APPENDIX J
X-RAY FLUORESCENCE (XRF) DATA

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This appendix contains data from the Delta Innov-X hand-held XRF analyzer. Results from the instrument were downloaded to a computer and tabulated; comments were added for sample identification, calibrations, blanks, and other notes. However, some calibration data from October 26 and 27, 2011, either were not saved or were accidentally deleted, so the data set is not complete for those dates.

Two Standard Reference Materials (SRM) were used as calibration verification check standards (CCVs) in the field. Copies of the NIST Certificates of Analysis for SRM 2710a and SRM 2711 are included in this appendix (Attachments I-1 and I-2).

Some samples were analyzed *in situ*, while other samples were collected into a thin plastic bag and analyzed in a sheltered area. Samples analyzed *in situ* are identified as such in the XRF Notes section of the table. A thin plastic bag was placed over the XRF instrument to protect the window during the *in situ* analyses; all other samples were collected in thin plastic bags and analyzed in a sheltered area. Results for samples analyzed in situ and under shelter should be considered comparable because the samples were analyzed through the same type of thin plastic bag.

The XRF sample results were compared to laboratory analytical results for metals for six mine and tailings pile samples, and for eleven background samples. A good correlation was observed for lead, (R^2 = 0.987) zinc (R^2 = 0.998), copper (R^2 = 0.990), and cadmium (R^2 = 0.980) for the mine site samples. Other metals had elevated reporting limits with the XRF, and the XRF data were not comparable to laboratory analytical results. The background samples had generally poor correlations. The XRF was not used after Field Event 2 in 2011.

Soil descriptions for the transect samples are presented in Table I-1. XRF results are presented in Table I-2, and XRF sample location coordinates are shown in Table I-3. Transect sample locations are shown on Figures I-1, I-2, and I-3.

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Table J-1 - Transect Measurement Location Soil Descriptions
Van Stone Mine

Transect and Location Number	Date	Soil Description	Notes
Lower Tailings Pile			
Transect 1			E side of AOI-3
T1-SS-100	11/4/11	Damp, gray-brown, slightly silty SAND with trace rootlets (SW)	Below 0.5" duff. XRF analysis.
T1-SS-200	11/4/11	Dry, gray-brown, slightly silty SAND with trace rootlets (SW)	Below 0.5" duff. XRF analysis only.
T1-SS-300	11/4/11	Dry, light brown, slightly sandy SILT with occasional rootlets (ML)	Below 0.5" duff. XRF analysis.
T1-SS-400	11/4/11	Dry, brown, slightly silty SAND with trace organics (rootlets and duff) (SW)	Below 1" duff
T1-SS-500	11/4/11	Dry, light brown, slightly sandy SILT with trace gravel and occasional rootlets (ML)	Below 3" duff and wood
T1-SS-750	11/4/11	Dry, light-brown, slightly silty SAND (SW)	Below 1" duff
T1-SS-1000	11/4/11	Dry, brown to gray-brown, slightly silty SAND (SW)	Below 0.5" duff
Transect 2			SE side of AOI-3
T2-SS-100	11/4/11	Damp, gray to gray-brown, slightly silty SAND with trace gravels (SW)	Below 0.5" duff. XRF analysis.
T2-SS-200	11/4/11	Dry, gray brown to yellow-brown, slightly silty SAND with occasional rootlets (SW)	Below 0.5" duff. XRF analysis only.
T2-SS-300	11/4/11	Dry, light gray, silty SAND (SM)	Tailings. XRF analysis.
T2-SS-400	11/4/11	Dry, light brown to gray brown, slightly silty SAND (SW)	Below 4" duff. XRF analysis only.
T2-SS-500	11/4/11	Dry, gray brown, slightly silty SAND (SW)	Below 1" duff. XRF analysis.
T2-SS-750	11/4/11	Dry, gray brown, slightly silty SAND with trace organics (duff and rootlets) (SW)	Below 3" duff. XRF analysis only.
T2-SS-750 3-5"	11/4/11	Dry, light-brown, slightly silty SAND with occasional rootlets (SW)	Below 3" duff. XRF analysis only.
T2-SS-1000	11/4/11	Dry, brown to gray-brown slightly silty SAND with trace organics (duff and rootlets) (SW)	Below 6" duff and wood debris. XRF analysis only.
Transect 3			S side of AOI-3
T3-SS-100	11/3/11	Dry, gray-brown, slightly sandy SILT with trace roots (ML)	Below 0.5" roots. XRF analysis.
T3-SS-200	11/3/11	Dry, gray-brown, slightly sandy SILT with trace roots and debris (ML)	Below 0.5" roots. XRF analysis only.
T3-SS-300	11/3/11	Dry, light brown, slightly sandy SILT (ML)	Below 0.5" roots. XRF analysis.
T3-SS-400	11/3/11	Dry, red brown, slightly sandy SILT with trace roots (ML)	Below 1" roots. XRF analysis only.
T3-SS-500	11/3/11	Dry, red brown, slightly sandy SILT with trace roots (ML)	Below 1" roots. XRF analysis.
T3-SS-750	11/3/11	Dry, red brown, slightly sandy SILT with trace roots and wood debris (ML)	Below 1" roots. XRF analysis only.
T3-SS-1000	11/3/11	Dry, brown, slightly sandy SILT with trace roots (ML)	Below 1" roots. XRF analysis only.

Table J-1 - Transect Measurement Location Soil Descriptions
Van Stone Mine

Transect and Location Number	Date	Soil Description	Notes
Transect 4			W side of AOI-3
T4-SS-100	11/3/11	Damp, light gray SAND with trace silt (SP)	Tailings. XRF analysis.
T4-SS-200	11/3/11	Damp, light gray SAND (SP)	Tailings. XRF analysis.
T4-SS-300	11/3/11	Dry , brown, slightly sandy SILT with trace gravel and occasional rootlets (ML)	Below 4" duff and wood debris. XRF analysis.
T4-SS-400	11/3/11	Damp, brown, sandy SILT with trace gravel and occasional rootlets (ML)	Below 3" duff and burn debris. XRF analysis only.
T4-SS-500	11/3/11	Dry, gray-brown, slightly sandy SILT with trace gravel (ML)	Below 0.5" duff. XRF analysis.
T4-SS-750	11/3/11	Dry, brown, silty SAND with trace gravel and scattered rootlets (SM)	Below 2" duff. XRF analysis only.
T4-SS-1000	11/3/11	Damp, red-brown, silty SAND with trace gravel and occasional rootlets (SM)	Below 1" duff. XRF analysis only.
Upper Tailings Pile			
Transect 5			NW side of AOI-3
T5-SS-100	11/4/11	Dry, light brown, slightly silty SAND with scattered rootlets (SW)	Below 6" duff and debris. XRF analysis.
T5-SS-200	11/4/11	Dry, gray brown to brown, slightly silty SAND (SW)	Below 3" duff and wood. XRF analysis only.
T5-SS-300	11/4/11	Dry, gray brown, slightly silty SAND (SW)	Below 1" duff. XRF analysis.
T5-SS-400	11/4/11	Dry, gray brown, slightly silty SAND (SW)	Below 1" duff. XRF analysis only.
T5-SS-500	11/4/11	Dry, red-brown to gray brown, slightly silty SAND (SW)	Below 3" duff. XRF analysis.
T5-SS-750	11/4/11	Dry, gray-brown, slightly silty SAND (SW)	Below 2" duff. XRF analysis only.
T5-SS-1000	11/4/11	Dry, gray-brown, slightly silty SAND (SW)	Below 1.5" duff
Transect Samples			
Transect 6			SW side of AOI-2
T6-SS-100	11/6/11	Dry, gray-brown, slightly sandy SILT (ML)	Below 2" duff. XRF analysis.
T6-SS-200	11/6/11	Dry, brown SILT with occasional rootlets (ML)	Below 6" duff. XRF analysis only.
T6-SS-300	11/6/11	Dry, light brown SILT with occasional rootlets (ML)	Below 4" duff. XRF analysis.
T6-SS-400	11/6/11	Dry, brown, silty SAND with numerous rootlets (SM)	Below 8" duff. XRF analysis only.
T6-SS-500	11/6/11	Damp, dark brown-black, slightly sandy SILT with scattered rootlets (ML)	Below 6" duff. XRF analysis.
T6-SS-750	11/6/11	Dry, gray-brown, slightly sandy SILT with trace gravel (ML)	Below 6" duff. XRF analysis only.
T6-SS-1000	11/6/11	Dry, brown, silty SAND with trace gravel (SM)	Below 1" duff. XRF analysis only.

Table J-1 - Transect Measurement Location Soil Descriptions
Van Stone Mine

Transect and Location Number	Date	Soil Description	Notes
Transect 7			NW side of AOI-2
T7-SS-100	11/7/11	Dry, gray-brown, SAND (SP)	Below 4" duff. XRF analysis.
T7-SS-200	11/7/11	Dry, brown to gray-brown, slightly silty SAND (SW)	Below 2" duff. XRF analysis only.
T7-SS-300	11/7/11	Dry, gray-brown, SAND (SP)	Below 4" duff. XRF analysis.
T7-SS-400	11/7/11	Dry, light-brown, slightly silty SAND with occasional rootlets (SW)	Below 0.5" duff. XRF analysis only.
T7-SS-500	11/7/11	Dry, light-brown, slightly silty SAND (SW)	Below 3" duff. XRF analysis.
T7-SS-750	11/7/11	Dry, light-brown, slightly silty SAND with occasional rootlets (SW)	Below 3" duff. XRF analysis only.
T7-SS-1000	11/7/11	Dry, gray-brown, slightly silty SAND (SW)	Below 4" duff. XRF analysis only.
Transect 8			N side of AOI-2
T8-SS-100	11/5/11	Dry, red-brown, slightly silty SAND (SW)	Below 1" duff. XRF analysis.
T8-SS-200	11/5/11	Dry, light brown, slightly silty SAND with trace rootlets (SW)	Below 3" duff. XRF analysis only.
T8-SS-300	11/5/11	Damp, brown, slightly sandy SILT with trace gravel and scattered rootlets (SM)	Below 0.5" duff. XRF analysis.
T8-SS-400	11/5/11	Dry, light brown, slightly silty SAND with trace rootlets (SW)	Below 12" duff. XRF analysis only.
T8-SS-500	11/5/11	Dry, red-brown, slightly silty SAND (SW)	Below 0.5" duff. XRF analysis.
T8-SS-750	11/5/11	Dry, black to brown, slightly silty SAND (SW)	Below 0.5" duff. XRF analysis only.
T8-SS-1000	11/5/11	Dry, brown to black, slightly silty SAND with trace rootlets (SW)	Below 4" duff and wood debris. XRF analysis only.
Transect 9			E side of AOI-2
T9-SS-100	11/5/11	Dry, brown, slightly silty SAND with trace rootlets (SW)	Below 0.5" duff. XRF analysis.
T9-SS-200	11/5/11	Dry, gray-brown, slightly silty SAND with trace rootlets (SW)	Below 3" duff. XRF analysis only.
T9-SS-300	11/5/11	Dry, red-brown, slightly silty SAND with trace rootlets (SW)	Below 1" duff. XRF analysis.
T9-SS-400	11/5/11	Dry, brown, slightly silty SAND with trace rootlets (SW)	Below 1" duff. XRF analysis only.
T9-SS-500	11/5/11	Dry, gray brown to light brown, slightly silty SAND with trace rootlets (SW)	Below 1" duff. XRF analysis.
T9-SS-750	11/5/11	Dry, light brown, slightly silty SAND (SW)	Below 1" duff. XRF analysis only.
T9-SS-1000	11/5/11	Dry, gray-brown, slightly silty SAND with trace rootlets (SW)	Below 1" duff. XRF analysis only.
Transect 10			SE side of AOI-2
T10-SS-150	11/6/11	Dry, red-brown, slightly sandy SILT with numerous rootlets (SM)	Below 3" duff. XRF analysis.
T10-SS-300	11/6/11	Damp, gray-brown, slightly silty SAND with occasional rootlets (SW)	Below 3" duff. XRF analysis only.
T10-SS-450	11/6/11	Dry, light brown, slightly silty SAND (SW)	Below 3" duff. XRF analysis only.

Table J-1 - Transect Measurement Location Soil Descriptions
Van Stone Mine

Transect and Location Number	Date	Soil Description	Notes
T10-SS-500	11/6/11	Dry, brown, slightly silty SAND (SW)	Below 1" duff. XRF analysis.
T10-SS-600	11/6/11	Dry, brown, slightly silty SAND (SW)	Below 2" duff. XRF analysis only.
T10-SS-750	11/6/11	Dry, light brown, slightly silty SAND (SW)	Below 6" duff. XRF analysis.
T10-SS-1000	11/6/11	Dry, light brown, slightly silty SAND (SW)	Below 3" duff. XRF analysis only.
T10-SS-1250	11/6/11	Dry, light brown to red-brown, slightly silty SAND (SW)	Below 3" duff. XRF analysis only.
Waste Rock Piles			
Transect 11			West side of AOI-1
T11-SS-300	11/2/11	Dry, light gray, slightly silty SAND with trace gravel and occasional rootlets (SW)	Below 1" duff. XRF analysis.
T11-SS-500	11/2/11	Dry, light red-brown, slightly sandy SILT with trace gravel (ML)	Below 1" duff. XRF analysis only.
T11-SS-600	11/2/11	Dry, red-brown, slightly sandy SILT with trace gravel (ML)	Below 1" duff. XRF analysis only.
T11-SS-750	11/2/11	Dry, gray-brown, slightly sandy SILT with trace gravel (ML)	Below 0.5" duff. XRF analysis only.
T11-SS-900	11/2/11	Dry, light brown, slightly sandy SILT with trace gravel (ML)	Below 3" duff. XRF analysis.
T11-SS-1000	11/2/11	No description	No sample collected, XRF analysis in situ. Below 0.5" duff
T11-SS-1200	11/2/11	Dry, red-brown, slightly sandy SILT with trace gravel and occasional rootlets (ML)	Below 3" duff. XRF analysis.
T11-SS-1250	11/2/11	Damp, red-brown, slightly sandy SILT with trace gravel and occasional rootlets (ML)	Below 2" duff. XRF analysis only.
T11-SS-1500	11/2/11	Dry, red-brown, slightly sandy SILT with trace gravel and occasional rootlets (ML)	Below 0.5" debris. XRF analysis only.
T11-SS-1750	11/2/11	Dry, gray-brown, slightly sandy SILT with occasional rootlets (ML)	Below 2" duff
T11-SS-2000	11/2/11	Dry, gray-brown, silty SAND with trace gravel and scattered rootlets (SM)	Below 2" duff. XRF analysis only.
Transect 12			West side of AOI-1
T12-SS-150	11/3/11	Dry, brown, slightly sandy SILT with trace gravel and occasional rootlets (ML)	Below 3" duff. XRF analysis.
T12-SS-300	11/3/11	Damp, red-brown, silty SAND with trace gravel and occasional rootlets (SM)	Below 6" duff. XRF analysis only.
T12-SS-450	11/3/11	Dry, red-brown, slightly sandy SILT with occasional rootlets (ML)	Below 3" duff. XRF analysis.
T12-SS-500	11/2/11	No description	No sample collected, XRF analysis in situ. Below 0.5" duff
T12-SS-600	11/3/11	Dry, light brown, slightly sandy SILT with trace gravel and occasional rootlets (ML)	Below 5" duff. XRF analysis only.

Table J-1 - Transect Measurement Location Soil Descriptions
Van Stone Mine

Transect and Location Number	Date	Soil Description	Notes
T12-SS-750	11/2/11	Dry, brown, slightly sandy SILT with occasional rootlets (ML)	Below 0 to 1" duff. XRF analysis.
T12-SS-1000	11/2/11	No description	No sample collected, XRF analysis in situ. Below 0 to 3" duff.
T12-SS-1250	11/3/11	Dry, light brown, SILT with trace gravel and occasional rootlets (ML)	Below 8" duff. XRF analysis only.
T12-SS-1500	11/3/11	Dry, red-brown, slightly sandy SILT with trace gravel and occasional rootlets (ML)	Below 2" duff. XRF analysis only.
Transect 13			NW side of AOI-1
T13-SS-150	10/31/11	Dry, red-brown, slightly silty SAND with occasional rootlets (SW)	Below 4" wood. XRF analysis.
T13-SS-300	10/31/11	Dry, brown, slightly silty SAND with rootlets (SW)	Below 1" duff. XRF analysis.
T13-SS-450	10/31/11	Dry, light brown, slightly silty SAND with occasional rootlets (SW)	Below 2 to 3" duff. XRF analysis only.
T13-SS-500	10/31/11	Damp, brown, slightly silty SAND with trace rootlets (SW)	XRF analysis.
T13-SS-600	10/31/11	Dry, brown, slightly silty SAND with trace rootlets (SW)	Below 3" duff. XRF analysis only.
T13-SS-750	10/31/11	Damp, brown to black, slightly silty SAND (SW)	Below 1" duff. XRF analysis only.
T13-SS-1000	10/31/11	Dry, Red-brown to light brown, slightly silty SAND (SW)	Below 1.5" duff. XRF analysis.
T13-SS-1250	10/31/11	Dry, red-brown to yellow brown, slightly silty SAND (SW)	Below 1" duff. XRF analysis only.
Transect 14			NW side of AOI-1
T14-SS-150	11/7/11	Dry, light brown, slightly silty SAND with organics (wood, roots) (SW)	Below 1" duff. XRF analysis only.
T14-SS-300	11/7/11	Dry, gray-brown, slightly silty SAND with scattered rootlets (SW)	Below 0.5" duff. XRF analysis.
T14-SS-450	11/7/11	Dry, gray brown, silty SAND with organics (wood, roots) (SM)	Below 8" duff. XRF analysis only.
T14-SS-500	10/30/11	Dry, light brown, slightly silty SAND with occasional rootlets (SW)	XRF analysis.
T14-SS-600	11/7/11	Dry, red-brown, slightly silty SAND with occasional rootlets (SW)	Below 2" duff. XRF analysis only.
T14-SS-750	10/30/11	Dry, red-brown, slightly silty SAND with occasional rootlets (SW)	XRF analysis.
T14-SS-800	11/7/11	Dry, gray brown, slightly silty SAND with organics (wood, roots) (SW)	Below 2" duff. XRF analysis only.
T14-SS-1000	10/30/11	Damp, gray-brown, slightly silty SAND with rootlets (SW)	XRF analysis.
Transect 15			SE side of AOI-1
T15-SS-200	11/1/11	Dry, red-brown, slightly gravelly, silty SAND (SP)	Below 1" duff. XRF analysis.
T15-SS-400	11/1/11	Dry, red-brown, silty SAND with trace gravel and occasional rootlets (SM)	Below 1 to 2" duff. XRF analysis only.
T15-SS-500	11/1/11	No description	No sample collected, XRF analysis in situ. Below 2" duff

