

Montana Environmental Trust Group Trustee of the Montana Environmental Custodial Trust

FORMER EAST HELENA SMELTER GROUNDWATER CONDITIONS UPDATE OCTOBER 27, 2020





2019 CORRECTIVE ACTION MONITORING PLAN



- Primary Objective
 - Collect data to evaluate groundwater response to IMs
- Performance Monitoring Components
 - ✓ Groundwater Level Trend Analysis
 - ✓ Groundwater Quality Trend Analysis
 - ✓ Plume Stability Evaluation



2019 CORRECTIVE ACTION MONITORING PLAN







2019 Monitoring Scope

- ✓ Semiannual Groundwater Monitoring (23 wells in Spring/78 wells in Fall)
- ✓ Semiannual Residential / Water Supply Well Monitoring (20 wells Spring/Fall)
- Semiannual Surface Water Monitoring (7 sites Spring/Fall)
- ✓ Groundwater Levels (187 wells)/Surface Water Elevations (9 sites) (Spring/Fall)
 - ✓ 2020 CAMP of Similar Scope



Groundwater Elevation Trends









TREND ANALYSIS – Plant Site Selenium



✓ Overall decreasing trends in source areas (West Se, Slag Pile), downgradient of West Se

✓ Source area spikes in 2018 due to precip trends, higher water levels, increased infiltration

✓ Trends due to SPHC and/or transient condition (source flushing)



TREND ANALYSIS – Downgradient Selenium





- Mixed trends: Significant decreases on east side, stable or slight increases decreases on west side
- Furthest downgradient wells show either slight decreasing trends or stable concentrations
- ✓ EH-141 decreased ~15% since peaking in 2014 – furthest Se MCL exceedance
- Trends due to westward shift in flow direction, SPHC effects on Lamping Field groundwater flow









TREND ANALYSIS – Plant Site Arsenic



- ✓ Source area arsenic concentrations nearly all currently decreasing
- ✓ DH-80 installed downgradient of former acid plant; following 2016 AP Source Removal concentration decreased 35%; further decreases in 2019/2020
- ✓ North Plant Arsenic area well DH-17 53% decline in post-IM period
- Trends due to SPHC and source removal



TREND ANALYSIS – Downgradient Arsenic



- ✓ Primarily decreasing trends currently
- ✓ Exceptions (EH-115, EH-114)
- ✓ EH-111 65% decrease since post-SPHC peak
- ✓ Contrast EH-106/111 decreases with EH-115/114 increases (~375' west of -106/-111)
- ✓ Trends due to decreasing source concentrations, SPHC, plume shift





PLUME STABILITY ANALYSIS – Downgradient Selenium



Year	Planar Area (acres)	Average Selenium Concentration (mg/L)
2010	74	0.112
2014	111	0.123
2015	112	0.121
2016	114	0.136
2017	79	0.108
2018	74	0.078
2019	82	0.088



EVALUATION RESULTS

- ✓ Plume area increase 2010 to 2014, decrease after 2016
- ✓ Average concentrations overall decrease ~20% from 2010 to 2019
- ✓ Plume centroid migrating downgradient (transient plume as source area concentrations decrease)
- ✓ Note fragmentation of plume since 2017



PLUME STABILITY ANALYSIS – Downgradient Arsenic



- ✓ No significant change in plume area (as anticipated)
- ✓ Average concentrations stable although maximum concentrations decreasing (i.e., EH-100, EH-111).
- ✓ Plume Centroid slight westward shift 2017-2019



PLUME STABILITY ANALYSIS – Plant Site Selenium and Arsenic







20174

2017-As

2016As



2016As

2017As

2010As



010As



	0.0035								
0.001	The p		1.	0.665					
	0.004	30	0.54						
6	0.0035	,	2010As						
P	10.0		2016As	0.27					
N.		7							
Contraction of the	2016-45		1185	0.97					
6	2010-43	2.58 24	NY CO	Care again					

