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UNITED STATES ENVIRONMENTAL PROTECTION A

WASHINGTON, D.C. 20460

OFFICE OF EMERGENCY AND REMEDIAL RESPONSE
HAZARDOUS SITE EVALUATION DIVISION
SITE ASSESSMENT BRANCH

SF FILE NUMBER
S-1.07

HRS DOCUMENTATION RECORD COVER SHEET

Richardson Flat Tailings
Region VIII

This package has undergone and passed EPA quality assurance for proposal to the National Priorities List.

Barbara B. Beck 08/29/91

Regional Coordinator Date

Robert Myers for Janet Grubbs 8-29-91

Branch Chief Date

HRS DOCUMENTATION RECORD—REVIEW COVER SHEET

Name of Site: Richardson Flat Tailings

Contact Persons

Site Investigation: Kevin Mackey (Name)	(303) 757-4984 (Telephone)
Documentation Record: Kevin Mackey (Name)	(303) 757-4984 (Telephone)

Pathways, Components, or Threats Not Evaluated

During the course of this evaluation neither the ground water migration pathway nor the soil exposure pathway threats were evaluated. In general, this stems from a lack of human targets associated with either pathway, and in the case of the ground water migration pathway, the general lack of site-specific information on the underlying hydrogeology associated with the Richardson Flat Tailings site.

HRS DOCUMENTATION RECORD

Name of Site: Richardson Flat Tailings

EPA Region: VIII

Date Prepared: May 1991

Street Address of Site: NW 1/4, Section 1, Township 2 South, Range 4 East

County and State: Summit County, Utah

General Location in the State: Northeastern

Topographic Map: Park City West

Latitude: 40°40'50"

Longitude: 111°26'40"

Scores

Air Migration Pathway	9.62
Ground Water Migration Pathway	Not Scored
Soil Exposure Migration Pathway	Not Scored
Surface Water Migration Pathway	100
HRS SITE SCORE	50.23

TABLE 4-1
SURFACE WATER MIGRATION PATHWAY SCORESHEET

Factor Categories and Factors	Maximum Value	Value Assigned	
Drinking Water Threat			
Likelihood of Release			
1. Observed Release	550	550	
2. Potential to Release by Overland Flow			
2a. Containment	10	-	
2b. Runoff	25	-	
2c. Distance to Surface Water	25	-	
2d. Potential to Release by Overland Flow [lines 2a x (2b + 2c)]	500	-	
3. Potential to Release by Flood			
3a. Containment (flood)	10	-	
3b. Flood Frequency	50	-	
3c. Potential to Release by Flood (lines 3a x 3b)	500	-	
4. Potential to Release (lines 2d + 3c, subject to a maximum of 500)	500	-	
5. Likelihood of Release (higher of lines 1 or 4)	550		550
Waste Characteristics			
6. Toxicity/Persistence	a	10,000	
7. Hazardous Waste Quantity	a	10,000	
8. Waste Characteristics	100		100
Targets			
9. Nearest Intake	50	0	
10. Population			
10a. Level I Concentrations	b	0	
10b. Level II Concentrations	b	0	
10c. Potential Contamination	b	0	
10d. Population (lines 10a + 10b + 10c)	b	0	
11. Resources	5	5	

TABLE 4-1 (CONCLUDED)

Factor Categories and Factors	Maximum Value	Value Assigned	
Environmental Threat			
- Likelihood of Release			
22. Likelihood of Release (same value as line 5)	550		550
Waste Characteristics			
23. Ecosystem Toxicity/Persistence/ Bioaccumulation	a	5×10^8	
24. Hazardous Waste Quantity	a	10,000	
25. Waste Characteristics	1,000		1000
26. Sensitive Environments			
26a. Level I Concentrations	b	0	
26b. Level II Concentrations	b	50	
26c. Potential Contamination	b	50.05	
26d. Sensitive Environments (lines 26a + 26b + 26c)	b	100.05	
27. Targets (value from line 26d)	b		100.05
Environmental Threat Score			
28. Environmental Threat Score ([lines 22 x 25 x 27]/82,500, subject to a maximum of 60)	60		60
Surface Water Overland/Flood Migration Component Score for a Watershed			
29. Watershed Score (lines 13 + 21 + 28, subject to a maximum of 100)	c 100		100
Surface Water Overland/Flood Migration Component Score			
30. Component Score (S_{of})[c] (highest score from line 29 for all watersheds evaluated, subject to a maximum of 100)	100		100

[a]Maximum value applies to waste characteristics category.
[b]Maximum value not applicable.
[c]Do not round to nearest integer.

