Preliminary Assessment
DEER TRAIL MINE and MILL
Narrative Report

CERCLIS ID WAN001002355
Stevens County, Washington

June 2004

WASHINGTON STATE
DEPARTMENT OF
ECOLOGY

Prepared by
Phil Leinart, Hydrogeologist
Toxics Cleanup Program
Eastern Regional Office
Washington Department of Ecology

SECTION 1
INTRODUCTION

1.1 GENERAL

The Washington Department of Ecology (Ecology), Eastern Regional Office, Toxics Cleanup Program conducted a Preliminary Assessment (PA) of the Deer Trail Mine & Mill site, located in Stevens County, Washington (Figure 1 and Figure 2). PA activities were conducted under a Site Assessment Cooperative Agreement between Ecology and the U.S. Environmental Protection Agency (EPA). The EPA CERCLIS identification number for the site is WAN001002355.

1.2 PURPOSE, SCOPE AND METHOD

The purpose of the PA is three fold:

- To determine the potential release of hazardous substances into the environment.
- To assess the immediate or potential threat to human health and the environment.
- To collect information to support a decision regarding the need for further action under CERCLA.

PA activities consisted of research and file review, and represent a general initial screening investigation. No site visit was made. Sources of information and data used in the PA are listed in Section 5, References. Principal PA references included EPA Region 10 Geographic Information Query System (XINFO); Ecology's file on Madre Minning Ltd., SWDP #5293, and; Ecology Publication No. 02-030-24 (Raforth, et al., 2002).

This report presents site background information (Section 2), discusses migration and exposure pathway and potential receptors (Section 3), and provides conclusions and recommendations (Section 4).

moderately high, rugged mountains dissected by narrow valleys. Elevations in the vicinity range from about 3200 feet to more than 4700 feet above mean sea level. The mill site and tailings ponds are in the valley bottom at an elevation of approximately 3500 feet above mean sea level. Shrubs, bushes and conifer forest cover a portion of the site; other areas are bare or sparsely vegetated. Average annual precipitation is estimated to be approximately 25 -30 inches, most falling as snow during the winter months (SCS, 1982; WA Dept of Ecology, Water Quality Permit SWDP #5293, and; USGS, 1994).

The Deer Trail Mine and Mill complex consists of two contiguous 20-acre patented mining or mill-site claims (private ownership) surrounded by nearly one-quarter square mile area of mining-impacted land owned by U.S. Government, Bureau of Land Management (BLM). From the information examined during this investigation, it is not possible to fully determine what features are on public land vs. private property. Nevertheless, it is likely that the flotation mill and tailing ponds are located on the 40 acres of private property.

Mining features apparently situated on BLM ground consist principally of underground workings, surface cuts including hillside terracing, waste rock dumps and access roads. These mine features are generally situated west and south of the mill and tailings pond area. For the mine and mill site complex as a whole, at least 11 adits connecting with over 4000 feet of underground workings are reported prior to 1976. The total area of ground disturbance at the mine/mill complex is estimated to be approximately 25 acres.

2.3 OWNERSHIP HISTORY

Great Northwest Investments, P.O. Box 2505, Mt. Vernon, WA 98273, is the current owner of record for the patented (i.e. private) part of the mine/mill site (Stevens County Assessor, 2003). The U.S. Government through the Bureau of Land Management, Spokane Area Office, current controls the remaining portion of the site (BLM, 2003).

During the early 1980's, the Deer Trail Mine/Mill site was operated by Madre Mines Ltd. Madre latter changed names to Cortez Corporation, and then to Cortez Limited. Cortez Limited is reported to have leased mining rights from a company called Oregon Leo Mining and Timber company (owners: Joel Grimm and Robert Friedlander) who, in turn, were leasing from the apparent principal owner of the time, Max (Mack) Slate (Simmons, 2001).

