MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
ABANDONED MINE RECLAMATION BUREAU

ABANDONED HARDROCK MINE PRIORITY SITES
1995
SUPPLEMENTAL SUMMARY REPORT

Prepared For:

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Abandoned Mine Reclamation Bureau
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The cover photograph is of the Empire Stamp Mill
located near Marysville, Montana.
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1.0 INTRODUCTION

This document supplements the 1993 and 1994 Hazardous Materials Inventory Summary Report published by the Montana Department of Environmental Quality (formerly known as the Montana Department of State Lands)/Abandoned Mine Reclamation Bureau (MDEQ/AMRB). The Hazardous Materials Inventory was implemented to consistently characterize and rank the extent of environmental problems associated with the Abandoned Hardrock Mine Priority Sites. This 1995 supplemental report includes an additional 25 sites to the 332 sites inventoried in 1993 and 1994.

This report is organized into six sections. Section 1.0 presents the introduction, project objectives, a brief description of the project tasks, and a summary of the findings. Section 2.0 briefly describes field methods used during the inventory. Section 3.0 discusses data evaluation techniques and data management for the project. Section 4.0 presents a brief description of the Abandoned and Inactive Mines Scoring System (AIMSS) which was developed to rank the priority sites. Section 5.0 presents one page summaries for each of the priority sites. The summaries typically provide details about each site, such as volumes of wastes, contaminant concentrations, observed releases to surface water and groundwater, water quality criteria exceedances, and potential safety hazards. Section 6.0 presents the references cited in the text.

This Summary Report is supported by several other project documents and databases, including:

- The Sampling and Analysis Plan (SAP) presents the sampling approach for the Abandoned Mines Hazardous Materials Inventory. The SAP also contains instructions on completing the Inventory Form and the Standard Operating Procedures (SOPs) for conducting the field sampling activities (MDEQ/AMRB-Pioneer, 1994a).

- The Quality Assurance Project Plan (QAPjP) describes quality assurance procedures used for evaluating the field and lab data for the project (MDEQ/AMRB-Pioneer, 1994b).

- The Laboratory Analytical Protocol (LAP) describes laboratory requirements for the project (MDEQ/AMRB-Pioneer, 1994c).

- The Health and Safety Plan (HSP) describes practices and procedures to be followed by field investigators who performed the project to minimize exposure to hazardous materials and to eliminate any possibility of physical injury (MDEQ/AMRB-Pioneer, 1994d).

- The Abandoned Hardrock Mines Project Report is a compilation of the reports listed above, as well as this Summary Report, the AIMSS Report, the Data Validation/Evaluation Report, and the completed Hazardous Materials Inventory Forms for each site (MDEQ/AMRB-Pioneer, 1994e).

- The Abandoned Hardrock Mine Priority Sites, Hazardous Materials Inventory Databases.

The complete Abandoned Hardrock Mines Project Report, including the 1993 and 1994 inventories, can be viewed in Helena, Montana, at the Montana State Library; the MDEQ/AMRB office; or the MDEQ/Environmental Remediation Division (ERD; formerly known as the Montana Department of Health and Environmental Sciences/Solid and Hazardous Waste Bureau) office or in Missoula, Montana, at the United States Department of Agriculture/Forest Service (USFS), Region 1 office.

1.1 PROJECT OBJECTIVES

There are an estimated 6,000 abandoned or inactive hardrock mine and milling sites in Montana. This legacy of Montana's mining past has left a wide range of problems and challenges for the MDEQ/AMRB and other state and federal agencies charged with the reclamation and mitigation of these problems.

The problems associated with the abandoned and inactive hardrock mine sites are varied and range from safety hazards caused by hazardous mine openings, dangerous highwalls, and dilapidated structures, to threats to human and non-human life and the environment by mining waste containing elevated levels of heavy metals and other contaminants. To date, the MDEQ/AMRB has conducted a great deal of work to eliminate the problems of unsafe openings, highwalls, and structures, and has made over 1,500 of these sites safer.

In 1991, the MDEQ/AMRB concluded that substantial progress had been made in eliminating imminent hazards to public health and safety at abandoned hardrock mine sites. However, limited progress was realized with regard to the problems relating to heavy metal and mineral processing reagent contamination of surface water and groundwater. Not only were some of these sites causing severe environmental degradation, but they were also the sites of highest concern to the public. Additionally, the MDEQ/AMRB recognized that there were a number of other state and federal programs that had resources available to address their problems, but there was no coordinated approach to determining which specific sites should be addressed first. As a result, the MDEQ/AMRB solicited various state and federal agencies, requesting assistance in the identification of suspected problem sites. The following agencies responded to the MDEQ/AMRB request: USFS-Region 1, the United States Department of the Interior/Bureau of Land Management (BLM), MDEQ/ERD, and the

Montana Department of Natural Resources and Conservation (DNRC). A list of the 332 suspect sites was compiled from the input of these agencies supplemented by a review of existing data from the MDEQ/AMRB master inventory. This list included the majority of the highest potential hazard sites in Montana. These sites were investigated and inventoried during the 1993 and 1994 field seasons. As result of the 1993 and 1994 inventory activities and continued records searches, 25 additional sites were identified, investigated, and ranked during the 1995 field season by the MDEQ/AMRB. This 25-site supplement to the 1993 and 1994 priority sites list is presented in Table 1-1. The agencies previously listed agreed to a cooperative course of action, with MDEQ/AMRB designated as the lead agency. The agencies established the following objectives:

- to identify and prioritize those abandoned mine sites that are presently the most serious threats to public health and safety and the environment;

- to collect data on each priority site in a consistent manner to identify problems associated with each site and to directly compare and rank sites. All sampling and analysis methods will strictly follow United States Environmental Protection Agency (EPA) protocols to ensure consistent and accurate results; and

- to develop a long-term strategy to utilize statutory and financial resources available to systematically reduce the hazards associated with the prioritized abandoned mine sites.

Upon completion of this report, the first two objectives stated above are fulfilled, and the framework to complete the third objective is in place.

1.2 PROJECT DESCRIPTION

The additional 25 priority sites investigated during the 1995 field season under the Abandoned Mines Hazardous Materials Inventory were located in 7 counties and in 10 out of the 206 mining districts in Montana. Site investigations began September 14, 1995, and were completed on November 13, 1995. One field crew consisting of three to four scientists, engineers, and technicians were in the field for approximately 14 days to complete the data collection effort.

The site investigation conducted at each site involved the following tasks: overall site reconnaissance; mapping; collection of tailings, slag, waste rock, adit discharge, flooded shafts, stream water, and sediment samples; field analysis of solid matrix samples using an X-ray Fluorescence (XRF) Spectrometer; and measurements of field parameters in water, including flow rates, pH, specific conductance, temperature,

County	*District*	*Site Name*	*PA #*
Cascade	Neihart	IXL/Eureka	07-083
Cascade	Neihart	Cornucopia	07-147
Cascade	Neihart	Ontario	07-148
Cascade	Neihart	Benton/Big Snowy	07-151
Cascade	Neihart	Lucky Strike	07-169
Cascade	Neihart	Lower Black Diamond Jay	07-174
Cascade	Neihart	Haystack Creek	07-179
Granite	Combination	Combination II	20-009
Granite	Combination	Sunrise/Queen Millsite	20-036
Granite	Phillipsburg	Douglas Creek Waste Rock	20-503
Granite	Princeton	Port Royal Mill Tailings	20-016
Jefferson	Basin	Bullion Smelter	22-505
Jefferson	Clancy	Frohner	22-243
Judith Basin	Hughesville	Carter	23-019
Judith Basin	Hughesville	M.T.A.	23-040
Judith Basin	Hughesville	Belfont	23-060
Judith Basin	Hughesville	Sinclair	23-501
Judith Basin	Hughesville	May and Edna	23-502
Park	Big Timber Canyon	Stemwinder (South)	34-500
Powell	Emery	Emma Darling	39-027
Powell	Emery	Bonanza	39-501
Powell	Emery	Hidden Hand	39-502
Powell	Emery	Spring Creek	39-503
Sanders	Plains	S & H	45-017
Sweetgrass	Big Timber Canyon	Kelly	34-113

TABLE 1-1: 1995 ABANDONED MINE PRIORITY SITES

oxidation reduction potential, and alkalinity. The field team members also photographed sample locations and significant site features, video taped the site, and evaluated safety hazards.

The physical setting and topography associated with these sites ranged from gently sloping land in valley bottoms to very steep, high elevation, mountainous areas. Access to sites was often difficult due to poor road conditions or absence of maintained roads. Access to several sites was limited to travel on foot or by helicopter. Ownership of the priority sites is a mix of public lands (USFS, BLM, etc.) and patented lands (private ownership). The priority sites consist of primarily inactive/abandoned mine sites; however, exploration activities were in progress at a few of the sites.

Significant features at the sites included tailings ponds, impoundments, and piles; waste rock dumps or piles; mine openings, including adits, shafts, glory holes, and exploration trenches; miscellaneous buildings and structures; and roads. Mine opening discharges and streams adjacent to or flowing through the sites were common.

Hazardous materials observed at some of the sites included copper sulfate and a barrel full of an unknown liquid. Some of the sites support wildlife, domestic grazing, or aquatic life. Residential occupation of the sites was observed in rare cases, but residences located adjacent to the sites occurred more frequently.

1.3 SUMMARY OF FINDINGS

The following information is provided as an overview of the data compiled during the 1995 supplemental investigation to the Hazardous Materials Inventory.

Laboratory Sampling

- Total number of lab samples: 125 (does not include the QA/QC duplicates), representing approximately 2,019 data points generated by the laboratories.
- Total number of XRF samples: 375 (does not include the QA/QC duplicates), representing approximately 5,196 data points.

Waste Rock Associated with the 1995 Priority Sites

- Estimated total volume: 172,744 cubic yards.
- Estimated total area: 723,665 square feet (16.6 acres).
- Estimated total unvegetated/uncovered area: 556,691 square feet (12.8 acres).

Mill Tailings Associated with the 1995 Priority Sites

- Estimated total volume: 597,692 cubic yards.
- Estimated total area: 2,642,075 square feet (60.7 acres).
- Estimated unvegetated/uncovered area: 777,344 square feet (17.8 acres).

Slag Material Associated with the 1995 Priority Sites

- Estimated total volume: 737 cubic yards.
- Estimated total area: 1,100 square feet (0.2 acre).
- Estimated unvegetated/uncovered area: 1,100 square feet (0.2 acre).

Adit Discharges Associated with the 1995 Priority Sites

- Total number of discharging adits: 14.
- Number of adit discharges with pH $\leq$ 5.00: 2.
- Number of adit discharges with pH $\leq$ 6.00: 3.

Flooded Shafts Associated with the 1995 Priority Sites

- Total number of open shafts with water: 0.

Water Quality Criteria

- Number of discharges exceeding Safe Drinking Water Act MCL/MCLGs: 3.
- Number of adit discharges exceeding acute aquatic life criteria: 8.
- Number of adit discharges exceeding chronic aquatic life criteria: 9.
- Number of observed releases to surface water/sediment directly attributable: 9.
- Acute aquatic life exceedances in surface water: 12.
- Chronic aquatic life exceedences in surface water: 14.
- MCL exceedances in surface water attributable to the site: 7.

2.0 INVESTIGATION METHODS

2.1 DATABASE AND LITERATURE SEARCH

Data collected in the field was supplemented by an extensive literature search and the use of several computer databases. This supplemental information was used to complete the inventory forms and fulfill receptor information requirements for the AIMSS. The computer databases used to collect this information were:

- The Montana Bureau of Mines and Geology (MBMG) Well Logs Database, which was compiled by the MBMG and the DNRC. This database was used to estimate the number of wells within a one-and four-mile radius of each site.

- The Montana Rivers Information System (MRIS), Version 2.0, compiled by the Montana State Library for the Montana Department of Fish, Wildlife, and Parks (MDFWP). This database was used to assign classifications relating to riparian habitat quality, wetlands frontage, fisheries habitat and species classification, and sport fisheries classification for stream reaches potentially impacted by each site, where applicable.

- The MDEQ/Water Quality Bureau (WQB) - Community Water Supplies Database. The MDEQ/WQB provided a list of surface water resources presently used for drinking water supplies in Montana.

Additional information was obtained from the following sources:

- Peak and average stream flow estimates were obtained from United States Department of Interior/Geological Survey (USGS) flow monitoring reports on gaged streams.

- Population estimates were obtained by counting buildings delineated on the USGS quadrangle maps and USFS Forest Visitors Maps. Field observations supplemented this source of information.

- Land ownership was determined from USFS Forest Visitor Maps, unless more accurate records were available.

- Historic mine/millsite operations, mineralogy, and geology were obtained from several sources, including: United States Bureau of Mines (USBM) Circulars, USGS Bulletins and Professional Papers, and MBMG Memoirs, Bulletins, and Circulars.

- Historic analytical data were obtained from the MDEQ/AMRB project files, the MDEQ/ERD project files, the MDEQ/WQB, USFS project files, and MBMG data collected for the USFS. This data was reviewed prior to site visits to provide the investigators with background information on potential hazards associated with each site.

2.2 FIELD METHODS

A detailed discussion of specific investigation methodologies is found in the MDEQ/AMRB Hazardous Materials Inventory SAP (MDEQ/AMRB-Pioneer, 1994a). The purpose of this section is to describe some of the unique details of the investigative methods used to fulfill the project objectives.

The inventory form used during the 1995 investigation was almost identical to the 1994 form. The inventory form was used during the investigation to guide and focus the investigative tasks to ensure consistent evaluation of each site. Literature and database searches were performed prior to the field investigations to provide investigators with background information on each site.

Sampling was performed on waste rock dumps, mill tailings, streams, ponds, adit discharges, and from domestic groundwater wells or monitoring wells, when present.

Each mill tailings deposit was characterized both spatially and vertically by hand-auguring to determine accurate depths and delineate stratification or differences in metals concentrations between the upper oxidized zone(s) and the lower reduced zones. Subsamples were collected from each visually distinct strata.

Typically, several subsamples were collected from each waste rock dump in order to better characterize these very heterogeneous waste sources. Subsamples from the tailings and waste rock were analyzed in the field using XRF Spectrometers. The field screening data allowed the investigators to make informed decisions on the number of samples required for laboratory analyses and indicated how best to composite the subsamples from the potential sources in order to send representative samples to the laboratory, while minimizing the number of samples to achieve this end. The XRF analyses also provided an increased number of valid and discrete data points per site achieving a more thorough understanding of the problems associated with each site. Solids were characterized additionally by field measurement of pH and radioactivity.

Stream sediment samples were also analyzed in the field with the XRF in order to assist in the assessment the extent of contamination and migration from the waste sources.

Surface water sampling was often conducted to characterize impacts to drainage basins, as well as contributions from individual sites, when multiple sources were

present. Waters were additionally characterized in the field by measuring flow rates, pH, specific conductance, alkalinity, and temperature.

Site mapping was conducted using a Global Positioning System supplemented with standard "Chain and Compass" surveying techniques when necessary. The primary purpose of mapping was to estimate volume and area of waste sources and record sample locations. Other significant site features, such as streams or drainages, roads, mine openings, and structures, were also recorded on the site sketches. Sample locations and other significant site features were documented on photographic slides and video tape to assist the resource managers in their evaluation of the priority sites.

3.0 DATA EVALUATION AND COMPARISONS

The purpose of this section is to discuss data quality validation and evaluation, as well as comparisons of the data to pertinent criteria.

3.1 DATA VALIDATION AND EVALUATION

3.1.1 Laboratory Data Validation and Evaluation

The laboratory utilized during this investigation complied all of the QA/QC performance requirements defined in the Contract Laboratory Program (CLP) Statement of Work (SOW, March 1990). The data packages provided by the laboratory allowed comprehensive data validation and evaluation procedures to be completed. Laboratory data validation and evaluation were performed according to guidelines developed by the EPA.

The laboratory data were validated in accordance with the document Laboratory Data Validation Functional Guidelines for Evaluating Inorganics (EPA, 1988). The data validation procedures were performed partially by laboratory chemists and partially by a data reviewer from Pioneer Technical Services, Inc. The data validation procedure included an evaluation of the following:

- holding times;
- initial and continuing calibrations;
- calibration and preparation blanks;
- inductively coupled plasma (ICP) interference check samples;
- laboratory control samples (LCS);
- laboratory duplicate sample analyses (precision assessment);
- matrix spike sample analyses (accuracy assessment);
- furnace atomic absorption (AA) quality control;
- ICP serial dilutions;
- sample result verification;
- field blank analyses; and
- overall assessment of data for the case.

Data evaluation occurred after the data validation process was completed and the appropriate qualifiers had been applied to the data. The data evaluation process involved a statistical analysis of the data to identify outliers and assess the quality of the data overall. Data evaluation was performed on the laboratory data which met the Data Quality Objectives (DQOs) outlined in the QAPjP for the Abandoned Mines Hazardous Materials Inventory (MDEQ/AMRB-Pioneer, 1994b).

Although numerous qualifications (flags) were applied to the laboratory data compiled during this investigation, and a small portion of the data were evaluated as outliers, none of the data were flagged "R" or were otherwise considered unusable. Consequently, 100 percent of the laboratory data (soil and water) collected during this investigation are considered valid and useable for all of the objectives of this project.

The limitations of the data should be considered when making interpretations. Please refer to the document entitled Data Validation and Evaluation Report for the Abandoned Mines Hazardous Materials Inventory for a detailed description of the procedures followed and results provided by the overall data assessments.

3.1.2 X-Ray Fluorescence Spectrometer Data Validation

Data provided by the field portable XRF Spectrometer were also validated; the XRF data were validated according to manufacturer specifications. The validation procedures for XRF data were not as rigorous as for laboratory data; consequently, additional procedures, utilizing standard statistical techniques, were employed to evaluate the overall quality of the XRF data. These additional procedures included assessment of XRF duplicate data to quantify precision, as well as comparing XRF data to corresponding laboratory data to assess inter-method precision and correlation.

3.1.3 Other Field Measurements

Field parameter measurements, such as pH, Eh, and specific conductance, were not evaluated for data quality. SOPs (MDEQ/AMRB-Pioneer, 1994a) were carefully followed in the field to achieve a consistent and acceptable level of quality.

3.2 DATA INTERPRETATION

The analytical data collected was compared to site-specific background or upgradient concentrations, as well as drinking water standards and aquatic life criteria. The following sections explain how these comparisons were made.

3.2.1 Background Soil Comparison

Background soil samples were collected to establish the extent to which metals concentrations were elevated in comparison to the local background. Constituents present at concentrations greater than three times background concentrations were considered "attributable" to the site. Background samples were typically applied to groups of sites in close proximity to one another and within similar geologic units. Occasionally, background samples collected during the 1993 and 1994 investigations were used.

3.2.2 Observed Releases to Groundwater, Surface Water, and Sediment

An observed release to surface water is defined as a downstream surface water or stream sediment sample concentration at more than three times the upstream surface water or sediment sample concentration, for any constituent that can be attributed to the site. Groundwater, surface water, and stream sediment analytical data were used to document observed releases from the priority sites.

3.2.3 MCL/MCLG, Aquatic Life Criteria Comparisons

Maximum Contaminant Levels (MCLs) and Maximum Contaminant Level Goals (MCLGs) are drinking water standards promulgated under the federal Safe Drinking Water Act (SDWA; 40 CFR Parts 141, 143). MCLs, and MCLGs apply to public water systems; however, they may be relevant and appropriate to surface or groundwater if those waters are used as drinking water. Groundwater and surface water metals concentrations observed in samples collected were evaluated against these standards. The current SDWA MCLs and MCLGs expressed in micrograms per liter (μg/L) are:

Arsenic: 50 μg/L	Barium: 2,000 μg/L	Cadmium: 5 μg/L
Copper: 1,300 μg/L	Chromium: 100 μg/L	Mercury: 2 μg/L
Nickel: 100 μg/L	Antimony: 6 μg/L	Lead: 15 μg/L*
Cyanide: 200 μg/L		

*Not an MCL, but an action level.

Surface water and mine discharge analytical results were also evaluated against the freshwater acute and chronic aquatic life criteria as presented in the Montana Numeric Water Quality Standards, Circular WQB-7, July 15, 1995. Some of these criteria are expressed as a function of total hardness and were corrected for the hardness measured in each sample, when applicable.

3.3 DATA MANAGEMENT

The data collected under this project has been input into the data manager dBase IV, Version 2.0. Four files were created to contain the data and aid in any manipulation of the data that may be desired. These files are summarized briefly below.

- PTSDATA.DBF contains field data collected for each sample during the Hazardous Materials Inventory;
- XRFDATA.DBF contains all the XRF analytical results generated in the field during the Hazardous Materials Inventory;

- LABDATA.DBF contains the data from all of the laboratory analyses performed during the Hazardous Materials Inventory; and

- PRIORITY.DBF is the modified dBase file provided to Pioneer by MDEQ/AMRB from the master inventory.

The information from these four files can be readily combined with one another to form a relational database.

4.0 SITE RANKING

The final task of the Hazardous Materials Inventory involved the development of a system to rank the severity of hazards or environmental threats associated with the sites investigated in order to assist the MDEQ/AMRB in prioritizing reclamation efforts and allocation of resources. This system, the Abandoned and Inactive Mines Scoring System (AIMSS), closely follows the EPA's Hazard Ranking System, although the AIMSS is specifically focused on potential hazards typically associated with the abandoned or inactive hardrock mines.

