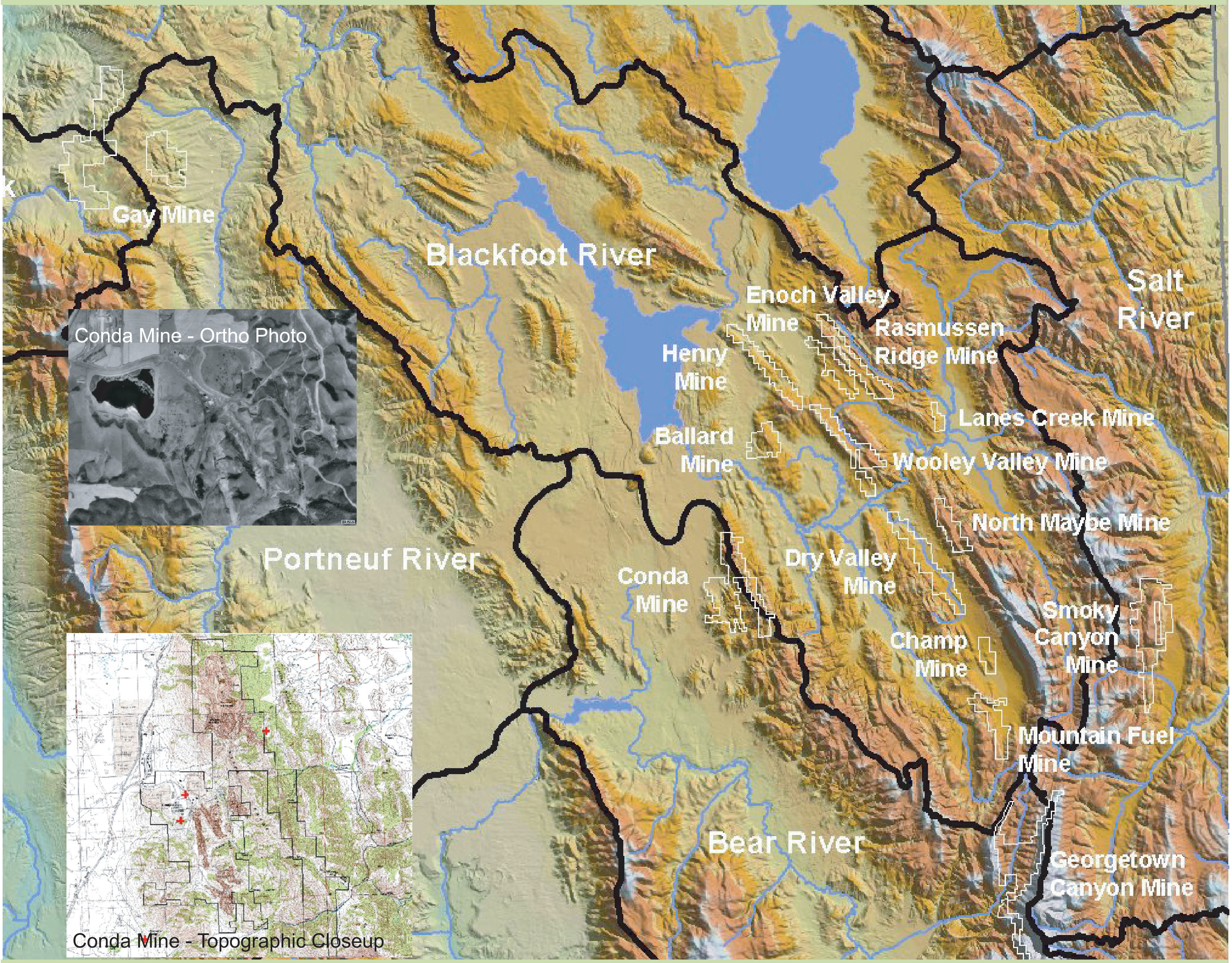
Area Wide Investigation
Southeast Idaho Phosphate Mining Resource Area

Final Data Gap Technical Memorandum

May 2001

Prepared for

Idaho Department of Environmental Quality



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AREA WIDE INVESTIGATION
SOUTHEAST IDAHO PHOSPHATE MINING RESOURCE AREA
Contract Number C023
Task Order AWI-00-01

Prepared for

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FINAL

DATA GAP
TECHNICAL MEMORANDUM

Selenium Project

Southeast Idaho Phosphate Mining Resource Area

May 2001

Prepared by

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1.0 INTRODUCTION

The Idaho Department of Environmental Quality (IDEQ) retained Tetra Tech EM Inc. (TtEMI) to assist the IDEQ in the development of human health and ecological risk assessments associated with past phosphate mining operations in the Southeast Idaho Phosphate Mining Resource Area (Resource Area). These investigations will support future agency risk management decisions for the region. This work is being carried out as part of an Area Wide Scope of Work referenced in the July 2000 *Interagency Memorandum of Understanding concerning Contamination from Phosphate Mining Operations in Southeastern Idaho* (MOU) negotiated between the IDEQ and tribal/federal agencies with jurisdictional responsibilities in the region. The MOU specified the IDEQ as the lead agency for coordinating the future activities of the area wide investigation and for establishing regional cleanup guidance to assist lead agencies in implementing future site-specific remedial efforts. The area wide investigation is incorporated as part of an Administrative Order of Consent (AOC) negotiated with the responsible mining companies.

