UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 6TH AVENUE
SEATTLE, WASHINGTON

RECORD OF DECISION

DECLARATION,
DECISION SUMMARY,
AND
RESPONSIVENESS SUMMARY

FOR

EASTERN MICHAUD FLATS SUPERFUND SITE
POCATELLO, IDAHO

JUNE 1998

PREFACE

This Record of Decision documents the remedial action plan for contaminated ground water and associated sources and contaminated soils at the Eastern Michaud Flats Superfund site. This Record of Decision serves three functions:

- It certifies that the remedy selection process was carried out in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act as amended, and to the extent practicable, with the National Contingency Plan.
- It summarizes the technical parameters of the remedy, specifying the treatment, engineering, and institutional components, as well as remediation goals.
- It provides the public with a consolidated source of information about the site, the selected remedy, and the rationale behind the selection.
- In addition, the Record of Decision provides the framework for transition into the next phases of the remedial process, Remedial Design and Remedial Action.

The Record of Decision consists of three basic components: a Declaration, a Decision Summary, and a Responsiveness Summary. The Declaration functions as an abstract for the key information contained in the Record of Decision and is signed by the U.S. Environmental Protection Agency Regional Administrator. The Decision Summary provides an overview of the site characteristics, the alternative evaluated, and an analysis of those options. The Decision Summary also identifies the selected remedy and explains how the remedy fulfills statutory requirements. The Responsiveness Summary addresses public comments received on the Proposed Plan, the Remedial Investigation/Feasibility Study, and other information in the administrative record.

This Record of Decision is organized into three main sections: the Declaration, the Decision Summary, and Appendices. Appendix A contains additional tables and figures; Appendix B consists of the Responsiveness Summary; Appendix C contains the concurrence letter from the State of Idaho; and, Appendix D contains the method used to estimate concentrations of radon in indoor air.

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LIST OF ACRONYMS USED IN THIS DOCUMENT

AFLB	American Falls Lake Bed
AOC	Administrative Order on Consent
ARAR	Applicable or Relevant and Appropriate Requirements
ATSDR	Agency for Toxic Substances Disease Registry
BAPCO	Bannock Paving Company
BLM	Bureau of Land Management
CAA	Clean Air Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COCs	Contaminants of Concern
COPCs	Contaminants of Potential Concern
CRP	Community Relations Plan
CT	Central Tendency
E&E	Ecology & Environment
ECAO	Environmental Criteria Assessment Office
EMF	Eastern Michaud Flats Site
EPA	U.S. Environmental Protection Agency
FIP	Federal Implementation Plan
FMC	FMC Corporation
FS	Feasibility Study
HEAST	Health Effects Assessment Summary Tables
HI	Hazard Index
HQ	Hazard Quotient
ICR	Incremental Carcinogenic Risk
IDEQ	Idaho Division of Environmental Quality
IRIS	Integrated Risk Information System
IWW	Industrial Wastewater
MCL	Maximum Contaminant Level
Mg/Kg	Milligrams/Kilograms (parts per million)
NAAQS	National Ambient Air Quality Standards
NCP	National Contingency Plan
NPDES	National Pollutant Discharge Elimination System
NPL	National Priority List
NWI	National Wetland Inventory
O&M	Operation & Maintenance
OSHA	Occupational Safety and Health Administration
OU	Operable Unit
PM_{10}	Particulate Matter less than 10 microns
PRP	Potentially Responsible Party
RCRA	Resource Conservation Recovery Act
RfD	Reference Dose
RI/FS	Remedial Investigation/Feasibility Study

LIST OF ACRONYMS USED (CONTINUED)

RI	Remedial Investigation
RME	Reasonable Maximum Exposure
ROD	Record of Decision
SF	Slope Factor
SIMPLOT	J.R. Simplot Company Don Plant
SIP	State Implementation Plan
TIP	Tribal Implementation Plan
UCL	Upper Confidence Limit
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

RECORD OF DECISION
EASTERN MICHAUD FLATS SUPERFUND SITE

Declaration for the Record of Decision

Site Name and Location

Eastern Michaud Flats
FMC and Simplot Operable Units
Pocatello, Idaho

Statement of Basis and Purpose

This decision document presents the selected remedial actions for the Eastern Michaud Flats Site located near the city of Pocatello, Idaho. The remedy was developed in accordance with the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 U.S.C. §9601 *et. seq.* (CERCLA) as amended, and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 C.F.R. Part 300. This decision is based on the administrative record for this site.

A letter indicating the State of Idaho concurs with the selected remedy is in Appendix C of this ROD. The Shoshone Bannock Tribes have substantially participated in the RI/FS and provided comments on the proposed plan and draft ROD in September 1997. In those comments, which are attached to the responsiveness summary in Appendix B, the Tribes indicated that they would not concur with the ROD as drafted. In the subsequent eight months EPA has worked to understand and address the concerns of the Tribes. This ROD and responsiveness summary has been changed as a result. However, on some critical issues, EPA could not agree to the changes requested by the Tribes, for reasons explained in the responsiveness summary. On June 4, 1998 EPA received a letter from the Tribes identifying which actions in the ROD they support and the reasons for non-concurrence on the ROD. This letter is included in Appendix C of this ROD.

Assessment of the Site

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response actions selected in this Record of Decision (ROD), may present an imminent and substantial endangerment to public health, welfare, or the environment.

Description of the Selected Remedy

The EPA has divided the site into two operable units (OUs) in order to facilitate a cleanup of this large site. Following an agreement with FMC Corporation and J.R. Simplot Company, the owner and operators of the two industrial plants, respectively, at the site, these operable units each incorporate action for the Off-Plant areas identified in the Proposed Plan. The operable units are:

FMC operable unit (includes all of the Off-Plant Area)
Simplot operable unit (includes all of the Off-Plant Area)

The remedy described in this ROD addresses both OUs and involves capping contaminated soils, extraction of contaminated ground water, and monitoring and institutional controls. The major components of the selected remedy are highlighted below.

FMC Operable Unit

- Cap Old Phossy Waste Ponds and Calciner Solids Storage area and line Railroad Swale to reduce or eliminate infiltration of rainwater and prevent incidental exposure to contaminants.
- Monitor Ground water and implement legally enforceable controls that will run with the land to prevent use of contaminated ground water for drinking purposes under current and future ownership. Ground water monitoring and enforceable controls will continue until site contaminants of concern (COCs) in ground water decline to below the Maximum Contaminant Levels (MCLs) or risk-based concentrations (RBCs) for those substances.
- Implement legally binding land use controls that will run with the land to prevent potential future residential use and control potential worker exposures under future ownership.
- Implement contingent ground water extraction/treatment system if contaminated ground water migrates beyond Company owned property and into adjoining springs or the Portneuf River. Containment of contamination shall be achieved via hydrodynamic controls such as long-term ground water gradient control provided by low level pumping. Extracted ground water will be treated and recycled within the plant to replace unaffected ground water that would have been extracted and used in plant operations.
- Conduct operation and maintenance on capped areas and ground water extraction system, if implemented.

Simplot Operable Unit

- Implement a ground water extraction system to contain contaminants associated with the phosphogypsum stack.

- Implement legally enforceable land use controls to prevent potential future residential use of the Simplot property and control potential worker exposures under current and future ownership.

- Excavate contaminated soils from the dewatering pit and east overflow pond.

- Monitor ground water and implement legally enforceable controls that will run with the land to prevent use of contaminated ground water for drinking purposes under current and future ownership. Ground water monitoring and enforceable controls will continue until site contaminants of concern in ground water decline to below MCLs or RBCs for those substances.

- Implement operation and maintenance on the ground water extraction system

Off-Plant Area - Actions Common to Both Simplot and FMC Operable Units

- Implement legally enforceable land use controls and monitoring in the Off-Plant area to restrict property use due to potential exposure to radionuclides in soils and inform future property owners of the potential human health risks associated with consumption of homegrown fruits and vegetables

- Monitor fluoride levels around the site in order to determine the levels of fluoride present and to evaluate the potential risk to ecological receptors . If levels which are measured indicate a risk may exist, further evaluation would occur followed by source control or other action, if necessary.

- Conduct ground water monitoring in the off-plant area to: 1) determine the effectiveness of the Plants' source control measures; 2) insure contaminants are not migrating into the off-plant area; and, 3) insure that the remedy remains protective of human health and the environment.

Except as expressly stated in CERCLA, the NCP, or this ROD, the ROD is not designed to address FMC's or Simplot's ongoing operations, or to preclude, or in any way affect, the need for the Plants' ongoing operations to comply with other environmental laws or regulations.

While not part of the selected remedy, the remedy assumes continued operation of the Plants by FMC and Simplot in compliance with all Federal and State environmental requirements as well as the applicable closure requirements in the event that either Plant ceases operation. If new information becomes available that indicates that the remedy is not protective of human health or the environment, additional CERCLA action may be required.

Declaration of Statutory Determinations

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. This remedy utilizes permanent solutions and alternative treatment (or resource recovery) technologies, to the maximum extent practicable for this site. However, because treatment of the principal threats of the site was not found to be practicable, this remedy does not utilize the statutory preference for treatment.

Because this remedy will result in hazardous substances remaining on-site above health-based levels, a review will be conducted within five years after commencement of remedial actions to ensure that the remedy continues to provide adequate protection of human health and the environment.

Charles C. Clarke
for Regional Administrator
U.S. Environmental Protection Agency
Region 10

6-8-98
Date

RECORD OF DECISION
EASTERN MICHAUD FLATS Superfund SITE

DECISION SUMMARY

1.0 SITE NAME, LOCATION, AND DESCRIPTION

1.1 Site Name and Location

The Eastern Michaud Flats Superfund (EMF) site is located in Southeastern Idaho, approximately 2.5 miles northwest of Pocatello, Idaho (See Figure 1 - Regional Setting). The EMF site includes two adjacent phosphate ore processing plants- the FMC Corporation Elemental Phosphorus Plant (FMC) and the J.R. Simplot Company Don Plant (Simplot)- both of which are active facilities that have been operating since the 1940s. These plants occupy 2,475 acres of the site with approximately 1,450 acres associated with FMC operations and approximately 1,025 associated with the Simplot Don Plant. Figure 2 shows land ownership around the FMC and Simplot Plants. The entire site encompasses the areal extent of contamination deemed necessary by EPA for implementation of any response action and includes both the Company Plant areas and surrounding Off-Plant areas.

1.2 General Site Description

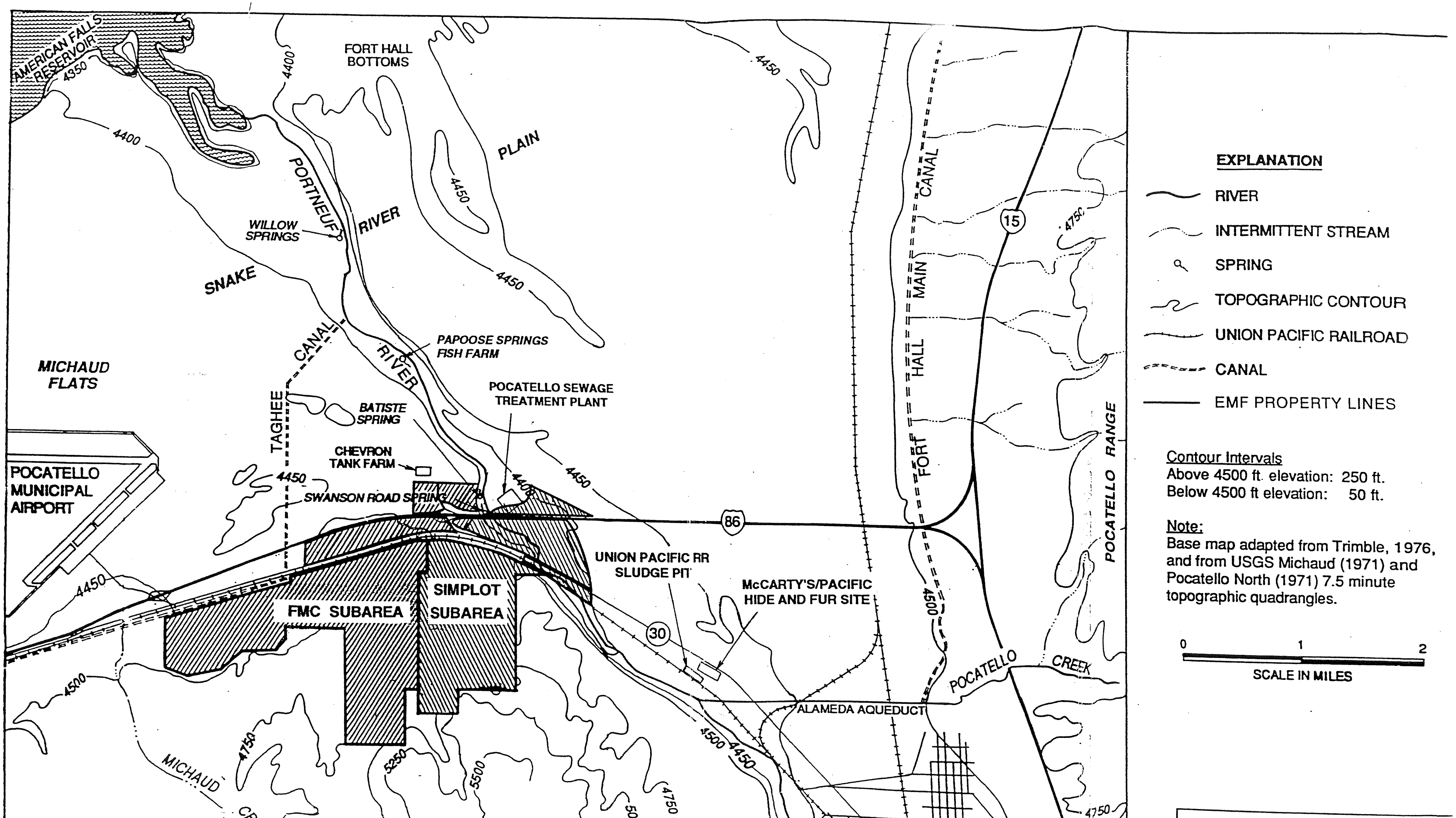
The EMF Site is located at the base of the northern slope of the Bannock Range, where it merges with the Snake River Plain. The southern part of the site extends into the foothills of the Bannock Range. The northern part of the site is located at the southeastern edge of the Michaud Flats. The eastern edge of the site is approximately 2.5 miles northwest of Pocatello, Idaho. The nearest residence is within ½ mile north of the Simplot plant and FMC property.

The following is a brief overview of the major features of the site.

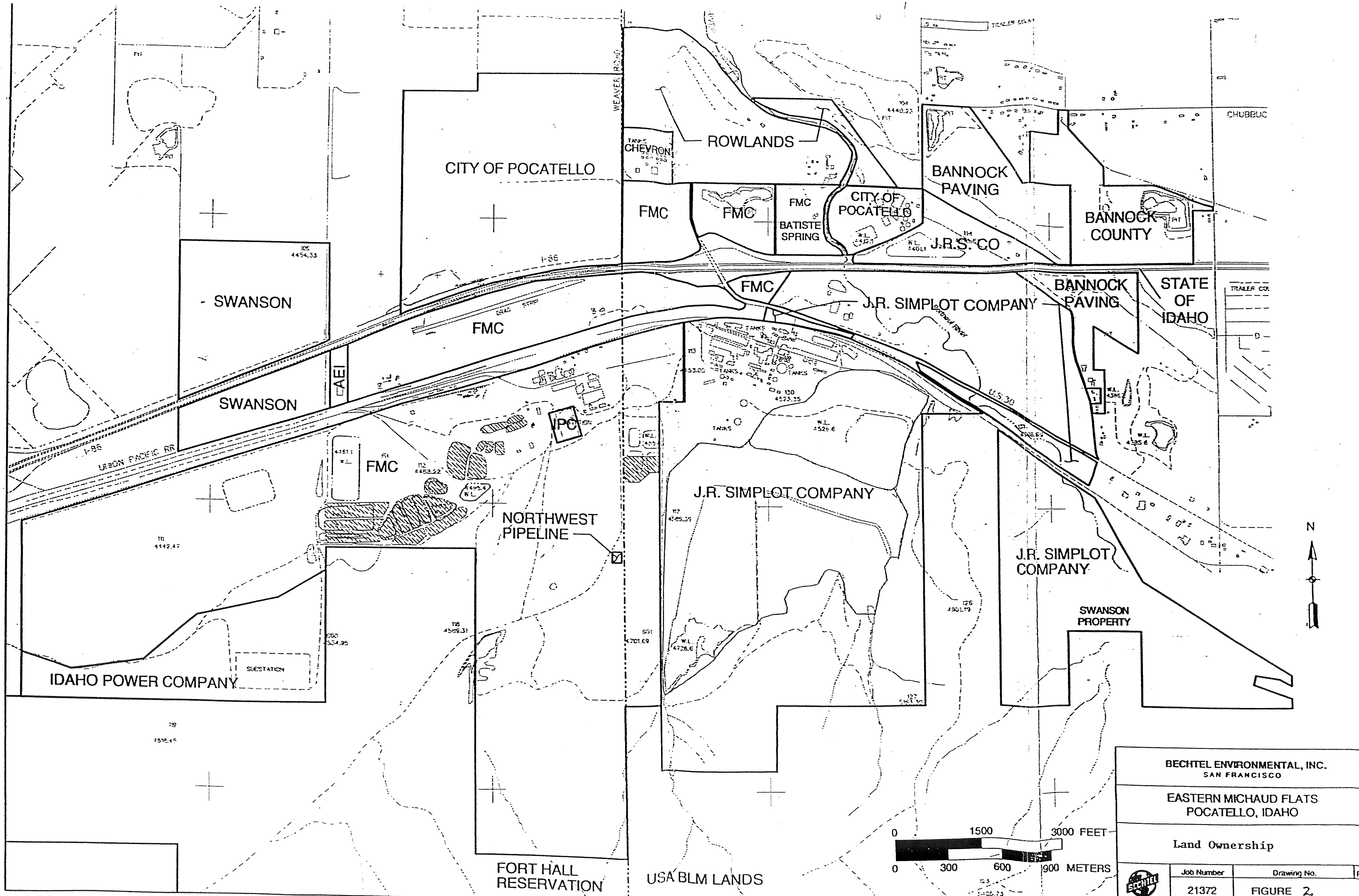
1.2.1 Land Use

The EMF site includes land on the Fort Hall Indian Reservation, Bannock and Power Counties, and portions of the cities of Pocatello and Chubbuck. Fort Hall Indian Reservation land in the vicinity of the site is mainly agricultural. The Bureau of Land Management (BLM) lands in the vicinity of the site are designated as multiple use. Unincorporated land in Bannock and Power Counties is mostly agricultural with scattered residences. Pocatello and Chubbuck land in the vicinity of the site is primarily zoned for residential use. Figure 3 shows the zoning in the vicinity of the site.

Approximately 40% of the land in the vicinity of the site is used for agricultural purposes (50% to 60% is actively used; the rest is fallow); approximately 10% of the land is residential; 15% to 20% is industrial; 10% is occupied by the Pocatello Municipal Airport; less than 5% is commercial; and



EASTERN MICHAUD FLATS
POCATELLO, IDAHO
FEASIBILITY STUDY
REGIONAL SETTING
FIGURE 1


CITY OF POCATELLO
WEAVER ROAD
CHEVRON
TANKS
ROWLANDS
FMC
FMC
FMC
BATISTE SPRING
CITY OF POCATELLO
BANNOCK PAVING
J.R.S. CO
BANNOCK COUNTY
CHUBBUC
SWANSON
I-86
FMC
J.R. SIMPLOT COMPANY
BANNOCK PAVING
STATE OF IDAHO
TRAILER CT
FMC
SWANSON
AEI
U.S. 30
IPC
UNION PACIFIC RR
FMC
TANKS
J.R. SIMPLOT COMPANY
NORTHWEST PIPELINE
J.R. SIMPLOT COMPANY
SWANSON PROPERTY
N
SUBSTATION
IDAHO POWER COMPANY
FORT HALL RESERVATION
USA BLM LANDS
0 1500 3000 FEET
0 300 600 900 METERS
BECHTEL ENVIRONMENTAL, INC.
SAN FRANCISCO
EASTERN MICHAUD FLATS
POCATELLO, IDAHO
Land Ownership
Job Number
21372
Drawing No.
FIGURE 2
Rev

the remainder is undeveloped sagebrush steppe, mainly in the hills south of the site, or riparian wetland bordering the Portneuf River in the Fort Hall bottoms area north of the site.

Four schools are located within the EMF study area: Wilcox Elementary School and Hawthorne Junior High School in the City of Pocatello; Chubbuck Elementary School in Chubbuck; and, the Idaho State Aircraft Mechanics School at the Pocatello Airport. In addition, six licensed day-care centers and one retirement home, the Cottonwood Cove Retirement Community, are located in the study area. There are no hospitals or nursing homes within the study area.

1.2.2 Geology and Hydrogeology

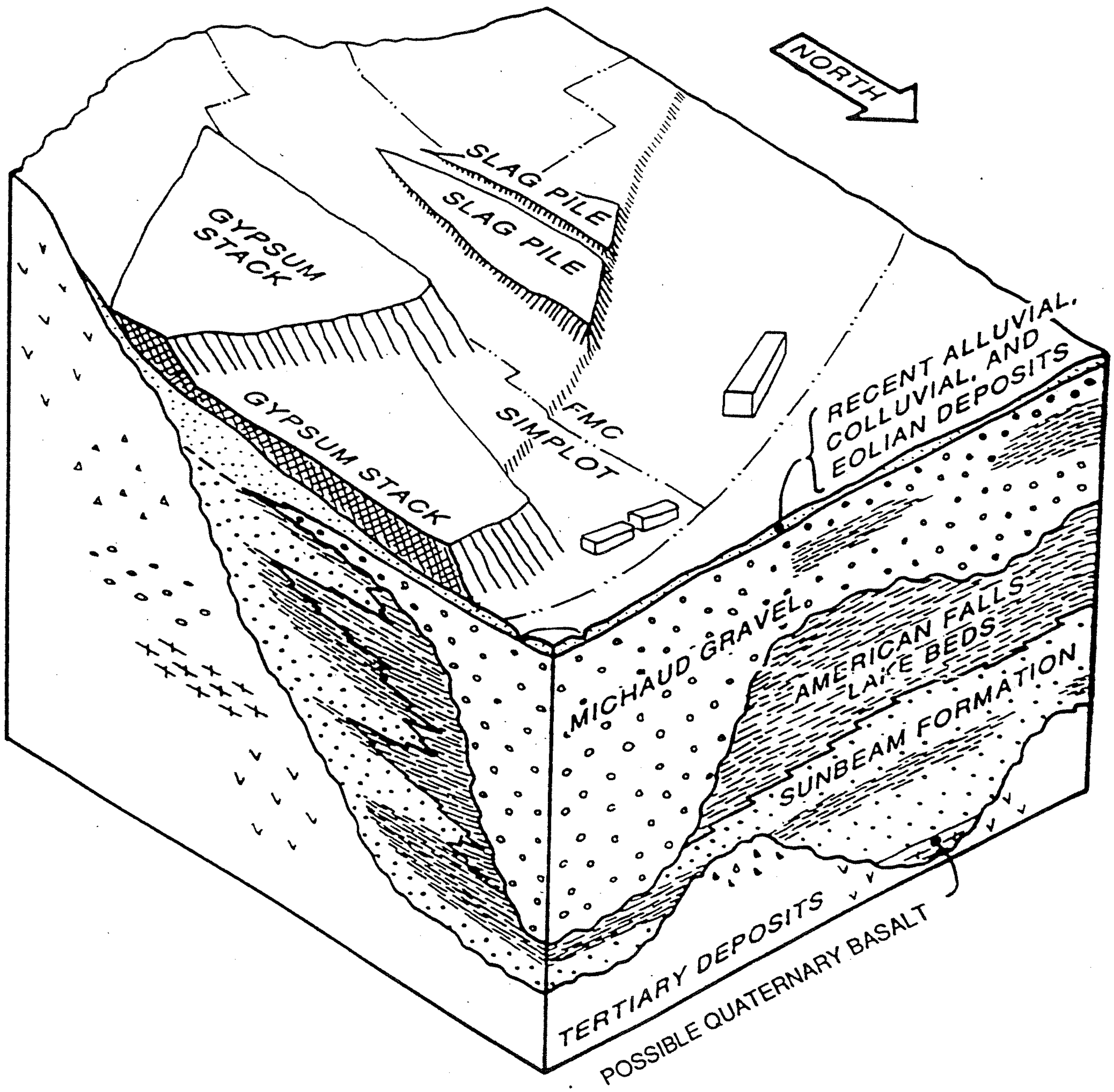
Volcanic bedrock and coarse gravel underlay the site. The general stratigraphy in the study area includes (from the bottom) volcanic bedrock units, coarse volcanic and quartzitic gravel, fine-grained sediments of the American Falls Lake Bed, the Michaud gravels, and calcareous silts and clays (Figure 4 shows a schematic block diagram at the site). The latter surface soils range in thickness from 10 to 40 feet and have an alkaline pH that neutralizes acidic solutions and precipitates metals. (Figure 5 shows the location of hydrogeologic cross sections and Figures 6 and 7 show the east - west cross section across the FMC and Simplot Plants).

Ground water at the site flows from the Bannock Range foothills toward the north/northeast through unconsolidated sediment overlying the volcanic bedrock. Figures 8 and 9 depict the ground water flow patterns at the FMC and Simplot Plants. Shallow and deep aquifer zones, separated by confining strata, are present in the Plant areas and to the north. Depths to water in the shallow aquifer range from 170 feet below ground surface in the Bannock Range area to 55 feet below ground surface in the Michaud Flats area. Shallow ground water flows into the valley where it mixes with the more prolific Michaud Flats and Portneuf River ground water systems. Ground water within the deeper aquifer is either captured by production wells at the Plants or continues northward where it flows upward to the shallow aquifer (Figure 10 depicts the effects of plant production wells on deep ground water flowpaths). The shallow ground water and a significant portion of the deeper ground water flowing under the Plants discharges to the Portneuf River through Batiste Springs, Swanson Road Springs, and as baseflow to the River in the reach between these springs.

1.2.3 Hydrology (Surface Water)

The Portnuef River, which lies to the east and north of the Plants, is the major surface water at the site. To the south of Interstate 86, it is a losing stream. To the north of Interstate 86, it is a gaining stream fed by ground water base flow and a series of springs. The Portneuf River flows into the American Falls Reservoir. Figure 11 shows the major surface water features in the region.

Rainwater which falls or flows onto the FMC and Simplot Plants is captured and controlled on-site such that there is no stormwater runoff from the facilities. The only surface water flowing from the EMF facilities is the permitted discharge of non-contact cooling water through the IWW ditch to the Portneuf River.



EXPLANATION

FACILITY BUILDINGS

FACILITY PROPERTY BOUNDARIES

PORTNEUF RIVER

NOT TO SCALE

SIDES OF BLOCK REPRESENT APPROXIMATELY 8000 FEET

HEIGHT OF BLOCK REPRESENTS APPROXIMATELY 400 FEET

BECHTEL ENVIRONMENTAL, INC.
SAN FRANCISCO

EASTERN MICHAUD FLATS
POCATELLO, IDAHO

Schematic Block Diagram Showing Stratigraphic Setting at EMF Facilities

JOB No.	DRAWING NO.	REV.
21372	FIGURE 4	

1.2.4 Climate

The EMF site is located in a semi-arid region, with approximately 11 inches of total precipitation during a year. Net annual potential evapotranspiration rates[1] in the area exceed annual precipitation. Prevailing winds are from the southwest as shown in Figure 12. However, there is also a secondary wind component out of the southeast which appears to be a drainage wind that flows out of the Portneuf River valley, primarily at night.

1.2.5 Ecology

The FMC and Simplot plants are industrial facilities and much of the land surface has been disturbed resulting in limited areas with vegetation. Major terrestrial vegetation cover types and wildlife habitats around the Plants include agricultural, sagebrush steppe and wetland/riparian. Figure 13 shows the habitat and vegetation cover types in the vicinity of the site. Wildlife habitats in the vicinity of the EMF site include: sagebrush steppe, grassland riparian, cliff and juniper. Listed species which occur within the vicinity of the Site include the bald eagle, the peregrine falcon and possibly the orchid Ute Ladies'-tresses. The bald eagle and the orchid Ute Ladies'-tresses are listed as threatened, and the peregrine falcon is listed as endangered under the Endangered Species Act.

The most significant aquatic habitats in the vicinity of the site are the Portnuef River and associated springs and riparian corridor and the Fort Hall Bottoms (a sacred site to the Shoshone-Bannock Tribes). These areas are designated wetlands under the National Wetland Inventory of the United States Fish and Wildlife Service. The Portneuf River supports an extensive riparian community, which is an important source of food, cover, and nesting sites for many wildlife species. Thousands of individuals of numerous migratory bird species use areas in and near the site, particularly the Fort Hall Bottoms.

1.3 Site Subareas

During the course of the RI, all property outside of the FMC and Simplot operational areas (beyond their fence line) was described as "off-site." Although the term "site" or "on-site" is defined in EPA regulations as, "the areal extent of contamination and all suitable areas in very close proximity to the contamination necessary for implementation of the response action," generally, site boundaries are not fixed until the RI is completed and the "areal extent of contamination" has been ascertained. In the risk assessment and FS, adjacent company owned properties, some of which were acquired during the RI, are considered to be part of the plant and were not evaluated for either current or future residential use. The FS and risk assessment refer to these areas as the FMC Subarea, Simplot Subarea, and Off-site Subarea based on ownership in order to facilitate the RI/FS process prior to precise fixing of site extent or boundary.

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[1] Evapotranspiration is highly variable from point to point and is highly dependent on the presence of vegetation.

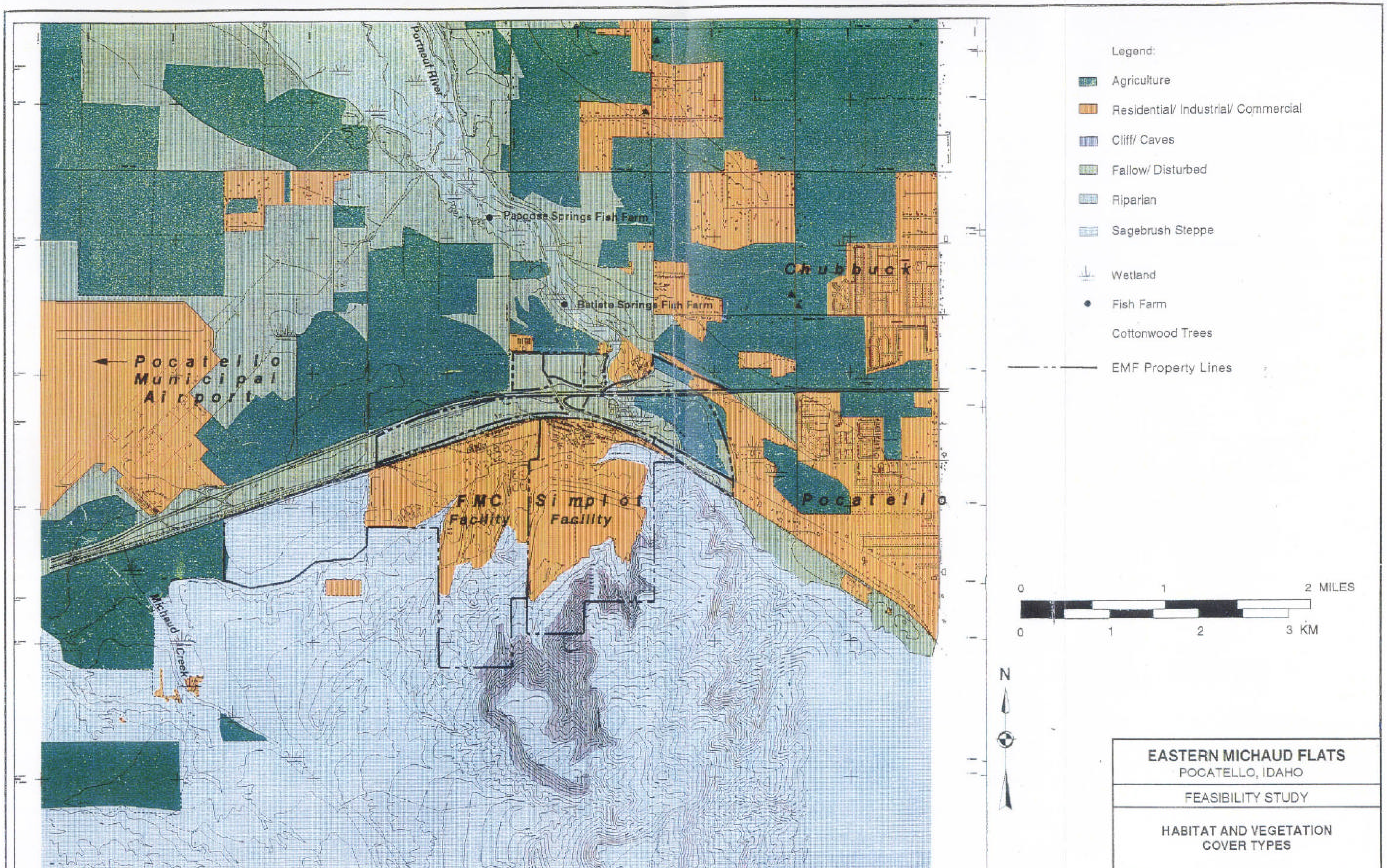

Portneuf River
Papoose Springs Fish Farm
Batiste Springs Fish Farm
Chubbuck
Pocatello Municipal Airport
FMC Facility
Simplot Facility
Pocatello
Michaud Creek
Legend:
Agriculture
Residential/ Industrial/ Commercial
Cliff/ Caves
Fallow/ Disturbed
Riparian
Sagebrush Steppe
Wetland
Fish Farm
Cottonwood Trees
EMF Property Lines
0 1 2 MILES
0 1 2 3 KM
N
EASTERN MICHAUD FLATS
POCATELLO, IDAHO
FEASIBILITY STUDY
HABITAT AND VEGETATION COVER TYPES

Figure 13

For clarity, the proposed plan and this ROD refer to these areas as the FMC Plant, Simplot Plant, and Off-Plant areas based on ownership and on the RI/FS documents. "Off-site" would be inaccurate because the Off-Plant is officially within the site. The three areas of the site are discussed separately below:

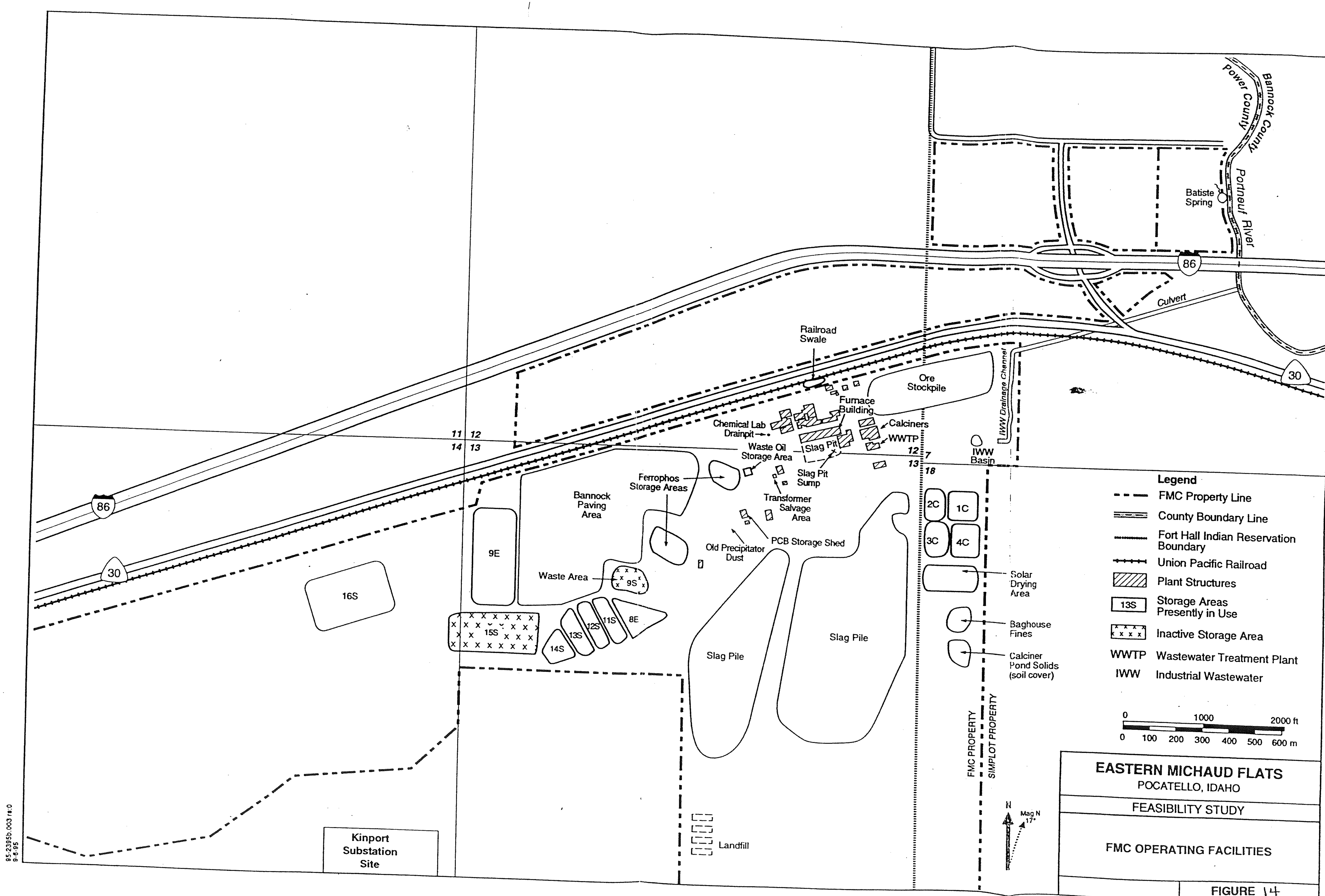
1.3.1 FMC Plant Area

The FMC Plant Area is defined as all properties owned by FMC Corporation and is shown in Figure 14. These properties were owned by FMC at the beginning of the remedial investigation in 1992, with the exception of the Batiste Property. This 23-acre parcel was purchased from the Union Pacific Railroad by FMC in August 1995 and is shown as Batiste Springs on Figure 2. The FMC Plant operations areas are primarily those portions of the FMC Plant Area located south of Highway 30. This area includes all ore processing, byproduct handling, and byproduct and waste storage facilities. The northern FMC properties are defined as all adjacent property owned by FMC which is within the FMC Subarea north of Highway 30. The majority of the FMC Plant is located within the boundaries of the Fort Hall Indian Reservation.

The FMC plant manufactures elemental phosphorus. The phosphate rock is crushed, conveyed and formed into briquettes. The briquettes are heated or "calcined" to remove organic material and water, and to form heat-hardened nodules for further processing. Calciner emissions go through a series of primary and secondary wet scrubbers. The nodules are cooled and blended with coke and silica before being fed to an electric arc furnace. In the furnace high temperatures drive off phosphorus and carbon monoxide. Furnace off-gases pass through electrostatic precipitators to remove dust before entering condensers, where phosphorus is condensed into a liquid. The carbon monoxide is used as a primary fuel and any excess is flared. Molten residues are periodically withdrawn from the furnace and allowed to solidify into the by-product slag and co-product ferrophos. The slag, predominantly calcium silicate, is stockpiled at the facility. Various lined and unlined surface impoundments have been used to manage process wastewater containing phosphorus. Bannock Paving Company (BAPCO) operated a paving and aggregate handling facility on land leased from and adjacent to the FMC Plant during the RI. Activities periodically conducted at this facility included asphalt batching, coke drying, and slag and ferrophos crushing. Operations at BAPCO were discontinued on March 12, 1995.

1.3.2 Simplot Plant Area

The Simplot Plant area is defined as all those properties and operating facilities owned by the J.R. Simplot Company and is shown in detail in Figure 15. The Don Plant area is defined as the portion of the Simplot Subarea located to the south of the Union Pacific Railroad, which runs parallel to Highway 30. The Don Plant area includes all ore processing, byproduct and product handling, and byproduct and waste storage facilities. The northern Simplot properties are defined as all contiguous property owned by the J.R. Simplot Company to the north of the Don Plant northern fence line. The northern Simplot properties include ponds used in the treatment of various non-contact water streams, laboratory wastes and storm water from the Don Plant. The Portneuf River flows through the northeastern portion of the



EASTERN MICHAUD FLATS
POCATELLO, IDAHO

FEASIBILITY STUDY

FMC OPERATING FACILITIES

FIGURE 14

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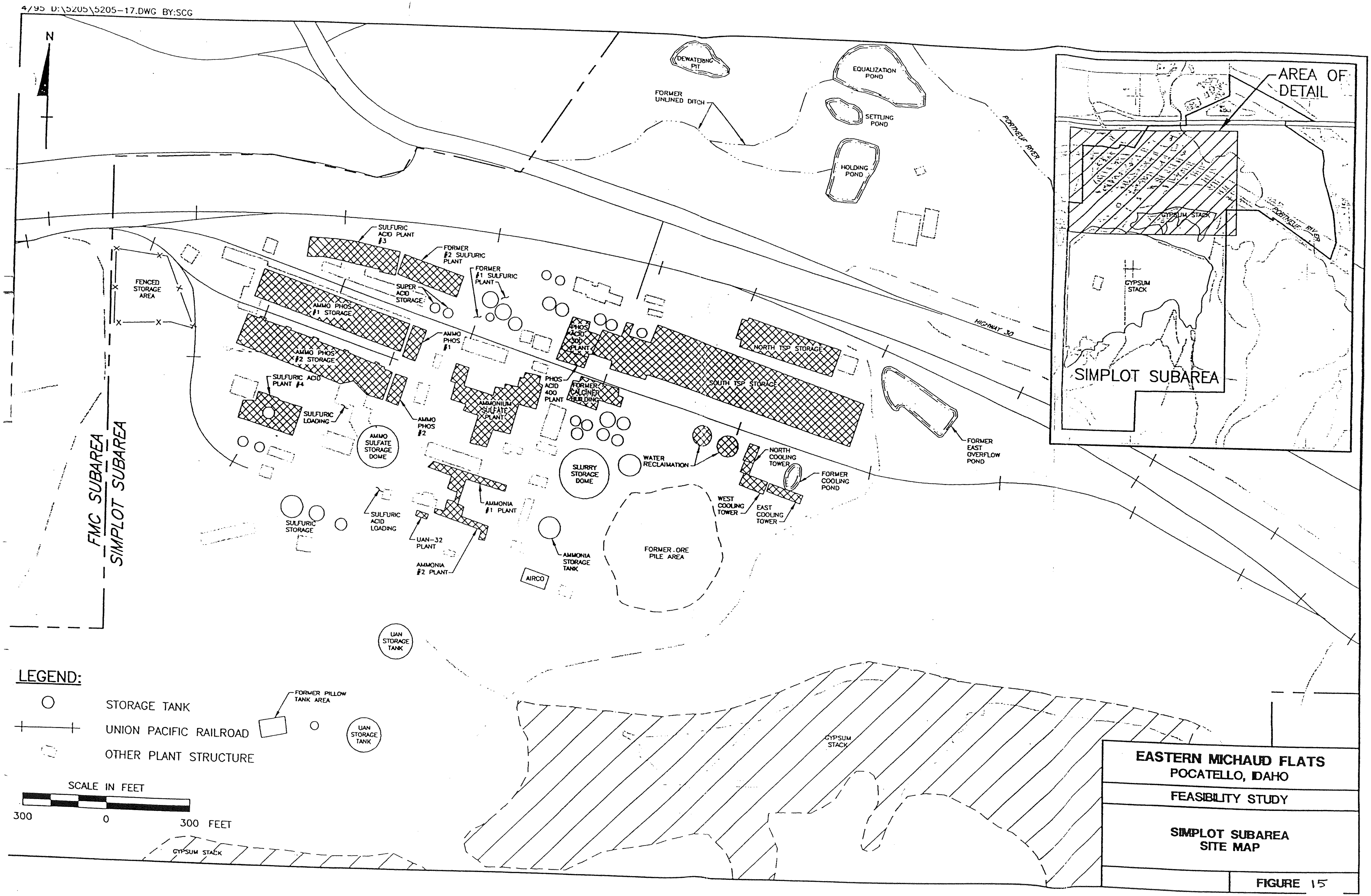


EASTERN MICHAUD FLATS
POCATELLO, IDAHO

FEASIBILITY STUDY

SIMPLOT SUBAREA SITE MAP

FIGURE 15

Simplot Subarea, but for the purposes of the FS it was included in the Off-Plant Subarea. The Simplot Subarea is not located on the Fort Hall Indian Reservation.

The Simplot plant processes phosphate rock into phosphoric acid and other fertilizers. The phosphate rock is ground and slurried at the mine and transported to the facility by pipeline. There it is reacted with sulfuric acid to produce phosphoric acid and by-product gypsum (calcium sulfate). The phosphoric acid is used to make various grades of fertilizer or is concentrated to produce stronger acids which are feedstocks to subsequent production lines. A system of baghouses and scrubbers are used to control air emissions. The gypsum is slurried with water and transported to an unlined gypsum stack south of the processing facilities. Other process waters are collected and treated (pH adjustment) in a series of lined ponds. The treated water is nutrient rich and sold for irrigation/fertilization.

The FMC and Simplot plants are both operating facilities and, together, currently employ approximately 1,000 people.

1.3.3 Off-Plant Area

In the FS, the Off-Plant area is all land surrounding the FMC and Simplot Plants with contamination originating from the Plants. A general description of land use in the vicinity of the FMC and Simplot Plants is provided in section 1.2.1.

The area which comprises the Offsite Subarea includes urban commercial and residential areas, agricultural areas, and areas of rangeland for cattle grazing within the Fort Hall Indian Reservation and Bureau of Land Management (BLM) lands. Major vegetation cover and wildlife habitat types existing in the areas include sagebrush steppe, riparian/wetlands, agriculture, and disturbed/urban areas.

For the purpose of implementing this ROD, the off-plant area is divided into the following areas:

<u>Areas Subject to Land Use Controls</u>

These are areas where soil contaminant levels exceed a HQ of 1 for cadmium (RME case) and/or which pose a 1 in 10,000 excess risk from radium-226 as shown in Figures 27 and 28. These areas include the Interstate 86 Right-of-Way (51 acres); Chevron Tank Farm (20 acres); City of Pocatello Property (326 acres); a portion of the land owned by private party named R. Rowland, and a portion of BLM lands to the SW of the FMC facility.

<u>Areas Subject to Fluoride Monitoring</u>

This area generally corresponds to the 3-mile radius of the RI/FS study area. (While the areal extent of fluoride contamination in the vicinity of the site is not clearly definable, and some contamination may extend beyond this boundary, it appears that the greatest impacts to the environment would be found within the 3 - mile radius. However, there may be specific areas outside the three mile radius, which may contain sensitive species or be of particular ecological or cultural value where sampling should also occur).

Areas Subject to Company Monitoring for Residential Development

This area as shown in Figure 29 was not found to exceed the criteria established for the imposition of Land Use Controls but was either close enough to the threshold of a HQ of 1 for cadmium, or adjacent to lands that exceeded the threshold, to warrant notification to current and future property owners if residential use is likely to occur.

2.0 SITE HISTORY AND ENFORCEMENT ACTIVITIES

2.1 Historical Land Use

2.1.1 FMC Plant

FMC has produced elemental phosphorus from phosphate shale since 1949. The FMC plant produces elemental phosphorus which is sold and used in a variety of products from cleaning compounds to foods. The raw materials for the process are phosphate ore, coke, and silica. Ore is shipped to the plant in rail cars and stockpiled at the plant. The primary by-products from the production process are slag, ferrophos, carbon monoxide and several aqueous streams (phossy water/solids, precipitator slurry, calciner water/solids, and industrial wastewater). In the past many of the aqueous streams were managed in unlined surface impoundments. Table 1 provides a historical summary of unlined ponds at FMC.

The FMC facility is located within the original boundaries of the Fort Hall Indian Reservation on land originally allotted to individual Shoshone-Bannock Tribal Members. Ownership of the land changed when the Bureau of Indian Affairs issued to those Indian land owners who applied for and were granted Certificates of Competency on the lands. Ownership of the lands was taken out of trust and fee patents were issued. The Shoshone-Bannock Tribes, as a sovereign nation, and with the Bureau of Indian Affairs as trustee, retain full jurisdiction over all lands and resources within the present reservation boundaries.

2.1.2 Simplot Plant

The Simplot plant produces 12 principal products including five grades of solid fertilizer and four grades of liquid fertilizers. The raw materials for their processes are phosphate ore, which is transported to the plant via a slurry pipeline from the Smoky Canyon mine, sulfur, air, and natural gas. The primary waste or by-product from the Simplot Plant is phosphogypsum (gypsum) which is transported to large unlined stacks south of the processing plant. The plant also treats water from the various processes which is nutrient rich and is sold for irrigation and fertilization.

The Simplot plant has been in operation at this location since 1944. The Simplot plant is not within the boundaries of the Fort Hall Reservation and therefore is not subject to tribal jurisdiction.

2.2 Previous Studies

The Eastern Michaud Flats site has been the subject of a number of historical investigations that focused on various media, including springs, ground water, surface water, river sediments, air quality, and ecology. Appendix A of the RI report provides a summary of the previous investigations in the vicinity of the site. The following are conclusions from a few of the investigations on ground water.

Between 1972 and 1973, the Idaho Department of Health and Welfare conducted a ground water monitoring study downgradient of the two facilities. Ground water samples analyzed by the State of Idaho indicated levels of arsenic, lead, and cadmium above the Primary Federal Drinking Water Standards. A downgradient well at the Pilot House Cafe was condemned in 1976 due to high arsenic levels.

In 1977, the United States Geologic Survey (USGS) prepared an Environmental Impact Statement to address the development of phosphate resources in southeast Idaho. In the EIS, relatively high levels of phosphate (0.35 to 7.5 parts per million) detected in samples from Batiste Spring were attributed to discharges to the Portneuf River from the FMC and Simplot facilities.

Studies by Perry et al., 1990 and Goldstein, 1981 showed increased sulfate, calcium, and nutrient concentrations at Batiste Springs relative to the other springs' studies. Water quality of Batiste Spring was described by Balmer and Noble (Goldstein, 1981) as showing an increase in levels of hardness, chloride, sulfate, phosphate, nitrate, and ammonia from 1930 through the 1970's. The report also found fluctuating concentrations of mercury, arsenic, and cadmium in Batiste Spring in the 1970's.

During 1987, Ecology & Environment (E&E) conducted a site inspection for EPA at FMC and Simplot. A total of 24 wells (six production, 13 monitoring, and five domestic) and one spring was sampled to assess the extent of possible ground water contamination downgradient of the two facilities. E&E concluded that water-bearing intervals underlying the facilities contain metals at concentrations exceeding federal drinking water standards. There also appeared to be a potential plume in the shallow water-bearing interval northeast of the FMC facility. In pond, waste, and soil samples, E&E found elevated levels (ten times greater than background levels or three times greater than the respective analytes' detection limit) of cadmium, chloride, total chromium, copper, fluoride, and selenium.

2.3 Listing on the National Priorities List

The Site was listed on the National Priorities List (NPL) on August 30, 1990 (Federal Register Volume 55, Number 169, 35502). EPA took this action pursuant to its authority under Section 105 of CERCLA. EPA, FMC, and Simplot negotiated an Administrative Order on Consent (AOC), under which FMC and Simplot agreed to conduct an RI/FS for the EMF site. The AOC was issued by EPA on May 30, 1991.

2.4 Company Actions to Date

Since 1991, Simplot and FMC have completed a number of actions, which have resulted in significant environmental improvements. Some of these improvements were made independently by the Companies, and others were done to comply with state, tribal, and/or federal requirements. These actions have helped to reduce the extent of the Superfund remedy as compared to what might have been necessary if the facilties were no longer in operation or abandoned. The following is a summary of these actions:

2.4.1 Simplot

- Two areas within the former unlined ditch which conveyed water to the treatment ponds were excavated. The removed soil was incorporated into the gypsum stack. The areas had been identified by Remedial Investigation sampling as containing the highest concentrations of contaminants within the ditch. A sealed pipe was installed and the ditch subsequently filled with clean soil. This action has eliminated the potential for worker exposure to the soils in the ditch through removal and covering and eliminated the hydraulic head from the conveyed water.

- The East Overflow Pond was removed from service and a new single-lined pond was installed in an adjacent area. Monitoring indicated that discontinuation of use of the East Overflow Pond and use of a new lined pond has resulted in a significant improvement in local ground water quality.

- A lined holding pond was installed in the irrigation water treatment system, and a new liner was installed in the existing holding pond. These actions have reduced the potential for seepage from the holding pond.

- The leaking transfer line between the Nitrogen Solutions Plant and the Urea Ammonium Nitrate (UAN) storage tank was repaired. This action has reduced the input of nitrogen compounds from this pipe to ground water.

- The gypsum thickeners in the phosphoric acid plant were upgraded to reduce the water content of the slurry sent to the stack. This upgrade has reduced the slurry water content by approximately 1 to 3 percent. Based on recent operating data, this value corresponds to a reduction in water sent to the stack of between 25 and 70 gallons per minute. This is expected to reduce the rate of seepage from the stack to ground water.

- Use of chemical flocculants in the gypsum thickeners was initiated to increase the solids content and improve the settling characteristics of the slurry. Use of these flocculants, combined with the increased carbon content of the gypsum (due to the discontinuation of the use of the calciners) has resulted in a reduction of the rate of seepage through the gypsum stack as evidenced by the increased wetness of the gypsum used for dike building and increased size of the ponded areas.

- A new rim ditching method was initiated on the gypsum stack which allows for a more rapid construction of a smaller dike and has resulted in the current six weeks slurry application cycle. This has effectively increased the potential evaporative surface on an annual basis. It has also reduced the duration of standing water (applied head) over any one part of the stack, further reducing seepage. Ground water level fluctuations in areas close to the stacks have been relatively small as compared to wider fluctuations in the past. This provides some evidence that seepage has been reduced by these modifications.

- Historical delivery of phosphate ore was by rail car, with the ore being stored onsite in a pile. In September 1991, delivery by pipeline of an ore slurry was initiated, and all rail car delivery, dry ore handling and pile storage ceased. This has significantly reduced point source and fugitive air emissions associated with the former bulk ore handling and storage procedures.

- From 1960 to 1991, calciners were used to reduce the organic content of the phosphate ore before it was introduced to the phosphoric acid process. The decommissioning of the calciners has reduced point source emissions to air.

- Certain roads within the Don Plant area have been paved. This paving has reduced fugitive air emissions.

- Additional air emission control systems have been installed on certain units within the plant, including scrubbers on the filters and tank farm in the phosphoric acid plant, a second absorber in the solutions plant, and a scrubber in the ammonium nitrate facility.

- Existing air pollution control systems have been upgraded, including systems in the Granulation II Plant, the Nitric Acid Plant, and in the central boilers.

- Enhanced maintenance has been initiated on the reclaim cooling towers, which has reduced losses due to drift and therefore total air emissions from the towers.

2.4.2 FMC

The most significant changes which have occurred within the FMC Subarea since the RI/FS AOC was issued include:

- The slag pit sump was dewatered in March 1991.

- The John Zink scrubbers were placed in service in December 1991 with the goal of reducing radionuclide air emissions.

- Pond 8S, a formerly utilized unlined pond, was covered and dewatered in the summer of 1994 as a temporary measure.

- The railroad swale, an area which receives stormwater runoff from the operating areas of the plant, was partially lined in 1994.

- New Pond 16S, built to meet RCRA minimum technology requirements (MTRs), was placed in service in 1993.

- Since August 1993, FMC has paved approximately 5 miles (8 km) of formerly unpaved roadways. In addition, approximately 200,000 ft^2 (18,580 m^2) of formerly unpaved nonroadway plant areas have been paved.

- A new, lined solar drying area for calciner pond solids was constructed and placed into operation in 1993.

- Use of septic systems was eliminated on a plant-wide basis. The entire facility was connected to the municipal sanitary sewer system during 1995.

- A new system for waste management of precipitator slurry has been initiated, using lime precipitation.

- Coke unloading was enclosed to control fugitive dust. Dust from this operation is collected and recycled to the process. This modification was placed in service in May 1995.

- In August 1993, ventilation and dust collection for ore screening and crushing was improved sufficiently so that the requirement that respirators be worn in the area was eliminated.

- Furnace tap hoods were modified for chill pits areas to improve collection of emissions from slag and ferrophos tapping. These modifications were completed in phases from 1992 to 1995.

- The furnace, proportioning, briquetting and shale buildings were tightened in 1994 to reduce fugitive emissions.

- In 1996, the recycling hopper at the ore crusher was improved, and a windscreen was installed to reduce fugitive emissions.

- The Bannock Paving Co. is in the process of removing stockpiles of materials and ceasing all operations within the FMC Plant.

2.5 History of EPA Enforcement Activity

On May 30, 1991, FMC and Simplot were issued an AOC by EPA to conduct the RI/FS pursuant to Section 106 of CERCLA 42 U.S.C.§9606.

2.5.1 FMC Plant

FMC submitted a RCRA Part A permit application on November 19, 1980, and subsequently withdrew the application on February 18, 1981. The withdrawal of the Part A permit application was due to a federal law, known as the Bevill Amendment which exempted waste generated from mineral and ore industry production. A portion of the exemption was lifted on March 1, 1990, which made mineral processing wastes, previously exempt, subject to RCRA. FMC resubmitted the Part A application on February 27, 1990. A Part B permit application was submitted in 1991.

FMCs National Pollutant Discharge Elimination System (NPDES) permit was issued on November 24, 1982, and expired November 23, 1987. FMC has applied for renewal of the NPDES permit. The current permit authorizes the discharge of non-contact cooling water from the industrial wastewater (IWW) cooling basin to the Portneuf River and regulates thermal loading.

On October 12, 1993, EPA signed an Action Memorandum, under the authority of Sections 104 and 122 of CERCLA, authorizing FMC to remove the hydraulic head and begin interim capping of pond 8S which is a RCRA regulated unit. Action at this unit is discussed in more detail in section 4.2 of this ROD.

In July 1993, EPA's National Enforcement Investigation Center conducted a multimedia compliance investigation of the FMC facility. Based upon the findings of this investigation, Notices of Violation under RCRA were issued on March 5, 1993 and August 3, 1994.

In 1997 a NOV was issued to FMC for violation of reporting requirements under the Emergency Planning and Community Right-to-Know Act of 1986. In 1998 a fine of $262,000 was imposed for these violations.

2.5.2 Simplot Plant

The most recent enforcement action at the Simplot plant was a 1994 Notice of Violation issued by the Idaho Division of Environmental Quality (IDEQ) for alleged hazardous waste generator violations. In April 1995, Simplot agreed to an AOC from IDEQ to resolve the alleged violations. All terms of this AOC were met by May 29, 1996. There have been no documented violations of the State of Idaho air requirements during the course of the RI from 1991 to the present.

2.5.3 Off-Plant Area

There have not been any enforcement actions relating to the Off-Plant area

FMC and Simplot have complied with the requirements of the AOC for the RI/FS.

3.0 HIGHLIGHTS OF COMMUNITY PARTICIPATION

EPA developed a Community Relations Plan (CRP) for the Eastern Michaud Flats site. The CRP was designed to promote public awareness of EPA activities and the investigations and to promote public involvement in the decision-making process. The CRP summarizes the concerns of local citizens, interest groups, industries, and local government representatives.

There have been a number of activities during the course of the RI/FS in an effort to keep the public informed about the progress and the results of the work at the site. The following is a summary of these activities:

June 6, 1997	Fact sheet: Public Comment Period Extension
May 13 & 14, 1997	Public Hearings conducted in Pocatello and Fort Hall, Idaho

April 21, 1997	FS Proposed Plan Fact Sheet
March 5, 1997	Idaho State Journal Article on Proposed Plan
Sept 10, 1995	Idaho State Journal Article on Risk Assessment Findings
August 16, 1995	Idaho State Journal Article on Air Monitoring Findings
October 28, 1993	Fact Sheet on Pond Closure at FMC
September 29, 1993	Fact Sheet on first round of sampling results
March 9, 1993	Remedial Investigation Update
April 15, 1992	Remedial Investigation Update/Ground Water Monitoring Program
December 23, 1991	Current Site Activities/Description of Community Concerns
December 20, 1991	Community Relations Plan
September 1991	Introduction to Superfund Process Fact Sheet
January 23, 1991	Congressional Update: Special Notice Letters Sent to Potentially Responsible Parties

The RI/FS was released to the public with the proposed plan in April 1997. The Proposed Plan, which identified EPA's preferred alternative, was mailed to individuals on the EMF mail list. All of the documents mentioned above, as well as previous reports from earlier investigations, were made available to the public in the Administrative Record located at the places listed below:

Idaho State University Library
Government Documents Department
9th and Terry
Pocatello, Idaho 83209

U.S. Environmental Protection Agency
Region 10
Park Place Building
1200 Sixth Avenue, 7th Floor Records Center
Seattle, Washington 98101

EPA published a notice of the availability of these documents in the Idaho State Journal and Shoshone Bannock News on April 21, 1997. EPA met with the Shoshone Bannock Tribes Business Council on January 14, 1997, and IDEQ on January 13, 1997, to discuss EPA's Proposed Plan for cleanup and to answer any questions. The public comment period on the Proposed Plan was held from April 21, 1997 to July 10, 1997. EPA held public meetings May 13-14, 1997, in Pocatello and on the Fort Hall Reservation. At these meetings, representatives of EPA, FMC, and Simplot gave presentations on the findings of the RI and risk assessment and proposed plan, and then answered questions about the proposed cleanup and remedial alternatives under consideration. The Responsiveness Summary, which is Appendix B of this ROD, contains EPA's responses to the written and oral comments that were received during the comment period. This decision is based on the Administrative Record for this site.

EPA has kept local, state, tribal, and federal officials who could be affected by activities at the site informed through frequent updates and briefings.

EPA will continue to keep all interested parties informed about each significant step of the Superfund process through the final decision and clean up of the Eastern Michaud Flats site.

4.0 SCOPE AND ROLE OF RESPONSE ACTION

The FMC and Simplot Plants are operating facilities. Except as stated expressly in CERCLA, in the NCP, or in this ROD, this ROD is not designed to either address the Plants' ongoing operations or preclude or in any way affect the need for FMC's and Simplot's ongoing operations to comply with other environmental laws or regulations. The selected remedy assumes continued operation of the plants in compliance with all Federal and State environmental requirements as well as any applicable closure requirements in the event either plant ceases operation.

The remedy selected by EPA and documented in this ROD includes the remedial actions deemed necessary for the site to protect human health and the environment. The risk assessment determined that exposures to contaminated soils and ground water pose the greatest risks to human health and the environment. The control of these risks is a principal part of the remedial actions described in the selected remedy. Risks from inhalation of airborne contaminants are lower than from soil and ground water but are still great enough to be of potential concern, particularly for plant workers. Implementation of control requirements under the Clean Air Act will reduce plant emissions and reduce potential risks from airborne contaminants.

All of the remedial actions are included in this decision, and no additional Operational Units or projects are proposed. Therefore, this ROD can be identified as the "Final" ROD since no other protective actions, except those otherwise referenced by applicable regulation (i.e., RCRA closures) or actions being conducted by other regulatory programs, are necessary at this time. In addition to this ROD, the EPA Air and RCRA programs are actively involved in resolving a number of regulatory issues at the FMC facility which have some bearing on the CERCLA work. These program activities are discussed briefly below:

4.1 Air

EPA has promulgated National Ambient Air Quality Standards (NAAQS) as authorized under Section 109 of the Clean Air Act (CAA). These standards are based on the latest scientific health information and are designed to protect public health with an ample margin of safety. Areas violating any NAAQS are required to develop a State Implementation Plan (SIP), which must include enforceable emission limitations on sources of air pollution, to bring the area back into attainment. Portions of Power and Bannock Counties in Idaho, including certain portions within the Fort Hall Indian Reservation, violate the NAAQS for particulate matter exceeding regulatory criteria (PM_{10}) (particulate matter of 10 microns or less). EPA is responsible for developing a Federal Implementation Plan (FIP) for that portion of the PM_{10} nonattainment area within the Reservation. (Simplot is subject to regulation under the Clean Air Act and State Air permits under a State Implementation Plan (SIP) to Construct and Operate pursuant to IDAPA 16.01.1012 (Rules and Regulations for the Control of Air Pollution in Idaho)).

EPA's Air Program anticipates publishing a notice of proposed rulemaking during 1998. Public meetings and workshops will be scheduled to discuss the contents of the FIP control strategy. At the time of proposal, the public will be provided a 60-day review and comment period. Promulgation of rules for the FIP will occur after EPA has responded to the public comments. EPA fully anticipates that control requirements for FMC in the FIP will help the area to attain the NAAQS. Full implementation of all control technologies at the FMC Plant may take up to four years after final rules are set, however, EPA expects to see emission reductions and improvements in air quality within six months of finalizing the rule.