The AIMSS also evaluated potential safety hazards associated with the sites such as hazardous mine openings, highwalls, and structures, and generated a separate safety score for each site. The AIMSS utilized the data collected for each site to assign a ranking score.

The AIMSS is focused towards the physical site setting and potential hazards associated with abandoned and inactive mines due to its capability to evaluate mine opening discharges and large quantities of mine wastes. The AIMSS scoring method evaluates relative risks between sites. This accounts for site-specific contaminant concentrations and the varying toxicity of different constituents, as well as adit discharges in the source evaluation. This method more effectively discriminates between sites with higher concentrations or more toxic constituents in relation to sites with lower concentrations or less toxic constituents. In order to generate an overall Mine Site Human Health and Environmental Hazard Score, the AIMSS evaluates the groundwater pathway, surface water pathway, air pathway, and direct contact pathway. Under each pathway, the AIMSS evaluates observed releases, potential to release, pathway characteristics, waste characteristics, and targets.

Table 4-1 lists the 1995 supplemental priority sites and their associated AIMSS score, sorted in descending order. The necessary data for ranking each of the 1995 inventory sites was collected.

The AIMSS also generates a distinct safety score for each site by evaluating site accessibility and safety hazards present (i.e., shafts, stopes, open adits, hazardous structures, and explosives/other hazardous materials or chemicals). Table 4-2 lists the 1995 supplemental priority sites and their associated safety score, sorted in descending order.

1995 RANK	County	District	Site Name	PA #	AIMSS SCORE
1	Granite	Combination	Combination II	20-009A	99.32
2	Powell	Emery	Spring Creek Tailings	39-503	28.13
3	Jefferson	Clancy	Frohner	22-243	22.68
4	Granite	Phillipsburg	Douglas Creek Waste Rock	20-503	14.10
5	Powell	Emery	Hidden Hand	39-502	6.53
6	Cascade	Neihart	Benton/Big Snowy	07-151	2.67
7	Cascade	Neihart	Lower Black Diamond Jay	07-174	2.06
8	Powell	Emery	Bonanza	39-501	1.20
9	Cascade	Neihart	Haystack Creek	07-179	1.18
10	Judith Basin	Hughesville	Carter	23-019	1.14
11	Powell	Emery	Emma Darling	39-027	1.07
12	Cascade	Neihart	Cornucopia	07-147	1.00
13	Cascade	Neihart	IXL/Eureka	07-083	0.84
14	Judith Basin	Hughesville	Sinclair	23-501	0.77
15	Granite	Princeton	Port Royal Mill Tailings	20-016	0.64
16	Judith Basin	Hughesville	Belfont	23-060	0.40
17	Judith Basin	Hughesville	M.T.A	23-040	0.36
18	Sanders	Plains	S & H	45-017	0.29
19	Judith Basin	Hughesville	May and Edna	23-502	0.25
20	Granite	Combination	Sunrise/Queen Millsite	20-036	0.22
21	Park	Big Timber Canyon	Stemwinder (South)	34-500	0.16
22	Jefferson	Basin	Bullion Smelter	22-505	0.11
23	Cascade	Neihart	Lucky Strike	07-169	0.06
24	Sweetgrass	Big Timber Canyon	Kelly	34-113	0.03
25	Cascade	Neihart	Ontario	07-148	0.01

TABLE 4-1: 1995 ABANDONED HARDROCK MINES PRIORITY SITES AMISS RANKING

1995 RANK	County	District	Site Name	PA #	SAFETY SCORE
1	Powell	Emery	Hidden Hand	39-502	145.60
2	Powell	Emery	Emma Darling	39-027	76.80
3	Sanders	Plains	S & H	45-017	75.00
4	Powell	Emery	Bonanza	39-501	67.20
5	Judith Basin	Hughesville	Sinclair	23-501	45.00
6	Cascade	Neihart	Haystack Creek	07-179	44.00
7	Judith Basin	Hughesville	M.T.A	23-040	42.00
8	Granite	Combination	Sunrise/Queen Millsite	20-036	30.80
9	Granite	Phillipsburg	Douglas Creek Waste Rock	20-503	24.60
10	Cascade	Neihart	Lucky Strike	07-169	23.70
11	Judith Basin	Hughesville	Carter	23-019	19.80
12	Jefferson	Basin	Bullion Smelter	22-505	18.40
13	Jefferson	Clancy	Frohner	22-243	7.80
14	Cascade	Neihart	IXL/Eureka	07-083	7.40
15	Cascade	Neihart	Cornucopia	07-147	6.90
16	Cascade	Neihart	Lower Black Diamond Jay	07-174	2.55
17	Cascade	Neihart	Benton/Big Snowy	07-151	1.90
18	Judith Basin	Hughesville	Belfont	23-060	1.25
19	Cascade	Neihart	Ontario	07-148	1.15
20	Sweetgrass	Big Timber Canyon	Kelly	34-113	1.00
21	Park	Big Timber Canyon	Stemwinder (South)	34-500	1.00
22	Powell	Emery	Spring Creek Tailings	39-503	0.00
23	Granite	Princeton	Port Royal Mill Tailings	20-016	0.00
24	Judith Basin	Hughesville	May and Edna	23-502	0.00
25	Granite	Combination	Combination II	20-009A	0.00

TABLE 4-2: 1995 ABANDONED HARDROCK MINES PRIORITY SITES SAFETY RANKING

5.0 SITE SUMMARY FORMS

The following section presents a one page summary sheet for each of the 25 sites investigated during the 1995 inventory. Each summary sheet provides the site name, location, and other geographic information; and investigation details and summary of findings. Analytical data obtained at each site is summarized on the back of each summary sheet.

SAMPLE DESIGNATION LEGEND

GW: Groundwater sample from well, spring, shaft, or adit discharge.

SW: Surface water sample from stream, river, or ditch.

AD: Adit discharge.

SE: Stream sediment sample.

TP: Mill tailings sample from tailings pond or pile, or streamside tailings deposit.

WR: Waste rock sample from waste rock dump.

SS: Background soil sample.

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY

Mine/Site Name: IXL/Eureka
Legal Description: T 14N R 8E
Mining District: Neihart
Latitude: N 46° 57' 18"
Longitude: W 110° 42' 43"
Land Status: Private
Quad: Neihart
Inspectors: Tuesday, Flammang, Sampson
Organization: Pioneer Technical Services, Inc.

County: Cascade
Section(s): NW 1/4, NE 1/4, Section 28
Mine Type: Hardrock/Ag, Pb, Zn
Primary Drainage: Belt Creek
USGS Code: 10030105
Secondary Drainage: Snow Creek/Carpenter Creek
Date Investigated: September 24, 1995
P.A. # 07-083

- No mill tailings were observed at the site during the investigation.

- The volume of waste rock associated with the site was approximately 3,575 cubic yards. WR-3 was situated in an intermittent stream bed. The following elements were elevated at least three times background:

  Antimony: 68.2J mg/kg
  Arsenic: 36 to 97.7 mg/kg
  Cadmium: 6.5J to 7J mg/kg
  Copper: 33.4JX to 59.9 mg/kg
  Iron: 83,700 mg/kg
  Lead: 2,880 to 3,130 mg/kg
  Mercury: 0.48 to 4.3 mg/kg
  Silver: 27.6 to 45.2 mg/kg
  Zinc: 581 to 1,590J mg/kg

- One discharging adit was observed at the site which flowed over and along the west side of WR-3. No MCLs were exceeded in the adit water sample, but acute and chronic aquatic life criteria were exceeded for zinc, and the chronic aquatic life criteria was exceeded for aluminum, cadmium, and lead. The pH of the adit discharge was 6.38.

- No surface water flowed on or near the site during the investigation. The nearest flowing surface water was over 1,000 feet away; no surface water samples were collected.

- An observed release to the intermittent drainage (sediment) was documented for silver, which is directly attributable to the site.

- Potential safety hazards observed at the site included three open adits, one fenced open shaft, three shaft/subsidence structures, a highwall, and two unstable waste piles.

I.X.L./ EUREKA (all 4 sites) PA# 07-083
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER-TUESDAY
INVESITIGATION DATE: 9/24/95

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	Sb (mg/Kg)	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Ca (mg/Kg)	Cr (mg/Kg)	Co (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Pb (mg/Kg)	Mg (mg/Kg)	Mn (mg/Kg)	Hg (mg/Kg)	Ni (mg/Kg)	Ag (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
07-083-SE-1	5.4 UJ	29.3 J	44.4	9.2	1590	15.6	7.2	72.6	38300	428 JX	3800 J	1660	0.055	12.8	8.8	1450	NR
07-083-SE-2	4.9 UJ	43.7 J	95.4	20.8	2680	17.5	12.2	55.2	25400	681 JX	7360 J	4250	0.049	27.4	1.1	2500	NR
07-083-WR-1	68.2 J	36.0	15.0	7.0 J	19.3	1.6 U	1.8 U	59.9	9810	2880	56.8	25.6	4.3	2.3 U	45.2	1590 J	NR
07-083-WR-3	6.3 UJ	97.7	16.6 J	6.5 J	35900	2.0 U	2.2 U	33.4 JX	83700	3130	46.2	12.5	0.48	2.8 U	27.6	581	NR
BACKGROUND	4.7 UJ	9.6	87.6	1.32 JX	NR	27.2 J	9.05 J	10.8 J	21100	52.4 JX	NR	708 J	0.04	10.3	0.5 B	135	NR

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	Total Sulfur Acid Base (t/1000t)	Neutral Potent. (t/1000t)	Tot. Sulfur Acid Base Potential (t/1000t)	Sulfate Sulfur %	Pyritic Sulfur %	Organic Sulfur %	Pyritic Sulfur Acid Base (t/1000t)	Pyritic Sulfur Acid Base Potential (t/1000t)	Lime Req. Sobek (t/1000t)	Lime Req. Sobek (Tons) /1ft.	Potential Acidity (t/1000t)	Lime Req. Dolihopf (t/1000t)	Lime Req. Dolihopf (Tons) /1ft.
07-083-WR-1	0.29	9.06	-1.33	-10.4	0.18	0.01	0.10	0.31	-1.64	-1.64	-3.44	7.86	-11.23	-23.59
07-083-WR-3	9.09	284	-6.56	-291	0.15	1.62	7.32	50.6	-57.20	-57.20	-120.12	282.89	-361.81	-759.81

WATER MATRIX ANALYSES

Metals in Water
Results in ug/l

FIELD ID	Al (ug/L)	Sb (ug/L)	As (ug/L)	Ba (ug/L)	Cd (ug/L)	Ca (ug/L)	Cr (ug/L)	Co (ug/L)	Cu (ug/L)	Fe (ug/L)	Pb (ug/L)	Mg (ug/L)	Mn (ug/L)	Hg (ug/L)	Ni (ug/L)	Ag (ug/L)	Zn (ug/L)	HARDNESS (mg CaCo3/L))
07-083-AD-1	103 JX	2.7 UJ	1.2 U	4.8 U	1.1	18500	9.6 U	10.9 U	4.4 U	709	3.5	3700	99.4	0.16 U	17.7	0.21 U	340	61.5

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Wet Chemistry
Results in mg/l

FIELD ID	Total Dissolved Solids	CHLORIDE	SULFATE	NO3/NO2-N	CYANIDE
07-083-AD1	103	< 5	40.0	NR	NR

Legend

SE-1- Immediately below WR-3.
SE-2- Upstream above WR-1 & WR-3.
WR-1- Composite WR1A, 1B, 2A, 2B, 4A, 4B.
WR-3- WR-3.
BACKGROUND- From the Ripple (07-183-SS1) (1994 data).
AD-1- Adit at WR-3.

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY

Mine/Site Name: Cornucopia
Legal Description: T 14N R 8E
Mining District: Neihart
Latitude: N 46° 57' 17"
Longitude: W 110° 41' 27"
Land Status: Private
Quad: Neihart
Inspectors: Tuesday, Flammang
Organization: Pioneer Technical Services, Inc.

County: Cascade
Section(s): SW 1/4, SE 1/4, Section 22
Mine Type: Hardrock/Ag, Pb, Zn
Primary Drainage: Belt Creek
USGS Code: 10030105
Secondary Drainage: Snow Creek/Carpenter Creek
Date Investigated: September 25, 1995
P.A. # 07-147

- No mill tailings were observed at the site during the investigation.

- The volume of waste rock observed at the site was approximately 8,475 cubic yards. Waste rock was located in a drainage. The following elements were elevated at least three times background:
  Arsenic: 58.9 to 184 mg/kg
  Lead: 194 to 723 mg/kg
  Mercury: 0.22 to 0.33 mg/kg
  Silver: 4.6 to 58.8 mg/kg
  Zinc: 559 mg/kg

- One discharging adit was observed at the site which flowed over and through WR-2. Field parameters were taken with a pH of 7.99. A previously collected sample of the discharge exceeded acute and chronic aquatic life criteria for copper and zinc, and the sample exceeded chronic aquatic life criteria for lead and iron.

- An intermittent unnamed tributary to Snow Creek flowed adjacent and through WR-2 during the investigation. Acute and chronic aquatic life criteria were exceeded for zinc and cadmium, while lead exceeded the chronic aquatic life criteria. The MCL for cadmium was exceeded.

- An observed release to the tributary via sediment was documented for arsenic, lead, and silver.

- Potential safety hazards observed included two partially collapsed buildings, a large pit with collapsed shaft, a collapsed adit with a 25 foot highwall, and two unstable waste piles.

Cornucopia PA# 07-147
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER-TUESDAY
INVESITIGATION DATE: 9/25/95

Metals in soils
Results per dry weight basis

SOLID MATRIX ANALYSES

FIELD ID	Sb (mg/Kg)	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Ca (mg/Kg)	Cr (mg/Kg)	Co (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Pb (mg/Kg)	Mg (mg/Kg)	Mn (mg/Kg)	Hg (mg/Kg)	Ni (mg/Kg)	Ag (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
07-147-SE-1	5.4 UJ	5.77	46.1 J	1.4 J	2570	16.0	12.4	15.5 JX	23000	30.0	4860	492	0.043 U	14.7	0.8 U	102	NR
07-147-SE-2	6.3 UJ	35.8	57.8 J	2.3 J	2370.0	8.9	6.8	17.9 JX	20300	124	1980	365	0.050 U	6.7	8.0	228	NR
07-147-WR-1	5.9 UJ	184	78.2 J	3.1 J	947	5.2	4.3	28.4 JX	49800	723	1890	163	0.33	5.4	58.8	559	NR
07-147-WR-2	5.7 UJ	56.9	53.0 J	2.2 J	2460	11.7	5.0	25.9 JX	23900	194	1770	278	0.22	8.2	4.6	217	NR
BACKGROUND	4.7 UJ	9.6	87.6	1.32 JX	NR	27.2 J	9.05 J	10.6 J	21100	52.4 JX	NR	708 J	0.04	10.3	0.5 B	135	NR

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	Total Sulfur Acid Base t/1000t	Neutral Potent. t/1000t	Tot. Sulfur Acid Base Potential t/1000t	Sulfate Sulfur %	Pyritic Sulfur %	Organic Sulfur %	Pyritic Sulfur Acid Base t/1000t	Pyritic Sulfur Acid Base Potential t/1000t	Lime Req. Sobek (t/1000t)	Lime Req. Sobek (t/ac.) 1ft.	Potential Acidity	Lime Req. Dolihopf (t/1000t)	Lime Req. Dolihopf (t/ac.) 1ft.
07-147-WR-1	0.26	8.12	-3.88	-12.0	0.24	<0.01	0.02	0.00	-3.88	-3.88	-8.15	6.25	-12.66	-26.59
07-147-WR-2	0.10	3.12	1.37	-1.76	0.05	0.05	<0.01	1.56	-0.19	-0.19	-0.40	2.73	-1.71	-3.58

Metals in Water
Results in ug/l

WATER MATRIX ANALYSES

FIELD ID	Sb (ug/L)	As (ug/L)	Ba (ug/L)	Cd (ug/L)	Ca (ug/L)	Cr (ug/L)	Co (ug/L)	Cu (ug/L)	Fe (ug/L)	Pb (ug/L)	Mg (ug/L)	Mn (ug/L)	Hg (ug/L)	Ni (ug/L)	Ag (ug/L)	Zn (ug/L)	HARDNESS (mg CaCo3/L))
07-147-SW-1	2.7 U	1.8 U	24.2	7.5	22700	9.6 U	10.9 U	4.4 U	29.2	1.8 JX	7780	18.0 J	0.16 U	13.9 U	0.21 UJX	2450	88.8
07-147-SW-2	2.7 U	2.0	11.8	4.4	11700	9.6 U	10.9 U	4.4 U	32.8	2.2 JX	3800	5.2 UJ	0.16 U	13.9 U	0.45 JX	1150	44.8
CC-GW-7	45.9 U	2.3 U	12	3.1 U	14800	2.8 U	4.3 U	16.4	1290.0	11.7	4620	111	0.1 U	14.2 U	2.20 U	107	56.0

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Wet Chemistry
Results in mg/l

FIELD ID	Total Dissolved Solids	CHLORIDE	SULFATE	NO3/NO2-N	CYANIDE
07-147-SW-1	98	< 5	77	NR	NR
07-147-SW-2	46	< 5	36	NR	NR

Legend

SE-1- 20' below road.
SE-2- 175' below base of WR2 where stream reappears.
WR-1- Composite WR1A, 1B, 1C.
WR-2- Composite WR2A, 2B, 2C.
BACKGROUND- From the Ripple (07-163-SS1) (1994 data).
SW-1- Same as SE-1.
SW-2- Same as SE-2.
CC-GW-7- Adit discharge (GW1 on sketch)

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY

Mine/Site Name: Ontario
Legal Description: T 14N R 8E
Mining District: Neihart
Latitude: N 46° 57' 00"
Longitude: W 110° 41' 32"
Land Status: Private
Quad: Neihart
Inspectors: Tuesday, Flammang
Organization: Pioneer Technical Services, Inc.

County: Cascade
Section(s): NW 1/4, NE 1/4, Section 27
Mine Type: Hardrock/Ag, Pb, Zn
Primary Drainage: Belt Creek
USGS Code: 10030105
Secondary Drainage: Snow Creek/Carpenter Creek
Date Investigated: September 25, 1995
P.A. # 07-148

- No mill tailings were observed at the site during the investigation.

- The volume of waste rock observed at the site was approximately 975 cubic yards. The waste rock was adjacent to the adit discharge. The following elements were elevated at least three times background:

  Arsenic: 145 mg/kg
  Cadmium: 13J mg/kg
  Copper: 35.4JX mg/kg
  Lead: 347 mg/kg
  Manganese: 3,090 mg/kg
  Mercury: 0.15 mg/kg
  Zinc: 948 mg/kg

- One discharging adit was observed at the site which flowed adjacent to the waste rock. No MCLs or chronic aquatic life criteria were exceeded; however, the acute aquatic life criteria was exceeded for silver. The pH was 6.5.

- No surface water flowed on or near the site during the investigation. The nearest surface water was over 1,000 feet away; no surface water samples were collected.

- Potential safety hazards observed included a small shed and highwall at the caved adit.

Ontario PA# 07-148
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER-TUESDAY
INVESITIGATION DATE: 9/25/95

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	Sb (mg/Kg)	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Ca (mg/Kg)	Cr (mg/Kg)	Co (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Pb (mg/Kg)	Mg (mg/Kg)	Mn (mg/Kg)	Hg (mg/Kg)	Ni (mg/Kg)	Ag (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
07-148-WR-1	6.9 UJ	145	59.6 J	13.0 J	6380	19.1	25.5	35.4 JX	42100	347	2820	3090	0.15	52.9	1.2	948	NR
BACKGROUND	4.7 UJ	9.6	87.6	1.32 JX	NR	27.2 J	9.05 J	10.8 J	21100	52.4 JX	NR	708 J	0.04	10.3	0.5 B	135	NR

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	Total Sulfur Acid Base (t/1000t)	Neutral Potent. (t/1000t)	Tot. Sulfur Acid Base Potential (t/1000t)	Sulfate Sulfur %	Pyritic Sulfur %	Organic Sulfur %	Pyritic Sulfur Acid Base (t/1000t)	Pyritic Sulfur Acid Base Potential (t/1000t)	Lime Req. Sobek (t/1000t)	Lime Req. Sobek (ton.) 1R.	Potential Acidity	Lime Req. Dollhopf (t/1000t)	Lime Req. Dollhopf (ton.) 1R.
07-148-WR-1	0.49	15.3	14.0	-1.33	0.03	0.20	0.26	6.25	7.73	7.73	16.23	15.08	-1.35	-2.83

WATER MATRIX ANALYSES

Metals in Water
Results in ug/l

FIELD ID	Sb (ug/L)	As (ug/L)	Ba (ug/L)	Cd (ug/L)	Ca (ug/L)	Cr (ug/L)	Co (ug/L)	Cu (ug/L)	Fe (ug/L)	Pb (ug/L)	Mg (ug/L)	Mn (ug/L)	Hg (ug/L)	Ni (ug/L)	Ag (ug/L)	Zn (ug/L)	HARDNESS (mg CaCo3/L))
07-148-AD-1	2.7 U	1.8 U	7.0	0.10	8360	9.6 U	10.9 U	4.4 U	139	1.3 UX	2540	19.1 J	0.16 U	13.9 U	1.4 JX	7.6 U	31.3

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Wet Chemistry
Results in mg/l

FIELD ID	Total Dissolved Solids	CHLORIDE	SULFATE	NO3/NO2-N	CYANIDE
07-148-AD-1	12	< 5	< 5	NR	NR

Legend
WR-1- Composite WR1A and WR1B.
BACKGROUND- From the Ripple (07-163-SS1) (1994 data).
AD-1- Adit discharge above road and WR1.