Having gone through a series of conveyances, trades and reacquisitions, the historic ownership of the federal ground is complex. Moreover, many maps showing land ownership are inaccurate in regards to federal lands in the Deer Trail area. According to BLM records (BLM, 2003) previous claimants of unpatented mining claims associated with the Deer Trail Mine/Mill complex include the following:

- Slate Mclennan C Inc.
- Balkin Enterprises
- Frank A Stiles

2.4.2 Ecology Stream Water and Sediment Quality Investigation

During 2000 the Deer Trail mine was one of ten mining districts selected for a stream water and sediment quality study conducted by Ecology (Raforth, et al., 2002). The Deer Trail district was selected for the study because of the occurrence of primary or secondary arsenic minerals.

Metals and general chemistry parameters included:

Water:

- Metals - Aluminum, Arsenic, Iron, Mercury, Cadmium, Copper, Lead and Zinc.
- General Chemistry and Physical Properties – Hardness, Total Suspended Solids, Total Dissolved Solids, Sulfate, Turbidity , Flow, Temperature, pH (field) and Conductivity (field)

Sediment:

Metals - Aluminum, Antimony, Beryllium, Cadmium, Chromium, Copper, Iron, Manganese, Nickel, Silver, Zinc, Arsenic, Lead, Mercury, Selenium, Thallium

Summarizing Raforth, et al., 2002, two water quality samples and a sediment sample were collected in Cedar Canyon area of Alder Creek above and below the Deer Trail mill tailings impoundment. The upstream sample site was in a small tributary to Alder Creek above the mill tailings pond. The downstream sample was taken in the main stream channel below the tailings impoundment. The two sample sites were approximately ¼ mile apart. Low-flow water samples and a sediment sample were taken during October 2000. High-flow water samples were collected during May 2001.

Field measurements and general chemistry for water are shown in Table 2; metals concentration in water are shown in Table 3. Sediment grain size and metals concentrations are shown in Table 4. Water and sediment quality criteria can be found in Appendix A.

Table4. Grain Size and Metals Concentrations in Deer Trail District Sediment Samples Collected October 2000 (low flow). Concentrations in mg/Kg, dry. Source: Raforth, et al, 2002.

Sample Location	% Gravel	% Sand	% Silt	% Clay	Al	Sb	[illegible]
Alder Creek Upstream	40.6	55.6	3.5	0.3	**12500**	5UJ	[illegible]
Alder Creek Downstream	58.2	28.6	9.9	3.3	**18000**	5UJ	[illegible]

Sample Location	Cd	Cr	Cu	Fe	Mn	Ni	[illegible]
Alder Creek Upstream	0.5U	**7.2**	**7.2**	**16800**	**399**	**3.2**	1[illegible]
Alder Creek Downstream	**2.9***	**18.2**	**111***	**31900**	**3980***	**12.7**	**1[illegible]**

Sample Location	Zn	As	Pb	Hg	Se	Tl
Alder Creek Upstream	**41.2**	**3.63**	**6.9**	0.004U	**0.55**	**0.41**
Alder Creek Downstream	**452***	**21***	**447***	**0.021**	**0.48**	0.3U

Note: Metals detections highlighted in **BOLD**
*exceeds sediment quality guideline
U = Not detected at or above the reported value
UJ = not detected at or above the reported estimated value

Significant findings of the Deer Trail mine stream quality study are described below (as quoted or summarized from Raforth, et al., 2002). See Appendix A for water and sediment quality criteria.

WATER SAMPLES

- Conductivity increased from upstream to downstream, with a more than 3-fold increase during high flow. Conductivity decreased from low flow to high flow but showed a greater contrast between the upstream and downstream values during high flow.

- Near the downsteam sampling site a side channel contained a heavy charge of yellow-orange ferric hydroxide which was associated with seepage from the streambank. This may represent baseflow from water seeping in part through the tailings and is less diluted by the overland flow noted across the top of the tailings that subsequently reports to the main stream channel. This side channel was not sampled for general chemistry, metals, or sediments during low flow, and merges into the main channel during high flow.

2.5 SUMMARY OF SITE OPERATIONS AND WASTE CHARACTERIZATION

Mining operations in the Deer Trail District can be separated into two periods: Pre-1950 era and a 1980s Madre Mines, Ltd. phase. Early on, the Deer Trail District operated intermittently from 1894 to 1947, with the most productive years being 1894 to 1911. Pre-1980s appurtenances included a 120-ton per day flotation mill and three tailings impoundments; surface disturbance amounted to about 20 acres.