WORKSHEET FOR COMPUTING HRS SITE SCORE

		S	S^2
1.	Ground Water Migration Pathway Score (S_{gw}) (from Table 3-1, line 13)	NE	NE
2a.	Surface Water Overland/Flood Migration Component (from Table 4-1, line 30)	100	$1x10^4$
2b.	Ground Water to Surface Water Migration Component (from Table 4-25, line 28)	NE	--
2c.	Surface Water Migration Pathway Score (S_{sw}) Enter the larger of lines 2a and 2b as the pathway score.	100	$1x10^4$
3.	Soil Exposure Pathway Score (S_s) (from Table 5-1, line 22)	NE	NE
4.	Air Migration Pathway Score (S_a) (from Table 6-1, line 12)	9.62	92.54
5.	Total of $S_{gw}^2 + S_{sw}^2 + S_s^2 + S_a^2$		10092.54
6.	**HRS Site Score** Divide the value on line 5 by 4 and take the square root		50.23

17 Utah Department of Natural Resources, August 13, 1987, Correspondence Regarding Water Diversions Along Silver Creek.

18 Supplementary Documentation to HRS Package for Richardson Flat Tailings.

19 Personal Communication from Steve Yarbrough (E & E FIT) to Kevin Mackey (E & E FIT) Regarding Direct Observation of Flood Plain Tailings into Silver Creek, May 16, 1991.

20 Supplemental Photo Log Showing Flood Plain Tailings Slumping Into Silver Creek.

21 Schmelzer, H. (E & E FIT), May 20, 1991, Personal Communication Regarding the Location of the Offsite Air Sampler for July 7 and 14, 1986, Air Sampling Event at the Richardson Flat Tailings.

22 Slam, Muhammad, 5/28/91, Utah Department of Health, personal communication regarding population within specified distance rings for potential air migration pathway assessment, Richardson Flat Tailings, Summit County, Utah.

23 Shacklette, H.T. and J.G. Boerngen, 1984, Element Concentrations in Soils and other Surficial Materials of the Conterminous United States, U.S. Geological Survey Professional Paper 1270, Table 9.

24 Ecology and Environment, Inc., 1991, Memo to HRS File on Richardson Flat Tailings Regarding Correction in Aerial Photo Scale and Actual Site Area.

25 Utah State Department of Health, July 6, 1990, correspondence regarding the documentation of tailings material sloughing into the onsite diversion ditch at Richardson Flat Tailings.

26 Not used.

27 Sample Quantitation Limits derived for air samples collected at Richardson Flat Tailings, TDD #F08-9104-01.

28 15-mile downstream segment map for Richardson Flat Tailings.

29 4-mile radius of influence map for Richardson Flat Tailings.

30 Utah Division of Wildlife Resources, Electroshock Data for Silver Creek and Prouction Data for the Weber River above Echo Lake, Summit County, UT.

31 Lilquist, Nancy, June 27, 1991, personal communication regarding fishery production values in Silver Creek, Summit County, UT.

32 Air Migration Pathway Target Population Calculations for Richardson Flat Tailings, 1991, Summit County, Utah.

33 Personal communication with Mrs. Standley Pace regarding commercial use of hay grown in the Silver Creek drainage, 1991.

2.4.1 Hazardous Substances

Hazardous substance	Evidence	Sample ID	Reference
			4, 12

SURFACE TAILINGS
Surface Tailings Samples

Element	RFT-TA-1 (Ref.4 Tbl. 3) (mg/kg)	RFT-TA-2 (Ref.4 Tbl. 3) (mg/kg)	RFT-TA-3 (Ref. 4 Tbl. 3) (mg/kg)
Arsenic	220j	208j	222j
Cadmium	21.1	41.2	95.9
Chromium	[2.0]	6.0	8.8
Copper	149	205	336
Lead	2580	3060	4520
Mercury	0.99	1.3	0.88
Silver	12.6	18.5	22.1
Zinc	3220	5710	14100

SUBSURFACE TAILINGS
Subsurface Tailings Samples

Element	FR-SS-3	RF-SS-4	RF-SS-5	RF-SS-6
	(Ref. 12, Tbls. 5 - µg/g)			
Arsenic	311	328	218	34
Cadmium	53	169	61	15
Chromium	6.3	16	14	15
Copper	225	225	335	105
Lead	2770	4720	4920	1090
Mercury	0.94	1.97	2.26	0.40
Silver	7.9	13	26	6.9
Zinc	3980	23200	12700	1510

Samples collected from tailings material contained in Source #1 (main tailings impoundment) showed significant levels of inorganic contamination. Analysis of surface tailings for waste characterization showed concentrations of arsenic, copper, lead, mercury, silver and zinc (Ref. 4, Tbl. 3). Analysis of subsurface tailings samples revealed levels of arsenic, cadmium, copper, lead, mercury, silver and zinc in concentrations elevated above those detected in surface tailings samples. The increase in metals concentration with depth indicates a possible leaching of inorganic substances from tailings material (Ref. 12, Tbl. 5).