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY

Mine/Site Name: Benton/Big Snowy
Legal Description: T 14N R 8E
Mining District: Neihart
Latitude: N 46° 56' 44"
Longitude: W 110° 42' 04"
Land Status: Private
Quad: Neihart
Inspectors: Tuesday, Flammang
Organization: Pioneer Technical Services, Inc.

County: Cascade
Section(s): SW 1/4, NW 1/4, Section 27
Mine Type: Hardrock/Pb, Ag, Au
Primary Drainage: Belt Creek
USGS Code: 10030105
Secondary Drainage: Snow Creek/Carpenter Creek
Date Investigated: September 25, 1995
P.A. # 07-151

- No mill tailings were observed at the site during the investigation.
- The volume of waste rock associated with the site was approximately 9,250 cubic yards. Waste rock was situated in a intermittent drainage. The following elements were elevated at least three times background:

Antimony: 22.1 to 28.9 mg/kg	Arsenic: 95.4 to 160 mg/kg
Cadmium: 22.6J mg/kg	Lead: 3,210 to 3,560 mg/kg
Copper: 65.6 to 169 mg/kg	Silver: 50.7 to 60.4 mg/kg
Mercury: 0.36 to 0.48 mg/kg	Zinc: 5,000J mg/kg

- There were no discharging adits, filled shafts, seeps, or springs observed at the site during the investigation.
- No surface water flowed on or near the site during the investigation. The nearest flowing surface water was over 1,000 feet away; no surface water samples were collected.
- Observed releases to the intermittent drainage (sediment) were documented for cadmium and zinc, which were directly attributable to the site.
- Potential safety hazards observed at the site included a small wood building and two unstable collapsed adit trenches.

Benton/ Big Snowy (2 sites) PA# 07-151
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER-TUESDAY
INVESITIGATION DATE: 9/25/95

Metals in soils
Results per dry weight basis

SOLID MATRIX ANALYSES

FIELD ID	Sb (mg/Kg)	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Ca (mg/Kg)	Cr (mg/Kg)	Co (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Pb (mg/Kg)	Mg (mg/Kg)	Mn (mg/Kg)	Hg (mg/Kg)	Ni (mg/Kg)	Ag (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
07-151-SE-1	9.8 J	99.6	68.9	12.4 J	2030	8.0	5.5	57.8	27600	1650	2680	833	0.14	5.9	28.3	2810 J	NR
07-151-SE-2	6.8 UJ	110	423	2.1 J	1450	14.7	4.9	136	26100	2090	3650	558	0.38	8.6	58.2	596 J	NR
07-151-WR-1	28.9 J	95.4	16.9	22.6 J	184	3.0	1.7 U	65.6	15300	3210	314	89	0.48	2.2 U	50.7	5000 J	NR
07-151-WR-3	22.1 J	160	69.1	1.7 J	2470	4.8	2.0 U	169	26700	3560	684	91.3	0.36	2.9	60.4	361 J	NR
BACKGROUND	4.7 UJ	9.6	87.6	1.32 JX	NR	27.2 J	9.05 J	10.8 J	21100	52.4 JX	NR	708 J	0.04	10.3	0.5 B	135	NR

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Request

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	Total Sulfur Acid Base t/1000t	Neutral Potent. t/1000t	Tot. Sulfur Acid Base Potential t/1000t	Sulfate Sulfur %	Pyritic Sulfur %	Organic Sulfur %	Pyritic Sulfur Acid Base t/1000t	Pyritic Sulfur Acid Base Potential t/1000t	Lime Req. Sobek (t/1000t)	Lime Req. Sobek (t/ac.) 1ft.	Potential Acidity	Lime Req. Dollhopf (t/1000t)	Lime Req. Dollhopf (t/ac.) 1ft.
07-151-WR-1	0.58	18.1	-1.53	-19.6	0.35	0.08	0.15	2.50	-4.03	-4.03	-8.46	15.39	-21.15	-44.42
07-151-WR-3	0.90	28.1	-21.92	-31.0	0.86	<0.01	0.04	0.00	-2.92	-2.92	-6.13	21.41	-54.16	-113.74

Legend

SE-1- Downstream of site, 50' below WR1.
SE-2- Upstream of site, 30' above WR3.
WR-1- Composite of WR1, 2A, 2B.
WR-3- Composite of WR3A, WR3B.
BACKGROUND- From the Ripple (07-163-SS1) (1994 data).

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY

Mine/Site Name: Lucky Strike
Legal Description: T 14N R 8E
Mining District: Neihart
Latitude: N 46° 56' 57"
Longitude: W 110° 42' 55"
Land Status: Private
Quad: Neihart
Inspectors: Tuesday, Flammang, Sampson
Organization: Pioneer Technical Services, Inc.

County: Cascade
Section(s): SE 1/4, NW 1/4, Section 28
Mine Type: Hardrock/Ag, Pb, Zn
Primary Drainage: Belt Creek
USGS Code: 10030105
Secondary Drainage: Snow Creek/Carpenter Creek
Date Investigated: September 24, 1995
P.A. # 07-169

- No mill tailings were observed at the site during the investigation.
- The volume of waste rock associated with the site was approximately 2,400 cubic yards. Waste rock was in the direct path of the adit discharge. The following elements were elevated at least three times background:

Antimony: 32.1J mg/kg	Arsenic: 61.6 mg/kg
Cadmium: 6.2J mg/kg	Copper: 224 mg/kg
Lead: 954 mg/kg	Manganese: 3,000 mg/kg
Mercury: 0.94 mg/kg	Silver: 59.1 mg/kg
Zinc: 1,200J mg/kg	

- One discharging adit was observed at the site which flowed over and along the waste rock. Acute and chronic aquatic life criteria were exceeded for copper and zinc, and no MCLs were exceeded. The pH was 7.98.
- No surface water flowed on or near the site during the investigation. The nearest surface water was over 1,000 feet away; no surface water samples were collected.
- Potential safety hazards observed at the site included one partially open adit, a metal shed, two loadouts, and three highwalls.

Lucky Strike PA# 07-169
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER-TUESDAY
INVESITIGATION DATE: 9/24/95

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	Sb (mg/Kg)	As (mg/Kg)	Be (mg/Kg)	Cd (mg/Kg)	Ca (mg/Kg)	Cr (mg/Kg)	Co (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Pb (mg/Kg)	Mg (mg/Kg)	Mn (mg/Kg)	Hg (mg/Kg)	Ni (mg/Kg)	Ag (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
07-169-WR-1	32.1 J	61.6	46.9	6.2 J	2230	11.5	11.2	224	37100	954	3070	3000	0.94	10.3	59.1	1200 J	NR
BACKGROUND	4.7 UJ	9.6	87.6	1.32 JX	NR	27.2 J	9.05 J	10.8 J	21100	52.4 JX	NR	708 J	0.04	10.3	0.5 B	135	NR

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	Total Sulfur Acid Base t/1000t	Neutral Potent. t/1000t	Tot. Sulfur Acid Base Potential t/1000t	Sulfate Sulfur %	Pyritic Sulfur %	Organic Sulfur %	Pyritic Sulfur Acid Base t/1000t	Pyritic Sulfur Acid Base Potential t/1000t	Lime Req. Sobek (t/1000t)	Lime Req. Sobek (lbs/) 1ft.	Potential Acidity	Lime Req. Dollhopf (t/1000t)	Lime Req. Dollhopf (lbs/) 1ft.
07-169-WR-1	0.55	17.2	2.83	-14.4	0.20	0.07	0.28	2.19	0.64	0.64	1.34	15.63	-15.99	-33.59
07-169-WR-1 DUP	0.55	17.2	3.23	-14.0	0.21	0.05	0.29	1.56	1.67	1.67	3.51	15.55	-15.40	-32.33

WATER MATRIX ANALYSES

Metals in Water
Results in ug/l

FIELD ID	Al (ug/L)	Sb (ug/L)	As (ug/L)	Be (ug/L)	Cd (ug/L)	Ca (ug/L)	Cr (ug/L)	Co (ug/L)	Cu (ug/L)	Fe (ug/L)	Pb (ug/L)	Mg (ug/L)	Mn (ug/L)	Hg (ug/L)	Ni (ug/L)	Ag (ug/L)	Zn (ug/L)	HARDNESS (mg CaCo3/L))
07-169-AD-1	172 JX	4.4 J	2.0	8.6	0.91	29900	10.7	10.9 U	21.3	665	6.8	10500	811	0.16 U	13.9 U	1.3	135	118

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Wet Chemistry
Results in mg/l

FIELD ID	Total Dissolved Solids	CHLORIDE	SULFATE	NO3/NO2-N	CYANIDE
07-169-AD-1	159	< 5	51	NR	NR

Legend

WR-1- Composite of WR1A, 1B, 2A, 2B, 3
BACKGROUND- From the Ripple (07-153-SS1) (1994 data).
AD-1- Adit at WR-2.

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY

Mine/Site Name: Lower Black Diamond Jay
Legal Description: T 14N R 8E
Mining District: Neihart
Latitude: N 46° 57' 18"
Longitude: W 110° 42' 00"
Land Status: Private
Quad: Neihart
Inspectors: Tuesday, Flammang, Liebelt
Organization: Pioneer Technical Services, Inc.

County: Cascade
Section(s): SW 1/4, SW 1/4, Section 22
Mine Type: Hardrock/Ag, Pb, Zn
Primary Drainage: Belt Creek
USGS Code: 10030105
Secondary Drainage: Snow Creek/Carpenter Creek
Date Investigated: September 27, 1995
P.A. # 07-174

- No mill tailings were observed at the site during the investigation.
- The volume of waste rock associated with the site was approximately 1,875 cubic yards. Waste rock was located in the drainage of an unnamed tributary of Snow Creek. The following elements were elevated at least three times background:

  Arsenic: 223 mg/kg
  Copper: 66.2 mg/kg
  Lead: 8,590 mg/kg
  Mercury: 0.47 mg/kg
  Silver: 12.9 mg/kg
  Zinc: 644J mg/kg

- One discharging adit was observed at the site which flowed into the waste rock dump. Field parameters were taken with a pH of 8.01.
- Surface water flowed from an unnamed tributary of Snow Creek along the base of the waste rock dump. The chronic aquatic life criteria was exceeded for lead, while the acute aquatic life criteria was exceeded for silver in the upstream sample. No MCLs were exceeded.
- An observed release of silver to the unnamed tributary of Snow Creek (sediment) was documented, which is directly attributable to the site.
- Potential safety hazards observed at the site included two buildings and an open shaft on the ridge above the site.

Lower Black Diamond Jay PA# 07-174
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER-TUESDAY
INVESITIGATION DATE: 9/27/95

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	Sb (mg/Kg)	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Ca (mg/Kg)	Cr (mg/Kg)	Co (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Pb (mg/Kg)	Mg (mg/Kg)	Mn (mg/Kg)	Hg (mg/Kg)	Ni (mg/Kg)	Ag (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
07-174-SE-1	8.9 J	59.5	119	17.3 J	1520	23.2	16.0	142	21900	1180	4400	3330	0.051	18.9	44.2	3510 J	NR
07-174-SE-2	10.9 J	120	65.1	10.1 J	2090	41.1	18.9	167	39600	970	9680	3290	0.052	23.1	8.8	1750 J	NR
07-174-WR-1	6.0 UJ	223	33.0	2.7 J	4630	11.9	2.8	66.2	51400	8590	7030	609	0.47	7.1	12.9	644 J	NR
BACKGROUND	4.7 UJ	9.6	87.6	1.32 JX	NR	27.2 J	9.05 J	10.8 J	21100	52.4 JX	NR	708 J	0.04	10.3	0.5 B	135	NR

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	Total Sulfur Acid Base (t/1000t)	Neutral Potent. (t/1000t)	Tot. Sulfur Acid Base Potential (t/1000t)	Sulfate Sulfur %	Pyritic Sulfur %	Organic Sulfur %	Pyritic Sulfur Acid Base (t/1000t)	Pyritic Sulfur Acid Base Potential (t/1000t)	Lime Req. Sobek (t/1000t)	Lime Req. Sobek (tons) 1S.	Potential Acidity	Lime Req. Dolihopf (t/1000t)	Lime Req. Dolihopf (tons) 1S.
07-174-WR-1	1.63	50.9	-0.66	-51.6	1.39	0.06	0.18	1.87	-2.54	-2.54	-5.33	40.08	-50.93	-106.95

WATER MATRIX ANALYSES

Metals in Water
Results in ug/l

FIELD ID	Sb (ug/L)	As (ug/L)	Ba (ug/L)	Cd (ug/L)	Ca (ug/L)	Cr (ug/L)	Co (ug/L)	Cu (ug/L)	Fe (ug/L)	Pb (ug/L)	Mg (ug/L)	Mn (ug/L)	Hg (ug/L)	Ni (ug/L)	Ag (ug/L)	Zn (ug/L)	HARDNESS (mg CaCo3/L))
07-174-SW-1	2.7 U	1.8 U	4.8 U	0.35	7230	9.6 U	10.9 U	4.4 U	43.8	1.3 UX	1830	5.2 UJ	0.16 U	13.9 U	0.21 UJX	7.6 U	25.6
07-174-SW-2	2.7 U	1.8 U	12.8	0.23	6720	9.6 U	10.9 U	4.4 U	117	2.4 JX	2030	8.4 J	0.16 U	13.9 U	3.0 JX	32.8	25.1

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Wet Chemistry
Results in mg/l

FIELD ID	Total Dissolved Solids	CHLORIDE	SULFATE	NO3/NO2-N	CYANIDE
07-174-SW-1	<5.00	< 5	7	NR	NR
07-174-SW-2	10	< 5	14	NR	NR

Legend

SE-1- Downstream of site, 40' below collapsed mill structure.
SE-2- Upstream from site, 50' above WR1.
WR-1- Composite WR1A, WR1B, WR1C.
BACKGROUND- From the Ripple (07-163-SS1) (1994 data).
SW-1- Same as SE-1.
SW-2- Same as SE-2.

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY

Mine/Site Name: Haystack Creek
Legal Description: T 14N R 8E
Mining District: Neihart
Latitude: N 46° 58' 42"
Longitude: W 110° 43' 11"
Land Status: Public
Quad: Neihart
Inspectors: Tuesday, Flammang, Sampson
Organization: Pioneer Technical Services, Inc.

County: Cascade
Section(s): SW 1/4, NW 1/4, Section 16
Mine Type: Hardrock/Ag, Pb, Zn
Primary Drainage: Belt Creek
USGS Code: 10030105
Secondary Drainage: Haystack Creek/Carpenter Creek
Date Investigated: September 23, 1995
P.A. # 07-179

- No mill tailings were observed at the site during the investigation.

- The volume of waste rock associated with the site was approximately 5,850 cubic yards. All three waste rock piles were adjacent to Haystack Creek. The following elements were elevated at least three times background:
  Arsenic: 45.4J mg/kg
  Cadmium: 4.7 to 4.9 mg/kg
  Copper: 98.6 to 261 mg/kg
  Lead: 589JX to 2,800JX mg/kg
  Mercury: 0.40 to 0.73 mg/kg
  Silver: 3.5 mg/kg
  Zinc: 1,010 to 1,250 mg/kg

- Two discharging adits were observed at the site. AD-2 (located at the upper portion of the site) discharged along the road. Field parameters were taken for AD-2 with a pH of 5.59. At AD-1, acute and chronic aquatic life criteria were exceeded for aluminum, cadmium, copper, and zinc. Chronic aquatic life criteria were exceeded for iron and lead, and the MCL was exceeded for cadmium. The pH for AD-1 was 3.16.

- Surface water samples taken from Haystack Creek had chronic and acute aquatic life criteria exceedences for copper and zinc. Chronic aquatic life criteria were exceeded for aluminum, cadmium, iron, and lead. No MCLs were exceeded.

- Observed releases in Haystack Creek (sediment) were documented for cadmium, lead, and zinc, and in water for cadmium, lead, zinc, and arsenic.

- Potential safety hazards observed at the site included an open adit at the upper site, two small unstable slopes associated with collapsed AD-1 and AD-2, and steep slopes on WR-2.

Haystack Creek PA# 07-179
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER-TUESDAY
INVESITIGATION DATE: 9/23/95

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	Sb (mg/Kg)	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Ca (mg/Kg)	Cr (mg/Kg)	Co (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Pb (mg/Kg)	Mg (mg/Kg)	Mn (mg/Kg)	Hg (mg/Kg)	Ni (mg/Kg)	Ag (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
07-179-SE-1	6.9 UJ	5.8 UJ	124	10.0	2560	5.4	58.6	168	25100	674 JX	5980 J	2700	0.081	16.2	1.1 U	896	NR
07-179-SE-2	5.9 UJ	5.0 UJ	123	0.85	1440	13.5	17.4	59.5	15900	81.1 JX	3560 J	940	0.042 U	13.1	1.0 U	213	NR
07-179-SE-3	5.7 UJ	9.4 J	142	4.4	2300	10.8	18.7	158	27900	310 JX	4180 J	859	0.050	11.1	0.75 U	870	NR
07-179-SE-4	5.7 UJ	6.5 J	144	2.5	1680	16.5	23.3	115	26700	175 JX	4370 J	1150	0.043 U	18.1	0.78 U	278	NR
07-179-WR-1	5.1 UJ	4.3 UJ	15.6	4.7	654	1.6 U	1.8 U	17.6	3820	1680 JX	935 J	15.3	0.73	2.6	1.3	1010	NR
07-179-WR-2	9.6 J	45.4 J	83.4	4.9	2260	3.7	3.3	98.6	27600	2800 JX	6420 J	148	0.40	7.0	3.5	1250	NR
07-179-WR-3	6.2 UJ	25.9 J	204	1.5	2320	11.3	9.9	261	43900	589 JX	9800 J	423	0.53	6.7	1.4	328	NR
BACKGROUND	4.7 UJ	9.6	87.6	1.32 JX	NR	27.2 J	9.05 J	10.8 J	21100	52.4 JX	NR	708 J	0.04	10.3	0.5 B	135	NR

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	Total Sulfur Acid Base (t/1000t)	Neutral Potent. (t/1000t)	Tot. Sulfur Acid Base Potential (t/1000t)	Sulfate Sulfur %	Pyritic Sulfur %	Organic Sulfur %	Pyritic Sulfur Acid Base (t/1000t)	Pyritic Sulfur Acid Base Potential (t/1000t)	Lime Req. Sobek (t/1000t)	Lime Req. Sobek (t/ac.) 1ft.	Potential Acidity	Lime Req. Dolthopf (t/1000t)	Lime Req. Dolthopf (t/ac.) 1ft.
07-179-WR-1	0.12	3.75	-0.07	-3.82	0.07	0.03	0.02	0.94	-1.01	-1.01	-2.12	3.20	-4.09	-8.59
07-179-WR-2	0.34	10.6	3.95	-6.67	0.20	0.06	0.08	1.87	2.08	2.08	4.37	9.06	-6.39	-13.42
07-179-WR-2 DUP	0.35	10.9	4.05	-6.89	0.19	0.07	0.09	2.19	1.86	1.86	3.91	9.45	-6.75	-14.18
07-179-WR-3	0.47	14.7	-0.24	-14.9	0.32	0.06	0.09	1.87	-2.12	-2.12	-4.45	12.19	-15.54	-32.62

WATER MATRIX ANALYSES

Metals in Water
Results in ug/l

FIELD ID	Al (ug/L)	Sb (ug/L)	As (ug/L)	Ba (ug/L)	Cd (ug/L)	Ca (ug/L)	Cr (ug/L)	Co (ug/L)	Cu (ug/L)	Fe (ug/L)	Pb (ug/L)	Mg (ug/L)	Mn (ug/L)	Hg (ug/L)	Ni (ug/L)	Ag (ug/L)	Zn (ug/L)	HARDNESS (mg CaCo3/L))
07-179-SW-1	94.4 JX	2.7 UJ	1.2 U	10.0	1.6	16500	9.6 U	10.9 U	6.6	313	4.2	2690	129	0.16 U	13.9 U	0.23	329	52.2
07-179-SW-2	78.4 JX	2.7 UJ	1.2 U	10.6	0.21	15200	9.6 U	10.9 U	7.0	319	0.61	2650	77.7	0.16 U	13.9 U	0.26	60.8	48.9
07-179-SW-3	249 JX	2.7 UJ	1.2 U	13.7	0.27	11100	9.6 U	10.9 U	14.0	1650	2.4	2390	126	0.16 U	13.9 U	0.29	77.4	37.5
07-179-SW-4	59.1 JX	2.7 UJ	1.2 U	10.7	0.20	10100	9.6 U	10.9 U	5.9	138	3.6	2210	23.6	0.16 U	13.9 U	0.21 U	49.9	34.2
07-179-AD-1	1710 JX	2.7 UJ	1.2 U	12.3	30.3	48100	9.6 U	29.5	68.9	4070	119	4720	1110	0.16 U	28.1	0.21 U	4980	140

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Wet Chemistry
Results in mg/l

FIELD ID	Total Dissolved Solids	CHLORIDE	SULFATE	NO3/NO2-N	CYANIDE
07-179-SW-1	124	< 5	43	NR	NR
07-179-SW-2	117	< 5	36	NR	NR
07-179-SW-3	109	< 5	39	NR	NR
07-179-SW-4	216	< 5	29	NR	NR
07-179-AD-1	338	< 5	181	NR	NR

Legend

SE-1- 80 feet downstream of WR-1.
SE-2- 40 feet upstream of WR-2.
SE-3- 30' downstream of WR-3.
SE-4- 20' upstream of open adit above WR-3.
WR-1- Composite WR1A, WR1B.
WR-2- Composite WR2A, WR2B.
WR-3- Composite WR3A, WR3B.
BACKGROUND- From the Ripple (07-183-SS1) (1994 data).
AD-1- Lower collapsed adit at lower site.
SW-1- Same as SE-1.
SW-2- Same as SE-2.
SW-3- Same as SE-3.
SW4- Same as SE-4.