From 1980 until 1984 Madre Mines, Ltd. attempted to redevelop and produce ore deposits at the Deer Trail Mine. Principal metal production consisted of silver, lead and zinc hosted by a hydrothermal quartz-calcite vein system (Moen, 1976). Secondary metals consisted of copper and gold. Ore minerals consisted of sphalerite, galena, argentite, cyrargyrite, native silver, pyargyrite, tetrahedrite and cerrussite. The country rock is Precambrian era medisediments of the Deer Trail Group (Fluet et al., 1987). Major rock types in the general area include argillite, phyllite, quartzite, and dolomite (Moen, 1976).

During 1981 Madre Mines applied for and received a State Waste Discharge Permit (No. 5293) to discharge up to 2200 gallons per day of mine and mill wastewater into tailing ponds. Madre's redevelopment plan consisted of mining 25,000 tons per year of silver ore that would be processed by the onsite flotation mill at a rate of 100 tons per day. Wastewater was intended to be handled by a closed-circuit system, i.e. mine and mill wastewater was to be discharged into the tailing ponds and then recirculated back for re-use in the mill.

Madre's principal activities during redevelopment consisted of overhauling and expanding the underground workings; surface excavation (for an additional two acres of disturbance) that included terracing of the hillside, road construction and stream rechanneling; refurbishing and operation of the flotation mill; and expansion of tailing impoundments.

Contaminants of concern associated with the Deer Trail Mine and Mill operation include metals associated principally with the tailing impoundments. Other potential sources of metals contamination include waste rock dumps, the mill site, surface cuts and excavations including roads, and mine water drainage. In addition, chemicals used in the milling process could have been released into the environment.

There is a record of stream water and sediment quality impact downstream of the mine and mill site (Ecology, SWDP #5293 and Raforth, et al., 2002). A review of the Ecology's Madre Madre Mines Ltd, SWDP #5293 file indicates that the tailing ponds remain a threat to surface water quality as a result of seepage and erosion of the dikes. In addition, surface-water runoff and leaching of other source areas into surface water are likely occurring.

SECTION 3
MIGRATION/EXPOSURE PATHWAYS AND TARGETS

3.1 GROUND WATER MIGRATION PATHWAY

Tectonically, the Deer Trail mining district is situated at the east margin of the southern tip of the Kootenay Arc, just west of the extent of the Proterozoic Belt basin. Here, the Kootenay Arc is a northeast trending structural belt containing multiple deformed Proterozoic and Paleozoic shallow-water-marine (meta) sedimentary rocks (Derkey, et al., 1990). Rocks in the immediate vicinity of the Deer Trail mine consist of steeply dipping, northeast trending argillite, phyllite, quartzite, and dolomite of the Edna Dolomite and Togo Formation which belong to the Precambrian Deer Trail Group (Fluet et al., 1987 and Moen, 1976). Locally, the rocks have been intruded by the Cretaceous Loon Lake Batholith (Moen, 1976). The region has been subject to Pleistocene continental glaciation.

Ore of the Deer Trail mine is in a 1 to 6 feet wide quartzite-calcite vein hosted by metasedimenty rocks. Ore shoots are tabular to lenticular and as much a 2 ½ feet wide (Derkey, et al., 1990). Moen, 1976 reports that high-grade ore shoots contained as much as 2000 ounces per ton silver with an overall average ore yield of approximately 280 ounces per ton silver and 10 percent lead. From 1902 to 1947 over 1800 tons of ore yielded 2 ounces of gold, 304,500 ounces of silver, 323,500 pounds of lead and nearly 300 pounds of copper (Moen, 1976).

Ore minerals consisted of sphalerite, galena, argentite, cyrargyrite, native silver, pyargyrite, tetrahedrite and cerrussite. Gangue (non-ore minerals) included of pyrite, calcite, quartz and limonite (Derkey, et al., 1990 and Moen, 1976).