1.1 BACKGROUND

Phosphate mining has been practiced in southeastern Idaho throughout most of the 20th century, starting with the Waterloo mine in 1907. The major phosphate mines in this region are open pit or contour strip operations that were developed near surface exposures of the Phosphoria Formation. The phosphate ore is transported by truck, rail and slurry pipeline to local processing facilities in Soda Springs and Pocatello, Idaho. Production from this region represents a significant source of phosphorous for industrial and agricultural applications. Nearly 40 percent of the United States (U.S.) phosphate reserves occur in the Phosphoria Formation in southeastern Idaho, northern Utah, and western Wyoming.

In 1996, isolated livestock losses associated with excessive selenium uptake prompted concerns regarding potential ecological and human health impacts from past mining operations (Montgomery Watson [MW] 1999b). In response to these concerns, five companies operating mines in the region formed an "*ad hoc*" Selenium Committee with the IMA to characterize the environmental risks and identify mitigation measures associated with phosphate mining. The IMA Selenium Committee, composed of the companies listed in Table 1, was formed in 1997 to voluntarily and jointly address mining related environmental issues from a regional basis. An Interagency/Phosphate Industry Selenium Working Group (SeWG) was subsequently established to facilitate communication and participation by cooperating federal, state, local, and tribal entities. The SeWG consisted of voluntary representatives, including:

- IDEQ
- Idaho Department of Lands
- Idaho Department of Fish and Game (IDFG)
- Idaho Department of Health (IDH)
- Shoshone-Bannock Tribes
- Southeastern District Health Department (SDHD)
- U.S. Forest Service (FS)
- U.S. Bureau of Land Management (BLM)
- U.S. Bureau of Indian Affairs (BIA)
- U.S. Fish and Wildlife Service (FWS)
- U.S. Environmental Protection Agency (EPA)
- U.S. Geological Survey (USGS)
- Other Interested Stakeholders (i.e. ranchers, Greater Yellowstone Coalition, etc.)

Table 1. List of Area Wide Mines and Operators, Southeast Idaho (MW 1999b)

Company	Mines	
	Active	Inactive
Astaris Production LLC	Dry Valley Mine	Gay Mine[1]
J.R. Simplot Company	Smoky Canyon Mine	Lanes Creek Mine Conda Mine Gay Mine[1]
Nu-West	Rasmussen Ridge Mine[2]	Mountain Fuel Mine Champ Mine North Maybe Canyon Mine South Maybe Canyon Mine[3] Georgetown Canyon Mine
P4 Production LLC[4]	Enoch Valley Mine	Henry Mine Ballard Mine
Rhodia Inc.		Wooley Valley Mine

Notes:
[1]Gay Mine was leased by FMC Corporation and J.R. Simplot Company, individually and jointly.
[2]Rasmussen Ridge Mine is leased by Nu-West Industries, Inc., an affiliated company of Nu-West Mining, Inc.
[3]South Maybe Canyon Mine is not included in the scope of the Selenium Project. It is being addressed currently under a consent order with Nu-West and the U.S. Forest Service.
[4]P4 Production LLC is a joint venture between Monsanto and Solutia, Inc.

In August 2000, the IDEQ was specified as the lead agency for coordinating the future activities of the area wide investigation and for establishing regional cleanup guidance to assist lead agencies in implementing future site-specific remedial efforts. The IDEQ subsequently established an Interagency Technical Group to coordinate their activities with the other jurisdictional and administrative agencies. The IDEQ also established the Selenium Area Wide Advisory Committee (SeAWAC) to continue to solicit input from the mining companies, project stakeholders, and other participants in the former SeWG.

Much of the characterization and risk assessment work conducted under the auspices of the IMA Selenium Committee is documented in a series of reports prepared by MW (MW 1998a, MW 1998b, MW 1999a, MW 1999b, and MW 2000). The Selenium Project investigations have focused on a 2,500–square mile area in southeastern Idaho that comprises portions of Caribou, Bear Lake, Bonneville, and Bingham counties (Figure 1). The primary surface mines in this region are listed in Table 1. One of the 15 regional mines, the South Maybe Canyon Mine, is being addressed under a separate consent order and is not included in the scope of the Selenium Project.

1.2 REVIEW OF PRELIMINARY AREA WIDE RISK ASSESSMENT

TtEMI reviewed the area wide investigation and preliminary risk assessment documents compiled by the IMA Selenium Committee (TtEMI 2001). The ecological and human health risk assessments were preliminary in nature and generally followed established U.S. EPA guidance. However, issues were noted relative to the development of the conceptual site model (CSM), assessment and measurement endpoints, exposure assessment parameters, and toxicity factors.

The principal concerns associated with the ecological risk assessment included incomplete problem formulation and the use of non-conservative factors in the screening level risk assessment. These issues, while important, can only be resolved once the contaminants of potential concern (COPC) for human health and the contaminants of potential ecological concern (COPEC) screening is fully supported by data developed using appropriate detection limits. The validity of the COPC and COPEC screening process was confounded by uncertainties associated with small sample size, restricted media representation, and laboratory detection limits.

