Health Consultation

Air Contamination
at the

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

CERCLIS NO. IDD984666610

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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).

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1-800-447-1544

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

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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 fenceline. 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).

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.

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.

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 PM2.5, 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 were 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/m^3) 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/m^3 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/m^3) 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/m^3 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/m^3) 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/m^3

at locations immediately north of FMC. Based on a limited set of data collected by IDEQ in 1998 and 1999, *annual average* concentrations of PM2.5 currently do not exceed health-based standards throughout Chubbuck and Pocatello.

The weight-of-evidence suggests that, in the years before the PM2.5 monitoring studies were conducted, *annual average* PM2.5 concentrations likely exceeded EPA's health-based comparison value (15 ug/m^3) 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 PM2.5/PM10 ratios. In other words, this finding is somewhat uncertain since it is based on estimated—not measured—concentrations of PM2.5.

Appendix D.2 presents the evidence ATSDR considered in reaching its conclusion regarding *annual average* concentrations of PM2.5.

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/m^3), nitrate (27.15 ug/m^3), and sulfate (83.9 ug/m^3) (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/m^3, 11.29 ug/m^3, and 10.92 ug/m^3; 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/m^3. 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 (PO_4^{3-}). 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/m^3 (Bechtel 1996; USEPA 1999d). The highest *long-term average* concentration of total phosphorous reported to date is 5.45 ug/m^3, 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/m^3 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/m^3. 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, fenceline 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 fenceline 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 fenceline 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 fenceline 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/m^3, 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/m^3). The *average* concentrations[3] of aluminum in PM10 at these stations (0.15 ug/m^3 and 0.85 ug/m^3), 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/m^3) (Bechtel 1995; IDEQ 1999b). Average concentrations in PM10 measured during the RI ranged from 0.000502 to 0.00127 ug/m^3 (Becthel 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/m^3. 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/m^3) was only marginally higher than the corresponding comparison value (0.51 ug/m^3). 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/m^3). 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/m^3), 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/m^3). 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/m^3) 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/m^3). 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/m^3) 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/m^3). 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/m^3) 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/m^3). 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 fenceline 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, PM2.5, 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 PM2.5 are evaluated, with a greater emphasis placed on evaluating the potential PM2.5 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 PM2.5 or PM10 that are considered protective for all segments of the population. Threshold concentrations for PM 2.5 or PM 10 (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 PM2.5 standard may not be protective of all sensitive subpopulations, though it is generally believed that the proposed *annual* PM2.5 standard is protective of the general population and probably many of the sensitive subpopulations. However, when establishing the PM2.5 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/m^3 (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 PM2.5 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 (PM2.5) 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 PM2.5 exposures or with PM2.5 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 PM2.5 standard of 15 ug/m^3 and a 24-hour PM2.5 standard of 65 ug/m^3 (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 PM2.5 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* PM2.5 levels (concentrations above 15 ug/m^3) 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 PM2.5 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 PM2.5 exposures in the EMF study area.

PM2.5 levels (concentration above 150 ug/m^3 and 65 ug/m^3, 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 an 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 ug/m^3 increase in PM2.5, and the ACS study showed a 17% increase in mortality for every 25 ug/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 ug/m^3 (mean) and 9–34 ug/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 PM2.5, 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 PM2.5 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 PM2.5.

The epidemiological evidence, results of monitoring data from the EMF study area from 1994 to present (annual average PM10), and subsequent estimates of PM2.5 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 PM2.5 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 PM2.5 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 PM2.5 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)	
Health End Points	***Observed Association with PM***
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/m^3 at Garrett and Gould) and in Chubbuck (110 ug/m^3 at Chubbuck School) were not considerably different. The risks of combined chronic and acute adverse health effects for other years, during the1975 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/m^3 in the 24-hour average PM10 level (or an increase of 5-6 ug/m^3 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 2–49 ug/m^3. The five highest 24-hour sulfate ion concentrations detected at the IDEQ monitoring stations ranged from 18–73 ug/m^3 for the STP monitor, 13–32 ug/m^3 for the Chubbuck School monitor, 25–67 ug/m^3 for the Garret and Gould monitor, and 26–84 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 know 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 know 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/m^3 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 that 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 time 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 the 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 PM2.5 and PM10. However, this consistency 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, 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 fenceline; 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 PM2.5 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 fenceline.

