorous was not detected in 24-hour average samples, and other times it was

² In this section, "total phosphorous" refers to the concentration of phosphorous measured by the x-ray fluorescence analytical method, which essentially measures all forms of phosphorous collected on particulate filters. Thus, "total phosphorous" includes phosphorous pentoxide, phosphoric acid, and other forms of the metal.

detected at concentrations as high as 26.8 ug/m³ (Bechtel 1996; USEPA 1999d). The highest *long-term average* concentration of total phosphorous reported to date is 5.45 ug/m³, at a location immediately north of FMC and based on nearly 1 year of routine sampling (Bechtel 1996). Though neither ATSDR nor EPA have published health-based comparison values for total phosphorous, the “Public Health Implications” section of this report carefully reviews available toxicological data for this metal.

ATSDR also reviewed data available on concentrations of phosphate ion, which were measured by IDEQ using ion chromatography. Data trends for phosphate ion were quite similar to those discussed above for phosphorous. However, because these measurements were not conducted routinely, representative average concentrations of phosphate ion cannot be calculated and compared to the average phosphorous concentrations. Nonetheless, the sporadic measurement of phosphate ion concentrations provides some insight into the magnitude of concentrations that have been observed in the area. More specifically, at the Pocatello Sewage Treatment Plant, 38 24-hour average measurements of phosphate ion have been made over a 5-year period, of which, half had phosphate ion concentrations between 10 and 50 ug/m³ and the other half had phosphate ion concentrations lower than this range (IDEQ 1999b). Of the more limited phosphate ion measurements at IDEQ’s three other monitoring stations, which are all in residential neighborhoods, no concentrations of phosphate ion were found to exceed 10 ug/m³. The “Public Health Implications” section of this report comments on the significance of these measurements.

Finally, ATSDR obtained and reviewed emissions and monitoring data for phosphine, an inorganic form of phosphorous that is released from FMC’s on-site waste management ponds (Bechtel 1998b; FMC 1999a, 1999b, 1999c, 1999d, 2000a). Unlike the data available for the other chemicals emitted by FMC and Simplot, no off-site ambient air monitoring data are available for phosphine, thus greatly limiting ATSDR’s ability to evaluate past and current exposures. Nonetheless, ATSDR has learned that FMC has developed “pond management standards” that include provisions for emissions monitoring, fence line air monitoring, and “a response action plan to ensure that the public will not be exposed to phosphine . . . levels that exceed federal guidelines” (Bechtel 1998). These management standards reportedly have been reviewed and approved by both EPA and the Shoshone-Bannock Tribes (Bechtel 1998). ATSDR reviewed a limited set of phosphine sampling data that FMC collected, which indicated that phosphine concentrations measured at the facility fence line using an OSHA-approved sampling and analytical method ranged from nondetect to 101 ppb (Bechtel 1998). Subsequent continuous measurements have shown phosphine concentrations at the edge of on-site ponds to range from nondetect to 2,310 ppb (FMC 1999a, 1999b, 1999c), and measurements of phosphine air concentrations at the facility fence line on four occasions have reportedly exceeded 1.0 ppm: 1.90 ppm on October 6, 1999; 1.10 ppm on October 23, 1999; 2.50 ppm on November 15, 1999; and 3.16 ppm on November 16, 1999 (FMC 1999d, 2000). These fence line measurements were collected using “hand-held monitors and Draegers” and not using methods approved by federal agencies (OSHA has an approved phosphine sampling method). ATSDR reviewed additional phosphine monitoring data, but they were collected using a hand-held device that is known to

report “false positive” detects for phosphine and, thus, are not included in this health consultation. Section IV.E reviews the significance of the measured phosphine concentrations, but ATSDR notes that the available data for this pollutant are limited.

Metals and other inorganics. Several ambient air monitoring studies have measured concentrations of metals and other inorganics in particulate matter at various locations in the EMF study area (Bechtel 1995; IDEQ 1999b; USEPA 1999d). Combined, these studies characterize airborne levels of more than 40 metals and other inorganics—most of which are emitted by either FMC or Simplot, or by both facilities. Table 3 lists these elements and summarizes how the measured concentrations compared to health-based comparison values. The table classifies the metals and other inorganics into three categories:

- 8 metals or inorganics were measured at levels exceeding their corresponding health-based comparison value on at least one occasion. For these elements, the frequency with which concentrations exceeded comparison values is summarized below, and the significance of these concentrations is reviewed in the “Public Health Implications” section of this report.
- 16 metals or inorganics were always measured at levels lower than their corresponding health-based comparison values. Thus, the monitoring data suggest that ambient air concentrations of these 16 elements have not reached “unsafe” or “unhealthy” levels in the EMF study area. Accordingly, toxicological evaluations of these metals and inorganics are not provided in this health consultation.
- 25 of the metals or inorganics that were measured during the air monitoring studies do not have health-based comparison values published by ATSDR or EPA. Of these elements, six (calcium, carbon, phosphorous, potassium, silicon, and sulfur) had highest concentrations greater than 1.0 ug/m³, and the remaining 19 had concentrations lower than this level. The “Public Health Implications” puts the monitoring data for these 25 metals and inorganics into perspective.

As noted earlier, and described in detail in Appendix B, when ambient air concentrations of a given pollutant exceed corresponding comparison values, this situation does not necessarily suggest that adverse health effects will occur, but it rather suggests that concentrations of the pollutant should be evaluated in greater detail to make conclusions on public health implications. As a critical input to the toxicological evaluations presented later in this report, the following list describes in greater detail the extent to which concentrations of 8 metals exceeded health-based comparison values. The “Public Health Implications” section of this report comments on the significance of the following trends.

Note, in the summaries below, results from three different studies were considered for identifying the maximum concentrations of metals and other inorganics (Bechtel 1995; IDEQ

1999b; USEPA 1999d). Since one of these studies (IDEQ 1999b) did not routinely analyze filters for chemical composition, ATSDR used only the data from the Remedial Investigation and the Fort Hall Source Apportionment Study to comment on *average concentrations* of metals and other inorganics.

Aluminum. Though concentrations of aluminum were measured in several air monitoring studies, only two monitoring locations (monitoring station 6 from the RI, see Appendix A.2, and the “Primary” station in the Fort Hall Source Apportionment Study, see Appendix A.4) reported concentrations of aluminum greater than the metal’s most conservative health-based comparison value (3.7 ug/m³). The *average concentrations*³ of aluminum in PM10 at these stations (0.15 ug/m³ and 0.85 ug/m³), however, were considerably lower than the comparison value. Concentrations of aluminum measured at all other monitoring stations were also considerably lower than the comparison value as well.

Arsenic. Three air monitoring studies indicated that concentrations of arsenic have recently, and frequently, exceeded the most conservative health-based comparison value (0.0002 ug/m³) (Bechtel 1995; IDEQ 1999b). Average concentrations in PM10 measured during the RI ranged from 0.000502 to 0.00127 ug/m³ (Bechtel 1995). Moreover, at the “Primary” station in the Fort Hall Source Apportionment Study, the highest annual average concentration of arsenic in PM10 was 0.0012 ug/m³. This study clearly showed that the elevated metals concentration at the “Primary” station were caused primarily by emissions from FMC. Concentrations measured both in the immediate vicinity of the EMF site and in nearby residential areas, therefore, were found to be higher than the most conservative health-based comparison value.

Barium. Of the numerous reported concentrations of barium that ATSDR reviewed, only one concentration—from a sample collected by IDEQ at the Pocatello Sewage Treatment Plant in 1991—exceeded the corresponding most conservative health-based comparison value. This one concentration (0.57 ug/m³) was only marginally higher than the corresponding comparison value (0.51 ug/m³). At all other monitoring locations, every concentration of barium reported was considerably lower than the comparison value.

Beryllium. Of the many studies that measured ambient air concentrations of metals, only the RI measured ambient levels of beryllium (Bechtel 1995). As Appendix A.2 shows, every concentration of beryllium measured at six of the seven monitoring locations in this study was lower than the corresponding health-based comparison value (0.0004

³ Average concentrations cited for the Fort Hall Source Apportionment Study are based on data from dichotomous samples. It is assumed that the sum of the average metal concentration in the fine fraction and the average metal concentration in the coarse fraction is equal to the average metal concentration in PM10.

ug/m³). Station 2, on the other hand, which was located immediately north of FMC in an unpopulated area, had a single concentration in TSP higher than this comparison value. The *average* concentration of beryllium in PM10 at this station (0.000179 ug/m³), however, was lower than the health-based comparison value.

Cadmium. Every study that has conducted speciated particulate monitoring in the EMF study area has reported both highest and average concentrations of cadmium at levels exceeding the most conservative health-based comparison value (0.0006 ug/m³). This trend was observed for every monitoring station in the RI (see Appendix A.2), for the Shoshone-Bannock monitors (see Appendix A.4), and for the IDEQ air monitoring network (see Appendix A.9). The highest average cadmium concentration in PM10 (0.035 ug/m³) was observed at the “Primary” station in the Fort Hall Source Apportionment Study; the cadmium detected at this station was shown to originate primarily from FMC’s emissions (USEPA 1999d). The levels of cadmium measured at stations closer to the FMC and Simplot facilities were consistently higher than the levels measured at stations further from the industrial complex.

Chromium. Three studies have routinely analyzed particulate filters to measure concentrations of chromium (Bechtel 1995; IDEQ 1999b; USEPA 1999d). Interpreting these ambient air monitoring data, however, is complicated by the fact that chromium is often found in two different states (hexavalent and trivalent). These states have entirely different implications from a toxicological perspective. As an initial screening, ATSDR compared the measured concentrations of chromium to the most conservative health-based comparison value for the metal, which happens to be for the hexavalent state (0.00008 ug/m³). This initial screening found that *highest* and *average* concentrations of chromium at every sampling location, whether in residential neighborhoods or in close proximity to the EMF study area, exceeded the comparison value for hexavalent chromium. The highest average concentration of total chromium in PM10 (0.029 ug/m³) was observed at the “Primary” station in the Fort Hall Source Apportionment Study. Moreover, concentrations of chromium at locations along the perimeter of FMC and Simplot were consistently higher than those at downwind monitoring locations.

Manganese. Concentrations of manganese were measured in three studies, but only a small subset of the concentrations reported in two of these studies exceeded the corresponding health-based comparison value (0.04 ug/m³). As Appendix A.2 describes, data collected during the RI indicate that ambient air concentrations of manganese in TSP exceeded the comparison value on at least one occasion at six of the seven monitoring locations, including at the two monitoring stations near residential neighborhoods. At all seven monitoring stations, however, the *average* concentrations of manganese in PM10 were notably lower than the comparison value. Consistent with this trend, monitoring data collected by IDEQ indicate that concentrations of manganese in PM10 generally exceeded the health-based comparison value on days when particulate concentrations

were high, but the IDEQ data are insufficient for calculating average concentrations. In the Fort Hall Source Apportionment Study, manganese never exceeded its comparison value in the fine fraction of particulate matter; in the coarse fraction, however, one sample had a manganese concentration (0.067 ug/m³) greater than the comparison value. The average levels of manganese in PM10 during the Fort Hall Source Apportionment Study were lower than the comparison value.

Vanadium. Ambient levels of vanadium in the vicinity of the EMF study area have been routinely measured during three different sampling efforts. Two of the sampling efforts never detected the metal at levels higher than the most conservative comparison value (0.2 ug/m³). The RI, on the other hand, reported several concentrations in TSP at levels higher than the comparison value, but only in unpopulated areas in the immediate vicinity of FMC and Simplot. At all seven monitoring stations that operated during the RI, *average* concentrations of vanadium in PM10 were lower than the comparison value.

Sulfur Dioxide. For more than 20 years, IDEQ has measured ambient air concentrations of sulfur dioxide in the EMF study area. Specifically, IDEQ monitored sulfur dioxide levels at the Pocatello Sewage Treatment Plant from 1977 to the present and at Garret and Gould from 1994 to the present. Overall, every *annual average* concentration of sulfur dioxide at both monitoring locations was less than EPA's health-based air quality standard (an *annual average* concentration of 0.03 ppm). However, a subset of *24-hour average* concentrations of sulfur dioxide at the Pocatello Sewage Treatment Plant were higher than EPA's corresponding health-based standard (a *24-hour average* concentration of 0.14 ppm) at least once a year, but not more than six times a year, from 1977 to 1985 (IDHW 1988).⁴ Since IDEQ's sulfur dioxide monitoring prior to 1994 was limited to one sampling location, however, the area over which elevated sulfur dioxide concentrations occurred in the past is not known, but is likely limited to the immediate vicinity of the monitors at the Pocatello Sewage Treatment Plant. Since 1985, concentrations of sulfur dioxide measured by IDEQ have not exceeded health-based comparison values. Therefore, the data suggest that *24-hour average* concentrations of sulfur dioxide exceeded health-based standards in a limited geographic area periodically between 1977 and 1985, but not again since. The "Public Health Implications" section of this report puts the past elevated concentrations of sulfur dioxide into perspective.

Other pollutants. In addition to the pollutants listed above, ATSDR obtained and reviewed information characterizing ambient air concentrations of other pollutants. However, most air quality studies conducted in the Pocatello area have focused on particulate matter, and relatively few studies have measured concentrations of other pollutants, like volatile organic compounds. Nonetheless, recent reports by IDEQ indicate that concentrations of carbon monoxide, nitrogen

⁴ It should be noted that EPA also has a *3-hour average* air quality standard, but this standard is not based on adverse health effects. Ambient air concentrations of sulfur dioxide at the Pocatello Sewage Treatment Plant exceeded this *3-hour average* standard only once in 1977, once in 1980, and twice in 1985.

dioxide, and ozone in Power and Bannock Counties are lower than EPA's corresponding health-based standards (IDEQ 1998a).

More specifically, IDEQ has conducted fairly extensive sampling for nitrogen dioxide at its Garret and Gould monitoring station in Pocatello (see Figure 3). Over the course of 5 years of sampling (from 1994 to 1999), annual average concentrations of nitrogen dioxide were always roughly one-third of EPA's health-based NAAQS of 0.053 ppm. Further, IDEQ has measured ozone concentrations in the EMF study area, but only during special studies conducted in the winter months, when ozone levels are typically at their lowest. All ozone concentrations measured during these studies were less than half of EPA's one-hour average health-based standard of 0.120 ppm, but the extent and timing of sampling are extremely limited.

Finally, ATSDR gathered data on air quality measurements of hydrogen cyanide, a chemical released to the air primarily by the waste-management ponds at FMC. The data obtained by ATSDR indicate that monitoring for hydrogen cyanide has been performed only within the FMC property boundary, and no off-site monitoring data are available. The limited on-site data suggest that air concentrations of hydrogen cyanide at the FMC fence line range from nondetects to as high as 430 ppb (Bechtel 1998). More recent monitoring at on-site locations along the perimeter of the waste management ponds has revealed hydrogen cyanide concentrations ranging from nondetects to 990 ppb (FMC 1999a, 1999b, 1999c, 1999d, 2000). FMC continues to monitor emissions and off-site transport of hydrogen cyanide as part of its "pond management plan," which both EPA and the Shoshone-Bannock Tribes have approved. Though implementation of this plan provides some level of comfort that off-site concentrations of hydrogen cyanide do not reach levels of health concern, ATSDR notes that only limited monitoring data are available to support such a conclusion.

Extensive information on pollutants other than those listed above are not readily available for the EMF study area. However, the previous summary reviews air quality data for a very large subset of pollutants released by FMC and Simplot, especially those released in greatest quantities.

E. Public Health Implications (Adult and Children's Health): Are the Levels of Air Pollution Unhealthy?

This section evaluates the public health implications of the levels of air pollution in the EMF study area. In general, the ambient air monitoring data described in the previous section indicate that a large segment of the population throughout the EMF study area have, at some time since 1975, been exposed to some site-related air contaminants, including PM₁₀, PM_{2.5}, and the various constituent of these airborne particles (e.g., metals, fluorides, phosphoric acid, sulfuric acid). This section provides a public health context to the exposures that have occurred to individuals who live near the EMF study area, including residents of Chubbuck, Pocatello, and the Fort Hall Indian Reservation. It is important to note that ambient air monitoring levels are used in this health consultation as a surrogate for exposure in the EMF study area. Actual

individual exposure to air pollutants is determined by a complex interplay between human activity, including the locations where time is spent, housing characteristics (as they influence penetration of outdoor pollutants), and other factors.

This section opens by providing relevant background information on the many studies that have been conducted in other parts of the country to determine public health implications associated with exposures to particulate matter. Following this general background discussion are detailed health evaluations for the following six categories of site-related contaminants:

- Particulate matter: exposures to PM₁₀ and PM_{2.5} are evaluated, with a greater emphasis placed on evaluating the potential PM_{2.5} exposures.
- Sulfates: exposures to sulfates measured in the EMF study area are evaluated.
- Acid Aerosols: exposures to several ionic species (other than sulfates) are considered, including an evaluation of exposures to phosphoric acid.
- Metals and inorganics: exposures to the 8 metals with at least one concentration greater than its comparison value (see Table 3) are evaluated in detail, and exposures to other metals and inorganics are also briefly discussed.
- Sulfur dioxide: exposures to sulfur dioxide are reviewed and evaluated.
- Phosphine and hydrogen cyanide: potential exposures to these chemicals are briefly reviewed.

For contaminants that are believed to have reached levels that might be associated with adverse health effects, the following discussion identifies populations that are believed to be at the greatest risk. For reference, Appendix B explains some of the health-based comparison values and guidelines that were used to evaluate the public health implications of exposures in the EMF study area. It is important to note that there is some scientific debate regarding the levels of PM_{2.5} or PM₁₀ that are considered protective for all segments of the population. Threshold concentrations for PM_{2.5} or PM₁₀ (i.e., a level below which no adverse health effects are likely) have not been established within the scientific literature.

As a result, EPA's PM₁₀ standard and proposed PM_{2.5} standard may not be protective of all sensitive subpopulations, though it is generally believed that the proposed *annual* PM_{2.5} standard is protective of the general population and probably many of the sensitive subpopulations. However, when establishing the PM_{2.5} standards, EPA intended for the annual average and 24-hour levels to work as a dual standard. That is, the 24-hour standard alone does

not protect against short-term health effects but the two standards working in concert are protective. Therefore, EPA set a value of 40 ug/m³ (termed an air quality index, or AQI) as a rough surrogate for the general level of protection provided by the two standards in combination. For more information regarding EPA's use of AQIs, see the notice in the Federal Register, Volume 64, No. 149, page 42542, Wednesday, August 4, 1999.

The following evaluation of the public health implications of exposures to PM incorporates the understanding that there are no currently established PM thresholds and the understanding of the dual nature of the PM_{2.5} standards.

Relevant Background Information on Health Implications of Exposures to PM and Related Constituents. Over the past 20 years, numerous investigators have researched the public health implications of inhalation exposures to PM. The following discussion reviews this large volume of research, which provided a basis for much of the evaluations presented later in this section.

Prior to 1987, EPA enforced health-based standards that regulated ambient air concentrations of total suspended particulates, or TSP. By 1987, a growing amount of research had shown that the particles of greatest health concern were actually PM₁₀, which, at the time, were shown to be capable of penetrating into sensitive regions of the respiratory tract. Consequently, EPA and the states took action in 1987 to monitor and regulate ambient levels of PM₁₀. Since 1987, hundreds of additional studies (mostly epidemiological) have been published on the health effects of PM. These studies generally suggest that adverse health effects in children and other sensitive populations have been associated with exposure to particle levels well below that allowed by EPA's PM₁₀ standard (USEPA 1997). Moreover, it is generally believed that fine particles (PM_{2.5}) can penetrate into the lungs more deeply than PM₁₀ and that fine particles are more likely to contribute to adverse health effects than coarse particles (i.e., particles larger than 2.5 microns, but smaller than 10 microns).

According to the various studies on PM, many health effects were found to be associated with PM_{2.5} exposures or with PM_{2.5} exposures coupled with exposures to other pollutants (USEPA 1997). A partial list of these health effects follows:

- premature death
- respiratory-related hospital admissions and emergency room visits
- aggravated asthma
- acute respiratory symptoms, including aggravated coughing and difficult or painful breathing

- chronic bronchitis
- decreased lung function that can be experienced as shortness of breath

These studies indicate that elderly, infants, and persons with chronic cardiopulmonary disease, influenza, or asthma, are most susceptible to mortality and serious morbidity effects from short-term acutely elevated exposures. Others are susceptible to less serious health effects such as transient increases in respiratory symptoms, decreased lung function, or other physiological changes. Chronic exposure studies suggest relatively broad susceptibility to cumulative effects of long-term repeated exposure to fine particulate pollution, resulting in substantive estimates of population loss of life expectancy in highly polluted environments (Pope 2000). It is important to note that susceptibility may also be dependent on a number of exposure factors, including duration of exposure. The degree to which an added particle burden may impact an individual will likely be affected by their age, health status, medication usage, and their overall susceptibility to PM inhalation exposures. Certainly, one factor that may promote increased risk in the older population is that, over their lifespan, they may have had more exposure and hence more opportunity to accumulate particles or damage their lungs (USEPA 1996). Current epidemiological research does not provide conclusive evidence of an association between exposure to PM, in general, and cancer. However, since PM is made up of various constituents, depending on the source(s), there are likely to be chemicals included in PM that are potential carcinogens.

For reasons above, EPA proposed revisions to its PM standards in 1997 to include a primary (health-based) annual average PM_{2.5} standard of 15 ug/m³ and a 24-hour PM_{2.5} standard of 65 ug/m³ (USEPA 1997). EPA's scientific review concluded that fine particles are a better surrogate for those components of PM most likely linked to mortality (death) and morbidity (disease) effects at levels below the previous standard, while high concentrations of coarse fraction particles are linked to effects such as aggravation of asthma (USEPA 1997).⁵

The body of scientific knowledge used to set the health-based PM_{2.5} standard consisted primarily of epidemiological studies of communities exposed to elevated levels of PM—communities like those in and around the EMF study area. These epidemiological studies found consistent associations between exposure and adverse health effects both for short-term or acute PM exposure scenarios (i.e., usually measured in days) and for long-term or chronic exposure scenarios (i.e., usually measured in years) (USEPA 1996). Chronic exposures are best measured using *annual average* PM_{2.5} levels (concentrations above 15 ug/m³) for one or several years; whereas, acute exposures are best measured by using the *24-hour average* PM₁₀ and

⁵ A legal debate still surrounds EPA's promulgation of the PM_{2.5} standard. Regardless of the legal status of the standard, the authors of this report believe the epidemiological evidence considered in developing the standard is compelling and therefore use this epidemiological evidence to assess public health implications associated with PM_{2.5} exposures in the EMF study area.

PM_{2.5} levels (concentration above 150 ug/m³ and 65 ug/m³, respectively). It should be noted that the epidemiological studies indicate increased health risks associated with PM exposures, either alone or in combination with other air pollutants.

PM-related increases in individual health risks are small, but likely significant from an overall public health perspective because of the large numbers of individuals in susceptible risk groups that are exposed to ambient PM (USEPA 1996). Although the epidemiological data provide support for the associations mentioned above, an understanding of the underlying biological mechanisms has not yet emerged (USEPA 1996). Much of the toxicological findings related to PM are derived from controlled exposure studies in humans and laboratory animals. These studies have most extensively focused on acidic aerosols (a subclass of PM), namely sulfuric acid aerosols and various sulfates and nitrates, and have included characterization of acid aerosols effects on pulmonary mechanical functions, lung particle clearance mechanisms, and other lung defense mechanisms (USEPA 1996). Controlled human exposures to PM constituents other than acid aerosols are limited. Laboratory animal studies and occupational exposure studies provide information on other PM substances, including metals, diesel emissions, crystalline silica, and other miscellaneous particles. Human exposure studies of particles other than acid aerosols generally provide insufficient data to draw conclusions regarding health effects (USEPA 1996). A recent study (Godleski, et al. 2000), funded by the Health Effects Institute (HEI), an independent and unbiased source of information, supported by both public and private sources, found that concentrated airborne particles had adverse effects on the electrical regulation of the heart in dogs with a pre-existing heart condition, while the impact on normal dogs was not clear. Moreover, biological evidence indicates that urban combustion particles can penetrate past the primary defense mechanisms of the lung, can elicit inflammatory changes in the lung and systematically (throughout the body), contain a constituent (soluble transition metals) that by itself can be demonstrated to produce lung damage, can produce electrocardiogram changes including arrhythmia (heart irregularities), and can kill animals with pre-existing heart and lung disease (Schwartz 1999). Human studies have also reported inflammatory changes, including systemic changes, and changes to cardiovascular risk factors (Schwarz 1999). Although scientific evidence has provided some clues into the biological mechanisms of how PM may elicit adverse health effects in animals and humans, clear evidence of the exact mechanisms has not emerged.