2.4.2.1.2. Hazardous Wastestream Quantity

Hazardous Wastestream	Quantity (pounds)	Reference
Not evaluated		

sum: (pounds)

Hazardous Wastestream Quantity Value (W):

2.4.2.1.5. Source Hazardous Waste Quantity Value

Source Hazardous Waste Quantity Value: 502,721.15

The quantity value is 502,721.15 (see previous page) based on a Tier D (areal) evaluation of waste quantity.

2.4.1 Hazardous Substances

Hazardous substance	Evidence		Sample ID	Reference
				Ref4,Tbl.3
	FLOODPLAIN TAILINGS PILE TAILINGS SAMPLES (mg/kg)			
Element	RFT-TA-4	RFT-TA-5		
Arsenic	259j	175j		
Cadmium	117	250		
Copper	281	265		
Lead	9300	31600		
Mercury	8.2	7.6		
Silver	62.8	115		
Zinc	16200	33800		

2.4.2.1.2. Hazardous Wastestream Quantity

Hazardous Wastestream	Quantity (pounds)	Reference
Not evaluated		

sum: (pounds)

Hazardous Wastestream Quantity Value (W):

2.4.2.1.5. Source Hazardous Waste Quantity Value

After measuring the areal perimeter of Source #2 and utilizing the guidance given in Tables 2-5 and 2-6 of Ref. 1 the assigned HRS value for Source #2 is 20,730.77.

Source Hazardous Waste Quantity Value: 20,730.77

4.1 OVERLAND/FLOOD MIGRATION COMPONENT

4.1.1.1 DEFINITION OF HAZARDOUS SUBSTANCE MIGRATION PATH FOR OVERLAND/FLOOD COMPONENT

An intermittent stream enters the site area for Source #1 from the east and is diverted into the onsite diversion ditch (Ref. 3, 7). Runoff from the southern side of Source 1 enters the drainage ditch along its length (Ref 4, See Photos 1 and 3 which show tailings material visually sloughing into the ditch from the northern and southern sides of the diversion ditch).
Samples collected from tailings material located on the southern edge of the tailings pile showed high levels of arsenic, mercury, cadmium, copper, lead and zinc.

High Bioaccumulation Factor Substances	Tailings Samples (Ref.4,Tbl.3) Concentration in mg/kg			Subsurface Tailings Samples (Ref.12,Tbl.5) Concentration in µg/g		
	RFT-TA-1	RFT-TA-2	RFT-TA-3	RF-SS-3	RF-SS-4	RF-SS-5
Arsenic	220j	208j	222j	311	328	218
Cadmium	21.1	41.2	95.9	53	169	61
Copper	149	205	336	225	225	335
Lead	2580	3060	4520	2770	4720	4920
Mercury	0.99	1.3	0.88	0.94	1.97	2.26
Silver	12.6	18.5	22.1	7.9	13	26
Zinc	3220	5710	14,100	3980	23200	12700

The probable point of entry is the first point of documented slumping of the source material into the drainage ditch, a point at the eastern end of the site where the diversion ditch begins (Ref. 4, Photos 1 and 3) near sample RFT-SW/SE-4 and continues to a point near the old slurry pipe where the Utah State Health Department observed tailings material slumping into the diversion ditch 2800 feet downgradient (Ref. 25).
No human food chain species are believed to live in the diversion ditch. Emergent wetlands characterized by sedge and horsetail line the ditch (Ref. 16; Ref. 4, Photo 1, 3). The diversion ditch empties into a wetland of approximately 10 acres (Refs. 6 & 7) and is found to enter into Silver Creek south of the culvert running under State Route 40. The distance from the probable point of contaminant entry to Silver Creek is 1800 feet (Ref. 4, 7 and 17).
Source 2 constitutes the bank of the western side of Silver Creek about 300 feet upstream of the confluence of Silver Creek and the wetland area and extends from there for about 2500 feet upstream (Ref. 4, 7).
Silver Creek is a perennial stream with an average annual discharge of 3.3 cfs based on five measurements (Ref. 10, pg. 54). There are no drinking water intakes along Silver Creek but there are irrigation intakes including one within a half mile from the site (Ref. 18). Silver Creek is a fishery for trout (Ref. 15) and is bordered by a number of wetlands (Ref. 16).
Silver Creek empties into the Weber River 11 miles from the probable point of contaminant entry (Ref. 28). The average annual discharge for the Weber River is 214 cfs (Ref. 13). Again, there are no drinking water intakes along the Weber River within the target distance limit. There are irrigation intakes present along Silver Creek, including one within one-half mile of the site (Ref. 18).

