

**MONTANA DEPARTMENT OF STATE LANDS
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY**

Mine/Site Name: <u>Middle Fork Warm Springs</u>	County: <u>Jefferson</u>
Legal Description: <u>T 8 N R 2 W</u>	Section(s): <u>SE 1/4, SE 1/4, Sec. 30, SW 1/4,</u>
Mining District: <u>Alhambra</u>	<u>SW 1/4, Sec. 29</u>
Latitude: <u>N 46° 25' 00"</u>	Mine Type: <u>Hardrock/Unknown</u>
Longitude: <u>W 111° 53' 48"</u>	Primary Drainage: <u>Warm Springs Creek</u>
Land Status: <u>Public</u>	USGS Code: <u>10030101</u>
Quad: <u>Clancy</u>	Secondary Drainage: <u>Middle Fork Warm</u>
Inspectors: <u>Babits, Lasher, Flammang</u>	<u>Springs Creek</u>
Organization: <u>Pioneer Technical Services, Inc.</u>	Date Investigated: <u>August 17, 1993</u>
	P.A. # <u>22-046</u>

- No mill tailings were observed at this site during the investigation.
- The volume of waste rock associated with this site was estimated to be approximately 17,700 cubic yards. The following elements were elevated at least three times background:

Arsenic: 3,010J to 24,000J mg/kg	Cadmium: 5J to 7.3J mg/kg
Mercury: 0.189 to 0.273 mg/kg	Lead: 992J to 2,550J mg/kg
Zinc: 523J to 1,350J mg/kg	Copper: 93.8 to 252 mg/kg
- There were four discharging adits identified at the site. The adit discharges were sampled for field parameters only. The pH measurements ranged from 6.61 to 7.16.
- An unnamed tributary to Middle Fork Warm Springs Creek flowed directly through the waste rock material at the site. Observed releases to this tributary were documented for arsenic, cadmium, copper, lead, and zinc. The MCL for cadmium was exceeded in the downstream sample; this exceedance was directly attributable to the site. Acute and chronic aquatic life criteria for zinc and the chronic aquatic life criteria for copper were exceeded in the downstream sample; these exceedances were also directly attributable to the site.
- One potentially hazardous open adit was identified at the site.

Middle Fork Warm Springs PA# 22-046
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER - BABITS
INVESTIGATION DATE: 08/17/93

SOLID MATRIX ANALYSES

Metals in soils Results per dry weight basis

FIELD ID	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Co (mg/Kg)	Cr (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Hg (mg/Kg)	Mn (mg/Kg)	Ni (mg/Kg)	Pb (mg/Kg)	Sb (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
22-046-SE-1	7.43 J	23 J	0.6 U	5.53	3.63	12.6	9220	0.031 U	223	4.51	9.5 U	7.21 U	28.4 J	NR
22-046-SE-2	1130 J	37.9 J	14.7 J	13.4	15.8	115	32500	0.206	814	7.71	263 J	7.59 U	1610 J	NR
22-046-WR-1	5540 J	14.2 J	0.7 J	2.17 U	1.53 U	63.4	24100	0.08	41.4	2.83 U	992 J	6.86 U	188 J	NR
22-046-WR-2	3010 J	12.9 J	0.5 U	3.5	1.38 U	114	30100	0.189	296	2.55 U	2450 J	6.18 U	523 J	NR
22-046-WR-3	4290 J	9.29 J	5.0 J	1.86 U	1.61	93.8	30400	0.273	453	2.43 U	1890 J	5.89 U	1350 J	NR
22-046-WR-4	24000 J	8.4 J	7.3 J	10.9	3.55	252	68600	0.027 U	1200	7.77	2550 J	6.07 U	1100 J	NR
BACKGROUND	32.1 J	77.7 J	0.9 J	14.1	16.8	29.2	27200	0.03 U	587	9.28	52.7 J	5.46 U	116 J	NR

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	ACID BASE v/1000x	NEUTRAL POTENT v/1000x	SULFUR ACID BASE POTENT v/1000x	ORGANIC SULFUR %	PYRITIC SULFUR %	PYRITIC ACID BASE v/1000x	SULFUR ACID BASE POTENT v/1000x
22-046-WR-1	0.25	7.81	-6.12	-13.9	0.01	<0.01	0.00	-6.12
22-046-WR-2	0.74	23.1	-1.81	-24.9	0.06	0.02	0.62	-2.44
22-046-WR-3	1.19	37.2	7.71	-29.5	0.38	0.25	7.81	-0.10
22-046-WR-4	6.65	208	10.4	-197	3.46	1.59	49.7	-39.2

U - Not Detected, J - Estimated Quantity, X - Outline for Accuracy or Precision, NR - Not Requested

WATER MATRIX ANALYSES

Metals in Water Results in ug/L

FIELD ID	As	Ba	Cd	Co	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Sb	Zn	HARDNESS CALC (mg CaCO3/L)
22-046-SW-1	2.5	6.17	2.57 U	9.7 U	6.83 U	1.77 J	67.5	0.25 J	6.07	12.7 U	0.72 U	30.7 U	13.3	28.1
22-046-SW-2	23.1	8.27	8.27 J	9.7 U	6.83 U	12.8 J	337	0.21 J	317	12.7 U	2.22	30.7 U	1290	101

U - Not Detected, J - Estimated Quantity, X - Outline for Accuracy or Precision, NR - Not Requested

Wet Chemistry Results in mg/l

FIELD ID	TOTAL DISSOLVED SOLIDS	CHLORIDE	SULFATE	NO3/NO2-N	CYANIDE
22-046-SW-1	81	< 5.0	9	< 0.05	NR
22-046-SW-2	176	< 5.0	61	< 0.05	NR

LEGEND

- SE1 - Upgradient (2007) on unnamed tributary of Middle Fork Warm Springs
SE2 - Downgradient (1507) on unnamed tributary of Middle Fork Warm Springs
WR1 - Composite of subsamples WR5B and 5C
WR2 - Composite of subsamples WR5A, 6A, and 6B
WR3 - Composite of subsamples WR1, 2, 3A, and 3B
WR4 - Composite of subsamples WR4A and 4B

- BACKGROUND - 50 feet South and East of SW-1
SW1 - Same as sample SE1
SW2 - Same as sample SE2

**MONTANA DEPARTMENT OF STATE LANDS
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY**

Mine/Site Name: Alhambra Hot Springs
Legal Description: T 8 N R 3 W
Mining District: Alhambra
Latitude: N 46° 27' 05"
Longitude: W 111° 59' 02"
Land Status: Private/Public
Quad: Clancy
Inspectors: Babits, Flammang, Lasher
Organization: Pioneer Technical Services, Inc.

County: Jefferson
Section(s): NW 1/4, NE 1/4, Sec. 16
Mine Type: Hardrock/Gravel
Primary Drainage: Prickly Pear Creek
USGS Code: 10030101
Secondary Drainage: Warm Springs Creek
Date Investigated: August 17, 1993
P.A. # 22-049

- No mill tailings were observed at the site during the investigation.
- The volume of waste rock associated with this site was estimated to be approximately 5,560 cubic yards. The following elements were elevated at least three times background:

Barium: 310J to 529J mg/kg	Mercury: 0.473 to 2.26 mg/kg
Lead: 4,260 mg/kg	Antimony: 17.5J mg/kg
- No discharging adits, filled shafts, seeps, or springs were observed at the site during the investigation.
- Warm Springs Creek was flowing approximately 300 feet south of the site; however, no surface water or sediment samples were collected due to lack of a direct runoff route.
- A potentially hazardous 10 foot highwall was identified above the upper waste rock dump.

Alhambra Hot Springs PA# 22-049
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER - BABITS
INVESTIGATION DATE: 08/17/93

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Co (mg/Kg)	Cr (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Hg (mg/Kg)	Mn (mg/Kg)	Ni (mg/Kg)	Pb (mg/Kg)	Sb (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
22-049-WR-1	21.2 J	310 J	1.2 J	1.66 U	1.17 U	171	3650	2.26	53.7	2.17 U	4260 J	17.5 J	148 J	NR
22-049-WR-2	14.3 J	529 J	1.4 J	4.75	1.18 U	10.2	9920	0.473	288	3.43	106 J	5.3 U	66.1 J	NR
BACKGROUND	32.1 J	77.7 J	0.9 J	14.1	16.8	29.2	27200	0.03 U	587	9.28	52.7 J	5.46 U	116 J	NR

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

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	ACID BASE POTENT v/1000	NEUTRAL POTENT v/1000	SULFUR ACID BASE POTENT v/1000	SULFATE SULFUR %	PYRITIC SULFUR %	ORGANIC SULFUR %	PYRITIC SULFUR ACID BASE POTENT v/1000	SULFUR ACID BASE POTENT v/1000
22-049-WR-1	0.07	2.19	1.43	-0.76	0.02	<0.01	0.05	0.00	1.43
22-049-WR-2	0.05	1.56	4.30	2.74	0.03	<0.01	0.02	0.00	4.30

LEGEND

WR1 - Sample of subsample WR1
WR2 - Composite of subsamples WR2, 3A, and 3B
BACKGROUND - From Middle Fork Warm Springs
(22-046-SS-1)

**MONTANA DEPARTMENT OF STATE LANDS
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY**

Mine/Site Name: <u>Solar Silver</u>	County: <u>Jefferson</u>
Legal Description: <u>T 8 N R 2 W</u>	Section(s): <u>SE 1/4, SE 1/4, Sec. 30</u>
Mining District: <u>Warm Springs</u>	Mine Type: <u>Hardrock/Pb, Ag, Au</u>
Latitude: <u>N 46° 25' 00"</u>	Primary Drainage: <u>Middle Fork Warm Springs Creek</u>
Longitude: <u>W 111° 53' 48"</u>	USGS Code: <u>10030101</u>
Land Status: <u>Private/Public</u>	Secondary Drainage: <u>Unnamed tributary to Middle Fork Warm Springs Creek</u>
Quad: <u>Clancy</u>	Date: <u>August 17, 1993</u>
Inspectors: <u>Babits, Flammang, Lasher</u>	P.A. # <u>22-054</u>
Organization: <u>Pioneer Technical Services, Inc.</u>	

- No mill tailings were observed at this site during the investigation.
- The volume of waste rock associated with this site was estimated to be approximately 1,700 cubic yards. The following elements were elevated at least three times background:
Arsenic: 2,760J mg/kg Lead: 715J mg/kg
Zinc: 667J mg/kg
- One discharging adit was observed at the site during the investigation. The discharge eventually flowed into an unnamed tributary of Middle Fork Warm Springs Creek. MCLs for arsenic and cadmium were exceeded in the adit discharge. Acute and chronic aquatic life criteria were exceeded for copper and zinc, and the chronic aquatic life criteria for iron was exceeded. The pH measurement in the adit discharge was 6.94.
- Middle Fork Warm Springs Creek flowed directly adjacent to the waste rock dump. Observed releases to Middle Fork Warm Springs Creek were documented for arsenic, lead, and zinc. The MCL for cadmium was exceeded in the downstream sample; however, the exceedance was not attributable to the site. Acute and chronic aquatic life criteria for zinc were exceeded in the downstream sample; these exceedances were directly attributable to the site.
- One potentially hazardous open adit was identified at the site.

Solar Silver PA# 22-054
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER - BABITS
INVESTIGATION DATE: 08/17/93

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Co (mg/Kg)	Cr (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Hg (mg/Kg)	Mn (mg/Kg)	Ni (mg/Kg)	Pb (mg/Kg)	Sb (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
22-046-SE-2	1130 J	37.9 J	15 J	13.4	15.8	115	32500	0.206	814	7.71	263 J	7.59 U	1610 J	NR
22-046-WR-5	2760 J	29.1 J	1 J	6.95	6.07	83	56800	0.037	720	3.4	715 J	6.91 U	667 J	NR
BACKGROUND	32.1 J	77.7 J	1 J	14.1	16.8	29.2	27200	0.03 U	587	9.28	52.7 J	5.46 U	116 J	NR

U - Not Detected, J - Estimated Quantity, X - Outlier for Accuracy or Precision, NR - Not Reported

Acid/Base Accounting

FIELD ID	TOTAL SULFUR			SULFUR			PYRITIC SULFUR			PYRITIC SULFUR			SULFUR		
	%	u/1000	ACID BASE	NEUTRAL	POTENT	u/1000	ACID BASE	POTENT	u/1000	ACID BASE	POTENT	u/1000	ACID BASE	POTENT	u/1000
22-046-WR-5	1.37	42.8		-5.6	-48	125	<0.01	0.16	0	-5.55					

WATER MATRIX ANALYSES

Metals in Water
Results in ug/L

FIELD ID	As	Ba	Cd	Co	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Sb	Zn (mg CaCO3/L)
22-046-SW-1	2.5	6.17	2.57 U	9.7 U	6.83 U	1.77 J	67.5	0.25 J	6.07	12.7 U	0.72 U	30.7 U	13.3
22-046-SW-2	23.1	8.27	8.27 J	9.7 U	6.83 U	12.8 J	337	0.21 J	317	12.7 U	2.22	30.7 U	1290
22-046-SW-7	152	6.4	10.9 J	9.7 U	6.83 U	108 J	4810	0.22 J	1490	12.7 U	5.03	30.7 U	2250

Wet Chemistry
Results in mg/l

FIELD ID	TOTAL DISSOLVED SOLIDS			CHLORIDE	SULFATE	NO3/NO2-N	CYANIDE
22-046-SW-1	81	<	5.0	9	<	0.05	NR
22-046-SW-2	176	<	5.0	61	<	0.05	NR
22-046-SW-7	373	<	5.0	172	<	0.05	NR

LEGEND

SE1 - Upgradient on unnamed tributary (250' of Mdd. Fr. Wm. Spgs)
 SE2 - Downgradient (150') unnamed tributary from waste rock dump ?
 WR5 - Composite of subsamples WR7B and 7A
 BACKGROUND - from the Middle Fork Warm Springs (22-046-SB-1)

NOTE: 22-046-WR-5 was collected and submitted to the lab under 22-046, not as 22-054 (Solar Silver)

SW1 - Same as sample SE1
 SW2 - Same as sample SE2
 SW7 - Acid discharge at waste rock dump ?

**MONTANA DEPARTMENT OF STATE LANDS
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY**

Mine/Site Name: <u>Bullion</u>	County: <u>Jefferson</u>
Legal Description: <u>T 7N R 6W</u>	Section(s): <u>SW 1/4, SE 1/4, Sec. 13</u>
Mining District: <u>Basin</u>	Mine Type: <u>Hardrock/Au, Ag, Cu, Pb, Zn</u>
Latitude: <u>N 46° 21' 22"</u>	Primary Drainage: <u>Basin Creek</u>
Longitude: <u>W 112° 17' 40"</u>	USGS Code: <u>10020006</u>
Land Status: <u>Private/Public</u>	Secondary Drainage: <u>Jack Creek</u>
Quad: <u>Basin</u>	Date Investigated: <u>July 6, 1993</u>
Inspectors: <u>Bullock, Belanger, Clark</u>	P.A. # <u>22-008</u>
Organization: <u>Pioneer Technical Services, Inc.</u>	

- There were approximately 4,200 cubic yards of tailings on site. The following elements were elevated at least three times background:
Arsenic: 2,440 to 4,470 mg/kg Cadmium: 2.9 mg/kg
Copper: 172 to 257 mg/kg Mercury: 0.373J to 0.575J mg/kg
Lead: 3,330J to 5,110J mg/kg Antimony: 151 to 196 mg/kg
- There were approximately 42,150 cubic yards of waste rock on site. The following were elevated at least three times background:
Arsenic: 1,690J to 18,100J mg/kg Cadmium: 4.1 mg/kg
Copper: 137 to 372 mg/kg Mercury: 0.383J to 0.519J mg/kg
Lead: 3,610J to 11,300J mg/kg Antimony: 66 to 254 mg/kg
Zinc: 695 mg/kg
- There were two discharging adits on site. One entered surface water and was sampled as GW-1. This discharge had a flow rate of approximately 7 gpm, the pH was 2.92, and a specific conductance of 2610 umhos/cm. This discharge exceeded MCL/MCLGs for arsenic, cadmium, copper, nickel, and antimony. The chronic and acute aquatic life criteria for arsenic, cadmium, copper, lead, and zinc were exceeded. The chronic aquatic life criteria for iron was also exceeded.
- The tributary of Jack Creek received the adit discharge and flowed through the tailings. Observed releases were documented for arsenic, cadmium, copper, lead, and zinc. Arsenic and cadmium exceeded MCLs in the downstream surface water sample. Acute and chronic aquatic life criteria were exceeded for cadmium, copper, and zinc both upstream and downstream of the site. Observed releases to the stream sediments were also documented for arsenic, copper, lead, antimony, and zinc.
- There were no hazardous openings on site. There were five hazardous structures and three highwalls at pits or trenches.

Bullion PA# 22-008
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER - BULLOCK
INVESTIGATION DATE: 07/06/93

SOLID MATRIX ANALYSES

Results per dry weight basis

FIELD ID	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Co (mg/Kg)	Cr (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Hg (mg/Kg)	Mn (mg/Kg)	Ni (mg/Kg)	Pb (mg/Kg)	Sb (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
22-008-SE-1	9 J	29.9	0.5 U	3.1	4.1	8.6	7440	0.038 J	163	4	8 J	3 U	34	NR
22-008-SE-2	2180 J	48.1	0.6 U	11.6	5.5	192	39200	0.062 J	853	13	179 J	15	313	NR
22-008-SE-3	1230 J	56.4	0.9	9	7.4	146	18600	0.066 J	396	7	393 J	21	275	NR
22-008-TP-1	2440 J	88.9	2.9	2.2	2.6	257	7260	0.203 J	16.9	4	3330 J	196	558	NR
22-008-TP-2	3420 J	118	0.5 U	1.1 U	2.8	172	11600	0.575 J	18.5	2 U	3870 J	164	104	NR
22-008-TP-3	4470 J	40.6	0.5 U	14	8.2	674	15100	0.373 J	7.9	4	5110 J	151	175	NR
22-008-WR-1	18100 J	138	0.8 U	1.7	2.3	137	36700	0.383 J	84.7	2 U	3610 J	254	135	NR
22-008-WR-2	1690 J	22.5	4.1	2.1	1 U	372	15800	0.519 J	83.7	2 U	11300 J	66	695	NR
BACKGROUND	68 J	344	0.6 U	22.1	20.3	35	35000	0.08 J	6830	21	39 J	5 U	188	NR

U - Not Detected, J - Estimated Quantity, X - Outline for Accuracy or Precision, NR - Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	ACID BASE %	NEUTRAL POTENT %	ACID BASE POTENT %	ORGANIC SULFUR %	PYRITIC SULFUR %	PYRITIC ACID BASE %	ACID BASE POTENT %	ACID BASE POTENT %
22-008-TP-1DUP	0.31	9.68	0.42	-9.3	0.08	0.09	2.81	-2.39	
22-008-TP-1	0.32	10	0.58	-9.4	0.09	0.08	2.5	-1.92	
22-008-TP-2	0.21	6.56	-0.9	-7.5	0.01	0.01	0.31	-1.23	
22-008-TP-3	1.21	37.8	-3.3	-41	0.1	1.24	38.7	-42	
22-008-WR-1	1.04	32.5	-2.6	-35	0.09	0.02	0.62	-3.23	
22-008-WR-2	1.41	44	-4.4	-48	0.33	<0.01	0	-4.39	

WATER MATRIX ANALYSES

Results in ug/L

FIELD ID	As	Ba	Cd	Co	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Sb	Zn	HARDNESS CALC. (mg CaCO ₃ /L)
22-008-GW-1	12700	8.57	736	508	13.3 J	19400 J	325000 J	0.038 U	31000 JX	142	743 JX	147	80600 J	366
22-008-SW-1	2.02	13.6	2.57 U	9.7 U	15 J	12.2 J	105 J	0.038 U	4.6 JX	12.7 U	4.96 JX	30.7 U	45.2 J	19.7
22-008-SW-2	208	12.5	26.4	20.5	6.83 U	631 J	8470 J	0.038 U	1200 JX	12.8	15.4 JX	30.7 U	2960 J	33.2
22-008-SW-3	92.5	13.6	22.9	17.1	10.9 J	424 J	4280 J	0.038 U	930 JX	12.7 U	15.2 JX	30.7 U	2570 J	35.7

Results in mg/l

FIELD ID	TOTAL DISSOLVED SOLIDS	CHLORIDE	SULFATE	NO ₃ /NO ₂ -N	CYANIDE
22-008-GW-1	72	< 5.0	< 5	< 0.05	NR
22-008-SW-1	114	< 5.0	47	< 0.05	NR
22-008-SW-2	137	< 5.0	47	< 0.05	NR

LEGEND

SE1 - Upgradient on Jack Creek
 SE2 - Adit #6 discharge after flowing through dump
 SE3 - Downgradient Jack Creek, approx. 100' below TP2
 TP1 - Composite of subsamples TP1A-A, B, C, and TP1B-A, B
 TP2 - Composite of subsamples TP2A-A, B, and TP2B-A, B
 TP3 - Composite of subsamples TP3A-D, 2A-C, and 2B-C
 WR1 - Composite of subsamples WR1A, 2C, and 3B
 WR2 - Composite of subsamples WR2A, 5B, and 3D
 BACKGROUND - From the Bullion Mine (22-008-SS-1)
 TP1DUP - Duplicate of sample 22-008-TP-1
 GW1 - Adit discharge above mill
 SW1 - Same as sample SE1
 SW2 - Same as sample SE2
 SW3 - Same as sample SE3

U - Not Detected, J - Estimated Quantity, X - Outline for Accuracy or Precision, NR - Not Requested

**MONTANA DEPARTMENT OF STATE LANDS
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY**

Mine/Site Name: <u>Josephine</u>	County: <u>Jefferson</u>
Legal Description: <u>T 8N R 6W</u>	Section(s): <u>SE 1/4, NE 1/4, Section 26</u>
Mining District: <u>Basin</u>	Mine Type: <u>Hardrock/Au, Ag, Pb</u>
Latitude: <u>N 46° 24' 58"</u>	Primary Drainage: <u>Basin Creek</u>
Longitude: <u>W 112° 18' 36"</u>	USGS Code: <u>10020006</u>
Land Status: <u>Private</u>	Secondary Drainage: <u>Clear Creek</u>
Quad: <u>Three Brothers</u>	Date Investigated: <u>August 2, 1994</u>
Inspectors: <u>Bisch, Flammang, West</u>	P.A. # <u>22-031</u>
Organization: <u>Pioneer Technical Services, Inc.</u>	

- No mill tailings were observed at the site.
- The volume of waste rock observed at the site was estimated to be 21,680 cubic yards. Several of the dumps were situated directly in the Clear Creek floodplain. The following elements were elevated to at least three times the background concentrations:
Silver: 30.8 to 64.7 mg/kg
Arsenic: 1,960J mg/kg
Lead: 3,000 to 10,600 mg/kg
- One discharging adit and two filled shafts were observed at the site. The pH of the adit discharge, which eventually entered Clear Creek, was measured at 4.16. The MCL for cadmium and the EPA action level for lead were exceeded in the adit discharge, as were the acute and chronic aquatic life criteria for silver, cadmium, copper, lead, and zinc and the chronic aquatic life criteria for mercury. One of the filled shafts that was sampled during the investigation had a pH of 5.8. No MCLs were exceeded in water contained in the shaft.
- Observed releases to Clear Creek were documented for silver and lead. No MCLs were exceeded in Clear Creek; however, the acute and chronic aquatic life criteria for silver and lead were exceeded in the downstream sample. These exceedances were directly attributable to the site.
- Potential safety hazards observed at the site included two fenced but open shafts, a collapsing loadout structure, and several collapsing cabins.

SOLID MATRIX ANALYSES

FIELD	Ag	Au	Ba	Cd	Co	Cr	Cu	Pb	Hg	Mn	Ni	Pb	Sb	Zn	CYANIDE
ID	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
22-031-SE1	3.4	82.2 J	13.3 J	0.9 UJ	1.8 UJ	1.5 UJ	41.9	4470 JX	0.17 JX	20.3 J	3.1 U	465	11.3 UJ	45.9	NR
22-031-SE2	1.1 U	32.2 J	63.3 J	1.0 UJ	2.5 J	1.7 UJ	11.4	3990 JX	0.06 JX	418 J	3.5 U	72.4	12.5 UJ	53.5	NR
22-031-WR1	30.8	225 J	19.7 J	0.7 UJ	1.4 UJ	1.2 UJ	75.4	8960 JX	0.70 JX	66.4 J	2.5 U	3000	8.9 UJ	46.4	NR
22-031-WR2	64.7	1960 J	17.0 J	0.7 UJ	1.4 UJ	1.1 UJ	106	7020 JX	0.50 JX	1.7 J	2.4 U	10600	23.0 J	68.0	NR
BACKGROUND	1.0 U	84.1 J	67.8 J	1.0 UJ	2.5 J	2.5 J	55.9	7500 JX	0.24 JX	442 J	3.5 U	53.3	12.5 UJ	57.6	NR

FIELD ID	TOTAL SULFUR		NEUTRAL POTENT		SULFUR ACID BASE		SULFATE SULFUR		PYRITIC SULFUR		ORGANIC SULFUR		PYRITIC ACID BASE		SULFUR ACID BASE	
	%	g/1000g	%	g/1000g	%	g/1000g	%	g/1000g	%	g/1000g	%	g/1000g	%	g/1000g	%	g/1000g
22-031-WR1	0.10	3.12	-0.70	-3.8	0.10	-3.8	0.10	-3.8	-0.01	0.01	0.01	0.01	0.00	0.00	-0.70	-0.70
22-031-WR2	0.38	11.9	-3.30	-15	0.26	-15	0.26	-15	0.03	0.09	0.09	0.09	0.94	0.94	-4.24	-4.24

Metals in Water
Results in ug/L

FIELD ID	Ag	Au	Ba	Cd	Co	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Sb	Zn	CALC. (mg CuCO ₃ /L)
22-031-AD1	2.55	15.3	11.4	10.4	8.4 U	6.8 U	295	446	0.10	259	14.4 U	554 J	516 U	1430	48.4
22-031-GW1	0.28	7.1	5.5 U	4.0 U	8.4 U	6.8 U	5.9 U	898	0.08 U	48.1	14.4 U	22.8 J	516 U	156 U	2.8
22-031-GW2	0.26	7.5	5.5 U	4.0 U	8.4 U	6.8 U	5.9 U	1050	0.08 U	57.7	14.4 U	23.4 J	516 U	27.2	3.0
22-031-SW1	0.72	7.8	5.5 U	4.0 U	8.4 U	6.8 U	13.7	241	0.13	20.8	14.4 U	39.8 J	516 U	84.1	8.7
22-031-SW2	0.21	3.5	5.5 U	4.0 U	8.4 U	6.8 U	5.9 U	32.1	0.11	2.3 U	14.4 U	2.0 J	516 U	156 U	4.2

U = Not Detected; J = Estimated Quantities; S = Outlier for Analysis; Pb = Precision; MS = Mass Spectrometer

FIELD I.D.	TOTAL DISSOLVED SOLIDS	CHLORIDE	SULFATE	NO ₃ /NO ₂ -N	CYANIDE
22-031-AD1	68	<5.0	66	<0.05	NR
22-031-GW1	13	<5.0	10	<0.05	NR
22-031-GW2	<4.0	<5.0	10	<0.05	NR
22-031-SW1	40	<5.0	<5.0	0.23	NR
22-031-SW2	<4.0	<5.0	<5.0	0.09	NR

MS1 - 100 measurements from MS1 in Chert Creek.
MS2 - Dry sediment sample collected upstream from MS1 and MS3.
MS3 - Composite of sediments MS1A, 1B, 1A, 1A, 1B, 1A, 1A, 1B, and 1B.
MS2 - Composite of sediments MS2A through 2C.

