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Colorado Department
of Public Health
and Environment

TO: Eric Jacobson, Ouray Hydropower Plant
Dick Fowler, Ouray Hydropower Plant
David Vince, City of Ouray

FROM: Camille Price, Idarado Project Manager

DATE: June 19, 2001

RE: Sampling of May, 2001 Sediment Release from Ouray Hydro Dam

Sampling of the Uncompahgre River above and below the Ouray Hydropower reservoir was conducted on May 1 and May 5, 2001 to measure any impacts on the Uncompahgre River resulting from monthly spring and summer maintenance operations. For one day during the months of April through August, sediments that have settled behind the dam during winter months are flushed from the reservoir into the river downstream. Sediments accumulated behind the dam were also sampled to determine their suitability for use as gravel.

On May1, immediately prior to the flushing of sediments from the reservoir, Ouray High School's Applied Technology Class and I collected a water sample of the river upstream of the reservoir, i.e. at 0835 hours. The height of water measured by the staff gauge on the dam spillway was noted at 2 feet, flowing at approximately five feet per second. The width of the spillway was measured at 18.75 feet. The flow measured approximately 185 cubic feet per second (cfs).

The gate on the reservoir was opened at 0900 hours to allow the reservoir to drain. When the gate was fully opened, flow from the 50.5-inch diameter outlet, flowing at approximately 4 feet per second, passed an estimated 100 cfs. The water depth remained steady at 0.4 feet above the spillway during the initial 5 hours of drainage, i.e., approximately 37.5 cfs. Thus, the total flow through the reservoir during that time was 138 cfs. At approximately 1430 hours, the river started to rise, and at 1500 hours, the staff gauge measured a water depth of 0.7 feet above the spillway.

A water sample was collected at 0930 hours at a location approximately 1.5 miles downstream of the reservoir, immediately above the confluence with Canyon Creek. Flow was estimated at approximately 138 cfs.

As a result of high temperatures, the river began to rise in the reservoir at 1430 hours. At that time it became apparent that the maximum profile of sediment had been exposed. Two samples of gravel were then collected. A composite sample of coarse sediments (sand, gravel and cobbles) and a composite sample of fine sediments (coarse sand) were each collected from the exposed bank ranging from a depth of 0 to 2.5 feet below the ground surface to the top of water.

Because the climate on May 1 did not allow for total release of stored water and sediment from behind the dam, flushing the reservoir and subsequent sampling was repeated on May 5. Weather conditions were cold and snowing. The downstream water sample was taken at 0830hours. The height of water measured by the staff gauge on the dam spillway was noted at 1 foot, flowing at approximately five feet per second. The width of the spillway was measured at 18.75 feet. The flow measured approximately 95 cubic feet per second (cfs). The gate was opened a t 0935 hours and within ten minutes, there was no release form the spillway; the pipe released approximately 100 cfs.

One composite sediment sample was taken from behind the reservoir at 1115 hours, ranging from a depth of 0 to 15 feet below the ground surface. The downstream sample was taken at 1230 hours; the flow was estimated at 100 cfs.

Water samples were analyzed for pH, electro-conductivity, total suspended solids and total metals concentrations of the following metals: antimony, arsenic, barium, beryllium, cadmium, chromium, copper, fluoride, iron, lead, manganese, mercury, nickel, selenium, silver, sulfate, thallium and zinc.

The sediment samples were analyzed for: texture; pH; acid generation potential; total metals and Simulated Precipitation Leaching Procedure (SPLP) concentrations of the following metals: antimony, arsenic, barium, beryllium, cadmium, chromium, copper, fluoride, iron, lead, manganese, mercury, nickel, selenium, silver, sulfate, thallium and zinc.

The attached tables provide a summary of the analytical results. Copies of the analytical reports are provided in Appendix A.

Water quality at the downstream location after release of the sediments on May 5 had increased concentrations and loading of metals as well as Total Suspended Solids (TSS) when compared to the same location prior to the release of sediments (Tables 1 and 2). Increased metals concentrations and loadings were nearly identical: antimony increased approximately 5 times; arsenic was 6 times greater; barium was 6 time greater; cadmium was 3 times greater; copper was 6 times greater; iron was 40 times greater; lead was 30 times greater; and manganese was 4.5 times greater than respective metal concentrations and loadings at the same location prior to sediment release. Total suspended solids were 95 times greater than TSS measured at the same location prior to sediment release.

The coarse and fine fraction of sediments gathered on May 1 from the surface to 2.5 feet below the surface each had a pH of 7.4, were not acid generating, and were classified as loamy sand. The composite sample ranging from 0 to 15 feet below the surface collected on May 5 had a pH of 7.3, was not acid generating, and was classified as a sandy loam. Metals concentrations in the fine fraction of sediments were generally higher than metals concentrations in the coarse fraction and the composite sample (Table 3).