- 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 PM2.5 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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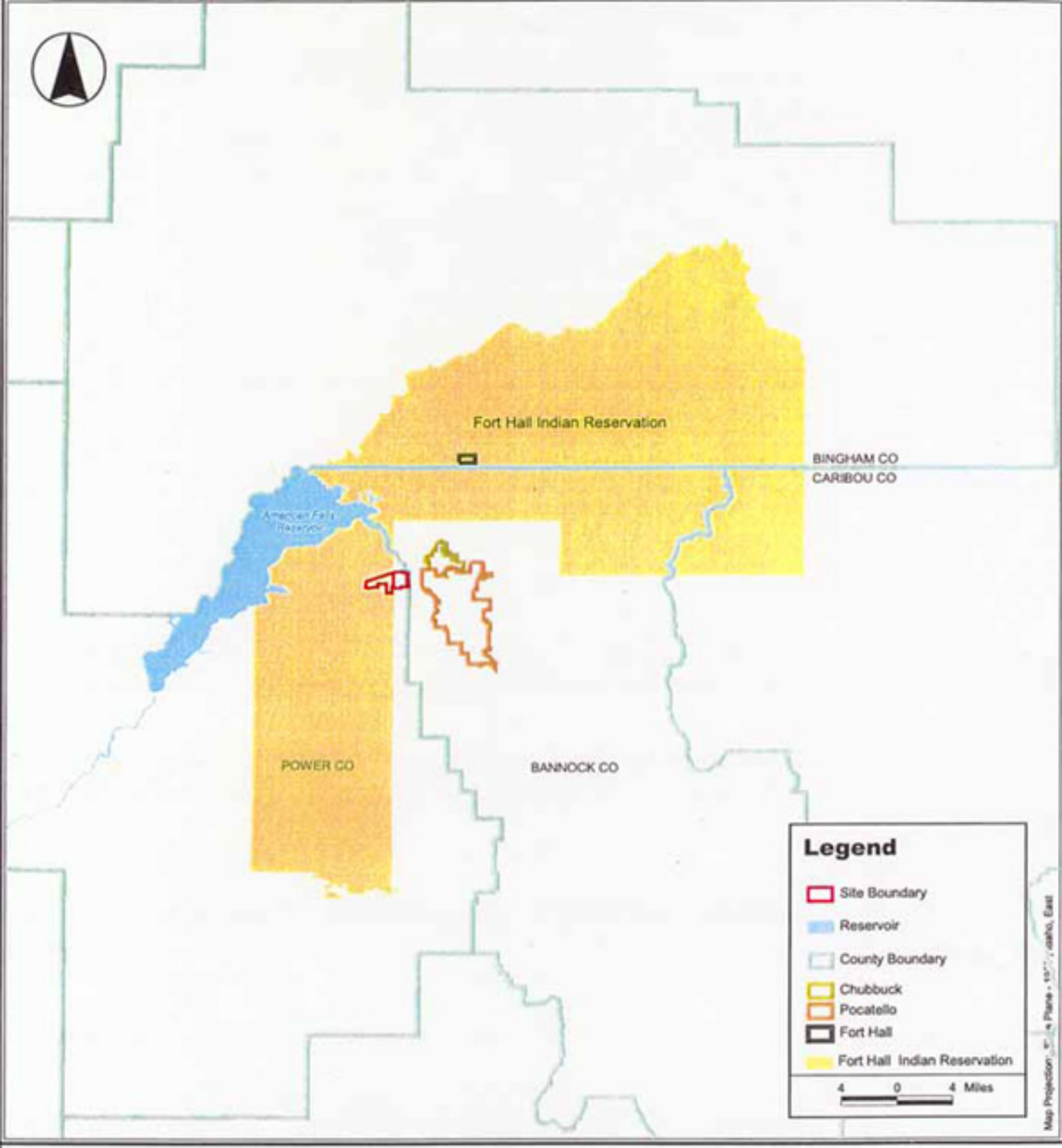