**MONTANA DEPARTMENT OF STATE LANDS
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY**

Mine/Site Name: <u>Basin Millsite</u>	County: <u>Jefferson</u>
Legal Description: <u>T 6 N R 5 W</u>	Section(s): <u>NE 1/4, SW 1/4, Sec. 17</u>
Mining District: <u>Basin</u>	Mine Type: <u>Millsite/Custom mill</u>
Latitude: <u>N 46° 16' 17"</u>	Primary Drainage: <u>Boulder River</u>
Longitude: <u>W 112° 15' 18"</u>	USGS Code: <u>10020006</u>
Land Status: <u>Private</u>	Secondary Drainage: <u>Basin Creek</u>
Quad: <u>Basin</u>	Date Investigated: <u>July 9, 1993</u>
Inspectors: <u>Babits, Lasher/Pierson</u>	P.A. # <u>22-036</u>
Organization: <u>Pioneer Technical Services, Inc./Thomas, Dean and Hoskins</u>	

- The volume of tailings associated with this site was estimated to be approximately 19,000 cubic yards. The following elements were elevated at least three times background:

Arsenic: 2,840JX mg/kg	Barium: 350 mg/kg
Cadmium: 27.7 mg/kg	Copper: 252 mg/kg
Mercury: 0.585J mg/kg	Manganese: 1,360J to 5,050J mg/kg
Lead: 102 to 3,340 mg/kg	Antimony: 37J mg/kg
Zinc: 4,460 mg/kg	

- The volume of waste rock associated with this site was estimated to be approximately 1,735 cubic yards. The following elements were elevated at least three times background:

Arsenic: 139JX to 232JX mg/kg	Cadmium: 38.5 to 103 mg/kg
Copper: 342 to 963 mg/kg	Mercury: 0.493J to 0.517J mg/kg
Manganese: 1,370J mg/kg	Lead: 2,190 to 11,900 mg/kg
Antimony: 35J to 329J mg/kg	Zinc: 3,770 to 12,500 mg/kg

- No discharging adits, filled shafts, seeps, or springs were identified at the site.

- No surface water was flowing on or near the site during the investigation. The nearest surface water was over 1,000 feet away; no surface water samples were collected due to the lack of a direct runoff route.

- No hazardous mine openings were identified at the site.

Basin Millsite PA# 22-036
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER - BABITS
INVESTIGATION DATE: 07/08/93

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Co (mg/Kg)	Cr (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Hg (mg/Kg)	Mn (mg/Kg)	Ni (mg/Kg)	Pb (mg/Kg)	Sb (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
22-036-TP-1	39 JX	43.5	0.5 U	3.6	11.9	25.5	10700	0.014 J	1360 J	4	102	6 UJ	135	0.308 U
22-036-TP-2	2840 JX	350	27.7	9.3	10.8	252	26900	0.585 J	5050 J	11	3340	37 J	4460	0.302 U
22-036-WR-1	232 JX	64.1	38.5	4.9	1.7	963	18900	0.493 J	672 J	6	11900	329 J	3770	NR
22-036-WR-2	139 JX	59.1	103	4.4	7.4	342	17300	0.517 J	1370 J	4	2190	35 J	12500	NR
BACKGROUND	15	65.1	0.5 U	4	6.3 J	10.3 J	9160	0.01 J	344 J	6	11 JX	7 UJ	94	NR

U: Not Detected; J: Estimated Quantity; X: Outlier for Accuracy as Precision NR: Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	TOTAL SULFUR v/1000	NEUTRAL POTENT v/1000	SULFUR ACID BASE POTENT v/1000	SULFATE SULFUR %	PYRITIC SULFUR %	ORGANIC SULFUR %	PYRITIC SULFUR ACID BASE POTENT v/1000	SULFUR ACID BASE POTENT v/1000
22-036-TP-1	<0.01	0	94.4	94.4	<0.01	<0.01	0.04	0	94.4
22-036-TP-2	1.69	52.8	114	61.2	0.34	1.12	0.23	35	79
22-036-WR-1	2.91	90.9	3.63	-87	<0.01	2.16	0.84	67.5	-63.8
22-036-WR-2	2.19	68.4	9.8	-59	0.85	0.63	0.71	19.7	-9.88

LEGEND

TP1 - Composite of subsamples TP1A-A, B, 1B-A, and -B
TP2 - Composite of subsamples TP1A-C, 1C-A, 1C-B, and 1C-C
WR1 - Composite of subsamples WR1, 2, 3, 4, 5, 6, and 7
WR2 - Same as sample 22-036-WR-1 (Split)
BACKGROUND - From Morning Glory Mine (22-077-SS-1)

**MONTANA DEPARTMENT OF STATE LANDS
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY**

Mine/Site Name: <u>Perry Park</u>	County: <u>Jefferson</u>
Legal Description: T <u>8 N</u> R <u>6 W</u>	Section(s): <u>NW 1/4, SW 1/4, Sec. 36</u>
Mining District: <u>Basin</u>	Mine Type: <u>Placer/Au</u>
Latitude: <u>N 46° 24' 03"</u>	Primary Drainage: <u>Basin Creek</u>
Longitude: <u>W 112° 18' 02"</u>	USGS Code: <u>1002006</u>
Land Status: <u>Private/Public</u>	Secondary Drainage: <u>Grub Gulch</u>
Quad: <u>Three Brothers</u>	Date Investigated: <u>July 9, 1993</u>
Inspectors: <u>Babits, Bullock, Clark</u>	P.A. # <u>22-039</u>
Organization: <u>Pioneer Technical Services, Inc.</u>	

- No mill tailings were observed at this site during the investigation.
- No waste rock was observed at this site during the investigation.
- Approximately 22,000 cubic yards of placer dredgings were identified at the site. The material consisted of very large cobbles and boulders; consequently, no samples were collected.
- The dredged material was situated directly in Grub Gulch. A sediment sample did not indicate any metals values elevated above background. No surface water samples were collected.
- No hazardous mine openings or structures were identified at the site.

Perry's Park PA# 22-039
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER - BABITS
INVESTIGATION DATE: 07/09/93

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Co (mg/Kg)	Cr (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Hg (mg/Kg)	Mn (mg/Kg)	Ni (mg/Kg)	Pb (mg/Kg)	Sb (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
22-039-SE-1	15 J	27.1	0.5 U	4.7	3.6	6.8	10000	0.028 J	428	4	8 J	4 U	66	NR
BACKGROUND	88	76	0.7 U	9.5	10.9 J	49.7 J	20400	0.107 J	654 J	9	117 JX	8 UJ	104	NR

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

LEGEND

SE1 - Grab Oulch below placer diggings approx. 3007 above crossing

BACKGROUND - From the Enterprise (22-07 & SS-1)

**MONTANA DEPARTMENT OF STATE LANDS
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY**

Mine/Site Name: Buckeye
Legal Description: T 8 N R 6 W
Mining District: Basin
Latitude: N 46° 23' 52"
Longitude: W 112° 17' 38"
Land Status: Private/Public
Quad: Three Brothers
Inspectors: Babits, Lasher/Pierson
Organization: Pioneer Technical Services, Inc/
Thomas Dean & Hoskins, Inc.

County: Jefferson
Section(s): NW 1/4, SE 1/4, Sec. 36
Mine Type: Hardrock/Au
Primary Drainage: Basin Creek
USGS Code: 10020006
Secondary Drainage: Basin Creek
Date Investigated: July 6, 1993
P.A. # 22-072

- The volume of tailings associated with this site was estimated to be approximately 20,750 cubic yards. The following elements were elevated at least three times background:

Arsenic: 708JX to 17,100JX mg/kg	Cadmium: 3.9 to 24.9 mg/kg
Copper: 168 to 1,160 mg/kg	Lead: 417 to 14,100 mg/kg
Antimony: 76J to 2,350J mg/kg	Zinc: 1,250 to 4,040 mg/kg

- The volume of waste rock associated with this site was estimated to be approximately 6,130 cubic yards. The following elements were elevated at least three times background:

Arsenic: 628JX mg/kg	Mercury: 0.342J mg/kg
Manganese: 1,970 mg/kg	Lead: 1,850 mg/kg
Antimony: 29J mg/kg	Zinc: 340 mg/kg

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

- Basin Creek flowed directly adjacent to the tailings. Surface water and sediment samples were collected upstream and downstream from the site. No MCLs were exceeded in the Basin Creek samples. Acute and chronic aquatic life criteria were exceeded for copper and zinc in the downstream sample; these exceedances were directly attributable to the site.

- No hazardous mine openings or structures were identified at the site.

Buckeye PA# 22-072
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER - BABITS
INVESTIGATION DATE: 07/05/93

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Co (mg/Kg)	Cr (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Hg (mg/Kg)	Mn (mg/Kg)	Ni (mg/Kg)	Pb (mg/Kg)	Sb (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
22-074-SE-2	2360	30	1.2	10.5	12.6 J	60.6 J	47100	0.083 J	455 J	9	415 JX	42 J	208 JX	NR
22-072-SE-3	997 JX	30.4	0.9	7.2	4.8	44.3	19200	0.056 J	488 J	6	589	74 J	253	NR
22-072-TP-1	17100 JX	29.6	24.9	4	1.4	1180	24400	0.108 J	24.2 J	2 U	14100	2350 J	4040	0.271 U
22-072-TP-2	252 JX	224	3.9	16.2	17	168	16900	0.082 J	237 J	22	281	12 UJ	1250	0.577 U
22-072-TP-3	708 JX	74.4	0.9 U	5.2	7	51.2	6610	0.057 J	61.7 J	5 U	213	19 J	300	0.41 U
22-072-TP-4	7180 JX	66.4	0.4 U	5.6	3.8	17.9	21000	0.03 J	393 J	4	417	76 J	54	0.268 U
22-072-WR-1	628 JX	31	0.5 U	4.1	1.4 U	35	18600	0.342 J	1970 J	5	1850	29 J	340	NR
BACKGROUND	88	76	0.7 U	9.5	10.9 J	49.7 J	20400	0.107 J	654 J	9	117 JX	8 UJ	104	NR

U - Not Detected; J - Estimated Quantity; X - Qualify for Accuracy or Precision; NR - Not Reported

Acid/Base Accounting

FIELD ID	TOTAL SULFUR		NEUTRAL		SULFUR ACID BASE		SULFATE		PYRITIC		ORGANIC		PYRITIC		SULFUR ACID BASE	
	%	g/1000	POTENT	g/1000	POTENT	g/1000	%	%	%	%	%	%	g/1000	g/1000	POTENT	g/1000
22-072-TP-1	2.45	76.5	-2	-79	0.64	0.11	0.06	0.27	1.54	48.1	50.1	519	0.27	1.54	48.1	50.1
22-072-TP-2	0.31	9.68	-0.9	-11	0.05	0.05	0.02	0.02	0.02	0.62	0.4	0.4	0.02	0.02	0.62	0.4
22-072-TP-3DUP	0.09	2.81	1.03	-1.8	0.05	0.05	0.02	0.02	0.02	0.62	0.19	0.19	0.02	0.02	0.62	0.19
22-072-TP-3	0.09	2.81	0.82	-2	0.05	0.04	0.04	<0.01	0.13	4.06	4.66	4.66	0.05	0.04	0.04	<0.01
22-072-TP-4	0.04	1.25	-0.8	-2.1	0.04	0.04	0.04	0.16	0.16	4.06	4.96	5.19	0.04	0.04	0.04	0.16
22-072-WR-1	0.87	27.2	8.72	-19	0.58	0.58	0.58	0.16	0.16	4.06	4.96	5.19	0.58	0.58	0.58	0.16
22-072-WR-1DUP	0.88	27.5	9.25	-18	0.59	0.59	0.59	0.16	0.16	4.06	4.96	5.19	0.59	0.59	0.59	0.16

WATER MATRIX ANALYSES

Metals in Water
Results in ug/L

FIELD ID	As	Ba	Cd	Co	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Sb	Zn	HARDNESS CALC
22-074-SW-2	10.1 J	4.43	2.57 U	9.7 U	6.83 U	6.23 J	187	0.038 U	143	12.7 U	9.67 J	30.7 U	129	23.3
22-072-SW-3	18.1	5.53	2.57 U	9.7 U	9.27 J	15.9 J	284 J	0.038 U	161 JX	12.7 U	14.5 JX	30.7 U	165 J	25.9

U - Not Detected; J - Estimated Quantity; X - Qualify for Accuracy or Precision; NR - Not Reported

Wet Chemistry
Results in mg/l

FIELD ID	TOTAL DISSOLVED SOLIDS	CHLORIDE	SULFATE	NOMINOUS N	CYANIDE
22-074-SW-2	80	< 5.0	8	< 0.05	NR
22-072-SW-3	88	< 5.0	8	< 0.05	NR

LEGEND

22-074-SE2 - In Basin Creek down on PPE from Enterprise Mine
 SE3 - Downgradient of PPE of tailings in Basin Creek
 TP1 - Composite of subsamples TP1A-A, 1A-B, and 1B-A
 TP2 - Composite of subsamples TP2B-B, 1B-C, 1C-B, and 1D-B
 TP3 - Composite of subsamples TP3C-A and 1D-A
 TP4 - Sample of TP3 subsample
 BACKGROUND - From the Enterprise Mine (22-074-SW-1)
 SW3 - Same as sample SE3
 22-074-SW2 - Same as 22-074-SE2 sample

**MONTANA DEPARTMENT OF STATE LANDS
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY**

Mine/Site Name: <u>Enterprise</u>	County: <u>Jefferson</u>
Legal Description: <u>T 8 N R 6 W</u>	Section(s): <u>NW 1/4, SE 1/4, Sec. 36</u>
Mining District: <u>Basin</u>	Mine Type: <u>Hardrock/Au</u>
Latitude: <u>N 46° 23' 52"</u>	Primary Drainage: <u>Basin Creek</u>
Longitude: <u>W 112° 17' 38"</u>	USGS Code: <u>10020006</u>
Land Status: <u>Public</u>	Secondary Drainage: <u>Basin Creek</u>
Quad: <u>Three Brothers</u>	Date Investigated: <u>July 6, 1993</u>
Inspectors: <u>Babits, Lasher/Pierson</u>	P.A. # <u>22-074</u>
Organization: <u>Pioneer Technical Services, Inc./Thomas, Dean and Hoskins, Inc.</u>	

- No mill tailings were observed at this site during the investigation.
- The volume of waste rock associated with this site was estimated to be approximately 22,930 cubic yards. The following elements were elevated at least three times background:
Arsenic: 5,840 to 22,400 mg/kg Lead: 1,000JX to 3,520JX mg/kg
Antimony: 91J to 291J mg/kg
- One discharging adit was identified at the site. MCLs were exceeded for arsenic, copper, cadmium, and antimony in the adit discharge. Acute and chronic aquatic life criteria were exceeded for arsenic, cadmium, copper, lead, and zinc, and chronic aquatic life criteria were exceeded for iron and mercury. The pH measurement in the adit discharge was 2.9.
- The adit discharge entered Basin Creek downstream from the site. Surface water and sediment samples were collected from Basin Creek upstream and downstream from the adit discharge confluence. Acute and chronic aquatic life criteria were exceeded for copper and zinc in the downstream sample; these exceedances were directly attributable to the adit discharge.
- Observed releases to Basin Creek (sediment) were documented for arsenic, lead, and antimony, which were directly attributable to the site.
- No hazardous mine openings were identified at the site.

Enterprise PA# 22-074
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER - BABITS
INVESTIGATION DATE: 07/06/93

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Co (mg/Kg)	Cr (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Hg (mg/Kg)	Mn (mg/Kg)	Ni (mg/Kg)	Pb (mg/Kg)	Sb (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
22-074-SE-1	15	29.2	0.6 U	8.1	5.7 J	12.9 J	15400	0.031 J	412 J	6	34 JX	7 UJ	95 JX	NR
22-074-SE-2	2360	30	1.2	10.5	12.6 J	60.6 J	47100	0.083 J	455 J	9	415 JX	42 J	208 JX	NR
22-074-WR-1	5840	81.5	0.9	2.2 U	2.3 J	62.4 J	37000	0.068 J	131 J	3 U	1000 JX	91 J	133 JX	NR
22-074-WR-2	22400	24.4	1.4	2.1 U	1.4 UJ	94.6 J	33100	0.209 J	208 J	3 U	3520 JX	291 J	78 JX	NR
BACKGROUND	88	76	0.7 U	9.5	10.9 J	49.7 J	20400	0.107 J	654 J	9	117 JX	8 UJ	104 JX	NR

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

Acid/Base Accounting

FIELD ID	TOTAL		SULFUR		NEUTRAL		SULFUR		SULFATE		PYRITIC		ORGANIC		PYRITIC		SULFUR		SULFUR	
	SULFUR	%	ACID BASE	U/1000x	POTENT	U/1000x	ACID BASE	POTENT	U/1000x	%	SULFUR	ACID BASE	SULFUR	%	SULFUR	ACID BASE	POTENT	U/1000x	ACID BASE	POTENT
22-074-WR-1	0.38		11.9		-3.1		-15		0.36		<0.01		0.03		0		55		-3.1	
22-074-WR-2	2.97		92.8		-4.8		-98		0.63		1.76		0.58				-59.8			

WATER MATRIX ANALYSES

Metals in Water
Results in ug/L

FIELD ID	As	Ba	Cd	Co	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Sb	Zn	HARDNESS CALC. (mg CaCO3/L)
22-074-SW-1	3.71 J	4.27	2.57 U	9.7 U	6.83 U	2.43 J	99.7	0.130 J	13.3	12.7 U	5.42 J	30.7 U	12.9	23
22-074-SW-2	10.1 J	4.43	2.57 U	9.7 U	6.83 U	6.23 J	167	0.038 U	143	12.7 U	9.67 J	30.7 U	129	23.3
22-074-SW-4	15500 J	13.9	146	42	6.83 U	1340 J	131000	0.081 J	28900	31.7	1340 J	84.2	23400	192

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
22-074-SW-1	43	< 5.0	< 5	< 0.05	NR
22-074-SW-2	80	< 5.0	8	< 0.05	NR
22-074-SW-4	1050	< 5.0	622	< 0.05	NR

LEGEND

SE1 - Upgradient in Basin 100' above confluence with unnamed tributary
SE2 - In Basin Creek down of PPE of edit discharge
WR1 - Composite of subsamples WR2A and 2D
WR2 - Composite of subsamples WR2B and 2C
BACKGROUND - 300' upgradient from SW1, From Enterprise (22-074-SS-1)

SW1 - Same as sample SE1
SW2 - Same as sample SE2
SW4 - Acid discharge.

**MONTANA DEPARTMENT OF STATE LANDS
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY**

Mine/Site Name: <u>Doris</u>	County: <u>Jefferson</u>
Legal Description: T <u>6N</u> R <u>5W</u>	Section(s): <u>SW 1/4, SE 1/4, Section 7</u>
Mining District: <u>Basin</u>	Mine Type: <u>Hardrock/Unknown</u>
Latitude: <u>N 46° 66' 58"</u>	Primary Drainage: <u>Basin Creek</u>
Longitude: <u>W 112° 16' 30"</u>	USGS Code: <u>10020006</u>
Land Status: <u>Private</u>	Secondary Drainage: <u>Basin Creek</u>
Quad: <u>Basin</u>	Date Investigated: <u>June 17, 1994</u>
Inspectors: <u>Bullock, Bisch, Clark, West</u>	P.A. # <u>22-293</u>
Organization: <u>Pioneer Technical Services, Inc.</u>	

- No mill tailings were observed at the site.
- The volume of waste rock observed at the site was estimated to be 4,470 cubic yards. The following elements were elevated to at least three times the background concentrations:

Silver: 17 mg/kg	Mercury: 3.33J mg/kg
Cadmium: 11.9JX mg/kg	Manganese: 2410JX mg/kg
Cobalt: 10.4 mg/kg	Lead: 182JX to 2,000JX mg/kg
Copper: 531J mg/kg	Zinc: 722 to 1,570 mg/kg
- Waste rock was actively eroding into Basin Creek at the site. An observed release to Basin Creek (sediment) was documented for copper.
- No MCLs were exceeded in Basin Creek; however, acute and chronic aquatic life criteria for copper and zinc were exceeded in both the upstream and downstream samples. Additionally, the chronic aquatic life criteria for lead and mercury were exceeded in both the upstream and downstream samples.
- Potential safety hazards observed at the site included two partially backfilled adits and a collapsing loadout structure (low hazard potential).

Doris PA# 22-293
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER - BULLOCK
INVESTIGATION DATE: 06/17/94

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	Ag (mg/Kg)	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Co (mg/Kg)	Cr (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Hg (mg/Kg)	Mn (mg/Kg)	Ni (mg/Kg)	Pb (mg/Kg)	Sb (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
22-293-SE1	0.7	45.9 JX	37.2	2.5 JX	6.5	3.5 J	161 J	9170 J	0.07 J	608 JX	3.9	89.3 JX	6.6 UJ	284	NR
22-293-SE2	0.6 U	74.5 JX	48.7	3.3 JX	7.5	0.9 UJ	27.3 J	5410 J	0.06 J	937 JX	2.5	87.1 JX	5.9 UJ	292	NR
22-293-WR1	17	44.4 JX	9.68	11.9 JX	4.7	3.2 J	531 J	18800 J	3.33 J	527 JX	5.5	2000 JX	5.8 J	1570	NR
22-293-WR2	0.6 U	5.7 UJX	7.84	2.4 JX	10.4	4.9 J	82.2 J	22100 J	0.07 J	2410 JX	8.4	182 JX	6.3 UJ	722	NR
BACKGROUND	1.0 U	84.1 J	67.8 J	1.0 UJ	2.5	2.5 J	55.9	7500 JX	0.24 JX	442 J	3.5 U	53.3	12.5 UJ	57.6	NR

U - Not Detected, J - Estimated Quantity, X - Outlier for Accuracy or Precision, NR - Not Reported

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	TOTAL SULFUR ACID BASE %/1000	NEUTRAL POTENT %/1000	SULFUR ACID BASE POTENT %/1000	SULFATE SULFUR %	PYRITIC SULFUR %	ORGANIC SULFUR %	PYRITIC SULFUR ACID BASE %/1000	SULFUR ACID BASE POTENT %/1000
22-293-WR1	0.93	29.1	2.93	-26	0.61	0.05	0.27	1.56	1.36
22-293-WR2	0.27	8.43	13.6	5.20	<0.01	0.07	2.19	2.19	11.4

WATER MATRIX ANALYSES

Metals in Water
Results in ug/L

FIELD ID	Ag	As	Ba	Cd	Co	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Sb	Zn	HARDNESS CALC (mg CaCO3/L)
22-293-SW1	0.13 JX	13.0	19.4	2.6 U	8.7 U	4.7 U	11.2	390	0.14	29.8	8.0 U	2.9	29.4 U	91.1	24.1
22-293-SW2	0.22 JX	13.7	18.9	2.6 U	8.7 U	4.7 U	11.8	404	0.12	32.7	8.0 U	3.0	29.4 U	98.7	23.5

Wet Chemistry
Results in mg/l

FIELD ID	TOTAL DISSOLVED SOLIDS	CHLORIDE	SULFATE	NO3NO2-N	CYANIDE
22-293-SW1	53	<5	9.0	0.06	NR
22-293-SW2	64	<5	7.0	0.06	NR

LEGEND

SE1 - Downstream in Basin Creek
SE2 - Upstream in Basin Creek
WR1 - Composite of subsamples WR1A through 1C
WR2 - One sample of the WR2 subsample
BACKGROUND - From the Jumpline Mine (22-431-881)
SW1 - Same as sample 22-293-SE1
SW2 - Same as sample 22-293-SE2

U - Not Detected, J - Estimated Quantity, X - Outlier for Accuracy or Precision, NR - Not Reported

**MONTANA DEPARTMENT OF STATE LANDS
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY**

Mine/Site Name: <u>Jack Creek Tailings</u>	County: <u>Jefferson</u>
Legal Description: <u>T 7N R 6W</u>	Section(s): <u>SW 1/4, NE 1/4, Sec. 14</u>
Mining District: <u>Basin</u>	Mine Type: <u>Tailings</u>
Latitude: <u>N 46° 21' 42"</u>	Primary Drainage: <u>Basin Creek</u>
Longitude: <u>W 112° 18' 27"</u>	USGS Code: <u>10020006</u>
Land Status: <u>Private/Public</u>	Secondary Drainage: <u>Jack Creek</u>
Quad: <u>Basin</u>	Date Investigated: <u>July 6, 1993</u>
Inspectors: <u>Bullock, Belanger, Clark</u>	P.A. # <u>22-296</u>
Organization: <u>Pioneer Technical Services, Inc.</u>	

- There were approximately 23,000 cubic yards of tailings on site. The following elements were elevated at least three times background:

Arsenic: 1,890 mg/kg	Cadmium: 2.2 to 4.0 mg/kg
Copper: 381J mg/kg	Lead: 147 to 681JX mg/kg
Antimony: 26J mg/kg	
- There was no waste rock on site.
- There were no discharging mine openings, seeps, or springs identified at this site.
- Jack Creek ran through the tailings impoundment area. No observed releases to Jack Creek were documented; and no MCL/MCLGs were exceeded in upstream or downstream surface water samples. The acute aquatic life criteria was exceeded for lead in the downstream sample, which was directly attributable to the site.
- There were no hazardous openings on site.

Jack Creek Tailings PA# 22-296
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER - BULLOCK
INVESTIGATION DATE: 07/06/93

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Co (mg/Kg)	Cr (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Hg (mg/Kg)	Mn (mg/Kg)	Ni (mg/Kg)	Pb (mg/Kg)	Sb (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
22-296-SE-1	573	31.5	4.2	12.9	16.1	127 J	26700	0.013 UJ	579	7 J	158	6 U	284 J	NR
22-296-SE-2	263	24.2	1.7	7.6	3.1 J	83.1 J	8890	0.015 J	440 J	3 U	79 JX	8 UJ	201	NR
22-296-TP-1	132	141	4.0	14.7	15.6	91.1 J	26800	0.044	402	21 J	147	6 U	348 J	NR
22-296-TP-2	1890	67.2	2.2	8.4	7.5 J	381 J	21500	0.096 J	215 J	6	681 JX	26 J	323	NR
BACKGROUND	68 J	344	0.6 U	22.1	20.3	35	35000	0.08 J	6830	21	39 J	5 U	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 v/1000x	NEUTRAL POTENT v/1000x	SULFUR ACID BASE POTENT v/1000x	SULFATE SULFUR %	PYRITIC SULFUR %	ORGANIC SULFUR %	PYRITIC SULFUR ACID BASE v/1000x	SULFUR ACID BASE POTENT v/1000x
22-296-SE-1	0.03	0.94	4.05	3.12	0.02	<0.01	0.01	0	4.05
22-296-SE-2	0.01	0.31	3.1	2.79	<0.01	<0.01	0.01	0	3.1
22-296-TP-1	0.08	2.5	4.76	2.26	0.01	0.03	0.04	0.94	3.82
22-296-TP-2	0.08	2.5	1.63	-0.9	0.05	0.01	0.02	0.31	1.32

WATER MATRIX ANALYSES

Metals in Water
Results in ug/L

FIELD ID	As	Ba	Cd	Co	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Sb	Zn	HARDNESS CALC (mg CaCO3/L)
22-296-SW-1	20.8 J	13.1	3.83	9.7 U	6.83 U	63.6 J	723	0.038 U	145	12.7 U	8.96 J	30.7 U	416	25.6
22-296-SW-2	36.5 J	17.7	2.57 U	9.7 U	6.83 U	65.2 J	1170	0.038 U	156	20.4	14.7 J	30.7 U	411	25.5

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
22-296-SW-1	58	< 5.0	10	< 0.05	NR
22-296-SW-2	54	< 5.0	14	< 0.05	NR

LEGEND

SE1 - Upgradient of tailings on Jack Creek
SE2 - Downgradient of tailings on Jack Creek
TP1 - Composite of subsamples TP1A-A, B, C, and TP1B-A, B, C
TP2 - Composite of subsamples TP2C-A, B, and TP2D-A
BACKGROUND - From the Bullion Mine (22-008-SB-1)
SW1 - Same as sample SE1
SW2 - Same as sample SE2

**MONTANA DEPARTMENT OF STATE LANDS
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY**

Mine/Site Name: <u>Lady Leith</u>	County: <u>Jefferson</u>
Legal Description: <u>T 7N R 5W</u>	Section(s): <u>NE 1/4, NW 1/4, Section 6</u>
Mining District: <u>Basin</u>	Mine Type: <u>Hardrock/Pb, Zn</u>
Latitude: <u>N 46° 23' 28"</u>	Primary Drainage: <u>Basin Creek</u>
Longitude: <u>W 112° 16' 48"</u>	USGS Code: <u>10020006</u>
Land Status: <u>Private/Public</u>	Secondary Drainage: <u>Basin Creek</u>
Quad: <u>Three Brothers</u>	Date Investigated: <u>June 15, 1994</u>
Inspectors: <u>Bisch, Clark, West</u>	P.A. # <u>22-316</u>
Organization: <u>Pioneer Technical Services, Inc.</u>	

- No mill tailings were observed at the site.
- The volume of waste rock observed at the site was estimated to be 3,505 cubic yards. The following elements were elevated to at least three times the background concentrations:

Silver: 3.6 to 22.2 mg/kg	Mercury: 0.12J to 0.13J mg/kg
Arsenic: 79.2JX to 3,740JX mg/kg	Manganese: 4,720JX to 5,820 mg/kg
Cadmium: 8.0JX to 32.2JX mg/kg	Lead: 355JX to 4,950JX mg/kg
Copper: 246J mg/kg	Antimony: 78.8J mg/kg
Zinc: 620 to 1,100 mg/kg	
- Two discharging adits were observed at the site. The MCL and acute and chronic aquatic life criteria for cadmium were exceeded in the discharge from Adit #1; and the MCL for arsenic was exceeded in the discharge from Adit #2. Additionally, acute and chronic aquatic life criteria for copper, lead, and zinc were exceeded in the Adit #1 discharge; and acute and chronic aquatic life criteria for zinc were exceeded in the Adit #2 discharge.
- An unnamed tributary to Basin Creek flows through the site. Observed releases to the stream were documented for manganese (surface water) and arsenic, cadmium, lead, and zinc (sediment).
- No MCLs were exceeded in the tributary; however, the chronic aquatic life criteria for lead was exceeded in the downstream sample. These exceedances were directly attributable to the site.
- Potential safety hazards observed at the site included a fenced, but open shaft and multiple collapsing cabins (low hazard potential).