Table J-1 - Transect Measurement Location Soil Descriptions
Van Stone Mine

Transect and Location Number	Date	Soil Description	Notes
T15-SS-600	11/1/11	Dry, brown, slightly silty SAND with trace gravel and occasional rootlets (SW)	Below 1" duff. XRF analysis only.
T15-SS-750	11/1/11	Dry, red-brown, sandy SILT with trace gravel and occasional rootlets (ML)	Below 0.5" plants. XRF analysis.
T15-SS-800	11/1/11	Dry, red-brown, silty SAND with trace gravel and scattered rootlets (SM)	Below 2" duff. XRF analysis only.
T15-SS-1000	11/1/11	Dry, brown, slightly silty SAND with trace gravel and scattered rootlets (SW)	Below 0.5" moss. XRF analysis.
T15-SS-1250	11/1/11	Dry, light red-brown, silty SAND with trace gravel (SM)	Below 1" duff. XRF analysis only.
T15-SS-1500	11/1/11	Dry, light red-brown, sandy SILT with trace gravel and occasional rootlets (ML)	Below 2" duff. XRF analysis only.
Transect 16			NE side of AOI-1
T16-SS-0	6/21/12	Damp, black organic soil over red-brown, sandy SILT with roots and rootlets (OL/SM)	Below ~ 3.5" duff. No tailings observed.
T16-SS-315	6/21/12	Damp, black organic soil over red-brown, sandy SILT with roots and rootlets (OL/SM)	Below 1.5 to 2" duff. No tailings observed.
T16-SS-770	6/21/12	Moist, light brown, slightly gravelly sandy SILT (SP-SM)	Below ~ 1.5" duff. No tailings observed.
Transect 17			SW side of AOI-1
T17-SS-0	6/21/12	Damp, red-brown, sandy SILT soil with roots and rootlets (SM)	Below ~ 1' duff. No tailings observed.
T17-SS-500	6/21/12	Damp, black organic soil over red-brown, sandy SILT with roots and rootlets (OL/SM)	Below ~ 3.5" duff. No tailings observed.
Transect 18			SW side of AOI-1
T18-SS-0	6/21/12	Damp, red-brown, silty SAND with rootlets (SM)	Below ~ 0.5 to 1" duff. No tailings observed.
T18-SS-350	6/21/12	Damp, black organic soil over red-brown, sandy SILT with roots and rootlets (OL/SM)	Below 1 to 2" duff. No tailings observed.

Table J-2 - XRF Screening Results

Van Stone Mine

HC Sample ID	Date	Time	V	V +/-	Cr	Cr +/-	Mn	Mn +/-	Fe	Fe +/-	Co	Co +/-	Ni	Ni +/-	Cu	Cu +/-	Zn	Zn +/-	As	As +/-	Se	Se +/-	Mo	Mo +/-	Ag	Ag +/-	Cd	Cd +/-	Sb	Sb +/-	Hg	Hg +/-	Pb	Pb +/-
XRF Transect Measurements																																		
T1-SS-500	11/4/2011	15:11:25	332	26	<LOD	29	671	11	15298	56	5.9	0.3	14	4	15.4	1.7	149	2	<LOD	2.9	<LOD	1.1	<LOD	1.9	<LOD	8	<LOD	10	<LOD	20	<LOD	3.6	46.4	1.3
T1-SS-200	11/7/2011	21:15:26	273	24	<LOD	28	274	8	13824	50	6.5	0.3	<LOD	12	18.1	1.7	116	1.8	3	0.8	<LOD	1.1	<LOD	2	<LOD	9	<LOD	10	<LOD	21	<LOD	3.5	20.2	1.1
T1-SS-750	11/7/2011	21:19:32	329	25	<LOD	28	904	12	14485	52	6.3	0.3	<LOD	11	16.3	1.7	174	2	5.7	0.9	<LOD	1.1	<LOD	1.8	<LOD	8	<LOD	9	<LOD	19	<LOD	3.4	39.9	1.2
T1-SS-100	11/7/2011	21:23:26	200	23	<LOD	27	303	8	12681	48	4.3	0.3	<LOD	11	33	1.9	1084	6	<LOD	4.4	<LOD	1.2	<LOD	1.7	<LOD	8	<LOD	10	<LOD	19	5.6	1.4	167.2	1.9
T1-SS-300	11/7/2011	21:27:09	402	26	<LOD	29	362	9	14446	52	5.9	0.3	<LOD	11	16.6	1.7	83.4	1.6	4.3	0.8	<LOD	1.1	<LOD	1.9	<LOD	8	<LOD	10	<LOD	19	<LOD	3.4	11.6	1
T1-SS-400	11/7/2011	21:31:17	172	24	<LOD	27	376	8	13669	49	6.2	0.3	<LOD	11	15.2	1.6	154.9	2	3.9	0.9	<LOD	1	<LOD	1.8	<LOD	8	<LOD	9	<LOD	18	<LOD	3.3	35.9	1.2
T1-SS-1000	11/7/2011	21:35:09	295	25	<LOD	29	626	10	16997	60	8.4	0.4	<LOD	12	16.2	1.7	139	1.9	5.3	0.9	<LOD	1.1	<LOD	1.9	<LOD	8	<LOD	9	<LOD	19	<LOD	3.4	28.1	1.2
T1-SS-500	11/7/2011	21:38:54	223	24	<LOD	28	365	9	13583	50	6.5	0.3	<LOD	12	16.6	1.7	182	2	<LOD	3	<LOD	1.1	<LOD	1.8	<LOD	8	<LOD	10	<LOD	19	<LOD	3.6	54.6	1.3
T2-SS-500	11/4/2011	13:27:07	305	26	<LOD	28	518	10	16243	58	7.1	0.4	<LOD	12	15.4	1.7	152	2	6.2	0.9	<LOD	1.1	<LOD	1.8	<LOD	8	<LOD	10	<LOD	19	<LOD	3.5	22.6	1.1
T2-SS-200	11/8/2011	7:57:31	178	24	29	10	482	9	15219	55	7.2	0.3	<LOD	12	23.2	1.8	278	3	4.9	1.1	<LOD	1.1	<LOD	1.9	<LOD	8	<LOD	9	<LOD	19	<LOD	3.6	67.6	1.4
T2-SS-400	11/8/2011	8:02:17	378	26	<LOD	29	324	8	15935	57	7.7	0.4	<LOD	12	22.6	1.8	111.8	1.8	5.5	0.8	<LOD	1.1	<LOD	1.9	<LOD	8	<LOD	10	<LOD	19	<LOD	3.5	19.3	1.1
T2-SS-100	11/8/2011	8:07:28	322	25	<LOD	28	268	8	12449	47	5.5	0.3	<LOD	12	21.4	1.8	202	2	4.3	1.1	<LOD	1.1	<LOD	1.8	<LOD	8	<LOD	10	<LOD	20	<LOD	3.6	74	1.5
T2-SS-750	11/8/2011	8:12:51	152	23	<LOD	26	909	11	11690	43	5	0.3	<LOD	11	13.6	1.6	172	2	8.2	1.1	<LOD	1	<LOD	1.7	<LOD	8	<LOD	9	<LOD	17	<LOD	3.2	75.2	1.4
T2-SS-750	11/8/2011	8:16:47	277	25	<LOD	28	656	10	14510	52	6.6	0.3	<LOD	11	14.4	1.7	153	2	6.5	0.8	<LOD	1.1	<LOD	1.9	<LOD	8	<LOD	9	<LOD	19	<LOD	3.4	13	1
T2-SS-1000	11/8/2011	8:20:24	550	31	<LOD	33	2195	19	26365	89	11.6	0.5	<LOD	13	22.2	1.9	275	3	10.4	0.9	<LOD	1.2	<LOD	2	<LOD	8	11	3	<LOD	20	<LOD	3.9	21.4	1.2
T2-SS-300	11/8/2011	8:24:23	<LOD	63	<LOD	27	128	7	5105	27	2.3	0.2	<LOD	12	18.1	2	2416	11	<LOD	7	<LOD	1.4	<LOD	1.6	<LOD	9	12	4	<LOD	21	8.8	1.8	377	3
T2-SS-500	11/8/2011	8:28:07	284	24	<LOD	27	467	9	14629	52	7.1	0.3	<LOD	11	15.6	1.7	133	1.9	4.3	0.8	<LOD	1.1	<LOD	1.9	<LOD	8	<LOD	9	<LOD	18	<LOD	3.4	12.8	1
T3-SS-500	11/3/2011	13:47:39	312	26	<LOD	29	521	10	13884	53	7.3	0.3	<LOD	12	18.1	1.8	143	2	5	0.9	<LOD	1.1	<LOD	2.1	<LOD	9	<LOD	10	<LOD	20	<LOD	3.6	29.7	1.2
T3-SS-750	11/3/2011	14:04:42	339	27	<LOD	31	475	10	14727	57	7.6	0.4	14	4	19.3	1.9	125.4	2	3.9	0.9	<LOD	1.2	<LOD	2.1	<LOD	9	<LOD	10	<LOD	21	3.8	1.3	19.7	1.1
T4-SS-500	11/3/2011	15:55:49	228	27	<LOD	30	353	9	14776	58	5.7	0.4	<LOD	13	15.4	1.9	182	2	6.5	0.9	<LOD	1.2	<LOD	2	<LOD	9	<LOD	10	<LOD	21	<LOD	3.8	24.9	1.2
T3-SS-750	11/3/2011	20:49:35	267	25	<LOD	28	452	9	15337	55	7.3	0.3	<LOD	12	16.2	1.7	135.4	1.9	3.7	0.8	<LOD	1.1	<LOD	2	<LOD	8	<LOD	10	<LOD	19	3.9	1.2	20.5	1.1
T3-SS-200	11/3/2011	20:54:03	351	26	42	10	355	9	15157	55	8	0.3	<LOD	12	21.4	1.8	200	2	4.5	0.9	<LOD	1.1	<LOD	2	<LOD	8	<LOD	10	<LOD	19	3.8	1.2	28.4	1.2
T3-SS-500	11/3/2011	20:58:23	308	25	<LOD	28	520	10	14424	52	9.1	0.3	<LOD	11	15.8	1.7	153	2	3.4	0.9	<LOD	1.1	<LOD	1.9	<LOD	8	<LOD	9	<LOD	19	<LOD	3.4	33	1.2
T3-SS-1000	11/3/2011	21:02:29	277	25	<LOD	28	358	8	15259	54	7.5	0.3	<LOD	11	201	3	254	3	8.5	1	<LOD	1.1	<LOD	1.9	<LOD	8	<LOD	9	<LOD	19	<LOD	3.5	41.7	1.2
T3-SS-300	11/3/2011	21:06:42	98	22	<LOD	27	186	7	7792	35	3.3	0.3	<LOD	12	171	3	2275	10	<LOD	10	<LOD	1.6	<LOD	1.6	<LOD	9	<LOD	10	<LOD	20	11.2	1.8	880	5
T3-SS-400	11/3/2011	21:10:56	299	25	<LOD	28	450	9	12669	47	6.9	0.3	<LOD	11	19.7	1.7	157	2	3.9	0.8	<LOD	1.1	<LOD	1.9	<LOD	8	<LOD	9	<LOD	18	<LOD	3.3	21.6	1.1
T3-SS-100	11/3/2011	21:21:41	324	26	<LOD	29	366	9	15284	55	7.5	0.3	<LOD	12	15.6	1.7	204	2	3.1	0.9	<LOD	1.1	<LOD	2	<LOD	8	<LOD	10	<LOD	19	<LOD	3.6	30.1	1.2
T3-SS-200	11/8/2011	9:26:25	406	26	<LOD	29	338	8	15022	54	7	0.3	<LOD	12	17.9	1.7	193	2	3.9	0.9	<LOD	1.1	<LOD	1.9	<LOD	8	<LOD	9	<LOD	19	<LOD	3.5	27.5	1.2
T3-SS-500	11/8/2011	9:30:19	327	25	<LOD	28	506	9	14753	53	7.9	0.3	<LOD	11	18.1	1.7	156	2	4.6	0.9	<LOD	1.1	<LOD	1.9	<LOD	8	<LOD	9	<LOD	18	5.9	1.2	33.2	1.2
T3-SS-100	11/8/2011	9:34:10	405	27	<LOD	30	426	9	16391	59	8.6	0.4	<LOD	12	18.6	1.8	227	2	4.8	0.9	<LOD	1.1	<LOD	2	<LOD	8	<LOD	10	<LOD	19	5.9	1.3	33.2	1.2
T3-SS-1000	11/8/2011	9:38:11	232	24	<LOD	28	370	9	15625	55	8.1	0.3	<LOD	12	206	3	249	3	8.2	1	<LOD	1.1	<LOD	1.9	<LOD	8	<LOD	9	<LOD	18	<LOD	3.4	38.9	1.2
T3-SS-750	11/8/2011	9:42:15	284	25	<LOD	28	425	9	15503	55	8.1	0.3	<LOD	12	17.8	1.7	134	1.9	3.9	0.8	<LOD	1.1	<LOD	1.9	<LOD	8	<LOD	9	<LOD	18	4	1.2	18.9	1.1
T3-SS-300	11/8/2011	9:46:23	144	23	<LOD	27	217	8	8262	36	3.8	0.3	<LOD	12	177	3	2311	10	<LOD	10	2.5	0.5	<LOD	1.7	<LOD	9	<LOD	10	<LOD	20	11.9	1.8	906	5
T3-SS-400	11/8/2011	9:50:19	321	25	<LOD	28	532	10	13659	50	6.8	0.3	<LOD	11	17.5	1.7	142.1	2	5.7	0.8	<LOD	1.1	<LOD	1.9	<LOD	8	<LOD	9	<LOD	19	<LOD	3.4	20.3	1.1
T4-SS-500	11/3/2011	20:19:02	260	25	<LOD	29	337	9	14748	54	6	0.3	<LOD	12	16.8	1.7	183	2	4.4	0.9	<LOD	1.1	<LOD	2	<LOD	8	<LOD	10	<LOD	19	<LOD	3.6	25.1	1.2
T4-SS-300	11/3/2011	20:23:34	342	27	<LOD	29	726	11	14238	53	6.3	0.3	<LOD	12	13.8	1.7	148	2	6.7	0.9	<LOD	1.1	<LOD	1.9	<LOD	8	<LOD	10	<LOD	19	<LOD	3.5	33.9	1.2
T4-SS-100	11/3/2011	20:27:52	88	22	<LOD	28	127	7	6128	31	3	0.2	<LOD	13	29	2	3853	15	<LOD	5.3	<LOD	1.4	<LOD	1.6	<LOD	9	19	4	<LOD	22	17	2	224	2
T4-SS-400	11/3/2011	20:32:00	307	26	<LOD	29	585	10	16126	58	7.8	0.4	<LOD	12	20.7	1.8	236	3	5.8	1	<LOD	1.1	<LOD	2	<LOD	8	<LOD	10	<LOD	19	<LOD	3.6	37.1	1.2
T4-SS-200	11/3/2011	20:36:39	<LOD	67	<LOD	29	154	7	7500	36	2.4	0.3	<LOD	13	21	2	4253	17	<LOD	5.5	<LOD	1.5	1.7	0.5	<LOD	9	17	4	<LOD	22	20	2	241	3
T4-SS-750	11/3/2011	20:41:21	158	23	<LOD	26	453	9	13602	49	6.9	0.3	<LOD	11	14.9	1.7	104	1.7	3.2	0.8	<LOD	1	<LOD	1.9	<LOD	8	<LOD	9	<LOD	18	<LOD	3.3	20.7	1.1
T4-SS-1000	11/3/2011	20:45:30	278	25	<LOD	28	320	8	13397	50	5.6	0.3	<LOD	11	11.3	1.7	82.5	1.6	2.7	0.8	<LOD	1.1	<LOD	2	<LOD	8	<LOD	10	<LOD	19	4.1	1.2	21.9	1.1
T4-SS-400	11/8/2011	8:32:12	320	25	<LOD	28	516	10	14232	52	7.4	0.3	<LOD	12	21.2	1.8	205	2	7.9	0.9	<LOD	1.1	<LOD	1.9	<LOD	8	<LOD	10	<LOD	19	<LOD	3.6	28.5	1.2
T4-SS-100	11/8/2011	8:35:53	<LOD	65	<LOD	28	134	7	8148	37	3.3	0.3	<LOD	12	23	2	3697	15	<LOD	5.3	<LOD	1.4	<LOD	1.6	<LOD	9	12	4	<LOD	22	18	2	227	2
T4-SS-750	11/8/2011	8:39:37	127	23	<LOD	27	442	9	13719	50	5.8	0.3	<LOD	11	10.9	1.6	120.3	1.8	4.3	0.8	<LOD	1.1	<LOD	1.9	<LOD	8	<LOD	9	<LOD	18	<LOD	3.3	18.6	1.1
T4-SS-1000	11/8/2011	8:43:18	236	25	<LOD	28	345	9	15708	57	6.3	0.3	<LOD	12	11.5	1.7	90.4	1.6	3.6	0.9	<LOD	1.1	<LOD	2	<LOD	8	<LOD	10	<LOD	19	<LOD	3.5	28.1	1.2
T4-SS-300	11/8/2011	8:47:04	274	24	<LOD	27	533	10	13151	48	5.4	0.3	<LOD	11	15.5	1.7	163	2	5.8	0.9	<LOD	1.1	<LOD	1.9	<LOD	8	<LOD	9	<LOD	18	<LOD	3.4	40.1	1.2
T4-SS-200	11/8/2011	8:50:44	72	22	<LOD	28	140	7	6792	33	3	0.3	15	4	22	2	3425	14	<LOD	5	<LOD	1.4	<LOD	1.6	<LOD	9	18	4	<LOD	22	18	2	196	2
T4-SS-500	11/8/2011	8:54:53	369	26	<LOD	29	331	8	14149	52	6.4	0.3	<LOD	11	16.3	1.7	177	2	4.6	0.9	<LOD	1.1	<LOD	2	<LOD	8	<LOD	10	<LOD	19	<LOD	3.6	22.2	1.1
T4-SS-750	11/9/2011	8:32:08	205	24	<LOD	28	443	9	13902	50	7.6	0.3	<LOD	11	15.3	1.7	107.9	1.7	3	0.8	<LOD	1.1	<LOD	1.9	<LOD	8	<LOD	9	<LOD	18	<LOD	3.4	22	1.1
T4-SS-100	11/9/2011	8:36:48	<LOD	65	<LOD	28	145	7	6857	33	2.5	0.3	<LOD	13	24	2	3320	14	<LOD	5.5	<LOD	1.4	1.9	0.5	<LOD	9	15	4	<LOD	22	15	2	248	3
T4-SS-750	11/9/2011	8:41:14	192	24	<LOD	27	440	9	13814	51	4.9	0.3	<LOD	12	8.8	1.7	92.6	1.6	<LOD	2.5	<LOD	1.1	<LOD	1.9	<LOD	8	<LOD	10	<LOD	19	<LOD	3.5	20.8	1.1
T4-SS-100	11/9/2011	9:04:25	96	22	<LOD	28	131	7	7551	36	3.2	0.3	<LOD	13	28	2	3718	15	<LOD	5.7	<LOD	1.4	<LOD	1.6	10	3	13	4	<LOD	22	22	2	263	3
T5-SS-500	11/4/2011	11:02:57	260	26	<LOD	29	703	11	17585	63	8.3	0.4	<LOD	12	17	1.8	103.9	1.8	5.7	0.8	<LOD	1.1	<LOD	2	<LOD	8	<LOD	10	<LOD	19	<LOD	3.5	14.3	1.1
T5-SS-200	11/8/2011	8:58:42	219	25	<LOD	28	680	11	13538	51	5.2	0.3	<LOD	12	12.5	1.7	65.8	1.5	5	0.9	<LOD	1.1	<LOD	2	9	3	<LOD	10	<LOD	19	<LOD	3.5	21.3	1.1
T5-SS-100	11/8/2011	9:03:03	208	24	<LOD	26	317	8	12066	45	4.3	0.3	<LOD	11	9.4	1.6	80.8	1.5	3.6	0.8	<LOD	1.1	<LOD	1.8	<LOD	8	<LOD	9	<LOD	19	<LOD	3.5	16.8	1.1
T5-SS-300	11/8/2011	9:07:49	243	25	<LOD	29	408	9	13921	52	5.5	0.3	<LOD	12	10	1.7	98	1.7	3.5	0.9	<LOD	1.1	<LOD	2	<LOD	8	<LOD	10	<LOD	19	<LOD	3.6	30.8	1.2
T5-SS-400	11/8/2011	9:11:36	174	23	<LOD	27	515	9	11009	43	5	0.3	<LOD	11	10.3	1.7	101.9	1.7	5.3	0.9	<LOD	1.1	<LOD	2	<LOD	8	<LOD	9	<LOD	19	<LOD	3.5	30.6	1.2
T5-SS-500	11/8/2011	9:15:20	247	25	<LOD	28	491	9	14871	54	7.4	0.3	<LOD	11	17.5	1.7	96.6	1.7	3.7	0.8	<LOD	1.1	<LOD	1.9	<LOD	8	<LOD	10	<LOD	19	<LOD	3.4	13.2	1
T5-SS-750	11/8/2011	9:19:01	299	24	<LOD	28	490	9	13586	49	7.3	0.3	<LOD	11	13	1.6	113.2	1.7	4.6	0.8	<LOD	1.1	<LOD	1.9	<LOD	8	<LOD	9	<LOD	18	<LOD	3.3	14.3	1
T5-SS-1000	11/8/2011	9:22:36	293	24	<LOD	28	502	9	14281	51	6.9	0.3	<LOD	11	14.2	1.7	127.3	1.8	3.1	0.8	<LOD	1.1	<LOD	1.8	<LOD	8	<LOD	9	<LOD	19	<LOD	3.4	17	1