Eastern Michaud Flats

Pocatello, Idaho

CERCLIS No. IDD98466610

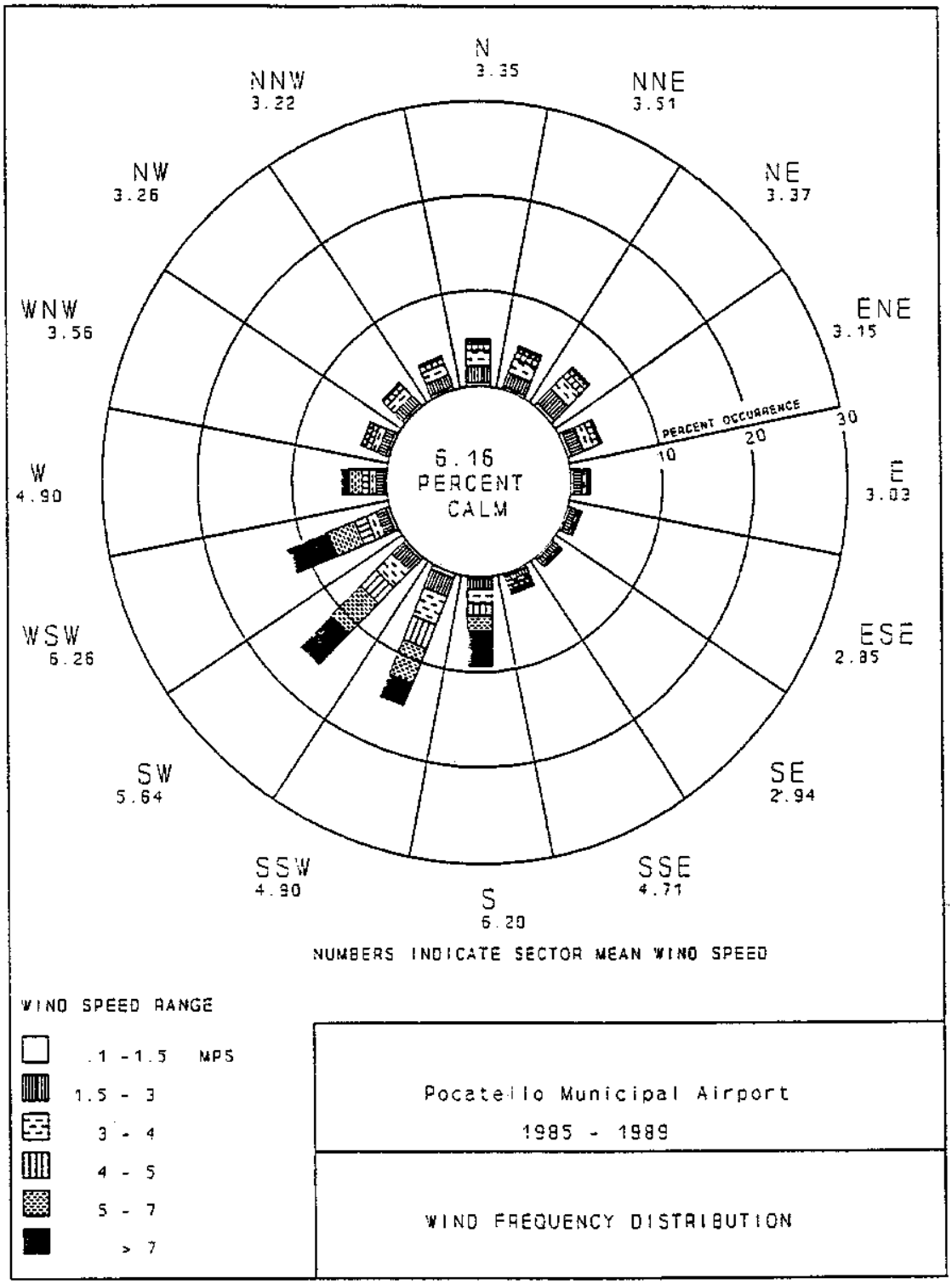
Power County, Idaho

Figure 1: General Study Area for