Summary of Preliminary Results of EPA Remedial Investigation
Molycorp molybdenum mine
Questa, New Mexico

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Introduction

On August 26, 2003 the EPA and their consultants, CDM Federal, presented preliminary results from sampling done at the Molycorp molybdenum mine, along the Red River, in Questa, and at the tailing ponds west of Questa. The following is a short summary of those results.

Among the factors used by EPA at this stage in the RI are the SLC (Screening Level Criteria) that are used in evaluating data. The SLC for each metal (or anions in the case of fluoride and sulfate) is a number that has been established as a standard to indicate a potential human health or environmental concern based upon results from numerous studies in the scientific literature. For example, aluminum has an SLC of 3.7 mg/L (parts per million) in groundwater under EPA guidelines. Thus, any samples that exceed 3.7 mg/L of aluminum in groundwater indicate potential problems from aluminum contamination. The SLC are used to help EPA identify those metals or other analytes that might be contributing to contamination at a site under study. The concept of SLC is applied to groundwater, surface water, soils, and other media to help EPA focus on those analytes that are most likely to cause pollution at a site. The SLC is <u>not</u> a number used for regulatory purposes. In other words, if some samples exceed the SLC for different metals, those samples are not necessarily in violation of state or federal standards, which are established separately. The SLC is a tool that helps the EPA sort through large amounts of data and focus on those analytes that are most likely causing contamination at a site.

<u>Alluvial Groundwater Quality—Sugar Shack/Sulphur Gulch waste rock piles</u>

Groundwater in alluvium below and adjacent to the "front dumps" (Sugar Shack South, Middle Dump, and Sulphur Gulch dump just north of NM Hwy 38) showed the results summarized in Table 1 below. All of the metals (and fluoride) listed in Table 1 exceeded the SLC in at least one well, and some metals exceeded the SLC in ten wells. These data are consistent with numerous other data collected by Molycorp, the New Mexico Environment Department, U.S. Geological Survey, and other agencies over the past 35 years. The samples in Table 1 were collected from groundwater wells below or adjacent to the "front dumps" at the mine and clearly show the impacts of metals leaching from the waste piles into the underlying alluvium.

Table 1. Alluvial Groundwater Quality:
Sugar Shack/Sulphur Gulch waste rock piles

Metal/Constituent	Average (mg/L)	SLC (mg/L)	Number of Wells>SLC
Aluminum (Al)	39.0	3.7	10
Arsenic (As)	0.0019	0.000045	1
Beryllium (Be)	0.0137	0.0073	10
Cadmium (Cd)	0.035	0.0018	10
Cobalt (Co)	0.262	0.22	2
Copper (Cu)	0.558	0.14	10
Fluoride (F^-)	26.0	0.22	10
Lead (Pb)	0.023	0.015	1
Manganese (Mn)	22.26	0.17	10
Nickel (Ni)	0.492	0.073	10
Selenium (Se)	0.0256	0.018	1
Zinc (Zn)	4.61	1.1	10

Colluvial Groundwater Quality—Sugar Shack/Sulphur Gulch waste rock piles

Similar data were collected from the colluvium below and adjacent to the "front dumps" (Table 2). Colluvium is any loose, heterogeneous, and incoherent mass of soil material and/or rock fragments deposited by rainwash, sheetwash, or slow continuous downslope creep, usually collecting at the base of slopes or hillsides. At the Molycorp mine, some colluvium underlies all of the waste rock piles. As for the alluvial groundwater samples, the SLC were exceeded for all metals and fluoride in Table 2.

Table 2. Colluvial Groundwater Quality:
Sugar Shack/Sulphur Gulch waste rock piles

Metal/Constituent	Average (mg/L)	SLC (mg/L)	Number of Wells>SLC
Aluminum (Al)	159.6	3.7	4
Arsenic (As)	0.0037	0.000045	3
Beryllium (Be)	0.093	0.0073	4
Cadmium (Cd)	0.098	0.0018	4
Cobalt (Co)	0.82	0.22	4
Copper (Cu)	3.15	0.14	4
Fluoride (F^-)	74.95	0.22	4
Iron (Fe)	9.91	1.1	1
Lead (Pb)	0.244	0.015	1
Manganese (Mn)	99.1	0.17	4
Nickel (Ni)	1.82	0.073	4
Selenium (Se)	0.072	0.018	2
Zinc (Zn)	14.92	1.1	4

Seeps and Springs—Mine Site

Several springs and seeps on mine property were sampled in the winter of 2003. Water discharging from these seeps and springs has consistently shown pH values from 2.5 to 5 over past sampling events, and EPA sampling in the fall of 2002 confirmed these low (acid) pH values. Table 3 summarizes data from springs and seeps for the winter of 2003.