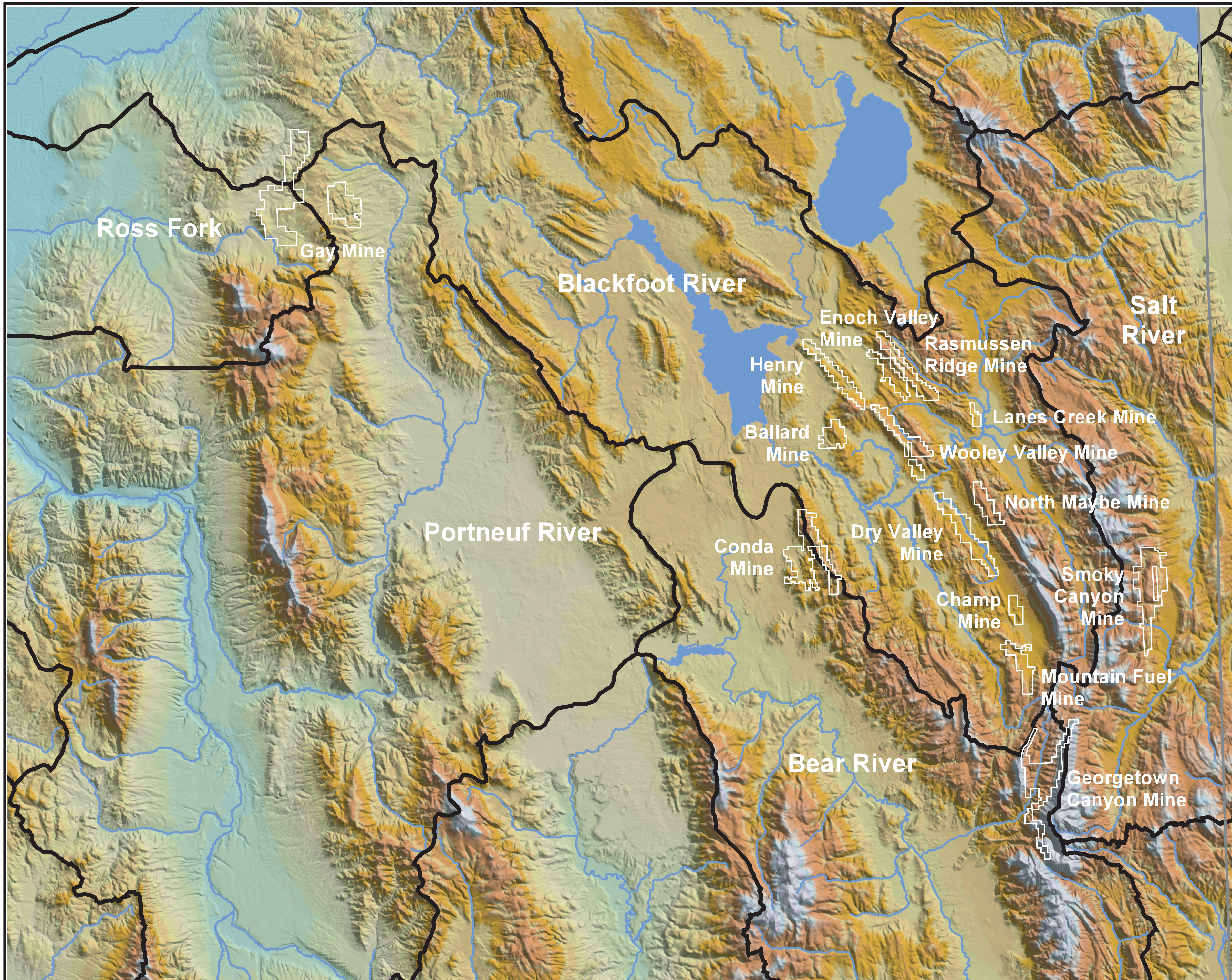


Figure 1

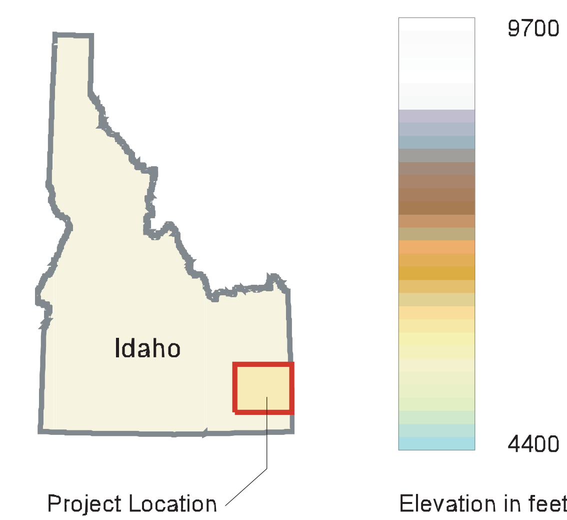
Southeast Idaho Phosphate Mining Resource Area

Legend

Mine Permit Areas (outlined in white)

Watershed Boundaries

Rivers and Lakes



N

0 4 8 12 Miles

Tetra Tech EM Inc.

2/15/01 Idaho_data50.apr
GIS cartography by Ed Madej
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Conclusions of the preliminary human health risk assessment were also affected by the uncertainties of the screening process as related to the selection of the COPCs for human health. Beyond the fundamental concern associated with COPCs, the primary issue for the human health risk assessment is related to the lack of consideration for sensitive populations, such as children, or those with potentially unique exposure potentials such as Native Americans or subsistence groups.