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY

Mine/Site Name: Combination II
Legal Description: T 8N R 14W
Mining District: Combination
Latitude: N 46° 28' 00"
Longitude: W 113° 23' 30"
Land Status: Public
Quad: Black Pine Ridge
Inspectors: Tuesday, Flammang
Organization: Pioneer Technical Services, Inc.

County: Granite
Section(s): E 1/2, Section 6; E 1/2, Section 7
Mine Type: Millsite/Au
Primary Drainage: Flint Creek
USGS Code: 17010202
Secondary Drainage: South Fork Lower Willow Creek
Date Investigated: October 19, 1995
P.A. # 20-009A

- The site is the downstream extension of the Combination Millsite (P.A. # 20-009) investigated in 1993.

- The volume of tailings associated with the site was approximately 80,250 cubic yards. All of the tailings were located in the drainage of South Fork Lower Willow Creek. The following elements were elevated at least three times background:
  Antimony: 229JX to 485JX mg/kg
  Arsenic: 652JX to 1,490JX mg/kg
  Cadmium: 15.9J to 39.5J mg/kg
  Copper: 1,919JX to 5,020JX mg/kg
  Lead: 3,910JX to 9,000JX mg/kg
  Mercury: 70.5 to 282 mg/kg
  Zinc: 220J to 353J mg/kg

- No waste rock was observed at the site during the investigation.

- There were no discharging adits, filled shafts, seeps, or springs observed at the site during the investigation.

- Surface water from South Fork Lower Willow Creek flowed through the site. Acute and chronic aquatic life criteria were exceeded for copper and zinc. Chronic aquatic life criteria were exceeded for mercury and lead. Acute aquatic life criteria was exceeded for silver, and the MCL for antimony was exceeded.

- Observed releases to South Fork Lower Willow Creek (sediment) were documented for antimony, mercury, and zinc, and observed releases to water were documented for antimony and zinc.

- No potential safety hazards were observed during the investigation.

Combination II Tailings PA# 20-009
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER-TUESDAY
INVESITIGATION DATE: 10/19/95

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	Sb (mg/Kg)	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Ca (mg/Kg)	Cr (mg/Kg)	Co (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Pb (mg/Kg)	Mg (mg/Kg)	Mn (mg/Kg)	Hg (mg/Kg)	Ni (mg/Kg)	Ag (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
20-009-SE-1	98.1 JX	266 JX	516 J	16.6 J	2320	13.8 J	19.0	1270 JX	17200 JX	1600 JX	3210	784 JX	46.7	14.5	26.3 JX	522 J	NR
20-009-SE-2	64.5 JX	258 JX	340 J	9.1 J	1520	7.7 J	15.1	1060 JX	13600 JX	1550 JX	1700	1070 JX	24.7	5.4	23.2 JX	268 J	NR
20-009-SE-3	79.3 JX	223 JX	460 J	12.1 J	2150	8.6 J	15.0	1220 JX	15800 JX	1450 JX	2870	707 JX	43.0	18.3	18.8 JX	394 J	NR
20-009-SE-4	26.7 JX	117 JX	361 J	5.6 J	1950	8.8 J	8.7	582 JX	11800 JX	769 JX	2190	639 JX	14.3	8.1	9.7 JX	157 J	NR
20-009-TP2	229 JX	652 JX	320 J	15.9 J	132	2.2 J	3.2	1910 JX	10700 JX	3910 JX	267	357 JX	122	2.3 U	65.0 JX	353 J	0.666
20-009-TP3	447 JX	1230 JX	400 J	36.4 J	123	2.3 UJ	2.6 U	4400 JX	12500 JX	7620 JX	40.5	91.5 JX	70.5	3.3 U	110 JX	220 J	1.49
20-009-TP4	485 JX	1490 JX	716 J	39.5 J	353	2.4 UJ	2.7 U	5020 JX	14700 JX	9000 JX	189	181 JX	282	3.5 U	108 JX	317 J	0.313
BACKGROUND	33.3	76.3	329	2	NR	6.06	6.18	116	11700	85.8	NR	1530 J	1.33 J	6.77	NR	47.4	NR

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	Total Sulfur Acid Base t/1000t	Neutral Potent. t/1000t	Tot. Sulfur Acid Base Potential t/1000t	Sulfate Sulfur %	Pyritic Sulfur %	Organic Sulfur %	Pyritic Sulfur Acid Base t/1000t	Pyritic Sulfur Acid Base Potential t/1000t	Lime Req. Sobek (t/1000t)	Lime Req. Sobek (lbs.) 1ft.	Potential Acidity	Lime Req. Dollhopf (t/1000t)	Lime Req. Dollhopf (lbs.) 1ft.
20-009-TP2	0.06	1.87	0.8	-1.07	0.04	0.01	0.01	0.31	0.49	0.49	1.03	1.56	-0.95	-2.00
20-009-TP3	0.16	5	1.07	-3.93	0.15	<0.01	0.01	0	1.07	1.07	2.25	3.83	-3.45	-7.24
20-009-TP4	0.09	2.81	1.05	-1.77	0.08	<0.01	0.01	0	1.05	1.05	2.20	2.19	-1.42	-2.99

WATER MATRIX ANALYSES

Metals in Water
Results in ug/l

FIELD ID	Sb (ug/L)	As (ug/L)	Ba (ug/L)	Cd (ug/L)	Ca (ug/L)	Cr (ug/L)	Co (ug/L)	Cu (ug/L)	Fe (ug/L)	Pb (ug/L)	Mg (ug/L)	Mn (ug/L)	Hg (ug/L)	Ni (ug/L)	Ag (ug/L)	Zn (ug/L)	HARDNESS (mg CaCo3/L))
20-009-SW-1	9.3	2.7	61.5	0.20	3240	8.7 U	8.3 U	23.6 J	84.0 J	2.7	1940	15.7 J	0.48 JX	16.9 U	0.52 JX	26.1	16.1
20-009-SW-2	8.8	2.5	54.4	0.16	3010	8.7 U	8.3 U	25.0 J	172 J	4.0	1820	16.8 J	0.50 JX	16.9 U	0.21 UJX	29.4	15.0
20-009-SW-3	5.8	1.8	53.5	0.16	3100	8.7 U	8.3 U	24.0 J	153 J	3.0	1810	17.9 J	0.46 JX	16.9 U	0.57 JX	22.8	15.2
20-009-SW-4	2.4	1.5 U	63.5	0.068	3370	8.7 U	8.3 U	16.5 J	160 J	1.0	1760	17.9 J	0.22 JX	16.9 U	0.48 JX	9.1 U	15.7

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Wet Chemistry
Results in mg/l

FIELD ID	Total Dissolved Solids	CHLORIDE	SULFATE	NO3/NO2-N	CYANIDE
20-009-SW-1	46	< 5	10	NR	NR
20-009-SW-2	38	< 5	< 5	NR	NR
20-009-SW-3	40	< 5	11	NR	NR
20-009-SW-4	35	< 5	5	NR	NR

Legend

SE-1- 2 miles downstream of Combination Mill in South Fork Lower Willow Creek at USFS/private boundary.
SE-2- Below Hg-amalgam mill in South Fork Lower Willow Creek; 8000 feet downstream from Combination Mill.
SE-3- Above Hg-amalgam mill in South Fork Lower Willow Creek, 5500 feet downstream from Combination Mill.
SE-4- Just below Combination Mill in South Fork Lower Willow Creek.
TP2- Composite of TP2A,2B, 2C, 2D, 2E, 2F.
TP3- Composite of TP3A, 3B, 3C, 3D.
TP4- TP4B.
BACKGROUND- Taken from Combination Mill (20-009-SS1) (1993 data).
SW-1- Same as SE-1.
SW-2-Same as SE-2.
SW-3- Same as SE-3.
SW-4- Same as SE-4.

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY

Mine/Site Name: Sunrise/Queen Millsite
Legal Description: T 8N R 14W
Mining District: Combination
Latitude: N 46° 29' 03"
Longitude: W 113° 20' 05"
Land Status: Private
Quad: Henderson Mountain
Inspectors: Tuesday, Flammang
Organization: Pioneer Technical Services, Inc.

County: Granite
Section(s): NE 1/4, NE 1/4, Section 3
Mine Type: Millsite/Au
Primary Drainage: Flint Creek
USGS Code: 17010202
Secondary Drainage: Henderson Creek
Date Investigated: October 16, 1995
P.A. # 20-036

- The volume of tailings associated with the site was approximately 1,550 cubic yards. Most of the tailings have washed out of the impoundment with approximately 95% of the remaining tailings covered with ponded water in Henderson Creek. The following elements were elevated at least three times background:
  Arsenic: 866J to 1,230J mg/kg
  Copper: 374J to 450J mg/kg
  Iron: 42,400 to 50,300 mg/kg
  Mercury: 4.3J to 5.9J mg/kg
- The mine site and waste rock dumps were not investigated during the investigation; the dumps were up the hillside and well away from water.
- There were no adit discharges, filled shafts, seeps, or springs investigated during the investigation.
- Surface water from Henderson Creek flowed through the tailings. Chronic aquatic life criteria was exceeded for mercury. No acute aquatic life criteria or MCLs were exceeded.
- Observed releases to Henderson Creek (sediment) was documented for arsenic, copper, and iron; arsenic and iron were observed releases to water.
- Potential safety hazards observed at the site included a collapsing bunkhouse.

Sunrise/ Queen Millsite PA# 20-036
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER-TUESDAY
INVESITIGATION DATE: 10/16/95

Metals in soils
Results per dry weight basis

SOLID MATRIX ANALYSES

FIELD ID	Sb (mg/Kg)	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Ca (mg/Kg)	Cr (mg/Kg)	Co (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Pb (mg/Kg)	Mg (mg/Kg)	Mn (mg/Kg)	Hg (mg/Kg)	Ni (mg/Kg)	Ag (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
20-036-SE-1	6.8 UJX	381 J	193	1.2	3100	4.8 J	6.0 J	77.8 J	28500	9.3 UJ	3550	1710	0.19 J	3.1 UJX	1.0 U	21.7	NR
20-036-SE-2	5.5 UJX	15.2 J	91.5	0.59 U	2160	4.6 J	3.3 J	14.4 J	7280	9.1 J	1090	326	0.067 J	3.0 JX	0.78 U	23.4	NR
20-036-TP1	10.6 JX	1230 J	40.2	2.8	480	1.3 UJ	1.5 UJ	374 J	50300	38.8 J	115	15.4	5.9 J	1.9 UJX	16.5	10.4	0.374
20-036-TP2	6.4 UJX	866 J	89.4	2.8	1060	2.4 J	2.2 UJ	450 J	42400	28.1 J	777	77.7	4.3 J	3.8 JX	9.9	15.9	0.853
BACKGROUND	33.3	76.3	329	2	NR	6.06	6.18	116	11700	85.8	NR	1530 J	1.33 J	6.77	NR	47.4	NR

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	Total Sulfur Acid Base t/1000t	Neutral Potent. t/1000t	Tot. Sulfur Acid Base Potential t/1000t	Sulfate Sulfur %	Pyritic Sulfur %	Organic Sulfur %	Pyritic Sulfur Acid Base t/1000t	Pyritic Sulfur Acid Base Potential t/1000t	Lime Req. Sobek (t/1000t)	Lime Req. Sobek (t/ac.) 1ft.	Potential Acidity	Lime Req. Dollhopf (t/1000t)	Lime Req. Dollhopf (t/ac.) 1ft.
20-036-TP-1	0.29	9.06	-0.94	-10	0.28	0.01	<0.01	0.31	-1.25	-1.25	-2.63	6.88	-9.77	-20.52
20-036-TP-2	0.33	10.3	3.04	-7.27	0.32	<0.01	0.01	0	3.04	3.04	6.38	7.81	-5.97	-12.53

Metals in Water
Results in ug/l

WATER MATRIX ANALYSES

FIELD ID	Sb (ug/L)	As (ug/L)	Ba (ug/L)	Cd (ug/L)	Ca (ug/L)	Cr (ug/L)	Co (ug/L)	Cu (ug/L)	Fe (ug/L)	Pb (ug/L)	Mg (ug/L)	Mn (ug/L)	Hg (ug/L)	Ni (ug/L)	Ag (ug/L)	Zn (ug/L)	HARDNESS (mg CaCo3/L))
20-036-SW-1	4.6	87.9	106	0.046 U	36400	8.7 U	8.3 U	7.3 J	1540 J	0.93	7270	119 J	0.14 UJX	16.9 U	0.37 JX	9.1 U	121
20-036-SW-2	4.6	16.6	113	0.046 U	33900	8.7 U	8.3 U	3.4 J	286 J	0.95	6570	167 J	0.20 JX	16.9 U	0.46 JX	9.1 U	112

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Wet Chemistry
Results in mg/l

FIELD ID	Total Dissolved Solids	CHLORIDE	SULFATE	NO3/NO2-N	CYANIDE
20-036-SW-1	208	7	22.0	NR	NR
20-036-SW-2	174	< 5	16	NR	NR

Legend

SE-1- Downstream of site in Henderson Creek.
SE-2- Upstream of site in Henderson Creek.
TP1- Composite of TP1A, 1B.
TP2- Composite of TP2A, 2B, 3A, 3B.
BACKGROUND- Taken from the Combination Mill (20-009-SS1) (1993 data).
SW-1- Same as SE-1.
SW-2- Same as SE-2.

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY

Mine/Site Name: Douglas Creek Waste Rock
Legal Description: T 7N R 13W
Mining District: Philipsburg
Latitude: N 46° 18' 50"
Longitude: W 113° 16' 15"
Land Status: Private
Quad: Philipsburg
Inspectors: Tuesday, Flammang, Bisch
Organization: Pioneer Technical Services, Inc.

County: Granite
Section(s): SE 1/4, SW 1/4, Section 31
Mine Type: Hardrock/Au, Ag
Primary Drainage: Flint Creek
USGS Code: 17010202
Secondary Drainage: Douglas Creek
Date Investigated: October 19, 1995
P.A. # 20-503

- No mill tailings were observed at the site during the investigation.
- The volume of waste rock associated with the site was approximately 76,000 cubic yards. Waste rock was located adjacent to Douglas Creek and the diverted adit discharge. The following elements were elevated at least three times background:
  Arsenic: 1,450JX mg/kg Lead: 116JX mg/kg
  Mercury: 2.5 mg/kg
- One discharging adit was observed at the site which flowed around the waste rock. Acute and chronic aquatic life criteria were exceeded for zinc. Chronic aquatic life criteria was exceeded for iron and mercury. No MCLs were exceeded. The pH was 6.5.
- Surface water from Douglas Creek flowed near the waste rock. Acute and chronic aquatic life criteria were exceeded for zinc. Chronic aquatic life criteria was exceeded for mercury, and the MCL for antimony was exceeded.
- Potential safety hazards observed at the site included an open adit, a collapsing cabin, a loadout, and a highwall above a pit.

Douglas Creek Waste Rock PA# 20-503
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER-TUESDAY
INVESITIGATION DATE: 10/19/95

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	Sb (mg/Kg)	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Ca (mg/Kg)	Cr (mg/Kg)	Co (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Pb (mg/Kg)	Mg (mg/Kg)	Mn (mg/Kg)	Hg (mg/Kg)	Ni (mg/Kg)	Ag (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
20-503-SE-1	45.3 JX	1770 JX	169 J	3.5 J	1130	2.1 UJ	4.0	62.8 JX	13300 JX	331 JX	1140	5610 JX	2.3	3.1 U	48.1 JX	661 J	NR
20-503-SE-2	28.1 JX	1910 JX	160 J	3.3 J	1260	2.1 J	4.9	65.4 JX	11200 JX	313 JX	1690	5800 JX	4.1	2.9 U	71.5 JX	672 J	NR
20-503-WR-1	5.9 JX	1450 JX	152 J	1.2 J	1700	1.8 UJ	2.9	18.4 JX	16900 JX	116 JX	1150	258 JX	2.5	2.7 U	27.2 JX	57.8 J	NR
BACKGROUND	4 UJ	25 J	286	0.5 U	NR	4.6	9.8	9	13900	9	NR	1230	0.161 JX	11	NR	41	NR

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	Total Sulfur Acid Base (t/1000t)	Neutral Potent. (t/1000t)	Tot. Sulfur Acid Base Potential (t/1000t)	Sulfate Sulfur %	Pyritic Sulfur %	Organic Sulfur %	Pyritic Sulfur Acid Base (t/1000t)	Pyritic Sulfur Acid Base Potential (t/1000t)	Lime Req. Sobek (t/1000t)	Lime Req. Sobek (Mac.) 1ft.	Potential Acidity	Lime Req. Dolihopf (t/1000t)	Lime Req. Dolihopf (Mac.) 1ft.
20-503-WR-1	0.37	11.6	2.16	-9.4	0.3	<0.01	0.07	0	2.16	2.16	4.54	9.22	-8.82	-18.53
20-503-WR-1 (dup)	0.37	11.6	1.96	-9.6	0.29	0.02	0.08	0.62	1.34	1.34	2.81	9.30	-9.17	-19.26

WATER MATRIX ANALYSES

Metals in Water
Results in ug/l

FIELD ID	Sb (ug/L)	As (ug/L)	Ba (ug/L)	Cd (ug/L)	Ca (ug/L)	Cr (ug/L)	Co (ug/L)	Cu (ug/L)	Fe (ug/L)	Pb (ug/L)	Mg (ug/L)	Mn (ug/L)	Hg (ug/L)	Ni (ug/L)	Ag (ug/L)	Zn (ug/L)	HARDNESS (mg CaCo3/L))
20-503-SW-1	6.9	101	19.0	1.6	61000	8.7 U	8.3 U	5.8 J	886 J	1.5	11700	9180 J	0.14 UJX	16.9 U	1.9 JX	1550	200
20-503-SW-2	8.1	128	22.7	0.25	15500	8.7 U	8.3 U	4.7 J	294 J	1.4	3320	1700 J	0.17 JX	16.9 U	0.21 UJX	417	52.3
20-503-AD-1	4.6	188	12.4	3.5	131000	8.7 U	9.1	12.1 J	3830 J	1.5	24200	21700 J	0.22 JX	16.9 U	4.2 JX	3330	426

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Wet Chemistry
Results in mg/l

FIELD ID	Total Dissolved Solids	CHLORIDE	SULFATE	NO3/NO2-N	CYANIDE
20-503-SW-1	326	< 5	190	NR	NR
20-503-SW-2	102	< 5	43.0	NR	NR
20-503-AD-1	691	< 5	451	NR	NR

Legend

SE-1- Downstream of site in Douglas Creek.
SE-2- Upstream of site in Douglas Creek.
WR-1- Composite of WR1A, 1B, 1C, 1D.
BACKGROUND- Taken from Granite Mtn Mine (20-110-SS1) (1993 data).
AD-1- Adit discharge above WR1.
SW-1- Same as SE-1.
SW-2- Same as SE-2.

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY

Mine/Site Name: Port Royal Mill Tailings
Legal Description: T 8N R 12W
Mining District: Princeton
Latitude: N 46° 22' 00"
Longitude: W 113° 07' 00"
Land Status: Public
Quad: Maxville/Pikes Peak
Inspectors: Tuesday, Flammang, Bisch
Organization: Pioneer Technical Services, Inc.

County: Granite
Section(s): NE 1/4, Section 32; NW 1/4, NW 1/4, Section 33
Mine Type: Tailings/Au
Primary Drainage: Flint Creek
USGS Code: 17010202
Secondary Drainage: Royal Gold Creek/Boulder Creek
Date Investigated: October 17, 1995
P.A. # 20-016

- The volume of mill tailings observed at the site was approximately 3,875 cubic yards. The tailings were mostly revegetated. The following elements were elevated at least three times background:
  Antimony: 16.8JX mg/kg
  Arsenic: 54J to 63.6J mg/kg
  Cadmium: 3.8 mg/kg
  Copper: 429J to 924J
  Lead: 1,290J to 2,050J
  Mercury: 1.3J to 11.6J mg/kg
  Zinc: 786 to 1,480 mg/kg
- No waste rock dumps were observed at the site during the investigation.
- No discharging adits, filled shafts, seeps, or springs were observed at the site during the investigation.
- Royal Gold Creek flowed through the tailings. The acute and chronic aquatic life criteria were exceeded for copper. The chronic aquatic life criteria was exceeded for mercury and lead, while the acute aquatic life criteria was exceeded for silver. No MCLs were exceeded.
- An observed release in Royal Gold Creek (sediment) of arsenic, cadmium, copper, mercury, and zinc was attributable to the site.
- No potential safety hazards were observed at the site during the investigation.