4.1.2.1 LIKELIHOOD OF RELEASE

4.1.2.1.1 Observed Release

Direct Observation

- Basis for Direct Observation

Source #1: Tailings material was visually observed (Ref. 4, Photo 3) sloughing into the diversion ditch near sample location RFT-TA-2. Aerial photography shows tailings material slumping into the ditch along its entire course (Refs. 7 & 8).

- Hazardous Substances in the Release

Samples collected from tailings material visibly sloughing into the diversion ditch contained elevated levels of cadmium, copper, mercury and zinc. Observations made during the July 18-20, 1989 site inspection indicated an observed release to the diversion ditch by direct observation. Material was visible sloughing into the diversion ditch near sample location RFT-TA-2 (Ref. 4, Photo 3 and Figure 3). Available aerial photography also shows the diversion ditch running through the tailings material (Ref. 7 and 8). Samples collected from this material contained elevated concentrations of cadmium, copper, mercury and zinc (Ref. 4, Tbl. 3). Additional sampling conducted during the July 19 and 20, and July 30 through August 2, 1985 sampling effort at Richardson Flats further characterized the chemical composition of the tailings material (Ref. 12, Tbl. 5).

Sample ID	Sampling Location	Depth	Date	Reference
RFT-TA-1	Easternmost tailings sample near edge of diversion ditch	0-6"	7/18-20/89	4,Tbl. 3
RFT-TA-2	Tailings sample near south edge of diversion ditch	0-6"	7/18-20/89	4,Tbl. 3
RFT-TA-3	Western-most tailings sample near south edge of diversion ditch	0-6"	7/18-20/89	4,Tbl. 3

Sample ID	Sampling Location	Depth	Date	Reference
RF-SS-3	Surface tailings sample from main tailings pile north of diversion ditch	1-3.5′	7/19-30/85	9,pg6;12,Tbl.5
RF-SS-4	Main tailings pile N of diversion ditch	3.5-7.5′	7/19-30/85	9,pg6;12,Tbl.5
RF-SS-5	Main tailings pile N of diversion ditch	12.0-17.8′	7/19-30/85	9,pg6;12,Tbl.5
RF-SS-6	Main tailings pile N of diversion ditch	17.8-18.0′		9,pg6;12,Tbl.5

Direct Observations

- Basis for Direct Observation -- Source #2

Tailings material was visibly observed slumping into Silver Creek from the floodplain tailings piles (Ref. 19; 20 Photos 1 and 2). Aerial photography shows floodplain tailings lining the bank of Silver Creek (Ref. 7 and 8). Analysis of floodplain tailings shows the presence of several CERCLA hazardous substances in the tailings material (Ref. 4, Tbl. 3).

- Contaminated Samples

Sample ID	Sampling Location	Depth	Date	Reference
Source #2:				
RPT-TA-4	Southern-most flood plain tailings smpl	0-6"	7/18-20/89	4,Tbl.3
RPT-TA-5	Northern-most flood plain tailings smpl	0-6"	7/18-20/89	" "

Sample ID	Hazardous Substance	Concentration	Sample Quantitation Limit	Reference
Source #2:				
RFT-TA-4	Arsenic	259j (mg/kg)	10	4,Tbl.3; Ref.4A
RFT-TA-4	Cadmium	117 "	1	"
RFT-TA-4	Copper	281 "	1	"
RFT-TA-4	Lead	9300 "	10	"
RFT-TA-4	Mercury	8.2 "	0.3	"
RFT-TA-4	Silver	62.8j "	1	"
RFT-TA-4	Zinc	16200j "	1	"
RFT-TA-5	Arsenic	175j "	9	"
RFT-TA-5	Cadmium	250 "	1	"
RFT-TA-5	Copper	265 "	1	"
RFT-TA-5	Lead	31600 "	9	"
RFT-TA-5	Mercury	7.6 "	0.3	"
RFT-TA-5	Silver	115j "	1	"
RFT-TA-5	Zinc	33800j "	1	"

Attribution:

Hazardous Substances Released: Arsenic, mercury, cadmium, lead, copper and zinc.