Table 3. Springs and Seeps Water Quality, Mine Site, Winter 2003.

Analyte (mg/L)	**Capulin**	**Goat Hill**	**Seep 13**	**Seep 13 Lower**	**SLC (mg/L)**
Aluminum	11.3	1520.0	27.0	121.0	3.7
Fluoride	114.0	78.6	5.8	15.6	0.22
Manganese	533.0	432.0	3.42	16.2	0.170
Zinc	116.0	99.3	0.817	4.06	1.10

Like the alluvial and colluvial samples in Tables 1 and 2, all four metals in Table 3 greatly exceed the SLC. Data for another important spring, Cabin Spring, were not included in the preliminary RI results. However, the data shown in Table 4 provide further evidence that springs on mine property discharge contaminated water. In the case of Cabin Spring, this discharge is directly into the Red River.

Table 4. Analytical data for Cabin Spring, 1994-1998 (collected by Vail Engineering and submitted to NMED). All data in mg/L, except pH (standard units) and Alkalinity (mg/L of $CaCO_3$).

Date	**SO_4**	**Cond.**	**Mn**	**Zn**	**Al**	**pH**	**TDS**	**Alk.**	**F**	**Fe**
10/13/94	1118	1874	33.20	2.8	32.7	5.1	2040	0	14.8	0.05
2/14/95	1163	1925	37.25	2.35	37.2	4.9	1626	1	19.8	1.32
11/9/95	1170	1965	20.7	4.2	36.0	4.5	2020	5	19.0	0.209
2/26/96	1160	1988	13.8	3.49	--	4.7	--	--	11.6	--
11/5/96	1160	1895	22.9	4.35	40.9	5.6	--	--	--	--
3/13/97	1080	1692	18.7	3.81	34.8	4.6	--	--	--	--
7/21/97	800	1351	13.4	2.94	26.1	4.5	--	3	--	--
9/9/97	790	1309	13.1	2.78	24.3	4.5	1260	0	8.25	<0.2
11/3/97	980	1507	17.8	3.25	31.4	4.5	--	--	18.7	--
3/9/98	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
4/30/98	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
8/06/01	--	--	--	--	37	4.6	--	5	19	--
NMED 1996*	--	--	20.10	3.54	34.50	--	--	--	--	--
Average	**1047**	1723	**21.2**	**3.33**	**33.0**	**4.76**	**1737**	1.8	**15.4**	0.44
NMWQCC standard	600	--	0.2	10.0	5.0	6-9	1000	--	1.6	1.0

--, no data or standard

xxx—exceeds New Mexico Water Quality Control Commission (NMWQCC) human health standard.

* Table 8, Slifer report, 1996; CLP ID# MFQ266.

Note: Complete data for 2001-2002 and sample results from 6/25/03 were not available at this time.

Tailings Facility—Groundwater Quality

At the tailings facility, two different aquifers have been identified. The "basal aquifer" has eight wells drilled into it, and the "upper aquifer" has fifteen wells. Table 5 below summarizes the sample results from these aquifers.

Table 5. Tailings Facility—Groundwater Quality.

Well Type	Metal/Anion	Average (mg/L)	SLC (mg/L)	Number of Wells>SLC
Basal aquifer	Arsenic	0.0009	0.000045	6
(8 wells)	Fluoride	0.54	0.22	8
	Iron	1.2	1.1	1
	Manganese	0.221	0.17	1
	Molybdenum	0.167	0.018	3
Upper aquifer	Arsenic	0.00047	0.000045	10
(15 wells)	Fluoride	0.57	0.22	11
	Iron	11.3	1.1	4
	Manganese	1.4	0.17	5
	Molybdenum	0.76	0.018	8

These data indicate that metals have leached from the tailings into groundwater. The direction of groundwater flow at the tailing ponds is toward the Red River. Several interceptor wells are supposed to capture this contaminated water before it reaches the Red River. The effectiveness of these wells in capturing this water will be investigated in the RI.