Lady Leith PA# 22-316
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER - BISCH
INVESTIGATION DATE: 06/15/94

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	Ag (mg/Kg)	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Co (mg/Kg)	Cr (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Hg (mg/Kg)	Mn (mg/Kg)	Ni (mg/Kg)	Pb (mg/Kg)	Sb (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
22-316-SE1	0.6 U	41.4 JX	21.0	1.4 JX	4.8	7.1 J	15.3 J	11100 J	0.04 J	246 JX	3.3	77.1 JX	6.1 UJ	65.7	NR
22-316-SE2	0.6 U	211 JX	67.7	4.5 JX	15.4	8.9 J	31.7 J	21700 J	0.07 J	1190 JX	6.8	203 JX	5.6 UJ	357	NR
22-316-WR1	15.7	3080 JX	26.0	4.8 JX	10.7	5.3 J	58.7 J	35000 J	0.05 J	1360 JX	3.0	2730 JX	5.8 UJ	620	NR
22-316-WR3	3.6	79.2 JX	16.0	8.0 JX	10.9	4.4 J	67.5 J	30100 J	0.12 J	5820 JX	6.3	355 JX	4.8 UJ	981	NR
22-316-WR6	22.2	3740 JX	10.7	32.2 JX	12.7	1.7 J	246 J	40400 J	0.13 J	4720 JX	1.4 U	4950 JX	78.8 J	1100	NR
BACKGROUND	0.6 U	23.1	178	2.0 J	9.7	3.9	23.1	13600	0.04 J	1280	3.4	42.3	6.4 UJ	120	NR

U - Not Detected, J - Estimated Quantity, X - Outline for Accuracy or Precision, NR - Not Reported

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	ACID BASE P/1000	NEUTRAL P/1000	SULFUR POTENT P/1000	SULFUR ACID BASE P/1000	ORGANIC SULFUR %	PYRITIC SULFUR P/1000	PYRITIC ACID BASE P/1000	PYRITIC SULFUR POTENT P/1000
22-316-WR1	0.75	23.4	-3.18	-27	0.55	0.20	0.00	0.00	-3.18
22-316-WR3	0.77	24.1	91.2	67.1	0.13	0.26	11.9	79.3	79.3
22-316-WR6	0.36	11.1	-1.85	-13.0	0.33	0.03	0.00	0.00	-1.85

WATER MATRIX ANALYSES

Metals in Water
Results in ug/L

FIELD ID	Ag	As	Ba	Cd	Co	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Sb	Zn	HARDNESS CALC (mg CaCO ₃ /L)
22-316-AD1	0.69 JX	15.9	5.1	10.6	21.7	4.7 U	16.4	1670	0.11	536	15.1	84.3	29.4 U	1180	55.5
22-316-AD2	0.12 UX	68.1	10.4	2.6 U	8.7 U	4.7 U	4.6 U	2430	0.11 U	1730	8.0 U	2.8	29.4 U	895	122
22-316-SW1	0.12 UX	3.4	2.8	2.6 U	8.7 U	4.7 U	4.6 U	350	0.11 U	4.4 U	8.0 U	1.1 U	29.4 U	13.5	16.9
22-316-SW2	0.12 UX	5.9	3.5	2.6 U	8.7 U	4.7 U	4.6 U	952	0.11 U	27.5	8.0 U	2.1	29.4 U	21.1	18.9

U - Not Detected, J - Estimated Quantity, X - Outline for Accuracy or Precision, NR - Not Reported

Wet Chemistry
Results in mg/l

FIELD ID	TOTAL DISSOLVED SOLIDS	CHLORIDE	SULFATE	NONNO ₃ -N	CYANIDE
22-316-AD1	120	<5	81	<0.05	NR
22-316-AD2	131	<5	70	<0.05	NR
22-316-SW1	10	<5	<5	<0.05	NR
22-316-SW2	9.0	<5	5.0	<0.05	NR

LEGEND

SE1 - Upstream above site
SE2 - Downstream below site
WR1 - Grab sample of the WR1 sub-sample
WR3 - Grab sample of the WR3 sub-sample
WR6 - Composite of sub-samples WR1, 3, and 6
BACKGROUND - From the Boulder Creek River (22-112-0813)

AD1 - Upstream with active discharge associated with WR1
AD2 - All treated above creek associated with WR1
SW1 - Same as sample 22-114-0811
SW2 - Same as sample 22-114-0812

**MONTANA DEPARTMENT OF STATE LANDS
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY**

Mine/Site Name: <u>Old Basin Millsite</u>	County: <u>Jefferson</u>
Legal Description: <u>T 6N R 5W</u>	Section(s): <u>SW 1/4, Section 17; SE 1/4, Section 18</u>
Mining District: <u>Basin</u>	Mine Type: <u>Millsite/Au, Zn, Cu, Ag, Pb</u>
Latitude: <u>N 46° 16' 10"</u>	Primary Drainage: <u>Boulder River</u>
Longitude: <u>W 112° 16' 46"</u>	USGS Code: <u>10020006</u>
Land Status: _____	Secondary Drainage: <u>Basin Creek</u>
Quad: <u>Basin</u>	Date Investigated: <u>N/A</u>
Inspectors: <u>N/A</u>	P.A. # <u>22-500</u>
Organization: <u>Pioneer Technical Services, Inc.</u>	

- A site visit was not conducted at the site during the 1994 inventory. The EPA investigated the site in 1990, and the northwestern part of the site was investigated by MDSL in 1993 (Basin Millsite Inventory, 22-036).
- According to the EPA, the total surface area covered by tailings at this site was estimated to be 280,000 square feet. However, the EPA's identification of "tailings" includes waste rock. Using this area, the volume of tailings was estimated to range from 10,000 to 30,000 cubic yards. The following elements were elevated to at least three times the background concentrations:
Arsenic: 72 to 1,640 mg/kg
Lead: 274 to 2,710 mg/kg
- No discharging adits, filled shafts, seeps, or springs were associated with the site.
- The Boulder River flows adjacent to the site on the south side. Observed releases to the Boulder River were documented for arsenic (surface water) and lead (sediment). No MCLs were exceeded. The water metals data were not comparable to aquatic life standards due to the lack of associated water hardness data.
- Potential safety hazards associated with the site include a collapsing brick smelter stack and flue and a collapsing loadout structure. Potentially hazardous mine openings were not evaluated by the EPA.

**MONTANA DEPARTMENT OF STATE LANDS
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY**

Mine/Site Name: <u>Mantle East</u>	County: <u>Jefferson</u>
Legal Description: <u>T 6 N R 5 W</u>	Section(s): <u>SE 1/4, NW 1/4, Sec. 9</u>
Mining District: <u>Cataract</u>	Mine Type: <u>Hardrock-Underground/Au</u>
Latitude: <u>N 46° 17' 26"</u>	Primary Drainage: <u>Boulder River</u>
Longitude: <u>W 112° 14' 21"</u>	USGS Code: <u>10020006</u>
Land Status: <u>Private</u>	Secondary Drainage: <u>Cataract Creek</u>
Quad: <u>Mount Thompson</u>	Date Investigated: <u>July 7, 1993</u>
Inspectors: <u>Babits, Lasher/Pierson</u>	P.A. # <u>22-032</u>
Organization: <u>Pioneer Technical Services, Inc./Thomas, Dean and Hoskins, Inc.</u>	

- No mill tailings were observed at this site during the investigation.
- The volume of waste rock associated with this site was estimated to be approximately 4,148 cubic yards. The following elements were elevated at least three times background:

Arsenic: 76JX mg/kg	Copper: 38.4 to 66.6 mg/kg
Mercury: 0.208J to 0.254J mg/kg	Manganese: 1,110J mg/kg
Lead: 114 to 288 mg/kg	
- No discharging adits, filled shafts, seeps, or springs were identified at the site during the investigation.
- WR-5 was situated directly in the Cataract Creek drainage. Sediment samples were collected from Cataract Creek upstream and downstream from the site; no observed releases were documented.
- No hazardous openings or structures were identified at the site.

Mantle (East) PA# 22-032
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER - BABITS
INVESTIGATION DATE: 07/07/93

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Co (mg/Kg)	Cr (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Hg (mg/Kg)	Mn (mg/Kg)	Ni (mg/Kg)	Pb (mg/Kg)	Sb (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
22-032-SE-1	271 JX	79.2	9.5	17.1	6.9	360	17600	0.048 J	1070 J	6	232	12 J	889	NR
22-032-SE-2	144	45.8	7.4	16.7	3.8 J	254 J	8780	0.016 J	988 J	4	134 JX	9 J	580 JX	NR
22-032-WR-1	20 JX	38.5	0.6 U	8.6	1.7	38.4	11000	0.208 J	1110 J	7	114	7 UJ	136	NR
22-032-WR-2	76 JX	52.3	0.6 U	8.4	2.6	66.6	18000	0.254 J	1020 J	5	288	7 UJ	278	NR
BACKGROUND	15	65.1	0.5 U	4	6.3 J	10.3 J	9160	0.01 J	344 J	6	11 JX	7 UJ	94	NR

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

Acid/Base Accounting

FIELD ID	TOTAL		NEUTRAL		SULFUR		SULFATE		PYRITIC		ORGANIC		PYRITIC		SULFUR	
	SULFUR	ACID BASE	POTENT.	POTENT.	ACID BASE	POTENT.	SULFUR	%	SULFUR	%	SULFUR	%	SULFUR	%	ACID BASE	POTENT
	%	1/1000	1/1000	1/1000	1/1000	1/1000	%		%		%		%		1/1000	1/1000
22-032-WR-1	0.19	5.94	6.71	8.54	0.77	-2.7	0.08	0.03	0.94	0.03	0.08	0.13	0.94	0.03	5.77	7.61
22-032-WR-2	0.36	11.2														

LEGEND

SE1 - Upgradient on Olatum Creek
SE2 - Downgradient on Olatum Creek
WR1 - Composite of subsamples WR1, 2, 3, and 4
WR2 - Composite of WR5A and 5B
BACKGROUND - From the Morning Glory (22-077 SS-1)

**MONTANA DEPARTMENT OF STATE LANDS
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY**

Mine/Site Name: <u>Crystal</u>	County: <u>Jefferson</u>
Legal Description: <u>T 7N R 5W</u>	Section(s): <u>NW 1/4, All 1/4, Sec. 20</u>
Mining District: <u>Basin/Cataract</u>	Mine Type: <u>Hardrock/Au, Ag, Cu, Pb, Zn</u>
Latitude: <u>N 46° 21' 01"</u>	Primary Drainage: <u>Cataract Creek</u>
Longitude: <u>W 112° 15' 37"</u>	USGS Code: <u>10020006</u>
Land Status: <u>Private/Public</u>	Secondary Drainage: <u>Uncle Sam Gulch</u>
Quad: <u>Basin</u>	Date Investigated: <u>July 7, 1993</u>
Inspectors: <u>Babits, Lasher/Pierson</u>	P.A. # <u>22-073</u>
Organization: <u>Pioneer Technical Services, Inc./ Thomas, Dean and Hoskins, Inc.</u>	

- No mill tailings were observed at this site during the investigation.
- Approximately 15 acres of disturbed (strip mined) area was identified at the site. The following elements were elevated at least three times background:

Arsenic: 458J to 7,310 mg/kg	Cadmium: 2.1 to 18.4 mg/kg
Copper: 292 to 1,250 mg/kg	Iron: 65,100 mg/kg
Mercury: 0.492J mg/kg	Lead: 188J to 3,570 mg/kg
Antimony: 23 to 73 mg/kg	Zinc: 479 to 3,260 mg/kg
- One discharging adit was identified at the site. The pH measurement in the adit discharge was 3.41. MCLs for arsenic, cadmium, and copper were exceeded in the adit discharge. Acute and chronic aquatic life criteria were exceeded for arsenic, cadmium, copper, lead, and zinc.
- Waste rock was observed directly in the Uncle Sam Gulch drainage. Observed releases to Uncle Sam Gulch were documented for arsenic, cadmium, copper, iron, lead, and zinc. MCLs were exceeded for arsenic, cadmium, and copper in the downstream sample; these exceedances were directly attributable to the site. Acute and chronic aquatic life criteria were exceeded for arsenic and cadmium in the downstream sample, again attributable to the site.
- The U.S. Department of Energy was conducting a research project at this site at the time of the investigation. Settling ponds were being constructed for the treatment of Acid Mine Drainage.
- Two potentially hazardous open adits and a hazardous loadout structure were identified at the site.

Crystal PA# 22-073
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER - BABITS
INVESTIGATION DATE: 07/07/83

SOLID MATRIX ANALYSES

Metals in soils
 Results per dry weight basis

FIELD ID	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Co (mg/Kg)	Cr (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Hg (mg/Kg)	Mn (mg/Kg)	Ni (mg/Kg)	Pb (mg/Kg)	Sb (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
22-073-SE-1	434 J	19.3	8.1	1.8	1.4	27.4	4820	0.048 J	224	3	513 J	10	1110	NR
22-073-SE-2	1900 J	49.4	1	7.7	2.1	203	17600	0.057 J	758	4	999 J	57	487	NR
22-073-WR-1	2510 J	94	18.4	16.5	6.3	292	38100	0.059 J	1310	13	862 J	23	3260	NR
22-073-WR-2	524 J	39.6	0.6 U	17.6	5.2	337	39000	0.062 J	2640	10	559 J	7	479	NR
22-073-WR-3	448 J	59	17.8	8.4	1.7	376	13800	0.031 J	743	7	3570 J	32	2230	NR
22-073-WR-4	3880 J	341	2.1	7.6	3.4	410	23600	0.062 J	1350	6	3350 J	65	783	NR
22-073-WR-5	7310 J	11.4	0.5 U	1.3	1 U	1250	65100	0.492 J	19.7	2	3090 J	73	290	NR
22-073-WR-6	458 J	45	2	5.4	2.4	88.5	10200	0.051 J	263	3	188 J	6	492	NR
22-073-WR-7	390 J	23.5	0.4 U	1.6	2	39.7	5580	0.107 J	140	3	339 J	9	103	NR
22-073-SE-3	539	57	13.6	20.2	2.6 J	848 J	11600	0.033 J	1020 J	5	387 JX	15 J	937 JX	NR
BACKGROUND	140 J	193	0.7 U	9.4	14.9	71.2	21200	0.114 J	1930	11	56 J	5 U	159	NR

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

Acid/Base Accounting

FIELD ID	TOTAL SULFUR		NEUTRAL POTENT		SULFUR ACID/BASE POTENT		ORGANIC SULFUR		PYRITIC SULFUR		PYRITIC SULFUR ACID/BASE POTENT	
	%	g/1000	%	g/1000	%	g/1000	%	g/1000	%	g/1000	%	g/1000
22-073-WR-1	0.61	19.1	2.13	-17	0.29	0.16	0.16	5	-2.87			
22-073-WR-2	0.01	0.31	4.83	4.52	0.01	<0.01	<0.01	0	4.83			
22-073-WR-3	0.63	19.7	7.36	-12	<0.01	0.37	0.39	11.6	-4.2			
22-073-WR-4	0.25	7.81	5.47	-2.3	0.24	<0.01	0.01	0	5.47			
22-073-WR-5	3.75	117	-9.8	-127	0.35	2.47	0.93	77.2	-87			
22-073-WR-6	0.01	0.31	6.65	6.34	<0.01	0.01	<0.01	0.31	6.34			
22-073-WR-7	0.08	2.5	-0.9	-3.4	<0.01	0.02	0.1	0.62	-1.51			

WATER MATRIX ANALYSES

Metals in Water Results in ug/L

FIELD ID	As	Ba	Cd	Co	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Sb	Zn (mg CaCO ₃ /L)	HARDNESS CALC.
22-073-SW-1	5.59	6.4	2.57 U	9.7 U	6.83 U	10.8 J	228 J	0.038 U	15.8 JX	12.7 U	5.14 JX	30.7 U	38.4 J	9.5
22-073-SW-2	724	10.4	131	52.7	8.4 J	3130 J	9340 J	0.038 U	2100 JX	12.7 U	46.8 JX	30.7 U	11500 J	46.6
22-073-SW-4	9810	29.8	1010	363	12.5 J	26700 J	112000 J	0.038 U	13600 JX	59.1	425 JX	172	84300 J	224

Wet Chemistry Results in mg/l

FIELD ID	TOTAL DISSOLVED SOLIDS	CHLORIDE	SULFATE	NO ₃ NO ₂ -N	CYANIDE
22-073-SW-1	46	< 5.0	< 10	< 0.05	NR
22-073-SW-2	191	< 5.0	97	< 0.05	NR
22-073-SW-4	1230	< 5.0	710	< 0.05	NR

LEGEND

- SE1 - Approx. 300' upgradient on Uncle Sam Gulch
 SE2 - Downgradient of acid discharge PPE in Uncle Sam Gulch
 22-073-SE1 - Uncle Sam Gulch, prior to discharge
 WR1 - Composite of subsamples WR1A and 1B
 WR2 - Composite of subsamples WR1C and 1D
 WR3 - Composite of subsamples WR2A, 2B, 2C, and 2D
 WR4 - Composite of subsamples WR3A, 3B, 3C, 3E, and 3F
 WR5 - Sample of subsample WR4A
 WR6 - Composite of subsamples WR4B, 4C, 4D, and 4E
 WR7 - Composite of subsamples WR4F and 4G
 BACKGROUND - From Crystal Mine (22-073-SS-1)
 SW1 - Same as SE1
 SW2 - Same as SE2
 SW4 - Acid discharge

**MONTANA DEPARTMENT OF STATE LANDS
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY**

Mine/Site Name: <u>Eva May</u>	County: <u>Jefferson</u>
Legal Description: <u>T 7N R 5W</u>	Section(s): <u>NW 1/4, NW 1/4, Sec. 22</u>
Mining District: <u>Cataract</u>	Mine Type: <u>Hardrock/Pb, Cu, Au, Ag</u>
Latitude: <u>N 46° 21' 00"</u>	Primary Drainage: <u>Cataract Creek</u>
Longitude: <u>W 112° 13' 20"</u>	USGS Code: <u>10020006</u>
Land Status: <u>Private/Public</u>	Secondary Drainage: <u>Cataract Creek</u>
Quad: <u>Mount Thompson</u>	Date Investigated: <u>July 7, 1993</u>
Inspectors: <u>Bullock, Belanger, Clark</u>	P.A. # <u>22-075</u>
Organization: <u>Pioneer Technical Services, Inc.</u>	

- The volume of tailings associated with this site was estimated to be approximately 11,000 cubic yards. The following elements were elevated at least three times background:

Arsenic: 1300 mg/kg	Cadmium: 2.8 mg/kg
Lead: 1450JX mg/kg	Antimony: 70 mg/kg
- The tailings may erode into Cataract Creek during storm events.
- The volume of waste rock associated with this site was estimated to be approximately 92,000 cubic yards. The following elements were elevated at least three times background:

Arsenic: 14,700 mg/kg	Cadmium: 11.2 mg/kg
Copper: 357J mg/kg	Mercury: 0.199J to 0.585J mg/kg
Lead: 1270JX to 5970JX mg/kg	Antimony: 114J to 165J mg/kg
Zinc: 1660JX mg/kg	
- The adit discharge at Adit #2 exceeded the MCL for arsenic and the MCL/MCLG for Cadmium. Acute aquatic life criteria was exceeded for iron, copper, and zinc. Chronic aquatic life criteria was exceeded for cadmium, copper, lead and zinc. The adit discharge had a low flow rate of approximately 5 gpm and had a pH of 6.67 and a specific conductance of 355 umhos/cm. The discharge entered a small diversion ditch from Cataract Creek which flowed through WR-2 then returned to the Creek.
- Water samples from Cataract Creek were not collected during this investigation due to high relative flows. Sediment samples collected from Cataract Creek documented observed releases of arsenic, copper, lead, and antimony.

Eva May PA# 22-075
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER - BULLOCK
INVESTIGATION DATE: 07/07/93

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Co (mg/Kg)	Cr (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Hg (mg/Kg)	Mn (mg/Kg)	Ni (mg/Kg)	Pb (mg/Kg)	Sb (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
22-075-SE-1	49	33.9	0.8	2.1	3.2 J	30.2 J	5940	0.036 J	291 J	3	87 JX	11 J	174 JX	NR
22-075-SE-2	8	25.3	0.6 U	3	4.2 J	9.4 J	5870	0.022 J	240 J	3 U	14 JX	7 UJ	75 JX	NR
22-075-TP-1	1300	170	2.8	3	4.7 J	206 J	22300	0.082 J	160 J	4	1450 JX	70 J	420 JX	NR
22-075-WR-1	384	31.6	0.7	7.9	1.2 UJ	357 J	29900	0.585 J	102 J	2 U	1270 JX	165 J	60 JX	NR
22-075-WR-2	14700	4.2	11.2	1.5 U	1 UJ	56.5 J	14200	0.199 J	9.4 J	2 U	5970 JX	114 J	1660 JX	NR
BACKGROUND	140 J	193	0.7 U	9.4	14.9	71.2	21200	0.114 J	1930	11	56 J	5 U	159	< 1.227

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	ACID BASE POTENT	NEUTRAL POTENT	SULFUR ACID BASE POTENT	ORGANIC SULFUR %	PYRITIC SULFUR %	PYRITIC ACID BASE POTENT	SULFUR ACID BASE POTENT
22-075-TP-1	0.23	7.19	-0.2	-7.4	0.02	0.01	0.31	-0.52
22-075-WR-1DUP	2.83	82.2	-3	-85	0.15	<0.01	0	-3.02
22-075-WR-1	2.83	82.2	-3.5	-86	0.14	<0.01	0	-3.52
22-075-WR-2DUP	2.59	80.9	-3.7	-85	0.83	1.15	35.9	-39.6
22-075-WR-2	2.56	80.6	-3.9	-85	0.83	1.18	36.9	-40.8

Cation/Exchange Capacity

FIELD ID	milliequivalents/100g
22-075-TP-1	6.17

Mechanical Analysis and % Coarse Material

FIELD ID	% CLAY	% SAND	% SILT	% COARSE MATERIAL (>2mm)
22-075-TP-1	2	82	16	0

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

WATER MATRIX ANALYSES

Metals in Water
Results in ug/L

FIELD ID	As	Ba	Cd	Co	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Sb	Zn	HARDNESS CALC
22-075-GW-1	65.9 J	132	5.93	9.7 U	6.83 U	87.2 J	1750	0.230 J	1300	12.7 U	11.7 J	30.7 U	1490	178

Wet Chemistry
Results in mg/l

FIELD ID	TOTAL DISSOLVED SOLIDS	CHLORIDE	SULFATE	NO3/NO2-N	CYANIDE
22-075-GW-1	260	< 5.0	72	< 0.05	NR

LEGEND

SE1 - Downstream Catalyst Creek.
SE2 - Upstream Catalyst Creek.
TP1 - Composite of subsamples TP1A, 1B, 1C, and 1D-A.
WR1 - Composite of subsamples WR1B and 1C.
WR2 - Sample of the WR2A subsample.
BACKGROUND - From the Crystal Mine (22-075-SS-1).
WR1DUP - Duplicate of the 22-075-WR-1 sample.
WR2DUP - Duplicate of the 22-075-WR-2 sample.
GW1 - Discharge from well #2.

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

**MONTANA DEPARTMENT OF STATE LANDS
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY**

Mine/Site Name: <u>Morning Glory</u>	County: <u>Jefferson</u>
Legal Description: T <u>7N</u> R <u>5W</u>	Section(s): <u>E 1/4, NW 1/4, Sec. 33</u>
Mining District: <u>Cataract</u>	Mine Type: <u>Hardrock/Ag, Pb, Au, Zn</u>
Latitude: <u>N 46° 19' 05"</u>	Primary Drainage: <u>Boulder River</u>
Longitude: <u>W 112° 14' 35"</u>	USGS Code: <u>10020006</u>
Land Status: <u>Public</u>	Secondary Drainage: <u>Cataract Creek</u>
Quad: <u>Mount Thompson</u>	Date Investigated: <u>July 7, 1993</u>
Inspectors: <u>Bullock, Belanger, Clark</u>	P.A. # <u>22-077</u>
Organization: <u>Pioneer Technical Services, Inc.</u>	

- The volume of tailings associated with this site was estimated to be approximately 7200 cubic yards. The following elements were elevated at least three times background:

Arsenic: 91 to 2250 mg/kg	Cadmium: 4.8 to 7.8 mg/kg
Copper: 97.3J to 150J mg/kg	Mercury: 0.188J to 0.248J mg/kg
Manganese: 5190J to 22,800J mg/kg	Nickel: 25 mg/kg
Lead: 475JX to 2070JX mg/kg	Zinc: 1140JX to 1210JX mg/kg
- The tailings oxidized zone, ranging 2 to 4 feet deep, contained significantly higher concentrations of arsenic and lead than the underlying reduced zone.
- The volume of waste rock associated with this site was estimated to be approximately 29,000 cubic yards. The following elements were elevated at least three times background:

Arsenic: 48 mg/kg	Cadmium: 1.5 mg/kg
Cobalt: 11.9 mg/kg	Copper: 33.6J mg/kg
Mercury: 0.54J mg/kg	Manganese: 3830J mg/kg
Lead: 88JX mg/kg	
- There were no adit discharges, seeps or springs associated with this site.
- Cataract Creek flowed along the base of the waste rock dumps and tailings impoundment. No surface water samples were collected due to the high dilution effect from the creek. Sediment samples were collected up and down stream of the site, as well as in Uncle Sam Creek, just above its confluence with Cataract Creek. The down stream sample (SE-2) showed significant increases in arsenic, cadmium, cobalt, copper, lead, and zinc concentrations, but due to the very high concentrations found in the Uncle Sam Creek Sample (SE-3), no observed release could be directly attributed to this site. The Crystal Mine was situated on the headwaters of Uncle Sam Creek and was probably the source of contaminants found in SE-3

Morning Glory PA# 22-077
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER - BULLOCK
INVESTIGATION DATE: 07/07/93

SOLID MATRIX ANALYSES

Metals in soils
 Results per dry weight basis

FIELD ID	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Co (mg/Kg)	Cr (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Hg (mg/Kg)	Mn (mg/Kg)	Ni (mg/Kg)	Pb (mg/Kg)	Sb (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
22-077-SE-1	9	19.6	0.6 U	2.5	1.6 UJ	19.3 J	3450	0.012 U	284 J	3 U	33 JX	7 UJ	135 JX	NR
22-077-SE-2	93	19.1	4.1	10.6	1.7 J	170 J	4960	0.01 U	617 J	2 U	91 JX	6 UJ	243 JX	NR
22-077-SE-3	539	57	13.6	20.2	2.6 J	848 J	11600	0.033 J	1020 J	5	387 JX	15 J	937 JX	NR
22-077-TP-1	2250	65.4	7.8	3.1	5.5 J	150 J	17400	0.248 J	5190 J	7	2070 JX	66 J	1140 JX	NR
22-077-TP-2	91	26.4	4.8	2.4	7.2 J	97.3 J	12900	0.188 J	22800 J	25	475 JX	6 J	1210 JX	NR
22-077-WR-1	48	22.1	1.5	11.9	7.8 J	33.6 J	19900	0.54 J	3830 J	12	88 JX	6 UJ	185 JX	NR
BACKGROUND	15	65.1	0.5 U	4	6.3 J	10.3 J	9160	0.01 J	344 J	6	11 JX	7 UJ	94 JX	NR

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

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	ACID BASE POTENT /10000	NEUTRAL POTENT /10000	SULFUR ACID BASE POTENT /10000	SULFATE SULFUR %	PYRITIC SULFUR %	ORGANIC SULFUR %	PYRITIC SULFUR ACID BASE /10000	SULFUR ACID BASE POTENT /10000	LEGEND
22-077-SS-1	0.01	0.31	1.92	1.61	0.01	<0.01	<0.01	0	1.92	SE1 - Cataract Creek upgradient.
22-077-TP-1	0.19	5.94	74.6	68.7	0.08	0.08	0.03	2.5	72.1	SE2 - Cataract Creek downgradient.
22-077-TP-2	0.27	8.43	128	120	0.02	0.2	0.05	6.25	122	SE3 - Uncle Sam Creek at confluence with Cataract Creek.
22-077-WR-1	0.73	22.8	73.3	50.5	0.12	0.47	0.14	14.7	58.6	TP1 - Composite of subsamples TP1A-A and 1B-A.
										TP2 - Composite of subsamples TP1A-B, 1A-C, 1B-B, and 1B-C.
										WR1 - Composite of subsamples WR1A, 1B, 1C, 2A, and 2B.
										BACKGROUND - From the Morning Glory Mine (22-077-SS-1)
										SS1 - Same as the BACKGROUND sample.