1.3 OBJECTIVES

As part of the initial Selenium Project investigations, a variety of environmental media (surface water, groundwater, soils, plant and animal tissue) were analyzed to characterize the nature and extent of contamination in the Resource Area. Because the preliminary studies used a phased approach for data acquisition, the number and distribution of samples were sometimes less than optimal for supporting area wide risk conclusions. The sampling regime proposed herein is predicated on balancing scientific vigor, statistical significance, defensibility, and costs.

The objective of this technical memorandum is to develop an approach for addressing technical shortcomings identified in the preliminary risk assessments developed for the Selenium Project. This report is considered a working document that initially focuses on the spring sampling events. Technical note(s) will be developed to supplement this document following the review of the results of the spring sampling episodes. Detailed work plans for the characterization of each media will be developed by the IMA and/or IDEQ and approved by the IDEQ prior to implementing the investigation.

Section 2 of this report discusses the site summary data that was submitted by the mining companies. Section 3 is a review of the major ecological and human health risk assessment issues that are outstanding in the current process. Section 4 summarizes the major abiotic data gaps and Section 5 describes the primary biotic data gaps.

2.0 REVIEW OF SITE SUMMARIES

Representatives of the mining companies prepared site summaries for individual mines to supplement the administrative record. The site summaries were intended to provide supplemental data that was not explicitly included in the preliminary risk assessment. Reports were provided to the IDEQ for 12 of the 15 major mines in the Resource Area (Table 2). TtEMI reviewed the site summaries to determine if adequate data was available to support the risk assessment or COPEC screening process.

Table 2. Analyses and Media Representation in Site Summary Documents

Title	Mine	Sample Analyticals							
		Surface Water	Ground Water	Sediment	Soil	Vegetation	Mammal	Fish	Other[1]
Preliminary Assessment and Site Inspection of the South Maybe Canyon Mine and Waste Rock Dump Near Soda Springs, Idaho, TRC Environmental Corp, September 1997	South Maybe Canyon	Se and other elements[2]	NA	NA	Se and other elements[3]	NA	NA	NA	NA
First Supplement to the Site Inspection Report for the South Maybe Canyon Mine and Waste Rock Dump: Results of Selenium Levels in Soils, Vegetation, and Biota in Dry Valley and Maybe Canyon, Caribou County, Idaho, TRC Environmental Corp, December 1997	South Maybe Canyon	Se	NA	NA	Se	Se	NA	NA	Se
Second Supplement to the Site Inspection Report for the South Maybe Canyon Mine and Waste Rock Dump: Groundwater Assessment of Maybe Canyon, TRC Environmental Corp, December 1997	South Maybe Canyon	Se and other elements[4]	Se and other elements[4]	NA	NA	NA	NA	NA	NA
Maybe Canyon Site Investigation Caribou National Forest, Caribou County, Idaho, TRC Environmental Corp, March 1999	South Maybe Canyon	Se and other elements[5]	Se and other elements[5]	Se and other elements[6]	Se and other elements[6]	Se and other elements[6]	Se and other elements[6]	NA	Se and other elements[6]
First Supplement to the Maybe Canyon Site Investigation, Caribou National Forest, Caribou County, Idaho, TRC Environmental Corp, February 2001	South Maybe Canyon	Se and other elements (no lab reports)[7]	Se and other elements (no lab reports)[7]	NA	Se (no lab reports)	Se (no lab reports)	NA	NA	NA
Site Specific Summaries for Nu-West Industries, Nu-West Industries, January 2000	South Maybe Canyon, North Maybe Canyon, Champ, Champ Extension, Mountain Fuel, Georgetown Canyon	Summary of 26 metal detects (no lab reports)[8]	NA	NA	Se (no lab reports)	Se (no lab reports)	NA	NA	NA

Table 2. Analyses and Media Representation in Site Summary Documents (continued)

Title	Mine	Sample Analyticals							
		Surface Water	Ground Water	Sediment	Soil	Vegetation	Mammal	Fish	Other[1]
Pit Backfill and Pit Lake Hydrogeochemical Evaluation for FMC Dry Valley Mine Extension Environmental Impact Statement, Caribou County, Idaho, Maxim Technologies, Inc., January 2000	Dry Valley Extension, Champ	Total metals[9]	Total metals[10]	NA	NA	NA	NA	NA	NA
Mitigation and Monitoring Plan South Extension Project, Astaris LLC, June 2000	Dry Valley	NA	NA	NA	NA	NA	NA	NA	NA
Final Environmental Impact Statement, Dry Valley Mine-South Extension Project, US Dept of the Interior, US Dept of Ag, US Army Corps of Engineers, June 2000	Dry Valley	Se (no lab reports)	NA	NA	Select metals	Se, Cd, As, Zn	NA	Select metals	NA
J.R. Simplot Company Conda Mine (Site Summary), J.R. Simplot Company, December 2000	Conda Mine	Se (no lab reports)	NA	NA	NA	Se	Na	NA	NA
Site Specific Summaries for Monsanto's Properties, Monsanto Company, February 2001	Ballard, Henry, Enoch Valley, South Rasmussen	Se and other elements (no lab reports)[11]	Se and other elements (no lab reports)[11]	NA	Se (no lab reports)	Se (no lab reports)	Blood Se, Mo, Zn, Fe, Mg, Cu, Ca, PO_4 (no lab reports)	NA	NA
Gay Mine Reclamation Site Specific Summary, Shoshone-Bannock Lands, Idaho, Brown and Caldwell, February 2001	Gay	Se (no lab reports)	NA	Se and Cd (no lab reports)	Se and Cd (no lab reports)	NA	NA	NA	NA