In addition to controls for PM-10 and Section 107 criteria air pollutants, FMC has been identified as a source of certain hazardous air pollutants (HAPs) listed in section 112 of the Clean Air Act and will be subject to Maximum Achievable Control Technology (MACT) by November 15, 2000. Unlike Section 107 air pollutants like PM-10, Section 112 HAPs are effective immediately upon the promulgation of an EPA rule which links specific HAPs to specific types of facilities. These rules are therefore not subject to implementation plans by a state, tribe or the federal government. A specific rulemaking linking type of facility with specific HAPs is required because Congress listed 188 different HAPs in Section 112, and a blanket requirement that every facility test to be certain they are meeting every one of them, would be excessively expensive, time consuming and burdensome to administer. Section 112 requires rules to examine industrial processes and requires compliance with those HAPs the facility actually generates based on its function. A Section 112 like regulatory process for PM-10 would have obviated the SIP/TIP/FIP problem at FMC year ago, but EPA is no more able to apply Section 112 to FMC's PM-10 emissions than it is to apply Superfund. Because of the ongoing FIP development efforts, the findings of the human health risk assessment, and the role of Superfund at operating facilities this ROD does not include action for ongoing emissions from the plants.

4.2 RCRA

FMC is an operating facility regulated under the Resource Conservation and Recovery Act regulations (RCRA) for management of hazardous waste. EPA implements these regulations on Tribal land because even RCRA- authorized states, like Idaho, do not have jurisdiction. Currently, the various waste ponds at FMC can be divided, for purposes of closure, into three broad categories which are discussed below:

Current Ponds

The units where the RCRA operational and closure requirements are applicable include Ponds 11-16S, 8S, 8E, and 9E. These ponds either are currently in use, or have been in use since 1980, for management of hazardous waste. The RCRA regulated units at FMC are subject to specific standards for closure, characterization of releases, and ground water corrective action. RCRA closure requirements at 40 CFR §265.111, require closure to: 1)minimize maintenance and 2)control, minimize or eliminate releases to the extent necessary to protect human health and the environment after closure has been completed.

Former Ponds

The specific phossy waste ponds and calciner solids areas, which are the subject of this ROD (1S-7S, 1E-7E, 9S and 10S), received similar wastes as some of the current RCRA units. However, they were taken out of service and closed long before the RCRA requirements became effective. Closure of these pond areas was accomplished via a variety of mechanisms including excavation of some material, oxidation of phosphorus, drying, and/or placement of soil or concrete covers. Table 1 provides a historical summary of the former unlined ponds. Due to the time that has passed since these ponds were closed, EPA has determined that the RCRA closure requirements are neither applicable nor relevant and appropriate for CERCLA actions in these areas. The FS alternatives for these areas were designed to reduce infiltration, prevent incidental ingestion, reduce exposure to radiation, and minimize maintenance.

Pond 8S

Pond 8S is a RCRA regulated unit and was the last unlined pond at FMC. Early RI sampling data indicated that this pond was a major contributor to ground water contamination with a release rate of 15.3 gallons per minute. In October 1993, a time critical removal under the CERCLA program for removal of the hydraulic head and interim capping was initiated by FMC as a result of an EPA Action Memorandum. The primary goal of the time critical removal was to reduce the hydraulic loading of the waste to reduce the movement of arsenic, selenium, nitrate, gross alpha, fluoride, manganese and phosphorus into the ground water. FMC proceeded with dewatering the waste, filling the pond with sand and slag, and installation of an interim cap to achieve this goal. At that time, capping of the pond with wastes in place was selected for two reasons: (1) proven technologies to deactivate the waste in a large surface impoundment of this type did not appear to be available, and (2) the continued input of contaminants to ground water warranted immediate action. FMC proceeded with dewatering the waste and installation of an interim cap to achieve this goal. Final closure of this pond must be conducted in accordance with the requirements at 40 CFR Part 265 Subpart G, which requires not only short term reduction of risks, but also action to: (1) minimize maintenance and (2) control, minimize or eliminate releases to the extent necessary to protect human health and the environment after closure has been completed. Closure of this pond was managed by the CERCLA program up until 1997 when the RCRA program took the lead for the final cap design.

5.0 SUMMARY OF SITE CHARACTERISTICS

Between 1991 and 1996, an RI/FS was performed to determine the nature and extent of contamination at the site and provide sufficient data for the risk assessment. Using the results from previous investigations and knowledge of the site, FMC and Simplot developed a sampling plan for collecting/analyses of surface and subsurface soils, ground water, surface water, sediment, plants and animals, and air. In addition, ground water modeling, air modeling and sampling of FMC and Simplot products and by-products were conducted to develop a comprehensive understanding of the source and fate of site contaminants. Details of these investigations are provided in the RI report.

The major characteristics of the site and the nature and extent of contaminant releases are summarized below by environmental media:

5.1 Geologic Setting

The EMF Site is located at the juncture between the Basin and Range physiographic province to the south and the Snake River Plain to the north. The EMF Site is at the base of the northern slope of the Bannock Range and extends onto the southeastern margin of the Michaud Flats.

The Michaud Flats is a portion of the Snake River Plain to the north and west of Pocatello, Idaho. The Michaud Flats is a roughly elliptical area about nine miles long and five miles wide, bounded to the west by Bannock Creek, to the north by American Falls Reservoir, to the east by the Portneuf River, and to the south by the Bannock Range.

The stratigraphy of the Site area can be generally described as discontinuous layers of unconsolidated sediments deposited on an erosional surface that was incised in volcanic bedrock. The sedimentary unit immediately above the bedrock is a gravel derived from volcanic rocks. Overlying the gravel is varying thicknesses of fine-grained silts, clays, and sands that form a discontinuous, semi-confining unit. The fines are overlain by another coarse-grained unit, called Michaud Gravel, that consists of quartzite, chert, and volcanic gravel, cobbles, and boulders (see Figure 4). Above the second gravel unit is a finer-grained unit that consists of interfingered silts, clays, and sands. In the western part of the EMF Site area, a separate but discontinuous third coarse-grained layer is present. Deposits of windblown silt (loess) and a colluvial silt layer of variable thickness mantle the study area. The loess layer ranges from 2 to more than 100 feet thick at the EMF facilities, and is calcareous. To the north and east of the facilities, the Michaud Gravel occurs in scoured channels, and the fine-grained layers present in the western and central areas of the facilities are generally absent to the east.

5.2 Hydrogeology

Within the Michaud Flats area, the aquifer system can be divided into a shallow aquifer and a deeper aquifer. The shallow aquifer is Michaud Gravel which is typically overlain by a silt aquitard, but is locally unconfined. Hydraulic conductivity in the shallow aquifer ranges from 30 ft/day to 1,000 feet per day. The deeper aquifer contains the gravel and volcanics of the Sunbeam and Starlight Formations, and the Big Hole Basalt. The deeper aquifer is the primary water-producing aquifer within the Michaud Flats Area with a hydraulic conductivity ranging from 30 feet per day to 340 feet per day. The deeper aquifer underlies the American Falls Lake Beds, the regional aquitard between the shallow and deeper aquifers. Ground water that flows into the deeper aquifer system discharges to the Portneuf River (via springs and base flow contribution), American Falls Reservoir, or to one of the numerous springs and seeps in the Fort Hall Bottoms. Agricultural, industrial, and domestic water supply wells extract ground water from the regional (deeper) aquifer.

The Portneuf River, which flows along the old track of the Bonneville Floods, is underlain by the very coarse, permeable Michaud Gravel. The Portneuf River exhibits a transition near the Interstate 86 (I-86) bridge from a losing stream in its upstream portion to a gaining stream. The gaining section of the Portneuf River is associated with numerous springs and a large flux of ground water that occurs as base flow.

Ground water enters the site from the Bannock Hills south of the site and from the Michaud Flats north and west of the site. The two flows converge and commingle beneath the FMC facility and then leave the site, moving in an east-northeasterly direction toward the Portneuf River. Figures 8 and 9 depict the contours of shallow and deeper ground water elevations in the vicinity of the Plants. Upon reaching the river, the ground water that had flowed under the site either discharges to the river or meets and mixes with a high-volume, high-velocity flow of ground water that moves down the Portneuf River valley to the southeast of the facilities. The latter flow dilutes and carries the ground water from beneath the site in a northwesterly direction parallel to the river channel, out into the Fort Hall bottoms northwest of the site.

Withdrawal rates for irrigation wells in the deep aquifer throughout the Michaud Flats are approximately 1,000 g.p.m. The FMC production wells have a total combined flow rate of approximately 875 g.p.m. Extraction from Simplot production wells is about 3,300 to 4,000 g.p.m. combined flow. The Simplot and FMC production wells are located below the American Falls Lake Bed (AFLB) and create cones of depression in the deeper aquifer. When the FMC and Simplot plants cease operations and no longer extract ground water most of this extracted ground water will discharge to the Portneuf River. It is currently unclear what effect cessation of pumping would have on ground water contaminant concentrations and migration.

5.3 Surface Water Hydrology

Major surface water features of the region include the Snake River, Portneuf River, and the American Falls Reservoir. The reservoir is an impoundment of the Snake and Portneuf Rivers and Bannock Creek, among others; both rivers discharge into the reservoir at its east end.

The Portneuf River flows from southeast to northwest through the region and passes northeast of the Simplot Don Plant. Michaud Creek passes the FMC facility to the west. Surface water in the EMF study area also includes numerous springs and associated spring drainage channels along the Portneuf River.

5.4 Climate

The EMF region climate is semi-arid, characterized by a wide range of temperatures. The warmest temperatures generally occur from June through August (daily mean maximum temperature 84.1°F), and the coldest temperatures occur from December through February (daily mean minimum temperature of 17.8°F). The highest and lowest temperatures recorded at the Pocatello Municipal Airport were 104°F in August 1969, and minus 33°F in February 1985, respectively.

The annual mean precipitation for the region is 10.86 inches per year, with the greatest amount of precipitation occurring during the spring. The mean potential evaporation is 29.76 inches for the 3-month summer period and 3.36 inches for the winter months. The areal and seasonal distribution of precipitation also influences hydrogeologic characteristics. Precipitation patterns in this region are strongly linked to topography, with larger amounts of snow and overall precipitation falling at higher elevations. The higher elevations (i.e., the Bannock Range and Pocatello Range) serve as recharge areas for aquifers in the valleys.

The prevailing wind direction is from the southwest; however, a strong secondary flow emerges from the Portneuf River valley, particularly under valley wind conditions. It then flows past the site and moves out into the flats to the northwest. In addition, the air monitoring results and the surface soil concentration patterns suggest that the complex terrain at the site can produce wind patterns that carry appreciable amounts of site-related contaminants to the west-southwest, the prevailing upwind direction, at least as far as the Michaud Creek area. The annual average wind speed is 10.2 miles per hour (mph), though the area occasionally experiences stagnation conditions, particularly during the winter months.

The combination of the arid climate, strong winds that can mobilize fugitive dust from unprotected soils, stagnant conditions that can trap airborne contaminants, and air pollution sources, including the site and other sources, has resulted in airborne contaminant concentrations that occasionally have exceeded acceptable levels. This has lead to the Pocatello area being designated a PM_{10} nonattainment area.

5.5 Ecosystems and Species of Concern

A variety of habitats and vegetation exist in the vicinity of the site as shown in FIGURE 13. There are also a number of species of concern in the vicinity of the EMF Site. A complete discussion of ecosystem types and wildlife is provided in the Ecologic Risk Assessment, which also includes identification and discussion of listed species and designated wetlands.

Native upland ecosystem characteristic of the semi-arid temperate climate of southeastern Idaho is prevalent in the site area. The high plateau of the Michaud Flats and the foothills of the Bannock Range support sagebrush steppe communities dominated by sagebrush and a variety of other shrubs and grasses. This community is replaced with juniper woodlands and cliff/cave/canyon communities at higher elevations. Extensive cultivated agricultural areas are also located near the site, comprising approximately 40% of the EMF Site area.

Wildlife typical of sagebrush steppes is abundant in the site area and includes small mammals such as the deer mouse, large herbivore such as the mule deer, carnivores such as the coyote, raptors such as the red-tailed hawk, gallinaceous game birds such as the sage grouse, and numerous species of songbirds.

Aquatic and wetland communities are well-developed in the site vicinity. According to the National Wetland Inventory (NWI) maps of the United States Fish and Wildlife Service (USFWS), the Portneuf River channel, the river's associated riparian corridor, and the Fort Hall Bottoms are designated wetlands. Other wetlands include areas along Michaud Creek and other locations. The Portneuf River supports an extensive riparian community dominated by willow, red-osier dogwood, and other scrub/shrub riparian vegetation. This riparian zone is an important source of food, cover, and nesting sites for many wildlife species such as songbirds and piscivorous birds. The riverine, open-water, and mudflat habitats of the Portneuf River and American Falls Reservoir are significant nesting and wintering habitats for waterbirds. Thousands of individuals of numerous migratory bird species use areas in and near the site, particularly the Fort Hall Bottoms. Common species of migratory birds include waterfowl such as ducks, geese, and swans; colonial birds such as pelicans, herons, shorebirds, and gulls; and raptors.

Eleven species of concern listed as endangered, threatened, and rare are reported to occur in the site area. The bald eagle and the orchid Ute Ladies'-tresses are listed as threatened and the peregrine falcon is listed as endangered under the Endangered Species Act. A wintering population of bald eagles is listed by the State of Idaho and by the USFWS as endangered in Idaho. The remaining species of concern are identified as State of Idaho Special Concern species and/or are identified as federal

Category 2 species, which indicates they are being considered for listing as a threatened or endangered species.

5.6 Key Remedial Investigation Findings

Phosphate ore is the primary raw material for both the FMC and Simplot facility operations. Contaminants identified through RI sampling and analysis of environmental media are primarily linked to constituents of the phosphate ore and sulfur and nitrogen which is used in the Simplot process. Table 2 shows the ratios of concentrations of constituents in phosphate ore relative to local background soils. No contamination was found to be associated with the relatively small amounts of reagents, catalysts and fuels used by the facilities. Therefore, the feasibility study focused on the various phosphate ore-based products, byproducts, wastes, and emissions for each facility.

The primary constituents of the phosphate ore are calcium, phosphorus and fluoride. The ore also contains trace concentrations of other elements including antimony, arsenic, beryllium, boron, cadmium, chromium, copper, Lead-210, mercury, molybdenum, nickel, selenium, silver, thallium, uranium-238, vanadium, and zinc. Key findings pertaining to the nature and extent of contamination, source contribution, and contaminant fate and transport are summarized below for each environmental medium.

5.6.1 Soils and Solids

During the RI both surface and subsurface soil samples were collected over a large area of the site. Figure 16 shows the surface soil sampling locations. A number of factors have contributed to the soil contamination patterns observed at the site:

- Raw materials and waste materials have been deposited at various locations at both Plants;
- Old wastewater storage and treatment ponds that contained settled solids have been closed and regraded, with the settled solids left in place in some cases;
- Waste materials, mainly slag and gypsum, have been used extensively as fill and to surface roadways;
- Infiltration of wastewater has carried contaminants down into subsurface soils beneath the gypstack and at the locations of unlined ponds where sustained hydraulic heads existed; and
- Airborne contaminants have been deposited on the ground surface.

The key RI findings with respect to nature and extent of EMF Site-related Contaminants in soils are as follows:

- Soil Contaminants of Concern (COCs) are principally derived from phosphate ore, which contains phosphorus, fluoride, arsenic, beryllium, cadmium, chromium, vanadium, zinc, uranium-238 (and its decay products) and other elements. The frequency of detection of contaminants in soils at the site, are shown in Tables 3 and 3A.

- Although the presence of phosphate ore-based products, byproducts and waste materials are common within the FMC and Simplot Plants, the Contaminants in these materials are not prone to migrate to underlying soils and ground water in areas where a sustained hydraulic head does not exist.

- The underlying soils at the facilities have been contaminated primarily in those areas where a sustained hydraulic head was or is present, or where materials have been integrated into the fill.

- Deposition of airborne materials such as cadmium, fluoride, radium, and zinc has occurred in the Plant and Off-Plant Areas since the Plants began operation. Underlying soils have not been influenced in the Off-Plant area. Figures 17 and 18 depict the cadmium and fluoride concentrations in surface soils.

- The radionuclides of potential concern at the EMF site are natural uranium (U-235 and U-238) and thorium, which originated as constituents of the phosphate ore processed at the site, and daughter radionuclides produced by the disintegration of the uranium and thorium. However, because U-238 is much more abundant in the ore than U-235 or thorium, U-238 and its daughters appear to be the radionuclides of greatest concern at the EMF site. Table 4 shows the locations where gross alpha activities were measured above the soil screening level (based on 41 pCi/G soil gross alpha activity and 4pCi/l radon level) in subsurface soil at Simplot (a comparable table was not available for FMC).

- The native soils at the site are generally alkaline (pH of 7 or higher) because of their calcareous nature. This is consistent with most soils in the arid regions of the western United States. This is significant, as alkaline soils tend to retain metals and prevent their migration through soil horizons to ground water.

5.6.2 Ground water

During the RI, approximately 77 monitoring wells were installed which are shown in Figure 19. Ground water within the FMC and Simplot Plants flows generally north and northeast from the facilities and is either captured by facility production wells in the lower aquifer or flows northward along a relatively narrow path to eventually discharge to springs/river north of I-86.

Ground water flow from the facilities (i.e., containing EMF-related Contaminants) is small in comparison with the flux in the regional or deeper aquifer. The combined shallow aquifer flux from the EMF facilities was calculated from the RI flow model as 4.5 cfs. This discharge is only about 20 percent of the total calculated flow in the shallow aquifer from all sources (21 cfs) and a very small fraction of the estimated average ground water discharge to the Portneuf River in the gaining reach north of the Simplot facility (approximately 200 cfs).

The key RI findings with respect to nature and extent of EMF Site-related Contaminants in ground water are as follows:

- Contaminants have been released to ground water throughout the FMC and Simplot Plant areas. Contaminants that have been measured in the ground water at levels above the Safe Drinking Water Act Maximum Contaminant Levels (MCLs) include the following: antimony, arsenic, barium, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, thallium, gross alpha, and gross beta (Table 5 provide a summary of the ground water analytical results at the site). These concentrations decline with increasing distance from the Plants and meet MCLs in the Off-Plant area (see Figure 20 depicting arsenic concentrations in the shallow aquifer throughout the plant areas). Current evidence suggests that the area of ground water contamination is not expanding and contaminant concentrations are not increasing.

- Contaminants have been primarily transported to the shallow ground water system underlying the facilities from unlined impoundments and ponds. At sources where there is no sustained hydraulic head, downward migration of contaminants is limited. The contaminants transported by this process are mainly monovalent cations such as sodium, potassium, and lithium; metals and transition elements capable of forming oxyanions such as arsenic, boron, phosphorus, selenium, sulfur, and vanadium; and, soluble anions such as chloride.

- The predominant mechanisms controlling contaminant concentrations in ground water are attenuation in the vadose zone and advective mixing, where the EMF Site-influenced shallow aquifer flow merges with the large volume of ground water flowing through the Michaud Flats and Portneuf River ground water systems (see Figure 21 showing the ground water flow at FMC). Although slightly elevated concentrations of contaminants were detected in the upper portion of the deeper aquifer near source areas, in most areas ground water movement is upward from the deeper aquifer to the shallow aquifer, thereby limiting the downward migration of contaminants to the deeper aquifer.

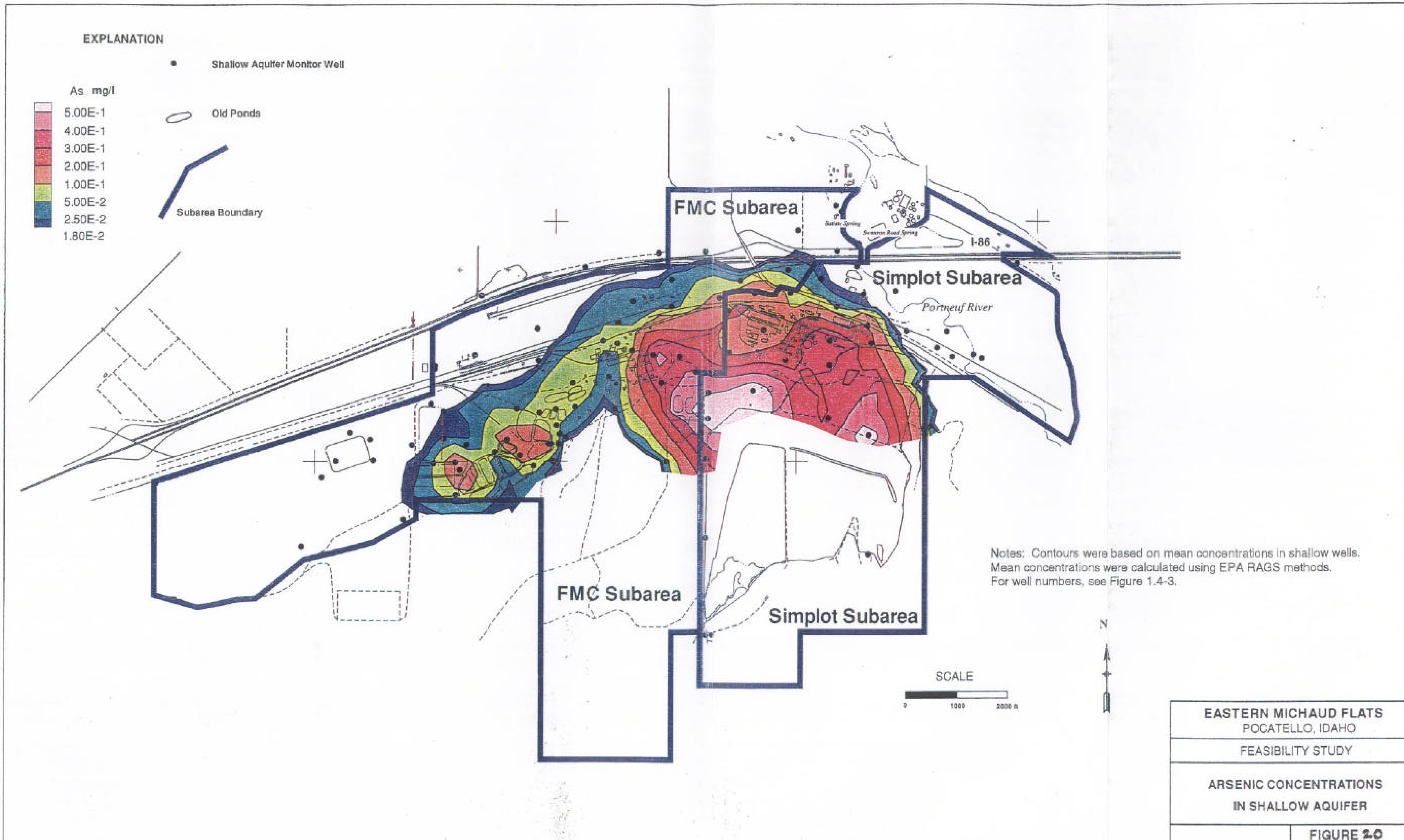
- Shallow ground water from the Simplot and FMC Plants discharge to the Portneuf River. However, there does not appear to be any measurable effect on surface water quality downstream of the discharge attributable to the Plants other than small increases in some major ion concentrations.

5.6.3 Surface Water/Sediments

There are no active water courses within the Simplot and FMC Subareas. Runoff is controlled in these areas and evidence of recent erosion is not present. The process operations of the facilities are for the most part a closed loop, and the only active surface discharge to the Portneuf River is the Industrial Waste Water (IWW) ditch which carries cooling waters from FMC operations. The key RI findings with respect to nature and extent of contamination, source contribution and Contaminant fate and transport in surface water/sediments are as follows:

- The primary migration pathway for contaminants to surface water is via ground water discharge to the Portneuf River and adjacent springs.

- Although contaminants from the site do enter the surface water pathway through the ground water pathway, the contribution is negligible in terms of concentration and load


EXPLANATION
Shallow Aquifer Monitor Well
As mg/l
5.00E-1
4.00E-1
3.00E-1
2.00E-1
1.00E-1
5.00E-2
2.50E-2
1.80E-2
Old Ponds
Subarea Boundary
FMC Subarea
Simplot Subarea
I-86
Portneuf River
FMC Subarea
Simplot Subarea
Notes: Contours were based on mean concentrations in shallow wells.
Mean concentrations were calculated using EPA RAGS methods.
For well numbers, see Figure 1.4-3.
SCALE
N
EASTERN MICHAUD FLATS
POCATELLO, IDAHO
FEASIBILITY STUDY
ARSENIC CONCENTRATIONS
IN SHALLOW AQUIFER
FIGURE 20

compared to the loads from the river upgradient of the site and the influx of nonsite influenced ground water.

- The IWW ditch is the only active surface water discharge from the facilities. Samples from a boring on the bank of the ditch showed elevated levels of several COPCs. A grab sample of water in the ditch taken in 1992 contained elevated levels of selenium, gross alpha, orthophosphate, fluoride, and several other parameters. Subsequent sampling in July 1993 showed the water in the ditch met drinking water standards. FMC attributed the elevated concentrations in 1992 to a plant upset.

- Erosion of soils containing site related contaminants and air deposition of contaminants on the Portneuf River were not found to be significant transport pathways to surface water.

- Four trace elements detected in surface water were selected for being of potential concern to aquatic and semiaquatic biota - mercury, selenium, silver, and vanadium. Elevated levels of these COPCs were detected at various springs and Portneuf River locations.

- COPCs in sediments include: cadmium, fluoride, mercury, and selenium because of their potential toxicity to fish and wildlife and tendency to mobilize in the aquatic food chain. Cadmium in particular was found to be 2.5 times higher in the Portneuf River Delta at the Fort Hall Bottoms than at a similar location on the Snake River.

5.6.4 Air

The region is an arid zone with varying topography. Regional air movement is generally from the west/southwest, with localized wind flow patterns controlled by the topography. The EMF Site is located in a nonattainment area for PM_{10}. During the RI an air monitoring program was set up with seven monitoring locations around the site. These locations are shown in Figure 22. The key RI findings with respect to air are as follows:

- During the RI, airborne contaminant concentrations were measured at seven locations around the site for up to one year. The highest concentrations of all of the COPCs, except lead-210, were found at Station 2, which was located just outside the FMC fence line, south of Highway 30.

- Concentrations of arsenic, cadmium, total chromium, total phosphorus, lead-210, polonium-210, thorium-230, and uranium were observed above regional background levels. Table 6 provides a summary of the air analytical results.

- Ambient air concentrations of contaminants decline beyond the FMC and Simplot Plant boundaries.

- Over the last several years, major changes in ore handling at the Simplot Plant and other operational changes at both Plants have reduced airborne emissions.

- More recent air monitoring data collected by the EPA and Shoshone Bannock Tribe show that maximum particulate emissions from the Plants may be as much as three times higher than maximum values measured during the RI and recent average values are approximately 50% higher than that measured during the RI.

5.6.5 Terrestrial and Aquatic Investigations

Due to the minimal contact and use of the Plant areas by wildlife, the focus of the risk assessment was on ecosystems in the Off-Plant areas. The key findings of the ecological investigations are as follows:

Detailed ecological investigations of the EMF Site were conducted in September and October of 1994, to provide site-specific, supplementary data for the ecological risk assessment. Uptake of COPCs in terrestrial food chains was investigated by chemically analyzing co-located samples of soil, sagebrush, grass (thickspike wheatgrass), and small mammals (deer mouse) in sagebrush-steppe habitats, and co-located samples of soil and shrubs (Russian olive) in riparian habitats. The nature and extent of sediment contamination was investigated in depositional areas of the Portneuf River delta at the American Falls Reservoir. Samples were chemically analyzed for cadmium, fluoride, zinc and other contaminants. Laboratory toxicity testing was conducted by the Companies with contaminated sediment collected from the Portneuf River at the IWW outfall. All sampling activities were statistically designed to allow comparison of site-related contamination with unaffected reference areas.

The results of the aquatic investigations demonstrated that cadmium is elevated approximately 2.5 times background in depositional sediments of the Portneuf River delta (see Table 7). However, the chemical analysis showed that the majority of cadmium is strongly bound to sediments and, thus, is not in a bioavailable form. In addition, based on the Company study[2] sediment from near the IWW outfall was not toxic to laboratory test species of selected benthic invertebrates. Moreover, no other contaminants were found in Portneuf River delta sediment at levels significantly above background or levels of concern. Therefore, potential risks of adverse effects of sediment contamination on benthic life are expected to be minimal.

The results of the terrestrial ecological investigations for soil, vegetation, and deer mice as compared to background are summarized in Tables 8-10. The results demonstrate that cadmium, fluoride, and zinc are elevated in riparian and upland soils and in plant tissue samples, and that cadmium and fluorides are elevated in small mammal tissue samples collected near the site. Fluoride concentrations in vegetation appeared to be related to current fluoride emissions which are deposited on plant surfaces and absorbed in gaseous form by plants. There was no correlation between fluoride concentrations in soil and fluoride concentrations in vegetation.

In general, the data confirm that the mobility of cationic metals such as cadmium and zinc is limited by the arid, high-pH soils of the site vicinity. Hence, concentrations of COPCs are much reduced in the terrestrial food chain compared with their concentrations in soil. In addition, it is likely that soil contamination at the site is confined to the surficial soil horizon.

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[2] While this study was conducted independently by the Companies without direct EPA oversight previous studies of benthic life in the Portneuf River confirm the findings.

6.0 SUMMARY OF SITE RISKS

CERCLA response actions at the Eastern Michaud Flats site as described in this ROD are intended to protect human health and the environment from current and potential future exposure to hazardous substances found at the site.

To assess the risks posed by site contamination, a "Baseline Human Health and Ecological Risk Assessment," (Risk Assessment) was prepared by E&E, a contractor to EPA. The Risk Assessment assumes that there is no site cleanup.

6.1 Human Health Risks

6.1.1 Approach to Human Health Risks

An assessment of the risks to human health involve a five-step process: identification of contaminants of potential concern (COPCs), an assessment of contaminant toxicity, an exposure assessment for the population at risk, quantitative characterization of the risk, and an analysis of uncertainty.

6.1.2 Conceptual Site Model

Individuals potentially exposed to site-related contaminants include current and potential future site workers and nearby residents. Figure 23 shows the conceptual site model for human exposure. The principal current and/or potential future exposure pathways are:

- Inhalation of airborne contaminants;
- Dermal contact with, and incidental ingestion of, contaminated soils and waste materials;
- External radiation exposure from contaminated soils and waste materials;
- Ingestion of homegrown produce grown in contaminated soils (risks estimated based on uptake of contaminants by plant roots;
- Use of contaminated ground water as a source of drinking water; and
- Ingestion and dermal contact with contaminated surface water and consumption of fish from those waters.

Both the FMC and Simplot Plants are operating facilities enclosed by perimeter fences with controlled access. Normally, only Plant employees and authorized visitors can gain access to the facilities. Trespassing may be possible, but trespassers have rarely been seen at either Plant. Together, the two Plants currently employ approximately 1,000 people.

Under current conditions, individuals who experience exposure at the Plants appear to be limited to Plant workers. Current workers could be exposed to contaminants through incidental ingestion of soils, inhalation of contaminated air, and external exposure to gamma radiation from contaminants in soil and waste materials. Contaminated ground water is not used as drinking water at either Plant. The FMC

Plant obtains its drinking water from wells in the deep aquifer which currently meets MCLs. Employees at the Simplot Plant use bottled water.

Residents living around the site are the individuals likely to experience the greatest exposures to site-related contaminants in the Off-Plant areas. Currently, the nearest residence is approximately 1/4 mile north from the FMC Plant Area (see Figure 24 for the existing residential areas). Site-related contaminants are found in surface soils throughout much of the site as a result of the migration and deposition of airborne particles. Residents could be exposed to site-related contaminants by breathing contaminated air, through incidental ingestion of contaminated soil, and by exposure to gamma radiation from radionuclides deposited on the soil. In addition, many residents of the area consume homegrown produce, and some consume homegrown beef. Currently, there are no residences in areas where ground water has been contaminated by the site. Therefore, use of ground water as drinking water is not a complete exposure pathway for current residents of the site, but it could be a potential future exposure pathway if existing wells affected by site-related contamination were returned to service, if new wells were installed in the contaminated area, or if the plume were to expand or shift and thereby affect presently unaffected existing or future drinking water wells.

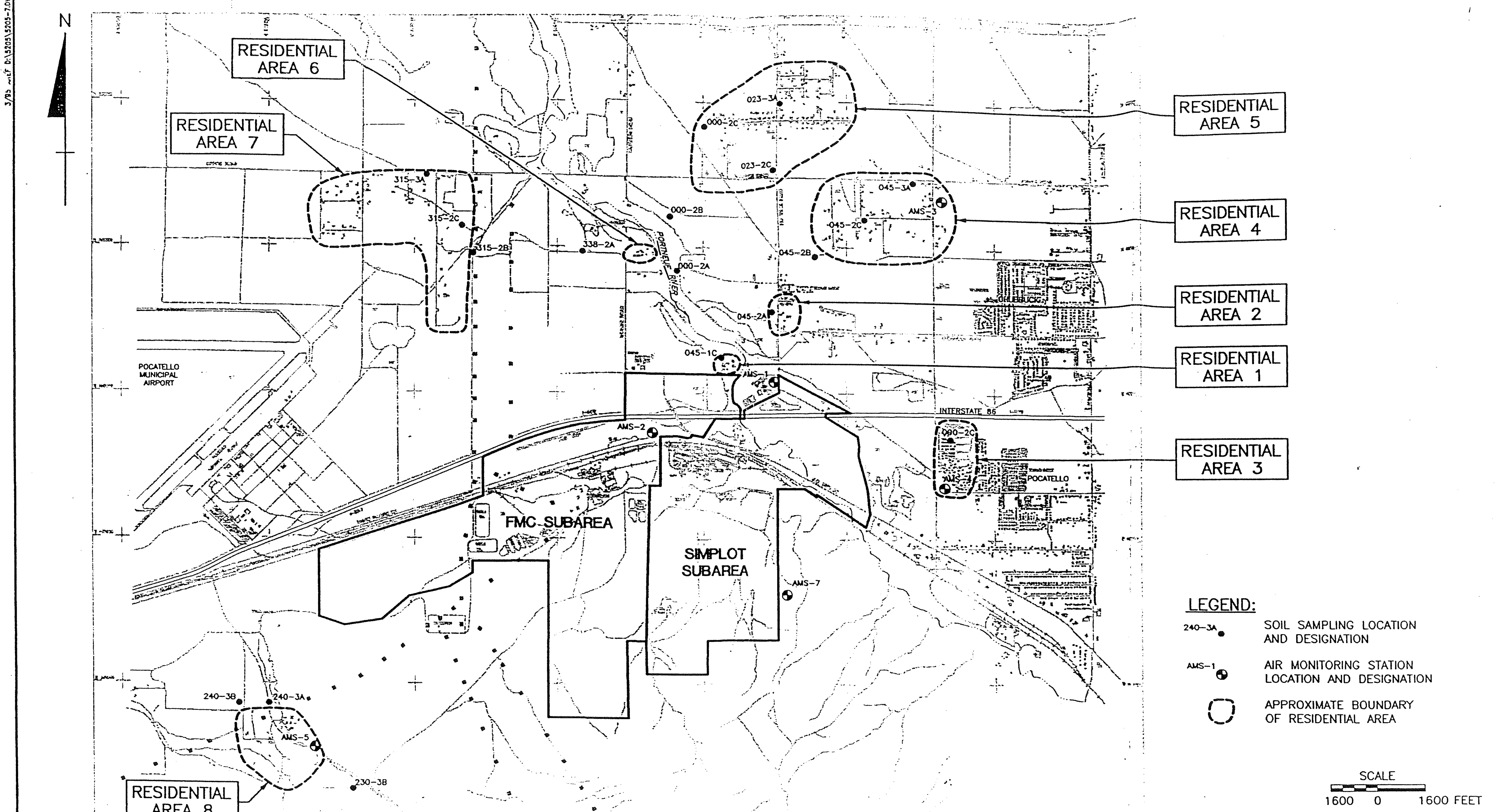
6.1.3 Background Concentrations

Many of the metals, other inorganic chemicals, and radionuclides that constitute the principal contaminants at the site also are natural constituents of soil, ground water, surface water, and sediment. Therefore, it was necessary to determine what the natural background concentrations were in the various media in order to determine whether concentrations measured in samples were consistent with natural levels or due to contamination. For soils, background values were obtained by determining the 95th percentile concentration of local subsurface soils. Ground water background values were determined from the 95th percentile concentration in wells determined to be either hydrological upgradient or cross gradient from potential site-related contamination sources and free of site related influences. For air, background was obtained from determining the 95th percentile from air monitoring data collected at Station 6 (background location).

6.1.4 Contaminants of Potential Concern

An initial screening analysis was done, using information available at the time, to identify the contaminants of potential concern (COPC). This screening involved two steps. In the first step, contaminants were selected based upon a very conservative estimate of potential health risk. Maximum concentrations of chemicals in media (*e.g.*, soil, air, and ground water) at the site were compared to conservative risk-based concentrations. These risk-based concentrations were derived using standard EPA exposure assumptions assuming residential exposures in the Off-Plant area and industrial exposures for the Plant Areas; acceptable cancer risk levels of $1x10^{-7}$ for soil and $1x10^{-6}$ for water; and acceptable HQs of 0.1. Tables 11-13 show the screening criteria for soils, ground water, and air, respectively.

The second step in the selection of COPCs was a more refined screening which narrowed the list of COPCs by considering factors such as frequency of occurrence of each COPC, detection limits, and background concentrations for inorganics only.

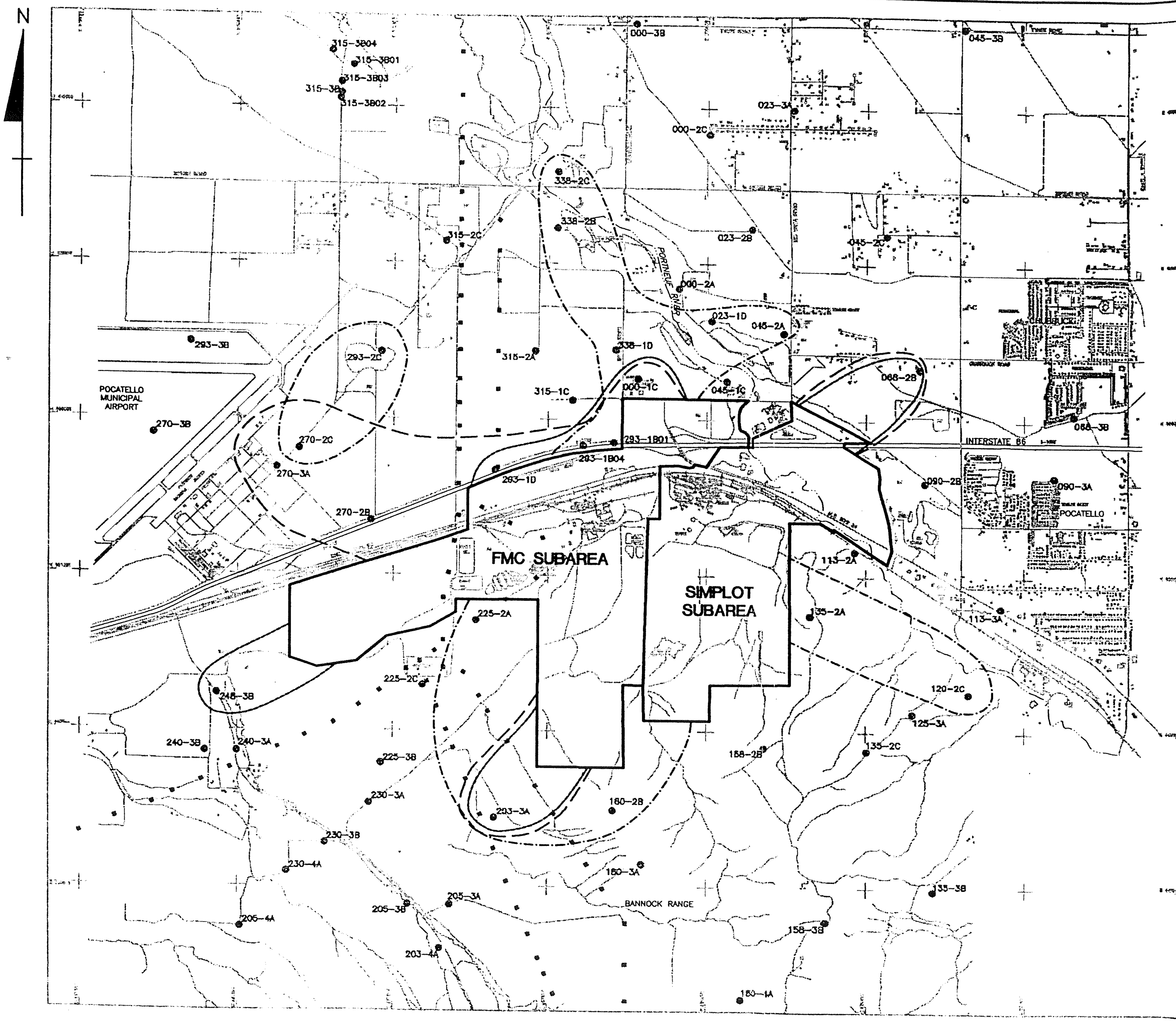


EASTERN MICHAUD FLATS
POCATELLO, IDAHO

FEASIBILITY STUDY

EXISTING RESIDENTIAL AREA AND SAMPLING LOCATIONS USED IN THE BASELINE RISK ASSESSMENT

FIGURE 24



NOTES:

1. CONTOURS SHOWN CORRESPOND TO INCREMENTAL CANCER RISK OF 10^{-6}.
2. NO AREAS EXCEED 10^{-6} RISK FOR URANIUM-238.

LEGEND:

270-3A (symbol)	SOIL SAMPLING LOCATION AND DESIGNATION
———	RADIUM-226
— — —	LEAD-210
-·-·-	POLONIUM-210

SCALE

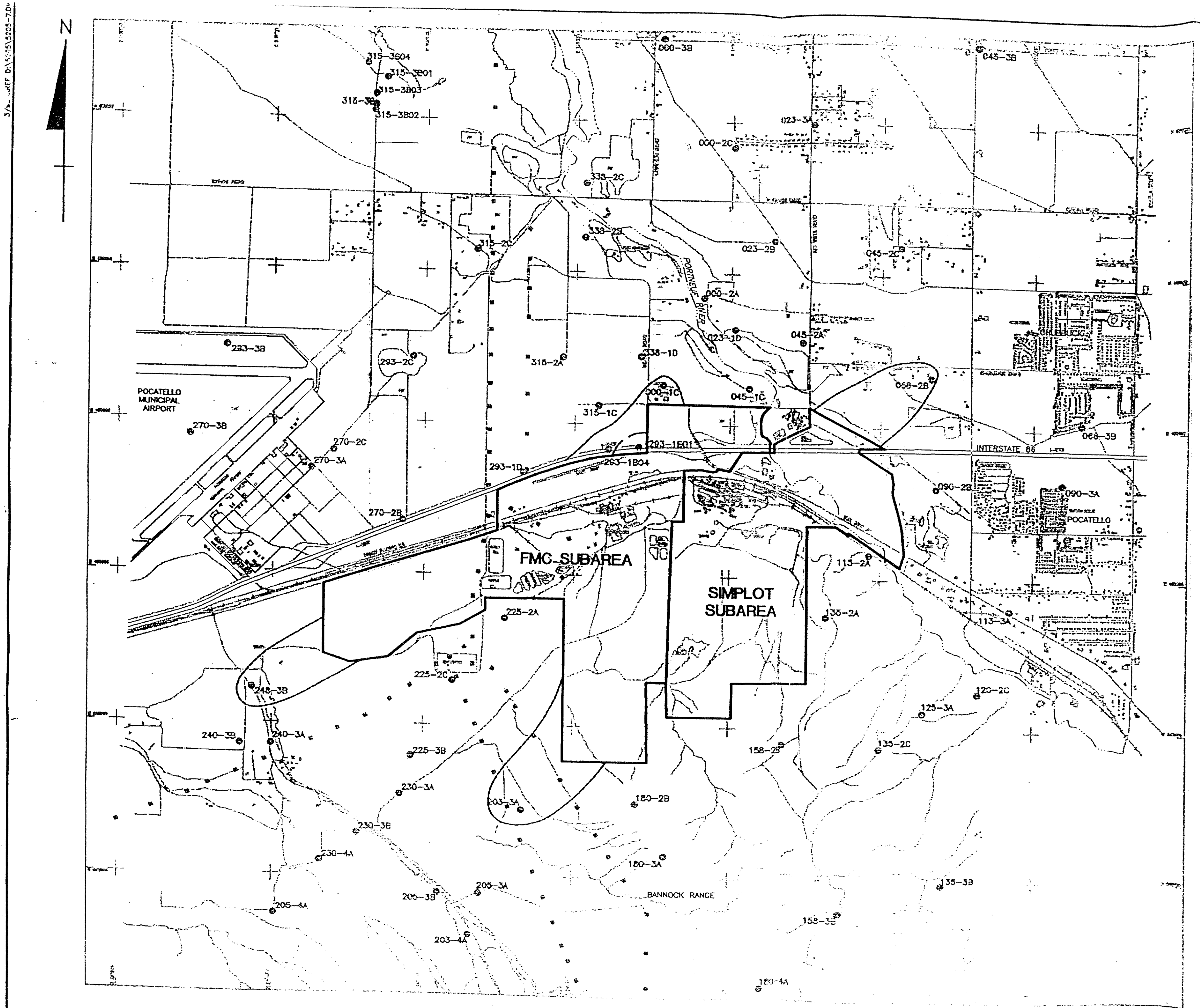
1600 0 1600 FEET

EASTERN MICHAUD FLATS
POCATELLO, IDAHO

FEASIBILITY STUDY

OFFSITE SUBAREA AREAS WHERE RADIONUCLIDE ACTIVITIES IN SURFACE SOILS EXCEED THE 10^{-6} INCREMENTAL CANCER RISK LEVEL

FIGURE 25



NOTES:

1. CONTOURS SHOWN CORRESPOND TO INCREMENTAL CANCER RISK OF 10^{-5}.
2. NO AREAS EXCEED 10^{-5} RISK FOR URANIUM–238, POLONIUM–210.

LEGEND:

270–3A ●	SOIL SAMPLING LOCATION AND DESIGNATION
———	RADIUM–226
– – – –	LEAD–210

SCALE

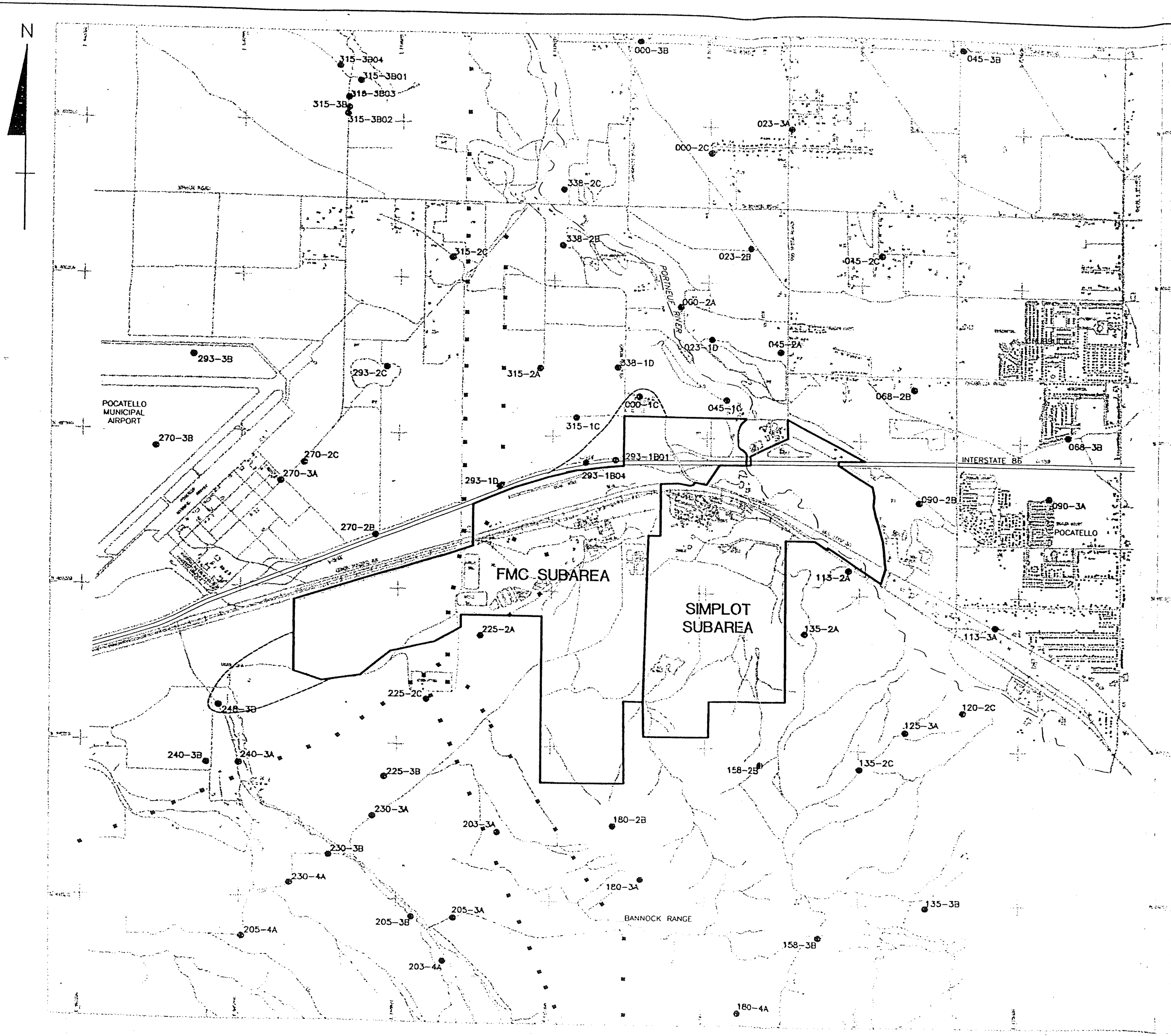
1600 0 1600 FEET

EASTERN MICHAUD FLATS
POCATELLO, IDAHO

FEASIBILITY STUDY

OFFSITE SUBAREA
AREAS WHERE RADIONUCLIDE ACTIVITIES IN SURFACE SOILS EXCEED THE 10^{-5} INCREMENTAL CANCER RISK LEVEL

FIGURE 26



NOTES:

1. CONTOURS SHOWN CORRESPOND TO INCREMENTAL CANCER RISK OF 10^{-4}
2. NO AREAS EXCEED 10^{-4} RISK FOR URANIUM–238, POLONIUM–210, AND LEAD–210.

LEGEND:

270–3A ● SOIL SAMPLING LOCATION AND DESIGNATION

——— RADIUM–226

SCALE

1600 0 1600FEET

EASTERN MICHAUD FLATS

POCATELLO, IDAHO

FEASIBILITY STUDY

OFFSITE SUBAREA AREAS WHERE RADIONUCLIDE ACTIVITIES IN SURFACE SOILS EXCEED THE 10^{-4} INCREMENTAL CANCER RISK LEVEL

FIGURE 27

The list of COPCs[3] for soil, air, and ground water developed for the Risk Assessment are shown in Table 14. The potential for these COPCs to impact health was further evaluated using more realistic and site-specific exposure assumptions.

6.1.5 Toxicity Assessment

The toxicity assessment presents the toxicity data for the COPCs at the EMF site and provides an estimate of the relationships between the extent of exposure to the COPCs and the likelihood and/or severity of potential adverse health effects. The EMF site has both chemical and radiological contaminants that exert their toxicological effects in different ways and require different assessment approaches.

Toxicity information is provided in the Risk Assessment for the COPCs. Generally, cancer risks are calculated using toxicity factors known as slope factors (SFs), while noncancer risks are assessed using reference doses (RfDs). Tables 15 - 17 show the toxicity values for carcinogens, noncarcinogens, and radionuclides.

6.1.5.1 Quantitative Indices of Toxicity

Quantitative indices of toxicity were compiled for the dose-response assessment that was used in estimating the relationship between the extent of exposure to a contaminant and the potential increased likelihood and/or severity of adverse effects.

The following EPA sources were used to obtain toxicity values:

- The Integrated Risk Information System (IRIS) computer database. This is the preferred source of toxicity values because these data are the most recent EPA criteria available and have been reviewed extensively by EPA;
- The Health Effects Assessment Summary Tables (HEAST). These tables were consulted if a toxicity value was unavailable on IRIS. EPA's Environmental Criteria and Assessment Office (ECAO) established these values for use in risk assessments; and
- EPA's Environmental Criteria Assessment Office.

EPA developed Slope Factors (SFs) for estimating excess lifetime cancer risks associated with exposure to potential carcinogens. SFs are expressed in units of $(mg/kg\text{-}day)^{-1}$ and are multiplied by the estimated intake of a potential carcinogen, in mg/kg-day, to provide an upper-bound estimate of the excess lifetime cancer risk associated with exposure at that intake level. The term "upper-bound" reflects the conservative estimate of the risks calculated from the SF. Use of this approach makes underestimates of the actual cancer risk highly unlikely. SFs are derived from the results of human epidemiological

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[3] Other contaminants may be added to this list if new analytical methods become available (such as for P_4) or new information indicates other contaminants pose a potential risk.

Table 14

SUMMARY OF COPCs BY MEDIA

Chemical	Soil	Groundwater	Air[b]
Aluminum			X
Antimony	X		
Arsenic	X	X	X
Beryllium	X	X	
Boron	X	X	
Cadmium	X		X
Chromium			X
Crystalline Quartz			X
Fluoride	X	X	X
Gross alpha	X[a]	X[a]	
Gross beta	X[a]	X[a]	
Lead-210	X		X
Manganese	X	X	
Mercury	X	X	
Nickel	X	X	X
Nitrate		X	
Phosphorus			X
PM_{10}			X
Polonium-210	X	a	X
Potassium-40	X	a	
Radium-226	a	X	
Radon	a,c		
Selenium	X	X	X
Silver	X		X
Tetrachloroethene		X	
Thallium	X		
Thorium-230	a	a	X
Trichloroethene		X	
Uranium-234		a	
Uranium-238	X	a	X
Vanadium	X	X	
Zinc	X	X	

a Individual radionuclides potentially responsible for elevated gross alpha and gross beta levels are also COPCs.

b Chemicals that exceeded background concentrations and lacked inhalation toxicity criteria (reference concentrations and inhalation unit risks) were retained as COPCs.

c Retained as a COPC mainly for evaluation of potential radon infiltration into buildings under alternate future commercial or industrial uses of the site.

COPC = Contaminant of potential concern.

studies, or chronic animal bioassay data, to which mathematical extrapolation from high to low doses, and from animal to human studies, have been applied.

EPA developed Reference Doses (RfDs) to indicate the potential for adverse health effects from exposure to chemicals exhibiting noncarcinogenic effects. RfDs, which are expressed in units of mg/kg-day, are estimates of lifetime daily exposure for humans, including sensitive subpopulations likely to be without risk of adverse effect. Estimated intakes of contaminants of concern from environmental media (*e.g.*, the amount of a contaminant of concern ingested from contaminated drinking water) can be compared to the RfD. RfDs are derived from human epidemiological studies or animal studies to which uncertainty factors have been applied.

6.1.5.2 Combining Radionuclide and Chemical Cancer Risks

The methods used by EPA for estimating cancer risks from exposure to chemical and radionuclide carcinogens are similar in their general approach, but differ significantly in some of their details. One important difference is in the way toxicity values (*i.e.*, SFs) were developed. For both radionuclides and chemical carcinogens, SFs are obtained by extrapolating from experimental and epidemiological data. However, for radionuclides, human epidemiological data usually form the basis of the extrapolation, while for many chemical carcinogens, laboratory experiments are the primary basis of the SF extrapolation. Another even more fundamental difference between the two is that SFs for chemical carcinogens generally represent an upper bound or 95% confidence limit value, while radionuclide SFs are best estimates or central tendency values. In light of these differences, the two sets of risk estimates are tabulated separately in the risk assessment.

6.1.6 Exposure Assessment

The exposure assessment characterizes the exposure scenarios, identifies potentially exposed populations and their exposure pathways and routes of exposure, and quantifies exposure in terms of chronic daily dose (mg/kg/day or milligrams of contaminant taken into the body per kilogram of body weight per day). EPA Superfund guidance recommends that both RMEs (reasonable maximum exposures) and average exposures be calculated in site risk assessment. RME exposures are calculated using assumptions that result in higher than average exposures to ensure that the risk assessment results are protective of the reasonably maximally exposed individual. For this risk assessment, RME and average exposures (identified as the central tendency (CT)) were quantified by using Region 10 EPA default exposure factors (*e.g.*, body weight, contact rate, exposure frequency and duration) with site-specific exposure point concentrations.

Exposure and risk estimates were calculated for all of the chemicals and radionuclides selected as COPCs for an environmental medium for every sampling location using the 95% Upper Confidence Limit (UCL) of the arithmetic mean of the concentrations measured at those locations. Because some of the concentrations of some of the COPCs were at or close to background levels at many of the locations evaluated, the exposures and risk associated with background concentrations also were calculated for each exposure scenario for comparison.

For workers, only RME exposures were calculated since default exposure factors were not available. For residents site-specific information was used in estimating intake factors for consumption of homegrown produce. Potential residential exposures from the other pathways were estimated using

EPA's standard default exposure factors. Categories of workers selected for the risk assessment and the exposure factors used in the risk assessment were based on information provided by FMC and Simplot.

6.1.6.1 Alternate Future Uses of the FMC and Simplot Plants

Both Plants are currently expected to continue operations for the foreseeable future; however, one or both plants could cease operations and be converted to an alternate use. Because of the industrial nature of the plants and the large amount of waste materials at the facilities, future residential use of the Plant areas was considered unlikely. A more likely future use would be some alternate commercial or industrial use. Under such a future use scenario, a worker at the redeveloped site would probably have the greatest potential exposure to site contaminants. Accordingly, the potential exposure of a hypothetical future site worker was evaluated to assess the risks the Plant area could pose in the future if it were to be converted to a different use. The exposure pathways for the hypothetical future plant worker were assumed to be the same as those for current workers, with two additions. Because the site is not served by a public water supply system, ground water might be used as a source of potable water, in which case future plant workers could be exposed to contaminants in ground water. In addition, during Plant redevelopment, new buildings could be constructed in areas having elevated levels of radionuclides in the soil. Workers using such buildings could be exposed to elevated levels of radon in indoor air that infiltrated the buildings from the adjacent soil.

6.1.7 Risk Characterization

For carcinogens, risks are estimated as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to the specific carcinogen. Excess lifetime cancer risk is calculated by multiplying the SF (see toxicity assessment, section 6.1.2) by the quantitative estimate of exposure, the "chronic daily intake." These risks are probabilities generally expressed in scientific notation (*e.g.*, $1x10^{-6}$). An excess lifetime cancer of 1x10 indicates that an individual has a one in one million (1:1,000,000) chance of developing cancer as a result of site-related exposure to a carcinogen under the specific exposure conditions assumed.

The potential for noncarcinogenic effects is evaluated by comparing an exposure level over a specified time period (lifetime) with a RfD (see toxicity assessment section above) derived for a similar exposure period. The ratio of exposure to toxicity is called a hazard quotient (HQ). Hazard quotients are calculated by dividing the exposure by the specific RfD. By adding the hazard quotients for all COPCs that effect the same target organ (liver, nervous system, etc.), the hazard index (HI) can be calculated.

The RME provides a conservative but a realistic exposure scenario for considering remedial actions at a Superfund site. Based on the RME, when the excess lifetime cancer risk estimates are below $1x10^{-6}$, or when the noncancer HI is less than 1, EPA generally considers the potential human health risks being below levels of concern. Remedial action may be warranted when excess lifetime cancer risks exceed $1x10^{-4}$ (one in ten thousand) and HIs exceed 1.0. Between $1x10^{-6}$ and $1x10^{-4}$, clean up may or may not be selected, depending on individual site conditions including human health and ecological concerns.

The following discussion summarizes the cancer and noncancer risk characterization results for the Eastern Michaud Flats Superfund site.

6.1.7.1 Residential Areas

6.1.7.1.1 Near Plant Areas

As discussed earlier, an area north of the FMC and Simplot fence lines was evaluated in the risk assessment for possible residential use. Because of its proximity to the Plants, it seems unlikely that any residences would be constructed there in the future. In addition, most of the land in this area is owned by FMC or Simplot, and deed restrictions barring residential use have already been or will be placed on these parcels. Nevertheless, all of the residential exposure pathways in this area have potential Incremental Carcinogenic Risks (ICRs) and HQs substantially above benchmark levels (cancer risk of $1x10^{-6}$ or a HQ quotient of 1) in the Northern areas of the FMC and Simplot plants and south of I-86, and the exposure point concentrations are all well above background levels. The highest potential cancer risks are for external radiation exposure from soils (ICRs from $4.5x10^{-4}$ to $4x10^{-3}$) and potential use of contaminated ground water as drinking water (chemical ICRs - $1.7x10^{-4}$ to $9.5x10^{-4}$ due to arsenic; rad ICRs - $1.5x10^{-5}$ to $9.5x10^{-5}$ due to lead-210, estimated from gross alpha). The ICRs for inhalation of airborne contaminants are also elevated in this area (Air Monitoring Station 2: chemical ICR - $1.5x10^{-5}$ due to cadmium, chromium (VI), and arsenic; rad ICR - $6.0x10^{-5}$ due to polonium-210).

6.1.7.1.2 Existing Residential Areas

In the existing residential areas, shown in Figure 24, the incremental radiological cancer risks for the exposure pathways arising from soil are due mainly to external radiation exposure and, for the RME case, fall between $1x10^{-4}$ and $1x10^{3}$ throughout much of the area. Table 18 summarizes the radionuclide cancer risks in existing residential areas and Table 19 summarizes the radiological carcinogenic risks to residents from soil and vegetation. At some locations the exposure point concentrations are comparable to background levels, but at the locations with the higher ICRs the exposure point concentrations are at least 1.5 times background levels. Figures 25-27 show Off-Plant areas were radionuclide activities exceed $1x10^{-4}$ to $1x10^{-6}$ incremental risks.

The incremental chemical cancer risks from the soil pathways range from about $1x10^{-6}$ to $8.4x10^{-5}$ and are mainly due to arsenic. Table 20 summarizes the chemical cancer risks in existing residential areas. The exposure point concentrations giving rise to these risks are comparable to background levels at most locations, but the locations with the higher ICRs have exposure point concentrations 1.5 to 2 times background.

IHQs exceed 1 for the residential soil pathways for antimony, boron, cadmium, fluoride, mercury, vanadium, and zinc. Table 21 summarizes the noncarcinogenic risks to residents from soil and vegetation. The IHQs for cadmium are substantially above 1 at several locations (see Figure 28). The exposure point concentrations of cadmium are due to consumption of homegrown produce.

New information on the quantities of homegrown produce items consumed became available after the HHRA for the EMF site was completed. This information lead EPA to reevaluate the estimates of exposure to site-related contaminants from consumption of homegrown produce and the associated risks. The revised consumption rates, which are approximately 2 to 3 times lower than the original estimates, are believed to more realistically reflect the actual quantities of homegrown produce items likely to be consumed by residents of the Pocatello area. Only the estimated cadmium exposures were quantitatively reevaluated because cadmium was the only COPCs for which the IHQs for this pathway exceeded 1 in existing residential areas. The estimated exposure to the other COCs would also change in proportion to the estimated changes in the cadmium exposures. Revised estimates of the incremental hazard quotients for cadmium exposure from consumption of homegrown produce are reflected in Table 22. In the existing residential areas around the site, IHQs for cadmium exposure via this pathway are highest in residential areas 1, 2, 4, and 6 north of the site, where IHQs for reasonable maximum exposure range from approximately 0.7 (in area 4, southwest of Siphon and Philbin Roads) to approximately 1.4 (in area 1, Rowlands Dairy).

Air emissions from the site have resulted in PM_{10} levels that exceed the NAAQS annual average standard for PM_{10} at Station 2, which was located just north of the FMC fence line, and PM_{10} levels that are noticeably elevated at Station 1. The ICRs for inhalation of airborne contaminants also exceed $1x10^{-6}$ away from the immediate site area (see Table 23 for a summary of the chemical risks to residents from inhalation). The radiological cancer risks are somewhat elevated (ICRs of $1.0x10^{-5}$ and $1.1x10^{5}$) at Stations 3 and 5, which are located near existing residences, due to exposure point concentrations of polonium-210 that are 35% to 40% above background levels (see Table 24 for a summary of the radiological carcinogenic risks to residents from inhalation). The chemical cancer risks slightly exceed $1x10^{-6}$ at Stations 1 and 5 (ICRs of 2.2x10 and 1.1x10) due to exposure point concentrations of cadmium and chromium (VI) 2 to 9 times higher than background levels. Stations 3 and 5 are located near existing residences.

6.1.7.2 Plant Workers

Tables 25-26 summarize chemical cancer risks for workers at FMC and Simplot and Tables 27-28 summarize the radiological risks. The greatest estimated ICRs to current site workers are from exposure to external radiation from soil and other surficial material. These risks range from $1.3x10^{-4}$ to $8.0x10^{-4}$ for the various worker categories evaluated and are 3 to 9 times higher than the risks for identical exposures to local background soils. Incidental soil ingestion and inhalation of airborne contaminants also have estimated ICRs great enough to be of potential concern. Both the radiological and chemical cancer risks were of a similar magnitude for these two pathways. The incremental radiological cancer risks range from $6.0x10^{-6}$ to $2.0x10^{5}$, and the chemical cancer risks range from 1.8x10 to 8.3x10 These risks are approximately 3 to 10 times higher than the corresponding background risks. The soil ingestion risks are due to arsenic, beryllium, and the lead-210 and radium-226 levels estimated from the gross alpha measurements. The inhalation risks are due to cadmium, chromium (VI), arsenic, and polonium-210. None of the estimated IHQs for noncarcinogenic effects exceeded 1 for current site workers. However, PM_{10} levels exceed the NAAQS annual average standard at Station 2, which was used to estimate the exposure of Plant workers to airborne contaminants.