In summary, the weight-of-epidemiological evidence suggests that ambient PM exposure has affected and continues to affect the public health of U.S. populations. However, a great deal of uncertainty remains regarding many issues related to the overall scientific inquiry into the health effects of PM (USEPA 1996). Moreover, several viewpoints currently exist on how best to interpret the epidemiological data: one sees PM exposure indicators as surrogate measures of complex ambient air pollution mixtures and reported PM-related effects represent those of the overall mixture; another holds that reported PM-related effects are attributable to PM components (per se) of the air pollution mixture and reflect independent PM effects; and yet another suggests that PM can be viewed both as a surrogate indicator as well as a specific cause

of health effects. Whichever the case, reduction of PM exposure would be expected to lead to reductions in the frequency and severity of PM-associated health effects (USEPA 1996).

PM2.5 and PM10 Exposures. ATSDR estimates that at least 53,710 persons have been exposed at some time between 1975 and the present to potentially unhealthy levels of either PM10 or PM2.5. This finding is based on census data and the area of impact shown in Figure 4. Of this exposed population, ATSDR estimates that at least 12,129 persons (that is, 6,619 children 6 years and younger and 5,510 adults aged 65 and older) are in subpopulations that may be sensitive to the effects of exposure to PM. It is important to note that it is likely that these estimates either overstate or understate the actual population exposed to unhealthy levels of PM. As indicated in Figure 4, since levels of air pollution were not measured at locations north of the EMF study area, ATSDR cannot establish the northern extent of the area of impact.

The health concerns expressed by community members in the EMF study area (i.e., increased incidence of asthma, upper respiratory illness, and heart disease) are reasonably consistent with adverse health outcomes reported in the epidemiological research for both acute and chronic exposures to PM2.5 and PM10 above health-based standards. However, the consistency between the concerns and the epidemiological studies does *not* suggest that any given incident of these health outcomes is *caused* solely by inhalation exposures to PM2.5 or PM10. Rather, causality of any given disease is usually a result of multiple factors. For example, smoking is a strong risk factor for many lung and heart diseases. Therefore, smokers comprise another population group at likely increased risk for PM-related health effects (USEPA 1996).

The following discussion first evaluates the increased risks from exposures to PM2.5 (annual averages) based on results from chronic mortality epidemiological studies and then evaluates the increased risks from exposures to PM2.5 and PM10 (24-hour maximum values) based on results from acute mortality and morbidity epidemiological studies. The ambient air concentrations of PM reported in these epidemiological studies is compared to estimated and measured levels of PM in the EMF study area. The discussions present a qualitative evaluation of the data collected in the EMF study area and should provide context for understanding the risk of adverse health effects to persons exposed in the EMF study area.

Chronic Exposures to Annual Average PM2.5 Levels. Two large cohort studies, the Harvard Six-City Study (Dockery 1993) and the American Cancer Society Study (ACS) (Pope 1995), found an association between excess mortality in adults and increasing PM2.5 concentrations in various cities and metropolitan areas of the United States (not including the Pocatello area). More specifically, the Harvard Six-City Study showed a 31% increase in mortality for every 25 $\mu\text{g}/\text{m}^3$ increase in PM2.5, and the ACS study showed a 17% increase in mortality for every 25 $\mu\text{g}/\text{m}^3$ increase in PM2.5. The reported ranges of annual average PM2.5 for the Harvard Six-City Study (HSCS) and the ACS study were 11–30 $\mu\text{g}/\text{m}^3$ (mean) and 9–34 $\mu\text{g}/\text{m}^3$ (median), respectively, for the least to the highest levels of PM2.5 in a given city during the study period. The risks calculated

above were based on the excess mortality between the least to the most polluted cities (USEPA 1996).

Given the importance of the HSCS and ACS studies, HEI funded a study to re-analyze the results of the HSCS and ACS studies. The first major conclusion of the re-analysis study was that the original results of these two studies was of high quality and that the independent analysis of the data produced essentially the same results as the original studies. Moreover, the study tested the original results against a range of alternative variables and analytic models without substantially altering the original findings of an association between indicators of PM air pollution and mortality. In addition, an association between sulfur dioxide and mortality was observed and persisted when other possible confounding variables were included; furthermore, when sulfur dioxide was included in models with fine particulates or sulfate, the associations between these pollutants and mortality diminished. The study found relatively robust associations of mortality with fine particles, sulfates, and sulfur dioxide. The final interpretation by the researchers, related to their expanded analysis of the data, suggested that increased risk of mortality may be attributable to more than one component of the complex mix of ambient air pollutants in urban areas of the United States (Krewski, et al. 2000).

These and other chronic exposure studies, taken together, suggest that there may be increases in mortality in disease categories that are consistent with long-term exposure to airborne particles and that at least some fraction of these deaths reflect cumulative PM impacts above and beyond those exerted by acute exposures events (USEPA 1996). Also important is the fact that the Harvard Six-City Study and the ACS study controlled for subject-specific information regarding other relevant risk factors (such as cigarette smoking, occupational exposure, etc.); thus, these studies appear to provide reliable information about the effects of long-term exposures to PM (USEPA 1996). Moreover, the findings of an independent re-analysis by the HEI of these studies only serves to strengthen the conclusions of the original study and to show they were sound science. Overall, the weight-of-epidemiological data suggests long-term, repeated PM exposure has been associated with increased population-based mortality rates as well as increased risk of mortality in broad-based cohorts or samples of adults and children. Chronic exposures studies of PM suggest rather broad susceptibility to cumulative effects of long-term repeated exposure. There is no evidence that increased mortality risk is unique to any well-defined susceptible subgroup (Pope 2000).

Based on the epidemiological evidence, the extensive monitoring data available, and the estimates of historic levels of PM_{2.5}, the community residing in the area of impact (see Figure 4); that is, in the populated areas northeast of FMC and Simplot (i.e., between the Pocatello Sewage Treatment Plant and Chubbuck School monitoring stations), may have experienced adverse health effects similar to those reported in the literature from chronic exposures to PM_{2.5} during several years between 1975 and 1993. Chronic exposures

and the resulting increased risk of adverse health effects to those residing in Pocatello during this same time frame are also elevated but are likely to be less than those experienced by persons living in areas between Chubbuck and the Pocatello Sewage Treatment Plant. As previously indicated, the numerous studies on PM suggest that the elderly, individuals with pre-existing heart or lung disease, children (not included in Harvard Six-City Study or ACS Study), and asthmatics are the most at risk for adverse health effects from chronic exposure to PM_{2.5}.

The epidemiological evidence, results of monitoring data from the EMF study area from 1994 to present (annual average PM₁₀), and subsequent estimates of PM_{2.5} levels, indicate that exposure to PM during this time frame within the area of impact were likely to result in only minimal risks for adverse health effects for the general public and for probably many sensitive subpopulations. However, as previously indicated, there is no clear threshold level for PM. Therefore, some hypersensitive segments of the subpopulations residing in the EMF study area may have experienced adverse health effects from their long-term PM exposure during the 1994 to present time frame.

Persons living on the Fort Hall Indian Reservation, especially areas of the reservation nearest to the FMC and Simplot facilities, have likely been and are still being exposed to annual average levels of PM_{2.5} and PM₁₀ above levels of health concern; however, the actual levels and areal extent of this exposure cannot be determined because of the lack of monitoring data north of the facilities and north of Interstate 86.

Acute Exposures to 24-Hour Average PM_{2.5} and PM₁₀ Levels. Early indications that fine particles are likely important contributors to observed PM-mortality and morbidity (disease) effects came from evaluations of past serious air pollution episodes in Britain and the United States. The more severe episodes were characterized by several days of calm winds, during which large coarse particles rapidly settled out of the atmosphere and concentrations of fine mode particles dramatically increased (USEPA 1996). These meteorological conditions have been reported on numerous occasions in the EMF study area since 1975, the most recent being a severe 6-day inversion at the end of December 1999.

Most of the epidemiological studies of PM to date have focused on acute exposures (usually daily) and their association with various health end points; such as, mortality counts, hospitalizations, symptoms, and lung function. Unfortunately, until recently (following the promulgation of the new proposed PM_{2.5} standards), there have been very little daily monitoring of fine particles, and most of the studies used other methods of measuring particulate concentrations (Pope 2000). The table on the following page provides a summary of the epidemiological evidence of health effects of acute exposure to PM (Pope 2000).

Summary of Epidemiological Evidence of Health Effects of Acute Exposure to PM Air Pollutants (Adapted from Pope 2000)	
<i>Health End Points</i>	<i>Observed Association with PM</i>
Episodes of death and hospitalizations	Elevated respiratory and cardiovascular mortality and hospitalizations.
Mortality (death)	Elevated daily respiratory and cardiovascular mortality counts. Effects persisted with various approaches to control for time trends, seasonality, and weather. Near-linear associations with little evidence of threshold.
Hospitalization and other health-care visits	Elevated hospitalizations, emergency room visits, and clinic/outpatient visits for respiratory and cardiovascular disease. Effects generally persisted with various approaches to control for time trends, seasonality, and weather.
Symptoms/lung function	Increased occurrence of lower respiratory symptoms, cough, and exacerbation of asthma. Only relatively weak associations with respiratory symptoms. Small, often significant declines in lung function.

The results of a major study in the United States that evaluated the association of short-term exposures to PM₁₀ and other pollutants, as related to mortality and morbidity (as measured by hospitalizations), was released in 2000 (Samet, et al. 2000). HEI's National Morbidity, Mortality, and Air Pollution Study (NMMAPS) used several new and innovative approaches to overcome some of the limitations of previous studies of daily exposures to air pollutants and its relationship to death and hospitalizations. The approach used was to characterize the effects of PM₁₀ alone or in combination with gaseous air pollutants in a consistent way, in a large number of cities, using the same statistical approach. The study looked at the effects of PM₁₀ and other pollutants on mortality in the 20 and 90 largest U.S. cities. In addition, the study looked at morbidity, as measured by daily PM₁₀ effects on hospitalization among those 65 years of age and older, in 14 U.S. cities. The HEI concluded that the study has made substantial contribution in addressing major limitations of previous studies. The results of the 20 and 90 city mortality studies were generally consistent with an average approximate 0.5% increase in overall mortality for every 10 ug/m³ increase in PM₁₀ measured the

day before death. This effect was slightly higher for deaths due to heart and lung disease than for total deaths. The PM10 effect on mortality also did not appear to be affected by other pollutants in the model. The 14-city hospital admission study of persons 65 years or older indicated that there was a consistent approximate 1% increase in admissions for cardiovascular diseases and about a 2% increase in admissions for pneumonia and COPD for each 10 ug/m³ increase in PM10 (Samet, et al. 2000).

The results of these epidemiological studies suggest that the maximum 24-hour levels of PM10 and PM2.5 in the EMF study area between 1975 and the present (see Table A-1) have exceeded concentrations, on numerous occasions, that are associated with adverse health effects. The monitoring data and estimates suggest that the highest levels were detected either near the FMC and Simplot facilities or in the City of Pocatello. These data indicate that the population of Pocatello, because of the meteorological conditions that trap pollutants in the Portneuf Valley during inversion conditions, was at a higher risk of adverse health effects from acute levels of PM10 and PM2.5 than was the population of Chubbuck. However, this did not hold true during the December 1999 inversion, when the maximum PM2.5 levels for the same day (12/29/99), detected in Pocatello (119 ug/m³ at Garrett and Gould) and in Chubbuck (110 ug/m³ at Chubbuck School) were not considerably different. The risks of combined chronic and acute adverse health effects for other years, during the 1975 to present time frame, for persons residing in Chubbuck and between the Pocatello Sewage Treatment Plant and Chubbuck would not be considered minimal.

According to the epidemiological literature, some of the adverse health effects associated with the range of maximum 24-hour levels of PM10 and 2.5 in the EMF study area, including the levels detected during the December 1999 inversion, are increased total acute mortality, increased hospital admissions for the elderly (>65 years) for lung and heart disease, chronic obstructive pulmonary disease (COPD), pneumonia, ischemic heart disease, and increased respiratory symptoms (i.e., increased cough and decreased lung function) (USEPA 1996). Overall, the PM risk estimates from total mortality epidemiological studies suggest that an increase of 10 ug/m³ in the 24-hour average PM10 level (or an increase of 5-6 ug/m³ in PM2.5) is associated with increased risks of adverse health effects of 0.5–1.5% (Pope 2000), with even higher risks possible for elderly sub-populations and for those with pre-existing respiratory conditions (USEPA 1996). Moreover, the levels of PM 2.5 detected in the Chubbuck and Pocatello areas, during the December 1999 inversion, were about 2 to 3 times higher than the AQI set by EPA (see previous discussion on the meaning of the AQI).

Persons living on the Fort Hall Indian Reservation, especially areas of the reservation nearest to the FMC and Simplot facilities, may have been and may still be exposed to maximum 24-hour levels of PM10 and PM2.5 above levels of health concern; however,

the actual levels and areal extent of this exposure cannot be determined because of the lack of monitoring data north of the facilities (north of Interstate 86).

Sulfate Exposures. Some chronic epidemiological studies have shown that the annual mean levels of sulfate (SO_4^{-2}), a subset of fine PM, to be associated with increased mortality in adults, increased bronchitis in children, and decreased lung function in children (USEPA 1996). The two main studies (the Harvard Six-City Study and the ACS study) indicated that every 15 ug/m^3 increase in annual average sulfate concentrations was associated with increases of 46 and 10%, respectively, in adult mortality (USEPA 1996). As previously indicated, annual average concentrations for sulfate ion in the EMF study area are not available for comparison to the levels found in epidemiologic studies associated with chronic adverse health effects.

Acute epidemiologic studies have associated sulfate exposures with increased hospitalizations and increased respiratory symptoms. The range of sulfate concentrations for these studies was $2\text{--}49 \text{ ug/m}^3$. The five highest 24-hour sulfate ion concentrations detected at the IDEQ monitoring stations ranged from $18\text{--}73 \text{ ug/m}^3$ for the STP monitor, $13\text{--}32 \text{ ug/m}^3$ for the Chubbuck School monitor, $25\text{--}67 \text{ ug/m}^3$ for the Garret and Gould monitor, and $26\text{--}84 \text{ ug/m}^3$ for the ISU monitor. Based on these data and the results of the three epidemiological studies found in the literature, it can be reasonably assumed that persons, especially certain sensitive sub-populations residing in parts of Chubbuck and Pocatello, may have experienced an increased risk of adverse health effects during some of these days.

Acid Aerosol Exposures (including ionic species other than sulfates). Studies of past episodes of air pollution suggest that both acute and chronic health effects are associated with inhalation exposures to strongly acidic PM. For example, studies of historical pollution episodes, notably the London Fog episodes of the 1950's and early 1960's, indicate that acute exposures to extremely elevated levels of acid aerosols may be associated with excess human mortality. Studies evaluating present-day U.S. levels of acid aerosols have not found associations between acid aerosols and acute and chronic mortality, but the series of hydrogen ion (H^+) data used may not have spanned a long enough time frame to detect H^+ associations. However, several morbidity studies have associated H^+ concentrations with increased bronchitis and reduced lung function in children and an increase in respiratory hospital admissions (USEPA 1996). Furthermore, based on animal studies, it is known that sulfuric acid aerosols exert their action throughout the respiratory tract, with the site of deposition dependent upon the particle size and the response dependent on mass and number concentration of specific deposition sites (USEPA 1996). However, the animal studies on acid aerosols provide no evidence that ambient acidic PM components contribute to mortality and essentially no quantitative guidance as to ambient acidic PM levels at which mortality would be expected to occur in either healthy or diseased humans. Furthermore, the effects seen in these animal studies were at acid levels that exceed worst-case ambient concentrations by more than an order of magnitude (USEPA 1996).

Several acids, such as, sulfuric acid, phosphoric acid, and hydrofluoric acid, are known to be released from the phosphate plants. In addition, phosphorous pentoxide (a signature constituent of the FMC emissions) and sulfur dioxide can be transformed in the atmosphere into phosphoric acid and sulfuric acid, respectively. All of these acids are considered potential respiratory irritants. The concentrations of ammonium ion present in filter samples is indicative of the elevated levels of ammonia being released in the EMF study area. It is possible, under certain conditions, that the levels of ammonia will neutralize all or some of the acids present in the ambient air thus ameliorating their potential respiratory effects. Because hydrogen ion data are quite limited in the EMF study area, a more definitive conclusion regarding the acidic nature of the ambient air in the EMF study area and resulting health implications cannot be made.

The presence of other ionic species, such as chloride and potassium ions, detected in the filter samples may be indicative of other acidic, basic, or other species (salts) that were present in the ambient air. Since the concentrations of these ions present in the EMF study area are relatively small, however, it cannot be determined from the available data if they contribute more or less to the overall acidity of the ambient air or are part of metallic or other salts that may have more important toxicological implications.

Exposures to Metals and Inorganics. The chemical analyses of filter samples performed during the RI, by the IDEQ, and by the Sho-Ban Tribe, present results for the elemental forms of metals and other inorganics. Therefore, the public health implications of exposure to the metals and other inorganics detected must be made on this basis. However, it is likely that the elements detected and presented in Table 3 were part of various compounds (either salts or covalently bound organic species of metals) which may be more or less toxic than the elemental species. However, it is important to note that scientific evidence indicates that different metallic salts show similar toxicity, whereas, more differences are found between elemental species with different valence states or metals covalently bonded to organic species. In some cases, the public health implications for these elements cannot be determined due to the paucity of studies for the elemental species. For example, the elements calcium, magnesium, and sodium were detected from filter samples; however, they were likely in the ambient air in the form of various salts formed with other elements. The public health implications of these metallic compounds cannot be determined, since the true forms of the metals in ambient air are not known. In some cases, the toxicity of the metallic compounds in ambient air may be greater (or less) than the elemental metal detected on a filter sample. Therefore, the toxicological evaluation of the individual elements below may overstate or understate the toxicological significance of exposure to metallic compounds in the ambient air. Acceptable analytical methods for determining the concentrations of metallic compounds in air have not been developed.

The public health implications of silicon, bromine, carbon, and chloride ion cannot be determined because they usually form other compounds of varying toxicological properties. For example, silicon in its crystalline forms has different toxicological significance than silicon in its amorphous form. The carbon fraction of ambient particulate matter consists of both elemental

and organic carbon. Elemental carbon, also known as carbon black or graphitic carbon, has a chemical structure similar to impure graphite and is emitted directly into the atmosphere predominantly during combustion. Organic carbon is either emitted directly by sources or can be formed in the atmosphere by chemical reactions of hydrocarbons. Soot is commonly represented as elemental carbon, black carbon, or light absorbing carbon measured by thermal/optical or optical absorption techniques; however, soot has no firmly established definition (USEPA 1996).

The following discussion evaluates the public health implications of exposure to the eight metals that were detected above health-based comparison values: aluminum, arsenic, barium, beryllium, cadmium, chromium, manganese, and vanadium. As indicated above, only the public health implications of the elemental forms of these metals can be evaluated; these elemental forms are different from the species that may have been present in the ambient air. Furthermore, as previously indicated, the calculation of average annual metals concentrations and the reporting of 24-hour maximum levels were possible from the RI and Sho-Ban data. However, for the IDEQ data, only the maximum 24-hour levels were reported.

Aluminum. Elemental aluminum has not been classified as to its carcinogenicity. The average concentrations of aluminum detected at the RI and Sho-Ban monitors were all below levels of public health concern. However, the maximum level of aluminum detected at the Sho-Ban monitors (5.55 ug/m^3) was above the chronic health comparison value (3.7 ug/m^3) for non-carcinogenic health effects. The maximum level is more appropriately compared to levels in the literature that have caused adverse health effects because of short-term or acute exposures. The maximum levels of aluminum detected were compared to animal and human studies in the literature. Based on this evaluation, the levels detected in the EMF study area were about 540 and 1,260 times lower than the no-observed-adverse-effect level (NOAEL) and lowest-observed-adverse-effect level from animal studies (ATSDR 1999a); therefore, adverse health effects from short-term exposure to aluminum is not likely based on the available data. The maximum concentrations of aluminum detected at monitors located in residential areas were below health-comparison values.

Arsenic. EPA has classified arsenic as a human carcinogen via the inhalation route. Based on the highest average concentration of arsenic detected during the RI, exposure to arsenic would result in a no apparent increase risk of cancer. The maximum 24-hour level detected was compared to studies in the literature that investigated the non-carcinogenic effects of exposure to arsenic in animals and humans. Based on this comparison, the levels of arsenic in air were about 18,000 and 40,000 times lower than the NOAEL and the lowest-observed-adverse-effect level (LOAEL), respectively (ATSDR 2000a). Based on this analysis, it is unlikely that adverse health effects would result from short-term exposure to the levels detected in the EMF study area.

Barium. No studies were found in the literature regarding carcinogenic effects in humans or animals after inhalation exposure to barium (ATSDR 1992a). The average concentrations of barium detected during the RI were well below the chronic health comparison value for all monitoring stations. However, the maximum level detected for the IDEQ analysis of selected filter samples was slightly above the chronic health comparison value of 0.51 ug/m³ for non-carcinogenic health effects. Although there are not many studies in the literature for inhalation effects after exposure to barium, maximum levels of barium detected in the EMF study area were well below levels likely to result in adverse health effects from short-term exposures (ATSDR 1992a).

Beryllium. Beryllium is classified by EPA as a probable human carcinogen via the inhalation route. All of the average concentrations of beryllium detected during the RI were below the health-based comparison value for carcinogenic health effects. The maximum level of beryllium detected during the RI was at least 400,000 times lower than the lowest acute LOAEL for respiratory and other effects in animals (ATSDR 2000b). Therefore, adverse health effects from short-term exposure to the levels of beryllium detected in the EMF study area are not likely to occur.

Cadmium. EPA has classified cadmium as a probable human carcinogen via the inhalation route. Based on the highest average concentration of cadmium detected from samples taken during the RI and for the Sho-Ban monitoring, chronic exposure to cadmium would result in no apparent increased risk of cancer. The maximum level of cadmium detected during the RI, for the Sho-Ban monitoring, or during IDEQ's selective filter sampling, were evaluated to determine potential non-carcinogenic health effects from acute exposures to cadmium. Based on this evaluation, the maximum levels of cadmium found in residential areas of the EMF study were at least 3,900 and 6,700 times lower than the lowest NOAEL and LOAEL, respectively, for less serious health effects found in animal studies (ATSDR 1999b). For non-residential areas (near the FMC facility), the maximum levels of cadmium were at least 400 and 690 times lower than the lowest NOAEL and LOAEL, respectively, for less serious health effects found in animal studies (ATSDR 1999b). Moreover, for these same non-residential areas, the maximum levels of cadmium were at least 1,600 and 16,300 times lower than the lowest NOAEL and LOAEL, respectively, for serious respiratory effects found in animal studies (ATSDR 1999b). Based on this analysis alone, exposure to cadmium detected in the EMF study area is not likely to result in adverse health effects. However, there are some uncertainties with this evaluation related to cadmium and other metals. Please see the summary of the health effects of exposure to metals below for more details of these uncertainties.

Chromium. EPA considers hexavalent chromium to be a human carcinogen via the inhalation route; whereas, trivalent chromium has not been shown to be a carcinogen. Since the results from the RI are reported as total chromium, the concentrations of

hexavalent chromium and trivalent chromium in the EMF study area are not known. Clearly, however, the relative quantity of hexavalent chromium cannot exceed the total chromium levels. Therefore, as a worst-case scenario of exposure, this analysis assumes that all of the total chromium reported is hexavalent chromium—a highly conservative assumption.

The resulting evaluation of the levels of chromium detected in residential areas (monitoring stations # 3 and #4) for their carcinogenic health effects, indicate a no apparent increased risk of cancer. In addition, if the highest average level of total chromium detected in non-residential area (Sho-Ban monitors next to FMC) were evaluated for its carcinogenic health risks, the resulting analysis would indicate a low risk of cancer. However, it is likely that the actual risks are lower because all of the chromium is probably not predominantly in the hexavalent form.