Port Royal Mill Tailings PA# 20-016
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER-TUESDAY
INVESITIGATION DATE: 10/17/95

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	Sb (mg/Kg)	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Ca (mg/Kg)	Cr (mg/Kg)	Co (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Pb (mg/Kg)	Mg (mg/Kg)	Mn (mg/Kg)	Hg (mg/Kg)	Ni (mg/Kg)	Ag (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
20-016-SE-1	8.8 JX	6.9 UJ	49.3	1.9	1100	2.5 UJ	2.9 UJ	51.2 J	8400	369 J	1530	841	0.17 J	3.7 UJX	1.2 U	275	NR
20-016-SE-2	7.4 JX	8.8 JX	45.5 J	2.0 J	938	2.2 UJ	2.5 U	32.8 JX	4210 JX	143 JX	812	1300 JX	0.084	3.1 U	1.9 JX	652 J	NR
20-016-SE-3	15.2 UJX	31.8 JX	84.5 J	5.8 J	5330	4.7 UJ	6.9	206 JX	13400 JX	817 JX	2170	910 JX	1.6	6.8 U	7.5 JX	1000 J	NR
20-016-TP1	16.8 JX	63.6 J	78.2	3.8	905	2.6 UJ	3.0 UJ	924 J	11800	2050 J	580	255	11.6 J	3.8 UJX	17.8	1480	1.08
20-016-TP2	12.7 JX	54.0 J	80.4	2.4	701	1.8 UJ	2.0 UJ	429 J	9810	1290 J	644	1070	1.3 J	2.6 UJX	4.1	786	<0.282
BACKGROUND	5 U	17 JX	122	0.8 J	NR	34.2 J	10.4 J	34.6	23500 J	38 J	NR	1040 J	0.06 J	36 J	NR	106 J	NR

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	Total Sulfur Acid Base t/1000t	Neutral Potent. t/1000t	Tot. Sulfur Acid Base Potential t/1000t	Sulfate Sulfur %	Pyritic Sulfur %	Organic Sulfur %	Pyritic Sulfur Acid Base t/1000t	Pyritic Sulfur Acid Base Potential t/1000t	Lime Req. Sobek (t/1000t)	Lime Req. Sobek (lbs.) 1ft.	Potential Acidity	Lime Req. Dollhopf (t/1000t)	Lime Req. Dollhopf (lbs.) 1ft.
20-016-TP1	0.02	0.62	2.63	2.01	0.02	<0.01	<0.01	0	2.63	2.63	5.52	0.47	2.70	5.67
20-016-TP2	0.01	0.31	3.14	2.82	0.01	<0.01	<0.01	0	3.14	3.14	6.59	0.23	3.63	7.63

WATER MATRIX ANALYSES

Metals in Water
Results in ug/l

FIELD ID	Sb (ug/L)	As (ug/L)	Ba (ug/L)	Cd (ug/L)	Ca (ug/L)	Cr (ug/L)	Co (ug/L)	Cu (ug/L)	Fe (ug/L)	Pb (ug/L)	Mg (ug/L)	Mn (ug/L)	Hg (ug/L)	Ni (ug/L)	Ag (ug/L)	Zn (ug/L)	HARDNESS (mg CaCo3/L))
20-016-SW-1	1.9	1.5 U	3.2	0.046 U	7250	8.7 U	8.3 U	5.0 J	34.4 J	1.4	585	4.5 J	0.17 JX	16.9 U	0.34 JX	16.0	20.5
20-016-SW-2	1.9 U	1.5 U	4.5	0.046 U	7270	8.7 U	8.3 U	6.5 J	176 J	2.9	584	32.5 J	0.22 JX	16.9 U	0.25 JX	12.6	20.6
20-016-SW-3	1.9 U	1.5 U	4.2	0.046 U	7860	8.7 U	8.3 U	5.9 J	130 J	2.3	638	7.9 J	0.20 JX	16.9 U	0.53 JX	15.9	22.3

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Wet Chemistry
Results in mg/l

FIELD ID	Total Dissolved Solids	CHLORIDE	SULFATE	NO3/NO2-N	CYANIDE
20-016-SW-1	28	< 5	5	NR	NR
20-016-SW-2	32	< 5	6	NR	NR
20-016-SW-3	41	< 5	6	NR	NR

Legend

SE-1- Upstream of tailings in Royal Gold Creek.
SE-2- Just below tailings/wetlands deposit in Royal Gold Creek.
SE-3- Above Nonpareil in Royal Gold Creek.
TP1- Composite TP1A, TP1C (floodplain).
TP2- Composite TP1B and TP1D (reprocess area).
BACKGROUND- Taken from Jackson Park Mine (20-027-SS1) (1993 data).
SW-1- Same as SE-1.
SW-2- Same as SE-2.
SW-3- Same as SE-3.

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY

Mine/Site Name: Bullion Smelter
Legal Description: T 7N R 6W
Mining District: Basin
Latitude: N 46° 21' 22"
Longitude: W 112° 17' 40"
Land Status: Public
Quad: Basin
Inspectors: Tuesday, Flammang, Clark, Liebelt
Organization: Pioneer Technical Services, Inc.

County: Jefferson
Section(s): NE 1/4, SW 1/4, Section 14
Mine Type: Smelter/Au, Ag, Cu, Pb, Zn
Primary Drainage: Basin Creek
USGS Code: 10020006
Secondary Drainage: Jack Creek
Date Investigated: September 14, 1995
P.A. # 22-505

- No mill tailings were observed at the site during the investigation.
- The volume of waste rock associated with the site was approximately 1,425 cubic yards. The following elements were elevated at least three times background:
  Arsenic: 371 mg/kg
  Lead: 286J mg/kg
- The volume of slag material associated with the site was approximately 737 cubic yards. The following elements were elevated at least three times background:
  Antimony: 17.4J mg/kg
  Cadmium: 6.6 mg/kg
  Copper: 1,940J mg/kg
  Iron: 199,000 mg/kg
  Lead: 767J mg/kg
  Zinc: 9,510J mg/kg
- There were no discharging adits, filled shafts, seeps, or springs observed at the site during the investigation.
- Surface water from an unnamed tributary of Jack Creek flowed approximately 20 feet south of the site. The acute aquatic life criteria for silver was exceeded. No other aquatic life criteria or MCLs were exceeded.
- Potential safety hazards observed at the site included an ore bin above the site to the north and a highwall behind the ore bin.

Bullion Smelter PA# 22-505
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER-TUESDAY
INVESITIGATION DATE: 9/14/95

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	Sb (mg/Kg)	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Ca (mg/Kg)	Cr (mg/Kg)	Co (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Pb (mg/Kg)	Mg (mg/Kg)	Mn (mg/Kg)	Hg (mg/Kg)	Ni (mg/Kg)	Ag (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
22-505-SE-1	5.6 UJ	5.4	75.4	0.59 U	1690	5.8	6.5	19.4 J	11800	20.8 J	1880	383	0.054	3.3	1.33	85.7 J	NR
22-505-SE-2	5.8 UJ	6.1	106	0.96	1480	7.1	16.0	15.8 J	15000	14.9 J	3090	735	0.048 U	6.9	0.96 U	44.2 J	NR
22-505-SL-1	17.4 J	45.9	299	6.6	97500	14.6	63.6	1940 J	199000	767 J	3900	6390	0.036	2.3 U	30.4	9510 J	NR
22-505-WR-1	7.5 J	371	184	0.58 U	611	16.3	9.9	77.7 J	26000	286 J	5080	348	0.040	10.2	2.4	72.0 J	NR
BACKGROUND	5 U	68 J	344	0.6 U	NR	20.3	22.1	35	35000	39 J	NR	6830	0.08 J	21	NR	188	NR

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	Total Sulfur Acid Base #/1000t	Neutral Potent. #/1000t	Tot. Sulfur Acid Base Potential #/1000t	Sulfate Sulfur %	Pyritic Sulfur %	Organic Sulfur %	Pyritic Sulfur Acid Base #/1000t	Pyritic Sulfur Acid Base Potential #/1000t	Lime Req. Sobek (t/1000t)	Lime Req. Sobek (t/ac.) 1ft.	Potential Acidity	Lime Req. Dollhopf (t/1000t)	Lime Req. Dollhopf (t/ac.) 1ft.
22-505-SL1	0.82	25.6	38.5	12.9	0.38	0.02	0.42	0.62	37.90	37.90	79.59	22.66	19.80	41.59
22-505-WR-1	0.03	0.94	1.29	0.35	0.02	<0.01	0.01	0.00	1.29	1.29	2.71	0.78	0.64	1.34

WATER MATRIX ANALYSES

Metals in Water
Results in ug/l

FIELD ID	Al (ug/L)	Sb (ug/L)	As (ug/L)	Ba (ug/L)	Cd (ug/L)	Ca (ug/L)	Cr (ug/L)	Co (ug/L)	Cu (ug/L)	Fe (ug/L)	Pb (ug/L)	Mg (ug/L)	Mn (ug/L)	Hg (ug/L)	Ni (ug/L)	Ag (ug/L)	Zn (ug/L)	HARDNESS (mg CaCo3/L))
22-505-SW-1	50.3 JX	2.7 UJ	1.2 U	35.4	0.064 U	6710	9.6 U	10.9 U	4.4 U	90.7	0.58 U	1430	5.2 U	0.16 U	13.9 U	0.56	7.6 U	22.6
22-505-SW-2	54.7 JX	2.7 UJ	1.2 U	35.9	0.064 U	6530	9.6 U	10.9 U	4.4 U	77.3	0.58 U	1430	5.2 U	0.16 U	13.9 U	0.21 U	7.6 U	22.2

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Wet Chemistry
Results in mg/l

FIELD ID	Total Dissolved Solids	CHLORIDE	SULFATE	NO3/NO2-N	CYANIDE
22-505-SW-1	194	< 5	< 5	NR	NR
22-505-SW-2	50	< 5	6	NR	NR

Legend

SE-1- Downstream of site in tributary.
SE-2- Upstream of site in tributary.
SL1- Slag pile in west-center of site.
WR-1- Subsample of WR1B.
BACKGROUND- From the Bullion Mine (22-008-SS1) (1993 data).
SW-1- Same as SE-1.
SW-2- Same as SE-2.

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY

Mine/Site Name: Frohner
Legal Description: T 8N R 5W
Mining District: Clancy
Latitude: N 46° 26' 28"
Longitude: W 112° 12' 48"
Land Status: Private
Quad: Chessman Reservoir
Inspectors: Tuesday, Flammang, Clark, Liebelt
Organization: Pioneer Technical Services, Inc.

County: Jefferson
Section(s): NW 1/4, SE 1/4, Section 15
Mine Type: Hardrock/Au, Ag, Cu, Pb, Zn
Primary Drainage: Lump Gulch
USGS Code: 10030101
Secondary Drainage: Lump Gulch
Date Investigated: September 15, 1995
P.A. # 22-243

- No mill tailings were observed at the site during the investigation.

- The volume of waste rock associated with the site was approximately 11,730 cubic yards. Adit discharges flowed over and through WR-6 and WR-7 The following elements were elevated at least three times background:
  Antimony: 16.3J mg/kg
  Arsenic: 372J to 6,050 mg/kg
  Copper: 48.2J mg/kg
  Lead: 261J to 4,250J mg/kg
  Mercury: 0.62 to 0.97 mg/kg

- Two discharging adits were observed at the site which flowed over and through the waste rock. At AD-1, the acute and chronic aquatic life criteria were exceeded for cadmium, copper, lead, and zinc; pH was 7.49. Chronic aquatic life criteria was exceeded for aluminum and iron. The MCL was exceeded for cadmium. At AD-2, the acute and chronic aquatic life criteria were exceeded for aluminum, arsenic, copper, lead, and zinc; pH was 3.90. The chronic aquatic life criteria was exceeded for iron, and the MCL was exceeded for cadmium.

- Surface water flowed from an unnamed tributary of Lump Gulch along the base of WR-7. Acute and chronic aquatic life criteria were exceeded for aluminum, cadmium, copper, and zinc. Chronic aquatic life criteria was exceeded for iron and lead, and the MCL was exceeded for cadmium.

- An observed release to the unnamed tributary of Lump Gulch was documented for arsenic and lead in water and sediments, and copper in water.

- Potential safety hazards observed at the site included a cabin and a fenced open stope; two open shafts exist, but have been grated.

Frohner Mine PA# 22-243
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER-TUESDAY
INVESITIGATION DATE: 9/15/95

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	Sb (mg/Kg)	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Ca (mg/Kg)	Cr (mg/Kg)	Co (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Pb (mg/Kg)	Mg (mg/Kg)	Mn (mg/Kg)	Hg (mg/Kg)	Ni (mg/Kg)	Ag (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
22-243-SE-1	5.9 UJ	375 J	62.3	1.8	789	3.0	5.6	16.5	10400	298 J	1160 J	1200	0.065	5.8	1.0 U	192	NR
22-243-SE-2	7.0 UJ	8.0 J	312	0.88	1030	4.2	6.2	6.4	7500	18.6 J	1010 J	3120	0.048	3.2 U	0.71 U	28.3	NR
22-243-WR-1	16.3 J	6050	52.4	0.56 U	17.6	1.6 U	1.9 U	48.2 J	10700	4250 J	19.1	3.3	0.97	2.4 U	26.6	50.3 J	NR
22-243-WR-2	5.5 UJ	372 J	26.9	0.59 U	36.9	1.7 U	1.9 U	10.9	3660	1410 J	31.7 J	6.8	0.62	3.2	2.8	88.8	NR
22-243-WR-3	5.4 UJ	802	76.4	0.57 U	66.9	1.7 U	1.9 U	9.8 J	8020	261 J	19.7	16.9	0.62	2.4 U	1.1	59.0 J	NR
BACKGROUND	3.4 UJ	10	52.7	1.3	NR	2.23 J	3.15	6.12	6390	21.9	NR	284	0.035 J	2.6	NR	43.6	NR

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	Total Sulfur Acid Base t/1000t	Neutral Potent. t/1000t	Tot. Sulfur Acid Base Potential t/1000t	Sulfate Sulfur %	Pyritic Sulfur %	Organic Sulfur %	Pyritic Sulfur Acid Base t/1000t	Pyritic Sulfur Acid Base Potential t/1000t	Lime Req. Sobek (t/1000t)	Lime Req. Sobek (lbs.) 1ft.	Potential Acidity	Lime Req. Dollhopf (t/1000t)	Lime Req. Dollhopf (lbs.) 1ft.
22-243-WR-1	0.26	8.12	-1.71	-9.38	0.23	0.01	0.02	0.31	-2.02	-2.02	-4.24	6.33	-10.05	-21.10
22-243-WR-2	0.08	2.50	-0.86	-3.36	0.07	0.01	<0.01	0.31	-1.17	-1.17	-2.46	1.95	-3.52	-7.38
22-243-WR-3	0.12	3.75	-3.90	-7.65	0.11	0.01	<0.01	0.31	-4.21	-4.21	-8.84	2.89	-8.49	-17.83

WATER MATRIX ANALYSES

Metals in Water
Results in ug/l

FIELD ID	Al (ug/L)	Sb (ug/L)	As (ug/L)	Ba (ug/L)	Cd (ug/L)	Ca (ug/L)	Cr (ug/L)	Co (ug/L)	Cu (ug/L)	Fe (ug/L)	Pb (ug/L)	Mg (ug/L)	Mn (ug/L)	Hg (ug/L)	Ni (ug/L)	Ag (ug/L)	Zn (ug/L)	HARDNESS (mg CaCo3/L))
22-243-SW-1	853 J	2.7 UJ	35.8	19.4	7.3	12700	9.6 U	10.9 U	13.5	1730	15.4	2020	2460	0.16 U	13.9 U	0.80	40.1	1420
22-243-SW-2	37.1 UJ	2.7 UJ	1.2 U	16.6	0.064 U	8780	9.6 U	10.9 U	4.4 U	40.4	0.58 U	1180	5.2 U	0.16 U	13.9 U	0.23	26.8	7.6 U
22-243-AD-1	199 J	2.7 UJ	120	55.5	8.9	12800	9.6 U	10.9 U	22.1	1920	112	1240	610	0.16 U	13.9 U	0.31	37.0	1080
22-243-AD-2	1350 J	2.7 UJ	1440	17.0	36.1	24900	9.6 U	33.0	20.8	33200	459	4550	10000	0.16 U	25.1	1.8	80.9	5590

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Wet Chemistry
Results in mg/l

FIELD ID	Total Dissolved Solids	CHLORIDE	SULFATE	NO3/NO2-N	CYANIDE
22-243-SW-1	119	< 5	60	NR	NR
22-243-SW-2	51	< 5	7	NR	NR
22-243-AD-1	106	< 5	41	NR	NR
22-243-AD-2	297	< 5	178	NR	NR

Legend

SE-1- 40 feet downstream of WR7 in Lump Gulch.
SE-2- Upstream of WR7 in Lump Gulch.
AD-1- Discharging adit associated with WR8.
AD-2- Discharging adit associated with WR7.
SW-1- Same as SE-1.
SW-2- Same as SE-2.
WR-1- Composite WR1, WR2, WR3, and WR4.
WR-2- Composite WR5 and WR6.
WR-3- Composite WR7A and WR7B.

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY

Mine/Site Name: Carter
Legal Description: T 15N R 9E
Mining District: Hughesville
Latitude: N 47° 05' 25"
Longitude: W 110° 38' 36"
Land Status: Private
Quad: Barker
Inspectors: Tuesday, Flammang, Liebelt
Organization: Pioneer Technical Services, Inc.

County: Judith Basin
Section(s): SW 1/4, NW 1/4, Section 6
Mine Type: Hardrock/Ag, Pb
Primary Drainage: Dry Fork Belt Creek
USGS Code: 10030105
Secondary Drainage: Green Creek/Galena Creek
Date Investigated: September 26, 1995
P.A. # 23-019

- No mill tailings were observed at the site during the investigation.
- The volume of waste rock associated with the site was approximately 3,500 cubic yards. Water from the adit discharge flowed over and on the east side of the lower waste rock dump. The following elements were elevated at least three times background:
  Arsenic: 205 to 214 mg/kg
  Cadmium: 6.7J mg/kg
  Copper: 135JX to 564JX mg/kg
  Iron: 121,000 mg/kg
  Lead: 1,840 to 2,050 mg/kg
  Manganese: 2,270 mg/kg
  Mercury: 0.15 to 0.32 mg/kg
- One discharging adit was observed at the site which flowed over and along the waste rock. The chronic aquatic life criteria was exceeded for iron. No acute aquatic life criteria or MCLs were exceeded. The pH was 7.3.
- Green Creek flowed 75 to 100 feet from the waste rock dump. The chronic aquatic life criteria was exceeded for lead. No acute aquatic life criteria or MCLs were exceeded.
- An observed release to Green Creek was documented for copper (sediment) and iron (water).
- Potential safety hazards associated with the site included an adit opening, a highwall associated with the adit, and unstable waste rock piles.

Carter Mine PA# 23-019
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER-TUESDAY
INVESITIGATION DATE:

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	Sb (mg/Kg)	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Ca (mg/Kg)	Cr (mg/Kg)	Co (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Pb (mg/Kg)	Mg (mg/Kg)	Mn (mg/Kg)	Hg (mg/Kg)	Ni (mg/Kg)	Ag (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
23-019-SE-1	6.0 UJ	38.7	67.7 J	2.9 J	6890	1.9 U	3.9	163 JX	22700	70.1	3980	638	0.049 U	4.0	0.9 U	442	NR
23-019-SE-2	10.2 UJ	34.7	102 J	3.0 J	32400	4.9	7.3	48.8 JX	20400	97.2	15800	513	0.069 U	11.3	1.5 U	696	NR
23-019-WR-1	5.4 UJ	214	97.4 J	1.5 J	51900	1.7 U	5.7	135 JX	30000	1840	31100	2270	0.32	9.7	22.9	287	NR
23-019-WR-2	6.8 UJ	205	46.6 J	6.7 J	23800	2.1 U	2.4 U	564 JX	121000	2050	6180	180	0.15	3.1 U	12.0	228	NR
BACKGROUND	3.98 UJ	5.1 J	159 J	1 U	NR	8.09 J	3.83	9.81 J	13300	61.4	NR	548	0.02772	7.93	NR	130	NR

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	Total Sulfur Acid Base	Neutral Potent.	Tot. Sulfur Acid Base Potential	Sulfate Sulfur %	Pyritic Sulfur %	Organic Sulfur %	Pyritic Sulfur Acid Base	Pyritic Sulfur Acid Base Potential	Lime Req. Sobek	Lime Req. Sobek (fine.) 1/8.	Potential Acidity	Lime Req. Dollhopf	Lime Req. Dollhopf (fine.) 1/8.
23-019-WR-1	0.72	22.5	184	162	0.15	0.24	0.33	7.50	177.00	177.00	371.70	21.33	203.34	427.01
23-019-WR-2	3.21	100	20.9	-79.3	1.07	0.37	1.77	11.6	-9.38	-9.38	-19.70	91.96	-88.82	-186.52

WATER MATRIX ANALYSES

Metals in Water
Results in ug/l

FIELD ID	Sb (ug/L)	As (ug/L)	Ba (ug/L)	Cd (ug/L)	Ca (ug/L)	Cr (ug/L)	Co (ug/L)	Cu (ug/L)	Fe (ug/L)	Pb (ug/L)	Mg (ug/L)	Mn (ug/L)	Hg (ug/L)	Ni (ug/L)	Ag (ug/L)	Zn (ug/L)	HARDNESS (mg CaCo3/L))
23-019-SW-1	2.7 U	6.9	27.8	0.16	45600	9.6 U	10.9 U	4.4 U	518	2.9 JX	18200	113 J	0.16 U	13.9 U	0.21 UJX	93.8	189
23-019-SW-2	2.7 U	2.5	38.6	0.064 UJ	52800	9.6 U	10.9 U	4.4 UJ	136	1.4 J	14800	40.5	0.16 U	13.9 U	0.21 U	11.0 J	193
23-019-AD-1	2.7 U	14.9	8.6	0.064 UJ	39700	9.6 U	10.9 U	8.3 J	1410	1.2 J	20800	205	0.16 U	13.9 U	1.1	86.8 J	185

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Wet Chemistry
Results in mg/l

FIELD ID	Total Dissolved Solids	CHLORIDE	SULFATE	NO3/NO2-N	CYANIDE
23-019-SW-1	198	< 5	46	NR	NR
23-019-SW-2	184.0	< 5	27.0	NR	NR
23-019-AD-1	168.0	< 5	42	NR	NR

Legend

SE-1- 6' downstream of adit discharge confluence with Green Creek.
SE-2- 260' upstream of WR1 north side.
WR-1- Composite of WR1A, WR1B, WR1C.
WR-2- Composite of WR2A, WR2B, WR2C.
BACKGROUND- From the Tiger Mine (23-056-SS1) (1993 data).
AD-1- Taken at adit portal.
SW-1- Same as SE-1.
SW-2- Same as SE-2.

