HRS DOCUMENTATION RECORD COVER SHEET

Name of Site: Southwest Jefferson County Mining

EPA ID No.: MON000705443

Contact Persons

EPA Contact: Michelle Quick
U.S. Environmental Protection Agency, Region 7
901 North 5th Street
Kansas City, Kansas 66101
(913) 551-7335

Documentation Record: Kumud Pyakuryal, Tetra Tech EM Inc.

Pathways, Components, or Threats Not Scored

Soil exposure and air migration pathways were not completed, because associated pathway scores will have no effect on the NPL listing.

HRS DOCUMENTATION RECORD

Name of Site:	Southwest Jefferson County Mining
EPA Region:	7
Date Prepared:	April 2009
Street Address of Site*:	Approximately 0.5 mile west of State Highway WW, where Silver Lake Trail meets Thunder Ridge Road (see Figure 1 in Reference 39 and Reference 52)
City, County, State:	Dittmer, Jefferson County, Missouri 63023
General Location in the State: (Ref. 3; 38).	The site is located in the SW ¼ of Jefferson County, Missouri
Topographic Map:	The location of site is shown on the, U.S.Geological Survey, 7.5-Minute Series Topographic Map for Richwoods, Missouri Quadrangle and Fletcher, Missouri Quadrangle (Ref.3).
Latitude and Longitude*:	38° 11’ 12.46’’ North and 90° 45’ 32.31’’ West

The latitude and longitude coordinates listed above specify the approximate center of Source 1 presented in Figure 1 in Reference 39 and topographic maps included in Reference 3.

Scores	
Air Pathway	Not Scored
Ground Water Pathway	100.00
Soil Exposure Pathway	Not Scored
Surface Water Pathway	100.00
HRS SITE SCORE	70.71

* - The street address, coordinates, and contaminant locations presented in this HRS documentation record identify the general area in which the site is located. They represent one or more locations EPA considers to be part of the site based on the screening information EPA used to evaluate the site for NPL listing. EPA lists national priorities among the known "releases or threatened releases" of hazardous substances; thus, the focus is on the release, not precisely delineated boundaries. A site is defined as where a hazardous substance has been "deposited, stored, placed, or otherwise come to be located." Generally, HRS scoring and the subsequent listing of a release merely represent the initial determination that a certain area may need to be addressed under the Comprehensive Environmental Response, Compensation, and Liability Act. Accordingly, EPA contemplates that the preliminary description of facility boundaries at the time of scoring will be refined as more information is developed as to where the contamination has come to be located.

WORKSHEET FOR COMPUTING HRS SITE SCORE

		S	S^2
1.	Ground Water Migration Pathway Score (S_{gw}) (from Table 3-1, line 13)	100	10,000
2a.	Surface Water Overland/Flood Migration Component (from Table 4-1, line 30)	100.00	
2b.	Ground Water to Surface Water Migration Component (from Table 4-25, line 28)	0.00	
2c.	Surface Water Migration Pathway Score (S_{sw}) Enter the larger of lines 2a and 2b as the pathway score.	100.00	10,000
3.	Soil Exposure Pathway Score (S_s) (from Table 5-1, line 22)	0.00	0.00
4.	Air Migration Pathway Score (S_a) (from Table 6-1, line 12)	0.00	0.00
5.	Total of $S_{gw}^2 + S_{sw}^2 + S_s^2 + S_a^2$		20,000
6.	**HRS Site Score** Divide the value on line 5 by 4 and take the square root	70.71	

TABLE 3–1

GROUND WATER MIGRATION PATHWAY SCORESHEET

Factor Categories and Factors	**Maximum Value**	**Value Assigned**
Likelihood of Release to an Aquifer		
1. Observed Release:	550	550
2. Potential to Release:		
2a. Containment	10	
2b. Net Precipitation	10	Not Scored
2c. Depth to Aquifer	5	Not Scored
2d. Travel Time	35	Not Scored
2e. Potential to Release [lines 2a x (2b + 2c + 2d)]	500	
3. Likelihood of Release (higher of lines 1 and 2e)	550	550
Waste Characteristics		
4. Toxicity/Mobility	a	10,000
5. Hazardous Waste Quantity	a	10,000
6. Waste Characteristics	100	100
Targets		
7. Nearest Well	50	50
8. Population:		
8a. Level I Concentrations	b	360
8b. Level II Concentrations	b	Not Scored
8c. Potential Contamination	b	Not Scored
8d. Population (lines 8a + 8b + 8c)	b	360
9. Resources	5	Not Scored
10. Wellhead Protection Area	20	Not Scored
11. Targets (lines 7 + 8d + 9 + 10)	b	410
Ground Water Migration Source For An Aquifer		
12. Aquifer Source [(lines 3 x 6 x 11)/82,500][c]	100	100
Ground Water Migration Pathway Score		
13. Pathway Score (S_{gw}), (highest value from line 12 for all aquifers evaluated)[c]	100	100

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

TABLE 4–1
SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SPREADSHEET

Factor Categories and Factors	Maximum Value	Value Assigned
Drinking Water Threat		
Likelihood of Exposure		
1. Observed Release.	550	550
2. Potential to Release by Overland Flow:		
2a. Containment	10	
2b. Runoff	25	Not Scored
2c. Distance to Surface Water	25	Not Scored
2d. Potential to Release by Overland Flow (lines 2a[2b+2c])	500	Not Scored
3. Potential to Release by Flood:		
3a. Containment (Flood)	10	Not Scored
3b. Flood Frequency	50	Not Scored
3c. Potential to Release by Flood (lines 3a x 3b)	500	Not Scored
4. Potential to Release (lines 2d + 3c, subject to a maximum of 500)	500	Not Scored
5. Likelihood of Release (higher of lines 1 and 4)	550	550
Waste Characteristics		
6. Toxicity/Persistence	(a)	Not Scored
7. Hazardous Waste Quantity	(a)	Not Scored
8. Waste Characteristics	100	Not Scored
Targets		
9. Nearest Intake	50	Not Scored
10. Population		
10a. Level I Concentrations	(b)	Not Scored
10b. Level II Concentrations	(b)	Not Scored
10c. Potential Contamination	(b)	Not Scored
10d. Population (lines 10a + 10b + 10c)	(b)	Not Scored
11. Resources	5	Not Scored
12. Targets (lines 9 + 10d + 11)	(b)	Not Scored
Drinking Water Threat Score		
13. Drinking Water Threat Score ([lines 5 x 8 x 12]/82,500, subject to maximum of 100)	100	Not Scored
Human Food Chain Threat		
Likelihood of Release		
14. Likelihood of Release (same value as line 5)	550	550
Waste Characteristics		
15. Toxicity/Persistence/Bioaccumulation	(a)	50,000,000
16. Hazardous Waste Quantity	(a)	10,000
17. Waste Characteristics	1,000	560
Targets		
18. Food Chain Individual	50	45
19. Population		
19a. Level I Concentrations	(b)	Not Scored
19b. Level II Concentrations	(b)	0.03
19c. Potential Human Food Chain Contamination	(b)	Not Scored

Factor Categories and Factors	Maximum Value	Value Assigned
19d. Population (lines 19a + 19b + 19c)	(b)	0.03
20. Targets (lines 18 + 19)	(b)	45.03
Human Food Chain Threat Score:		
21. Human Food Chain Threat Score ([lines 14 x 17 x 20]/82,500, subject to a maximum of 100)	100	100
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	1,000
Targets		
26. Sensitive Environments		
26a. Level I Concentrations	(b)	0
26b. Level II Concentrations	(b)	25
26c. Potential Contamination	(b)	Not Scored
26d. Sensitive Environments (lines 26a + 26b + 26c)	(b)	25
27. Targets (value from line 26d)	(b)	25
Environmental Threat Score		
28. Environmental Threat Score ([lines 22 x 25 x 27]/82,500, subject to a maximum of 60) Surface Water Overland/Flood Migration Component Score for a Watershed	60	60
29. Watershed Score[c] (lines 13 + 21 + 28, subject to a maximum of 100) Surface Water Overland/Flood Migration Component Score	100	100
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.

SITE DESCRIPTION

The Southwest Jefferson County Mining (MON000705443) site is located in the southwest quadrant of Jefferson County, Missouri. Jefferson County is bordered on the north by St. Louis County and the Meramec River, on the east by the Mississippi River, on the south by St. Genevieve and St. Francis Counties, and on the west by Washington and Franklin Counties. The County encompasses 664 square miles. According to the U.S. Census Bureau, the estimated 2007 population of Jefferson County is 216,076 people. The county seat is located in Hillsboro, Missouri (Ref. 4, p. 5). Mining activities in Jefferson County began in the early 1800s in southern Jefferson County, where the Cambrian dolomite source rock is concentrated along Big River and other major streams. The first production operation was a lead shot tower erected in 1809 in the southern part of Herculaneum. Two mines were in operation as early as 1818: Gray's mine was located on the Big River and McKane's mine was located on Dry Creek. Many other mines were opened in the 1830s and 1840s for the production of lead, zinc, and barium (tiff). By 1855, three smelters were operating in Jefferson County, including Valles Mines, Mammoth Mines, and Sandy Mines. Historical records indicate that over three million pounds of lead was shipped out of Jefferson County annually during this time period, making it one of the leading lead producers (Ref. 4, p. 6).

The study area considered in the 2007 Pre-Comprehensive Environmental Response, Compensation, and Liability Information System Site Screening Assessment (Pre-CERCLIS SSA) conducted by the U.S. Environmental Protection Agency (EPA) included 252 potential mining sites located throughout Jefferson County that were identified on maps prepared from the inventory of mines, occurrences and prospects (IMOP) database (Ref. 5, p. 4; 6, p. 13; 9, p.4; 48, pp. 5, 6, 13). The state of Missouri maintains IMOP, which currently has over 21,000 entries of mining and mining related sites in Missouri. For purposes of this study, Jefferson County was divided into four quadrants: northeast (NE), northwest (NW), southeast (SE), and southwest (SW). The NE quadrant contains six mining sites, the NW quadrant contains 12 mining sites, the SE quadrant contains 42 mining sites, and the SW quadrant contains 192 mining sites. EPA sampled tailings, surface water, sediment, residential soils, and private drinking water wells at or near some of the mining sites. Because the SW quadrant contained most of the identified mining sites, sampling activities focused on that area.