Results from the Simulated Precipitation Leaching Procedure indicated very low concentrations of antimony, barium, fluoride, iron, lead, silver and zinc. All other parameters analyzed were below detection limits (Table 4).

As discussed in previous correspondence from the State to Messrs. Jacobson and Vince, dated April 10, 2001, the Colorado Department of Public Health and Environment's Hazardous Materials and Waste Management's *Proposed Soil Remediation Objectives Policy Document*, dated 12/31/97, has been referenced to determine if the dam sediments are suitable for use as gravel This document has as its objectives: (a) protection of potential human receptors who come in direct contact with soils; and (b) protection of underlying groundwater. The policy specifies that the Toxic Characteristic Leaching Procedure (TCLP) or Synthetic Precipitation Leaching Procedure (SPLP) be used to determine the leaching potential of the soils from a site, and that the test results be compared to a drinking water standard multiplied by a dilution factor of 22 for the conservative Colorado site.

In that same correspondence, the State indicated that if analyses of the sediments indicate that the pH ranges between 6.5 and 8.5, AND does not have an acid generating potential, AND SPLP metals analyses are below the State's published drinking water standards times a dilution factor of 22, the CDPHE will determine that there will be no restriction on the use or disposal of the sediments. The State advised Mr. Jacobson to contact the Colorado Division of Minerals and Geology determine if a mining permit would be required for sediment removal operations. Tom Gillis is the DMG Senior Environmental Protection Specialist in Durango; his phone number is (970) 247-5523.

The attached analytical results indicate that the pH of the sediments range between 6.5 and 8.5, AND do not have an acid generating potential, AND SPLP metals analyses are below the State's published drinking water standards times a dilution factor of 22. Therefore, the CDPHE hereby determines that the use of the sediments as a sand and gravel source is protective of potential human receptors that come in direct contact with soils and is protective of underlying groundwater. With the exception of silver in the fine fraction, the sediment leachate is protective of freshwater aquatic life (concentration of silver protective of freshwater aquatic life is 0.00012 ppm whereas the silver SPLP concentration is the fine fraction of sediments measured 0.0002 ppm).

Review of the attached water quality data indicates that ceasing the release of sediments from the Ouray Hydropower reservoir into the Uncompahgre River will eliminate the pulse of increased sedimentation and metals loading resulting from such practice, providing additional protection of the physical and chemical components of the downstream aquatic habitat.

Please contact me if you have any questions, comments or concerns. I can be reached at

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cc: Dan Scheppers, CDPHE-HMWMD
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TABLE 1

UNCOMPAHGRE RIVER SURFACE WATER SAMPLES
TOTAL METALS CONCENTRATIONS
Concentrations in milligrams per liter (mg/L)
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Location	URUS	URDS	URUS	URDS1	URDS2
Analyte	Uncompahgre R. Upstream of Dam Prior to Release May 1, 2001	Uncompahgre R. Below Reservoir After Release May 1, 2001	Uncompahgre R. Upstream of Dam After Release May 5, 2001	Uncompahgre R. Below Reservoir Prior to Release May 5, 2001	Uncompahgre R. Below Reservoir After Release May 5, 2001
Flow (cfs)	185	138	95	95	100
pH (su)	5.5	5.7	5.9	6.3	6.3
Conductivity (umhos/cm)	241	255	286	318	349
TSS	86	264	8	22	2090
Antimony	0.0003	0.0004	0.003	0.0003	0.0014
Arsenic	0.0118	0.0133	0.0057	0.0066	0.038
Barium	0.49	0.144	0.032	0.036	0.222
Berylium	0.0002	0.0003	BD	BD	0.002
Cadmium	0.0021	0.0022	0.0018	0.0017	0.0053
Chromium	BD	BD	BD	BD	0.02
Copper	0.21	0.24	0.14	0.14	0.85
Fluoride	0.2	0.2	0.3	0.3	0.2
Iron	8.83	12.1	3.26	3.82	147
Lead	0.0185	0.031	0.0097	0.0122	0.344
Manganese	0.573	0.736	0.575	0.562	2.52
Mercury	BD	BD	BD	BD	BD
Nickel	BD	BD	BD	BD	0.01
Selenium	BD	BD	BD	BD	BD
Silver	0.00011	0.00015	BD	BD	0.00038
Sulfate	100	110	130	140	150
Thallium	BD	BD	BD	BD	BD
Zinc	0.64	0.62	0.49	0.46	1.2

