



UTAH DEPARTMENT of
ENVIRONMENTAL QUALITY
**WATER
QUALITY**

Evaluation of UDEQ Sediment Data Collected in Response to the Gold King Mine Release

Data Collected: August 8, 2015 – October 26, 2015

Prepared and Reviewed by:

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Summary

The Utah Department of Environmental Quality (DEQ) collected sediment samples from up to five sites on at least 4 different days between August and October, 2015 on the San Juan River plus one sample collected at McElmo Wash on one day. The sampling locations were selected in the field to be more likely representative of depositional environments in the river. The first round of sediment samples was collected prior to the predicted arrival of the contaminated water from the Gold King Mine to Utah. The second sampling round was collected after the contaminated water had started crossing into Utah.

The solids/sediment portion of the contamination from the Gold King Mine was expected to travel slower and more dispersed than the dissolved water contamination because the solids could settle to the river bed in upstream sections of the San Juan River system, including in the Animas River, prior to being re-entrained and transported downstream to Utah.

At each site, ten (10) samples of the top (approximately) 1 cm of sediment were combined for laboratory analyses for each DEQ sediment sample collected at each location. Sediments were analyzed for metals and metalloids and are reported in dry weight concentrations. The Screening Analysis table compares the sediment concentrations to human health-based screening values for soil because sediment-specific screening values are unavailable. The screening-level analyses show that sediment concentrations were lower than the health-based screening values for soil which indicates that health effects to people from exposure to these pollutants in sediment are unlikely. UDAF also reviewed the sediment data and found it difficult to predict adverse effects to the health of livestock and use of irrigation waters. Storm events or natural spring runoff waters may vary the amount of elements found in waters. Continual monitoring and data collection will be necessary for long-term planning, evaluation, and continued use of the San Juan River for agricultural purposes.

While some patterns observed in pollutant concentrations in the UDWQ sediment appear to be related to the Gold King Mine spill, additional analyses are necessary. At the Stateline sample location, sediment concentrations were generally similar between the pre- and post- plume arrival samples with the exception of mercury that increased over an order of magnitude before decreasing to pre-plume concentrations by the last sampling event. The concentrations in sediment at Montezuma Creek and Bluff of aluminum, arsenic, beryllium, cobalt, copper, cadmium, chromium, iron, lead, manganese, vanadium, and zinc all increase by approximately a factor of two after the pollutant plume was predicted to arrive in Utah. The sediment concentrations then consistently decreased for the next sampling round about a month later. However, these same patterns were not consistently exhibited in the sediment samples from the downstream locations of Mexican Hat and Clay Hills. Metals concentrations in sediment at these locations did not always increase after the predicted plume arrival. For instance, beryllium concentrations were lower post-plume at the Stateline site, increased at the Montezuma and Sand Island sites, was lower post-plume at the Mexican hat site. In addition, no pre-plume sediment sample is available for the Clay Hills location to conduct a pre-plume comparison. The lack of consistent patterns of contamination at the lower San Juan sites (Mexican Hat and Clay Hills) may be an indication that the contaminated sediments from the Gold King Mine release haven't been transported to these locations yet.

The results of the San Juan sediment samples were also compared to [concentrations measured in USGS cores collected from the San Juan River delta in Lake Powell in 2010-2011](#). The pollutant concentrations from the approximately 4.5 meter long cores were variable within the cores and Core 3 shows a marked increase in metals concentration at approximately 3.9 meters. The concentrations in USGS Lake Powell cores were generally higher than the DEQ sediment samples but still within the same order of magnitude for aluminum, cobalt, chromium, copper, iron, lead, manganese, vanadium, and zinc. However, the USGS core samples were not dated and based on the currently available data and small number of samples, the differences between the concentrations measured in the Lake Powell cores and DEQ sediments cannot be interpreted with confidence. More sophisticated measuring methods including dating of the sediments and repeating the study are also likely needed.

Future analyses should consider all watershed sources such as mining sources upstream including the Gold King Mine, permitted discharges and natural sources. Additional analyses are also necessary to evaluate the potential impacts of storm events on the observed concentrations. Previous analyses suggested that hydrologic influences from two large flashy tributaries (McElmo Wash and Chinle Wash) may have an important influence on background conditions in the San Juan River. DEQ is developing a long term monitoring plan to further investigate these questions.