For acute non-carcinogenic health effects, the maximum total chromium concentration detected in residential areas would be about 57 times lower than the lowest LOAEL for less serious respiratory effects in studies of humans exposed to hexavalent chromium (ATSDR 2000c). However, when compared to studies of animals exposed to the less toxic trivalent chromium, the maximum exposure levels in residential areas is about 25,000 times lower than the lowest LOAEL for less serious respiratory health effects (ATSDR 2000c). The maximum total chromium concentration detected in non-residential areas of the EMF study area was from the Sho-Ban monitors. This level is about 10 times lower than the lowest LOAEL for less serious respiratory effects in humans exposed to hexavalent chromium (ATSDR 2000c). However, when compared to studies of animals exposed to the less toxic trivalent chromium, the maximum exposure levels in non-residential areas is about 4,500 times lower than the lowest LOAEL for less serious respiratory health effects (ATSDR 2000c).

For chronic non-carcinogenic health effects, the average concentration of total chromium detected in residential areas would be about 90 times lower than the lowest LOAEL for less serious respiratory effects in humans exposed to hexavalent chromium (ATSDR 2000c). However, when compared to studies of humans exposed to the less toxic trivalent chromium, the maximum exposure levels in residential areas is about 3,300 lower than the lowest NOAEL for renal effects and about 90,000 times lower than the lowest LOAEL for less serious respiratory health effects (ATSDR 2000c). The maximum total chromium concentration detected in non-residential areas of the EMF study area was from a sample from an RI monitor near the FMC and Simplot facilities. This level is about 115 times lower than the lowest LOAEL for less serious respiratory effects in humans exposed to hexavalent chromium (ATSDR 2000c). However, when compared to studies of humans exposed to the less toxic trivalent chromium, the maximum exposure levels in non-residential areas is about 4,300 times lower than the

lowest NOAEL for renal effects and about 114,000 times lower than the lowest LOAEL for less serious respiratory health effects (ATSDR 2000c).

The actual hexavalent chromium levels in ambient air in the EMF study area are undoubtedly much lower than the total chromium levels used in the above evaluation. In this analysis, the actual estimates of health risk are likely closer to the estimates for studies in which humans and animals were exposed to the less toxic trivalent chromium. Therefore, persons living in populated and non-populated areas of the EMF study are not likely to experience adverse non-carcinogenic health effects from their short- or long-term exposures to chromium.

Manganese. No studies were found in the literature regarding carcinogenic effects in humans or animals after inhalation exposure to manganese (ATSDR 2000d). For non-carcinogenic health effects, the maximum level detected in the EMF study area (at the Sewage Treatment Plant) was compared to animal and human studies in the literature. Based on this evaluation, the maximum level detected in the EMF study area were about 11,600 times lower than the NOAEL for short-term adverse respiratory health effects found in animal studies (ATSDR 2000). Based on this evaluation, the levels of manganese detected in the EMF study are not likely to result in adverse health effects.

Vanadium. No studies were found in the literature regarding carcinogenic or chronic non-carcinogenic effects in humans or animals after inhalation exposure to vanadium (ATSDR 1992b). For short-term non-carcinogenic health effects, the maximum levels detected in the EMF study area were compared to animal and human studies in the literature. Based on this evaluation, the maximum vanadium levels were about 75 times lower than the LOAEL for less serious respiratory effects in humans (i.e., bronchial irritation) (ATSDR 1992b). However, the maximum concentration detected was at the monitoring station located near the site perimeter and not in residential areas. Moreover, recent sampling at the site perimeter did not indicate that the levels of vanadium were above acute health-comparison values. The maximum levels detected in residential areas were below health comparison values. Based on this evaluation, it is unlikely that exposures to vanadium in populated areas of the EMF study would result in acute adverse health effects.

Summary of Metals Exposures. Although the above evaluation did not indicate a public health concern for individual metals, there is some uncertainty with this analysis. Current science provides little evidence as to whether the mix of these air contaminants may increase or decrease their toxicological effects because of cumulative exposures. Some of the metals (e.g., cadmium) were detected at levels in the fine fraction that were similar or greater than levels found in highly urbanized areas of the United States (ATSDR 1999). In addition, many of the metals detected in the EMF study area are transition metals. As indicated above, there is growing biological evidence that indicates

that urban combustion particles (i.e., fine PM) can penetrate past the primary defense mechanisms of the lung, can elicit inflammatory changes in the lung and systematically (throughout the body), contain a constituent (soluble transition metals) that by itself can be demonstrated to produce lung damage, can produce electrocardiogram changes including arrhythmia (heart irregularities), and can kill animals with pre-existing heart and lung disease (Schwartz 1999). The extent to which the above evaluation of exposures to metals in the EMF study area is able to capture these concerns is not known. However, the epidemiological evidence (presented above) does indicate that PM, a measure of a mix of contaminants present in air, including all the metals detected in the EMF study area, is a good surrogate measure for estimating the short-term and long-term adverse cardiopulmonary health effects from exposure. From this standpoint, ATSDR evaluated and made definitive public health statements regarding the cumulative health effects of the exposure to the mix of metal contaminants present in the EMF study area as measured by PM.

Sulfur Dioxide Exposures. As previously indicated, annual average concentrations of sulfur dioxide at the Pocatello Sewage Treatment Plant have been below EPA's annual health-based standard since this monitoring station's inception. However, some 24-hour measurements of sulfur dioxide have exceeded EPA's health-based standard. In addition, the levels of sulfur dioxide detected at the STP during the period 1977–1985 exceeded ATSDR's Minimal Risk Level (MRL) of 0.01 ppm at least once a year during that period. Moreover, the maximum levels detected for these years indicate that levels of sulfur dioxide were 17–24 times higher than the MRL. Furthermore, ATSDR considers a concentration of sulfur dioxide of 0.1 ppm to be a minimal LOAEL (ATSDR 1998d). Available human controlled exposure studies indicate that sensitive asthmatics may respond to concentrations of sulfur dioxide as low as 0.1 ppm. Healthy non-asthmatics respond to higher concentrations of sulfur dioxide (greater than or equal to 1.0 ppm). Factors that have been shown to exacerbate the respiratory effects of sulfur dioxide include exercise and breathing of dry or cold air. Animal data support the human data on respiratory effects of sulfur dioxide (ATSDR 1998d).

As previously indicated, the only potentially unhealthy levels of sulfur dioxide measured in the EMF study area were detected at the Pocatello Sewage Treatment Plant during the years 1977 to 1985. Sulfur dioxide levels at this location did not exceed health-based comparison values from 1986 to the present, neither did sulfur dioxide levels at Garret and Gould between 1994 and 1999. Based on the available data, ATSDR suspects that the higher levels of sulfur dioxide from 1977 to 1985 were confined to areas in the immediate vicinity of the Pocatello Sewage Treatment Plant; however, ATSDR cannot rule out the possibility that certain sensitive individuals (i.e., asthmatics) were not exposed to sulfur dioxide at levels of health concern some time during this period. For these individuals, exposure to elevated levels of sulfur dioxide, along with elevated PM exposures, could increase the risk for adverse respiratory health effects. Since 1985, the levels of sulfur dioxide detected at the STP have been below levels of public health concern.

Potential Exposure to Phosphine and Hydrogen Cyanide from FMC. Phosphine, a colorless gas with a characteristic fish- or garlic-like odor, is a severe respiratory irritant. Gastrointestinal, respiratory, and central nervous system (CNS) effects have been noted in workers exposed to mean concentrations less than 10 ppm (Jones 1964). EPA has insufficient information to classify phosphine as to its potential as a human carcinogen (USEPA 1999b). NIOSH has a recommended exposure limit (REL) for phosphine of 0.3 ppm (300 ppb) and a short-term exposure limit (STEL) of 1 ppm (1,000 ppb) (NIOSH 1994). The RELs are time-weighted average (TWA) concentrations for up to a 10-hour workday during a 40-hour workweek, and the STEL is a 15-minute TWA exposure that should not be exceeded anytime during the workday (NIOSH 1994). As previously noted, FMC has measured some phosphine concentrations at the ponds at levels above the STEL. However, the public health implications of these environmental levels in relation to the on-site workers is beyond the scope of this health consultation. Using OSHA-approved methods, the maximum level of phosphine detected at the fence line was 101 ppb—an average of the fence line concentrations was not available. Based on limited animal studies reported by EPA (USEPA 1999b), short-term exposures (less than one year) to phosphine at the maximum levels detected at the fence line are not likely to result in adverse respiratory health effects. The effects of chronic exposures (greater than one year) to phosphine are still unknown (USEPA 1999b). However, additional sampling for phosphine at the fence line using other, less reliable, methods have on several occasions indicated that phosphine levels may have exceeded the STEL. These measured concentrations, if correct, suggest that a passerby, offsite worker (not FMC or Simplot), or other individual in the area might suffer from adverse health effect if exposed to the peak levels of phosphine for as little as 15 minutes.

Based on available data and knowledge of site-conditions, current exposures to the non-worker public would probably only be on an infrequent basis and for only a short duration. Therefore, based on limited environmental and scientific data alone, the occasional visitor to the area around the FMC site would not experience any adverse respiratory health effects from exposure to phosphine at 101 ppb. However, fence line and possibly off-site concentrations of phosphine may have been higher in the past and may have reached levels of public health concern (i.e., above the STEL) in the recent past, but the methods used may be unreliable. Therefore, the complete public health implication of off-site exposures to phosphine cannot be determined based on available data. Because of the toxicity of phosphine, continued operation of FMC's Pond Management Plan is needed to ensure that emissions do not reach levels of health concern to the off-site non-worker public. Moreover, more monitoring at the fence line, using OSHA-approved methods, is needed.

The maximum concentration of hydrogen cyanide (HCN) detected at the ponds was 990 ppb or 0.990 ppm. This level is almost five times lower than NIOSH's STEL (4.7 ppm)—NIOSH has not established a TLV-TWA guidance for HCN (ATSDR 1997b). The concentration of HCN at the fence line was compared to the lowest LOAELs reported in ATSDR's toxicological profile (ATSDR 1997e). The maximum HCN concentration at the perimeter is about 15, 100, and 140 time below the lowest chronic, intermediate, and acute LOAEL, respectively. Therefore, based

on the current site conditions, where it is likely that current exposures to the non-worker public would be on an infrequent bases and for only a short time, it is not likely that adverse respiratory health effects would occur from exposure to the maximum HCN level detected at the fence line. However, fence line and possibly off-site concentrations of HCN may have been higher in the past. Therefore, the complete public health implication of off-site exposures to HCN cannot be determined based on available data. Because of the toxicity of HCN (albeit not as toxic as phosphine), continued operation of FMC's Pond Management Plan is needed to ensure that emissions do not reach levels of health concern to the off-site non-worker public.

V. CONCLUSIONS

Based on a review of available data and discussions with local, state, tribal, and federal environmental and health officials, ATSDR concludes the following:

- **Transport of Emissions from FMC and Simplot.** FMC and Simplot have released, and continue to release, large quantities of toxic chemicals to the air. According to monitoring and modeling studies, these chemicals have transported, and continue to transport, to virtually every location in the EMF study area, including locations in Chubbuck, Pocatello, and portions of the Fort Hall Indian Reservation. Ambient air concentrations of these toxic chemicals clearly vary from location to location within this region; the public health implications of the levels of contamination are reviewed below.
- **Air Quality in Chubbuck and Pocatello from 1975 to the present.** Levels of air pollution throughout Chubbuck and Pocatello have been and continue to be a *public health hazard* as a result of emissions from FMC, Simplot, and other sources. The unhealthy levels of air pollution in these cities occurs infrequently and is usually associated with a small number of days with particular meteorological conditions (inversions). ATSDR believes potentially unhealthy levels of air pollution in these cities will likely occur periodically in the future, unless emissions of particulate matter from FMC and Simplot and other sources are reduced. The components of air pollution causing the health hazard are PM (short-term and long-term) and sulfates (short-term only); insufficient monitoring data are available to comment on long-term exposures to sulfates. These components periodically reached levels that are associated with increased incidence of respiratory and cardiac conditions. Populations at greatest risk for suffering adverse health effects include individuals with pre-existing heart or lung disease, the elderly, children, and asthmatics.

Some population living near the phosphate plants may have also been exposed between 1977–1985 to levels of sulfur dioxide above levels of health concern. This population's

exposures to PM, as well as sulfur dioxide, likely increased their risk for adverse respiratory health effects.

Between 1994 and 1998, long-term average ambient air concentrations of PM₁₀ throughout Chubbuck and Pocatello were notably lower than in previous years, thus reducing health risks associated with chronic exposures. However, the recent severe inversions in the Portneuf Valley clearly show that potentially unhealthy acute exposures to PM can still occur and probably will occur in the future unless air emissions from FMC and Simplot and other major sources are reduced.

- **Air Quality on the Fort Hall Indian Reservation.** The highest concentrations of site-related contaminants in the entire EMF study area are consistently measured on the Fort Hall Indian Reservation, at a location between FMC and Interstate 86. These elevated levels of air pollution pose a *public health hazard* to individuals who are exposed to the air in this part of the reservation. Deed restrictions will prevent people from living in this area of concern, but access to this area is not restricted and potentially unhealthy exposures may still be occurring.
- Residents of the Fort Hall Indian Reservation who live immediately north of Interstate 86 might also have been exposed to potentially unhealthy levels of air pollution from 1975 to the present, but this cannot be confirmed since no ambient air monitoring has ever been conducted in this area. Thus, ATSDR cannot derive reliable estimates of past or present exposure for residents on most of the Fort Hall Indian Reservation, though some level of exposure to emissions from FMC and Simplot undoubtedly exists. Due to the data gaps, ATSDR considers current and past inhalation exposures among residents who live on the Fort Hall Indian Reservation at locations north of Interstate 86 to be an *indeterminate public health hazard*.

Air monitoring devices need to be installed on the Fort Hall Indian Reservation at locations north of Interstate 86 to characterize potential exposures and fill this important data gap.

- **Review of Community Concerns.** The health concerns expressed by community members in the EMF study area (i.e., increased incidence of asthma, upper respiratory illness, and heart disease) are reasonably consistent with adverse health outcomes reported in the epidemiological research for both acute and chronic exposures to elevated levels of PM_{2.5} and PM₁₀. However, this consistency does *not* suggest that any given incident of these health outcomes is *caused* solely by inhalation exposures to PM_{2.5} or PM₁₀. Rather, causality of any given disease is usually a result of multiple factors, such as smoking or exposure to indoor air contaminants.

- **Exposures to Acid Aerosols.** The phosphate plants release several acids (e.g., sulfuric acid, phosphoric acid, and hydrofluoric acid) and chemicals that react in the air to form acids (e.g., phosphorous pentoxide, a signature constituent of the FMC emissions). Though these acids are respiratory irritants, the available data suggest that exposures to these individual acids in the EMF study area are not at levels of health concern. However, since the available data are limited, routine sampling of ionic species is needed to confirm this conclusion.
- **Exposures to Metals and Other Inorganics.** Neither short-term nor long-term exposures to the elemental forms of the metals and other inorganics detected in PM in the EMF study area are likely to result in adverse health effects. For non-carcinogenic adverse health effects, the concentrations of individual metals were well below levels in the scientific literature that showed adverse health effects in humans and animals. For adverse carcinogenic health effects, the concentration of metals is not likely to result in an appreciable increased risk of cancer in the exposed population. However, this conclusion is limited by the fact that data on annual average concentrations for metals are not available for time periods before 1994, when levels of PM, and hence heavy metals, were notably higher. For some metals, the paucity of toxicological data and the lack of data on the exact chemical species found in the ambient air prevents a complete assessment of the public health implications of exposure.
- **Uncertainty in Acid and Metals Analyses.** Although ATSDR's evaluation did not indicate a public health concern for individual metals and acids, there is some uncertainty with this analysis. Current science provides little evidence as to whether the mix of these air contaminants may increase or decrease their toxicological effects because of cumulative exposures. Some of the metals (e.g., cadmium) were detected at levels in the fine fraction that were similar or greater than levels found in highly urbanized areas of the United States. In addition, many of the metals detected in the EMF study area are transition metals. There is growing biological evidence that indicates that urban combustion particles (i.e., fine PM) can penetrate past the primary defense mechanisms of the lung, can elicit inflammatory changes in the lung and systematically (throughout the body), contain a constituent (soluble transition metals) that by itself can be demonstrated to produce lung damage, can produce electrocardiogram changes including arrhythmia (heart irregularities), and can kill animals with pre-existing heart and lung disease. The extent to which ATSDR's evaluation of exposures to metals in the EMF study area is able to capture these concerns is not known. However, the epidemiological evidence does indicate that PM, a measure of a mix of contaminants present in air, including most of the metals and acids detected in the EMF study area, is a good surrogate measure for estimating the short-term and long-term adverse cardiopulmonary health effects from exposure. From this standpoint, ATSDR evaluated and made definitive public health statements regarding the cumulative health effects of the

exposure to the mix of metal and acid contaminants present in the EMF study area as measured by PM.

- **Potential Exposures to phosphine and hydrogen cyanide.** Though the monitoring data collected in the last 2 years suggest that off-site exposures hydrogen cyanide from FMC are not at levels of health concern for the non-worker population, no information is available to quantify exposures that might have occurred in earlier years. Moreover, phosphine may have reached levels of health concern at the FMC fence line; however, these levels of health concerns were obtained using unreliable methods. ATSDR recommends that more monitoring be performed to confirm these data. Thus, the complete public health implications of off-site exposures to phosphine and hydrogen cyanide cannot be determined based on available data. ATSDR notes, however, that ongoing operation of FMC's Pond Management Plan should ensure that emissions do not reach levels of health concern in the future.
- **Potential Future Exposures.** Continued measures to reduce all major emissions sources of PM are needed to ensure that the decreasing airborne levels of PM in the EMF study area continue, and continued monitoring is needed to verify this trend. In general, future trends in inhalation exposure to PM and, consequently, the risks for PM-related illnesses will parallel the future trends in airborne levels of PM.
- **Exposures to Radionuclides.** The findings of this health consultation (i.e., air pathway exposures and populations-at-risk) will be used by ATSDR in a future health consultation to address the concerns of the Shoshone-Bannock Tribe regarding potential exposures to airborne radionuclides.

VI. RECOMMENDATIONS

ATSDR recommends the following actions to ensure that residents of Chubbuck, Pocatello, and the Fort Hall Indian Reservation are not exposed to unhealthy levels of air pollution that may originate from FMC, Simplot, or other emissions sources in the EMF study area:

- Given the weight-of-evidence suggesting that levels of air pollution throughout the EMF study area have reached potentially unhealthy levels as recently as December 1999, ATSDR recommends that the existing IDEQ and at least the "primary" Shoshone-Bannock ambient air monitoring stations continue to operate to characterize air quality. More specifically, both PM_{2.5} and PM₁₀ should continue to be monitored; sampling filters on days with high particulate levels should continue to be analyzed for levels of the same metals, other inorganics, and ionic species that are currently measured; and sampling filters from at least one station should be *routinely analyzed* for concentrations of these same constituents such that their annual average levels—an important parameter for evaluating health concerns—can be calculated.

- ATSDR recommends that IDEQ continue to issue warnings on days when levels of air pollution are expected to reach potentially unhealthy levels and to communicate these warnings to the local media. Residents in the EMF study area are encouraged to heed these warnings, which generally recommend residents, especially persons with respiratory conditions, to remain indoors and to avoid moderate levels of exercise as much as possible. By following these precautions, residents can best protect themselves from air pollution in the EMF study area as it occasionally reaches potentially unsafe levels.

Note: IDEQ currently characterizes air quality in Pocatello and Chubbuck on a daily basis using an Air Quality Index (AQI). The AQI ranges from zero (no pollution) to five hundred (large amounts of pollution). This index is updated on a daily basis and can be accessed through the hotline number at 208-236-6173 or on the Web at http://www.state.id.us/deq/ro_p/pro_air/aqi_report_pro.shtml. If further information is requested, residents should contact IDEQ at 208-236-6160.

- ATSDR recommends that at least one ambient air monitoring station be installed to measure ambient air concentrations of particulate matter on the Fort Hall Indian Reservation, north of Interstate 86, and near where people live. Such monitoring is needed to quantify the extent of inhalation exposures to site-related contaminants among residents of the reservation. To ensure that future monitoring efforts generate data useful for conducting public health evaluations, ATSDR will comment on relevant sampling plans or proposals, if requested.
- To minimize the amount of particulate matter released to the air in the EMF study area, ATSDR recommends that EPA, IDEQ, the Shoshone-Bannock Tribes, and the cities of Chubbuck and Pocatello continue to develop and implement air pollution control initiatives and enforce the existing ones. Additionally, to ensure that emissions of hydrogen cyanide and phosphine do not reach levels of health concern, ATSDR recommends that EPA carefully oversee, possibly by periodically collecting audit samples, the ongoing operation of FMC's Pond Management Plan. Moreover, ATSDR recommends that OSHA-approved methods be used to determine if phosphine has reached levels of health concern at the FMC fence line.
- ATSDR recommends that a public health evaluation be performed to assess potential inhalation exposures to airborne radionuclides. ATSDR has already committed to complete such an evaluation.

Knowing that FMC and Simplot continue to emit toxic chemicals to the air, though in lower quantities than have been emitted in the past, ATSDR is committed to reviewing ambient air monitoring data, emissions monitoring data, and health outcome data as they become available

for the EMF study area. The Public Health Action Plan (Section VII) provides additional information on future site-related activities.

VII. PUBLIC HEALTH ACTION PLAN

The Public Health Action Plan (PHAP) for this health consultation describes the actions taken or planned for the EMF site. The purpose of the PHAP is to ensure that this health consultation not only identifies public health hazards, but provides a plan of action designed to mitigate and prevent adverse human health effects resulting from future exposure to hazardous substances in the environment. ATSDR is committed to following up on this plan to ensure that it is implemented. As needed, ATSDR will revise this PHAP by identifying the actions completed and those in progress. The public health actions taken or to be implemented are as follows:

Actions Completed

1. In 1990, ATSDR completed a public health assessment of the EMF site.
2. In 1995, ATSDR completed a health study of persons residing on the Fort Hall Indian Reservation by investigating concerns related to a number of respiratory and renal disorders.
3. In 1997, ATSDR completed a Site Review and Update for the EMF site.
4. From 1997 to 1999, the Idaho Division of Health, Bureau of Environmental Health and Safety (IDOH-BEHS) under a cooperative agreement with ATSDR, collaborated with the Southeastern District Health Department in Pocatello and the Shoshone-Bannock Tribal Health and Human Services in Fort Hall to complete several health education and outreach activities. The following actions were completed during this time frame:
 - conducted environmental health needs assessments among residents of Fort Hall and Pocatello between August and October 1997.
 - conducted an environmental health needs assessment among health care providers serving the Pocatello area between November 1997 and April 1998.
 - conducted a needs assessment among educators in Pocatello School District 25 and the Fort Hall School District in April 1999.
 - formed the Fort Hall/Pocatello Environmental Health Education Working Group to develop and implement an environmental health education strategy to address concerns and needs identified in the needs assessment.
 - participated in several public availability sessions and meetings conducted by either ATSDR or EPA.

- developed an environmental health education/outreach strategy for implementation in Fort Hall and Pocatello. Activities implemented to date include 1) forming a technical advisory group; 2) publishing articles in the local newspapers discussing identified priority environmental health issues; 3) conducting continuing medical education seminars for health care providers; 4) conducting community environmental health presentations; and, 5) distributing educational materials at several local health fairs and community events
5. In 1998, ATSDR completed three health consultations that addressed the public health implications related to contamination of groundwater, surface water, and sediment.
 6. In 2000, ATSDR, working with IDOH-BESH, developed a fact sheet to accompany the public release of this health consultation.

Action Planned

1. Using the results of this health consultation, ATSDR will evaluate of the public health implications of airborne radionuclides in the EMF study area.
2. ATSDR will evaluate the cancer incidence on the Fort Hall Indian Reservation and in the Pocatello area.
3. After completing the health evaluations for airborne radionuclides and cancer incidence, ATSDR will prepare a comprehensive public health assessment that aggregates the overall public health issues for the EMF site.
4. IDOH-BESH, under the cooperative agreement with ATSDR, will continue to conduct health education/outreach activities, as needed.
5. ATSDR's Division of Health Studies is considering the feasibility of conducting a health study that would examine the effect(s) of air pollution on the cardiopulmonary health of persons who resided in the vicinity of the site.
6. The Shoshone-Bannock Tribe is developing plans to site two new PM_{2.5} monitors on the Fort Hall Indian Reservation. These plans include the possibility of having them located at a different site than the current locations of the Primary, Background, and Sho-Ban monitors.

