

SITE HAZARD ASSESSMENT

WORKSHEET 1

Summary Score Sheet

SITE INFORMATION:

Van Stone Mine

21 Miles N.E. of Colville off Van Stone Road

Colville, Stevens County, WA

Section/Township/Range: Sections 28 – 33/T38N/R40E

Latitude: 48° 45' 38"

Longitude: 117° 45' 24"

Ecology Facility Site ID No.: ~~5418085~~ **FSID: 1554858**

Site scored/ranked for the February 21, 2007 update

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

The Van Stone Mine site is a former cadmium, lead, and zinc mine/mill located in the upper portion of the Onion Creek watershed, 21 miles northeast of Colville, WA, which reportedly was active in 1930, 1937, 1942, and 1952-1956. George Van Stone claimed and worked the mine/mill until 1926, when it was acquired by the Hecla Mining Company, with the Van Stone Mining Company taking ownership in 1930. Other owners/operators include:

- Willow Creek Mines – 1938-1942
- American Smelter and Refining (Asarco) – 1950's-1960's
- Callahan Mining Corporation – 1972-1990

Production through the end of 1956 was 2.24 million tons of ore milled, yielding 10,700 tons of lead concentrates and 120,000 tons of zinc concentrates.

Production at the mine was from two open pits a couple hundred feet south of the Spirit pluton. Rock was removed from the mine (located in the far northeast corner of Section 33), crushed on site, with usable material being trucked off site for further processing. Fine-grained tailings were carried in a slurry via an elevated wooden flume first to the old tailings pile (far northwest corner of the same section), and later to a large tailings pile located in the northeast corner of Section 20/northwest corner of Section 30). The new tailings pile walls were built up from the dried tailings and stand some 50 feet above ground surface. The wooden flume was replaced by flexible pipe during the 1990's.

Equinox Resources, the current owner, acquired the property in 1990 and placed it back into production in 1991, with operations being suspended late in 1992 due to low metal prices.

BACKGROUND/ENVIRONMENTAL SAMPLING

Onion Creek has been categorized by the Washington Department of Ecology (Ecology) as a Class AA (Extraordinary) surface water body. There have been many comprehensive investigations of the

entire Onion Creek watershed carried during the past several decades. This site hazard assessment will focus on several of these to document hazardous contaminants of concern for the purpose of scoring and ranking this site under the Washington Ranking Method (WARM).

A site inspection of the Callahan Mines/former Van Stone Mines site (hereinafter referred to as site) was conducted by Ecology on October 16, 1985, under the U.S. Environmental Protection Agency (EPA) federal Superfund program. This was based on findings from an Ecology Eastern Regional Office (ERO) investigation some 10 years earlier of Onion Creek, the receiving waters for runoff from the two major tailings piles, that showed suspended solids and heavy metals concentrations increasing downstream substantially on reception of tailings runoff, measured during a period of high surface water flow, with serious impact to its water quality and beneficial uses.

A series of water samples were collected from the Middle Fork of Onion Creek, beginning with the mill's water supply dam upstream of both the North and South pits, and concluding downstream below the newer tailings pond. These samples were taken during a period of prolonged low flow runoff and did not show the significant increases in lead and zinc concentrations recorded in the earlier study. However, EP toxicity measurements from a sample of the newer tailings pile showed a value for lead so elevated as to characterize these tailings as a Dangerous Waste by Ecology standards

Ecology & Environment, Inc. conducted a further federal inspection of the site in June of 2001 as part of the EPA Upper Columbia River Mines and Mills study, collecting a series of 12 waste rock, 21 tailings pile, seven surface soil, and five sediment samples throughout the entire mine/mill site. The following table summarizes ranges of analytical results which document specific metal concentrations exceeding their respective Model Toxics Control Act (MTCA) health-based cleanup levels.

Table 1. SOIL SAMPLING RESULTS

Sample Medium	Analyte Found	Sample Result Mg/kg (ppm)	Applicable Standard	(ppm)
Waste rock	Cadmium	27.9 – 234	MTCA A Industrial*	2
	Lead	1,520 – 76,500		1,000
	Mercury	0.26 – 1.5		2
	Zinc	3,450 – 20,600		24,000 ⁺
Tailings	Lead	4,710	“	1000
	Mercury	0.17		2
	Zinc	2,610 – 5,870		24,000 ⁺
Stained soil areas	Cadmium	24.7 – 940	“	1000
	Copper	218 - 461		2960 ⁺
	Lead	771 – 181,000		1000
	Mercury	0.15 – 6.0		2
	Zinc	3,560 – 431,000		24,000 ⁺

*MTCA A Industrial refers to the Model Toxics Control Act Table 745-1 Method A Soil Cleanup Levels for Industrial Properties.