TABLE 2

UNCOMPAHGRE RIVER SURFACE WATER SAMPLES
TOTAL METALS LOADING
Killigrams per Day

Location	URUS	URDS	URUS	URDS1	URDS2
Analyte	Uncompahgre R. Upstream of Dam Prior to Release May 1, 2001	Uncompahgre R. Below Reservoir After Release May 1, 2001	Uncompahgre R. Upstream of Dam After Release May 5, 2001	Uncompahgre R. Below Reservoir Prior to Release May 5, 2001	Uncompahgre R. Below Reservoir After Release May 5, 2001
Flow (cfs)	185	138	95	95	100
pH (su)	5.5	5.7	5.9	6.3	6.3
Conductivity (umhos/cm)	241	255	286	318	349
TSS	86	264	8	22	2090
Antimony	0.135	0.135	0.07	0.07	0.34
Arsenic	5.35	4.49	1.33	1.54	9.31
Barium	222.09	48.68	7.45	8.38	54.39
Berylium	0.09	0.1	BD	BD	0.49
Cadmium	0.95	0.744	0.419	0.396	1.29
Chromium	BD	BD	BD	BD	4.9
Copper	95.18	81.14	32.59	32.59	208.25
Fluoride	90.65	67.62	69.82	69.82	44
Iron	4002	4901.01	758.77	889	36,015
Lead	8.3	10.48	2.26	2.84	84.28
Manganese	259.71	248.84	133.8	130.8	617.4
Mercury	BD	BD	BD	BD	BD
Nickel	BD	BD	BD	BD	2.45
Selenium	BD	BD	BD	BD	BD
Silver	0.05	0.051	BD	BD	0.09
Sulfate	45,325	37191	30,257.50	32,585	36,750
Thallium	BD	BD	BD	BD	BD
Zinc	290.08	209.62	114.05	109.65	294

TABLE 3

UNCOMPAHGRE RIVER SEDIMENT SAMPLES
TOTAL METALS CONCENTRATIONS
Concentrations in milligrams per killigram (mg/kg)

Location	Seds A	Seds B	Seds C
	Coarse Fraction Behind Dam 0 - 2 feet	Fine Fraction Behind Dam 0 - 2 feet	Composite Sample Behind Dam 0 - 15 feet
Analyte	May 1, 2001	May 1, 2001	May 5, 2001
ABP*	34	30	47
pH	7.4	7.4	7.3
Texture	Loamy Sand	Loamy Sand	Sandy Loam
Antimony	0.3	0.2	0.04
Arsenic	13.2	14.6	15.3
Barium	77.7	114	75.2
Berylium	1	64	0.32
Cadmium	0.9	1.75	0.43
Chromium	1	3	2
Copper	38	114	56
Fluoride	0.3	0.3	0.4
Iron	15,800	24,900	15,000
Lead	55.4	88.9	96
Manganese	679	1,140	1,190
Mercury	0.02	0.02	BD
Nickel	3	4	3
Selenium	0.1	0.3	BD
Silver	0.21	0.73	0.697
Sulfate	BD	BD	30
Thallium	0.21	0.19	0.102
Zinc	153	354	123

ABP = Acid Base Potential: Acid generating potential compared to
Acid Neutralizing Potential.
Measured in Tons CaCO3 per KTon.

TABLE 4

UNCOMPAHGRE RIVER SEDIMENT SAMPLES
SIMULATED PRECIPITATION LEACHING PRODCEDURE
Concentrations in milligrams per Liter (mg/L)

Location	Seds A	Seds B	Seds C	CO Drinking Water	SCDMS**
	Coarse Fraction Behind Dam 0 - 2 feet	Fine Fraction Behind Dam 0 - 2 feet	Composite Sample Behind Dam 0 - 15 feet	Standards x 22 dilution factor	Fresh Water Aquatic Life Screening Levels
Analyte	May 1, 2001	May 1, 2001	May 5, 2001		
ABP*	34	30	47		
pH	7.4	7.4	7.3		
Texture	Loamy Sand	Loamy Sand	Sandy Loam		
Antimony	0.0004	0.0016	0.0004	0.132	NA
Arsenic	BD	BD	BD	1.1	0.19
Barium	0.039	0.031	0.056	44	NA
Berylium	BD	BD	BD	0.088	NA
Cadmium	BD	BD	BD	0.011	0.0011
Chromium	BD	BD	BD	NA	
Copper	BD	BD	BD	2.2	0.012
Fluoride	0.3	0.3	0.4	NA	NA
Iron	0.01	BD	BD	NA	1
Lead	0.0002	0.0007	0.0005	0.33	0.0032
Manganese	BD	BD	0.017	NA	NA
Mercury	BD	BD	BD	0.044	1.2E-05
Nickel	BD	BD	BD	NA	0.16
Selenium	BD	BD	BD	1.1	0.036
Silver	BD	0.0002	BD	NA	0.00012
Sulfate	BD	BD	30	NA	NA
Thallium	BD	BD	BD	0.044	NA
Zinc	BD	BD	0.01	NA	0.11

ABP = Acid Base Potential: Acid generating potential compared to Acid Neturalizing Potential.
Measured in Tons $CaCO_3$ per KTon.

**SCDMS = Superfund Chemical Data Matirx, June 1996