Surface soils of the site are a division of the Huckleberry silt loam. The soil is described as a moderately deep, well drained soil on the foot slopes of mountains, formed in colluvium and residuum derived from shaly rock and is mantled with volcanic ash (SCS, 1982). Average annual precipitation is estimated to be approximately 25 to 30 inches, most falling as snow during the winter months (SCS, 1982; Ecology, SWDP #5293, and; USGS, 1994, Figure 3).

Ground water in the general vicinity of the Deer Trail Mine/Mill site occurs in two types of aquifers: 1) fractured metasedimentary bedrock, and 2) unconsolidated alluvial and glacial deposits. Water in the bedrock aquifer is primarily present in the fractures, faults and joints. Unconsolidated deposits typically consist of coarse sand, gravel and cobble, but may have a clay, silt or fine sand component. Porosity of the unconsolidated aquifers is generally dependent on the parent rock type.

Hydraulic conductivity of both the bedrock and unconsolidated aquifers is expected to be highly variable. Based upon the geology of the area, hydraulic conductivity of the fracture bedrock aquifers can be estimated to be 10^{-6} to 10^{-2} centimeters per second; the

Based upon previous investigations by Ecology (Raforth, et al., 2002, and; Ecology, SWDP #5293), it is evident that surface-water runoff from the Deer Trail mine/mill site has impacted sediment quality in Cedar Canyon, a tributary of Alder Creek. Impacts to stream quality are detailed in Section 2.4 above and include surface water runoff from the site and seepage from the tailing ponds. Effects include, but are not limited to, sediment quality guidelines being exceeded for copper, manganese, silver, zinc, arsenic, and lead downstream of the mine and mill.

Flow in Cedar Canyon downstream of the Deer Trail mine/mill site was estimated to be 0.2 cubic feet per second during October 2000 and 0.3 cubic feet per second during May 2001 (see Table 2 above, from Raforth, et al., 2002). Flows in Alder Creek near Fruitland ranged from 0 (dry) to 7.5 cubic feet per second during intermittent stream flow monitoring by Ecology's Water Resources Program between April 1986 and September 1991 (Ecology, 2004d).

There are approximately 50 acres of upland drainage associated with the site and potential contaminant sources. Including surface cuts and excavations, dumps, roads and tailings ponds, ground disturbance at the mine/mill site is estimated to be 25 acres. The 2-year, 24-hour rainfall is 1.5 inches (WRCC, 2004). Cedar Canyon is not a Federal Emergency Management Agency (FEMA) designated floodplain, however, a very narrow (< 10 foot wide) "floodplain" may be expected to occur along the banks of Cedar Canyon.

The Ecology Right Tracking System shows 44 water right claims on Alder Creek from the Deer Trail site to the confluence of the Columbia River (Ecology, 2004a). Purposes include domestic (household), irrigation, livestock watering, mining and industrial/commercial. Of the 16 entries, 6 are for domestic households. Based on an average of 2.28 people per household for Stevens County (USCB, Census 2000), the total number of individuals served by surface water from Alder Creek is approximately 14. Because of the fluctuating water levels of Lake Roosevelt and the National Recreation Area land status, it is believed that no surface-water out takes occur along the reservoir between Alder Creek and Glasglow Canyon, the estimated 15 mile target distance limit

Based upon wetlands inventory maps (EPA XINFO, 2004), it is estimated that there are approximately two miles of wetland frontage along Alder Creek. Because of the fluctuating character of Lake Roosevelt, it is difficult to assess what wetlands effectually "front" the reservoir.

The Columbia River (Roosevelt Lake) is an important recreational fishery. Although Alder Creek is not a listed fishery, some reaches are believed to be fish habitat.

3.3 SOILS EXPOSURE PATHWAY

SECTION 4
CONCLUSIONS AND RECOMMENDATIONS

The Deer Trail Mine and Mill is an inactive silver, lead and zinc mine and mill located in Stevens County, Washington. The site is about 5 ½ miles southeast of the village of Fruitland and approximately 2 miles north of the Spokane Indian Reservation. The facility is situated near the head of Cedar Canyon, a tributary of Alder Creek. Alder Creek, in turn, flows westerly into the Columbia River (Lake Roosevelt).