**MONTANA DEPARTMENT OF STATE LANDS
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY**

Mine/Site Name: <u>Crescent/Alsace</u>	County: <u>Jefferson</u>
Legal Description: <u>T 8N R 5W</u>	Section(s): <u>NE 1/4, NE 1/4, Section 29</u>
Mining District: <u>Cataract</u>	Mine Type: <u>Hardrock/Pb, Ag, Zn, Au</u>
Latitude: <u>N 46° 25' 17"</u>	Primary Drainage: <u>Boulder River</u>
Longitude: <u>W 112° 14' 45"</u>	USGS Code: <u>10020006</u>
Land Status: <u>Private</u>	Secondary Drainage: <u>Cataract Creek</u>
Quad: <u>Chessman Reservoir</u>	Date Investigated: <u>August 12, 1994</u>
Inspectors: <u>Tuesday, Bisch, Flammang</u>	P.A. # <u>22-106</u>
Organization: <u>Pioneer Technical Services, Inc.</u>	

- The volume of tailings observed at the site was estimated to be 840 cubic yards. The following elements were elevated to at least three times the background concentrations:
Silver: 32.6 mg/kg Lead: 4,570 mg/kg
Cadmium: 3.67 mg/kg Zinc: 618 mg/kg
Copper: 356 mg/kg
- The volume of waste rock observed at the site was estimated to be 8,460 cubic yards. The following elements were elevated to at least three times the background concentrations:
Silver: 35.8 mg/kg Lead: 5,820 mg/kg
Copper: 583 mg/kg Zinc: 340 mg/kg
Iron: 41,300 mg/kg
- One discharging adit was observed at the site. The MCL and acute and chronic aquatic life criteria for cadmium, and the MCLG and acute and chronic aquatic life criteria for copper were exceeded in the adit discharge. Additionally, the acute and chronic aquatic life criteria for zinc and the chronic aquatic life criteria for mercury were exceeded in the adit discharge.
- The headwaters of Cataract Creek flows directly adjacent to the site. Observed releases to Cataract Creek were documented for cadmium, copper, lead, and zinc.
- The MCL for cadmium and acute and chronic aquatic life criteria for cadmium, copper, and zinc were exceeded in the downstream sample. These exceedances were directly attributable to the site.
- Potential safety hazards observed at the site included a partially collapsed adit, an unstable loadout structure, several collapsing buildings, and various scattered wooden and metal debris.

Crescent/Alsace PA# 22-106
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER - TUESDAY
INVESTIGATION DATE: 08/12/94

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Co (mg/Kg)	Cr (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Hg (mg/Kg)	Mn (mg/Kg)	Ni (mg/Kg)	Pb (mg/Kg)	Sb (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
22-106-SE1	1.5 U	55.2	6.3	30.1	11.5	903	26300	0.08	2170	5.0 U	441	18.0 UJ	1200	NR
22-106-SE2	1.1 U	62.0	1.0 U	5.4	8.9	13.8	13800	0.04	307	3.6 U	11.0 U	12.9 UJ	31.2	NR
22-106-SE3	1.4 U	89.2	29.9	45.6	8.0	529	20800	0.08	4880	4.6 U	793	16.3 UJ	2580	NR
22-106-TP1	32.6	131 J	3.67	2.25	4.16 J	356	18500	0.103	165	4.5	4570	10.2 UJ	618	<0.285
22-106-WR1	35.8	218	0.7 U	1.5 U	4.5	583	41300	0.29	216	2.6 U	5820	9.4 UJ	340	NR
BACKGROUND	1.0 U	84.1 J	67.8 J	1.0 UJ	2.5 B	55.9	7500 JX	0.24 JX	442 J	3.5 U	53.3	12.5 UJ	57.6	NR

V: Not Detected, J: Estimated Quantity, X: Outlier for Accuracy or Precision, NR: Not Reported

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	ACID BASE %/1000	NEUTRAL POTENT %/1000	SULFUR ACID BASE POTENT %/1000	ORGANIC SULFUR %	PYRITIC SULFUR %	PYRITIC ACID BASE %/1000	SULFUR ACID BASE POTENT %/1000
22-106-TP1	0.21	6.56	-1.51	-8.1	0.13	0.04	1.25	-2.76
22-106-WR1	0.75	23.4	-3.35	-27	0.07	0.06	1.87	-5.22

WATER MATRIX ANALYSES

Metals in Water
Results in ug/L

FIELD ID	As	Ba	Cd	Co	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Sb	Zn	HARDNESS CALC (mg CaCO3/L)
22-106-AD1	0.12	2.8	17.0	133	6.8 U	2820	602	0.18	1960	31.5	873	51.6 U	22400	85.2
22-106-SW1	0.12 U	1.1 U	14.8	24.6	6.8 U	54.2	112	0.17	904	14.4 U	16.8	51.6 U	3350	42.0
22-106-SW2	0.12 U	2.1	24.5	4.0 U	6.8 U	5.9 U	903	0.21	56.1	14.4 U	4.1	51.6 U	15.6 U	38.5
22-106-SW3	0.28	2.4	24.6	5.7	6.8 U	80.2	1380	0.18	619	14.4 U	100	51.6 U	539	42.1
22-106-SW4	0.12 U	1.1 U	5.5 U	4 U	6.8 U	5.9 U	12.3 U	0.19	2.3 U	17.0	1.3	51.6 U	15.6 U	0.1 U

V: Not Detected, J: Estimated Quantity, X: Outlier for Accuracy or Precision, NR: Not Reported

Wet Chemistry
Results in mg/l

FIELD ID	TOTAL DISSOLVED SOLIDS	CHLORIDE	SULFATE	NITROGEN-N	CYANIDE
22-106-AD1	218	<5	151	<0.05	NR
22-106-SW1	27	<5	40	<0.05	NR
22-106-SW2	25	<5	6.0	<0.05	NR
22-106-SW3	19	<5	6.0	<0.05	NR

LEGEND

SEE: Determination of site in Current Check
SEE: Upgrades of materials per above table
SEE: Downgrades of materials in sample by field test
TP1: Composite of subsamples TP1-A-J through TP1-D without TP1-B-3
NR: Composite of subsamples NR1-A, B, and NR2-A through 2C
BACKGROUND: From the Sample Map (22-106-001)

AD1: All Subsamples were NR2
SW1: Same as sample 22-106-001
SW2: Same as sample 22-106-002
SW3: Same as sample 22-106-003
SW4: QA/QC sample

**MONTANA DEPARTMENT OF STATE LANDS
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY**

Mine/Site Name: <u>Boulder Chief</u>	County: <u>Jefferson</u>
Legal Description: <u>T 7N R 5W</u>	Section(s): <u>SW 1/4, NW 1/4, Section 27</u>
Mining District: <u>Cataract</u>	Mine Type: <u>Hardrock/Pb, Ag, Cu</u>
Latitude: <u>N 46° 19' 48"</u>	Primary Drainage: <u>Cataract Creek</u>
Longitude: <u>W 112° 12' 24"</u>	USGS Code: <u>10020006</u>
Land Status: <u>Private</u>	Secondary Drainage: <u>Cataract Creek</u>
Quad: <u>Mount Thompson</u>	Date Investigated: <u>June 14, 1994</u>
Inspectors: <u>Bullock, Bisch, Clark, West</u>	P.A. # <u>22-132</u>
Organization: <u>Pioneer Technical Services, Inc.</u>	

- The volume of mill tailings observed at the site was estimated to be 138 cubic yards. The following elements were elevated to at least three times the background concentrations:

Silver: 76 mg/kg	Mercury: 0.53J mg/kg
Arsenic: 186 mg/kg	Lead: 24,300 mg/kg
Cadmium: 170 mg/kg	Antimony: 105J mg/kg
Copper: 302 mg/kg	Zinc: 23,700 mg/kg
- The volume of waste rock observed at the site was estimated to be 14,225 cubic yards. The following elements were elevated to at least three times the background concentrations:

Silver: 3.2 to 17.8 mg/kg	Mercury: 0.83J mg/kg
Cadmium: 9.5J to 13.6J mg/kg	Manganese: 10,100 mg/kg
Copper: 158 mg/kg	Lead: 364 to 7680 mg/kg
Zinc: 883 to 1060 mg/kg	
- One discharging adit was observed at the site; however, the discharge had no measurable flow at the time of the investigation (standing water) and eventually seeped into a waste rock dump (WR2) after a relatively short surface expression. A sample was collected for field parameters only; the pH was 3.0 and S.C. was 497 uS/cm.
- Observed releases to an unnamed tributary of Cataract Creek were documented for lead and zinc. The MCL for cadmium was exceeded in the tributary as were the acute and chronic aquatic life criteria for cadmium, copper, lead, and zinc. These exceedances were directly attributable to the site.
- Visual impacts to terrestrial vegetation were observed for approximately 1/4-mile downgradient from the site. The stressed vegetation was due to eroding waste rock and tailings (likely occurring during snowmelt and high runoff precipitation events).
- Potential safety hazards observed at the site included an open pit (fenced) with a 30-foot highwall and a collapsing, wooden loadout structure.

Boulder Chief PA# 22-132
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER - BULLOCK
INVESTIGATION DATE: 06/14/94

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	Ag (mg/Kg)	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Co (mg/Kg)	Cr (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Hg (mg/Kg)	Mn (mg/Kg)	Ni (mg/Kg)	Pb (mg/Kg)	Sb (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
22-132-SE1	0.6 U	7.0	45.6	9.1 J	5.1	5.2	17.6	8500	0.03 U	396	7.9	156	6.4 UJ	1140	NR
22-132-SE2	0.7 U	11.3	93.7	0.9 J	7.8	8.2	22.2	13000	0.05 J	709	11.9	16.3	7.3 UJ	45.8	NR
22-132-SE3	24.2	37.8	44.5	69.4 J	5.6	3.0	71.1	8780	0.06 J	1830	4.9	2130	27.7 J	9420	NR
22-132-TP1	76	186	8.5	170 J	1.3 U	0.7 U	302	9300	0.53 J	51	1.5	24300	105 J	23700	NR
22-132-WR1	4.9	113	113	136 J	9.8	1.0 U	27.2	29700	0.07 J	10100	5.3	364	8.0 UJ	883	NR
22-132-WR2	17.8	26.7	90.2	9.5 J	2.7	2.5	158	13300	0.83 J	556	5.8	7680	5.1 UJ	1060	NR
22-132-WR3	3.2	19.8	126	0.6 J	2.3	2.2	31.4	12600	0.06 J	239	2.4	723	4.5 UJ	30.2	NR
BACKGROUND	0.6 U	23.1	178	2.0 J	9.7	3.9	23.1	13600	0.04 J	1280	3.4	42.3	6.4 UJ	120	NR

U - Not Detected, J - Estimated Quantity, X - Outline for Accuracy or Precision, NR - Not Reported

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	ACID BASE POTENT V/1000	NEUTRAL POTENT V/1000	SULFUR ACID BASE POTENT V/1000	ORGANIC SULFUR %	PYRITIC SULFUR %	PYRITIC ACID BASE POTENT V/1000	SULFUR ACID BASE POTENT V/1000
22-132-TP1	3.67	115	-5.14	-120	0.42	1.06	33.1	-38.3
22-132-WR1	0.04	1.25	3.44	2.19	0.04	<0.01	0.00	3.44
22-132-WR2	0.51	15.9	3.95	-12	0.30	0.03	0.94	2.73
22-132-WR3	0.06	1.87	-0.04	-1.9	0.05	0.01	0.31	-0.35

WATER MATRIX ANALYSES

Metals in Water
Results in ug/L

FIELD ID	Ag	As	Ba	Cd	Co	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Sb	Zn	HARDNESS CALC (mg CaCO ₃ /L)
22-132-SW1	0.12 U	3.5	9.9	5.1	8.7 U	5.5	4.6 U	200	0.11 U	7.1	8.0 U	21.9	29.4 U	806	28.9
22-132-SW2	0.12 U	4.0	10.6	2.6 U	8.7 U	4.7 U	4.6 U	151	0.11 U	6.4	8.0 U	1.9	29.4 U	4.5 U	24.2
22-132-SW3	2.15	5.6	10.4	35.1	8.7 U	4.7 U	8.7	479	0.11 U	40.7	8.0 U	289	29.4 U	6300	33.5

U - Not Detected, J - Estimated Quantity, X - Outline for Accuracy or Precision, NR - Not Reported

Wet Chemistry
Results in mg/l

FIELD ID	TOTAL DISSOLVED SOLIDS	CHLORIDE	SULFATE	NO ₃ NO ₂ -N	CYANIDE
22-132-SW1	91	<5	15	<0.05	NR
22-132-SW2	82	<5	8.0	<0.05	NR
22-132-SW3	121	<5	40	<0.05	NR

LEGEND

- SE1 - Determination in laboratory to nearest 0.1 mg, below confidence with nois drainage
 SE2 - Upstream in laboratory to nearest 0.1 mg, above confidence with nois drainage
 SE3 - PPS of water drainage with laboratory to nearest 0.1 mg
 TP1 - Composite of subsamples TP1A and 1B
 WR1 - Composite of subsamples WR1A and 1B
 WR2 - Composite of subsamples WR2A, 2B, and 2C
 WR3 - Composite of subsamples WR3A and 3B

- BACKGROUNDS - From the Boulder Chief Mine (22-132-SE1)
 SW1 - Same as sample 22-132-SE1
 SW2 - Same as sample 22-132-SE2
 SW3 - Same as sample 22-132-SE3

**MONTANA DEPARTMENT OF STATE LANDS
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY**

Mine/Site Name: <u>Rocker/Ada</u>	County: <u>Jefferson</u>
Legal Description: T <u>7N</u> R <u>5W</u>	Section(s): <u>SW 1/4, NE 1/4, Section 17</u>
Mining District: <u>Cataract</u>	Mine Type: <u>Hardrock/Au, Ag, Pb</u>
Latitude: <u>N 46° 21' 52"; N 46° 21' 44"</u>	Primary Drainage: <u>Cataract Creek</u>
Longitude: <u>W 112° 14' 48"; W 112° 15' 12"</u>	USGS Code: <u>10020006</u>
Land Status: <u>Private/Public</u>	Secondary Drainage: <u>Rocker Creek</u>
Quad: <u>Basin and Mount Thompson</u>	Date Investigated: <u>June 16, 1994</u>
Inspectors: <u>Bullock, Bisch, Clark, West</u>	P.A. # <u>22-170</u>
Organization: <u>Pioneer Technical Services, Inc.</u>	

- No mill tailings were observed at the site.
- The volume of waste rock observed at the site was estimated to be 7,525 cubic yards. The following elements were elevated to at least three times the background concentrations:

Silver: 6.7 to 116 mg/kg	Mercury: 0.26J to 1.25J mg/kg
Arsenic: 601JX to 1,190JX mg/kg	Lead: 1,030JX to 5,440JX mg/kg
Cobalt: 34.2 mg/kg	Antimony: 42.3J to 631J mg/kg
Copper: 159J to 1,030J mg/kg	Iron: 55,500J mg/kg
- Multiple discharging adits were observed at the site during the investigation: the MCL for arsenic was exceeded in AD-1, AD-2, and AD-4; the MCLs for cadmium and copper were exceeded in AD-1 and AD-5; and the MCL for antimony was exceeded in AD-1. Additionally, acute and chronic aquatic life criteria for copper and zinc were exceeded in all the adit discharges at the site.
- Several of the adit discharges flowed directly into Rocker Creek. Observed releases to Rocker Creek were documented for arsenic, copper, and zinc. Acute and chronic aquatic life criteria for copper and zinc were exceeded in Rocker Creek downstream from the site. These exceedances were directly attributable to the site.
- Potential safety hazards observed at the site included a partially open shaft and a collapsing headframe and loadout structure.
- Vehicular access to this site is not possible. The site which is spread out over an area exceeding 3/4-mile in length can be reached by hiking approximately 1/2-mile along a well-marked trail.

Rocker/ADA PA# 22-170
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER - BULLOCK
INVESTIGATION DATE: 06/16/94

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	As (mg/Kg)	Au (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Co (mg/Kg)	Cr (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Hg (mg/Kg)	Mn (mg/Kg)	Ni (mg/Kg)	Pb (mg/Kg)	Sb (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
22-170-SE1	0.5 U	135 JX	32.0	3.1 JX	34.2	4.9 J	305 J	14800 J	0.07 J	1650 JX	4.3	93.1 JX	5.5 UJ	258	NR
22-170-SE2	0.6 U	14.8 JX	76.6	0.8 JX	8.2	10.3 J	6.6 J	15900 J	0.06 J	604 JX	2.0	30.7 JX	6.6 UJ	33.6	NR
22-170-WR1	92	797 JX	28.3	1.6 JX	1.6	1.9 J	159 J	31800 J	1.25 J	106 JX	1.4 U	2120 JX	123 J	77.6	NR
22-170-WR2	116	1190 JX	32.2	1.9 JX	34.2	0.8 UJ	1030 J	55500 J	0.26 J	21.1 JX	4.1	3690 JX	631 J	42.4	NR
22-170-WR3	6.7	1010 JX	17.6	1.3 JX	2.0 U	2.2 J	245 J	17200 J	0.51 J	148 JX	1.9 U	1030 JX	42.3 J	121	NR
22-170-WR4	40.4	601 JX	18.2	0.5 UJ	1.5 U	0.8 UJ	270 J	14100 J	0.52 J	8.0 JX	1.4 U	5440 JX	61.4 J	63.5	NR
BACKGROUND	0.6 U	23.1	178	2.0 J	9.7	3.9	23.1	13600	0.04 J	1280	3.4	42.3	6.4 UJ	120	NR

U: Not Detected, J: Estimated Quantity, X: Outlier for Accuracy or Precision, NR: Not Reported

Acid/Base Accounting

FIELD ID	TOTAL		SULFUR		PYRITIC		ORGANIC		PYRITIC		SULFUR		ACID BASE	
	SULFUR %	ACID BASE	ACID BASE	POTENT	SULFUR	ACID BASE	SULFUR	ACID BASE	SULFUR	ACID BASE	SULFUR	ACID BASE	POTENT	U/1000
22-170-WR1	0.61	19.1	-3.67	-23	0.56	-0.01	0.05	0.00	0.00	-3.67				
22-170-WR2	3.83	120	-9.13	-129	0.68	1.33	1.82	41.5	-50.7					
22-170-WR3	0.15	4.69	-2.22	-6.9	0.14	-0.01	0.01	0.00	-2.22					
22-170-WR4	0.33	10.3	-3.15	-14	0.30	0.01	0.02	0.31	-3.46					

WATER MATRIX ANALYSES

Metals in Water
Results in ug/L

FIELD ID	As	Au	Ba	Cd	Co	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Sb	Zn	HARDNESS CALC (mg CaCO3/L)
22-170-AD1	26.3 JX	3310	10.9	47.9	245	4.7 U	6170	147000	0.11 U	11800	42.4	256	58.7	6810	138
22-170-AD2	0.19 JX	79.9	2.1 U	2.6 U	8.7 U	4.7 U	16.4	140	0.11	7.6	8.0 U	1.8	29.4 U	234	27.2
22-170-AD3	0.12 UJ	47.2	23.8	2.6 U	8.7 U	4.7 U	22.2	6200	0.11 U	1580	9.8	10.5	29.4 U	239	65.3
22-170-AD4	0.31 JX	82.7	4.9	2.6 U	8.7 U	4.7 U	17.3	839	0.13	381	8.0 U	16.6	29.4 U	138	7.7
22-170-AD5	0.20 JX	2.9	21.6	24.5	53.4	4.7 U	1600	6900	0.11 U	2250	15.2	20.5	29.4 U	3930	69.8
22-170-SW1	0.12 UJ	11.9	6.3	4.4	8.7 U	4.7 U	51.7	692	0.11	68.9	8.0 U	1.1 U	29.4 U	56.1	15.0
22-170-SW2	0.12 UJ	3.9	9.6	2.6 U	8.7 U	4.7 U	4.6 U	373	0.16	26.9	8.0 U	1.6	29.4 U	4.5 U	10.1

U: Not Detected, J: Estimated Quantity, X: Outlier for Accuracy or Precision, NR: Not Reported

Wet Chemistry
Results in mg/l

FIELD ID	TOTAL DISSOLVED SOLIDS	CHLORIDE	SULFATE	NO3/NO2-N	CYANIDE
22-170-AD1	669	<5	521	<0.05	NR
22-170-AD2	59	<5	15	<0.05	NR
22-170-AD3	88	<5	30	<0.05	NR
22-170-AD4	7.0	<5	<5	<0.05	NR
22-170-AD5	218	<5	117	<0.05	NR
22-170-SW1	45	<5	8.0	<0.05	NR
22-170-SW2	13	<5	<5	<0.05	NR

LEGEND

- SE1 - Concentration Factor Check
 SE2 - Upstream Factor Check
 WR1 - Composite of sub-sample WEA, WEA, WEA, WEA, and WEA
 WR2 - One sample of the WR2 sub-sample
 WR3 - Composite of sub-sample WR1 and WR2
 WR4 - One sample of the WR4 sub-sample
 BACKGROUND - From the Boulder Creek Valley (22-132 WR)
- AD1 - Discharge associated with WEA, from one end side of WEA and Stone
 into ground at River Bank
 AD2 - Discharge from AD1 and WR2 as path west of main working (WR4)
 AD3 - Discharge associated with WEA on the north side of the creek
 AD4 - Discharge from the upstream side and over ridge
 AD5 - Boulder side left discharge
 SW1 - Stone at sample 22-170-SW1
 SW2 - Stone at sample 22-170-SW2

**MONTANA DEPARTMENT OF STATE LANDS
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY**

Mine/Site Name: Nellie Grant
Legal Description: T 8N R 5W
Mining District: Clancy
Latitude: N 46° 26' 16"
Longitude: W 112° 12' 07"
Land Status: Private/Public
Quad: Chessman Reservoir
Inspectors: Bullock, Tuesday, Babits, Lasher,
Clark, Belanger, Flammang/Pierson
Organization: Pioneer Technical Services,
Inc./Thomas, Dean and Hoskins, Inc.

County: Jefferson
Section(s): SW 1/4, SW 1/4, Sec. 14
Mine Type: Hardrock/Au, Ag, Cu, Pb, Zn
Primary Drainage: Lump Gulch
USGS Code: 10030101
Secondary Drainage: Lump Gulch
Date Investigated: May 18 and 19, 1993
P.A. # 22-244

- There were approximately 10,000 cubic yards of uncovered tailings on site. The following elements were elevated at least three times background:
Arsenic: 4,210 to 9,500 mg/kg Cadmium: 10.8 to 312 mg/kg
Cobalt: 27 to 28.8 mg/kg Chromium: 19.7J to 26J mg/kg
Copper: 50.5 to 467 mg/kg Iron: 29,500 to 61,400 mg/kg
Mercury: 0.106J to 0.235J mg/kg Nickel: 36.6 to 37.3 mg/kg
Lead: 9,380 to 13,500 mg/kg Zinc: 763 to 33,700 mg/kg
- There were approximately 2,500 cubic yards of uncovered waste rock on site. The following elements were elevated at least three times background:
Arsenic: 969 to 2,570 mg/kg Cadmium: 7.6 to 9.2 mg/kg
Cobalt: 10.8 mg/kg Copper: 87.2 to 143 mg/kg
Iron: 33,600 mg/kg Mercury: 0.156J to 0.184J mg/kg
Lead: 7,410 to 15,500 mg/kg Zinc: 417 to 934 mg/kg
- There were no discharging adits on site. There were three shafts that did not discharge; but, held water. Shaft #3 was sampled as GW-3 and pH 3.51 and a specific conductance of 640 umhos/cm. Arsenic and cadmium exceeded MCL/MCLGs. There were two monitoring wells on site that were potentially downgradient (GW-3 and 4) and one spring (GW-1) that was upgradient. There were observed releases of arsenic, cadmium, cobalt, copper, iron, nickel, lead, and zinc in GW-3 and cadmium and zinc in GW-4. The MCL/MCLGs were exceeded for cadmium in GW-3 and 4 and the MCL was exceeded for arsenic in GW-3.
- Lump Gulch Creek ran through eroded tailings. There were observed releases of cadmium and zinc in downstream surface water in the creek. Cadmium exceeded MCL/MCLGs in downstream surface water in the creek. The acute and chronic aquatic life criteria for copper, lead, and zinc were exceeded in downstream surface water in the creek. Elevated upgradient metal concentrations (SW-1) indicated the possible presence of an upgradient source.

Nelle Grant Mine PA# 22-244
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER-BULLOCK
INVESTIGATION DATE: 06/18/93 & 05/19/93

SOLID MATRIX ANALYSES

Results per dry weight basis (mg/kg)

Metals in soils

FIELD ID	As	Ba	Cd	Co	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Sb	Zn	CYANIDE
22-244-SE-1	599	43.9	6.4	8.65	1.82 J	39.4	6860	0.122 J	1780	7.06	744	4.17 UJ	393	NR
22-244-SE-2	879	26.1	1.6	1.37 U	1.15 U	27.3	7540	0.034 J	102	2.01 U	1190	4.2 UJ	202	NR
22-244-SE-3	354	284	56.1	8.35	13.7 J	231	20700	0.274 J	763	7.16	995	10.9 UJ	2310	NR
22-244-SE-4	488	40	7.0	8.18	1.14 U	42.3	5660	0.114 J	1920	8.63	561	4.16 UJ	440	NR
22-244-TA-1	4210	46.7	10.8	1.41 U	2.36 J	50.5	29500	0.111 J	46.9	2.59	9380	4.32 UJ	763	NR
22-244-TA-2	9330	53.2	312.0	28.8	19.7 J	467	57500	0.235 J	758	36.6	13500	31 J	33700	NR
22-244-TA-3	9500	95.3	190.0	27	26 J	321	81400	0.106 J	589	37.3	9670	12.6 J	21200	NR
22-244-WR-1	969	48.5	9.2	1.31	0.936 U	87.2	8490	0.184 J	8.61	1.64 U	15500	6.74 J	934	1.07U
22-244-WR-3	2570	81.2	7.6	10.8	2.89 J	143	33600	0.156 J	73.7	1.75 U	7410	3.65 UJ	417	NR
BACKGROUND	10	52.7	1.3	3.15	2.23 J	6.12	6390	0.035 J	284	2.6	21.9	3.4 UJ	43.6	NR

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	ACID BASE POTENTIAL V/1000	NEUTRAL POTENTIAL V/1000	SULFUR ACID BASE POTENTIAL V/1000	SULFATE %	PYRITIC SULFUR %	ORGANIC SULFUR %	PYRITIC SULFUR ACID BASE POTENTIAL V/1000	SULFUR ACID BASE POTENTIAL V/1000
22-244-TA-1	1.49	46.5	-4.17	-51.0	1.33	0.06	0.10	1.87	-6.35
22-244-TA-2	8.95	280	5.17	-274	2.51	3.56	2.88	1.11	-106
22-244-TA-3	6.97	218	-2.24	-220	0.31	4.84	1.82	151	-153
22-244-WR-1	3.00	93.7	-12.7	-106	1.14	0.78	1.08	24.4	-37
22-244-WR-3	1.33	41.5	-17.9	-59.5	1.07	0.09	0.17	2.81	-20.7
0	3.05	95.3	-12.1	-107	1.18	0.76	1.11	23.7	-35.9

LEGEND

- SE1 - Lump Outlets @ culvert N of main access road to loggertine.
- SE2 - 1/2 way down center drainage @ edge of slumped tailings.
- SE3 - Outlet of pond S of access road in Lump Outlets.
- SE4 - Lump Outlets Creek in tailings deposit downstream of SW1.
- TP1 - Sample of the subsample TP1-A1.
- TP2 - Sample of the subsample TP1-B1.
- TP3 - Sample of the subsample TP1-B2.
- WR1 - Composite of the subsamples WR1D1, WR1D2, WR1D3, and RTLT.
- WR3 - Composite of the subsamples WR1D3, L3, L4, and L5.
- BACKGROUND - From the Nelle Grant (22-244-SS-1).
- WR1D1, D2 - Duplicates of the sample 22-244-WR-1.