The greatest estimated ICRs to potential future Plant area workers are from inhalation of radon in buildings that may be constructed on or near soils containing radioactive contaminants (approximately $4x10^{-3}$), use of contaminated site ground water as drinking water (1.6x10 to 1.7x10), and external radiation exposure from radionuclides in the soil ($4.8x10^{-4}$ to $9.5x10^{-4}$). The radon risks were estimated based on modeling which is described in Appendix D and are 7 to 8 times higher than background; the external radiation risks are 2.8 to 4.6 times higher than background; and the potential drinking water risks, which are due to lead-210 and radium-226 (estimated from gross alpha activities) and arsenic, are 15 to 21 times higher than background. The risks to potential future plant area workers from incidental soil ingestion and inhalation of airborne contaminants are lower but are still great enough to be of potential concern. The sources and magnitude of these risks are similar to those for current site workers.

6.1.7.2.1 Noncarcinogenic Risks

Noncarcinogenic risks were only identified for future workers at the Plants and are shown in Tables 29 and 30. The incremental hazard quotients range from 1-14 and are due to potential ingestion of contaminated ground water containing arsenic, fluoride, manganese, and vanadium.

6.1.7.3 Assessment of Potential Health Effects from Inhalation of Airborne Particulate Matter (PM_{10})

Airborne particulate matter has been identified as a COPC for air at the EMF site, but its potential health effects could not be assessed in the quantitative risk assessment because there are no quantitative toxicological indices available for particulate matter. However, NAAQS have been established for airborne particulate matter. Thus, the potential for adverse health effects from inhalation of airborne particulate matter was assessed by comparing the PM_{10} levels measured in the EMF study area to the NAAQS.

PM_{10} levels were measured at six air monitoring stations in the EMF study area and a reference location (Station 6) located approximately 13 miles west-southwest of the site (the prevailing upwind direction) every second day for a year beginning in October 1993. The locations of the air monitoring stations are shown in Figure 22. Briefly, stations 2, 1, and 3 were located at increasing distances from the site in the prevailing downwind direction. Station 4 was located at the northwestern edge of the city of Pocatello, between the site and the city. Station 5 was located southwest of the site along Michaud Creek and is upwind of the site under prevailing wind conditions; however, it appears to receive contamination from the site when the wind is very light or is blowing from other directions. Station 7 was located east of the site on the shoulder of the Bannock Hills, at a higher elevation than the other stations.

The maximum and average PM_{10} and TSP values recorded at each station are given in Table 31. The NAAQSs for PM_{10} are: a 24-hour average of 150 $\mu g/m^3$, not to be exceeded more than once per year, and an expected annual arithmetic mean of 50 $\mu g/m^3$. The concentrations of PM_{10} at the air monitoring stations in the vicinity of the EMF site ranged from a minimum daily average of 0.2 $\mu g/m^3$ at Station 5 to a maximum of 150.74 $\mu g/m^3$ at Station 2, which was located in the prevailing downwind direction just across the northern fence line of FMC. The maximum PM_{10} concentration detected at Station 2 was the only detected concentration that approached the 24-hour average standard of 150 $\mu g/m^3$. The annual concentration standard of 50 $\mu g/m^3$ was exceeded only at Station 2 (55.75 $\mu g/m^3$). The annual average PM_{10} concentrations measured at stations 1, 2, and 4 were approximately 60%, 200%, and 30% higher than those at Station 6, the background station. Annual average concentrations at stations 3, 5, and 7 were comparable to the background levels.

Information on the characteristics of the airborne contaminants is discussed in the risk assessment. Analysis of available information suggests that the elevated PM_{10} levels at stations 1 and 2 are due to a combination of active emissions and fugitive dust from the Plants. At Station 2, the highest PM_{10} levels were associated with wind speeds more than 10 mph, which suggests that the highest levels at this station were mainly due to fugitive dust. At Station 1, high levels were associated with both low and high wind speeds, indicating that both active emissions and fugitive dust from the Plants can result in high

PM_{10} levels at this station. Station 4 is located on the edge of Pocatello and is not directly downwind from the Plants under most meteorological conditions. This suggests that the modestly elevated PM_{10} levels seen at this station were due at least in part to non-Plant-related sources such as dust, wood smoke, and vehicular emissions.

Maximum daily average PM_{10} levels were elevated only at stations 2, 5, and 7. As discussed above, the highest levels at Station 2 are probably due to fugitive dust from the Plants. Stations 5 and 7 appear to receive the greatest amounts of contamination from the Plants when the winds are light, indicating that the elevated maximum levels seen at these stations probably reflect active emissions from the Plants.

The concentrations measured at all of the stations are indicative of the exposure's residents living near those stations could experience. Currently, there are no residents living near stations 1 or 2, which had the highest annual average levels. Residents do live in the vicinity of stations 3, 4, and 5; however, PM_{10} levels either are not consistently elevated (stations 3 and 5) or do not appear to reflect site-related contamination (Station 4) at these locations.

The airborne contaminant concentrations measured at Station 2 have been assumed to be of representative exposure point concentrations for Plant workers since airborne contaminant concentrations were not measured within the operating areas of the Plants. Based on this assumption, it appears that Plant workers could be exposed to PM_{10} concentrations above the NAAQSs.

The PM_{10} levels measured at Station 2 could cause respiratory irritation and could aggravate the symptoms of patients with a previous history of asthma, bronchitis, emphysema, or other respiratory diseases.

6.2 Ecological Risk Assessment

A baseline ecological risk assessment was conducted for the EMF site to evaluate the potential for effects of site-related contamination on the natural environment in accordance with EPA regulatory guidance. The findings of the ecological risk assessment are presented below.

Important ecosystems occurring in the vicinity of the site include the riverine, open-water, and mudflat habitats of the Portneuf River and American Falls Reservoir. Extensive areas of native upland sagebrush steppe ecosystems also occur in the foothills and river plains adjacent to the site.

The potential site-related exposure of terrestrial plants and wildlife to COPCs[4] (See Table 32 for a list of Ecological COPCs) was quantitatively estimated. Exposure of aquatic and semi-aquatic birds and mammals to cadmium in river delta sediment was also quantitatively estimated. The following receptors of concern at the site were selected for evaluation:

- Sagebrush Steppe Habitat: shrubs (big sagebrush), grasses (thickspike wheatgrass), mammalian carnivores (coyote), small mammals (deer mouse),

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[4]Other contaminants may be added to this list if new analytical methods become available (such as for P_4) or new information indicates other contaminants pose a potential risk.

Table 32

SUMMARY OF ECOLOGICAL COPCs BY MEDIA

Chemical	Soil	Sediment: Portneuf River	Sediment: Portneuf River Delta[a]	Surface Water
Arsenic		X[b]		
Beryllium		X[c]		
Cadmium	X (shaded)	X[b]	X (shaded)	
Chromium	X	X		
Copper		X		
Fluoride	X (shaded)	X[b]		
Lead-210		X[c]		
Mercury		X[b]		X[d]
Molybdenum	X			
Selenium		X[b, c]		X
Silver	X[c]	X		X
Thallium		X[c]		
Vanadium	X	X		X
Zinc	X (shaded)	X[b]		
Total number of COPCs	7	13	1	4

a See Section 3.
b COPC selected for investigation in Portneuf River delta.
c Chemical exceeds background; ecological screening criteria not available.
d Mercury is considered a COPC in surface water due to the insensitivity of the analytical method (see Section 2.3.2.2) and the concern with mercury contamination of the aquatic food chain, raised from previous studies in American Falls Reservoir (see Appendix F).

Key:

COPC = Contaminant of Potential Concern.
(shaded) = COPC selected for quantitative risk analysis.

large herbivorous mammals (mule deer), upland game birds (sage grouse), raptors (red-tailed hawks), and songbirds (horned larks).

- Riparian Habitat: shrubs (Russian olive) and songbirds (cedar waxwing).
- River Delta Habitat: waterfowl (mallard), shorebirds (spotted sandpipers), and semi-aquatic herbivorous mammals (muskrat).

Cumulative exposure estimates were derived based on site-specific contaminant data and exposure parameters published in literature, such as dietary composition, home range, exposure duration, ingestion rate, and body weight. Both dietary exposure routes and incidental ingestion of contaminated media were quantitatively assessed. Estimated exposures to COPCs were greater for receptors at the site areas compared to exposure for receptors at background locations. The importance of soil ingestion versus food as a percentage of total exposure varied with location, receptor, and COPCs.

The potential toxic effects of COPCs were evaluated based on toxicity benchmarks derived from literature. Conservative assumptions were used where necessary to account for uncertainties of extrapolation from literature studies. Toxicity reference values derived in this manner are likely to encompass the broad range of wildlife sensitivity to COPCs.

For each receptor, the potential ecological risks of each COPC were estimated by calculating a hazard quotient (HQ), which is defined as the total estimated exposure received through all relevant pathways divided by the appropriate toxicity reference value. An HQ greater than 1 indicates a potential risk of adverse chronic effects resulting from exposure. HQ's for plants, mammals, and birds are summarized in Tables 33-35.

Potential risks of adverse effects of fluoride on resident plant and wildlife species of the sagebrush steppe ecosystem were identified. Potential site-related risks were not identified for cadmium or zinc in any of the habitats affected by the site. The estimated risks of fluoride are only marginally above the threshold for toxic effects, and by inference the species at risk may be marginally but not severely affected. Because the potential risks were quantified for effects on individual organisms using conservative assumptions to account for uncertainty, and because the upland species most likely to be impacted occur commonly throughout the region, widespread or significant ecological effects at the population and community levels are not expected.

Given the ongoing air emissions and cumulative toxicity of fluoride, the potential for impacts is expected to increase over time with continued air deposition. A reduction in fluoride loadings could allow for a reduction in the potential for harmful effects on the ecosystem in the future, as well as a reduction in current risks.

6.3 Uncertainty

The numerical results of a risk assessment have inherent uncertainty because of limited knowledge regarding exposure and toxicity, and because of limitations due to the accuracy and representativeness of environmental sampling. Whenever available and appropriate, site specific information from the RI was used for estimation of exposure to reduce uncertainty. Where information was incomplete, conservative assumptions were made and/or conservative default values were used to ensure protection of public health and the environment.

The following sections summarize the most significant uncertainties associated with scenarios in the EMF Human Health and Ecological Risk Assessments.

6.3.1 Uncertainty in the Human Health Risk Assessment

The greatest uncertainties affecting the estimates of potential residential exposures appear to be in the estimates of the soil-to-plant and plant-to-animal transfer factors and in the bioavailability of contaminants in soils that might be accidentally ingested. The soil-to-plant transfer factor for cadmium, which accounts for the bulk of the estimated noncancer risk from consumption of homegrown produce, was based on actual data for the local area, and therefore appears to be fairly reliable.

The greatest uncertainties affecting the estimates of potential worker exposures appear to be the estimates of specific radionuclide concentrations in ground water and soil that had to be estimated from gross alpha measurements, the estimates of radon infiltration into buildings that might be constructed on site in the future, and estimates of the external radiation exposure to current workers derived from the aerial radiological survey of the area conducted in 1986. Confidence in the estimated radiological risks associated with potential ground water consumption is low because of the first factor cited. While there is considerable uncertainty in the modeling process used to estimate potential radon concentrations in future site buildings, the values obtained appear to be consistent with concentrations actually measured in existing site buildings in the past; therefore, these risk estimates appear to be at least moderately reliable. There are some uncertainties in estimating current external radiation exposures from measurements made in 1986. The 1986 data, however, were actual exposure rates measured for the site; therefore, the risk estimates based on these measurements also are believed to be at least moderately reliable.

Uncertainty in the quantitative toxicity estimates for the COPCs for the site also affects the reliability of the risk estimates. However, the confidence in the reference doses and slope factors for the COPCs driving the estimated risks for the site is considered to be moderate to good.

6.3.1.1 Air Pathway Uncertainty

The following are several factors that contribute to the uncertainty associated with the risk estimates for the air pathway: (1) The meteorology during the Superfund air monitoring may not have adequately represented the range of possible valley weather patterns. (2) Only three of four furnaces were in operation during the CERCLA monitoring period (the associated feedstock operations and calcining were also at reduced capacity). (3) Air monitors were sited for chemical speciation and to verify the representativeness of the model. There were not necessarily sited to represent the Reasonable Maximum Exposed Individual. (4) Since the Remedial Investigation air monitoring effort was completed, FMC's ore has been mined from a different source. Current feedstocks may be richer in some COPCs. (5) Certain constituents were not included in the study, (i.e., Phosphine and Hydrogen Cyanide). (6) Wedding filters were used for collection of PM_{10} data. These filters may on average provide readings 20% less than comparable Sierra Anderson Units. Another source of uncertainty with the air pathway risk estimates are in relation to phosphorus and its oxidation products. Quantitative evaluation of potential risks from phosphorus and its oxidation products were unavailable due the lack of a standard

EPA method for measurement of these constituents in air, and lack of information of the toxicological effects from inhaling low levels of these substances over a prolonged period of time. Because of the importance of assessing the risks from releases of phosphorus and its oxidation products to the air at the EMF site, EPA investigated the use of non-EPA methods for measuring these substances in air. Several methods were considered, but none were sufficiently specific and well validated to generate quality data that would meet EPA's guidelines for data useability in risk assessments. Therefore, EPA reluctantly concluded that it was not possible to collect useable data on the concentrations of phosphorus and/or its oxidation products as part of the RI for the site.

In addition, more recently EPA's air program and the Shoshone Bannock Tribes established three new air quality monitoring sites adjacent to the industrial complex northwest of Pocatello in October 1996. From October 7 through December 31, 1996, these sites recorded twenty-two days when levels of particulate matter near the industrial complex were measured above the national particulate standard of 150 micrograms per cubic meter. These levels are nearly 50% higher than that measured during a comparable period of time during the Superfund air monitoring program. It is uncertain what has contributed to these observed differences and it is unclear if the specific contaminants of concern evaluated in the risk assessment would also be expected to increase by 50%.

6.3.1.2 Summary of the Exposure Assessment Uncertainties:

Overall, the exposure estimates obtained are probably highly to moderately reliable for COPCs at the EMF site. Several of the factors adding uncertainty to the estimates tend to result in overestimation of exposure. These include:

- The directed nature of the sampling program;
- The use of conservatively estimated or extrapolated values for some exposure point concentrations; and,
- The use of conservative exposure parameter values in the exposure estimation calculations.

One factor that could lead to an underestimation of the exposures is:

- The use of sample quantitation limits that could result in missing low concentrations of some contaminants that might pose significant risks.

Finally, one factor that could lead to overestimation or underestimation of exposures is:

- The use of the steady state assumption for source concentration estimates.

The cumulative effect of all of the exposure uncertainties most likely is to overestimate the true potential exposure.

6.3.1.3 Summary of Toxicity Assessment Uncertainties

The basic uncertainties underlying the assessment of the toxicity of a chemical include:

- Uncertainties arising from the design, execution, or relevance of the scientific studies that form the basis of the assessment;

- Uncertainties involved in extrapolating from the underlying scientific studies to the exposure situation being evaluated, including variable responses to chemical exposures within human and animal populations, between species, and between routes of exposure; and

- The absence of quantitative toxicological indices for some chemicals that may result in underestimation of the total risks posed by the site.

These basic uncertainties could result in a toxicity estimate, based directly on the underlying studies, that either under-or overestimates the true toxicity of a chemical.

6.3.2 Ecological Risk Assessment Uncertainties

Confidence in the results of the risk assessment is considered to be high. Maximal use was made of site-specific exposure data, thereby reducing a major source of uncertainty. Exposure estimates for plants and wildlife was based on statistically designed sampling; hence, the modeled exposure estimates have a high degree of reliability. Toxicity testing and chemical analysis of sediments provides adequate information to evaluate potential impacts of contaminants to the Portneuf River, which were judged to be minimal. In general, the risk assessment is more likely to overestimate rather than underestimate the risks of adverse effects of the site because of the conservative nature of the assumptions used.

Principal uncertainties and limitations of the risk assessment are related to selection of a limited number of COPCs and endpoint species for evaluation, deficiencies of the fluoride chemical analyses, assumptions used to derive exposure estimates and toxicity reference values, the limited field verification of risks, and interpretation of the broader ecological significance of the hazard quotients.

6.4 Need for Action

The Baseline Risk Assessment (Human and Ecological) supports the conclusion that hazardous substances are found on the site and that the actual or threatened release of these substances from this site, if a response action is not taken, may present an imminent and substantial endangerment to public health, welfare, or the environment.

7.0 Remedial Action Objectives

The overall objective of the remedial actions for the Eastern Michaud Flats site is to provide an effective mechanism for protecting human health and the environment from contaminated site soils and ground water. To address the potential risks from the site, the following cleanup objectives were developed:

7.1 FMC and Simplot Plant

- Reduce the exposure to radon that would occur in future buildings constructed within the Plant Areas under a future industrial scenario.

- Prevent external exposure to radionuclides in soils at levels that pose estimated excess cancer risks greater than 1×10^{-4}, or site specific background levels where that is not practicable.

- Prevent ingestion or inhalation of soils containing Contaminants of Concern (COCs) at levels that pose estimated excess risks above 1×10^{-4}, a non cancer risk HQ of 1, or site-specific background levels where that is not practicable.

- Reduce the release and migration of COCs to the ground water from facility sources that may result in concentrations in ground water exceeding risk-based concentration (RBCs) or chemical specific Applicable or Relevant and Appropriate Requirement (ARAR), specifically Maximum Contaminant Levels (MCLs).

- Prevent potential ingestion of ground water containing COCs having concentrations exceeding RBCs or MCLs (chemical specific ARARs) (see Table 36). The RBCs shown in Table 36 correspond to a cancer risk of 10^{-6} or a Hazard Index of 1.0.
- Restore ground water that has been impacted by site sources to meet all RBCs or MCLs for the COCs

7.2 Off-Plant Area

The following cleanup objectives would apply for the Off-Plant Area:

- Prevent future consumption of homegrown produce grown in areas of the site where soil constituents levels result in a potential noncarcinogenic risk exceeding a HQ of 1.

- Prevent external exposure to radium-226 in soils at levels that pose cumulative estimated excess risks above 1×10^{-4}.

- Prevent the potential for future impacts to ecological receptors by monitoring fluoride at the site and surface water at springs (see Table 37 of ecological COCs and Risk-based Concentrations). If monitoring data indicates that fluoride levels in the environment are increasing, beyond that observed during the RI sampling, and the potential for an unacceptable ecological risk is indicated, additional actions, including source controls, may be required.

TABLE 36

RISK BASED AND MAXIMUM CONCENTRATION OF CONTAMINANTS OF CONCERN IN GROUNDWATER				
Substance of Concern	Units	Maximum Detected Concentration	Risk Based Concentration	Maximum Contaminant Level (MCL)
Antimony	mg/l	1.07	.006	.006
Arsenic	mg/l	5.53	.000048	.05
Beryllium	mg/l	.083	.000019	.004
Boron	mg/l	89	1.36	_
Cadmium	mg/l	3.9	.008	.005
Chromium	mg/l	7.58	.077	0.1
Fluoride	mg/l	2,815	.93	4
Manganese	mg/l	91.2	.077	_
Mercury	mg/l	.0043	.0046	.002
Nickel	mg/l	3.46	.299	0.1
Nitrate	mg/l	660	25.03	10
Radium-226	pCi/L	7.09	.39	5*
Selenium	mg/l	19.73	.07	.05
Thallium	mg/l	9.09	.001	.002
Vanadium	mg/l	22.317	.108	_
Zinc	mg/l	28.9	3.92	_
Tetrachloroethene	mg/l	.035	.001	.005
Trichloroethene	mg/l	.028	.002	.005
Gross Alpha[b]	pCi/L	1,690	_	15
Gross Beta[c]	pCi/L	1,355 pCi/l	_	4 mrem/yr

Key:

* Combined Ra 226 and Ra 228

[a] RBCs for groundwater based on drinking water and watering homegrown produce. RBC value based on cancer risk of 10^{-6} or HQ=1

[b] Individual radionuclides potentially responsible for elevated gross alpha and gross beta levels are also COPCs. These include, but are not limited to, Lead-210, Polonium-210, Potassium-40, Thorium-230, Uranium-234, and Uranium-238.

[c] Beta particle and photon activity based on consumption of 2 liters/day

Shaded chemicals are COCs identified in the FS

- Prevent potential ingestion of ground water containing COCs having concentrations exceeding RBCs or MCLs (chemical specific ARARs) (see Table 36). The RBCs shown in Table 36 correspond to a cancer risk of 10^{-6} or a Hazard Index of 1.0.

With respect to radionuclides and metals in soils, the above remediation goals were established after first considering the 10^{-6} excess risk as the point of departure. However, since local background for these radionuclides poses risks greater than 10^{-6}, the 10^{-4} level is the most protective risk level which is measurable and above background.

8.0 DESCRIPTION OF ALTERNATIVES

Each of the remediation alternatives in this section was developed as a way to mitigate the risks from contamination on the site. A general discussion of each of the alternatives follows.

The FS evaluated a range of alternatives for each subarea that could be used to address actual and/or potential threats posed by the site. These alternatives are summarized below and include capital and Operation and Maintenance (O&M) costs discounted at a 5 percent rate of return over 30 years. Since the FS alternatives used similar numbering for each subarea, the following letters have been added to the alternatives: 0- represents an Off-Plant area alternative, F- represents an FMC plant alternative, and S- represents a Simplot plant alternative.

These alternatives were initially compared on the basis of effectiveness, implementability and cost. The alternatives presented below were evaluated in detail. Alternatives F1 and S1 (no action) for the FMC and Simplot plants were eliminated because they were identical to alternatives F2 and S2 (no further action), but did not recognize actions already taken by the Companies. EPA considers alternatives O1, F2, and S2 as the baseline by which other alternatives should be compared.

All alternatives include some provision for review of the cleanup at least every 5 years to ensure the remedy remains protective. The primary difference among the alternatives at FMC is the type of capping proposed for the old phossy pond and calciner solids areas. The primary difference for Simplot alternatives is the action to be taken on the gypsum stack. These alternatives are as follows:

8.1 Off-Plant area

8.1.1 Alternative 01: No Action

Capital Cost: $0
Annual O&M Cost: $0
Present Worth 30-Year Cost Estimate: $0

No action would be taken under this alternative. It was included because it is required by EPA's guidance, and establishes a baseline to compare the level of environmental protection provided by other alternatives.

8.1.2 Alternative 02: Vegetation/Bio Monitoring

Capital Cost: $0
Annual O&M Cost: $12,200
30-Year Cost Estimate: $187,544

Alternative 2 consists of a program to monitor levels of fluoride in the Off-Plant area. This would consist of periodic collection and analysis of vegetation or some other form of biomonitoring to assess the levels of fluoride in the environment. This alternative has been developed to address the potential risk for ecological receptors due to ingestion of vegetation containing fluoride.

8.1.3 Alternative 03: Institutional Controls

Capital Cost: $183,094
Annual O&M Cost: $12,200
Present Worth 30-Year Cost Estimate: $370,637

This alternative includes the monitoring elements of alternative 02, and land use controls[5] such as recorded deed restrictions, and environmental easements to restrict property use and inform future property owners of the potential human health risks associated with consumption of homegrown produce from this area. Implementation of this alternative would likely include a combination of these controls with a preference for environmental easements.

8.1.4 Alternative 04: Removal and Replacement of Soil Cover

Capital Cost: $6,869,304
Annual O&M Cost: $12,200
Present Worth 30-Year Cost Estimate: $7,056,848

Alternative 04 includes all actions under alternative 03, and removal/replacement and/or covering of soils at the time of any future residential development if the soils exceed cadmium or radium-226 levels that represent an unacceptable excess risk.

8.2 FMC Subarea (FMC)

8.2.1 Alternative F2: No Further Action

Capital Cost: $0
Annual O&M Cost: $0
Present Worth 30-Year Cost Estimate: $0

No further action would be taken under this alternative. It was included because it is required by EPA's guidance, and establishes a baseline to compare the level of environmental protection provided by other alternatives. This alternative does recognize a number of actions taken during the course of the RI by FMC to meet various environmental regulations (see section 2.4.2). Some of the major actions include: Installation of air scrubbers (1991); closure of the unlined pond 8S (1994); construction of new RCRA surface impoundment- 16S (1993); paving of plant roads (1993); construction of a new lined calciner pond (1993); and, placement of some deed restrictions on FMC property to prohibit residential use in the future. FMC has estimated that the costs of the various projects completed over the last few years at $31,600,000.

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[5] The Off-Plant areas are currently zoned as industrial by Bannock County. However this alternative does not rely on zoning to control future land use, because it is subject to change by local government.

8.2.2 Alternative F3: Institutional Controls and Ground water Monitoring

Capital Cost: $63,000
Annual O&M Cost: $84,000
Present Worth 30-Year Cost Estimate: $1,354,000

Alternative F3 relies on the use of institutional controls to prevent or minimize contact, ingestion, or inhalation of contaminants in soils and ground water. Institutional controls include the following: plant access restrictions such as fencing and security; plant work rules such as use of personal protection equipment; plant construction practices to reduce radon levels in buildings; land use restrictions controlling future use; and water usage restrictions to prevent ingestion of affected ground water. This alternative also includes a ground water monitoring program to evaluate the effectiveness and efficiency of the remedial action selected.

8.2.3 Alternative F4: Institutional Controls, Surface Controls and Soil Cover, and Ground water Monitoring

Capital Cost: $3,130,000
Annual O&M Cost: $109,000
Present Worth 30-Year Cost Estimate: $4,798,000

This alternative includes all actions of alternative F3 (institutional controls) plus grading, soil cover, and vegetation for the calciner pond solids area[6] and old phossy waste pond areas (Ponds 1S-7S, 1E-7E, 9S, and 10S), and lining of the railroad swale. Grading would consist of backfilling low areas (e.g., former Ponds 1E, 4E, and 9S) to bring them up to the surrounding grade levels, and then shaping the surfaces to enhance surface drainage and reduce the potential for infiltration. A surface soil cover of 12 inches would be placed over the backfill. Runoff would be directed toward natural drainage collection areas in the northern and northwestern portions of the FMC property. The total area to be graded and covered is approximately 44 acres. Actions in the railroad swale area would involve extension of the existing liner to prevent infiltration of surface water runoff.

8.2.4 Alternative F4A: Institutional Controls, Surface Controls and Capillary Barrier Cap, and Ground water Monitoring

Capital Cost: $6,620,000
Annual O&M Cost: $109,000
Present Worth 30-Year Cost Estimate: $8,288,000

This alternative includes all actions of alternative F4 but replaces the 12 inches of soil cover with a capillary barrier cap for the calciner pond solids area and old phossy waste pond areas (Ponds 1S-7S, 1E-7E, 9S, and 10S). The capillary barrier cap design under consideration consists of 2 feet of top soil underlain by a 6-inch gradational layer and 18 inches of well sorted coarse material, which can be either slag or river gravel. Runoff would be directed toward natural drainage collection areas in the northern and northwestern portions of the FMC property, as included in alternative F4. The total area to be graded and covered is approximately 44 acres.

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[6] In 1993 the old calciner ponds were replaced with double lined ponds. The calciner solids are the material and underlying contaminated soil that was excavated from the old ponds. It is now stored in an area south of the new ponds.

8.2.5 Alternative F5A: Institutional Controls, Source Containment and Native Soil Cap, and Ground water Monitoring

Capital Cost: $3,994,000
Annual O&M Cost: $109,000
Present Worth 30-Year Cost Estimate: $5,662,000

This alternative includes all actions of alternative F4 (institutional controls and grading and soil cover) except that the cover on the calciner solids area and old phossy waste pond areas would include an additional 12 inches of subgrade material below the soil cover (the FS refers to this as a "native soil cap"). For the calciner pond solids area, hydro seeding with native plant species is proposed. For the old phossy waste pond areas, vegetative cover is also proposed; however, due to the location of these areas with respect to active plant operations, other surface materials that would withstand local traffic may be appropriate above the native soil cap. Like alternative 4, the total area to be covered with native soil is approximately 44 acres.

8.2.6 Alternative F5B: Institutional Controls, Source Containment and Asphaltic Concrete Cap, and Ground water Monitoring

Capital Cost: $4,443,000
Annual O&M Cost: $153,000
Present Worth 30-Year Cost Estimate: $6,787,000

This alternative includes all actions under alternative F5A (institutional controls, grading, and native soil cap) except that an asphaltic concrete cap would be placed over the old phossy waste ponds. Grading, shaping, and placing soil cover on the calciner pond solids would be the same as described in Alternative 4. The asphaltic cap would consist of 10 inches of subgrade material, 9 inches of base, topped with a minimum of two inches of asphaltic concrete.

8.2.7 Alternative F5C: Institutional Controls, Surface Controls and Multi-Layer Cap, Source Containment, and Ground water Monitoring

Capital Cost: $11,856,000
Annual O&M Cost: $109,000
Present Worth 30-Year Cost Estimate: $13,524,000

Institutional Controls and Ground water Monitoring were described under Alternative F3 and are also included in this alternative. This alternative includes all actions of alternative F4 (institutional controls) plus grading, soil cover, and vegetation for the calciner pond solids area and old phossy waste pond areas (Ponds 1S-7S, 1E-7E, 9S, and 10S) and lining of the railroad swale. Grading and placement of the cap in the old phossy waste ponds would be the same as described in Alternative F5A, except that instead of a native soil cap, a multi-layer cap would be used. The multi-layer cap would consist of a minimum of six inches of subgrade overlain by a geosynthetic clay liner (GCL), and a flexible membrane liner (40 mil minimum). A protective cover with a minimum thickness of three and one-half feet would be constructed above the GCL and flexible membrane liner. The upper layer would consist of 12 inches of topsoil, which would be hydro seeded with native vegetation.

8.2.8 Alternative F6A- Institutional Controls, Source Containment and Asphaltic Concrete Cap, Excavation and Disposal, and Ground water Monitoring

Capital Cost: $10,160,000
Annual O&M Cost: $153,000
Present Worth 30-Year Cost Estimate: $12,504,000

Institutional Controls and Ground water Monitoring were described under Alternative F3 and are also included in this alternative. This alternative includes all actions of alternative F3 (institutional controls) plus grading, soil cover, and vegetation for the calciner pond solids area and old phossy waste pond areas (Ponds 1S-7S, 1E-7E, 9S, and 10S) and lining of the railroad swale.

This alternative includes the asphaltic cap as described under alternative F5B for the old phossy waste ponds and adds excavation and disposal of the calciner pond solids into a new, secure landfill. The landfill would have two geomembrane bottom liners, with a leachate collection between the two liners. A multi-layer cap similar to that described in F5C would be placed over the calciner pond solids once all of the solids have been excavated and placed in the new landfill.

8.2.9 Alternative F6B: Institutional Controls, Surface Controls and Soil Cover, Excavation and Stabilization, and Ground water Monitoring

Capital Cost: $14,675,000
Annual O&M Cost: $109,000
Present Worth 30-Year Cost Estimate: $16,343,000

This alternative is identical to F6A with the exception that the calciner solids would be stabilized prior to placement in a new landfill. Excavation and ex-situ stabilization consists of excavating and removing the calciner pond solids from their existing disposal area, mixing these materials with Portland cement or another stabilizing agent, and placing the stabilized material in a new landfill. The landfill would have a cap as described in Alternative F6A.

8.2.10 Alternative F7-Institutional Controls, Surface Controls and Multi-Layer Cap, and Ground water Monitoring, Extraction and Recycling:

Capital Cost: $12,381,000
Annual O&M Cost: $123,000
Present Worth 30-Year Cost Estimate: $14,264,000

Institutional Controls and Ground water Monitoring were described under Alternative F3 and are included in this alternative. This alternative also includes the actions for the calciner solids area described under alternative F4, and the actions for the old phossy waste pond areas described under alternative F5C. This alternative adds a ground water extraction system. This system would consist of installing wells near the northern boundary of the FMC property, and extracting ground water from the shallow aquifer at a rate sufficient to capture contaminated ground water above MCLs. Ground water flow modeling indicates extraction of a total of approximately 350 gallons per minutes at two locations would be sufficient to intercept the ground water plume. This water is expected to be near or below MCLs when extracted. The water may be of a quality suitable for use in the FMC plant without treatment or potentially discharged to the Portneuf River. This discharge would be subject to the requirements of the NPDES permit program.

8.2.11 Alternative F8B- Institutional Controls, Surface Controls and Asphaltic Concrete Cap, Excavation and Stabilization, and Ground water Monitoring, Extraction, Treatment and Recycling

Capital Cost: $18,988,000
Annual O&M Cost: $704,000
Present Worth 30-Year Cost Estimate: $29,802,000

Institutional Controls and Ground water Monitoring were described under Alternative F3 and are included under this alternative. This alternative also includes actions for the old phossy waste ponds described under alternative F5B, actions for the calciner pond solids area described under F6B, and ground water extraction described under alternative F7. This alternative adds a process to treat extracted ground water. Extracted ground water would be piped to an equalization tank, treated by chemical precipitation (ferric chloride), and added to the Industrial Waste Water basin return water line. Solids produced from the treatment process would be disposed of in an on-site hazardous waste management unit.

8.3 Simplot Plant

8.3.1 Alternative S2: No Further Action

Capital Cost: $0
Annual O&M Cost: $0
Present Worth 30-Year Cost Estimate: $0

No further action would be taken under this alternative. It was included because it is required by EPA's guidance, and establishes a baseline to compare the level of environmental protection provided by other alternatives. This alternative does recognize a number of actions taken during the course of the RI by Simplot to meet various environmental regulations (see section 2.4.1). Some of the major actions taken or planned include removal of the unlined East Overflow Pond and replacement with a lined impoundment, repair of a leaking underground line from the Nitrogen Solutions Plant and replacement with a double lined pipe, installation of several lined treatment ponds, installation of an ore slurry pipeline, decommissioning of the calciners, road paving, and installation of additional air emission control systems. Simplot has estimated that the costs of the various environmental projects completed during the last few years at approximately 56 million dollars.

8.3.2 Alternative S3: Institutional Controls & Ground water Monitoring

Capital Cost: $96,434
Annual O&M Cost: $62,464
Present Worth 30-Year Cost Estimate: $1,056,659

This alternative combines a variety of institutional controls for ongoing Don Plant operations including the following; additional worker safety programs and personnel monitoring primarily to reduce risks from gamma radiation; requirements for radon-resistant buildings constructed in the plant area in the future; and, ground water quality monitoring and legally enforceable restrictions to prevent use of impacted ground water.

8.3.3 Alternative S4A: Institutional Controls, Removal/Disposal, Source Control #1

Capital Cost: $855,585
Annual O&M Cost: $145,119
Present Worth 30-Year Cost Estimate: $3,086,420

This alternative includes the institutional controls and ground water monitoring of alternative S3 and adds the following components: (1) Excavation of Phosphate Ore Residue from the dewatering pit, disposal of excavated material on the Gypsum Stack and covering the excavated area with soil and vegetation; (2) Excavation of gypsum sediments from the former east overflow pond, disposal on the gypsum stack, and installation of a new 60 mil, high density polyethylene synthetic lined pond. The new pond would be used for the temporary storage of liquids during plant upsets or power failures; (3) Improvements in the Gypsum Stack Decant System to reduce the amount of ponded water on the surface of the upper gypsum stack; and, (4) Construction of a stable road surface on the gypsum stack to reduce fugitive emissions.

8.3.4 Alternative S4B: Institutional Controls, Removal/Disposal, Ground water Containment, Source Control #1

Capital Cost: $1,544,406
Annual O&M Cost: $175,619
Present Worth 30-Year Cost Estimate: $4,224,405

This alternative includes all the components of alternative 4a (institutional controls, ground water monitoring, and source control) plus the installation of a network of ground water extraction system wells immediately downgradient of the gypsum stack. The purpose of this extraction system is to intercept ground water Contaminants from the gypsum stack and prevent them from spreading further into the aquifer. The extracted ground water may be of sufficient quality to be used in the Simplot process without treatment.

8.3.5 Alternative S5: Institutional Controls, Removal/Disposal, Source Control #2

Capital Cost: $56,344,875
Annual O&M Cost: $7,959,463
Present Worth 30-Year Cost Estimate: $175,402,962

This alternative is the same as Alternative S4B, except that instead of installing an improved decant system on the gypsum stack and a ground water extraction system, an impervious geosynthetic liner would be installed on the top of the gypsum stack and the decanted liquid returned to the process via a leachate collection system. Under this option gypsum placement would continue on top of the new liner. This alternative would also include asphalt paving of roads on the gypstack due to increased traffic during installation of the synthetic liner.

9.0 SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

The NCP requires that each remedial alternative analyzed in detail in the FS be evaluated according to specific criteria. The purpose of this evaluation is to promote consistent identification of the relative advantages and disadvantages of each alternative, thereby guiding selection of remedies offering the most effective and efficient means of achieving site cleanup goals. There are nine criteria by which feasible remedial alternatives are evaluated. While all nine criteria are important, they are weighed differently in the decision-making process depending on whether they describe a consideration of technical or socioeconomic merits (primary balancing criteria), or involve the evaluation of non-EPA reviewers that may influence an EPA decision (modifying criteria).

9.1 Threshold Criteria

The remedial alternatives were first evaluated by comparison with the threshold criteria: overall protection of human health and the environment and compliance with ARARs. The threshold criteria must be fully satisfied by candidate alternatives before the alternatives can be given further consideration in the remedy selection process.

9.1.1 **<u>Overall protection of human health and the environment</u>** *Determines whether an alternative eliminates, reduces, or controls threats to public health and the environment through institutional controls, engineering controls, or treatment.*

Off-Plant area- Alternative 01 (no action) and Alternative 02 (monitoring only) do not control exposures from potential consumption of homegrown fruits and vegetables to satisfy this criterion. Alternatives 03 (institutional controls and monitoring) and 04 (institutional controls, monitoring, and soil removal) both meet this criterion by preventing or controlling potential future exposures to soils in the Off-Plant area. Note: Since alternatives 01 and 02 do not meet this threshold criteria they are not discussed further in this ROD.

Simplot- Alternative S2, (no further action) would not meet this criterion because it does not prevent exposure to indoor radon or contaminated ground water above MCLs in the future. Alternatives S3 (institutional controls) or S4A (institutional controls, removal/disposal, gypsum decant system) would provide protection of human health for future workers by land use restrictions but would not eliminate or reduce contamination to ground water at the gypsum stack. Alternatives S4B (institutional controls, removal/disposal, ground water extraction) and alternative S5 (gypsum stack liner) meet this criterion by capturing leachate either at the base of the gypsum stack or on the liner, thereby reducing or eliminating contamination to ground water. This should result in significant improvement in ground water quality in the Plant area. Note: Since alternatives S2, S3, and S4a do not meet this threshold criteria they are not discussed further in this ROD.

FMC- Alternative F2 (no further action), and alternative F3 (institutional controls & ground water monitoring) do not provide sufficient protection for future workers from potential ingestion of contaminants in ground water or from radon emissions from soils and solids. Alternatives F4 through F8B meet this criterion by relying on institutional controls for protection of future workers from exposure to contaminants in ground water and on a combination of engineering controls and institutional controls for protection from contaminants in soils and solids. All of these alternatives except F8B ultimately rely - fully or partially - on natural processes to reduce contaminants in ground water to MCLs or background levels. Alternatives F7, F8A, and F8B would accelerate the process to some degree. Note: Since alternatives F2 and F3 do not meet this threshold criteria they are not discussed further in this ROD.

9.1.2. Compliance with Applicable or Relevant and Appropriate Requirements (ARARs) *evaluates whether the alternative meets State and Federal environmental and facility siting laws and regulations that pertain to the site or, if not, if a waiver is justified.*

Off-Plant area- No specific ARARs have been identified for the Off-Plant area soils. Ground water in this area currently meets drinking water standards and it is expected to continue to meet MCLs.

Simplot- Both alternative S4B and S5 meet the requirements of all identified ARARs for current Simplot operations and for a future alternate industrial scenario.

FMC- As discussed in section 4 of this ROD a number of ponds and units at FMC are subject to regulation under RCRA. EPA has determined that the RCRA closure requirements are neither applicable nor relevant and appropriate for CERCLA actions in the areas which are the subject of this ROD. The FS alternatives for these areas were designed to reduce infiltration, prevent incidental ingestion, reduce exposure to radiation, and minimize maintenance. Alternatives F4 (grading and soil cover), F4A (capillary barrier cap), F5A (native soil cap), F5B (asphaltic cap), and F5C (multi-layer cap) will minimize infiltration (to at least a 1×10^{-7} cm/sec permeability), minimize maintenance, and control, minimize or eliminate releases to the extent necessary to protect human health and the environment. These alternatives plus F6A, F6B, F7, and F8B meet the requirements of all identified ARARS for current FMC operations and for a future alternate industrial scenario.

9.2 Primary Balancing Criteria

For those alternatives satisfying the threshold criteria, five primary balancing criteria are used to evaluate other aspects of the potential remedies. No single alternative will necessarily receive the highest evaluation for every balancing criterion. This phase of the comparative analysis is useful in refining the relative merits of candidate alternatives for site clean up. The five primary balancing criteria are: long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; short-term effectiveness; implementability; and cost.

9.2.1. __Long-term effectiveness and permanence__ This criterion addressed the results of each alternative with respect to the risk remaining at the site after the conclusion of the remedial action. Evaluation of this criterion includes an assessment of the magnitude of the residual risk from untreated waste or treatment residuals. It also includes an assessment of the adequacy, reliability, and useful life of any controls that are to be used to manage hazardous substances that remain on site after the remediation.

Off-Plant area- Alternatives 03 and 04 would both satisfy this criterion although alternative 04 may be a more permanent and reliable option which eventually could allow for unrestricted use of surrounding properties once removal/replacement had occurred.

Simplot- Both alternative S4B and S5 would provide long term effectiveness in improving ground water quality during continued Don Plant operation. Alternative S4B may be more reliable than alternative S5 since lining of the gypsum stack involves considerable long-term management. In addition, alternative S5 could become less effective over time if the liner were breached or the drain system became clogged.

FMC- All remaining alternatives satisfy this criterion with regard to reliability. The multi-layer cap (F5C) and a capillary barrier cap (F4A) provide a higher level of permanence than the 12-inch soil cover in alternative F4. The Stabilization of calciner solids (F6B) would provide a slightly higher level of long term risk reduction for this material than the other alternatives.

9.2.2. __Reduction of toxicity, mobility, or volume through treatment or recycling__ Evaluation of this criterion included: an assessment of the treatment processes to be employed by each remedial action and the types of wastes they would treat; the amount of waste that would be destroyed or treated; the projected amount of reduction in toxicity, mobility, or volume; the degree to which the treatment is irreversible; and the types and quantities of residuals that would remain after treatment. Also considered in this assessment is whether the alternative would satisfy the expressed preference of Section 121 of CERCLA for remedial actions that reduce toxicity, mobility, or volume of hazardous waste.

Off-site- Neither alternative 03 nor 04 contain any form of treatment.

Simplot- None of the alternatives contain any form of treatment or volume reduction, although both alternatives S4B and S5 include paving on the gypsum stack roads which would physically restrict the mobility of dust and soil contaminants and recycling of contaminated water within the plant.

FMC- All capping alternatives reduce the mobility of contaminants to ground water but do not use any form of treatment. The ground water extraction and recycling in alternative F7, if it were effective, may reduce the residual contamination remaining in the ground water. The addition of ground water treatment as in alternative F8B, if it were effective, would reduce the mobility and reduce the volume of contaminants.

9.2.3 Short-term effectiveness The potential health effects and environmental impacts of each alternative action during construction and implementation were evaluated by this criterion. The factors assessed in this evaluation include the protection of the community and site workers during implementation and construction, environmental impacts during implementation, and the estimated time required to meet cleanup standards.

Off-Plant area- Only Alternative 04 involves any soil removal to achieve the cleanup goal. There could be some short term risks to workers and the environment during implementation of the alternative. Alternative 03 does not involve excavation of soils and does not pose any short-term risks to workers or the environment.

Simplot- Alternative S4B provides the highest short-term effectiveness in terms of rapidity of ground water restoration. This alternative also poses lesser risks to workers and the environment during construction as compared to alternative S5.

FMC- Because all activities will occur at the plant, grading, hauling, and placement of the various cap or cover materials would have little impact on the community or the surrounding environment. Most of the source containment alternatives would not be effective in achieving ground water restoration in the short-term. Alternatives F7, F8, FB may be slightly more effective through ground water extraction. Alternatives F6A and F6B would pose a slightly greater risk to workers for this criterion during excavation/disposal of calciner solids. However, these risks can be easily controlled with personal protective equipment. All alternatives are relatively equal in regard to the time required to complete the action and achieve risk reduction for soils.

9.2.4 Implementability This criterion evaluated the terms of technical and administrative feasibility and the availability of services and materials to accomplish the remediation. Technical feasibility includes relative ease of installation or constructability; the ease of additional remediation, if necessary; and the ease of monitoring the effectiveness of the remediation. Administrative feasibility addresses the degree of procedural difficulty anticipated for each alternative in permitting and institutional requirements.

Off-Plant area- Alternative 03 includes administrative actions to secure the necessary institutional controls in the Off-Plant area. Alternative 04 would include similar controls but would also involve closer scrutiny to trigger the evaluation of soil conditions and cleanup at the time of land use changes in the future. Alternative 04 would be more difficult to implement than alternative 03.

Simplot- Differences between the alternatives in terms of implementability are primarily related to technical feasibility. Alternative S5 would be more difficult to implement due to potential problems with stack stability, potential for liner breaches, longer implementation time, and necessary process modifications. Both alternatives S4B and S5 are equivalent in administrative feasibility and availability of services and materials.

FMC- There are no technical or administrative barriers that would affect the implementation of source containment (capping phossy ponds or excavation and capping of the calciner pond solids) and all alternatives are fairly equal. Alternative F6B would require some initial test of the solidification process prior to full-scale operations. However, these activities can be readily implemented with no anticipated difficulties regarding feasibility or reliability.

9.2.5 Estimated Cost

Consistent with EPA guidance, the cost analysis for each alternative consisted of an order-of-magnitude estimation (accurate to a range from +50% to -30%) of capital, O&M and present worth costs determined for 30 years at a 5 percent discount rate. Table 9-1 summarizes the estimated costs and time required to implement for the range of alternatives. The estimates are based on quotations from vendors and contractors, conventional cost estimating guides, generic unit prices, and prior experience in the area. They are intended as a guide in evaluating the alternatives based on information available at the time of the estimate. Actual costs would depend on true labor and material costs, final scope, schedule, and actual site conditions.

Off-Plant area- Alternative 03 ($370,637) is significantly less costly than Alternative 04 ($7,056,848).

Simplot- The present worth costs for alternative S5 ($175,402,962) are much higher than that for alternative S4B ($4,224,405).

FMC- Alternative F4 is the least costly alternative that meets the threshold criteria for the phossy waste ponds and calciner solids area with a present worth cost of $4,798,000. The most costly alternative is alternative F8B which includes treatment of ground water with a present worth cost of $27,723,000.

9.3 Modifying Criteria

The two modifying criteria are state acceptance and community acceptance.

9.3.1 State acceptance The State of Idaho, Department of Environmental Quality, and Shoshone Bannock Tribes have been involved with the review of the Remedial Investigation, Feasibility Study, Risk Assessment and Proposed Plan for the site. A concurrence letter from the State is included in Appendix C.

9.3.2. Community acceptance. The greatest number of comments received on the proposed plan related to concerns about air quality in the vicinity of the plants and the need for ground water extraction at FMC. EPA carefully considered these comments and made a change in the approach to ground water extraction at FMC. With respect to air quality Superfund is not the appropriate authority to address the ongoing air emissions from an operating facility, and therefore no action specific to control of air emissions is included in this ROD. The EPA responses to the comments are included in the Responsiveness Summary in Appendix A. The local community has been kept informed throughout the process by fact sheets and meetings.

10.0 THE SELECTED REMEDY

EPA's selected remedy combines elements from several alternatives described above. The selected remedy meets the requirements of the two mandatory threshold criteria, protection of public health and the environment, and compliance with ARARs. EPA believes the following actions provide overall protection of human health and the environment while providing the best balance of benefits and tradeoffs for the Eastern Michaud Flats site. The selected remedy uses a combination of containment and institutional controls to achieve optimum compliance with the five balancing criteria: long-term effectiveness, short-term effectiveness, implementability, reduction in toxicity, mobility and volume through treatment and cost.

The preferred remedy presented in the proposed plan outlined separate actions for the FMC plant, Simplot plant, and Off-Plant areas. The selected remedy combines actions for these areas into two operable units: the FMC Plant and Simplot Plant. The actions proposed for the Off-Plant areas are included in each of the two operable units. This is the result of an underlying agreement between the two Companies in order to allow for the creation of two operable units and ultimately two consent decrees. The selected remedy consists of the following actions for each operable unit:

10.1 Simplot Operable Unit (OU)

10.1.1 Ground water

10.1.1.1 Ground water Extraction (Alternative S4B)

Remediation of ground water in the Simplot OU will consist of installation of a network of shallow ground water wells on the northern edge of the gypsum stack and/or downgradient of the Nitrogen Solutions Plant, and the installation of extraction pumps and conveyance piping. The extracted ground water will be recycled into the Don Plant Process. The purpose of the extraction well network is: (1) to contain the migration of COCs from the phosphogypsum stack and reduce the areal extent of shallow ground water contamination within the Plant Area in excess of MCLs or RBCs, and (2) prevent the migration of COCs above MCLs or RBCs into the off-plant area.

Insufficient information was generated by the RI to sufficiently characterize this area for the purposes of designing a ground water extraction system, or estimating recovery time once the gypsum stack is closed. However, a focused hydraulic test was begun in February 1997, pursuant to an EPA approved Workplan, to support development of the ground water extraction alternative. Information from this work will be used to help design the ground water extraction and reuse system including: (1) placement of additional wells to provide the required ground water capture; (2) adjustment of pumping rates as needed; and (3) modifications in the Don Plant process for reuse of the extracted ground water.

Operation and maintenance of the extraction system shall continue until COCs in ground water throughout the Operable Unit are reduced to below MCLs or Risk-based concentrations (cancer risk levels of 10^{-6} and noncancer risk $HI<1$ for residential use), or until EPA determines that continued ground water extraction would not be expected to result in additional cost-effective reduction in contaminant concentrations within the Simplot OU.

10.1.1.1.2 Ground water Extraction System Evaluation

Once the ground water extraction system is implemented, its performance and effectiveness shall be evaluated on at least a quarterly basis. The frequency of monitoring may be reduced, with EPA approval. The evaluation shall be designed to determine the effectiveness of the ground water extraction system with respect to the following:

1. Horizontal and vertical extent of the plume(s) and contaminant concentration gradients;
2. Rate and direction of contaminant migration;
3. Changes in contaminant concentrations or distribution over time; and,
4. Effects of any modifications on the ability of the extraction system to achieve containment.

Ground water extraction will be monitored and adjusted as warranted by the performance data collected during operation. Modifications to the ground water extraction system may include any or all of the following:

1. At individual wells where containment has been attained, pumping rates may be adjusted to achieve the greatest efficiencies;
2. Alternating pumping at wells to eliminate stagnation points;
3. Pulse pumping to allow aquifer equilibration and to allow adsorbed contaminants to partition into ground water; and,
4. Additional extraction wells may be installed at EPA-approved locations to facilitate or accelerate containment of the contaminate plume and help ensure eventual achievement of ground water remediation goals.

10.1.1.2 Improvement to Gypsum Decant System (Alternative S4B)

This element of the selected remedy utilizes engineering controls to reduce the volume of water on the surface of the gypsum stack, which is a contributor to ground water contamination. Improvements to the water decant system will increase the flow rate of water returned to the phosphoric acid plant from the stack, and will consequently reduce the volume of water on top of the stack. This in turn is expected to further reduce seepage to ground water and increase the stability of the stack. A variety of potential decant improvements are under evaluation ranging from siphon systems to more complex capture and drain systems. Improvements to the decant system are considered to be part of Don Plant operations, and as such, design of the system will be part of the ongoing process of optimization of the plant water balance performed by Don Plant personnel. Exact details of the system would be developed based on operational considerations at the time of implementation.

10.1.1.3 Ground water Monitoring and Evaluations (Alternative S4B)

Ground water monitoring and evaluation shall be conducted as part of the cleanup remedy for this OU to determine the effectiveness of the extraction system and other source control measures in reducing the contamination in the Plant area and preventing migration of contaminants to the off-plant area. A surface and ground water monitoring plan shall be submitted including a quality assurance program plan and a sampling plan for EPA approval during the remedial design. At a minimum, the monitoring program shall include semiannual sampling of shallow and deep aquifers and surface water springs,whose source is the shallow aquifer,and an annual evaluation of monitoring data.

10.1.2 Air (Alternative S4B)

Reduction of fugitive emissions from current roads on the face of the gypsum stack will be accomplished by constructing a stable road surface over the gypsum. This will be implemented by placing a gravel road-base over the permanent roads on the stack. The placement of the road-base would be preceded by rough grading, compacting the gypsum road surface and the installation of a woven stabilization geofabric. The geofabric would prevent the gravel from being pushed into the gypsum and prevent the gypsum from migrating through the gravel and back to the road surface. This system will create a barrier between vehicle traffic and the gypsum and should also reduce wind and water erosion of the gypsum on the road surfaces.

10.1.3 Soils and Solids (Alternative S4B)

The selected remedy for the Dewatering Pit is to excavate solids (primarily phosphate ore residue), dispose of the excavated material on the gypsum stack and cover the excavated area with soil and vegetation. Similar action will be taken at the East Overflow Pond, except the area will be covered with a new double lined surface impoundment for collection of non-hazardous plant water.

The selected remedy also combines a variety of institutional controls for ongoing Don Plant operations. Specific details of these components are as follows:

10.1.3.1 Worker Safety Programs (Alternative S4B)

This element involves the addition of an education component to inform workers of the potential health hazards at the facility which are the focus of the Superfund process. An information sheet shall be prepared by Simplot and included in annual health and safety training for current workers and in initial training for new workers.

10.1.3.2 Personnel Monitoring (Alternative S4B)

Exposure to external gamma radiation was estimated by the Baseline Risk Assessment to be the principal potential risk to Simplot workers (primarily to workers on the gypsum stack). Simplot shall implement a program requiring gypsum stack workers to wear radiation-measuring devices which would allow for characterization of actual exposure and reduction of uncertainties associated with this pathway. If an unacceptable level of exposure is measured for any worker, job rotation of this worker, or other protective measures, shall be initiated. If exposure levels are shown to be consistently below the 1×10^{-4} risk based level for the first few years, the monitoring may be discontinued upon EPA approval.

10.1.4 Land Use Controls (Alternative S4B)

Simplot shall implement legally enforceable land use controls that will run with the land (i.e., deed restrictions, limited access, well restrictions and/or well head protection) to prevent ingestion of ground water with COCs above MCLs or RBCs. These controls will remain in place as long as the ground water exceeds MCLs or RBCs.

Simplot shall also implement legally enforceable land use controls that run with the land in the form of deed restrictions to eliminate the possibility for future residential use of the Simplot Plant Area.

10.1.4.1 Construction of Radon-Resistant Buildings (Alternative S4B)

The areas where gross alpha activities were measured above the soil screening level in subsurface soil are shown in Table 4. For these areas, land use controls shall require any future office buildings to be constructed using the radon controlling methods specified in the document "Radon Prevention in the Design and Construction of Schools and Other Large Buildings" (EPA/626/R-92/016, 1994). Following construction, and annually thereafter, the indoor air shall be tested for radon. If the radon activity exceeds either 4 pCi/l, as specified in "Citizens Guide to Radon" (EPA 1992), or any promulgated standard in effect at the time of these future sampling events, additional controls shall be implemented to reduce the radon activity below the target level or promulgated standard.

10.1.5 Off-Plant Area

The following elements of the selected remedy exist in both the FMC and Simplot Ous.

10.1.5.1 Fluoride Monitoring (Alternative O3)

In order to determine the levels of fluoride present and to evaluate the potential risk to ecological receptors, a fluoride monitoring program will be implemented. The monitoring shall generally occur within a three-mile radius of the FMC and Simplot Plants (there may be specific areas outside the three mile radius, which may contain sensitive species or be of particular ecological or cultural value where sampling should also occur) and shall include sampling of vegetation, soils, and appropriate biomonitors. A monitoring plan including a quality assurance program plan and a sampling plan shall be submitted for EPA approval during the remedial design. An evaluation of monitoring data will be conducted annually to determine the fluoride levels and spatial and temporal trends in the environment. If levels which are measured indicate a risk may exist, further evaluation will occur followed by source control or other action, if necessary.

10.1.5.2 Soils (Alternative O3)

This element of the selected remedy is designed to accomplish the following two goals. The first goal is to prevent exposure to soils which pose a 1 in 10,000, or greater, excess risk from radium-226 and the second goal is to restrict the use of agricultural products grown on areas of the site where contaminant levels exceed a HQ of 1 for cadmium (RME case). In order to implement this element the off-plant area is divided into the following areas:

<u>Areas Subject to Land Use Controls</u>

These are areas where soil contaminant levels exceed a HQ of 1 for cadmium (RME case) and/or which pose a 1 in 10,000, or greater, excess risk from radium-226 as shown in Figures 27 and 28. These areas include the Interstate 86 Right-of-Way (51 acres); Chevron Tank Farm (20 acres); City of Pocatello Property (326 acres); a portion of the land owned by a private party named R. Rowland, and a portion of BLM lands to the SW of the FMC facility. In this area the PRPs shall implement legally enforceable land use controls (purchase of a recorded easement with accompanying deed restriction) restricting the use of agricultural products grown thereon for human consumption due to the presence of cadmium in soils. For those areas contaminated with radium-226 legally enforceable land use controls shall be implemented to prevent future residential use.

<u>Areas Subject to Company Monitoring for Residential Development</u>

This area as shown in Figure 29 was not found to exceed the criteria established for the imposition of Land Use Controls but was either close enough to the threshold, or adjacent to lands that exceeded the threshold, to warrant notification to current and future property owners if residential use is likely to occur. In this area the PRPs shall monitor property use for residential development and inform residential property owners of potential human health risks associated with consumption of homegrown fruits and vegetables due to the presence of cadmium in soils. Similar restrictions on use of agricultural products could be implemented on such areas, as necessary.

In conjunction with this monitoring and land use controls described above, a test program shall be developed to evaluate actual uptake into produce which may be grown by residents in the affected off-plant areas. A monitoring plan including a quality assurance program plan and a sampling plan shall be submitted for EPA approval during the remedial design. Cadmium concentrations in the soil and produce shall be measured over multiple growing seasons. The results of the test program will be used to determine if monitoring and land use controls are still required or if any additional action is necessary to prevent potential health risks associated with consumption of homegrown fruits and vegetables.

10.1.5.3 Ground water Monitoring

Ground water monitoring and evaluation in the off-plant area shall be conducted as part of the cleanup remedy to: (1) determine the effectiveness of the Plants' source control measures, (2) insure contaminants are not migrating into the off-plant area, and (3) insure that the remedy remains protective of human health and the environment. A surface and ground water monitoring plan shall be submitted including a quality assurance program plan and a sampling plan for EPA approval during the remedial design. At a minimum, the monitoring program shall include quarterly sampling of shallow and deep aquifers and surface water springs whose source is the shallow aquifer and a semiannual evaluation of monitoring data.

10.1.6 Estimated costs for the Simplot OU

The total estimated cost of the selected remedy in the Simplot OU is shown below. These costs are estimated and are considered to be accurate to within -30% to +50%. Costs are described using the present worth methodology with a discount rate equal to 5 percent. The cost estimate includes direct and indirect capital costs, as well as annual operations and maintenance costs.

Estimated Capital Costs: $1,683,000
Estimated O&M Costs: $192,000
Estimated Total Costs: $4,571,000

10.2 FMC Operable Unit

10.2.1 Contaminated Ground water (Alternative F4/F4A)

10.2.1.1 Ground water Monitoring and Evaluation

Ground water monitoring and evaluation shall be conducted as part of the cleanup remedy for this OU to determine the effectiveness of the source control measures in reducing the contamination in the Plant area. A surface and ground water monitoring plan including a quality assurance program plan and a sampling plan, shall be submitted for EPA approval during the remedial design. At a minimum, the monitoring program shall include semiannual sampling of shallow and deep aquifers and surface water springs whose source is the shallow aquifer. A comprehensive evaluation of monitoring data will be conducted annually.

Ground water monitoring will continue and be integrated, to the extent practicable, with the RCRA ground water monitoring program. EPA will periodically review ground water data with the following goals: (1) insure the source control measures at the old phossy waste ponds, calciner solids, and railroad swale are effective, (2) Insure there are no new sources of contamination from existing or new hazardous waste surface impoundments or landfills, (e.g., Pond 9E, Phase IV Ponds, Pond 15S, Pond 8E and the lined calciner ponds), and (3) confirm eventual achievement of MCLs or RBCs. Based on these goals EPA will determine if additional steps are necessary in order to insure the remedy remains protective and ground water is returned to beneficial uses. As stated in the 1991 Region 10 Memorandum of Understanding Between the RCRA and CERCLA programs for the EMF Site[7], selection of an alternative

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[7] If remedial activities conducted pursuant to the NCP at a RCRA facility address only a portion of the units or releases at the facility requiring remediation, the permit would address any such remaining corrective action requirements pursuant to subpart S.

under CERCLA does not preclude more stringent monitoring or corrective actions under RCRA to prevent further and/or future contamination.

10.2.1.2 Contingent Ground water remedy (Alternative F8B)

This element of the selected remedy for ground water is a contingent ground water extraction system. Extraction, if needed, will occur at the locations and rates which will be appropriate to ensure that the contaminated ground water does not migrate beyond Company-owned property and into adjoining springs or the Portneuf River. Containment of contamination shall be achieved via hydrodynamic controls such as long-term ground water gradient control provided by low level pumping. Extracted ground water shall be treated and recycled within the plant to replace unaffected ground water that would have been extracted and used in plant operations.

FMC shall monitor, on a quarterly basis, contaminant levels in the shallow aquifer and nearby springs along the downgradient margin of the current plume. This data shall be evaluated for changes in the concentrations of key parameters (intra well comparisons). Increasing trends in these wells shall trigger resampling to confirm the change(s). If the increase is verified, additional interpretation shall be conducted as directed by EPA. The trigger of the contingency extraction system will be based on evaluations of "clean" wells and nearby springs beyond the plume. Constituent levels in "unimpacted" wells will be compared to MCLs, RBCs, or Aquatic criteria levels (surface water at springs), whichever is more stringent. The above evaluations shall include statistical methods for both intra well comparisons and comparisons with MCLs as described in the 1989 Interim Guidance on Statistical Analysis of Ground-Water Monitoring at RCRA Facilities and in the 1992 Addendum to the Interim Final Guidance. The final determination of plume expansion will be made by EPA, in consultation with IDEQ and the Tribes, and will depend on, (1) expert knowledge of the ground water system at the EMF Site, and (2) statistical results from monitoring wells and springs from which levels of contamination can be measured.

Ground water extraction, if required, shall consist of installing extraction wells in the northern portion of the FMC plant, and extracting ground water from the shallow aquifer at a rate sufficient to capture the contaminated ground water in which concentrations of COPCs exceed MCLs or RBCs. Extracted ground water would be treated prior to discharge or reuse within the Plant. Bench-scale and/or pilot testing will be required during treatment plant design.

To reduce the time needed to install a ground water extraction system, the needed technical data and information shall be gathered, and the design drafted, during the general site remedial design phase.

Ground water extraction, if necessary, shall be periodically monitored and adjusted as warranted by the performance data collected during operation. Modifications to the ground water extraction system may include any or all of the following:

1. At individual wells where containment has been attained, pumping rates may be adjusted to achieve the greatest efficiencies;
2. Stagnation points may be eliminated by using alternating pumping;
3. Pulse pumping may be used to allow aquifer equilibration and to allow adsorbed contaminant to partition into ground water; and,
4. Additional extraction wells may be installed at EPA-approved locations to facilitate or accelerate containment of the contaminate plume and help ensure eventual achievement of ground water remediation goals.

The contingent ground water remedy shall insure that the contamination in the shallow aquifer does not spread any further and institutional controls will ensure that the shallow contaminated aquifer is not used for drinking purposes now or in the future.

10.2.1.2.1 Ground water Extraction System Monitoring

If the ground water extraction system is implemented, its performance shall be monitored on at least a quarterly basis. On approval by EPA, the frequency of monitoring may be reduced. The monitoring system shall be designed to evaluate the effectiveness of the ground water extraction system with respect to the following:

1. Horizontal and vertical extent of the plume(s) and contaminant concentration gradients;
2. Rate and direction of contaminant migration;
3. Changes in contaminant concentrations or distribution over time; and,
4. Effects of any modifications on the ability of the extraction system to achieve containment.