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Observed Release Factor Value: 550

4.1.2.1.2.1.2 **Runoff**

Drainage Area

Drainage area for the watershed:

Drainage area value:

Rainfall

2-year, 24-hour Rainfall (inches):
Reference:

Soil Group

Soil Group	Reference	Soil Group Designation
Not Evaluated		

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Drainage Area Value:
2-year, 24-hour Rainfall:
Soil Group Designation:
Rainfall/Runoff Value:

Runoff Factor Value:

4.1.2.1.2.2 **Potential to Release by Flood**

Source	Hazardous Waste Quantity Value 0.5 (yes/no)	Floodplain Category	Containment Factor Value	Flood Frequency Factor Value	Potential to Release by Flood Factor Value
Not Evaluated					

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Containment Value:
Flood Frequency Value: Potential to Release by Flood Factor Value:

4.1.2.2.2 Hazardous Waste Quantity

Source Number	Source Hazardous Waste Quantity Value (Section 2.4.2.1.5.)	Is source hazardous constituent quantity data complete? (yes/no)
#1	502,721.15	No
#2 -	20,730.77	No

Sum of values: 523,451.92 assigned value = 10,000

4.1.2.2.3 Waste Characteristics Factor Category Value
Tox/pers = 10,000; Hazardous Waste Quantity Tier D Evaluation = 10,000
10,000 x 10,000 = 1 x 10^8 ∴ per table 2-7 assigned value = 100

Toxicity/persistence factor value
X hazardous waste quantity factor value: 1 x 10^8

==========

Hazardous Waste Quantity Factor Value: 10,000
Waste Characteristics Factor Category Value: 100

4.1.2.3.1 Nearest Intake

Location of Nearest Drinking Water Intake: There are no drinking water intakes downgradient of Source 1 or 2 on Silver Creek.
Distance from the probable point of entry:
Reference: 10

Potential Contamination:

Type of surface water body:

Dilution Weight:

==========

Nearest Intake Factor Value: 0

4.1.2.3.2.3 Level II Concentration

Intake	Distance Along the In-water Segment from the Probable Point of Entry	Population	References

Not evaluated.

Level II Population Factor Value:

4.1.2.3.3 **Resources**

- Irrigation (5 acre minimum) of commercial food crops or commercial forage crops: Water is diverted from Silver Creek for irrigation of approximately 316 acres of pastureland. This diversion point is located approximately 2300 feet downstream of sample location RFT-SE-9 (Ref. 10, 14, 17, 18 and 33).

- Watering of commercial livestock

- Ingredient in commercial food preparation

- Major or designated recreation area, excluding drinking water use

- Any portion of the surface water is designated by a state for drinking water use under Section 305(a) of the Clean Water Act as amended

- Any portion of the surface water is usable for drinking water purposes

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Resources Factor Value: 5

4.1.3.2.2 Hazardous Waste Quantity

Source Number	Source Hazardous Waste Quantity Value (Section 2.4.2.1.5.)	Is source hazardous constituent quantity data complete? (yes/no)
#1 -	502,721.15	No
#2	20,730.77	No

Sum of values: 523,451.92 from Ref. 1, Tbl. 2-6.
Waste Quantity = 10,000

4.1.3.2.3 Waste Characteristics Factor Category Value

Using observed release values by direct observation of tailings material from Source #1 sloughing into the diversion ditch and observed release through direct observation for Source #2 the FIT documented an observed release of mercury into Silver Creek. ∴

For mercury Tox/pers = 10,000
Haz Waste Quantity = 10,000
Bioaccumulation factor value = 5×10^4
$\therefore 10{,}000 \times 5 \times 10^8 = 5 \times 10^{12}$
From Table 2-7 (ref. 1) the assigned waste characteristics value = 1,000.

Toxicity/persistence factor value
X hazardous waste quantity factor value: 1×10^8

(Toxicity/persistence x hazardous waste quantity)
X bioaccumulation potential factor value: 5×10^{12}

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Hazardous Waste Quantity Assigned Value: 10,000
Waste Characteristics Factor Category Value: 1000

Level I Fisheries

Identity of fishery	Extent of the Level I Fishery (Relative to Probable Point of Entry)

Most Distant Level II Sample

Sample ID:
Reference:

Level II Fisheries

Identity of fishery	Extent of the Level II Fishery (Relative to Probable Point of Entry)
Silver Creek	Contamination to Silver Creek is documented by direct observation of tailings material sloughing into Silver Creek and from samples collected from the Flood Plain Tailings piles and sediment in Silver Creek near the tailings. Samples RFT-TA-4 and RFT-TA-5 collected from the flood plain tailings pile contained high levels of arsenic, cadmium, copper, lead, mercury, silver and zinc. The same substances were detected in sediment samples collected from Silver Creek near the Flood Plain Tailings piles. Conversations with Glen Davis, Utah Division of Wildlife indicate that Silver Creek is classified as a cold water fishery (Ref. 15).