The ground water migration, soil exposure, and surface water migration pathways pose significant concern at the site. This documentation record evaluated the ground water migration and surface water migration pathways. Arsenic, barium, cadmium, and lead were found in Source 1 (Twin Barite Tailing Pond). Source 1 is a fishery and a National Wetland Inventory (NWI) defined wetland is situated on top it (Ref. 11, p. 1; 50, pp. 1-3). Lead has been documented at significantly elevated concentrations in drinking water wells. As of May 2008, a total of 92 ground water samples, collected from wells at 46 properties, contained lead at concentrations above the MCL of 15 microgram per liter (µg/L). A comparison between the dissolved and total lead in the well samples revealed that all samples had relative percent differences (RPD) of less than 5 percent, indicating the lead existed overwhelmingly in a dissolved form (Ref. 4, p. 19). Because of human health concerns, EPA investigative actions are ongoing to characterize and mitigate exposure to contamination in the area. Ten wells located downgradient of Source 1 and which serve a population of 36 individuals subject to Level I contamination (with concentrations above the drinking water MCL) have been evaluated for the HRS documentation record assessment and scoring purposes. EPA investigations in the area have presented extensive residential soil contamination (Ref. 4, pp. 37-43). During the removal activities, it was determined that the alluvial soils were excavated for residential fill material and transported throughout Jefferson County (Ref. 4, pp. 12-13, 57). Even though the Soil Exposure Pathway was not scored, there is extensive soil contamination throughout Southwest Jefferson County which is being addressed by the Removal program.

The primary source scored in this documentation record package is Twin Barite Plant Tailings Pond; multiple possible sources are present in southwest Jefferson County, including Dresser Mine No. 10 Tailings Pond, and Dresser Mine No. 11 Tailings Pond. These sources are located at a relative local high in comparison with depths where drinking water wells draw and maintain no engineering control or cover (Ref. 9, p. 4; 48, pp. 85 – 92; 55, p. 1). Therefore, source contaminants are uncontained and available for release. As stated earlier, the Twin Barite Tailings Pond is a fishery. It is stocked with bass, catfish, and crappie for human consumption. Further, a NWI defined wetland is located within the confines of Twin Barite Tailings Pond (Ref. 11, p.1; 50, pp. 1-3).

According to the Jefferson County, Missouri Soil Survey publication, Jefferson County receives approximately 38 inches of annual precipitation. Of this, 17 inches, usually falls in April through September. The heaviest 24-hour rainfall on record is 4 inches. The average relative humidity in mid-afternoon and at dawn is 59 and 83 percent, respectively. The prevailing wind is from the south. Average wind speed is highest, 11 miles per hours, from January to April. Jefferson County is divided into seven physiographic regions, from the northeast to the south. They are (i) a small area of Dissected Till Plains, (ii) the River Hills, (iii) the Zell Platform, (iv) the Burlington Escarpment, (v) the Crystal Escarpment, (vi) the Salem Escarpment, and (vii) the Avon Escarpment. The highest point in the county is about 1,060 feet above seal level and the lowest point is in the Mississippi River bottom at about 385 feet above sea level. The Big River on the eastern edge drains approximately 37 percent of the county; the Meramec River drains approximately 15 percent of the county; and smaller streams draining directly into the Mississippi River make up approximately 48 percent of the county (Ref. 42, pp. 9, 10).

REFERENCES

Reference Number	Description of the Reference
1	U. S. Environmental Protection Agency (EPA). 1990. Hazard Ranking System, Final Rule, 40 CFR Part 300, Volume 55, No. 241. December 14. Excerpt. 1 Page. ***Note:*** A complete copy of the rule is available from the Region 7 Docket upon request.
2	EPA. 2004. Superfund Chemical Data Matrix. January. Excerpt. 9 Pages. A complete copy of SCDM is available at http://www.epa.gov/superfund/sites/npl/hrsres/tools/scdm.htm.
3	U. S. Geological Survey (USGS). 1981. 7.5 minute series Topographic Quadrangle Maps of Missouri: 1981, Fletcher and Richwoods, Scale 1:24,000. 2 Sheets.
4	Tetra Tech EM Inc. (Tetra Tech). 2008. Preliminary Assessment Report for Jefferson County Lead Site in Jefferson County, Missouri. CERCLIS I.D. MON000705443. Under the Superfund Technical Assessment and Response (START) 3 Contract (EP-S7-06-01). May 7. 1684 pages.
5	Tetra Tech. 2007. Pre-CERCLIS Site Screening Assessment Report for Jefferson County Lead Site in Jefferson County, Missouri. CERCLIS I.D. MON000705443. Under the START 3 Contract (EP-S7-06-01). July 25. 1282 pages.
6	Tetra Tech. 2006. Quality Assurance Project Plan for a Pre-CERCLIS Screening and Integrated Site Assessment in Jefferson County, Missouri. CERCLIS I.D. MON000705443. Under the START 3 Contract (EP-S7-06-01). May 30. 19 pages.
7	Tetra Tech. 2007. Quality Assurance Project Plan for a Combined Removal Site Evaluation and Removal Action at the Jefferson County Lead Site in Jefferson County, Missouri. Under the START 3 Contract (EP-S7-06-01). December 17. 22 pages.
8	U. S. Census Bureau. 2008. Jefferson County QuickFact Sheet from the U.S. Census Bureau. On-line Address: http://quickfacts.census.gov/qfd/states/29/29099.html. Accessed on September 25, 2008. 3 pages.
9	Missouri Department of Natural Resources (MDNR). 2008. Memorandum: Jefferson County Sample Area Mining History and Geology, by Cheryl Seeger, PhD. October 10. 19 pages.
10	Tetra Tech. 2008. Record of telephone Conversation between David Zimmermann, Tetra Tech, and Sheryl Mazurek, property owner, regarding sampling at the Twin Barite Tailings Pond. September 9. 2 pages.
11	Tetra Tech. 2008. Record of Telephone Conversation between Kumud Pyakuryal, Tetra Tech, and Sheryl Mazurek, property owner, regarding the fishing information for the Twin Barite Tailings Pond. October 10. 1 page.
12	Tetra Tech. 2008. Quality Assurance Project Plan for a Site Inspection for the Jefferson County Lead Site. Under the START 3 Contract (EP-S7-06-01). August 15. 21 pages.
13	EPA Region 7. 2008. HRS Analysis Results Supplement for ASR #3166 for the Jefferson County Lead Site. August 4. 7 pages.
14	EPA Region 7. 2008. HRS Analysis Results Supplement for ASR #3167 for the Jefferson County Lead Site. August 4. 8 pages.
15	EPA Region 7. 2008. HRS Analysis Results Supplement for ASR #3209 for the Jefferson County Lead Site. July 21. 7 pages.
16	EPA Region 7. 2008. HRS Analysis Results Supplement for ASR #3210 for the Jefferson County Lead Site. August 4. 8 pages.
17	EPA Region 7. 2008. HRS Analysis Results Supplement for ASR #3222 for the Jefferson County Lead Site. July 21. 6 pages.
18	EPA Region 7. 2008. HRS Analysis Results Supplement for ASR #3223 for the Jefferson County Lead Site. July 21. 6 pages.
19	EPA Region 7. 2008. HRS Analysis Results Supplement for ASR #3224 for the Jefferson County Lead Site. July 21. 6 pages.
20	EPA Region 7. 2008. HRS Analysis Results Supplement for ASR #3360 for the Jefferson County Lead Site. August 4. 1 page.
21	EPA Region 7. 2008. HRS Analysis Results Supplement for ASR #3381 for the Jefferson County Lead Site. August 4. 1 page.