10.2.1.3 Point of Compliance for Ground water

For the purposes of the Superfund remedial action, the ground water cleanup levels for the Plant Area shall be based on MCLs or RBCs. However, under certain circumstances, other regulatory authorities may require more stringent ground water standards within the plant boundaries. Such regulatory authorities would include, but not necessarily be limited to, RCRA, which might require ground water corrective action as result of any releases from RCRA regulated units.

10.2.2 Soils and Solids

10.2.2.1 Capping Ponds and Calciner Solids Area (Alternative F4/F4A)

EPA's selected remedy for reducing infiltration and preventing direct exposure in the FMC OU old phossy ponds 1S-7S, 1E-7E, 9S, and 10S and Former Calciner Pond Solids Storage Area is either installation of a soil cover or capillary barrier cap and vegetation. Those ponds or areas which were more extensively used and contain a greater volume of waste are expected to require a capillary barrier cap, or equivalent, in order to reduce infiltration and provide a greater level of permanence than a soil cover. Due to the presence of buried elemental phosphorus in some areas, the higher level of permanence afforded by the capillary barrier cap is warranted and the additional cost is justified. A soil cover and vegetation may be sufficient in areas which were used for a relatively short period of time and/or contain significantly lower volume of waste. Decisions on which cap/cover is applied at each of the old phossy ponds and calciner solids area will be made by EPA during the course of the remedial design using all relevant information available at that time.

Soil Cover, grading, and vegetation, where applicable, shall consist of backfilling low areas (e.g., former Ponds 1E and 4E) to bring them up to the surrounding grade levels, and then shaping the surface to enhance surface drainage and reduce the potential for infiltration. Design and performance criteria shall be based on achieving a reduction in infiltration (to at least $1x10^{-7}$ cm/sec), prevention of incidental ingestion, and reduction of exposure to radiation. A surface soil cover of at least 12 inches shall be placed over the backfill and vegetation suitable to the area and climate shall be established and maintained. In low areas where surface water flow must be directed over old pond areas, concrete, gunite, or asphaltic concrete, or culverts shall be added to enhance runoff. Runoff shall be directed toward natural drainage collection areas in the northern and northwestern portions of the FMC OU. The drainage collection areas shall be constructed in a manner to avoid ponding of surface runoff water.

Capillary Barrier Caps, where appropriate, shall consist of a minimum of 2 feet of vegetated native top soil underlain by a 6-inch gradational layer and 18 inches of well sorted coarse material (slag or river gravel). Design and performance criteria shall be based on achieving a reduction in infiltration (to at least $1x10^{-7}$ cm/sec), prevention of incidental ingestion, and reduction of exposure to radiation.

FMC shall maintain the integrity and effectiveness of the caps and soil covers, including making repairs to the covers as necessary to correct the effects of settling, subsidence, erosion, or other events. Ponds not subject to the remedial actions of this ROD remain subject to other requirements and regulations.

10.2.2.2 Railroad Swale (Alternative F4/F4A)

FMC shall install and maintain a synthetic liner in the eastern portion of the railroad swale to reduce infiltration of surface water and leaching potential. FMC shall modify and extend the existing liner at least 850 feet to the east. The liner shall have, at a minimum, a 30-mil PVC liner and be covered by a protective sand layer with a minimum thickness of 6 inches. Design and construction shall conform with work conducted on the existing liner in the western portion of the railroad swale and shall include sampling during design for potential generation of gases which could affect liner performance. FMC shall maintain the integrity and effectiveness of the liner and final cover, including making repairs to the cover as necessary to correct the effects of settling, subsidence, erosion, or other events.

10.2.3 Land Use Restrictions

FMC shall implement legally enforceable land use controls that will run with the land (i.e., deed restrictions, limited access, well restrictions and/or well head protection) to prevent ingestion of ground water with COCs above MCLs or RBCs. These controls will remain in place as long as the ground water exceeds MCLs or RBCs.

FMC shall also implement legally enforceable land use controls that run with the land in the form of deed restrictions to eliminate the possibility for future residential use of the FMC Plant Area.

10.2.3.1 Construction of Radon Resistant Buildings (Alternative F4/F4A)

At the FMC Plant, land use controls shall require any future office buildings to be constructed using the radon controlling methods specified in the document "Radon Prevention in the Design and Construction of Schools and Other Large Buildings" (EPA/626/R-92/016, 1994). Following construction and annually thereafter the indoor air shall be tested for radon. If the radon activity exceeds either 4 pCi/l, as specified in "Citizens Guide to Radon" (EPA 1992), or any promulgated standard in effect at the time of these future sampling events, additional controls shall be implemented to reduce the radon activity below the target level or promulgated standard.

10.2.4 Off-Plant Area

The following elements of the selected remedy exist in both the FMC and Simplot OUs.

10.2.4.1 Fluoride Monitoring (Alternative O3)

In order to determine the levels of fluoride present and to evaluate the potential risk to ecological receptors a fluoride monitoring program will be implemented. The monitoring shall occur within a three-mile radius of the FMC and Simplot Plants (there may be specific areas outside the three mile radius, which may contain sensitive species or be of particular ecological or cultural value where sampling should also occur) and shall include sampling of vegetation, soils, and appropriate biomonitors. A monitoring plan including a quality assurance program plan and a sampling plan shall be submitted for EPA approval during the remedial design. An evaluation of monitoring data will be conducted annually to determine the fluoride levels and spatial and temporal trends in the environment. If levels which are measured indicate a risk may exist, further evaluation will occur followed by source control or other action, if necessary.

10.2.4.2 Soils (Alternative O3)

This element of the selected remedy is designed to accomplish two goals. First, to prevent exposure to soils which pose a 1 in 10,000, or greater, excess risk from radium-226 and secondly to restrict the use of agricultural products grown on areas of the site where contaminant levels exceed a HQ of 1 for cadmium (RME case). In order to implement this element the off-plant area is divided into the following areas:

<u>Areas Subject to Land Use Controls</u>

These are areas where soil contaminant levels exceed a HQ of 1 for cadmium (RME case) and/or which poses a 1 in 10,000, or greater, excess risk from radium-226 as shown in Figures 27 and 28. These areas include the Interstate 86 Right-of-Way (51 acres); Chevron Tank Farm (20 acres); City of Pocatello Property (326 acres); a portion of the land owned by a private party named R. Rowland, and a portion of BLM lands to the SW of the FMC facility. In this area the PRPs shall implement legally enforceable land use controls (purchase of a recorded easement with accompanying deed restriction) restricting the use of agricultural products grown thereon for human consumptions due to the presence of cadmium in soils. For those areas contaminated with radium-226 legally enforceable land use controls shall be implemented to prevent future residential use.

<u>Areas Subject to Company Monitoring for Residential Development</u>

This area is shown in Figure 29 and was not found to exceed the criteria established for the imposition of Land Use Controls but was either close enough to the threshold, or adjacent to lands that exceeded the threshold, to warrant notification to current and future property owners if residential use is likely to occur. In this area the PRPs shall monitor property use for residential development and inform residential property owners of potential human health risks associated with consumption of homegrown fruits and vegetables due to the presence of cadmium in soils. Similar restrictions on use of agricultural products could be implemented on such areas, as necessary.

In conjunction with this monitoring and land use controls described above, the PRPs shall develop a test program to evaluate actual uptake into produce which may be grown by residents in the affected off-plant areas. A monitoring plan including a quality assurance program plan and a sampling plan shall be submitted for EPA approval during the remedial design. Cadmium concentrations in the soil and produce shall be measured over multiple growing seasons. The results of the test program will be used to determine if monitoring and land use controls are still required or if any additional action is necessary to prevent potential health risks associated with consumption of homegrown fruits and vegetables.

10.2.4.3 Ground water Monitoring

Ground water monitoring and evaluation in the off-plant area shall be conducted as part of the cleanup remedy to: (1) determine the effectiveness of the Plants' source control measures, (2) insure contaminants are not migrating into the off-plant area, and (3) insure that the remedy remains protective of human health and the environment. A surface and ground water monitoring plan shall be submitted including a quality assurance program plan and a sampling plan for EPA approval during the remedial design. At a minimum, the monitoring program shall include quarterly sampling of shallow and deep aquifers and surface water springs whose source is the shallow aquifer and a semiannual evaluation of monitoring data.

10.2.5 Estimated Cost for FMC Operable Unit

The total estimated cost of the selected remedy is shown below. These costs are estimated and are considered to be accurate to within -30% to +50%. Costs are described using the present worth methodology with a discount rate equal to 5 percent. The cost estimate includes direct and indirect capital costs, as well as annual operations and maintenance costs. Costs reflect a range from grading and soil covers to capillary barrier cap and implementation of the contingent ground water extraction system.

Estimated Capital Costs: $3,313,000 to $7,176,000
Estimated Annual O&M Costs:$121,200 to $837,200
Estimated Total Costs:$4,848,000 to $20,660,000

10.3 Five Year Review Requirements

Because this remedy will result in hazardous substances remaining on site above heath-based levels, a review will be conducted within five years after commencement of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment. The review will include, at a minimum, evaluation of the following:

<u>Ground water</u>

- Review Simplot extraction system operation and maintenance records along with ground water monitoring data to confirm the effectiveness of the system and achievement of the following goals: (1) contain the migration of COCs from the phosphogypsum stack and reduce the areal extent of shallow ground water contamination within the Plant Area in excess of MCLs or RBC, and (2) prevent the migration of COCs above MCLs or RBCs into the off-plant area.
- Review and evaluate all ground water monitoring data to: (1) determine the effectiveness of the Plants' source control measures in reducing COCs throughout the site, (2) insure contaminants are not migrating into the off-plant area, and (3) insure that the remedy remains protective of human health and the environment.
- Determine if/when remediation goals have been achieved, and if not, that institutional controls are still in place to prevent human exposure to contaminated ground water.

<u>Soils</u>

- Evaluate current land use in the off-plant area and the effectiveness of land use controls to restrict property use and inform residents of the potential risks associated with consumption of homegrown fruits and vegetables.

- Evaluate the integrity of the caps and soil covers to ensure their effectiveness.
- Evaluate the effectiveness of surface grading and runoff controls to reduce potential infiltration in capped/covered areas.

Plant Areas

- Evaluate FMCs and Simplots compliance status with environmental (such as the CAA, IDAPA, CWA, and RCRA) and worker health and safety requirements to ensure that the remedy remains protective.
- Determine if Plant closure has occurred or is planned, and if so, verify that any required/planned closure procedures are protective.
- Determine the status of any RCRA closures at FMC and review the closure procedures and areas to ensure that the remedy remains protective.
- Determine if institutional controls are in place to prevent residential use of Plant Areas and control radon in buildings.
- Evaluate worker safety program and personnel monitoring to ensure that the remedy is protective of workers.

Air

- Compare fluoride monitoring results with the findings of the ecological risk assessment and any other available information to insure that the remedy remains protective of the environment.
- Review any relevant information related to the air pathway to ensure the remedy is protective.

11.0 STATUTORY DETERMINATIONS

EPA's primary responsibility under CERCLA is to ensure that remedial actions are undertaken which protect human health, welfare, and the environment. In addition, Section 121 of CERCLA, 42 U.S.C. § 9621, establishes cleanup standards which require that the selected remedial action complies with all ARARs, unless such requirements are waived in accordance with established criteria. The selected remedy must be cost effective and must utilize permanent solutions, alternative treatment technologies, or resource recovery technologies to the maximum extent practicable. The following sections discuss how the selected remedy meets these requirements.

11.1 Protection of Human Health and the Environment

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. The remedy will be protective of exposure to ground water through implementation of Institutional Controls to ensure no human exposure to contaminated ground water, and a monitoring program to ensure that the contaminated plume does not spread and contaminant concentrations eventually decline. Ground water extraction at Simplot and source controls (soil excavation and capping) at both Plants will reduce the release and migration of COCs to the ground water and eventually restore ground water to meet all RBCs or MCLs for the COCs. Source controls will also have the added benefit of preventing ingestion or inhalation of soils containing COCs at levels that pose estimated excess risks.

Personnel monitoring and source controls will also prevent external exposure to radionuclides in soils at levels that pose excess cancer risks.

Legally enforceable land use controls will reduce potential exposure to radon that would occur in future buildings constructed within the Plant Areas. They will also prevent future consumption of homegrown produce grown in areas of the site where soil constituents levels result in a potential noncarcinogenic risk exceeding a HQ of 1 and prevent external exposure to radium-226 in soils at levels that pose cumulative estimated excess risks above 1×10^{-4}.

Monitoring ground water and fluoride will insure that the remedy remains protective of human health and the environment. Air emissions from the Plants are to be controlled by other Federal and State regulatory programs however, the final remedy for the site requires a periodic reevaluation of the air pathway to ensure that the remedy remains effective and is protective of human health and the environment

Because this remedy will result in hazardous substance remaining on-Site above health-based levels, a review will be conducted within five years after commencement of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

11.2 Applicable or Relevant and Appropriate Requirements

The selected remedy will comply with all chemical, action, and location-specific federal and state ARARs. No ARAR waivers will be used. Specifically:

40 C.F.R. Part 141, Safe Drinking Water Act. MCLs, and non-zero MCLGs are relevant and appropriate for the ground water at the site.

Clean Water Act Water Quality Criteria 40 CFR Part 131. This regulation sets criteria for developing water quality standards based on toxicity to aquatic organisms and human health. This regulation would be applicable if the contingent ground water remedy was implemented and there was direct discharge to surface waters. These regulations are relevant and appropriate for ground water which discharges to surface water as a non-point source such as at the springs.

Idaho Ground Water Standards (IDAPA Sec. 16.01.02.299). Protects ground water for beneficial uses, along with the Idaho Antidegradation Policy (IDAPA Sec. 16.01.02.051), which requires that existing water uses and water quality be maintained and protected. These ARARs will be met by source control and ground water extraction.

Clean Water Act National Pollutant Discharge Elimination System 40 CFR Part 122, 124, 136. This regulation requires best management practices and other efforts to minimize pollutants in discharges to surface water. These regulations would be applicable if the contingent ground water remedy were implemented. Treated ground water will be discharged in a manner which complies the substantive requirements of the above-mentioned ARAR, or in compliance with FMC's NPDES permit, whichever is more stringent.

Clean Air Act, 42 U.S.C. 7401 et seq.) National Primary and Secondary Ambient Air Quality Standards, 40 C.F.R. Part 50; CAA National Emissions Standards for Hazardous Air Pollutants, 40 C.F.R. Part 60; CAA New Source Performance Standards, 40 C.F.R. Part 61. These regulations establish standards for air quality to protect public health and welfare and establish emissions standards for designated hazardous air pollutants.

Resource Conservation and Recovery Act 42 U.S.C. 6901-6987 40 CFR 261-264; 268. These regulations define when a solid waste is as hazardous wastes and the requirements that must be met by generators, transporters, and for treatment, storage and disposal of those wastes, including land disposal restrictions.

IDAPA 16.01.01. This regulation contains primary and secondary air quality standards for fluoride concentrations in ambient air which result in total fluoride content in vegetation used for feed or forage. The standards are relevant and appropriate if agricultural feed sources were grown on the site.

The policy, guidance, and regulations which are not ARARs but were nevertheless considered in the selection of the remedy, or which impact the remedy includes the following:

Occupational Safety and Health Act (OSHA), 29 U.S.C. 651; the implementing regulations under OSHA, 20 C.F.R. Parts 1910 and 1926. These regulations must be complied with during all remedial activities.

"Radon Prevention in the Design and Construction of Schools and Other Large Buildings." (EPA/626/R-92/016, 1994) and "Citizens Guide to Radon" (EPA 1992). These documents provide guidance on controlling radon in future buildings at the site.

EPA's Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes (40 CFR 191) and EPA's National Emission Standards for Hazardous Air Pollutants (40 CFR 61) set standards equivalent to a risk of approximately 3×10^{-4}. These documents provide guidance on the level of protectiveness from radiation that have been set by other programs.

11.3 Cost Effectiveness

The selected remedy affords overall effectiveness proportionate to its costs. The selected source control remedy at FMC and Simplot is cost effective because it will achieve most cleanup goals without adverse effects on the plant operations. The no action alternative and other more limited alternatives would not achieve the cleanup goals. The use of impermeable caps at FMC and a liner on the Gypsum stack at Simplot would increase costs over $100 million without achieving the goals much more quickly than natural recovery after source control.

11.4 Utilization of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable

The selected remedy utilizes permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable for this site. Source control at FMC and ground water extraction at Simplot is expected to eliminate and/or reduce the source of the problem such that the shallow aquifer will recover naturally to its beneficial use.

11.5 Preference for Treatment as a Principal Element

The selected remedy utilizes alternative treatment (or resource recovery) technologies to the maximum extent practicable for this site. However, because treatment of the remaining threats of the site was not found to be practicable, the selected remedy does not satisfy the statutory preference for treatment as a principal element.

12.0 Documentation of Significant Differences

Subsequent to issuing the Proposed Plan, EPA reviewed public comments. In response EPA has re-evaluated the ground water extraction for hydraulic control for the FMC Plant and made a change which is discussed below. This change is a logical outgrowth of the information available to the public in the Proposed Plan and the RI/FS reports. An additional public notice or public comment period was determined not to be necessary.

12.1 FMC Operable Unit Extraction and Treatment

The Proposed Plan included an element for hydraulic control of the contaminated plume. After further review of the data and consideration of public comments, EPA has determined that this action is not required, at this time, to protect public health and the environment. Current evidence suggests that ground water associated with the FMC Plant is not spreading and contaminant concentrations are not increasing. There are currently no human exposures to ground water contamination originating from the Plant and institutional controls will prevent any potential future exposures. The extraction for hydraulic control would remove a greater volume of contaminants from the ground water but at a higher cost and with only marginal reductions in the time to achieve the cleanup goals. The implementability of the extraction for hydraulic control is also questionable due to the lack of acceptable alternatives for disposal of the ground water.

However, the levels and locations of contaminants in ground water will require careful monitoring, and ground water extraction and treatment could be necessary in the future. Therefore, the selected remedy includes a contingent ground water extraction and treatment system with conditions for implementation. If, at any time, plume expansion[8] is detected which could pose a threat to human health or the environment, ground water extraction will be immediately implemented to contain the area of ground water contamination.

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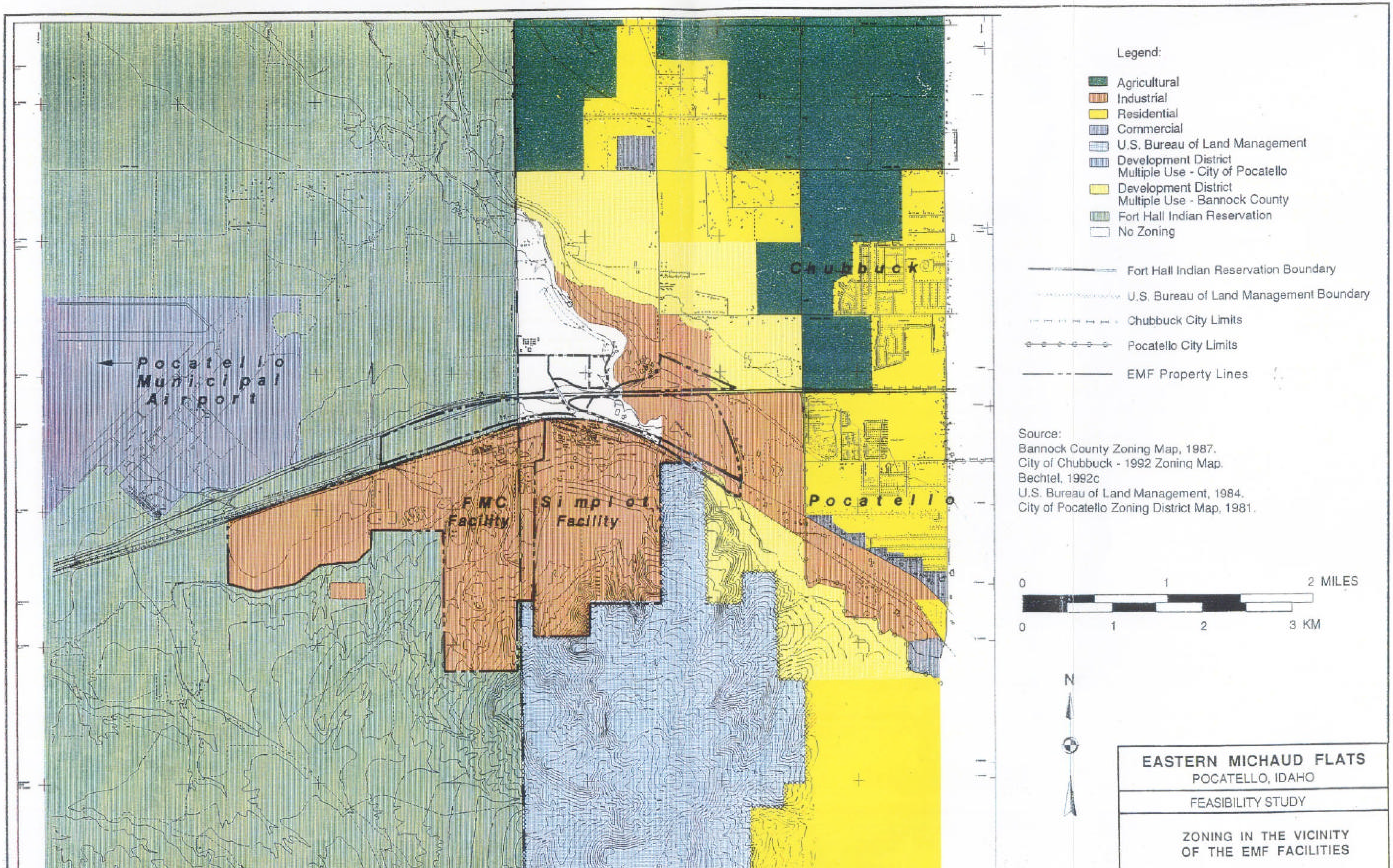
[8]The final determination of plume expansion will be made by EPA and will depend on; (1) expert knowledge of the ground water system at the EMF Site; and, (2) statistical results from monitoring wells and springs from which levels of contamination can be measured.

APPENDIX A

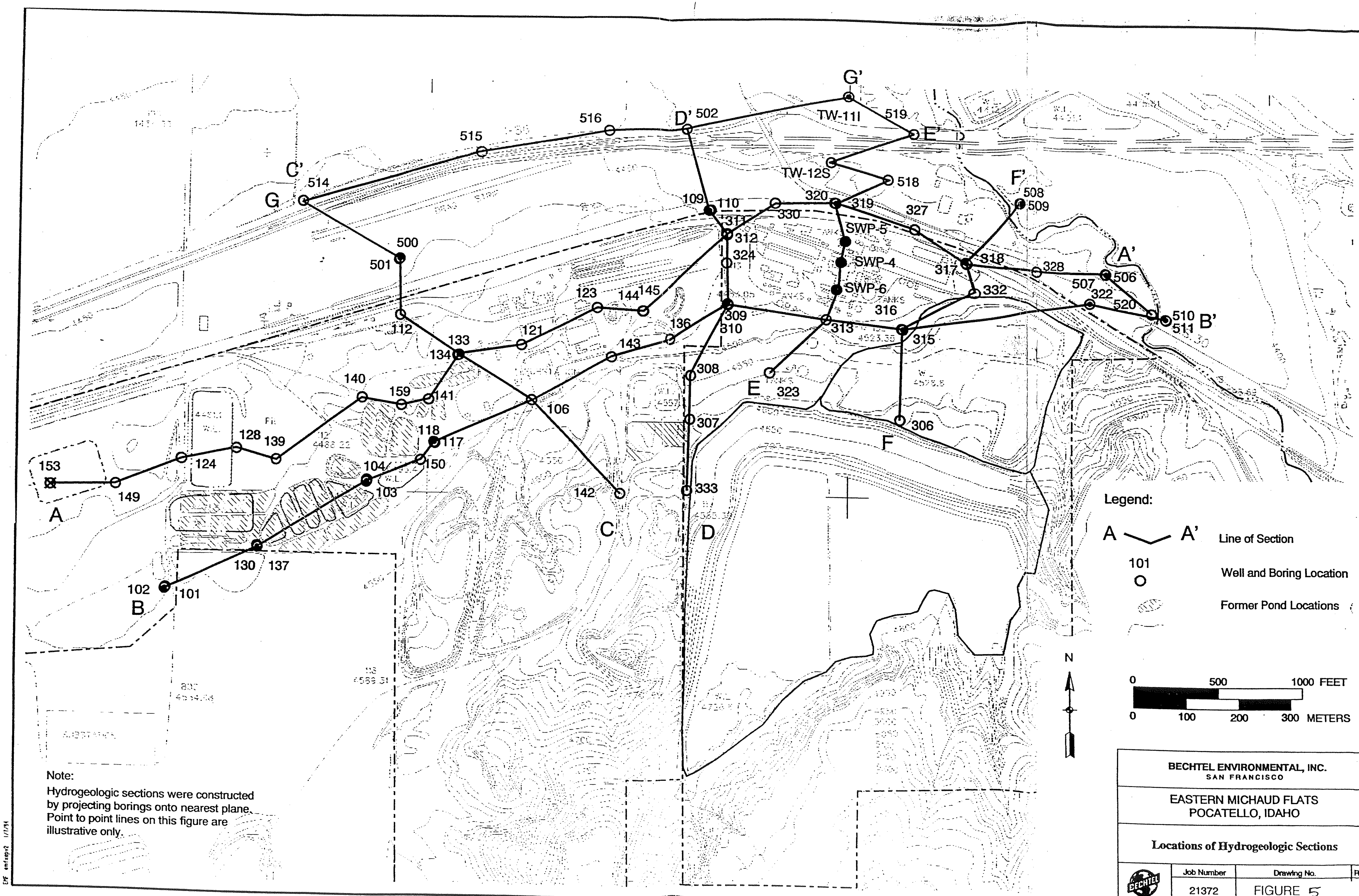
ADDITIONAL FIGURES AND TABLES

RECORD OF DECISION
FOR
FINAL REMEDIAL ACTION
EASTERN MICHAUD FLATS SUPERFUND SITE
POCATELLO, IDAHO

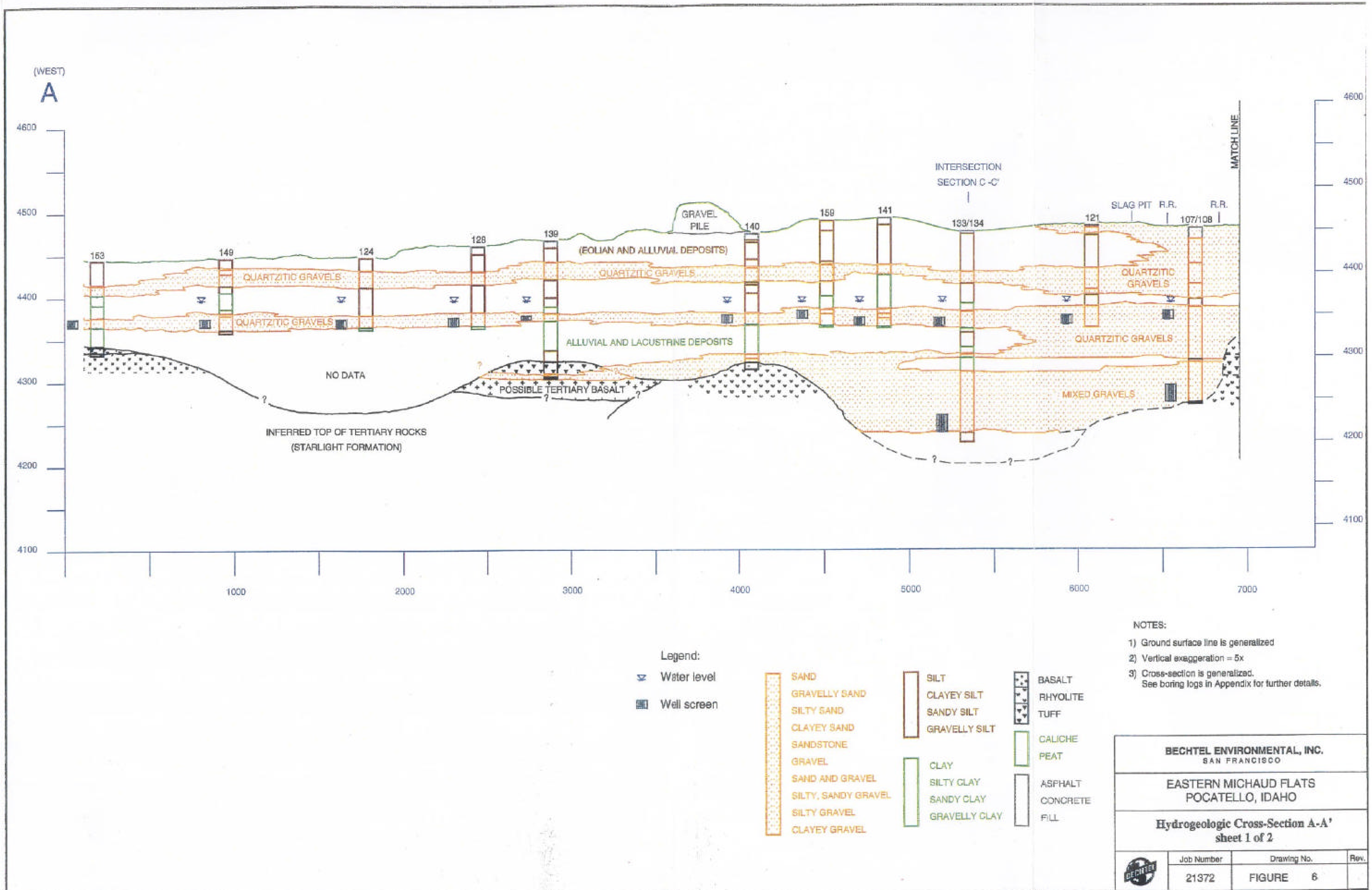


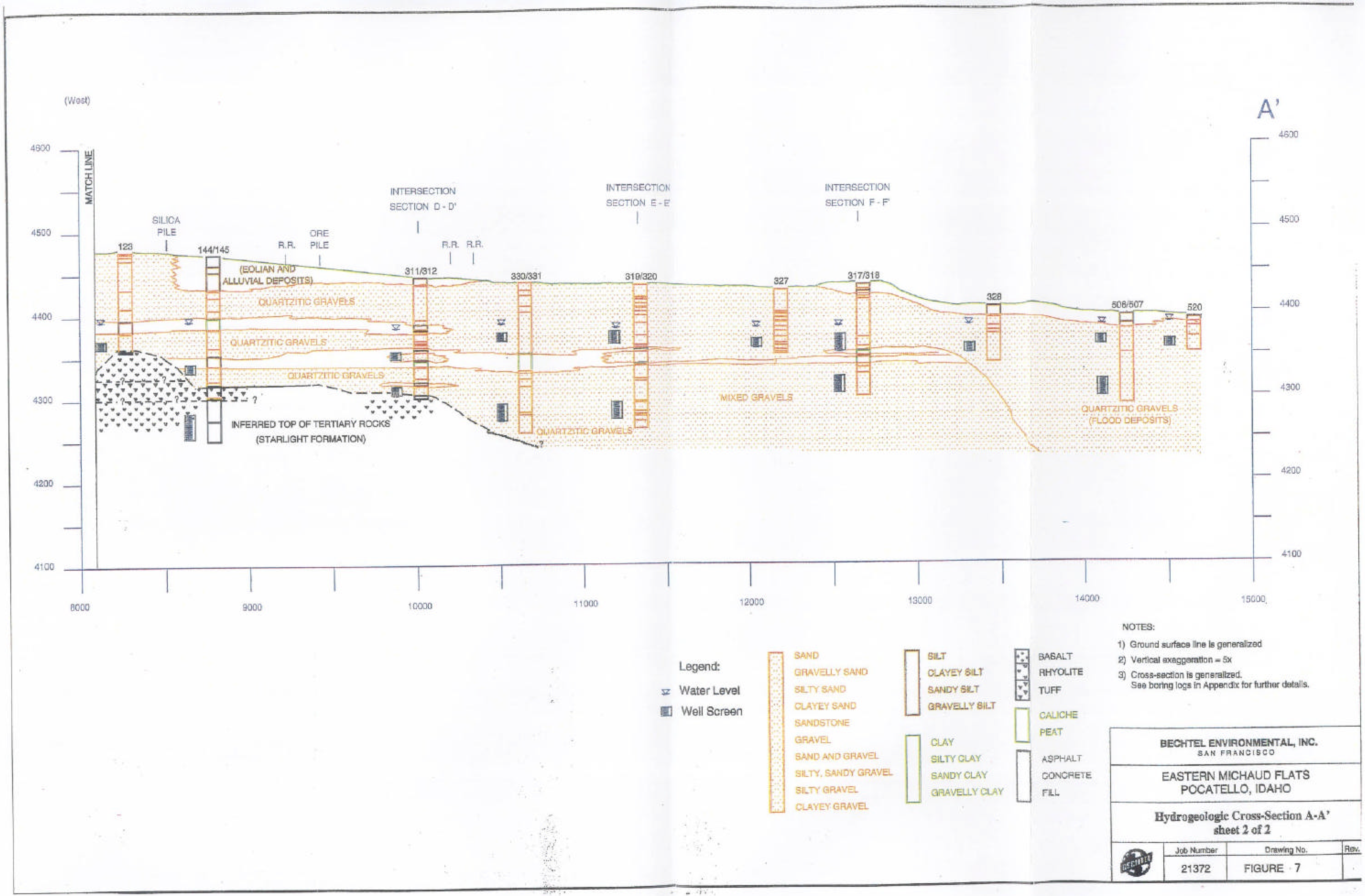
Legend:
Agricultural
Industrial
Residential
Commercial
U.S. Bureau of Land Management
Development District Multiple Use - City of Pocatello
Development District Multiple Use - Bannock County
Fort Hall Indian Reservation
No Zoning
Fort Hall Indian Reservation Boundary
U.S. Bureau of Land Management Boundary
Chubbuck City Limits
Pocatello City Limits
EMF Property Lines
Pocatello Municipal Airport
Chubbuck
FMC Facility
Simplot Facility
Pocatello
Source:
Bannock County Zoning Map, 1987.
City of Chubbuck - 1992 Zoning Map.
Bechtel, 1992c
U.S. Bureau of Land Management, 1984.
City of Pocatello Zoning District Map, 1981.
0 1 2 MILES
0 1 2 3 KM
N
EASTERN MICHAUD FLATS
POCATELLO, IDAHO
FEASIBILITY STUDY
ZONING IN THE VICINITY OF THE EMF FACILITIES

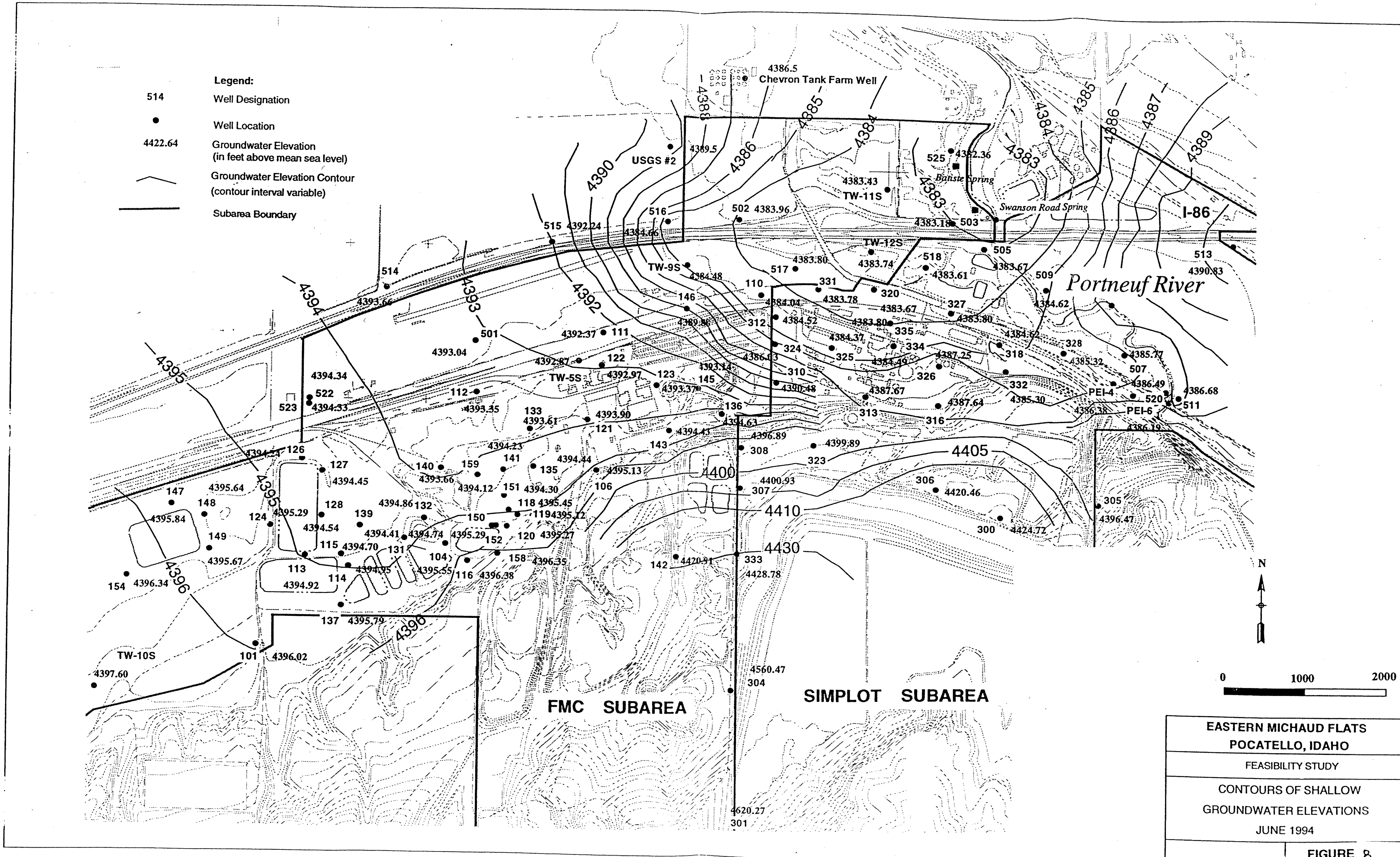
Figure 3

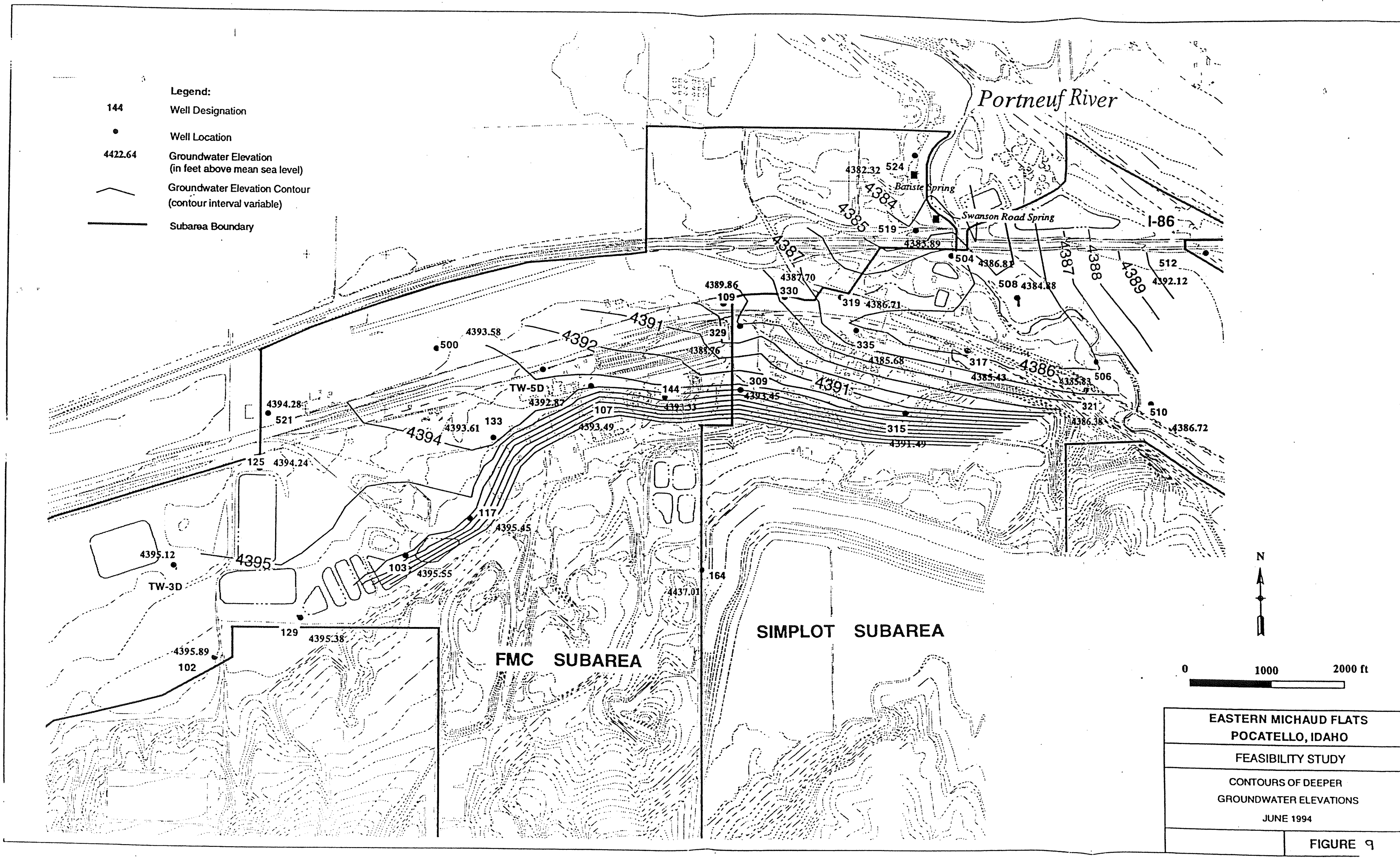


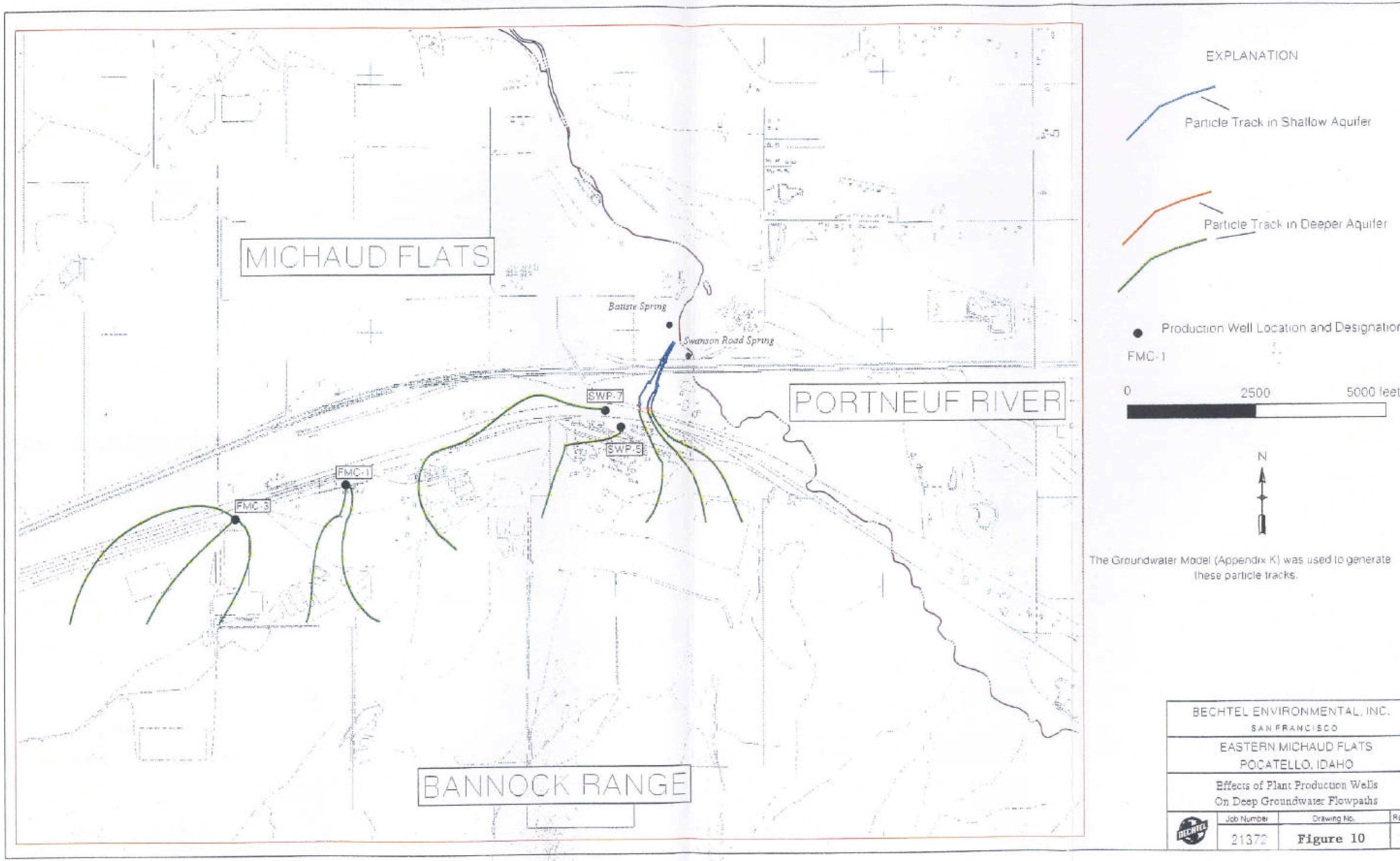
A
A'
B
B'
C
C'
D
D'
E
E'
F
F'
G
G'
TW-11I
TW-12S
SWP-5
SWP-4
SWP-6
Legend:
A A' Line of Section
101 Well and Boring Location
Former Pond Locations
N
0 500 1000 FEET
0 100 200 300 METERS
Note:
Hydrogeologic sections were constructed by projecting borings onto nearest plane. Point to point lines on this figure are illustrative only.
BECHTEL ENVIRONMENTAL, INC.
SAN FRANCISCO
EASTERN MICHAUD FLATS
POCATELLO, IDAHO
Locations of Hydrogeologic Sections
Job Number
21372
Drawing No.
FIGURE 5
Rev.

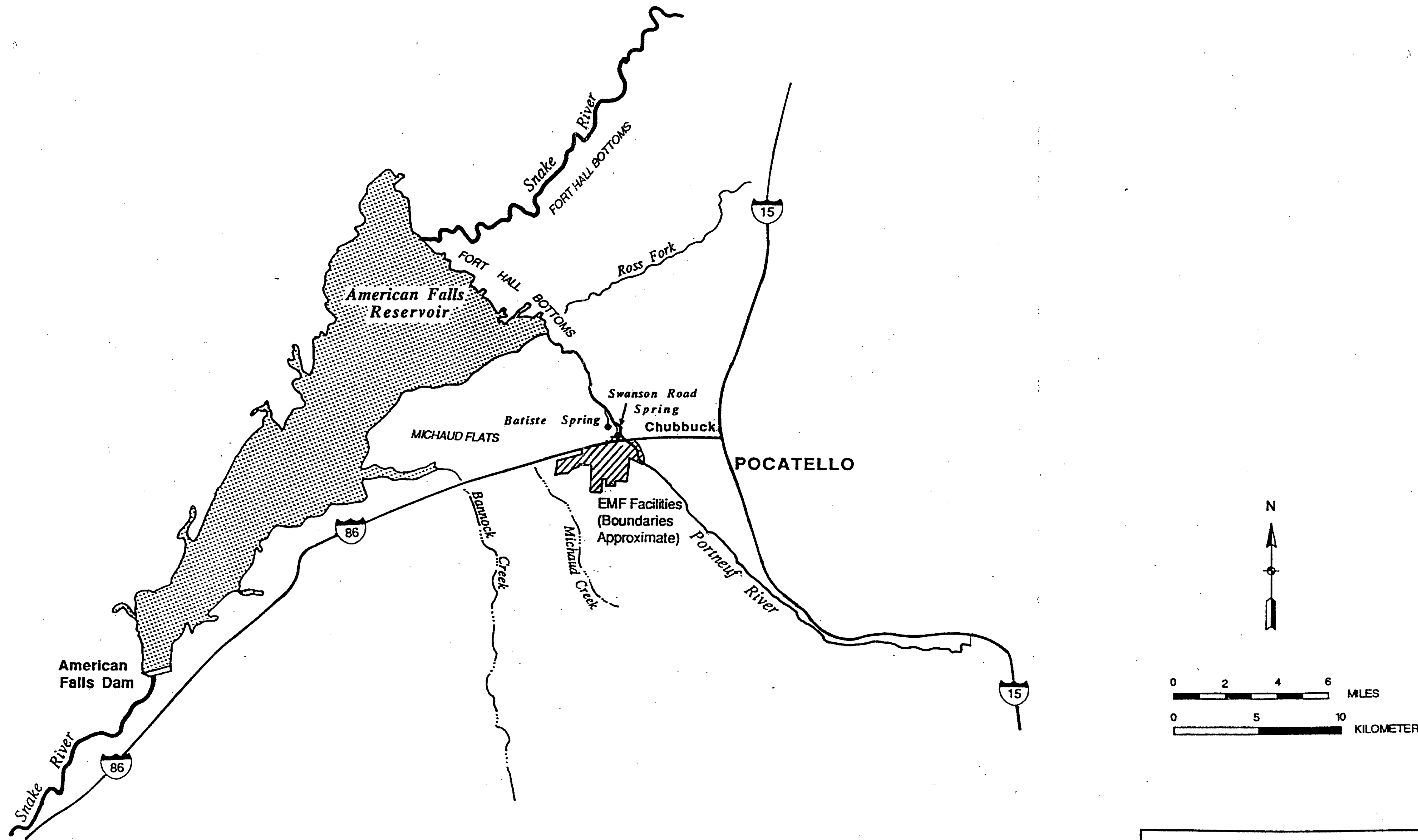

(WEST)
A
INTERSECTION SECTION C-C'
MATCH LINE
GRAVEL PILE
SLAG PIT
R.R.
R.R.
153
149
124
128
139
140
159
141
133/134
121
107/108
(EOLIAN AND ALLUVIAL DEPOSITS)
QUARTZITIC GRAVELS
QUARTZITIC GRAVELS
QUARTZITIC GRAVELS
QUARTZITIC GRAVELS
QUARTZITIC GRAVELS
ALLUVIAL AND LACUSTRINE DEPOSITS
NO DATA
POSSIBLE TERTIARY BASALT
MIXED GRAVELS
INFERRED TOP OF TERTIARY ROCKS (STARLIGHT FORMATION)
4600
4500
4400
4300
4200
4100
1000
2000
3000
4000
5000
6000
7000
Legend:
Water level
Well screen
SAND
GRAVELLY SAND
SILTY SAND
CLAYEY SAND
SANDSTONE
GRAVEL
SAND AND GRAVEL
SILTY, SANDY GRAVEL
SILTY GRAVEL
CLAYEY GRAVEL
SILT
CLAYEY SILT
SANDY SILT
GRAVELLY SILT
CLAY
SILTY CLAY
SANDY CLAY
GRAVELLY CLAY
BASALT
RHYOLITE
TUFF
CALICHE
PEAT
ASPHALT
CONCRETE
FILL
NOTES:
1) Ground surface line is generalized
2) Vertical exaggeration = 5x
3) Cross-section is generalized. See boring logs in Appendix for further details.
BECHTEL ENVIRONMENTAL, INC.
SAN FRANCISCO
EASTERN MICHAUD FLATS
POCATELLO, IDAHO
Hydrogeologic Cross-Section A-A'
sheet 1 of 2
Job Number
21372
Drawing No.
FIGURE 6
Rev.


(West)
A'
MATCH LINE
SILICA PILE
ORE PILE
R.R.
INTERSECTION SECTION D - D'
INTERSECTION SECTION E - E'
INTERSECTION SECTION F - F'
123
144/145
311/312
330/331
319/320
327
317/318
328
506/507
520
(EOLIAN AND ALLUVIAL DEPOSITS)
QUARTZITIC GRAVELS
MIXED GRAVELS
QUARTZITIC GRAVELS (FLOOD DEPOSITS)
INFERRED TOP OF TERTIARY ROCKS (STARLIGHT FORMATION)
4600
4500
4400
4300
4200
4100
8000
9000
10000
11000
12000
13000
14000
15000
Legend:
Water Level
Well Screen
SAND
GRAVELLY SAND
SILTY SAND
CLAYEY SAND
SANDSTONE
GRAVEL
SAND AND GRAVEL
SILTY, SANDY GRAVEL
SILTY GRAVEL
CLAYEY GRAVEL
SILT
CLAYEY SILT
SANDY SILT
GRAVELLY SILT
CLAY
SILTY CLAY
SANDY CLAY
GRAVELLY CLAY
BASALT
RHYOLITE
TUFF
CALICHE
PEAT
ASPHALT
CONCRETE
FILL
NOTES:
1) Ground surface line is generalized
2) Vertical exaggeration = 5x
3) Cross-section is generalized. See boring logs in Appendix for further details.
BECHTEL ENVIRONMENTAL, INC.
SAN FRANCISCO
EASTERN MICHAUD FLATS
POCATELLO, IDAHO
Hydrogeologic Cross-Section A-A' sheet 2 of 2
Job Number
21372
Drawing No.
FIGURE 7
Rev.


Legend:
514 Well Designation
Well Location
4422.64 Groundwater Elevation (in feet above mean sea level)
Groundwater Elevation Contour (contour interval variable)
Subarea Boundary
Chevron Tank Farm Well
USGS #2
Batiste Spring
Swanson Road Spring
I-86
Portneuf River
FMC SUBAREA
SIMPLOT SUBAREA
N
0 1000 2000 ft
EASTERN MICHAUD FLATS
POCATELLO, IDAHO
FEASIBILITY STUDY
CONTOURS OF SHALLOW GROUNDWATER ELEVATIONS
JUNE 1994
FIGURE 8


Legend:
144 Well Designation
Well Location
4422.64 Groundwater Elevation (in feet above mean sea level)
Groundwater Elevation Contour (contour interval variable)
Subarea Boundary
Portneuf River
Batiste Spring
Swanson Road Spring
I-86
FMC SUBAREA
SIMPLOT SUBAREA
N
0 1000 2000 ft
EASTERN MICHAUD FLATS
POCATELLO, IDAHO
FEASIBILITY STUDY
CONTOURS OF DEEPER GROUNDWATER ELEVATIONS
JUNE 1994
FIGURE 9


MICHAUD FLATS
Batiste Spring
Swanson Road Spring
PORTNEUF RIVER
SWP-7
SWP-5
FMC-1
FMC-3
BANNOCK RANGE
EXPLANATION
Particle Track in Shallow Aquifer
Particle Track in Deeper Aquifer
Production Well Location and Designation
FMC-1
0
2500
5000 feet
N
The Groundwater Model (Appendix K) was used to generate these particle tracks.
BECHTEL ENVIRONMENTAL, INC.
SAN FRANCISCO
EASTERN MICHAUD FLATS
POCATELLO, IDAHO
Effects of Plant Production Wells
On Deep Groundwater Flowpaths
Job Number
Drawing No.
Rev.
21372
Figure 10



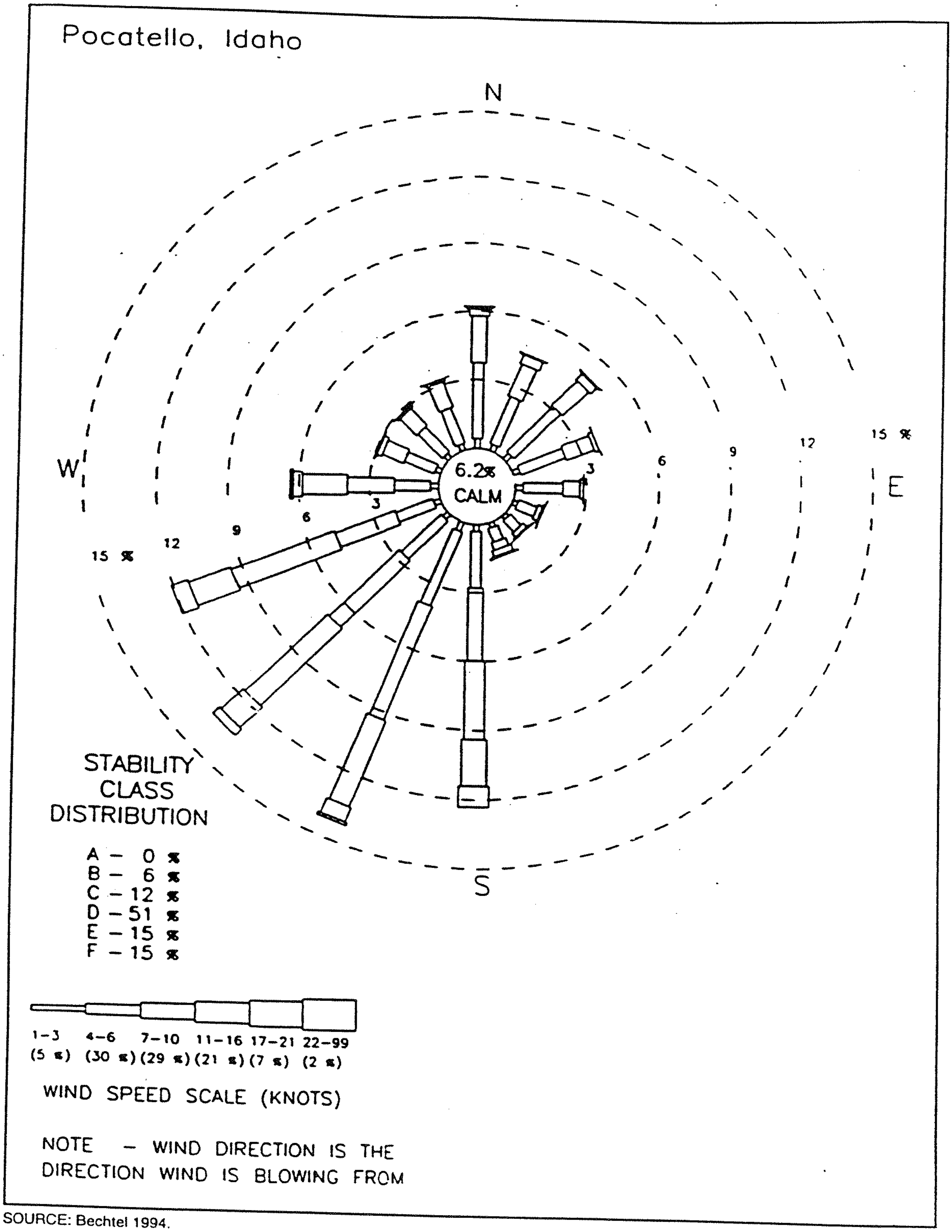
Reference: USGS Idaho Falls and Pocatello Topographic Maps, 1962 - 1:250,000 series

EASTERN MICHAUD FLATS
POCATELLO, IDAHO

FEASIBILITY STUDY

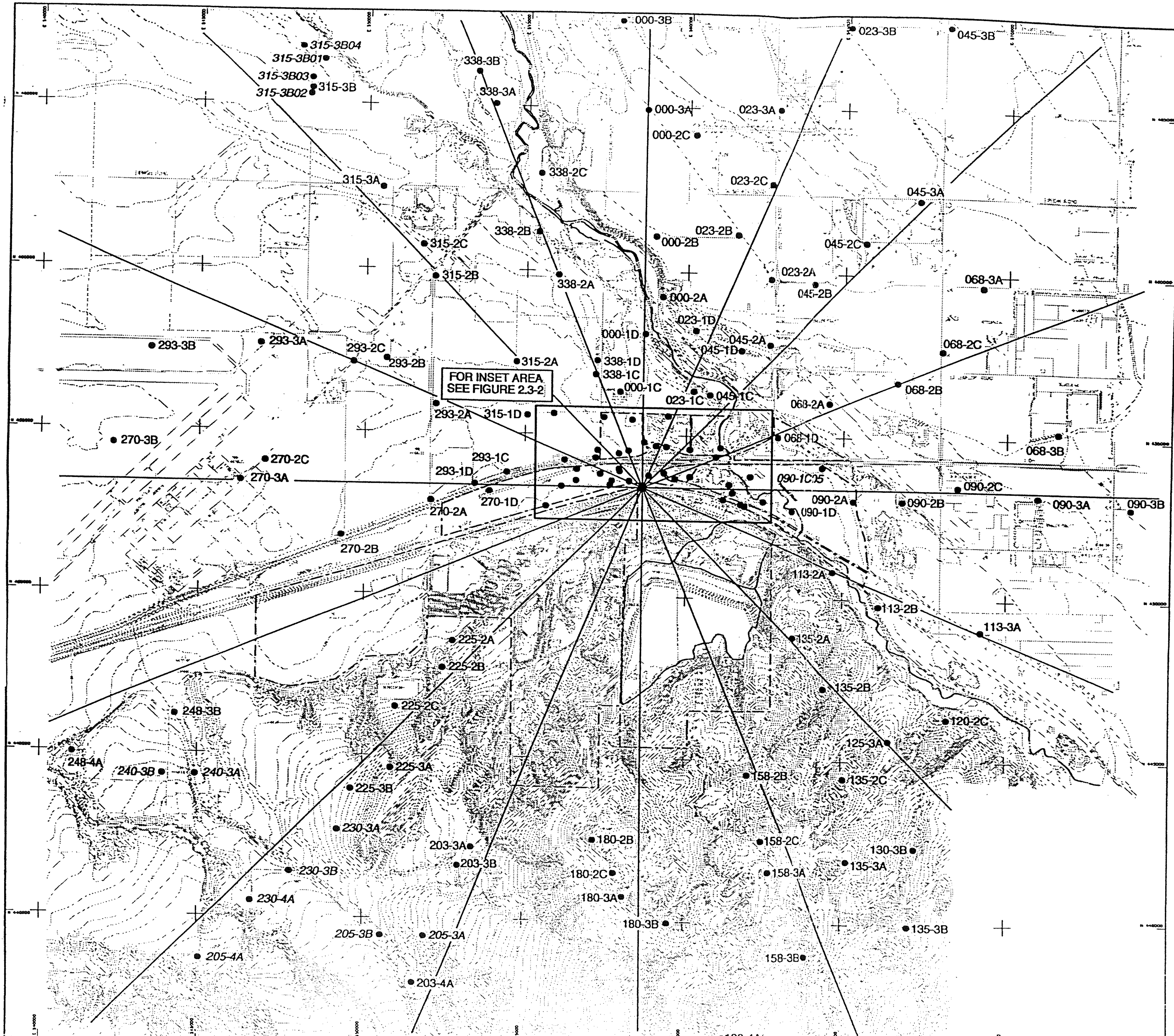
MAJOR SURFACE WATER FEATURES IN THE REGION

FIGURE 11



SOURCE: Bechtel 1994.