During the early 1980s Madre Mines, Ltd. attempted to redevelop ore deposits in the vicinity of the Deer Trail Mine. Previous to that, the Deer Trail Mine operated from 1894 to 1947, with the most productive years being 1894 to 1911.

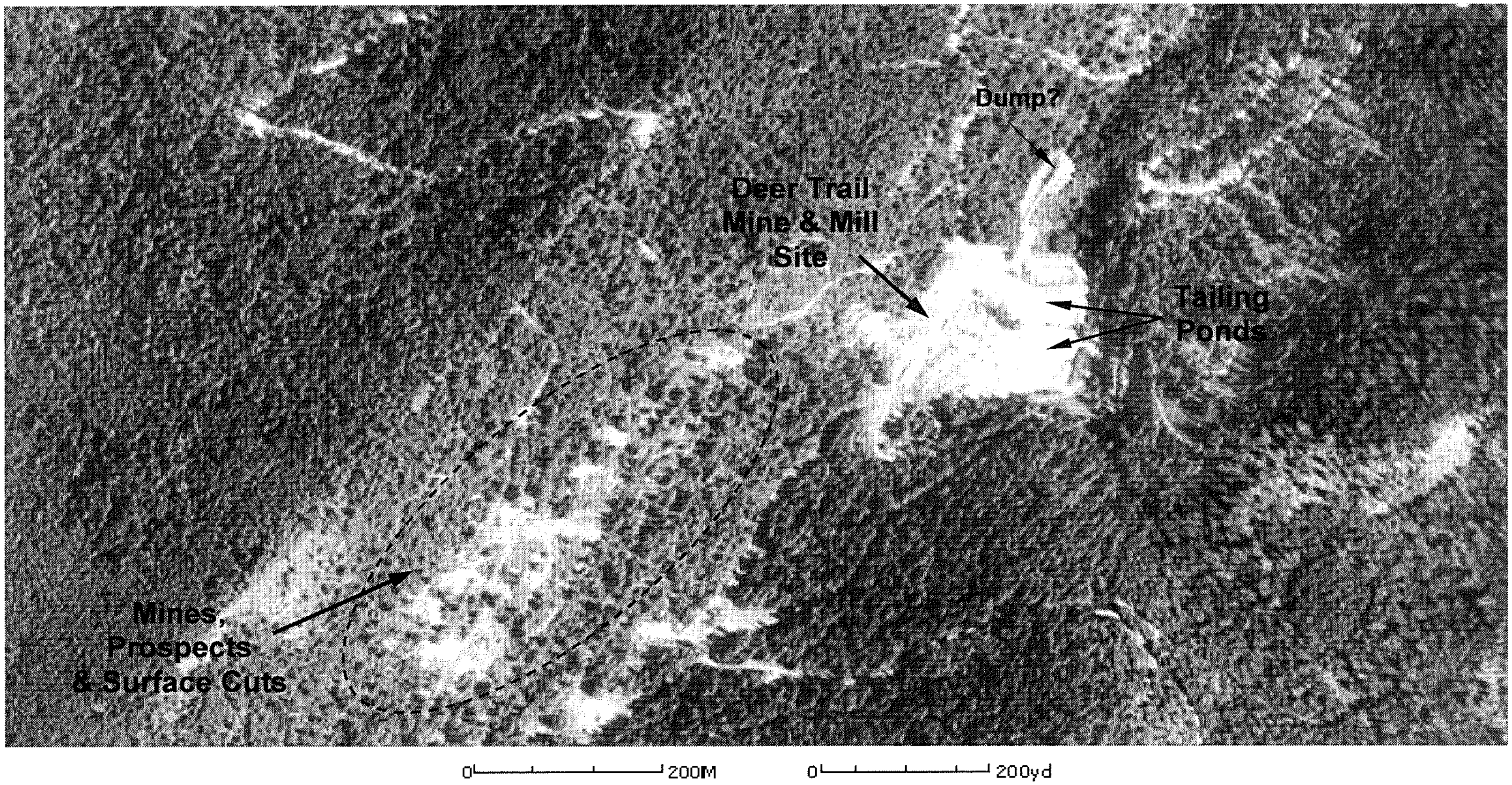
In 1981 Madre Mining applied for and received a State Waste Discharge Permit (No. 5293) to discharge up to 2200 gallons per day of mine and mill wastewater into tailing ponds. The redevelopment plan consisted of mining 25,000 tons per year of silver ore that would be processed by the onsite mill at a rate of 100 tons per day. Wastewater was intended to be handled by a closed-circuit system. Principal activities consisted of overhauling and expanding the underground workings; surface excavation, road construction and stream rechanneling; refurbishing and operation of an existing flotation mill; and expansion of tailing impoundments.