ATSDR will reevaluate and expand the Public Health Action Plan (PHAP) when needed. New environmental, toxicological, health outcome data, or the results of implementing the above proposed actions may warrant additional actions at this site.

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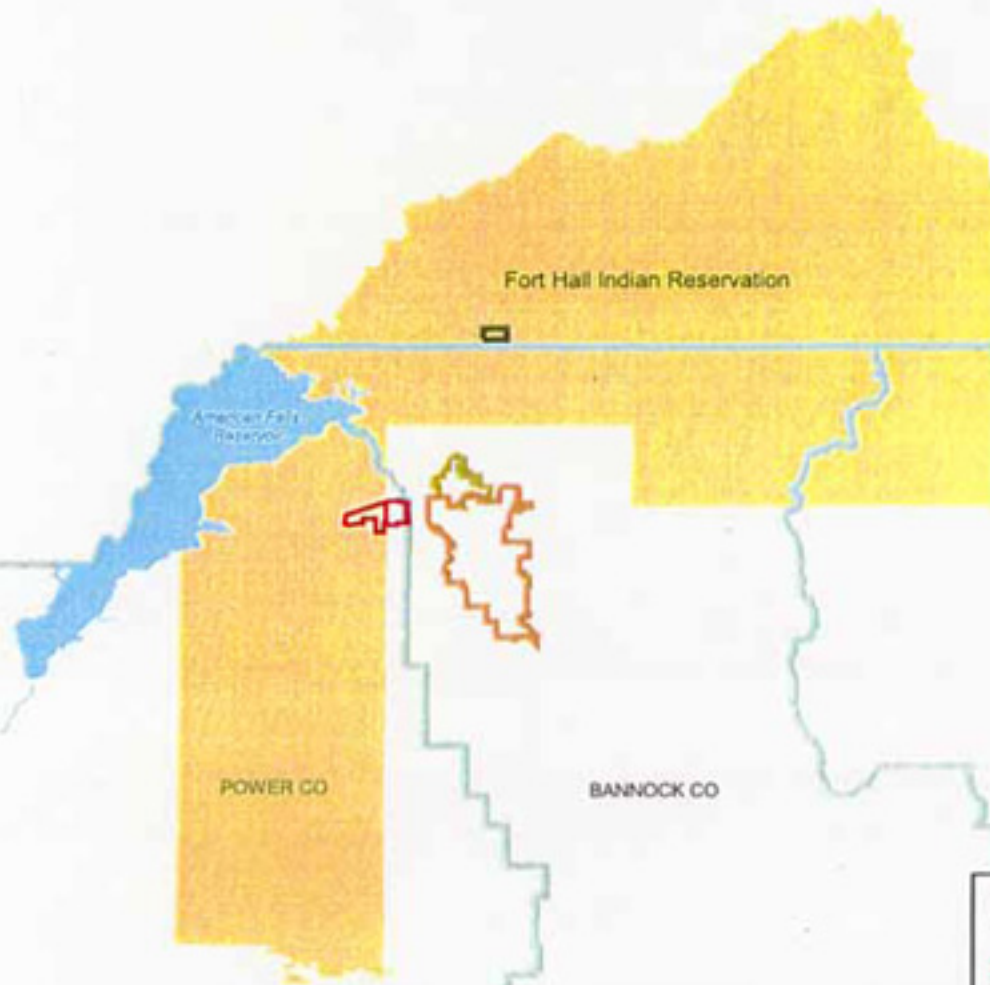
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Legend

- Site Boundary
- Reservoir
- County Boundary
- Chubbuck
- Pocatello
- Fort Hall
- Fort Hall Indian Reservation

4 0 4 Miles

Map Projection: NAD 83, UTM Zone 18N, UTM, Datum: NAD 83, East

Eastern Michaud Flats

Pocatello, Idaho

CERCLIS No. IDD98466610

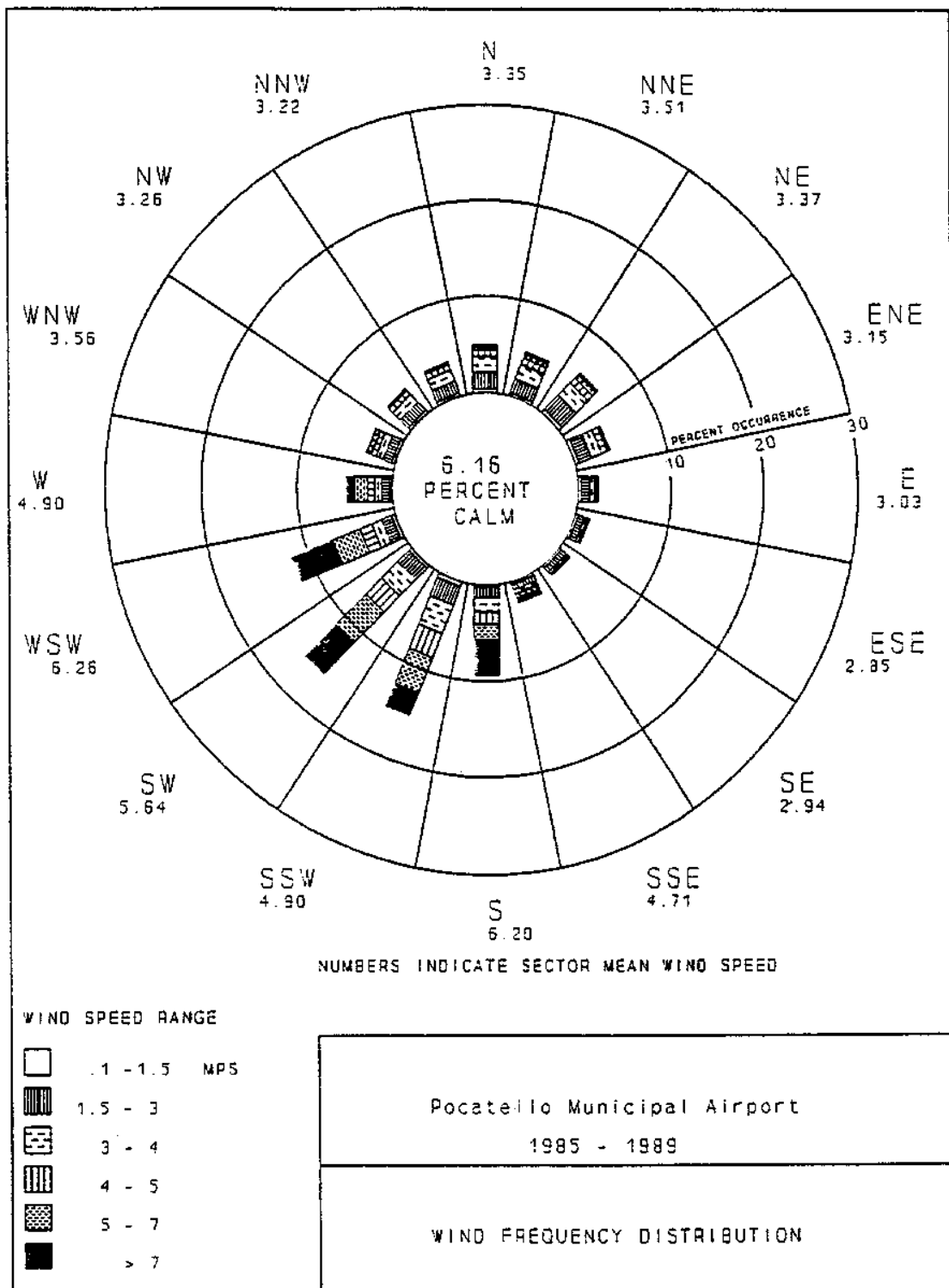


Power County, Idaho

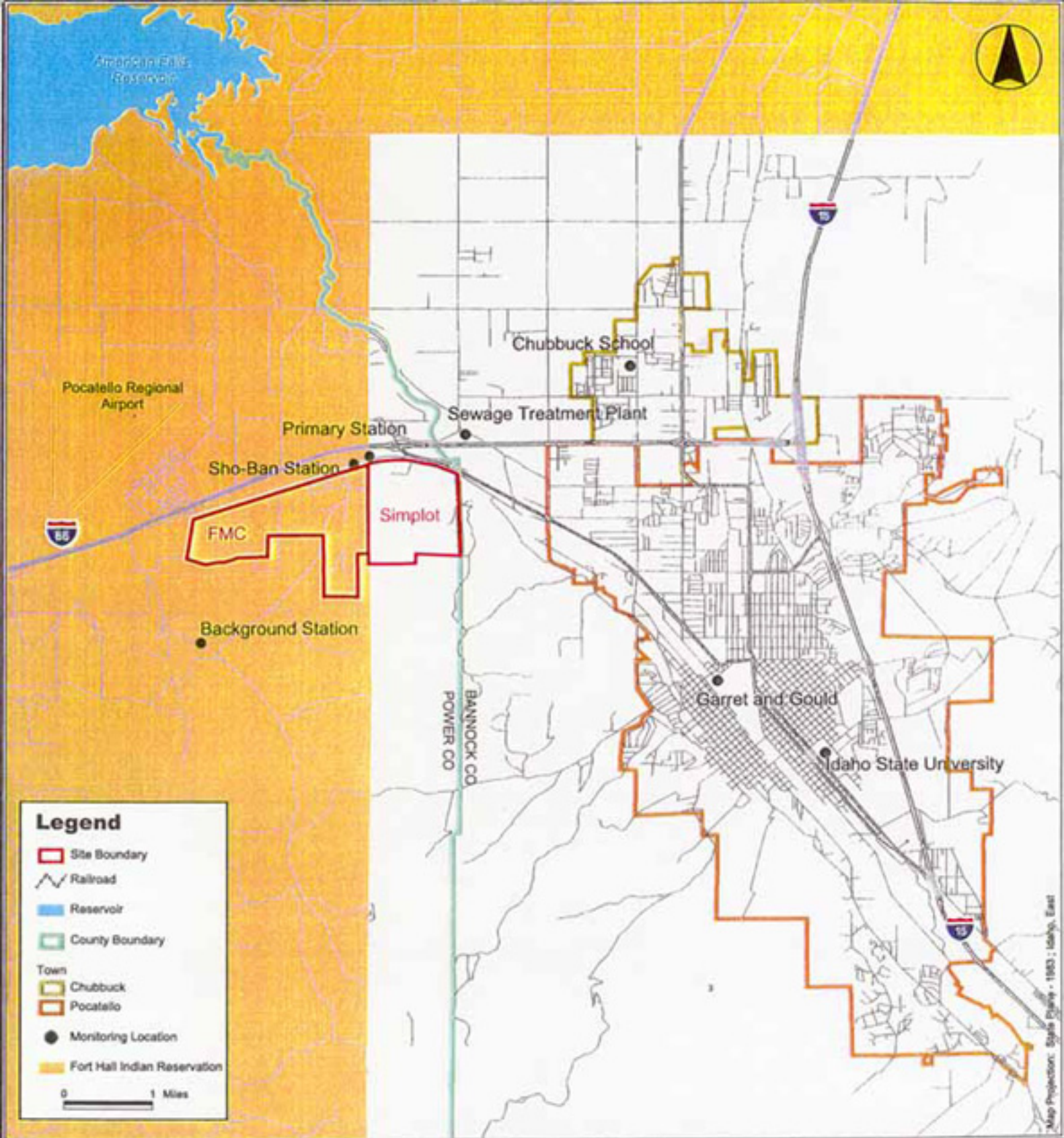
Figure 1: General Study Area for EMF Health Consultation



Figure 2
Windrose Prepared from Meteorological Data Collected at
the Pocatello Municipal Airport between 1985 and 1989



Source: TRC 1993.

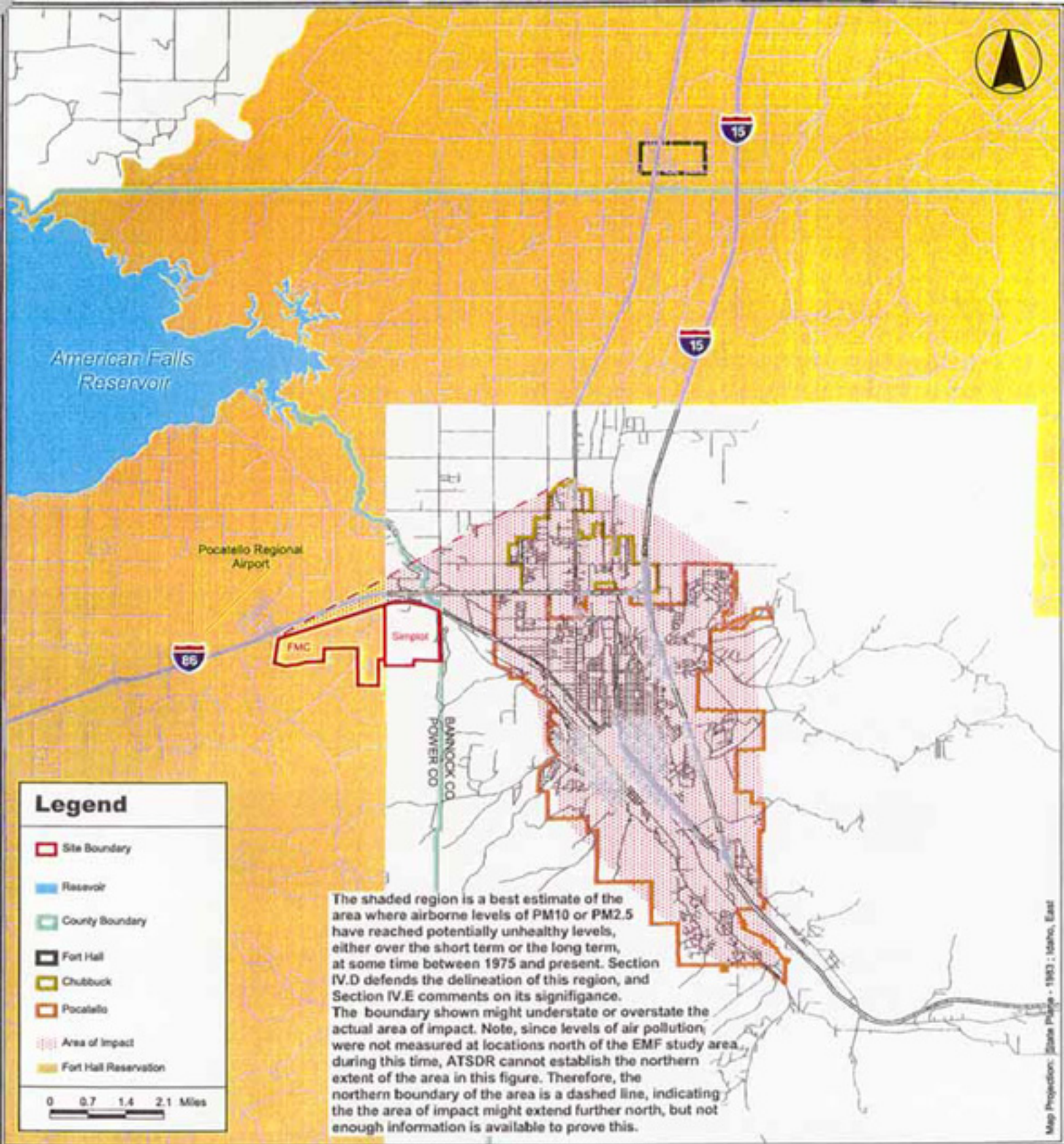


Eastern Michaud Flats

Pocatello, Idaho

CERCLIS No. IDD984666610

Figure 3: Monitoring Locations



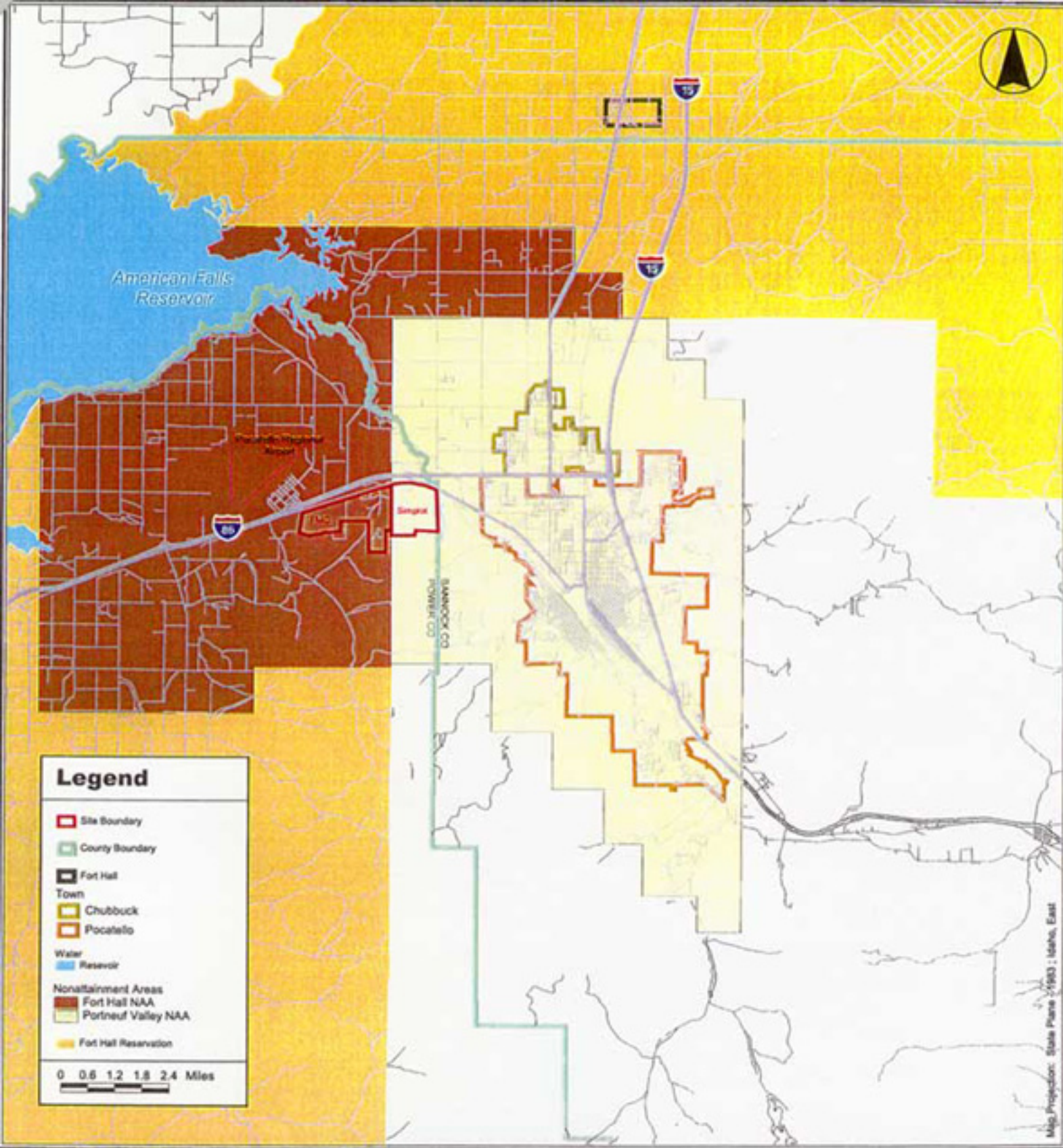
Eastern Michaud Flats

Pocatello, Idaho

CERCLIS No. IDD984666610

Figure 4: Area of Impact of PM10 and 2.5 Exposures in EMF Study Area (1975-1993)

Demographic Statistics Within the Area of Impact*	
Total Population	53710
White	50517
Black	418
American Indian, Eskimo, Aleut	841
Asian or Pacific Islander	663
Other Race	1274
Hispanic Origin	2398
Children Aged 6 and Younger	6619
Adults Aged 65 and Older	5510
Females Aged 15 - 44	12724
Total Housing Units	21321



Eastern Michaud Flats

Pocatello, Idaho

CERCLIS No. IDD984666610

Figure 5: The Fort Hall PM10 Nonattainment Area and the Portneuf Valley PM10 Nonattainment Area

Table 1
1997 and 1998 TRI Air Emissions Data for FMC and Simplot

Facility	Pollutant	Pounds Released to the Air, by Reporting Year	
		1997	1998
Emissions Data Reported by FMC	Antimony compounds	130	130
	Arsenic compounds	27	30
	Barium compounds	1,656	1,000
	Cadmium compounds	3,631	2,520
	Chromium compounds	2,505	2,350
	Copper compounds	84	80
	Cyanide compounds	13,152	232,136
	Hydrogen fluoride	5,311	Not reported
	Manganese compounds	14	10
	Nickel compounds	284	270
	Phosphine	16,992	35,170
	Phosphorous (yellow or white)	0	0
	Selenium compounds	1,975	1,940
Zinc compounds	1,657	1,130	
Emissions Data Reported by Simplot	Ammonia	121,000	425,000
	Hydrogen fluoride	33,000	36,000
	Methanol	Not reported	15,000
	Nitrate compounds	0	0
	Nitric acid	0	0
	Phosphoric acid	0	0
	Sulfuric acid aerosols	39,830	67,850

Notes: The table only lists emissions to the air. As required by TRI, the facilities also reported releases of the listed compounds to other media (e.g., surface water and soils).
 TRI data are self-reported, and the accuracy of the TRI data for these two facilities is not known.
 The TRI regulations require facilities to disclose releases of a wide range of hazardous air pollutants, but not for all toxic contaminants. Therefore, the data in this table should not be viewed as a comprehensive emissions inventory.
 Source of information: USEPA 1999c.

**Table 2
PM10 Emissions Data for the Fort Hall Nonattainment Area and the
Portneuf Valley Nonattainment Area**

Sources in the Fort Hall PM10 Nonattainment Area (USEPA 1999a)	
Source Name	Estimated PM10 Emissions (tons per year)
FMC	727
Paved Roads	571
Agricultural Windblown Dust	310
All Other Sources	198
Sources in the Portneuf Valley Nonattainment area (IDEQ 1999a)	
Source Name	Estimated PM10 Emissions (tons per year)
Unpaved Roads	1,230
Windblown Dust (Agricultural)	894
Windblown Dust (non-Agricultural)	492
Paved Roads	419
Agricultural Tilling	376
Fires	363
Residential Heating	237
Residential and Commercial Construction	175
Road Construction	142
Simplot	135
All Other Sources	362

Notes: The Fort Hall Nonattainment Area is located in the southernmost portion of the Fort Hall Indian Reservation and does not include the town of Fort Hall. Approximately 500 people live within the Fort Hall Nonattainment Area (USEPA 1999a).
 The Portneuf Valley Nonattainment Area spans approximately 100 square miles and includes the cities of Chubbuck and Pocatello (IDEQ 1999a). Roughly 75,000 people live within this nonattainment area (USEPA 1999a).
 The emissions data in this table are estimates and might understate or overstate actual emissions levels.

**Table 3
Overview of Monitoring Studies of Metals and Other Inorganics**

Elements with at least one ambient air concentration higher than corresponding health-based comparison values (further evaluation of these elements is presented in the “Public Health Implications” section of this report):		
Aluminum Arsenic Barium	Beryllium Cadmium Chromium	Manganese Vanadium
Elements with all measured concentrations lower than corresponding health-based comparison values (these elements are not evaluated further in the report):		
Antimony Chlorine Cobalt Copper Iron Lead	Mercury Molybdenum Nickel Selenium Silver	Strontium Thallium Tin Titanium Zinc
Elements detected in the EMF study area, but for which ATSDR and EPA have not developed health-based comparison values (a brief evaluation of these elements is presented in the “Public Health Implications” section of this report):		
Bromine Calcium Carbon Cesium Gallium Germanium* Gold* Indium*	Iodine Lanthanum Magnesium Palladium* Phosphorous Potassium Rhodium Rubidium	Scandium Silicon Sodium Sulfur Tellurium Tungsten Uranium Yttrium Zirconium

Notes: Elements in this table refer to those that were measured by x-ray fluorescence, which includes some elements (like bromine) that are typically not categorized as metals. Refer to Appendices A.2, A.3, and A.9 for a detailed review of the ambient air monitoring data that led to the above classifications. Many of the elements listed above are potentially radionuclides. As explained earlier, this health consultation does not evaluate public health hazards for exposures to radionuclides. A future ATSDR health consultation will address this topic. * denotes elements that were reported as detected by air monitoring studies, but the measurement uncertainty exceeded the actual concentration. As a result, it is not certain whether these elements are present in the air in the vicinity of the EMF site. Therefore, these elements are not discussed further in the “Public Health Implications” section of this health consultation.