Figure 12. WIND ROSE, POCATELLO AIRPORT, 1984 TO 1989



Legend:

315-3B Phase I soil sample location and designation

315-3B01 Phase II soil sample location and designation

EMF Property Lines

N

0 3000 6000 FEET

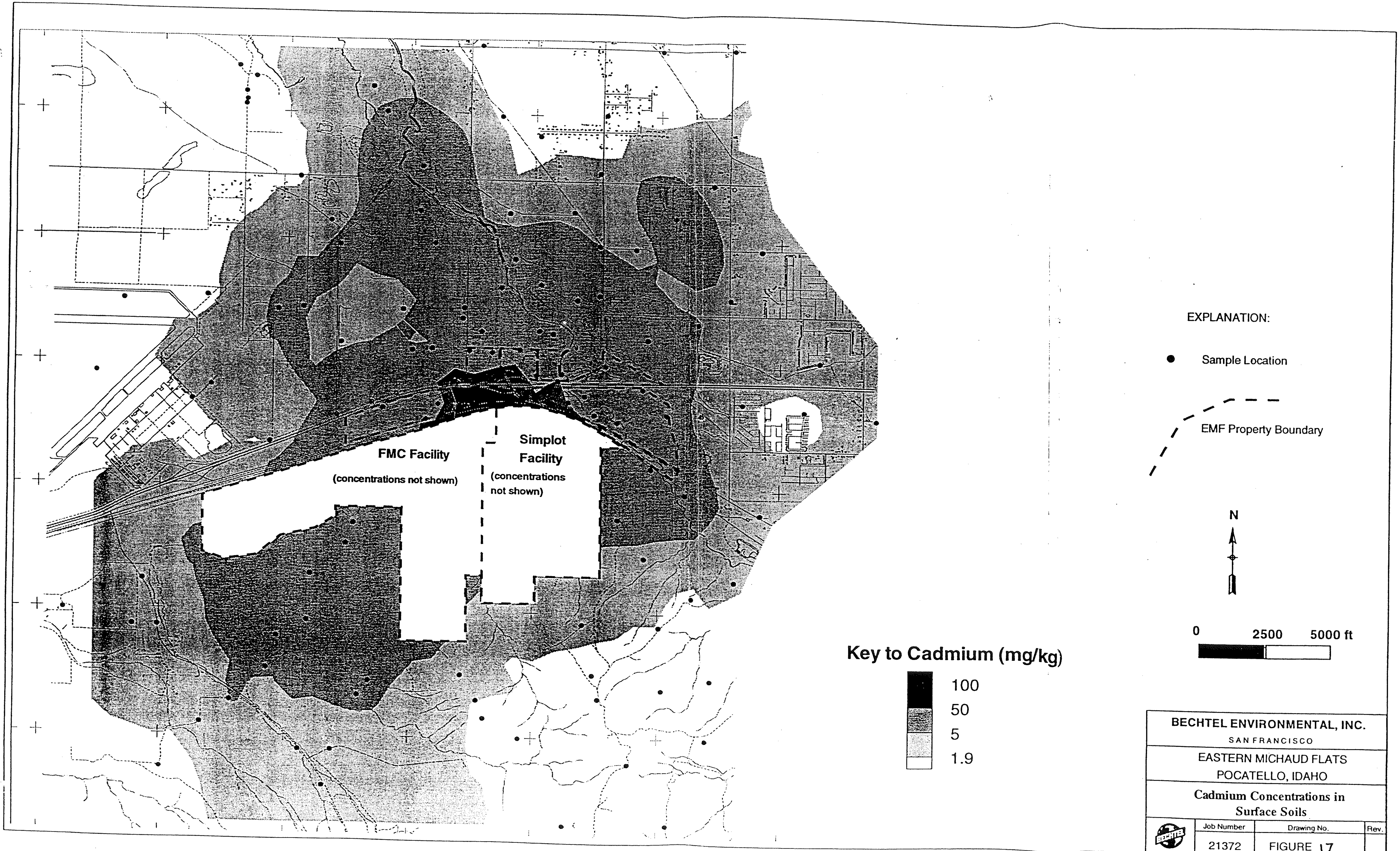
0 500 1000 1500 METERS

BECHTEL ENVIRONMENTAL, INC.
SAN FRANCISCO

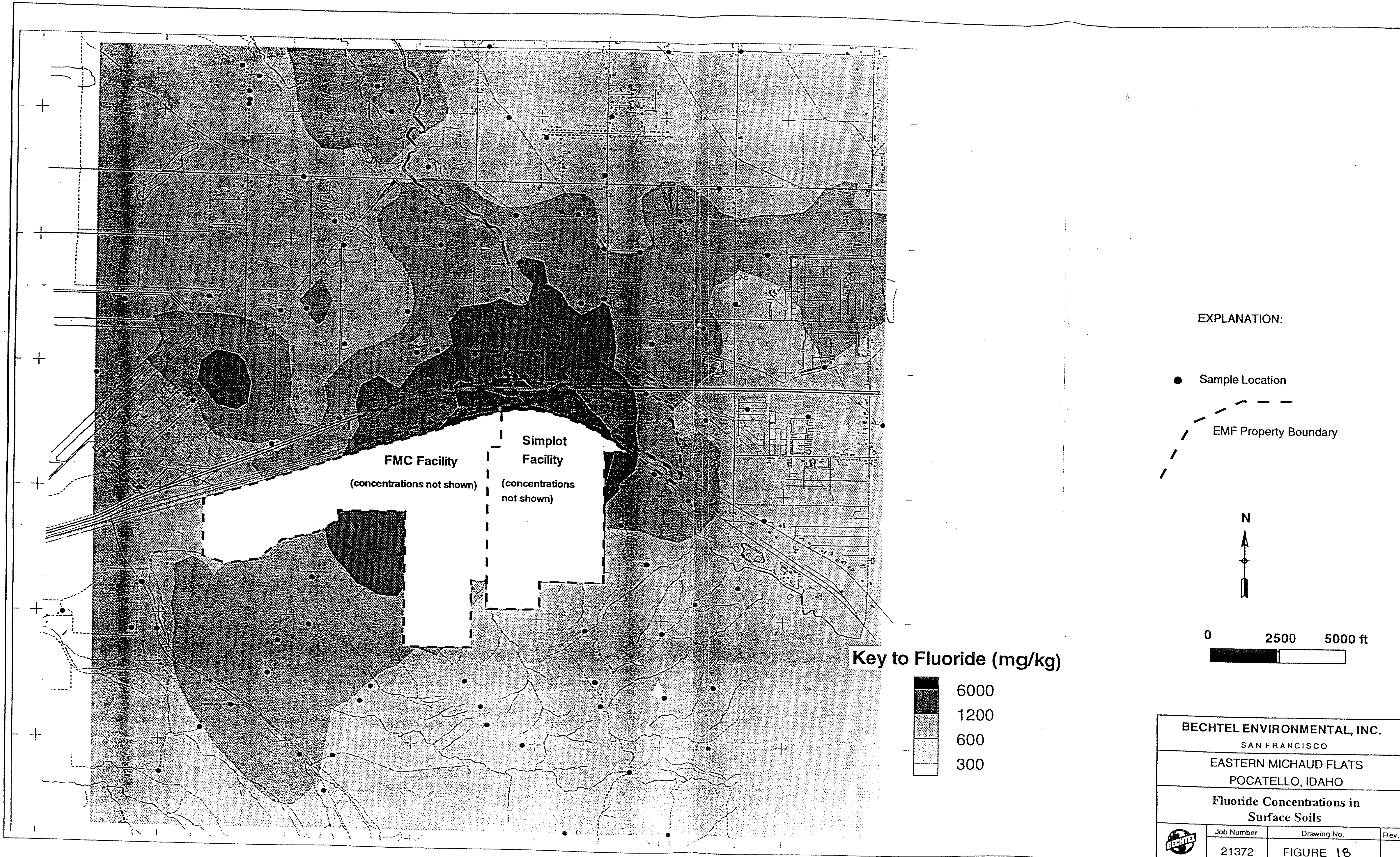
EASTERN MICHAUD FLATS
POCATELLO, IDAHO

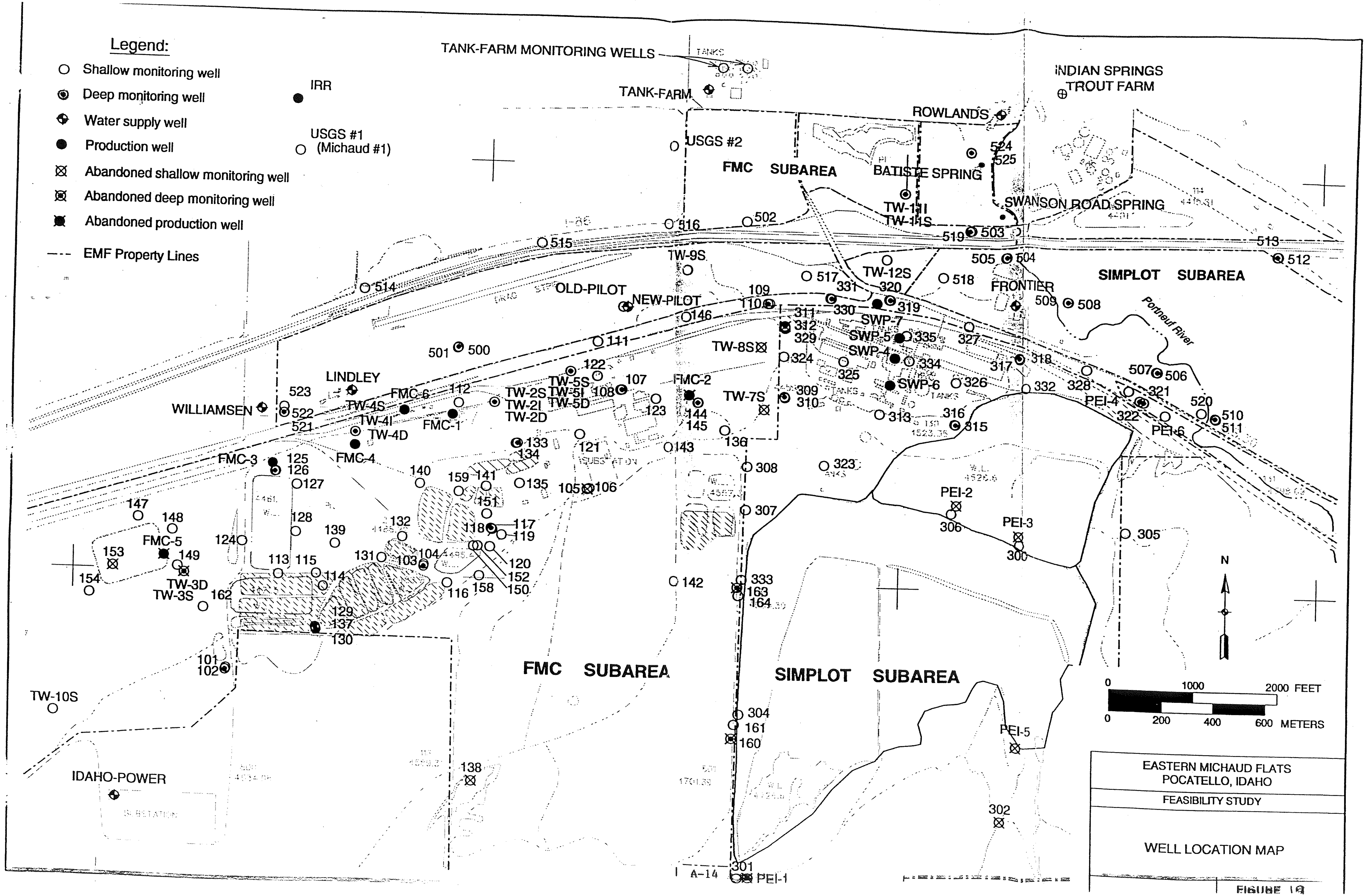
Surface Soil Sample Locations

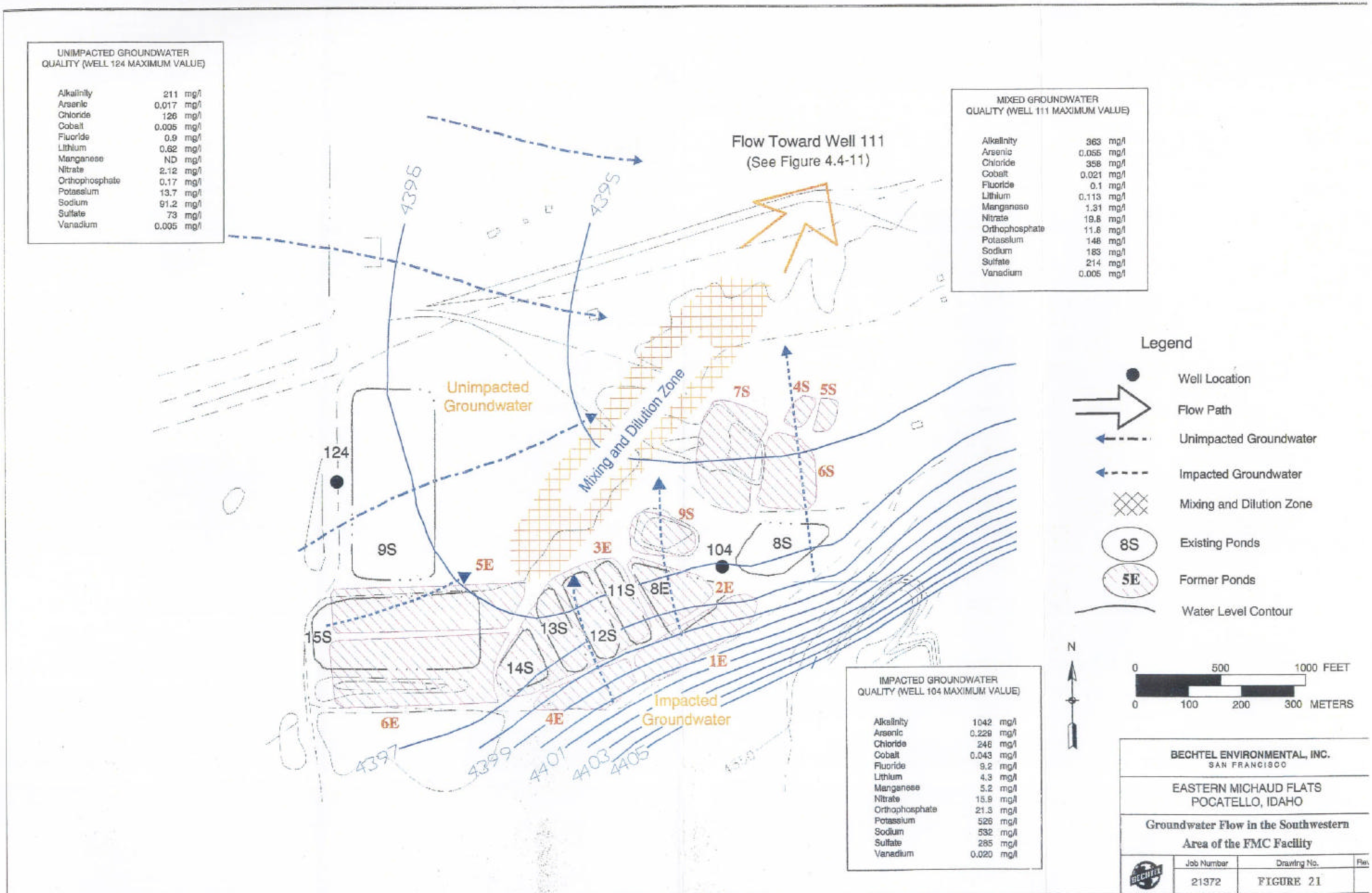
Job Number	Drawing No.	Rev.
21372	FIGURE 16	



FMC Facility
(concentrations not shown)
Simplot Facility
(concentrations not shown)
Key to Cadmium (mg/kg)
100
50
5
1.9
EXPLANATION:
Sample Location
EMF Property Boundary
N
0
2500
5000 ft
BECHTEL ENVIRONMENTAL, INC.
SAN FRANCISCO
EASTERN MICHAUD FLATS
POCATELLO, IDAHO
Cadmium Concentrations in Surface Soils
Job Number
21372
Drawing No.
FIGURE 17
Rev.


FMC Facility
(concentrations not shown)
Simplot Facility
(concentrations not shown)
Key to Fluoride (mg/kg)
6000
1200
600
300
EXPLANATION:
Sample Location
EMF Property Boundary
N
0
2500
5000 ft
BECHTEL ENVIRONMENTAL, INC.
SAN FRANCISCO
EASTERN MICHAUD FLATS
POCATELLO, IDAHO
Fluoride Concentrations in Surface Soils
Job Number
21372
Drawing No.
FIGURE 18
Rev.


Legend:
Shallow monitoring well
Deep monitoring well
Water supply well
Production well
Abandoned shallow monitoring well
Abandoned deep monitoring well
Abandoned production well
EMF Property Lines
TANK-FARM MONITORING WELLS
TANK-FARM
IRR
USGS #1 (Michaud #1)
USGS #2
INDIAN SPRINGS TROUT FARM
ROWLANDS
FMC SUBAREA
BATISTE SPRING
SWANSON ROAD SPRING
SIMPLOT SUBAREA
FRONTIER
OLD-PILOT
NEW-PILOT
LINDLEY
WILLIAMSEN
Portneuf River
FMC SUBAREA
SIMPLOT SUBAREA
IDAHO-POWER
N
0 1000 2000 FEET
0 200 400 600 METERS
EASTERN MICHAUD FLATS
POCATELLO, IDAHO
FEASIBILITY STUDY
WELL LOCATION MAP



UNIMPACTED GROUNDWATER QUALITY (WELL 124 MAXIMUM VALUE)

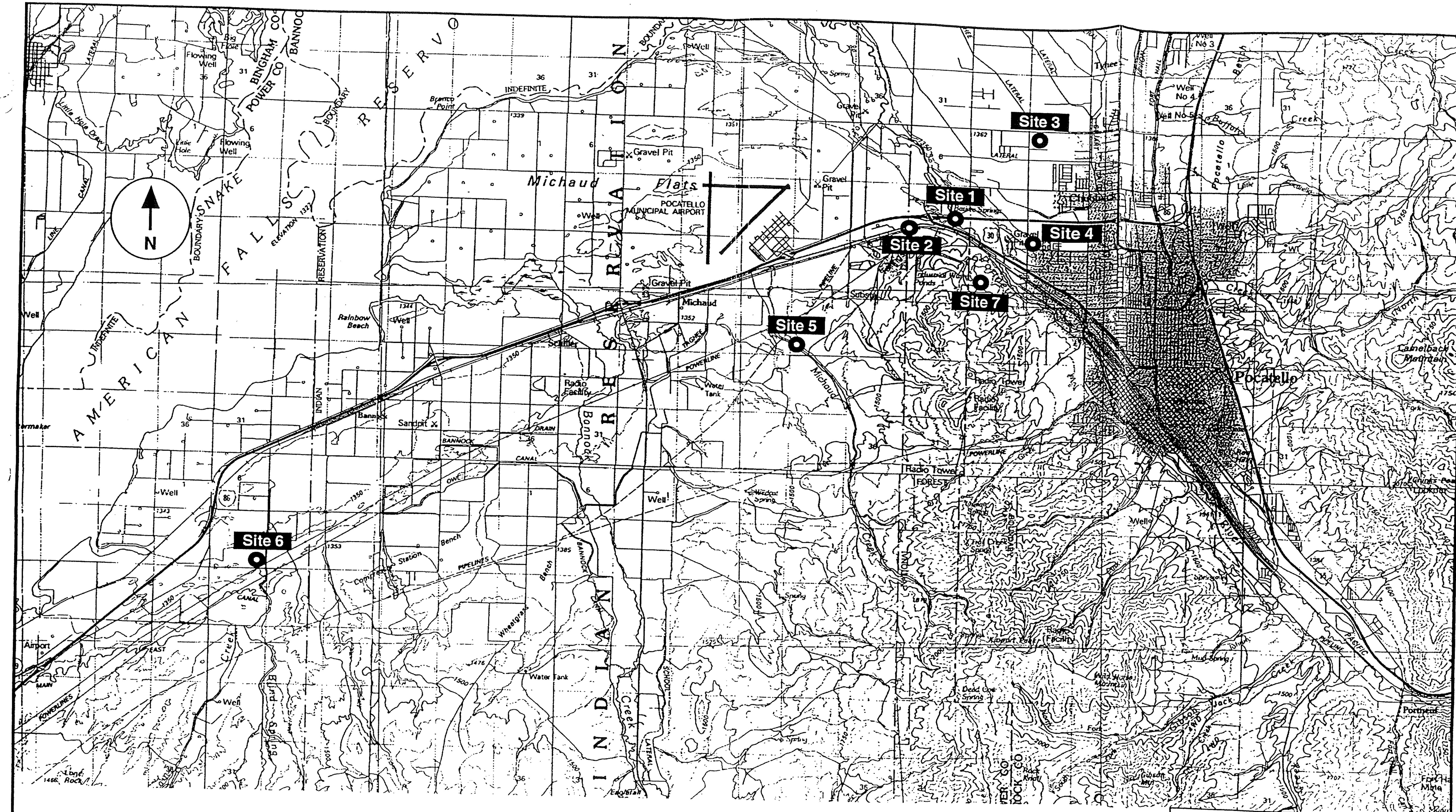
Alkalinity	211	mg/l
Arsenic	0.017	mg/l
Chloride	126	mg/l
Cobalt	0.005	mg/l
Fluoride	0.9	mg/l
Lithium	0.62	mg/l
Manganese	ND	mg/l
Nitrate	2.12	mg/l
Orthophosphate	0.17	mg/l
Potassium	13.7	mg/l
Sodium	91.2	mg/l
Sulfate	73	mg/l
Vanadium	0.005	mg/l

MIXED GROUNDWATER QUALITY (WELL 111 MAXIMUM VALUE)

Alkalinity	363	mg/l
Arsenic	0.055	mg/l
Chloride	358	mg/l
Cobalt	0.021	mg/l
Fluoride	0.1	mg/l
Lithium	0.113	mg/l
Manganese	1.31	mg/l
Nitrate	19.8	mg/l
Orthophosphate	11.6	mg/l
Potassium	148	mg/l
Sodium	183	mg/l
Sulfate	214	mg/l
Vanadium	0.005	mg/l

IMPACTED GROUNDWATER QUALITY (WELL 104 MAXIMUM VALUE)

Alkalinity	1042	mg/l
Arsenic	0.229	mg/l
Chloride	246	mg/l
Cobalt	0.043	mg/l
Fluoride	9.2	mg/l
Lithium	4.3	mg/l
Manganese	5.2	mg/l
Nitrate	15.9	mg/l
Orthophosphate	21.3	mg/l
Potassium	526	mg/l
Sodium	532	mg/l
Sulfate	285	mg/l
Vanadium	0.020	mg/l



Legend:

– Monitoring Site

0 1 2 3 4 5 miles

95-2204b.004
9-19-95 me/is:2

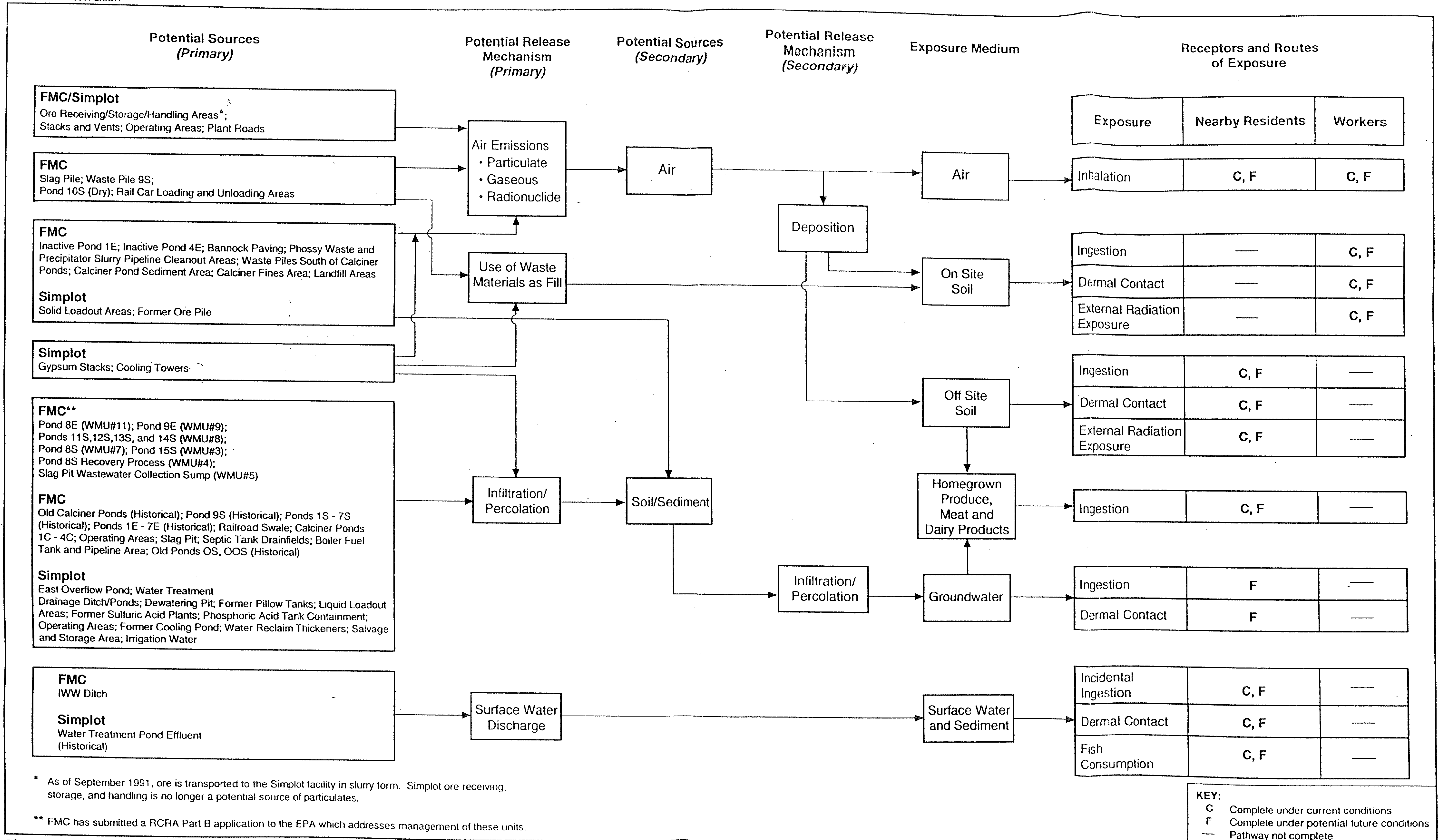
BECHTEL ENVIRONMENTAL, INC.
SAN FRANCISCO

EASTERN MICHAUD FLATS
POCATELLO, IDAHO

EMF Air Monitoring Sites

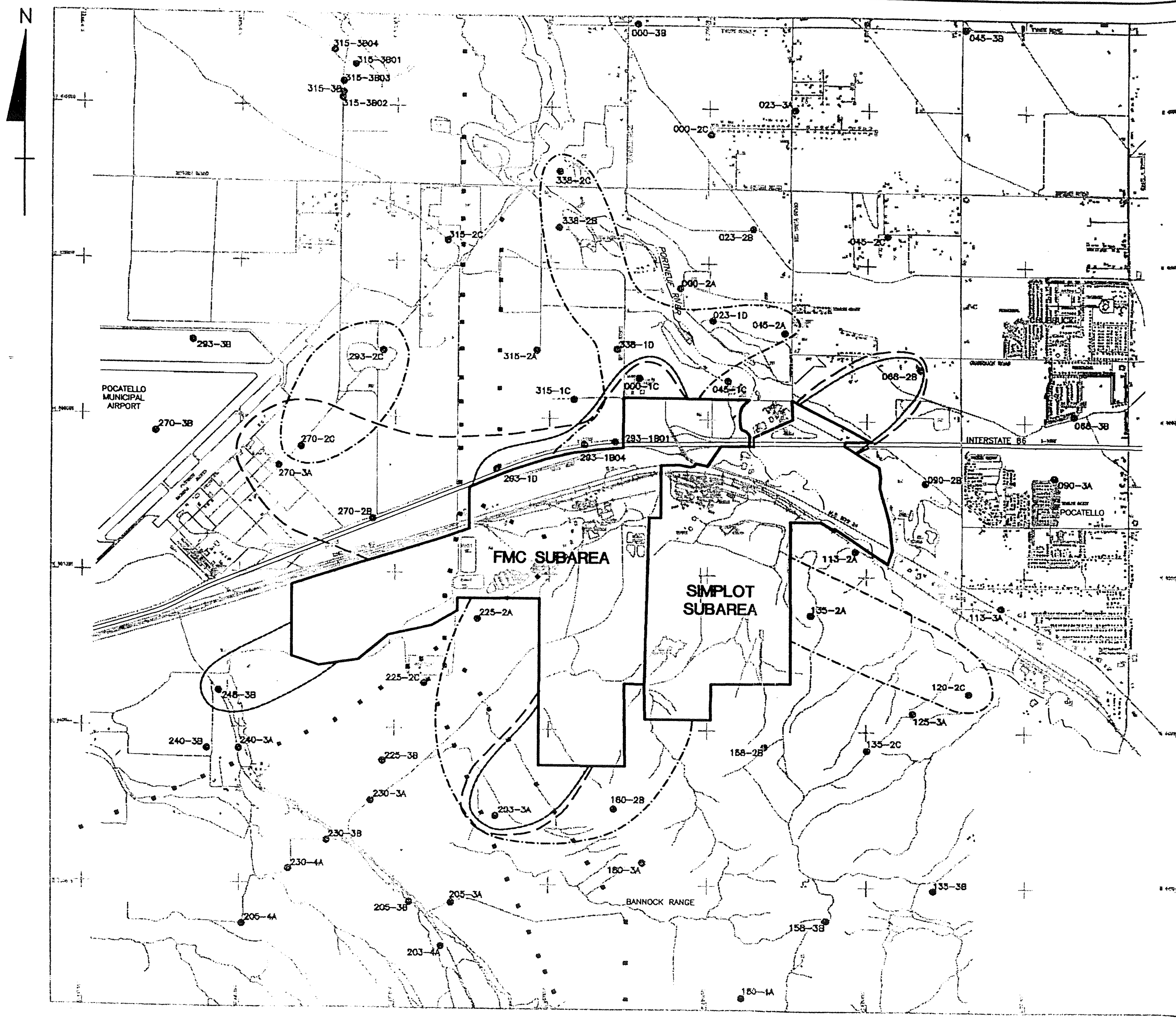
JOB No.	DRAWING NO.	REV.
21372	FIGURE 22	

02: ZP3090\ZP3090FL.CDR



SOURCE: Adapted from Bechtel 1994

Figure 2.3 CONCEPTUAL SITE MODEL FOR POTENTIAL HUMAN EXPOSURE TO CONTAMINANTS FROM THE EASTERN MICHAUD FLATS SITE



NOTES:

1. CONTOURS SHOWN CORRESPOND TO INCREMENTAL CANCER RISK OF 10^{-6}.
2. NO AREAS EXCEED 10^{-6} RISK FOR URANIUM-238.

LEGEND:

270-3A ● SOIL SAMPLING LOCATION AND DESIGNATION

——— RADIUM-226

— — — LEAD-210

-·-·-·- POLONIUM-210

SCALE

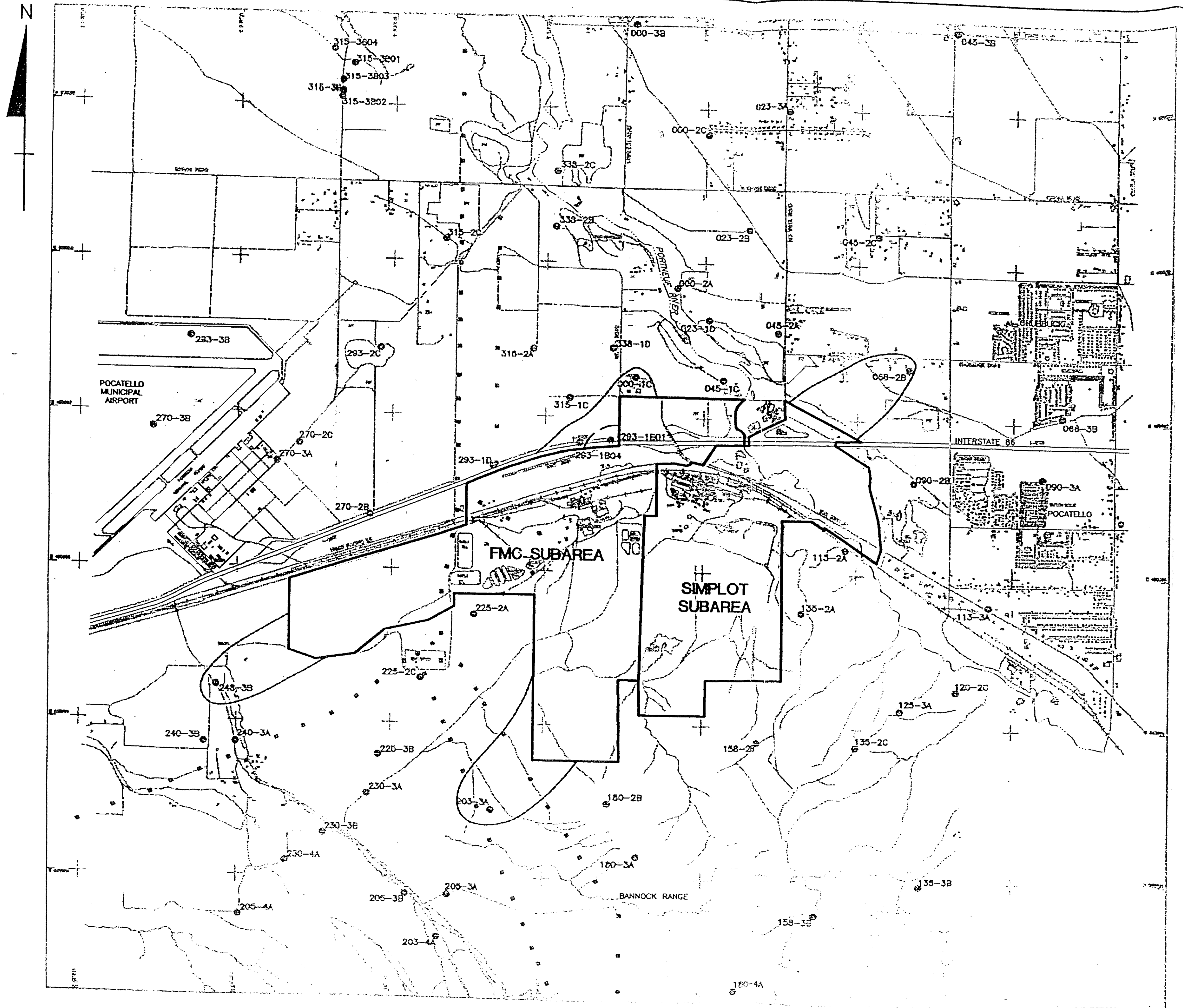
1600 0 1600 FEET

EASTERN MICHAUD FLATS
POCATELLO, IDAHO

FEASIBILITY STUDY

OFFSITE SUBAREA AREAS WHERE RADIONUCLIDE ACTIVITIES IN SURFACE SOILS EXCEED THE 10^{-6} INCREMENTAL CANCER RISK LEVEL

FIGURE 25



NOTES:

1. CONTOURS SHOWN CORRESPOND TO INCREMENTAL CANCER RISK OF 10^{-5}.
2. NO AREAS EXCEED 10^{-5} RISK FOR URANIUM-238, POLONIUM-210.

LEGEND:

270-3A ● SOIL SAMPLING LOCATION AND DESIGNATION

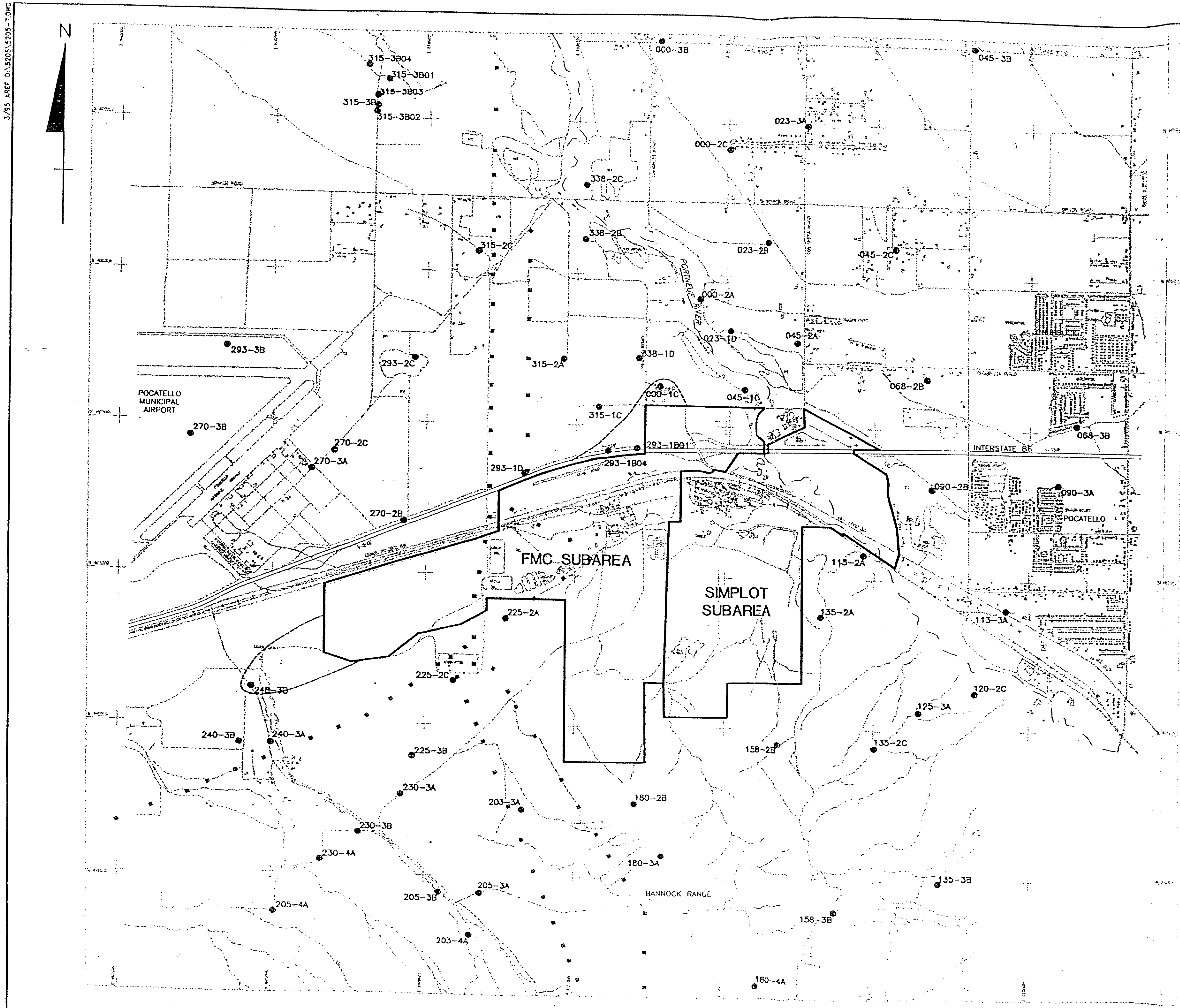
——— RADIUM-226

– – – LEAD-210

SCALE

1600 0 1600 FEET

EASTERN MICHAUD FLATS POCATELLO, IDAHO
FEASIBILITY STUDY
OFFSITE SUBAREA AREAS WHERE RADIONUCLIDE ACTIVITIES IN SURFACE SOILS EXCEED THE 10^{-5} INCREMENTAL CANCER RISK LEVEL
FIGURE 26



3/95 XREF D:\5205\5205-7.DWG

NOTES:

1. CONTOURS SHOWN CORRESPOND TO INCREMENTAL CANCER RISK OF 10^{-4}
2. NO AREAS EXCEED 10^{-4} RISK FOR URANIUM-238, POLONIUM-210, AND LEAD-210.

LEGEND:

270-3A ● SOIL SAMPLING LOCATION AND DESIGNATION

———— RADIUM-226

SCALE

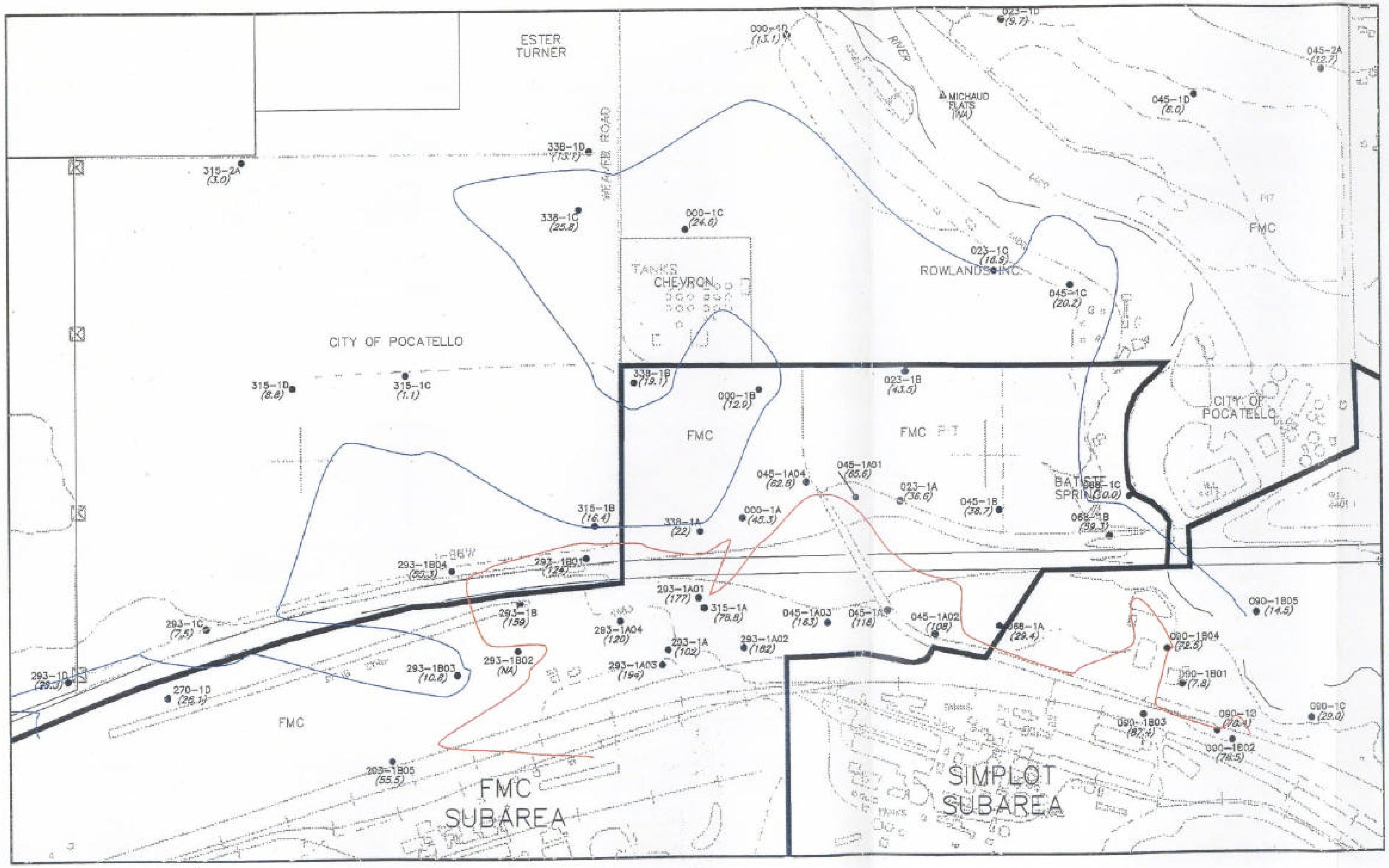
1600 0 1600FEET

EASTERN MICHAUD FLATS
POCATELLO, IDAHO

FEASIBILITY STUDY

OFFSITE SUBAREA AREAS WHERE RADIONUCLIDE ACTIVITIES IN SURFACE SOILS EXCEED THE 10^{-4} INCREMENTAL CANCER RISK LEVEL

FIGURE 27



LEGEND:

113-2A ● SAMPLING LOCATIONS

(3.01) CADMIUM CONCENTRATION (mg/kg)

CT CASE (71 mg/kg)

RME CASE (16.9 mg/kg)

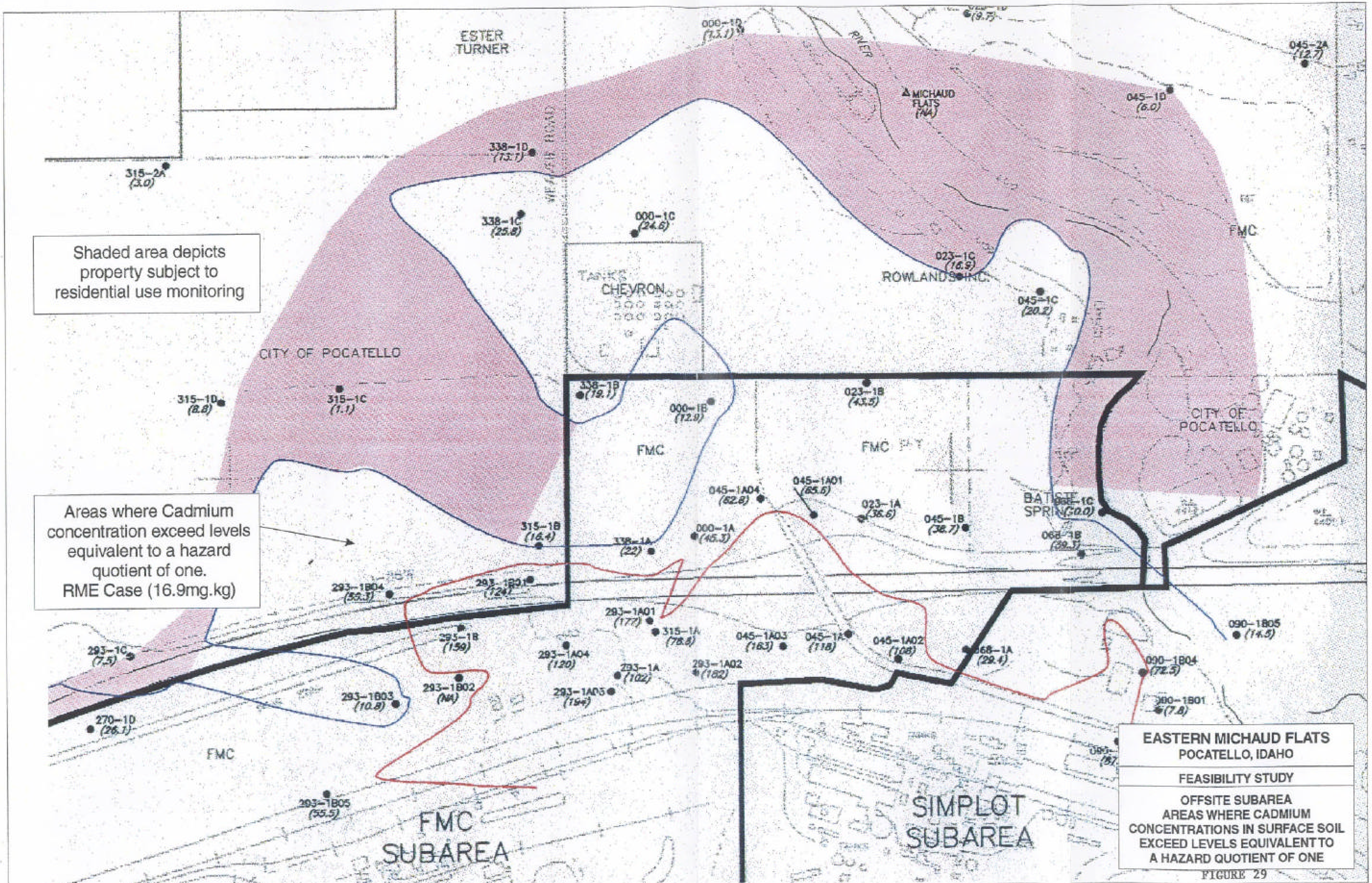
SCALE 400 0 400 FEET

EASTERN MICHAUD FLATS
POCATELLO, IDAHO

FEASIBILITY STUDY

OFFSITE SUBAREA AREAS WHERE CADMIUM CONCENTRATIONS IN SURFACE SOIL EXCEED LEVELS EQUIVALENT TO A HAZARD QUOTIENT OF ONE

FIGURE 28


Shaded area depicts property subject to residential use monitoring
Areas where Cadmium concentration exceed levels equivalent to a hazard quotient of one. RME Case (16.9mg.kg)
ESTER TURNER
RIVER
MICHAUD FLATS (NA)
CITY OF POCATELLO
CHEVRON
ROWLANDS INC.
FMC
FMC PLT
BATISTE SPRING
CITY OF POCATELLO
FMC SUBAREA
SIMPLOT SUBAREA
315-2A (3.0)
338-1D (13.1)
338-1C (25.8)
000-1C (24.6)
045-2A (12.7)
045-1D (6.0)
023-1C (16.9)
045-1C (20.2)
315-1D (8.8)
315-1C (1.1)
338-1B (19.1)
000-1B (12.9)
023-1B (43.5)
045-1A04 (62.8)
045-1A01 (65.6)
023-1A (36.6)
045-1B (38.7)
315-1B (16.4)
338-1A (22)
000-1A (45.3)
293-1B04 (55.3)
293-1B01 (124)
293-1A01 (177)
315-1A (78.8)
045-1A03 (163)
045-1A02 (108)
068-1A (29.4)
090-1B05 (14.5)
090-1B04 (72.5)
293-1C (7.5)
293-1B (159)
293-1A04 (120)
293-1A (102)
293-1A02 (182)
293-1B03 (10.8)
293-1B02 (NA)
293-1A05 (194)
270-1D (26.1)
293-1B05 (55.5)
EASTERN MICHAUD FLATS
POCATELLO, IDAHO
FEASIBILITY STUDY
OFFSITE SUBAREA
AREAS WHERE CADMIUM CONCENTRATIONS IN SURFACE SOIL EXCEED LEVELS EQUIVALENT TO A HAZARD QUOTIENT OF ONE
FIGURE 29

A-23

Table 1
FMC Facility – Unlined Former Ponds
Historical Summary

Pond No.	When Built	When Use Ended	When Dried	Material Received	Cover Material(s)	Other Notes
00S	1954-55	1956	?	Precipitator dust and phossy residuals. Mixed with ore pile and reprocessed.	NA	Site is under Mobile Shop now; Mobile Shop constructed in 1965.
0S	1954-55	1956	Prior to 1965	Precipitator dust and phossy residuals. Some mixed with ore pile and reprocessed.	Slag	Site was a pit only, not a "pond"; site now is a mobile equipment parking lot.
1S	1954	Oct. 1961	1972	Phossy water and phossy solids. Reclaimed to plant twice per year.	Slag, soil.	Initially hauled in slurry truck; pipeline installed in 1957. P_4 was reclaimed to plant from 1966-1972.
2S	1955	Oct. 1961	1972	Phossy water and phossy solids Reclaimed to plant twice per year.	Slag, soil.	P_4 was reclaimed to plant twice a year until September 1965. P_4 continued to be reclaimed to plant from 1966-1972.
3S	Nov. 1961	Jun. 1965	Dec. 1976	Precipitator dust slurry; slag pit water and solids; phossy water and phossy solids; residuals from P_4 reclaim operation on ponds 1S and 2S and east end of 3S	Capped with 3 feet of soil, then covered with crushed slag.	Settled solids were routinely dug out twice a year until 1965. P4 in east end was reclaimed in 1972-1976; approximately 100 feet of east end was filled with slag after reclaiming; this area is not capped as is the rest of the former pond.
4S	Apr. 1966	Mar. 1967	Jul. 1976	Precipitator dust slurry	Capped with 3 to 6 feet of soil.	

A-24

Table 1
FMC Facility – Unlined Former Ponds
Historical Summary (Cont'd)

Pond No.	When Built	When Use Ended	When Dried	Material Received	Cover Material(s)	Other Notes
5S	Jul. 1965	Mar. 1967	Mar. 1976	Phossy water and phossy solids	Capped with baghouse dust; precipitator dust slurry; fluid bed drier product prills and dust; slag; final soil cap on top.	Very difficult to dry because of pyrophoric contents; fine solids would not support cover weight.
6S	Apr. 1967	Feb. 1969	Jul. 1976	Precipitator dust slurry; some phossy water and phossy solids in NE corner.	Capped with soil; south end partially filled with slag and paved with asphalt for use as a new slag haul road.	New slag haul road over south end.
7S	Mar. 1969	Sep. 1970	Jan. 1980	Precipitator dust slurry with phossy hot spots.	Two high - P_4 areas capped with cement; entire area capped with 6 to 10 feet of pit-run slag, then three feet of soil.	New slag haul road over south end; This site is now byproduct ferrophosphorus stockpile, approximately 25 feet high.
8S	Oct. 1970	Sep. 1993	?	Phossy water and phossy solids; some precipitator dust slurry.	Cover design in progress.	Site was raw material source for 8S P_4 recovery plant, built in 1982, closed in 1993.
9S	1971	1974 (?)	Nov. 1980	Precipitator dust slurry; slag pit water and solids. Material dried and sold.	Not capped.	Contents were dried in place and about 20 to 25 feet dug out for outside sales; small quantity remains in place.

A-25

Table 1
FMC Facility – Unlined Former Ponds
Historical Summary (Cont'd)

Pond No.	When Built	When Use Ended	When Dried	Material Received	Cover Material(s)	Other Notes
1E	Apr. 1965	Fall 1982	Oct. 1980	Phossy water and carryover fine solids from upstream ponds; precipitator dust slurry and dried slurry. Material dried and sold.	Not capped.	Filled with dredged precipitator dust slurry from fluid bed drier surge pond in fall of 1982.
2E	Apr. 1965	Oct. 1967	1977	Phossy water and carryover fine solids from upstream ponds. Some material removed and sold.	Site is beneath current Phase IV ponds (8E).	Site was used for storage of precipitator slurry fluid bed drier product, then dug out for lined pond 8E construction in 1984; residual precipitator dust sent to 4E site. Some material was removed and sold.
3E	May 1967	Sep. 1970	1980	Phossy water and carryover fine solids from upstream ponds.	Site is beneath current Phase IV ponds (11S-14S).	Contents dug out for construction of new lined ponds in 1980; this site now occupied by lined ponds 11S, 12S, 13S, and 14S.
4E	May 1967	1980	Oct. 1980	Phossy water and carryover fine solids from upstream ponds; precipitator dust slurry overflow.	Not capped.	Received precipitator slurry from fluid bed drier slurry pond in fall of 1982. Some material removed and sold.

Table 1
FMC Facility – Unlined Former Ponds
Historical Summary (Cont'd)

Pond No.	When Built	When Use Ended	When Dried	Material Received	Cover Material(s)	Other Notes
5E	Apr. 1968	1972-73 (?)	1981	Phossy water and very minor carryover fine solids from upstream ponds.	Site is beneath current Pond 15S.	Dried gray settled soil (4" to 6") placed in area just south of new 15S lined pond. New lined pond 15S was built on this site in 1982.
6E	Nov. 1968	1980-81	1981	Same as 5E.	Same as 5E.	Same as 5E.
7E	Dec. 1969	1980-81	1981	Received phossy water only a few seasons; no solids observed in 7E.	Not capped.	Eastern ± 150 feet used for construction of lined pond 15S (1982) and 9E (1986).

Table 2

RATIOS OF CONCENTRATIONS OF SUBSTANCES IN PHOSPHATE ORE RELATIVE TO LOCAL BACKGROUND SOILS EASTERN MICHAUD FLATS POCATELLO, IDAHO

Chemical	Local Background Soils	Ore
Aluminum	1.00	0.89
Antimony	1.00	7.64
Arsenic	1.00	1.90
Barium	1.00	0.56
Beryllium	1.00	1.90
Boron	1.00	5.80
Cadmium	1.00	40.95
Calcium	1.00	3.06
Chromium	1.00	29.89
Cobalt	1.00	0.11
Copper	1.00	8.25
Fluoride	1.00	22.00
Iron	1.00	0.62
Lead	1.00	0.42
Lead-210	1.00	1.65
Lithium	1.00	0.73
Magnesium	1.00	0.09
Manganese	1.00	0.25
Mercury	1.00	2.25
Molybdenum	1.00	6.98
Nickel	1.00	8.13
Orthophosphate	1.00	935.14
Phosphorus	1.00	98.07
Potassium-40	1.00	0.53
Selenium	1.00	4.49
Silver	1.00	2.68
Thallium	1.00	97.04

Table 2

RATIOS OF CONCENTRATIONS OF SUBSTANCES IN PHOSPHATE ORE RELATIVE TO LOCAL BACKGROUND SOILS EASTERN MICHAUD FLATS POCATELLO, IDAHO

Chemical	Local Background Soils	Ore
Uranium-238	1.00	6.24
Vanadium	1.00	21.94
Zinc	1.00	18.77

Table 3

SUMMARY OF ON-SITE SURFACE SOIL ANALYTICAL RESULTS

Chemical[a]	Units	Frequency of Detection	Minimum Detected Concentration	Maximum Detected Concentration	Average	Background	Frequency of Exceedance of Background	RBC for Worker Soil Ingestion	Frequency of Exceedance of RBC for Worker Soil Ingestion
Aluminum	mg/kg	31/31	6160	20400	12405.81	13900	10/31	2599726.00	0/31
Antimony	mg/kg	1/30	7.8	7.8	5.68	2.2	1/30	358.58	0/30
Arsenic	mg/kg	21/21	2.2	15.8	7.82	7.7	9/21	1.43	21/21
Barium	mg/kg	31/31	85.8	847	242.03	188	12/31	61611.59	0/31
Beryllium	mg/kg	26/26	0.3	2.9	1.10	1	8/26	0.58	22/26
Boron	mg/kg	23/23	5.8	1550	112.45	12.8	20/23	80636.05	0/23
Cadmium	mg/kg	26/31	0.71	918	58.27	1.9	24/31	448.23	1/31
Chromium	mg/kg	31/31	16.3	763	177.09	27.5	25/31	896457.30	0/31
Cobalt	mg/kg	27/31	0.64	8.9	3.98	7.6	2/31		
Copper	mg/kg	31/31	8.4	109	37.08	12.6	28/31	33258.56	0/31
Fluoride	mg/kg	31/31	410	155000	16867.74	600	30/31	53787.44	3/31
Lead	mg/kg	27/29	5.5	157	20.88	29.1	6/29		
Lead-210	pCi/g	31/31	12	216	73.75	3.03	31/31	6.24	31/31
Lithium	mg/kg	26/26	4	36.9	10.86	16.1	2/26	17929.14	0/26
Manganese	mg/kg	31/31	46.1	557	255.81	482	1/31	4475.04	0/31
Mercury	mg/kg	9/13	0.06	15.6	1.59	0.16	6/13	268.91	0/13
Molybdenum	mg/kg	18/29	1.9	36.3	6.86	2.15	17/29	4482.29	0/29
Nickel	mg/kg	30/30	11.7	3400	154.90	15.5	26/30	17929.14	0/30
Selenium	mg/kg	18/18	0.62	680	45.07	1.36	16/18	4482.29	0/18
Silver	mg/kg	16/30	1.1	87.1	6.37	1.9	13/30	4482.29	0/30
Uranium-238	pCi/g	31/31	12	216	73.75	3.88	31/31	4.42	31/31
Vanadium	mg/kg	31/31	23.5	980	237.55	45.4	23/31	6275.20	0/31
Zinc	mg/kg	31/31	53.4	15200	846.21	52.8	31/31	268937.20	0/31

[a] Lead-210 and Uranium-238 were the only radionuclides measured in on-site soil.

Table 3A

SUMMARY OF OFF-SITE SURFACE SOIL ANALYTICAL RESULTS

Chemical	Units	Frequency of Detection	Minimum Detected Concentration	Maximum Detected Concentration	Average	Background	Frequency of Exceedance of Background	RBC for Residential Soil and Homegrown Produce Ingestion	Frequency of Exceedance of RBC for Residential Soil and Homegrown Produce Ingestion
Aluminum	mg/kg	142/143	1,150	18,900	12,520.21	13,900	35/143	221,655.20	0/143
Antimony	mg/kg	16/127	3.8	26.6	3.97	2.2	16/127	14.92	3/127
Arsenic	mg/kg	128/137	1	18.4	5.39	7.7	22/137	0.35	128/137
Barium	mg/kg	143/143	69.8	770	169.03	188	24/143	3,365.12	0/143
Beryllium	mg/kg	125/138	0.14	2	0.77	1	25/138	0.20	123/138
Boron	mg/kg	132/136	1.42	197	10.86	12.8	28/136	115.95	1/136
Cadmium	mg/kg	135/139	0.32	189	22.08	1.9	104/139	6.70	62/139
Chromium	mg/kg	143/143	9.3	608	81.85	27.5	76/143	69,081.38	0/143
Cobalt	mg/kg	115/138	1.8	11.3	4.75	7.6	7/138		""
Copper	mg/kg	143/143	8.7	84.4	21.52	12.6	127/143	348.77	0/143
Fluoride	mg/kg	143/143	164	27,200	2,469.95	600	72/143	3,759.49	22/143
Lead	mg/kg	143/143	0.8	2,030	42.55	29.1	46/143	500.00	1/143
Lead-210	pCi/g	76/94	0.441	50.8	6.69	3.03	51/89	0.57	69/89
Lithium	mg/kg	143/143	6.1	65.6	13.45	16.1	22/143	1,367.48	0/143
Manganese	mg/kg	143/143	44.9	1,330	428.32	482	44/143	144.34	138/143

Table 3A

SUMMARY OF OFF-SITE SURFACE SOIL ANALYTICAL RESULTS

Chemical	Units	Frequency of Detection	Minimum Detected Concentration	Maximum Detected Concentration	Average	Background	Frequency of Exceedance of Background	RBC for Residential Soil and Homegrown Produce Ingestion	Frequency of Exceedance of RBC for Residential Soil and Homegrown Produce Ingestion
Mercury	mg/kg	79/115	0.05	1.2	0.15	0.16	19/115	3.05	0/115
Molybdenum	mg/kg	32/134	1.3	19.1	2.61	2.15	23/134	131.29	0/134
Nickel	mg/kg	134/143	6.7	124	23.20	15.5	55/143	578.30	0/143
Polonium-210	pCi/g	94/94	0.387	50.9	7.76	3.58	59/89	4.88	55/89
Potassium-40	pCi/g	94/94	5.96	31.4	16.97	20.5	17/89	0.07	89/89
Selenium	mg/kg	87/129	0.29	16.3	1.75	1.36	38/129	228.64	0/129
Silver	mg/kg	100/139	0.2	10.8	1.72	1.9	32/139	91.51	0/139
Thallium	mg/kg	117/137	0.02	3.9	0.48	0.27	51/137	6.16	0/137
Uranium-238	pCi/g	81/94	0.0111	26.9	3.97	3.88	22/89	1.08	72/89
Vanadium	mg/kg	143/143	10.6	729	101.38	45.4	49/143	502.82	10/143
Zinc	mg/kg	143/143	43.7	1,540	223.21	52.8	139/143	855.16	12/143

Table 4

LOCATIONS WHERE GROSS ALPHA ACTIVITIES WERE MEASURED ABOVE THE SOIL SCREENING LEVEL IN SUBSURFACE SOIL

Sample ID	Location	Sample Depth (feet)	Sample Description	Activity (pCi/g)
S004B	Beneath gypsum stack	20	Pale brown silt	52.5
S004B	Beneath gypsum stack	70	Pale brown silt	55.7
S006B	Beneath gypsum stack	10	Dark brown silty sandy	69.4
S036B	Ammonia #1 plant	2	Gravel	44.5
S049B	Ammonium sulfate plant	2	Tan silt with gravel	47.2
S052B	Triple superphos. plant	2	Dark brown clayey silt	49.1 J
S068B	Cooling tower area	5	With gravel	42.5 J
S069B	Cooling tower area	1	Brown silt	205.0 J
S070B	Former cooling pond	7	Silty gravel	50.1
S071B	Former cooling pond	2	Light gray gravel	364.0
S071B	Former cooling pond	5	(Backfill)	160.0 J
S100B	Former cooling pond	2	Weak red silty sand	178.0
S100B	Former cooling pond	5	Black silt (fill)	155.0
S100B	Former cooling pond	7	Light yellowish-brown sandy	60.5
S100B	Former cooling pond	10	Gravel	90.1
S101B	Cooling tower area	2	Tan silt	72.2
S103B	Former phos acid rail car cleaning	7	Fill (sandstone)	156.0

Table 5

SUMMARY OF GROUNDWATER ANALYTICAL RESULTS

Chemical	Units	Frequency of Detection	Minimum Detected Concentration	Maximum Detected Concentration	Average	Background	Frequency of Exceedance of Background	Primary MCL	Frequency of Exceedance of Primary MCL	Secondary MCL	Frequency of Exceedance Secondary MCL	RBC for Residential Water Ingestion	Frequency of Exceedance of RBC for Residential Water Ingestion
Metals													
Aluminum	mg/l	146/631	0.0168	567.4	3.118134	0.591777	47/631			0.05	110/631	45.06706	4/631
Antimony	mg/l	17/737	0.039	1.073	0.0339533	0.05	14/737	0.006	17/737			0.006199296	17/737
Arsenic	mg/l	639/714	0.0014	5.532	0.1119846	0.0162075	439/714	0.05	258/714			0.000048003	639/714
Barium	mg/l	791/813	0.0079	2.2245	0.1205218	0.22378	65/813	2	2/813			1.087297	3/813
Beryllium	mg/l	63/673	0.0002	0.0833	0.0009556	0.001	49/673	0.004	5/673			0.000019586	63/673
Boron	mg/l	639/690	0.0343	89	0.9693398	0.238107	393/690					1.362344	87/690
Cadmium	mg/l	104/746	0.0001	3.9	0.0224268	0.0025	34/746	0.005	23/746			0.007775578	15/746
Chromium	mg/l	386/616	0.0003	7.584	0.0346992	0.006828	32/616	0.1	5/616			0.07661079	5/616
Cobalt	mg/l	266/742	0.0024	0.1389	0.0090511	0.008325	182/742						--
Copper	mg/l	131/644	0.002	1.1235	0.0107905	0.0049975	99/644	1.3	0/644	1	2/644	0.5539213	4/644
Iron	mg/l	277/586	0.01	154.31	1.282207	0.648248	64/586			0.3	106/586		--
Lead	mg/l	72/742	0.0006	0.71	0.002061	0.002	42/742	0.015	7/742				--
Lithium	mg/l	563/572	0.005	4.146	0.1266687	0.0613445	311/572					0.3103279	44/572
Manganese	mg/l	443/704	0.001	91.2	0.7798741	0.03625	345/704			0.05	333/704	0.07661277	312/704
Mercury	mg/l	91/290	0.0001	0.0043	0.0002734	0.00037	35/290	0.002	8/290			0.004634573	0/290
Molybdenum	mg/l	119/670	0.0092	0.2555	0.0122956	0.048	17/670					0.07763741	3/670
Nickel	mg/l	102/697	0.0079	3.4581	0.0292505	0.01	99/697	0.1	10/697			0.2986646	7/697
Selenium	mg/l	406/626	0.0005	19.735	0.047591	0.004866	224/626	0.05	39/626			0.07523498	30/626
Silver	mg/l	60/665	0.002	0.02	0.0021373	0.002	43/665			0.1	0/665	0.07611	0/665
Thallium	mg/l	49/711	0.0003	9.0899	0.0154203	0.002	13/711	0.002	13/711			0.001245546	21/711
Vanadium	mg/l	312/632	0.0021	22.317	0.1332993	0.01	137/632					0.1077162	21/632
Zinc, total	mg/l	109/450	0.0029	28.914	0.2644352	0.0174	70/450			5	5/450	3.920542	5/450
Volatile Organics													

Table 5

SUMMARY OF GROUNDWATER ANALYTICAL RESULTS

Chemical	Units	Frequency of Detection	Minimum Detected Concentration	Maximum Detected Concentration	Average	Background	Frequency of Exceedance of Background	Primary MCL	Frequency of Exceedance of Primary MCL	Secondary MCL	Frequency of Exceedance Secondary MCL	RBC for Residential Water Ingestion	Frequency of Exceedance o RBC for Residential Water Ingestion
1,1,1-Trichloroethane	mg/l	2/136	0.008	0.009	0.0026249								
2-Butanone	mg/l	7/107	0.003	0.01	0.0099019								
Acetone	mg/l	26/106	0.026	3.275	0.1919811								
Carbon disulfide	mg/l	7/112	0.001	0.168	0.0047277								
Chlorobenzene	mg/l	2/136	0.001	0.0018	0.0025202								
Chloroform	mg/l	2/127	0.001	0.001	0.0024961								
Ethyl benzene	mg/l	4/136	0.001	0.002	0.0025074								
Methylene chloride	mg/l	2/106	0.001	0.0033	0.0027028								
Tetrachloroethene	mg/l	12/136	0.001	0.035	0.00275	0.002875	6/136	0.005	1/136			0.001428671	9/136
Toluene	mg/l	8/111	0.001	0.004	0.0024685								
Trichloroethene	mg/l	14/135	0.001	0.028	0.0029278	0.0025	9/135	0.005	5/135			0.002542289	9/135
Xylenes	mg/l	8/130	0.001	0.011	0.0026635								
Semivolatile Organic													
Benzoic acid	mg/l	2/125	0.001	0.003	0.024632								
Bis(2-ethylhexyl) phthalate	mg/l	65/83	0.001	0.054	0.0083072								
Di-n-butylphthalate	mg/l	9/112	0.001	0.004	0.0049018								
Di-n-octylphthalate	mg/l	2/134	0.001	0.002	0.0049328								
Diethylphthalate	mg/l	2/122	0.001	0.001	0.0049344								
Dimethylphthalate	mg/l	11/123	0.001	0.087	0.0079674								

Table 5

SUMMARY OF GROUNDWATER ANALYTICAL RESULTS

Chemical	Units	Frequency of Detection	Minimum Detected Concentration	Maximum Detected Concentration	Average	Background	Frequency of Exceedance of Background	Primary MCL	Frequency of Exceedance of Primary MCL	Secondary MCL	Frequency of Exceedance Secondary MCL	RBC for Residential Water Ingestion	Frequency of Exceedance of RBC for Residential Water Ingestion
Tetrahydrofuran	mg/l	1/46	0.292	0.292	0.0087935								
Radionuclides													
Antimony-125	pCi/L	1/12	9	9	3.283								
Cesium-134	pCi/L	2/12	3.07	3.9	0.4954171								
Cobalt-57	pCi/L	1/12	4.48	4.48	0.9096667								
Cobalt-60	pCi/L	2/12	3.86	4.21	1.138579								
Europium-152	pCi/L	1/12	11.7	11.7	2.684625								
Europium-154	pCi/L	1/12	8.22	8.22	2.154041								
Gross alpha	pCi/L	563/841	-7.235	1,690	9.514483			15	58/841				
Gross beta	pCi/L	745/766	0.785	1,355	51.34504			50	134/766				
Lead-210	pCi/L	3/11	47.85	308.3	149.7827								
Polonium-210	pCi/L	1/7	-0.049	-0.049	0.0891143								
Potassium-40	pCi/L	7/12	32.9	1,330	275.4083								
Radium-226	pCi/L	593/623	0.05	7.09	0.6405725			20	0/623			0.3931652	282/623
Radium-228	pCi/L	275/520	-0.1	13.9	1.218124			20	0/520			0.4717982	271/520
Ruthenium-106	pCi/L	1/12	23.7	23.7	7.08625								
Sodium-22	pCi/L	3/12	2.5	3.34	1.377383								
Thorium-228	pCi/L	3/7	-0.035	0.33	0.0898286								
Thorium-230	pCi/L	2/7	-0.009	0.3	0.1535286								
Thorium-232	pCi/L	2/7	-0.019	-0.017	0.0665286								
Uranium-233/234	pCi/L	7/7	0.199	28.75	8.732285							2.923504	3/7
Uranium-235	pCi/L	3/7	0.104	0.4105	0.1337							2.923504	0/7
Uranium-238	pCi/L	8/12	7.125	180	52.83454							1.670574	8/12

Table 5

SUMMARY OF GROUNDWATER ANALYTICAL RESULTS

Chemical	Units	Frequency of Detection	Minimum Detected Concentration	Maximum Detected Concentration	Average	Background	Frequency of Exceedance of Background	Primary MCL	Frequency of Exceedance of Primary MCL	Secondary MCL	Frequency of Exceedance Secondary MCL	RBC for Residential Water Ingestion	Frequency of Exceedance of RBC for Residential Water Ingestion
Yttrium-88	pCi/L	1/12	3.34	3.34	0.6949583								
Zinc-65	pCi/L	1/12	4.781	4.781	-1.015333								
Water Quality													
Ammonia (NH3 as N)	mg/l	181/781	0.2	1,220	3.151017								
Calcium	mg/l	835/837	15.4	1,211	140.6328								
Chloride	mg/l	820/821	9	7,750	154.5226	183.4	194/821			250	122/821		
Fluoride	mg/l	784/905	0.08	2,815	7.501513	0.8	235/905	4	44/905	2	69/905	0.9319686	168/905
Magnesium	mg/l	837/837	0.5	694	61.53564								
Nitrate (NO3 as N)	mg/l	823/879	0.05	660	6.605705								
Orthophosphate (PO4 as P)	mg/l	691/781	0.015	4,760	43.98905								
Phosphorus, total	mg/l	709/796	0.015	6,830	50.9344								
Potassium	mg/l	884/884	2.9	29,010	99.35796								
Sodium	mg/l	823/823	12.6	5,208	164.1313	63.15144	472/823			20	805/823		
Sulfate	mg/l	890/891	0.83	36,400	422.047								

Key:

MCL = Maximum Contaminant Level.
RBC = Risk-based concentration.