Table J-2 - XRF Screening Results

Van Stone Mine

HC Sample ID	Date	Time	V	V +/-	Cr	Cr +/-	Mn	Mn +/-	Fe	Fe +/-	Co	Co +/-	Ni	Ni +/-	Cu	Cu +/-	Zn	Zn +/-	As	As +/-	Se	Se +/-	Mo	Mo +/-	Ag	Ag +/-	Cd	Cd +/-	Sb	Sb +/-	Hg	Hg +/-	Pb	Pb +/-
T6-SS-500	11/6/2011	11:16:26	77	22	<LOD	26	209	7	9359	38	4.5	0.3	<LOD	11	19.6	1.7	55.5	1.3	4	0.8	<LOD	1	<LOD	1.8	<LOD	8	<LOD	10	<LOD	19	<LOD	3.2	11.7	1
T6-SS-100	11/8/2011	9:58:23	201	24	<LOD	27	757	11	14536	52	6.7	0.3	<LOD	11	12.5	1.6	200	2	<LOD	3.4	<LOD	1.1	<LOD	1.8	<LOD	8	<LOD	9	<LOD	18	<LOD	3.3	86.4	1.5
T6-SS-400	11/8/2011	10:02:38	<LOD	65	<LOD	26	262	8	9901	39	4.2	0.3	<LOD	11	12.9	1.7	152	2	4.2	0.8	<LOD	1.1	<LOD	1.7	<LOD	8	<LOD	9	<LOD	18	<LOD	3.3	23	1.1
T6-SS-300	11/8/2011	10:09:55	251	25	<LOD	29	303	8	16364	59	7.5	0.4	<LOD	12	13.5	1.7	115.9	1.8	3.1	0.8	<LOD	1.1	<LOD	1.9	<LOD	8	<LOD	10	<LOD	19	<LOD	3.6	18.7	1.1
T6-SS-750	11/8/2011	10:14:23	244	24	<LOD	27	449	9	12133	46	4.9	0.3	<LOD	11	8.9	1.6	94.6	1.6	<LOD	2.6	<LOD	1.1	<LOD	1.8	<LOD	8	<LOD	10	<LOD	20	<LOD	3.5	25.6	1.1
T6-SS-1000	11/8/2011	10:17:59	259	25	<LOD	28	213	7	13596	50	4.5	0.3	<LOD	11	10.7	1.7	42.7	1.2	<LOD	2.4	<LOD	1.1	<LOD	1.9	<LOD	8	<LOD	10	<LOD	19	<LOD	3.4	15.1	1
T6-SS-200	11/8/2011	10:21:30	316	25	<LOD	28	465	9	15418	55	6.8	0.3	<LOD	11	15.5	1.7	127.1	1.9	4.8	0.8	<LOD	1.1	<LOD	1.9	<LOD	8	<LOD	10	<LOD	19	<LOD	3.5	18.1	1.1
T6-SS-500	11/8/2011	10:25:41	<LOD	60	<LOD	24	179	6	9468	36	4.4	0.3	<LOD	10	15.7	1.6	60.4	1.3	3.6	0.7	<LOD	1	<LOD	1.6	<LOD	7	<LOD	9	<LOD	17	<LOD	3	13.7	1
T7-SS-500	11/7/2011	11:19:02	252	25	<LOD	28	268	8	11737	45	3.9	0.3	<LOD	12	8.3	1.7	88.5	1.6	<LOD	2.6	<LOD	1.1	<LOD	1.9	<LOD	8	<LOD	10	<LOD	20	3.9	1.2	25.4	1.2
T7-SS-750	11/7/2011	18:34:02	319	26	<LOD	29	1160	14	16927	60	6.6	0.4	<LOD	12	14.3	1.7	106.4	1.8	3.3	0.8	<LOD	1.1	<LOD	1.9	<LOD	8	<LOD	10	<LOD	19	4.2	1.2	18	1.1
T7-SS-1000	11/7/2011	18:39:39	299	26	<LOD	29	812	12	15027	55	5.3	0.3	<LOD	12	9.3	1.7	79.1	1.6	<LOD	2.7	<LOD	1.1	<LOD	2	<LOD	8	<LOD	10	<LOD	20	<LOD	3.6	27.8	1.2
T7-SS-500	11/7/2011	18:43:39	208	24	36	9	187	7	9946	40	4.2	0.3	<LOD	11	8.2	1.7	117.7	1.8	<LOD	2.5	<LOD	1.1	<LOD	1.9	<LOD	8	<LOD	10	<LOD	20	<LOD	3.6	21.5	1.1
T7-SS-400	11/7/2011	18:48:19	270	28	<LOD	31	717	12	20330	72	9.4	0.4	<LOD	12	15.3	1.8	96.7	1.7	4.5	0.9	<LOD	1.2	<LOD	2.1	<LOD	9	<LOD	10	<LOD	20	<LOD	3.8	19.1	1.2
T7-SS-200	11/7/2011	18:52:19	240	24	39	9	424	9	13775	51	4.8	0.3	<LOD	11	9.4	1.7	98.4	1.7	<LOD	2.5	<LOD	1.1	<LOD	1.9	<LOD	9	<LOD	11	<LOD	22	<LOD	3.5	22.4	1.1
T7-SS-100	11/7/2011	18:56:31	130	24	<LOD	29	222	8	13860	53	5.5	0.3	<LOD	12	26.7	2	1540	8	10.4	1.5	1.3	0.4	<LOD	1.8	<LOD	9	<LOD	10	<LOD	20	9.1	1.6	141.1	1.9
T7-SS-300	11/7/2011	19:00:39	235	25	<LOD	28	290	8	11560	45	3.3	0.3	14	4	5.8	1.6	67.7	1.5	3	0.9	<LOD	1.1	<LOD	1.8	<LOD	8	<LOD	10	<LOD	20	<LOD	3.5	23.1	1.1
T8-SS-500	11/5/2011	13:01:32	189	24	<LOD	28	610	10	14293	52	4.9	0.3	<LOD	11	18.9	1.7	182	2	5.8	0.9	<LOD	1.1	<LOD	1.8	<LOD	8	<LOD	9	<LOD	19	<LOD	3.5	28	1.1
T8-SS-100	11/7/2011	19:06:44	269	26	<LOD	29	649	11	17921	63	8.4	0.4	<LOD	12	16.3	1.7	218	2	3.6	0.9	<LOD	1.1	<LOD	1.9	<LOD	8	<LOD	10	<LOD	19	<LOD	3.6	40.2	1.2
T8-SS-500	11/7/2011	20:11:28	298	25	31	10	674	11	15120	54	5.8	0.3	<LOD	12	16.1	1.7	177	2	5.6	0.9	<LOD	1.1	<LOD	1.8	<LOD	8	<LOD	9	<LOD	19	<LOD	3.4	25.8	1.1
T8-SS-200	11/7/2011	20:15:28	299	25	<LOD	28	1136	13	15726	56	7.9	0.3	<LOD	12	15	1.7	260	3	5.4	0.8	<LOD	1.1	<LOD	1.9	<LOD	8	13	3	<LOD	19	<LOD	3.4	17.6	1.1
T8-SS-300	11/7/2011	20:19:20	<LOD	65	<LOD	26	346	8	8117	34	3.6	0.3	<LOD	11	<LOD	4.7	58.6	1.4	2.6	0.9	<LOD	1.1	<LOD	1.8	<LOD	8	<LOD	10	<LOD	19	<LOD	3.3	26.1	1.1
T8-SS-400	11/7/2011	20:23:18	365	26	<LOD	29	903	12	14067	52	4.6	0.3	<LOD	12	9.7	1.7	133.1	1.9	5.3	0.9	<LOD	1.1	<LOD	1.8	<LOD	8	<LOD	10	<LOD	19	<LOD	3.5	30.3	1.2
T8-SS-750	11/7/2011	20:27:09	188	24	<LOD	28	646	11	11988	46	3.9	0.3	<LOD	11	6.7	1.7	276	3	3.2	1	<LOD	1.1	<LOD	1.8	<LOD	8	<LOD	10	<LOD	19	3.6	1.2	41.2	1.3
T8-SS-1000	11/7/2011	20:31:08	486	29	38	10	1334	15	19923	70	5.3	0.4	24	4	10.8	1.8	150	2	2.7	0.8	<LOD	1.1	<LOD	1.9	<LOD	9	<LOD	10	<LOD	20	4.4	1.3	15.2	1.1
T9-SS-500	11/5/2011	16:18:21	299	26	41	10	577	10	13965	51	5.4	0.3	13	4	13	1.7	67.9	1.4	<LOD	2.3	<LOD	1.1	<LOD	1.8	<LOD	8	<LOD	10	<LOD	19	<LOD	3.4	14.4	1
T9-SS-200	11/7/2011	20:35:40	174	24	<LOD	27	557	10	13525	50	5.6	0.3	<LOD	11	13.2	1.7	144.1	2	6.4	1	<LOD	1.1	<LOD	1.8	<LOD	8	<LOD	9	<LOD	18	<LOD	3.4	47.8	1.3
T9-SS-300	11/7/2011	20:40:23	385	25	<LOD	27	455	9	11981	44	4.8	0.3	<LOD	11	9.1	1.6	62.2	1.4	3	0.8	<LOD	1	<LOD	1.8	<LOD	8	<LOD	9	<LOD	18	<LOD	3.2	12.2	1
T9-SS-400	11/7/2011	20:44:27	231	25	<LOD	28	674	11	13275	50	5.8	0.3	<LOD	11	7.3	1.7	95.8	1.7	3.5	0.9	<LOD	1.1	<LOD	2	<LOD	9	<LOD	10	<LOD	20	<LOD	3.4	28.1	1.2
T9-SS-500	11/7/2011	20:48:20	288	25	<LOD	28	610	10	15817	56	7.7	0.3	<LOD	11	12.7	1.7	77.7	1.5	3.3	0.8	<LOD	1.1	<LOD	1.9	<LOD	8	<LOD	9	<LOD	19	<LOD	3.4	15.5	1
T9-SS-1000	11/7/2011	20:56:35	318	26	<LOD	28	594	10	16950	60	7.4	0.4	<LOD	12	16.1	1.7	121.5	1.8	2.5	0.8	<LOD	1.1	<LOD	1.9	<LOD	8	<LOD	10	<LOD	19	<LOD	3.5	16.1	1.1
T9-SS-750	11/7/2011	21:00:27	230	25	<LOD	28	798	11	16796	59	7.8	0.4	<LOD	11	15.1	1.7	99.6	1.7	8.8	0.9	<LOD	1.1	<LOD	1.8	<LOD	8	<LOD	9	<LOD	18	<LOD	3.4	20.6	1.1
T9-SS-100	11/8/2011	9:54:21	301	26	36	10	272	8	14662	56	6.8	0.4	<LOD	12	15.4	1.8	68.3	1.5	<LOD	2.5	<LOD	1.1	<LOD	2.1	<LOD	9	<LOD	10	<LOD	21	4.8	1.2	16.4	1.1
T10-SS-500	11/6/2011	15:06:27	354	26	<LOD	29	1022	13	13966	52	5.7	0.3	<LOD	12	21.7	1.8	650	4	3.9	1	<LOD	1.1	<LOD	1.9	<LOD	8	<LOD	10	<LOD	20	<LOD	3.8	50.8	1.3
T10-SS-750	11/6/2011	15:23:30	302	25	<LOD	28	504	10	15462	55	6	0.3	<LOD	12	12.7	1.7	110.6	1.8	2.6	0.8	<LOD	1.1	<LOD	1.9	<LOD	8	<LOD	10	<LOD	19	4.5	1.2	17.4	1.1
T10-SS-1000	11/6/2011	17:59:08	277	26	<LOD	29	783	12	16597	60	6.9	0.4	<LOD	12	9.2	1.7	121.7	1.9	5.2	0.8	<LOD	1.1	<LOD	1.9	<LOD	8	<LOD	10	<LOD	19	<LOD	3.5	17.9	1.1
T10-SS-150	11/6/2011	18:04:41	121	22	<LOD	25	606	10	10798	40	5.5	0.3	<LOD	10	9.3	1.6	89.9	1.5	<LOD	2.9	<LOD	1	<LOD	1.7	<LOD	8	<LOD	9	22	6	<LOD	3.1	54.1	1.3
T10-SS-300	11/6/2011	18:16:59	234	25	42	10	208	8	10918	45	5.4	0.3	<LOD	12	10.9	1.8	43	1.3	<LOD	2.5	<LOD	1.2	<LOD	2.1	<LOD	9	<LOD	11	<LOD	23	<LOD	3.8	14.1	1.1
T10-SS-450	11/6/2011	18:21:15	249	27	<LOD	30	834	12	18197	66	8.1	0.4	<LOD	12	13.4	1.8	143	2	10.5	1	<LOD	1.1	<LOD	2	<LOD	8	<LOD	10	<LOD	19	<LOD	3.7	43.5	1.3
T10-SS-600	11/6/2011	18:32:30	244	24	<LOD	27	404	9	14911	53	7.7	0.3	<LOD	11	14.4	1.7	94.1	1.6	2.7	0.8	<LOD	1.1	<LOD	1.8	<LOD	8	<LOD	9	<LOD	19	<LOD	3.4	17.3	1.1
T10-SS-1250	11/6/2011	18:36:43	264	25	<LOD	28	593	10	18344	63	8.7	0.4	<LOD	11	14.6	1.7	121.4	1.8	4.4	0.8	<LOD	1	<LOD	1.9	<LOD	8	<LOD	9	<LOD	18	<LOD	3.4	16	1.1
T10-SS-500	11/6/2011	18:41:28	332	27	<LOD	30	1381	15	14098	54	6.4	0.3	<LOD	12	25.5	1.9	668	4	9.4	1.1	<LOD	1.2	<LOD	1.9	<LOD	9	<LOD	10	<LOD	20	<LOD	3.9	47.3	1.3
T10-SS-750	11/6/2011	18:45:35	277	26	<LOD	29	607	10	16587	59	6.9	0.4	<LOD	12	11.9	1.7	113	1.8	2.6	0.8	<LOD	1.1	<LOD	1.9	<LOD	8	<LOD	10	<LOD	19	<LOD	3.5	13.5	1
T11-SS-500	11/2/2011	10:07:55	316	26	59	10	569	10	16624	59	6.1	0.4	14	4	15.9	1.8	218	2	3.7	0.9	1.4	0.4	<LOD	1.9	<LOD	8	<LOD	10	<LOD	20	<LOD	3.7	25.5	1.1
T11-SS-750	11/2/2011	10:32:57	220	24	<LOD	28	340	8	17086	59	7.3	0.4	<LOD	11	12.5	1.7	228	2	<LOD	3.2	<LOD	1.1	<LOD	1.9	<LOD	8	<LOD	9	<LOD	19	<LOD	3.5	72.9	1.4
T11-SS-1000	11/2/2011	10:51:54	179	24	<LOD	27	448	9	12667	47	5.3	0.3	<LOD	11	10.1	1.6	190	2	6.5	1	<LOD	1.1	<LOD	1.9	<LOD	8	<LOD	9	<LOD	19	<LOD	3.5	44.5	1.3
T11-SS-1000	11/2/2011	10:58:05	106	25	<LOD	29	599	11	13170	52	4.4	0.3	<LOD	12	8.3	1.8	163	2	10.7	1.3	<LOD	1.2	<LOD	1.9	<LOD	9	<LOD	10	<LOD	19	<LOD	3.8	98.9	1.7
T11-SS-1250	11/2/2011	11:15:51	216	27	<LOD	30	662	12	13963	56	3.4	0.3	17	4	7.4	1.9	179	2	3.3	0.9	<LOD	1.2	<LOD	1.9	<LOD	9	<LOD	10	<LOD	20	<LOD	3.8	21.8	1.2
T11-SS-1500	11/2/2011	11:44:15	231	27	<LOD	30	467	10	19962	72	9.5	0.4	<LOD	13	14.2	1.8	101	1.8	5.1	0.9	<LOD	1.1	<LOD	2	<LOD	8	<LOD	10	<LOD	19	<LOD	3.6	14.8	1.1
T11-SS-2000	11/3/2011	7:15:34	269	26	<LOD	28	862	12	18394	64	8.9	0.4	<LOD	12	13.2	1.7	111.3	1.8	5.1	0.9	<LOD	1.1	<LOD	1.9	<LOD	8	<LOD	9	<LOD	19	<LOD	3.4	24.6	1.1
T11-SS-300	11/3/2011	7:20:03	100	21	28	9	130	6	5360	27	2.4	0.2	21	4	25.5	1.9	1590	8	<LOD	4.5	1.8	0.4	<LOD	1.6	9	3	<LOD	10	<LOD	21	7.8	1.6	175	2
T11-SS-600	11/3/2011	7:26:10	143	23	<LOD	27	427	9	14956	53	7.3	0.3	<LOD	11	9.9	1.6	255	3	4.4	0.9	<LOD	1.1	<LOD	1.8	<LOD	8	<LOD	9	<LOD	18	<LOD	3.4	35.6	1.2
T11-SS-1200	11/3/2011	7:30:52	134	23	<LOD	26	1033	12	15111	53	7	0.3	<LOD	11	12.2	1.6	174	2	<LOD	3.7	<LOD	1.1	<LOD	1.7	<LOD	8	<LOD	9	<LOD	17	<LOD	3.2	113.6	1.6
T11-SS-900	11/3/2011	7:35:26	332	27	<LOD	30	809	12	18320	65	7.8	0.4	<LOD	12	17.3	1.8	442	4	5.7	0.9	<LOD	1.1	<LOD	2	<LOD	8	<LOD	10	<LOD	19	<LOD	3.8	27.7	1.2
T11-SS-1500	11/2/2011	11:40:58	227	35	<LOD	39	604	14	21663	98	9.1	0.5	<LOD	16	18	2	109	2	6.3	1.1	<LOD	1.4	<LOD	2	<LOD	8	<LOD	10	<LOD	19	<LOD	4.7	14.4	1.4
T12-SS-500	11/2/2011	15:30:21	143	25	<LOD	29	298	9	13057	54	4.4	0.3	<LOD	13	<LOD	5.5	527	4	5	1.4	<LOD	1.2	<LOD	2	<LOD	9	<LOD	11	<LOD	21	<LOD	4.1	107.8	1.8
T12-SS-750	11/2/2011	16:03:10	189	23	<LOD	27	465	9	12172	45	5.5	0.3	<LOD	11	11.9	1.6	193	2	4.8	0.8	<LOD	1.1	<LOD	1.9	<LOD	8	<LOD	9	<LOD	19	<LOD	3.5	23.7	1.1
T12-SS-1000	11/2/2011	16:24:45	165	24	<LOD	27	662	10	15069	54	6	0.3	<LOD	11	10.5	1.6	212	2	4.5	0.9	<LOD	1.1	<LOD	1.8	<LOD	8	<LOD	9	<LOD	18	<LOD	3.4	34.4	1.2
T12-SS-1250	11/3/2011	10:30:58	307	27	<LOD	30	670	11	19314	68	7.4	0.4	<LOD	12	12	1.7	284	3	5.4	0.9	<LOD	1.1	<LOD	2	<LOD	8	<LOD	10	<LOD	20	<LOD	3.7	34.1	1.2
T12-SS-1500	11/3/2011	10:55:49	256	25	<LOD	28	782	11	14315	52	5	0.3	<LOD	11	14.8	1.7	206	2	4.6	0.9	<LOD	1.1	<LOD	1.8	<LOD	8	<LOD	9	<LOD	19	<LOD	3.5	26.4	1.1
T12-SS-1500	11/7/2011	21:05:54	134	23	<LOD	27	397	9	13699	50	6.9	0.3	<LOD	11	12.1	1.6	212	2	3.9	0.8	<LOD	1	<LOD	1.8	<LOD	8	<LOD	9	<LOD	18	<LOD	3.3	22.5	1.1
T12-SS-1250	11/7/2011	21:10:33	319	27	<LOD	30	609	11	20658	72	9.2	0.4	<LOD	12	12.9	1.7	244	3	6.6	0.9	<LOD	1.1	<LOD	2	<LOD	8	<LOD	10	<LOD	20	3.9	1.2	32.7	1.2