Notes:
NA = No Analysis
[1] Other includes benthic macroinvertebrate, terrestrial and aquatic invertebrate
[2] Al, As, Ba, B, Cd, Ca, Cr, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Ag, Na, V, Zn
[3] Al, Sb, As, Ba, Be, Bi, B, Cd, Ca, Cr, Co, Cu, Ga, Fe, Pb, Li, Mg, Mn, Hg, Mo, Ni, K, Sc, Ag, Na, Sr, Tl, V, Zn
[4] Ca, Mg, K, Na
[5] Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Mo, Ni, K, Ag, Na, Tl, Ur, V, Zn
[6] Sb, As, Be, Cd, Cr, Co, Cu, Fe, Pb, Mn, Hg, Mo, Ni, Ag, Tl, V, Zn
[7] Al, Sb, Ba, Ca, Cd, Cr, Cu, Fe, Mg, Mn, Hg, K, Na, Si, Zn
[8] Al, Sb, As, Ba, Be, B, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Mo, Ni, K, Se, Ag, Na, Tl, Ur, V, Zn
[9] Al, Sb, As, Ba, Be, Cd, Cr, Co, Cu, Fe, Pb, Mn, Hg, Ni, Ag, Na, Sr, Tl, V, Zn
[10] Al, Sb, As, Ba, Ca, Cd, Cr, Cu, Fe, Mg, Mn, Mo, K, Na, Ni, V, Zn
[11] As, Ba, Ca, Cd, Cr, Fe, Pb, Mg, Mn, Hg, Ag, Na

The site summaries and associated documents provide important new information that can be used to augment the risk assessment process. Extensive chemical data on a broad range of media were available for the South Maybe Mine; however, a comprehensive multi-element dataset was not available for the 14 mines included in the area wide investigation. Thus, additional data are required to complete the COPC and COPEC screening processes and augment the risk assessment.

3.0 RISK ASSESSMENT ISSUES

The overall goal of the area wide investigations is to provide sufficient data to complete the human health and ecological risk assessments for the Resource Area. The potential risks are dependent on the type, concentration, nature, extent, fate and transport of contaminants in the environment, and the potential exposure to human and ecological receptors. The data must also be evaluated relative to naturally occurring background concentrations to place the risk assessments in the proper context. The following sections discuss key risk assessment issues that strongly influence the data needs.

3.1 CONTAMINANTS OF POTENTIAL CONCERN

Determining the COPCs for human receptors and COPECs for ecological receptors is a key data gap in development of the risk assessments. Contaminants can have significantly different effects depending on the concentrations and receptors. Therefore, the list of COPCs used in the human health risk assessment may be different from the list of COPECs used in the ecological risk assessment. Because of the potential differences in effects, separate screening processes must be conducted for the human health and ecological risk assessments.

The investigations that have been conducted to date are insufficient to develop defensible COPC and COPEC lists. Future investigations must ensure that the data collected can support the selection of contaminants.

3.2 DETERMINATION OF SOURCE TERMS

A key component of risk assessment is definition of the source term. This is necessary to calculate exposure point concentrations (EPC) that are realistic representations of the target receptors. To define the source terms, the primary and secondary sources must be evaluated in sufficient detail to provide bounding estimates of the mass and distribution of a constituent.

Primary and secondary sources must be evaluated to determine the concentration and the areal extent of contaminants. For the Resource Area, the primary sources are the mine pits and waste dumps and the secondary sources are sediments and soils that have been impacted by releases from the mine sites. If uncontrolled, the primary and secondary sources may continue to release contaminants into the environment. Future investigations must ensure that sufficient quantities of representative samples from all source areas are collected to support development of EPCs.

3.3 DETERMINATION OF BACKGROUND CONDITIONS

Chemical constituents can occur naturally at concentrations that are indicative of potential risk to human or ecological receptors. However, since these background concentrations cannot be attributed to a particular source, removal and cleanup are not feasible methods to lower the potential risk associated with these elevated background concentrations. Therefore, background concentrations for all affected media must be determined to ensure that only those contaminants that are associated with a specific source area drive remedial decisions.

The background investigations that have been conducted to date have been limited in terms of sample quantities and the range of chemical constituents that were analyzed. Future investigations must ensure that sufficient quantities of representative samples are collected to support the determination of background concentrations for all media.

3.4 CONTAMINANT FATE AND TRANSPORT

Human and ecological receptors can be exposed to contaminants in either primary or secondary source areas. The potential for exposure is often controlled by the environmental fate and transport processes affecting the source areas and the physical and chemical properties of the individual contaminants. An understanding of the fate and transport of the contaminants of concern is necessary to evaluate the potential for exposure to human and ecological receptors.

Contaminants can be transported from the primary source area by a variety of physical processes. They can be transported on soil particles by wind or water, dissolved in surface or groundwater, and volatilized into the air. The physical properties of the area and the physical and chemical properties of the individual contaminants will determine where contaminants pose a potential for exposure to receptors. Additionally, the bioavailability and the movement of contaminants into the food chain must be evaluated to understand potential exposures.