Table 6

SUMMARY OF AIR ANALYTICAL RESULTS

Chemical	Units	Frequency of Detect	Minimum Detected Concentration	Maximum Detected Concentration	Average	Background	Frequency of Exceedance of Background	RBC for Inhalation	Frequency of Exceedance of RBC for Inhalation
Aluminum	$\mu g/m^3$	143/206	0.01348758	0.7558537	0.1422603	0.333965	20/206		
Arsenic	$\mu g/m^3$	234/323	0.0001552321	0.004613158	0.0006511955	0.0014533	41/323	0.0004146172	139/323
Barium	$\mu g/m^3$	148/206	0.001654159	0.02286252	0.003815881	0.004592	55/206	3.836927	0/206
Beryllium	$\mu g/m^3$	11/206	0.0001574981	0.0002707787	0.0000893683	0.0000853	11/206	0.0007453238	0/206
Cadmium	$\mu g/m^3$	135/323	0.001322299	0.05603214	0.002797181	0.000683	135/323	0.0009937652	135/323
Chromium	$\mu g/m^3$	144/323	0.0006014503	0.1021287	0.0037329	0.000636	143/323	0.0001490648	144/323
Gross alpha	pCi/m^3	12/16	0.0009556486	0.0523169	0.006434824				
Gross beta	pCi/m^3	15/16	0.002679193	0.01173803	0.006193763				
Lead-210	pCi/m^3	328/351	0.0020951	0.1169215	0.02316781	0.053491	24/351	0.001190476	328/351
Manganese	$\mu g/m^3$	203/206	0.0005923851	0.02644496	0.005779869	0.013395	16/206	0.3756432	0/206
Nickel	$\mu g/m^3$	35/244	0.003167659	0.009066898	0.002123739	0.002563	35/244	0.007453239	3/244
Phosphorus	$\mu g/m^3$	130/323	0.1804351	19.10782	1.188753	0.202894	127/323		
Polonium-210	pCi/m^3	343/351	0.0003668404	0.3505943	0.01910664	0.015654	103/351	0.001831502	327/351
Radium-226	pCi/m^3	49/351	0.00001792433	0.003332056	0.0001055182	0.001053	10/351	0.001587302	1/351
Radium-228	pCi/m^3	72/234	0.0001174482	0.01580375	0.00103737	0.002883	14/234	0.006901311	2/234
Selenium	$\mu g/m^3$	27/206	0.01621767	0.1208713	0.01149783	0.008532	27/206		
Silver	$\mu g/m^3$	21/206	0.001137036	0.004287942	0.0006996106	0.000595	21/206		

Key at end of table.

Table 6

SUMMARY OF AIR ANALYTICAL RESULTS

Chemical	Units	Frequency of Detect	Minimum Detected Concentration	Maximum Detected Concentration	Average	Background	Frequency of Exceedance of Background	RBC for Inhalation	Frequency of Exceedance of RBC for Inhalation
Thallium	$\mu g/m^3$	6/206342	0.03193704	0.04337898	0.01717279	0.01711	6/206		
Thorium-230	pCi/m^3	235/351	0.0000232234	0.001498582	0.0001042818	0.000103	95/351	0.0001642036	48/351
Thorium-232	pCi/m^3	6/234	0.00002112716	0.00009968953	0.00000735504	0.0000268	5/234	0.000170068	0/234
Uranium	pCi/m^3	347/351	0.00000282146	0.005288986	0.0002094924	0.0000762	181/351	0.0001984127	88/351
Vanadium	$\mu g/m^3$	141/323	0.001553667	0.1215817	0.004166464	0.000857	141/323		
Zinc	$\mu g/m^3$	293/323	0.001158892	0.415641	0.02132566	0.010402	170/323		

Key:

RBC = Risk-based concentration.

Table 7

PORTNEUF RIVER DELTA SEDIMENT INVESTIGATION
SUMMARY OF STATISTICAL COMPARISON TO BACKGROUND

Element	Average Concentration (mg/kg)		Is Portneuf Significantly Greater than Snake?[a]	Element/Aluminum Ratio		Is Portneuf Significantly Greater than Snake?[a]
	Snake	Portneuf		Snake	Portneuf	
Aluminum	5,050	8,100	Yes	NA	NA	NA
Arsenic	3.11	2.89	No	2.30×10^{-4}	1.36×10^{-4}	No
Cadmium	0.369	0.934	Yes	1.70×10^{-5}	2.94×10^{-5}	Yes
Fluoride	247	345	Yes	7.79×10^{-2}	6.92×10^{-2}	No
Selenium	0.622	0.812	No	4.55×10^{-5}	3.37×10^{-5}	No
Zinc	35.2	42.9	Yes	3.05×10^{-3}	2.23×10^{-3}	No

[a] Average concentrations were compared ($p < 0.2$). Appendix C discusses the statistical approach and tests used.

Key:

NA = Not applicable.

Table 8

TERRESTRIAL ECOLOGICAL INVESTIGATIONS
SUMMARY OF STATISTICAL COMPARISON TO BACKGROUND FOR SOIL (mg/kg)

Habitat	Chemical	Location	Frequency of Detection	Minimum Detected Concentration	Maximum Detected Concentration	Average Concentration	Is Impacted Area Significantly Greater Than Background Area?[a]
Sagebrush steppe	Cadmium	Bannock Hills SW	10/10	18.6	34.1	27.2	Yes
		Michaud Flats	10/10	9.4	31.1	21.0	Yes
		Ferry Butte[b]	10/10	0.47	1.2	0.68	—
	Fluoride	Bannock Hills SW	10/10	1,100	1,840	1,454	Yes
		Michaud Flats	10/10	850	3,200	1,793	Yes
		Ferry Butte[b]	10/10	330	421	363	—
	Zinc	Bannock Hills SW	10/10	183	342	256	Yes
		Michaud Flats	10/10	88.4	219	156	Yes
		Ferry Butte[b]	10/10	49.4	64.1	56.5	—
Riparian	Cadmium	Portneuf	10/10	0.64	27.6	10.3	Yes
		Snake[b]	10/10	0.17	0.4	0.26	—
	Fluoride	Portneuf	10/10	321	2,930	1,073	Yes
		Snake[b]	10/10	175	298	245	—
	Zinc	Portneuf	10/10	47.5	197	114	Yes
		Snake[b]	10/10	15.5	31.5	24.1	—

[a] Average concentrations were compared ($p < 0.2$). Appendix C discusses the statistical approach and tests used.
[b] Background area.

Table 9

TERRESTRIAL ECOLOGICAL INVESTIGATIONS
SUMMARY OF STATISTICAL COMPARISON TO BACKGROUND FOR VEGETATION (mg/kg)

Habitat	Chemical	Vegetation	Location	Frequency of Detection	Minimum Detected Concentration	Maximum Detected Concentration	Average Concentration	Is Impacted Area Significantly Greater Than Background Area[a]
Sagebrush steppe	Cadmium	Sagebrush foliage (unwashed)	Bannock Hills SW	10/10	0.81	1.2	0.99	Yes
			Michaud Flats	10/10	0.97	1.7	1.27	Yes
			Ferry Butte[b]	5/10	0.2	0.35	0.17	—
		Sagebrush foliage (washed)	Bannock Hills SW	10/10	0.59	1.2	0.77	Yes
			Michaud Flats	10/10	0.61	1.5	1.10	Yes
			Ferry Butte[b]	4/10	0.21	0.34	0.17	—
		Thickspike wheatgrass (stems and leaves)	Bannock Hills SW	10/10	0.33	0.88	0.54	Yes
			Michaud Flats	10/10	0.33	0.59	0.46	Yes
			Ferry Butte[b]	2/10	0.14	0.40	0.12	—
	Fluoride	Sagebrush foliage (unwashed)	Bannock Hills SW	18/20	47.3	122	74.2	Yes[c]
			Michaud Flats	19/20	25.5	114	55.6	Yes[c]
			Ferry Butte[b]	0/20	—	—	12.1[d]	—
		Sagebrush foliage (washed)	Bannock Hills SW	0/20	—	—	—	—[c]
			Michaud Flats	0/20	—	—	—	—[c]
			Ferry Butte[b]	0/20	—	—	—	—
		Thickspike wheatgrass (stems and leaves	Bannock Hills SW	10/10	39.6	111	62.1	Yes[c]
			Michaud Flats	4/10	25.0	51.1	22.4	Yes[c]
			Ferry Butte[b]	0/10	—	—	12.2[e]	—

Table 9

TERRESTRIAL ECOLOGICAL INVESTIGATIONS
SUMMARY OF STATISTICAL COMPARISON TO BACKGROUND FOR VEGETATION (mg/kg)

Habitat	Chemical	Vegetation	Location	Frequency of Detection	Minimum Detected Concentration	Maximum Detected Concentration	Average Concentration	Is Impacted Area Significantly Greater Than Background Area[a]
	Zinc	Sagebrush foliage (unwashed)	Bannock Hills SW	10/10	26.1	39.8	31.2	No
			Michaud Flats	10/10	30.6	49.1	38.3	Yes
			Ferry Butte[b]	10/10	22.7	44.1	30.2	—
		Sagebrush foliage (washed)	Bannock Hills SW	10/10	22.4	31.5	26.0	No
			Michaud Flats	10/10	15.0	43.9	32.7	Yes
			Ferry Butte[b]	10/10	23.5	40.7	27.6	—
		Thickspike wheatgrass (stems and leaves)	Bannock Hills SW	10/10	6.5	16.5	11.5	Yes
			Michaud Flats	10/10	7.9	15.1	10.8	Yes
			Ferry Butte[b]	10/10	5.2	10.5	8.2	—
Riparian	Cadmium	Russian olive (fruit)	Portneuf	5/10	0.2	0.33	0.18	Yes[c]
			Snake[b]	1/10	0.66[f]	0.66[f]	0.10	—

Table 9

TERRESTRIAL ECOLOGICAL INVESTIGATIONS
SUMMARY OF STATISTICAL COMPARISON TO BACKGROUND FOR VEGETATION (mg/kg)

Habitat	Chemical	Vegetation	Location	Frequency of Detection	Minimum Detected Concentration	Maximum Detected Concentration	Average Concentration	Is Impacted Area Significantly Greater Than Background Area[a]
	Fluoride	Russian olive (fruit)	Portneuf	0/10	—	—	12.0[d]	—[e]
			Snake[b]	0/10	—	—	11.9[d]	—
	Zinc	Russian olive (fruit)	Portneuf	10/10	7.3	13.3	10.2	Yes
			Snake[b]	10/10	5.4	9.4	7.2	—

a Average concentrations were compared (p <0.2). Appendix C discusses the statistical approach and tests used.
b Background area.
c Meaningful statistical comparison to background area not possible because all background samples were less than method detection limit. Potentially impacted area judged to be elevated because of high frequency of detects compared with background area.
d One-half of detection limit.
e Meaningful statistical comparisons not possible; all reported values were less than method detection limit.
f Outlier.

Table 10

TERRESTRIAL ECOLOGICAL INVESTIGATIONS
SUMMARY OF STATISTICAL COMPARISON TO BACKGROUND FOR DEER MICE (mg/kg)

Chemical	Tissue	Location	Frequency of Detection	Minimum Detected Concentration	Maximum Detected Concentration	Average Concentration	Is Impacted Area Significantly Greater than Reference Area[a]
Cadmium	Whole body	Bannock Hills SW	10/10	0.24	1.2	0.61	Yes
		Michaud Flats	10/10	0.08	0.42	0.22	Yes
		Ferry Butte[b]	10/10	0.02	0.15	0.07	—
Fluoride	Whole body	Bannock Hills SW	10/10	93.8	173	128	Yes[c]
		Michaud Flats	10/10	50.4	135	90.9	Yes[c]
		Ferry Butte[b]	0/10	—	—	6.8[d]	—
	Femur	Bannock Hills SW	7/10	196	760	297	Yes
		Michaud Flats	10/10	291	1,030	633	Yes
		Ferry Butte[b]	3/10	195	301	130	—
Zinc	Whole body	Bannock Hills SW	10/10	31.7	48.1	38.5	No
		Michaud Flats	10/10	33	43.5	37.6	No
		Ferry Butte[b]	10/10	28.2	48.3	38.6	—

Table 3-3 (Cont.)

a Average concentrations were compared (p <0.2). Appendix C discusses the statistical approach and tests used.
b Background area.
c Meaningful statistical comparison to background area not possible because all background samples were less than the method detection limit. Potentially impacted area judged to be elevated because of high frequency of detects compared with background area.
d One-half of method detection limit.

Table 11

EMF SOIL SCREENING CRITERIA

Analyte	Units	Background	Lower RBC	Higher RBC
Aluminum	mg/kg	13,900	22,165.52	221,655.2
Antimony	mg/kg	2.2	1.491719	14.91719
Arsenic	mg/kg	7.7	0.034565	0.34565
Barium	mg/kg	188	336.5123	3,365.123
Beryllium	mg/kg	1	0.020117	0.201167
Boron	mg/kg	12.8	11.59451	115.9451
Cadmium	mg/kg	1.9	0.669825	6.698249
Chromium	mg/kg	27.5	6,908.139	69,081.38
Cobalt	mg/kg	7.6	a	a
Copper	mg/kg	12.6	34.87675	348.7675
Fluoride	mg/kg	600	375.9492	3,759.492
Lead	mg/kg	29.1	a	400[b]
Lead-210	pCi/g soil	3.03	0.057346	0.573462
Lithium	mg/kg	16.1	136.7482	1,367.482
Manganese	mg/kg	482	14.43405	144.3405
Mercury	mg/kg	0.16	0.305078	3.050778
Molybdenum	mg/kg	2.15	13.12949	131.2949
Nickel	mg/kg	15.5	57.82999	578.2999
Polonium-210	pCi/g soil	3.58	0.488262	4.882621
Potassium-40	pCi/g soil	20.5	0.007029	0.070288
Selenium	mg/kg	1.36	22.86415	228.6415
Silver	mg/kg	1.9	9.150839	91.50838
Strontium	mg/kg	NA	413.6858	4,136.858
Thallium	mg/kg	0.27	0.615519	6.155192
Uranium	mg/kg	NA	20.94732	209.4732
Uranium-238	pCi/g soil	3.88	0.108358	1.083576

Key at end of table.

Table 11

EMF SOIL SCREENING CRITERIA

Analyte	Units	Background	Lower RBC	Higher RBC
Vanadium	mg/kg	45.4	50.2819	502.819
Zinc	mg/kg	52.8	85.51619	855.1619

a No toxicity values were available at the time data were compiled.
b Residential soil screening level (EPA 1994e).

Key:

NA = Not analyzed for in soil samples.
RBC = Risk-based concentration.

Table 12

EMF GROUNDWATER SCREENING CRITERIA

Analyte	Units	Background	Lower RBC	Higher RBC	Primary MCL	Secondary MCL
Aluminum	mg/L	0.591777	4.506706	45.06706	—	0.05
Antimony	mg/L	0.05	0.0006199296	0.006199296	0.006	—
Arsenic	mg/L	0.0162075	4.800307E-06	4.800307E-05	0.05	—
Barium	mg/L	0.22378	0.1087297	1.087297	2	—
Beryllium	mg/L	0.001	1.958621E-06	1.958621E-05	0.004	—
Boron	mg/L	0.238107	0.1362344	1.362344	—	—
Cadmium	mg/L	0.0025	0.0007775578	0.007775578	0.005	—
Chromium	mg/L	0.008751	0.007661079	0.07661079	0.1	—
Copper	mg/L	0.0049975	0.05539213	0.5539213	1.3[a]	1
Fluoride	mg/L	0.8	0.09319686	0.9319686	4	2
Lithium	mg/L	0.0613445	0.03103279	0.3103279	—	—
Manganese	mg/L	0.03625	0.007661277	0.07661277	—	0.05
Mercury	mg/L	0.000965	0.0004634573	0.004634573	0.002	—
Molybdenum	mg/L	0.048	0.007763741	0.07763741	—	—
Nickel	mg/L	0.01	0.02986646	0.2986646	0.1	—
Nitrate	mg/L	4.636	2.502857	25.02857	10	—
Radium-226	pCi/L	1.552	0.03931652	0.3931652	20	—
Radium-228	pCi/L	5.32	0.04717982	0.4717982	20	—
Selenium	mg/L	0.0051345	0.007523498	0.07523498	0.05	—
Silver	mg/L	0.00228	0.007611	0.07611	—	0.1
Strontium	mg/L	—	0.8780887	8.780887	—	—
Tetrachloroethene	mg/L	0.002875	0.0001428671	0.001428671	0.005	—
Thallium	mg/L	0.02	0.0001245546	0.001245546	0.002	—
Trichloroethene	mg/L	0.0025	0,0002542289	0.002542289	0.005	—
Uranium	mg/L	—	0.004645992	0.04645992	0.02	—
Uranium-233/234	pCi/L	—	0.2923504	2.923504	—	—

Key at end of table.

Table 12

EMF GROUNDWATER SCREENING CRITERIA

Analyte	Units	Background	Lower RBC	Higher RBC	Primary MCL	Secondary MCL
Uranium-235	pCi/L	—	0.2923504	2.923504	—	—
Uranium-238	pCi/L	—	0.1670574	1.670574	—	—
Vanadium	mg/L	0.01	0.01077162	0.1077162	—	—
Zinc	mg/L	0.0174	0.3920542	3.920542	—	5
Gross alpha	pCi/L	5.432	—	—	15	—
Gross beta	pCi/L	10.2	—	—	[b]	—

[a] MCLG.
[b] 4 millirems/year.

Key:

— = No values available.
MCL = Maximum contaminant level.
MCLG = Maximum contaminant level goal.
RBC = Risk-based concentration.

Table 13

EMF AIR SCREENING CRITERIA

Analyte	Units	Background	Lower RBC	Higher RBC	NAAQS
Aluminum	µg/m3	0.333965	—	—	—
Arsenic	µg/m3	0.0014533	0.000041	0.00041	—
Barium	µg/m3	0.004592	0.383693	3.83693	—
Beryllium	µg/m3	0.0000853	0.000075	0.00075	—
Cadmium	µg/m3	0.000683	0.000099	0.00099	—
Chromium	µg/m3	0.000636	0.000015	0.00015	—
Crystalline quartz	µg/m3	42.0456	—	—	—
Crystobalite	µg/m3	3.89105	—	—	—
Gaseous Fluoride	µg/m3	0.064727	—	—	—
Lead-210	pCi/m3	0.053491	0.000119	0.00119	—
Manganese	µg/m3	0.013395	0.037564	0.37564	—
Nickel	µg/m3	0.002563	0.000745	0.00745	—
Tridymite	µg/m3	7.7821	—	—	—
Phosphorus	µg/m3	0.202894	—	—	—
PM_{10}	µg/m3	23.9005	—	—	150[a], 50[b]
Polonium-210	pCi/m3	0.015654	0.000183	0.00183	—
Radium-226	pCi/m3	0.001053	0.000159	0.00159	—
Radium-228	pCi/m3	0.002883	0.00069	0.0069	—
Selenium	µg/m3	0.008532	—	—	—
Silver	µg/m3	0.000595	—	—	—
Thallium	µg/m3	0.01711	—	—	—
Thorium-230	pCi/m3	0.000103	0.000016	0.00016	—
Thorium-232	pCi/m3	0.0000268	0.000017	0.00017	—
Particle Fluoride	µg/m3	165.625	—	—	—
Uranium	pCi/m3	0.0000762	0.00002	0.0002	—
Vanadium	µg/m3	0.000857	—	—	—
Zinc	µg/m3	0.010402	—	—	—

[a] 24-hour average concentration.
[b] Annual average concentration.
— = Values not available.
NAAQS = National ambient air quality standards (40 CFR, Part 50).
RBC = Risk-based concentration.

Table 15

TOXICITY VALUES FOR CARCINOGENIC EFFECTS

Chemical	CAS Number	Carcinogen Class	Route	Oral SF $(mg/kg\text{-}day)^{-1}$ or INHL Unit Risk $(\mu g/m^3)^{-1}$	Target Organ	Tumor Type	Species	Exposure Route	Source
Arsenic	7440-38-2	A	Oral	1.75	Skin	—	Human	Drinking water	IR
		A	Inhalation	0.0043	Lung	Cancer	Human, male	Inhalation, occupational exposure	IR
Beryllium	7440-41-7	B2	Oral	4.3	Whole body	Gross tumors, all sites combined	Rat/Long-Evans, male	Drinking water	IR
		B2	Inhalation	0.0024	Lung	—	Human	Inhalation, occupational exposure	IR
Cadmium	7440-43-9	—	Oral	—	—	—	—	—	—
		B1	Inhalation	0.0018	Lung, trachea, bronchus	Cancer	Human/white male	Inhalation, occupational exposure	IR
Chromium (VI)	18540-29-9	—	Oral	—	—	—	—	—	—
		A	Inhalation	0.012	Lung	Cancer	Human	Inhalation, occupational exposure	IR
Lead	7439-92-1	B2	Oral	—	—	—	—	—	—
		B2	Inhalation	—	—	—	—	—	—
Nickel refinery dust	7440-02-0rd	—	Oral	—	—	—	—	—	—
		A	Inhalation	0.00024	Lung	Cancer	Human	Inhalation, occupational exposure	IR
Tetrachloroethene	127-18-4	C-B2	Oral	0.052	Liver	—	Mice	Oral, Gavage	ECAO
		C-B2	Inhalation	5.8×10^{-7}	Blood, liver	Leukemia	—	Inhalation	ECAO
Trichloroethene	79-01-6	B2	Oral	0.011	Liver	—	—	Oral, Gavage	ECAO
		B2	Inhalation	1.7×10^{-6}	Lung	—	—	Inhalation	ECAO

Key.

ECAO = Environmental Criteria and Assessment Office (EPA).
IR = IRIS (EPA 1994b)
SF = Slope factor.

Table 16

TOXICITY VALUES FOR NONCARCINOGENIC EFFECTS

Chemical	CAS Number	Route	RfD Type	Oral RfD (mg/kg-day) or Inhalation RfC (mg/m^3)	UF	MF	Confidence Level	Target Organ	Critical Effect	Source	Date
Aluminum	7429-90-5	Oral	Chronic	1	100	—	Low	Central nervous system	Neurobehavioral deficits	ECAO	1-Jan-95
			Subchronic	—	—	—	—	—	—	—	—
		Inhalation	Chronic	—	—	—	—	—	—	—	—
			Subchronic	—	—	—	—	—	—	—	—
Antimony	7440-36-0	Oral	Chronic	0.0004	1,000	1	Low	Whole body	Longevity	IR	01-Feb-91
			Subchronic	0.0004	1,000	—	—	Whole body	Increased mortality	HE	31-Mar-94
		Inhalation	Chronic	—	—	—	—	—	—	—	—
			Subchronic	—	—	—	—	—	—	—	—
Arsenic	7440-38-2	Oral	Chronic	0.0003	3	1	Medium	Skin	Hyperpigmentation	IR	01-Mar-93
			Subchronic	0.0003	3	—	—	Skin	Keratosis	HE	31-Mar-94
		Inhalation	Chronic	—	—	—	—	—	—	—	—
			Subchronic	—	—	—	—	—	—	—	—
Beryllium	7440-41-7	Oral	Chronic	0.005	100	1	Low	—	None observed	IR	01-Feb-93
			Subchronic	0.005	100	—	—	—	None observed	HE	31-Mar-94
		Inhalation	Chronic	—	—	—	—	—	—	—	—
			Subchronic	—	—	—	—	—	—	—	—
Boron	7440-42-8	Oral	Chronic	0.09	100	1	Medium	Testes	Atrophy	IR	01-Sep-94
			Subchronic	0.09	100	—	—	Testes	Lesions	HE	31-Mar-94
		Inhalation	Chronic	0.02	100	—	—	Respiratory tract	Irritation	HE	31-Mar-94
			Subchronic	0.02	100	—	—	Respiratory tract	Irritation	HE	31-Mar-94
Cadmium	7440-43-9	Oral, Water	Chronic	0.0005	10	1	High	Kidney	Significant proteinuria	IR	01-Feb-94
			Subchronic	0.0005	—	—	—	Kidney	Significant proteinuria	CO	—
		Oral, Food	Chronic	0.001	10	1	High	Kidney	Significant proteinuria	IR	01-Feb-94
			Subchronic	0.001	—	—	—	Kidney	Significant Proteinuria	CO	—

Key at end of table.

Table 16

TOXICITY VALUES FOR NONCARCINOGENIC EFFECTS

Chemical	CAS Number	Route	RfD Type	Oral RfD (mg/kg-day) or Inhalation RfC (mg/m^3)	UF	MF	Confidence Level	Target Organ	Critical Effect	Source	Date
		Inhalation	Chronic	—	—	—	—	—	—	—	—
			Subchronic	—	—	—	—	—	—	—	—
Chromium(III)	16065-83-1	Oral	Chronic	1	100	10	Low	—	None observed	IR	01-Mar-88
			Subchronic	1	1,000	—	—	—	None observed	HE	31-Mar-94
		Inhalation	Chronic	—	—	—	—	—	—		—
			Subchronic	—	—	—	—	—	—		—
Chromium(VI)	18540-29-9	Oral	Chronic	0.005	500	1	Low	—	None observed	IR	01-Mar-88
			Subchronic	0.02	100	—	—	—	None observed	HE	31-Mar-94
		Inhalation	Chronic	4E-06	—	—	—	—	—	SI	—
			Subchronic	4E-06	—	—	Low	Respiratory tract	Nasal effects	ECAO	14-Feb-93
Crystalline quartz[a]	14808-60-7	Oral	Chronic		—	—	—	—	—	—	—
			Subchronic		—	—	—	—	—	—	—
		Inhalation	Chronic		—	—	—	—	—	—	—
			Subchronic		—	—	—	—	—	—	—
Fluoride, Soluble	16984-48-8	Oral	Chronic	0.06	1	1	High	Teeth	Fluorosis	IR	7-1-94
			Subchronic	0.06	1	—	—	Teeth	Fluorosis	CO	—
		Inhalation	Chronic	0.06	—	—	—	Teeth	Fluorosis	CO	—
			Subchronic	0.06	—	—	—	Teeth	Fluorosis	CO	—
Lead	7439-92-1	Oral	Chronic		—	—	—	—	—	—	—
			Subchronic		—	—	—	—	—	—	—
		Inhalation	Chronic		—	—	—	—	—	—	—
			Subchronic		—	—	—	—	—	—	—
Manganese	7439-96-5	Oral, Water	Chronic	0.005	1	1	Varied	Central nervous system	Effects	IR	01-Apr-94
			Subchronic	0.005	1	—	—	Central nervous system	Effects	HE	31-Mar-94

Key at end of table.

Table 16

TOXICITY VALUES FOR NONCARCINOGENIC EFFECTS

Chemical	CAS Number	Route	RfD Type	Oral RfD (mg/kg-day) or Inhalation RfC (mg/m^3)	UF	MF	Confidence Level	Target Organ	Critical Effect	Source	Date
		Oral, Food	Chronic	0.14	1	1	Varied	Central nervous system	Effects	IR	01-Apr-94
			Subchronic	0.14	1	—	—	Central nervous system	Effects	HE	31-Mar-94
		Inhalation	Chronic	0.00005	1,000	1	Medium	CNS	Impairment of neurobehavioral function	IR	01-Dec-93
			Subchronic	0.00005	—	—	—	CNS	Impairment of neurobehavioral function	CI	—
Mercury (Inorganic)	7439-97-6	Oral	Chronic	0.0003	1,000	—	—	Kidney	Effects	HE	31-Mar-94
			Subchronic	0.0003	1,000	—	—	Kidney	Effects	HE	31-Mar-94
		Inhalation	Chronic	0.0003	30	—	—	Nervous system	Neurotoxicity	HE	31-Mar-94
			Subchronic	0.0003	30	—	—	Nervous system	Neurotoxicity	HE	31-Mar-94
Nickel, Soluble Salts	7440-02-0	Oral	Chronic	0.02	300	1	Medium	Whole body	Decreased weight	IR	01-Jan-92
			Subchronic	0.02	300	—	—	Whole body	Decreased weight	HE	31-Mar-94
		Inhalation	Chronic	—	—	—	—	—	—	—	—
			Subchronic	—	—	—	—	—	—	—	—
Nitrate	14797-55-8	Oral	Chronic	1.6	1	1	High	Blood	Methemoglobinemia	IR	01-Oct-91
			Subchronic	1.6	—	—	—	Blood	Methemoglobinemia	CO	—
		Inhalation	Chronic	—	—	—	—	—	—	—	—
			Subchronic	—	—	—	—	—	—	—	—
Phosphoric Acid[a]	7664-38-2	Oral	Chronic	—	—	—	—	—	—	—	—
			Subchronic	—	—	—	—	—	—	—	—
		Inhalation	Chronic	—	—	—	—	—	—	—	—
			Subchronic	—	—	—	—	—	—	—	—
Phosphorus Pentoxide[a]	1314-56-3	Oral	Chronic	—	—	—	—	—	—	—	—
			Subchronic	—	—	—	—	—	—	—	—

Key at end of table.

Table 16

TOXICITY VALUES FOR NONCARCINOGENIC EFFECTS

Chemical	CAS Number	Route	RfD Type	Oral RfD (mg/kg-day) or Inhalation RfC (mg/m^3)	UF	MF	Confidence Level	Target Organ	Critical Effect	Source	Date
		Inhalation	Chronic	—	—	—	—	—	—	—	—
			Subchronic	—	—	—	—	—	—	—	—
Selenium	7782-49-2	Oral	Chronic	0.005	3	1	High	Whole body	Selenosis	IR	01-Sep-91
			Subchronic	0.005	3	—	—	Whole body	Selenosis	HE	31-Mar-94
		Inhalation	Chronic	—	—	—	—	—	—	—	—
			Subchronic	—	—	—	—	—	—	—	—
Silver	7440-22-4	Oral	Chronic	0.005	3	1	Low	Skin	Argyria	IR	01-Dec-91
			Subchronic	0.005	3	—	—	Skin	Argyria	HE	31-Mar-94
		Inhalation	Chronic	—	—	—	—	—	—	—	—
			Subchronic	—	—	—	—	—	—	—	—
Tetrachloroethene	127-18-4	Oral	Chronic	0.01	1,000	1	Medium	Liver	Hepatotoxicity	IR	1-Mar-88
			Subchronic	0.1	100	—	—	Liver	Hepatotoxicity	HE	31-Mar-94
		Inhalation	Chronic	—	—	—	—	—	—	—	—
			Subchronic	—	—	—	—	—	—	—	—
Thallium	6533-73-9	Oral	Chronic	0.000069[b]	3000	1	Low	Liver	Increased SGOT	IR	01-Sep-90
			Subchronic	0.000698[b]	300	—	—	Liver	Increased SGOT	HE	31-Mar-94
		Inhalation	Chronic	—	—	—	—	—	—	—	—
			Subchronic	—	—	—	—	—	—	—	—
Trichloroethene	79-01-6	Oral	—	—	—	—	—	—	—	—	—
			—	—	—	—	—	—	—	—	—
		Inhalation	—	—	—	—	—	—	—	—	—
			—	—	—	—	—	—	—	—	—
Uranium, soluble salts	7440-61-1	Oral	Chronic	0.003	1,000	1	Medium	Whole body	Weight loss	IR	01-Oct-89
			Subchronic	0.003	—	—	—	—	—	CO	—

Key at end of table.

Table 16

TOXICITY VALUES FOR NONCARCINOGENIC EFFECTS

Chemical	CAS Number	Route	RfD Type	Oral RfD (mg/kg-day) or Inhalation RfC (mg/m^3)	UF	MF	Confidence Level	Target Organ	Critical Effect	Source	Date
		Inhalation	Chronic	—	—	—	—	—	—	—	—
			Subchronic	—	—	—	—	—	—	—	—
Vanadium	7440-62-2	Oral	Chronic	0.007	100	—	—	Whole body	Lifetime	HE	31-Mar-94
			Subchronic	0.007	100	—	—	Whole body	Lifetime	HE	31-Mar-94
		Inhalation	Chronic	—	—	—	—	—	—	—	—
			Subchronic	—	—	—	—	—	—	—	—
Zinc	7440-66-6	Oral	Chronic	0.3	3	1	Medium	Blood	Decrease (47%), erythrocyte superoxide dismutase	IR	01-Oct-92
			Subchronic	0.3	3	—	—	Blood	Decreased blood enzyme	HE	31-Mar-94
		Inhalation	Chronic	—	—	—	—	—	—	—	—
			Subchronic	—	—	—	—	—	—	—	—

[a] Quantitative toxicity values were requested for these chemicals from ECAO; however, ECAO concluded that the available information was insufficient to support derivation of such values.

[b] Derived from RfD for thallium carbonate.

Key:

CI = Extrapolated from chronic inhalation RfC.
CO = Extrapolated from chronic oral RfD.
ECAO = Environmental Criteria and Assessment Office (EPA).
HE = HEAST (EPA 1994c).
IR = IRIS (EPA 1994b).
MF = Modifying factor.
NA = Not available.
RfD = Reference dose.
SGOT = Serum glutamic oxylate transaminase.
SI = Extrapolated from subchronic inhalation RfC.
SO = Extrapolated from subchronic oral RfD.
UF = Uncertainty factor.
WD = Withdrawn from IRIS or HEAST.

Key at end of table.

Table 17

TOXICITY VALUES (SLOPE FACTORS) FOR RADIONUCLIDES

Radionuclide	CASRN	SF_O (Risk/pCi)	SF_I (Risk/pCi)	SF_E (Risk/Year per pCi/g Soil)
Lead-210+D	014255-04-0(+D)	1.01E-09	3.86E-09	1.45E-10
Polonium-210	013981-52-7	3.26E-10	2.14E-09	3.30E-11
Potassium-40	013966-00-2	1.25E-11	7.46E-12	6.11E-07
Radium-226+D	013982-63-3(+D)	2.96E-10	2.75E-09	6.74E-06
Radium-228+D	015262-20-1(+D)	2.48E-10	9.94E-10	3.28E-06
Radon-222+D	014859-67-7(+D)	--	7.57E-12	--
Thorium-228+D	014274-82-9(+D)	2.31E-10	9.68E-08	9.94E-07
Uranium-233	013968-55-3	4.48E-11	1.41E-08	3.52E-11
Uranium-234	013966-29-5	4.44E-11	1.40E-08	2.14E-11
Uranium-235	015117-96-1	4.52E-11	1.30E-08	2.63E-07
Uranium-235+D	015117-96-1(+D)	4.70E-11	1.30E-08	2.65E-07
Uranium-238	007440-61-1	4.27E-11	1.24E-08	1.50E-11
Uranium-238+D	007440-61-1(+D)	6.20E-11	1.24E-08	5.25E-08

Key:

CASRN = Radionuclide CAS Number.
SF_O = Slope factor for oral exposure.
SF_I = Slope factor for inhalation exposure.
SF_E = Slope factor for external exposure.

Source: HEAST 1994 (EPA 1994c).

TABLE 18
RADIOLOGICAL CANCER RISKS ESTIMATED IN THE BASELINE RISK ASSESSMENT FOR CURRENT EXPOSURE PATHWAYS IN EXISTING RESIDENTIAL AREAS

		Soil Ingestion, External Radiation Exposure and Inhalation of Airborne Contaminants			Soil Ingestion, External Radiation Exposure, Inhalation of Airborne Contaminants, and Consumption of Homegrown Produce		
Residential Area	Exposure Case	Estimated CR	Incremental CR	CR Ratio	Estimated CR	Incremental CR	CR Ratio
1	RME CT	8.78e-04 1.89e-04	3.72e-04 7.98e-05	1.74 1.73	8.78e-04 1.89e-04	3.72e-04 7.98e-05	1.74 1.73
2	RME CT	5.90e-04 1.26e-04	8.47e-05 1.75e-05	1.17 1.16	5.90e-04 1.26e-04	8.48e-05 1.76e-05	1.17 1.16
3	RME CT	3.14e-05 6.69e-06	2.96e-06 6.30e-07	1.10 1.10	3.14e-05 6.69e-06	2.96e-06 6.30e-07	1.10 1.10
4	RME CT	9.37e-04 2.02e-04	4.32e-04 9.32e-05	1.85 1.86	9.37e-04 2.02e-04	4.32e-04 9.32e-05	1.85 1.86
5	RME CT	1.42e-03 3.07e-04	4.40e-04 9.51e-05	1.45 1.45	1.42e-03 3.07e-04	4.40e-04 9.51e-05	1.45 1.45
6	RME CT	6.02e-04 1.33e-04	1.14e-04 2.43e-05	1.23 1.22	6.02e-04 1.33e-04	1.14e-04 2.43e-05	1.23 1.22
7	RME CT	5.59e-04 1.21e-04	5.424e-05 1.18e-05	1.12 1.11	5.60e-04 1.21e-04	5.43e-05 1.18e-05	1.12 1.11
8	RME CT	1.22e-03 2.61e-04	0e+00 0e+00	0.84 0.83	1.22e-03 2.61e-04	0e+00 0e+00	0.84 0.83

TABLE 19
SUMMARY OF RADIOLOGICAL CARCINOGENIC HUMAN HEALTH RISKS TO CURRENT RESIDENTS ESTIMATED IN THE BASELINE RISK ASSESSMENT FROM THE SOIL AND VEGETATION PATHWAYS

Residential Area	RME ICR - Incidental Soil Ingestion	Risk Ratio(1)	RME ICR - External Radiation Exposure	Risk Ratio(2)	RME ICR - Homegrown Produce Ingestion
1	7.0E-06	5.5	3.6E-04	1.8	0.00
2	8.2E-06	6.3	7.18E-05	1.1	1E-7
3	0	—	0	—	0.00
4	1.1E-05	8.0	4.11E-04	1.9	0.00
5	7.96E-06	6.1	4.22E-04	1.9	0.00
6	4.5E-06	3.9	9.92E-05	1.2	0.00
7	6.5E-06	5.1	3.75E-05	1.1	1E-7
8	0	—	0	—	0.00

(1) Background risk for incidental soil ingestion for radionuclides was estimated at 1.5E-06
(2) Background risk from the BRA 4.77E-04

TABLE 20
CHEMICAL CANCER RISKS ESTIMATED IN THE BASELINE RISK ASSESSMENT
FOR CURRENT EXPOSURE PATHWAYS IN EXISTING RESIDENTIAL AREAS

Residential Area	Exposure Case	Soil Ingestion and Inhalation of Airborne Contaminants			Soil Ingestion, Inhalation of Airborne Contaminants, and Consumption of Homegrown Produce		
		Estimated CR	Incremental CR	CR Ratio	Estimated CR	Incremental CR	CR Ratio
1	RME CT	2.25e-05 3.47e-06	4.47e-06 7.62e-07	1.25 1.28	9.17e-05 7.86e-06	1.40e-05 1.37e-06	1.18 1.21
2	RME CT	9.12e-06 1.52e-06	3.26e-06 5.86e-07	1.56 1.63	1.51e-05 1.90e-06	4.41e-06 6.59e-07	1.41 1.53
3	RME CT	1.96e-05 2.97e-06	2.26e-06 3.65e-07	1.13 1.14	8.55e-05 7.15e-06	9.18e-06 8.04e-07	1.12 1.13
4	RME CT	1.65e-05 1.87e-06	3.00e-06 3.76e-07	1.22 1.25	5.82e-05 3.69e-06	5.36e-06 4.74e-07	1.10 1.15
5	RME CT	2.34e-05 2.61e-06	5.45e-06 4.85e-07	1.30 1.23	1.04e-04 6.47e-06	2.60e-05 1.09e-06	1.33 1.20
6	RME CT	2.32e-05 2.76e-06	5.16e-06 3.82e-07	1.29 1.16	9.65e-05 6.30e-06	1.89e-05 6.72e-07	1.24 1.12
7	RME CT	1.89e-05 2.50e-06	4.01e-06 4.49e-07	1.27 1.22	6.80e-05 5.13e-06	7.51e-06 5.83e-07	1.12 1.13
8	RME CT	2.33e-05 3.13e-06	5.31e-06 4.91e-07	1.29 1.19	9.94e-05 7.16e-06	2.17e-05 8.85e-07	1.28 1.14

HAZARD QUOTIENTS FOR CURRENT EXPOSURE PATHWAYS IN EXISTING EXPOSURE AREAS

Residential Area	Location	Chemical	Exposure Case	Soil Ingestion and Inhalation of Airborne Contaminants			Soil Ingestion, Inhalation of Airborne Contaminants, and Consumption of Homegrown Produce		
				Estimated HQ	Incremental HQ	HQ Ratio	Estimated HQ	Incremental HQ	HQ Ratio
1	Rowlands Dairy	Arsenic	RME	0.06	0.01	1.17	0.35	0.05	1.17
			CT	0.03	0.00	1.17	0.09	0.01	1.17
		Beryllium	RME	0.00	0.00	1.03	0.00	0.00	1.03
			CT	0.00	0.00	1.03	0.00	0.00	1.03
		Boron	RME	0.00	0.00	2.38	0.93	0.54	2.38
			CT	0.00	0.00	2.38	0.20	0.12	2.38
		Cadmium[a]	RME	0.07	0.07	27.93	1.27	1.23	27.93
			CT	0.04	0.03	27.93	0.32	0.31	27.93
		Chromium(VI)	RME	0.01	0.01	9.22	0.01	0.01	9.22
			CT	0.01	0.01	9.22	0.01	0.01	9.22
		Fluoride	RME	0.19	0.16	5.79	0.98	0.82	6.13
			CT	0.09	0.08	5.68	0.26	0.22	6.01
		Manganese	RME	0.01	0.00	1.00	0.29	0.00	1.00
			CT	0.00	0.00	1.00	0.06	0.00	1.00
		Nickel	RME	0.00	0.00	1.78	0.16	0.07	1.78
			CT	0.00	0.00	1.78	0.04	0.02	1.78
		Selenium	RME	0.00	0.00	1.96	0.02	0.01	1.96
			CT	0.00	0.00	1.96	0.01	0.00	1.96
		Vanadium	RME	0.04	0.03	2.71	0.14	0.09	2.71
			CT	0.02	0.01	2.71	0.04	0.03	2.71
		Zinc	RME	0.00	0.00	4.10	0.48	0.36	4.10
			CT	0.00	0.00	4.10	0.10	0.08	4.10
2	Rio Vista and Chubbock Rds.	Beryllium	RME	0.00	0.00	1.24	0.00	0.00	1.24
			CT	0.00	0.00	1.24	0.00	0.00	1.24
		Boron	RME	0.00	0.00	1.00	0.35	0.00	1.00
			CT	0.00	0.00	1.00	0.08	0.00	1.00
		Cadmium[a]	RME	0.05	0.04	17.56	0.80	0.76	17.56
			CT	0.02	0.02	17.56	0.20	0.19	17.56

Key at end of Table

Table 21

HAZARD QUOTIENTS FOR CURRENT EXPOSURE PATHWAYS IN EXISTING EXPOSURE AREAS

Residential Area	Location	Chemical	Exposure Case	Soil Ingestion and Inhalation of Airborne Contaminants			Soil Ingestion, Inhalation of Airborne Contaminants, and Consumption of Homegrown Produce		
				Estimated HQ	Incremental HQ	HQ Ratio	Estimated HQ	Incremental HQ	HQ Ratio
		Chromium(VI)	RME	0.01	0.01	9.22	0.01	0.01	9.22
			CT	0.01	0.01	9.22	0.01	0.01	9.22
		Fluoride	RME	0.10	0.06	2.94	0.46	0.30	2.88
			CT	0.05	0.03	2.96	0.12	0.08	2.90
		Manganese	RME	0.01	0.00	1.00	0.28	0.00	1.00
			CT	0.00	0.00	1.00	0.06	0.00	1.00
		Mercury	RME	0.00	0.00	1.03	0.22	0.01	1.03
			CT	0.00	0.00	1.03	0.05	0.00	1.03
		Nickel	RME	0.00	0.00	1.46	0.13	0.04	1.46
			CT	0.00	0.00	1.46	0.03	0.01	1.46
		Silver	RME	0.00	0.00	1.59	0.08	0.03	1.59
			CT	0.00	0.00	1.59	0.02	0.01	1.59
		Thallium	RME	0.01	0.00	1.71	0.02	0.01	1.71
			CT	0.01	0.00	1.71	0.01	0.00	1.71
		Vanadium	RME	0.03	0.01	1.76	0.09	0.04	1.76
			CT	0.01	0.01	1.76	0.03	0.01	1.76
		Zinc	RME	0.00	0.00	3.12	0.36	0.25	3.12
			CT	0.00	0.00	3.12	0.08	0.05	3.12
3	Trailer Court southeast of Philbin Rd. and I-86	Arsenic	RME	0.06	0.01	1.13	0.34	0.04	1.13
			CT	0.03	0.00	1.13	0.09	0.01	1.13
		Beryllium	RME	0.00	0.00	1.00	0.00	0.00	1.00
			CT	0.00	0.00	1.00	0.00	0.00	1.00
		Boron	RME	0.00	0.00	1.00	0.29	0.00	1.00
			CT	0.00	0.00	1.00	0.06	0.00	1.00
		Cadmium[a]	RME	0.01	0.01	2.90	0.13	0.09	2.90
			CT	0.00	0.00	2.90	0.03	0.02	2.90
		Chromium(VI)	RME	0.00	0.00	3.21	0.00	0.00	3.21

Table 21

HAZARD QUOTIENTS FOR CURRENT EXPOSURE PATHWAYS IN EXISTING EXPOSURE AREAS

Residential Area	Location	Chemical	Exposure Case	Soil Ingestion and Inhalation of Airborne Contaminants			Soil Ingestion, Inhalation of Airborne Contaminants, and Consumption of Homegrown Produce		
				Estimated HQ	Incremental HQ	HQ Ratio	Estimated HQ	Incremental HQ	HQ Ratio
			CT	0.00	0.00	3.21	0.00	0.00	3.21
		Fluoride	RME	0.04	0.00	1.11	0.18	0.02	1.09
			CT	0.02	0.00	1.11	0.05	0.00	1.10
		Manganese	RME	0.01	0.00	1.24	0.44	0.08	1.24
			CT	0.01	0.00	1.24	0.10	0.02	1.24
		Mercury	RME	0.00	0.00	1.00	0.18	0.00	1.00
			CT	0.00	0.00	1.00	0.04	0.00	1.00
		Nickel	RME	0.00	0.00	1.16	0.10	0.01	1.16
			CT	0.00	0.00	1.16	0.02	0.00	1.16
		Selenium	RME	0.00	0.00	1.03	0.01	0.00	1.03
			CT	0.00	0.00	1.03	0.00	0.00	1.03
		Silver	RME	0.00	0.00	1.49	0.08	0.03	1.49
			CT	0.00	0.00	1.49	0.02	0.01	1.49
		Vanadium	RME	0.02	0.00	1.11	0.06	0.01	1.11
			CT	0.01	0.00	1.11	0.02	0.00	1.11
		Zinc	RME	0.00	0.00	1.48	0.17	0.06	1.48
			CT	0.00	0.00	1.48	0.04	0.01	1.48
4	Southwest of Siphon and Philbin Rds.	Arsenic	RME	0.04	0.00	1.00	0.20	0.00	1.00
			CT	0.03	0.00	1.00	0.10	0.00	1.00
		Beryllium	RME	0.00	0.00	1.49	0.00	0.00	1.49
			CT	0.00	0.00	1.48	0.00	0.00	1.48
		Boron	RME	0.00	0.00	1.00	0.38	0.00	1.00
			CT	0.00	0.00	1.00	0.16	0.00	1.00
		Cadmium[a]	RME	0.04	0.03	14.10	0.64	0.60	14.10
			CT	0.03	0.02	7.05	0.08	0.07	7.05
		Chromium(VI)	RME	0.00	0.00	3.04	0.00	0.00	3.04
			CT	0.00	0.00	3.04	0.00	0.00	3.04
		Fluoride	RME	0.05	0.02	1.65	0.28	0.12	1.73

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Key at end of Table

Table 21

HAZARD QUOTIENTS FOR CURRENT EXPOSURE PATHWAYS IN EXISTING EXPOSURE AREAS

Residential Area	Location	Chemical	Exposure Case	Soil Ingestion and Inhalation of Airborne Contaminants: Estimated HQ	Incremental HQ	HQ Ratio	Soil Ingestion, Inhalation of Airborne Contaminants, and Consumption of Homegrown Produce: Estimated HQ	Incremental HQ	HQ Ratio
			CT	0.06	0.01	1.31	0.16	0.04	1.33
		Manganese	RME	0.01	0.01	1.61	0.57	0.22	1.61
			CT	0.02	0.00	1.28	0.30	0.07	1.28
		Mercury	RME	0.00	0.00	1.03	0.22	0.01	1.03
			CT	0.00	0.00	1.00	0.09	0.00	1.00
		Nickel	RME	0.00	0.00	1.31	0.12	0.03	1.31
			CT	0.00	0.00	1.16	0.07	0.01	1.16
		Selenium	RME	0.00	0.00	1.00	0.01	0.00	1.00
			CT	0.00	0.00	1.00	0.00	0.00	1.00
		Silver	RME	0.00	0.00	1.17	0.06	0.01	1.17
			CT	0.00	0.00	1.00	0.03	0.00	1.00
		Thallium	RME	0.01	0.00	1.00	0.01	0.00	1.00
			CT	0.01	0.00	1.00	0.01	0.00	1.00
		Vanadium	RME	0.03	0.01	1.79	0.09	0.04	1.79
			CT	0.03	0.01	1.31	0.06	0.01	1.31
		Zinc	RME	0.00	0.00	2.58	0.30	0.18	2.58
			CT	0.00	0.00	2.08	0.16	0.08	2.08
5	East and West of Rio Vista Rd. Between Siphon and Tyhee Rds.	Antimony	RME	0.14	0.11	3.97	3.31	2.48	3.97
			CT	0.07	0.05	3.97	0.74	0.55	3.97
		Arsenic	RME	0.07	0.02	1.37	0.41	0.11	1.37
			CT	0.09	0.01	1.08	0.25	0.02	1.08
		Beryllium	RME	0.00	0.00	1.00	0.00	0.00	1.00
			CT	0.00	0.00	1.00	0.00	0.00	1.00
		Boron	RME	0.00	0.00	1.10	0.43	0.04	1.10
			CT	0.00	0.00	1.00	0.16	0.00	1.00
		Cadmium[a]	RME	0.01	0.01	3.32	0.15	0.11	3.32
			CT	0.01	0.00	2.56	0.03	0.02	2.56
		Chromium(VI)	RME	0.00	0.00	3.04	0.00	0.00	3.04

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Table 21

HAZARD QUOTIENTS FOR CURRENT EXPOSURE PATHWAYS IN EXISTING EXPOSURE AREAS

Residential Area	Location	Chemical	Exposure Case	Soil Ingestion and Inhalation of Airborne Contaminants			Soil Ingestion, Inhalation of Airborne Contaminants, and Consumption of Homegrown Produce		
				Estimated HQ	Incremental HQ	HQ Ratio	Estimated HQ	Incremental HQ	HQ Ratio
			CT	0.00	0.00	3.04	0.00	0.00	3.04
		Fluoride	RME	0.03	0.00	1.04	0.17	0.01	1.03
			CT	0.04	0.00	1.00	0.12	0.00	1.00
		Manganese	RME	0.01	0.00	1.26	0.44	0.09	1.26
			CT	0.02	0.00	1.20	0.28	0.05	1.20
		Mercury	RME	0.00	0.00	1.28	0.27	0.06	1.28
			CT	0.00	0.00	1.07	0.10	0.01	1.07
		Nickel	RME	0.00	0.00	1.15	0.10	0.01	1.15
			CT	0.00	0.00	1.07	0.04	0.00	1.07
		Selenium	RME	0.00	0.00	1.23	0.01	0.00	1.23
			CT	0.00	0.00	1.15	0.01	0.00	1.15
		Silver	RME	0.00	0.00	1.49	0.08	0.03	1.49
			CT	0.00	0.00	1.11	0.04	0.00	1.11
		Thallium	RME	0.01	0.00	1.11	0.01	0.00	1.11
			CT	0.01	0.00	1.00	0.01	0.00	1.00
		Vanadium	RME	0.02	0.00	1.00	0.05	0.00	1.00
			CT	0.02	0.00	1.00	0.04	0.00	1.00
		Zinc	RME	0.00	0.00	1.66	0.19	0.08	1.66
			CT	0.00	0.00	1.52	0.12	0.04	1.52
6	Between Weaver Rd. and the Portneuf River	Antimony	RME	0.10	0.07	2.89	2.41	1.57	2.89
			CT	0.09	0.06	2.73	1.02	0.64	2.73
		Arsenic	RME	0.07	0.01	1.22	0.36	0.06	1.22
			CT	0.07	0.00	1.00	0.22	0.00	1.00
		Beryllium	RME	0.00	0.00	1.38	0.00	0.00	1.38
			CT	0.00	0.00	1.00	0.00	0.00	1.00
		Boron	RME	0.00	0.00	1.25	0.49	0.10	1.25
			CT	0.00	0.00	1.00	0.21	0.00	1.00
		Cadmium[a]	RME	0.04	0.04	16.59	0.76	0.71	16.59
			CT	0.04	0.04	10.51	0.12	0.11	10.51

Key at end of Table

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Table 21

HAZARD QUOTIENTS FOR CURRENT EXPOSURE PATHWAYS IN EXISTING EXPOSURE AREAS

Residential Area	Location	Chemical	Exposure Case	Soil Ingestion and Inhalation of Airborne Contaminants			Soil Ingestion, Inhalation of Airborne Contaminants, and Consumption of Homegrown Produce		
				Estimated HQ	Incremental HQ	HQ Ratio	Estimated HQ	Incremental HQ	HQ Ratio
		Chromium(VI)	RME	0.00	0.00	3.04	0.00	0.00	3.04
			CT	0.00	0.00	3.04	0.00	0.00	3.04
		Fluoride	RME	0.08	0.05	2.58	0.45	0.29	2.79
			CT	0.08	0.03	1.80	0.23	0.10	1.83
		Manganese	RME	0.02	0.01	1.83	0.65	0.29	1.83
			CT	0.02	0.01	1.40	0.33	0.09	1.40
		Mercury	RME	0.00	0.00	1.00	0.18	0.00	1.00
			CT	0.00	0.00	1.00	0.11	0.00	1.00
		Nickel	RME	0.00	0.00	1.29	0.12	0.03	1.29
			CT	0.00	0.00	1.24	0.07	0.01	1.24
		Selenium	RME	0.00	0.00	1.00	0.01	0.00	1.00
			CT	0.00	0.00	1.00	0.00	0.00	1.00
		Silver	RME	0.00	0.00	1.70	0.09	0.04	1.70
			CT	0.00	0.00	1.28	0.04	0.01	1.28
		Thallium	RME	0.01	0.00	1.71	0.02	0.01	1.71
			CT	0.01	0.00	1.48	0.01	0.00	1.48
		Vanadium	RME	0.03	0.01	1.81	0.09	0.04	1.81
			CT	0.03	0.01	1.43	0.07	0.02	1.43
		Zinc	RME	0.00	0.00	3.06	0.36	0.24	3.06
			CT	0.00	0.00	2.36	0.18	0.10	2.36
7	Southwest of Siphon Rd. and Tahgee Canal Transect	Arsenic	RME	0.06	0.01	1.10	0.33	0.03	1.10
			CT	0.07	0.00	1.00	0.19	0.00	1.00
		Beryllium	RME	0.00	0.00	1.72	0.00	0.00	1.72
			CT	0.00	0.00	1.23	0.00	0.00	1.23
		Boron	RME	0.00	0.00	1.00	0.30	0.00	1.00
			CT	0.00	0.00	1.00	0.13	0.00	1.00
		Cadmium*	RME	0.02	0.02	8.02	0.37	0.32	8.02
			CT	0.02	0.02	5.02	0.06	0.05	5.02

Key at end of Table

Table 21

HAZARD QUOTIENTS FOR CURRENT EXPOSURE PATHWAYS IN EXISTING EXPOSURE AREAS

Residential Area	Location	Chemical	Exposure Case	Soil Ingestion and Inhalation of Airborne Contaminants			Soil Ingestion, Inhalation of Airborne Contaminants, and Consumption of Homegrown Produce		
				Estimated HQ	Incremental HQ	HQ Ratio	Estimated HQ	Incremental HQ	HQ Ratio
		Chromium(VI)	RME	0.00	0.00	3.04	0.00	0.00	3.04
			CT	0.00	0.00	3.04	0.00	0.00	3.04
		Fluoride	RME	0.04	0.01	1.18	0.19	0.03	1.19
			CT	0.04	0.00	1.00	0.11	0.00	1.00
		Manganese	RME	0.01	0.01	1.57	0.55	0.20	1.57
			CT	0.02	0.01	1.52	0.35	0.12	1.52
		Mercury	RME	0.00	0.00	1.00	0.16	0.00	1.00
			CT	0.00	0.00	1.00	0.06	0.00	1.00
		Nickel	RME	0.00	0.00	1.28	0.11	0.03	1.28
			CT	0.00	0.00	1.09	0.07	0.01	1.09
		Selenium	RME	0.00	0.00	1.07	0.01	0.00	1.07
			CT	0.00	0.00	1.00	0.00	0.00	1.00
		Silver	RME	0.00	0.00	1.17	0.06	0.01	1.17
			CT	0.00	0.00	1.00	0.03	0.00	1.00
		Thallium	RME	0.01	0.00	1.19	0.01	0.00	1.19
			CT	0.00	0.00	1.00	0.01	0.00	1.00
		Vanadium	RME	0.02	0.00	1.14	0.06	0.01	1.14
			CT	0.02	0.00	1.00	0.04	0.00	1.00
		Zinc	RME	0.00	0.00	1.90	0.22	0.11	1.90
			CT	0.00	0.00	1.69	0.13	0.05	1.69
8	Michaud Creek	Arsenic	RME	0.07	0.02	1.28	0.38	0.08	1.28
			CT	0.08	0.00	1.06	0.25	0.01	1.06
		Beryllium	RME	0.00	0.00	1.17	0.00	0.00	1.17
			CT	0.00	0.00	1.16	0.00	0.00	1.16
		Boron	RME	0.00	0.00	1.61	0.63	0.24	1.61
			CT	0.00	0.00	1.55	0.40	0.14	1.55
		Cadmium[a]	RME	0.02	0.02	7.19	0.33	0.28	7.19
			CT	0.02	0.02	5.44	0.06	0.05	5.44

Key at end of Table

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Table 21

HAZARD QUOTIENTS FOR CURRENT EXPOSURE PATHWAYS IN EXISTING EXPOSURE AREAS

Residential Area	Location	Chemical	Exposure Case	Soil Ingestion and Inhalation of Airborne Contaminants			Soil Ingestion, Inhalation of Airborne Contaminants, and Consumption of Homegrown Produce		
				Estimated HQ	Incremental HQ	HQ Ratio	Estimated HQ	Incremental HQ	HQ Ratio
		Chromium(VI)	RME	0.00	0.00	4.49	0.00	0.00	4.49
			CT	0.00	0.00	4.49	0.00	0.00	4.49
		Fluoride	RME	0.05	0.02	1.47	0.24	0.08	1.49
			CT	0.06	0.01	1.32	0.16	0.04	1.33
		Manganese	RME	0.01	0.00	1.41	0.50	0.14	1.41
			CT	0.02	0.00	1.26	0.29	0.06	1.26
		Mercury	RME	0.01	0.01	7.96	1.68	1.47	7.96
			CT	0.01	0.01	5.56	0.51	0.42	5.56
		Nickel	RME	0.00	0.00	1.32	0.12	0.03	1.32
			CT	0.00	0.00	1.27	0.08	0.02	1.27
		Thallium	RME	0.02	0.01	2.22	0.02	0.01	2.22
			CT	0.02	0.01	2.08	0.02	0.01	2.08
		Vanadium	RME	0.02	0.00	1.10	0.06	0.01	1.10
			CT	0.02	0.00	1.00	0.04	0.00	1.00
		Zinc	RME	0.00	0.00	2.02	0.23	0.12	2.02
			CT	0.00	0.00	1.81	0.14	0.06	1.81

a: The HQs for cadmium that include consumption of homegrown produce reflect the revised homegrown produce consumption rates described in the Addendum to Appendix E.