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

WATER MATRIX ANALYSES

Results in ug/L

Metals in Water

FIELD ID	As	Ba	Cd	Co	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Sb	Zn (mg CaCOML)
22-244-GW-1	5.85	5.8	2.57	5.99 U	12.1 J	5 J	125	0.19 J	2.77	8.78 U	1.85	18.3 U	6 U 9.98
22-244-GW-2	3.85	28.3	2.55 U	5.99 U	8.37 J	1.35 U	831	0.21 J	486	8.78 U	1.36 U	18.3 U	6 U 86.7
22-244-GW-3	53.4	33.2	107	132	13.4 J	369 J	9270	0.13 J	3520	29.5	1090	18.3 U	12700 111
22-244-GW-4	4.28	22.5	82.9	5.99 U	5 U	5.2 J	13.5 U	0.091 J	1320	20	1.38	18.3 U	10600 190
22-244-SW-1	123	21.2	4.37	5.99 U	7.73 J	17.1 J	1770	0.19 J	501	8.78 U	98.5	18.3 U	315 14.1
22-244-SW-2	45.4	19.9	559	71.8	15.3 J	720 J	3630	0.21 J	9860	87	316	57.4	58900 309
22-244-SW-3	20.6	20	263	5.99 U	5 U	19.1 J	312	0.22 J	130	10.9	18.2	18.3 U	2110 27.3

Wet Chemistry Results in mg/L

FIELD ID	TOTAL DISSOLVED SOLIDS	CHLORIDE	SULFATE	NOMINOUS-N	CYANIDE
22-244-GW-1	70	< 5.0	< 5	< 0.05	NR
22-244-GW-2	153	< 5.0	16	< 0.05	NR
22-244-GW-3	289	< 5.0	171	< 0.05	NR
22-244-GW-4	345	< 5.0	175	< 0.05	NR
22-244-SW-1	64	< 5.0	15	< 0.05	NR
22-244-SW-2	817	< 5.0	491	< 0.68	NR
22-244-SW-3	90	< 5.0 q	49	< 0.05	NR

LEGEND

- GW1 - Background spring, approximately 35 yards.
- GW2 - Monitoring well furthest South along access road.
- GW3 - Shaft #3, East of building.
- GW4 - Monitoring well furthest North along access road.
- SW1 - Same as sample SE1.
- SW2 - Same as sample SE2.
- SW3 - Same as sample SE3.

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

**MONTANA DEPARTMENT OF STATE LANDS
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY**

Mine/Site Name: General Grant
Legal Description: T 8N R 5W
Mining District: Clancy
Latitude: N 46° 26' 16"
Longitude: W 112° 12' 07"
Land Status: Private/Public
Quad: Chessman Reservoir
Inspectors: Bullock, Babits, Flammang,
Lasher, Clark/Pierson
Organization: Pioneer Technical Services,
Inc./Thomas, Dean and Hoskins, Inc.

County: Jefferson
Section(s): SW 1/4, SW 1/4, Sec. 15
Mine Type: Hardrock/Pb, Zn
Primary Drainage: Lump Gulch
USGS Code: 10030101
Secondary Drainage: Lump Gulch
Date Investigated: May 19, 1993
P.A. # 22-245

- There were no tailings on site.
- There were approximately 1,580 cubic yards of waste rock on site. The following elements were elevated at least three times background:
Arsenic: 2,320 to 5,130 mg/kg Copper: 55.4 mg/kg
Mercury: 0.244J to 0.542J mg/kg Lead: 3,810 to 5,400 mg/kg
Zinc: 444 mg/kg
- There were no discharging mine openings on site. There was one filled shaft that did not discharge. This shaft was sampled as GW-1 and had a pH 6.47 and specific conductance of 100 umhos/cm. Cadmium exceeded the MCL/MCLG in this sample.
- There was no surface water on site. The nearest surface water was one mile away. No surface water or sediment samples were collected.
- The shaft was hazardous mine openings, but was covered with an AMRB grate.

General Grant PA# 22-245
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER - BULLOCK
INVESTIGATION DATE: 05/19/93

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Co (mg/Kg)	Cr (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Hg (mg/Kg)	Mn (mg/Kg)	Ni (mg/Kg)	Pb (mg/Kg)	Sb (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
22-245-WR-1	2320	55.6	3.4	1.26 U	1.05 U	112	10300	0.244 J	79.5	1.84 U	3810	3.84 UJ	444	NR
22-245-WR-2	5130	44.4	1.9	1.12 U	2.42 J	55.4	7970	0.572 J	2.8	1.64 U	5400	4.1 J	66	NR
BACKGROUND	10	52.7	1.3	3.15	2.23 J	6.12	6390	0.035 J	284	2.6	21.9	3.4 UJ	43.6	NR

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

Acid/Base Accounting

FIELD ID	SULFUR				PYRITIC				ORGANIC				SULFUR			
	TOTAL %	SULFUR %	ACID BASE v/1000	NEUTRAL POTENT v/1000	SULFUR ACID BASE POTENT v/1000	PYRITIC SULFUR %	PYRITIC ACID BASE v/1000	PYRITIC POTENT v/1000	ORGANIC SULFUR %	ORGANIC ACID BASE v/1000	ORGANIC POTENT v/1000	ORGANIC %	SULFUR ACID BASE POTENT v/1000	SULFUR ACID BASE POTENT v/1000	SULFUR ACID BASE POTENT v/1000	SULFUR ACID BASE POTENT v/1000
22-245-WR-1	0.59	18.4	-4.75	-2.46	-23.2	0.51	0.02	-5.37	0.06	0.62	-5.37	0.06	-5.37	-5.37	-5.37	-5.37
22-245-WR-2	0.51	15.9	-2.46	-2.46	-18.4	0.47	<0.01	-2.46	0.05	0.00	-2.46	0.05	-2.46	-2.46	-2.46	-2.46

WATER MATRIX ANALYSES

Metals in Water
Results in ug/l

FIELD ID	As	Ba	Cd	Co	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Sb	Zn (mg CaCO3/L)	HARDNESS CALC
22-245-GW-1	10.7	46.7	6.3	5.99 U	5.67 J	1.87 J	693	0.14 J	568	8.78 U	17.2	18.3 U	773	33.8

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
22-245-GW-1	95	< 5.0	26	18	NR

LEGEND

WR1 - Composite of subsamples WR1-1 and 1-3
WR2 - Composite of subsamples WR2-1, 2-2, and 2-3
BACKGROUND - From the Nellie Grant Mine (22-244-S8-1)

OW1 - Discharge from shaft #1 at General Grant

**MONTANA DEPARTMENT OF STATE LANDS
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY**

Mine/Site Name: <u>Alta</u>	County: <u>Jefferson</u>
Legal Description: <u>T 7N R 4W</u>	Section(s): <u>SE 1/4, NW 1/4, Sec. 10</u>
Mining District: <u>Colorado</u>	Mine Type: <u>Hardrock/Au, Pb, Ag, Fe, Zn, Cu</u>
Latitude: <u>N 46° 22' 24"</u>	Primary Drainage: <u>Prickly Pear</u>
Longitude: <u>W 112° 05' 12"</u>	USGS Code: <u>10030101</u>
Land Status: <u>Private</u>	Secondary Drainage: <u>Spring Creek</u>
Quad: <u>Wickes</u>	Date Investigated: <u>August 17, 1993</u>
Inspectors: <u>Bullock, Belanger/Pierson</u>	P.A. # <u>22-001</u>
Organization: <u>Pioneer Technical Services, Inc./</u>	
<u>Thomas, Dean and Hoskins, Inc.</u>	

- There were no mill tailings associated with this site.
- Water discharging from the base of WR-1 was apparently a discharge from the main level shaft. This discharge constituted the start of flow in a small, unnamed tributary to Spring Creek. The discharge flow was approximately 10 gpm, pH was measured at 2.59, and specific conductance was 420 umhos/cm. Arsenic, cadmium, copper, nickel, and antimony exceeded MCLs and MCLGs. Acute aquatic life criteria were exceeded for arsenic, iron, cadmium, copper, and zinc. Chronic aquatic life criteria were exceeded for arsenic, mercury, cadmium, copper, and zinc.
- Approximately 175,000 cubic yards of waste rock material was located at this site. The volume of waste rock material was roughly estimated due to the large surface area on complex terrain and severe erosion. The following elements were elevated at least three times background:

Arsenic: 249J to 658J mg/kg
Lead: 3100J to 15, 100J mg/kg
- Severe erosion was occurring on several of the waste rock dumps.

Alta PA# 22-001
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER - BULLOCK
INVESTIGATION DATE: 08/17/93

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Co (mg/Kg)	Cr (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Hg (mg/Kg)	Mn (mg/Kg)	Ni (mg/Kg)	Pb (mg/Kg)	Sb (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
22-001-SE-1	821 J	97.4 J	1.3 J	2.8 J	4.1 J	230 JX	49900 J	0.12	291 J	6 J	1170 J	6 U	613 JX	NR
22-001-SE-2	46 J	120 J	0.5 U	5 J	8.9 J	32.3 JX	14300 J	0.049	761 J	10 J	96 J	6 U	120 JX	NR
22-001-WR-1	249 J	67.1 J	0.5 U	1.8 U	2.4 J	217 JX	30100 J	0.428	291 J	4 J	3940 J	6 U	366 JX	NR
22-001-WR-2	658 J	61.5 J	1.1 J	1.7 U	1.2 U	193 JX	23700 J	0.366	18.3 J	2 J	15100 J	5 U	328 JX	NR
22-001-WR-3	293 J	57 J	0.6 J	1.9 U	1.3 U	122 JX	12800 J	0.437	710 J	39 J	3100 J	6 U	205 JX	NR
BACKGROUND	187 J	92.1	6.6	11.4	8.4 J	232 J	31600	0.029	1040	11 J	447 J	6 UJ	618	NR

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

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	ACID BASE U/1000	TOTAL NEUTRAL POTENT U/1000	SULFUR ACID BASE POTENT U/1000	SULFATE SULFUR %	PYRITIC SULFUR %	ORGANIC SULFUR %	PYRITIC ACID BASE U/1000	SULFUR ACID BASE POTENT U/1000
22-001-WR-1	2.8	87.5	-0.6	-88	2.62	0.03	0.15	0.94	-1.58
22-001-WR-2	2.88	90	-3	-93	0.94	1.26	0.68	39.4	-42.4
22-001-WR-3DUP	0.86	27.5	-1.4	-29	0.84	<0.01	0.05	0	-1.44
22-001-WR-3	0.87	27.2	-1.6	-29	0.82	<0.01	0.06	0	-1.62

WATER MATRIX ANALYSES

Metals in Water
Results in ug/l

FIELD ID	As	Ba	Cd	Co	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Sb	Zn	HARDNESS CALC (mg CaCO3/L)
22-001-SW-1	1270	2.01 U	892 J	206	78.5	16200 J	368000	0.21 J	390000	117	26.3	329	289000	1230

U - Not Detected; J - Estimated Quantity; X - Outlier for Accuracy or Precision; NR - Not Requested; ND - No Data

Wet Chemistry
Results in mg/l

FIELD ID	TOTAL DISSOLVED SOLIDS	CHLORIDE	SULFATE	NO3/NO2-N	CYANIDE
22-001-SW-1	5810	ND	3450	< 0.05	NR

LEGEND

SE1 - At single stream below waste rock dump 1.
SE2 - Upgradient of site.
WR1 - Composite of subsamples WR1A, 1B, 1C, 1D, and 1E.
WR2 - Composite of subsamples WR2, 3, and 4.
WR3 - Composite of subsamples WR3, 6, 7, and 8.
BACKGROUND - From the Bertha Mine (22-002-SB-1).
WR3DUP - Duplicate of sample 22-001-WR-3.

SW1 - Same as sample SE1

**MONTANA DEPARTMENT OF STATE LANDS
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY**

Mine/Site Name: Bertha
Legal Description: T 7N R 4W
Mining District: Colorado
Latitude: N 46° 22' 55"
Longitude: W 112° 05' 10"
Land Status: Private
Quad: Jefferson City
Inspectors: Bullock, Flammang, Clark
Organization: Pioneer Technical Services, Inc.

County: Jefferson
Section(s): S 1/4, Sec. 3
Mine Type: Hardrock/Cu, Pb, Ag, Au, Zn
Primary Drainage: Little Prickly Pear
USGS Code: 10030101
Secondary Drainage: Spring Creek
Date Investigated: July 12, 1993
P.A. # 22-002

- This site was reclaimed by the MDSL/AMRB in 1987. Waste rock dumps and tailings ponds were almost completely revegetated.
- The volume of tailings associated with this site was roughly estimated at 115,000 cubic yards. Accurate estimation of volume was difficult due to covering and grading activities that occurred during the reclamation activities. The following elements were elevated at least three times background:
Copper: 2270J to 6320J mg/kg Mercury: 0.209 to 1.34 mg/kg
Antimony: 8J to 21J mg/kg
- The volume of waste rock at this site was roughly estimated at 19,000 cubic yards. The following elements were elevated at least three times background:
Cadmium: 21.3 mg/kg Copper: 998J to 2290J mg/kg
Mercury: 0.345 to 2.62 mg/kg Lead: 8170J mg/kg
Antimony: 8J to 21J mg/kg
- Spring Creek flowed along the reclaimed waste rock and tailings impoundments. Observed releases to Spring Creek (sediment) were documented for cadmium, copper, lead, and zinc. No MCLs or MCLGs were exceeded in Spring Creek water samples. Acute aquatic life criteria were exceeded for iron both up and down stream of the site. The unnamed tributary coming into Spring Creek from the northwest contained elevated levels of cadmium (25.80J ug/l), copper (1540 ug/l), lead (81.7 ug/l), and zinc (2920J ug/l). MCLs and MCLGs were exceeded for cadmium and copper in this tributary. Acute aquatic life criteria were exceeded for iron, cadmium, copper, and zinc. Chronic aquatic life criteria were exceeded for cadmium, copper, lead, and zinc. Stream flows were approximately 40 gpm in Spring Creek and 30 gpm in unnamed tributary. The pH and specific conductance of Spring Creek below the site was measured at 7.8 and 367 umhos/cm, respectively. The pH and specific conductance of the unnamed tributary was measured at 8.15 and 333 umhos/cm, respectively.

Bertha PA# 22-002
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER - TUESDAY
INVESTIGATION DATE: 06/22/93

SOLID MATRIX ANALYSES														
Metals in soils			Results per dry weight basis											
FIELD ID	Au (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Co (mg/Kg)	Cr (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Hg (mg/Kg)	Mn (mg/Kg)	Ni (mg/Kg)	Pb (mg/Kg)	Sb (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
22-002-SE-1	19 J	37.4	3.9	8.5	7 J	395 J	15100	0.015	740	7 J	223 J	6 UJ	739	NR
22-002-SE-2	78 J	51.6	2.7	8.1	11.3 J	186 J	29800	0.022	412	9 J	168 J	7 UJ	384	NR
22-002-SE-3	33 J	45.7	1.2	10.8	9.9 J	78.1 J	22400	0.014	476	10 J	68 J	6 UJ	121	NR
22-002-TP-1	90 J	34.7	7.6	6.4	1.5 U	6320 J	35400	1.34	1120	9 J	588 J	21 J	1200	NR
22-002-TP-2	44 J	32.7	3	4.1	3.6 J	2270 J	17400	0.209	485	5 J	245 J	8 J	371	NR
22-002-WR-1	420 J	70.9	21.3	3.6	1.1 U	2290 J	45700	2.62	362	2 U	8170 J	25 J	2520	NR
22-002-WR-2	30 J	38.7	4.4	7.7	3.8 J	998 J	27000	0.345	607	10 J	292 J	6 UJ	472	NR
BACKGROUND	187 J	92.1	6.6	11.4	8.4 J	232 J	31600	0.029	1040	11 J	447 J	6 UJ	618	NR

U - Not Detected, J - Estimated Quantity, K - Outlier for Accuracy Precision, NR - Not Reported

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

Acid/Base Accounting

FIELD ID	TOTAL SULFUR		NEUTRAL POTENT		SULFUR ACID BASE		PYRITIC SULFUR		ORGANIC SULFUR		PYRITIC SULFUR		PYRITIC SULFUR		SULFUR ACID BASE		SULFUR ACID BASE	
	%	1/10000	%	1/10000	%	1/10000	%	1/10000	%	1/10000	%	1/10000	%	1/10000	%	1/10000	%	1/10000
22-002-TP-1	3.6	112	38.2	-74	0.23	2.56	0.81	80	-41.7	2.3	1.08	28.4	13.7	90.7				
22-002-TP-2DUP	0.59	18.4	3.86	-15	0.35	0.05	0.19	1.56	2.3	2.81	1.08	28.4	13.7	90.7				
22-002-TP-2	4.19	131	-11	-142	1.84	0.91	1.44	28.4	-39.3	2.81	1.08	28.4	13.7	90.7				
22-002-WR-1	2.33	72.8	104	31.6	1.19	0.44	0.7	13.7	90.7									

WATER MATRIX ANALYSES													
Metals in Water		Results in ug/l											
FIELD ID	Au	Ba	Cd	Co	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Sb	Zn
22-002-SW-1	9.14 J	19.90	3.27 J	9.70 U	6.83 U	19.80	7220 JX	0.120	158	12.7 U	2.87	30.7 U	62.5 J
22-002-SW-2	10.91 J	81.20	25.80 J	9.70 U	6.83 U	1540	3710 JX	0.110	1620	22.5	81.7	30.7 U	2920 J
22-002-SW-3	5.58 J	73.30	2.57 U	9.70 U	6.83 U	19.00	2770 JX	0.150	153	12.7 U	15.1	30.7 U	109 J

Wet Chemistry		Results in mg/l			
FIELD ID	TOTAL DISSOLVED SOLIDS	CHLORIDE	SULFATE	NO3/NO2-N	CYANIDE
22-002-SW-1	526	< 5.0	253	< 0.05	NR
22-002-SW-2	352	< 5.0	115	< 0.05	NR
22-002-SW-3	340	< 5.0	113	< 0.05	NR

LEGEND													
SE1 - Spring Creek immediately downstream of tailings pond 2													
SE2 - Unnamed tributary in Spring Creek which flows past Northern workings													
SE3 - Spring Creek upgradient of tailings pond 1													
TP1 - Sample of the TP1A subsample													
TP2 - Composite of subsamples TP3A-A, 3A-B, 3B-A, 3B-C, 3B-D, and 3C-A through 3C-C													
WR1 - Composite of subsamples WR1A, 1B, and 1C													
WR2 - Composite of subsamples WR2A and 2B													

BACKGROUND - From the Bertha Mine (22-002-SB-1)													
SW1 - Same as sample SE1													
SW2 - Same as sample SE2													
SW3 - Same as sample SE3													

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

**MONTANA DEPARTMENT OF STATE LANDS
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY**

Mine/Site Name: <u>Bluebird</u>	County: <u>Jefferson</u>
Legal Description: <u>T 7N R 5W</u>	Section(s): <u>N 1/2, All 1/4, Sec. 13</u>
Mining District: <u>Colorado</u>	Mine Type: <u>Hardrock//Au, Ag</u>
Latitude: <u>N 46° 21' 32"</u>	Primary Drainage: <u>Spring Creek</u>
Longitude: <u>W 112° 10' 00"</u>	USGS Code: <u>10030101</u>
Land Status: <u>Private/Public</u>	Secondary Drainage: <u>Curtain Gulch</u>
Quad: <u>Mount Thompson</u>	Date Investigated: <u>July 8, 1993</u>
Inspectors: <u>Babits, Lasher/Pierson</u>	P.A. # <u>22-003</u>
Organization: <u>Pioneer Technical Services, Inc./Thomas, Dean and Hoskins, Inc.</u>	

- No mill tailings were observed at this site during the investigation.
- The volume of waste rock associated with this site was estimated to be approximately 70,550 cubic yards. The following elements were elevated at least three times background:

Arsenic: 100JX to 587JX mg/kg	Copper: 441 mg/kg
Mercury: 0.407J mg/kg	Lead: 4,990 mg/kg
Zinc: 1,910 mg/kg	
- Three discharging adits were identified at the site during the investigation; all of these discharges entered Curtain Creek. One sample was collected for laboratory analysis. MCLs for arsenic, cadmium, and copper were exceeded in the adit discharge. Acute and chronic aquatic life criteria were exceeded for cadmium, copper, and zinc and chronic aquatic life criteria were exceeded for iron and lead.
- Curtain Creek flowed directly through two waste rock dumps at the site. Observed releases to Curtain Creek were documented for arsenic, copper, and zinc. The MCL for cadmium was exceeded in the downstream surface water sample; however, the exceedance was not attributable to the site. Acute and chronic aquatic life criteria for copper and zinc were exceeded in the downstream sample; these exceedances were directly attributable to the site.
- One potentially hazardous partially collapsed shaft was identified at the site.

Blue Bird PA# 22-003
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER - BABITS
INVESTIGATION DATE: 07/08/93

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Co (mg/Kg)	Cr (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Hg (mg/Kg)	Mn (mg/Kg)	Ni (mg/Kg)	Pb (mg/Kg)	Sb (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
22-003-WR-1	587 JX	50.6	1.4	14.2	19.8	441	47000	0.407 J	1440 J	11	4990	11 J	1910	NR
22-003-WR-2	100 JX	37.1	0.5 U	4	3.9	18.9	31400	0.102 J	584 J	3 U	29	6 UJ	45	NR
BACKGROUND	28 JX	123	0.7	14.9	24.3	50.4	25400	0.052 J	1810 J	14	258	5 UJ	255	NR

U : Not Detected, J : Estimated Quantity, X : Outlier for Accuracy or Precision, NR : Not Reported

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	ACID BASE POTENTIAL	NEUTRAL POTENTIAL	SULFUR ACID BASE POTENTIAL	ORGANIC SULFUR %	PYRITIC SULFUR %	PYRITIC SULFUR ACID BASE POTENTIAL
22-003-WR-1	1.06	33.1	9.94	-23	0.12	0.02	9.31
22-003-WR-2	0.21	6.56	78.6	72	0.08	0.03	77.7

WATER MATRIX ANALYSES

Metals in Water
Results in ug/L

FIELD ID	As	Ba	Cd	Co	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Sb	Zn	HARDNESS CALC (mg CaCO3/L)
22-003-SW-1	142	12.1	25.1	16.2	6.83 U	1620 J	19000 J	0.038 U	4590 JX	12.7 U	8.21 JX	30.7 U	3600 J	206
22-003-SW-2	2.64 J	4.93	2.57 U	9.7 U	6.83 U	3.13 J	29.9	0.210 J	4.08 U	12.7 U	6.81 J	30.7 U	7.57 U	37.4
22-003-SW-4	31.7	8.77	12.2	9.7 U	9.33 J	605 J	4700 J	0.038 U	1390 JX	12.7 U	13 JX	30.7 U	1540 J	113

U : Not Detected, J : Estimated Quantity, X : Outlier for Accuracy or Precision, NR : Not Reported

Wet Chemistry
Results in mg/l

FIELD ID	TOTAL DISSOLVED SOLIDS	CHLORIDE	SULFATE	NO3/NO2-N	CYANIDE
22-003-SW-1	375	< 5.0	173	< 0.05	NR
22-003-SW-2	91	< 5.0	11	0.05	NR
22-003-SW-4	217	< 5.0	81	< 0.05	NR

LEGEND

WR1 - Composite of subsamples WR1A, 1B, 1C, and 2.
WR2 - Composite of subsamples WR2A, 2B, 2C, and 4.
BACKGROUND - 300 feet above discharging well.
From Bluebird Mine (22-003-SS-1).
SW1 - At opposite side discharge
SW2 - At opposite spring headwaters
SW4 - The downgradient spring sample after confluence with three acid discharges.

**MONTANA DEPARTMENT OF STATE LANDS
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY**

Mine/Site Name: Corbin Flats
Legal Description: T 7N R 4W
Mining District: Colorado
Latitude: N 46° 23' 13"
Longitude: W 112° 02' 30"
Land Status: Private
Quad: Jefferson City
Inspectors: Tuesday, Belanger, Lasher
Organization: Pioneer Technical Services, Inc.

County: Jefferson
Section(s): S 1/2, Sec. 1
Mine Type: Mill/Cu, Pb, Zn
Primary Drainage: Prickly Pear Creek
USGS Code: 10030101
Secondary Drainage: Spring Creek
Date Investigated: July 12, 1993
P.A. # 22-004

- The volume of partially revegetated tailings associated with this site was estimated to be approximately 700,000 cubic yards. The following elements were elevated at least three times background:

Arsenic: 975J to 1,270J mg/kg	Manganese: 17,500 to 20,400 mg/kg
Cadmium: 61.7 to 104 mg/kg	Lead: 7,540J to 15,500J mg/kg
Copper: 897J to 2,010J mg/kg	Antimony: 104J to 194J mg/kg
Mercury: 0.31 to 1.45 mg/kg	Zinc: 9,360 to 13,500 mg/kg
- Spring Creek was observed flowing directly through the tailings; although, it appeared that previous attempts were made to reroute the creek to the north of the tailings. The MCL for cadmium was exceeded in both upstream and downstream samples from Spring Creek; the MCL for arsenic was exceeded in the downstream sample. Acute and chronic aquatic life criteria for cadmium, copper, and zinc and the chronic aquatic life criteria for mercury were exceeded in both upstream and downstream samples. Acute and chronic aquatic life criteria for lead and the chronic aquatic life criteria for iron were exceeded in the downstream sample. Metals concentrations measured in upstream and downstream sediment samples were very similar to background concentrations.
- Observed releases to Spring Creek were documented for arsenic and lead. The MCL exceedance for arsenic and the acute and chronic aquatic life criteria exceedances for lead in the downstream sample were directly attributable to the site.
- A residential well located adjacent to and downgradient from the site was sampled during the investigation. No MCLs were exceeded.
- Several residences were located near the site, and the area was observed being used for recreational purposes during the investigation. The site had a high potential for hazardous dust propagation.