Reference Number	Description of the Reference
22	EPA Region 7. 2008. HRS Analysis Results Supplement for ASR #3387 for the Jefferson County Lead Site. July 21. 10 pages.
23	EPA Region 7. 2008. HRS Analysis Results Supplement for ASR #3388 for the Jefferson County Lead Site. July 21. 11 pages.
24	EPA Region 7. 2008. HRS Analysis Results Supplement for ASR #3416 for the Jefferson County Lead Site. July 21. 6 pages.
25	EPA Region 7. 2008. HRS Analysis Results Supplement for ASR #3420 for the Jefferson County Lead Site. August 4. 1 page.
26	EPA Region 7. 2008. HRS Analysis Results Supplement for ASR #3423 for the Jefferson County Lead Site. July 21. 8 pages.
27	EPA Region 7. 2008. HRS Analysis Results Supplement for ASR #3472 for the Jefferson County Lead Site. July 21. 1 page.
28	EPA Region 7. 2008. HRS Analysis Results Supplement for ASR #3543 for the Jefferson County Lead Site. July 21. 1 page.
29	EPA Region 7. 2008. HRS Analysis Results Supplement for ASR #3685 for the Jefferson County Lead Site. July 21. 1 page.
30	EPA Region 7. 2008. HRS Analysis Results Supplement for ASR #3706 for the Jefferson County Lead Site. August 4. 1 page.
31	EPA Region 7. 2008. HRS Analysis Results Supplement for ASR #3711 for the Jefferson County Lead Site. August 4. 5 pages.
32	EPA Region 7. 2008. HRS Analysis Results Supplement for ASR #3715 for the Jefferson County Lead Site. July 21. 20 pages.
33	EPA Region 7. 2008. HRS Analysis Results Supplement for ASR #3739 for the Jefferson County Lead Site. July 21. 10 pages.
34	EPA Region 7. 2008. HRS Analysis Results Supplement for ASR #3748 for the Jefferson County Lead Site. August 4. 4 pages.
35	EPA Region 7. 2008. HRS Analysis Results Supplement for ASR #3753 for the Jefferson County Lead Site. July 21. 2 pages.
36	EPA Region 7. 2008. HRS Analysis Results Supplement for ASR #3766 for the Jefferson County Lead Site. July 21. 6 pages.
37	EPA Region 7. 2008. HRS Analysis Results Supplement for ASR #3786 for the Jefferson County Lead Site. July 21. 3 pages.
38	MDNR. 2005. Preliminary Assessment/Site Inspection/Removal Assessment Report for Valles Mines Company Site, Jefferson County, Missouri. CERCLIS I.D. MON000704446. March 31. 228 pages.
39	Tetra Tech. 2008. Figure 1: Southwest Jefferson County Mine Areas. Source: 2008 EPA Preliminary Assessment and ESRI Media Kit 2006. October 1. 1 sheet.
40	Wharton, H.M. Barite Ore Potential of Four Tailings Ponds in the Washington County Barite District, Missouri. Missouri Geological Survey and Water Resources. 1972. Excerpt. 20 pages.
41	Miller, D. and J. Vandike. 1997. Ground water Resources of Missouri. Missouri State Water Plan Series Volume II. Excerpt. 28 Pages.
42	U.S. Department of Agriculture. 2005. Soil Survey of Jefferson County, Missouri. 10 pages. http://soildatamart.nrcs.usda.gov/Manuscripts/MO099/0/Jefferson_MO.pdf
43	Missouri Department of Natural Resources. 2007. Missouri Environmental Geology Atlas. 3 Page.
44	Adamski, J.C., J.C. Peterson, D.A. Freiwald, and J.V. Davis. 1995. Environmental and Hydrologic Setting of the Ozark Plateaus Study Unit, Arkansas, Kansas, Missouri, and Oklahoma. U.S. Geological Survey Water-Resources Investigations Report 94-4022. Excerpt. 52 Pages.
45	Thompson, Thomas L. 1995. The Stratigraphic Secession in Missouri, Volume 40, Revised. 12 pages.
46	Orndorff, Randall, D. Weary, and S. Sebela. 2001. Geologic Framework of the Ozarks of South-Central Missouri-Contributions to a Conceptual Model of Karst. 7 Pages.

Reference Number	Description of the Reference
47	MDNR. 2001. Bedrock Geologic Map of the Fletcher 7.5'Quandrangle, Jefferson and Washington Counties, Missouri; Bedrock Geologic Map of the Richwoods 7.5' Quadrangle, Franklin, Jefferson, and Washington Counties, Missouri; Bedrock Geologic Map of the Tiff 7.5' Quadrangle, Washington, St. Francois and Jefferson Counties, Missouri; Bedrock Geologic Map of the Vineland 7.5' Quadrangle, Jefferson and St. Francois Counties, Missouri July. 4 Sheets.
48	Tetra Tech. 2008. Site Inspection Report for Southwest Jefferson County Lead Site in Jefferson County, Missouri. CERCLIS I.D. MON000705443. Under the Superfund Technical Assessment and Response (START) 3 Contract (EP-S7-06-01). December 2. 223 pages.
49	EPA Region 7. 2008. HRS Analysis Results Supplement for ASR #4031 for the Jefferson County Lead Site Inspection. November 14. 16 pages.
50	U.S. Fish and Wildlife Service (USFWS). 2008. National Wetlands Inventory Data for Twin Barite Plant Tailings Pond, at: http://www.fws.gov/wetlands/data/index.html. Accessed on December 12 and 17. 3 pages.
51	Tetra Tech. 2008. Jefferson County Lead Site Residential Property Screening Form for property numbers: JC0120, JC0121, JC0138, JC0226, JC0290, JC0291, JC0292, JC0294, JC0312, JC0316, JC0353, JC0358, JC0360, JC0448, and JC0466. 30 pages.
52	Tetra Tech. 2009. Southwest Jefferson County Mine Areas: Site Faults and Gradient. January 26. 1 sheet.
53	Missouri Department of Natural Resources Division of Geology & Land Survey prepared in cooperation with Division of Environmental Quality. Non-Coal Mined Lands (208 strategy) Data Date 1981. Presented on U.S. Geological Survey, Richwoods, Missouri Quadrangle, 7.5 Minute Series. Topographic Map. 1981. 1 Sheet.
54	Tetra Tech. 2009. Record of Telephone Conversation between Kumud Pyakuryal, Tetra Tech, and Sheryl Mazurek, property owner, and Nick Cahill, Country Fish Farms, LLC, regarding the fishing information for the Twin Barite Tailings Pond. January 21-22. 1 page.
55	Tetra Tech. 2009. Memorandum by Dave Gray, Tetra Tech, "Collection of Source Area Samples from Tailings Ponds." January 28. 1 page.

2.2 SOURCE CHARACTERIZATION

2.2.1 SOURCE IDENTIFICATION

Name of Source: Twin Barite Plant Tailings Pond or Twin Barite Tailings Pond
Number of Source: 1

Source Type: Pile

Description and Location of Source (with reference to a map of the site): Source 1 is depicted on Figures 1 and 2A of the U.S. EPA Site Inspection (SI) as Twin Barite Plant Tailing Pond (Ref. 48, pp. 85, 87). In addition, it is depicted in Reference 53.While the Twin Barite Plant itself is located in Washington County, adjacent and west of Jefferson County, Missouri, the tailings pond associated with its operation is located in Jefferson County. Its location is noted in the Public Land Survey System (PLSS) format in Table 1 (Ref. 9, pp. 1, 18). The geographic coordinates for the approximate center of the tailings pond, Source 1, are 38° 11' 12.46'' North and -90° 45' 32.31'' West (Refs. 3; 12, pp. 15, 19, 21). Evidence observed during the 2008 SI indicated that no engineering controls or containment features were present at the Twin Barite Tailings Pond (Ref. 48, pp. 94-100; 55, p. 1).

Table 1

MDNR ID	Description	Commodity	Acres	Status	Comment
221-044	Twin Barite Plant Tailings Pond West ½ of Section 24, Northwest Section 25, and Northeast Section 26 Township 40 North and Range 2 East	Barite	50 **90** 2	Strip mine - barren **Tailings pond - water** Processing area - idle	Idle (11/82)
Source: Ref. 9, p. 18; 53, p. 1					

Contaminants commonly associated with mining districts are heavy metals. Hazardous metals arsenic, barium, cadmium, and lead were found at Source 1 during the SI investigation (Ref. 48, p. 16, 78). Documentation during sampling indicated materials found in Source 1 were mine tailings (Ref. 48, pp. 99, 100; 55, p. 1). In addition, Reference 53 depicts the footprint of Source 1, as documented by MDNR during its 208 Strategy Study from 1982.

Mining activities in Jefferson County began in the early 1800s in southern Jefferson County, where Cambrian dolomite source rock is concentrated along the Big River and other major streams (Ref. 9, p. 1, 2, 7; 40, pp. 2, 5). This tailings pile associated with the former barite mine was assigned a site number of 221-044 by the MDNR, Division of Geology and Land Survey (Ref. 9, p. 18). This source is being evaluated as "pile" because it was designed and used as a disposal site for tailings processed by washer plants (Ref. 40, pp. 7-9). These disposal ponds allowed the tailings to dewater, but they were not constructed to treat water. This source is shown on the Richwoods, Missouri Quadrangles (Refs. 3; 12, p. 19; 39, Figure 1). The mine is located in the western half of Section 24 and northeast quarter of Section 25, and northwest quarter of Section 26, Township 40 North and Range 2 East (Ref. 12, pp. 1, 18). Figure 1 (Reference 39) presents an extrapolated area associated with the tailings pile with overlays showing the locations of ground water samples collected in relative downgradient locations (Ref. 39, p. 1).

Features associated with the area were mapped by the Missouri Division of Geology and Land Survey (DGLS) and department of Environmental Quality (DEQ) in the early 1980s as part of a project referred to as the 208 project. The 208 project was completed in 1982, and it delineated areas of non-coal mined lands, tailings ponds and plant areas (Ref. 53, p. 1). These maps were developed from topographic maps, orthophoto quadrangles and personal communications. The maps were digitized using a commercial GIS system, using the topographic base as a guide. While improving the coverage over that derived from the topographic maps, these maps also pre-dated cessation of barite mining in the area (Ref. 9, p. 5-10).

2.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE

All source samples were collected at the tailings pond. The sampling associated with Source 1 was conducted during the SI (Ref. 12, pp. 9-10). Associated results are presented in Table 2 below. The samples were collected from the pond. Please note that the percent solids for Source 1 samples 4031-04, -05, and -06 were 65.9, 84.1, and 86.6, respectively (Ref. 48, p. 78; 49, pp. 1-2).

