

FINAL VERSION
SITE HAZARD ASSESSMENT
WORKSHEET 1
Summary Score Sheet

SITE INFORMATION:

Sheridan Mine

Wauconda, Okanogan County, WA 98859

Section/Township/Range: S24 – T38N – R31E

Latitude: 48.77755

Longitude: -118.85766

Ecology Facility Site ID No.: 5672082

Site scored/ranked for the February, 2012 update: January, 2012

SITE DESCRIPTION (management areas, substances of concern, and quantities):

This site is an abandoned gold and silver mine that operated intermittently until 1920. It is reported that the mine produced as much as \$100,000 in ore. Developments include multiple adits on several raises over 500 vertical feet and following a strike for approximately 400 feet. Remains of the mill buildings are still visible on the site, as well as some of the wooden ore chutes. Very little tailings remain on the site, but a large quantity of waste rock is still in place.

Michael Hucton, from the Okanogan County Health District, first visited this site on May 30th, 1995. A single soil sample was collected from the tailings area near the mill, with the results given below. A water sample was also collected from within the uppermost adit, with the results also summarized in the table below.

1995 Sampling Results

Analyte	Surface Water Concentrations (ug/l)	Cleanup Level (ug/l)	Tailings Concentrations (mg/kg)	Cleanup Level (mg/kg)
Arsenic	385	5.0	19.6	20
Cadmium	6.00	5.0	1.50	2.0
Chromium	20.0	50.0	9.70	2000
Lead	24.0	15.0	453.9	250
Mercury	<0.5	2.0	0.03	2.0
Selenium	<5.0	--	1.60	--
Silver	<5.0	--	1.10	--
Copper	<20.0	--	861.6	--
Zinc	1400	--	212	--
Nickel	100	--	273	--
Antimony	<5.0	--	<0.005	--
Beryllium	16.0	--	1.50	--

Cleanup level values reflect Model Toxics Control Act (MTCA) Method A Cleanup Levels for Ground Water and Method A Soil Cleanup Levels for Unrestricted Land Uses.

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On June 14th, 2011, the site was revisited by Douglas Hale, of Okanogan County Public Health, along with Ray Lasmanis, geologist with Washington State Department of Natural Resources. Although recent timber harvest activities have left the hillside criss-crossed with skid trails and piled with logging slash, all of the originally noted features were located. There was substantial surface water flow across most of the surrounding hillside, but none of the adits showed outflow or standing water in quantities that could be sampled. Soil samples were collected from several of the waste rock piles, as well as two locations that were considered to be representative of background conditions. The remains of the mill tailings were not distinguishable from the surrounding soils, and although one sample was collected near the mill site, the results may not reflect mill tailings. Sample results were as follows:

2010 Sampling Results

Analyte	SM001 (mg/kg)	SM002 Background (mg/kg)	SM003 (mg/kg)	SM004 (mg/kg)	SM005 (mg/kg)	SM006 Background (mg/kg)	Cleanup Level (mg/kg)
Arsenic	6.0	<2.5	98.0	40.05	18.7	<2.5	20
Barium	94.0	610	110	116	70.0	276	--
Cadmium	1.2	0.72	0.9	0.92	14.4	0.39	2.0
Chromium	2.46	3.24	2.97	3.44	5.25	4.96	2000
Lead	610	6.4	24.6	22.0	525	5.8	250
Mercury	0.9252	0.033	1.839	0.7332	1.067	0.0267	2.0
Selenium	<2.5	<2.5	<2.5	<2.5	3.34	<2.5	--
Silver	19.4	<0.25	0.74	<0.25	116	<0.25	--

Cleanup level values reflect Model Toxics Control Act (MTCA) Method A Cleanup Levels for Ground Water and Method A Soil Cleanup Levels for Unrestricted Land Uses.



Remains of the old mill structure, and location of sample SM005 (at left).

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View of main waste rock pile below the major adits.



Typical adit partially blocked by soil and rock.

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Except for the main waste rock pile, much of this site is well advanced in natural reclamation. Although the waste rock samples indicate elevated metals concentrations above natural background levels, there appears to be little risk of surface water contamination due to runoff. Topography in this vicinity is extremely steep, making the possibility of widespread aquifer contamination unlikely. Vehicle access is assumed to be minimal, due to the presence of a steel DNR pipe gate located approximately a quarter-mile from the site (although it was unlocked at the time of the site inspection).