Screening Values

Screening values are taken from the Agency for Toxic Substance and Disease Registry (ATSDR). As is most appropriate for recreational exposures, ATSDR Environmental Media Evaluation Guideline (EMEG) health-based child intermediate exposure (>14 days up to one year) comparison values, were chosen first if available, followed by ATSDR EMEG health-based child chronic exposure (>1 year) comparison values. In the absence of EMEGs, ATSDR child Reference Dose Media Evaluation Guidelines (RMEGs), based upon EPA RfDs, were used. In the absence of RMEGs, EPA risk-based Regional Screening Levels (RSLs) were used.

Analyte	CAS #	Units	Soil CV (ppm)/(mg/kg)	
			Health-Based Comparison Value for Water Ingestion (CV) [Total Metals]	CV Type and Source
Aluminum	7429-90-5	mg/kg	50,000	Child Chronic EMEG
Antimony	7440-36-0	mg/kg	20	Child RMEG
Arsenic	7440-38-2	mg/kg	15	Child Chronic EMEG
Barium	7440-39-3	mg/kg	10,000	Child Chronic EMEG
Beryllium	7440-41-7	mg/kg	100	Child Chronic EMEG
Cadmium	7440-43-9	mg/kg	25	Child Intermediate EMEG
Calcium	7440-70-2	mg/kg	-	No CVs available
Chromium	7440-47-3	mg/kg	250	Child Intermediate EMEG Cr(VI)
Cobalt	7440-48-4	mg/kg	500	Child Intermediate EMEG
Copper	7440-50-8	mg/kg	500	Child Intermediate EMEG
Iron	7439-89-6	mg/kg	55,000	Child RSL
Lead	7439-92-1	mg/kg	400	Child RSL
Magnesium	7439-95-4	mg/kg	-	No Screening Level Available
Manganese	7439-96-5	mg/kg	2,500	Child RMEG
Molybdenum	7439-98-7	mg/kg	250	Child RMEG
Nickel	7440-02-0	mg/kg	1,000	Child RMEG
Nitrate+Nitrite	HZ2100-10-T	mg/kg	-	No Screening Level Available
Nitrite	14797-65-0	mg/kg	5,000	Child RMEG
Potassium	7440-22-4	mg/kg	-	No Screening Level Available
Selenium	7782-49-2	mg/kg	250	Child Chronic EMEG
Silver	7440-22-4	mg/kg	250	Child RMEG
Sodium	7440-23-5	mg/kg	-	No Screening Level Available
Sulfate		mg/kg	-	No Screening Level Available
Thallium	7440-28-0	mg/kg	0.78	Child RSL
Vanadium	7440-62-2	mg/kg	500	Child Intermediate EMEG
Zinc	7440-66-6	mg/kg	15,000	Child Intermediate EMEG
Mercury	7439-97-6	mg/kg	9.4	Child RSL
			RMEG: ATSDR Reference Dose Media Evaluation Guide	
			EMEG: ATSDR Environmental Media Evaluation Guide	
			RSL: EPA Regional Screening Level	