Table 2

Source 1 Analytical Data
Jefferson County, Missouri
Date: 09/17/2008

EPA Sample Number/Sample Designation	Sampling Depth (feet)	Sample Quantitation Limit (mg/kg)	Hazardous Substance	Concentration (mg/kg)	Reference
4031-04/SOIL 4	0-2	6.4	Arsenic	16.3	48, pp. 78, 100, 117, 125, 129, 133, 152, 158; 49, p. 1
4031-04/SOIL 4	0-2	2.6	Barium	6,400	48, pp. 78, 100, 117, 125, 129, 133, 152, 158; 49, p. 1
4031-04/SOIL 4	0-2	1.3	Cadmium	84.4	48, pp. 78, 100, 117, 125, 129, 133, 152, 158; 49, p. 1
4031-04/SOIL 4	0-2	6.4	Lead	991	48, pp. 78, 100, 117, 125, 129, 133, 152, 158; 49, p. 1
4031-05/SOIL 5	0-2	5.0	Arsenic	5	48, pp. 78, 99, 117, 125, 129, 134, 152, 159; 49, p. 1
4031-05/SOIL 5	0-2	2.0	Barium	147	48, pp. 78, 99, 117, 125, 129, 134, 152, 159; 49, p. 1
4031-05/SOIL 5	0-2	1.0	Cadmium	29.8	48, pp. 78, 99, 117, 125, 129, 134, 152, 159; 49, p. 1
4031-05/SOIL 5	0-2	5.0	Lead	23.1	48, pp. 78, 99, 117, 125, 129, 134, 152, 159; 49, p. 1, 2
4031-06/SOIL 6	0-2	2.3	Barium	50.6	48, pp. 78, 99, 117, 125, 129, 134, 152, 160; 49, p. 1, 2
4031-06/SOIL 6	0-2	1.1	Cadmium	19	48, pp. 78, 99, 117, 125, 129, 134, 152, 160; 49, p. 1, 2
4031-06/SOIL 6	0-2	5.7	Lead	23	48, pp. 78, 99, 117, 125, 129, 134, 152, 160; 49, p. 1, 2

Notes:
EPA United States Environmental Protection Agency
U The analyte was not detected at or above the reporting limit
mg/kg Milligrams per kilogram

2.2.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY

Table 3

Source 1 Containment

Containment Description	Containment Factor Value	Reference
Gas release to air: -	NS	NS
Particulate release to air: -	NS	NS
Release to ground water: Source 1 has no maintained engineered cover or run on and/or run off control system, functioning leachate collection and removal system immediately above the liner.	10	Ref. 55, p. 1
Release via overland migration and/or flood: Source 1 has no maintained engineered cover or run on and/or run off control system, functioning leachate collection and removal system immediately above the liner.	10	Ref. 55, p. 1

Notes:

NS Not Scored

2.2.4 HAZARDOUS WASTE QUANTITY

2.4.2.1.1. Hazardous Constituent Quantity

The information available is not sufficient to evaluate Tier A, as required in Section 2.4.2.1.1 of the HRS. As a result, the evaluation of Hazardous Waste Quantity proceeds to evaluate Tier B, hazardous wastestream quantity (Ref. 1, p.51590-51591).

2.4.2.1.2. Hazardous Wastestream Quantity

The information available is not sufficient to evaluate Tier B, as required in Section 2.4.2.1.2 of the HRS. As a result, the evaluation of Hazardous Waste Quantity proceeds to evaluate Tier C, volume (Ref.1, p. 51591.

2.4.2.1.3. Volume

The information available is not sufficient to evaluate Tier C, as required in Section 2.4.2.1.3 of the HRS. As a result, volume is assigned a value of zero, and the evaluation of Hazardous Waste Quantity proceeds to evaluate Tier D, area (Ref. 1, p. 51591).

2.4.2.1.4. Area

Description

Based on the estimated value provided by MDNR, the area of Source 1 is 90 acres (Ref. 9, p. 18). Therefore, based on the HRS Table 2-5 on page 51591, the total acres (90) was converted to square feet (3,920,400) and divided by 13 to arrive at the Hazardous Waste Quantity Value of 301,569.

Table 4

Source Type	Area	Units	References
Pile	3,920,400	Square feet	1, Table 2-5; 9, p. 18

Sum (ft^2): 3,920,400

Equation for Assigning Value (Table 2-5): A/13

Area Assigned Value: 301,569
(Ref. 1, p. 51591)

2.4.2.1.5. Source Hazardous Waste Quantity Value

Highest assigned value assigned from HRS Table 2-5: 301,569
(Ref. 1, p. 51591)

SUMMARY OF SOURCE DESCRIPTIONS

Table 5 **Summary of Source 1 Descriptions**							
Source No.	**Source Hazardous Waste Quantity Value**	**Source Hazardous Constituent Quantity Complete? (Y/N)**	**Containment Factor Value by Pathway**				
			Ground Water (GW) (Table 3-2)	**Surface Water (SW)**		**Air**	
				Overland/ flood (Table 4-2)	**GW to SW (Table 3-2)**	**Gas (Table 6-3)**	**Particulate (Table 6-9)**
1	301,569	No	10	10	Not Scored	Not Scored	Not Scored

Description of Other Possible Sources/Sites

The focus of EPA Region 7 sampling activities in Southwest Jefferson County has been at residential homes (Ref. 4, p. 10-12; 5, pp. 8-12). Numerous barite tailings ponds are found throughout the area; however, only Source 1 has been evaluated as a source in the immediate HRS watershed for scoring purposes (Ref. 9, pp. 1, 9-19; 52; 55, p.1). Further remedial investigations may be warranted to establish inter-watershed contamination. It should be noted, however, tailings ponds in western Jefferson County were generally created near head of valleys, at a higher elevation than the general topography in the area; in turn, this placed the tails and process water at higher elevations than the water table for the majority of the area. The tailings and process water were also located upgradient of major streams in the area, some of which may be losing streams (Ref. 9, p. 4).

In 1972 a report was published by the Missouri Geological Survey & Water Resources which evaluated the barite ore potential of tailings ponds in the area (Ref. 40). The intent of the study was to quantify the amount of barite ore in the tailings ponds to determine if it is economically feasible to recover the ore using modern separation techniques (Ref. 40, pp 2, 3). The report summarized that there are large barite reserves present in the district tailings ponds (Ref. 40, pp. 3, 18). As part of this study, a total of 865 samples were collected and assayed from 185 boreholes collected from four representative tailings ponds (Ref. 40, pp. 10, 12). The average amount of barite in the tailings was 5 percent (Ref. 40, p. 18). Quantitative analysis of low grade composite samples from the four tailings ponds tested trace amounts of lead (Ref. 40, p. 19).

In Jefferson County, a number of tailings piles have been identified but have not yet been sampled to characterize the hazardous constituents associated with them. Numerous of these large former mining operations are included in pages 9 through 19 of Reference 9. The EPA Superfund lead investigation sampling in Jefferson County indicates an area-wide ground water contamination as documented during past EPA Region 7 investigations and listed in References 4; 5; 13 through 37 (analytical results for analytical service requests 3166, 3167, 3209, 3210, 3222, 3223, 3224, 3360, 3381, 3387, 3388, 3416, 3420, 3423, 3472, 2543, 3685, 3706, 3711, 3715, 3739, 3748, 3753, 3766, and 3786); 48; and 49. For scoring purposes, only Source 1 or Twin Barite Tailing Pond has been included in this HRS evaluation; however, it is important to note that two other tailings pond sources, 25-acre Dresser Number 10 and 18-acre Dresser Mine Number 11, were sampled during the 2008 SI. The 25-acre Dresser Number 10 contained arsenic up to 39 mg/kg, barium up to 5,930 mg/kg, cadmium up to 126 mg/kg, and lead up to 1,200 mg/kg. The 18-acre Dresser Mine Number 11 contained arsenic up to 33.1 mg/kg, barium up to 4,360 mg/kg, cadmium up to 144 mg/kg, and lead up to 694 mg/kg (Ref, 48, p. 21)

In addition to the large operations described above, at one time Jefferson County was host to hundreds and possibly thousands of small mines that were worked by hand (Refs. 9, pp. 1-4). It is not known what impact these smaller diggings may have had on the environment.

In 2005, MDNR conducted a CERCLA assessment activity at and near Valles Mines Company (MON000704446). This site includes a former lead mining, milling, and smelter operation. Of the approximately 4,500 acres owned by the company at this location, only a small portion of the property was assessed as part of the investigation (Ref. 38, pp. 4, 5). The 2005 MDNR report found a release of cadmium, lead, and zinc from the site into Valles Mines and Finney Creek surface water and sediment. The data indicated that the probable mechanism of release is runoff from the smelter and mill ruins areas, and slumping of the chat piles that extend along the eastern bank of Valles Mines Creek near the mill ruins (Ref. 38, p. 18). The contamination associated with the Valles Mines site is noted in figures in Reference 38 (Ref. 38, pp. 27 to 42; 39).

3.0 GROUND WATER MIGRATION PATHWAY

3.0.1 GENERAL CONSIDERATIONS

The southwestern portion of Jefferson County is located in the Salem Plateau ground water province (Ref. 41, p. 6).

Regional Geology

Soil types in this region are controlled by the underlying parent materials, including loess and rock residuum. Six general soil associations are found in Jefferson County, distinguished by the type of landscape produced and its suitability for general land use, such as agriculture. These associations include the Haynie-Tice-Waldron Association, the Sonsac-Useful-Moko Association, the Wrengart-Goss Association, the Menfro-Gasconade Association, the Minnith-Pevely Association, and the Haymond-Freeburg-Horsecreek-Bloomsdale Association (Ref. 4, p. 18; 42, pp. 1-10).

Soils around the Twin Barite Plant Tailings are generally Goss very cobbly slit loam having 15 to 50 percent slopes. Goss soils are well drained and formed on clayey residuum weathered from cherty limestone (Ref. 42, pp. 1-7).

Bedrock Units

The table below presents a summary of the geologic units and rock thicknesses present in the southwestern Jefferson County area (Ref. 44, pp. 10 – 11; 47, sheets 1- 4).