SPECIAL CONSIDERATIONS (include limitations in site file data or data which cannot be accommodated in the model, but which are important in evaluating the risk associated with the site, or any other factor(s) over-riding a decision of no further action for the site):

ROUTE SCORES:

Surface Water/Human Health:	<u>8.7</u>	Surface Water/Environmental.:	<u>17.7</u>
Air/Human Health:	<u>2.4</u>	Air/Environmental:	<u>26.2</u>
Groundwater/Human Health:	<u>18.0</u>		

OVERALL RANK: 4

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WORKSHEET 2
Route Documentation

1. **SURFACE WATER ROUTE**

- a. List those substances to be considered for scoring: Source: 1,2
Arsenic, cadmium, lead.
- b. Explain basis for choice of substance(s) to be used in scoring.
Soil sample analysis shows arsenic, cadmium, and lead contamination of on-site soils in excess of MTCA Method A Cleanup Levels for Unrestricted Land Use.
- c. List those management units to be considered for scoring: Source 1,2
Contaminated on-site soils.
- d. Explain basis for choice of unit to be used in scoring:
Analytical confirmation of these contaminants in on-site soils.

2. **AIR ROUTE**

- a. List those substances to be considered for scoring: Source: 1,2
Arsenic, cadmium, lead.
- b. Explain basis for choice of substance(s) to be used in scoring:
Soil sample analysis shows arsenic, cadmium, and lead contamination of on-site soils in excess of MTCA Method A Cleanup Levels for Unrestricted Land Use.
- c. List those management units to be considered for scoring: Source: 1,2
Contaminated on-site soils.
- d. Explain basis for choice of unit to be used in scoring:
Analytical confirmation of these contaminants in on-site soils.

3. **GROUNDWATER ROUTE**

- a. List those substances to be considered for scoring: Source: 1,2
Arsenic, cadmium, lead.
- b. Explain basis for choice of substance(s) to be used in scoring:
Soil sample analysis shows arsenic, cadmium, and lead contamination of on-site soils in excess of MTCA Method A Cleanup Levels for Unrestricted Land Use.
- c. List those management units to be considered for scoring: Source: 1,2
Contaminated on-site soils.
- d. Explain basis for choice of unit to be used in scoring:
Analytical confirmation of these contaminants in on-site soils.

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WORKSHEET 4

Surface Water Route

1.0 SUBSTANCE CHARACTERISTICS

1.1 Human Toxicity										
Substance		Drinking Water Standard (µg/L)	Value	Acute Toxicity (mg/kg-bw)	Value	Chronic Toxicity (mg/kg/day)	Value	Carcinogenicity		Value
								WOE	PF*	
1	Arsenic	10	8	763 (rat)	5	0.001	3	1	1.75	7
2	Cadmium	5	8	225 (rat)	5	0.0005	5	0.8	ND	--
3	Lead	5	8	ND	--	<0.001 NOAEL	10	0.8	ND	--

*Potency Factor

Source: 1, 2, 5

Highest Value: 10

(Max = 10)

Plus 2 Bonus Points? 2

Final Toxicity Value: 12

(Max = 12)

1.2 Environmental Toxicity					
Substance			Acute Water Quality Criteria		Non-Human Mammalian Acute Toxicity
			(µg/L)	Value	(mg/kg) Value
1	Arsenic		360	4	NS --
2	Cadmium		3.9	8	NS --
3	Lead		82	6	NS --

Source: 1, 2, 5

Highest Value: 8

(Max = 10)

1.3 Substance Quantity	
Explain Basis: Disturbed area measured at approximately 6,750 sq. ft. by GIS.	Source: <u>1, 6, 11, 15</u> Value: 7 (Max = 10)

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2.0 MIGRATION POTENTIAL

		Source	Value
2.1	Containment: Management unit scored as a spills/discharges/contaminated soil at the surface, with ineffectively maintained run-on/runoff controls (vegetated buffer). Explain basis: Surrounding vegetation provides an un-maintained barrier to runoff.	<u>1, 6, 15</u>	<u>4</u> (Max = 10)
2.2	Surface Soil Permeability: Sands/gravels/gravelly sandy loam	<u>1, 3, 6</u>	<u>1</u> (Max = 7)
2.3	Total Annual Precipitation: 11.6 inches (based on Oroville station)	<u>6, 7</u>	<u>1</u> (Max = 5)
2.4	Max 2yr/24hr Precipitation: 1.66 in	<u>6, 14</u>	<u>2</u> (Max = 5)
2.5	Flood Plain: Not in a flood plain	<u>8, 11</u>	<u>0</u> (Max = 2)
2.6	Terrain Slope: 40'/65' x 100 = 61.5%	<u>11</u>	<u>5</u> (Max = 5)