The investigations that have been conducted to date have indicated a potential for a number of contaminants to migrate away from the source areas and to concentrate in the food chain. Based on the

CSM and the chosen measurement and assessment endpoints, the appropriate abiotic and biotic media must be sampled to evaluate the movement of contaminants through the environment and the food chain.

3.5 EXPOSURE ASSESSMENT

The activity patterns of human and ecological receptors provide an indication of the potential for exposure to contaminants in the environment. For humans, the important considerations include dietary habits, duration and frequency of use, and types of activities that are conducted in the area. These parameters may vary between different cultural or age groups. For ecological receptors, similar types of dietary and life history information are needed to adequately predict potential exposures.

Domestic livestock present a special case of non-human receptors. Their activities are largely controlled by humans. Therefore, information on grazing patterns, feedlot use, and slaughter practices are necessary to estimate their potential exposure. This data will also help predict food chain exposure to humans.

The current risk evaluations have focused on a limited group of potential receptors. The chosen human receptor groups and ecological receptors must be fully evaluated to ensure that the appropriate exposure parameters are used in the risk assessments.

4.0 ABIOTIC MEDIA DATA GAPS

Based on review of the area wide investigation reports and site summaries, additional characterization of the soils and surface water are required to support the risk assessments and the COPC and COPEC screening processes. The rationale for additional sampling is presented for each media type as well as proposed analytical suites and numbers of samples. As discussed earlier, detailed work plans will be developed by the IMA and/or IDEQ and approved by the IDEQ prior to implementation of any fieldwork.

4.1 SOILS

For this report, the term “soil” includes earthen materials that are capable of supporting native and adapted vegetation. Thus, undisturbed surface soils, run-on-impacted soils, and mining byproducts (overburden and waste rock) are all considered soil if they support vegetation. These three conditions need further characterization for source term and background definition.

4.1.1 Waste Rock Dumps

The waste rock dumps are considered primary sources. The 1998 investigation (MW 1999b) contained data from 9 waste rock dumps at 5 mines (TtEMI 2001). The laboratory analyses of these samples were restricted to the preliminary short list for COPECs developed by the IMA (i.e., Cd, Mn, Ni, Se, V, Zn). More complete chemical and mineralogical characterization of the Phosphoria Formation has been conducted by the USGS (Desborough et al. 1999, Herring et al. 2000a, Herring et al. 2000b, Piper 1999, Piper et al. 2000). The objective of the waste rock characterization is to establish the general range of character of the waste rock dump surfaces. This data will support the establishment of COPCs and COPECs and development of bounding conditions for the source terms.

Additional waste rock samples should be collected from each of the 14 area wide mines. The sample locations should be selected to represent the dominant lithologic condition in the waste dumps at the particular mine. Secondarily, the oldest exposed surfaces should be selected for sampling to account for weathering-related releases. Areas that are known to be composed of pre-strip overburden or salvaged soils should be avoided. Where possible, the sampling sites should be on low-gradient slopes and in well-drained (convex) landscape positions. The proposed analytes are listed in Table 3.

4.1.2 Soils in Floodplains

Soils in the floodplains of streams that drain mines may accumulate sediments containing elevated levels of contaminants. In addition, water carrying dissolved contaminants may also enter the fluvial soil systems during flooding or under seepage conditions. Some of the highest levels of contaminants were measured in soils in the floodplains downstream of the Maybe Canyon Mine, suggesting that preferential deposition of fines or some other process is resulting in the concentration of contaminants in this part of the landscape.

Table 3. Proposed Analyses and Methods for Spring Sampling Episodes

Parameter	Surface Water	Sediment	Soil
Aluminum	200.8	--	--
Antimony	200.8	3050B/6010B	3050B/6010B
Arsenic	200.8	3050B/6010B	3050B/6010B
Barium	200.7	3050B/6010B	3050B/6010B
Beryllium	200.7	3050B/6010B	3050B/6010B
Boron	200.7	3050B/6010B	3050B/6010B
Cadmium	200.8	3050B/6010B	3050B/6010B
Chromium	200.8	3050B/6010B	3050B/6010B
Copper	200.8	3050B/6010B	3050B/6010B
Lead	200.8	3050B/6010B	3050B/6010B
Manganese	200.7	3050B/6010B	3050B/6010B
Mercury	245.1	3050B/6010B	3050B/6010B
Molybdenum	200.8	3050B/6010B	3050B/6010B
Nickel	200.8	3050B/6010B	3050B/6010B
Selenium	ICP-HG	ICP-HG	ICP-HG
Silver	200.8	3050B/6010B	3050B/6010B
Thallium	200.8	3050B/6010B	3050B/6010B
Uranium	200.8	3050B/6010B	3050B/6010B
Vanadium	200.8	3050B/6010B	3050B/6010B
Zinc	200.7	3050B/6010B	3050B/6010B
Fluoride	300.0	3050B/6010B	3050B/6010B
Alkalinity	310.1	--	--
Calcium	200.7	--	--
Carbonates	310.1	--	--
Chloride	300.0	--	--
Gross Alpha/Beta	900.0/9310	--	--
Hydroxide	310.1	--	--
Iron	200.7	--	--
Magnesium	200.7	--	--
Nitrate–N	300.0	--	--
Potassium	200.7	--	--
Settleable Solids	160.5	--	--
Sulfate	300.0	--	--
Sodium	200.7	--	--
TOC	SM5310B	--	--
TSS	160.2	--	--
TDS	160.1	--	--
Hardness	Calculated	--	--
Phosphorus	300.0	--	--
pH	310.1	USDA # 60-21a	USDA # 60-21a
Electrical Conductivity	--	--	9050A
Organic Carbon	--	USDA # 60-24	USDA # 60-24
Particle Size Dist.	--	ASA # 9 15-4.2.2	ASA # 9 15-4.2.2

Notes:

[1]Dissolved oxygen, oxidation reduction potential, pH, specific conductance, temperature, and turbidity will be measured in the field.