Table 6

Age	Geologic Unit	Average Thickness (Feet)	Occurrence of Unit
Ordovician	Jefferson City Dolomite	120	Present generally northeast of Valle Mile-Vineland Fault Zone (down-faulted)
	Roubidoux Formation	200	Present along fault zone and underlying Jefferson City Dolomite
	Gasconade Dolomite	240	Present along fault zone and underlying Roubidoux Formation
Cambrian	Eminence Dolomite	150 – 200	Uppermost bedrock in parts of along southwestern edge of Jefferson County. Uppermost bedrock around Twin Barite Plant area.
	Potosi Dolomite	250	Major host rock for barite and lead ores mined in area. Uppermost bedrock in much of southwestern Jefferson County including the Dresser Mine No. 11 area.
	Elvins Group (Derby-Doerun and Davis	300	Underlies entire area
	Bonneterre Formation	350	Underlies entire area
	Lamotte Sandstone	200	Underlies entire area

The Ordovician-aged Jefferson City Dolomite is present in the southwestern Jefferson County are, and is present generally northeast of the Valles Mine—Vineland Fault zone, which runs generally west-northwest to east-southeast along the southern part of the County (Refs. 47 sheets 1-4). The Jefferson City Dolomite consists of light brown to tan crystalline, silty dolomite with conglomerate, orthoquartzite, and shale beds (Ref. 41 p. 11). The underlying Roubidoux formation consists of dolostone, sandstone, and chert exposed. It is deeply weathered and eroded, with sandstone boulders, chert residuum, and colluvium marking its presence. The unit is reported to be about 200 feet thick (Ref. 47, sheets 1-4).

The Ordovician-aged Gasconade Dolomite generally exists along the fault zone or as remnants at higher elevations. The Gasconade is composed of two units separated by an algal bed—typically silicified and vertically fractured— referred to as "the cryp reef". The Gasconade dolomites form glades, benches, and small bluffs in the northern and western portions of the Richwood geologic map quadrangle. The upper Gasconade consists of 40 to 60 feet of gray to tan to brown, medium to coarsely crystalline, thick to massively bedded dolomites with less than 10 percent chert. The lower Gasconade is about 180 feet of gray to tan, fine to medium crystalline, thin bedded dolomite with up to 30 percent chert (Ref. 47, sheets 1-4). The Gunter Member, a persistent sandstone unit, is present at the base of the Gasconade. In some areas, the lower part of the lower Gasconade, above the Gunter Member, is identified as the "Van Buren." The Van Buren is generally a finely crystalline dolomite containing little chert, and is similar to the upper Gasconade (Ref. 44, pp. 10-11). The total thickness of the Gasconade in the area is approximately 240 feet (Ref. 47, sheets 1-4).

Underlying the Gasconade is the Cambrian-aged Eminence dolomite. The Eminence Dolomite generally surrounds the Twin Barite Plant tailings pile (Source 1) (Ref. 3; 47, sheets 1-4). It consists of gray to tan, medium- to coarsely-crystalline, thick to massively bedded dolomite with minor nodular chert. The Eminence varies from about 150 to 200 feet thick in northeastern Washington County which is adjacent to Jefferson County, and has a gradational contact with the underlying Potosi dolomite. This gradational contact is marked by approximately 20 feet of druse and chalcedony increasing downward (Ref. 47, sheets 1-4).

The Potosi Dolomite consists of dark brown to gray to tan (at bottom) medium- to finely-crystalline dolomite. Exposures are generally massive and frequently have extensive vertical fractures and joints. The Potosi has distinctive weathering products of red clay, quarts druse, and masses of banded chalcedony. Dissolution, mineralization and secondary alteration are prevalent along structural features and associated fractures. The Potosi dolomite is approximately 250 feet thick in the area and is the major host rock for the barite and lead ores in the area. The contact with the underlying Derby-Doerun dolomite is gradational and problematic in the area (Ref. 47, sheets 1-4). The Potosi Dolomite is mapped as the uppermost bedrock unit underlying the northern part of the Twin Barite Plant tailings pile and deeper drainageways in the area. It is also the uppermost bedrock south of the Fletcher Fault Complex, immediately south of the pond (Ref. 47, sheets 1-4).

Underlying the Potosi is the Elvins Group, which consists of the Derby-Doerun Dolomite and Davis Formation (Ref. 44, pp. 10-11). The Elvins Group is about 300 feet thick and consists of shales, siltstones and dolomites. The Derby-Doerun is an argillaceous dolomite and the upper part maybe difficult to distinguish from the overlying Potosi. It is approximately 120 feet thick in the area (Ref. 47, sheets 1-4). The underlying Davis formation consists of about 180 feet of shale, siltstone, fine-grained sandstone, dolomite and limestone conglomerate (Ref. 41, p. 8).

The Cambrian Bonneterre formation underlies the Davis formation and is a medium to finely crystalline dolomite. Locally the Bonneterre can be a limestone, and some parts of the Bonneterre are glauconitic and shaly. The Bonneterre increases in sand content towards its base (Ref. 41, p. 9). The Bonneterre is the host-rock for the ore deposits of the Old Lead Belt in St. Francois County to the south and the Viburnum Trend—sometimes called the "New Lead Belt"—in southwestern Washington County. Together, these lead deposits form a roughly circular pattern around the pre-Cambrian formations of the

St. Francois Mountains. Most of the ores occur where lead-bearing solutions have permeated porous zones in the Bonneterre formation (Ref. 45, pp.4-5). The presence of ore is controlled by structures such as clastic carbonate bars or ridges, algal structures, and masses of submarine breccia. Major ore production has been from the lower half of the formation. In the Lead Belt and Viburnum Trend area, the Bonneterre is approximately 375 to 400 feet thick (Ref. 45, pp. 4-5). On average the thickness of the Boneterre is 350 feet (Ref. 41, pp. 8-9).

The Bonneterre conformably overlies the Lamotte Sandstone, which is the oldest sedimentary rock formation in the Salem Plateau (Ref. 41, p. 7). The Lamotte is predominantly a quartzose sand, but grades laterally to an arkosic sandstone or conglomerate. It varies in color from light gray to dark brown or red. The Lamotte unconformably overlies Precambrian basement rocks. The Lamotte ranges in thickness from about 100 feet, along the margins of the St Francois Mountains, to over 300 feet in the western and southern parts of the Salem Plateau. It averages about 200 feet in thickness (Ref. 41, p. 7).

Structural Features

The Missouri Environmental Geology Atlas (MEGA) includes geographic information system (GIS) drawing files and database information for bedrock geology, faults, sinkholes, and water wells (Ref. 43). Certified wells and wells identified from old Missouri well logs are included in the MEGA database. A geologic map is included in MEGA; however, it groups similar formations. More detailed geologic information for the area is available (Ref. 47, sheets 1-4) and is referenced in this section.

Bedrock in the area has been deformed by both normal and strike-slip faulting. In general, structural features trend both northeast-southwest and northwest-southeast and are probably related to the Sainte Genevieve Fault System. Regional dip is generally northward and locally controlled by structural deformation along fault zones (Ref. 47, sheets 1-4).

Twin Barite Tailings Pond is located in the Fletcher Fault Complex, which is an area of intensely disrupted bedrock where merging and cross-cutting fault segments occur along the northeastern boundary of the Richwoods Horst Block. The Fletcher Fault is shown on the bedrock geologic map as just south of the tailings pond, and the Ditch Creek Fault System is mapped about 0.5 mile to the north. The Fletcher fault is several hundred feet wide and smaller scale fault segments and structures are not shown (Ref. 47. Sheets 1-4). In general, the younger rocks have dropped down to the northeast, leaving the Ordovician Gasconade, or the Cambrian-aged Eminence as the uppermost bedrock, with the underlying Potosi exposed at lower elevations along stream valleys. Approximately 400 feet of displacement has occurred along the Fletcher Fault in consecutive northeast down-thrown segments, spanning the middle Potosi to the lower part of the Gasconade (Ref. 47, Sheets 1-4). The Ditch Creek Fault System passes through the Horseshoe Road neighborhood where several Level I targets are located. The bedrock map for the Richwoods quadrangle includes a geological cross-section showing this fault zone in the Horseshoe Road area (Ref. 47, sheets 1-4).

<u>Ozark Aquifer – Regional</u>
Ground water is the principal source of public and private water supplies in the area. The Cambrian Eminence and Potosi dolomites along with younger Ordovician rocks, present northeast of the Valles Mine-Vineland Fault Zone, form the Ozark Aquifer. The Ozark Aquifer is the most important aquifer in the Salem Plateau, providing water for nearly every, town, city, rural water district, and the vast majority of private wells in the area (Ref. 41, p. 19). Of the Ozark aquifer formations, the Potosi dolomite is the most prolific and reliable aquifer. In its outcrop area or where it is near surface, such as in the mine area, the Potosi dolomite generally produces water at about 20 to 30 gallons per minute (Ref. 41, p. 19). The upper part of the Eminence yields 50 to 75 gallons per minute (gpm), principally due to secondary porosity developed along fractures (Ref. 41, p. 20).

The Ozark aquifer is regionally considered to be unconfined; however, deeper units can be locally confined or semiconfined in some areas because of local rock characteristics. The Ozark aquifer consists of relatively permeable horizontal zones separated by less permeable zones (Ref. 41, p. 21).

The direction of shallow ground water flow is controlled by many factors. In areas lacking karst development, flow in the shallower units is usually controlled by topography, with ground water elevations highest along topographic divides and lowest along streams. Ground water flow in these areas is towards the local drainage. Deeper ground water movement is generally dependent on the region dip of the rocks, away from the St. Francis Mountains. Although primary permeability accounts for some ground water flow, secondary porosity provided by faulting, jointing, fracturing, and dissolution of carbonate rock has a greater influence on current hydrologic conditions in the Salem Plateau (Ref. 41, p. 21).

The MEGA database includes data on certified well depths and static water levels. Certified wells included in MEGA around the Twin Barite area have well depths of about 210 to 450 feet, with intervals of broken or fractured limestone and chert bedrock being logged (Ref. 43). Known depths for the Level I target wells are similar, ranging from 250 to 400 feet (Ref. 51; Section 3.1.1 of the HRS documentation record). Based on the well depths and likely thicknesses of the faulted strata, the private wells appear to be producing from the regional Ozark Aquifer. Reference 52 presents MEGA database information for regional groundwater elevations, bedrock geology, major geological faults, certified wells and MDNR well logs combined in a map with the Twin Barite tailings pond and nearby Level I targets. This Figure shows the Level I target wells downgradient of the Twin Barite tailings pond and younger rocks in contact with older rocks across fault lines (Refs. 43 and 52).