Appendix J

Cancer Incidence Evaluation 1990–2001

Figure J-1 Eastern Michaud Flats Cancer Analysis Area



Table J-1. Comparison of cancer incidence rates between the Eastern Michaud Flats cancer analysis area and the remainder of the state of Idaho using all geocoded cases.

Cancer Site/Type	Sex	Eastern Michaud Flats						Remainder of Idaho		
		Observed Cases	Person Years	Crude Rate (1)	A.A.I. Rate (1,2)	Expected Cases (3)	P-Value (4)	Observed Cases	Person Years	Crude Rate (1)
All sites combined	Total	2,215	691,128	320.49	359.96	2,515.2	0.000 <<	54,935	13,440,017	408.74
All sites combined	Male	1,173	341,820	343.16	388.08	1,323.4	0.000 <<	29,421	6,719,684	437.83
All sites combined	Female	1,042	349,307	298.30	331.94	1,191.8	0.000 <<	25,514	6,720,333	379.65
Bladder	Total	121	691,128	17.51	20.08	116.1	0.674	2,590	13,440,017	19.27
Bladder	Male	88	341,820	25.74	29.42	90.7	0.831	2,037	6,719,684	30.21
Bladder	Female	33	349,307	9.45	10.69	25.4	0.168	553	6,720,333	8.23
Brain	Total	33	691,128	4.77	5.10	42.0	0.182	872	13,440,017	6.49
Brain	Male	23	341,820	6.73	7.16	24.5	0.871	512	6,719,684	7.62
Brain	Female	10	349,307	2.86	3.05	17.5	0.076	360	6,720,333	5.36
Breast	Total	323	691,128	46.74	51.65	379.0	0.004 <<	8,145	13,440,017	60.60
Breast	Male	3	341,820	0.88	0.99	2.5	0.921	56	6,719,684	0.83
Breast	Female	320	349,307	91.61	102.30	376.5	0.003 <<	8,089	6,720,333	120.37
Cervix	Female	18	349,307	5.15	5.46	24.5	0.221	499	6,720,333	7.43
Colon	Total	176	691,128	25.47	28.91	185.4	0.519	4,092	13,440,017	30.45
Colon	Male	80	341,820	23.40	26.69	89.3	0.351	2,003	6,719,684	29.81
Colon	Female	96	349,307	27.48	31.07	96.0	1.000	2,089	6,720,333	31.08
Endometrium	Female	56	349,307	16.03	18.05	69.6	0.108	1,508	6,720,333	22.44
Esophagus	Total	17	691,128	2.46	2.80	20.7	0.493	459	13,440,017	3.42
Esophagus	Male	13	341,820	3.80	4.31	15.8	0.584	352	6,719,684	5.24
Esophagus	Female	4	349,307	1.15	1.30	4.9	0.912	107	6,720,333	1.59
Hodgkin's Lymphoma	Total	11	691,128	1.59	1.60	19.2	0.062	376	13,440,017	2.80
Hodgkin's Lymphoma	Male	4	341,820	1.17	1.19	10.5	0.043 <<	209	6,719,684	3.11
Hodgkin's Lymphoma	Female	7	349,307	2.00	1.99	8.8	0.707	167	6,720,333	2.48
Kidney and Renal Pelvis	Total	45	691,128	6.51	7.33	58.7	0.076	1,285	13,440,017	9.56
Kidney and Renal Pelvis	Male	30	341,820	8.78	9.86	35.2	0.439	776	6,719,684	11.55
Kidney and Renal Pelvis	Female	15	349,307	4.29	4.82	23.6	0.082	509	6,720,333	7.57
Larynx	Total	14	691,128	2.03	2.31	20.2	0.195	448	13,440,017	3.33
Larynx	Male	11	341,820	3.22	3.65	16.3	0.224	364	6,719,684	5.42
Larynx	Female	3	349,307	0.86	0.97	3.9	0.912	84	6,720,333	1.25
Leukemia	Total	35	691,128	5.06	5.65	60.8	0.000 <<	1,320	13,440,017	9.82
Leukemia	Male	13	341,820	3.80	4.26	35.7	0.000 <<	787	6,719,684	11.71
Leukemia	Female	22	349,307	6.30	6.95	25.1	0.621	533	6,720,333	7.93
Liver	Total	13	691,128	1.88	2.12	14.9	0.745	327	13,440,017	2.43
Liver	Male	7	341,820	2.05	2.30	9.3	0.584	205	6,719,684	3.05
Liver	Female	6	349,307	1.72	1.94	5.6	0.984	122	6,720,333	1.82
Lung and Bronchus	Total	245	691,128	35.45	40.48	307.7	0.000 <<	6,832	13,440,017	50.83
Lung and Bronchus	Male	150	341,820	43.88	50.12	181.7	0.018 <<	4,079	6,719,684	60.70
Lung and Bronchus	Female	95	349,307	27.20	30.89	126.0	0.005 <<	2,753	6,720,333	40.97
Melanoma of the Skin	Total	69	691,128	9.98	10.87	100.1	0.001 <<	2,118	13,440,017	15.76
Melanoma of the Skin	Male	43	341,820	12.58	13.85	54.5	0.128	1,180	6,719,684	17.56
Melanoma of the Skin	Female	26	349,307	7.44	7.97	45.6	0.002 <<	938	6,720,333	13.96
Multiple Myeloma	Total	18	691,128	2.60	2.96	27.3	0.080	602	13,440,017	4.48
Multiple Myeloma	Male	11	341,820	3.22	3.66	15.0	0.366	336	6,719,684	5.00
Multiple Myeloma	Female	7	349,307	2.00	2.26	12.2	0.159	266	6,720,333	3.96
Non-Hodgkin's Lymphoma	Total	92	691,128	13.31	14.85	98.4	0.561	2,134	13,440,017	15.88
Non-Hodgkin's Lymphoma	Male	41	341,820	11.99	13.35	51.4	0.161	1,124	6,719,684	16.73
Non-Hodgkin's Lymphoma	Female	51	349,307	14.60	16.31	47.0	0.596	1,010	6,720,333	15.03
Oral Cavity and Pharynx	Total	54	691,128	7.81	8.82	64.7	0.198	1,421	13,440,017	10.57
Oral Cavity and Pharynx	Male	39	341,820	11.41	12.84	46.1	0.331	1,020	6,719,684	15.18
Oral Cavity and Pharynx	Female	15	349,307	4.29	4.80	18.6	0.477	401	6,720,333	5.97
Ovary	Female	59	349,307	16.89	18.59	50.1	0.241	1,062	6,720,333	15.80
Pancreas	Total	60	691,128	8.68	9.86	51.8	0.285	1,144	13,440,017	8.51
Pancreas	Male	25	341,820	7.31	8.33	26.2	0.913	587	6,719,684	8.74
Pancreas	Female	35	349,307	10.02	11.35	25.6	0.088	557	6,720,333	8.29
Prostate	Male	367	341,820	107.37	123.24	416.0	0.016 <<	9,387	6,719,684	139.69
Rectum & Rectosigmoid	Total	63	691,128	9.12	10.33	74.1	0.216	1,632	13,440,017	12.14
Rectum & Rectosigmoid	Male	40	341,820	11.70	13.32	42.1	0.818	943	6,719,684	14.03
Rectum & Rectosigmoid	Female	23	349,307	6.58	7.39	31.9	0.126	689	6,720,333	10.25
Stomach	Total	27	691,128	3.91	4.44	31.9	0.446	705	13,440,017	5.25
Stomach	Male	20	341,820	5.85	6.67	19.7	1.000	442	6,719,684	6.58
Stomach	Female	7	349,307	2.00	2.25	12.2	0.166	263	6,720,333	3.91
Testis	Male	29	341,820	8.48	8.38	19.8	0.061	384	6,719,684	5.71
Thyroid	Total	28	691,128	4.05	4.16	41.1	0.040 <<	821	13,440,017	6.11
Thyroid	Male	5	341,820	1.46	1.57	9.6	0.168	203	6,719,684	3.02
Thyroid	Female	23	349,307	6.58	6.71	31.5	0.143	618	6,720,333	9.20

Notes: 1. Rates are expressed as the number of cases per 100,000 persons per year (person-years).
 2. Compare these age and sex-adjusted incidence (A.A.I.) rates to the crude rates for the remainder of the state of Idaho.
 3. Expected cases are based upon age and sex-specific rates for the remainder of the state of Idaho (compare to observed).
 4. P-values compare observed and expected cases, are two tailed, based upon the Poisson probability distribution.
 "<<" denotes significantly fewer cases observed than expected, ">>" denotes significantly more cases observed than expected (p=.05).
 Statistical Notes: Rates based upon 10 or fewer cases (numerator) should be interpreted with caution.
 Rates shown for ZIP Code analyses are not comparable to those in state or county analyses due to population estimation procedures.

Table J-2. Comparison of cancer incidence rates between the Eastern Michaud Flats cancer analysis area and the remainder of the state of Idaho using cases geocoded to the census block group quality or better.

Cancer Site/Type	Sex	Eastern Michaud Flats						Remainder of Idaho		
		Observed Cases	Person Years	Crude Rate (1)	A.A.I. Rate (1,2)	Expected Cases (3)	P-Value (4)	Observed Cases	Person Years	Crude Rate (1)
All sites combined	Total	2,204	691,128	318.90	357.99	2,110.9	0.045 >>	46,081	13,440,017	342.86
All sites combined	Male	1,163	341,820	340.24	384.66	1,097.0	0.050 >>	24,381	6,719,684	362.83
All sites combined	Female	1,041	349,307	298.02	331.53	1,013.9	0.403	21,700	6,720,333	322.90
Bladder	Total	121	691,128	17.51	20.09	97.8	0.026 >>	2,183	13,440,017	16.24
Bladder	Male	88	341,820	25.74	29.44	76.1	0.196	1,711	6,719,684	25.46
Bladder	Female	33	349,307	9.45	10.68	21.7	0.029 >>	472	6,720,333	7.02
Brain	Total	32	691,128	4.63	4.94	35.2	0.662	731	13,440,017	5.44
Brain	Male	22	341,820	6.44	6.84	20.3	0.761	424	6,719,684	6.31
Brain	Female	10	349,307	2.86	3.06	14.9	0.243	307	6,720,333	4.57
Breast	Total	322	691,128	46.59	51.48	327.6	0.785	7,039	13,440,017	52.37
Breast	Male	3	341,820	0.88	1.00	2.1	0.727	48	6,719,684	0.71
Breast	Female	319	349,307	91.32	101.97	325.4	0.748	6,991	6,720,333	104.03
Cervix	Female	18	349,307	5.15	5.48	19.9	0.780	407	6,720,333	6.06
Colon	Total	175	691,128	25.32	28.74	154.3	0.109	3,406	13,440,017	25.34
Colon	Male	79	341,820	23.11	26.36	73.5	0.549	1,647	6,719,684	24.51
Colon	Female	96	349,307	27.48	31.07	80.9	0.110	1,759	6,720,333	26.17
Endometrium	Female	56	349,307	16.03	18.03	59.6	0.701	1,290	6,720,333	19.20
Esophagus	Total	17	691,128	2.46	2.80	17.6	1.000	389	13,440,017	2.89
Esophagus	Male	13	341,820	3.80	4.31	13.4	1.000	298	6,719,684	4.43
Esophagus	Female	4	349,307	1.15	1.29	4.2	1.000	91	6,720,333	1.35
Hodgkin's Lymphoma	Total	11	691,128	1.59	1.59	16.9	0.176	329	13,440,017	2.45
Hodgkin's Lymphoma	Male	4	341,820	1.17	1.19	9.2	0.095	184	6,719,684	2.74
Hodgkin's Lymphoma	Female	7	349,307	2.00	1.97	7.7	0.999	145	6,720,333	2.16
Kidney and Renal Pelvis	Total	45	691,128	6.51	7.32	49.6	0.571	1,085	13,440,017	8.07
Kidney and Renal Pelvis	Male	30	341,820	8.78	9.86	28.8	0.879	637	6,719,684	9.48
Kidney and Renal Pelvis	Female	15	349,307	4.29	4.82	20.7	0.243	448	6,720,333	6.67
Larynx	Total	14	691,128	2.03	2.31	16.8	0.598	372	13,440,017	2.77
Larynx	Male	11	341,820	3.22	3.65	13.4	0.627	299	6,719,684	4.45
Larynx	Female	3	349,307	0.86	0.97	3.4	1.000	73	6,720,333	1.09
Leukemia	Total	35	691,128	5.06	5.66	51.0	0.023 <<	1,108	13,440,017	8.24
Leukemia	Male	13	341,820	3.80	4.26	29.4	0.001 <<	648	6,719,684	9.64
Leukemia	Female	22	349,307	6.30	6.98	21.6	0.986	460	6,720,333	6.84
Liver	Total	13	691,128	1.88	2.12	12.8	1.000	280	13,440,017	2.08
Liver	Male	7	341,820	2.05	2.30	8.0	0.903	177	6,719,684	2.63
Liver	Female	6	349,307	1.72	1.94	4.7	0.680	103	6,720,333	1.53
Lung and Bronchus	Total	245	691,128	35.45	40.48	256.6	0.493	5,697	13,440,017	42.39
Lung and Bronchus	Male	150	341,820	43.88	50.13	150.8	0.993	3,386	6,719,684	50.39
Lung and Bronchus	Female	95	349,307	27.20	30.88	105.8	0.317	2,311	6,720,333	34.39
Melanoma of the Skin	Total	68	691,128	9.84	10.70	83.2	0.100	1,760	13,440,017	13.10
Melanoma of the Skin	Male	42	341,820	12.29	13.52	45.8	0.642	990	6,719,684	14.73
Melanoma of the Skin	Female	26	349,307	7.44	7.96	37.4	0.063	770	6,720,333	11.46
Multiple Myeloma	Total	18	691,128	2.60	2.95	23.1	0.340	509	13,440,017	3.79
Multiple Myeloma	Male	11	341,820	3.22	3.66	12.5	0.804	280	6,719,684	4.17
Multiple Myeloma	Female	7	349,307	2.00	2.26	10.6	0.349	229	6,720,333	3.41
Non-Hodgkin's Lymphoma	Total	92	691,128	13.31	14.84	83.0	0.347	1,799	13,440,017	13.39
Non-Hodgkin's Lymphoma	Male	41	341,820	11.99	13.33	43.4	0.794	948	6,719,684	14.11
Non-Hodgkin's Lymphoma	Female	51	349,307	14.60	16.31	39.6	0.091	851	6,720,333	12.66
Oral Cavity and Pharynx	Total	54	691,128	7.81	8.82	53.3	0.962	1,170	13,440,017	8.71
Oral Cavity and Pharynx	Male	39	341,820	11.41	12.85	37.2	0.813	824	6,719,684	12.26
Oral Cavity and Pharynx	Female	15	349,307	4.29	4.80	16.1	0.914	346	6,720,333	5.15
Ovary	Female	59	349,307	16.89	18.56	42.8	0.021 >>	904	6,720,333	13.45
Pancreas	Total	60	691,128	8.68	9.85	44.1	0.026 >>	974	13,440,017	7.25
Pancreas	Male	25	341,820	7.31	8.32	22.0	0.572	491	6,719,684	7.31
Pancreas	Female	35	349,307	10.02	11.35	22.2	0.014 >>	483	6,720,333	7.19
Prostate	Male	363	341,820	106.20	121.85	345.6	0.362	7,795	6,719,684	116.00
Rectum & Rectosigmoid	Total	63	691,128	9.12	10.32	61.4	0.869	1,351	13,440,017	10.05
Rectum & Rectosigmoid	Male	40	341,820	11.70	13.29	34.7	0.414	776	6,719,684	11.55
Rectum & Rectosigmoid	Female	23	349,307	6.58	7.39	26.6	0.559	575	6,720,333	8.56
Stomach	Total	27	691,128	3.91	4.45	26.2	0.920	579	13,440,017	4.31
Stomach	Male	20	341,820	5.85	6.68	16.3	0.419	366	6,719,684	5.45
Stomach	Female	7	349,307	2.00	2.25	9.9	0.468	213	6,720,333	3.17
Testis	Male	29	341,820	8.48	8.35	16.8	0.008 >>	325	6,719,684	4.84
Thyroid	Total	28	691,128	4.05	4.16	36.1	0.197	721	13,440,017	5.36
Thyroid	Male	5	341,820	1.46	1.58	8.2	0.340	175	6,719,684	2.60
Thyroid	Female	23	349,307	6.58	6.70	27.9	0.410	546	6,720,333	8.12

Notes: 1. Rates are expressed as the number of cases per 100,000 persons per year (person-years).

2. Compare these age and sex-adjusted incidence (A.A.I.) rates to the crude rates for the remainder of the state of Idaho.

3. Expected cases are based upon age and sex-specific rates for the remainder of the state of Idaho (compare to observed).

4. P-values compare observed and expected cases, are two tailed, based upon the Poisson probability distribution.

"<<" denotes significantly fewer cases observed than expected, ">>" denotes significantly more cases observed than expected (p=.05).

Statistical Notes: Rates based upon 10 or fewer cases (numerator) should be interpreted with caution.

Rates shown for ZIP Code analyses are not comparable to those in state or county analyses due to population estimation procedures.

Table J-3 American Indian/Alaska Native Invasive Cancer Incidence Counts and Rates for Bannock, Bingham, and Power Counties, Idaho, 1990–2001.

Primary Site	Three Counties Combined			Bannock			Bingham			Power		
	Rate	Cases	Pop	Rate	Cases	Pop	Rate	Cases	Pop	Rate	Cases	Pop
All Sites	344.6	100	63,571	682.3	79	26,172	130.6	20	34,575	38.4	1	2,824
Bladder	5.3	2	63,571	13.8	2	26,172	0.0	0	34,575	0.0	0	2,824
Brain	5.4	3	63,571	2.9	1	26,172	4.9	1	34,575	38.4	1	2,824
Breast	31.5	8	63,571	60.1	6	26,172	11.9	2	34,575	0.0	0	2,824
Breast in situ	4.9	2	63,571	5.5	1	26,172	4.9	1	34,575	0.0	0	2,824
Cervix	6.2	2	63,571	16.5	2	26,172	0.0	0	34,575	0.0	0	2,824
Colorectal	41.5	10	63,571	81.4	8	26,172	15.4	2	34,575	0.0	0	2,824
Endometrium	27.1	7	63,571	54.0	6	26,172	10.0	1	34,575	0.0	0	2,824
Esophagus	0.0	0	63,571	0.0	0	26,172	0.0	0	34,575	0.0	0	2,824
Hodgkin Lymphoma	0.0	0	63,571	0.0	0	26,172	0.0	0	34,575	0.0	0	2,824
Kidney and Renal Pelvis	8.9	3	63,571	22.9	3	26,172	0.0	0	34,575	0.0	0	2,824
Larynx	3.5	1	63,571	9.5	1	26,172	0.0	0	34,575	0.0	0	2,824
Leukemia	7.7	5	63,571	19.7	5	26,172	0.0	0	34,575	0.0	0	2,824
Liver and Bile Duct	13.0	3	63,571	32.3	3	26,172	0.0	0	34,575	0.0	0	2,824
Lung and Bronchus	29.4	9	63,571	51.7	6	26,172	18.3	3	34,575	0.0	0	2,824
Melanoma of the Skin	17.6	5	63,571	36.7	4	26,172	5.4	1	34,575	0.0	0	2,824
Myeloma	7.1	2	63,571	19.0	2	26,172	0.0	0	34,575	0.0	0	2,824
Non-Hodgkin Lymphoma	11.0	3	63,571	28.4	3	26,172	0.0	0	34,575	0.0	0	2,824
Oral Cavity and Pharynx	10.3	3	63,571	18.8	2	26,172	5.4	1	34,575	0.0	0	2,824
Ovary	8.6	4	63,571	21.7	4	26,172	0.0	0	34,575	0.0	0	2,824
Pancreas	6.5	2	63,571	16.0	2	26,172	0.0	0	34,575	0.0	0	2,824
Prostate	47.3	12	63,571	91.3	9	26,172	18.9	3	34,575	0.0	0	2,824
Stomach	26.0	6	63,571	43.2	3	26,172	17.5	3	34,575	0.0	0	2,824
Testis	3.9	3	63,571	9.2	3	26,172	0.0	0	34,575	0.0	0	2,824
Thyroid	0.0	0	63,571	0.0	0	26,172	0.0	0	34,575	0.0	0	2,824
Pediatric Age 0 to 19	14.5	4	27,322	35.5	4	11,030	0.0	0	15,062	0.0	0	1,230

Rates are per 100,000 and age-adjusted to the 2000 U.S. (18 age groups) standard.

Appendix K

ATSDR Glossary of Terms

ATSDR Glossary of Terms

The Agency for Toxic Substances and Disease Registry (ATSDR) is a federal public health agency with headquarters in Atlanta, Georgia, and 10 regional offices in the United States. ATSDR's mission is to serve the public by using the best science, taking responsive public health actions, and providing trusted health information to prevent harmful exposures and diseases related to toxic substances. ATSDR is not a regulatory agency, unlike the U.S. Environmental Protection Agency (EPA), which is the federal agency that develops and enforces environmental laws to protect the environment and human health. This glossary defines words used by ATSDR in communications with the public. It is not a complete dictionary of environmental health terms. If you have questions or comments, call ATSDR's toll-free telephone number, 1-888-42-ATSDR (1-888-422-8737).

General Terms

Absorption

The process of taking in. For a person or an animal, absorption is the process of a substance getting into the body through the eyes, skin, stomach, intestines, or lungs.

Acute

Occurring over a short time [compare with chronic].

Acute exposure

Contact with a substance that occurs once or for only a short time (up to 14 days) [compare with intermediate duration exposure and chronic exposure].

Additive effect

A biologic response to exposure to multiple substances that equals the sum of responses of all the individual substances added together [compare with antagonistic effect and synergistic effect].

Adverse health effect

A change in body function or cell structure that might lead to disease or health problems

Aerobic

Requiring oxygen [compare with anaerobic].

Ambient

Surrounding (for example, ambient air).

Anaerobic

Requiring the absence of oxygen [compare with aerobic].

Analyte

A substance measured in the laboratory. A chemical for which a sample (such as water, air, or blood) is tested in a laboratory. For example, if the analyte is mercury, the laboratory test will determine the amount of mercury in the sample.

Analytic epidemiologic study

A study that evaluates the association between exposure to hazardous substances and disease by testing scientific hypotheses.

Antagonistic effect

A biologic response to exposure to multiple substances that is less than would be expected if the known effects of the individual substances were added together [compare with additive effect and synergistic effect].

Background level

An average or expected amount of a substance or radioactive material in a specific environment, or typical amounts of substances that occur naturally in an environment.

Biodegradation

Decomposition or breakdown of a substance through the action of microorganisms (such as bacteria or fungi) or other natural physical processes (such as sunlight).

Biologic indicators of exposure study

A study that uses (a) biomedical testing or (b) the measurement of a substance [an analyte], its metabolite, or another marker of exposure in human body fluids or tissues to confirm human exposure to a hazardous substance [also see exposure investigation].

Biologic monitoring

Measuring hazardous substances in biologic materials (such as blood, hair, urine, or breath) to determine whether exposure has occurred. A blood test for lead is an example of biologic monitoring.

Biologic uptake

The transfer of substances from the environment to plants, animals, and humans.

Biomedical testing

Testing of persons to find out whether a change in a body function might have occurred because of exposure to a hazardous substance.

Biota

Plants and animals in an environment. Some of these plants and animals might be sources of food, clothing, or medicines for people.

Body burden

The total amount of a substance in the body. Some substances build up in the body because they are stored in fat or bone or because they leave the body very slowly.

CAP [see Community Assistance Panel.]

Cancer

Any one of a group of diseases that occur when cells in the body become abnormal and grow or multiply out of control.

Cancer risk

A theoretical risk for getting cancer if exposed to a substance every day for 70 years (a lifetime exposure). The true risk might be lower.

Carcinogen

A substance that causes cancer.

Case study

A medical or epidemiologic evaluation of one person or a small group of people to gather information about specific health conditions and past exposures.

Case-control study

A study that compares exposures of people who have a disease or condition (cases) with people who do not have the disease or condition (controls). Exposures that are more common among the cases may be considered as possible risk factors for the disease.