Concentrations of Substances (in mg/kg)	Flood Plain Tailings Samples		Silver Creek Sediment Samples Near Flood Plain Tailings	
	RFT-TA-4*	RFT-TA-5*	RFT-SE-2*	RFT-SE-3*
Arsenic	259j	175j	590	427
Cadmium	117	250	91.4j	82.0j
Copper	281	265	753	459
Lead	9300	31,600	14,200	9880
Mercury	9.2	7.6	4.9	6.0
Silver	62.8	115	47.5	30.3
Zinc	16,200	33,800	15,500	15,100

*Ref. 4, Tbl. 3

The extent of the Level II Fishery is the most upstream portion of Silver Creek subject to an observed release, downstream to the most downgradient location of documented slumping tailings material (Ref. 1, Sect. 4.1.3.3). This distance was evaluated using available aerial photography of known scale (Ref. 7). Distance measurements were made in a conservative manner with measurements made near the point of obvious tailings deposition and extending to the downstream-most point of deposition. Distance measurements include only the stretch of Silver Creek where the flood plain tailings obviously border the Silver Creek Channel. Using Ref. 7 (aerial photo with scale of 1"=350') the length of Silver Creek subject to an observed release through direct observation measured is 2450 feet or .46 miles.

4.1.3.3.1 **Food Chain Individual**

Sample ID: RFT-TA-4
Hazardous Substance: Mercury
Bioaccumulation Potential: 50,000

Identity of Fishery	Type of Surface Water Body	Reference	Dilution Weight
Silver Creek	Minimal Stream	#13	1

Observations made along Silver Creek near Source #2 (flood plain tailings) indicate an observed release of contaminants to Silver Creek through direct observation (Ref. 20, Photos 1 and 2; Ref. 19). Samples collected from the flood plain tailings material (Source #2) have shown significant concentrations of cadmium (Bioaccumulation Value = 5000), copper (Bioaccumulation Value = 50,000), mercury (Bioaccumulation Value = 50,000) and zinc (Bioaccumulation Value = 500) present in the material (Ref. 1,2,4,7,20).

Silver Creek is classified as a cold water fishery (Ref. 15) and stream flow measurements in Silver Creek give the annual average discharge of 3.3 cfs (Ref. 10) placing Silver Creek in the minimal stream category and result in an assigned weighting factor of 1 (Ref. 1, Tbl. 4-13).

Since there is an observed release of a hazardous substance in tailings samples slumping into a fishery (i.e., Silver Creek), a Level II release is documented resulting in an assigned value of 45 for an observed release through direct observation of the flood plain tailings sloughing into Silver Creek.

Food Chain Individual Factor Value: 45

4.1.3.3.2.2 Level I Concentrations

Identity of Fishery	Annual Production (pounds)	Reference	Human Food Chain Population Value

Sum of Human Food Chain Population Values:

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Level I Concentrations Factor Value:

4.1.4.2 WASTE CHARACTERISTICS

4.1.4.2.1 Ecosystem Toxicity/Persistence/Bioaccumulation

Hazardous Substance	Source No.	Ecosystem Toxicity Factor Value	Persistence Factor Value	Ecosystem toxicity/ Persistence factor Factor Value (Table 4-20)	Ref.
Arsenic	#2	10	1	10	1,4, 16,24, 25
Cadmium	#1, #2	1000	1	1000	"
Copper	#1, #2	100	1	100	"
Lead	#2	1000	1	1000	"
Mercury	#1, #2	10,000	1	10,000	"
Silver	#2	10,000	1	10,000	"
Zinc	#1, #2	10	1	10	"

Hazardous Substance	Ecosystem Toxicity/ Persistence Factor Value	Bio-accumulation Factor Value (Section 4.1.3.2.1.2)	Ref.	Ecosystem Toxicity/ Persistence/ Bioaccumula- Factor Value (Table 4-21)
Arsenic	10	50	1,2,4, 16	500
Cadmium	1000	5000	"	$5x10^6$
Copper	100	50,000	"	$5x10^6$
Lead	1000	5000	"	$5x10^6$
Mercury	10,000	50,000	"	$5x10^8$
Silver	10,000	50	"	$5x10^5$
Zinc	10	500	"	5000

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Ecosystem Toxicity/Persistence/Bioaccumulation Factor Value: $5x10^8$

4.1.4.3 ENVIRONMENTAL THREAT - TARGETS

Level I Concentrations

Sample ID:
Sample Medium:
Location:
Reference:

Hazardous Substance	Hazardous Substance Concentration	Benchmark Concentration	Benchmark

Reference for Benchmarks:

Most Distant Level I Sample

Sample ID:
Distance from the probable point of entry:
Reference:

Most Distant Level II Sample

Sample ID:
Distance from the probable point of entry:
Reference:

4.1.4.3.1.2. Level II Concentrations

Sensitive Environments

Sensitive Environment	Distance from Probable Point of Entry to Nearest Point of Sensitive Environment	Reference	Sensitive Environment Value(s)