Because dissolution and fracturing have created abundant secondary porosity in the Ozark aquifer, hydraulic properties vary with direction. Horizontal hydraulic conductivities typically range from 0.001 to 86 feet per day (ft/day), and yields range from 50 to 100 gpm (Ref. 44, p. 49). Permeable residuum coupled with karst features produce complex ground water conditions, with rapid percolation of waters to the bedrock aquifers. Municipal wells completed at depths of 950 to 1,500 feet below ground surface have shown increased turbidity following rainstorms, illustrating the rapidity of the recharge from the surface (Ref. 44, p. 49).

In addition, mine shafts or tunnels and deep exploratory borings could also act as conduits for ground water flow both vertically and laterally. Because of these features, ground water flow may not always follow topography or, for deeper ground water, the generally northwestern regional flow towards the Meramec River (Ref. 41, pp. 11-12).

<u>Aquifer/Stratum Name: Ozark Aquifer (Jefferson City, Gasconade, Roubidoux, Eminence, and Potosi)</u>

The area around the Twin Barite tailings pond has been disrupted by numerous faults and associated fracturing or folding. The uppermost bedrock varies from the Ordovician-aged Gasconade to the Cambrian Potosi, depending on location. In general, fault blocks towards the northeast and northwest are down-dropped relative to those of the Richwoods Horst Block to the southwest. This has brought the younger strata into lateral contact with the older rocks. The geologic bedrock map and MDNR well logs indicate the Eminence dolomite is the uppermost bedrock near Source 1; however, it has eroded and may be thin. In other locations it has been down-faulted and the overlying strata are still present (Refs. 47; 52). MDNR well log number 028431, a foundation test hole in the Twin Barite area, indicated that 155 feet of Eminence Dolomite was present beneath about 100 feet of Gasconade (Ref. 43).

The Potosi Dolomite is the major host rock for the lead and barite ores mined in the source areas and is the main bedrock unit outcropping in the Dresser Mine #11 area as well as underlying the tailings pile at the Twin Barite Plant area. The dolomite consists of dark brown to gray to tan (at bottom) medium- to finely-crystalline dolomite. Dissolution, mineralization and secondary alteration are prevalent along structural features and associated fractures. The Potosi dolomite averages 250 feet thick; however, the thickness may vary due to erosion and faulting (Ref. 47, sheet 1-4). Based on Section 3.1.2.4 of the HRS, the karst Potosi dolomite is assigned a hydraulic conductivity of $1x10^{-2}$ cm/sec.

The Eminence and Potosi dolomites are the lowermost units of the Ozark Aquifer system. The same hydraulic conductivity is assigned to these karst dolomites (Ref. 44, pp. 10 – 11; 47, sheets 1- 4; HRS Section 3.1.2.4).

Aquifer/Stratum Name: St. Francois Confining Unit—Derby-Doe Run Dolomite and Davis Formation
Underlying the Ozark aquifer is the St. Francois confining unit, consisting of the lower permeable Elvins Group (Ref 41, p. 9, 19; 44, p. 10). The St. Francois confining unit is saturated, but its hydraulic conductivity is generally too low to yield appreciable water (Ref. 41, p. 19). These confining units hydrologically separate the overlying Ozark aquifer from the deeper St. Francois aquifer; however, they only restrict rather than prevent water interchange between the two units (Ref. 41, p. 15).

Penetration of the St. Francois confining unit could increase the ability of contaminants to enter the underlying St. Francois aquifer. Where both the Ozark aquifer and the St. Francois aquifer are open to a well, it is possible that water from the shallow Ozark aquifer formations infiltrates the deeper Lamotte. Because the potentiometric surface of the Ozark aquifer is generally above that of the Lamotte, the potential exists for down-hole water movement in the well during non-pumping periods (Ref. 41, p. 16).

Aquifer/Stratum Name: St. Francois Aquifer—Bonneterre Dolomite and Lamotte Sandstones
The St. Francois aquifer underlies the St. Francois confining unit and consists of Cambrian-age dolomites, and limestones of the Bonneterre Formation and the underlying Lamotte Sandstone (Ref. 41, pp. 7-9). The St. Francois aquifer is used in the unconfined outcrop area around the St. Francois Mountains, where it is the only local source of ground water (Ref. 41, p. 15). This aquifer is rarely used where it is confined, because the thicker overlying Ozark Aquifer is more readily available. Consequently, in the site area, the St. Francis Aquifer is not considered to be a significant source of ground water. Horizontal hydraulic conductivities in the St. Francois aquifer range from 0.1 to 8.6 ft/day and yields range from 100 to 500 gpm (Ref. 44, p. 50). The Lamotte Sandstone is responsible for most of the water produced from the St. Francois aquifer. The overlying Bonneterre typically has low hydraulic conductivity and yields only modest quantities of water (Ref. 41, p. 14).

SUMMARY OF AQUIFER(S) BEING EVALUATED

Table 7

Aquifer No.	Aquifer Name	Is Aquifer Interconnected with Upper Aquifer within 2 miles? (Y/N/NA)	Is Aquifer Continuous Within 4-mile TDL? (Y/N)	Is Aquifer Karst? (Y/N)
1	Ozark Aquifer	Yes	Yes	N *

Note

* Insufficient data to document karst throughout area.

3.1 LIKELIHOOD OF RELEASE

3.1.1 OBSERVED RELEASE

Aquifer Being Evaluated: 1

Chemical Analysis

In support of the CERCLA assessment activities, EPA collected ground water samples from various private drinking water wells. Ground water sample locations are presented in Figure 1 of Reference 39 (Ref. 39). In addition, Reference 52 depicts contaminated wells downgradient of Source 1 and background wells that are cross-gradient and outside of the influence of the source. A total of 92 samples contained lead at concentrations above the MCL of 15 µg/L (Ref. 4, p. 11). A comparison between the dissolved and total lead in the well samples revealed that all samples had relative percent differences (RPD) of less than 5 percent, indicating the lead existed overwhelmingly in a dissolved form (Ref. 4, p. 19). Because of human health concerns, EPA investigative actions are ongoing to characterize and mitigate exposure to contamination in the area. For scoring purposes, only targets associated with Source 1 with lead contamination have been used in this documentation record.

- Background Concentrations:

Table 8

Date	Sample Number/ Location	Hazardous Substance	Result (µg/L)	SQL (µg/L)	Appx. Well Elev. (ft amsl)	Well Depth (ft bgs)	Elev. of Total Depth (ft amsl)	References
03/19/2007	3388-40/ JC-0296	Lead	1U	1.00	600	268	332	4, pp. 846, 859, 875, 917; 5, pp. 296-297; 23, pp. 1, 5; 52
09/27/2006	3222-113/ JC-0129	Lead	1U	1.00	660	310	350	4, pp. 306-307, 578, 587, 589; 17, pp. 1, 5; 52

Notes:

Appx. Approximate elevations from topographic map (Ref. 3)
ft amsl Feet above mean sea level
ft bgs Feet below ground surface
SQL Sample quantitation limit
Unk Unknown
U Analyte is analyzed for but not detected above the reported detection limit or sample quantitation limit.

- Contaminated Samples:

Table 9								
Sample Number/ Location	**Analyte**	**Result (µg/L)**	**Date**	**SQL (µg/L)**	**Appx. Well Elev. (ft amsl)**	**Well Depth (ft bgs)**	**Elev. of Total Depth (ft amsl)**	**References**
3388-032/ JC-0226	Lead	19.4	3/15/2007	1	650	330	320	4, pp. 875, 909; 23, p. 4; 39; 51, pp. 5-6
3388-048/ JC-0318	Lead	21.6	3/12/2007	1	730	280	450	4, pp. 875, 925; 23, p. 6; 39; 5, 340-341
3388-034/ JC-0290	Lead	22	3/20/2007	1	760	Unk.	Unk.	4, pp. 875, 911; 23, p. 6; 39; 51, 7-8
3388-038/ JC-0294	Lead	22.7	3/23/2007	1	720	300	420	4, pp. 875, 915; 23, p. 5; 39; 51, p. 13-14
3388-045/ JC-0312	Lead	22.7	3/19/2007	1	770	250	520	4, pp. 875, 922; 23, p. 6; 39; 51, p.15-16
3388-035/ JC-0291	Lead	24.6	3/15/2007	1	820	400	420	4, pp. 875, 912; 23, p. 5; 39; 51, p. 9-10
3388-046/ JC-0316	Lead	25.7	3/12/2007	1	740	Unk.	Unk.	4, pp. 875, 923; 23, p. 6; 39; 51, p. 17-18
3388-068/ JC-0358	Lead	32.7	3/20/2007	1	760	250	510	4, pp. 877, 945; 23, p. 9; 39; 51, p. 21-22
3416-012/ JC-0360	Lead	34.1	3/23/2007	1	780	Unk.	Unk.	4, pp. 981, 994; 24, p. 2; 39; 51, p. 23-24
3388-108/ JC-0353	Lead	43.1	3/19/2007	1	740	Unk.	Unk.	4, pp. 876, 958; 23, p. 10; 39; 51, p. 19-20

Notes:

Appx.	Approximate elevations from topographic map (Ref. 3, 4)
ft amsl	Feet above mean sea level
ft bgs	Feet below ground surface
SQL	Sample quantitation limit (ug/L)
Unk	Unknown

Comparison of Background Wells with Target Wells

Elevations and depths for the background wells as identified in Table 8 (above) are similar to the well depths and elevations for the Level 1 samples identified in Table 9. Bedrock in the area is highly faulted Ordovician-aged Gasconade (generally at higher elevations) and the underlying Cambrian Eminence and Potosi (Refs. 43; 47, sheets 1-4; 52). All of these rocks are part of the same Ozark Aquifer (Ref. 41, p. 8; 44, p. 11). Elevations for the base of the well indicate the wells would be completed in the Ozark aquifer. Typically, wells are constructed as open hole beneath about 80 feet of casing (Ref. 41, p. 25).