CAS registry number

A unique number assigned to a substance or mixture by the American Chemical Society Abstracts Service.

Central nervous system

The part of the nervous system that consists of the brain and the spinal cord.

CERCLA [see Comprehensive Environmental Response, Compensation, and Liability Act of 1980]

Chronic

Occurring over a long time [compare with acute].

Chronic exposure

Contact with a substance that occurs over a long time (more than 1 year) [compare with acute exposure and intermediate duration exposure]

Cluster investigation

A review of an unusual number, real or perceived, of health events (for example, reports of cancer) grouped together in time and location. Cluster investigations are designed to confirm case reports; determine whether they represent an unusual disease occurrence; and, if possible, explore possible causes and contributing environmental factors.

Community Assistance Panel (CAP)

A group of people from a community and from health and environmental agencies who work with ATSDR to resolve issues and problems related to hazardous substances in the community. CAP members work with ATSDR to gather and review community health concerns, provide information on how people might have been or might now be exposed to hazardous substances, and inform ATSDR on ways to involve the community in its activities.

Comparison value (CV)

Calculated concentration of a substance in air, water, food, or soil that is unlikely to cause harmful (adverse) health effects in exposed people. The CV is used as a screening level during the public health assessment process. Substances found in amounts greater than their CVs might be selected for further evaluation in the public health assessment process.

Completed exposure pathway [see exposure pathway].

Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA)

CERCLA, also known as Superfund, is the federal law that concerns the removal or cleanup of hazardous substances in the environment and at hazardous waste sites. ATSDR, which was created by CERCLA, is responsible for assessing health issues and supporting public health activities related to hazardous waste sites or other environmental releases of hazardous substances. This law was later amended by the Superfund Amendments and Reauthorization Act (SARA).

Concentration

The amount of a substance present in a certain amount of soil, water, air, food, blood, hair, urine, breath, or any other media.

Contaminant

A substance that is either present in an environment where it does not belong or is present at levels that might cause harmful (adverse) health effects.

Delayed health effect

A disease or an injury that happens as a result of exposures that might have occurred in the past.

Dermal

Referring to the skin. For example, dermal absorption means passing through the skin.

Dermal contact

Contact with (touching) the skin [see route of exposure].

Descriptive epidemiology

The study of the amount and distribution of a disease in a specified population by person, place, and time.

Detection limit

The lowest concentration of a chemical that can reliably be distinguished from a zero concentration.

Disease prevention

Measures used to prevent a disease or reduce its severity.

Disease registry

A system of ongoing registration of all cases of a particular disease or health condition in a defined population.

DOD

United States Department of Defense.

DOE

United States Department of Energy.

Dose (for chemicals that are not radioactive)

The amount of a substance to which a person is exposed over some time period. Dose is a measurement of exposure. Dose is often expressed as milligram (amount) per kilogram (a measure of body weight) per day (a measure of time) when people eat or drink contaminated water, food, or soil. In general, the greater the dose, the greater the likelihood of an effect. An "exposure dose" is how much of a substance is encountered in the environment. An "absorbed dose" is the amount of a substance that actually got into the body through the eyes, skin, stomach, intestines, or lungs.

Dose (for radioactive chemicals)

The radiation dose is the amount of energy from radiation that is actually absorbed by the body. This is not the same as measurements of the amount of radiation in the environment.

Dose-response relationship

The relationship between the amount of exposure [dose] to a substance and the resulting changes in body function or health (response).

Environmental media

Soil, water, air, biota (plants and animals), or any other parts of the environment that can contain contaminants.

Environmental media and transport mechanism

Environmental media include water, air, soil, and biota (plants and animals). Transport mechanisms move contaminants from the source to points where human exposure can

occur. The environmental media and transport mechanism is the second part of an exposure pathway.

EPA

United States Environmental Protection Agency.

Epidemiologic surveillance [see Public health surveillance].

Epidemiology

The study of the distribution and determinants of disease or health status in a population; the study of the occurrence and causes of health effects in humans.

Exposure

Contact with a substance by swallowing, breathing, or touching the skin or eyes. Exposure may be short-term [acute exposure], of intermediate duration, or long-term [chronic exposure].

Exposure assessment

The process of finding out how people come into contact with a hazardous substance, how often and for how long they are in contact with the substance, and how much of the substance they are in contact with.

Exposure-dose reconstruction

A method of estimating the amount of people's past exposure to hazardous substances. Computer and approximation methods are used when past information is limited, not available, or missing.

Exposure investigation

The collection and analysis of site-specific information and biologic tests (when appropriate) to determine whether people have been exposed to hazardous substances.

Exposure pathway

The route a substance takes from its source (where it began) to its end point (where it ends), and how people can come into contact with (or get exposed to) it. An exposure pathway has five parts: a source of contamination (such as an abandoned business); an environmental media and transport mechanism (such as movement through groundwater); a point of exposure (such as a private well); a route of exposure (eating, drinking, breathing, or touching), and a receptor population (people potentially or actually exposed). When all five parts are present, the exposure pathway is termed a completed exposure pathway.

Exposure registry

A system of ongoing follow-up of people who have had documented environmental exposures.

Feasibility study

A study by EPA to determine the best way to clean up environmental contamination. A number of factors are considered, including health risk, costs, and what methods will work well.

Geographic information system (GIS)

A mapping system that uses computers to collect, store, manipulate, analyze, and display data. For example, GIS can show the concentration of a contaminant within a community in relation to points of reference such as streets and homes.

Grand rounds

Training sessions for physicians and other health care providers about health topics.

Groundwater

Water beneath the earth's surface in the spaces between soil particles and between rock surfaces [compare with surface water].

Half-life ($t_{1/2}$)

The time it takes for half the original amount of a substance to disappear. In the environment, the half-life is the time it takes for half the original amount of a substance to disappear when it is changed to another chemical by bacteria, fungi, sunlight, or other chemical processes. In the human body, the half-life is the time it takes for half the original amount of the substance to disappear, either by being changed to another substance or by leaving the body. In the case of radioactive material, the half life is the amount of time necessary for one half the initial number of radioactive atoms to change or transform into another atom (that is normally not radioactive). After two half lives, 25% of the original number of radioactive atoms remain.

Hazard

A source of potential harm from past, current, or future exposures.

Hazardous Substance Release and Health Effects Database (HazDat)

The scientific and administrative database system developed by ATSDR to manage data collection, retrieval, and analysis of site-specific information on hazardous substances, community health concerns, and public health activities.

Hazardous waste

Potentially harmful substances that have been released or discarded into the environment.

Health consultation

A review of available information or collection of new data to respond to a specific health question or request for information about a potential environmental hazard. Health consultations are focused on a specific exposure issue. Health consultations are therefore more limited than a public health assessment, which reviews the exposure potential of each pathway and chemical [compare with public health assessment].

Health education

Programs designed with a community to help it know about health risks and how to reduce these risks.

Health investigation

The collection and evaluation of information about the health of community residents. This information is used to describe or count the occurrence of a disease, symptom, or clinical measure and to evaluate the possible association between the occurrence and exposure to hazardous substances.

Health promotion

The process of enabling people to increase control over, and to improve, their health.

Health statistics review

The analysis of existing health information (i.e., from death certificates, birth defects registries, and cancer registries) to determine if there is excess disease in a specific population, geographic area, and time period. A health statistics review is a descriptive epidemiologic study.

Indeterminate public health hazard

The category used in ATSDR's public health assessment documents when a professional judgment about the level of health hazard cannot be made because information critical to such a decision is lacking.

Incidence

The number of new cases of disease in a defined population over a specific time period [contrast with prevalence].

Ingestion

The act of swallowing something through eating, drinking, or mouthing objects. A hazardous substance can enter the body this way [see route of exposure].

Inhalation

The act of breathing. A hazardous substance can enter the body this way [see route of exposure].

Intermediate duration exposure

Contact with a substance that occurs for more than 14 days and less than a year [compare with acute exposure and chronic exposure].

In vitro

In an artificial environment outside a living organism or body. For example, some toxicity testing is done on cell cultures or slices of tissue grown in the laboratory, rather than on a living animal [compare with in vivo].

In vivo

Within a living organism or body. For example, some toxicity testing is done on whole animals, such as rats or mice [compare with in vitro].

Lowest-observed-adverse-effect level (LOAEL)

The lowest tested dose of a substance that has been reported to cause harmful (adverse) health effects in people or animals.

Medical monitoring

A set of medical tests and physical exams specifically designed to evaluate whether an individual's exposure could negatively affect that person's health.

Metabolism

The conversion or breakdown of a substance from one form to another by a living organism.

Metabolite

Any product of metabolism.

mg/kg

Milligram per kilogram.

mg/cm²

Milligram per square centimeter (of a surface).

mg/m³

Milligram per cubic meter; a measure of the concentration of a chemical in a known volume (a cubic meter) of air, soil, or water.

Migration

Moving from one location to another.

Minimal risk level (MRL)

An ATSDR estimate of daily human exposure to a hazardous substance at or below which that substance is unlikely to pose a measurable risk of harmful (adverse), non-cancerous effects. MRLs are calculated for a route of exposure (inhalation or oral) over a specified time period (acute, intermediate, or chronic). MRLs should not be used as predictors of harmful (adverse) health effects [see reference dose].

Morbidity

State of being ill or diseased. Morbidity is the occurrence of a disease or condition that alters health and quality of life.

Mortality

Death. Usually the cause (a specific disease, a condition, or an injury) is stated.

Mutagen

A substance that causes mutations (genetic damage).

Mutation

A change (damage) to the DNA, genes, or chromosomes of living organisms.

National Priorities List for Uncontrolled Hazardous Waste Sites (National Priorities List or NPL)

EPA's list of the most serious uncontrolled or abandoned hazardous waste sites in the United States. The NPL is updated on a regular basis.

National Toxicology Program (NTP)

Part of the Department of Health and Human Services. NTP develops and carries out tests to predict whether a chemical will cause harm to humans.

No apparent public health hazard

A category used in ATSDR's public health assessments for sites where human exposure to contaminated media might be occurring, might have occurred in the past, or might occur in the future, but where the exposure is not expected to cause any harmful health effects.

No-observed-adverse-effect level (NOAEL)

The highest tested dose of a substance that has been reported to have no harmful (adverse) health effects on people or animals.

No public health hazard

A category used in ATSDR's public health assessment documents for sites where people have never and will never come into contact with harmful amounts of site-related substances.

NPL [see National Priorities List for Uncontrolled Hazardous Waste Sites]

Physiologically based pharmacokinetic model (PBPK model)

A computer model that describes what happens to a chemical in the body. This model describes how the chemical gets into the body, where it goes in the body, how it is changed by the body, and how it leaves the body.

Pica

A tendency to eat nonfood items, such as dirt, paint chips, and clay. Some children exhibit pica-related behavior.

Plume

A volume of a substance that moves from its source to places farther away from the source. Plumes can be described by the volume of air or water they occupy and the direction they move. For example, a plume can be a column of smoke from a chimney or a substance moving with groundwater.

Point of exposure

The place where someone can come into contact with a substance present in the environment [see exposure pathway].

Population

A group or number of people living within a specified area or sharing similar characteristics (such as occupation or age).

Potentially responsible party (PRP)

A company, government, or person legally responsible for cleaning up the pollution at a hazardous waste site under Superfund. There may be more than one PRP for a particular site.

ppb

Parts per billion.

ppm

Parts per million.

Prevalence

The number of existing disease cases in a defined population during a specific time period [contrast with incidence].

Prevalence survey

The measure of the current level of disease(s) or symptoms and exposures through a questionnaire that collects self-reported information from a defined population.

Prevention

Actions that reduce exposure or other risks, keep people from getting sick, or keep disease from getting worse.

Public availability session

An informal, drop-by meeting at which community members can meet one-on-one with ATSDR staff members to discuss health and site-related concerns.

Public comment period

An opportunity for the public to comment on agency findings or proposed activities contained in draft reports or documents. The public comment period is a limited time period during which comments will be accepted.

Public health action

A list of steps to protect public health.

Public health advisory

A statement made by ATSDR to EPA or a state regulatory agency that a release of hazardous substances poses an immediate threat to human health. The advisory includes recommended measures to reduce exposure and reduce the threat to human health.

Public health assessment (PHA)

An ATSDR document that examines hazardous substances, health outcomes, and community concerns at a hazardous waste site to determine whether people could be harmed from coming into contact with those substances. The PHA also lists actions that need to be taken to protect public health [compare with health consultation].

Public health hazard

A category used in ATSDR's public health assessments for sites that pose a public health hazard because of long-term exposures (greater than 1 year) to sufficiently high levels of hazardous substances or radionuclides that could result in harmful health effects.

Public health hazard categories

Public health hazard categories are statements about whether people could be harmed by conditions present at the site in the past, present, or future. One or more hazard categories might be appropriate for each site. The five public health hazard categories are no public health hazard, no apparent public health hazard, indeterminate public health hazard, public health hazard, and urgent public health hazard.

Public health statement

The first chapter of an ATSDR toxicological profile. The public health statement is a summary written in words that are easy to understand. The public health statement explains how people might be exposed to a specific substance and describes the known health effects of that substance.

Public health surveillance

The ongoing, systematic collection, analysis, and interpretation of health data. This activity also involves timely dissemination of the data and use for public health programs.

Public meeting

A public forum with community members for communication about a site.

Radioisotope

An unstable or radioactive isotope (form) of an element that can change into another element by giving off radiation.

Radionuclide

Any radioactive isotope (form) of any element.

RCRA [see Resource Conservation and Recovery Act (1976, 1984)]

Receptor population

People who could come into contact with hazardous substances [see exposure pathway].

Reference dose (RfD)

An EPA estimate, with uncertainty or safety factors built in, of the daily lifetime dose of a substance that is unlikely to cause harm in humans.

Registry

A systematic collection of information on persons exposed to a specific substance or having specific diseases [see exposure registry and disease registry].

Remedial investigation/Feasibility Study

The CERCLA process of determining the type and extent of hazardous material contamination at a site.

Resource Conservation and Recovery Act (1976, 1984) (RCRA)

This Act regulates management and disposal of hazardous wastes currently generated, treated, stored, disposed of, or distributed.

RFA

RCRA Facility Assessment. An assessment required by RCRA to identify potential and actual releases of hazardous chemicals.

RfD [see reference dose]

Risk

The probability that something will cause injury or harm.

Risk communication

The exchange of information to increase understanding of health risks.

Risk reduction

Actions that can decrease the likelihood that individuals, groups, or communities will experience disease or other health conditions.

Route of exposure

The way people come into contact with a hazardous substance. Three routes of exposure are breathing [inhalation], eating or drinking [ingestion], or contact with the skin [dermal contact].

Safety factor [see uncertainty factor]

SARA [see Superfund Amendments and Reauthorization Act]

Sample

A portion or piece of a whole. A selected subset of a population or subset of whatever is being studied. For example, in a study of people the sample is a number of people chosen from a larger population [see population]. An environmental sample (for example, a small amount of soil or water) might be collected to measure contamination in the environment at a specific location.

Sample size

The number of units chosen from a population or an environment.

Solvent

A liquid capable of dissolving or dispersing another substance (for example, acetone or mineral spirits).

Source of contamination

The place where a hazardous substance comes from, such as a landfill, waste pond, incinerator, storage tank, or drum. A source of contamination is the first part of an exposure pathway.

Special populations

People who might be more sensitive or susceptible to exposure to hazardous substances because of factors such as age, occupation, sex, or behaviors (for example, cigarette smoking). Children, pregnant women, and older people are often considered special populations.

Stakeholder

A person, group, or community who has an interest in activities at a hazardous waste site.

Statistics

A branch of mathematics that deals with collecting, reviewing, summarizing, and interpreting data or information. Statistics are used to determine whether differences between study groups are meaningful.

Substance

A chemical.

Substance-specific applied research

A program of research designed to fill important data needs for specific hazardous substances identified in ATSDR's toxicological profiles. Filling these data needs would allow more accurate assessment of human risks from specific substances contaminating the environment. This research might include human studies or laboratory experiments to determine health effects resulting from exposure to a given hazardous substance.

Superfund [see Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and Superfund Amendments and Reauthorization Act (SARA)]

Superfund Amendments and Reauthorization Act (SARA)

In 1986, SARA amended the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and expanded the health-related responsibilities of ATSDR. CERCLA and SARA direct ATSDR to look into the health effects from substance exposures at hazardous waste sites and to perform activities including health education, health studies, surveillance, health consultations, and toxicological profiles.

Surface water

Water on the surface of the earth, such as in lakes, rivers, streams, ponds, and springs [compare with groundwater].

Surveillance [see public health surveillance]

Survey

A systematic collection of information or data. A survey can be conducted to collect information from a group of people or from the environment. Surveys of a group of people can be conducted by telephone, by mail, or in person. Some surveys are done by interviewing a group of people [see prevalence survey].

Synergistic effect

A biologic response to multiple substances where one substance worsens the effect of another substance. The combined effect of the substances acting together is greater than the sum of the effects of the substances acting by themselves [see additive effect and antagonistic effect].

Teratogen

A substance that causes defects in development between conception and birth. A teratogen is a substance that causes a structural or functional birth defect.

Toxic agent

Chemical or physical (for example, radiation, heat, cold, microwaves) agents that, under certain circumstances of exposure, can cause harmful effects to living organisms.

Toxicological profile

An ATSDR document that examines, summarizes, and interprets information about a hazardous substance to determine harmful levels of exposure and associated health effects. A toxicological profile also identifies significant gaps in knowledge on the substance and describes areas where further research is needed.

Toxicology

The study of the harmful effects of substances on humans or animals.

Tumor

An abnormal mass of tissue that results from excessive cell division that is uncontrolled and progressive. Tumors perform no useful body function. Tumors can be either benign (not cancer) or malignant (cancer).

Uncertainty factor

Mathematical adjustments for reasons of safety when knowledge is incomplete. For example, factors used in the calculation of doses that are not harmful (adverse) to people. These factors are applied to the lowest-observed-adverse-effect-level (LOAEL) or the no-observed-adverse-effect-level (NOAEL) to derive a minimal risk level (MRL). Uncertainty factors are used to account for variations in people's sensitivity, for differences between animals and humans, and for differences between a LOAEL and a NOAEL. Scientists use uncertainty factors when they have some, but not all, the information from animal or human studies to decide whether an exposure will cause harm to people [also sometimes called a safety factor].

Urgent public health hazard

A category used in ATSDR's public health assessments for sites where short-term exposures (less than 1 year) to hazardous substances or conditions could result in harmful health effects that require rapid intervention.

Volatile organic compounds (VOCs)

Organic compounds that evaporate readily into the air. VOCs include substances such as benzene, toluene, methylene chloride, and methyl chloroform.

Other glossaries and dictionaries:

Environmental Protection Agency (<http://www.epa.gov/OCEPAterms/>)

National Library of Medicine (NIH)

(<http://www.nlm.nih.gov/medlineplus/mplusdictionary.html>)

For more information on the work of ATSDR, please contact:

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Appendix L

**Eastern Michaud Flats Public Health Assessment
Public Release Review Comments
Addressed**

Response to Comments Received during the Public Comment Period

BCEH made this public health assessment available for public review and comment, starting on July 28, 2004. We distributed this public health assessment to 35 persons or organizations. We also made copies available on the Idaho Department of Health and Welfare (IDHW) Web site and at the Idaho State University Library, Marshall Public Library, Portneuf District Library, the Pocatello office of the Idaho Department of Environmental Quality, American Falls Library, and the Shoshone-Bannock Library. Further, we held public meetings at the Fort Hall Indian Reservation and at the Red Lion Hotel conference room at Pocatello to present our findings and discuss them with the public. Upon distribution of the public health assessment, we requested that comments be provided by August 26, 2004—a schedule that was announced in the Idaho State Journal, Power County News, Idaho Unido, and the Sho-Ban News. All references to page numbers in the following responses to public comments are from the July 28, 2004 version of the public health assessment.

Comment #1:

“The current completed exposure pathways...” The statement “A potential exposure pathway exists for site-related contaminants for individuals who consume fish from the Portneuf River” is incomplete and misleading. As stated in *{this commenter’s}* Summary Comments, EPA’s Record of Decision for the EMF Site determined that no further action was required for the Portneuf River surface water and sediment pathway based on the Remedial Investigation and the Human Health Risk Assessment (HHRA) and Ecological Risk Assessment (ERA) for the EMF Site. Risks associated with facility-related impacts to the downstream Portneuf River delta (the most sensitive aquatic wildlife exposure location) were evaluated and determined to be insignificant. Furthermore, the negative findings of benthic invertebrate sediment toxicity testing, in conjunction with the demonstrated non-bioavailability of EMF-facility related constituents from Portneuf River delta sediment samples, underscores the lack of potential for significant bioaccumulation of facility-related constituents within the aquatic food chain. Thus, the potential for human exposure to site-related contamination via the ingestion of higher trophic level aquatic organisms (including fish) is negligible.

Finally, FMC terminated its NPDES discharge *{into}* the Portneuf River in 2002 so there is no rationale to conclude that conditions are different than at the time of the 1998 ROD or the 1995 ERA. The draft Assessment completely fails to identify numerous non-EMF Site point and non-point discharges that negatively impact water quality *{of}* the Portneuf River and instead focuses on historic EMF operations, which have since changed and which have been shown to have had insignificant impacts.

Response:

BCEH identifies human exposure pathways by examining environmental and human components that might lead to contact with contaminants of concern. A pathway analysis considers five principal elements: a source of contamination, transport through an environmental medium, a point of exposure, a route of human exposure, and an exposed population. *Potential exposure pathways* are those for which exposure seems possible, but one or more of the elements is not clearly defined. Potential pathways indicate that *exposure to a contaminant could have occurred in the past, could be occurring now, or could occur in the future*. Identification of an exposure pathway does not imply that health effects will occur, since exposures may, or may not be, substantive. Considering the above definition of a potential exposure pathway, BCEH disagrees with the comment that “the statement ‘A potential exposure pathway exists for site-related contaminants for individuals who consume fish from the Portneuf River is incomplete and misleading’.”

In Section 3.3.6 (page 23), BCEH stated that “available surface water and sediment data suggest that maximum concentrations of arsenic and selenium are well below health comparison values for surface water (based on ingestion exposure pathways). Therefore, BCEH believes that site-related contaminants in fish from the Portneuf River are unlikely to pose a health risk to people who consume these fish infrequently.” Because of the lack of data on site-related contaminants in fish tissue, BCEH was not able to accurately evaluate the health implications associated with fish consumption. For this reason, BCEH stated that a potential (rather than a complete) exposure pathway exists for site-related contaminants for people who consume fish from the Portneuf River.

As part of the public health assessment process, BCEH requests input from the community members and responds to their health concerns. During this health assessment, community members expressed concerns about possible health effects associated with eating fish from the Portneuf River. Elevated polychlorinated biphenyls (PCBs) levels (690 microgram per kilogram wet weight) were found in Utah suckers (Maret and Ott, 1997). In light of concerns expressed by community members, BCEH worked with the Idaho Department of Fish and Game (IDFG) and the IDHW’s Bureau of Laboratories to collect and analyze edible fish from the Portneuf River for PCBs and heavy metals to more accurately evaluate any health effects associated with fish consumption.

BCEH is aware that there are other non-EMF site point and non-point discharges that negatively impact water quality of the Portneuf River. For this reason, BCEH separated the evaluation of non-site related contaminants (such as PCBs) from the site-related contaminants. With regard to *site-related* contaminants, the EMF site has been identified as the major contamination source. BCEH also stated that “BCEH believes that site-related contaminants in fish from the Portneuf River are unlikely to pose a health risk to people who consume these fish infrequently” and

further fish sampling is “due to elevated PCB levels *and to confirm that site-related contaminants in fish will not pose a health risk to the general public.*”

BCEH notes that considering sources other than FMC and Simplot is consistent with ATSDR’s Congressional mandate as outlined in Section 104(I) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA). This mandate states: “ATSDR may consider additional information on the risks to the potentially affected population from all sources of such hazardous substances including known point or non-point sources other than the facility in questions.”

Maret TR and Ott DS 1997. Organochlorine compounds in fish tissue and bed sediment in the Upper Snake River Basin, Idaho and western Wyoming, 1992-94: U.S. Geological Survey Water Resources Investigations Report 97-4080, p. 23.