Sum of Sensitive Environments Value:

Wetlands

Source #1

Wetland	Wetland Frontage	Reference
In diversion ditch	1.06 miles	4,7,16,17,25
Silver Creek	0.92 miles	4,7,16,17,25

Total Wetland Frontage: 1.98 miles

Wetland Value: 50

Sum of Sensitive Environments Value + Wetland Value: 0+50=50

For Source #1 the total wetland frontage includes the diversion ditch bottom land from the point of direct observation of tailings material sloughing into the ditch bottom (sample RFT-SE-4) to the last point of direct observation (reported by the Utah State Health Department, Ref 25) near the old slurry pipe (measured distance of 2800 feet). Utilizing wetland frontage for both sides of the ditch a total wetland frontage value for the diversion ditch is 1.06 miles (Ref. 7, 17, 4 and 25).

Wetland frontage for Source #2 was calculated along the banks of Silver Creek. The FIT utilized available aerial photography (Ref.s 7 and 8) to designate a length of wetland subject to an observed release through direct observation. In calculating total wetland frontage, a conservative approach is taken using only the wetland frontage where Silver Creek is obviously bisecting Source #2 (flood-plain tailings). The total wetland frontage for this section is .46 miles. Taking into account both banks of Silver Creek, a total wetland frontage associated with the Richardson Flat Tailings Pond and the Flood Plain Tailings is 50.

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Level II Concentrations Factor Value: 50

The remainder of the diversion ditch and Silver Creek (portions of both waterways not subject to an observed release through direct observation) were evaluated for potential contamination. Measurements were made from the last point of observed contamination in the Richardson Flat Tailings Pond diversion ditch (near the Old Slurry pipe) to a point 15 miles downstream past the confluence of Silver Creek and the Weber River. These measurements were made using wetland inventory maps (Ref. 16 and 16A) and yielded a total of 24 miles of wetland frontage associated with the remaining portion of the diversion ditch, Silver Creek and the Weber River (taking into account both banks of these bodies).

An additional 0.4 miles of wetland frontage was added due to the wetlands associated with Silver Creek near the floodplain tailings. The additional 0.4 mile was measured (Ref. 16 and 16A) downstream of the floodplain tailings along Silver Creek to the confluence of the diversion ditch drainage with Silver Creek.

Measurements yielded a total of 24.40 miles of wetland frontage associated with the diversion ditch drainage, Silver Creek and the Weber River (taking into account both banks of these water bodies). Average annual stream flow for the Weber River near Coalville, Utah is 214 ft^3/sec (Ref. 13, pg. 236) yielding a dilution factor of 0.01 (Ref. 1, Tbl 4-13). Average annual stream flow for Silver Creek is 3.3 ft^3/sec yielding a dilution factor of 1 for the Silver Creek drainage (Ref. 10). Summing the value for total wetland frontage and dividing by 10, the measurements yield a potential contamination factor value of 52.55.

Sum of $D_j(W_j + S_j)$: 525.50
(Sum of $D_j(W_j + S_j)$)/10: 52.55

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Potential Contamination Factor Value: 52.55

- Level I Samples

Sample ID: AM-04
Reference for Benchmarks: #2

Hazardous Substance	Hazardous Substance Concentration	Benchmark	Benchmark Level
Arsenic	.0928 ug/m^3	Cancer Risk 2.3×10^{-7} mg/m^3	1
Cadmium	.0825 ug/m^3	Cancer Risk 5.6×10^{-7} mg/m^3	1
Lead	1.6478 ug/m^3	NAAQS 1.5ug/m^3	1
Zinc	1.1546 ug/m^3	--	2

Attribution: Sampling conducted at the Richardson Flat Tailings Pond on July 8 and 9, 1986 documented an observed release of heavy metals to the air pathway. On Day 1 of the air investigation the FIT began sampling at 1745 hours on July 8, 1986 with sample AM-01. Sampling concluded on July 9, 1986 with the shut off of the last sampler at 0700 hours.

Based on sampler locations during this time period (wind direction data provided in Reference #11, Figure 4), sampler AM-01 served as a background while samplers AM-03 and AM-04 were located downwind. According to Henry Schmelzer (FIT project officer) sampler AM-04 was located off the main tailings pile on the tailings dam (Ref. 21). A comparison of sampling results for Day 1 indicates an observed release of lead, cadmium, arsenic and zinc (Ref. 11, Tbl. 3).

Given the offsite location of sample station AM-04 and the high levels of contaminants detected, an observed release through chemical analysis is substantiated for Source #1.