Attribution

Mining in Jefferson County has a long history dating back hundreds of years into the 1700's. Numerous small mines rapidly opened throughout western Jefferson County, and produced as much as 1,500 pounds of ore per day. Jefferson County became more prominent after 1800. Early mining was done by farmers who operated small mines during the winter to support their income (Ref. 9, p. 1).

Elevated levels of lead have been detected in both the soil and ground water collected from the Southwest Jefferson County Mining site during past sampling activities (Ref. 4, p. 9). There were concerns on the recovery methods of the mining and milling processes in Jefferson County during the timeframe in which hand mining was performed. Much of the barite was left behind during excavation and the fine materials were typically left or lost during the process. Once the ore was excavated it was then transported to the washer plants for cleansing (Ref. 40, pp. 6-9). Mining process in the area has contributed to the heavy metal contamination in the residential yards and ground water throughout the site (Ref. 4, pp. 9, 23).

As depicted in References 39, 48 (page 85 and 87), and 52, the private wells used in scoring the site are downgradient and near Source 1.

As discussed in Section 2.2.1 of this documentation record, mine tailings were observed at Source 1, which is located upgradient of contaminated drinking water wells used for scoring purposes (Ref. 48, pp. 94-100; 52). In addition, Reference 53 depicts the footprint of Source 1, as documented by MDNR during its 208 Strategy Study from 1982. Therefore, since no other source is known to be between the background wells and the release wells, the contamination in the release wells can be attributed to the site.

Hazardous Substances Released

Lead

Ground Water Observed Release Factor Value: 550.00

3.2 WASTE CHARACTERISTICS

3.2.1 TOXICITY/MOBILITY

Table 10

Toxicity and Mobility

Hazardous Substance	Source No.	Toxicity Factor Value	Mobility Factor Value	Does Haz. Substance Meet Observed Release? (Yes/No)	Toxicity/ Mobility (Table 3-9)	Reference
Arsenic	1	10,000	1.0 E-2	N	100	Ref. 2, p. 2, 3
Barium	1	10,000	1.0E-2	N	100	Ref. 2, p. 4, 5
Cadmium	1	10,000	1.0E-2	N	100	Ref. 2, p. 6, 7
Lead	OR, 1	10,000	1	Yes	10,000	Ref. 2, p. 8, 9

Toxicity/Mobility Factor Value: 10,000.00
(Ref. 1, Table 3-9)

3.2.2 HAZARDOUS WASTE QUANTITY

Table 11

Source No.	Source Type	Source Hazardous Waste Quantity
1	Pile	301,569

Sum of Values: 301,569

Hazardous Waste Quantity Factor Value: 10,000.00
(Ref. 1 Table 2-6)

3.2.3 WASTE CHARACTERISTICS FACTOR CATEGORY VALUE

Toxicity/Mobility Factor Value: 10,000.00
Hazardous Waste Quantity Factor Value: 10,000.00

Toxicity/Mobility Factor Value X
Hazardous Waste Quantity Factor Value: 100,000,000.00

Waste Characteristics Factor Category Value: 100.00
(Ref. 1, Tables 2-7 and 3-1)

3.3 TARGETS

3.3.1 NEAREST WELL

Per Table in Section 3.3.2.2 of the documentation record, lead concentrations were found in numerous drinking water wells at concentrations meeting observed release criteria and above the MCL. Therefore, subject to Level I lead concentrations. Per Section 3.3.1 of the HRS, if one of more drinking water wells is subject to Level I contamination, a Nearest Well Factor Value of 50.00 is assigned. (Ref. 1, p. 51602-51603; 2, pg. 9). Sample 3416-012 collected from a private drinking water well located at sampling location JC-0360 has been used to assign the nearest well value; this well served two residents (4, pp. 981, 994; 5, pp. 422-423; 24, p. 2; 39; 51, pp. 23-24).

Table 12							
Sample #	**Location**	**Analyte**	**Result**	**Units**	**Date**	**Sample Quantitation Limit**	**References**
3416-012	JC-0360	Lead	34.1	ug/L	3/23/2007	1	4, pp. 981, 994; 24, p. 2; 39; 52

Nearest Well Factor Value: 50.00
(Ref. 1, Table 3-11)

3.3.2 POPULATION

3.3.2.1 Level of Contamination

The number of persons in a household is listed on the field sheets presented in Reference 51. The population associated with all private wells subject to Level I concentration is based on the number of persons living in that household. Although past investigative sampling data suggested additional residents subject to Level I contamination, only 36 individuals documented in the table below were considered for scoring purposes.

3.3.2.2 Level I Concentrations

Table 13								
Sample #	**Location**	**Analyte**	**Result**	**Units**	**Date**	**Sample Quantitation Limit**	**Persons**	**References**
3388-032	**JC-0226**	Lead	19.4	ug/L	3/15/2007	1	3	4, pp. 875, 909; 5, pp. 172-173; 23, p. 4; 39; 51, pp. 5-6
3388-048	**JC-0318**	Lead	21.6	ug/L	3/16/2007	1	1	4, pp. 875, 925; 5, pp. 340-341; 23, p. 6; 39
3388-034	**JC-0290**	Lead	22	ug/L	3/12/2007	1	3	4, pp. 875,

Table 13								
Sample #	**Location**	**Analyte**	**Result**	**Units**	**Date**	**Sample Quantitation Limit**	**Persons**	**References**
								911; 5, pp. 284-285; 23, p. 5; 39; 51, pp. 7-8
3388-038	**JC-0294**	Lead	22.7	ug/L	3/14/2007	1	2	4, pp. 875, 915; 5, pp. 292-293; 23, p. 5; 39; 51, pp. 13-14
3388-045	**JC-0312**	Lead	22.7	ug/L	3/6/2007	1	14	4, pp. 875, 922; 5, pp. 328-329; 23, p. 6; 39; 51, pp. 15-16
3388-035	**JC-0291**	Lead	24.6	ug/L	3/15/2007	1	1	4, pp. 875, 912; 5, pp. 286-287; 23, p. 5; 39; 51, pp. 9-10
3388-046	**JC-0316**	Lead	25.7	ug/L	3/12/2007	1	6	4, pp. 875, 923;5, pp. 336-337; 23, p. 6; 39; 51, pp. 17-18
3388-068	**JC-0358**	Lead	32.7	ug/L	3/20/2007	1	2	4, pp. 877, 945; 5, pp. 418-419; 23, p. 9; 39
3416-012	**JC-0360**	Lead	34.1	ug/L	3/23/2007	1	2	4, pp. 981, 994; 5, pp. 422-423; 24, p. 2; 39; 51, pp. 23-24
3388-108	**JC-0353**	Lead	43.1	ug/L	3/19/2007	1	2	4, pp. 876, 958; 5, pp. 408-409; 23, p. 10; 39; 51, pp. 19-20

Sum of Population Served by Level I Wells: 36
Sum of Population Served by Level I Wells x 10: 360

Level I Concentrations Factor Value: 360

3.3.2.3 Level II Concentrations

Not Scored.

Sum of Population Served by Level II Wells: Not Scored

Level II Concentrations Factor Value: Not Scored

3.3.2.4 Potential Contamination

Not Scored

3.3.3 RESOURCES

Not Scored

Resources Factor Value: Not Scored

3.3.4 WELLHEAD PROTECTION AREA

Not Scored

Wellhead Protection Area Factor Value: Not Scored

4.0 SURFACE WATER MIGRATION PATHWAY

4.1 OVERLAND/FLOOD MIGRATION COMPONENT

4.1.1.1 Definition of Hazardous Substance Migration Path for Overland/Flood Component

Most of the larger cities in Jefferson County occur in the Cahokia-Joachim watershed, including Desoto, Olympian Village, and the communities along the Mississippi River. However, the community of Dittmer is located on the Big watersheds, as defined by USGS Hydrologic Unit 07140104. Numerous creeks and rivers drain associated watersheds in this area, primarily draining towards the Big River. The Big River is the primary surface water feature in the general vicinity of the site (Ref. 3, pp. 1-2; 48, p. 24).

For the HRS scoring purposes, the surface water migration pathway evaluation is limited to Source 1, which is a pond/fishery. It is situated on the western portion of Southwest Jefferson County Lead site, immediately east of the Washington County border line (Ref. 3; 48, pp. 85 – 86). An unnamed intermittent creek enters the source from the south and exists through its northern portion (Ref. 3; 48, p. 87).

A 1.2-acre Palustrine, scrub shrub wetland with an approximately 904 feet perimeter is located within Source 1 (Ref. 48, p. 25; 50, pp. 1-2). The entire area on the western portion of Source 1 constituting the wetland has been classified by the USFWS as: Palustrine, Scrub Shrub, Broad-Leaved Deciduous, Artificially Flooded, Diked/Impounded, (Ref. 50, p. 3).

Because the probable point of entry (PPE) is located in the source, and the delineated wetland area is in it (Twin Barite Tailings Pond), the wetland perimeter is included for the HRS evaluation (Ref. 11, p. 1; 50, pp. 1-3). Because the wetland is located in surface water as defined by the HRS, no overland migration route or single PPE is defined for the evaluation purposes (see definitions in Reference 1, Section 4.0.2 and 4.1.1.1, p. 51605). The 15-mile Target Distance Limit was not evaluated beyond Source 1.

Source 1 is also a documented human food chain fishery (Ref. 11, p.1; 50, pp. 1-3).

4.1.2.1 LIKELIHOOD OF RELEASE

4.1.2.1.1 Observed Release

An observed release by direct observation can be documented to the surface water migration pathway.