Corbin Flats PA# 22-004
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER - TUESDAY
INVESTIGATION DATE: 07/12/93

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Co (mg/Kg)	Cr (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Hg (mg/Kg)	Mn (mg/Kg)	Ni (mg/Kg)	Pb (mg/Kg)	Sb (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
22-004-SE-1	104 J	34.5	3.2	4.3	4.5 J	76.6 J	12800	0.104	458	5 J	223 J	6 UJ	506	NR
22-004-SE-2	63 J	20.3	3.3	3	1.6 U	161 J	9460	0.026	1320	3 J	204 J	7 UJ	561	NR
22-004-TP-1	1270 J	66.5	61.7	2.6	2.3 J	897 J	20400	0.31	20400	20 J	7540 J	104 J	9360	NR
22-004-TP-2	975 J	87.9	104	5.1	4.2 J	2010 J	27800	1.45	17500	19 J	15500 J	194 J	13500	NR
BACKGROUND	187 J	92.1	6.6	11.4	8.4 J	232 J	31600	0.029	1040	11 J	447 J	6 UJ	618	NR

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

Acid/Base Accounting

FIELD ID	TOTAL SULFUR		NEUTRAL POTENT		SULFUR ACID BASE		PYRITIC SULFUR		ORGANIC SULFUR		PYRITIC SULFUR ACID BASE		SULFUR ACID BASE POTENT	
	%	1/1000	%	1/1000	%	1/1000	%	1/1000	%	1/1000	%	1/1000	%	1/1000
22-004-TP-1	1.5	46.9	3.2	66.6	-44	0.59	0.56	0.35	17.5	-14.3	33.4	33.2		
22-004-TP-2	2.66	83.1			-17	0.84	1.07	0.75						

WATER MATRIX ANALYSES

Metals in Water
Results in ug/L

FIELD ID	Au	Ba	Cd	Co	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Sb	Zn	HARDNESS CALC. (mg CaCO3/L)
22-004-GW-1	9.12 J	30.70	4.03 J	9.70 U	6.83 U	3.70	76.1 JX	0.120	18.1	12.7 U	3.95	30.7 U	66.8 J	197
22-004-SW-1	20.51 J	8.40	241 J	11.00	6.83 U	233	630 JX	0.095	8580	59.3	17.3	44.1	26300 J	536
22-004-SW-2	103	50.6	25.1 J	9.7 U	7.97	348	6530	0.094	8830	12.7 U	960	30.7 U	5630	215

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
22-004-GW-1	686	< 5.0	156	< 0.05	NR
22-004-SW-1	326	< 5.0	144	0.36	NR
22-004-SW-2	406	< 5.0	206	0.24	NR

LEGEND

SE1 - Upstream in Spring Creek
SE2 - Downstream of tailings in Spring Creek
TP1 - Composite of subsamples TP1A-A, 1B-1 through 1B-3, and 1C-1 through 1C-4
TP2 - Composite of subsamples TP1D-1 through 1D-4
BACKGROUND - From the Bertha Mine (22-002-S5-1)

GW1 - Residential well
SW1 - Same as sample SE1
SW2 - Same as sample SE2

**MONTANA DEPARTMENT OF STATE LANDS
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY**

Mine/Site Name: <u>Gregory</u>	County: <u>Jefferson</u>
Legal Description: T <u>7N</u> R <u>4W</u>	Section(s): <u>N 1/2, Sec. 4</u>
Mining District: <u>Colorado</u>	Mine Type: <u>Hardrock/Pb, Zn, Au, Ag</u>
Latitude: <u>N 46° 23' 14"</u>	Primary Drainage: <u>Clancy Creek</u>
Longitude: <u>W 112° 06' 48"</u>	USGS Code: <u>10030101</u>
Land Status: <u>Private</u>	Secondary Drainage: <u>Clancy Creek</u>
Quad: <u>Jefferson City</u>	Date Investigated: <u>August 17, 1993</u>
Inspectors: <u>Bullock, Belanger, Pierson</u>	P.A. # <u>22-005</u>
Organization: <u>Pioneer Technical Services, Inc./Thomas, Dean and Hoskins, Inc.</u>	

- Approximately 10,000 cubic yards of tailings were associated with this site. The following elements were elevated at least three times background:
Arsenic: 5870J mg/kg
- The volume of waste rock at this site was approximately 30,000 cubic yards. The following elements were elevated at least three times background:
Arsenic: 770J to 1060J mg/kg
Mercury: 0.412 to 0.544 mg/kg
Lead: 4910J to 11500J mg/kg
- Erosion of waste rock and tailings into drainages was occurring.
- An observed release to Clancy Creek was documented for lead. Also, the acute aquatic life criteria for copper was exceeded in Clancy Creek, which was directly attributable to the site. Observed releases to the unnamed tributary of Clancy Creek were documented for arsenic and lead. The MCL for cadmium was also exceeded in this tributary; however, the exceedance could not be attributed to the site. The pH of Clancy Creek dropped from 7.73 to 7.58 between the up- and down-gradient sample locations. Specific conductance increased from 190 to 240 umhos/cm. The unnamed tributary made up less than 5 percent of the flow of Clancy Creek at this location.

FIELD ID	Metals in soils					Results per dry weight basis										SOLID MATRIX ANALYSES									
	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Co (mg/Kg)	Cr (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Hg (mg/Kg)	Mn (mg/Kg)	Ni (mg/Kg)	Pb (mg/Kg)	Sb (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)											
22-005-TP-1	5820 J	92.1 J	6.6 J	5.67 U	8.67	331	90700	0.208	334	7.4 U	2180 J	17.9 U	1060 J	NR											
	22 J	125 J	0.5 U	6.5 J	11.1 J	14.1 JX	13200 J	0.039	906 J	30 J	83 J	6 U	156 JX	NR											
	5870 J	81.2 J	1.4 J	1.8 J	4.4 J	161 JX	21700 J	0.063	60.8 J	6 J	577 J	5 U	195 JX	NR											
	1740 J	104 J	0.8 J	4.3 J	8.2 J	204 JX	19700 J	0.04	347 J	5 J	705 J	7 U	273 JX	NR											
	1060 J	45.5 J	4.1 J	3 J	1.2 U	453 JX	35500 J	0.457	163 J	14 J	11500 J	5 U	1090 JX	NR											
	381 J	90.4 J	0.6 U	2.1 U	1.5 U	168 JX	30100 J	0.412	70.5 J	8 J	4910 J	7 U	220 JX	NR											
22-005-WR-3	770 J	101 J	0.6 J	2.3 J	8 J	129 JX	58400 J	0.544	181 J	9 J	6790 J	6 U	563 JX	NR											
	187 J	92.1	6.6	11.4	8.4 J	232 J	31600	0.029	1040	11 J	447 J	6 UJ	618	NR											
BACKGROUND																									
U - Not Detected, J - Estimated Quantity, X - Outlier for Accuracy or Precision, NR - Not Reported																									
FIELD ID	Acid/Base Accounting				PYRITIC				SULFUR				CYANIDE												
	TOTAL SULFUR %	ACID BASE v/1000t	NEUTRAL POTENT v/1000t	SULFUR ACID BASE POTENT v/1000t	SULFATE SULFUR %	PYRITIC SULFUR %	ORGANIC SULFUR %	PYRITIC SULFUR ACID BASE v/1000t	SULFUR ACID BASE POTENT v/1000t	CYANIDE v/1000t															
22-005-TP-1	0.48	15	-6.7	-22	0.46	-0.01	0.02	0	-6.73																
22-005-TP-2	0.29	9.06	-3.3	-12	0.24	0.01	0.04	0.31	-3.61																
22-005-WR-1	3.96	124	-7.3	-132	1.75	1.52	0.71	47.5	-54.8																
22-005-WR-2	1.87	58.4	-3.7	-62	0.94	0.47	0.46	14.7	-18.4																
22-005-WR-2DUP	1.9	59.4	-3.3	-63	0.98	0.43	0.49	13.4	-16.7																
22-005-WR-3	2.1	65.6	-5.8	-71	2.03	0.01	0.06	0.31	-6.1																
22-005-WR-3DUP	2.13	66.5	-6.3	-73	2.05	0.01	0.07	0.31	-6.34																

FIELD		Metals in Water														Results in ug/L		CALC.	
ID		As	Ba	Cd	Co	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Sb	Zn	(mg CaCO ₃ /L)				
22-005-SW-1		4.45	7.13	2.93 J	9.7 U	6.83 U	39.5 J	146	0.27 J	591	12.7 U	14.4	30.7 U	640	89.2				
22-005-SW-2		3.17	5.8	3 J	9.7 U	6.83 U	2.5 J	105	0.22 J	91.9	15.5	0.75	30.7 U	31.1	76				
22-005-SW-3		30.3	20.2	84.9 J	33.7	8.07	1020 J	10800	0.34 J	14000	22.3	200	36.5	14900	316				
22-005-SW-4		216	2.01 U	135 J	36.8	6.83 U	2230 J	51700	0.39 J	9670	31.7	48.1	30.7 U	20400	156				
22-005-SW-5		4.81	43.7	2.57 U	9.7 U	6.83 U	1.55 U	510	0.29 J	133	14.6	3.73	30.7 U	29.9	177				

Wet Chemistry

Results in mg/l

TOTAL	DISSOLVED	CHLORIDE	SULFATE	NO ₃ /NO ₂ -N	CYANIDE
161	<	5.0	58	< 0.05	NR
131	<	5.0	30	< 0.05	NR
851	<	5.0	556	0.07	NR
878	<	5.0	586	< 0.05	NR
260	<	5.0	97	< 0.05	NR

LEGEND

SE3 - Downstream tributary sample above culvert
SE5 - Upgradient tributary sample
TP1 - Sample of the TP1 subsample
TP2 - Composite of subsamples TP2A and 2B
WR1 - Composite of subsamples WR1A through 1E, and 2A through 2C.
WR2 - Composite of subsamples WR2A through 3C.
WR3 - Composite of subsamples WR3A and 4B.
BACKGROUND - From the Bertha Mine (22-007-BS-1).
WR2DUP - Duplicate of the 22-005-WR-2 sample.
WR3DUP - Duplicate of the 22-005-WR-3 sample.

SW1 - Clancy Creek downstream from tailings and confluence
SW2 - Upstream Clancy Creek at Pegasus gauging station.
SW3 - Downstream tributary sample above culvert
SW4 - Mouth of small Northern tributary coming downstream of waste rock dump 2.

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

**MONTANA DEPARTMENT OF STATE LANDS
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY**

Mine/Site Name: <u>Washington</u>	County: <u>Jefferson</u>
Legal Description: <u>T 7N R 4W</u>	Section(s): <u>SW 1/4, NW 1/4, Sec. 17</u>
Mining District: <u>Colorado</u>	Mine Type: <u>Hardrock/Au, Ag, Cu, Pb, Zn</u>
Latitude: <u>N 46° 21' 39"</u>	Primary Drainage: <u>Prickly Pear Creek</u>
Longitude: <u>W 112° 08' 14"</u>	USGS Code: <u>10030101</u>
Land Status: <u>Private</u>	Secondary Drainage: <u>Spring Creek</u>
Quad: <u>Mount Thompson</u>	Date Investigated: <u>August 16, 1993</u>
Inspectors: <u>Bullock, Belanger, Pierson</u>	P.A. # <u>22-007</u>
Organization: <u>Pioneer Technical Services, Inc./Thomas, Dean and Hoskins, Inc.</u>	

- The volume of tailings associated with this site was estimated to be approximately 86,000 cubic yards. The following elements were elevated at least three times background:

Arsenic: 9180J to 11,000J mg/kg	Cadmium: 31.9J to 68.9J mg/kg
Iron: 95,700J to 101,000J mg/kg	Mercury: 0.207 mg/kg
Lead: 4310J to 5830J mg/kg	Antimony: 43 mg/kg
Zinc: 5660JX to 10700JX mg/kg	
- Tailings were actively eroding into this tributary of Spring Creek.
- The volume of waste rock associated with this site was estimated to be approximately 36,000 cubic yards. The following elements were elevated at least three times background:

Arsenic: 2410J to 3250J mg/kg	Cadmium: 16.4J to 20.8J mg/kg
Mercury: 0.384 to 0.39 mg/kg	Lead: 2330J to 4420J mg/kg
Antimony: 19 mg/kg	Zinc: 5660JX to 10700JX mg/kg
- Two adit discharges were associated with this site, making up all of the flow of this tributary of Spring Creek during mid-summer, low-flow conditions. Both adit discharges exceeded the MCL for arsenic. Acute aquatic life criteria were exceeded for iron and zinc at both adits and for arsenic at Adit #1. Chronic aquatic life criteria were exceeded for zinc at both adits and also for arsenic and cadmium at Adit #1. Adit discharge pH measurements were 7.86 and 7.27 for Adit #1 and Adit #2, respectively.
- This tributary to Spring Creek flowed intermittently above the adit discharges and below it flowed through the waste rock and tailings. Observed releases were observed for arsenic, lead and zinc. The chronic aquatic life criteria for lead was exceeded and was directly attributed to this site. The upgradient surface water sample indicated the presence of an upgradient contaminant source.

Washington PA# 22-007
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER - BULLOCK
INVESTIGATION DATE: 08/16/93

SOLID MATRIX ANALYSES

Metals in soils Results per dry weight basis

FIELD ID	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Cu (mg/Kg)	Cr (mg/Kg)	Fe (mg/Kg)	Hg (mg/Kg)	Mn (mg/Kg)	Ni (mg/Kg)	Pb (mg/Kg)	Sb (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
22-007-SE-1	5100	28.4	32.7 J	7.2	8.6	46400	0.084	3210	9	2280	34	5080	NR
22-007-SE-2	44	29.9	2.6 J	12.6	32.6	22900	0.028 U	875	21	133	6 U	184	NR
22-007-TP-1	9180 J	20.8 J	31.9 J	13.2 J	7.6 J	95700 J	0.207	2770 J	19 J	5830 J	43	5660 JX	NR
22-007-TP-2	11000 J	13.3 J	68.9 J	17.7 J	19.9 J	101000 J	0.08	6360 J	24 J	4310 J	6 U	10700 JX	NR
22-007-WR-1	2410	26.6	16.4 J	5.6	7.9	30900	0.384	1470	6	2330	16	2970	NR
22-007-WR-2	3250	24.1	20.8 J	4.3	3.9	33700	0.39	987	6	4420	19	3010	NR
BACKGROUND	187 J	92.1	6.6	11.4	8.4 J	31600	0.029	1040	11 J	447 J	6 UJ	618	NR

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

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	ACID BASE v/1000	NEUTRAL POTENT v/1000	SULFUR ACID BASE POTENT v/1000	ORGANIC SULFUR %	PYRITIC ACID BASE v/1000	PYRITIC ACID BASE POTENT v/1000
22-007-TP-1	11.7	366	47.5	-318	1.65	319	-271
22-007-TP-2	10.6	331	124	-207	2.35	337	-213
22-007-TP-2DUP	10.3	322	124	-199	2.38	337	-214
22-007-WR-1	4.89	153	48.6	-104	3.41	43.1	5.54
22-007-WR-2	4.13	129	29.0	-100	1.33	12.8	16.2

WATER MATRIX ANALYSES

Metals in Water Results in ug/L

FIELD ID	As	Ba	Cd	Ca	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Sb	Zn	HARDNESS CALC (mg CaCO3/L)
22-007-GW-1	621	21.2	2.57 U	9.7 U	9.57 J	2.03	3660 J	0.260 J	1740 JX	12.7 U	2.35	30.7 U	336	245
22-007-GW-2	172	21.5	2.57 U	10.6	6.83 U	3.3	17700 J	0.160 J	3630 JX	12.7 U	4.27	30.7 U	2230	367
22-007-SW-1	1060	12.8	36.2	9.7 U	6.83 U	56.9 J	7310	0.140	5130	33.5	471	32.7	10800	478
22-007-SW-2	59.3	9.87	32.7	9.7 U	6.83 U	13.5 J	950	0.120 U	4090	28	2.51	30.7 U	9980	438
22-007-SW-3	2.43	78.1	27.3	9.7 U	6.83 U	58.8 J	55.7	0.120 U	982	27.8	3.26	30.7 U	3920	162

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

Wet Chemistry Results in mg/l

FIELD ID	TOTAL DISSOLVED SOLIDS	CHLORIDE	SULFATE	NO3/NO2-N	CYANIDE
22-007-GW-1	343	< 5.0	132	< 0.05	NR
22-007-GW-2	512	< 5.0	318	< 0.05	NR
22-007-SW-1	776	5.0	498	< 0.05	NR
22-007-SW-2	712	< 5.0	1140	< 0.05	NR
22-007-SW-3	325	< 5.0	193	< 0.05	NR

LEGEND

- SE1 - In stream approx. 300' downstream of tailings pond 4
SE2 - Between tailings and waste rock at road
TP1 - Composite of subsamples TP1A-A through 1A-C, 2A-A through 2A-D, and 3A-A through 3A-C
TP2 - Composite of subsamples TP2A-A through 4A-C, and 4B-C
WR1 - Composite of subsamples WR1A, 1B, and 2A through 2C
WR2 - Composite of subsamples WR2A, 2B, and 4
TP2DUP - Duplicate of the 22-007-TP-2 sample
BACKGROUND - From the Berlin Mine (22-007-58-1)
- GW1 - Discharge from edit #1
GW2 - Discharge from edit #2
SW1 - Same as sample SE1
SW2 - Same as sample SE2
SW3 - Upgradient of site approx. 200 feet.

**MONTANA DEPARTMENT OF STATE LANDS
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY**

Mine/Site Name: <u>Crawley Camp</u>	County: <u>Jefferson</u>
Legal Description: <u>T 7N R 4W</u>	Section(s): <u>SW 1/4, SW 1/4, Section 7</u>
Mining District: <u>Colorado</u>	Mine Type: <u>Hardrock/Unknown</u>
Latitude: <u>N 46° 22' 04"</u>	Primary Drainage: <u>Clancy Creek</u>
Longitude: <u>W 112° 09' 30"</u>	USGS Code: <u>10030101</u>
Land Status: <u>Private</u>	Secondary Drainage: <u>Clancy Creek</u>
Quad: <u>Mount Thompson</u>	Date Investigated: <u>June 13, 1994</u>
Inspectors: <u>Bullock, Bisch, Clark, West</u>	P.A. # <u>22-028</u>
Organization: <u>Pioneer Technical Services, Inc.</u>	

- No mill tailings were observed at the site.
- The volume of waste rock observed at the site was estimated to be 2,800 cubic yards. The following elements were elevated to at least three times the background concentrations:

Silver: 2.8 to 114 mg/kg	Mercury: 0.43J mg/kg
Arsenic: 73.7 to 459 mg/kg	Lead: 553 to 1820 mg/kg
Copper: 75.4 mg/kg	Antimony: 1,150J mg/kg
- The two waste rock dumps associated with this site are situated directly in the floodplain of Upper Clancy Creek. Additionally, the discharging adit associated with the site flowed directly into Upper Clancy Creek. The MCL for arsenic, the acute aquatic life criteria for zinc, and the chronic aquatic life criteria for copper, iron, lead, and zinc were all exceeded in the adit discharge.
- An observed release to Upper Clancy Creek was documented for arsenic. The chronic aquatic life criteria for lead was exceeded in both the upstream and downstream samples, and the chronic aquatic life criteria for iron was exceeded in the downstream sample.
- Potential safety hazards observed at the site included two partially collapsed cabins (low hazard potential).

Crawley Camp PA# 22-028
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER - BULLOCK
INVESTIGATION DATE: 06/13/94

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	Ag (mg/Kg)	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Co (mg/Kg)	Cr (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Hg (mg/Kg)	Mn (mg/Kg)	Ni (mg/Kg)	Pb (mg/Kg)	Sb (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
22-028-SE1	1.5 U	949	395	46.4 J	61.4	22.1	460	117000	0.12 J	37300	27.4	278	67.0 J	6440	NR
22-028-SE2	0.8 U	216	41.1	1.2 J	10.4	16.3	14.7	16500	0.04 U	603	10.0	30.2	8.4 UJ	72.4	NR
22-028-WR1	114	459	47.8	2.5 J	1.7 U	1.1	75.4	20300	0.07 J	28.9	2.1	1820	1150 J	228	NR
22-028-WR2	2.8	73.7	23.7	1.3 J	1.4 U	0.7 U	33.8	8250	0.43 J	12	1.2 U	553	6.0 J	58.8	NR
BACKGROUND	0.6 U	23.1	178	2.0 J	9.7 B	3.9	23.1	13600	0.04 J	1280	3.4	42.3	6.4 UJ	120	NR

U - Not Detected; J - Estimated Quantity; B - Outline for Accuracy or Precision; NR - Not Reported

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	TOTAL SULFUR 8/1000	ACID BASE 8/1000	NEUTRAL POTENT 8/1000	SULFUR ACID BASE POTENT 8/1000	ORGANIC SULFUR %	PYRITIC SULFUR %	PYRITIC SULFUR ACID BASE 8/1000	PYRITIC SULFUR ACID BASE POTENT 8/1000
22-028-WR1	0.74	23.1	-4.72	-9	-28	0.32	0.05	1.56	-6.28
22-028-WR2	0.19	5.94	-3.10	-9	-9	0.01	<0.01	0.00	-3.10

WATER MATRIX ANALYSES

Metals in Water
Results in ug/L

FIELD ID	Al	As	Ba	Cd	Co	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Sb	Zn (mg CaCO ₃ L)	HARDNESS CALC
22-028-AD1	0.43	50.8	5.7	2.6 U	8.7 U	4.7 U	12.9	5870	0.11 U	386	8.0 U	9.8	29.4 U	140	75.0
22-028-SW1	0.12 U	16.8	2.7	2.6 U	8.7 U	4.7 U	4.6 U	1390	0.11 U	225	8.0 U	4.7	29.4 U	75.9	72.1
22-028-SW2	0.12 U	4.0	3.6	2.6 U	8.7 U	4.7 U	4.6 U	370	0.11 U	20.7	8.0 U	2.9	29.4 U	4.7	53.7

U - Not Detected; J - Estimated Quantity; X - Outline for Accuracy or Precision; NR - Not Reported

Wet Chemistry
Results in mg/l

FIELD ID	TOTAL DISSOLVED SOLIDS	CHLORIDE	SULFATE	NO ₃ NO ₂ -N	CYANIDE
22-028-AD1	116	<5	32	<0.05	NR
22-028-SW1	125	<5	32	<0.05	NR
22-028-SW2	80	<5	5.0	<0.05	NR

LEGEND

SE1 - Determination in Upper Cherry Creek, less existing from all discharges on vegetation
SE2 - Determination in Upper Cherry Creek
WR1 - Composite of subsamples WR1A and 1B
WR2 - Composite of subsamples WR2A and 2B
BACKGROUND - From the Boulder Creek Mine (22-112-081)
AD1 - All discharges above NR2
SW1 - Same as sample 22-028-SE1
SW2 - Same as sample 22-028-SE2

**MONTANA DEPARTMENT OF STATE LANDS
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY**

Mine/Site Name: <u>Argentine</u>	County: <u>Jefferson</u>
Legal Description: <u>T 7N R 5W</u>	Section(s): <u>SW 1/4, NW 1/4, Sec. 2</u>
Mining District: <u>Colorado</u>	Mine Type: <u>Hardrock/Unknown</u>
Latitude: <u>N 46° 23' 20"</u>	Primary Drainage: <u>Clancy Creek</u>
Longitude: <u>W 112° 11' 53"</u>	USGS Code: <u>10030101</u>
Land Status: <u>Private/Public</u>	Secondary Drainage: <u>South Fork Quartz Creek</u>
Quad: <u>Chessman Reservoir</u>	Date Investigated: <u>August 16, 1993</u>
Inspectors: <u>Bullock, Belanger, Pierson</u>	P.A. # <u>22-102</u>
Organization: <u>Pioneer Technical Services, Inc./ Thomas, Dean and Hoskins, Inc.</u>	

- There were no mill tailings associated with this site.
- The volume of waste rock associated with this site was estimated to be approximately 26,000 cubic yards. The following elements were elevated at least three times background:

Arsenic: 259J mg/kg	Manganese: 2540 mg/kg
Lead: 785J to 7640J mg/kg	Zinc: 610J to 1490J mg/kg
- Three of the adits had minor discharges, although only the adit associated with WR-2 had significant flow. Water samples were collected from this adit (GW-2) and from the adit associated with WR-1 (GW-1). The MCL/MCLG for cadmium was exceeded in GW-1. Acute aquatic life criteria were exceeded for iron, cadmium, copper, lead and zinc in GW-1, and for iron and zinc in GW-2. Chronic aquatic life criteria were exceeded for cadmium, copper, lead, and zinc in GW-1 and for zinc in GW-2.
- An unnamed tributary to the South Fork of Spring Creek bisects the site. Vegetative buffer strips were present between the stream and the waste rock dumps. Observed releases were documented for manganese, lead, and zinc. There were no MCLs or MCLGs exceeded, however, acute and chronic aquatic life criteria were exceeded for zinc and were directly attributable to the site.

Argentine PA# 22-102
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER - BULLOCK
INVESTIGATION DATE: 08/16/93

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Co (mg/Kg)	Cr (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Hg (mg/Kg)	Mn (mg/Kg)	Ni (mg/Kg)	Pb (mg/Kg)	Sb (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
22-102-SE-1	27	41.8	3.4 J	4.1	3.5	34.7	9900	0.04 U	2620	3	449	7 U	439	NR
22-102-SE-2	6 U	13.8	0.7 U	2.5 U	3.4	3.4	5790	0.037 U	146	3 U	35	8 U	30	NR
22-102-WR-1	55.6 J	72.7 J	2.6 J	8.94	6.89	97.3	23000	0.032 U	2540	6.69	785 J	7.54 U	610 J	NR
22-102-WR-2	259 J	22.6 J	8.6 J	3.16	1.47	231	23300	0.056	877	2.41 U	7640 J	5.84 U	1490 J	NR
BACKGROUND	88	76	0.7 U	9.5	10.9 J	49.7 J	20400	0.107 J	654 J	9	117 JX	8 UJ	104	NR

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

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	ACID BASE POTENTIAL v/1000x	NEUTRAL POTENTIAL v/1000x	SULFUR ACID BASE POTENTIAL v/1000x	ORGANIC SULFUR %	PYRITIC SULFUR %	PYRITIC ACID BASE POTENTIAL v/1000x	PYRITIC ACID BASE POTENTIAL v/1000x
22-102-WR-1	0.15	4.69	4.99	0.3	0.08	0.04	1.25	3.74
22-102-WR-2	2.43	75.9	-7.2	-83	0.32	0.76	23.7	-30.9

WATER MATRIX ANALYSES

Metals in Water
Results in ug/L

FIELD ID	As	Ba	Cd	Co	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Sb	Zn	HARDNESS CALC (mg CaCO ₃ /L)
22-102-GW-1	1.49 U	2.01 U	7.63	9.7 U	6.83 U	26.5	1050 J	0.190 J	3110 JX	12.7 U	106	30.7 U	729	19.2
22-102-GW-2	1.49 U	16.7	2.57 U	9.7 U	6.83 U	3.27	3190 J	0.120 J	9110 JX	13.8	4.36	30.7 U	3990	415
22-102-SW-1	3.15	5.33	2.77	9.7 U	6.83 U	7.67	138 J	0.140 J	1600 JX	12.7 U	17	30.7 U	385	41.4
22-102-SW-2	2.18	4.8	2.57 U	9.7 U	6.83 U	2.47	66.5 J	0.118 U	7.5 JX	14.5	1.97	30.7 U	8.83	28.9

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	NO ₃ /NO ₂ -N	CYANIDE
22-102-GW-1	79	< 5.0	24	< 0.05	NR
22-102-GW-2	643	< 5.0	338	< 0.05	NR
22-102-SW-1	102	< 5.0	22	< 0.05	NR
22-102-SW-2	72	< 5.0	6	< 0.05	NR

LEGEND

SE1 - Downgradient of site

SE2 - Upgradient of site

WR1 - Composite of subsamples WR1A, 1C, and 2B

WR2 - Composite of subsamples WR1A and 2A

BACKGROUND - From the Enterprise Mine (22-074-SS-1)

GW1 - Associated with waste rock dump 1

GW2 - Associated with waste rock dump 3

SW1 - Same as sample SE1

SW2 - Same as sample SE2

**MONTANA DEPARTMENT OF STATE LANDS
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY**

Mine/Site Name: Wickes Smelter
Legal Description: T 7N R 4W
Mining District: Colorado
Latitude: N 46° 21' 06"
Longitude: W 112° 06' 01"
Land Status: Private
Quad: Wickes
Inspectors: Bullock, Belanger, Pierson
Organization: Pioneer Technical Services,
Inc./Thomas, Dean and Hoskins, Inc.