Table J-2 - XRF Screening Results

Van Stone Mine

HC Sample ID	Date	Time	V	V +/-	Cr	Cr +/-	Mn	Mn +/-	Fe	Fe +/-	Co	Co +/-	Ni	Ni +/-	Cu	Cu +/-	Zn	Zn +/-	As	As +/-	Se	Se +/-	Mo	Mo +/-	Ag	Ag +/-	Cd	Cd +/-	Sb	Sb +/-	Hg	Hg +/-	Pb	Pb +/-
T12-SS-150	11/8/2011	17:38:55	184	24	<LOD	28	625	10	14886	54	6.8	0.3	<LOD	12	13.5	1.7	115.7	1.8	6.4	0.8	<LOD	1.1	<LOD	2	<LOD	8	<LOD	10	<LOD	19	<LOD	3.5	17.9	1.1
T12-SS-300	11/8/2011	17:43:16	76	23	<LOD	26	245	8	13386	49	6.1	0.3	<LOD	11	7.6	1.6	110.2	1.7	7.2	0.9	<LOD	1.1	<LOD	1.8	<LOD	8	<LOD	9	<LOD	18	<LOD	3.3	23.6	1.1
T12-SS-450	11/8/2011	17:48:44	268	27	<LOD	31	514	10	20805	73	9.6	0.4	<LOD	13	7.6	1.7	707	5	<LOD	4.5	<LOD	1.2	<LOD	2	<LOD	8	<LOD	10	<LOD	20	<LOD	4	159.9	2
T12-SS-600	11/8/2011	17:53:22	305	26	<LOD	29	1484	15	15818	57	6.9	0.3	<LOD	12	11.8	1.7	231	2	5.5	0.9	<LOD	1.1	<LOD	1.9	<LOD	8	<LOD	9	<LOD	19	<LOD	3.6	22.8	1.1
T13-SS-500	10/31/2011	14:06:06	196	24	<LOD	27	569	10	14625	52	6.6	0.3	<LOD	11	11.4	1.6	110.4	1.7	3.3	0.8	<LOD	1	<LOD	1.8	<LOD	8	<LOD	9	<LOD	19	3.7	1.1	15.3	1
T13-SS-750	10/31/2011	14:28:49	<LOD	65	<LOD	25	786	11	11417	43	4.5	0.3	<LOD	10	10.2	1.6	70.6	1.4	3.8	0.8	<LOD	1	<LOD	1.8	<LOD	8	<LOD	9	<LOD	18	<LOD	3.1	18.3	1.1
T13-SS-1000	10/31/2011	14:50:34	205	24	<LOD	28	998	12	14670	53	7.3	0.3	<LOD	11	11.6	1.6	129.4	1.9	5.2	1	<LOD	1.1	<LOD	1.9	<LOD	8	<LOD	9	<LOD	18	<LOD	3.4	56.8	1.3
T13-SS-1250	10/31/2011	15:26:22	227	25	<LOD	28	408	9	16305	58	8.5	0.4	<LOD	12	17.6	1.7	115.8	1.8	2.9	0.8	<LOD	1.1	<LOD	2	<LOD	8	<LOD	10	<LOD	19	<LOD	3.5	15.3	1.1
T13-SS-1250	10/31/2011	15:32:02	179	24	<LOD	27	290	8	8918	37	3.5	0.3	<LOD	11	6.3	1.7	55.8	1.4	<LOD	2.5	<LOD	1.1	<LOD	1.9	<LOD	8	<LOD	10	<LOD	20	<LOD	3.5	18.9	1.1
T13-SS-450	11/1/2011	19:12:33	269	24	<LOD	27	750	11	14054	50	7.5	0.3	<LOD	11	14.1	1.6	121.6	1.8	3.4	0.9	<LOD	1	<LOD	1.8	<LOD	8	<LOD	9	<LOD	18	<LOD	3.3	31.2	1.1
T13-SS-600	11/1/2011	19:20:02	170	23	<LOD	26	1060	12	13082	47	5.5	0.3	<LOD	11	11.8	1.6	137.1	1.9	7.2	0.9	<LOD	1.1	<LOD	1.8	<LOD	8	<LOD	9	<LOD	17	<LOD	3.2	36.1	1.2
T13-SS-300	11/1/2011	19:24:15	241	26	<LOD	29	1003	13	18079	63	7.9	0.4	<LOD	12	12.6	1.7	120.3	1.8	6.1	1	<LOD	1.1	<LOD	1.9	<LOD	8	12	3	<LOD	19	<LOD	3.5	39.7	1.3
T13-SS-150	11/1/2011	19:28:47	247	24	<LOD	27	538	10	14700	52	8.5	0.3	<LOD	11	14	1.6	131	1.8	5.5	0.8	<LOD	1.1	<LOD	1.9	<LOD	8	<LOD	9	<LOD	18	<LOD	3.2	19.6	1.1
T14-SS-500	10/30/2011	18:51:38	141	25	<LOD	29	1076	13	16984	61	6.6	0.4	<LOD	12	20	1.8	809	5	6.5	0.9	<LOD	1.1	<LOD	1.9	<LOD	8	<LOD	10	<LOD	18	<LOD	3.8	25.6	1.2
T14-SS-500	10/30/2011	19:00:35	143	23	<LOD	25	576	10	12770	47	5.9	0.3	<LOD	11	15.4	1.7	785	5	<LOD	3.1	<LOD	1.1	<LOD	1.8	<LOD	8	<LOD	9	<LOD	18	<LOD	3.7	69.6	1.4
T14-SS-750	10/30/2011	19:06:27	170	26	<LOD	29	316	9	15546	58	6.3	0.4	<LOD	12	9.8	1.7	79	1.6	2.9	0.9	<LOD	1.2	<LOD	2	<LOD	8	<LOD	10	<LOD	19	<LOD	3.6	19.4	1.1
T14-SS-1000	10/31/2011	8:56:55	211	25	<LOD	29	391	9	14133	52	4.4	0.3	<LOD	12	38.7	1.9	286	3	4.4	1.1	<LOD	1.2	<LOD	2	<LOD	8	<LOD	10	<LOD	19	<LOD	3.7	64.5	1.4
T14-SS-1000	10/31/2011	9:03:36	221	26	<LOD	29	399	9	15001	56	6.2	0.3	<LOD	12	36.7	2	293	3	5.5	1.1	<LOD	1.2	<LOD	2	<LOD	8	<LOD	10	<LOD	20	<LOD	3.7	58.3	1.4
T14-SS-800	11/7/2011	18:07:29	249	25	<LOD	28	432	9	13514	50	7	0.3	<LOD	12	13.2	1.7	90.7	1.6	4.1	0.8	<LOD	1.1	<LOD	2	<LOD	8	<LOD	9	<LOD	19	4.5	1.2	16.8	1.1
T14-SS-300	11/7/2011	18:15:21	153	23	<LOD	28	213	7	8499	37	3.3	0.3	<LOD	12	27.5	2	2376	10	<LOD	5.4	2.1	0.4	<LOD	1.8	<LOD	9	<LOD	10	<LOD	20	14.4	1.7	250	2
T14-SS-600	11/7/2011	18:19:19	216	25	<LOD	29	541	10	17397	61	8.4	0.4	<LOD	12	16.2	1.7	88.3	1.6	<LOD	2.4	<LOD	1.1	<LOD	2	<LOD	8	<LOD	9	<LOD	19	<LOD	3.4	14.3	1.1
T14-SS-450	11/7/2011	18:23:52	267	25	30	10	275	8	15455	56	7.5	0.3	<LOD	12	26.1	1.8	488	4	2.9	1	<LOD	1.1	<LOD	2	<LOD	8	<LOD	10	<LOD	19	<LOD	3.7	42.7	1.3
T14-SS-150	11/7/2011	18:29:28	286	27	43	10	704	11	17866	65	6.7	0.4	<LOD	13	11.6	1.8	612	4	4.4	1	<LOD	1.2	<LOD	1.9	<LOD	9	<LOD	10	<LOD	20	<LOD	4	51	1.4
T15-SS-500 - Not used	11/1/2011	11:42:10	<LOD	83	<LOD	37	407	12	29338	113	9.9	0.6	<LOD	16	24	3	15172	55	78	7	5.8	0.9	<LOD	1.8	<LOD	10	24	4	<LOD	24	27	4	3032	13
T15-SS-1000	11/1/2011	12:47:40	112	24	<LOD	28	450	9	16312	58	6.7	0.3	<LOD	11	13.3	1.7	123.9	1.8	3.9	0.9	<LOD	1.1	<LOD	1.8	<LOD	8	<LOD	9	<LOD	19	<LOD	3.3	24.7	1.1
T15-SS-750	11/1/2011	13:17:10	229	25	<LOD	28	933	12	14520	53	6.2	0.3	<LOD	12	11.3	1.7	210	2	5.5	0.8	<LOD	1.1	<LOD	1.9	<LOD	9	<LOD	10	<LOD	20	3.7	1.2	19.5	1.1
T15-SS-750	11/1/2011	13:26:12	242	25	<LOD	29	952	12	17476	61	8.8	0.4	<LOD	12	13.6	1.7	176	2	3.8	0.8	<LOD	1.1	<LOD	2.1	<LOD	9	<LOD	10	<LOD	21	3.7	1.2	19.1	1.1
T15-SS-500	11/1/2011	14:37:29	<LOD	58	<LOD	23	741	10	8318	32	3.8	0.2	<LOD	10	<LOD	4.3	417	3	<LOD	3.2	<LOD	1	<LOD	1.5	<LOD	7	<LOD	8	<LOD	16	<LOD	3.1	93.9	1.4
T15-SS-800	11/1/2011	19:02:06	243	25	<LOD	28	464	9	19410	66	8.7	0.4	<LOD	12	15.6	1.7	195	2	5.2	0.9	<LOD	1.1	<LOD	2	<LOD	9	<LOD	10	<LOD	21	<LOD	3.6	24.3	1.1
T15-SS-1500	11/1/2011	19:06:35	223	25	32	10	722	11	16839	59	7.7	0.4	<LOD	12	13.4	1.7	188	2	<LOD	2.5	<LOD	1.1	<LOD	1.9	<LOD	9	<LOD	10	<LOD	21	<LOD	3.6	21.8	1.1
T15-SS-1250	11/7/2011	20:52:33	208	25	<LOD	29	840	12	17540	62	8.3	0.4	<LOD	12	11.9	1.7	212	2	<LOD	2.8	<LOD	1.1	<LOD	1.9	<LOD	8	<LOD	10	<LOD	19	<LOD	3.6	38.9	1.2
T15-SS-200	11/8/2011	10:54:29	232	26	<LOD	29	461	10	18063	64	7.3	0.4	<LOD	12	11.6	1.8	1381	7	7.6	1.3	<LOD	1.2	<LOD	2	<LOD	8	<LOD	10	<LOD	20	4.8	1.5	120.2	1.8
T15-SS-400	11/8/2011	10:58:33	171	24	<LOD	27	571	10	16169	56	8.2	0.3	<LOD	11	12.8	1.6	301	3	4.8	0.9	<LOD	1.1	<LOD	1.8	<LOD	8	<LOD	9	<LOD	18	<LOD	3.4	26.1	1.1
T15-SS-600	11/8/2011	11:02:09	299	26	44	10	300	8	17241	61	8.2	0.4	<LOD	12	17.1	1.8	120.4	1.9	<LOD	2.6	<LOD	1.1	<LOD	2	<LOD	8	<LOD	10	<LOD	19	4.7	1.2	24.3	1.1
XRF Background Soil Measurements																																		
BG-10-SS	10/26/2011	15:22:47	<LOD	74	<LOD	29	213	8	8868	43	4.2	0.3	<LOD	12	9.3	1.9	518	4	4.3	1	<LOD	1.2	<LOD	1.4	<LOD	7	<LOD	8	<LOD	16	<LOD	4	26.8	1.3
BG-13-SS	10/26/2011	15:28:58	182	31	<LOD	36	823	15	17724	78	8	0.5	<LOD	15	11	2	46.2	1.6	8.5	1.3	<LOD	1.4	<LOD	2.1	<LOD	8	<LOD	10	<LOD	20	<LOD	4.3	51.6	1.7
BG-14-SS	10/26/2011	15:34:44	207	30	<LOD	35	280	10	11784	56	6.3	0.4	<LOD	14	9	2	30.8	1.4	5.5	1	<LOD	1.4	<LOD	2.1	<LOD	8	<LOD	10	<LOD	19	<LOD	4.2	13.9	1.3
BG-1-SS	10/26/2011	15:42:33	<LOD	66	<LOD	28	328	9	6653	35	3.6	0.3	<LOD	11	8.6	1.8	26.7	1.2	2.8	0.8	<LOD	1.2	<LOD	1.6	<LOD	8	<LOD	9	<LOD	17	<LOD	3.5	4.7	1.1
BG-2-SS	10/26/2011	15:48:37	115	27	<LOD	32	822	14	10571	50	3.8	0.3	<LOD	13	9	2	24.5	1.3	5.3	1	<LOD	1.3	<LOD	1.8	<LOD	8	<LOD	9	<LOD	19	<LOD	3.9	17	1.3
BG-3-SS	10/26/2011	15:55:14	108	23	<LOD	27	468	9	17987	61	9.6	0.4	<LOD	11	15	1.6	41.7	1.2	7.7	1	<LOD	1.1	<LOD	1.8	<LOD	8	<LOD	9	<LOD	17	<LOD	3.2	54.2	1.3
BG-4-SS	10/26/2011	16:01:20	<LOD	62	<LOD	24	168	7	10372	40	5	0.3	<LOD	10	9.3	1.6	26.1	1	4.4	0.8	<LOD	1	<LOD	1.5	<LOD	7	<LOD	8	<LOD	16	<LOD	3	23.5	1.1
BG-5-SS	10/26/2011	16:06:44	178	27	<LOD	30	497	10	21747	76	8.5	0.4	<LOD	13	15.6	1.8	487	4	5.3	0.9	<LOD	1.1	<LOD	2	<LOD	9	<LOD	10	<LOD	20	<LOD	3.8	27.9	1.2
BG-6-SS	10/26/2011	16:12:37	134	24	<LOD	28	791	11	17315	61	6.6	0.4	<LOD	12	14.6	1.7	129	1.9	4.2	0.9	<LOD	1.1	<LOD	1.8	<LOD	8	<LOD	9	<LOD	18	<LOD	3.3	36.4	1.2
BG-7-SS	10/26/2011	16:18:31	128	23	35	9	1068	12	14048	49	5.4	0.3	<LOD	11	6.8	1.5	53.5	1.3	3.7	0.7	<LOD	1	<LOD	1.6	<LOD	8	<LOD	9	<LOD	17	<LOD	3	15.9	1
BG-8-SS	10/26/2011	16:24:17	174	24	<LOD	28	384	9	14667	54	5.2	0.3	<LOD	12	8	1.7	93.1	1.7	3.1	0.8	<LOD	1.1	<LOD	1.9	<LOD	8	<LOD	10	<LOD	19	<LOD	3.4	20.5	1.1
Misc. Sample Locations																																		
LT-2-SS	10/26/2011	16:55:13	90	23	<LOD	28	127	7	3297	21	1.1	0.2	<LOD	13	45	2	3225	14	<LOD	13	<LOD	1.9	<LOD	1.6	<LOD	9	22	4	<LOD	22	11	2	1457	7
LT-3-SS	10/27/2011	10:28:23	69	22	<LOD	27	113	6	3794	22	2	0.2	15	4	94	3	2977	12	<LOD	13	<LOD	1.9	<LOD	1.6	<LOD	9	16	4	<LOD	22	6	2	1868	8
LT-1-SS	10/27/2011	10:38:37	101	25	<LOD	32	172	8	7886	40	2.7	0.3	<LOD	14	15	2	6588	26	<LOD	18	<LOD	2.4	<LOD	1.7	<LOD	10	30	4	<LOD	24	<LOD	9	2683	12
NP-2-SS	10/26/2011	16:50:31	90	24	<LOD	29	288	9	9665	42	2.6	0.3	<LOD	13	7.8	1.9	2760	12	18	2	1.5	0.5	<LOD	1.7	<LOD	9	18	4	<LOD	22	7.2	1.8	301	3
NP-3-SS	10/27/2011	10:45:33	<LOD	84	<LOD	36	209	9	8468	45	3.4	0.3	<LOD	16	26	3	20324	76	<LOD	28	<LOD	3.6	<LOD	1.9	<LOD	10	74	4	<LOD	25	<LOD	14	5503	23
NP-1-SS	10/27/2011	11:03:02	174	24	43	10	232	8	8654	39	4.2	0.3	15	4	7.6	1.9	1805	9	<LOD	7	<LOD	1.4	<LOD	1.7	<LOD	9	12	4	<LOD	22	<LOD	4.9	398	3
DRUM	11/3/2011	21:26:14	234	28	<LOD	32	552	11	25465	90	12.2	0.5	<LOD	13	26.6	2	752	5	5.8	1.1	<LOD	1.3	<LOD	2	<LOD	9	<LOD	10	<LOD	20	<LOD	4.3	52.5	1.4
Drum #2	11/3/2011	21:30:39	285	27	34	10	384	10	23202	81	10.3	0.4	<LOD	13	36	2	776	5	<LOD	4	<LOD	1.2	<LOD	1.9	<LOD	9	<LOD	10	<LOD	21	7.3	1.4	112.3	1.8
Soil Below Drum	11/3/2011	21:35:24	352	26	40	10	363	9	14864	55	4.2	0.3	<LOD	12	14.4	1.8	180	2	<LOD	2.8	<LOD	1.1	<LOD	1.9	<LOD	8	<LOD	10	<LOD	20	4.4	1.2	35.4	1.2
Drum #2	11/7/2011	21:43:41	306	29	<LOD	34	457	11	31746	109	14	0.5	<LOD	14	49	2	754	5	8.1	1.5	<LOD	1.3	<LOD	2	<LOD	9	<LOD	10	<LOD	21	7.3	1.5	145	2
Drum	11/7/2011	21:48:06	196	27	<LOD	32	575	11	28788	99	13.8	0.5	<LOD	13	27.7	2	816	5	<LOD	3.2	<LOD	1.2	<LOD	2	<LOD	9	11	3	<LOD	20	<LOD	4.3	53.4	1.4
Soil Below Drum	11/8/2011	10:34:09	290	25	<LOD	29	359	9	14353	53	6.5	0.3	<LOD	12	13.3	1.7	231	3	<LOD	2.9	<LOD	1.1	<LOD	2	<LOD	8	11	3	<LOD	20	<LOD	3.7	41.2	1.3