Sediment Screening Analysis

				No Exceedence					Above Screening Level					Prior to Plume Arrival					Estimated Plume Arrival					Post Plume Arrival				
				Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead	Magnesium	Manganese	Mercury	Molybdenum	Nickel	Potassium	Selenium	Silver	Sodium	Thallium	Vanadium	Zinc	
Screening Level Value for Sediment				50000	20	15	10000	100	25		250	500	55000	400		2500	9.4	250	1000		250			0.78	500	15000		
Monitoring Location	Site Description	Collection Date	Collection Time	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg		
4954000	Stateline	8/8/2015	1:23:00 PM	16600	ND	3.76	200	0.675	0.309	21900	14.2	4.12	8.65	11400	9.03	7060	280	0.00182	ND	8.11	4870	ND	0.044	722	0.181	29.4	40.1	
		8/15/2015	9:43:00 AM	12900	ND	3.2	217	0.541	0.203	9140	12.1	4.14	8.26	11900	6.99	3300	240	0.00535	ND	6.4	2660	ND	0.034	344	0.14	25.3	32	
		8/19/2015	8:15:00 AM	16200	ND	3.37	147	0.627	0.237	10600	11.6	4.36	9.9	11800	8.52	4350	246	0.0228	0.496	7.07	3810	ND	0.05	373	0.172	26.4	34.3	
		9/23/2015	6:30:00 PM	12600	ND	3.31	313	0.535	0.254	9530	12.1	3.76	6.63	10900	8.27	3490	251	0.00345	0.507	6.25	3180	ND	0.045	413	0.165	28.1	28.8	
GK06	McElmo Was	9/23/2015	10:52:00 AM	4920	ND	2.59	280	0.249	0.127	18000	3.82	1.61	2.27	5210	3.78	1780	461	0.00473	1.41	2.23	1810	ND	ND	197	0.08	10.1	13.6	
4953990	Montezuma	8/8/2015	2:54:00 PM	6140	ND	1.74	279	0.291	0.122	8470	5.02	1.76	3.43	5530	3.9	1900	156	ND	ND	2.8	1690	ND	ND	145	0.068	13.5	18.5	
		8/15/2015	10:30:00 AM	14600	ND	3.16	199	0.566	0.239	11100	13.9	4.23	7.94	12100	7.46	3810	241	0.00569	ND	6.67	3140	ND	0.032	393	0.171	26.7	33.1	
		8/19/2015	9:30:00 AM	14100	ND	3.06	198	0.551	0.185	8620	10.4	3.79	6.59	10700	7.6	3390	212	0.00761	0.422	6.22	3180	ND	0.03	440	0.126	23.1	30.6	
		9/22/2015	5:55:00 PM	10400	ND	3.04	161	0.437	0.173	20300	8.65	3.26	5.34	8070	7.09	2820	223	0.006	0.355	5.07	5080	ND	0.029	517	0.126	19.7	25.6	
		10/26/2015	2:00:00 PM	10400	ND	3.23	175	0.54	0.242	19900	10.4	4.35	7.69	11800	8.36	5550	267	0.00757	0.578	7.98	2790	ND	0.037	400	0.144	21.4	26.7	
4953250	Sand Island	8/8/2015	4:19:00 PM	7140	ND	2.13	232	0.321	0.127	7250	5.79	2.12	3.73	6340	4.28	1740	198	ND	ND	2.85	1810	ND	0.055	157	0.096	15.2	18.9	
		8/15/2015	11:31:00 AM	10600	ND	2.78	297	0.451	0.17	10500	9.53	3.19	6.35	9630	6.2	3120	223	0.00284	ND	4.96	2540	ND	0.024	277	0.131	22.9	26.7	
		8/19/2015	12:33:00 PM	10000	ND	2.31	228	0.381	0.146	7780	6.76	2.77	4.74	8270	5.51	2640	191	0.00565	ND	4.19	2500	ND	0.038	256	0.096	17	23.7	
		9/22/2015	1:59:00 PM	4250	ND	2.49	518	0.226	0.0796	4610	2.32	2.18	2.53	7750	4.24	1980	198	0.00301	ND	2.15	535	ND	ND	126	0.064	7.43	20.6	
4953000	Mexican Hat	8/8/2015	5:40:00 PM	8780	ND	2.7	271	0.423	0.165	6980	7.72	2.65	5.01	7630	5.52	2190	218	ND	0.43	4.09	2280	ND	0.068	291	0.13	18.9	26.1	
		8/15/2015	12:04:00 PM	7480	ND	2.2	213	0.374	0.145	13300	8.76	2.49	3.76	7210	4.75	3340	192	ND	ND	4.5	2120	ND	0.046	201	0.069	16.9	24.5	
		8/19/2015	1:03:00 PM	6470	ND	2.06	564	0.289	0.111	7940	5.13	2.53	3.45	7200	4.48	2000	182	0.00368	ND	3.6	1730	ND	ND	190	0.05	16.2	18.7	
		9/22/2015	9:56:00 AM	6350	ND	2.26	411	0.272	0.112	8150	5.61	2.15	3.11	5900	4.3	1970	169	0.0019	ND	3.44	1300	ND	ND	193	0.074	14.6	18.4	
		10/26/2015	4:15:00 PM	5300	ND	2.49	171	0.327	0.166	17300	5.23	2.71	4.4	7790	5.19	4120	207	0.00375	ND	4.87	1590	ND	ND	269	0.084	12.7	17.6	
4952940	Clay Hills	8/15/2015	2:30:00 PM	6160	ND	1.5	251	0.309	0.146	16900	6.31	2.07	2.83	6040	3.96	3550	176	0.00334	ND	3.68	1790	ND	ND	218	0.065	13.7	16.5	
		8/19/2015	3:09:00 PM	14400	ND	2.99	181	0.552	0.201	27400	12.4	3.81	5.56	10400	6.31	6580	262	0.00655	ND	8.02	4220	ND	ND	298	0.114	22	25.1	
		9/23/2015	1:50:00 PM	2770	ND	1.22	215	0.162	0.0648	9870	3.24	1.41	ND	3760	2.99	1790	171	ND	ND	ND	1130	ND	ND	180	0.056	8.18	11.5	
		10/27/2015	2:45:00 PM	2720	ND	1.1	163	0.178	0.087	13300	3.09	1.48	1.85	5190	ND	2780	138	0.00211	ND	2.52	787	ND	ND	113	0.033	6.74	10.4	

