County: Jefferson
Section(s): SW 1/4, SW 1/4, Sec. 15
Mine Type: Smelter/Cu, Zn, Pb
Primary Drainage: Spring Creek
USGS Code: 10030101
Secondary Drainage: Finn Gulch Creek
Date Investigated: August 17, 1993
P.A. # 22-358

- Contaminant sources at this site were associated with historic smelting activities and included possible kiln dust, clinker, and slag. The volume of waste material associated with this site was roughly estimated at 2000 to 4000 cubic yards. The following elements were elevated at least three times background:

Arsenic: 613J to 4290J mg/l	Cadmium: 26.6J mg/kg
Mercury: 3.18 to 20.9 mg/kg	Lead: 9400J to 31,700J mg/kg
Antimony: 20 to 26 mg/kg	Zinc: 2960JX to 19,000JX mg/kg
- The high mercury measurement was obtained in a sample of the suspected flue dust material directly north of the stack.
- Finn Gulch, a small intermittent tributary to Spring Creek, bisects the site. The drainage was dry at the time of this investigation. Sediment samples were collected up and down gradient of the site. An observed release of mercury to this drainage was documented.
- The town of Wickes was adjacent to this site. Direct contact hazards were considered significant, especially with regard to small children.

Wickes Tailings PA# 22-358
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER - BULLOCK
INVESTIGATION DATE: 08/17/93

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Co (mg/Kg)	Cr (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Hg (mg/Kg)	Mn (mg/Kg)	Ni (mg/Kg)	Pb (mg/Kg)	Sb (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
22-358-SE-1	77 J	38.9 J	1.5 J	3.7 J	4 J	188 JX	11200 J	4.8	354 J	4 J	700 J	5 U	384 JX	NR
22-358-SE-2	33 J	66.4 J	0.5 U	6.9 J	5 J	237 JX	16800 J	0.035 U	574 J	8 J	344 J	8 U	256 JX	NR
22-358-WR-1	613 J	67.9 J	15.7 J	18.9 J	5.7 J	6450 JX	65400 J	3.18	2940 J	8 J	25600 J	20	19000 JX	NR
22-358-WR-2	789 J	109 J	8.7 J	10.4 J	9.6 J	2370 JX	31900 J	20.9	1020 J	6 J	9400 J	26	6040 JX	NR
22-358-WR-3	4290 J	25.9 J	26.6 J	4.4 J	5.9 J	3780 JX	33500 J	35.2	467 J	3 J	31700 J	22	2960 JX	NR
BACKGROUND	187 J	92.1	6.6	11.4	8.4 J	232 J	31600	0.029	1040	11 J	447 J	6 UJ	618	NR

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

Acid/Base Accounting

FIELD ID	TOTAL SULFUR		NEUTRAL POTENTIAL		SULFUR ACID BASE POTENTIAL		SULFATE		PYRITIC		ORGANIC		PYRITIC		SULFUR	
	%	1/1000	%	1/1000	%	1/1000	%	1/1000	%	1/1000	%	1/1000	%	1/1000	%	1/1000
22-358-WR-1	1.82	56.9	-6.5	-63	0.47	0.46	0.89	14.4	-20.8							
22-358-WR-2	0.77	24.1	5.91	-18	0.44	0.07	0.26	2.19	3.72							
22-358-WR-3	2.38	74.4	2.48	-72	1.8	0.15	0.43	4.69	-2.21							

WATER MATRIX ANALYSES

Metals in Water
Results in ug/L

FIELD ID	As	Ba	Cd	Co	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Sb	Zn (mg CaCO ₃ /L)	HARDNESS CALC
22-358-GW-1	0.96 U	2.01 U	2.57 U	9.7 U	6.83 U	1.55 U	37.8	0.18 J	18.2	12.7 U	1.13	30.7 U	15.9	0.2

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

LEGEND

SE1 - Downgradient of site
SE2 - Upgradient of site
WR1 - Sample from the WR4 subsample
WR2 - Sample from the WR2 subsample
WR3 - Sample from the WR1 subsample
BACKGROUND - From the Bertha Mine (22-002-SB-1)

OW1 - QAOQC Blank

**MONTANA DEPARTMENT OF STATE LANDS
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY**

Mine/Site Name: <u>Elkhorn Queen</u>	County: <u>Jefferson</u>
Legal Description: <u>T 6N R 3W</u>	Section(s): <u>SE 1/4, NW 1/4, Sec. 26</u>
Mining District: <u>Elkhorn</u>	Mine Type: <u>Hardrock/Au, Ag, Pb, Zn, Cu</u>
Latitude: <u>N 46° 14' 46"</u>	Primary Drainage: <u>Elkhorn Creek</u>
Longitude: <u>W 111° 56' 42"</u>	USGS Code: <u>10020006</u>
Land Status: <u>Private/Public</u>	Secondary Drainage: <u>South Fork Queen</u>
Quad: <u>Tacoma Park</u>	Gulch
Inspectors: <u>Babits, Flammang, Lasher</u>	Date Investigated: <u>August 16, 1993</u>
Organization: <u>Pioneer Technical Services, Inc.</u>	P.A. # <u>22-027</u>

- No mill tailings were observed at this site during the investigation.
- The volume of waste rock associated with this site was estimated to be approximately 23,000 cubic yards. The following elements were elevated at least three times background:

Arsenic: 10,100J mg/kg	Cadmium: 405J mg/kg
Cobalt: 28.4 mg/kg	Iron: 112,000 mg/kg
Mercury: 0.441 mg/kg	Nickel :19.1 mg/kg
Lead: 40,200J mg/kg	Antimony: 64.6J mg/kg
Zinc: 20,000J mg/kg	
- There were no discharging adits, filled shafts, seeps, or springs identified at the site during the investigation.
- The South Fork of Queen Gulch was the nearest surface water to the site, which was located approximately 1,000 feet to the north. No surface water or sediment samples were collected due to the lack of a direct runoff route.
- Potential safety hazards identified at the site included an open shaft (with a headframe and loadout structure) and an open adit .

Elkhorn Queen PA# 22-027
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER - BABITS
INVESTIGATION DATE: 08/16/93

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Co (mg/Kg)	Cr (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Hg (mg/Kg)	Mn (mg/Kg)	Ni (mg/Kg)	Pb (mg/Kg)	Sb (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
22-027-WR-1	10100 J	118 J	405 J	28.4	2.38	87.6	112000	0.441	2590	19.1	40200 J	64.6 J	20000 J	NR
BACKGROUND	29.8 J	255 J	1.1 J	7.47	5.79	31.7	19700	0.039	1170	6.23	38.2 J	5.89 U	101 J	NR

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

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	ACID BASE %	NEUTRAL POTENT	SULFUR POTENT	ACID BASE %	SULFUR %	ORGANIC SULFUR %	PYRITIC SULFUR %	PYRITIC ACID BASE %	ACID BASE POTENT	SULFUR %
22-027-WR-1	4.24	132	38.0	-94.4	<0.01	3.08	2.06	96.2	-58.2		

LEGEND

WR1 - Composite of subsamples WR1A, 1B, and 1C
BACKGROUND - From Tacoma (22-284-S5-1)

**MONTANA DEPARTMENT OF STATE LANDS
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY**

Mine/Site Name: <u>Queen/Tourmaline Queen</u>	County: <u>Jefferson</u>
Legal Description: T <u>6N</u> R <u>3W</u>	Section(s): <u>SW 1/4, NE 1/4, Sec. 22</u>
Mining District: <u>Elkhorn</u>	Mine Type: <u>Hardrock/Au</u>
Latitude: <u>N 46° 15' 00"</u>	Primary Drainage: <u>Boulder River</u>
Longitude: <u>W 111° 57' 00"</u>	USGS Code: <u>10020006</u>
Land Status: <u>Private/Public</u>	Secondary Drainage: <u>Elkhorn Creek</u>
Quad: <u>Elkhorn</u>	Date Investigated: <u>August 16, 1993</u>
Inspectors: <u>Babits, Flammang, Lasher</u>	P.A. # <u>22-111</u>
Organization: <u>Pioneer Technical Services, Inc.</u>	

- No mill tailings were observed at this site during the investigation.
- The volume of waste rock associated with this site was estimated to be approximately 80,000 cubic yards. The following elements were elevated at least three times background:
Arsenic: 1,420J mg/kg Iron: 87,600 mg/kg
- No discharging adits, filled shafts, seeps, or springs were identified at the site during the investigation.
- Elkhorn Creek was flowing approximately 20 feet from the toe of WR-1. Surface water and sediment samples were collected upstream and downstream from the site. Chronic aquatic life criteria were exceeded for mercury and lead in both the upstream and downstream samples. Contaminant concentrations were not elevated in the downstream samples (surface water or sediment) when compared to the upstream samples.
- No hazardous mine openings or structures were identified at the site.

Queen PA# 22-111
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER - BABITS
INVESTIGATION DATE: 08/16/93

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	As (mg/kg)	Ba (mg/kg)	Cd (mg/kg)	Co (mg/kg)	Cr (mg/kg)	Cu (mg/kg)	Fe (mg/kg)	Hg (mg/kg)	Mn (mg/kg)	Ni (mg/kg)	Pb (mg/kg)	Sb (mg/kg)	Zn (mg/kg)	CYANIDE (mg/kg)
22-111-SE-1	156 J	37 J	45.1 J	4.17	9.32	279	14700	23.4	1570	5.36	2010 J	110 J	6880 J	NR
22-111-SE-2	140 J	17.8 J	36.3 J	2.47 U	6.29	212	14400	14.6	1050	4.81	1800 J	103 J	6140 J	NR
22-111-WR-1	1420 J	37.4 J	1.2 J	14.3	12.5	33.4	87600	0.032 U	395	5.93	73.4 J	4.73 U	167 J	NR
BACKGROUND	29.8 J	255 J	1.1 J	7.47	5.79	31.7	19700	0.039	1170	6.23	38.2 J	5.89 U	101 J	NR

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

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	ACID BASE POTENTIAL	NEUTRAL POTENTIAL	SULFUR ACID BASE POTENTIAL	SULFATE SULFUR %	PYRITIC SULFUR %	ORGANIC SULFUR %	PYRITIC SULFUR ACID BASE POTENTIAL	SULFUR ACID BASE POTENTIAL
22-111-WR-1	0.47	14.7	1.90	-12.8	0.38	<0.01	0.09	0.00	1.90

WATER MATRIX ANALYSES

Metals in Water
Results in ug/L

FIELD ID	As	Ba	Cd	Co	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Sb	Zn (mg CaCO ₃ /L)	HARDNESS CALC
22-111-SW-1	3.42	10.6	2.57 U	9.7 U	6.83 U	5.77 J	300	0.44 J	21.5	12.7 U	22.8	30.7 U	65.2	62.7
22-111-SW-2	4.39	11.1	2.57 U	9.7 U	6.83 U	4.03 J	262	0.36 J	18.9	12.7 U	21.7	30.7 U	58.4	61.9

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	NO ₃ /NO ₂ -N	CYANIDE
22-111-SW-1	108 <	5.0	10 <	0.05	NR
22-111-SW-2	114 <	5.0	10	0.08	NR

LEGEND

SE1 - Upstream on Elkhorn Creek
SE2 - Downstream on Elkhorn Creek
WR1 - Composite of subsamples WR1A, 1B, and 1C
BACKGROUND - From Teocoma (22-284-SS-1)
SW1 - Same as SE1
SW2 - Same as SE2

**MONTANA DEPARTMENT OF STATE LANDS
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY**

Mine/Site Name: <u>Tacoma</u>	County: <u>Jefferson</u>
Legal Description: <u>T 6N R 3W</u>	Section(s): <u>NW 1/4, NE 1/4, Sec. 34</u>
Mining District: <u>Elkhorn</u>	Mine Type: <u>Hardrock/Au, Ag, Pb</u>
Latitude: <u>N 46° 13' 58"</u>	Primary Drainage: <u>Elkhorn Creek</u>
Longitude: <u>W 111° 57' 47"</u>	USGS Code: <u>10020006</u>
Land Status: <u>Public</u>	Secondary Drainage: <u>Tacoma Gulch</u>
Quad: <u>Tacoma Park</u>	Date Investigated: <u>August 16, 1993</u>
Inspectors: <u>Babits, Flammang, Lasher</u>	P.A. # <u>22-284</u>
Organization: <u>Pioneer Technical Services, Inc.</u>	

- No mill tailings were observed at this site during the investigation.
- The volume of waste rock associated with this site was estimated to be approximately 7,320 cubic yards. The following elements were elevated at least three times background:

Arsenic: 177J mg/kg	Cadmium: 3.9 J to 12J mg/kg
Mercury: 0.175 to 0.507 mg/kg	Lead: 1,320J to 23,600J mg/kg
Zinc: 859J to 1,530J mg/kg	
- No discharging adits, filled shafts, seeps, or springs were identified at the site.
- An unnamed, minor, intermittent drainage (dry at the time of the investigation) was situated through the center of the site; however, no sediment samples were collected.
- Seven potentially hazardous open (or partially open) adits were identified at the site.

Tacoma PA# 22-284
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER - BABITS
INVESTIGATION DATE: 08/16/93

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	As (mg/kg)	Ba (mg/kg)	Cd (mg/kg)	Co (mg/kg)	Cr (mg/kg)	Cu (mg/kg)	Fe (mg/kg)	Hg (mg/kg)	Mn (mg/kg)	Ni (mg/kg)	Pb (mg/kg)	Sb (mg/kg)	Zn (mg/kg)	CYANIDE (mg/kg)
22-284-WR-1	177 J	168 J	12.0 J	6.97	1.39 U	334	30200	0.507	900	2.66	23600 J	6.34 J	1530 J	NR
22-284-WR-2	35.2 J	158 J	3.9 J	7.67	2.09	25.4	19100	0.175	835	2.66 U	1320 J	6.45 U	859 J	NR
BACKGROUND	29.8 J	255 J	1.1 J	7.47	5.79	31.7	19700	0.039	1170	6.23	38.2 J	5.89 U	101 J	NR

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

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	ACID BASE %	NEUTRAL POTENT	SULFUR ACID BASE %	SULFATE %	PYRITIC SULFUR %	ORGANIC SULFUR %	PYRITIC ACID BASE %	SULFUR ACID BASE %	POTENT
22-284-WR-1	0.03	0.94	14.3	13.3	0.02	<0.01	0.01	0.00	14.3	
22-284-WR-2	0.01	0.31	42.8	42.5	<0.01	<0.01	0.01	0.00	42.8	

LEGEND

WR1 - Composite of subsamples WR1, 2A, 2B, 5, and 6
WR2 - Composite of subsamples WR7, 8, and 9
BACKGROUND - From Tacoma (22-284-SS-1)

**MONTANA DEPARTMENT OF STATE LANDS
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY**

Mine/Site Name: <u>Sourdough</u>	County: <u>Jefferson</u>
Legal Description: <u>T 6N R 3W</u>	Section(s): <u>NW 1/4, SE 1/4, Sec. 10</u>
Mining District: <u>Elkhorn</u>	Mine Type: <u>Hardrock/Fe, Au</u>
Latitude: <u>N 46° 17' 00"</u>	Primary Drainage: <u>Elkhorn Creek</u>
Longitude: <u>W 111° 57' 37"</u>	USGS Code: <u>10020006</u>
Land Status: <u>Private/Public</u>	Secondary Drainage: <u>Greyback Gulch</u>
Quad: <u>Elkhorn</u>	Date Investigated: <u>August 20, 1993</u>
Inspectors: <u>Babits, Flammang, Lasher</u>	P.A. # <u>22-336</u>
Organization: <u>Pioneer Technical Services, Inc.</u>	

- There were no tailings on site.
- There were approximately 32,450 cubic yards of uncovered waste rock on site. The following were elevated at least three times background:
Arsenic: 105 to 560 mg/kg Copper: 336 to 750 mg/kg
Mercury: 0.848 mg/kg
- There was a discharging adit on site and it did not enter the creek by a surface route. The sample had a pH of 6.56. Cadmium exceeded the MCL/MCLG.
- The creek ran adjacent to waste rock. There was an observed release of copper in downstream surface water. No MCL/MCLGs were exceeded in downstream surface water. The chronic aquatic life criteria for lead was exceeded in downstream surface water, which was directly attributable to the site.
- There were five open adits and one highwall on site.

Sourdough PA# 22-336
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER - BABITS
INVESTIGATION DATE: 08/20/93

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Co (mg/Kg)	Cr (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Hg (mg/Kg)	Mn (mg/Kg)	Ni (mg/Kg)	Pb (mg/Kg)	Sb (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
22-336-SE-1	5.72 U	14.9	1.1 UJ	2.01 J	11.9 J	7.9	6070	0.062	148	5.37 J	7.84 U	7.56 U	11.8	NR
22-336-SE-2	46.2	72.4	1.1 UJ	13.3 J	36.3 J	203	20000	0.104	606	19.6 J	16.8	7.58 U	72.3	NR
22-336-WR-1	560	25.1	0.8 UJ	14.6 J	5.76 J	750	13500	0.044	1030	12.9 J	36.2	5.69 U	249	NR
22-336-WR-2	535	29.9	1.0 UJ	18.3 J	7.18 J	701	51800	0.056	770	6.54 J	70.6	6.57 U	126	NR
22-336-WR-3	105	29.3	0.7 UJ	15.3 J	13.8 J	336	24900	0.848	640	14 J	32.7	4.96 U	173	NR
BACKGROUND	76.1	157	0.7 UJ	15.5 J	55.6 J	64.1	24500	0.118	1260	33.5 J	86.7	4.86 U	121	NR

U - Not Detected, J - Estimated Quantity, X - Outlier for Accuracy or Precision, NR - Not Reported

Acid/Base Accounting

FIELD ID	TOTAL SULFUR		NEUTRAL POTENT		SULFUR ACID BASE POTENT		PYRITIC SULFUR		ORGANIC SULFUR		PYRITIC SULFUR ACID BASE POTENT		SULFUR ACID BASE POTENT	
	%	1/1000	%	1/1000	%	1/1000	%	1/1000	%	1/1000	%	1/1000	%	1/1000
22-336-WR-1	0.02	0.62	79.8	79.2	<0.01	0.01	0.02	0.31	0.02	0.02	0.31	79.5	79.5	79.5
22-336-WR-2	0.56	17.5	13.9	-3.6	0.38	0.06	0.12	1.87	0.12	0.12	1.87	12	12	12
22-336-WR-3	0.05	1.56	31.9	30.3	0.01	<0.01	0.04	0	0.04	0.04	0	31.9	31.9	31.9

WATER MATRIX ANALYSES

Metals in Water
Results in ug/L

FIELD ID	As	Ba	Cd	Co	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Sb	Zn	HARDNESS (mg CaCO ₃ /L)
22-336-SW-1	3.33 J	5	2.57 U	9.7 U	6.83 U	1.55 U	50.3 J	0.12 U	8.77	12.7 U	1.55 U	30.7 U	7.57 U	65.4
22-336-SW-2	2.47 J	5.87	2.57 U	9.7 U	8.73 J	6.5 J	145 J	0.12 U	11.7	12.7 U	2.24	30.7 U	7.57 U	70.4
22-336-SW-3	8.82 J	2.01 U	8.6	148	6.83 U	1120 J	34000 J	0.12 U	7480	35.4	1.55 U	30.7 U	429	470

U - Not Detected, J - Estimated Quantity, X - Outlier for Accuracy or Precision, NR - Not Reported

Wet Chemistry
Results in mg/l

FIELD ID	TOTAL DISSOLVED SOLIDS	CHLORIDE	SULFATE	NO ₃ /NO ₂ -N	CYANIDE
22-336-SW-1	99	< 5.0	11	< 0.05	NR
22-336-SW-2	80	< 5.0	7	< 0.05	NR
22-336-SW-3	684	< 5.0	467	0.31	NR

LEGEND

- SE1 - Upgradient approx. 300' from waste rock dump 4
SE2 - Downgradient approx. 50' from base of waste rock dump 5
WR1 - Composite of subsamples WR2, 3A, and 3B
WR2 - Composite of subsamples WR4A, 4B, 4C, and 4D
WR3 - Composite of subsamples WR5A, 5B, and 5C
BACKGROUND - North side of Greyback Creek
From Sourdough Mine (22-336-SB-1)
- SW1 - Same as sample SE1
SW2 - Same as sample SE2
SW3 - Add discharge of waste rock dump 5

**MONTANA DEPARTMENT OF STATE LANDS
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY**

Mine/Site Name: <u>Carmody</u>	County: <u>Jefferson</u>
Legal Description: <u>T 6N R 3W</u>	Section(s): <u>SW 1/4, NW 1/4, Section 14</u>
Mining District: <u>Elkhorn</u>	Mine Type: <u>Hardrock/Au, Ag</u>
Latitude: <u>N 46° 16' 20"</u>	Primary Drainage: <u>Elkhorn Creek</u>
Longitude: <u>W 111° 57' 05"</u>	USGS Code: <u>10020006</u>
Land Status: <u>Private</u>	Secondary Drainage: <u>Slaughterhouse Gulch</u>
Quad: <u>Elkhorn</u>	Date Investigated: <u>August 4, 1994</u>
Inspectors: <u>Flammang, Clark, West</u>	P.A. # <u>22-337</u>
Organization: <u>Pioneer Technical Services, Inc.</u>	

- The volume of tailings observed at the site was estimated to be 15,615 cubic yards. The following elements were elevated to at least three times the background concentrations:

Silver: 1.7J to 88.1J mg/kg	Iron: 95,500 to 108,000 mg/kg
Arsenic: 272 to 841 mg/kg	Mercury: 0.40 to 138 mg/kg
Cadmium: 5.1 to 175 mg/kg	Lead: 5,540 to 13,100 mg/kg
Cobalt: 52.7J mg/kg	Antimony: 487J to 1,170J mg/kg
Copper: 494 to 1,250 mg/kg	Zinc: 278 to 29,500 mg/kg
- Significantly high concentrations of cyanide were detected in TP-1 (4,704 mg/kg) and TP-3 (3,075 mg/kg).
- The volume of waste rock observed at the site was estimated to be 2,475 cubic yards. The following elements were elevated to at least three times the background concentrations:

Silver: 1.7J mg/kg	Iron: 138,000 mg/kg
Arsenic: 1,560 mg/kg	Mercury: 1.00 mg/kg
Cadmium: 6.6 mg/kg	Lead: 53.5 mg/kg
Copper: 616 mg/kg	
- No discharging adits, filled shafts, seeps, or springs were observed at the site during the investigation.
- Slaughterhouse Gulch flows through the center of the site. Observed releases to Slaughterhouse Gulch were documented for iron, lead, and zinc. No MCLs were exceeded in Slaughterhouse Gulch; however, the chronic aquatic life criteria for cadmium, copper, iron, and lead were exceeded in downstream samples. These exceedances were directly attributable to the site.
- Potential safety hazards observed at the site includes two open (but fenced) shafts, two open adits, three small open pits, and various collapsing wooden and metal structures.

Carmody PA# 22-337
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER - FLAMMANG
INVESTIGATION DATE: 08/04/94

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	Ag (mg/Kg)	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Co (mg/Kg)	Cr (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Hg (mg/Kg)	Mn (mg/Kg)	Ni (mg/Kg)	Pb (mg/Kg)	Sb (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
22-337-SE1	1.4 U	377	66.2	4.5	23.4 J	12.2	425	69400	0.20	682 JX	11.1	60.5	16.8 UJ	293	NR
22-337-SE2	0.8 U	73.7	51.2	1.3	7.7 J	4.7	112	21200	0.16	407 JX	4.9	31.7	9.3 UJ	67.0	NR
22-337-SE3	59.5 J	110	28.1	14.8	4.1 J	4.9	289	13600	72.0	267 JX	4.1	2410	205 J	6400	NR
22-337-SE4	22.5 J	57.1	46.9	19.3	6.7 J	13.6	110	16300	23.4	430 JX	14.0	1110	45.6 J	2060	NR
22-337-TP1	88.1 J	272	15	175	4.5 J	2.3	494	11600	7.53	2340 JX	6.1	5540	487 J	14700	4.704
22-337-TP2	1.7 J	448	223	6.4	18.7 J	38.1	1070	108000	0.10	285 JX	19.2	25.6	10.3 UJ	278	0.378
22-337-TP3	1.8 J	841	64.5	5.1	52.7 J	17.4	1210	95500	0.40	1210 JX	16.9	32.7	11.9 UJ	618	3.075
22-337-TP4	75.9 J	368	40.1	88.9	1.9 J	3.8	1250	16800	1.38	850 JX	5.5	13100	1170 J	29500	<0.285
22-337-WR1	1.7 J	1560	143	6.6	11.7 J	43.6	616	138000	1.00	434 JX	12.9	53.5	10.3 UJ	145	NR
BACKGROUND	0.5 U	21.3	267	0.5 U	9.3 J	15.0	13.9	17400	0.05	1410	11.1	17.7	5.8 UJ	85.8 J	NR

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

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	ACID BASE %	NEUTRAL POTENT	SULFUR ACID BASE POTENT	SULFUR %	SULFATE %	PYRITIC SULFUR %	ORGANIC SULFUR %	PYRITIC ACID BASE %	PYRITIC ACID BASE POTENT	SULFUR ACID BASE POTENT
22-337-TP1	<0.01	0.00	196	196	<0.01	<0.01	0.10	0.03	3.12	193	
22-337-TP2	1.64	51.2	1.02	-50	1.50	0.05	0.09	0.05	2.81	-1.80	
22-337-TP3	0.12	3.75	77.5	73.8	0.05	0.03	0.04	0.03	1.25	76.3	
22-337-TP4	0.07	2.19	118	116	0.05	0.02	<0.01	0.02	0.00	118	
22-337-WR1	1.79	55.9	-0.82	-57	1.73	0.01	0.01	0.05	0.31	-1.13	

WATER MATRIX ANALYSES

Metals in Water
Results in ug/L

FIELD ID	Ag	Au	Ba	Cd	Co	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Sb	Zn	HARDNESS CALC (mg CaCO ₃ /L)
22-337-GW1	0.12 U	5.2	5.5	4.0 U	8.4 U	6.8 U	5.9 U	53.7	0.13 JX	2.3 U	14.4 U	0.4 U	51.6 U	17.8	176
22-337-SW1	0.12 U	11.9	14.1	4.0 U	8.4 U	6.8 U	17.6	1420	0.08 UJ	34.0	15.7	2.4	51.6 U	19.8	126
22-337-SW2	0.12 U	8.0	11.2	4.0 U	8.4 U	6.8 U	7.9	402	0.17 JX	21.4	14.4 U	0.9	51.6 U	15.6 U	125
22-337-SW3	0.23	11.4	12.7	4.2	8.4 U	6.8 U	10.0	481	0.29 JX	17.3	20.2	21.3	51.6 U	49.2	129

Wet Chemistry
Results in mg/l

FIELD ID	TOTAL DISSOLVED SOLIDS	CHLORIDE	SULFATE	NO ₃ NO ₂ -N	CYANIDE
22-337-GW1	184	<5.0	37	0.26	<0.005
22-337-SW1	98	<5.0	8.0	<0.05	<0.005
22-337-SW2	111	<5.0	8.0	<0.05	<0.005
22-337-SW3	114	<5.0	8.0	<0.05	<0.005

LEGEND

- SE1 - Upgradient in Shagbush Creek, 150' above mouth
SE2 - Downgradient, below TP4 on Elk River Creek and above main well building
SE3 - In Elk River Creek upstream of confluence with Shagbush Creek
TP1 - Composite of sediments TP1A, 1B, 1C, and 1D
TP2 - Composite of sediments TP2A, 2B, 2C, and 2D
TP3 - Composite of sediments TP3A, TP3B, 3C, and 3D
TP4 - Composite of sediments TP4A through 4D
NR1 - Composite of sediments NR1A through 4B
NR2 - Upgradient in Shagbush Creek, 150' above mouth
NR3 - Downgradient, below TP4 on Elk River Creek and above main well building
SW1 - Same as sample 22-337-SE1
SW2 - Same as sample 22-337-SE2
SW3 - Same as sample 22-337-SE3
GW1 - Well located possibly downgradient of TP1 & upgradient of the rest outside fence on pump

**MONTANA DEPARTMENT OF STATE LANDS
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY**

Mine/Site Name: <u>Iron</u>	County: <u>Jefferson</u>
Legal Description: <u>T 7N R 3W</u>	Section(s): <u>SW 1/4, SW 1/4, Section 36</u>
Mining District: <u>Elkhorn</u>	Mine Type: <u>Hardrock/Fe</u>
Latitude: <u>N 46° 18' 37"</u>	Primary Drainage: <u>Muskrat Creek</u>
Longitude: <u>W 111° 55' 43"</u>	USGS Code: <u>10020006</u>
Land Status: <u>Private</u>	Secondary Drainage: <u>Muskrat Creek</u>
Quad: <u>Elkhorn</u>	Date Investigated: <u>August 9, 1994</u>
Inspectors: <u>Flammang, Belanger, West</u>	P.A. # <u>22-359</u>
Organization: <u>Pioneer Technical Services, Inc.</u>	

- No mill tailings were observed at the site.
- The volume of waste rock observed at the site was estimated to be 8,535 cubic yards. The following elements were elevated to at least three times the background concentrations:
Cobalt: 21.1 to 27.1 mg/kg Copper: 410 to 487 mg/kg
Iron: 64,700 to 75,200 mg/kg
- One discharging adit was associated with the site. No MCLs were exceeded in the adit discharge; however, the acute and chronic aquatic life criteria for copper and the chronic aquatic life criteria for mercury were exceeded in the discharge.
- A sediment sample was collected from the adit discharge drainage (downstream from where the adit discharge seeped into the ground). The sediment contained significantly elevated (>3X background) levels of cobalt, copper, iron, and zinc.
- Potential safety hazards observed at the site included several collapsing loadout structures and several collapsing cabins.