[2]Test methods may be modified to accommodate specific data quality objectives or unique laboratory conditions.

The fluvial soils are considered potential secondary sources. Additional sampling and analyses are required to evaluate the source terms associated with the fluvial soils. It will be important to characterize both the distribution and magnitude of contaminants. TtEMI proposes to develop the specific requirements after selecting representative fluvial systems and following the initial spring surface water sampling episodes. The delayed sampling is proposed for efficiency under the assumption that the list of COPCs can be reduced after evaluating the initial sampling results. Several sites will be sampled with the intent of characterizing the soils and evaluating the relative importance of direct sediment deposition and loading of dissolved contaminants by flooding or sub-irrigation. The sample design will be determined after representative sites are selected in consultation with the IDEQ.

Erosion and redistribution of soil materials to areas adjacent to the waste rock dumps have been suggested as potential dispersion processes. Sampling and analysis of the soils surrounding representative dumps may be required to test this hypothesis. Further definition of this potential process will be developed after field surveys.

4.1.3 Background Soil Conditions

Unimpacted soils in the Resource Area are expected to have somewhat elevated levels of contaminants relative to unmineralized areas, although mineral weathering and leaching processes may invalidate this assumption. Nonetheless, the levels of contaminants found in soils that have not been directly impacted by mining related discharges should be established for comparative purposes. The soils in active fluvial positions (≈100-year floodplain) are the primary targets for establishing background conditions. The location and number of sites will be determined in consultation with the IDEQ after field inspections in the Resource Area and evaluation of the spring surface water characterization. Background conditions may be established in fluvial systems upstream of mining disturbances or using the space-for-time approach of sampling older terraces (former floodplains). This effort will complement the determination of background conditions for stream sediments by sampling below the zone of active weathering.

4.2 SURFACE WATER

Surface water features represent important exposure points for many organisms. Multiple surface water features (seeps, streams, and ponds) exist in the Resource Area that could be impacted by mining-related discharges. Each class of surface water feature poses different issues for the risk assessment and the specific data needs are discussed in the following sections.

4.2.1 Seeps

Seeps emanating from the waste rock dumps contain relatively high concentrations of contaminants and may represent an important dispersion mechanism and/or local exposure point. The seep discharges may directly enter ponds and streams, infiltrate to the vadose zone and groundwater, or evaporate. An understanding of the number, location, and characteristics of the seeps at each mine is necessary to evaluate the contaminant loading and transport processes.

Seeps associated with the 14 primary mines are potentially major sources of contamination coming from the mine sites. Therefore, annual inventories should be conducted during spring runoff to identify all seeps at all mines. This inventory should include the location and estimated magnitude of flow for each seep. At each mine site, the two seeps with the highest observed flow should be sampled and analyzed for the metals listed in Table 3. This effort should include sampling of the seeps that were characterized in the 1998 investigation (MW 1999b).

4.2.2 Streams

Data gaps associated with surface water quality in streams are being partially addressed through baseline stream monitoring in the Blackfoot River and Salt Creek Watersheds that will be conducted by the IDEQ in spring 2001. This effort will be conducted in a manner that is applicable to both risk assessment and total maximum daily loading (TMDL) processes. The baseline monitoring will be coordinated with sampling efforts designed to specifically support the risk assessment. A detailed work plan is currently being developed and Table 3 is the proposed list of analytes for the stream sampling.

Implementation of the IDEQ monitoring program should resolve the data gaps issues associated with surface water in the streams. However, IDEQ recognizes that additional stream water quality characterization may be required following review of the spring stream data.

4.2.3 Ponds

The ponds and pit lakes that exist at many of the mines represent potential exposure sources for wildlife and/or livestock. Surface water in representative ponds and pit lakes should be characterized. Pit lakes and ponds within the lease areas should be characterized for the parameters listed in Table 3. This sampling effort will be conducted in the spring, with possible follow-up sampling required pending review of the initial results.

4.3 STREAM SEDIMENT

Sediments associated with some of the mines contain elevated concentrations of contaminants and represent secondary sources in some locations. Additional sediment samples will be collected and analyzed for the parameters listed in Table 3 as part of the IDEQ 2001 baseline stream monitoring program. The sediment sample locations will generally be collocated with surface water stations.

5.0 BIOLOGICAL MEDIA DATA GAPS

Data from previous investigations indicate that some contaminants associated with the waste rock have entered the ecological food chain and may occur at elevated levels. Further investigation is necessary to determine the magnitude and distribution of contaminants in the food chain and to identify potential plant and animal impacts. The following sections discuss the data needs associated with evaluation of biological media. The sampling of biological media will be conducted after the spring water sampling.