3.0 TARGETS

		Source	Value
3.1	Overland Distance to Down-Gradient Surface Water: ~2,420 ft. to E. Fk. Cougar Ck.	<u>11</u>	<u>7</u> (Max = 10)
3.2	Population Served within 2 miles (see WARM Scoring Manual Regarding Direction): $\sqrt{0} = 0$	<u>11</u>	<u>0</u> (Max = 75)
3.3	Area Irrigated by surface water within 2 miles downstream: 0.75 x $\sqrt{\text{acres}} = 0$ (Several water rights exist along Cougar Creek and Toroda Creek within two miles, but no irrigated acreage is indicated.)	<u>9</u>	<u>0</u> (Max = 30)
3.4	Distance to Nearest Down-Gradient Fishery Resource: Over 10,000 ft. to Toroda Creek	<u>10, 11</u>	<u>0</u> (Max = 12)
3.5	Distance to, and Name(s) of, Nearest Down-Gradient Sensitive Environment(s): Site is located on state-managed game land.	<u>10, 11</u>	<u>12</u> (Max = 12)

4.0 RELEASE

Explain Basis: No apparent release.	Source: <u>1, 6, 15</u> Value: 0 (Max = 5)
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WORKSHEET 5

Air Route

1.0 SUBSTANCE CHARACTERISTICS

1.1 Introduction – Review WARM Scoring Manual before scoring

1.2 Human Toxicity										
Substance		Amb. Air Standard (µg/m ³)	Value	Acute Toxicity (mg/ m ³)	Value	Chronic Toxicity (mg/kg/day)	Value	Carcinogenicity		Value
								WOE	PF*	
1	Arsenic	0.00023	10	ND	--	ND	--	1	50	9
2	Cadmium	0.00056	10	25 (rat)	10	ND	--	0.8	6.1	7
3	Lead	0.5	10	ND	--	ND	--	0.8	ND	--

* Potency Factor

Source: 1, 2, 5

Highest Value: 10

(Max = 10)

Plus 2 Bonus Points? 2

Final Toxicity Value: 12

(Max = 12)

1.3 Mobility (Use numbers to refer to above listed substances)				
1.3.1 Gaseous Mobility		1.3.2 Particulate Mobility		
Vapor Pressure(s) (mmHg)		Soil Type	Erodibility	Climatic Factor
1		Sandy loam	86	1 - 10

Source: NA

Value: NS

(Max = 4)

Source: 3,6

Value: 1

(Max = 4)

1.4 Highest Human Health Toxicity/ Mobility Matrix Value (from Table A-7)

Final Matrix Value: 6

(Max = 24)

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1.5 Environmental Toxicity/Mobility						
Substance		Non-human Mammalian Inhalation Toxicity (mg/m ³)	Acute Value	Mobility (mmHg)	Value	Matrix Value
1	Arsenic	ND	--	ND	--	--
2	Cadmium	25 (rat)	10	(particulate)	1	5
3	Lead	ND	--	ND	--	--

Highest Environmental Toxicity/Mobility Matrix Value (from Table A-7)

Final Matrix Value: 5
(Max = 24)

1.6 Substance Quantity	
Explain Basis: Estimated extent of surface soil contamination = approx. 6,750 s.f.	Source: <u>1, 6, 11, 15</u> Value: 5 (Max = 10)

2.0 MIGRATION POTENTIAL

	Source	Value
2.1 Containment: Waste pile outdoors, and uncovered.	<u>1, 6, 15</u>	10 (Max = 10)

3.0 TARGETS

	Source	Value
3.1 Nearest Population: Approximately 2,740 ft.	<u>1, 6, 11</u>	6 (Max = 10)
3.2 Distance to [and name(s) of] nearest sensitive environment(s) [fisheries excluded]: Site is located on state-managed game land.	<u>6, 11</u>	6 (Max = 7)
3.3 Population within 0.5 miles: $\sqrt{\text{pop.}} = 0 \text{ homes} \times 3 \text{ residents} = 0$. $\sqrt{0} = 0$	<u>6, 11</u>	0 (Max = 75)