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY

Mine/Site Name: M.T.A.
Legal Description: T 15N R 9E
Mining District: Hughesville
Latitude: N 47° 04' 55"
Longitude: W 110° 37' 47"
Land Status: Private
Quad: Barker
Inspectors: Tuesday, Flammang, Liebelt
Organization: Pioneer Technical Services, Inc.

County: Judith Basin
Section(s): NW 1/4, NE 1/4, Section 7
Mine Type: Hardrock/Ag-Pb
Primary Drainage: Dry Fork Belt Creek
USGS Code: 10030105
Secondary Drainage: Galena Creek
Date Investigated: September 26, 1995
P.A. # 23-040

- No mill tailings were observed at the site during the investigation.
- The volume of waste rock associated with the site was approximately 5,260 cubic yards. Waste rock was situated in a steep, dry drainage that discharges to Galena Creek. The following elements were elevated at least three times background:

Antimony: 14.8J mg/kg	Arsenic: 744 mg/kg
Barium: 159J mg/kg	Cadmium: 9.5J mg/kg
Copper: 66.7JX mg/kg	Lead: 11,900 mg/kg
Mercury: 3 mg/kg	Zinc: 1,640 mg/kg

- There were no discharging adits, filled shafts, seeps, or springs observed at the site during the investigation, though one adit probably discharges at wetter times of the year.
- No surface water flowed on or near the site during the investigation. The nearest surface water was over 1,000 feet away; no surface water samples were collected.
- Potential safety hazards observed at the site included two open adits and a loadout.

M.T.A. PA# 23-040
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER-TUESDAY
INVESITIGATION DATE: 9/26/95

Metals in soils
Results per dry weight basis

SOLID MATRIX ANALYSES

FIELD ID	Sb (mg/Kg)	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Ca (mg/Kg)	Cr (mg/Kg)	Co (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Pb (mg/Kg)	Mg (mg/Kg)	Mn (mg/Kg)	Hg (mg/Kg)	Ni (mg/Kg)	Ag (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
23-040-WR-1	14.8 J	744	641 J	9.5 J	299	1.7 U	2.0 U	66.7 JX	32100	11900	441	79.0	3.0	2.5 U	40.6	1640	NR
BACKGROUND	3.98 UJ	5.1 J	159 J	1 U	NR	8.09 J	3.83	9.81 J	13300	61.4	NR	548	0.02772	7.93	NR	130	NR

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	Total Sulfur Acid Base t/1000t	Neutral Potent. t/1000t	Tot. Sulfur Acid Base Potential t/1000t	Sulfate Sulfur %	Pyritic Sulfur %	Organic Sulfur %	Pyritic Sulfur Acid Base t/1000t	Pyritic Sulfur Acid Base Potential t/1000t	Lime Req. Sobek (t/1000t)	Lime Req. Sobek (t/ac.) 1ft.	Potential Acidity	Lime Req. Dollhopf (t/1000t)	Lime Req. Dollhopf (t/ac.) 1ft.
23-040-WR-1	1.22	38.1	-4.70	-42.8	1.04	0.06	0.12	1.87	-6.58	-6.58	-13.82	30.00	-43.38	-91.09

Legend

WR-1- WR1A, 2A, 2B, 3A, 3B.
BACKGROUND- From the Tiger Mine (23-059-SS1) (1993 data).

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY

Mine/Site Name: Belfont
Legal Description: T 15N R 9E
Mining District: Hughesville
Latitude: N 47° 05' 18"
Longitude: W 110° 37' 32"
Land Status: Private
Quad: Barker
Inspectors: Tuesday, Flammang, Liebelt
Organization: Pioneer Technical Services, Inc.

County: Judith Basin
Section(s): NE 1/4, SE 1/4, Section 6
Mine Type: Hardrock/Ag, Pb
Primary Drainage: Dry Fork Belt Creek
USGS Code: 10030105
Secondary Drainage: Daisy Creek/Galena Creek
Date Investigated: September 26, 1995
P.A. # 23-060

- No mill tailings were observed at the site during the investigation.
- The volume of waste rock associated with the site was approximately 2,325 cubic yards. The following elements were elevated at least three times background:

Arsenic: 1,030 mg/kg	Barium: 529 mg/kg
Cadmium: 5.7J mg/kg	Copper: 45.4 mg/kg
Iron: 44,600 mg/kg	Lead: 2,850 mg/kg
Mercury: 1.2 mg/kg	Zinc: 872J mg/kg

- There were no discharging adits, filled shafts, seeps, or springs observed at the site during the investigation, though at wetter times of the year, the adit shows evidence of discharging.
- Surface water flow from Daisy Creek was adjacent to the waste rock. Chronic and acute aquatic life criteria were exceeded for copper and zinc. Chronic aquatic life criteria were exceeded for cadmium and lead. No MCLs were exceeded.
- Potential safety hazards observed at the site included an open adit, two cabins, and a highwall.

BELFONT MINE PA# 23-060
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER-TUESDAY
INVESITIGATION DATE: 9/26/95

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	Sb (mg/Kg)	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Ca (mg/Kg)	Cr (mg/Kg)	Co (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Pb (mg/Kg)	Mg (mg/Kg)	Mn (mg/Kg)	Hg (mg/Kg)	Ni (mg/Kg)	Ag (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
23-060-SE-1	7.1 UJ	39.9	265	10.0 J	2130	5.9	5.3	482	47200	1410	1090	5630	0.15	5.0	4.9	1540 J	NR
23-060-SE-2	7.2 UJ	152	818	25.1 J	16100	5.6	2.5 U	1820	98000	9120	9940	17300	0.28	3.2 U	38.4	4960 J	NR
23-060-WR-1	7.8 J	1030	529	5.7 J	37.0	6.0	2.0 U	45.4	44600	2850	483	151	1.2	2.6 U	49.7	872 J	NR
BACKGROUND	3.98 UJ	5.1 J	159 J	1 U	NR	8.09 J	3.83	9.81 J	13300	61.4	NR	548	0.02772	7.93	NR	130	NR

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	Total Sulfur Acid Base (t/1000t)	Neutral Potent. (t/1000t)	Tot. Sulfur Acid Base Potential (t/1000t)	Sulfate Sulfur %	Pyritic Sulfur %	Organic Sulfur %	Pyritic Sulfur Acid Base (t/1000t)	Pyritic Sulfur Acid Base Potential (t/1000t)	Lime Req. Sobek (t/1000t)	Lime Req. Sobek (t/ac.) 1ft.	Potential Acidity	Lime Req. Dollhopf (t/1000t)	Lime Req. Dollhopf (t/ac.) 1ft.
23-060-WR-1	1.44	45.0	-9.78	-54.8	0.77	0.14	0.53	4.37	-14.20	-14.20	-29.82	38.99	-60.96	-128.01

WATER MATRIX ANALYSES

Metals in Water
Results in ug/l

FIELD ID	Sb (ug/L)	As (ug/L)	Ba (ug/L)	Cd (ug/L)	Ca (ug/L)	Cr (ug/L)	Co (ug/L)	Cu (ug/L)	Fe (ug/L)	Pb (ug/L)	Mg (ug/L)	Mn (ug/L)	Hg (ug/L)	Ni (ug/L)	Ag (ug/L)	Zn (ug/L)	HARDNESS (mg CaCo3/L))
23-060-SW-1	2.7 U	1.9	27.0	3.3	55900	9.6 U	10.9 U	142	357	32.3 JX	18100	844 J	0.16 U	13.9 U	0.66 JX	918	214
23-060-SW-2	2.7 U	1.8 U	24.8	4.3	60800	9.6 U	10.9 U	197	481	41.2 JX	19700	1060 J	0.16 U	13.9 U	2.7 JX	1020	233

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Wet Chemistry
Results in mg/l

FIELD ID	Total Dissolved Solids	CHLORIDE	SULFATE	NO3/NO2-N	CYANIDE
23-060-SW-1	306	< 5	170	NR	NR
23-060-SW-2	305	< 5	188	NR	NR

Legend

SE-1- Downstream of site in Daisy Creek.
SE-2- Upstream of site in Daisy Creek
WR-1- Composite of WR1A, WR1B, WR2A, & WR2B.
BACKGROUND- From the Tiger Mine (23-059-SS1) (1993 data).
SW-1- Same as SE1.
SW-2- Same as SE2.

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY

Mine/Site Name: Sinclair
Legal Description: T 15N R 9E
Mining District: Hughesville
Latitude: N 47° 04' 55"
Longitude: W 110° 38' 07"
Land Status: Private
Quad: Barker
Inspectors: Tuesday, Flammang, Liebelt
Organization: Pioneer Technical Services, Inc.

County: Judith Basin
Section(s): NE 1/4, NW 1/4, Section 7
Mine Type: Hardrock/Ag, Pb
Primary Drainage: Dry Fork Belt Creek
USGS Code: 10030105
Secondary Drainage: Galena Creek
Date Investigated: September 27, 1995
P.A. # 23-501

- No mill tailings were observed at the site during the investigation.
- The volume of waste rock associated with the site was approximately 1,679 cubic yards. The waste rock was adjacent to an unnamed tributary of Galena Creek. The following elements were elevated at least three times background:
  Arsenic: 203 mg/kg
  Copper: 33 mg/kg
  Lead: 5,000 mg/kg
  Mercury: 1.1 mg/kg
- There were no discharging adits, filled shafts, seeps, or springs observed at the site during the investigation.
- Surface water flowed from an unnamed tributary of Galena Creek along the base of the waste rock. Acute and chronic aquatic life criteria were exceeded for cadmium, copper, lead, and zinc. Chronic aquatic life criteria was exceeded for iron, and the MCL was exceeded for cadmium.
- An observed release to the unnamed tributary of Galena Creek (sediment) was documented for arsenic, copper, mercury, and (water) lead.
- Potential safety hazards observed at the site included a gated adit and a cabin.

Sinclair Mine PA# 23-501
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER-TUESDAY
INVESITIGATION DATE: 9/27/95

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	Sb (mg/Kg)	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Ca (mg/Kg)	Cr (mg/Kg)	Co (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Pb (mg/Kg)	Mg (mg/Kg)	Mn (mg/Kg)	Hg (mg/Kg)	Ni (mg/Kg)	Ag (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
23-501-SE-1	15.4 J	664	313	6.5 J	1610	5.7	3.1 U	236	40700	9960	810	289	1.7	3.9 U	115	1100 J	NR
23-501-SE-2	10.3 J	157	77.0	1.2 J	695	2.6	2.3 U	53.4	9910	6380	386	96.3	0.18	2.9 U	28.3	204 J	NR
23-501-WR-1	7.2 J	203	191	1.3 J	69.8	1.5 U	1.7 U	33.0	16000	5000	78.7	35.7	1.1	2.2 U	28.8	200 J	NR
BACKGROUND	3.98 UJ	5.1 J	159 J	1 U	NR	8.09 J	3.83	9.81 J	13300	61.4	NR	548	0.02772	7.93	NR	130	NR

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	Total Sulfur Acid Base (t/1000t)	Neutral Potent. (t/1000t)	Tot. Sulfur Acid Base Potential (t/1000t)	Sulfate Sulfur %	Pyritic Sulfur %	Organic Sulfur %	Pyritic Sulfur Acid Base (t/1000t)	Pyritic Sulfur Acid Base Potential (t/1000t)	Lime Req. Sobek (t/1000t)	Lime Req. Sobek (lbs./1 ton)	Potential Acidity	Lime Req. Dollhopf (t/1000t)	Lime Req. Dollhopf (lbs./1 ton)
23-501-WR1	0.57	17.8	-3.14	-20.9	0.51	0.03	0.03	0.94	-4.08	-4.08	-8.57	13.83	-21.21	-44.54

WATER MATRIX ANALYSES

Metals in Water
Results in ug/l

FIELD ID	Sb (ug/L)	As (ug/L)	Ba (ug/L)	Cd (ug/L)	Ca (ug/L)	Cr (ug/L)	Co (ug/L)	Cu (ug/L)	Fe (ug/L)	Pb (ug/L)	Mg (ug/L)	Mn (ug/L)	Hg (ug/L)	Ni (ug/L)	Ag (ug/L)	Zn (ug/L)	HARDNESS (mg CaCo3/L))
23-501-SW-1	2.7 U	3.8	21.3	17.2	26300	9.6 U	10.9 U	48.2	2000	121 JX	3090	1700 J	0.16 U	13.9 U	0.70 JX	2780	78.4
23-501-SW-2	2.7 U	4.9	23.3	12.2	26100	9.6 U	10.9 U	51.3	2190	24.1 JX	2710	1260 J	0.16 U	13.9 U	0.21 UJ	2560	76.4

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Wet Chemistry
Results in mg/l

FIELD ID	Total Dissolved Solids	CHLORIDE	SULFATE	NO3/NO2-N	CYANIDE
23-501-SW-1	127	< 5	82	NR	NR
23-501-SW-2	129	< 5	57	NR	NR

Legend

SE-1- 100 feet below WR1 in tributary of Galena Creek.
SE-2- 50 feet above site in tributary of Galena Creek.
WR-1- Composite of WR1A & WR1B.
BACKGROUND- From the Tiger Mine (23-059-SS1) (1993 data).
SW-1- Same as SE-1.
SW-2- Same as SE-2.

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY

Mine/Site Name: May and Edna
Legal Description: T 15N R 9E
Mining District: Hughesville
Latitude: N 47° 05' 25"
Longitude: W 110° 38' 36"
Land Status: Private
Quad: Barker
Inspectors: Tuesday, Flammang, Liebelt
Organization: Pioneer Technical Services, Inc.

County: Judith Basin
Section(s): SW 1/4, NW 1/4, Section 6
Mine Type: Hardrock/Ag, Pb
Primary Drainage: Dry Fork Belt Creek
USGS Code: 10030105
Secondary Drainage: Green Creek/Galena Creek
Date Investigated: September 26, 1995
P.A. # 23-502

- No mill tailings were observed at the site during the investigation.
- The volume of waste rock associated with the site was approximately 2,000 cubic yards. The waste rock was located adjacent to Green Creek and was in contact with surface water when flowing. The following elements were elevated at least three times background:
  Arsenic: 71.6 mg/kg
  Cadmium: 9.6J mg/kg
  Copper: 1,120JX mg/kg
  Iron: 135,000 mg/kg
  Lead: 1,740 mg/kg
  Mercury: 0.41 mg/kg
  Zinc: 491 mg/kg
- There were no discharging adits, shafts, or seeps at the site during the investigation; however, a spring was observed 20 feet south of the waste rock. No samples were collected.
- No other surface water flowed on or near the site except for the spring during the investigation. The next closest surface water source was over 1,000 feet away; no surface water samples were collected.
- Observed releases to Green Creek (sediment) were documented for cadmium, copper, and zinc.
- No potential safety hazards were observed during the investigation.

May & Edna PA# 23-502
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER-TUESDAY
INVESITIGATION DATE: 9/26/95

Metals in soils
Results per dry weight basis

SOLID MATRIX ANALYSES

FIELD ID	Sb (mg/Kg)	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Ca (mg/Kg)	Cr (mg/Kg)	Co (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Pb (mg/Kg)	Mg (mg/Kg)	Mn (mg/Kg)	Hg (mg/Kg)	Ni (mg/Kg)	Ag (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
23-502-SE-1	4.4 UJ	24.0	70.2 J	1.0 J	91600	5.1	3.2	4.38 JX	14000	320	35400	677	0.040 U	7.4	0.6 U	156	NR
23-502-SE-2	6.4 UJ	30.4	276 J	7.0 J	27100	3.8	15.4	87.0 JX	20700	383	14800	2950	0.056 U	13.5	4.3	1360	NR
23-502-WR-1	5.0 UJ	71.6	45.1 J	9.6 J	8700	6.5	1.8 U	1120 JX	135000	1740	983	229	0.41	11.6	54.8	491	NR
BACKGROUND	3.98 UJ	5.1 J	159 J	1 U	NR	8.09 J	3.83	9.81 J	13300	61.4	NR	548	0.02772	7.93	NR	130	NR

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	Total Sulfur Acid Base t/1000t	Neutral Potent. t/1000t	Tot. Sulfur Acid Base Potential t/1000t	Sulfate Sulfur %	Pyritic Sulfur %	Organic Sulfur %	Pyritic Sulfur Acid Base t/1000t	Pyritic Sulfur Acid Base Potential t/1000t	Lime Req. Sobek (t/1000t)	Lime Req. Sobek (t/ac.) 1ft.	Potential Acidity	Lime Req. Dollhopf (t/1000t)	Lime Req. Dollhopf (t/ac.) 1ft.
23-502-WR-1	9.27	290	21.2	-268	<0.01	1.07	10.0	33.6	-12.30	-12.30	-25.83	345.94	-405.92	-852.44

Legend

SE-1- 40 feet upstream of site in Green Creek.
SE-2- 25 feet downstream from site in Green Creek.
WR-1- Composite WR1A, 1B, 1C, 1D.
BACKGROUND- From the Tiger Mine (23-059-SS1) (1993 data).

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY

Mine/Site Name: Kelley
Legal Description: T 3N R 12E
Mining District: Big Timber Canyon
Latitude: N 46° 02' 07"
Longitude: W 110° 17' 25"
Land Status: Public
Quad: Crazy Peak
Inspectors: Tuesday, Flammang
Organization: Pioneer Technical Services, Inc.

County: Park
Section(s): SW 1/4, NW 1/4, Section 6
Mine Type: Hardrock/Ag-Pb
Primary Drainage: Big Timber Creek
USGS Code: 10070002
Secondary Drainage: Blue Lake
Date Investigated: October 6, 1995
P.A. # 34-113

- No mill tailings were observed at the site during the investigation.
- The volume of waste rock associated with the site was approximately 725 cubic yards. The following elements were elevated at least three times background:

Antimony: 25.2JX mg/kg	Arsenic: 145J mg/kg
Barium: 433 mg/kg	Cadmium: 5.2 mg/kg
Copper: 856J mg/kg	Lead: 2,640J mg/kg
Manganese: 4,660 mg/kg	Mercury: 0.44J mg/kg

- There were no discharging adits, filled shafts, seeps, or springs observed at the site during the investigation, though water was ponded in adit and probably flows at wetter times of the year.
- No surface water flowed on or near the site during the investigation. The nearest surface water was a small lake approximately 100 feet away; no surface water samples were collected.
- The potential safety hazard observed at the site consisted of a partially open adit.

Kelly Mine PA# 34-113
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER-TUESDAY
INVESITIGATION DATE: 10/6/95

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	Sb (mg/Kg)	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Ca (mg/Kg)	Cr (mg/Kg)	Co (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Pb (mg/Kg)	Mg (mg/Kg)	Mn (mg/Kg)	Hg (mg/Kg)	Ni (mg/Kg)	Ag (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
34-113-WR-1	25.2 JX	145 J	433	5.2	15300	14.9 J	24.9 J	856 J	52900	2640 J	6980	4660	0.44 J	19.9 JX	22.3	193	NR
BACKGROUND	7.97 UJ	16.3	78.3 J	0.68 J	NR	45.6	13.5	40.1 J	28500	37.2	NR	612	0.06378	24	NR	99	NR

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	Total Sulfur Acid Base t/1000t	Neutral Potent. t/1000t	Tot. Sulfur Acid Base Potential t/1000t	Sulfate Sulfur %	Pyritic Sulfur %	Organic Sulfur %	Pyritic Sulfur Acid Base t/1000t	Pyritic Sulfur Acid Base Potential t/1000t	Lime Req. Sobek (t/1000t)	Lime Req. Sobek (t/ac.) 1ft.	Potential Acidity	Lime Req. Dollhopf (t/1000t)	Lime Req. Dollhopf (t/ac.) 1ft.
34-113-WR-1	0.01	0.31	40.7	40.4	<0.01	0.01	<0.01	0.31	40.40	40.40	84.84	0.31	50.48	106.02

Legend

WR-1- Composite WR1A, WR1B, WR1C.
BACKGROUND- Taken from Poor Man/ Emma (49-001-SS1) (1993 data).