TABLE 22

REVISED HAZARD QUOTIENTS FOR CADMIUM EXPOSURE THROUGH COMSUMPTION OF HOMEGROWN PRODUCE

Residential Area	Location	Cadmium Concentration in Soil (mg/kg)	Percentile	Estimated HQ	Incremental HQ
1	Rowlands Dairy	20.2	50th	0.285	0.275
			95th	1.20	1.16
2	Rio Vista and Chubbock Rds.	12.7	50th	0.179	0.169
			95th	0.754	0.711
3	Trailer Court SE of Philbin Rd. and I-86	2.1	50th	0.030	0.019
			95th	0.125	0.082
4	Southwest of Siphon and Philbin Rds.	5.1	50th	0.072	0.062
		10.2	95th	0.606	0.563
5	East and West of Rio Vista Rd. Between Siphon and Tyhee Rds.	1.85	50th	0.026	0.016
		2.4	95th	0.143	0.100
6	Between Weaver Rd. and the Portneuf River	7.6	50th	0.107	0.097
		12.0	95th	0.713	0.670
7	Southwest of Siphon Rd. and Taghee Canal Transect	2.13	50th	0.030	0.020
		3.6	95th	0.214	0.171
8	Michaud Creek	3.93	50th	0.055	0.045
		5.2	95th	0.309	0.266
Soil Background	EMF Study Area	0.72	50th	0.010	0.000
			95th	0.043	0.000

TABLE 23
SUMMARY OF CHEMICAL CARCINOGENIC HUMAN HEALTH RISKS TO CURRENT RESIDENTS ESTIMATED IN THE BASELINE RISK ASSESSMENT FOR THE INHALATION PATHWAY

Residential Area	Air Sampling Station	ICR(1)	Risk Ratio(2)	Constituents Driving Risk
1	AMS-1	2.24E-06	2.5	Arsenic, cadmium, chromium (VI)
2	AMS-1	2.24E-06	2.5	Arsenic, cadmium, chromium (VI)
3	AMS-4	7.22E-07	1.5	Arsenic
4	AMS-3	8.99E-07	1.6	Arsenic, cadmium
5	AMS-3	8.99E-07	1.6	Arsenic, cadmium
6	AMS-3	8.99E-07	1.6	Arsenic, cadmium
7	AMS-3	8.99E-07	1.6	Arsenic, cadmium
8	AMS-5	1.1E-06	1.7	Cadmium

(1) Based on information presented in the BRA (Table K-19)
(2) The background risk, estimated from Air Monitoring Station 6 is 1.5E-6

Table 24
Summary of Radiological Carcinogenic Human Health Risks to Current Residents Estimated in the Baseline Risk Assessment for the Inhalation Pathway

Residential Area	Air Sampling Station	ICR	Risk Ratio[1]	Constituents Driving Risk
1	AMS-1	3.8E-6	1.1	Po-210
2	AMS-1	3.8E-6	1.1	Po-210
3	AMS-4	2.8E-6	1.1	Po-210,Pb-210
4	AMS-3	1.0E-5	1.35	Po-210,Pb-210
5	AMS-3	1.0E-5	1.25	Po-210,Pb-210
6	AMS-3	1.0E-5	1.35	Po-210,Pb-210
7	AMS-3	1.0E-5	1.35	Po-210,Pb-210
8	AMS-5	1.0E-5	1.35	Po-210,Pb-210

(1) The background risk, estimated from Air Monitoring Station 6 is 2.8E-5

Table 25

SUMMARY OF POTENTIAL CHEMICAL CANCER RISKS FOR WORKERS AT THE FMC FACILITY[a]

Receptor	Scenario	Estimated Cancer Risk	Background Cancer Risk	Incremental Cancer Risk	EP/Bkgd Ratio[b]	% by Pathway	COPCs Driving Risk
FMC Slag Pile Workers	Ingestion of Soil	1.02e-05	1.84e-06	8.32e-06	5.53	58.19	As, Be
	Inhalation of Airborne Contaminants	6.59e-06	6.07e-07	5.98e-06	10.85	41.81	Cd, Cr(VI), As
	Total Receptor	1.67e-05	2.44e-06	1.43e-05	6.85	100.00	As, Cd, Be
FMC Pond Workers	Ingestion of Soil	7.22e-06	1.23e-06	5.99e-06	5.88	61.91	Be, As
	Inhalation of Airborne Contaminants	4.06e-06	3.74e-07	3.69e-06	10.85	38.09	Cd, Cr(VI), As
	Total Receptor	1.13e-05	1.60e-06	9.68e-06	7.04	100.00	Be, Cd, As
FMC Maintenance Workers	Ingestion of Soil	6.48e-06	1.10e-06	5.38e-06	5.88	75.00	Be, As
	Inhalation of Airborne Contaminants	1.98e-06	1.82e-07	1.79e-06	10.85	25.00	Cd, Cr(VI), As
	Total Receptor	8.46e-06	1.28e-06	7.18e-06	6.59	100.00	Be, As, Cd
FMC Contract Workers	Ingestion of Soil	2.16e-06	3.67e-07	1.79e-06	5.88	75.00	Be, As
	Inhalation of Airborne Contaminants	6.59e-07	6.07e-08	5.98e-07	10.85	25.00	Cd, Cr(VI), As
	Total Receptor	2.82e-06	4.28e-07	2.39e-06	6.59	100.00	Be, As, Cd

Table 25

SUMMARY OF POTENTIAL CHEMICAL CANCER RISKS FOR WORKERS AT THE FMC FACILITY[a]

Receptor	Scenario	Estimated Cancer Risk	Background Cancer Risk	Incremental Cancer Risk	EP/Bkgd Ratio[b]	% by Pathway	COPCs Driving Risk
Future Site Worker	Ingestion of Soil	1.08e-05	1.84e-06	8.97e-06	5.88	1.46	Be, As
	Ingestion of Groundwater	6.83e-04	8.26e-05	6.01e-04	8.27	97.57	As
	Inhalation of Airborne Contaminants	6.59e-06	6.07e-07	5.98e-06	10.85	0.97	Cd, Cr(VI), As
	Total Receptor	7.01e-04	8.50e-05	6.16e-04	8.24	100.00	As

a See Table K-5 in Appendix K for a complete summary of results.
b Exposure point concentration to background concentration ratio.

Table 26

SUMMARY OF POTENTIAL CHEMICAL CANCER RISKS FOR WORKERS AT THE SIMPLOT FACILITY[a]

Receptor	Scenario	Estimated Cancer Risk	Background Cancer Risk	Incremental Cancer Risk	EP/Bkgd Ratio[b]	% by Scenario	COPCs Driving Risk
Simplot Gypstack Worker	Ingestion of Soil or Solids	1.36e-06	1.84e-06	0	0.74	0	As
	Inhalation of Airborne Contaminants	6.59e-06	6.07e-07	5.98e-06	10.85	100.00	Cd, Cr(VI), As
	Total Receptor	7.94e-06	2.44e-06	6.64e-06	3.25	100.00	Cd, Cr(VI), As, Be
Simplot Maintenance Worker	Ingestion of Soil or Solids	4.14e-06	1.10e-06	3.04e-06	3.76	62.88	Be, As
	Inhalation of Airborne Contaminants	1.98e-06	1.82e-07	1.79e-06	10.85	37.12	Cd, Cr(VI), As
	Total Receptor	6.12e-06	1.28e-06	4.83e-06	4.76	100.00	Be, As, Cd
Future Site Worker	Ingestion of Soil or Solids	6.90e-06	1.84e-06	5.06e-06	3.76	0.30	Be, As
	Ingestion of Groundwater	1.77e-03	8.26e-05	1.69e-03	21.42	99.35	As
	Inhalation of Airborne Contaminants	6.59e-06	6.07e-07	5.98e-06	10.85	0.35	Cd, Cr(VI), As
	Total Receptor	1.78e-03	8.50e-05	1.70e-03	20.96	100.00	As

a See Table K-8 in Appendix K for a complete summary of results.
b Exposure point concentration to background concentration ratio.

Table 27

SUMMARY OF POTENTIAL RADIOLOGICAL CANCER RISKS FOR WORKERS AT THE FMC FACILITY[a]

Receptor	Scenario	Estimated Cancer Risk	Background Cancer Risk	Incremental Cancer Risk	EP/Bkgd Ratio[b]	% by Scenario	COPCs Driving Risk
FMC Slag Pile Workers	Ingestion of Soil	1.99e-05	1.99e-06	1.79e-05	9.99	2.11	Pb-210, Ra-226
FMC Slag Pile Workers	Inhalation of Airborne Contaminants	3.00e-05	9.60e-06	2.04e-05	3.12	2.40	Po-210
FMC Slag Pile Workers	External Gamma Radiation Exposure	1.05e-03	2.44e-04	8.09e-04	9.07	95.49	Ext Rad
FMC Slag Pile Workers	Receptor Total	1.10e-03	2.56e-04	8.47e-04	4.32	100.00	Ext Rad
FMC Pond Workers	Ingestion of Soil	1.10e-05	1.30e-06	9.70e-06	8.44	1.55	Pb-210, Ra-226
FMC Pond Workers	Inhalation of Airborne Contaminants	1.85e-05	5.92e-06	1.26e-05	3.12	2.00	Po-210
FMC Pond Workers	External Gamma Radiation Exposure	8.97e-04	2.92e-04	6.05e-04	4.63	96.45	Ext Rad
FMC Pond Workers	Receptor Total	9.27e-04	2.99e-04	6.27e-04	3.10	100.00	Ext Rad
FMC Maintenance Workers	Ingestion of Soil	9.89e-06	1.17e-06	8.72e-06	8.44	3.04	Pb-210, Ra-226
FMC Maintenance Workers	Inhalation of Airborne Contaminants	8.99e-06	2.88e-06	6.11e-06	3.12	2.13	Po-210
FMC Maintenance Workers	External Gamma Radiation Exposure	4.03e-04	1.31e-04	2.72e-04	4.63	94.83	Ext Rad
FMC Maintenance Workers	Receptor Total	4.22e-04	1.35e-04	2.87e-04	3.12	100.00	Ext Rad
FMC Contract Workers	Ingestion of Soil	3.30e-06	3.90e-07	2.91e-06	8.44	3.04	Pb-210, Ra-226
FMC Contract Workers	Inhalation of Airborne Contaminants	3.00e-06	9.60e-07	2.04e-06	3.12	2.13	Po-210

Key at end of table.

Table 27

SUMMARY OF POTENTIAL RADIOLOGICAL CANCER RISKS FOR WORKERS AT THE FMC FACILITY[a]

Receptor	Scenario	Estimated Cancer Risk	Background Cancer Risk	Incremental Cancer Risk	EP/Bkgd Ratio[b]	% by Scenario	COPCs Driving Risk
FMC Contract Workers	External Gamma Radiation Exposure	1.34e-04	4.37e-05	9.06e-05	4.63	94.83	Ext Rad
FMC Contract Workers	Receptor Total	1.41e-04	4.51e-05	9.55e-05	3.12	100.00	Ext Rad
Future Site Worker	Ingestion of Groundwater	2.35e-05	7.87e-06	1.56e-05	14.91	0.28	Pb-210, Ra-226
Future Site Worker	Ingestion of Soil	1.65e-05	1.95e-06	1.45e-05	8.44	0.26	Pb-210, Ra-226
Future Site Worker	Inhalation of Airborne Contaminants	5.17e-03	6.15e-04	4.55e-03	8.40	81.93	Rn-222
Future Site Worker	Inhalation of Airborne Contaminants	3.00e-05	9.60e-06	2.04e-05	3.12	0.37	Po-210
Future Site Worker	External Gamma Radiation Exposure	1.41e-03	4.60e-04	9.53e-04	4.63	17.16	Ext Rad
Future Site Worker	Receptor Total	6.65e-03	1.09e-03	5.56e-03	6.07	100.00	Rn-222, Ext Rad

a See Table K-6 in Appendix K for a complete summary of results.
b Exposure point concentration to background concentration ratio.

Key:

COPCs = Contaminants of potential concern.

Table 28

SUMMARY OF POTENTIAL RADIOLOGICAL CANCER RISKS FOR WORKERS AT THE SIMPLOT FACILITY[a]

Receptor	Scenario	Estimated Cancer Risk	Background Cancer Risk	Incremental Cancer Risk	EP/Bkgd Ratio[b]	% by Scenario	COPCs Driving Risk
Simplot Gypstack Worker	Ingestion of Soil	9.25e-06	1.95e-06	7.30e-06	4.74	1.37	Pb-210, Ra-226
Simplot Gypstack Worker	Inhalation of Airborne Contaminants	3.00e-05	9.60e-06	2.04e-05	3.12	3.82	Po-210
Simplot Gypstack Worker	External Gamma Radiation Exposure	7.49e-04	2.44e-04	5.05e-04	4.63	94.81	Ext Rad
Simplot Gypstack Worker	Receptor Total	7.88e-04	2.55e-04	5.33e-04	3.09	100.00	Ext Rad
Simplot Maintenance Worker	Ingestion of Soil	8.82e-06	1.17e-06	7.65e-06	7.53	5.09	Pb-210, Ra-226
Simplot Maintenance Worker	Inhalation of Airborne Contaminants	8.99e-06	2.88e-06	6.11e-06	3.12	4.07	Po-210
Simplot Maintenance Worker	External Gamma Radiation Exposure	2.68e-04	1.31e-04	1.36e-04	2.82	90.84	Ext Rad
Simplot Maintenance Worker	Receptor Total	2.85e-04	1.35e-04	1.50e-04	2.11	100.00	Ext Rad
Future Site Worker	Ingestion of Soil	1.47e-05	1.95e-06	1.27e-05	7.53	0.27	Pb-210, Ra-226
Future Site Worker	Inhalation of Airborne Contaminants	4.63e-03	6.15e-04	4.01e-03	7.52	85.72	Rn-222
Future Site Worker	Ingestion of Groundwater	1.63e-04	6.82e-06	1.57e-04	20.95	3.35	Pb-210
Future Site Worker	Inhalation of Airborne Contaminants	3.00e-05	9.60e-06	2.04e-05	3.12	0.44	Po-210
Future Site Worker	External Gamma Radiation Exposure	9.39e-04	4.60e-04	4.79e-04	2.82	10.23	Ext Rad
Future Site Worker	Receptor Total	5.77e-03	1.09e-03	4.68e-03	5.28	100.00	Rn-222

Table 5-9 (Cont.)

[a] See Table K-9 in Appendix K for a complete summary of results.

[b] Exposure point concentration to background concentration ratio.

Key:

COPCs = Contaminants of potential concern.

Table 29

SUMMARY OF POTENTIAL NONCARCINOGENIC EFFECTS FOR WORKERS AT THE FMC FACILITY - CHEMICALS WITH MAXIMUM OVERALL HAZARD QUOTIENTS EXCEEDING 1[a]

Receptor	Chemical	Scenario	Estimated Hazard Quotient	Background Hazard Quotient	Incremental Hazard Quotient	EP/Bkgd Ratio[b]
Future Site Worker	Arsenic	Groundwater Ingestion	3.49	0.39	3.10	9.02
Future Site Worker	Manganese	Groundwater Ingestion	4.64	0.01	4.63	608.19

[a] See Table K-4 in Appendix K for a complete summary of results.
[b] Exposure point concentration to background concentration ratio.

Table 30

SUMMARY OF POTENTIAL NONCARCINOGENIC EFFECTS FOR WORKERS AT THE SIMPLOT FACILITY - CHEMICALS WITH MAXIMUM OVERALL HAZARD QUOTIENTS EXCEEDING 1[a]

Receptor	Chemical	Scenario	Estimated Hazard Quotient	Background Hazard Quotient	Incremental Hazard Quotient	EP/Bkgd Ratio[b]
Future Site Worker	Arsenic	Groundwater Ingestion	8.95	0.3865	8.57	23.16
Future Site Worker	Fluoride	Groundwater Ingestion	14.51	0.0697	14.44	208.34
Future Site Worker	Manganese	Groundwater Ingestion	1.32	0.0076	1.31	172.54
Future Site Worker	Vanadium	Groundwater Ingestion	1.28	0.0048	1.27	264.97

a See Table K-7 in Appendix K for a complete summary of results.
b Exposure point concentration to background concentration ratio.

TABLE 31
Measured Air Concentrations of PM_{10} and TSP

	Site	1	2	3	4	5	6	7
PM_{10}	Maximum	79.5	150.7	67.4	72.7	90.8	105.6	118.5
	Average	30.2	56.5	21.3	23.0	18.5	19.8	20.9
	Minimum	4.1	6.6	1.5	2.1	0.2	0.2	0.6
TSP	Maximum	218.7	442.6	261.1	161.3	167.8	293.0	176.4
	Average	60.3	137.1	50.5	46.2	33.0	32.0	26.3
	Minimum	15.0	27.5	5.5	5.5	1.5	2.3	0.5

Concentrations in $\mu g/m^3$

Table 33

HAZARD QUOTIENTS FOR PLANTS IN SAGEBRUSH STEPPE AND RIPARIAN HABITATS

Measurement Endpoint Species	Chemical	Location	EE (mg/kg)	TRV (mg/kg)	HQ
Sagebrush Steppe Habitat					
Sagebrush (washed)	Cadmium	Ferry Butte[a]	0.34	5	0.07
		Michaud Flats	1.24	5	0.25
		Bannock Hills SW	0.86	5	0.17
	Fluoride	Ferry Butte[a]	NA	50	NA
		Michaud Flats	NA	50	NA
		Bannock Hills SW	NA	50	NA
	Zinc	Ferry Butte[a]	28	150	0.19
		Michaud Flats	37.8	150	0.25
		Bannock Hills SW	28	150	0.19
Sagebrush (unwashed)	Cadmium	Ferry Butte[a]	0.35	5	0.07
		Michaud Flats	1.42	5	0.28
		Bannock Hills SW	1.06	5	0.21
	Fluoride	Ferry Butte[a]	12.1	50	0.24
		Michaud Flats	60.8	50	1.22
		Bannock Hills SW	85.7	50	1.71
	Zinc	Ferry Butte[a]	33.9	150	0.23
		Michaud Flats	41.4	150	0.28
		Bannock Hills SW	33.6	150	0.22
Thickspike wheatgrass	Cadmium	Ferry Butte[a]	0.27	5	0.05
		Michaud Flats	0.51	5	0.10
		Bannock Hills SW	0.65	5	0.13
	Fluoride	Ferry Butte[a]	12.2	50	0.24
		Michaud Flats	38.1	50	0.76
		Bannock Hills SW	86.9	50	1.74

Key at end of table.

Table 33

HAZARD QUOTIENTS FOR PLANTS IN SAGEBRUSH STEPPE AND RIPARIAN HABITATS

Measurement Endpoint Species	Chemical	Location	EE (mg/kg)	TRV (mg/kg)	HQ
	Zinc	Ferry Butte[a]	9.05	150	0.06
		Michaud Flats	12.5	150	0.08
		Bannock Hills SW	13.4	150	0.09
Riparian Habitat					
Russian olive	Cadmium	Snake River[a]	0.1	5	0.02
		Portneuf River	0.25	5	0.05
	Fluoride	Snake River[a]	11.9	50	0.24
		Portneuf River	12.0	50	0.24
	Zinc	Snake River[a]	8	150	0.05
		Portneuf River	11.3	150	0.08

[a] Background location.

Key:

EE = Estimated exposure.
HQ = Hazard quotient.
TRV = Toxicity reference value.
■ = HQ>1, potential risk identified.

Table 34

HAZARD QUOTIENTS FOR MAMMALS IN SAGEBRUSH STEPPE HABITAT

Measurement Endpoint Species	Chemical	Location	EE_{total} (mg/kg/d)	TRV (mg/kg/d)	HQ_{total}	Diet %	Soil %
Coyote	Cadmium	Ferry Butte[a]	0.01	0.16	0.06	—	—
		Michaud Flats	0.035	0.16	0.22	—	—
		Bannock Hills SW	0.06	0.16	0.38	—	—
	Fluoride	Ferry Butte[a]	0.625	5.38	0.12	—	—
		Michaud Flats	6.6	5.38	1.23	71.1%	28.9%
		Bannock Hills SW	7.61	5.38	1.41	81.9%	18.1%
	Zinc	Ferry Butte[a]	1.89	48	0.04	—	—
		Michaud Flats	1.89	48	0.04	—	—
		Bannock Hills SW	2.04	48	0.04	—	—
Deer mouse	Cadmium	Ferry Butte[a]	0.051	1.42	0.04	—	—
		Michaud Flats	0.203	1.42	0.14	—	—
		Bannock Hills SW	0.223	1.42	0.16	—	—
	Fluoride	Ferry Butte[a]	3.3	46.3	0.07	—	—
		Michaud Flats	14.5	46.3	0.31	—	—
		Bannock Hills SW	19.7	46.3	0.43	—	—
	Zinc	Ferry Butte[a]	2.6	408	0.01	—	—
		Michaud Flats	3.73	408	0.01	—	—
		Bannock Hills SW	3.9	408	0.01	—	—
Mule deer	Cadmium	Ferry Butte[a]	0.0045	0.09	0.05	—	—
		Michaud Flats	0.022	0.09	0.24	—	—
		Bannock Hills SW	0.02	0.09	0.22	—	—
	Fluoride	Ferry Butte	0.255[a]	2.94	0.09	—	—
		Michaud Flats	1.28	2.94	0.44	—	—
		Bannock Hills SW	1.52	2.94	0.52	—	—
	Zinc	Ferry Butte[a]	0.372	25.6	0.01	—	—
		Michaud Flats	0.488	25.6	0.02	—	—

Key at end of table.

Table 34

HAZARD QUOTIENTS FOR MAMMALS IN SAGEBRUSH STEPPE HABITAT

Measurement Endpoint Species	Chemical	Location	EE_{total} (mg/kg/d)	TRV (mg/kg/d)	HQ_{total}	Diet %	Soil %
		Bannock Hills SW	0.441	25.6	0.02	—	—

[a] Background location.

Key:

EE_{total} = Estimated exposure.
HQ_{total} = Hazard quotient.
TRV = Toxicity reference value.
— = Not calculated.
■ = HQ>1, potential risk identified.

Table 35

HAZARD QUOTIENTS FOR BIRDS IN SAGEBRUSH STEPPE AND RIPARIAN HABITATS

Measurement Endpoint Species	Chemical	Location	EE_{total} (mg/kg/d)	TRV (mg/kg/d)	HQ_{total}	Diet %	Soil %
Sagebrush Steppe Habitat							
Horned lark	Cadmium	Ferry Butte[a]	0.069	4.84	0.01	—	—
		Michaud Flats	0.247	4.84	0.05	—	—
		Bannock Hills SW	0.303	4.84	0.06	—	—
	Fluoride	Ferry Butte[a]	4.8	14.9	0.32	—	—
		Michaud Flats	19.9	14.9	1.34	46.3%	53.7%
		Bannock Hills SW	28.7	14.9	1.93	73.2%	26.8%
	Zinc	Ferry Butte[a]	2.47	100	0.02	—	—
		Michaud Flats	3.91	100	0.04	—	—
		Bannock Hills SW	4.61	100	0.05	—	—
Red-tailed hawk	Cadmium	Ferry Butte[a]	0.013	1.49	0.01	—	—
		Michaud Flats	0.045	1.49	0.03	—	—
		Bannock Hills SW	0.078	1.49	0.05	—	—
	Fluoride	Ferry Butte[a]	0.819	4.37	0.19	—	—
		Michaud Flats	8.64	4.37	1.98	71.1%	28.9%
		Bannock Hills SW	9.97	4.37	2.28	81.8%	18.2%
	Zinc	Ferry Butte[a]	2.48	30.9	0.08	—	—
		Michaud Flats	2.47	30.9	0.08	—	—
		Bannock Hills SW	2.67	30.9	0.09	—	—
Sage grouse	Cadmium	Ferry Butte[a]	0.017	1.13	0.02	—	—
		Michaud Flats	0.148	1.13	0.13	—	—
		Bannock Hills SW	0.156	1.13	0.14	—	—
	Fluoride	Ferry Butte[a]	1.9	3.28	0.58	—	—
		Michaud Flats	10.8	3.28	3.29	21.6%	78.4%
		Bannock Hills SW	9.72	3.28	2.96	37.7%	62.3%

Key at end of table.

Table 35

HAZARD QUOTIENTS FOR BIRDS IN SAGEBRUSH STEPPE AND RIPARIAN HABITATS

Measurement Endpoint Species	Chemical	Location	EE_{total} (mg/kg/d)	TRV (mg/kg/d)	HQ_{total}	Diet %	Soil %
	Zinc	Ferry Butte[a]	1.39	23.4	0.06	—	—
		Michaud Flats	2.14	23.4	0.09	—	—
		Bannock Hills SW	2.29	23.4	0.10	—	—
Riparian Habitat							
Cedar waxwing	Cadmium	Snake River[a]	0.025	4.79	0.01	—	—
		Portneuf River	0.131	4.79	0.03	—	—
	Fluoride	Snake River[a]	4.08	13.9	0.29	—	—
		Portneuf River	11.69	13.9	0.84	—	—
	Zinc	Snake River[a]	2.02	99	0.02	—	—
		Portneuf River	3.37	99	0.03	—	—

[a] Background location.

Key:

EE_{total} = Estimated exposure.
HQ_{total} = Hazard quotient.
TRV = Toxicity reference value.
— = Not calculated.
■ = HQ>1, potential risk identified.

TABLE 37

EMF SITE ECOLOGICAL RISK BASED AND MAXIMUM CONCENTRATION OF CONTAMINANTS OF CONCERN AT SPRINGS			
Substance of Concern	Units	Maximum Detected Concentration	EPA Freshwater Chronic Criteria[a]
Mercury (total)	mg/l	.0004	.000012
Selenium (total)	mg/l	.01	.005
Silver	mg/l	.004	.00012
Vanadium	mg/l	.09	.033[b]

Key:

[a] From U.S. EPA 1986, 1994. Hardness dependent water quality criteria calculated on a water hardness of 240.RBCs for groundwater based on drinking water and watering homegrown produce. RBC value based on cancer risk of 10^{-6} or HQ=1.

[b] Derived Freshwater Chronic Criteria - See Risk Assessment

APPENDIX B

RESPONSIVENESS SUMMARY

RECORD OF DECISION
FOR
FINAL REMEDIAL ACTION
EASTERN MICHAUD FLATS SUPERFUND SITE
POCATELLO, IDAHO

Eastern Michaud Flats Superfund Site: Response to Public Comments

U.S. Environmental Protection Agency (EPA) response to comments received during the 75-day public comment period (April 21, 1997 to July 10, 1997) on the Proposed Plan for remediation of the site.

Table of Contents

1. Overview

The purpose of this responsiveness summary is to summarize and respond to public comments submitted on the Proposed Plan for the cleanup of the Eastern Michaud Flats Superfund Site. The public comment period was held from April 21, 1997 to July 10, 1997. This responsiveness summary meets the requirements of Section 117 of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA).

In the Proposed Plan, issued April 21, 1997, the EPA described alternatives to address contaminants in soil and groundwater at the EMF site. These alternatives were based on information collected during a Remedial Investigation and Feasibility Study (RI/FS). The purpose of an RI/FS is to conduct a thorough study of the site and to assess potential alternatives for the cleanup of the site. The RI/FS and Proposed Plan were publicly available at the Idaho State University Library, and copies of a fact sheet were mailed to a list of interested local citizens developed as part of the EMF Community Relations Plan.

EPA held two public meetings on May 13 and May 14, 1997 to present the results of the RI/FS and outline EPA's proposed cleanup plan. The meetings were held in the Pocatello City Council Chambers, and the Tribal Council Chambers on the Fort Hall Indian Reservation. Approximately 75 people attended these meetings, including representatives of FMC and Simplot. Questions asked and answered at the public meetings are recorded in the meeting transcripts which are available in the Administrative Record for the site at the EPA Records Center.

A number of oral comments were received during the public meetings, and eight comment letters were received during the comment period. Members of the community were primarily concerned about the absence of any specific actions on air emissions from the FMC and Simplot plants.

2. Background on Community Involvement

EPA developed a Community Relations Plan (CRP) for the Eastern Michaud Flats site in 1991. The CRP was designed to promote public awareness of activities and investigations at the site and to promote involvement in the decision-making process. The CRP summarizes the initial concerns of local citizens, interest groups, industries, and local government representatives.

EPA mailed several fact sheets during the course of the RI/FS and communicated with the local media in an effort to keep the public informed about the progress of the work at the site. The following is a summary of the major activities:

June 6, 1997	Fact sheet: Public Comment Period Extension
May 13 & 14, 1997	Public Hearings conducted in Pocatello and Fort Hall, Idaho
April 21, 1997	EMF Proposed Plan Fact Sheet
March 5, 1997	*Idaho State Journal* Article on Proposed Plan
Sept 10, 1995	*Idaho State Journal* Article on Risk Assessment Findings
August 16, 1995	*Idaho State Journal* Article on Air Monitoring Findings
October 28, 1993	Fact Sheet on Pond Closure at FMC
September 29, 1993	Fact Sheet on first round of sampling results
March 9, 1993	Remedial Investigation Update
April 15, 1992	Remedial Investigation Update/Ground Water Monitoring Program
December 23, 1991	Current Site Activities/Description of Community Concerns
December 20, 1991	Community Relations Plan
September 1991	Introduction to Superfund Process Fact Sheet
January 23, 1991	Congressional Update: Special Notice Letters Sent to Potentially Responsible Parties

The RI/FS was released to the public with the proposed plan in April 1997. A fact sheet describing the Proposed Plan and cleanup alternatives was sent to individuals on the EPA EMF mail list. All of the documents mentioned above, as well as previous reports from earlier investigations, were made available to the public in the Administrative Record located at the locations listed below:

Idaho State University Library
Government Documents Department
9th and Terry
Pocatello, Idaho 83209

U.S. Environmental Protection Agency
Region 10
Park Place Building
1200 Sixth Avenue, 7th Floor Records Center
Seattle, Washington 98101

EPA published a notice of the availability of these documents on April 21, 1997 in the *Idaho State Journal* and the *Shoshone-Bannock News*. EPA met with representatives of the Shoshone Bannock Tribes Business Council on January 14, 1997, and the Idaho Department of Environmental Quality on January 13, 1997, to discuss EPA's Draft Proposed Plan for cleanup and to answer questions. Between February and May 1997 various articles appeared in the Idaho State Journal regarding the proposed clean up. The public comment period on the Proposed Plan was held from April 21, 1997 to July 10, 1997. EPA held public meetings May 13-14, 1997 in Pocatello and the Fort Hall Reservation. At these meetings, representatives of EPA, FMC, and Simplot gave presentations on the findings of the RI and risk assessment and proposed plan, and then answered questions about the proposed cleanup and remedial alternatives under consideration. This Responsiveness Summary, which is Appendix B of the ROD, contains EPA's responses to the written and oral comments that were received during the comment period.

3. Summary of Comments Received and Agency Responses

Part I - Summary of Community Concerns

General Comment: The greatest number of comments related to concerns about air quality in the vicinity of the plants. In general, most individuals believe that ongoing air emissions represent the greatest threat to public health, and that these emissions should be controlled through the EPA Superfund Record of Decision (ROD).

Response: EPA shares the community concerns regarding the ongoing air emissions from the FMC plant, most especially the emissions of particulate matter, (called PM-10 based on the size of particles). Because these emissions continue to periodically exceed National health-based standards, EPA is addressing these concerns under the Clean Air Act (CAA). The following provides a detailed explanation of what EPA is doing to address these concerns and why Superfund is not the legal tool to achieve the necessary particulate emission controls.

What EPA is doing to address concerns with air quality in Pocatello

Control of the air emissions from the FMC Pocatello plant is a top priority for EPA. In recognition of this priority the EPA Regional Administrator has designated a senior manager, Jim McCormick, to serve as a single point of contact for coordinating technical, legal, and policy issues among the EPA regulatory programs, FMC, and the Shoshone Bannock Tribes. EPA is also working to produce a CAA Federal Implementation Plan (FIP), as explained in the next paragraph, to address this problem in the manner dictated by law.

EPA created National Ambient Air Quality Standards (NAAQS) as authorized under Section 109 of the Clean Air Act (CAA), for the air pollutants, including PM-10, listed in Section 107 of the CAA. The NAAQs are based on the latest scientific health information and are designed to protect public health for both cancer and noncancer risks with an ample margin of safety. Section 107 mandates that States have the primary responsibility for PM-10 emissions and must discharge that responsibility by specifying through State Implementation Plans (SIP) how NAAQS will be attained and maintained. Portions of Power and Bannock Counties, including certain portions within the Fort Hall Indian Reservation, violate the NAAQS for PM-10. Consequently, this area is designated as a nonattainment area. FMC is a PM-10 source within this nonattainment area, but is not subject to Idaho's SIP because FMC is on Shoshone Bannock tribal land. The Tribes have not yet undertaken development of a Tribal Implementation Plan (TIP), therefore it is EPA's responsibility to develop a FIP for that portion of the PM-10 nonattainment area within the Fort Hall Reservation.

EPA's Air Program anticipates publishing a notice of proposed rulemaking during 1998. Public meetings and workshops will be scheduled to discuss the contents of the FIP control strategy. At the time of proposal, the public will be provided a 60-day review and comment period. Final rules for the FIP will occur after EPA has responded to the public comments. EPA fully anticipates that control requirements for FMC in the FIP will help the area to attain the NAAQS. While full implementation of all control technologies at the FMC Plant may take up to four years after final rules are set, EPA expects to see emission reductions and improvements in air quality within six months of finalizing the rule.

In addition to controls for PM-10 and criteria air pollutants, FMC has been identified as a source of certain hazardous air pollutants (HAPs) listed in Section 112 of the Clean Air Act and will be subject to Maximum Achievable Control Technology (MACT) rules no later than November 15, 2000. Unlike criteria air pollutants like PM-10, Section 112 HAP rules are effective immediately upon the promulgation of an EPA rule linking specific HAPs to specific types of facilities. These rules are therefore not subject to control plans by a state, tribe or the federal government. A specific rulemaking linking type of facility with specific HAPs is required because Congress listed 188 different HAPs in Section 112. As written, Section 112 requires EPA to examine industrial processes and require compliance with those HAPs the facility actually generates based on its function.

Limits on Superfund as a tool to regulate FMC's Ongoing Operations

The Superfund program is unique in that it provides for the cleanup of past hazardous waste releases and of hazardous waste requiring emergency response. Congressional enactment of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) was the solution to the gap in Federal environmental authority and it is intended to augment other Federal and State authorities. If a facility is subject to state or federal rules for an ongoing release then the Superfund program will defer control of that release to the appropriate authority.

Background on Superfund analysis of air emissions and risks

Once an area is identified as a Superfund site an investigation called the remedial investigation feasibility study (RI/FS) is conducted to characterize the nature and extent of site risks, develop and evaluate cleanup options, and gather other information necessary to select a remedy that is appropriate for a site. A baseline risk assessment is performed as part of the RI/FS to evaluate the potential threats to human health and the environment in the absence of any remedial action. EPA uses the results of the RI/FS and baseline risk assessment to make a series of site-specific risk management decisions in the Superfund remedy selection process.

At the Eastern Michaud Flats site during the scoping and conduct of the RI/FS it was apparent that air emissions (both current and the impacts of historical emissions) should be an important part of the site investigation. However, this investigation was complicated by the fact that past releases (on which Superfund is focussed) and ongoing emissions (the responsibility of other federal and state regulatory programs) associated with two operating facilities (FMC and Simplot) both contribute to overall site contamination and risk. Therefore, the initial goals of the RI/FS, with respect to the air pathway, were designed to answer the following questions:

- Are there any significant human health or ecological risks associated with air emissions from sources that potentially could be subject to Superfund cleanup?
- What areas at the site have been affected by historical deposition of airborne contaminants?
- What are the sources of all current emissions at the plants?
- Which sources of air emissions are potentially subject to a cleanup under Superfund? (Typically fugitive dusts from sources such as waste piles and abandoned or closed areas of the site would be subject to a cleanup under Superfund.)
- Which sources of current air emissions are subject to control under the authority of the Clean Air Act? (Ongoing emissions from stacks, buildings, and general operating areas are subject to control under the Clean Air Act.)

In order to help answer these questions the following activities were conducted during the RI:

1. Development of an air modeling program to evaluate off-plant transport of plant-derived contaminants with the goal of determining areas where deposition and impacts (both historical and current) on the soil and vegetation were likely to be the greatest.

2. Implementation of a soil sampling program to provide information on deposition patterns and the nature and extent of contaminants in soils surrounding the site.

3. Implementation of an air monitoring program with the following goals: a) assess ambient air concentration data from both plant and nonplant sources near the site, b) provide data to determine the accuracy of the air model, c) estimate risks associated with exposure to air contaminants from all sources. This program included collection of chemical specific data (i.e., the chemicals associated with the particles and gases such as arsenic, cadmium, and fluoride) as well as information on the particle sizes.

> As part of the air monitoring program ambient air quality samples were collected at seven sites (see figure 22 of the ROD), between October 2, 1993 and October 31, 1994. Sites 1, 2, and 7 were located within or near the boundaries of the FMC and Simplot plants. Sites 3, 4, and 5 were referred to as "community sites" in the RI and were located farther from the plant boundaries. Site 6, identified as the background location, was located approximately 12 miles (20 km) west-southwest of the facilities in the prevailing upwind direction. In addition to air quality monitoring, meteorological observations were also collected at Site 1 near the Simplot Plant, at Site 7 in the elevated terrain southeast of the Simplot Plant, and at the Pocatello Airport.

4. Development of an emissions inventory to help identify all sources of airborne contaminants from the site (i.e., stack emissions, fugitive dusts from roads, ore piles, ponds etc.).

Originally EPA had intended to use the air modeling information to estimate exposures from those sources potentially subject to Superfund cleanup. However, the Companies relied heavily on generic source characterization data in their model, rather than site specific data, and ultimately there was not good agreement between the modeling and monitoring results. With the potential unreliability of the air model results EPA chose to use the air monitoring data in the baseline risk assessment to estimate exposures to site contaminants. The downside of this approach is that the estimated risks included exposure to all airborne contaminants, including those from sources potentially subject to control under the Clean Air Act. It was not possible to separate out only those sources of emissions that could be potentially subject to Superfund cleanup. However, it was possible to draw the following conclusions from the air monitoring data that were useful in developing a cleanup plan for the site:

- Historical deposition of airborne contaminants has occurred in the plant and off-plant areas. The levels of contamination do not warrant a soil cleanup but do call for institutional controls to prevent exposure to radionuclides and cadmium already present in soil. Since contaminants will remain in place under this remedy a five-year review will be required in order to determine if the remedy remains effective and is protective of human health and the environment.

- The calculated inhalation risks from all air sources were highest at station 2. Based on a conservative residential scenario the excess cancer risks from all sources were less than a 1 in 10,000 at this location. The risks associated with air emissions from those areas potentially subject to a Superfund cleanup would be some portion of this total air risk. As a general policy in order to operate a consistent Superfund program, EPA generally uses the result of the baseline risk assessment to establish the basis for taking a remedial action. For sites where the cumulative site risk to an individual based on reasonable maximum exposure to historical releases for both current and future land use is less than 1 in 10,000, a cleanup is generally not warranted. While there is uncertainty associated with the air data and risk calculations, EPA does not believe additional information would substantially affect the risks associated with the sources which are potentially subject to Superfund action.

General Comment: A number of comments were received on the groundwater extraction alternative at the FMC plant. Most individuals stated that this action was not necessary given the already low levels of contamination at the northern edge of the company owned properties. Other individuals expressed concerns about extraction of water and then discharge, possibly without treatment, directly into the Portneuf River.

Response: EPA has considered these comments and reevaluated the groundwater monitoring data and selected a "contingent" groundwater extraction system for the FMC Plant. Implementation of the groundwater extraction and treatment system will be required if groundwater contaminants exceed risk-based values at a specified point(s) of compliance.

Part II - In-Depth Response to Specific Comments

1. Comment: Why aren't actions being proposed under Superfund to address the community concerns about air quality near the site?

Response: As stated above, Superfund is not the legislative tool to address the ongoing emissions from an operating facility. In addition, the Remedial Investigation evaluated air data in a baseline human health risk assessment. This assessment utilized conservative (i.e., protective), yet reasonable exposure assumption and scenarios to predict the likelihood of human health and environmental impacts related to the air pathway. The highest estimated incremental carcinogenic risks[1] to nearby residents from all air contaminants was at station 2 (adjacent to FMC fence line)[2]. Estimated risks at this location ranged from 1.5 in 100,000 to 6.0 in 100,000 from all air sources. Risks associated with sources potentially subject to a Superfund cleanup are expected to be a portion of these total risks. Under Superfund law action to reduce carcinogenic risk is generally warranted when risks exceed 1 in 10,000. Therefore, since the estimated site risks are less than 1 in 10,000 and because the Superfund-regulated source contribution to the risks is expected to be less than the risk from all sources, EPA is not proposing any specific actions under Superfund to reduce ongoing air emissions from those areas subject to Superfund. However, ongoing air emissions from operating facilities are subject to regulation under the Clean Air Act. EPA's air program is currently drafting regulatory limits for particulate emissions from the FMC facility because of its location on tribal land. Simplot, located on state land, is permitted for its air emissions by the State of Idaho.

2. Comment: Recent air monitoring results indicate that emission levels near the plants are higher than that measured during the Superfund investigations. What could be some of the reasons for these differences and if these results were used in the risk assessment would it change the overall findings?

Response: During the Superfund RI information on airborne chemicals and gases was collected during 1993-94 and then used in the risk assessment. Risks were calculated based on the actual concentration of chemical and radionuclides measured in airborne particulate matter smaller than 10 microns in size (PM_{10}). Subsequent air monitoring studies conducted by EPA's air program and the Shoshone Bannock Tribes since 1996 provide information on the total mass of airborne PM_{10}, but not the chemical or radiological composition of these particles. For this reason it is not possible to calculate quantitative risk estimated directly from this recent data in the same way the original risk estimates were obtained. However, the potential risks associated with the higher levels of particulate matter can be approximated by scaling the risk estimates using the total PM_{10} concentrations measured during the two periods if the composition of the particles during those periods is assumed to be the same (see attached qualitative assessment).

The results of this comparison show that the average PM_{10} concentration measured at Station 2 from October 1993 through September 1994 was 55.75 $\mu g/m^3$, while that measured at the Primary EPA station from October 1996 through May 1997 was 77.5 $\mu g/m^3$, approximately a 39% increase. If the 1996-97 risks from airborne particulate matter are approximated, as discussed above, by simply scaling the 1993-94 risk estimates using the average PM_{10} concentrations measured during these periods, the estimated 1996-97 risks at the Primary EPA monitoring station would be 39% higher than the 1993-94 risks at Station 2. In order to estimate the approximate 1996-97 risks for

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[1] With the exception of fluoride no non-carcinogenic risks were found to be associated with air emissions.

[2] This location is owned by FMC and deed restrictions will be placed on the property to prohibit any future residential use.

these groups, the 1993-94 "Estimated Cancer Risks" should be multiplied by 1.39. A brief review of the 1993-94 risk estimate indicates that all of the estimates for site workers and hypothetical future residents fell in a range generally considered acceptable by EPA's Superfund program and that none of the Incremental (i.e., site related) risk estimates would increase to values that would generally indicate a need for remedial measures as a result of the higher airborne particulate concentrations observed during the 1996-97 air monitoring program. This finding relates only to risks from specific airborne chemical and radiological contaminants, not to the total PM_{10} levels measured, which exceeded applicable standards on a number of occasions.

There are a number of possible reasons why the 1993-94 data differs from the 1996-97 data. Some of these factors include the following:

1. The location of Station 2 in 1993-94 and EPA's Primary monitoring station in 1996-97 were close to one another but were not exactly the same. As the differences between the results obtained at the Primary EPA station and the Sho-Ban station illustrate, small differences in monitoring locations, especially when they are close to an array of point and small area sources like at the EMF site, can lead to noticeable differences in the observations obtained.

2. A fourth furnace was operating at the FMC facility during most of the 1996-97 monitoring period that was not operating for much of the 1993-94 period. This could result not only in an increase in the total emissions during the latter period, but also in emissions coming from different point sources (i.e., the furnace flare and pressure relief valve for the fourth furnace) that were not active during much of the 1993-94 monitoring period. The difference in the locations of these additional sources relative to the monitoring locations could have contributed to the differences in the results obtained.

3. Two different air samplers, manufactured by different firms, are approved by EPA for use in measuring airborne particulate matter concentrations. Results obtained using either sampler are considered acceptable and equivalent by EPA for regulatory purposes, however most air monitoring practitioners recognize that the Anderson Sampler typically gives results slightly higher than those given by the Wedding Sampler. Wedding Samplers were used in the 1993-94 program whereas Anderson Samplers were used in the 1996-97 program. The small difference in the typical performance of the two samplers may have contributed to the difference in the results obtained during the two monitoring periods.

4. There are seasonal differences in meteorological conditions in the Pocatello area that contribute to characteristic seasonal differences in the levels of airborne particulate matter, with levels typically being higher in the fall and winter than in the other seasons. Particulate matter measurements are available for a full year for the 1993-94 monitoring period. However, results are only available for October through May for the 1996-97 period as of this writing. The present lack of results for the historically lower concentration period of June through September of 1997 means that the seasons with historically lower PM concentrations are currently under represented in the 1996-97 results.

5. Since the Remedial Investigation air monitoring effort was completed, FMC's ore has been mined from a different source. Current feedstocks may be richer in some contaminants of potential concern.

3. Comment: Should the EPA Superfund risk assessment findings be interpreted that there are no health effects from air emissions at the site?

Response: No. The Superfund risk assessment process primarily focuses on carcinogenic and noncarcinogenic risks under a very specific exposure scenario. Air emissions from the FMC plant have been shown to exceed the National Ambient Air Quality Standards for PM_{10} on many occasions. These health-based standards are based on the best scientific information available at the time. Exceedance of these standards indicates that health effects are possible. Whether any health effects are observed in an individual or population depends on many variables such as the types and frequency of exposures, individual response to a chemical, synergistic effects of other chemicals, lifestyle, vocation, and genetics.

4. Comment: Phosphorus was listed as a contaminant of concern but it was not discussed in the health effects summary in the risk assessment. What are the potential risks and uncertainties from phosphorus and what attempts did EPA make to quantify these risks and uncertainties?

Response: The EPA Superfund Program was aware of the potential importance of releases of phosphorus and its oxidation products to the air from the EMF Site and, as a result, listed phosphorus as a chemical of potential concern (COPC) for the air pathway (Table 2-1 of the Baseline Human Health Risk Assessment [BHHRA]). Efforts were made during the planning and scoping of the Remedial Investigation and the BHHRA to obtain the information that would have allowed the potential risks posed by these releases to be quantitatively evaluated in the risk assessment. However, two factors hampered these efforts and ultimately prevented quantitative evaluation of these potential risks: the lack of a standard EPA method for measuring the concentrations of phosphorus and/or its oxidation products in air, and the lack of information of the toxicological effects of inhaling low levels of these substances over a prolonged period of time.

Because of the potential importance of assessing the risks posed by releases of phosphorus and its oxidation products to the air at the EMF site, EPA investigated the use of non-EPA methods for measuring the concentrations of these substances in air. Several methods were identified and considered, but none were sufficiently specific and well validated to generate data that would be of sufficient quality to meet EPA's guidelines for data useability in risk assessments. Therefore, EPA reluctantly concluded that it would not be possible to collect useable data on the concentrations of phosphorus and/or its oxidation products as part of the RI for the site.

Since toxicological indices (slope factors [SFs] for carcinogenic effects and reference doses [RfDs] for noncarcinogenic effects) were not available for phosphorus or its oxidation products in EPA's Integrated Risk Information System (IRIS) database or its Health Effects Assessment Summary Tables (HEAST) [EPA's standard sources of toxicological information], the EMF project team contacted EPA's Environmental Criteria and Assessment Office (ECAO) for assistance. ECAO conducted a review of the scientific literature for information on the toxicity of phosphorus and its oxidation products via the inhalation route but concluded that there was insufficient information upon which to base even a provisional reference dose (RfD). The Agency for Toxic Substances and Disease Registry (ATSDR) released a Draft Toxicological Profile for White Phosphorus and White Phosphorus Smoke in June 1994 which concluded that Minimum Risk Levels (MRLs), which are similar to RfDs, also could not be established because of insufficient data.

When elemental phosphorus is exposed to the atmosphere it burns spontaneously forming various phosphorus oxides which absorb and react with moisture in the atmosphere to form phosphoric acid. When phosphoric acid dissolves in water (as it would if it were inhaled and contacted mucous secretions in the lungs), it ionizes forming various phosphate ions. Substantial amounts of phosphate ions are naturally present throughout the body and play an essential role in many bodily processes. Phosphates and phosphoric acid are also ingredients in many foods and beverages and are generally regarded as safe in that use by the FDA. Therefore, the small quantities of phosphoric acid and phosphate that might be absorbed through the lungs as a result of periodically inhaling the products of phosphorus emissions from the site would not be expected to result in adverse systemic health effects after being absorbed and neutralized by the body. However, the emission products would most likely exist as an acidic phosphoric acid mist which could be irritating to the lungs and respiratory tract when inhaled. Unfortunately, the scientific data needed to evaluate the potential health effects of inhaling low levels of phosphorus emission products repeatedly over a period of years is not available.

We acknowledge that because of the unknown, but apparently substantial, quantities of phosphorus and its oxidation products released from the site to the atmosphere, the agency's inability to quantitatively evaluate the potential health effects associated with these releases could represent a significant source of uncertainty in the risk assessment. Unfortunately, because of the lack of reliable analytical methods for measuring the concentrations of phosphorus and/or its oxidation products in air and the lack of toxicological information, it is not possible to quantitatively evaluate either the potential risks posed by these substances or the uncertainties created by omitting them from the quantitative risk assessment.

5. Comment: What is the jurisdiction for land use controls, particularly for building restrictions associated with radon?

Response: Land use controls, as part of the broader term, "institutional controls," is the use of existing institutions to achieve environmental protection or the elimination/reduction of environmental exposure or risk. The most common of these institutions, and the one to be used at this site to control future radon exposure (as well as to achieve other objectives listed in the ROD), is the existing legal system for the transfer of real property. The comment appears to have used the word, jurisdiction, because the FMC plant is on tribal land. With respect to lawful land transfers, **location on tribal land** does not significantly change how these land use controls operate.

The Tribes have deeded the current FMC property to FMC. FMC is therefore a private property owner who must obey tribal laws and regulations in the same way as any other owner of tribal property, or just as any property owner in a state of the United States must obey state law and regulation. In both cases, private property owners have the freedom to contract, including the right to sell their private property to a willing buyer. In such negotiations, the seller can place restrictions in the deed given to the buyer which limits what the buyer receives. These restrictions can and often do affect the purchase price. Common restrictions, such as those to protect the view of other property owners or prohibiting various uses like those typically found in zoning ordinances, often dictate land value. EPA does not usually rely on zoning because it is always subject to change, exemption or variance by local zoning authorities and therefore offers little assurance of a long term or even short term effect.

In this instance, EPA anticipates that FMC will enter into a Consent Decree with the United States, and will agree in the Decree that any sale or transfer of property will include those limitations contained in the ROD. This means FMC will not only agree to the limitations in the ROD for FMC, but for any owners who may come after FMC for as long as EPA determines any given restriction should remain in place.

As described above, legally enforceable deed restrictions will require any future office buildings to be constructed at the site to use the radon controlling methods specified in the document "Radon Prevention in the Design and Construction of Schools and Other Large Buildings" (EPA/626/R-92/016, 1994), or whatever radon guidance supersedes it or is otherwise available, applicable and appropriate. Further, following construction, and annually thereafter, the indoor air shall be tested for radon. If the radon levels exceed either 4.0 pCi/l, as specified in "Citizens Guide to Radon" (EPA 1992), or any promulgated standard in effect at the time of these future sampling events, additional controls shall be implemented to reduce the radon activity below the target level or promulgated standard. Like all other deeds and deed restrictions, these land use controls will be recorded and filed with the government office within the jurisdiction, tribal or state, responsible for a specific area of the site. Recording gives notice to any subsequent purchasers that any future land transfer will contain such restrictions.

6. Comment: What requirements are in place to insure that the Company-owned properties are properly dealt with in the future when the plants shut down?

Response: Both Companies will be required to close the plants in accordance with whatever state, tribal, or federal laws are in place at that time. In addition, at least every five years EPA will review all relevant data and information for the site as a whole to ensure the cleanup provides adequate protection of human health and the environment from historic releases.

7. Comment: In the Off-Plant Area where property restrictions such as deed restrictions are being proposed, will the property owners be compensated in any way for imposition of land use restrictions?

Response: If an environmental easement is used, the property owner is compensated by the

Company for not being able to use the property for certain purposes. There also may be some compensation for placement of a deed restriction since the property owner must agree to the restriction. Any compensation of property owners is between the Companies and property owners, and not EPA.

8. Comment: Who makes the decision on what type of land use restrictions will be used in the Off-Plant Areas?

Response: Based on the findings of the risk assessment EPA determines what types of use(s) are appropriate for this area. For example, based on available information, consumption of fruits and vegetables grown in this area would be restricted as well as residential use of certain portions of the Off-Plant Area and residential use of groundwater.

9. Comment: Would there be potential health risks if you lived on the land now occupied by the FMC and Simplot Plants?

Response: Yes. EPA did not consider future residential use of the Plant Areas to be likely, and per EPA guidance, did not evaluate this scenario in the risk assessment. However, the risk assessment did evaluate potential residential use of the Company-owned property north of the fence lines and along the I-86 right of way. Potential risks in this area are elevated and therefore require institutional controls to prevent future residential use but are within an acceptable risk range for industrial workers. The levels and types of contaminants in the Plant Areas are comparable to the area along the I-86 right of way and the potential risks would be expected to be equivalent. This is the basis for institutional controls in the Plant Area which will prohibit any future residential use.

10. Comment: During the RI/FS, has EPA conducted any long term epidemiology studies on possible health effects?

Response: No. EPA uses the risk assessment process as a tool to provide a nationally consistent basis for making decisions with a minimum of data. Epidemiological studies require large populations, an understanding of other risk factors (e.g., lifestyle, non-site exposures, etc.), and large amounts of data. It is unlikely that large studies of this type would yield any meaningful conclusions that would aid a site cleanup. However, if there was data that indicates that the site may pose more immediate health effects, this information would have been considered in developing a cleanup plan for the site. This type of information is typically identified during the listing of the site on the NPL and/or during scoping of the RI/FS. In addition the Agency for Toxic Substances and Disease Registry (ATSDR) has the responsibility for evaluating potential human exposures (past, present, and future) to site related contaminants. ATSDR has already completed one health study on the Fort Hall Indian Reservation and is in the process of conducting health consultations for air, groundwater, and soil at the EMF site. At any time, if new information becomes available that indicates the site remedy is not protective, as defined under CERCLA, EPA will consider amending the Record of Decision for the site.

11. Comment: FMC is a large company and can make decisions regarding a cleanup without EPA's involvement. Why is EPA involved in this process?

Response: Section 104(a)(1) of CERCLA requires EPA oversight of Company field activities and review of deliverables. In 1991, FMC and Simplot signed an Administrative Order on Consent (AOC) with EPA for the RI/FS at the EMF site. Under this agreement the Companies voluntarily agreed to allow EPA, the state, and tribe to provide oversight throughout the process, and EPA then selects the remedy for the site. After the ROD is finalized EPA will negotiate a consent decree with the Companies for the design and implementation of the cleanup plan. This agreement will require EPA oversight throughout the cleanup process.

12. Comment: Will there be new jobs associated with the site cleanup?

Response: At FMC and Simplot, there may be some additional increase in employees, particularly contract workers and temporary empioyees during some of the construction activities. The Companies should be contacted directly regarding any potential employment opportunities.

13. Comment: Will workers doing the cleanup work be required to wear protective equipment and meet the requirements of the Occupational Safety and Health Administration (OSHA)?

Response: Yes. Any work at the site will be preceded by development of a Health and Safety Plan designed to meet OSHA and plant requirements. All workers will be expected to comply with the Health and Safety Plan.

14. Comment: How does EPA know that groundwater and soil contamination have not spread further than the area sampled?

Response: During the Remedial Investigation, soils were sampled out to a distance of three miles from the plants in all directions. The results showed that the levels of soil contaminants decreased with increasing distance from the plants. The concentrations at three miles away were either indistinguishable from background or well bellow any risk-based level of concern. Groundwater monitoring was conducted at the plants and in the Off Plant areas. The same pattern of decreasing concentration with increasing distance was observed, and drinking water standards were met in the groundwater before leaving the Company owned properties.

15. Comment: Is it true that groundwater currently meets drinking water standards north of the Company-owned property?

Response: Yes. Concentrations of contaminants in groundwater do not exceed drinking water standards known as Maximum Contaminant Levels (MCLs) in wells on Company owned properties north of Highway 86, at Batiste Spring or Swanson Road Springs. Groundwater concentrations are also below MCLs (and generally are at background levels) in wells on non-Company owned properties such as the City of Pocatello land north of Highway 86, and the Chevron tank farm and Rowlands property.

16. Comment: What steps are being taken to prevent further spread of groundwater contamination?

Response: The proposed plan included three elements to address groundwater contaminants. These elements are as follows: 1) Control sources of contamination such as capping old pond areas; 2) Groundwater extraction to maintain hydraulic control and remove some contamination; and, 3) Groundwater monitoring to ensure that the selected remedy remains protective.

17. Comment: Is the Portneuf River a hydraulic barrier to groundwater movement?

Response: Yes, based upon available information. The RI evaluated groundwater elevations at more than 140 wells during at least 10 quarterly sampling events. Mapping of these elevations provides information on which way groundwater flows (high elevations to low elevations). It also shows concentrations of chemicals in groundwater declining down-gradient. Groundwater at the site is flowing from the foothills of the Bannock Range into the Michaud flats. On the east side of the river water is also flowing down gradient toward the river and can't flow past the river due to higher groundwater elevations on the west side.

18. Comment: What is the rationale for proposing FMC pump groundwater rather than just propose institutional controls?

Response: The intent of this alternative, as described in the Proposed Plan, was to maintain hydraulic control of the water and prevent any further spread of contamination. For the ROD this alternative was replaced with a contingent groundwater pump and treat remedy. This change was made since the area of contamination does not appear to be expanding and groundwater meets drinking water standards before reaching the springs. If the contingency is employed groundwater extraction will consist of installing extraction wells in the northern portion of the FMC plant, and extracting groundwater from the shallow aquifer at a rate sufficient to capture the contaminated groundwater in which concentrations of contaminants of potential concern exceed MCLs or Risk-based Concentrations (RBCs). Extracted groundwater would be treated prior to discharge or re-use within the Plant. Bench-scale and/or pilot testing may be required during treatment plant design. Implementation of the extraction system would be triggered by a set of criteria in the ROD for determining plume expansion and exceedence of risk-based drinking water levels in groundwater.

19. Comment: The Proposed Plan indicates that extracted groundwater could be put into the Portneuf River without treatment. What is the justification for this aspect of the Proposed Plan?

Response: It is possible that groundwater extracted for hydraulic control would already meet drinking water standards and other water quality standards (i.e., quality standards for aquatic organisms). This is primarily due to the fact that extraction wells on the northern edge of the plume would also withdraw large volumes of clean water. In this case the water could be discharged to the Portneuf River without treatment. Water extracted at Simplot will be used in their process, either with or without treatment depending on quality. At FMC the cleanup plan will require treatment if the contingent groundwater extraction system is implemented.

20. Comment: Are FMC and Simplot going to "treat" the contaminated groundwater that will be extracted under the proposed remedy for the site?

Response: At Simplot, extracted groundwater will be utilized in plant processes. Further testing is required to determine if this water will require any treatment. At FMC, the ROD requires treatment of groundwater if extraction becomes necessary.

21. Comment: Under the plan, how long will groundwater extraction at Simplot take place?

Response: The extraction system will continue to operate as long as there is contamination leaching from the gypsum stack and groundwater contaminants exceed risk or health-based levels. This may require operation of the system after the gypsum stack is closed and until groundwater levels reach acceptable levels.

22. Comment: How will actions in the site remedy clean the contaminated aquifer?

Response: The actions in the ROD are directed at reducing sources of contamination to the groundwater and allowing for natural recovery of the aquifer over time. Natural recovery of the aquifer may take several decades and relies on physical or biological processes (unassisted by human intervention) to reduce contaminant concentrations. Performance monitoring is a critical component of this remediation approach because monitoring is needed to ensure that the remedy is protective and that natural processes are reducing contamination levels as expected.

23. Comment: Will there be a third party review of the remedial design of the cleanup plan?

Response: Currently the State of Idaho, Shoshone-Bannock Tribe, and EPA will be reviewing design documents.

24. Comment: How many wells are in the Off-Plant Area and how often are they sampled?

Response: There are approximately 20 wells off site. During the RI from 1992-1996 they were sampled every 3 months. These wells are now being sampled twice a year.

25. Comment: It does not appear that Alternative 03 (Institutional Controls and Monitoring in the Off-Plant Area) would offer adequate controls for this area. What is the justification for this alternative?

Response: The risks found in most of the Off-Plant Area were not high enough to justify the significant cost of a soil cleanup. Use of institutional controls, such as deed restrictions or easements, would provide the same level of human health protection but at a substantially lower cost. In addition, there are only two privately-held parcels of land in this area. All other parcels are owned by either the Company or the City of Pocatello, and deed restrictions are already in place prohibiting residential uses.

26. Comment: The Plan does not say anything about the slag piles at FMC. Do these piles represent a risk?

Response: The slag is a glass-like material and is not a major source of contamination to either groundwater or air. Slag does emit gamma radiation at levels which can pose a risk to humans, particularly if an individual is in close proximity to it for extended periods of time. FMC has voluntarily entered into an agreement with EPA to no longer sell and distribute this material outside of their facility. FMC workers who work on or near the slag piles are partially shielded from the radiation while working in vehicles and heavy equipment.

27. Comment: In 1994, EPA issued a Notice of Violation under the Resource Conservation and Recovery Act (RCRA) at FMC, which has yet to be resolved. Without knowledge of what these violations were for, how can the public evaluate the adequacy of the Proposed Plan?

Response: While EPA cannot divulge the details of the RCRA case, we can say that the violations are primarily related to FMC's compliance with RCRA closure requirements at the operating waste disposal ponds. RCRA regulations require closure, within specific time frames, of hazardous waste units that do not meet certain standards. RCRA was designed to prevent impacts to public health and the environment through specific record keeping, engineering controls, monitoring, and reporting requirements. While all of the RCRA violations are considered serious, not all violations are necessarily correlated with a specific impact on the environment or direct threat to human health. Implementation of the Superfund ROD will help address the most significant risks associated with the past uncontrolled release of hazardous substances at the site, and actions by the RCRA program will help prevent future impacts to the environment and help bring the facility into compliance with the current RCRA requirements.

28. Comment: Is it possible for there to be an independent analysis of the RI/FS?

Response: Yes. Based on a request from a newly formed citizen group called the Pocatello Environmental Council, an independent review of the RI/FS is being conducted through the Technical Outreach Support for Communities Program of Oregon State University. While the results of this review may not be available until after the ROD is signed, if new relevant information indicates that the Superfund remedy is not protective, EPA will consider amending the ROD.

29. Comment: During the course of the study of the site, did anyone contact hospitals, doctors, or schools to learn of what impacts the site may have on the community?

Response: No. However, EPA did talk to a number of individuals representing a cross section of the community throughout the RI/FS process. Even before the RI began, EPA representatives met with community members to learn about their concerns with the site. Information from these discussions was incorporated into the site community relations plan and scope of the RI/FS. At that time and throughout the six-year site investigation, no such concerns were specifically identified for EPA to follow up on. In addition, the Agency for Toxics Substances and Disease Registry (ATSDR) has conducted one health study on the Fort Hall Reservation (and is in the process of conducting follow-up to this study) during which hospital records were reviewed and interviews conducted to determine the incidence of respiratory diseases on the reservation as compared to a control location.

30. Comment: How will the information that ATSDR is developing be used by EPA it its decision making?

Response: EPA will review ATSDR findings as they become available. If any new relevant information is presented (which was not available during the RI) indicating that the remedy is not adequately protective, EPA will consider amending the site cleanup plan as appropriate in order to ensure that it is protective of public health and the environment.

31. Comment: Why does the Plan only require capping of waste areas rather than excavation and treatment of contaminated soils?