Table J-2 - XRF Screening Results

Van Stone Mine

HC Sample ID	Date	Time	V	V +/-	Cr	Cr +/-	Mn	Mn +/-	Fe	Fe +/-	Co	Co +/-	Ni	Ni +/-	Cu	Cu +/-	Zn	Zn +/-	As	As +/-	Se	Se +/-	Mo	Mo +/-	Ag	Ag +/-	Cd	Cd +/-	Sb	Sb +/-	Hg	Hg +/-	Pb	Pb +/-
Pipe Soil	11/8/2011	10:29:34	<LOD	64	<LOD	27	156	7	4481	25	1.5	0.2	18	4	21.6	2	1941	9	<LOD	5.5	<LOD	1.4	<LOD	1.6	<LOD	9	<LOD	11	<LOD	21	8.6	1.7	268	3
PIPE SOIL	11/18/2011	10:34:52	77	22	46	9	147	7	4256	24	1.5	0.2	18	4	26	2	1364	7	<LOD	8	<LOD	1.5	<LOD	1.6	<LOD	9	15	4	<LOD	22	<LOD	5.1	568	4
RANDOM PIPE	11/18/2011	10:41:14	<LOD	105	704	23	495	17	101946	393	31.9	1.1	<LOD	22	707	7	730	6	<LOD	19	<LOD	2.6	10	0.7	<LOD	11	<LOD	13	<LOD	25	<LOD	9	2237	12
TAILINGS BOX	11/18/2011	10:46:25	<LOD	68	<LOD	30	241	8	12093	50	5.8	0.3	<LOD	13	113	3	5631	21	<LOD	10	<LOD	1.7	2	0.6	<LOD	9	21	4	<LOD	22	9	2	873	5
UT-LT-FINAL	11/18/2011	10:58:26	101	24	<LOD	29	188	8	9352	42	3.3	0.3	<LOD	13	30	2	6700	25	<LOD	8	<LOD	1.7	<LOD	1.7	<LOD	9	16	4	<LOD	22	<LOD	8	614	4
UT-LT-5000'	11/18/2011	11:06:55	458	29	84	11	1009	14	15319	59	5.9	0.4	15	4	17.8	1.9	107.8	1.9	<LOD	3.3	<LOD	1.2	<LOD	2.1	<LOD	9	<LOD	11	<LOD	23	<LOD	3.7	56.7	1.4
UT-LT-6000'	11/18/2011	11:13:11	237	26	<LOD	29	541	10	14701	55	5.8	0.3	<LOD	12	13.8	1.8	121.3	1.9	6.2	0.9	<LOD	1.1	<LOD	1.9	<LOD	8	<LOD	10	<LOD	19	<LOD	3.4	26.1	1.2
UT-LT-4000'	11/18/2011	11:19:08	102	24	<LOD	29	224	8	8876	41	2.6	0.3	<LOD	13	15	2	1586	8	<LOD	7	<LOD	1.4	<LOD	1.8	<LOD	9	<LOD	11	<LOD	22	<LOD	5.1	390	3
UT-LT-3000'	11/18/2011	11:25:35	340	26	45	10	427	9	12534	48	3.2	0.3	17	4	13.3	1.7	101.6	1.7	<LOD	2.8	<LOD	1.1	<LOD	1.8	<LOD	8	<LOD	10	<LOD	20	4.1	1.2	37.3	1.2
UT-LT-7000'	11/18/2011	11:30:21	298	25	36	9	221	7	9349	39	3.2	0.3	<LOD	12	11.5	1.7	33.8	1.2	<LOD	2.4	<LOD	1.1	<LOD	1.9	<LOD	9	<LOD	10	<LOD	20	<LOD	3.5	16.2	1.1
UT-LT-0'	11/18/2011	11:35:45	306	26	47	10	374	9	23680	80	10	0.4	<LOD	12	17.3	1.8	117.5	1.8	<LOD	2.8	<LOD	1.1	<LOD	2.1	<LOD	9	<LOD	11	<LOD	21	<LOD	3.6	35.9	1.2
UT-LT-2000'	11/18/2011	11:40:18	73	24	<LOD	28	197	8	7319	36	2.2	0.3	<LOD	13	20	2	1657	9	<LOD	6	<LOD	1.4	<LOD	1.7	<LOD	9	13	4	<LOD	22	<LOD	5.2	282	3
LT-DP-2	11/18/2011	11:45:50	256	22	<LOD	25	118	6	3946	21	1.6	0.2	<LOD	11	7	1.6	32.8	1.1	<LOD	2.4	<LOD	1	<LOD	1.6	<LOD	8	<LOD	10	<LOD	19	<LOD	3.4	20.8	1
LT-DP-1	11/18/2011	11:52:58	<LOD	62	<LOD	26	96	6	5753	28	2.9	0.2	<LOD	11	45	2	4135	16	<LOD	8	<LOD	1.5	<LOD	1.6	<LOD	9	20	4	<LOD	22	<LOD	6	559	4
LT-OC ROAD-CULVERT	11/18/2011	10:21:45	322	24	36	9	236	8	10679	43	4.7	0.3	16	4	28.6	1.9	1022	6	6.8	1.3	<LOD	1.2	<LOD	1.9	<LOD	8	<LOD	10	<LOD	20	4.5	1.4	121.7	1.7
PIPELINE DEBRIS PILE	11/18/2011	10:27:35	197	25	<LOD	28	614	11	12489	49	5.4	0.3	<LOD	12	9	1.7	83.5	1.6	4.3	0.9	<LOD	1.1	<LOD	1.9	<LOD	8	<LOD	10	<LOD	20	<LOD	3.5	32.6	1.2
UT-LT-PIPELINE CULVERT	11/18/2011	10:51:34	142	26	<LOD	31	375	10	10022	46	3.2	0.3	<LOD	14	7.5	2	459	4	5.5	1.4	<LOD	1.3	<LOD	2	<LOD	9	<LOD	11	<LOD	22	<LOD	4.3	93.1	1.8
UT-1-SS	10/26/2011	16:32:48	<LOD	68	<LOD	29	145	7	8636	40	3.6	0.3	<LOD	13	29	2	5316	20	<LOD	9	<LOD	1.7	<LOD	1.6	<LOD	9	28	4	<LOD	22	11	2	653	4
UT-2-SS	10/26/2011	16:39:51	92	22	<LOD	28	110	6	5815	29	2.8	0.2	<LOD	12	33	2	4958	19	<LOD	5.1	2.7	0.5	<LOD	1.5	<LOD	9	23	4	<LOD	22	25	2	219	2
UT-3-SS	10/26/2011	16:44:53	139	22	49	9	152	7	6141	30	2.9	0.2	19	4	96	3	3063	13	<LOD	7	1.7	0.5	<LOD	1.6	<LOD	9	12	4	<LOD	22	16.9	2	508	4
MS-1 COMP	11/18/2011	9:49:40	181	24	<LOD	29	299	9	10097	44	3.7	0.3	20	4	10	2	3857	15	10	3	<LOD	1.6	<LOD	1.8	<LOD	9	26	4	<LOD	22	<LOD	6	551	4
SWR-COMP	11/18/2011	9:55:06	106	30	<LOD	40	498	13	27252	111	7.8	0.6	<LOD	17	10	3	17400	65	<LOD	23	<LOD	3.1	<LOD	2	<LOD	10	64	4	<LOD	25	<LOD	13	3843	17
MS-2 COMP	11/18/2011	10:04:19	292	28	36	11	503	11	19910	77	6.4	0.4	19	5	13	2	8902	32	11	2	<LOD	1.7	<LOD	1.8	<LOD	9	24	4	<LOD	23	<LOD	8	303	3
MS-3 COMP	11/18/2011	10:10:45	166	33	<LOD	40	405	12	17373	79	6.8	0.5	<LOD	18	<LOD	11	23544	89	<LOD	27	<LOD	3.5	<LOD	2.2	<LOD	11	109	4	<LOD	25	<LOD	15	4997	21

Note: All reported elements are in Parts per Million (ppm)

Table J-3 - Map Coordinates of XRF Sample Measurements

Van Stone Mine

Sample Location ID	Longitude[1]	Latitude[1]	Sample Location ID	Longitude[1]	Latitude[1]
Transect Locations			**Transect Locations**		
T1-SS-100	-117.796269	48.777324	T8-SS-750	-117.775062	48.765419
T1-SS-200	-117.795958	48.777150	T8-SS-1000	-117.775518	48.766067
T1-SS-300	-117.795659	48.776970	T9-SS-100	-117.774200	48.762271
T1-SS-400	-117.795319	48.776793	T9-SS-200	-117.773847	48.762116
T1-SS-500	-117.795012	48.776598	T9-SS-300	-117.773478	48.762000
T1-SS-750	-117.794263	48.776135	T9-SS-400	-117.773137	48.761894
T1-SS-1000	-117.793602	48.775600	T9-SS-500	-117.772766	48.761741
T2-SS-100	-117.797863	48.776200	T9-SS-750	-117.771853	48.761409
T2-SS-200	-117.797579	48.776010	T9-SS-1000	-117.771004	48.761025
T2-SS-300	-117.797297	48.775814	T10-SS-150	-117.775226	48.760850
T2-SS-400	-117.797021	48.775596	T10-SS-300	-117.774678	48.760633
T2-SS-500	-117.796765	48.775383	T10-SS-450	-117.774140	48.760453
T2-SS-750	-117.795969	48.774936	T10-SS-500	-117.773938	48.760402
T2-SS-1000	-117.795229	48.774449	T10-SS-600	-117.773574	48.760264
T3-SS-100	-117.802027	48.775415	T10-SS-750	-117.773045	48.760058
T3-SS-200	-117.802005	48.775147	T10-SS-1000	-117.772188	48.759663
T3-SS-300	-117.801969	48.774863	T10-SS-1100	-117.771791	48.759569
T3-SS-400	-117.801920	48.774595	T10-SS-1250	-117.771260	48.759356
T3-SS-500	-117.801862	48.774324	T11-SS-300	-117.763630	48.760566
T3-SS-750	-117.801808	48.773639	T11-SS-500	-117.764508	48.760523
T3-SS-1000	-117.801780	48.772954	T11-SS-600	-117.764843	48.760767
T4-SS-100	-117.803179	48.777189	T11-SS-750	-117.765449	48.760984
T4-SS-200	-117.803599	48.777253	T11-SS-900	-117.765942	48.761378
T4-SS-300	-117.804009	48.777255	T11-SS-1000	-117.766160	48.761647
T4-SS-400	-117.804387	48.777254	T11-SS-1200	-117.766967	48.761880
T4-SS-500	-117.804822	48.777233	T11-SS-1250	-117.767168	48.761931
T4-SS-750	-117.805834	48.777120	T11-SS-1500	-117.768181	48.762018
T4-SS-1000	-117.806902	48.776886	T11-SS-1750	-117.769251	48.762096
T5-SS-100	-117.801936	48.778746	T11-SS-2000	-117.770279	48.762212
T5-SS-200	-117.802128	48.778992	T12-SS-150	-117.764409	48.762298
T5-SS-300	-117.802460	48.779188	T12-SS-300	-117.764876	48.762430
T5-SS-400	-117.802690	48.779396	T12-SS-450	-117.765536	48.762675
T5-SS-500	-117.802957	48.779639	T12-SS-500	-117.765935	48.762930
T5-SS-750	-117.803643	48.780132	T12-SS-600	-117.766339	48.763042
T5-SS-1000	-117.804277	48.780674	T12-SS-750	-117.766568	48.763144
T6-SS-100	-117.777722	48.760300	T12-SS-1000	-117.767430	48.763546
T6-SS-200	-117.778183	48.760273	T12-SS-1250	-117.768659	48.763753
T6-SS-300	-117.778609	48.760298	T12-SS-1500	-117.769441	48.764208
T6-SS-400	-117.778896	48.760237	T13-SS-150	-117.763135	48.764336
T6-SS-500	-117.779473	48.760142	T13-SS-300	-117.763712	48.764476
T6-SS-750	-117.780409	48.760342	T14-SS-150	-117.761308	48.765904
T6-SS-1000	-117.781487	48.760420	T14-SS-300	-117.761809	48.766113
T7-SS-100	-117.776430	48.762327	T14-SS-450	-117.762301	48.766244
T7-SS-200	-117.776848	48.762392	T14-SS-500	-117.762446	48.766352
T7-SS-300	-117.777262	48.762462	T14-SS-600	-117.762868	48.766451
T7-SS-400	-117.777650	48.762473	T14-SS-750	-117.763223	48.766773
T7-SS-500	-117.778111	48.762300	T14-SS-800	-117.763470	48.766908
T13-SS-450	-117.764303	48.764648	T14-SS-1000	-117.763342	48.767375
T13-SS-500	-117.764507	48.764691	T15-SS-200	-117.757368	48.759995
T13-SS-600	-117.764869	48.764835	T15-SS-400	-117.756492	48.759980
T13-SS-750	-117.765415	48.765029	T15-SS-500	-117.757230	48.758597
T13-SS-1000	-117.766316	48.765368	T15-SS-500	-117.756068	48.759860
T13-SS-1250	-117.766889	48.765941	T15-SS-600	-117.755651	48.759735
T7-SS-750	-117.779140	48.762314	T15-SS-750	-117.757137	48.757881
T7-SS-1000	-117.780173	48.762266	T15-SS-750	-117.755067	48.759402
T8-SS-100	-117.774067	48.763747	T15-SS-800	-117.754937	48.759264
T8-SS-200	-117.774190	48.764012	T15-SS-1000	-117.754146	48.759041
T8-SS-300	-117.774354	48.764254	T15-SS-1250	-117.753185	48.758828
T8-SS-400	-117.774536	48.764517	T15-SS-1500	-117.752197	48.758599
T8-SS-500	-117.774706	48.764766			