4.0 RELEASE

Explain Basis for scoring a release to air: None documented	Source: <u>6</u> Value: 0 (Max = 5)
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WORKSHEET 6
Groundwater Route

1.0 SUBSTANCE CHARACTERISTICS

1.2 Human Toxicity										
Substance		Drinking Water Standard (µg/L)	Value	Acute Toxicity (mg/ kg-bw)	Value	Chronic Toxicity (mg/kg/day)	Value	Carcinogenicity		Value
								WOE	PF*	
1	Arsenic	10	8	763 (rat)	5	0.001	3	1	1.75	7
2	Cadmium	5	8	225 (rat)	5	0.0005	5	0.8	ND	--
3	Lead	5	8	ND	--	<0.001 NOAEL	10	0.8	ND	--

* Potency Factor

Source: 1, 2, 5

Highest Value: 10

(Max = 10)

Plus 2 Bonus Points? 2

Final Toxicity Value: 12

(Max = 12)

1.2 Mobility (use numbers to refer to above listed substances)										
Cations/Anions [Coefficient of Aqueous Migration (K)]						OR Solubility (mg/L)				
1	Arsenic >1.0 = 3									
2	Cadmium >1.0 = 3									
3	Lead 0.1 – 1.0 = 2									

Source: 5, 6

Value: 3

(Max = 3)

1.3 Substance Quantity:										
Explain basis: Area is approx. 6,750 s.f., depth of waste rock is estimated at 6'. 6,750 x 6 = 40,500 cu. ft. / 27 = 1,500 cu. yds.									Source: <u>1, 6, 15</u>	
									Value: <u>4</u>	
									(Max=10)	

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2.0 MIGRATION POTENTIAL

		Source	Value
2.1	Containment (explain basis): Waste pile with no liner, no cover, and unmaintained vegetation acting as runoff control ($3 + 2 + 2 + 1 = 8$).	<u>1, 6, 15</u>	<u>8</u> (Max = 10)
2.2	Net precipitation: $6.4'' - 3.0'' = 3.4''$	<u>7</u>	<u>1</u> (Max = 5)
2.3	Subsurface hydraulic conductivity: Sands/gravels/gravelly sandy loam	<u>1, 3, 15</u>	<u>4</u> (Max = 4)
2.4	Vertical depth to groundwater: The nearest recorded well is a dry hole drilled to 100'. Site is 240' above valley floor, scored based on 200-300' vertical depth to groundwater.	<u>3, 6</u>	<u>2</u> (Max = 8)

3.0 TARGETS

		Source	Value
3.1	Groundwater usage: Private supply, no alternates available	<u>1, 9, 13</u>	<u>5</u> (Max = 10)
3.2	Distance to nearest drinking water well: ~2,740'	<u>4, 6, 11</u>	<u>2</u> (Max = 5)
3.3	Population served within 2 miles: $\sqrt{\text{pop.}} = 27 \text{ homes} \times 3 \text{ residents} = 81$; $\sqrt{81} = 9$	<u>6, 11</u>	<u>9</u> (Max = 100)
3.4	Area irrigated by wells within 2 miles: $0.75 \times \sqrt{\text{acres}} = 0.75 \times \sqrt{10} = 2.37$	<u>4, 6, 9</u>	<u>2</u> (Max = 50)

4.0 RELEASE

		Source	Value
	Explain basis for scoring a release to groundwater: None documented	<u>6</u>	<u>0</u> (Max = 5)

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SOURCES USED IN SCORING

1. Initial Investigation site visit by Michael Huchton, May 30th, 1995.
2. Soil sample analysis reports by White Earth Analytical and Cascade Analytical.
3. Soil log(s) on file at Okanogan County Health District.
4. Water Well Reports on file at Okanogan County Health District and/or Washington Department of Ecology.
5. Washington Department of Ecology, Toxicology Database for Use in Washington Ranking Method Scoring, January 1992.
6. Washington Department of Ecology, WARM Scoring Manual, April 1992.
7. See attached table identified as Reference 7.
8. Flood Insurance Rate Maps (FIRM).
9. Ecology Water Rights Information System (WRIS).
10. Washington Department of Fish & Wildlife StreamNet database.
11. GIS data layers provided by Okanogan County Planning Department, composite map is attached as Reference 11.
12. US Census 2000 data.
13. SENTRY Public Water system data from Washington Department of Health.
14. NOAA Atlas II Precipitation Frequency Data Output, site specific estimate.
15. Follow-up visit by Douglas Hale, June 14th, 2011.