Response: Placement of a thick cap over the old pond areas would reduce the risks from incidental exposure to contaminants and reduce infiltration of water into the wastes. During the RI/FS there were no readily available proven technologies for treating the contaminated phossy wastes and soils in the old ponds should they be removed. In addition, excavation of these wastes which are currently covered with some soil would pose a very significant danger to workers from elemental phosphorus which ignites when exposed to air. In addition to the dangers from fire are the inhalation risks from phosphorus pentoxide and phosphine gas. These very real dangers and significant costs do not justify the potential benefits of removing and treating this material.

32. Comment: What type of support has EPA provided the Tribes on environmental issues?

Response: Since 1991, the EPA Superfund program has funded a cooperative agreement with the Shoshone Bannock Tribes for technical support at the EMF site. Funding has been provided at approximately $50,000 per year. This money has allowed for a full time tribal representative to participate in meetings, review and comment on documents and data, and communicate with the Business Council and Land Use Commission on relevant data, key decisions and general progress in the investigation of the site. In addition to the Superfund support, a variety of other EPA programs have provided the Tribes with ongoing financial and technical support in addressing a variety of environmental issues.

33. Comment: The Proposed Plan indicates that it must meet state and federal environmental siting laws and regulations. What about tribal laws?

Response: Tribes have the ability to set laws and regulations for reservation lands. EPA interprets the requirement to meet state and federal laws and regulations to include tribal laws and regulations. One of the key steps of the Feasibility Study is to identify all Applicable and Relevant or Appropriate Requirements (ARARs) for the various alternatives being considered[3]. During this process the Shoshone Bannock Tribe did not identify any specific laws or regulations that should be considered an ARAR for the site. EPA has also reviewed the Law and Order Code of the Shoshone Bannock Tribe and the Ordinances and Policies to identify any potential tribal ARARs. Based upon this review, EPA has found no tribal ARARs that would apply to the selected remedy.

34. Comment: Are the tribal air quality regulations considered an ARAR?

Response: The boundaries of the Fort Hall Indian Reservation give the Shoshone Bannock Tribes jurisdiction over most of the FMC Plant. Therefore, Tribal air regulations established to control ongoing air emissions are binding just as state regulations are outside of the reservation. However, in this case the Tribal air regulations are not applicable because Superfund is not taking actions that will result in air emissions. The Tribal regulations would be binding on additional controls put into place by EPA's air program as a result of a FIP.

Specific Comments from the Shoshone Bannock Tribes

The following is a summary of specific comments received from the Shoshone Bannock Tribes on the EMF Proposed Plan and Draft Record of decision:

1. Comment: The ROD does not include action for air emissions based upon findings of the human health risk assessment and ecological risk assessment. Additional action associated with the air pathway is justified based upon the timeliness of implementing a FIP/TIP and the high degree of uncertainty in the air portion of the RI/FS at this site. The five-year review process may not ensure protection of human health or the environment from ongoing emissions.

Response: EPA is in agreement with the Tribes' concern that actions to control air emissions from the FMC plant need to be undertaken expeditiously. The Agency is also in agreement that considerable work needs to be undertaken before additional air emission controls are in place at FMC. The following outlines EPA's commitment to address these issues and how the agency will use its different programs to control air emissions from the operating facility.

What EPA is doing to address air issues

In recognition of the many concerns with air quality in the region, and delays in implementation of the necessary controls, EPA's air program has made the regulation of air emissions at FMC a priority. Here are the three main categories of concern, and what EPA is doing about the problem:

1) ***Particulate matter***: A federal implementation plan to impose controls on FMC to reduce particulate emissions by about 67% is in the final stage of preparation, and will be proposed in the Federal Register later this year.

[3] If no action is being proposed for a specific media, such as air, then no ARARs apply.

2) ***Radionuclide emissions***: EPA's air program is directing FMC to conduct additional testing this summer to establish new emission factors for compliance with the emission standard for this hazardous pollutant. EPA will be on site to provide close oversight of these tests.

3) ***Phosphine and hydrogen cyanide emissions***: FMC has notified EPA that emissions from waste ponds have on occasion exceeded CERCLA reportable quantities for these chemicals. EPA's removal program has continued to monitor the situation to insure there is no immediate threat to the public or the environment from these emissions. In order for these emissions to be addressed EPA Headquarters must determine if a source category is warranted for phosphorus facilities. If such a category is warranted, EPA Headquarters must establish a standard for these emissions as required under Section 112 of the CAA. In addition, since the major source of these emissions are the operating RCRA ponds, EPA's RCRA program is in the process of working with FMC to establish a technology-based emission standard.

Limits on Superfund as a tool to regulate FMC's ongoing operations

As stated previously in this document the Superfund program is unique in that it provides for the cleanup of past hazardous waste releases and of hazardous waste requiring emergency response. Congressional enactment of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) was the solution to the gap in Federal environmental authority and it is intended to augment other Federal and State authorities. If a facility is subject to state or federal rules for an ongoing release then the Superfund program will defer control of that release to the appropriate authority. For this reason, Superfund will not be involved in implementing items 1-3 above. Instead those actions will be carried out by the Air and RCRA programs.

The Superfund Record of Decision includes only those actions which are appropriate to site "cleanup" and risks associated with past practices. Despite any uncertainties in the risk assessment the Superfund program believes that collection of additional data or further analysis of continued air monitoring data would not alter the findings and ultimate basis for the actions in the ROD. Air monitoring being conducted by the EPA air program and Shoshone Bannock Tribes will continue for the foreseeable future.

2. Comment: The fluoride levels in sagebrush and soils identify an increase of contamination in the area and the Tribes believe source control of fluoride emissions is warranted. The Idaho standard for fluoride content in vegetation used for feed or forage for livestock is not protective of other species, specifically, migratory birds.

Response: The sources of fluoride are primarily from active facility operations and not subject to direct control under Superfund. Nevertheless, the ROD does include a requirement for continued monitoring of fluoride in the environment due to the potential risks calculated in the ecological risk assessment for plant and wildlife species of the sagebrush steppe ecosystem. If the monitoring indicates fluoride levels may be increasing then additional actions, including some source controls, may be warranted. In such a case EPA would then evaluate the sources and work with the state and Tribes to determine how best to achieve the necessary source controls. Currently, based on the findings of the ecological risk assessment, source controls or cleanup actions are not warranted.

3. **Comment**: The Tribes are concerned with the uncertainty associated with the ecological risk assessment findings for the Portneuf River, waterfowl, or sediment. The Tribes request CERCLA design and implement a monitoring program to ensure contaminants are not entering the Portneuf River via the National Pollutant Discharge Elimination System (NPDES) regulated discharge. The Tribes also request further study of the area be conducted in order to determine the validity of the modeling used in the ecological risk assessment.

Response: Based upon the findings of the RI, the EPA Superfund program does not believe that the FMC Industrial Waste Water Discharge is a continuous or significant source of contaminants to the Portneuf River. This conclusion is based on analysis of discharge water and sediments in the vicinity of the outfall. However, EPA agrees that further evaluation of this discharge, including additional monitoring, may be warranted. Since this is an ongoing discharge and not a past practice, it is appropriate that this work be conducted through the EPA NPDES program.

With regard to concerns with the uncertainty of the ecological risk assessment EPA does not agree that further study is necessary. At this site maximum use was made of site-specific exposure data for the risk assessment, thereby reducing a major source of uncertainty typically associated with the use of non site specific models. Fluoride exposure estimates for wildlife were based on statistically designed sampling and analysis of representative food items, hence the modeled dose estimates are considered to have a high degree of reliability. Toxicity testing and analysis of sediments provide adequate information to evaluate potential contaminants to the Portneuf River, which were judged to be minimal. In general, with the exception of analytical uncertainties for fluoride, the conservative assumptions used in the risk assessment are more likely to overestimate rather than underestimate the risks of adverse effects at the site. With the exception of the marginal risks associated with fluoride, potential site related risks were not identified for the riparian, riverine, or mudflat habitats associated with the Portneuf River. These are the ecosystems of greatest ecological concern in the site vicinity.

4. **Comment**: The ROD proposed implementing institutional controls in the form of environmental easements, deed restrictions, or zoning. With what jurisdiction entity will these easements, deed restrictions or zoning be filed? Should this option be carried forward the Tribes request these issues be clearly defined by all parties. The tribes assert and maintain jurisdiction within their reservation boundaries.

Response: (See the response to previous comment number 5 on page B-12). Like all other deeds and deed restrictions, these land use controls will be recorded and filed with the government office within the jurisdiction, tribal or state, responsible for a specific area of the site. Recording gives notice to any subsequent purchasers that any future land transfer will contain such restrictions.

EPA will work jointly with the Tribe to develop controls within the reservation boundary that will recognize the Tribes jurisdiction and meet the objective of the ROD.

5. Comment: The Endangered Species Act and the Migratory Birds Treaty Act should be added to the ARARs for this site. Migratory birds are affected by off-site migration of contamination.

Response: Based upon the risk evaluation of benthic invertebrates, waterfowl, shorebirds, songbirds, semi-aquatic mammals, and shrubs, potential site-related risks were not identified for the jurisdictional wetlands or listed species of riparian, riverine, and mudflat habitats with the Portnuef River. With the exception of potential impacts to migratory birds from exposure to contaminants in FMC open RCRA ponds, there is no other information that would suggest migratory birds are being affected by contamination at the site. The EPA RCRA program, which regulates the FMC ponds, is aware of the trustee concerns with regards to impacts to migratory waterfowl and has been working with FMC to solve this problem through eventual elimination of ponds and open bodies of water. The ROD does not include actions that would result in additional areas of standing water and therefore the Endangered Species Act and Migratory Birds Treaty Act are not applicable.

6. Comment: The ROD proposes a monitoring program to assure the contamination plume does not increase at the facility. The Tribes do not believe this option is the best balance of benefits and tradeoffs. Natural mixing of clean and contaminated water does not justify a no treatment option.

Response: Contaminated ground water exists at more than 85 percent of the sites on the National Priorities List (NPL). The goal of ground-water remediation at Superfund sites is to protect human health and the environment through a combination of short-term measures (e.g., provision of alternate water supplies) and long-term measures to restore ground-water quality appropriate for its beneficial uses. Remedial action for contaminated ground water generally is warranted when EPA determines, based on the results of the baseline risk assessment, that the contamination poses a current or potential threat to human health or the environment. Additionally, where the ground water is currently used (or is potentially usable) as a drinking water supply, exceedance of Maximum Contaminant Levels (MCLs) and non-zero Maximum Contaminant Level Goals (MCLGs) established under the Safe Drinking Water Act also may be used as the basis for taking a remedial action. The goals of the long-term ground-water cleanup program are to return usable ground waters to their beneficial uses wherever practicable, within a time frame and cost that is reasonable given the particular circumstances of the site. When restoration of ground water to beneficial uses is not practicable, EPA expects to prevent further migration of the plume, prevent exposure to the contaminated ground water, and evaluate further risk reduction.

Information collected during the RI indicates that some areas of former unlined ponds are still contributing chemicals to the groundwater to varying degrees and this will continue for some time regardless of reductions in infiltration. The materials beneath the former unlined ponds that contain these residual concentrations of contaminants are fine to very fine grained soils and wastes, which are above the water table. Extraction of groundwater adjacent to these areas would result in capture of impacted groundwater, but would not significantly reduce the time required to reach MCLs, because with very low levels of infiltration (5 percent), the source material will continue to release contaminants to the groundwater over the next several decades at nearly the same concentration (but at reduced quantities) as when the old ponds were in service. Additionally, to capture the groundwater over such a broad area would require many pumping wells and an extensive piping system. It is also likely that large quantities of unimpacted (clean) groundwater would be extracted by the pumping wells. Large quantities of water would require treatment, significantly increasing the treatment costs, without any appreciable environmental gain.

However, the goals of the long-term groundwater cleanup will be achieved at this site through institutional controls to prohibit use of water for drinking purposes, continued monitoring, extracting groundwater at Simplot, and, if necessary, implementation of the contingent groundwater extraction system at FMC.

7. **Comment:** The tribes request there be consistency with the RCRA program in the closure of pond areas at the facility. The tribes believe the most conservative measures must be utilized in all areas where definitive data is lacking and that the most stringent closure requirements are used.

Response: The selected Superfund remedy for capping old pond areas is consistent with many of the closure requirements of RCRA. The RCRA program can be very prescriptive as to how a landfill cap is constructed due to specific provisions in the regulations. Superfund is bound to consider a variety of factors in coming to a remedy decision including cost and risk reduction. Nonetheless EPA believes that the selected Superfund cap remedy meets the fundamental goals for a RCRA cap. That is, it minimizes infiltration and controls releases to the extent necessary to protect human health and the environment. At the old pond areas the potential risk reduction benefits to be gained by using the most stringent closure procedures do not justify the additional costs associated with multi-layer impermeable caps or excavation and treatment of wastes. In addition groundwater monitoring and five year reviews will be conducted indefinitely to ensure that the remedy is protective. This may not necessarily be the case at open ponds that are still operating which are subject to the specific closure requirements of RCRA.

8. **Comment**: The risk assessment for the site did not address risks to tribal culture from contamination on tribal lands. These risks should be addressed due to the essential interconnectedness of the tribal community, its religions, and environment.

Response: EPA acknowledges that the standard risk assessment process was not designed to evaluate risks to Tribal cultural and spiritual values. Clearly tribes and EPA need to work together in the future to develop tribal-specific risk assessments and risk management strategies to address these types of concerns. However, EPA has considered the Shoshone Bannock Tribe a partner during the design and conduct of the EMF site risk assessment. EPA sought input from the Shoshone Bannock Tribe during every phase of the RI and Risk Assessment.

During the RI both the Shoshone Bannock Tribe Superfund coordinator and representatives of U.S. Fish and Wildlife Service were involved in scoping the ecological risk assessment, selecting sampling locations in the field, and interpreting the results. Throughout this process every attempt was made to factor in tribal and agency concerns and include plant and animal species that were of particular interest. Maximal use was made of site-specific exposure data and EPA's confidence in the results of the ecological risk assessments is considered to be high.

With respect to the human health risk assessment EPA did evaluate exposure to contaminants in air, soil, groundwater, and from consumption of home-grown produce. As with the ecological risk assessment many conservative assumptions were used to account for uncertainties. In the Human Health Risk Assessment exposure to contaminants from consumption of home-grown produce were calculated using distributions from the U.S. Department of Agriculture Nationwide Food Consumption Surveys. These surveys take into account the physical characteristics (age, body weight, etc.) of individuals responding to the surveys and include many demographic subgroups within the overall population. EPA then took this information and estimated homegrown produce intake rates using a Monte Carlo simulation since individuals do not consume fixed amounts of homegrown produce. We believe this analysis provides a reasonably accurate estimate of potential exposures from home-grown produce and may provide a benchmark for other types of exposure such as from native plants used for ceremonial or medicinal purposes.

10. Comment: There appears to be considerable uncertainty in the ecological risk assessment particularly related to the bioassay of benthic invertebrates near the IWW outfall and use of modeling information to assess exposures to wildlife. The Tribe requests that the ROD include further study of the area in order to determine the validity of the modeling.

Response: See response to previous comment number nine. With regards to modeling of contaminants and ingestion rates, EPA recently reevaluated the sediment ingestion rates for waterfowl. In an August 15, 1997-letter the Department of Interior suggested considering a sediment ingestion rate of 18 percent for mallards, rather than the 3.3 percent value used in the ecological risk assessment. Apart from the question of which value provides a better sediment consumption estimate (EPA's is from a published source and is presented in USEPA guidance; the Department of Interior reference is from a site-specific study at another location in Idaho), the adjustment makes little overall difference in the risk calculations. In fact, the risk assessment already assumed a 18% sediment ingestion rate for another waterfowl species at the site, the spotted sandpiper, and the risks for that species (Hazard Quotient = 0.14) was comparable to the risks to the mallard (HQ = 0.17). For both species, sediment is only a small part of their total exposure, since most (>90%) of their exposure is through ingestion of contaminated prey (see Table 4-9 in the risk assessment report). Even if sediment exposure were increased by a factor of 18/3.3 = 5.4545 for the mallard, its total exposure would increase only by about 5%. This is not nearly sufficient to cause a change in the predicted risks (i.e., the mallard HQ would increase from 0.17 to approximately 0.18).

Shoshone-Bannock Tribes
Comments on EPA Proposed Plan / Record of Decision
Eastern Michaud Flats Superfund Site

Inherent and fundamental differences exist between Native American and European perspectives on environmental management. European culture examines the natural world in a stepped approach to satisfy the scientific principles involved. Science by it's very nature is based on observations and facts that can be verified, reproduced and visible to anyone. This alone creates a fundamental difference with the Native American perspective of the natural world. Fundamental to Native American culture is the interconnected nature of species and relationships. Sacredness is embeded in all forms - plants, animals, water, air and the natural landscape. Nature possesses a symbolic content with interpretation of these symbolisms derived from traditional culture. This holistic approach is a deep rooted cultural tradition, passed on from generation to generation

European culture creates its own sacred places in churches, wards and synagogues. This is not so with Native American. Native Americans are attached to the land, water and life forms that come from it. Spirituality is interwoven between individuals and the natural world with the belief that all things share a creator and creation. Sacred sites are not located at a single street address or within the walls of a church but to the reservation as a whole, the land, the life it supports, the water that runs through, all natural processes. Identification with plants and animals is a key characteristic of Indian culture. Plants and animals represent ties to generations past and present. This belief of interconnectedness is translated through their everyday lives and cultural traditions. Ceremonies serve an integral role in native American culture as they mark marriages, namings, funerals, first kills and intertwined with ceremonies and everyday activities are the relationship with plants, animals, gathering rituals, people, ancestors, water, sun and air .

All plants hold healing powers or qualities for both the body and spirit. An example sage brush, which is a most respected plant, signifies purification and is used in traditional Native American rituals. Water is referred to as the life blood of the reservation, it is used in spiritual ceremonies at sweat lodges which may be likened to the use of "holy water" in a Catholic church or Baptismal water used in other Christian religions. There is not a distinct separation of religion from plants, animals, and other land forms provided by the creator.

Scientific risk assessments, ecological assessments and overall management of environmental media conflict with traditional views. To develop an acceptable risk to humans, animals and plants by allowing for an acceptable amount of contamination is contrary to Native American ways. It is our hope that with this condensed version on Native American culture the U.S. EPA and industries involved with the Eastern Michaud Flats Superfund Site will gain a better appreciation and understanding of the significance environmental contamination has on traditional values, culture and all Shoshone-Bannock people on the Fort Hall Indian Reservation.

In spite of the philosophical differences, the tribes believe there is strong scientific argument, based on uncertainties with the Remedial Investigation, Human Health Risk Assessment and Ecological Risk Assessment, to support a non-concurrence with the Proposed Plan/ Record of Decision for the Eastern Michaud Flats as currently drafted.

AIR

The ROD does not include action for air emissions based upon findings of the human health risk assessment and ecological risk assessment. The ROD proposes to relinquish this portion of remediation to the air program, with a five year review period, at which time if it is evident that continued emissions have occurred then additional action under CERCLA will be considered. Although the air program is the authority which should regulate and insure compliance is maintained with the NAAQS, NESHAPS and other sections of the Clean Air Act, the Tribes request CERCLA address the uncertainties associated with this pathway prior. Concerns lie in the timeliness of implementing a FIP / TIP and believe continued emissions will and are occurring that may pose significant risks to public health and the environment. A five year review process may not ensure protection of human health or the environment from emissions.

There was a high degree of uncertainty in the air portion of the RI/FS at this site. However, the baseline risk assessment (BRA) came out with results quantifying the risks each pathway posed and used these risks to steer remediation options. Following is a list of uncertainties associated with the air pathway the Tribes believe need to be addressed, justifying additional action under CERCLA :

- Phosphorus Pentoxide (P_2O_5) was never characterized due to industries claim of inadequate or lacking technologies. Data suggests there is considerable emissions from this chemical. The literature available on the chronic effects of exposure to P_2O_5 is lacking. The tribes suggest ATSDR or the National Toxicology Program determine health effects from exposure to this chemical and techniques for development of methods to monitor this chemical.

- Air monitoring stations were not placed in locations that would intersect emission plumes from the plants. The intent of the air monitoring stations were to calibrate the modeling effort; do to problems with the model data from the monitors was used. Had the monitors been located in the direct pathway of the emission plumes, the results may have been significantly different, changing the risks measured from the air pathway and triggering additional remediation. Data from the monitors was used in calculating exposure for the industrial scenario. It would be expedient to place air monitors on-site to actually monitor concentrations in ambient air typical of what on-site workers would experience.

- Prior to the risk assessment and the RI/FS the FMC facility used ore from the Gay Mine. Since 1994 the facility has been using ore from the Dry Valley Mine, which has a unique chemical composition and is more enriched in metals and radionuclides. In addition, three furnaces were operating during air monitoring, current operation uses 4 furnaces. Logic follows that emissions from production using ore more enriched with metals and radionuclides would result in contaminants more concentrated. What impact the added furnace operation and the change of ore contributes to contaminants in the air and soil pathway and the overall risk assessment numbers needs to be addressed.

- Radionuclides at this site seem to be falling through the regulatory cracks. The Nuclear

Regulatory Commission regulates manmade radioactive material, the RCRA program regulates chemical wastes. CERCLA, through the RI/FS could have addressed this issue, or referred it to the NESHAPS program, but it has not been addressed. NESHAPS standard for compliance at this facility is based on one source of radioactive emissions, the stack emissions from the calciner scrubbers. The mandate of NESHAPS calls for all sources to be considered when developing permit limits. The emission from the ponds, as well as potential other sources (ground flare and furnace flares) need to be quantified and considered. This issue is of great concern to the Tribes. We request CERCLA work with the NESHAP program to assure these other sources are accounted for and the radionuclide issue is fully addressed through a regulatory program.

- The ATSDR Fort Hall Study indicated there was an increase in bronchial problems, pneumonia and respiratory illness in tribal members living on the Fort Hall Reservation. Statistical significance could not be assured due to the small population of tribal members. Perhaps this study should be expanded to include the surrounding communities. This would provide an added degree of assurance to what the actual risks are.

- FMC has been conducting an epidemiological study of its workers over the years. The Tribes believe this study could be relevant toward assessing actual risks to on-site workers. The Tribes request this study be evaluated.

SOILS

- Soil samples in the EMF area found elevated levels of carcinogens, chemical and radiological and non-carcinogen contaminants 1.5 to 2 times above background levels in residential areas. Initially consumption of homegrown produce was a pathway of concern and one of the determining factors resulting in HQ numbers over 1 which would trigger a remediation response. After further analysis this pathway was determined to be lesser of a risk, resulting in no remediation for off-site soils. Of concern is the degree of uncertainty in transfer factors between soil/plant, plant/animal, bioavailability through the food chain and ultimately actual levels of contaminants in the soil. The COPC continue to be present in the air, are in the soil, and the potential for impacts is expected to increase over time with continued air emissions. It makes little sense to remediate an area that is expected to be re-contaminated. To quantify risks posed by this site in terms of chronic daily dose while exposure continues and then develop remedial actions based on those risk numbers provides a false sense of security to the general public. Continued air emissions and resulting deposition on soils may increase the risks. The Tribes request the CERCLA program address the existing air emission issues and assure source controls are implemented before signing off on a ROD for this site.

- The Tribes believe the need for source control of fluoride emissions is warranted at this time as is a monitoring program and request this remedy be integrated. The fluoride levels in sagebrush steppe and soils clearly identifies an increase contamination in the area. In addition, on going studies in the area have documented increased fluoride levels in hay fields surrounding J.R. Simplot and FMC. These crops are used to feed buffalo, horses, cattle, sheep and other livestock. The tribes graze buffalo, cattle and horses in the Fort Hall Bottoms area as close as 3 miles from the plants. Approximately 150 horses and 300 Buffalo are grazed year round in the Fort Hall Bottoms area. During winter months they are supplemented with alfalfa, some that is grown in the EMF area. Approximately 2000 head of cattle graze in the area 6 months out of the year, from October through May. Historical problems in the area documented fluorosis in livestock. The Tribes believe it is warranted to identify, through local veterinarians or ranchers adverse effects elevated fluoride levels may have on livestock in the area through monitoring or a study.

The Rod.identifies IDAPA as an action specific ARAR for fluoride concentrations in ambient air which results in total fluoride content in vegetation used for feed or forage for livestock. This standard is not protective of other species, specifically, migratory birds. It is questionable if this standard is enforced within the state. Fluoride levels in the EMF area reflect elevated levels above this standard. The tribes believe source controls are needed to reduce emission to a degree protective of all flora and fauna in the area.

- ECOLOGICAL RISK ASSESSMENT

SURFACE WATER

The ecological risk assessment found no risk to the Portneuf River, waterfowl or sediment. The Tribes believe this is an area of uncertainty and request for some type of control to be put on the discharge point through the NPDES. The NPDES permit which FMC operates under is at least 10 years outdated and monitors for minimal parameters. The Tribes request CERCLA structure or implement a monitoring program to ensure contaminants are not entering the Portneuf River via the NPDES discharge Cadmium was found in the sediment of the Portneuf River at 2.5 times above background. The source of this is unknown but at question is the IWW ditch, where frequent upset/breakdown conditions have documented loading of the Portneuf River with contaminants.

> Our information is the bioassay study of benthic invertebrates in the Portneuf River, near the IWW outfall was conducted without oversight and an approved CERCLA sampling plan. Regardless, local organisms were used to identify if adverse effects from contamination had occurred. Local organisms would have been previously exposed to environmental contaminants and through the natural selection process may have mutated to develop resistance. This point is made to communicate one more factor contributing to the tribes uncertainty of the Ecological Risk Assessment findings.

- The Tribes have received information from the U.S. Fish and Wildlife indicating modeling of contaminants for different species of wildlife, based on ingestion rates, can be inaccurate when compared to actual scenarios at existing superfund sites. The tribes have expressed concern for some time as to the findings of the Ecological Risk Assessment. We request the ROD include further study of the area in order to determine the validity of the modeling.

- The ROD proposes implementing institutional controls in the form of environment easements, deed restrictions, or zoning. The tribes are concerned with this type of action, it allows industry to pollute as long as they have the financial means to purchase the land they contaminate and is contrary to the fundamental beliefs of Native Americans. Institutional controls offer no permanent long-term solution to controlling pollution sources. This type of option, in addition to source control, would offer added assurances but alone does little to uphold the mandatory threshold criteria of CERCLA; protection of public health and the environment. Jurisdictional issues have been at the forefront with regard to environmental regulation at FMC. Historical practice warrants concern; this entity chose to file for permits and zoning amendments within Bannock County and Power County while ignoring Tribal policies. With what jurisdiction entity will these easements, deed restrictions or zoning be filed? Tribal, County, BIA? Should this option be carried forward the Tribes request these issues be clearly defined by all parties. The tribes assert and maintain jurisdiction within the reservation boundaries.

- The Endangered Species Act and the Migratory Birds Treaty Act should be added to the ARARs for this site. Migratory birds are affected by off-site migration of contamination.

GROUNDWATER

- The ROD proposes a monitoring program to assure the contamination plume does not increase at the facility. The tribes recognize there is a need to balance the cost of a remediation option with the benefits afforded from it. However, we do not believe this option is the best balance of benefits and trade-offs. Contaminated groundwater mixes with cleanwater prior to discharging to the river, diluting the contamination to an acceptable level. This does not justify a no treatment option. Given the site history, the uncertainty surrounding the quantity of contamination in the ground throughout the facility, the natural attenuation process, and if attenuation of contaminants in the soil will continue to be bound at the same level all give rise to the need for some type of treatment. The tribes recognize that without hydraulic head on areas with contamination the driving force into the aquifer will be reduced. Still, the existing waste and contamination must be addressed. We support the pump and treat option, recognizing that this will not be a stagnant process; changing technologies or methodologies may allow for other option at a later date.

CAPPING

- The tribes request there be consistency with the RCRA program in the closure of pond areas at the facility. Many of the areas identified for capping through CERCLA are best guess estimates of the volume of contaminants based on the length of time the facility used the area. The tribes believe the most conservative measures must be utilized in all areas where definitive data is lacking as to the quantity and chemical characteristics of the waste. RCRA may have more stringent guidelines in closure requirements for hazardous waste. If this is the case, the tribes request these closure requirements be use.

We believe the above issues must be addressed to adequately protect public health and the environment. Although some comments may appear negative, the intent is to ensure all environmental contamination is addressed.

Qualitative Assessment of the Effect of Recent Air Monitoring Results on the findings of the Baseline Human Health Risk Assessment for the Eastern Michaud Flats Superfund Site.

Recent air monitoring results for October 1996 through May 1997 have revealed generally higher levels of airborne particulate matter immediately downwind from the EMF site than were found during the period from October 1993 through September 1994 that was used as the basis of the risk estimates for the air pathway in the Baseline Human Health Risk Assessment (BHHRA) for the site. This brief report examines the effect these higher airborne particulate levels would have on the results and conclusions of the risk assessment.

Quantitative estimates of the risks posed by airborne contaminants associated with the EMF site were based on the actual concentrations of chemicals and radionuclides measured in airborne particulate matter smaller than 10 μ in size (PM_{10}) - particles small enough to penetrate the lungs and deposit there. The recent air monitoring results provide information on the total mass of airborne PM_{10} but not on the chemical and radiological composition of these particles. Therefore it is not possible to calculate quantitative risk estimates directly from this recent data in the same way the original risk estimates were obtained. However, the potential risks associated with the higher levels of particulate matter can be approximated by simply scaling the risk estimates using the total PM_{10} concentrations measured during the two periods if the composition of the particles during those periods is assumed to be the same. Normally this would be a reasonable assumption, however the change in the source and composition of the ore being processed by the FMC facility between these two periods probably resulted in greater differences in the composition of the particulate matter released by that facility during these periods than would otherwise be expected. This and other factors that limit the accuracy and reliability of this simple scaling approach are discussed below.

During the 1993-94 air monitoring program the quantity and composition of airborne particulate matter was measured at seven locations in the vicinity of the EMF site (see Figure 3-3 of the BHHRA). One of these locations, Station 2, was located between the northern boundary of the FMC fenceline and Highway 30 just west of the boundary between the FMC and Simplot facilities. During the 1996-97 air monitoring program the total mass of airborne particulate matter (Total Suspended Particulates, or TSP) was measured at three locations, two locations immediately downwind of the EMF facilities near the former Station 2 location, and one at a nominally upwind location along Michaud Creek near the former Station 5 location. The primary EPA monitoring station (designated "Primary") for the 1996-97 period was located several hundred feet east of the 1993-94 Station 2 location; the second downwind station, established by the Shoshone-Bannock tribes (designated "Sho-Ban"), was also located east of the former Station 2 location. The mass of particulate matter in two smaller size fractions, PM_{10} and $PM_{2.5}$, also was measured at the Primary EPA station. A summary of the data available as of this writing is provided in Table 1. The available PM_{10} and $PM_{2.5}$ (PM fine) data are shown graphically in the attached figure.

As noted above, the quantitative risk estimates in the BHHRA were based on the concentrations of chemicals and radionuclides in the PM_{10} fraction. Therefore, only the PM_{10} measurements made at Station 2 and the Primary EPA station are relevant to the quantitative risk estimates and are reasonably comparable in terms of their geographical locations. The average PM_{10} concentration measured at Station 2 from October 1993 through September 1994 was 55.75 $\mu g/m^3$, while that measured at the Primary EPA station from October 1996 through May 1997 was 77.5 $\mu g/m^3$, approximately a 39% increase. If the 1996-97 risks from airborne particulate matter are approximated, as discussed above, by simply scaling the 1993-94 risk estimates using the average PM_{10} concentrations measured during these periods, the estimated 1996-97 risks at the Primary EPA monitoring station would be 39% higher than the 1993-94 risks at Station 2. In the BHHRA, the chemical and radionuclide concentrations in the PM_{10} fraction of airborne particles measured at Station 2 were used to estimate air pathway risks for workers at the FMC and Simplot facilities (BHHRA Tables 5-5, 5-6, 5-8, and 5-9) and the hypothetical risks to future residents that might live in the immediate vicinity of the Station 2 location (BHHRA Tables K-19 and K-20). In order to estimate the approximate 1996-97 risks for these groups, the 1993-94 "Estimated Cancer Risks" should be multiplied by 1.39. The appropriate "Background Cancer Risks" should then by subtracted to obtain the approximate 1996-97 "Incremental Cancer Risks". Site related factors, like the number of furnaces operating, would not affect background airborne particulate levels or risks, so the 1993-94 "Background Cancer Risks" can be used in this simple approach. A brief review of the 1993-94 risk estimates indicates that all of the estimates for site workers and hypothetical future residents fell in a range generally considered acceptable by EPA and that none of the Incremental (i.e.: site related) risk estimates would increase to values that would generally indicate a need for remedial measures as a result of the higher airborne particulate concentrations observed during the 1996-97 air monitoring program. This finding relates only to risks from specific airborne chemical and radiological contaminants, not to the total PM_{10} levels measured, which exceeded applicable standards on a number of occasions.

Uncertainties

One of the key assumptions inherent in the scaling approach to estimating the air pathway risks during the 1996-97 monitoring period is that the chemical and radiological composition of the airborne particulate matter was essentially the same during the 1993-94 and 1996-97 monitoring periods. If the source of the ore being processed at the facilities and the facility processes themselves had remained the same during these periods, it would probably be safe to assume that the composition of the particulate matter released from the facilities during those periods also was essentially the same. However, this was not the case. FMC changed the source of the ore processed it its facility between the two monitoring periods. The new ore supply is naturally higher in radionuclides than the old supply and there may be differences in the concentrations of some of the chemical constituents of the ore as well. All of the contaminants released to the environment by the EMF facilities are believed to originate as natural constituents of the ore processed by the facilities. Therefore a change in the composition of the ore being processed can be expected to result in a corresponding change in the composition of the particulate matter released by the facilities. In this case, the higher levels of radionuclides in the ore will likely have resulted in higher radionuclide concentrations in the particulate matter released by the FMC facility and correspondingly higher radiological cancer risks. Therefore, the radiological cancer risks for the 1996-97 monitoring period are probably somewhat higher than the simple scaling approach indicates.

A number of comments were received by EPA regarding the 1993-94 air monitoring program that raised concerns that the results obtained during the 1993-94 monitoring period were not representative of the long-term air quality in the vicinity of the EMF site. The main reasons expressed for these concerns were that only 3 of the 4 furnaces at the FMC facility were in operation during much of the 1993-94 monitoring period and that no extended periods of air stagnation, like those that have occurred in the area in the past, occurred during that period. Part of the reason for conducting additional air monitoring around the site was to collect additional data that might be more representative of the long-term air quality in the area. The fact that higher airborne particulate levels were measured during the 1996-97 monitoring period suggests that the concerns about the 1993-94 data may have been justified. Higher rates of particulate emissions from the facilities and less favorable meteorological conditions may indeed have contributed to the higher airborne particulate levels measured during the 1996-97 monitoring period, but there also were other factors that could have contributed to the differences in the results that should not be overlooked.

These factors include the following:

1. The locations of Station 2 in 1993-94 and EPA's Primary monitoring station in 1996-97 were close to one another but were not exactly the same. As the differences between the results obtained at the Primary EPA station and the Sho-Ban station illustrate, small differences in monitoring locations, especially when they are close to an array of point and small area sources like at the EMF site, can lead to noticeable differences in the observations obtained.
2. A fourth furnace was operating at the FMC facility during most of the 1996-97 monitoring period that was not operating for much of the 1993-94 period. This could result not only in an increase in the total emissions during the latter period, but also in emissions coming from different point sources (i.e.: the furnace flare and pressure relief valve for the fourth furnace) that were not active during much of the 1993-94 monitoring period. The difference in the locations of these additional sources relative to the monitoring locations could have contributed to the differences in the results obtained.
3. Two different air sampler models, manufactured by different firms, are approved by EPA

for use in measuring airborne particulate matter concentrations. Results obtained using either model are considered acceptable and equivalent by EPA for regulatory purposes, however most air monitoring practioners recognize that the Anderson Sampler typically gives results slightly lower than those given by the Wedding Sampler. Anderson Samplers were used in the 1993-94 program whereas Wedding Samplers were used in the 1996-97 program. The small difference in the typical performance of the two sampler models may have contributed to the difference in the results obtained during the two monitoring periods.

4. There are seasonal differences in meteorological conditions in the Pocatello area that contribute to characteristic seasonal differences in the levels of airborne particulate matter, with levels typically being higher in the fall and winter than in the other seasons. Particulate matter measurements are available for a full year for the 1993-94 monitoring period, however results are only available for October through May for the 1996-97 period as of this writing. The present lack of results for the historically lower concentration period of June through September of 1997 means that the seasons with historically lower PM concentrations are currently under represented in the 1996-97 results. This also could contribute to the differences observed between the 1993-94 and 1996-97 results.

Table 1

SUMMARY OF AIR MONITORING RESULTS FOR PARTICULATE MATTER
OCTOBER 1996 THROUGH JUNE 1997
EASTERN MICHAUD FLATS SITE, POCATELLO, IDAHO

Location	Sample Type	Sample Count	Concentration (ug/m3)			
			Minimum	Average	Maximum	Standard Deviation
Primary	TSP	168	8.3999996	84.9	419.70001	61.1
Primary	PM10	74	2.5	77.5	293.39999	53.5
Primary	PM-Fine	74	0.9	46.8	231.7	40.7
Sho-Ban	TSP	165	7.8000002	57.3	441.79999	59.0
Background	TSP	165	0	17.6	245.5	24.0

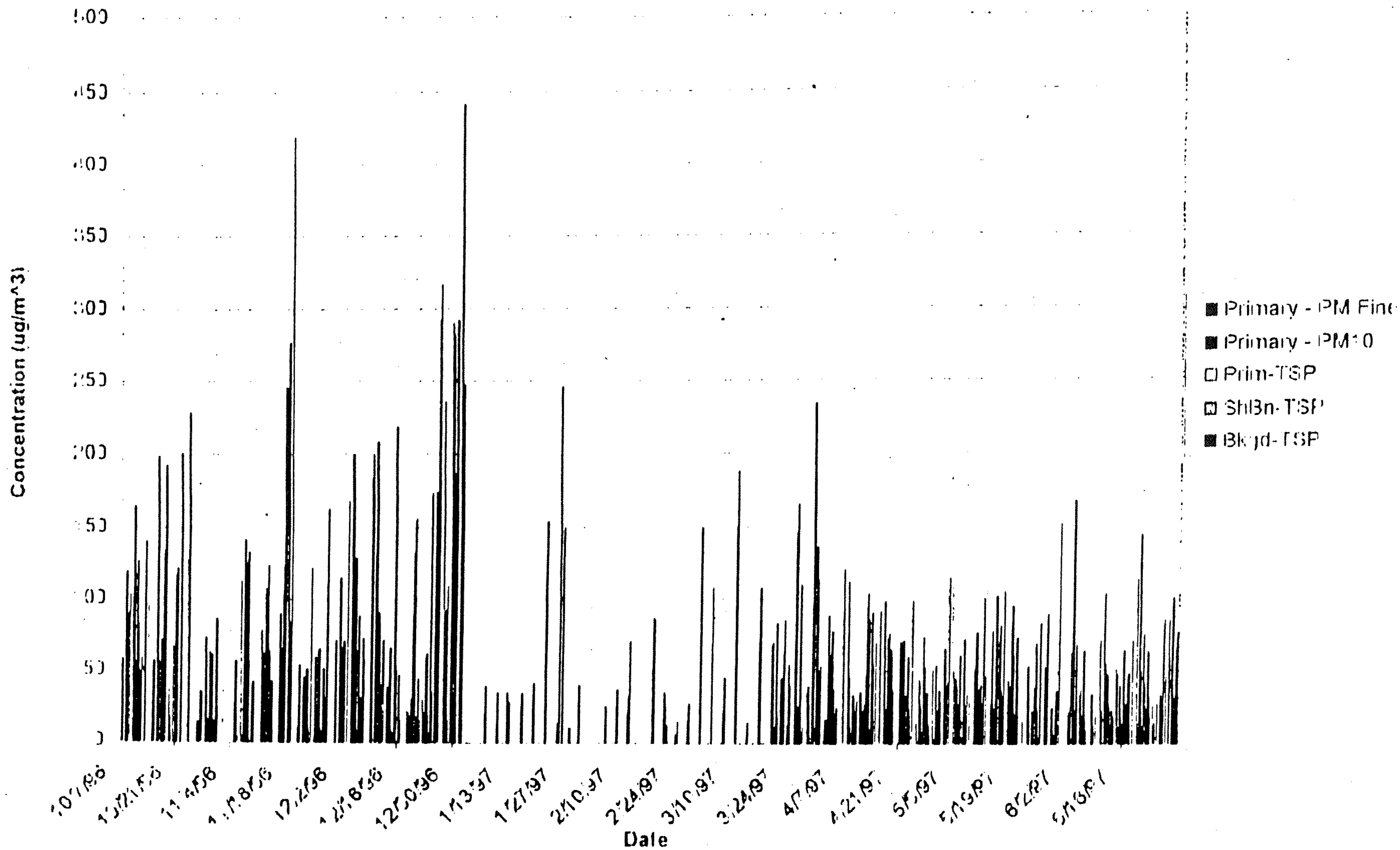
Date	Primary - P	Primary - P	Prim-TSP	ShBn-TSP	Bkgd-TSP
10/07/96				58.700001	
10/08/96			119.4	86.699997	27.1
10/09/96	52.200001	91.900002	85.699997	104.2	
10/10/96			165.2	117.9	56.400002
10/11/96			127.1	83.400002	29.6
10/12/96	26	50		59.700001	
10/13/96			140.5	72.5	34.799999
10/14/96			98.900002	35.5	16.700001
10/15/96	14.4	39.299999	57.900002	56.299999	
10/16/96			198.60001		57.099998
10/17/96			72.199997		17.6
10/18/96	65.400002	133.8	184.2	193.3	
10/19/96			39.299999	17.6	7.4000001
10/20/96			67.900002		3.5999999
10/21/96	68.599998	116.9	121.8	39.599998	
10/22/96			200.39999		6.8000002
10/23/96			96.699997		5.3000002
10/24/96	137.2	204.8	228.5		
10/26/96			8.3999996		14.6
10/27/96			36.299999	36.299999	20.6
10/28/96				73.599998	62.700001
10/29/96			17.9	63.5	4.5
10/30/96	59.700001	61.900002	13.5	16.1	15
10/31/96			86.699997	14.2	23.799999
11/02/96	32.400002	39.5			
11/05/96	28.700001	57.400002		21.700001	5.0999999
11/06/96			114.2	37.200001	4.0999999
11/07/96			141.89999	46.5	9
11/08/96	84.599998	126.8	133.2	55.599998	2.0999999
11/09/96			40.700001		43
11/10/96			41.5	48	53.5
11/11/96	32.099998	58.200001	55.900002	57.200001	78.599998
11/12/96			62.900002	69.400002	107.4
11/13/96			124	65.800003	61.400002
11/14/96	17.5	40.400002	43	12.2	3.8
11/15/96			42.900002	9.8999996	2.5999999
11/16/96			90.5	65.699997	1.1
11/17/96	56	105.8	123.7	245.3	2.5
11/18/96			276.79999	84.5	1
11/19/96			419.70001	135	4.5
11/20/96	11.4	25.1	22.1	11	1.3
11/21/96			54.5	54.700001	44.900002
11/22/96			41.200001	46.299999	2.3
11/23/96	39.200001	51.200001	51.5	9.8000002	2
11/24/96			122.6	53	4.5999999
11/25/96			60.099998	20.9	1.3
11/26/96	28.1	64.900002	65.599998	9	1.4
11/27/96			52.5	30.6	0.1
11/28/96			109.3	163.2	7.5
11/29/96	35.200001	82.699997	54.799999	7.8000002	0.6
11/30/96				71.199997	
12/01/96				115	6.0999999

12/02/96	46.900002	67.300003		70.699997	
12/03/96			168.39999	128.3	8.3999996
12/04/96			89.900002	199.10001	9.3000002
12/05/96	93.5	128.89999	128.89999	64	8.1999998
12/06/96			88.599998	32.5	0.6
12/07/96			73	57.099998	2.5
12/08/96	57.299999	72.599998	75	124.6	3.7
12/09/96			184.3	198.8	2.5999999
12/10/96			132.10001	208.10001	2.4000001
12/11/96	57.799999	91.300003	83.900002	40.700001	1
12/12/96			72.400002	27.9	5.1999998
12/13/96			39.900002	38.200001	12.5
12/14/96	42.299999	66.199997	63.799999	8.1000004	0.5
12/15/96			218.8	52.700001	1.2
12/16/96			47.5	15.5	11.9
12/17/96	0.9	2.5	14.3		23.5
12/18/96			23.5	21.299999	6.3000002
12/19/96			19.5	19.1	31.5
12/20/96	88.900002	132.60001	155.89999		18.4
12/21/96			45.200001	17.9	5.3000002
12/22/96			30.6	21.4	14.9
12/23/96	20.5	58.799999	62.200001	19.700001	7.8000002
12/24/96			173.60001	35.799999	2.2
12/25/96			174.3	56.299999	0.9
12/26/96	231.7	293.39999	316.79999	110.6	0.1
12/27/96			236.10001	47.599998	0
12/28/96	70.099998	92.900002	109.7	16.1	0.3
12/29/96			290.39999	282.10001	0.3
12/30/96			187.10001	292.60001	3
12/31/96			186	441.79999	1.9
01/01/97	197.8	246.89999			
01/07/97	22	39.900002			
01/10/97	13	35.299999			
01/12/97				35.299999	
01/13/97	18.4	28.4			
01/16/97	26.6	35.200001			
01/19/97	33.400002	42			
01/22/97	114.1	154.10001			
01/25/97	10.8	14.1			245.5
01/26/97			148.8		
01/28/97	10.7	10.9			
01/30/97				40.700001	
02/06/97	15.5	25.9			
02/09/97	25.5	37.400002			
02/11/97					21.6
02/12/97	32.900002	71.199997			
02/18/97	52.799999	86.900002	85.900002		
02/21/97	19.1	35.299999	25.4	12.5	12.7
02/24/97	6.3000002	15.8			
02/27/97	15.5	27.799999			
03/02/97	69.599998	149.89999			
03/05/97	68.400002	107.8			
03/08/97	22.799999	45.599998			

03/11/97	150.8	187.2			
03/14/97	5.5	14.8			
03/17/97	69.900002	107.6			
03/20/97	29.299999	69.199997	69.699997	46.5	15.3
03/21/97			83.300003	18.6	7.1999998
03/22/97			43.099998	45	29.200001
03/23/97	34.900002	62.400002	85.300003	42.400002	14.4
03/24/97			54.5	40.299999	23.9
03/26/97	70.199997	146.10001	165.89999		25.700001
03/27/97			109.2	37.400002	12
03/28/97			72.900002	44.599998	14.3
03/29/97	22.799999	36.099998	39.900002	26	3.9000001
03/30/97			96.300003	234.3	10.1
03/31/97			136.39999	113.2	15.9
04/01/97	18.299999	46.099998	53.700001	19.799999	10.1
04/02/97			12.7	10.7	16.9
04/03/97			88.099998	58.599998	14.3
04/04/97	21.4	61.299999	77.5	55.799999	38.200001
04/05/97			20.299999	25	19.5
04/06/97			67.300003	90	11.2
04/07/97	65.599998	120.9			
04/08/97			111.7	45.700001	12.6
04/09/97			32.200001	33.599998	32.299999
04/10/97	11.3	20.700001	20.200001	21.299999	29.9
04/11/97			35.5	35.700001	28.299999
04/12/97			23.6	27.200001	19.700001
04/13/97	48.200001	94.099998	103.5	85.300003	10.7
04/14/97			90.099998	54.599998	15.7
04/15/97			70.599998	30.700001	10.5
04/16/97	41.299999	91.5			
04/17/97			65.400002	98.199997	23.799999
04/18/97			72	75.800003	56.599998
04/19/97	27.799999	64.699997	58.900002	37.400002	7.4000001
04/21/97			70.199997	20.200001	8.1999998
04/22/97	32.700001	70.699997	65.099998	33.900002	10.1
04/23/97			59.799999	23.9	5.4000001
04/24/97			98.800003		3.7
04/25/97	36	60	61.700001	14.4	3.2
04/26/97			45.099998	25.5	8.6000004
04/27/97			73.099998	52.700001	16.200001
04/28/97	16.6	35.099998		13.7	6.5
04/29/97			51.700001	11.6	4.4000001
04/30/97			53.700001	10.4	3.9000001
05/01/97	24	36.799999	28.700001	7.8000002	6.3000002
05/02/97			30.200001	65.400002	4.8000002
05/03/97			41.900002	114.4	18
05/04/97	70.699997	112.3	107.9	50.400002	13.6
05/05/97			45.200001	41.099998	27.5
05/06/97			60.700001	39.200001	16.799999
05/07/97			71.599998	26.799999	16.6
05/08/97			34.299999	29	23.200001
05/10/97	28.299999	51.5	53.400002	76.400002	28.4
05/11/97			38.400002	40.5	28.799999

05/12/97			100.2	46.5	31.799999
05/13/97	60.900002	113.3	112.9	45.299999	27.5
05/14/97			77.5	30.200001	24.299999
05/15/97			101.6	39.599998	24.200001
05/16/97	48.200001	69.800003	81.099998	37	36
05/17/97			104.4	48.299999	28.700001
05/18/97			43.400002	24.799999	16
05/19/97	40.200001	82	94.900002	61	21.299999
05/20/97			65	72.800003	21.200001
05/22/97	15.8	43.200001	48.799999	65.199997	18.299999
05/23/97			53.400002	33.900002	16.299999
05/24/97			23.4	20.700001	10.6
05/25/97	38	69	63.299999	23.200001	4.6999998
05/26/97			83.400002	54.299999	6.1999998
05/27/97			52.799999	25.1	14.8
05/28/97	50.200001	89.199997			
05/29/97			25.1	16.5	7
05/30/97			29.1	36.599998	16.200001
05/31/97	87.199997	151.60001	151.5		
06/02/97				21.799999	
06/03/97	25.1	62.799999	87.300003	167.3	22.799999
06/04/97			68.199997	27.799999	13.7
06/05/97			38.799999	20.5	12.4
06/06/97			63.799999	16.700001	9.8999996
06/08/97			34.200001	12.5	7.8000002
06/09/97			19.9	21.200001	15.6
06/10/97			71.300003	23.5	
06/11/97			103.1	55.299999	9.3000002
06/12/97			48.200001	25.4	11.6
06/13/97			23.200001	19.799999	18.1
06/14/97			51.200001	48.400002	11.4
06/15/97			40.200001	18.4	14
06/16/97			64	28.200001	17.1
06/17/97			45.900002	48.400002	10.3
06/18/97			71.099998	24.9	15.4
06/19/97			113.6	32.299999	15.7
06/20/97			144.5	49.200001	12.2
06/21/97			74.900002	43.099998	24.700001
06/22/97			63.200001	32.599998	19.299999
06/23/97			27.1	25.1	15.3
06/24/97			24.4	28.799999	10.1
06/25/97			30.700001	33.799999	29.1
06/26/97			81.300003	86.199997	45.599998
06/27/97			85.099998	61	52.799999
06/28/97			95.099998	100.1	34.5
06/29/97			65.099998	76.199997	31.299999

Airborne Particulate Matter at the EMF site - 10/96 thru 6/97



APPENDIX C

STATE OF IDAHO CONCURRENCE WITH REMEDY

RECORD OF DECISION
FOR
FINAL REMEDIAL ACTION
EASTERN MICHAUD FLATS SUPERFUND SITE
POCATELLO, IDAHO

STATE OF IDAHO
DIVISION OF
ENVIRONMENTAL QUALITY

1410 North Hilton, Boise, ID 83706-1255, (208) 373-0502

Philip E. Batt, Governor

May 19, 1998

Chuck Clarke, Regional Administrator
U.S. Environmental Protection Agency
Region X
1200 Sixth Ave.
Seattle, WA 98101

Subject: State of Idaho Concurrence on the Eastern Michaud Flats Record of Decision

This letter is to notify the Environmental Protection Agency (EPA) that the State of Idaho concurs with the Record of Decision (ROD) for the East Michaud Flats Superfund site in Pocatello, Idaho.

I am pleased with the work by our respective staff which has lead to this ROD concurrence. The Division of Environmental Quality (DEQ) participated in review of the Remedial Investigation and Feasibility Study Report, including the risk assessment and preceding work plans, technical documents and data. DEQ participated in the evaluation of cleanup alternatives in preparation of the EPA proposed plan, and participated in public meetings held during the comment period. Subsequent to the close of the public comment period, DEQ provided review and comment on draft versions of the EPA Record of Decision and responsiveness summary. We intend to continue our involvement with EPA toward implementation of this ROD.

Sincerely,

Wallace N. Cory

Wallace N. Cory, P.E.
Administrator
Division of Environmental Quality

WNC:DN:mp

The SHOSHONE-BANNOCK TRIBES

FORT HALL INDIAN RESERVATION
PHONE (208) 238-3700
(208) 785-2080
FAX # (208) 237-0797

FORT HALL BUSINESS COUNCIL
P. O. BOX 306
FORT HALL, IDAHO 83203

June 3, 1998

Mr. Randall Smith, Director
Environmental Cleanup Office
U.S. EPA Region 10
1200 Sixth Avenue
Seattle, WA 98101

Dear Mr. Smith:

This letter is submitted on behalf of the Shoshone-Bannock Tribes of the Fort Hall Indian Reservation regarding the United States Environmental Protection Agency's Record of Decision for the Eastern Michaud Flats Superfund Site located on and adjacent to the Fort Hall Reservation. The remedial actions were developed in accordance with the requirements of the Comprehensive Environmental Response Compensation, and Liability Act of 1980, 42 U.S.C. Section 9601 et seq. (CERCLA) as amended, and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 C.F.R. Part 300.

In October 1997, we expressed our concern that the proposed Record of Decision (ROD) did not sufficiently address and protect human health and the environment. We met with you and members of your staff to attempt to resolve Tribal concerns based on our written comments as well as our non-concurrence with the proposed plan and ROD. In March of this year we again met with EPA representative to discuss our ongoing dissatisfaction with the proposed ROD. Further written comments were provided by the Tribes in April. Review of the Final ROD, Declaration, Decision Summary, and Responsiveness Summary has been completed by the Tribes. The Tribes support the following elements of the proposed plan: monitoring of fluoride emissions off-site, monitoring ground water to insure no increases in the contamination, and capping of historical pond areas. However, we believe these measures should accompany additional action such as treatment of groundwater and source control of toxic emissions.

The Fort Hall Reservation is the homeland of the Tribes as guaranteed by the Fort Bridger Treaty signed in 1868. Accordingly, the reservation lands are trust resources to be protected by the trustee EPA. In light of this, the Reservation is substantially different from the nearby off-reservation privately held lands and requires extra protection based on federal law. It is therefore incumbent upon the EPA, pursuant to the EPA Indian Policy, its general trust relationship with a tribal government and the Environmental Justice Policy, to afford such protections to the Shoshone-Bannock Tribes and their lands. The ROD in its final state fails to provide such protection. Instead, the treaty homelands are treated as any other private land in the Michaud Flats area. In addition, there is not sufficient protection for the human health of the Reservation population. We certainly would agree the overall remedy and actions taken by the U.S. Environmental Protection Agency are well intended. However, we must once again file non-concurrence with the Final ROD. This letter sets forth our reasons for non-concurrence.

Overall, we do not believe the remedial actions sufficiently protect human health and the environment of residents and members of the Shoshone-Bannock Tribes. The remedy assumes continued operation of the plants by FMC and Simplot in compliance with all Federal and State environmental requirements. The FMC plant is not in compliance with all Federal environmental requirements; specifically, the Resource Conservation and Recovery Act, and the Clean Air Act. In addition, toxic emissions through the air pathway historically and currently have no federal regulatory requirements and will not until a Federal and Tribal Implementation Plan is promulgated and a Federal Operating Permit is issued. Moreover, it is uncertain if toxic air emissions from the FMC facility will be regulated within this scheme. The National Pollution Discharge Elimination System permit FMC holds for discharge to the Portneuf River is a decade old and provides no contaminant limits on heavy metals, some of which were found elevated in the Portneuf River sediments. Groundwater contamination from this site is entering the Portneuf River and flowing into the Fort Hall Bottoms area. The Portneuf River is a gaining stream which dilutes the contaminants. However, attaining acceptable contaminant levels as a result of dilution, and at the point of dilution is not an acceptable remedy for the Tribes.

Our non-concurrence is also based on the inadequacy of studies, the failure to review existing health studies, and the lack of scientific investigation by the EPA. The EPA undertook a baseline human health and ecological risk assessment of the Michaud Flats area as part of the CERCLA investigation and the results of these assessments directed the cleanup remedy. A complete emission inventory was not conducted and the complete array of toxic emissions were not characterized or factored into the assessment, specifically, phosphorus pentoxide, speciation of radionuclides, hydrogen cyanide, and phosphine. The Tribes requested EPA to evaluate the FMC mortality study and epidemiological study of FMC workers. No action was taken on the Tribes' recommendation. Airborne contaminants from the plants at this Site have resulted in elevated concentrations of cadmium, fluoride, radionuclides, and zinc in surface soils. The Ecological Risk Assessment notes that the potential for impacts is expected to increase over time with continued air deposition. While monitoring for contaminants will provide information it does not provide a permanent solution for, or prevention of future contamination.

Neither the Human Health or Ecological Risk Assessments considered the impacts on cultural resources of the Tribes. In an October 1997 meeting EPA agreed to consider native uses of plants in the human health risk assessment. Subsequently the Tribes were notified by EPA that a comparison to the fruit and vegetable study conducted in the human health risk assessment would be the benchmark for consideration of health affects from cultural uses of native plants. The Tribes did not believe this comparison, consumption of fruits and vegetables by Non-Native Americans would be representative of the actual cultural uses of plants and animals, and the risks posed from those uses. Therefore, data on the cultural plants and uses was not provided to the EPA. While the ecological risk assessment identified risks to individual species, risks to the ecological community population was the departure point for determining action. Many Tribal members on the Fort Hall Reservation practice subsistence hunting and fishing and may be at greater risk for exposure to contaminants through ingestion of plants and animals containing contaminants.

Institutional controls within the boundaries of the Fort Hall Indian Reservation does not afford protection from future contamination of our land. Additionally, we assert our jurisdiction and sovereignty rights within the boundaries of the Reservation and would require any controls to comply with Tribal laws and policies.

Furthermore, we do not concur due to the inconsistency between EPA's RCRA and CERCLA programs at the FMC facility regarding hazardous waste. Although EPA RCRA and CERCLA programs have a memorandum of understanding regarding coordination of remedial activities at this site, environmental requirements imposed within the facility by these programs, regarding the same type of hazardous waste are inconsistent between the programs. The Tribes agree with the need to cap the old hazardous waste pond areas but believe there should be consistency on the requirements imposed.

In conclusion, our position with regard to the CERCLA remedial action on the Fort Hall Reservation has always been to insure that all environmental contamination is adequately addressed. As we have explained to EPA we must preserve our Reservation for future generations. Unfortunately, as presented, the EPA's Record of Decision does not adequately address or provide sufficient protection for present and future generations of the Shoshone-Bannock Tribes. We respectfully do not concur with the Record of Decision.

Sincerely,

Claudeo M. Broncho

Arnold Appenay, Chairman
Fort Hall Business Council

cc: Tribal Attorney Office
Genevieve Edmo, Land Use Director
Susan Hanson, Program Manager
Kathy Gorospe, Director, AIEO
Stan Speaks, BIA Area Director
Sam Hernandez, BIA
Chuck Clarke, Regional Administrator
Doug Cole, Tribal Liaison
Bill Adams, EPA Project Manager
Jim McCormick, FMC Coordinator
Gov. Phil Batt, State of Idaho
Wally Corey, DEQ
Gordon Brown, Pocatello, DEQ
Preston Sleeger, DOI
Susan Burch, U.S. Fish and Wildlife
Senator Dirk Kempthorne
Senator Larry Craig
Representative Mike Crapo

APPENDIX D

METHOD USED TO ESTIMATE CONCENTRATIONS OF RADON IN INDOOR AIR

RECORD OF DECISION
FOR
FINAL REMEDIAL ACTION
EASTERN MICHAUD FLATS SUPERFUND SITE
POCATELLO, IDAHO

Method Used to Estimate Radon Concentrations in Indoor Air

Both facilities at the EMF site are currently expected to continue operations for the foreseeable future; however, there is always a possibility that one or both facilities could cease operations and that the land could be converted to an alternate use. Because of the industrial nature of the facilities and the large amount of waste materials stored at the facilities, the likely alternate future use would be commercial or industrial use. Under such a future use scenario, a worker employed at the redeveloped site would probably have the greatest potential exposure to site contaminants. During site redevelopment, new buildings could be constructed in areas of the site with elevated levels of radionuclides in the soil. Workers using such buildings could be exposed to elevated levels of radon in indoor air that infiltrated the buildings from the adjacent soil.

Radon-222 concentrations in indoor air resulting from infiltration of vapors from contaminated soil were estimated using a two-step process. First, the concentration of radon-222 in soil gas adjacent to the building basement was estimated. The concentration in soil gas then was reduced using an attenuation factor to estimate the concentration of radon-222 in indoor air.

Neither radon-222 nor its parent, radium-226, was measured in site soils; therefore, the concentrations had to be estimated. First, the concentration of radium-226 was derived from the measured gross alpha activity using an extrapolative method recommended by EPA; 25% of the gross alpha activity was attributed to radium-226. The estimated radium-226 soil concentration was then multiplied by an emanation coefficient to obtain the concentration of radon-222 present in soil gas. Because radon-222 has a half-life of 3.8 days, the emanation factor accounts for the radioactive decay of some of the radon before it can escape from the soil. An emanation coefficient of 25% was used; this value is the average of the emanation coefficients reported for phosphogypsum (20%) and water treatment sludges (fertilizers) (30%) (USEPA 1993).

Once the concentration of radon-222 in soil gas adjacent to the building basement was determined, it was multiplied by an attenuation factor, derived using a model developed by Johnson and Ettinger (Johnson and Ettinger 1991), to obtain the concentration in the air inside the building. The model predicts an attenuation coefficient (AC) based on the infiltration of chemical vapors into buildings through cracks and openings in the foundation and on building ventilation characteristics (see Attachment A for the spreadsheet used to calculate the AC).

Johnson and Ettinger present a sample calculation showing the derivation of AC for a typical residential building. Since the model is being used in this report to estimate indoor radon concentrations in a hypothetical building that might be constructed on site in the future, the dimensions and other characteristics of which are unknown, most of the parameter values used in the sample calculation were retained unless there was a site-specific reason to modify them (see Attachment A). The effective diffusion coefficient, soil permeability, and the building ventilation rate were changed from values used in the sample calculation as follows:

- **The Effective Diffusion Coefficient:** The effective diffusion coefficient presented in the Johnson and Ettinger paper is for benzene and is inappropriate to use for radon. The radon diffusion coefficient used in the EMF calculations, 3×10^{-2} cm^2/s, is for sand-like material (Cothern and Smith 1987) and was provided in a memo from Bechtel Environmental, Inc., to the EPA (Bechtel 1995).

- **Soil Permeability:** The value used for soil permeability, 1.0×10^{-7}, which is slightly lower than the value used by Johnson and Ettinger, is the average permeability for fine- to medium-grained sand. The solid materials on the site range from very fine wind-blown soil (loess) and process wastes to coarse slag material, and it is not known on what type of material future construction might take place. The value used is believed to be a reasonable estimate of the average permeability of the materials at the site. The Johnson and Ettinger model is particularly sensitive to the value used for soil permeability. In fact, there is almost a direct correlation between the estimated soil permeability and the predicted concentration of radon in indoor air.

- **Building Ventilation Rate:** The default value for the building ventilation rate provided in Johnson and Ettinger was doubled to 5.8×10^{4} cm^{3}/s, which corresponds to a total basement air exchange rate of 1/hr. The default value which corresponds to a total basement air exchange rate of 0.5/hour is thought to be appropriate for relatively new residential buildings, but too conservative for commercial or industrial buildings where more activity likely would occur (i.e., frequent opening and closing of doors, etc.).

Finally, the indoor air radon concentrations predicted using the outlined approach were compared to the measured values obtained at the Simplot facility in 1990 (Bechtel 1993) as a reality check. The indoor air radon concentrations obtained starting from the gross alpha activity in background soil correspond well to the lowest levels measured in Simplot's buildings in 1990 (1.25 vs. 0.2 to 1.8 pCi/l). Likewise, the predicted radon-222 in indoor air corresponding to the exposure point gross alpha levels in FMC and Simplot soils are only slightly higher than the maximum concentrations detected in the Simplot buildings (predicted: FMC: 10.5, Simplot: 9.4 vs. maximum measured values of 7.9 and 8.3 pCi/l - excluding the Frontier Building where ore samples were stored). Although there is uncertainty in the model calculations because of the lack of facility-specific data, these comparisons suggest that the model provides a reasonable estimate of the levels of radon-222 in indoor air to which future site workers might be exposed.

References

Bechtel Environmental, Inc. (Bechtel), 1993, Eastern Michaud Flats RI/FS, Summary of EPA and Simplot Radon Studies, memo dated November 19, 1993.

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APPENDIX E

ADMINISTRATIVE RECORD INDEX

RECORD OF DECISION
FOR
FINAL REMEDIAL ACTION
EASTERN MICHAUD FLATS SUPERFUND SITE
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