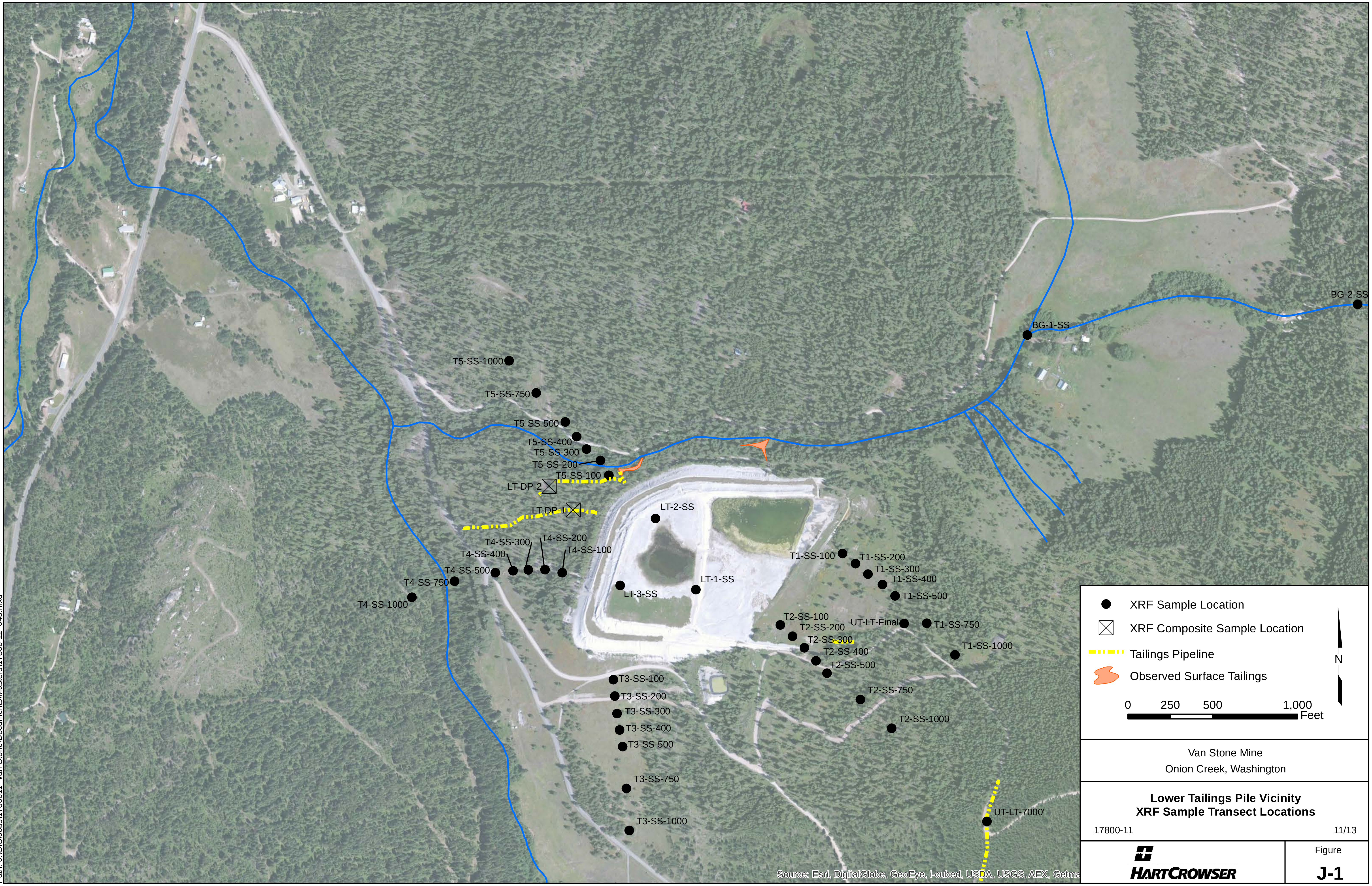
Table J-3 - Map Coordinates of XRF Sample Measurements

Van Stone Mine

Sample Location ID	Longitude[1]	Latitude[1]
Upper Tailings Pile		
UT-LT-2000'	-117.781393	48.763806
UT-LT-3000'	-117.784030	48.766424
UT-LT-4000'	-117.787599	48.766364
UT-LT-5000'	-117.791797	48.767861
UT-LT-6000'	-117.793921	48.770161
UT-LT-7000'	-117.792976	48.772873
UT-LT-Final	-117.794822	48.776146
Lower Tailings Pile		
LT-DP-1	-117.802844	48.778202
LT-DP-2	-117.803414	48.778603
LT-1-SS	-117.799909	48.776828
LT-2-SS	-117.800836	48.778011
LT-3-SS	-117.801769	48.776944
Upper Tailings Pile		
UT-1-SS	-117.776386	48.761194
UT-2-SS	-117.776853	48.761327
UT-3-SS	-117.774669	48.762511
Mill and Waste Rock Piles		
MS-1 COMP	-117.761284	48.762071
MS-2 COMP	-117.759639	48.764733
MS-3 COMP	-117.756857	48.763097
SWR COMP	-117.758543	48.755941
NP-1-SS	-117.761553	48.762727
NP-2-SS	-117.761186	48.761027
NP-3-SS	-117.760336	48.765811
Tailings Pipeline		
Pipeline Culvert	-117.786532	48.766572
Pipeline debris pile	-117.777555	48.764286
DRUM	-117.777555	48.764286
Drum #2	-117.777555	48.764286
Soil Below Drum	-117.777555	48.764286
Tailings Box	-117.763960	48.765416
UT-LT-0'	-117.774293	48.765056

Notes:

[1] - GPS coordinates in WGS 84



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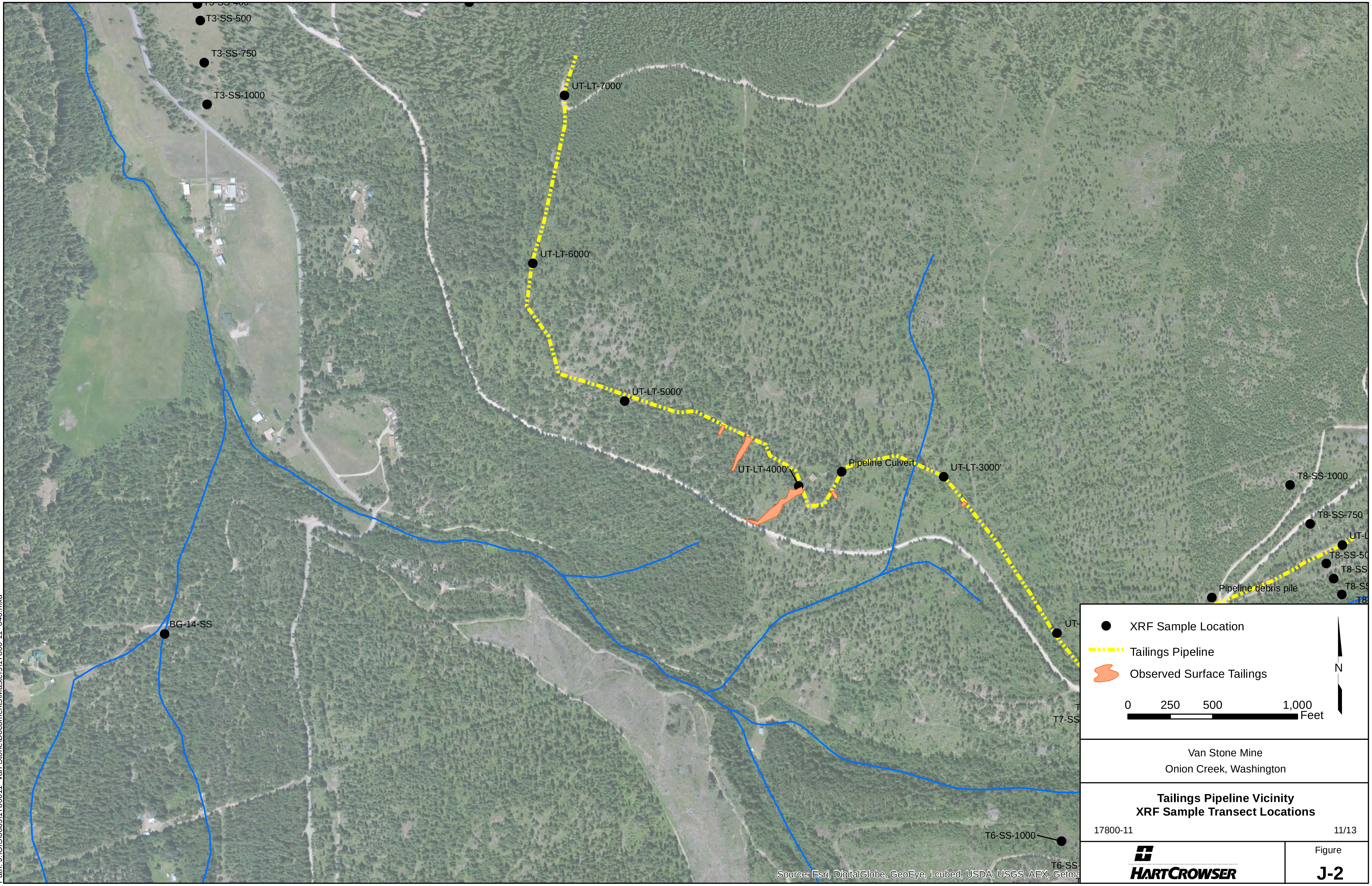

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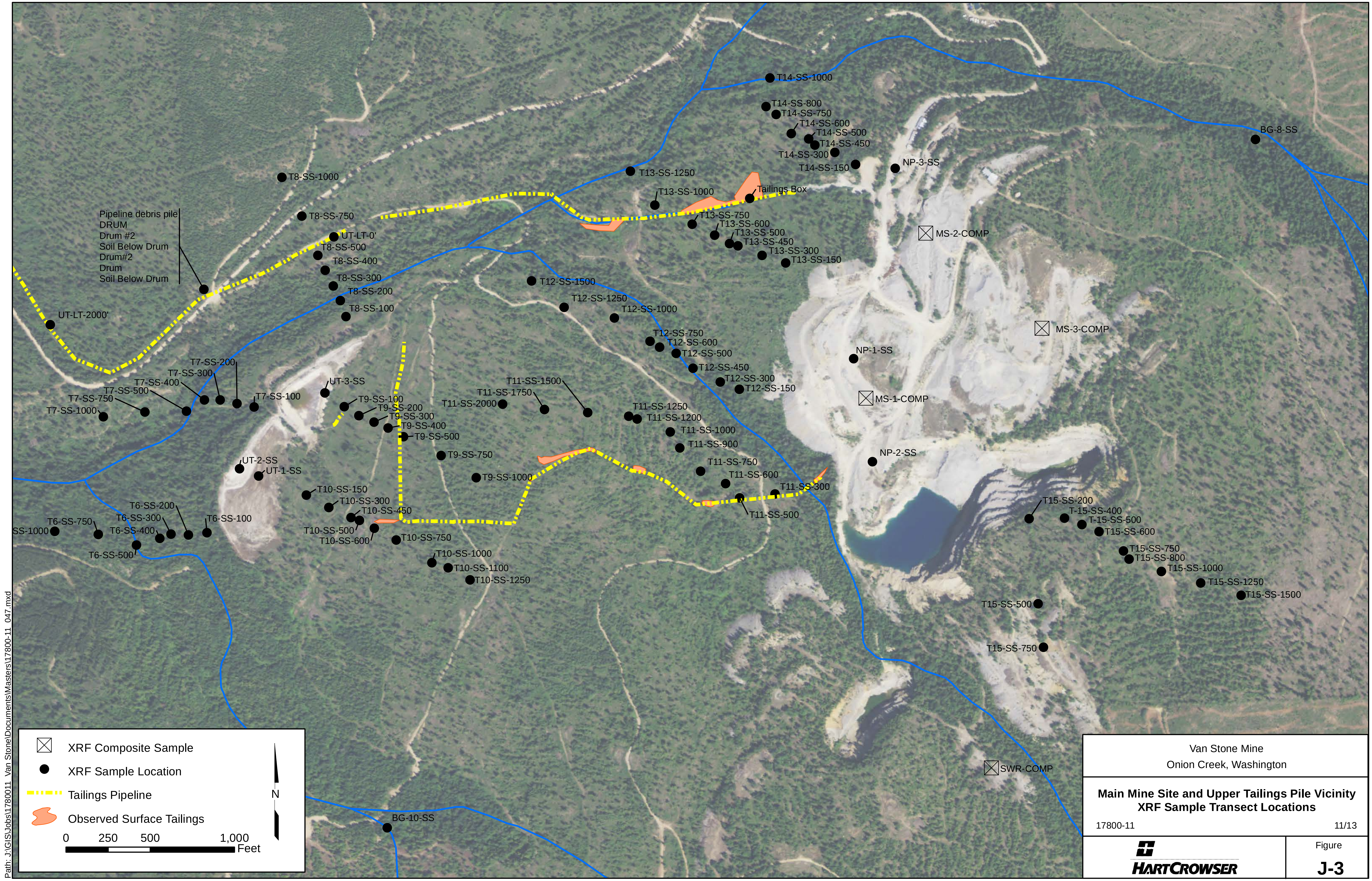

Van Stone Mine
Onion Creek, Washington

Main Mine Site and Upper Tailings Pile Vicinity XRF Sample Transect Locations

17800-11 11/13

HARTCROWSER

Figure J-3

National Institute of Standards & Technology

Certificate of Analysis

Standard Reference Material® 2711

Montana Soil

Moderately Elevated Trace Element Concentrations

This Standard Reference Material (SRM) is intended primarily for use in the analysis of soils, sediments, or other materials of a similar matrix. SRM 2711 is a moderately contaminated soil that was oven-dried, sieved, radiation sterilized, and blended to achieve a high degree of homogeneity. A unit of SRM 2711 consists of 50 g of the dried material.

The certified elements for SRM 2711 are given in Table 1. The values are based on measurements using one definitive method or two or more independent and reliable analytical methods. Noncertified values for a number of elements are given in Table 2 as additional information on the composition. The noncertified values should **NOT** be used for calibration or quality control. Analytical methods used for the characterization of this SRM are given in Table 3 along with analysts and cooperating laboratories. All values (except for carbon) are based on measurements using a sample weight of at least 250 mg. Carbon measurements are based on 100 mg samples.

NOTICE AND WARNINGS TO USERS

Expiration of Certification: This certification of SRM 2711 is valid, within the measurement uncertainties specified, until **31 December 2011**, provided the SRM is handled in accordance with instructions given in this certificate (see *Instructions for Use*). This certification is nullified if the SRM is damaged, contaminated, or otherwise modified.

Maintenance of SRM Certification: NIST will monitor this SRM over the period of its certification. If substantive technical changes occur that affect the certification before the expiration of this certificate, NIST will notify the purchaser. Return of the attached registration card will facilitate notification.

The overall direction and coordination of the analyses were under the chairmanship of M.S. Epstein and R.L. Watters, Jr. of the NIST Inorganic Analytical Research Division.

Statistical consultation was provided by S.B. Schiller of the NIST Statistical Engineering Division.

The technical and support aspects involved in the preparation, certification, and issuance of this SRM were coordinated through the NIST Standard Reference Materials Program by T.E. Gills and J.S. Kane. Revision of this certificate was coordinated through the NIST Standard Reference Materials Program by B.S. MacDonald of the NIST Measurement Services Division.

Willie E. May, Chief
Analytical Chemistry Division

John Rumble, Jr., Chief
Measurement Services Division

Gaithersburg, MD 20899
Certificate Issue Date: 18 July 2003
See Certificate Revision History on Page 6

INSTRUCTIONS FOR USE

Use: A minimum sample weight of 250 mg (dry weight - see *Instructions for Drying*) should be used for analytical determinations to be related to the certified values on this Certificate of Analysis.

To obtain the certified values, sample preparation procedures should be designed to effect complete dissolution. If volatile elements (i.e., mercury (Hg), arsenic (As), selenium (Se)) are to be determined, precautions should be taken in the dissolution of SRM 2711 to avoid volatilization losses.

Instructions for Drying: When nonvolatile elements are to be determined, samples should be dried for 2 h at 110 °C. Volatile elements (i.e., Hg, As, Se) should be determined on samples as received; separate samples should be dried as previously described, to obtain a correction factor for moisture. Correction for moisture is to be made to the data for volatile elements before comparing to the certified values. This procedure ensures that these elements are not lost during drying. The approximate weight loss on drying has been found to be in the range of 1.5 % to 2.2 %.

Source and Preparation of Material: The U.S. Geological Survey (USGS), under contract to the NIST, collected and processed the material for SRM 2711. The material is an agricultural soil collected in the till layer (upper 15.2 cm (6 in)) of a wheat field. The soil from a 3.05 m × 3.05 m (10 ft × 10 ft) area was shoveled into 0.114 m^3 (3 gal) plastic pails for shipment to the USGS laboratory for processing.