EMF Health Consultation

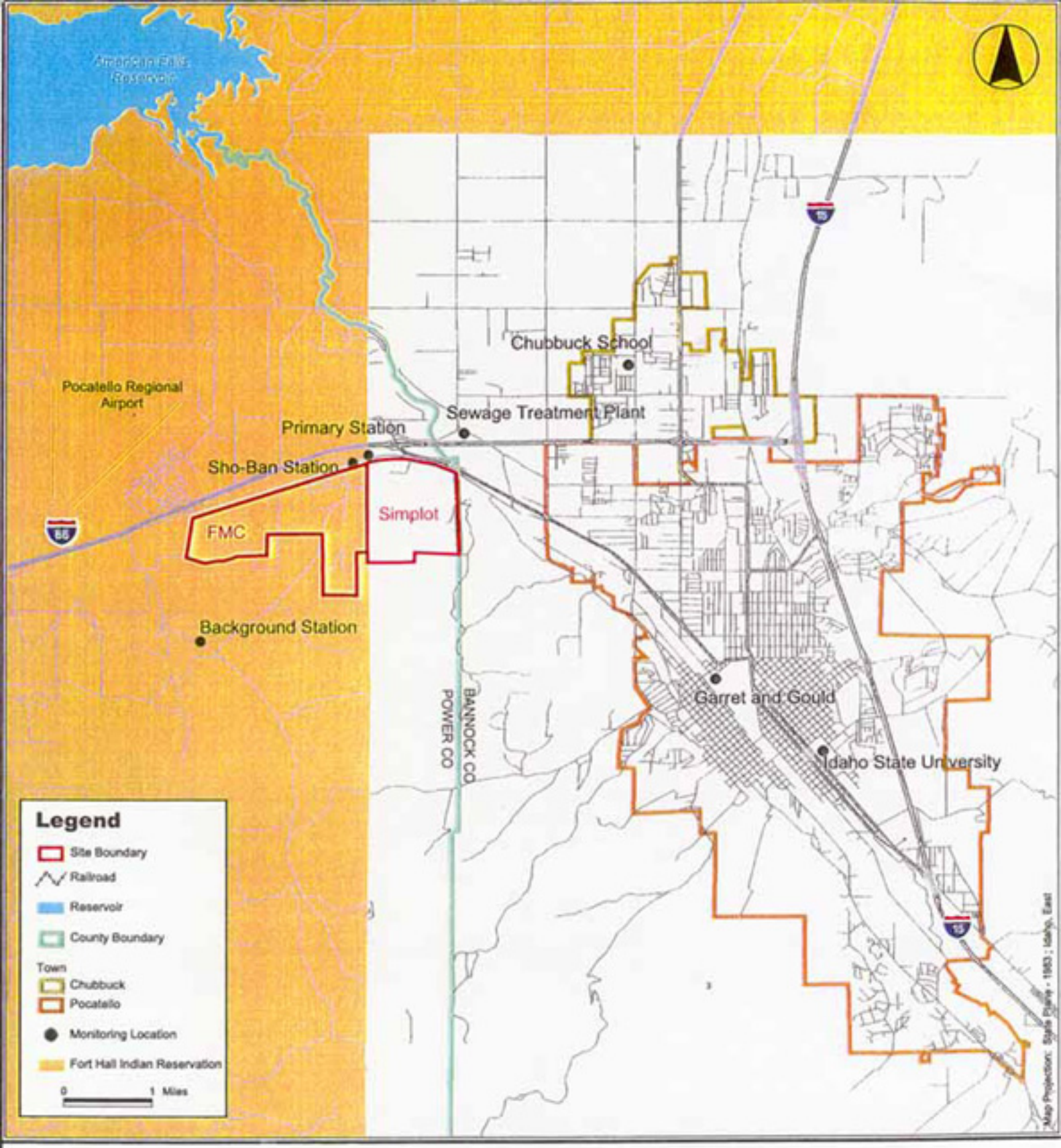
SAAGIS

PAC071999

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



Source: TRC 1993.