Ecology records show that there were numerous environmental troubles regarding Madre's operations at the mine/mill complex. The most significant problems included: 1) release of wastewater and silt (tailings?) into Alder Creek as a result of erosion of the tailings pond dikes; 2) problems with the dike wall integrity, and; 3) additional siltation of Alder Creek due to erosion and/or runoff from the site,

Contaminants of concern associated with the mine and mill include heavy metals and chemicals used in the milling process. Potential sources of metals contamination include the tailing ponds (both runoff and seepage), waste rock dumps, the mill site, surface cuts and excavations, roads, and mine water drainage. There is no record that the site has ever been reclaimed or restored.

Stream sampling during the period of Madre Mine operations showed elevated concentrations of arsenic in surface water downstream of the mine and mill. Water quality monitoring by Ecology in 2000 and 2001 confirms that surface-water runoff from the Deer Trail mine/mill site has impacted sediment quality in Cedar Canyon, a tributary of Alder Creek. Effects include, but are not limited to, sediment quality guidelines being exceeded for copper, manganese, silver, zinc, arsenic, and lead downstream of the mine and mill.

Several ecosystems and sensitive populations exist downstream of the Deer Trail Mine and Mill. Wetland areas are located along Alder Creek downstream of the mine/mill site. The Columbia River (Lake Roosevelt) is a major recreational fishery and Alder Creek is a suspected fishery. In regards to human health concerns, there are six domestic surface-water withdrawals from Alder Creek serving an estimated 14 people.



Deer Trail Mine and Mill

CERCLIS ID WAN001002355

Stevens County, Washington

LAT 48^{0} 02' 07" N   LON 118^{0} 05' 40" W

South portion of Section 1 & North portion Section 12,
Township 29 N., Range 37 E., W.M.

↑
North

Photo Date: 1 Aug 1995
Source: http://terraserver.microsoft.com

APPENDIX A

Water and Sediment Quality Criteria

Table 1. State Surface Water Quality Standards Pertinent to the Present Study
[see WAC 173-201A for complete standards]

Parameter	Class AA (extraordinary)	Class A (excellent)
Temperature	Shall not exceed 16.0°C due to human activities. When natural conditions exceed 18°C, no temperature increase will be allowed which will raise the receiving water temperature by greater than 0.3°C.	Shall not exceed 18.0°C due to human activities. When natural condition exceed 18.0°C no temperature increase will be allowed which will raise the receiving water temperature by greater than 0.3°C.
pH	Shall be within the range of 6.5 - 8.5 with a human caused variation within the above range of less than 0.2 units	Shall be within the range of 6.5 - 8.5 with a human caused variation within the above range of less than 0.5 units
Turbidity	Shall not exceed 5 NTU over background turbidity when the background turbidity is 50 NTU or less, or have more than a 10 percent increase in turbidity when the background turbidity is more than 50 NTU.	Shall not exceed 5 NTU over background turbidity when the background turbidity is 50 NTU or less, or have more than a 10 percent increase in turbidity when the background turbidity is more than 50 NTU.
Metals (ug/L)	Acute Criterion (@ 100 mg/L hardness)	Chronic Criterion (@ 100 mg/L hardness)
Arsenic[a]	360	190
Cadmium[a]	3.7	1.0
Copper[a]	17.0	11.4
Lead[a]	65	2.5
Mercury	2.1[a]	0.012[b]
Zinc[a]	114	104

[a]dissolved fraction

[b]total recoverable

values proposed by Persaud et al. (1993) and Ingersoll et al. (1996) were used for the present assessment. No sediment quality guidelines could be located for selenium, beryllium, or thallium.