Direct Observation

- Basis for Direct Observation

Based on the USGS NWI map, an HRS eligible wetland and fishery are located within the boundaries of Source 1 (Ref. 11, p. 1; 50, pp. 1-3). By definition, the deposition of the tailings containing hazardous substances at the wetland and fishery qualifies as an observed release by direct observation to surface water (Ref. 1, Section 4.1.2.1.1, p. 51609; Section 2.2.2 and Table 2 of this HRS documentation record).

This observed release by direct observation is also supported by photographs taken during the 2008 SI and the MDNR Strategy 208 Study (Ref. 1, Section 4.1.2.1.1, p. 51609; 48, pp. 99-100, 102-103; 53).

- Hazardous Substances in the Release

Hazardous substances associated with Source 1 were identified during the 2008 SI sampling. Analysis of the samples by EPA laboratory confirmed the presence of arsenic, barium, cadmium, and lead. The analytical data from these samples are summarized in Table 2 in Section 2.2.2.

In accordance with Section 4.1.2.1.1 (Ref. 1, p. 51609), an observed release factor value of 550 is assigned below and on line 1 of Table 4-1. Potential to release is not evaluated.

Likelihood of Release Value: 550

4.1.3.2 Waste Characteristics

4.1.3.2.1 Toxicity/Persistence/Bioaccumulation

Table 14						
Hazardous Substance	**Source Number /OR**	**Toxicity Factor Value**	**Persistence Factor Value[1]**	**Bioaccumulation Value[2]**	**Toxicity/Persistence/ Bioaccumulation Factor Value[2] (Table 4-16)[3]**	**Reference**
Arsenic	1/OR	10,000	1	5	50,000	2, pp. 2, 3
Barium	1/OR	10,000	1	500	5×10^6	2, pp. 4, 5
Cadmium	1/OR	10,000	1	5,000	$5x10^7$	2, pp. 6, 7
Lead	1/OR	10,000	1	5	50,000	2, pp. 8, 9

Notes:

1 - Persistence factor value for lake was used.
2 - Freshwater bioaccumulation factor values were used.
3 - Table found in Reference 1, page 51619
OR Observed Release

The compound with the highest toxicity/persistence/bioaccumulation factor value is cadmium. Its assigned value of 5×10^7 is entered below and on line 15 of Table 4-1.

4.1.3.2.2 Hazardous Waste Quantity

Table 15		
Source Number	**Source Hazardous Waste Quantity Value (Section 2.4.2.1.5)**	**Is Source Hazardous Constituent Quantity Data Complete? (yes/no)**
1. Twin Barite Tailings Pond	301,569	no
Sum of Values:	301,569	

A hazardous waste quantity value of 10,000 is selected from Table 2-6 of the HRS (Ref. 1, p. 51591) based on the Source Hazardous Waste Quantity Value of 301,569. This value is entered below and on line 16 of Table 4-1.

4.1.3.2.3 Waste Characteristics Factor Category Value

A waste characteristics product is computed by multiplying the toxicity/persistence factor value by the hazardous waste quantity factor value (the product of which is subject to a maximum of 1×10^8) and then multiplying that number by the bioaccumulation potential factor value. This product (subject to a maximum of 1×10^{12}) is then entered into Table 2-7 (Ref. 1, p. 51592) to obtain a waste characteristics factor category value. Cadmium yields the highest waste characteristics factor value.

Toxicity/persistence factor value × hazardous waste quantity factor value: 1×10^8
$10{,}000 \times 10{,}000 = 1 \times 10^8$

(Toxicity/persistence x hazardous waste quantity) × bioaccumulation potential factor value: 5×10^{11}
$1 \times 10^8 \times 5{,}000 = 5 \times 10^{11}$

Waste Characteristics Value: 560

4.1.3.3 Human Food Chain Threat-Targets

Twin Barite Tailings Pond or Source 1 is stocked and regularly fished. Greater than 20 pounds, if not 100 pounds or more, of fish are taken out of the pond for consumption annually (Ref. 11, p. 1). Hazardous substances with a bioaccumulation value of 500 or greater have been documented in this fishery (See Section 4.1.3.2.1 of this HRS documentation record). Therefore, it is an HRS-qualified human food chain fishery (Ref. 1, Section 4.1.3.3, p. 51620).

4.1.3.3.1 Food Chain Individual

There is an observed release of hazardous substances having a BCFV of 500 or greater to the watershed. A known fishery is subject to Level II actual contamination. Therefore, a food chain individual factor value of 45 is assigned.

Food Chain Individual Value: 45

4.1.3.3.2 Population

4.1.3.3.2.1 Level I Concentrations

No zone of Level I contamination has been identified for any fishery at this time.

4.1.3.3.2.2 Level II Concentrations

An observed release by direct observation has been documented in Source 1 (see Section 4.1.2.1.1 of this HRS documentation record). Because the PPE to surface water is located in Source 1 and the fishery is located wholly within Source 1, the entire fishery is evaluated as actually contaminated at Level II concentrations (see HRS Section 4.1.1.2). Based on confirmed consumption of greater than 20 pounds of fish from Source 1, a value of 0.03 is assigned for Level II Concentrations Factor Value (Ref. 11; HRS Table 4-18).

Level II Concentrations Factor Value: 0.03

4.1.3.3.2.3 Potential Human Food Chain Contamination

Not scored.

4.1.4.2 WASTE CHARACTERISTICS

4.1.4.2.1 Ecosystem Toxicity/Persistence/Bioaccumulation

Table 16					
Hazardous Substance	**Source Number/ OR**	**Ecosystem Toxicity Factor Value[1]**	**Persistence Factor Value[3]**	**Ecosystem Toxicity/ Persistence Factor Value (Table 4-20)[2]**	**Reference**
Arsenic	1/OR	10	1	10	2, pp. 7, 8
Barium	1/OR	1	1	1	2, pp. 9, 10
Cadmium	1/OR	10,000	1	10,000	2, pp. 9, 10
Lead	1/OR	1,000	1	1,000	2, pp. 13, 14

Notes:

1 Freshwater ecotoxicity values used from Reference 2.
2 Table found in Reference 1, page 51622.
3 Persistence factor value for lakes used.
OR Observed Release

Table 17			
Hazardous Substance	**Ecosystem Toxicity/ Persistence Factor Value**	**EcoBioaccumulation Factor Value[1] (Section 4.1.4.2.1.3)[2]**	**Ecosystem Toxicity/ Persistence/ Bioaccumulation Factor Value (Table 4-21)[3]**
Arsenic	10	5,000	50,000
Barium	1	500	500
Cadmium	10,000	50,000	5×10^{8}
Lead	1,000	50,000	5×10^{7}

Notes:

1 Freshwater bioaccumulation factor values used from Reference 2.
2 Reference 1, page 51622.
3 Table found in Reference 1, page 51623.

An ecosystem toxicity/persistence/bioaccumulation factor value of 500,000,000 (5×10^{8}) is assigned from the table above based on cadmium. This value is entered below and on line 23 in Table 4-1.

4.1.4.2.2 Hazardous Waste Quantity

Table 18		
Source Number	**Source Hazardous Waste Quantity Value (Section 2.4.2.1.5)**	**Is Source Hazardous Constituent Quantity Data Complete? (yes/no)**
1. Twin Barite Tailings Pond	301,569	no
Sum of Values:	301,569	

A hazardous waste quantity value of 10,000 is selected from Table 2-6 of the HRS rule (Ref. 1, p. 51591) based on the Source Hazardous Waste Quantity Value of 301,569. This value is entered below and on line 24 of Table 4-1 found on page 5 of this documentation record.

4.1.4.2.3 Waste Characteristics Factor Category Value

A waste characteristics factor value is computed by first multiplying the ecotoxicity/persistence factor value by the hazardous waste quantity factor value (the product of which is subject to a maximum of 1×10^8) and then multiplying that number by the bioaccumulation potential factor value. This product (subject to a maximum of 1×10^{12}) is then entered into Table 2-7 (Ref. 1, p. 51592) to obtain a waste characteristics factor category value. Of the hazardous substances in Section 4.1.4.2.1 of the HRS documentation record, cadmium produces the highest value. This value is entered below and on line 25 in Table 4-1.

Ecosystem toxicity/persistence factor value × hazardous waste quantity factor value: 1×10^8
$10{,}000 \times 10{,}000 = 1 \times 10^8$

(Ecosystem toxicity/persistence × hazardous waste quantity) × bioaccumulation potential factor value: 1×10^{12}
$1 \times 10^8 \times 50{,}000 = 5 \times 10^{12}$

Waste Characteristics Factor Value: 1,000

4.1.4.3 ENVIRONMENTAL THREAT - TARGETS

4.1.4.3.1 Sensitive Environments

4.1.4.3.1.1 Level I Concentrations

No zones of Level I contamination have been identified.

4.1.4.3.1.2 Level II Concentrations

An observed release by direct observation has been documented in Source 1 (see Section 4.1.2.1.1 of this HRS documentation record). Because the PPE to surface water is located in Source 1 and the wetland is located wholly within Source 1, the wetland is evaluated as actually contaminated at Level II concentrations (see HRS Section 4.1.1.2).

Wetlands

A USFWS defined wetland is located in Source 1 (Refs. 50, pp. 1-2). The entire area wetland on the western portion of the source has been classified by the USFWS:

- Palustrine, Scrub Shrub, Broad-Leaved Deciduous, Artificially Flooded, Diked/Impounded, (Ref. 50, p. 3).

Table 19		
Wetland	**Wetland Frontage**	**Reference**
Perimeter of the wetland	904 feet (0.17 mile)	50, p. 2, 3
Total Wetland Frontage:	904 feet (0.17 mile)	

A wetland value is assigned from Table 4-24 (Ref. 1, p. 51625).

Wetland Value: 25

Sum of Sensitive Environments Value + Wetland Value: 25

This value is entered below and on Table 4-1 line 26b.

Sensitive Environments Level II Value: 25

4.1.4.3.1.3 Potential Contamination

Potential targets in were not scored because they do not contribute significantly to the pathway score.