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY

Mine/Site Name: Stemwinder (South)
Legal Description: T 3N R 11E
Mining District: Big Timber Canyon
Latitude: N 46° 01' 50"
Longitude: W 110° 17' 32"
Land Status: Public
Quad: Crazy Peak
Inspectors: Tuesday, Flammang
Organization: Pioneer Technical Services, Inc.

County: Park
Section(s): SE 1/4, SE 1/4, Section 1
Mine Type: Hardrock/Ag-Pb
Primary Drainage: Big Timber Creek
USGS Code: 10070002
Secondary Drainage: Blue Lake
Date Investigated: October 6, 1995
P.A. # 34-500

- No mill tailings were observed at the site during the investigation.

- The volume of waste rock associated with the site was approximately 225 cubic yards. The waste rock was located adjacent to an unnamed tributary of Big Timber Creek and adit discharge flowed over and into it. The following elements were elevated at least three times background:

  Arsenic: 55.7J mg/kg
  Barium: 289 mg/kg
  Cadmium: 3.6 mg/kg
  Copper: 610J mg/kg
  Lead: 6,480J mg/kg
  Manganese: 1,940 mg/kg
  Mercury: 0.54J mg/kg

- One discharging adit was observed at the site which flowed over and through the waste rock. Chronic aquatic life criteria was exceeded for lead and mercury, while acute aquatic life criteria was exceeded for silver. No MCLs were exceeded, and the pH was 8.54.

- Surface water flowed from an unnamed tributary of Big Timber Creek near the waste rock. The chronic aquatic life criteria was exceeded for lead, copper, and mercury, while the acute aquatic life criteria was exceeded for silver. No MCLs were exceeded.

- An observed release to an unnamed tributary of Granite Lake (sediment) was documented for arsenic, copper, and lead.

- The potential safety hazard consisted of an open adit.

Stemwinder Mine PA# 34-500
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER-TUESDAY
INVESITIGATION DATE: 10/6/95

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	Sb (mg/Kg)	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Ca (mg/Kg)	Cr (mg/Kg)	Co (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Pb (mg/Kg)	Mg (mg/Kg)	Mn (mg/Kg)	Hg (mg/Kg)	Ni (mg/Kg)	Ag (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
34-500-SE-1	6.6 UJX	22.5 J	276	1.9	5350	21.3 J	17.4 J	80.9 J	21300	755 J	7880	647	0.037 UJ	29.1 JX	0.93 U	61.5	NR
34-500-SE-2	7.5 UJX	6.6 J	140	1.4	3070	24.9 J	12.8 J	13.8 J	14400	21.2 J	6150	312	0.037 UJ	28.7 JX	1.1 U	40.9	NR
34-500-WR-1	5.4 UJX	55.7 J	289	3.6	8380	21.6 J	22.7 J	610 J	34200	6480 J	7750	1940	0.54 J	22.0 JX	17.7	143	NR
BACKGROUND	7.97 UJ	16.3	78.3 J	0.68 J	NR	45.6	13.5	40.1 J	28500	37.2	NR	612	0.06378	24	NR	99	NR

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	Total Sulfur Acid Base #/1000t	Neutral Potent. #/1000t	Tot. Sulfur Acid Base Potential #/1000t	Sulfate Sulfur %	Pyritic Sulfur %	Organic Sulfur %	Pyritic Sulfur Acid Base #/1000t	Pyritic Sulfur Acid Base Potential #/1000t	Lime Req. Sobek #/1000t	Lime Req. Sobek (Bac.) 1ft.	Potential Acidity	Lime Req. Dollhopf #/1000t	Lime Req. Dollhopf (Bac.) 1ft.
34-500-WR-1	0.21	6.56	17.1	10.6	0.04	0.01	0.16	0.31	16.80	16.80	35.28	6.25	13.56	28.48

WATER MATRIX ANALYSES

Metals in Water
Results in ug/l

FIELD ID	Sb (ug/L)	As (ug/L)	Ba (ug/L)	Cd (ug/L)	Ca (ug/L)	Cr (ug/L)	Co (ug/L)	Cu (ug/L)	Fe (ug/L)	Pb (ug/L)	Mg (ug/L)	Mn (ug/L)	Hg (ug/L)	Ni (ug/L)	Ag (ug/L)	Zn (ug/L)	HARDNESS (mg CaCo3/L)
34-500-SW-1	1.9 U	1.5 U	5.3	0.046 U	6020	8.7 U	8.3 U	2.0 J	19.1 J	1.2	395	3.4 UJ	0.26 JX	16.9 U	0.36 JX	9.1 U	16.7
34-500-SW-2	2.1	1.5 U	4.9	0.046 U	5590	8.7 U	8.3 U	2.7 J	14.2 UJ	0.93 U	382	3.4 UJ	0.19 JX	16.9 U	0.21 UJX	9.1 U	15.5
34-500-AD-1	3.4	1.5 U	3.7	0.046 U	8850	8.7 U	8.3 U	2.4 J	34.4 J	11.9	496	3.4 UJ	0.15 JX	16.9 U	0.69 JX	9.1 U	24.1

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Wet Chemistry
Results in mg/l

FIELD ID	Total Dissolved Solids	CHLORIDE	SULFATE	NO3/NO2-N	CYANIDE
34-500-SW-1	21	< 5	< 5	NR	NR
34-500-SW-2	17	< 5	5	NR	NR
34-500-AD-1	37	< 5	7	NR	NR

Legend

SE-1- 50 feet downstream of mine in tributary.
SE-2- 50 feet upstream of mine in tributary.
WR-1- Composite of WR1A & WR1B.
BACKGROUND- Taken from Poor Marv Emma (49-001-SS1) (1993 data).
AD-1- Flowing adit at WR-1.
SW-1- Same as SE-1.
SW-2- Same as SE-2.

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY

Mine/Site Name: Emma Darling
Legal Description: T 7N R 8W
Mining District: Emery
Latitude: N 46° 23' 03"
Longitude: W 112° 34' 12"
Land Status: Public/Private
Quad: Baggs Creek
Inspectors: Tuesday, Flammang
Organization: Pioneer Technical Services, Inc.

County: Powell
Section(s): SW 1/4, NE 1/4, Section 2
Mine Type: Hardrock/Pb, Ag
Primary Drainage: Clark Fork River
USGS Code: 17010201
Secondary Drainage: Rocker Gulch/Cottonwood Creek
Date Investigated: September 16, 1995
P.A. # 39-027

- No mill tailings were observed at the site during the investigation.
- The volume of waste rock associated with the site was approximately 10,700 cubic yards. The following elements were elevated at least three times background:
  Antimony: 126J mg/kg
  Arsenic: 5,140 mg/kg
  Cadmium: 44.5 mg/kg
  Copper: 239J mg/kg
  Lead: 2,230J mg/kg
  Mercury: 1.1 mg/kg
  Zinc: 2,020J mg/kg
- There were no discharging adits, filled shafts, seeps, or springs observed at the site during the investigation.
- No surface water flowed on or near the site during the investigation. The nearest surface water was 500 feet away; no surface water samples were collected.
- Potential safety hazards observed included a fenced open shaft, an open pit, and a loadout.

Emma Darling PA# 39-027
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER-TUESDAY
INVESITIGATION DATE: 9/16/95

Metals in soils
Results per dry weight basis

SOLID MATRIX ANALYSES

FIELD ID	Sb (mg/Kg)	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Ca (mg/Kg)	Cr (mg/Kg)	Co (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Pb (mg/Kg)	Mg (mg/Kg)	Mn (mg/Kg)	Hg (mg/Kg)	Ni (mg/Kg)	Ag (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
39-027-WR-1	126 J	5140	130	44.5	17800	20.5	25.9	239 J	78500	2230 J	8250	2200	1.1	10.0	101	2020 J	NR
BACKGROUND	7 UJ	91	295	3.5	NR	36.9	13.9	67.3	43400	43	NR	2960	0.165	7	NR	171	NR

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	Total Sulfur Acid Base t/1000t	Neutral Potent. t/1000t	Tot. Sulfur Acid Base Potential t/1000t	Sulfate Sulfur %	Pyritic Sulfur %	Organic Sulfur %	Pyritic Sulfur Acid Base t/1000t	Pyritic Sulfur Acid Base Potential t/1000t	Lime Req. Sobek (t/1000t)	Lime Req. Sobek (t/ac.) 1ft.	Potential Acidity	Lime Req. Dollhopf (t/1000t)	Lime Req. Dollhopf (t/ac.) 1ft.
39-027-WR-1	3.40	106	149	43.0	<0.01	1.63	2.42	50.9	98.30	98.30	206.43	126.56	28.05	58.90

Legend

WR-1- Composite WR1A, 1B, 1C, 2A, 2B, 3A, 3B.
BACKGROUND- From the Emery Mine (39-004-SS1) (1993 data).

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY

Mine/Site Name: Bonanza
Legal Description: T 7N R 8W
Mining District: Emery
Latitude: N 46° 22' 45"
Longitude: W 112° 34' 12"
Land Status: Private
Quad: Baggs Creek
Inspectors: Tuesday, Flammang
Organization: Pioneer Technical Services, Inc.

County: Powell
Section(s): NE 1/4, NW 1/4, Section 11
Mine Type: Hardrock/Au, Pb, Ag
Primary Drainage: Clark Fork River
USGS Code: 17010201
Secondary Drainage: Rocker Gulch/Cottonwood Creek
Date Investigated: September 16, 1995
P.A. # 39-501

- No mill tailings were observed at the site during the investigation.
- The volume of waste rock associated with the site was approximately 9,300 cubic yards. The following elements were elevated at least three times background:
  Arsenic: 8,350 mg/kg
  Cadmium: 38 mg/kg
  Lead: 4,120J mg/kg
  Mercury: 0.69J mg/kg
  Zinc: 4,390J mg/kg
- There were no discharging adits, filled shafts, seeps, or springs observed at the site during the investigation.
- No surface water flowed on or near the site during the investigation. The nearest surface water was over 1,000 feet away; no surface water samples were collected.
- Potential safety hazards observed included an open incline, two buildings, two loadouts, and steep slopes on WR-1.

Bonanza Mine PA# 39-501
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER-TUESDAY
INVESITIGATION DATE: 9/16/95

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	Sb (mg/Kg)	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Ca (mg/Kg)	Cr (mg/Kg)	Co (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Pb (mg/Kg)	Mg (mg/Kg)	Mn (mg/Kg)	Hg (mg/Kg)	Ni (mg/Kg)	Ag (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
39-501-WR-1	13.3 J	8350	17.4	38.0	44200	10.9	14.5	62.6 J	49100	4120 J	17300	4400	0.69	15.8	29.1	4390 J	NR
BACKGROUND	7 UJ	91	295	3.5	NR	36.9	13.9	67.3	43400	43	NR	2960	0.165	7	NR	171	NR

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	Total Sulfur Acid Base t/1000t	Neutral Potent. t/1000t	Tot. Sulfur Acid Base Potential t/1000t	Sulfate Sulfur %	Pyritic Sulfur %	Organic Sulfur %	Pyritic Sulfur Acid Base t/1000t	Pyritic Sulfur Acid Base Potential t/1000t	Lime Req. Sobek (t/1000t)	Lime Req. Sobek (t/ac.) 1ft.	Potential Acidity	Lime Req. Dollhopf (t/1000t)	Lime Req. Dollhopf (t/ac.) 1ft.
39-501-WR-1	5.00	156	138	-18.3	<0.01	1.91	3.54	59.7	78.20	78.20	164.22	170.31	-40.39	-84.82

Legend

WR-1- Composite 1A, 1B, 2(1B), 2A, 2C.
BACKGROUND- From the Emery Mine (39-004-SS1) (1993 data).

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY

Mine/Site Name: Hidden Hand
Legal Description: T 7N R 8W
Mining District: Emery
Latitude: N 46° 23' 28"
Longitude: W 112° 33' 31"
Land Status: Public
Quad: Baggs Creek
Inspectors: Tuesday, Flammang
Organization: Pioneer Technical Services, Inc.

County: Powell
Section(s): NE 1/4, SE 1/4, Section 3
Mine Type: Hardrock/Au
Primary Drainage: Clark Fork River
USGS Code: 17010201
Secondary Drainage: Baggs Creek/Cottonwood Creek
Date Investigated: September 17, 1995
P.A. # 39-502

- No mill tailings were observed at the site during the investigation.

- The volume of waste rock associated with the site was approximately 7,700 cubic yards. The waste rock was in direct contact with water from the adit discharge and in an intermittent drainage. The following elements were elevated at least three times background:
  Antimony: 24.3J to 22.9J mg/kg
  Arsenic: 2,030 to 2,510 mg/kg
  Lead: 4,060J to 4,570 mg/kg
  Mercury: 0.56 mg/kg
  Zinc: 547J mg/kg

- One discharging adit was observed at the site which flowed over and through WR-4. No acute or chronic aquatic life criteria or MCLs were exceeded. The pH was 7.53.

- Surface water was collected downstream from the adit discharge and WR-4 in a tributary of Baggs Creek. Acute and chronic aquatic life criteria were exceeded for zinc. Chronic aquatic life criteria was exceeded for cadmium, and the MCL for cadmium was exceeded.

- Potential safety hazards observed at the site included four open adits, an open shaft, a partially collapsed cabin, a loadout, and a trench associated with a collapsed adit.

Hidden Hand Mine PA# 39-502
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER-TUESDAY
INVESITIGATION DATE: 9/17/95

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	Sb (mg/Kg)	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Ca (mg/Kg)	Cr (mg/Kg)	Co (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Pb (mg/Kg)	Mg (mg/Kg)	Mn (mg/Kg)	Hg (mg/Kg)	Ni (mg/Kg)	Ag (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
39-502-SE-1	7.4 UJ	401	225	56.6	6390	76.0	54.7	85.8 J	60800	1060 J	17100	5210	0.061	37.2	2.3	4610 J	NR
39-502-WR-1	22.9 J	2510	81.7	0.55	2620	29.2	3.9	33.7 J	57600	4570 J	7380	267	0.28	4.5	17.5	185 J	NR
39-502-WR-2	24.3 J	2030	107	3.6	11700	35.3	22.8	57.5 J	52400	4060 J	8630	924	0.56	9.0	16.6	547 J	NR
BACKGROUND	7 UJ	91	295	3.5	NR	36.9	13.9	67.3	43400	43	NR	2960	0.165	7	NR	171	NR

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	Total Sulfur Acid Base Potential (t/1000t)	Neutral Potent. (t/1000t)	Tot. Sulfur Acid Base Potential (t/1000t)	Sulfate Sulfur %	Pyritic Sulfur %	Organic Sulfur %	Pyritic Sulfur Acid Base (t/1000t)	Pyritic Sulfur Acid Base Potential (t/1000t)	Lime Req. Sobek (t/1000t)	Lime Req. Sobek (t/ac.) 1ft.	Potential Acidity	Lime Req. Dollhopf (t/1000t)	Lime Req. Dollhopf (t/ac.) 1ft.
39-502-WR-1	1.42	44.4	-1.54	-45.9	1.37	0.02	0.03	0.62	-2.17	-2.17	-4.56	33.68	-44.02	-92.44
39-502-WR-2	1.43	44.7	0.69	-44.0	1.27	0.03	0.13	0.94	-0.24	-0.24	-0.50	34.77	-42.60	-89.46

WATER MATRIX ANALYSES

Metals in Water
Results in ug/l

FIELD ID	Al (ug/L)	Sb (ug/L)	As (ug/L)	Ba (ug/L)	Cd (ug/L)	Ca (ug/L)	Cr (ug/L)	Co (ug/L)	Cu (ug/L)	Fe (ug/L)	Pb (ug/L)	Mg (ug/L)	Mn (ug/L)	Hg (ug/L)	Ni (ug/L)	Ag (ug/L)	Zn (ug/L)	HARDNESS (mg CaCo3/L))
39-502-SW-1	259 JX	3.9 J	7.7	12.5	5.9	60200	9.6 U	10.9 U	4.4 U	309	7.4	16500	65.0	0.16 U	13.9 U	0.64	548	218
39-502-AD-1	141 JX	5.8 J	19.8	15.1	1.8	83300	9.6 U	10.9 U	4.4 U	326	0.58 U	21200	845	0.16 U	13.9 U	0.56	111	295

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Wet Chemistry
Results in mg/l

FIELD ID	Total Dissolved Solids	CHLORIDE	SULFATE	NO3/NO2-N	CYANIDE
39-502-SW-1	446	< 5	178	NR	NR
39-502-AD-1	64	< 5	170	NR	NR

Legend

SE-1- Tributary of Baggs Creek below adit discharge and WR4.
WR-1- Composite of WR1A, 1B, 2A, 2B, (upper dumps).
WR-2- Composite of WR3A, 3B, 3C, 4A, 4B , (middle & lower dumps)
BACKGROUND- From the Emery Mine (39-004-SS1) (1993 data).
AD-1- Adit associated with WR-4.
SW-1- Same as SE-1.

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY

Mine/Site Name: Spring Creek Tailings
Legal Description: T 7N R 8W
Mining District: Emery
Latitude: N 46° 22' 05"
Longitude: W 112° 34' 29"
Land Status: Public
Quad: Sugarloaf Mountain
Inspectors: Tuesday, Clark, Liebelt
Organization: Pioneer Technical Services, Inc.

County: Powell
Section(s): NE 1/4, SW 1/4, Section 11
Mine Type: Millsite/Au
Primary Drainage: Clark Fork River
USGS Code: 17010201
Secondary Drainage: North Fork Cottonwood Creek/Spring Creek
Date Investigated: November 13, 1995
P.A. # 39-503

- The volume of tailings associated with the site was approximately 7,700 cubic yards. Surface water from Spring Creek flowed through the tailings. The following elements were elevated at least three times background:

  Antimony: 337 to 602 mg/kg
  Arsenic: 6,960 to 13,400 mg/kg
  Cadmium: 99.2J to 55.2J mg/kg
  Copper: 244 to 359 mg/kg
  Lead: 4,900J to 5,320J mg/kg
  Manganese: 17,400J mg/kg
  Zinc: 6,490J to 9,230J mg/kg

- There were no discharging adits, filled shafts, seeps, or springs observed at the site during the investigation.

- Surface water from Spring Creek flowed through the site. Chronic aquatic life criteria was exceeded for lead. No acute aquatic life criteria were exceeded. The MCL was exceeded for antimony.

- Observed releases to Spring Creek (sediment) were documented for antimony, arsenic, cadmium, copper, lead, manganese, and zinc; the water had documented releases attributable to the site for arsenic, cadmium, lead, and manganese.

- No potential safety hazards were observed at the site during the investigation.

Spring Creek Tailings PA# 39-503
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER-TUESDAY
INVESITIGATION DATE: 9/14/95

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	Sb (mg/Kg)	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Ca (mg/Kg)	Cr (mg/Kg)	Co (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Pb (mg/Kg)	Mg (mg/Kg)	Mn (mg/Kg)	Hg (mg/Kg)	Ni (mg/Kg)	Ag (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
39-503-SE-1	134	3110 J	93.3	30.9 J	12700	46.2 J	16.3	133	44700 J	1650 J	11200	8250 J	0.14	16.8	21.8 J	3750 J	NR
39-503-SE-2	8.7 UJ	114 J	74.6	2.1 J	6090	35.3 J	22.6	39.8	40500 J	62.4 J	15200	760 J	0.046 U	48.6	1.2 U	437 J	NR
39-503-TP1	337	6960 J	63.9	55.2 J	31800	37.0 J	14.3	244	54600 J	4900 J	17900	5750 J	0.40	13.5	60.7 J	6490 J	<0
39-503-TP2	602	13400 J	39.5	99.2 J	26300	16.1 J	11.6	359	57800 J	5320 J	12100	17400 J	0.31	3.2 U	96.3 J	9230 J	1
BACKGROUND	7 UJ	91	295	3.5	NR	36.9	13.9	67.3	43400	43	NR	2960	0.165	7	NR	171	NR

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	Total Sulfur Acid Base (t/1000t)	Neutral Potent. (t/1000t)	Tot. Sulfur Acid Base Potential (t/1000t)	Sulfate Sulfur %	Pyritic Sulfur %	Organic Sulfur %	Pyritic Sulfur Acid Base (t/1000t)	Pyritic Sulfur Acid Base Potential (t/1000t)	Lime Req. Sobek (t/1000t)	Lime Req. Sobek (lbs/) 1ft.	Potential Acidity	Lime Req. Dollhopf (t/1000t)	Lime Req. Dollhopf (lbs/) 1ft.
39-503-TP1	2.34	73.1	95.3	22.2	<0.01	1.98	0.48	61.9	33.4	33.40	70.14	76.25	23.81	50.01
39-503-TP2	3.72	116	105	-11.5	<0.01	2.99	1.38	93.4	11.3	11.30	23.73	136.56	-39.45	-82.85

WATER MATRIX ANALYSES

Metals in Water
Results in ug/l

FIELD ID	Sb (ug/L)	As (ug/L)	Ba (ug/L)	Cd (ug/L)	Ca (ug/L)	Cr (ug/L)	Co (ug/L)	Cu (ug/L)	Fe (ug/L)	Pb (ug/L)	Mg (ug/L)	Mn (ug/L)	Hg (ug/L)	Ni (ug/L)	Ag (ug/L)	Zn (ug/L)	HARDNESS (mg CaCo3/L))
39-503-SW-1	10.4 J	50.4	13.4	0.77 J	50300	9.8	8.3 U	2.8 J	190	35.5 J	12500	46.5 J	0.14 U	16.9 U	0.21 U	78.0	177000
39-503-SW-2	3.5 J	7.2	12.3	0.22 J	48900	8.7 U	8.3 U	2.0 U	25.3	0.93 U	12300	5.8 J	0.14 U	16.9 U	0.21 U	34.4	173000

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Wet Chemistry
Results in mg/l

FIELD ID	Total Dissolved Solids	CHLORIDE	SULFATE	NO3/NO2-N	CYANIDE
39-503-SW-1	250	< 5	95	NR	NR
39-503-SW-2	242	< 5	87	NR	NR

Legend

SE-1- In Spring Creek, 100' downstream from main tailings impoundment.
SE-2- In Spring Creek, 100' upstream from site.
TP1- Composite of subsamples TP1A-1 and TP1B-1.
TP2- Composite of subsamples TP1A-2, TP1B-2, and TP1B-3.
BACKGROUND- From the Emery Mine (30-004-SS-1) (1993 data).
SW-1- Same as SE-1.
SW-2- Same as SE-2

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY

Mine/Site Name: S & H
Legal Description: T 18N R 26W
Mining District: Plains
Latitude: N 47° 19' 35"
Longitude: W 114° 56' 20"
Land Status: Public
Quad: Keystone Peak
Inspectors: Tuesday, Flammang
Organization: Pioneer Technical Services, Inc.