Hazardous Substances Released:
Day 1: July 8 & 9, 1986 Ref. 11, Table 3

Containment	Background AM-01 (ug/m^3)	Dam AM-04 (ug/m^3)
Arsenic	.0091	.0928
Cadmium	.009	.0825
Lead	.0063	1.6478
Zinc	.0317	1.1546

Air Observed Release Factor Value: 550

6.1.2.1.2 **GAS SOURCE TYPE**

Source(s):

Source Type: Not Evaluated.

Rationale:

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Gas Source Type Factor Value: Not Evaluated

6.1.2.2 **PARTICULATE POTENTIAL TO RELEASE**

Source(s):

Hazardous Substance	Vapor Pressure	Reference

6.1.2.2.1 **PARTICULATE CONTAINMENT**

Not evaluated because of documented observed release from Source #1.

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Particulate Containment Factor Value:

57

6.1.2.2.3 **PARTICULATE MIGRATION POTENTIAL**

Not Evaluated.

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Particulate Migration Potential Factor Value: Not Evaluated

6.2.2 HAZARDOUS WASTE QUANTITY

Source Number	Source Hazardous Waste Quantity Value (Section 2.4.2.1.5)	Is Source Hazardous Constituent Quantity Data Complete? (yes/no)
1	502,721.15	No
2	20,730.77	No

Sum of values: 523,451.92
From Ref. 1,Tbl. 2-6 Waste Quantity = 10,000

6.2.3 WASTE CHARACTERISTICS FACTOR CATEGORY VALUE

Toxicity/mobility factor value
x hazardous waste quantity factor value = 2×10^6

For arsenic: toxicity/mobility factor value = 200
Hazardous waste quantity factor value = 10,000
$\therefore 200 \times 10{,}000 = 2 \times 10^6$

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Hazardous Waste Quantity Factor Value: 10,000
Waste Characteristics Factor Category Value: 32

6.3.1 NEAREST INDIVIDUAL FACTOR

Nearest Individual - Level I Concentrations

Residence, building or area subject to Level I concentrations: There are no regularly inhabited buildings within 1/4 mile of the Richardson Flat Tailings Pond (Source 1).
Location:
Source:
Distance from the nearest source in miles:
References: 7,11,22,29

Nearest Individual - Level II Concentrations

Residence, building or area subject to Level II concentrations: Zinc was detected at Level II contamination within the 0-1/4 mile distance ring. No other contamination was detected outside the 0-1/4 mile distance ring.
Location: Tailings Dam
Source: Richardson Flat Tailings Pond
Distance from the nearest source in miles: 20 feet
References: 7,11,22,29

Nearest Individual - Potential Contamination

Residence, building or area nearest to source: There are three small industrial buildings located .30 mile to the northwest of Source 1. These buildings are occupied by a total of eight workers on a daily basis (Ref. 22).
Location: 1/4-1/2 mile from Source #1.
Source: Richardson Flats Tailings (Source #1).
Distance from the nearest source in miles: .30 miles
References: 7,11,22,29
The nearest buildings to the site are a small cluster of industrial type structures located to the north of Keetley Junction. These structures lie 1600 feet northwest of Source #1 (Richardson Flat Tailings Pond). From Ref #1 Table 6-16 the assigned value for the nearest individual is 2.

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Nearest Individual Factor Value: 2

6.3.2.4. POTENTIAL CONTAMINATION

Distance Category	Population	Reference(s)	Population Range	Distance-Weighted Population Value
0-1/4	0	22,32	0	0
1/4-1/2	8 workers	"	1 - 10	0.2
1/2-1	4	"	1 - 10	0.06
1-2	0	"	0	0
2-3	4103.2	"	3001 - 10,000	12
3-4	356.8	"	301 - 1000	0.7

				12.96

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Distance-weighted Population Subject to Potential Contamination: 4472

Potential Contamination Factor Value: 12.96

6.3.3 RESOURCES

- Commercial agriculture -- There are approximately 316 acres of irrigated pastureland within 1/2 mile of source #1 (Ref. 18). Assigned value = 5

- Commercial silviculture

- Major or designated recreation areas

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Resources Factor Value: 5

6.3.4.2 POTENTIAL CONTAMINATION

Sensitive Environment	Distance Category	Reference(s)	Sensitive Environment Value(s)

Distance Category	Wetlands Acreage	Reference(s)	Wetlands Value per Distance Category
1/4-1/2	5	6,7	25

Distance Category	Sum of Sensitive Environment Values (S_j)	Wetland Acreage Value (W_j)	Distance Weight (D_j)	$D_j(W_j + S_j)$
1/4-1/2	0	25	.054	.054 (25+0)

Sum of $D_j(W_j + S_j)$: 1.35
(Sum of $D_j(W_j + S_j)$)/10: .135

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Sensitive Environments Potential Contamination Factor Value: .135