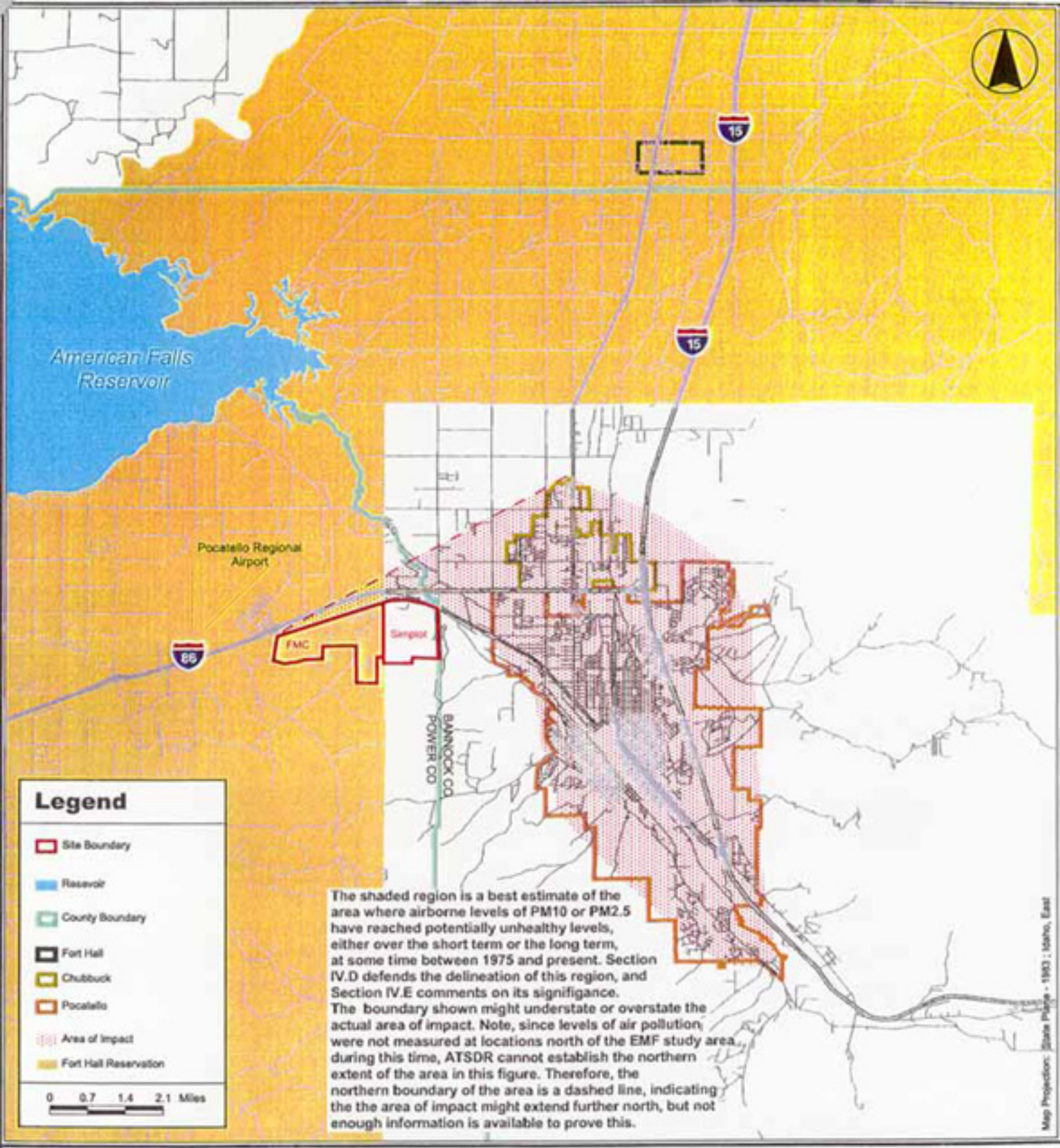


Eastern Michaud Flats

Pocatello, Idaho

CERCLIS No. IDD984666610

Figure 3: Monitoring Locations



Eastern Michaud Flats

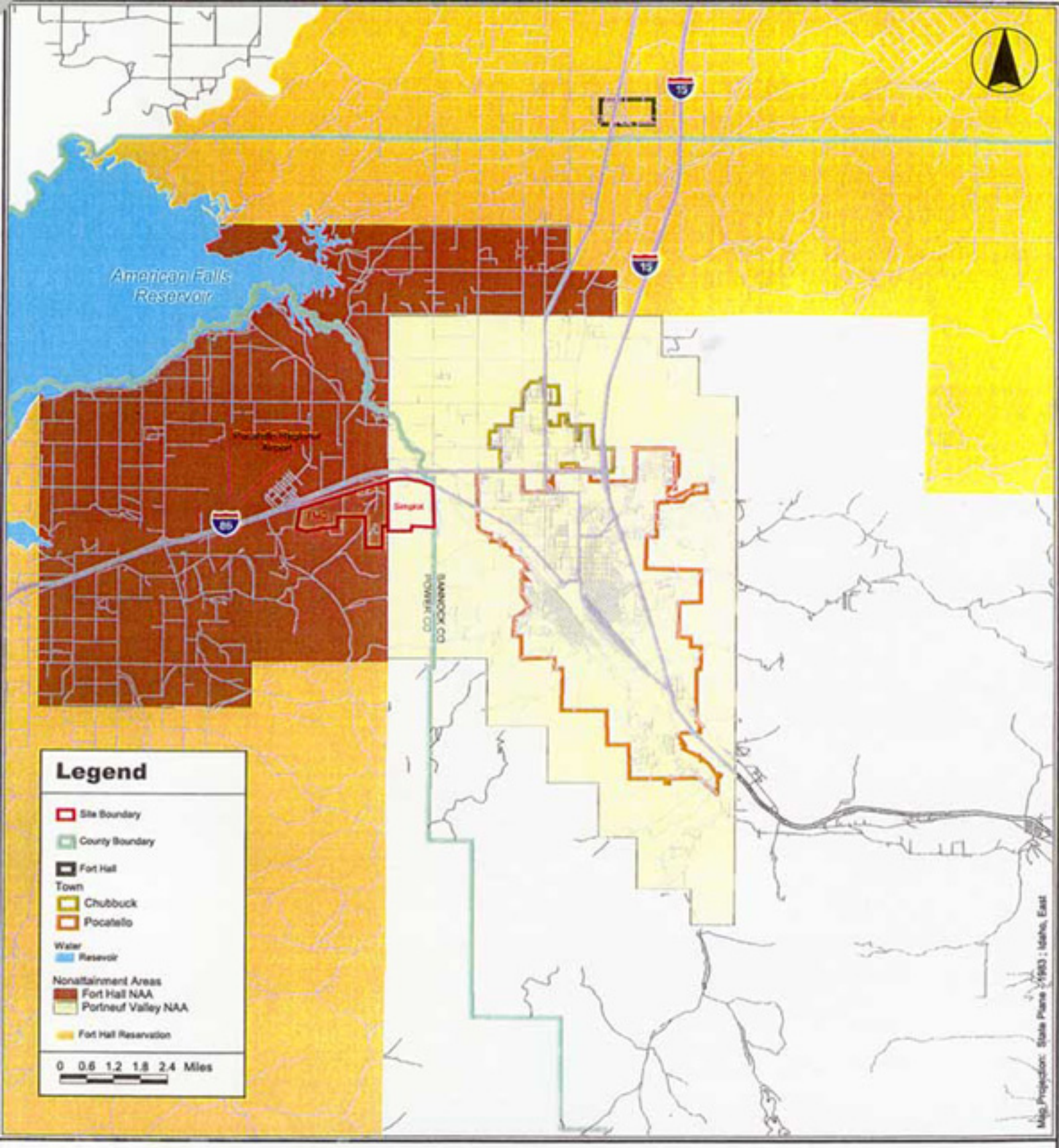
Pocatello, Idaho

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

PAC070699



Eastern Michaud Flats

Pocatello, Idaho

CERCLIS No. IDD984666610

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

SAIC GIS

FAC020900

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.

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 PM_{10} and adverse health effects have shown an increase in cardiopulmonary disease at levels below the current NAAQS for PM_{10}. 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 PM_{10} 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 PM_{10} 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 PM_{10} 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 PM_{10} 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 PM_{10} 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 PM_{10} and $PM_{2.5}$ (those exceeding their respective 24-hour average health-based CVs of 150 $\mu g/m^3$ and 65 $\mu g/m^3$) 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 <u>impacts</u> to the downstream Portneuf River delta (the most sensitive aquatic wildlife exposure location) were <u>insignificant</u>. 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 PM_{10} and $PM_{2.5}$ (those exceeding their respective 24-hour average health-based comparison values of 150 $\mu g/m^3$ and 65 $\mu g/m^3$) 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 PM_{10} 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 <u>non-residential</u> 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 PM_{10} 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 PM_{10} and adverse health effects showed an increase in cardiopulmonary diseases at levels below the current NAAQS levels for PM_{10}. 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 PM_{10}. 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 PM_{10}. 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 rational 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 CERLCA 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 exits 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 PM_{10} 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, PM_{10} 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.