Comment #2:

“**In the past...**” The last bullet states that “Before 2000, levels of particulate matter in air throughout Chubbuck and Pocatello, as well as part of the Fort Hall Indian reservation between FMC and Interstate 86, periodically exceeded EPA’s health-based comparison values for PM10 and PM2.5 reaching unhealthy air pollution levels as a result of emissions from FMC, Simplot and other sources.” *{This commenter}* believes that this statement is not adequately supported by either the ATSDR Air Contamination Health Consult (“Air Consult”) (ATSDR, 2000) or the current Assessment. *{This commenter}* provided detailed comments on the Air Consult that were essentially ignored by ATSDR, as evidenced by the lack any substantive revisions between the 2000 Public Comment Release Air Consult and the “final” 2001 Air Consult. The IDEQ’s draft Portneuf Valley PM-10 Nonattainment Area State Implementation Plan, Maintenance Plan and Redesignation Request (IDEQ, 2004) provides additional support to *{This commenter’s}* position – “The Portneuf Valley Nonattainment area (PVNAA) attained the PM10 National Ambient Air Quality Standards (NAAQS) on December 31, 1996.” Bearing in mind that IDEQ must have 3 continuous years of data below the NAAQS standard prior to demonstrating attainment, the last year that the PVNAA was actually non-attainment was 1993. The Air Consult and now the current Assessment continue to take the unsupported position that air quality represents a health hazard despite the fact that the PVA has met the health-based PM10 NAAQS for over 10 years. The BCEH’s attempt to distinguish the purpose of the Assessment from the goals and required compliance with the Clean Air Act and the National Ambient Air Quality Standards (NAAQS) is unconvincing and, similar to the Air Consult, the current Assessment is inconsistent with Federal and State regulatory controls with respect to the air pathway.

Response:

BCEH noticed that ATSDR did in fact provide responses to this commenter in the final 2001 health consultation (Appendix F: Response to Public Comments); however, ATSDR believed that the comments did not warrant changes to the health consultation.

This public health assessment is not an assessment of the adequacy of EPA's particulate matter National Ambient Air Quality Standards (NAAQS), as suggested. As stated in the sidebars on Pages 18 and 19, BCEH's evaluations are not meant to address the region's compliance, or lack thereof, with state and federal environmental standards, such as NAAQS. The purpose of this assessment is to evaluate the health implications of exposure to particulate matter (PM) and other contaminants in the EMF study area. For this purpose, BCEH used EPA's NAAQS as a guideline to determine when unhealthy levels of particulate matter occur. In addition, BCEH considers the current epidemiologic and toxicological studies in making determination of public health hazards. Many of the studies that have looked at exposure to association of PM₁₀ and adverse health effects have shown an increase in cardiopulmonary disease at levels below the current NAAQS for PM₁₀. Further, the scientific studies have not yet established a clear exposure threshold below which no adverse health effects are evident. Therefore, it is important to recognize that sensitive populations might experience adverse health effects when exposed to PM₁₀ concentrations lower than EPA's current standard. For this reason, we use conservative estimates to be protective of the most sensitive populations, such as asthmatics, elderly, and children. In light of the fact that some measured PM₁₀ and estimated PM_{2.5} concentrations in Chubbuck and Pocatello likely reached elevated levels at least once a year before 2000, BCEH and ATSDR stand by their conclusion that "Before 2000, levels of particulate matter in air throughout Chubbuck and Pocatello, as well as part of the Fort Hall Indian reservation between FMC and Interstate 86, periodically exceeded EPA's health-based comparison values (CVs) for PM₁₀ and PM_{2.5}, reaching unhealthy air pollution levels as a result of emissions from FMC, Simplot, and other sources."

Comment #3:

"**In the future...**" *{This commenter}* disagrees with BCEH's classification of the EMF site as an Indeterminate Public Health Hazard in the future. BCEH inappropriately equates emissions from the EMF facilities (now essentially limited to the J.R. Simplot Company) with ambient air quality throughout the regional airshed. Emission inventory data available from IDEQ show that the EMF facilities (FMC and the J.R. Simplot Don Plant) represent less than 20% of the particulate emission sources in the Portneuf Valley. Further, FMC's air emissions have been nearly eliminated with shutdown of the facility in December 2001. Even if *{this commenter}* agreed with BCEH's tenuous prediction regarding future inversion conditions, 80% of the particulate matter would be from non-EMF sources. BCEH's

classification is not credible given available data and should be deleted or changed to No Apparent Public Health Hazard.

Response:

The health assessment does not equate emissions from the EMF facilities with ambient air quality throughout the regional airshed. When interpreting the air monitoring data, BCEH and ATSDR recognized that sources other than FMC and Simplot might contribute to the measured air concentrations. Additional particulate matter sources (such as paved roads, windblown dust, fires, and residential heating) are acknowledged both in the assessment and the former health consultation (Appendix G).

As noted previously, the consideration of sources other than FMC and Simplot is consistent with ATSDR's congressional mandate as outlined in Section 104(I) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA). This mandate states: "ATSDR may consider additional information on the risks to the potentially affected population from all sources of such hazardous substances including known point or non-point sources other than the facility in question."

In order to clarify that other emission sources besides the EMF site contribute to PM levels in the PVA, the conclusion, "In the future, there are some uncertainties about the public health hazard associated with air contamination... Therefore, BCEH recommends that measures to control air pollution remain in place and classifies the EMF site as an *indeterminate public health hazard* in the future..." has been changed in the final assessment to read, "In the future, there are some uncertainties about the public health hazard associated with air contamination from the EMF site and other PM sources in the Portneuf Valley Airshed... Therefore, BCEH recommends that measures to control air pollution remain in place and classifies the exposure to air from the EMF site and other sources as an *indeterminate public health hazard* in the future."

BCEH also acknowledges in Section 3.3.4.1 that "After the closure of FMC, the total emissions of particulate matter from the site and resulting PM concentrations decreased appreciably" and that "In December 2001 air emissions related to facility operations ceased with the exception of minor sources related to decommissioning activities and fugitive dust."

However, air monitoring data showed the highest 24-hour average concentrations of PM₁₀ in 2002 and 2003 were measured at Primary Station, which is between the EMF site and Interstate 86, indicating that the EMF site is still a significant source of PM emissions. In addition, while PM₁₀ and PM_{2.5} are no longer a public health hazard in the Chubbuck and Pocatello area, this does not guarantee that unhealthy levels of PM₁₀ and PM_{2.5} (those exceeding their respective 24-hour average health-based CVs of 150 µg/m³ and 65 µg/m³) will not occur in severe inversion-producing

conditions in the future. Therefore, BCEH classifies the EMF site as an indeterminate public health hazard in the future.

Comment #4:

“Due to the limited available data...” The Community Slag Study has been conducted for several years under the direction of EPA with substantial involvement by the Southeastern District Health Department. EPA has the responsibility for evaluating the possible health effects of exposure to radiation from slag. *{This commenter}* fails to see where ATSDR/BCEH has a role in “evaluating” data when the Community Slag Study is being conducted under the direction of EPA. If ATSDR/BCEH desires to have input into the data review process, we suggest that they contact EPA to become active participants with EPA. Otherwise, reviewing documents that have already been reviewed by EPA adds no value.

Response:

ATSDR is mandated under the Superfund Act to assess the presence and nature of health hazards at Superfund sites, to help prevent or reduce further exposure and the illnesses that result from such exposures, and to expand the knowledge base about health effects from exposure to hazardous substances. With this in mind, EPA’s evaluation or review does not preclude ATSDR and BCEH from conducting an assessment and reviewing relevant documents. In addition, because residential exposure to radiation via slag was noted as a one of the community health concerns, BCEH and ATSDR have the obligation to address this concern (i.e., to evaluate the health implications of the residential exposure to the slag used in the communities). Upon review of the available data, BCEH supports EPA’s conclusion that slag from FMC should not be used in the construction of any inhabited buildings.

Comment #5:

“Due to the lack of site-related contaminant data...” *{This commenter}* does not agree that there is a lack of site-related contaminant data such that BCEH cannot evaluate the health effects of consumption of fish from the Portneuf River or that data on possible contaminants in fish tissue needs to be collected. Previous CERCLA studies provide data on water quality and sediment quality in the Portneuf River, which were evaluated by EPA’s contractor, Ecology & Environment. EPA’s ERA conservatively assessed the impact of possible contaminants on benthic organisms, which are the base of the food chain and may potentially impact higher trophic levels, namely fish and ultimately fish-eating birds of prey. The CERCLA RI study findings indicated that the extent of EMF-related contamination in the Portneuf River is restricted to the close proximity of the facilities. During the RI, regulatory oversight personnel had concerns regarding potential wildlife exposure to sediments within the Portneuf River delta ecosystem (located further downstream than the initial sampling locations on the Portneuf River). Any impacts in the river

delta would more likely represent historic releases. Based on these concerns, the RI added an additional field investigation of the Portneuf River delta. EPA developed a field sampling plan (FSP) (E&E, 1994) to collect additional data to further assess potential aquatic ecosystem impacts associated with historic EMF activities. The scope of the FSP was developed based on extensive input from EPA, EPA's contractor, IDEQ, Tribal representatives, and the PRPs. The Portneuf River delta component of these additional studies was focused upon further evaluating chemicals of potential concern, including those that may bioaccumulate, whether or not the chemicals had been shown to be site-related.

The results of this Portneuf River delta study indicated no significant bioavailability or potential for any of the evaluated constituents to bioaccumulate/biomagnify in aquatic food webs. Furthermore, toxicity tests conducted on benthic invertebrates in maximally impacted Portneuf River sediments (i.e., those sediments immediately downstream of the EMF site) were negative. Therefore, the COPCs related to the EMF site were found to pose relatively minimal risk to macroinvertebrates or to impact higher trophic levels, either by reducing their food source or directly impacting them through biomagnification. The delta study also found that delta sediment concentrations of arsenic, cadmium, mercury, selenium and zinc were significantly lower than concentrations found in Portneuf River sediment samples near the EMF site. Thus, EMF constituents were shown not to have significantly accumulated in delta sediments at that time. Further, it is reasonable to conclude that sediment concentrations have likely declined since the time of the river delta study due to reduced releases to the river.

Finally, none of these COPCs were present in downstream sediment samples (collected during the RI) at concentrations statistically significantly higher than upstream background levels. Therefore, any quantitative aquatic wildlife risk estimate for these chemicals would be indistinguishable from background. Upon reviewing the water quality and sediment data from the Portneuf River near the EMF site and further downstream in the Portneuf delta including the results of toxicity testing, EPA determined that analytical testing of fish tissue and macroinvertebrates which had been collected by FMC and Simplot was unnecessary.

As stated previously in our Summary Comments, EPA concluded that risks associated with facility-related impacts to the downstream Portneuf River delta (the most sensitive aquatic wildlife exposure location) were insignificant. This is reflected in EPA's Record of Decision for the EMF Site, which determined that no further action is required for the Portneuf River surface water and sediment pathway, based on the Remedial Investigation and the Human Health and Ecological Risk Assessments for the EMF Site. Furthermore, since FMC terminated its NPDES discharge *into* the Portneuf River in 2002, there is even less rationale for fish tissue sampling now than at the time of the Remedial Investigation.

Response:

See the response to comment #1.

Comment #6:

BCEH lists the need for worker protection from exposures to site-related contaminants in surface soil, surface water, and sediments. BCEH's reference to surface water and sediment exposure to workers is not correct. There is no identified worker exposure to surface water and sediment at the EMF facilities. Reference to these media should be deleted from this recommendation.

Response:

As discussed in Appendix G, workers at both facilities, especially workers responsible for the operation of the wastewater ponds, may come in contact with contaminated surface water and sediments, even though the length and frequency of such contact is probably very short and infrequent. According to EPA, excluding Resource Conservation and Recovery Act (RCRA)-regulated ponds at the FMC site which are currently closed or in closure, workers can still come in contact with surface water and sediments in on-site ponds at both facilities. For this reason, this recommendation stands.

Comment #7:

The recommendation that "appropriate remedial actions should be instituted to prevent the surface soil contaminants from migrating into the local groundwater and surface water," is unsupported and contrary to the findings of the EMF RI Report and the 1998 ROD (EPA, 1998). The EMF RI found that, in the absence of a sustained hydraulic head (e.g., material stockpiles, slag pile) there is no significant migration of contaminants into subsoils or groundwater. In addition, the EMF RI Report determined that the pathway of surface soil to surface water was not a significant migration pathway, which was the basis for EPA's conclusion in the 1998 ROD that no further action was required for surface water and sediments. This conclusion remains appropriate, particularly considering FMC terminated its NPDES permitted discharge in 2002.

Response:

The recommendation "Appropriate remedial actions and monitoring should be instituted or continued to prevent surface soil contaminants from migrating into the local groundwater and surface water, as well as to prevent future migration of site-related groundwater contaminants into any drinking water sources" was changed to "Appropriate remedial actions and monitoring should be instituted or continued to prevent future migration of site-related groundwater contaminants into any drinking water sources."

Comment #8:

The recommendation for agencies and the local cities to develop and implement air pollution control initiatives and enforce the existing ones is, at best, gratuitous and, at worst, implies that the regulatory agencies/cities have not been or are not complying with statutory and regulatory requirements. The Assessment apparently ignores the CAA, State of Idaho regulations and the IDEQ PM-10 SIP and Maintenance Plan. This recommendation should be deleted from the final Assessment.

Response:

As stated in the public health assessment, BCEH classifies the EMF site as an *indeterminate public health hazard* in the future because unhealthy levels of PM₁₀ and PM_{2.5} (those exceeding their respective 24-hour average health-based comparison values of 150 µg/m³ and 65 µg/m³) might occur in severe inversion-producing conditions in the future. BCEH believes that reducing all air emissions sources will help insure that unhealthy air exposures will not happen. The recommendation is not intended to imply that IDEQ, or the facilities at the EMF site, are not meeting their various mandates or regulatory requirements. Rather, the recommendation is meant to state the importance of continued development, implementation, and enforcement of air pollution control initiatives in the PVA (including the CAA, State of Idaho regulations, and the IDEQ PM₁₀ SIP and Maintenance Plan) to insure that the PVA air quality remains healthy in the future. For this reason, BCEH will not delete the recommendation from the final assessment.

Comment #9:

BCEH has provided no basis for drawing the conclusion that the suspension on the sale of slag for all construction uses should remain in place. Depending on results of the Community Slag Study, it is possible that slag use for non-residential construction (e.g., as road base or railroad ballast) could become viable, as some uses may not present a health risk issue. Ultimately it is up to EPA, FMC and Monsanto to determine if and when slag sales may resume and for what range of uses.

Response:

BCEH agrees that ultimately EPA, FMC and Monsanto will determine if and when slag sales may resume and for what types of uses. However, the Slag Exposure Study is still ongoing, and not enough data are present for BCEH to accurately evaluate the possible health effects of residential exposure to radiation in slag. Until further data show otherwise, FMC and Monsanto should continue the *voluntary* suspension on the sale of slag for all construction purposes. BCEH has revised its

recommendation to read: The *voluntary* suspension by *FMC and Monsanto* of the sale of slag for all construction uses should remain in place.

Comment #10:

As stated previously, *{this commenter}* does not agree that BCEH needs to coordinate with IDFG to test fish from the Portneuf River to identify potential impacts from site-related chemicals. Previous CERCLA studies provide data on water quality and sediment quality in the Portneuf River. Previous work indicates that EMF site-related constituents pose an insignificant ecological risk to benthic organisms, based on the findings of the toxicity studies and an assessment of bioavailability, which further indicates the COPCs are unlikely to bioaccumulate/biomagnify in aquatic food webs. The COPCs related to the EMF site pose relatively minimal risk potential to higher trophic levels. BCEH's recommendation to work with the Idaho Department of Fish and Game to test fish for analysis of PCBs and heavy metals is another example of agency "make work" that is unnecessary and a waste of taxpayer money.

Response:

As stated previously (Comment #1), because of elevated PCB levels (690 micrograms per kilogram wet weight) found in Utah suckers (Maret and Ott, 1997) and concerns expressed by community members regarding eating fish from the Portneuf River, BCEH justifies the analysis of edible fish from the Portneuf River for PCBs and heavy metals to more accurately evaluate health effects associated with fish consumption.

The mission of the Idaho Department of Health and Welfare (IDHW) is *to promote and protect the health and safety of all Idahoans*. In order to carry out IDHW's mission, BCEH conducts the Idaho Fish Consumption Advisory Program which informs Idahoans about contamination of Idaho water bodies that may impact fish and human health. BCEH issues consumption advisories regarding the amount of fish that can be safely eaten from these water bodies. Although PCBs are not known site-related contaminants, BCEH will evaluate Portneuf River fish for PCBs as part of its Fish Consumption Advisory Program. Additionally, in response to concerns expressed by community members, BCEH will capitalize on this opportunity to determine the actual heavy metals concentrations found in edible fish caught from the Portneuf River.

Comment #11:

{This commenter} provided the following comment on the Air Consult (ATSDR, 2000) "ATSDR's proposal to conduct an evaluation of the cancer incidence on the Fort Hall Indian Reservation and in the Pocatello area is not supported by this Air Consult or any of the previous ATSDR consults for the EMF site. The Air Consult identifies PM and sulfate as the air pollutants that drive the ATSDR finding that air

pollution represents a public health hazard; however, neither PM nor sulfate are considered to be carcinogens and, thus, play no role in cancer incidence. Further, the Air Consult did not find a public health hazard associated with airborne levels of specific elements or compounds that are identified carcinogens. Thus, the Air Consult itself does not support this proposed action.” The findings in the draft Assessment further fail to establish a credible rationale for this recommendation.

Response:

Morbidity and mortality data are one of the three major types of data and information (the others being environmental data and community health concerns) that BCEH and ATSDR use in the evaluation of a site. If possible, BCEH and ATSDR try to address community concerns regarding a particular health outcome by evaluating any existing health outcome data to determine the health status of a community. As indicated in the public health assessment and health consultation, available data indicate that long-term exposures to the elemental forms of certain airborne metals from the site, that are known or suspected human carcinogens, are likely to result in a low increased risk for cancer. However, the health consultation goes on to say that it is uncertain about the levels of these carcinogens prior to 1994, when the levels of PM, and hence heavy metals, were notably higher. Moreover, the conclusion is also uncertain because for some of the metals, the lack of toxicological data and data on the exact chemical species found in the ambient air prevents a complete assessment of the public health implications of exposures. BCEH and ATSDR believe, therefore, that the evaluation of the cancer incidence in the community is justified.

Additionally, because cancer incidence is one of the community’s health concerns, BCEH and ATSDR have the obligation to look at and address cancer rates in communities affected by the EMF site.

Comment #12:

FMC was not informed of or invited to participate in the “EMF Work Group,” which we believe is a fatal flaw in the ability of this Work Group to assist and advise BCEH on community health education activities. The work done to date by BCEH and ATSDR has shown that their representatives have an incomplete and/or incorrect understanding of EMF site data and risk assessment work, resulting in a less than credible effort at community health education. Without the ability to participate in this Work Group, FMC cannot comment on whether this group can or will provide accurate representation of the facts and data related to the EMF site. At a minimum, we hope that EPA’s Remediation Project Manager is a participant on the Work Group so that EPA is aware of and has input into any information distributed regarding the EMF site.

Response:

During the development of this health assessment and past health consultations, the EMF Work Group, (made up of community members and representatives from tribal, state, and federal health and environmental agencies), worked with community members to identify site-related health concerns and health education needs. During its lifetime, the work group has assisted ATSDR and BCEH in conducting an environmental health information needs assessment among impacted community members and the health professionals serving them. The work group has also informed ATSDR and BCEH in the development and implementation of health education activities designed to address the needs and concerns identified by the community.

Several representatives from EPA, including EPA's EMF site remediation project manager, participated in the working group. BCEH considered this individual a representative of FMC and Simplot. BCEH is open to having a representative from both FMC and Simplot placed on the working group.

Comment #13:

Consistent with our comments above, *{this commenter}* fails to see where ATSDR/BCEH has a role in "evaluating" slag exposure data. The Community Slag Study has been conducted for several years under the direction of EPA with substantial involvement by the Idaho Southeastern District Health Department. EPA, FMC and Monsanto have expended significant resources establishing the Community Slag Study, including development of the Graded Decision Guidelines and a process for interested parties to make inquiries and request surveys while remaining anonymous.

Response:

See the response to Comment #4.

Comment #14:

Some years ago, after critically reviewing water quality and sediment data from the Portneuf River near the EMF facilities and further downstream in the river delta, EPA determined that analytical testing of fish tissue was not indicated. The COPCs related to the EMF site were found to pose relatively minimal risk to macroinvertebrates due to a low bioavailability of the COPCs, as shown by toxicity test results. Therefore, EPA concluded that evaluation of potential impacts to higher trophic levels through analysis of edible fish tissue was unnecessary. Furthermore, based on the findings of the RI and Delta study, none of the COPCs, except for cadmium, was present in sediment samples immediately downstream of the facilities or in the delta at concentrations statistically significantly higher than upstream background levels. Therefore, any quantitative aquatic wildlife risk

estimate for these chemicals would be indistinguishable from background. With respect to cadmium, toxicity testing indicated that no further evaluation of potential risks was necessary.

Response:

See the responses to Comments #1 and 10.

Comment #15:

Consistent with our comments above, neither the Air Consult nor the Assessment establishes a credible need for further evaluation of cancer incidence in this area.

Response:

See the response to Comment #11.

Comment #16:

{This commenter} questions the value of a retrospective health study related to PM-10 exposures to the relatively small population of Pocatello and Chubbuck when other, much larger studies at other cities have already been completed. As we have commented previously on the Air Consult and on this Assessment, this study appears to be a critique regarding the adequacy of EPA's PM-10 and PM-2.5 NAAQS rather than a study aimed at protecting human health. ATSDR intends to study the period from late 1994 to March 2000, but the results of the study will not be available until at least 2005. Thus the results of the study would be of no use to the public since it will not represent current exposures because, in the period after 2000, there have been emission decreases from many sources as well as the cessation of FMC air emissions as a result of facility closure. Furthermore, since IDEQ has determined that the cities of Pocatello and Chubbuck are already in attainment with health-based standards and will continue to be in attainment, it is unclear why such a study should be undertaken.

Response:

As indicated in our response to a similar comment to the 2001 Air Contamination Health Consultation, the health consultation and this public health assessment are not an assessment of the adequacy of the PM₁₀ NAAQS, as suggested. The purpose, however, was to evaluate the public health implications of exposure to PM and other air contaminants in the EMF study area in relation to our current scientific knowledge of the epidemiologic and toxicological data. One of the reasons that EPA proposed standards for PM_{2.5} is that many of the health studies that examined the association of PM₁₀ and adverse health effects showed an increase in cardiopulmonary diseases at levels below the current NAAQS levels for PM₁₀. Moreover, as was pointed out to ATSDR during the peer review of the 2001 Air

Contamination Health Consultation, scientists have yet to establish a clear exposure threshold, below which no adverse health effects are evident.

As mandated by Congress, public health assessments and health consultations are intended to be a triage mechanism to determine the need for further public health actions, including health studies. Moreover, population-based research conducted to identify links between exposures and specific adverse health outcomes is a necessary part of this mandate. During the conduct of the 2001 ATSDR Health Consultation, the community expressed concerns regarding a perceived increased incidence of asthma, upper respiratory illness, and heart disease. These increased incidences were determined to be reasonably consistent with adverse health outcomes reported in the epidemiological research for both acute and chronic exposures to PM_{2.5} and PM₁₀. However, the consistency between the incidences and the epidemiological studies does *not* suggest that any given incident of these health outcomes is *caused* solely by inhalation exposures to PM_{2.5} or PM₁₀. Rather, causality of any given disease is usually a result of multiple factors. Testing the hypothesis that respiratory and heart disease are elevated in the cities of Chubbuck and Pocatello, Idaho, is beyond the scope of an ATSDR public health assessment or health consultation. The goal of the planned health study is to help shed light on whether PM exposures are associated with adverse cardiopulmonary health outcomes as measured by counts of hospital admissions or medical visits.

The rationale for this health study is based both on addressing a public health need and in extending the already extensive body of scientific literature on the effects of PM exposures. From a public health standpoint, the study will help to address the public's concern regarding a perceived excess incidence of respiratory and heart disease in the community (Chubbuck and Pocatello). An extensive body of epidemiologic literature relates short-term (daily) PM exposures to excesses in morbidity and mortality and long-term (yearly) PM exposures to excesses in mortality, especially related to respiratory health outcomes. Few data, however, relate midterm (30–120 days) and long-term effects to excesses in morbidity as measured by hospital admissions for respiratory and cardiovascular diseases.