⁺ MTCA Method B

Sediment samples collected from the confluence of the tailings pile and the pond located near the entrance of the mine/mill, and from the northwest corner of the mine pit water area showed significant concentrations of lead and zinc, and cadmium and zinc, respectively. This sufficiently documents historical release of these metals from the site to surface water (Onion Creek) for WARM scoring

purposes, as does more recent surface water sampling data by Ecology ERO collected from October, 18, 2005, and June 14, 2006.

Groundwater sampling data from 1990 – 1994 from a monitoring wells both adjacent and downgradient to the lower (newer) tailings pile area showed significantly high concentrations of both cadmium and lead.

The Van Stone Mine site was added by Ecology to its Confirmed and Suspected Contaminated Sites list on September 6, 2006, having notified the current owners, Equinox Resources, through an Early Notice Letter under MTCA sent September 1, 2006. The site status was: Awaiting Assessment. Ecology contacted Equinox Resources on September 18, 2006, that a site hazard assessment (SHA) would be conducted on the site.

An SHA site visit was made on November 2, 2006, by Michael Spencer, Ecology Toxics Cleanup Program (TCP) Headquarters. Mr. Spencer had also participated in the Site Inspection by Ecology of the North Pit/Onion Creek/tailings pile areas on October 16, 1985, under the EPA federal Superfund program. He met with Equinox Resources representative, Robert Jomphe. A tour of the mill site showed a nearly complete removal of all the crushing/refining equipment. Mr. Jomphe pointed out several areas where small amounts of petroleum-contaminated soils had been scraped up and put into drums. Most of the piping carrying tailings to the newer tailings pile had been taken up and piled along the road.

Water was observed exiting the North Pit pond into a tributary to Onion Creek. The overall appearance of both the North Pit and the newer tailing pile had not changed appreciably from what was seen and documented some twenty years earlier. No actual cleanup/containment of the mine pit or waste tailings piles has occurred.

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):

The scoring and ranking of this site was based on site-specific results from environmental samples collected throughout October 1985 - 1994, with reference to studies done as early as 1975-76. No new sampling data was generated during the SHA process. The ranking represents the overall relative threat to human health and the environment based on Washington Ranking Method (WARM) scoring elements reflecting components (mine pit pond, wastes piles, Onion Creek, etc.) of the entire site property (T38N, R40E, Sections 28 through 33).

ROUTE SCORES:

Surface Water/Human Health:	<u>38.3</u>	Surface Water/Environmental.:	<u>67.8</u>
Air/Human Health:	<u>14.8</u>	Air/Environmental:	<u>60.9</u>
Groundwater/Human Health:	<u>40.8</u>		

OVERALL RANK: 1

WORKSHEET 2
Route Documentation

1. **SURFACE WATER ROUTE**

- a. List those substances to be considered for scoring: Source: 1-3
Cadmium, copper, lead, mercury, and zinc
- b. Explain basis for choice of substance(s) to be used in scoring.
These metals were detected in either surface soils, waste rock, or tailings at the site in significant concentrations compared to their acceptable regulatory levels.
- c. List those management units to be considered for scoring: Source 1-4
Surface soils.
- d. Explain basis for choice of unit to be used in scoring:
The contaminating substances were detected in either surface soils, waste rock, or tailings at the site in significant concentrations compared to their acceptable regulatory levels, and for which there are no significant barriers to their migration in this route.

2. **AIR ROUTE**

- a. List those substances to be considered for scoring: Source: 1-3
Cadmium, copper, lead, mercury, and zinc
- b. Explain basis for choice of substance(s) to be used in scoring:
These metals were detected in either surface soils, waste rock, or tailings at the site in significant concentrations compared to their acceptable regulatory levels.
- c. List those management units to be considered for scoring: Source 1-4
Surface soils.
- d. Explain basis for choice of unit to be used in scoring:
The contaminating substances were detected in either surface soils, waste rock, or tailings at the site in significant concentrations compared to their acceptable regulatory levels, and for which there are no significant barriers to their migration in this route

3. GROUNDWATER ROUTE

- a. List those substances to be considered for scoring:

Source: 1-3

Cadmium, copper, lead, mercury, and zinc

- b. Explain basis for choice of substance(s) to be used in scoring:

These metals were detected in either surface soils, waste rock, or tailings at the site in significant concentrations compared to their acceptable regulatory levels.

- c. List those management units to be considered for scoring:

Surface soils.