County: Sanders
Section(s): SE 1/4, SW 1/4, Section 8
Mine Type: Hardrock/Cu, Ag
Primary Drainage: Clark Fork River
USGS Code: 17010204
Secondary Drainage: Clark Fork River
Date Investigated: October 7, 1995
P.A. # 45-017

- No mill tailings were observed at the site during the investigation.

- The volume of waste rock associated with the site was approximately 75 cubic yards. The waste rock was located adjacent to flow from the adit discharge. The following elements were elevated at least three times background:
  Copper: 622J mg/kg
  Lead: 99.4J mg/kg
  Barium: 51.7 mg/kg
  Iron: 15,400 mg/kg
  Mercury: 0.23J mg/kg

- One discharging adit was observed at the site which flowed adjacent to the waste rock and into the Clark Fork River. The chronic aquatic life criteria was exceeded for mercury. No acute aquatic life criteria or MCLs were exceeded. The pH was 7.15.

- Surface water flow from the Clark Fork River was near the site. However, no samples were collected due to the large volume of water in the river with respect to the negligible amount contributed from the site.

- Potential safety hazards observed at the site included an adit opening and a highwall above the adit opening.

S & H PA# 45-017
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER-TUESDAY
INVESITIGATION DATE: 10/7/95

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	Sb (mg/Kg)	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Ca (mg/Kg)	Cr (mg/Kg)	Co (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Pb (mg/Kg)	Mg (mg/Kg)	Mn (mg/Kg)	Hg (mg/Kg)	Ni (mg/Kg)	Ag (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
45-017-WR-1	4.1 UJX	14.1 J	51.7	0.43 U	208	2.4 J	1.4 U	622 J	15400	99.4 J	1820	30.4	0.23 J	5.8 JX	1.6	16.2	NR
BACKGROUND	5.39 U	7.89	8.8	0.5 U	NR	1.2 U	3.31	2.44 J	3120	7.59 J	NR	609	0.00965 UJ	2.22 U	NR	11.9	NR

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	Total Sulfur Acid Base t/1000t	Neutral Potent. t/1000t	Tot. Sulfur Acid Base Potential t/1000t	Sulfate Sulfur %	Pyritic Sulfur %	Organic Sulfur %	Pyritic Sulfur Acid Base t/1000t	Pyritic Sulfur Acid Base Potential t/1000t	Lime Req. Sobek (t/1000t)	Lime Req. Sobek (t/ac.) 1ft.	Potential Acidity	Lime Req. Dollhopf (t/1000t)	Lime Req. Dollhopf (t/ac.) 1ft.
45-017-WR-1	0.44	13.7	0.92	-12.8	0.05	0.01	0.38	0.31	0.61	0.61	1.28	13.36	-15.55	-32.65

WATER MATRIX ANALYSES

Metals in Water
Results in ug/l

FIELD ID	Sb (ug/L)	As (ug/L)	Ba (ug/L)	Cd (ug/L)	Ca (ug/L)	Cr (ug/L)	Co (ug/L)	Cu (ug/L)	Fe (ug/L)	Pb (ug/L)	Mg (ug/L)	Mn (ug/L)	Hg (ug/L)	Ni (ug/L)	Ag (ug/L)	Zn (ug/L)	HARDNESS (mg CaCo3/L))
45-017-AD-1	3.2	1.5 U	111	0.046 U	23000	8.7 U	8.3 U	7.2 J	19.1 J	0.93 U	6220	4.5 J	0.23 JX	16.9 U	0.99 JX	21.5	83.1

U- Not Detected; J- Estimated Quantity; X- Outlier for Accuracy or Precision; NR- Not Requested

Wet Chemistry
Results in mg/l

FIELD ID	Total Dissolved Solids	CHLORIDE	SULFATE	NO3/NO2-N	CYANIDE
45-017-AD-1	114	< 5	16.0	NR	NR

Legend

WR-1- Composite of WR1A, 1B.
BACKGROUND- Taken from Nancy Lee Mine (31-001-SS1) (1993 data).
AD-1- Adit discharge near WR-1.

6.0 REFERENCES

MBMG, 1994. Montana Bureau of Mines and Geology, Well Logs Database, July 14, 1994.

MDEQ/AMRB-Pioneer, 1994a. Sampling and Analysis Plan for the Abandoned Mines Hazardous Materials Inventory, May 1994.

MDEQ/AMRB-Pioneer, 1994b. Quality Assurance Project Plan for the Abandoned Mines Hazardous Materials Inventory, May 1994.

MDEQ/AMRB-Pioneer, 1994c. Laboratory Analytical Protocol for the Abandoned Mines Hazardous Materials Inventory, May 1994.

MDEQ/AMRB-Pioneer, 1994d. Health and Safety Plan for the Abandoned Mines Hazardous Materials Inventory, May 1994.

MDEQ/AMRB-Pioneer, 1994e. Abandoned Hardrock Mines Project Report for the Abandoned Hardrock Mine Priority Sites, December 1994.

MDEQ/WQB, 1995. Montana Department of Environmental Quality/Water Quality Bureau, Circular WQB-7, Montana Numeric Water Quality Standards, July 15, 1995.

MDFWP, 1989. Montana Department of Fish, Wildlife and Parks, Montana Rivers Information System Rivers Report, Version 2.0, Prepared by Montana Natural Resource Information System, December 1989.

GLOSSARY

Abandoned Mine; Abandoned Workings - Excavations, either open, caved, or sealed, that are deserted and in which further mining is not intended.

Acid Mine Water - Mine water which contains sulfuric acid, mainly due to the oxidation of iron pyrite.

Acidity - Estimate of the capacity for a neutral water to neutralize caustic wastes without disturbing biological activities.

Activator (floatation mill) - A reagent that facilitates floatation of selected mineral species in a flotation cell.

Acute Aquatic Life Criteria - EPA's maximum acute toxicity concentrations for protection of aquatic life and its uses as established under Section 304(a)(1) of the Clean Water Act, as amended.

Adit - A horizontal or nearly horizontal passage driven in rock from the surface of the working or dewatering of a mine.

Alkalinity - Estimate of the capacity for a neutral water to neutralize acidic wastes without disturbing biological activities.

Alluvium - Sediments deposited on land by streams and rivers.

AIMSS - Abandoned and Inactive Mines Scoring System.

Amalgamation - The process by which mercury is alloyed with some other metal to produce an amalgam. Used at one time for the extraction of gold and silver from pulverized ores.

Attribution - To document an observed release of a hazardous substance(s) to the environment, the presence of the hazardous substance(s) must be attributable to a waste source at the site. For example, if an observed release to surface water can be established for copper, the concentration of copper in any waste source at the site must exist at greater than three times the background concentration of copper to establish attribution to the site.

Ball Mill - A rotating horizontal cylinder in which nonmetallic materials are ground using various types of grinding media such as quartz pebbles, porcelain balls, or steel balls.

Barren Solution - Leaching solution that has been chemically stripped of metal values. Typically, the barren solution is recharged with leaching agent and recycled.

Benefication - The processing of ores for the purpose of (1) regulating the size of a desired product, (2) removing unwanted constituents, and (3) improving the quality, purity, or assay grade of a desired product.

BLM - United States Department of Interior, Bureau of Land Management.

Bore Hole - An exploratory or prospecting hole made by drilling.

CECRA - The Comprehensive Environmental Cleanup and Responsibility Act.

CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act of 1980, also known as Superfund: Amended in 1986 by the Superfund Amendments and Reauthorization Act (SARA).

Chronic Aquatic Life Criteria - EPA's maximum chronic toxicity concentrations for protection of aquatic life and its uses as established under Section 304(a)(1) of the Clean Water Act, as amended.

Claim - An area of land claimed by an individual or corporation for the ultimate purpose of mineral extraction. The dimensions of a lode claim are 600 by 1,500 feet; for a placer claim, 600 by 1,320 feet.

Collar - The term applied to the timbering or concrete around the mouth or top of a shaft. The junction of a mine shaft with the surface.

Collector (floatation mill) - A reagent that aids or facilitates the attraction of mineral particles to the froth in a floatation cell.

Comminution - To reduce solids to minute particles by crushing and grinding to liberate metals.

Concentrate - To separate metal or ore from the associated gangue or barren rock.

Concentrate (mineral concentrate) - Enriched ore after the removal of waste in a benefication mill.

Concentrator - Mill or plant in which ore is concentrated by removing unwanted constituents.

Containment - Engineered structures designed to prevent releases to groundwater, such as liners, covers, and run-on diversions.

Country Rock - General term applied to the rock surrounding and penetrated by mineralized veins; in a wider sense applied to the rocks invaded by and surrounding an igneous intrusion.

Cribbing - A method of timbering used primarily to rectify the removal of too great a percentage of the rock on the advance, and has the effect of replacing part of the rock.

Crosscut - (1) A passageway driven at right angles to the main entry to connect it with a parallel entry of air course. (2) A horizontal opening driven across the course of a vein or in general perpendicular to the direction of the main workings.

Crusher - A machine for crushing rock or other materials. Among the various types of crushers are the ball-mill, gyratory crusher, Hadsel mill, jaw crusher, rod mill, rolls, stamp mill, and tube mill.

Cyanide - A salt or ester of hydrocyanic acid. In aqueous solution, cyanide is used to dissolve metal from gangue material for later recovery.

Cyclone - A device for classification by centrifugal means of fine particles suspended in water, whereby the coarser grains collect and are discharged at the apex of the vessel, while the finer particles are eliminated with the bulk of the water at the discharge orifice.

Depressant (floatation mill) - A reagent that causes selected mineral species to sink in a floatation cell.

DNRC - Montana Department of Natural Resources and Conservation.

Drainage Basin Code - Code assigned to each discrete hydrologic unit by the U.S. Geological Survey.

Drift - A horizontal passage underground. A drift follows the vein, as distinguished from a crosscut, which intersects it.

Dump - A pile or heap of waste rock material or other non-ore refuse near a mine.

Electrowinning - Recovery of a metal from an ore or solution by electrochemical processes.

EPA - United States Environmental Protection Agency.

Face - The surface exposed by excavation. The working face, front, or forehead is the face at the end of the tunnel heading, or at the end of the full size excavation.

Floatation - The method of mineral separation which a froth created in water by a variety of reagents floats some finely crushed minerals, whereas other mineral sink.

Floatation Cell - Device in which froth floatation of ores is performed. It has provisions for receiving conditioned pulp, aerating the pulp, and for separate discharge of the resulting mineralized froth and impoverished tailings.

Floodplain - An alluvial plain caused by the overbank deposition of alluvial material. They typically appear as flat expanses of land bordering a stream or river. Most floodplains are accompanied by a series of alluvial terraces of varying levels.

Fluvial - Pertaining to or produced by the action of a stream or river.

Frother - A reagent which serves to stabilize the froth in a floatation cell until it can be scraped off into the concentrate launder.

Glory Hole - Large, open hole typically associated with a mined-out or widened shaft.

Gravity Mill - A process in which heavy metals or minerals are separated from waste by the action of agitation and gravity on materials suspended in a liquid, usually water.

Grizzly - A devise used for coarse screening of bulk materials. A rugged screen for rough sizing at a comparatively large size (for example, 6-inches); it can comprise fixed or moving bars, disks, or shaped tumblers or rollers.

Hand Auger - A large tool modeled after the carpenter's drill used in soil sampling.

HRS - EPA's Hazard Ranking System (Federal Register, Vol. 55, No. 241, pp. 51532-51667).

Hazardous Substance - CERCLA hazardous substances, pollutants, and contaminants as defined in CERCLA Sections 101(14) and 101(33).

Headframe - The vertical steel or timber frame at the top of a shaft, which carries the sheave or pulley for the hoist.

Heavy Metal - Principally the metals zinc, copper, cobalt, and lead; however, may include one or more of the following metals: bismuth, cadmium, gold, indium, iron, manganese, mercury, nickel, palladium, silver, thallium, and tin (often included, though not a metal).

Highwall - The unexcavated face of exposed overburden and coal or ore in an open-cast mine or the face or bank on the uphill side of contour strip mine excavation.

Hoist - (1) A drum on which wire rope is wound in the engine house, as the cage or skip is raised in the hoisting shaft. (2) An engine with a drum used for winding up a load from a shaft.

Inclined Shaft or Incline - A non-vertical shaft; usually along the dip of a vein.

Intermittent Stream - A stream or stretch of stream which flows only at certain times of the year when it receives water from springs, snow melt or storm runoff.

Jaw Crusher - A primary crusher designed to reduce large rocks or ores to sizes capable of being handled by a secondary crusher. It consists of a moving jaw, hinged at one end, which swings toward and away from a stationary jaw in a regular oscillatory cycle.

Jig (Mineral Jig) - A machine in which the feed is stratified in water by means of a pulsating motion and from which the stratified products are separately removed, the pulsating motion usually being obtained by alternate upward and downward currents of water.

Latitude - The angular distance north or south from the equator of a point on the earth's surface, expressed in degrees.

Leaching - (1) The removal in solution of the more soluble minerals by percolating waters. (2) Extracting a soluble metallic compound from an ore by selectively dissolving it in a suitable solvent, such as water, sulfuric acid, hydrochloric acid, cyanide, etc.

Legal Description - The Township, Range, Section, and typically quarter/quarter section location.

Level - A main underground roadway or passage driven along the level course to afford access to the stopes or workings and to provide ventilation and haulageways for the removal of ore.

Loadout - A receptacle for ore awaiting treatment or shipment, also referred to as an ore bin.

Longitude - An angular distance east or west from the meridian of some particular place to the prime meridian at Greenwich, England.

MCL - Maximum contaminant level: Established under the Safe Drinking Water Act.

MCLG - Maximum contaminant level goal: Established under the Safe Drinking Water Act.

Master Inventory - Inventory of all identifiable abandoned or inactive hardrock mine sites in Montana conducted by the MDEQ/AMRB.

Mesh - The number of openings per unit area of a screen (sieve).

Mill - A mineral treatment plant in which crushing, grinding, and further processing of ore is conducted to produce a product.

Milling - The processing of ore to produce a product.

Mine - Excavation of earth for the extraction of ore or other economic minerals.

Mine Development - The term used to describe the operations involved in preparing a mine for ore extraction. These operations may include tunneling, sinking, crosscutting, drifting, and raising.

Mineral - An inorganic substance occurring in nature, though not necessarily of inorganic origin, which has (1) a definite chemical composition or, more commonly, a characteristic range of composition, and (2) distinctive physical properties or molecular structure.

Mineral Deposit - A surface or underground body of mineral matter that may be utilized for its industrial mineral or metal content.

Mineral Dressing - Physical and chemical concentration of raw ore into a product from which a metal can be recovered for a profit.

MBMG - Montana Bureau of Mines and Geology.

MDEQ/AMRB - Montana Department of Environmental Quality/Abandoned Mine Reclamation Bureau.

MDEQ/ERD - Montana Department of Environmental Quality/Environmental Remediation Division.

MDEQ/WQB - Montana Department of Environmental Quality/Water Quality Bureau.

Observed Release - Concentration of hazardous substance(s) has increased significantly (greater than three times) above the background concentration for the site for that specific type of sample. For example, to document an observed release to surface water, a contaminant concentration detected in a surface water sample collected downstream from a site must exceed the concentration detected in a surface water sample collected upstream from the site by more than three times. See also "Attribution".

Open Pit Mining - A form of operation designed to extract minerals that lie near the surface.

Open Stope Method - Stoping in which no regular artificial method of support is employed, although occasional props or cribs may be used to hold local patches of insecure ground. Usually confined to relatively small, narrow ore bodies.

Ore - A mineral, or mineral aggregate, containing precious or useful metals, and which occurs in such quantity, grade, and chemical combination as to make extraction commercially profitable.

Ore Bin - A receptacle for ore awaiting treatment or shipment, also referred to as a loadout.

Ore Body - A solid and fairly continuous mass of ore, which may include low-grade ore and waste, as well as high-grade material.

Ore Deposit - A general term applied to rocks containing minerals of economic value in such amount that they can be profitably tracted.

Oxidation/Reduction Potential - The hypothetical electron activity at equilibrium. A measurement of the relative tendency (potential) of a solution to accept or transfer electrons, measured in volts.

Perennial Stream - A stream or stretch of a stream that flows continuously throughout the year.

pH - A measure of the degree of acidity or basicity of a solution. At 25°C, a pH of 7 is neutral. Acidity increases as measurements decrease below 7, and basicity increases as measurements increase above 7.

Placer - A mineral concentration resulting from weathering processes, usually involving water. Placer deposits are typically composed of heavy minerals, with gold, platinum, tin, and diamonds being the most important.

Ponded - A condition in which free water covers the soil surface, as in a closed depression.

Portal - (1) The surface entrance to a drift, tunnel, or adit; (2) The entrance to a mine.

PRP - Potentially Responsible Party.

Pregnant Solution - Metal-laden solution (cyanide, acid, etc.) resulting from a leach process.

Primary Drainage - The primary drainage is the smallest named stream segment/drainage basin that is locatable on the USGS Hydrologic Unit Map within which the mine site is located.

PA No. - Problem Area Number established by the MDEQ/AMRB.

Prospect - (1) A mineral property, the value of which has not been proved by exploration. (2) Non-producing mining property under development or considered worthy of such attention.

Pulp - A mixture of ground ore and water capable of flowing through suitably graded channels as a fluid.

QA/QC - Quality Assurance/Quality Control.

Raise - A vertical or inclined opening driven upward from a level to connect with the level above, or to explore the ground for a limited distance above one level.

Reagent - A chemical or solution used to produce a desired chemical reaction; a substance used in assay or floatation.

Rod Mill - A mill for fine grinding, employing long steel rods to grind the material.

Secondary Drainage - The secondary drainage is the smallest named stream segment/drainage that is locatable on the USGS Quadrangle Map within which the mine site is located.

Sediment - Solid material, both mineral and organic, that is in suspension, is being transported, or has been moved from its site of origin by air, water, or ice and has come to rest on the earth's surface either above or below the water level.

Sedimentation - The settling of solid particles of soil, coal, or mineral from liquid as a result of gravity or centrifuging.

Shaft - An excavation of limited area compared with its depth, made for access to underground mine workings.

Sluice (Sluice Box) - A long trough-like box set at an incline of about 1:20 through which placer gravel is carried by a stream of water. The gravel is washed away while most of the gold or other heavy materials are caught by riffles or blankets on the floor of the sluice.

Slurry - Fine solid particles suspended in a liquid, typically water, of a consistency that allows flow by gravity or pumping.

Source - Any area where a hazardous substance has been deposited, stored, disposed, or placed, plus those soils that have become contaminated from migration of a hazardous substance.

Specific Conductance - The specific conductance or conductivity of water (or other substance measured) is the electrical conductance of the material between opposite sides of a cube 1 centimeter in each direction.

Stamp Mill - An apparatus in which rock is crushed by a stamp battery.

Stope - An underground excavation from which ore has been removed.

Subsidence - A sinking down of a part of the earth's surface due to the collapse of underlying underground openings.

Surface Mining - The mining in surface excavations, including placer mining, mining in open pits, mining and removing ore from open cuts by hand or with mechanical excavating and transportation equipment, and the removal of overburden to uncover the ore.

Tailings - The refuse material resulting from the washing, concentration, or treatment of ground ore.

Tailings Pond - A pond with a constraining wall or dam to which mill effluents are run.

Tunnel - A horizontal or nearly horizontal underground passage that is open to the atmosphere at both ends.

USFS - United States Department of Agriculture, Forest Service.

USGS - United States Department of Interior, Geological Survey.

Waste - The rock that is too low in grade to be of economic value.

Waste Dump (Spoil Pile) - The area where mine wastes or spoil materials are discarded.

Wetlands - Areas that under normal circumstances have hydrophytic vegetation, hydric marshes, and wetland hydrology. It includes landscape units such as bogs, marshes, and lowlands covered with shallow ephemeral or intermittent waters. Permanent waters of streams and water deeper than 9 feet in lakes or reservoirs are not considered wetlands.

Winze - A vertical or inclined opening, or excavation, connecting two levels in a mine, differing from a raise only in construction. A winze is driven downward and a raise is excavated upward.

X-ray Fluorescence (XRF) Spectrometer - Instrument used for metals analysis of solid media by energy dispersive X-ray fluorescence.