Comment #17:

{This commenter} fails to see any value for ATSDR/BCEH to “review additional environmental sampling data and new studies as they become available.” As the Assessment points out, a Supplemental Remedial Investigation and Supplemental Feasibility Study is being conducted at the FMC Operable Unit by FMC under the direction of EPA with review and input from IDEQ and the Shoshone Bannock Tribes. If ATSDR/BCEH desire to have input into the data/report review process, we suggest that they contact EPA to become active participants, rather than acting as a “Johnny-come lately” and second guessing reports generated in the CERCLA process in which they have declined to participate. Reviewing documents that have already been reviewed by EPA, IDEQ and the Tribes and approved by EPA adds no value and is inconsistent with CERCLA.

Response:

In 1980, Congress created the Agency for Toxic Substances and Disease Registry (ATSDR) to implement the health-related sections of laws, such as the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), that protect the public from hazardous wastes and environmental spills of hazardous substances. As the lead agency within the Public Health Service for implementing the health-related provisions of CERCLA, ATSDR is mandated under the Superfund Act to assess the presence and nature of health hazards at Superfund sites, to help prevent or reduce further exposure and the illnesses that result from such exposures, and to expand the knowledge base about health effects from exposure to hazardous substances.

As part of a cooperative agreement between ATSDR and the State of Idaho, BCEH is required to follow this mandate as well. In effect, ATSDR and BCEH provide input into and are active participants in the CERCLA process. As outlined by Congressional mandate, ATSDR and BCEH have exercised their roles in the CERCLA process both in the assessment of health hazards at the EMF Superfund site and by informing communities of known public health hazards associated with the site.

As mentioned in previous responses, the data and report review by EPA, IDEQ, and the Tribes does not preclude ATSDR and BCEH from conducting an assessment and reviewing the relevant documents from a public health standpoint and is not inconsistent with CERCLA.

Comment #18:

Section 2.3, Land Use, paragraph 2, last sentence – “The number of people who access the land immediately north of FMC is believed to be limited, but passers by clearly use the area.” *{This commenter}* disagrees that there is clear evidence of significant access onto or use of FMC properties north of Highway 30 or north of Interstate 86 by “passers by.” We acknowledge that, despite significant efforts by FMC to discourage trespassing (including digging a 3-foot deep trench in front of the fenceline), trespassers may access the Portneuf River by foot across a small portion of the southeastern edge of the FMC property near the bridge on the frontage road. FMC Security personnel patrol and monitor these land holdings and County Sheriff personnel have been contacted to remove trespassers as needed. *{This commenter}* requests that the text “but passers by clearly use the area” be deleted from the final Assessment.

Response:

The text “but passersby clearly use the area” has been deleted from the final assessment.

Comment #19:

Section 3.3.1, Surface Soil Ingestion Pathway, paragraph 1, last sentence – “No new surface soil data has been generated since the [1998] health consultation was released.” FMC has collected additional site data, including surface soil data at the site, since the EMF Remedial Investigation and the 1998 health consultation. The data are available in FMC’s draft Remedial Investigation Update Memorandum submitted to EPA on June 1, 2004 pursuant to the Administrative Order on Consent (AOC) for the Supplemental Remedial Investigation and Supplemental Feasibility Study for the FMC Operable Unit.

Response:

This was changed to read “Since the health consultation was released, FMC collected additional surface soil data at the site, which was obtained to characterize background levels and was not for the purpose of assessing risks.”

Comment #20:

Section 3.3.4.1, Air Quality in Chubbuck and Pocatello, paragraph 1, Line 6 (page 18) and at Air Quality on the Fort Hall Indian Reservation, paragraph 1, line 11 (page 20) – “However, this does not guarantee that unhealthy levels of PM10...will not occur...in the future.” *{This commenter}* must point out that the Assessment goes well beyond an assessment of the air pathway for the EMF site into an assessment of the adequacy of EPA’s particulate matter NAAQS and then inappropriately equates emissions from the EMF facilities with ambient air quality throughout the regional airshed. Based on IDEQ’s air emissions inventory in the Portneuf Valley PM-10 Nonattainment Area State Implementation Plan, Maintenance Plan and Redesignation Request, the EMF facilities (FMC and the J.R. Simplot Don Plant) represent less than 20% of the total particulate matter sources in the PVA. Obviously, since FMC shut down in December 2001, the particulate emissions from FMC are now virtually nil. Even if *{this commenter}* agreed with BCEH’s tenuous prediction regarding future inversion conditions, over 80% of particulate matter emissions would not be from EMF sources. Associating potential future regional air quality issues with the EMF site is without basis, improper, and potentially libelous. In addition, the Assessment is at odds with the IDEQ SIP, MP and Redesignation Request that states “In conclusion, DEQ has provided convincing evidence that the PVNAA attained the PM10 NAAQS by December 31, 1996, has remained in attainment, and will continue to maintain the PM10 NAAQS through 2020.” The BCEH’s attempt in the shaded box on page 18 to distinguish the purpose of the draft Assessment from the goals and required compliance with the Clean Air Act and the National Ambient Air Quality Standards (NAAQS) is unconvincing and the Assessment, as was the Air Consult, is inconsistent with health-based Federal and State regulatory controls with respect to the air pathway.

Response:

See responses to Comments #2 and 3.

Comment #21:

Section 3.3.5, Residential Exposures to Radiation from Slag, – BCEH should recognize that both FMC and Monsanto have historically sold slag, but in recent years have voluntarily suspended slag sales and have sponsored and participated in the Community Slag Study. Thus, references to FMC should be reworded in this section to include Monsanto, starting at the end of the second paragraph (“Immediately thereafter, FMC and Monsanto voluntarily....” This change is also requested in the third and fifth paragraphs that presently list only FMC.

Response:

The changes requested in the above comment have been made in the final assessment.

Comment #22:

In the third paragraph, the reference to Pocatello is incorrect, i.e., “The study concluded that some citizens in Pocatello...” should read “The study concluded that some citizens in southeast Idaho...” This change is needed because the Community Slag Study included Soda Springs, Fort Hall, Pocatello, Chubbuck, and surrounding areas.

Response:

This was changed to read; “The study concluded that some citizens in southeast Idaho (including Pocatello)...”

Comment #23:

{This commenter} disagrees with the statement in the last paragraph that “BCEH cannot accurately evaluate the health effects of exposure to the radiation from slag use in the communities at this time.” As noted earlier in this paragraph, the Community Slag Study did not find any slag in the basement of any of the 1133 houses surveyed in Pocatello and Fort Hall. Some 21 residences showed radiations levels above action levels, but these were houses that did not contain slag. *{This commenter}* believes that BCEH should more properly conclude that there is no evidence that slag was used for basement construction in Pocatello or Fort Hall, thus there are no identified health concerns regarding slag use in home foundations around Pocatello and Fort Hall.

Response:

The *Elemental Phosphorus Slag Exposure Study: Phase I Final Report*, states that “No houses in Pocatello or Fort Hall were found to have slag in the construction.” An estimated “less than 0.5% of residences in these two communities might contain slag.” This health assessment clearly states this. It is important to note that among the 21 residences in Pocatello and Fort Hall identified and recommended for a follow-up evaluation after an initial screening, only two households completed the follow-up surveys as of November 1, 1998. Therefore, BCEH does not have enough data to accurately evaluate the health effects of exposure to the radiation from slag use in the communities. Because of the lack of data and resulting uncertainty regarding health risks, BCEH cannot state with confidence that there are “no identified health concerns regarding slag use in homes foundations around Pocatello and Fort Hall.”

Comment #24:

Section 3.3.5, Residential Exposures to Radiation from Slag, paragraph 5, line 2 – As noted in the previous comment, the statement that “This exposure study is being conducted according to an AOC between EPA and FMC” is not correct because the Community Slag Study is being conducted pursuant to an AOC between EPA, FMC and Monsanto. *{This commenter}* requests that BCEH provide an explanation why BCEH has not performed a Public Health Assessment for the Monsanto, Soda Springs, ID Superfund Site, considering that Monsanto slag was also sold for construction use at residences in that area.

Response:

Monsanto was added to the sentence as requested in the above comment. ATSDR did conduct an interim preliminary public health assessment for the Monsanto, Soda Springs, Idaho Superfund Site on March 25, 1992.

Comment #25:

Section 3.3.5, Residential Exposures to Radiation from Slag, paragraph 6, line 17 – *{This commenter}* disagrees with the statement that “The Slag Exposure Study is still on-going, therefore, BCEH will further evaluate slag exposure data when and if it becomes available.” *{This commenter}* fails to see any value for ATSDR/BCEH to “evaluate data when and if it becomes available.” As the Assessment points out, the Community Slag Study is being conducted under the direction of EPA. If ATSDR/BCEH desires to have input into the data review process, we suggest that they contact EPA to become active participants with EPA. Otherwise, reviewing documents that have already been reviewed by EPA adds no value.

Response:

See the responses to Comments #4, 9, and 17.

Comment #26:

Section 3.3.6, Fish Consumption Exposure Pathway, paragraph 1, line 3 – *{This commenter}* disagrees with the statement that “A completed exposure pathway exists for non-site related contaminants and a potential exposure pathway exists for site-related contaminants for individuals who consume fish from the Portneuf River.” As noted previously, from the Portneuf River near the EMF facilities and further downstream in the river delta, the COPCs related to the EMF site were found to pose relatively minimal risk potential macroinvertebrates due to a low bioavailability of the COPCs as shown in toxicity test results. Therefore, EPA concluded that evaluation of potential impacts to higher trophic levels through analysis of edible fish tissue concentrations was unnecessary. Furthermore, based on the findings of the RI and the river delta study, none of the COPCs were present in sediment samples immediately downstream of the facilities or in the delta at concentrations significantly higher statistically than upstream background levels, with the exception of cadmium. Therefore, any quantitative aquatic wildlife risk estimate for these chemicals would be indistinguishable from background. With respect to cadmium, toxicity testing indicated that no further evaluation of potential risks was necessary.

Further, EPA’s Record of Decision for the EMF Site determined that no further action is required for the Portneuf River surface water and sediment pathway based on the Remedial Investigation and the Human Health and Ecological Risk Assessments for the EMF Site.

Response:

See the responses to Comments #1 and 10.

Comment #27:

Appendix B Data Tables, Table B-1 – The table presents the maximum concentrations as a summary of the years of data but does not report the natural background concentrations. Thus, the table presents a distorted view of the potential risks. The conservative estimates of the mean concentrations obtained during the EMF RI (i.e., the 95% upper confidence limit of the mean) for regional background groundwater (Michaud Aquifer) are 0.0149 mg/l for arsenic, 5.52 mg/l for nitrate, 0.0057 mg/l for selenium and 72.57 mg/l for sulfate. None of the maximum concentrations reported for arsenic, nitrate or selenium exceed regional background. Five of the maximum concentrations reported for sulfate exceed regional background, but are far below the SMCL referenced in the table. Because

risks associated with regional background are an important consideration, *{this commenter}* suggests adding the regional background concentrations to Table B-1.

Response:

Regional background concentrations of arsenic, nitrate, selenium, and sulfate in groundwater are uncertain because the background samples may have been taken from different groundwater systems than those listed in Table B-1. For this reason, BCEH did not add the regional background concentrations to Table B-1.

Comment #28:

The Assessment is an impediment to economic development opportunities for the FMC property as well as the general city and county area.

Since FMC terminated plant operations in December 2001, the company has actively supported economic redevelopment of the property by an outside interest(s). To this end, FMC has provided substantial funding for and actively participated in Governor Kempthorne's Idaho Optimum Initiative (101) that was commissioned to identify and evaluate economic development opportunities for the FMC property in an effort to replace jobs lost by the closure of the plant and stimulate economic rebound in the Pocatello area.

One of the impediments to attracting high-paying industrial and manufacturing jobs in the area has been the uncertainty around the non-attainment status of the Portneuf Valley Airshed (PVA). Of great credit to the Idaho Department of Environmental Quality, the draft Portneuf Valley PM-10 Nonattainment Area State Implementation Plan, Maintenance Plan and Redesignation Request was recently submitted to EPA for approval. Redesignation of the PVA to attainment will provide certainty to prospective businesses interested in locating in the region. Unfortunately, the Assessment undermines the positive impact of the IDEQ's Redesignation Request by perpetuating uncertainty regarding future air quality in the region.

As drafted, the Assessment contradicts IDEQ's Redesignation Request and could be viewed by potential businesses as re-erecting the impediment to development that the IDEQ is seeking to remove.

Response:

BCEH's mission first and foremost is to protect the public from exposure to hazardous substances associated with hazardous waste sites. With this aim in mind, BCEH evaluates all available data and makes science-based decisions regarding the risks posed to the public by hazardous waste sites throughout Idaho. BCEH does not endeavor to erect impediments to economic development. In fact, BCEH believes that by ensuring that communities have safe, healthy environments, these

communities will attract more residents, workers, and businesses, and therefore be more economically viable.

BCEH's conclusion that the site poses an indeterminate health risk in the future does not contradict IDEQ's Redesignation Request, nor does it "re-erect the impediment to development that IDEQ is seeking to remove." As stated previously, BCEH's evaluations are not meant to address the region's compliance, or lack thereof, with state and federal environmental standards, such as EPA's NAAQS (see sidebars on Pages 18 and 19). BCEH considers the potential for human exposure to air of poor quality and, in this report, does not consider EPA's criteria for compliance or attainment. The findings must not be confused with EPA's evaluation of attainment for the region.

Comment #29:

The Assessment erroneously attributes regional air quality concerns and surface water quality concerns in the Portneuf River to the EMF Site.

Based on IDEQ's air emissions inventory (base year 2000) that was included with the Portneuf Valley PM-10 Nonattainment Area State Implementation Plan, Maintenance Plan and Redesignation Request, the J.R. Simplot Don Plant represents less than 20% of the total particulate matter sources in the PVA. Since FMC shut down in December 2001, particulate emissions from FMC have been and will remain negligible. Even if *{this commenter}* agreed with BCEH's speculation regarding future inversion conditions, over 80% of the particulate matter sources would be from non-EMF sources. Thus, BCEH's conclusion that particulate emissions from the EMF Site in the future could contribute significantly to poor air quality during inversion conditions in the PVA is without basis, improper and erroneous.

The Assessment is also incorrect regarding the need for further studies to determine potential impacts from the EMF Site to the Portneuf River, such as fish tissue analyses. EPA's Record of Decision for the EMF Site determined that no further action was required for the Portneuf River surface water and sediment pathway, based on the findings of the Remedial Investigation and the EPA Human Health Risk Assessment and Ecological Risk Assessment for the EMF Site. Considering that FMC terminated its NPDES discharge to the Portneuf River in 2002, there is even less rationale for fish tissue sampling currently than at the time of the Remedial Investigation. More troubling, the Assessment completely fails to identify numerous other point and non-point source discharges that have and continue to negatively impact water quality in the Portneuf River. The BCEH's recommendation and proposed action to work with the Idaho Department of Fish and Game to collect fish samples from the Portneuf River due to the EMF Site is unsupported and unjustified.

Response:

See the responses to Comments #1, 2, and 3.

Comment #30:

ATSDR'S and now BCEH'S reviews of EMF Site information have been neither timely nor provided any substantive new information. The Assessment fails to establish credible or convincing rationale for any further ATSDR/BCEH actions related to the EMF Site.

As FMC pointed out in its May 2000 comments on the ATSDR Air Contamination Health Consult ("Air Consult"):

"ATSDR's proposal to prepare a "comprehensive public health assessment" is unjustified by the Air Consult. Considering that this Air Consult, which is nothing more than a compilation of data from various readily-available sources, took the ATSDR over two years to complete, a comprehensive assessment would be expected to provide nothing more than a compilation of existing data from all of the ATSDR consults for the EMF site into one document over a two- to five-year tenure. This proposal is particularly egregious considering that only the Air Consult (*not the 1997 consults on groundwater, surface soils, and surface water and sediment*) found that the EMF site currently poses a public health hazard, a conclusion that is disputable."

Over three years have passed since ATSDR published the final Air Consult in March 2001 and this draft Assessment provides no new or meaningful information or analyses. As U.S. and Idaho State taxpayers, we must express our strong objection to the expenditure of public funds to simply repackage information and "conclusions" taken from the 1995 EPA Human Health Risk Assessment and Ecological Risk Assessment for the EMF Site that addressed all the relevant exposure pathways, including groundwater, surface soil, surface water and sediment, and air. ATSDR's and now BCEH's reviews of the site information have been neither timely nor provided any substantive new information. The Assessment fails to establish credible or convincing rationale for any further ATSDR/BCEH studies or other actions related to the EMF site.

As drafted, the Assessment should be withdrawn or, at a minimum, significantly revised to address the major flaws described herein.

Response:

In this public health assessment, BCEH revisited the conclusions and recommendations made in past health consultations for groundwater, surface soil, surface water and sediment, and air contamination (ATSDR 1998a, 1998b, 1998c, 2001a), and reviewed new environmental data, information regarding site

operations (i.e., closure of the FMC facility), health data, and community health concerns. In addition, BCEH conducted a cancer incidence analysis for the Pocatello and Fort Hall area in conjunction with the Cancer Data Registry of Idaho (CDRI). This public health assessment recommends actions to prevent, reduce, or further identify the possibility for site-related adverse health effects, as appropriate.

Contrary to the comment that “this assessment provides no new or meaningful information or analyses”, BCEH conducted a cancer incidence analysis for the Pocatello and Fort Hall area, evaluated the radiological contamination in the air, addressed the community health concerns, and evaluated the new air monitoring data in the assessment. On the basis of the new air monitoring data, BCEH classified the EMF site as a *no apparent public health hazard*, instead of the former classification of public health hazard in the 2001 Health Consultation. Also, BCEH put into perspective the public health implications of all of the exposure pathways associated with the EMF site, and provided the public an understanding of exposures they may have received from multiple pathways and contaminants.

Risk assessments, standard components of EPA’s evaluation process, are reviewed, along with other site documents, by BCEH and ATSDR, when they conduct a public health assessment or health consultation. A risk assessment finding does not preclude BCEH and ATSDR from conducting an assessment of a site. Risk assessments look only at current and future risks to help determine actions needed to remediate a site or reduce source emissions. Whereas, in addition to present and future risks, BCEH and ATSDR evaluate the public health implications of past exposures that are not usually addressed in the standard risk assessment. In this public health assessment, community health concerns were addressed and available health outcome data (such as cancer incidence data) were evaluated, neither of which were addressed in EPA’s risk assessment process.

Comment #31:

Are there groundwater samples taken between the FMC-Simplot sites and American Falls? If so, is there a baseline established and how often are the results reported? Is there a trend of contamination increasing and the types, also fish studies, Portneuf sediment studies...?

Response:

According to EPA, groundwater samples are collected mainly at or near the two facilities (directly down gradient from the site). A limited number of samples are taken between the site and the Portneuf River. However, no groundwater samples were taken between the facilities and American Falls Reservoir and EPA does not have baseline groundwater data for the site and surrounding areas.

The data from the FMC site or directly down gradient from FMC are collected and reported quarterly (every 3 months). Groundwater at the Simplot facility is not monitored regularly.

At this point, EPA has not determined an increasing trend in groundwater contamination down gradient from the site.

In addition to the sediment data generated during the RI, the *Evaluation of Water Quality Impacts Associated with FMC and Simplot Phosphate Ore Processing Facilities* (IDEQ 2004a), and PCBs data in fish tissue (Maret and Ott 1997), which were reviewed for this public health assessment, a few other studies are underway. The EPA will be conducting sediment sampling between the EMF facilities and the American Falls Reservoir. As mentioned earlier, BCEH will work with the IDFG and the IDHW Bureau of Laboratories to analyze edible fish harvested from the Portneuf River for site-related contaminants. BCEH will evaluate possible health effects associated with fish consumed from the Portneuf River.

Comment #32:

Lost on what this is about, who and what, why *{weren't}* the residents made aware better back then.

Response:

Please read the public health assessment (including the Summary) for answers to the above questions.

Comment #33:

You mentioned no contaminated water should be used for drinking. What is being done to prevent the water being used for irrigating agriculture, and therefore entering the food chain?

Response:

At present, no data or information are available for BCEH regarding site-related contaminants entering the food chain through the use of contaminated water to irrigate crops. If and when data become available, BCEH will evaluate any possible health effects associated with using contaminated water to irrigate agriculture.

Comment #34:

One of the slides stated that there was no risk to the general public from Simplot's gypsum pile. Here in eastern Idaho, we have strong winds that blow "fugitive dust" around the area. It is hard to say exactly where the PM came from. I would question

whether or not the gypsum pile is or is not a concern for the general public. Do we know exactly what components are part of the stack (metals etc)?

Response:

As discussed in the public health assessment, monitoring data from the Primary and Sho-Ban stations, which are nearest to the site and the gypsum stack, show that 24-hour health-based comparison values for PM₁₀ were exceeded only once (at both stations) since FMC shut down operations in 2001. PM_{2.5} concentrations (including 24-hour average) have not exceeded EPA's health-based CVs since 2000.

Therefore, PM₁₀ and PM_{2.5} levels (which include contributions from the gypsum stack) have been determined to no longer pose a public health hazard in Chubbuck, Pocatello, and the Fort Hall Reservation. However, some uncertainty exists about health effects associated with high-level, short-term (hourly) exposures to PM, such as may occur during periods of high winds.

Windblown dusts from ore handling activities mainly affected surface soils between the operation area and Interstate 86. Contaminant concentrations in surface soil decrease rapidly with distance from the EMF site. During the RI, constituents (including metals) in the gypsum pile were characterized. However, BCEH could not determine where the measured PM originated or what portion of the overall levels of PM measured near the site came from the gypsum stack.

Comment #35:

{BCEH received one comment from an individual who worked near the EMF site in the early 1970s. The comment contained personal information that would have identified the individual. For this reason, BCEH has removed identifying information from the individual's original comment and paraphrased where necessary.}

I worked on a ranch near the Eastern Michaud Flats Contamination Site in the early 1970s for approximately two years, seven days a week. Livestock was raised on the property, i.e., cattle, pigs, chickens, which were used as food for our family as well as livestock sales. We also grew a family garden, which was watered from local water sources, and fished and ate the fish from the Portneuf River.

During this period of time, we noticed our cattle becoming very sick, and we eventually lost ninety percent (90%) of our calf crop and the older cattle developed bone deformities. It was found that the cattle had contracted fluorine poisoning.

Recently, I was found to have developed terminal multiple melanoma *{or myeloma?}*, i.e., cancer of the blood and bone. The prognosis for my condition has been terminal. Although it cannot be specifically determined from where the disease originated, after review of the Public Health Assessment, it was my desire to make your Bureau aware of the foregoing.

Response:

In this public health assessment, BCEH and ATSDR focus on human health effects rather than on health effects seen in animals. However, BCEH does acknowledge fluorine poisoning reported in animals foraging near the EMF site. Most of the epidemiologic and toxicological studies have not demonstrated an association between human exposure to fluoride and cancer in humans. The International Agency for Research on Cancer (IRAC) has determined that the carcinogenicity of fluoride (as well as fluorine) to humans is not classifiable, which means that there is not enough scientific evidence at this time to classify fluoride and fluorine as known human carcinogens.

Past studies have shown that radiation doses delivered to the bone marrow could result in several blood-related illnesses such as myeloid and lymphatic leukemia (National Research Council 1990). However, limited evidence exists to show how much radiation exposure is needed to cause leukemia. A study was done on workers who used luminescent paint containing radium to paint numbers on watch dials. This painting was done by hand, with the common practice of using the lips to produce a point on the tip of the brush. Leukemia appeared shortly after ingestion of radium by radium dial painters. However, a review of U.S. studies of radium exposures in humans deemed this study inconclusive (Rowland 1994).

On the basis of radionuclide concentrations in air, measured between October 1993 and December 1993 near the EMF site, the estimated radiological dose to the bone red marrow to people living or working near the EMF site (7 millirem) is about 5,800 times lower than the lowest dose estimated in the entire group of radium dial painters (40 rem). Therefore, a significant increase in cancer likely would not result from exposures to radiation levels such as those that were measured between October 1993 and December 1993 (Section 3.3.4.2).

BCEH and ATSDR do not know what level of radiological exposure individuals living near the EMF site may have had in the early 1970s. However, on the basis of the cancer incidence analysis for the Pocatello and Fort Hall area between 1990 and 2001, the number of multiple myeloma (or melanoma) cases in these communities has not increased.