Source: 1-4

- d. Explain basis for choice of unit to be used in scoring:

The contaminating substances were detected in either surface soils, waste rock, or tailings at the site in significant concentrations compared to their acceptable regulatory levels, and for which there are no significant barriers to their migration in this route.

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	Cadmium	5	8	225 (rat)	5	0.0005	5	ND	ND	-
2	Copper	1300	2	ND	-	0.037	1	ND	ND	-
3	Lead	5	8	ND	-	<0.001 NOAEL	10	ND	ND	-
4	Mercury	2	8	ND	-	0.0003	5	ND	ND	-
5	Zinc	4000	2	ND	-	0.2	1	ND	ND	-

* Potency Factor

Source: 1-3,4

Highest Value: 10

(Max = 10)

Plus 2 Bonus Points? 2

Final Toxicity Value: 12

(Max = 12)

1.2 Environmental Toxicity (X) Freshwater () Marine					
Substance	Acute Water Quality Criteria		Non-Human Mammalian Acute Toxicity		
	(µg/L)	Value	(mg/kg)	Value	
1	Cadmium	3.9	8	-	-
2	Copper	18	6	-	-
3	Lead	82	6	-	-
4	Mercury	2.4	8	-	-
5	Zinc	120	4	-	-

Source: 1-3,4

Highest Value: 8

(Max = 10)

1.3 Substance Quantity	
Explain Basis: > 10 acres	Source: <u>1,2,4,5</u> Value: 10 (Max = 10)

2.0 MIGRATION POTENTIAL

		Source	Value
2.1	Containment: Maximum value of 10 points scored. Explain basis: Surface soil contamination no run-on/runoff controls.	1-3, 5	<u>10</u> (Max = 10)
2.2	Surface Soil Permeability: Sands with fines, silts	1,2,5	<u>3</u> (Max = 7)
2.3	Total Annual Precipitation: the average total precipitation for the area is approx. 20"	7	<u>2</u> (Max = 5)
2.4	Max 2yr/24hr Precipitation: 1.4 inches	5	<u>2</u> (Max = 5)
2.5	Flood Plain: Not in flood plain	1,2,4	<u>0</u> (Max = 2)
2.6	Terrain Slope: >8%	1,2,4	<u>5</u> (Max = 5)

3.0 TARGETS

		Source	Value
3.1	Distance to Surface Water: <1000' feet	1,2,10	<u>10</u> (Max = 10)
3.2	Population Served within 2 miles (see WARM Scoring Manual Regarding Direction): $\sqrt{(10 \times 3)} = 5.47 = 5$	8,9	<u>5</u> (Max = 75)
3.3	Area Irrigated by surface water within 2 miles: $(0.75) * \sqrt{\# \text{ acres}} = 0.75 * \sqrt{39} = 6.2 = 6$	8,9	<u>6</u> (Max = 30)
3.4	Distance to Nearest Fishery Resource: <1000 feet	2,4,9	<u>12</u> (Max = 12)
3.5	Distance to, and Name(s) of, Nearest Sensitive Environment(s): fishery resource <1000 feet	2,4,9	<u>12</u> (Max = 12)

4.0 RELEASE

Explain Basis: Documented by analytical data over many years of sampling	Source: <u>1-3</u> Value: 5 (Max = 5)
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WORKSHEET 5

Air Route

1.0 SUBSTANCE CHARACTERISTICS

1.1. Introduction (WARM Scoring Manual) – Please review before scoring

1.2 Human Toxicity										
	Substance	Air Standard (µg/m ³)	Value	Acute Toxicity (mg/m ³)	Value	Chronic Toxicity (mg/kg/day)	Value	Carcinogenicity		Value
								WOE	PF*	
1	Cadmium	0.00056	10	25 (rat)	10	ND	-	B1=0.8	6.1=7	6
2	Copper	3.3	9	ND	-	ND	-	ND	ND	-
3	Lead	0.5	10	ND	-	ND	-	ND	ND	-
4	Mercury	0.3	10	ND	-	8.5E-05	8	ND	ND	-
5	Zinc	ND	-	ND	-	ND	-	ND	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		Fine to medium sands	>220	1-10
2				
3				

Source:

Value:
(Max = 4)

Source: 1,2,6

Value: 3
(Max = 4)

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

Final Matrix Value: 18

(Max = 24)

1.5 Environmental Toxicity/Mobility						
	Substance	Non-human Mammalian Inhalation Toxicity (mg/m ³)	Acute Value	Mobility (mmHg)	Value	Matrix Value
1	Cadmium	25	10	(Particulate)	3	15
2						

Highest Environmental Toxicity/Mobility Matrix Value (Table A-7) = **Final Matrix Value: 15**
(Max = 24)