The material was spread on 30.5 cm × 61 cm (1 ft × 2 ft) polyethylene-lined drying trays in an air drying oven and dried for three days at room temperature. The material was then passed over a vibrating 2 mm screen to remove plant material, rocks, and large chunks of aggregated soil. Material remaining on the screen was deaggregated and rescreened. The combined material passing the screen was ground in a ball mill to pass a 74 µm screen and blended for 24 h. Twenty grab samples were taken and measured for the major oxides using X-ray fluorescence spectrometry and for several trace elements by using inductively coupled plasma atomic emission analysis to provide preliminary assessment of the homogeneity prior to bottling. The material was bottled into 50 g units and randomly selected bottles were taken for the final homogeneity testing.

Analysis: The homogeneity, using selected elements in the bottled material as indicators, was assessed using X-ray fluorescence spectrometry and neutron activation analysis. In a few cases, statistically significant differences were observed, and the variance due to material inhomogeneity is included in the overall uncertainty of the certified values. The estimated relative standard deviation is less than 3 % for those elements for which homogeneity was assessed.

Certified Values and Uncertainties: The certified values are weighted means of results from two or more analytical methods, or the mean of results from a single definitive method, except for mercury. Mercury certification is based on cold vapor atomic absorption spectrometry used by two different laboratories employing different methods of sample preparation prior to measurement. The weights for the weighted means were computed according to the iterative procedures of Paule and Mandel [1]. The stated uncertainty includes allowances for measurement imprecision, material variability, and differences among analytical methods. Each uncertainty is the sum of the half-width of a 95 % prediction interval and includes an allowance for systematic error among the methods used. In the absence of systematic error, a 95 % prediction interval predicts where the true concentrations of 95 % of the samples of this SRM lie. The certified values were corroborated by analyses from nine Polish laboratories cooperating on the certification under the direction of T. Plebanski and J. Lipinski, Polish Committee for Standardization Measures, and Quality Control. The Polish laboratory work was supported by the Maria Sklodowska-Curie Joint Fund.

Table 1. Certified Values

Element	Mass Fraction (%)			Element	Mass Fraction (µg/g)		
Aluminum	6.53	±	0.09	Antimony	19.4	±	1.8
Calcium	2.88	±	0.08	Arsenic	105	±	8
Iron	2.89	±	0.06	Barium	726	±	38
Magnesium	1.05	±	0.03	Cadmium	41.70	±	0.25
Phosphorus	0.086	±	0.007	Copper	114	±	2
Potassium	2.45	±	0.08	Lead	1162	±	31
Silicon	30.44	±	0.19	Manganese	638	±	28
Sodium	1.14	±	0.03	Mercury	6.25	±	0.19
Sulfur	0.042	±	0.001	Nickel	20.6	±	1.1
Titanium	0.306	±	0.023	Selenium	1.52	±	0.14
				Silver	4.63	±	0.39
				Strontium	245.3	±	0.7
				Thallium	2.47	±	0.15
				Vanadium	81.6	±	2.9
				Zinc	350.4	±	4.8

Noncertified Values: Noncertified values, shown below, are provided for information only. An element concentration value may not be certified, if a bias is suspected in one or more of the methods used for certification, or if two independent methods are not available.

Table 2. Noncertified Values

Element	Mass Fraction (%)	Element	Mass Fraction (µg/g)
Carbon	2	Bromine	5
		Cerium	69
		Cesium	6.1
		Chromium	47
		Cobalt	10
		Dysprosium	5.6
		Europium	1.1
		Gallium	15
		Gold	.03
		Hafnium	7.3
		Holmium	1
		Indium	1.1
		Iodine	3
		Lanthanum	40
		Molybdenum	1.6
		Neodymium	31
		Rubidium	110
		Samarium	5.9
		Scandium	9
		Thorium	14
		Tungsten	3
		Uranium	2.6
		Ytterbium	2.7
		Yttrium	25
		Zirconium	230

Table 3. Analytical Methods Used for the Analysis of SRM 2711

Element	Certification Methods *	Element	Certification Methods *
Ag	ID ICPMS; RNAA; **INAA**	Mo	**ID ICPMS**
Al	XRF1; XRF2; INAA; DCP; **ICP**	Na	INAA; FAES
As	RNAA; HYD AAS; **INAA**	Nd	**ICP**
Au	**INAA; FAAS**	Ni	ID ICPMS; ETAAS; **INAA**
Ba	XRF2; FAES; **ICP; INAA**	P	DCP; COLOR; XRF2; **ICP**
Br	**INAA**	Pb	ID TIMS; **POLAR; ICP**
C	**COUL**	Rb	**INAA**
Ca	XRF1; XRF2; DCP; INAA; **ICP**	S	ID TIMS
Cd	ID ICPMS; RNAA	Sb	INAA; ETAAS
Ce	**INAA; ICP**	Sc	**INAA; ICP**
Co	**INAA; ETAAS; ICP**	Se	RNAA; HYD AAS; **INAA**
Cr	**INAA; DCP; ICP**	Si	XRF1; XRF2; GRAV
Cs	**INAA**	Sm	**INAA**
Cu	RNAA; FAES; **ICP**	Sr	ID TIMS; **INAA; ICP**
Dy	**INAA**	Th	**ID TIMS; INAA; ICP**
Eu	**INAA**	Ti	INAA; XRF1; XRF2; DCP
Fe	XRF1; XRF2; DCP; **INAA**	Tl	ID TIMS; LEAFS
Ga	**INAA; ICP**	U	**ID TIMS**
Hf	**INAA**	V	INAA; ICP
Hg	CVAAS	W	**INAA**
Ho	**INAA**	Y	**ICP**
I	**INAA**	Yb	**INAA; ICP**
In	**INAA**	Zn	ID TIMS; **ICP; INAA; POLAR**
K	XRF1; XRF2; FAES; **ICP; INAA**	Zr	**INAA**
La	**INAA; ICP**		
Mg	XRF1; ICP		
Mn	INAA; ICP; XRF2; **XRF1**		

*Methods in **bold** were used to corroborate certification methods or to provide information values.

COLOR	Colorimetry; lithium metaborate fusion.
COUL	Combustion coulometry.
CVAAS	Cold vapor atomic absorption spectrometry.
DCP	Direct current plasma atomic emission spectrometry; lithium metaborate fusion.
ETAAS	Electrothermal atomic absorption spectrometry; mixed acid digestion.
FAAS	Flame atomic absorption spectrometry; mixed acid digestion, except for Au, leached with $HBr-Br_2$.
FAES	Flame atomic emission spectrometry; mixed acid digestion.
GRAV	Gravimetry; sodium carbonate fusion.
HYD AAS	Hydride generation atomic absorption spectrometry.
ICP	Inductively coupled plasma atomic emission spectrometry; mixed acid digestion.
ID ICPMS	Isotope dilution inductively coupled plasma mass spectrometry; mixed acid digestion.
ID TIMS	Isotope dilution thermal ionization mass spectrometry; mixed acid digestion.
INAA	Instrumental neutron activation analysis.
LEAFS	Laser enhanced atomic fluorescence spectrometry; mixed acid digestion.
POLAR	Polarography.
RNAA	Radiochemical neutron activation analysis; mixed acid digestion.
XRF1	Wavelength dispersive X-ray fluorescence on fused borate discs.
XRF2	Wavelength dispersive X-ray fluorescence spectrometry on pressed powder.

Participating NIST Analysts:

M. Adriaens	A. Marlow
E.S. Beary	J.R. Moody
C.A. Beck	P.J. Paulsen
D.S. Braverman	P. Pella
M.S. Epstein	T.A. Rush
J.D. Fassett	J.M. Smeller
K.M. Garrity	G.C. Turk
R.R. Greenberg	T.W. Vetter
W.R. Kelly	R.D. Vocke
R.M. Lindstrom	L.J. Wood
E.A. Mackey	R.L. Watters, Jr.

Participating Laboratories:

P. Briggs, D. Siems, J. Taggart, S. Wilson
U.S. Geological Survey
Branch of Geochemistry
Denver, CO, USA

P. Bienkowski
Institute of Ecology
Dziekanow Lesny, Poland

J.B. Bodkin
College of Earth and Mineral Sciences
The Pennsylvania State University
University Park, PA, USA

H. Matusiewicz
Technical University
Poznan, Poland

S.E. Landsberger, V.G. Vermette
Department of Nuclear Engineering
University of Illinois
Urbana, IL, USA

B. Ksiazek
Geological Enterprise
Warsaw, Poland

J. Lipinski, T. Plebanski
Polish Committee for Standardization,
Measures and Quality Control
Warsaw, Poland

G. Szoltyk
Forest Research Institute
Division in Sekocin,
Warsaw, Poland

M. Bielawska, B. Galczynska,
J. Galczynska, K. Galczynski,
K. Wiacek
Institute of Soil Science and Plant
Cultivation
Pulawy, Poland

J. Rojek
District Chemical Agricultural
Station
Bydgoszcz, Poland

I. Matuszczyk
Forest Research Institute
Division in Katowice,
Warsaw, Poland

E. Gorecka
Polish Geological Institute
Warsaw, Poland

Z. Jonca
Institute of Environmental
Protection
Warsaw, Poland

REFERENCE

[1] Paule, R.C.; Mandel, J.; *NBS Journal of Research*; Vol. 87, pp. 377-385, (1982).

Certificate Revision History: 18 July 2003 (The description of the SRM has been updated to include that this SRM was radiation sterilized, which was previously omitted); 18 January 2002 (This revision reflects a change in the certification expiration date); 23 August 1993 (Addendum added); 30 October 1992 (Original certificate date).

Users of this SRM should ensure that the certificate in their possession is current. This can be accomplished by contacting the SRM Program at: telephone (301) 975-6776; fax (301) 926-4751; e-mail srminfo@nist.gov; or via the Internet http://www.nist.gov/srm.

Addendum to Certificates

SRM 2709 San Joaquin Soil
SRM 2710 Montana Soil
SRM 2711 Montana Soil

Leachable Concentrations Using U.S. EPA Method 3050 for Flame Atomic Absorption Spectrometry (FAAS) and Inductively Coupled Plasma Atomic Emission Spectrometry (ICP-AES)

The certified concentrations of constituent elements in essentially all National Institute of Standards and Technology (NIST) chemical composition Standard Reference Materials (SRMs) are given as total concentrations. The certified concentrations are based on measurements obtained by two or more independent methods or techniques. The measurement methods require complete sample decomposition, or the sample may be analyzed nondestructively. Where complete sample decomposition is required, it can be accomplished by digestion with mixed acids or by fusion. For mixed acid decomposition, hydrofluoric acid must be included in the acid mixture used to totally decompose siliceous materials, such as soils and sediments.

For a number of environmental monitoring purposes, the concentrations of labile or extractable fractions of elements are more useful than total concentrations. Concentrations of labile or extractable fractions are generally determined using relatively mild leach conditions, which are unlikely to totally decompose the sample. It should be noted that results obtained using the mild leach conditions are often erroneously depicted in reports as total concentrations. However, reported concentrations of labile or extractable fractions of elements are generally lower than total concentrations; recovery can be total if an element in a given sample is completely labile. Results are often presented as measured concentration in the leachate in comparison to the total or certified concentration. The recovery of an element as a percent of total concentration is a function of several factors such as the mode of occurrence in the sample, leach medium, leach time and temperature conditions, and pH of the sample-leach medium mixture. References [1] through [27] may be consulted for detailed discussions of these factors and their effect on leach results. Some of these references provide leach data for one or more reference materials.

In its monitoring programs, the U.S. Environmental Protection Agency (EPA) has established a number of leach methods for the determination of labile or extractable elements. They include Methods 3015, 3050, and 3051. A number of cooperating laboratories using the variation to U.S. EPA Method 3050 for Flame Atomic Absorption Spectrometry (FAAS) and Inductively Coupled Plasma-Atomic Emission Spectrometry (ICP-AES) measurements, have reported data for SRMs 2709, 2710, and 2711. This variation of the method uses hydrochloric acid in its final step, which is different from Method 3050 for ICP-MS and Hydride Generation-Atomic Absorption Spectrometry (HG-AAS) measurements. The data obtained are presented in Tables 1, 2, and 3 of this addendum. The names of the cooperating laboratories are listed in Table 4. Several laboratories provided replicate (3 to 6) analyses for each of the three soil SRMs. The number of results for a given element varied from only one to as many as nine, as indicated in the data presented in Tables 1 through 3. Because of the wide range of interlaboratory results for most elements, only the data range and median of the individual laboratory means are given. Ranges differ somewhat from those in reference [26], since this addendum is based on a larger data set than had been available previously.

For SRMs 2710 and 2711, 17 laboratories provided data as part of contract work for the U.S. EPA. Each SRM was treated as a blind sample in one quarter of 1992. Since there was no within-laboratory replication of analysis in the design of the exercise, the 17-laboratory means of results were treated as single laboratory results from laboratories using replication, in establishing the median of the full data set. In a few cases, however, the contract laboratories mean was the only result available for a particular element (e.g., Antimony in SRM 2710). In others, the contract laboratories mean is also the median for the full leach data set (e.g., Arsenic in SRM 2710). An asterisk identifies those cases where the contract laboratories' means are given as the median value.

Please note none of the values in Tables 1 through 3 are certified, but are given as information on the performance of the three soils when used to evaluate, or to provide quality control for Method 3050 followed by FAAS and ICP-AES measurements only. The data should not be used for any other purpose. **The certified values, provided as total concentrations, are the best estimate of the true concentrations.**

Gaithersburg, MD 20899 John Rumble, Jr., Chief

Table 1. Leach Data from Cooperating Laboratories for Soil SRM 2709

Element	Range			Median	N	% Leach Recovery†
	Wt %					
Aluminum	2.0	-	3.1	2.6	5	35
Calcium	1.4	-	1.7	1.5	5	79
Iron	2.5	-	3.3	3.0	8	86
Magnesium	1.2	-	1.5	1.4	5	93
Phosphorus	0.05	-	0.07	0.07	3	100
Potassium	0.26	-	0.37	0.32	5	16
Silicon	---		---	< 0.01	1	< 1
Sodium	0.063	-	0.11	0.068	4	6
Titanium	0.03	-	0.04	0.038	3	11
	mg/kg					
Antimony	---		---	< 10	1	...
Arsenic	---		---	< 20	2	...
Barium	392	-	400	398	2	41
Cadmium	---		---	< 1	5	...
Chromium	60	-	115	79	5	61
Cobalt	10	-	15	12	5	90
Copper	26	-	40	32	7	92
Lead	12	-	18	13	5	69
Manganese	360	-	600	470	7	87
Molybdenum	---		---	< 2	2	...
Nickel	65	-	90	78	7	89
Selenium	nr	-	nr	0.014	1	< 1
Strontium	100	-	112	101	3	44
Vanadium	51	-	70	62	3	55
Zinc	87	-	120	100	7	94

$$\dagger\ \%\ \text{Leach Recovery} = 100 \times \left[\frac{\text{Median Value}}{\text{Certified/Information Value}}\right]$$

--- at or below the detection limit
... no % Leach Recovery calculated
nr no range reported by the laboratory

Table 2. Leach Data from Cooperating Laboratories for Soil SRM 2710

Element	Range			Median	N	% Leach Recovery†
		Wt %				
Aluminum	1.2	-	2.6	1.8	6	28
Calcium	0.38	-	0.48	0.41	7	33
Iron	2.2	-	3.2	2.7	9	80
Magnesium	0.43	-	0.60	0.57	6	67
Phosphorus	0.106	-	0.11	0.11	2	100
Potassium	0.37	-	0.50	0.45	6	21
Silicon	---		---	< 0.01	1	< 1
Sodium	0.049	-	0.062	0.054	5	5
Titanium	0.092	-	0.11	0.10	3	35
		mg/kg				
Antimony	3.4	-	12	7.9*	1*	21
Arsenic	490	-	600	590	3	94
Barium	300	-	400	360	3	51
Cadmium	13	-	26	20	8	92
Chromium	15	-	23	19	6	(49)
Cobalt	6.3	-	12	8.2	7	(82)
Copper	2400	-	3400	2700	8	92
Lead	4300	-	7000	5100	8	92
Manganese	6200	-	9000	7700	8	76
Mercury	27	-	37	32*	1*	98
Molybdenum	13	-	27	20	2	(100)
Nickel	8.8	-	15	10.1	8	71
Silver	24	-	30	28	3	79
Selenium	nr	-	nr	0.002	1	...
Strontium	94	-	110	100	3	(42)
Thallium	0.50	-	0.76	0.63*	1*	(48)
Vanadium	37	-	50	43	4	56
Zinc	5200	-	6900	5900	9	85

† $\% \text{ Leach Recovery} = 100 \times \left[\dfrac{\text{Median Value}}{\text{Certified/Information Value}}\right]$

( ) indicates that information value was used
--- at or below the detection limit
... no % Leach Recovery could be calculated
nr no range reported by the laboratory
* U.S. EPA contact laboratories mean; treated as one laboratory since no within-laboratory replication; see text

Table 3. Leach Data from Cooperating Laboratories for Soil SRM 2711

Element	Range			Median	N	% Leach Recovery†
	Wt %					
Aluminum	1.2	-	2.3	1.8	5	28
Calcium	2.0	-	2.5	2.1	5	73
Iron	1.7	-	2.6	2.2	7	76
Magnesium	0.72	-	0.89	0.81	5	77
Phosphorus	0.06	-	0.09	0.088	3	100
Potassium	0.26	-	0.53	0.38	5	16
Silicon	---		---	< 0.01	1	< 1
Sodium	0.020	-	0.029	0.026	4	2.3
Titanium	0.039	-	0.048	0.042	2	14
	mg/kg					
Antimony	...		...	< 10	1	...
Arsenic	88	- -	110	90	3	86
Barium	170	- -	260	200	2	28
Cadmium	32	-	46	40	6	96
Chromium	15	-	25	20	4	(43)
Cobalt	7	-	12	8.2	5	(82)
Copper	91	-	110	100	6	88
Lead	930	- -	1500	1100	7	95
Manganese	400	-	620	490*	7	77
Molybdenum	---		---	< 2	2	...
Nickel	14	-	20	16	7	78
Silver	2.5	-	5.5	4.0	1	86
Selenium	nr	-	nr	0.009	1	< 1
Strontium	48	-	55	50	3	20
Vanadium	34	- -	50	42	3	51
Zinc	290	- -	340	310	7	89

$$\dagger\ \text{\% Leach Recovery} = 100 \times \left[\frac{\text{Median Value}}{\text{Certified/Information Value}}\right]$$

( ) indicates that information value was used
--- at or below the detection limit
... no % Leach Recovery could be calculated
nr no range reported by the laboratory
* U.S. EPA contact laboratories mean; treated as one laboratory since no within-laboratory replication; see text

Table 4. Leach Study for Cooperating Laboratories

SRMs 2709, 2710, and 2711

S.A. Wilson: U.S. Geological Survey; Lakewood, CO, USA

J. Lipinski and T. Plebanski: Polish Committee for Standardization, Measures and Quality Control; Warsaw, Poland

E. Gorecka: Polish Geological Institute; Warsaw, Poland

M. Paul: Research Institute of Vegetable Crops; Skierniewice, Poland

I. Matuszczyk: Forest Research Institute; Warsaw, Poland

Z. Jonca: Institute of Environmental Protection; Warsaw, Poland

B. Ksiazek: Geological Enterprise; Warsaw, Poland

I. Twardowska: Polish Academy of Sciences, Institute of Environmental Engineering; Zabrze, Poland

SRMs 2710 and 2711

L. Butler and D. Hillman; U.S. Environmental Protection Agency, Las Vegas, NV, and 17 contract laboratories

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National Institute of Standards & Technology

Certificate of Analysis

Standard Reference Material® 2710a

Montana I Soil

Highly Elevated Trace Element Concentrations

This Standard Reference Material (SRM) is intended primarily for use in the analysis of soils, sediments, or other materials of a similar matrix. One unit of SRM 2710a consists of 50 g of the dried, powdered soil, blended with lead oxide.