Tailings Facility—Seeps and Springs

Seven seeps and springs south of the tailing ponds and just north of the Red River were also sampled in the winter of 2003. Data from these seeps and springs indicate that five of them exceed the SLC for both molybdenum and total dissolved solids. Because the pHs of these seeps and springs are close to neutral (pH= 7), other metals were measured below the SLC.

Red River Sampling

The EPA collected samples from surface water, sediment, fish tissues, macroinvertebrates (bugs), and bryophytes (mosses) in the Red River to determine changes in water quality and metals loading along the course of the river. The sampling began at a location called Zwergle Dam, about 3.5 miles upstream from the town of Red River, and continued downstream for fourteen miles to the USGS stream gage near the mouth of the Red River canyon just east of Questa. For the upper Red River, this sampling begins in an area of the river with no mining impacts and proceeds downstream through the town of Red River, past the Molycorp mine, and ends below the mine. The object of this sampling is to identify those stretches of the river, its sediments, and biota (fish, bugs, plants) that may be impacted by metals leaching into the river from either natural sources (geothermal scars) or mined areas.

Surface water in the upper Red River (Zwergle Dam-USGS gage station just east of Questa) showed small increases in aluminum, molybdenum, and zinc beginning at the east boundary of the Molycorp mine and throughout the mine property.

These increases were caused by a combination of poor quality water draining into the river from geothermal scar areas and water of similar quality draining from the Molycorp mine. The relative contributions of each source are being studied by the U.S. Geological Survey to quantify the effects of "natural" acid drainage from scar areas and the acid mine drainage created by the Molycorp mine. Data from the USGS studies underway confirm that significant increases in manganese, sulfate, fluoride, and zinc occur in the Cabin Springs area and downstream past Capulin Canyon.

Surface water in the lower Red River (from Questa to the state fish hatchery) showed small increases in molybdenum immediately below Outfall No. 002, which collects water draining from the tailing ponds and discharges it to the Red River. Aluminum and zinc concentrations in the lower Red River decrease steadily below the confluence of Cabresto Creek and the Red River, but are still greater than the EPA Chronic Aquatic Life SLC when adjusted for hardness (alkalinity measured as mg/L $CaCO_3$).

Molybdenum in sediments showed small increases through the Molycorp mine property and below Outfall 002 south of the tailing ponds.

Fish Sampling

In the spring of 2003 the New Mexico Fish and Game Department issued an advisory not to eat trout caught in the Red River because of potentially dangerous levels of arsenic found in fish tissue. Further studies identified the source of the arsenic as fish food at the hatchery, and the advisory has since been lifted when the hatchery began using different fish food. Arsenic is generally either not detected or is found at very low levels in the Red River and on the Molycorp mine.

The EPA measured both the density (population) and biomass (collective weight) of trout in the Red River from Zwergle Dam downstream to the fish hatchery. Data from 1997 to 2002 showed a steady decrease in fish biomass beginning at the Molycorp mill and continuing to Cabresto Creek where biomass began to increase. However, data from 2001 and 2002 showed essentially no fish living in the Red River as it flows through mine property.

EPA also measured benthic macroinvertebrate (river bugs) population densities and the number of different taxa (types of bugs) in the Red River. These bugs provide food for trout and are an indication of overall river health. The density of macroinvertebrates was very low through mine property and decreased from 1997 to 2002, but the number of taxa actually increased as the river flowed through mine property.

Brown and rainbow trout tissues were sampled for metals and both species showed increases in cadmium, copper, arsenic, zinc, and manganese as sampling progressed from Zwergle Dam downstream through the mine area, Questa, and to the lower Red River in the area of the fish hatchery. Similar results were seen for benthic macroinvertebrates and bryophytes, with increasing metals concentrations occurring as sampling moved from Zwergle Dam downstream through Questa.

Sampling for the RI is scheduled to be completed by early 2004. After the RI sampling is done, the Human Health and Ecological Risk Assessments will be done in 2004, followed by the evaluation of remedial alternatives in 2004-2005, and the release of the Proposed Plan in 2005. The final document produced in the RI/FS process is the Record of Decision (ROD), which will be issued after the Proposed Plan is approved.