Year	Parameter	Planar Area (acres)	Average Concentration (mg/L)		
2010		67	0.45		
2016		48	0.27		
2017	Selenium	35	0.23		
2018		52	0.34		
2019		51	0.24		
Year	Parameter	Planar Area (acres)	Average Concentration		
		1	(mg/L)		
2010		82	2.25		
2010 2016		82 77	2.25 1.29		
2010 2016 2017	Arsenic	82 77 77	2.25 1.29 1.19		
2010 2016 2017 2018	Arsenic	82 77 77 69	(mg/L) 2.25 1.29 1.19 0.94		

Software-generated contours are shown on each plot X = calculated plume centroid for given year Plume stability metrics calculated using method of Ricker (2008)

2018-As

 ✓ Plume areas have decreased
 ✓ Average concentrations decreased ~50%
 ✓ Slight eastward shift in Se plume centroid (towards slag pile) due to diminishing West Se Source influence

2019-As

PLANT SITE PLUME STABILITY

EVALUATION RESULTS

✓ Slag pile now primary Se source

2019 WATER RESOURCES MONITORING REPORT EAST HELENA FACILITY FIGURE

3-13



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ZINC AND CADMIUM CONCENTRATION TRENDS

- ✓ Persistent on-site elevated zinc and cadmium (1 mg/L +) associated with Former Acid Plant area and selected downgradient Speiss/Dross area wells; <u>no off-site migration above standard</u>
- ✓ Recent spike in Zn at DH-17 attributable to higher water levels and/or geochemical conditions
- \checkmark 5 wells added to 2020 CAMP to update information on Zn and Cd concentrations/distribution
- ✓ Zn spike at DH-17 short-term (decreased from >7 to <0.5 mg/L)
- \checkmark Continuing to track these other contaminants along with As and Se



SLAG PILE CONTAMINANT LOADING Significance of Post-1982 Upper Lift





Slag Pile Upper Lift Loading Contribution





Slag Pile Upper Lift Loading Contribution









Slag Type		Total Concentrations in Slag (mg/kg)				Slag Leachate Concentrations (mg/L)										
	Statistic	Arsenic Copp	Conner	lead	Selenium	Zinc	Phase I and II RFI SPLP Samples		RI/FS Slag Infiltration Basins							
			Соррег	Leau			Arsenic	Selenium	Arsenic	Copper	Lead	Selenium	Zinc	Potassium	Sulfate	pH (s.u.)
Unfumed Slag — (pre-early 1940s deep lift) ¹ —	Minimum	34.1	75.7	<10	10	1600	0.099	0.036	NA	NA	NA	NA	NA	NA	NA	NA
	Maximum	3060	54300	41600	160	114000	0.099	0.036	NA	NA	NA	NA	NA	NA	NA	NA
	Average	622	3772	14334	70	58239	0.099	0.036	NA	NA	NA	NA	NA	NA	NA	NA
Unfumed Slag (post-1982 upper lift) ²	Minimum	77	1900	<10	29	11119	0.009	0.059	0.353	0.043	0.021	NA	0.023	1950	1200	9.48
	Maximum	1840	23100	20300	325	149000	0.130	0.4	0.62	0.13	0.098	NA	0.10	2650	11750	9.97
	Average	755	7261	8453	132	101874	0.072	0.196	0.529	0.097	0.066	NA	0.05	2173	7225	9.66
Fumed Slag ³	Minimum	17	701	<10	<5	2080	0.028	NA	0.028	0.056	0.02	NA	0.788	54	480	6.16
	Maximum	377	5030	4425	14	28800	0.028	NA	0.054	0.28	0.045	NA	3.7	74	1450	7.77
	Average	90	1584	136	10	11718	0.028	NA	0.037	0.153	0.028	NA	2.65	65	1179	7.34

Table 1. Total and Leachate Concentrations for Unfumed and Fumed Slag from the Former East Helena Smelter

NOTES:

NA = not analyzed

¹Older unfumed slag totals from DH-69, -69, -76. SPLP results from DH-76 (one sample).

²Younger (upper lift) unfumed slag totals from DH-55, -74, -75, -76. SPLP results from DH-74 and DH-76 (three samples).

³Fumed slag totals from DH-55, -56, -65, -74, -75. SPLP results from DH-55 (one sample).



Slag Pile Upper Lift Loading Contribution