METALS CRITERIA FORMULAS

Washington State surface water quality standards for cadmium, lead, silver, and zinc are hardness dependent and can be calculated by the following formulas (WAC 173-201A):

Cadmium - acute = $(1.136672-[(\ln \text{hardness})(0.041838)])(e^{(1.128[\ln(\text{hardness})]-3.828)})$

Cadmium - chronic = $(1.101672-[(\ln \text{hardness})(0.041838)])(e^{(0.7852[\ln(\text{hardness})]-3.490)})$

Copper - acute = $(0.960)(e^{(0.9422[\ln(\text{hardness})]-1.464)})$

Copper - chronic = $(0.960)(e^{(0.8545[\ln(\text{hardness})]-1.465)})$

Lead - acute = $(1.46203-[(\ln \text{hardness})(0.145712)])(e^{(1.273[\ln(\text{hardness})]-1.460)})$

Lead - chronic = $(1.46203-[(\ln \text{hardness})(0.145712)])(e^{(1.273[\ln(\text{hardness})]-4.705)})$

Silver - acute = $(0.85)(e^{(1.72[\ln(\text{hardness})]-6.52)})$

Zinc - acute = $(0.978)(e^{(0.8473[\ln(\text{hardness})]+0.8604)})$

Zinc - chronic = $(0.986)(e^{(0.8473[\ln(\text{hardness})]+0.7614)})$

APPENDIX B

EPA XINFO Information Query Results

APPENDIX C

Product Information on
Xanthate and Methyl isobutyl carbinal

SECTION 5
REFERENCES

Aslchem International Inc., 2003, Xanthates, product description and data sheets, internet site http://www.aslchem.com/Xanthates.htm

Delorme, 1992, *Washington Atlas & Gazetteer*.

Derkey, Robert, Joseph, Nancy and Lasmanis, Raymond, 1990, *Metal Mines of Washington, Preliminary Report,* Washington Division of Geology and Earth Resources, Open File Report 90-18.

Encyclopedia Britinnica, 2004, *Xanthate*, definition from internet site http://www.britannica.com.

Fluet, D.W., A. Changkakoti, R.D. Morton, J. Gray, and H.R. Krouse. 1987, *The genesis of the Deer Trail Zn-Pb-Ag vein deposits, northeast Washington, U.S.A.--Evidence from fluid-inclusion and stable-isotope studies,* Canadian Journal of Earth Sciences, v. 24, no. 8.

Freeze, R. Allen and Cherry John A, 1979, *Groundwater,* Prentice-Hall.

Huntting, M.T. 1956, *Inventory of Washington minerals; Part II--Metallic minerals*, Washington Division of Mines and Geology Bulletin 37, Part II, 2 v.

Mills, J.W. 1977. *Zinc and lead ore deposits in carbonate rocks, Stevens County, Washington*, Washington Division of Geology and Earth Resources Bulletin 70.

Moen, Wayne S. 1976, *Silver Occurrences of Washington*, Washington Division of Geology and Earth Resources, Bulletin 69.

NIOSH Pocket Guide to Chemical Hazards, 2002, *Methyl isobutyl carbinol, CAS 108-11-2*, Center for Disease Control and Prevention, and National Institute for Occupational Health CD-ROM, DHHS (NIOSHO) Publication 2002-140.

Raforth, R. L., Norman, D. K., and Johnson, A. , 2002, *Second Screening Investigation of Water and Sediment Quality of Creeks in Ten Washington Mining Districts, with Emphasis on Metals*, Washington State Department of Ecology Publication No. 02-03-024. PDF copy available online at http://www.ecy.wa.gov/biblio/0203024.html.

Simmons, Amy N., 2001, *RE: Deer Trail Mine*, email regarding Deer Trail Mine ownership sent to Phillip M. Leinart, Washington State Department of Ecology Eastern Regional Office, Tuesday August 14, 2001.

Western Regional Climate Center (WRCC), 2004, *Map of two-Year, Twenty Four Hour Rainfall Event for Washington*, Atmospheric Sciences Center of the Desert Research Institute internet site http://www.wrcc.dri.edu.