1.6 Substance Quantity	
Explain Basis: >39 – 194 acres	Source: <u>1-4</u> Value: <u>9</u> (Max = 10)

2.0 MIGRATION POTENTIAL

		Source	Value
2.1	Containment: Waste pile outdoors, and uncovered	1,2,4	<u>10</u> (Max = 10)

3.0 TARGETS

		Source	Value
3.1	Nearest Population: < 1000'	1,2,4	<u>10</u> (Max = 10)
3.2	Distance to [and name(s) of] nearest sensitive environment(s): Freshwater wetlands <1000'	1-3, 9	<u>7</u> (Max = 7)
3.3	Population within 0.5 miles: $\sqrt{69} = 8.2 = 8$	1,2,4,8-10	<u>8</u> (Max = 75)

4.0 RELEASE

Explain Basis for scoring a release to air: None documented.	Source: <u>1,2,4</u> Value: <u>0</u> (Max = 5)
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WORKSHEET 6
Groundwater 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	Cadmium	5	8	225 (rat)	5	0.0005	5	ND	ND	-
2	Copper	1300	2	ND	-	0.037	1	ND	ND	-
3	Lead	5	8	ND	-	<0.001 NOAEL	10	ND	ND	-
4	Mercury	2	8	ND	-	0.0003	5	ND	ND	-
5	Zinc	4000	2	ND	-	0.2	1	ND	ND	-

* Potency Factor

Source: 1-3,5

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	OR	Solubility (mg/L)
1= Cd =>1.0 = 3		1=
2= Cu = 0.1 – 1.0 = 2		2=
3= Pb = 0.1 – 1.0 = 2		3=
4= Hg =>1.0 = 3		4=
5= Zn =>1.0 = 3		5=

Source: 5

Value: 3

(Max = 3)

1.3 Substance Quantity:	
<p>Explain basis: Unknown, use default value = 1</p>	<p>Source: <u>1-4,5</u> Value: 1 (Max=10)</p>

5.0 MIGRATION POTENTIAL

		Source	Value
2.1	Containment (explain basis): Contaminated area scored as waste piles: No liner (3); no cover (2); no leachate collection system (2); no run-on/runoff control system (3) = 10	1,2,4,6	<u>10</u> (Max = 10)
2.2	Net precipitation: 10.3" - 2.6" = 7.7"	7	<u>1</u> (Max = 5)
2.3	Subsurface hydraulic conductivity: clayey silty sands	1,2,4	<u>3</u> (Max = 4)
2.4	Vertical depth to groundwater: Obs. release to groundwater = 0'	1,2,11?	<u>8</u> (Max = 8)

6.0 TARGETS

		Source	Value
3.1	Groundwater usage: Public supply, unthreatened alts. avail.	8,9	<u>4</u> (Max = 10)
3.2	Distance to nearest drinking water well: 600 - 1300 feet	8,9	<u>4</u> (Max = 5)
3.3	Population served within 2 miles: $\sqrt{(8 \times 3 + 45)} = \sqrt{69} = 8.3 = 8$	8,9	<u>8</u> (Max = 100)
3.4	Area irrigated by (groundwater) wells within 2 miles: (0.75)* $\sqrt{0}$ acres = 0	8,9	<u>0</u> (Max = 50)

7.0 RELEASE

		Source	Value
	Explain basis for scoring a release to groundwater: Confirmed by presence of many contaminants in groundwater.	1,2,11	<u>5</u> (Max = 5)

SOURCES USED IN SCORING

1. Site Inspection Report, Callahan Mines, Colville, WA, Washington Department of Ecology, 1986.
2. Upper Columbia River Mines and Mills, Preliminary Assessment and Site Inspections Report, Ecology & Environment, Inc., August 15, 2002.
3. Van Stone Mine WQ Data, from samples collected by ECY ERO WQ staff, October 18, 2005, and June 14, 2006.
4. SHA site visit by Michael Spencer, Washington Department of Ecology Toxics Cleanup Program Headquarters, November 2, 2006.
5. Washington Department of Ecology, Toxicology Database for Use in Washington Ranking Method Scoring, January 1992
6. Washington State Department of Ecology, WARM Scoring Manual, April 1992.
7. Washington Climate – Net Rainfall Table – See Attachment 7.
8. Washington Department of Ecology, Water Rights Application System (WRATS) printout for two-mile radius of site.
9. Washington Department of Health, Sentry Internet Database printout for public water supplies
10. USGS Topo map for site area.
11. Groundwater Monitoring Well Data Summary (W1 and W2, Van Stone Mine) for period of 1990 – 1994, Patrick J. Hallinan, Ecology ERO-PMU, February 13, 2007.