5.1 TISSUE SAMPLES

TtEMI has prepared human health and ecological CSMs for the Selenium Project. Based on those CSMs, biological media were identified that require further assessment to understand the movement of contaminants through the food chain and the potential doses to various receptors. The evaluation indicated that the following media should be characterized to provide an understanding of the potential food chain exposure in the Resource Area:

- Fish
- Benthic Invertebrates
- Terrestrial Invertebrates
- Aquatic Plants
- Terrestrial Plants
- Small Mammals

The following sections discuss each media for tissue collection.

5.1.1 Fish Tissue Samples

Previous samples of fish tissue have been composed primarily of trout fillets; although, a limited number of whole body trout samples have also been analyzed. The fish samples were collected primarily at locations where a viable fishery was believed to exist for humans. Additionally, the samples were analyzed for a restricted number of contaminants based on the initial COPC and COPEC lists.

While trout represent the major species consumed by human receptors in the Resource Area, other species of fish are consumed by ecological receptors. Some of these species may be more extensively exposed to contaminants than trout. Additionally, the locations of the previous samples were, in most cases, remote from the most impacted stretches of streams supporting fish populations.

To support the risk assessment, analysis of both trout and benthic feeding fish will be required. Since ecological and some human receptors consume the entire fish, whole body analysis will be necessary to adequately evaluate the potential exposure to various receptors. The fish will be collected from areas where surface water and sediment are confirmed to be impacted based on the stream sampling as well as background locations. The contaminants to be analyzed will be determined from the results of the surface water and sediment analyses. This study design may be further refined pending review of the on-going USGS studies.

5.1.2 Benthic Invertebrates

Benthic macroinvertebrates, such as caddisfly larvae, provide a significant source of food for some ecological receptors. Data from the Maybe Canyon Mine indicated that benthic macroinvertebrates downstream of the mine contain elevated concentrations of several contaminants. To evaluate the potential for uptake into the benthic macroinvertebrate community and subsequent transfer to upper trophic level receptors, benthic macroinvertebrate tissue must be analyzed. These samples must be collected from areas determined by the surface water and sediment sampling to be the most impacted areas that support a benthic macroinvertebrate population as well as from background locations. The contaminants to be analyzed will be determined from the abiotic media sampling.

5.1.3 Aquatic Plants

Aquatic plants provide a significant source of food for some ecological receptors. Data from the South Maybe Canyon Mine suggest that aquatic plants below the mine contain elevated concentrations of several contaminants. To evaluate the potential for uptake into the aquatic plant community and subsequent transfer to upper trophic level receptors, aquatic plants must be analyzed. The number of samples required, sample locations, and contaminants of interest will be based on the results of the abiotic sampling.

5.1.4 Terrestrial Plants

Information on the typical levels of contaminants found in vegetation in the Resource Area is needed to support the risk assessment. Vegetation data may be needed from the reclaimed waste dumps, potentially impacted fluvial areas, and background locations. The exact requirements for vegetation are undetermined at this time pending the results of other studies (e.g., U.S. Forest Service and USGS). Additional work may not be needed if these studies are released in time and provide appropriate data for the risk assessment. Otherwise, the vegetation sampling will be conducted in summer 2001. Details of the vegetation sampling will be delayed until the COPC and COPEC lists are more clearly defined.

Characterization of culturally significant plants may be required to support the human health risk assessment. The need for sampling will be determined once Tribal representatives have supplied vegetation-use information. For instance, spring sampling may be required for camas, but this effort will be conducted by the IDEQ.

5.1.5 Small Mammals

Small mammals provide a significant source of food for some ecological receptors as well as perform other ecological functions. Data from the Maybe Canyon Mine indicated that small mammals near the mine have significantly elevated concentrations of several contaminants. To evaluate the potential for uptake into the small mammal community, effects on the small mammal community, and subsequent transfer to upper trophic level receptors, small mammal tissue must be analyzed. The number of samples required, sample locations, and contaminants of interest will be based on the results of the abiotic sampling.

5.2 COMMUNITY STRUCTURE AND BIOTIC INTEGRITY

The risk assessment will require multiple lines of evidence to determine if contaminants released from the mine sites actually present a risk to ecological receptors. One important line of evidence is to physically evaluate the biological communities present to determine if distinct impacts can be observed when compared to reference areas. These areas will primarily be associated with aquatic systems. The number and locations of the areas to be evaluated will be determined based on the results of the abiotic sampling.

5.3 TOXICITY TESTING

Based on the weight of evidence approach that will be used in the ecological risk assessment, multiple lines of evidence will be presented to support the risk determinations. It is clear based on existing data that exceedances of numerical standards for water quality will occur at some locations. Therefore, toxicity tests may be required to determine if toxicity actually exists or if the toxic effects are mitigated by the physical environment. The need for toxicity tests will be determined based on the results of the abiotic sampling.

5.4 LIVESTOCK EXPOSURES

The activities of domestic livestock are potentially subject to control by humans. The beef depuration study provided information on potential selenium levels in cattle tissue. Additional information on grazing patterns, pasture characteristics, duration of use, feedlot use, and slaughter practices are necessary. This data will be used to help predict exposure to the livestock as well as food chain exposure to humans.

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