Iron PA# 22-359
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER - FLAMMANG
INVESTIGATION DATE: 08/09/94

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	Ag (mg/Kg)	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Co (mg/Kg)	Cr (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Hg (mg/Kg)	Mn (mg/Kg)	Ni (mg/Kg)	Pb (mg/Kg)	Sh (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
22-359-SE2	2.4	119	74.9	4.6	164	10.2	4130	115000	0.30	671	17.4	85.5	13.2 UJ	451	NR
22-359-WR1	0.6 U	47.6	34.8	4.0	27.1	2.8	487	64700	0.33	773	4.0	20.1	7.4 U	106	NR
22-359-WR2	2.5	64.0	80.0	3.5	21.1	6.0	410	75200	0.06	332	2.7	53.9	7.6 U	96.0	NR
BACKGROUND	2.0	95.9	105	3.2	5.0	10.5	60.0	13300	0.17	1020	6.8	90.7	12.0 U	110	NR

U: Not Detected, L: Estimated Quantity, N: Not for Accuracy or Precision, NR: Not Reported

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %		SULFUR ACID BASE POTENTIAL		SULFUR ACID BASE POTENTIAL		PYRITIC SULFUR ACID BASE POTENTIAL		PYRITIC SULFUR ACID BASE POTENTIAL	
	%	U/1000	%	U/1000	%	U/1000	%	U/1000	%	U/1000
22-359-WR1	0.04	1.25	8.81	7.56	0.04	0.01	0.00	8.81	0.00	8.81
22-359-WR2	0.32	10.0	4.68	-5.3	0.24	0.05	0.94	3.75	0.94	3.75

WATER MATRIX ANALYSES

Metals in Water
Results in ug/L

FIELD ID	Ag	As	Ba	Cd	Co	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Sh	Zn	HARDNESS CALC (mg CaCO ₃ /L)
22-359-AD1	0.12 UX	2.0	5.5 U	4.0 U	8.4 U	6.8 U	15.7	452	0.12	3.6	14.4 U	1.1 U	51.6 U	156 U	71.2

U: Not Detected, L: Estimated Quantity, N: Not for Accuracy or Precision, NR: Not Reported

Wet Chemistry
Results in mg/l

FIELD ID	TOTAL DISSOLVED SOLIDS	CHLORIDE	SULFATE	NO ₃ /NO ₂ -N	CYANIDE
22-359-AD1	80	<5.0	10	0.09	NR

LEGEND

SED - Degrade and present above BBL in dry drainage 200' below water
WR1 - Composite of subsamples WBLA, 2A, 2B, 3A, and 3B
WR2 - Composite of subsamples WBLA, 4A, and 4B
BACKGROUND - From the Iron Mine (22-359-891)

AD1 - Sample taken with drive off road from associated with 891

**MONTANA DEPARTMENT OF STATE LANDS
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY**

Mine/Site Name: <u>Trumley Heap Leach</u>	County: <u>Jefferson</u>
Legal Description: <u>T 6N R 3W</u>	Section(s): <u>NW 1/4, SW 1/4, Section 15</u>
Mining District: <u>Elkhorn</u>	Mine Type: <u>Millsite/Au</u>
Latitude: <u>N 46° 16' 13"</u>	Primary Drainage: <u>Elkhorn Creek</u>
Longitude: <u>W 111° 58' 15"</u>	USGS Code: <u>10020006</u>
Land Status: <u>Private</u>	Secondary Drainage: <u>Turnley Meadows Creek</u>
Quad: <u>Elkhorn</u>	Date Investigated: <u>July 1, 1994</u>
Inspectors: <u>Bisch, Flammang, West</u>	P.A. # <u>22-501</u>
Organization: <u>Pioneer Technical Services, Inc.</u>	

- The overall volume of tailings associated with this site could not be determined accurately. The site was previously reclaimed, and bore holes were not drilled through the reclaimed tailings to determine total depth. Although the reclamation effort appeared to have consisted of application of cover soil and revegetation, tailings were observed at the surface in several scattered, isolated pockets. The following elements were elevated to at least three times the background concentrations:

Silver: 55.2 mg/kg	Mercury: 2.83 mg/kg
Arsenic: 229 mg/kg	Lead: 3,710 mg/kg
Cadmium: 130 mg/kg	Antimony: 309J mg/kg
Copper: 367 mg/kg	Zinc: 12,100J mg/kg
- No waste rock was observed at the site.
- Turnley Creek flows adjacent to the site on the north side. No observed releases to Turnley Creek were documented; additionally, no MCLs or aquatic life criteria were exceeded in Turnley Creek either upstream or downstream from the site.
- Of the four monitoring wells located at the site, all were installed downgradient from the reclaimed tailings pond (no upgradient wells were found). The shallowest well was sampled (static water level = 8.15 feet from the top of the casing); and no MCLs were exceeded in the sample.

Trumley Heap Leach PA# 22-501
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER -
INVESTIGATION DATE: 07/05/94

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	Ag (mg/Kg)	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Co (mg/Kg)	Cr (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Hg (mg/Kg)	Mn (mg/Kg)	Ni (mg/Kg)	Pb (mg/Kg)	Sb (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
22-501-SE1	0.6 U	8.3	28.0	0.6 U	5.7	12.8	13.6	8610	0.03 U	180	6.4	8.1 U	6.5 UJ	37.7 J	NR
22-501-SE2	0.7 U	8.1	19.2	0.7 U	2.5	5.8	7.2	8780	0.03 U	137	3.5	9.2 U	7.4 UJ	13.7 J	NR
22-501-SS2	10.7	459	83.3	31.6	12.3	12.5	94.6	24500	0.59	868	10.7	863	47.6 J	2860 J	NR
22-501-SS3	4.1	29.9	181	10.0	8.9	25.8	51.7	18800	0.25	961	13.9	239	16.3 J	902 J	NR
22-501-TP1	55.2	228	17.5	130	3.4	2.4	367	9570	2.83	1920	3.2	3710	309 J	12100 J	NR
BACKGROUND	0.5 U	21.3	267	0.5 U	9.3	15.0	13.9	17400	0.05	1410	11.1	17.7	5.8 UJ	85.8 J	NR

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

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	ACID BASE POTENT v/1000	NEUTRAL POTENT v/1000	SULFUR ACID BASE POTENT v/1000	ORGANIC SULFUR %	PYRITIC SULFUR %	PYRITIC SULFUR ACID BASE POTENT v/1000	SULFUR ACID BASE POTENT v/1000
22-501-TP1	0.05	1.56	1.46	145	0.03	0.09	0.94	145

WATER MATRIX ANALYSES

Metals in Water
Results in ug/L

FIELD ID	Ag	As	Ba	Cd	Co	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Sb	Zn	HARDNESS CALC. (mg CaCO ₃ /L)
22-501-GW1	0.12 U	1.1 U	50.9	2.6 U	11.1 JX	4.7 U	4.6 U	15.0	0.11 U	4.4 U	8.0 U	2.3	29.4 U	13.9	503
22-501-GW2	0.12 U	1.1 U	50.5	2.6 U	10.7 JX	4.7 U	4.6 U	9.4 U	0.11 U	4.4 U	8.0 U	1.8	29.4 U	17.2	510
22-501-GW3	0.12 U	1.1 U	2.1 U	2.6 U	8.7 UX	4.7 U	4.6 U	9.4 U	0.11 U	4.4 U	8.0 U	0.4 U	29.4 U	4.5 U	<0.1
22-501-SW1	0.12 U	1.4	11.9	2.6 U	8.7 UX	4.7 U	4.6 U	410 J	0.11 U	29.1	8.0 U	1.0	29.4 U	5.1	57.1
22-501-SW2	0.12 U	1.5	8.7	2.6 U	8.7 UX	4.7 U	4.6 U	240 J	0.11 U	19.2	8.0 U	0.7	29.4 U	4.5 U	52.2

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

Wet Chemistry
Results in mg/l

FIELD ID	TOTAL DISSOLVED SOLIDS	CHLORIDE	SULFATE	NO ₃ NO ₂ -N	CYANIDE
22-501-GW1	911	<5.0	532	1.72	0.01
22-501-GW2	997	<5.0	507	1.66	<0.005
22-501-GW3	NR	NR	NR	<0.005	<0.005
22-501-SW1	57	<5.0	10	0.07	0.01
22-501-SW2	80	<5.0	9.0	0.07	<0.005

LEGEND

- (B) - Determined in Trumley Creek
 (B2) - Upstream in Trumley Creek
 (B2) - 5 point composite on line SW spot across quarry registered on-site
 (B2) - 5 point composite on line SW spot below leach, downstream of on-site
 (B2) - Composite of subsamples TP1 and UNCL-1
 (B2) - From the Trumley Heap Leach (22-501-SE1)
 (B2) - From the Trumley Heap Leach (22-501-SE2)
- (B2) - Outlier indicating well, upstream aquifer
 (B2) - Duplicate of (B2)
 (B2) - Blank sample
 (B2) - Same as sample 22-501-SE1
 (B2) - Same as sample 22-501-SE2

**MONTANA DEPARTMENT OF STATE LANDS
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY**

Mine/Site Name: <u>Elkhorn Creek Tailings</u>	County: <u>Jefferson</u>
Legal Description: <u>T 6N R 3W</u>	Section(s): <u>SE 1/4, E 1/2, Section 15</u>
Mining District: <u>Elkhorn</u>	Mine Type: <u>Hardrock/Au</u>
Latitude: <u>N 46° 10' 11"</u>	Primary Drainage: <u>Elkhorn Creek</u>
Longitude: <u>W 111° 57' 18"</u>	USGS Code: <u>10020006</u>
Land Status: <u>Private</u>	Secondary Drainage: <u>Elkhorn Creek</u>
Quad: <u>Elkhorn</u>	Date Investigated: <u>August 8, 1994</u>
Inspectors: <u>Tuesday, Belanger, West</u>	P.A. # <u>22-502</u>
Organization: <u>Pioneer Technical Services, Inc.</u>	

- The volume of tailings observed at the site was estimated to be 51,635 cubic yards. The following elements were elevated to at least three times the background concentrations:

Silver: 54.1 to 86.4 mg/kg	Mercury: 1.71 to 9.36 mg/kg
Arsenic: 189 to 448 mg/kg	Lead: 3,380 to 8,800 mg/kg
Cadmium: 134 to 229 mg/kg	Antimony: 256 to 484 mg/kg
Copper: 323 to 687 mg/kg	Zinc: 12,300 to 18,400 mg/kg
- No waste rock was observed at the site.
- No discharging adits, filled shafts, seeps, or springs were observed at the site during the investigation.
- Elkhorn Creek flows through the center of the site. Observed releases to Elkhorn Creek were documented for lead and zinc. The MCL for cadmium and the acute and chronic aquatic life criteria for cadmium and zinc were exceeded in the downstream sample. These exceedances were directly attributable to the site.
- Potential safety hazards observed at the site included a collapsing mill building.

Elkhorn Creek Tailings PA# 22-502
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER - TUESDAY
INVESTIGATION DATE: 08/08/94

SOLID MATRIX ANALYSES

Metals in solids
Results per dry weight basis

FIELD ID	Ag (mg/Kg)	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Co (mg/Kg)	Cr (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Hg (mg/Kg)	Mn (mg/Kg)	Ni (mg/Kg)	Pb (mg/Kg)	Sb (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
22-502-SE1	54.8	164	22.2	89.8	3.5	4.4	332	10300	26.9	1380	6.1 J	3510	225	9440	NR
22-502-SE2	53.2	165	19.4	79.9	3.5	4.1	340	10200	40.2	1370	5.0 J	3590	226	9260	NR
22-502-SE3	93.0	159	37.7	38.1	8.5	8.0	409	28900	44.3	364	7.8 J	3190	209	11400	NR
22-502-TP1	86.4	320	24.0	180	2.9	4.0	601	11300	5.45	2580	6.7 J	5910	430	14800	8.18
22-502-TP2	74.5	448	32.2	229	4.1	4.9	687	14900	9.36	3200	10.3 J	8800	484	19400	10.8
22-502-TP3	54.1	189	10.0	134	3.2	2.9	323	7330	1.71	1690	3.3 J	3380	256	12300	1.91
BACKGROUND	0.5 U	21.3	267	0.5 U	9.3	15.0	13.9	17400	0.05	1410	11.1	17.7	5.8 UJ	85.8 J	NR

U - Not Detected, J - Estimated Quantity, X - Outlier for Accuracy or Precision, NR - Not Reported

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	TOTAL ACID BASE V/1000	NEUTRAL POTENT V/1000	SULFUR ACID BASE POTENT V/1000	SULFATE SULFUR %	PYRITIC SULFUR %	ORGANIC SULFUR %	PYRITIC ACID BASE V/1000	SULFUR ACID BASE POTENT V/1000
22-502-TP1	0.15	4.69	198	193	0.01	0.08	0.06	2.50	196
22-502-TP2	0.35	10.9	200	190	0.35	<0.01	0.01	0.00	200
22-502-TP3	0.17	5.31	204	199	0.02	<0.01	0.21	0.00	204

WATER MATRIX ANALYSES

Metals in Water
Results in ug/L

FIELD ID	Ag	As	Ba	Cd	Co	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Sb	Zn	HARDNESS CALC (mg CaCO ₃ /L)
22-502-SW1	0.22 JX	10.7	19.4	9.8	8.4 U	6.8 U	8.7	77.9 J	0.76	43.2 J	14.4 U	86.2 J	51.6 U	299	148
22-502-SW2	0.15 JX	9.2	15.6	6.6	8.4 U	6.8 U	9.5	108 J	0.36	34.4 J	14.4 U	66.4 J	51.6 U	181	141
22-502-SW3	0.32 JX	9.5	12.7	4.0 U	8.4 U	6.8 U	7.0	98.0 J	0.30	8.8 J	14.4 U	16.0 J	51.6 U	21.1	126

U - Not Detected, J - Estimated Quantity, X - Outlier for Accuracy or Precision, NR - Not Reported

**Wet Chemistry
Results in mg/l**

FIELD ID	TOTAL DISSOLVED SOLIDS	CHLORIDE	SULFATE	NO ₃ /NO ₂ -N	CYANIDE
22-502-SW1	121	<5.0	19	0.19	NR
22-502-SW2	125	<5.0	12	0.09	NR
22-502-SW3	100	<5.0	6	<0.05	NR

LEGEND

SE1 - Downstream Elkhorn Creek, below TP2.
 SE2 - Midstream Elkhorn Creek, between TP1 and TP2.
 SE3 - Upstream Elkhorn Creek, above TP1.
 TP1 - Composite of sediments TP1A-1 through 1A-4.
 TP2 - Composite of sediments TP2A-1 through 2A-4.
 TP3 - Composite of sediments TP3A-1 through 3A-4.
 BACKGROUND - From the Trenches Near Landfill (22-491,201).

SW1 - Same as sample 22-502,SE1.
 SW2 - Same as sample 22-502,SE2.
 SW3 - Same as sample 22-502,SE3.

**MONTANA DEPARTMENT OF STATE LANDS
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY**

Mine/Site Name: <u>Comet</u>	County: <u>Jefferson</u>
Legal Description: <u>T 7N R 5W</u>	Section(s): <u>S 1/2, Sec. 36</u>
Mining District: <u>Basin/High Ore</u>	Mine Type: <u>Hardrock/Au, Ag, Cu, Pb, Zn</u>
Latitude: <u>N 46° 18' 37"</u>	Primary Drainage: <u>Boulder River</u>
Longitude: <u>W 112° 10' 02"</u>	USGS Code: <u>10020006</u>
Land Status: <u>Private</u>	Secondary Drainage: <u>High Ore Creek</u>
Quad: <u>Mount Thompson</u>	Date Investigated: <u>July 8, 1993</u>
Inspectors: <u>Bullock, Belanger, Clark</u>	P.A. # <u>22-009</u>
Organization: <u>Pioneer Technical Services, Inc.</u>	

- The past reclamation project involving stream diversion and settling pond construction was in need of repair and maintenance. The diversion ditch was at risk of failure and the upper settling pond was at full capacity and ineffective.
- The volume of tailings associated with this site was estimated to be approximately 500,000 cubic yards. The following elements were elevated at least three times background:

Arsenic: 3400 to 4790 mg/kg	Cadmium: 13.0 to 20.1 mg/kg
Copper: 324J to 445J mg/kg	Iron: 33,900 to 39,700 mg/kg
Mercury: 0.338 to 0.975 mg/kg	Lead: 2330 to 4420 mg/kg
Antimony: 14 to 31 mg/kg	Zinc: 1900J to 3020J mg/kg
Manganese: 5860 to 8550 mg/kg	
- The lower tailings impoundment (TP2) was breached and actively eroding.
- The volume of waste rock associated with this site was estimated to be approximately 214,000 cubic yards. The following elements are elevated at least three times background:

Arsenic: 1260 to 1610 mg/kg	Cadmium: 23.6 to 36.4 mg/kg
Copper: 245J to 248J mg/kg	Manganese: 3930 to 6100 mg/kg
Mercury: 0.543 to 1.59 mg/kg	Lead: 2590 to 3750 mg/kg
Antimony: 25 mg/kg	Zinc: 3720J to 6060J mg/kg
- High Ore Creek had been diverted around most of the site, although diversion leakage, groundwater discharge, and runoff was still transporting contaminants to the creek. Observed releases to High Ore Creek were documented for arsenic, cadmium, copper, manganese, lead, and zinc; and MCLs for arsenic and cadmium were exceeded in the downstream sample. The acute aquatic life criteria was exceeded for zinc and the chronic aquatic life criteria for copper and zinc were exceeded; directly attributable to the site. Water pH in the stream remains above neutral as the stream flows through the impacted area.

Comet Tailings PA# 22-009
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER - BULLOCK
INVESTIGATION DATE: 07/08/93

SOLID MATRIX ANALYSES

Metals in soils **Results per dry weight basis**

FIELD ID	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Co (mg/Kg)	Cr (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Hg (mg/Kg)	Mn (mg/Kg)	Ni (mg/Kg)	Pb (mg/Kg)	Sb (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
22-009-SE-1	1670	150	19.3	17.4	4.7	224 J	18300	0.330	6060	4 J	1560	16	3670 J	NR
22-009-SE-2	25	120	1.2	5.3	8.7	7.8 J	11300	0.025	992	6 J	33	8 U	62 J	NR
22-009-TP-1	4790	224	17.7	16.1	1.8	324 J	39700	0.338	5860	6 J	1530	14	3010 J	NR
22-009-TP-2	4640	205	13.0	10.8	3.3	434 J	33900	0.975	7440	3 J	2610	26	1900 J	NR
22-009-TP-3	3400	239	20.1	12.6	3.3	445 J	32500	0.674	8550	2 U	2270	31	3020 J	NR
22-009-WR-1	1610	153	36.4	8.1	1.6	248 J	24500	1.59	3930	4 J	3750	13	6060 J	NR
22-009-WR-2	1260	65.0	23.6	5.0	1.5	245 J	23100	0.543	6100	3 U	2590	25	3720 J	NR
BACKGROUND	137	265	3.0	6.7	4.6	35.9 J	12100	0.019	1280	6 J	84	7 U	227 J	NR

Acid/Base Accounting

FIELD ID	TOTAL SULFUR		NEUTRAL POTENT		SULFUR ACID BASE		PYRITIC SULFUR		ORGANIC SULFUR		PYRITIC SULFUR		SULFUR ACID BASE		POTENT 1/1000
	%	1/1000	%	1/1000	%	1/1000	%	1/1000	%	1/1000	%	1/1000	%	1/1000	
22-009-SS-1DUP	0.02	0.62	7.23	6.61	<0.01	0.01	0.01	0.31	6.92						
22-009-SS-1	0.02	0.62	7.41	6.78	<0.01	0.01	<0.01	0	7.41						
22-009-TP-1	2.96	92.5	146	53.8	<0.01	3.47	0.38	108	37.9						
22-009-TP-2	1.92	60	79.7	19.7	0.4	1.34	0.18	14.9	37.8						
22-009-TP-3	1.84	57.5	104	46.6	0.63	0.99	0.22	30.9	73.2						
22-009-WR-1	1.18	36.9	41.1	4.22	0.57	0.37	0.24	11.6	29.5						
22-009-WR-2	1.6	50	45.3	-4.7	0.39	0.52	0.69	16.2	29.1						

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

WATER MATRIX ANALYSES

Metals in Water **Results in ug/L**

FIELD ID	Au	Ba	Cd	Co	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Sb	Zn
22-009-GW-1	13.4 J	44.4	7.87	9.7 U	6.83 U	57 J	39.9	0.038 U	455	12.7 U	6.51 J	30.7 U	1870
22-009-GW-2	11 J	45.5	8.37	9.7 U	6.83 U	63.2 J	22.4	0.130 J	440	12.7 U	6.37 J	30.7 U	2110
22-009-SW-1	56.7 J	27	7.03	9.7 U	6.83 U	20.8 J	429	0.042 J	1240	12.7 U	25.3 J	30.7 U	2020
22-009-SW-2	4.19 J	29.5	2.57 U	9.7 U	6.83 U	1.55 U	209	0.038 U	43.7	12.7 U	7.69 J	30.7 U	7.57 U

Wet Chemistry

Results in mg/l

FIELD ID	TOTAL DISSOLVED SOLIDS	CHLORIDE	SULFATE	NO ₃ /NO ₂ -N	CYANIDE
22-009-GW-1	327	< 5.0	69	< 0.05	NR
22-009-GW-2	354	< 5.0	70	< 0.05	NR
22-009-SW-1	194	< 5.0	70	< 0.05	NR
22-009-SW-2	101	< 5.0	8	< 0.05	NR

LEGEND

- SE1 - Downgradient approx. 0.25 mile from the end of reclaimed stream.
 SE2 - Upgradient approx. 300 feet above town.
 TP1 - Composite of subsamples TP1A-A, -B, -C.
 TP2 - Composite of subsamples TP2A-A, -B, -C, and -D.
 TP3 - Composite of subsamples TP1B-A, -B, -C, -D, -E, and TP1C-A, -B, -C.
 WR1 - Composite of subsamples WR1A, 1B, 1C, 1D, 1E, 2A, 2B, and 2C.
 WR2 - Composite of subsamples WR3A, 3B, 3C, and 3D.
 BACKGROUND - From the Comet Mine (22-009-SS-1).
- SSI - Background sample
 GW1 - Silver Hill shaft #1
 GW2 - Duplicates of sample 22-009-GW-1.
 SW1 - Same as sample SE1.
 SW2 - Same as sample SE2.

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

HARDNESS

CALC	Zn (mg CaCO ₃ /L)
286	
288	
129	
54.8	

**MONTANA DEPARTMENT OF STATE LANDS
ABANDONED MINE RECLAMATION BUREAU
HAZARDOUS MATERIALS INVENTORY
SITE SUMMARY**

Mine/Site Name: <u>Grey Eagle</u>	County: <u>Jefferson</u>
Legal Description: <u>T 7N R 5W</u>	Section(s): <u>SW 1/4, Sec. 35</u>
Mining District: <u>Basin/High Ore</u>	Mine Type: <u>Hardrock/Ag, Pb, Cu, Zn, Au</u>
Latitude: <u>N 46° 18' 52"</u>	Primary Drainage: <u>Boulder River</u>
Longitude: <u>W 112° 12' 00"</u>	USGS Code: <u>10020006</u>
Land Status: <u>Private</u>	Secondary Drainage: <u>Bishop Creek</u>
Quad: <u>Mount Thompson</u>	Date Investigated: <u>July 9, 1993</u>
Inspectors: <u>Bullock, Belanger, Clark</u>	P.A. # <u>22-029</u>
Organization: <u>Pioneer Technical Services, Inc.</u>	

- There were no tailings associated with this site.
- The volume of waste rock associated with this site was estimated to be approximately 73,000 cubic yards. The following elements were elevated at least three times background:

Copper: 503 mg/kg	Mercury: 0.411J mg/kg
Lead: 722 mg/kg	Zinc: 859 mg/kg
- Iron staining emanating from Adit #1 indicated past discharge, although no discharge was occurring at the time of the investigation. The water collected within the adit portal had a pH of 6.98 and a specific conductance of 354 umhos/cm.
- Bishop Creek, a tributary to High Ore Creek, flowed adjacent to the site. Observed releases to Bishop Creek (sediment) were documented for copper, lead, and zinc. No MCLs/MCLGs or aquatic life criteria were exceeded that were directly attributable to the site.

Grey Eagle PA# 22-029
AMRB HAZARDOUS MATERIALS INVENTORY
INVESTIGATOR: PIONEER - BULLOCK
INVESTIGATION DATE: 07/09/93

SOLID MATRIX ANALYSES

Metals in soils
Results per dry weight basis

FIELD ID	As (mg/kg)	Ba (mg/kg)	Cd (mg/kg)	Co (mg/kg)	Cr (mg/kg)	Cu (mg/kg)	Fe (mg/kg)	Hg (mg/kg)	Mn (mg/kg)	Ni (mg/kg)	Pb (mg/kg)	Sb (mg/kg)	Zn (mg/kg)	CYANIDE (mg/kg)
22-029-SE-1	63 JX	62.9	1.4	4.4	5.9	43.3	9470	0.013 J	817 J	4	266	12 J	361	NR
22-029-SE-2	7 JX	57.3	0.6 U	4.1	7.5	7.1	10500	0.01 U	557 J	5	14	8 UJ	32	NR
22-029-WR-1	265 JX	491	4.1	7.4	1.1 U	503	13900	0.411 J	1840 J	6	722	14 J	859	NR
BACKGROUND	137	265	3.0	6.7	4.6	35.9J	12100	0.019	1280	6J	84	7 U	227 J	NR

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

Acid/Base Accounting

FIELD ID	TOTAL SULFUR		NEUTRAL POTENT		SULFUR ACID BASE POTENT		SULFATE SULFUR		PYRITIC SULFUR		ORGANIC SULFUR		PYRITIC SULFUR ACID BASE POTENT	
	%	1/1000x	%	1/1000x	%	1/1000x	%	1/1000x	%	1/1000x	%	1/1000x	%	1/1000x
22-029-WR-1	1.74	54.4	84.2	29.8	0.51	0.72	0.51	0.72	0.51	22.5	61.7			

WATER MATRIX ANALYSES

Metals in Water
Results in ug/L

FIELD ID	As	Ba	Cd	Co	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Sb	Zn (mg CaCO3/L)	HARDNESS CALC.
22-029-SW-1	2.31	22.6	2.57 U	9.7 U	6.83 U	4.23 J	187 J	0.038 U	29.6 JX	12.7 U	9.68 JX	30.7 U	26.8 J	46.4
22-029-SW-2	1.69 U	21.9	2.57 U	9.7 U	6.83 U	2.9 J	159 J	0.038 U	16.6 JX	12.7 U	5.77 JX	30.7 U	13.3 J	32.4

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
22-029-SW-1	129 <	5.0	17 <	0.05	NR
22-029-SW-2	97 <	5.0	8 <	0.05	NR

LEGEND

SE1 - Downgradient of waste rock dumps on Bishop Creek
 SE2 - Upgradient of waste rock dumps on Bishop Creek
 WR1 - Composite of subsamples WR1A through 1D
 BACKGROUND - From the Comet Tailings (22-009-S5-1)
 SW1 - Same as sample SE1
 SW2 - Same as sample SE2