Certified Values: The certified concentrations for 22 elements, expressed as mass fractions [1] on a dry-mass basis, are provided in Table 1. Certified values are based on results obtained from critically evaluated independent analytical techniques. A NIST certified value is a value for which NIST has the highest confidence in its accuracy in that all known or suspected sources of bias have been investigated or taken into account [2].

Reference Values: The reference values for 13 constituents, expressed as mass fractions on a dry-mass basis, are provided in Table 2. Ten reference values are based on results obtained from a single NIST analytical method, and three are based on results form two NIST analytical methods. Reference values are non-certified values that are the best estimate of the true value; however, the values do not meet NIST criteria for certification and are provided with associated uncertainties that may not include all sources of uncertainty [2].

Information Values: The values for 13 elements are provided in Table 3 for information purposes only. These are non-certified values with no uncertainty assessed. The information values included in this certificate are based on results obtained from one NIST method.

Expiration of Certification: The certification of SRM 2710a is valid, within the measurement uncertainties specified, until **1 January 2019**, provided the SRM is handled in accordance with the instructions given in this certificate (see "Instructions for Use"). This certification is nullified if the SRM is damaged, contaminated, or otherwise modified.

Maintenance of SRM Certification: NIST will monitor this SRM over the period of its certification. If substantive technical changes occur that affect the certification before the expiration of this certificate, NIST will notify the purchaser. Registration (see attached sheet) will facilitate notification.

E.A. Mackey and R.R. Greenberg of the NIST Analytical Chemistry Division were responsible for coordination of the technical measurements leading to certification.

Statistical analyses were performed by J.H. Yen of the NIST Statistical Engineering Division.

Support aspects involved in the issuance of this SRM were coordinated through the NIST Measurement Services Division.

Stephen A. Wise, Chief
Analytical Chemistry Division

Robert L. Watters, Jr., Chief
Measurement Services Division

Gaithersburg, MD 20899
Certificate Issue Date: 7 April 2009

INSTRUCTIONS FOR USE

Sampling: The SRM should be thoroughly mixed by repeatedly inverting and rotating the bottle horizontally before removing a test portion for analysis. A minimum mass of 250 mg (dry mass - see *Instructions for Drying*) should be used for analytical determinations to be related to the mass fraction values in this Certificate of Analysis.

To obtain the certified values, sample preparation procedures should be designed to effect complete dissolution. If volatile elements (i.e., arsenic, mercury, selenium) will be determined, precautions should be taken in the dissolution of SRM 2710a to avoid volatilization losses.

Drying: To relate measurements to the certified, reference, and information values that are expressed on a dry-mass basis, users should determine a drying correction at the time of each analysis. The recommended drying procedure is oven drying for 2 h at 110 °C. Note that analytical determination of volatile elements (i.e., arsenic, mercury, selenium) should be determined on samples as received; separate samples should be dried as previously described to obtain a correction factor for moisture. Correction for moisture must be made to the data for volatile elements before comparing to the certified values. This procedure ensures that these elements are not lost during drying. The mass loss on drying for this material as bottled was approximately 2 %, but this value may change once the bottle is opened and the soil is exposed to air.

SOURCE, PREPARATION, AND ANALYSIS

Source and Preparation of Material[1]: The U.S. Geological Survey (USGS), under contract to NIST, collected and processed the material for SRM 2710a. The original collection site used for SRM 2710 was no longer available due to remediation efforts by the Montana Department of Environmental Quality. An alternative nearby site, located within the flood plain of the Silver Bow Creek, was selected. The site is approximately five miles west of Butte, Montana. Soil for SRM 2710a was placed in 22 plastic-lined five-gallon buckets using a common garden spade. The buckets were sealed and transferred to the USGS using a commercial freight carrier. At the USGS, the SRM 2710a soil was dried at room temperature, disaggregated, and sieved to remove coarse material (≥2 mm). The resulting soil was ball-milled in 50 kg portions together with an amount of lead oxide sufficient to achieve a mass fraction of 0.55 % lead in the final product. The entire ball-milled batch of soil was transferred to a cross-flow V-blender for mixing. The blended soil was radiation sterilized prior to bottling. In the final preparation step the blended material was split into containers using a custom-designed spinning riffler, which was used to divide the material into smaller batches, and then used to apportion approximately 50 g into each pre-cleaned bottle.

Every 100th bottle was set aside for chemical analyses designed to assess material homogeneity using X-ray fluorescence spectrometry (XRF), inductively coupled plasma optical emission spectrometry (ICP-OES), and inductively coupled plasma mass spectrometry (ICP-MS) at the USGS. Homogeneity assessments were performed at NIST as well, and results indicated that additional processing was needed to achieve optimum homogeneity. The material from all bottles was combined, and then ground in batches between stainless steel plates for a time sufficient to produce a powder of which ≥95 %, by mass, passed through a 200 mesh (74 µm) sieve. The resulting powder was blended, and 50 g portions were dispensed into bottles using the spinning riffler. Results from additional analyses indicated material homogeneity was acceptable (see below).

Analysis: The homogeneity was assessed for selected elements in the bottled material using X-ray fluorescence spectrometry and instrumental neutron activation analysis (INAA). The estimated relative standard deviation for material inhomogeneity is <1 % and no component for inhomogeneity was included in the expanded uncertainties of the certified or reference values.

Analyses of this material were performed at NIST and at the USGS (Denver, CO). Results from NIST were used to provide the certified, reference, and information values shown in Tables 1, 2, and 3 respectively. Results from the USGS were used to confirm those values. The analytical techniques used for each element are listed in Table 4; the analysts are listed in Tables 5 and 6.

---

[1] Certain commercial equipment, instruments, or materials are identified in this certificate in order to specify adequately the experimental procedure. Such identification does not imply recommendation or endorsement by the National Institute of Standards and Technology, nor does it imply that the materials or equipment identified are necessarily the best available for the purpose.

Table 1. Certified Values[(a,b)] (Dry-Mass Basis) for Selected Elements in SRM 2710a

Element	Mass Fraction (%)			Element	Mass Fraction (mg/kg)		
Aluminum	5.95	±	0.05	Antimony	52.5	±	1.6
Arsenic	0.154	±	0.010	Barium	792	±	36
Calcium	0.964	±	0.045	Cadmium	12.3	±	0.3
Copper	0.342	±	0.005	Cobalt	5.99	±	0.14
Iron	4.32	±	0.08	Lanthanum	30.6	±	1.2
Lead	0.552	±	0.003	Mercury	9.88	±	0.21
Magnesium	0.734	±	0.038	Strontium	255	±	7
Manganese	0.214	±	0.006	Uranium	9.11	±	0.30
Phosphorus	0.105	±	0.004				
Potassium	2.17	±	0.13				
Silicon	31.1	±	0.4				
Sodium	0.894	±	0.019				
Titanium	0.311	±	0.007				
Zinc	0.418	±	0.015				

[(a)] Certified values for all elements except lead and mercury are the equally weighted means of results from two or three analytical methods. The uncertainty listed with each value is an expanded uncertainty about the mean. The expanded uncertainty is calculated as $U = ku_c$, where u_c is intended to represent, at the level of one standard deviation, the combined effect of between-method and within-method components of uncertainty, following the ISO Guide [3,4]. The coverage factor (k) is determined from the Student's t-distribution corresponding to the appropriate associated degrees of freedom and approximately 95 % confidence for each analyte.

[(b)] The certified values for lead and mercury are each results from a single NIST method (see Table 4) for which a complete evaluation of all sources of uncertainty has been performed. The uncertainties for the certified values for these elements represent expanded uncertainties with a coverage factor of 2, with uncertainty components combined following the ISO Guide [4].

Table 2. Reference Values[a,b,c] (Dry-Mass Basis) for Selected Elements in SRM 2710a

Element	Mass Fraction (mg/kg)
Cesium	8.25 ± 0.11
Chromium	23 ± 6
Europium	0.82 ± 0.01
Gadolinium	3.0 ± 0.1
Lutetium	0.31 ± 0.01
Neodymium	22 ± 2
Nickel	8 ± 1
Rubidium	117 ± 3
Samarium	4.0 ± 0.2
Scandium	9.9 ± 0.1
Thallium	1.52 ± 0.02
Thorium	18.1 ± 0.3
Vanadium	82 ± 9

[a] Reference values for all elements except chromium, nickel, samarium, and vanadium are based on results from one analytical method at NIST (see Table 4) and the uncertainties represent the expanded uncertainties, which include the combined Type A and Type B with a coverage factor of 2, following the ISO Guide [4].

[b] Reference values for nickel and samarium are the equally weighted means of results from two analytical methods for nickel and two INAA experiments for samarium. The uncertainty listed with each value is an expanded uncertainty about the mean. The expanded uncertainty is calculated as $U = ku_c$, where u_c is intended to represent, at the level of one standard deviation, the combined effect of between-method and within-method components of uncertainty, following the ISO Guide [3,4]. The coverage factor (k) is determined from the Student's t-distribution corresponding to the appropriate associated degrees of freedom and approximately 95 % confidence for each analyte.

[c] Reference values for chromium and vanadium are based on a weighted mean calculated based on the Dersimonian-Laird method [5], which incorporates an estimate of the between-method variance into the weights. The expanded uncertainty listed with these values is calculated as $U = ku_c$, where $k = 2$, and u_c is intended to represent, at the level of one standard deviation, the combined effect of between-method and within-method components of uncertainty.

Table 3. Information Values[a] (Dry-Mass Basis) for Selected Elements in SRM 2710a

Element	Mass Fraction (mg/kg)
Boron	20
Cerium	60
Dysprosium	3
Gold	0.2
Hafnium	7
Indium	7
Selenium	1
Silver	40
Tantalum	0.9
Terbium	0.5
Tungsten	190
Ytterbium	2
Zirconium	200

[a] Information values are based on results from one analytical method at NIST

Table 4. NIST Methods Used for the Analysis of SRM 2710a

Element	Methods	Element	Methods
Ag	INAA	Na	INAA; XRF
Al	INAA; XRF	Nd	INAA
As	CCT-ICP-MS; INAA; XRF	Ni	ICP-MS; ICP-OES
Au	INAA	P	ICP-OES; XRF
B	PGAA	Pb	ID-ICP-MS
Ba	INAA: XRF	Rb	INAA
Ca	INAA; XRF	Sb	ICP-MS; INAA
Cd	ID-ICP-MS; PGAA	Sc	INAA
Ce	INAA	Se	CCT-ICP-MS
Co	INAA; ICP-OES	Si	PGAA; XRF
Cr	INAA; XRF	Sm	INAA[(a)]
Cs	INAA	Sr	ICP-OES; XRF
Cu	INAA; XRF	Ta	INAA
Dy	INAA	Tb	INAA
Eu	INAA	Th	INAA
Fe	INAA; PGAA; XRF	Ti	PGAA; XRF
Gd	PGAA	Tl	ICP-MS
Hf	INAA	U	ICP-MS; INAA
Hg	CV-ID-ICPMS	V	INAA; XRF
K	INAA; PGAA; XRF	W	INAA
La	INAA[(a)]	Yb	INAA
Lu	INAA	Zn	INAA; XRF
Mg	INAA; XRF	Zr	XRF
Mn	INAA; PGAA; XRF		

NIST Methods of Analysis

CCT-ICP-MS	Collision cell inductively coupled plasma mass spectrometry
CV-ID-ICP-MS	Cold vapor isotope dilution inductively coupled plasma mass spectrometry
ICP-MS	Inductively coupled plasma mass spectrometry
ICP-OES	Inductively coupled plasma optical emission spectrometry
ID-ICP-MS	Isotope dilution inductively coupled plasma mass spectrometry
INAA	Instrumental neutron activation analysis
PGAA	Prompt gamma-ray activation analysis
XRF	X-ray fluorescence spectrometry

USGS Methods of Analysis[(b)]

WD-XRF-2	Wavelength dispersive X-ray fluorescence spectrometry at USGS
ICP-OES-2	Inductively coupled plasma optical emission spectrometry at USGS
ICP-MS-2	Inductively coupled plasma mass spectrometry at USGS

[(a)]Two different INAA experiments, performed using different sub-samples and different analytical conditions, were used to provide certified and reference values for lanthanum and samarium, respectively.
[(b)]USGS Methods of Analysis were used to confirm results from certification methods.

Table 5. Participating NIST Analysts:

S.J. Christopher	S.A. Rabb
R.D. Day	J.R. Sieber
S.E. Long	R.O. Spatz
E.A. Mackey	R.S. Popelka-Filcoff
A.F. Marlow	B.E. Tomlin
J.L. Molloy	L.J. Wood
K.E. Murphy	L.L. Yu
R.L. Paul	R. Zeisler

Table 6. Participating USGS Laboratory and Analysts

Laboratory	Analysts
U.S. Geological Survey Branch of Geochemistry Denver, CO, USA	M.G. Adams Z.A. Brown P.L. Lamothe J.E. Taggart S.A. Wilson

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Users of this SRM should ensure that the certificate in their possession is current. This can be accomplished by contacting the SRM Program at: telephone (301) 975-2200; fax (301) 926-4751; e-mail srminfo@nist.gov; or via the Internet at http://www.nist.gov/srm.

Addendum to Certificate

Standard Reference Material® 2710a

Montana I Soil

Highly Elevated Trace Element Concentrations

Leachable Concentrations Determined Using USEPA Methods 200.7 and 3050B

The mass fraction values contained in the NIST Certificate of Analysis for SRM 2710a represent the total element content of the material. The measurement results used to provide the certified, reference or information values are obtained from methods that require complete sample decomposition, or from nondestructive analytical methods such as instrumental neutron activation analysis or prompt gamma-ray activation analysis. Where complete sample decomposition is required, it can be accomplished by digestion with mixed acids or by fusion. For mixed-acid decomposition, hydrofluoric acid must be included in the acid mixture used to totally decompose siliceous materials such as soils and sediments.

In its monitoring programs, the U.S. Environmental Protection Agency (USEPA) has established a number of leach methods for the preparation of soil samples for the determination of extractable elements. Six laboratories participated, five of which used USEPA Method 200.7; the remaining laboratory used USEPA SW-846 Method 3050B for preparation of soil samples. All elements were determined in leachates by inductively coupled plasma optical emission spectrometry. All laboratories provided individual results from duplicate portions, and these results were averaged together to provide one result for each element from each participating laboratory. Results rejected as outliers by the USEPA Contract Laboratory Program (CLP) officials were not included. Results are summarized in Table A1. The ranges of mass fraction values, median values (to two significant figures), and the number of results included for each are given for 23 elements. The percent recovery values based on the ratios of the median values to the total element content (from the certified, reference, or information values in the Certificate of Analysis) are listed in the last column of Table A1. **Note that the certified values provided as total mass fractions in the Certificate of Analysis are the best estimate of the true mass fraction values for this material.**

This USEPA CLP Study was coordinated by Clifton Jones, Quality Assurance and Technical Support Program (QATS), Shaw Environmental & Infrastructure Group, Las Vegas, NV, under the direction of John Nebelsick, USEPA, Analytical Services Branch. The participating laboratories are listed in Table A2.

Table A1. Results from Laboratories Participating in the EPA Contract Laboratory Program Study.

Element	n	Range (mg/kg)			Median (mg/kg)	Recovery (%)
Aluminum	6	8200	-	12000	10000	17
Antimony	6	5.0	-	12	9.6	18
Arsenic	6	1300	-	1600	1400	92
Barium	6	490	-	540	510	65
Beryllium	6	0.24	-	0.51	0.48	--
Cadmium	5	9.6	-	12	11	86
Calcium	6	1700	-	2000	1800	19
Chromium	6	9.2	-	11	10	41
Cobalt	6	2.8	-	5.2	3.8	64
Copper	6	3100	-	3500	3300	95
Iron	6	30000	-	36000	34000	79
Lead	6	4700	-	5800	5100	93
Magnesium	6	3200	-	3600	3500	48
Manganese	6	1500	-	1800	1700	77
Mercury	6	9.3	-	11.7	10	104
Nickel	5	4.8	-	6.1	5.5	69
Potassium	6	3800	-	4700	4100	19
Selenium	2	1.5	-	2.6	2.0	200
Silver	6	31	-	39	36	91
Sodium	6	550	-	650	590	7
Thallium	3	1.3	-	3.6	3.2	213
Vanadium	6	35	-	43	38	48
Zinc	6	3300	-	4400	3800	90

Table A2. List of CLP and non-CLP Participating Laboratories

A4 Scientific, Inc.
Bonner Analytical Testing Co.
Chem Tech Consulting Group
Datachem Laboratories, Inc.
Liberty Analytical Corporation
SVL Analytical, Inc.