

APPENDIX 3.5-0

Bulk Chemical Analyses of Topsoil, Overburden, and
Waste Rock Materials
Flambeau Project, Ladysmith, WI

1. Sample Preparation

- a. One subsample of each sample was oven dried prior to digestion.
- b. One subsample of each sample was digested in its natural moist condition in order to prevent any volatilization of mercury.
- c. One subsample was used for moisture determination.

2. Digestion

- a. All samples were digested in a microwave apparatus using sulfuric and nitric acid.
- b. Digestions were observed to be complete.

3. Analyses

- a. All air dried samples were analyzed for:

Aluminum	Molybdenum
Arsenic	Nickel
Barium	Selenium
Beryllium	Silicon
Cadmium	Silver
Calcium	Sodium
Chromium	Sulfur
Cobalt	Thallium
Copper	Tin
Iron	Titanium
Lead	Uranium
Magnesium	Zinc
Manganese	

- b. All moist samples were analyzed for: Mercury
- c. Total Kjeldahl Nitrogen, percent moisture and phosphorus were also determined in the topsoil samples.
- d. Total Carbon and percent moisture were also determined in the till, sandstone, and saprolite samples.
- e. Two determinations of silicon were made of waste rock samples WR-3 and WR-5. Two determinations of calcium, magnesium, and potassium were made of sample WR-5. The average values of each determination were used in Table No. 3.5-9.

FOTH AND VAN DYKE
 Engineers/Architects
 2737 S. Ridge Road
 P.O. Box 19012
 Green Bay, Wisc. 54307-9012

LABORATORY ANALYSIS RESULTS
 W.D.N.R. LAB CERT. NO. 405051240

Client: Kennecott
 Address: [blank]
 Name of Rep.: [blank]
 Telephone No.: (000) 000-0000
 Sampled By: [blank]
 Scope I.D.: 87K10
 Billing Line No.: [blank]
 Liaison: D. Turriff
 Supply Order No.: 21
 Result Sheet No.: 37950.01

Sample I.D.	Till (E)	Till (W)	Till (C)	Sand (E)	Sand (W)
Date Collected	11-12/87	11-12/87	11-12/87	11-12/87	11-12/87
Date Received	5/13/88	5/13/88	5/13/88	5/13/88	5/13/88

Parameters, units	Results				
Al, ug/g	41,200	52,600	38,900	5440	6140
As, ug/g	4.8	5.0	5.1	1.6	0.7
Ba, ug/g	27	53	22	8	4
Be, ug/g	< 4	< 4	< 4	< 4	< 4
Cd, ug/g	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Cr, ug/g	11	9.1	9.6	1.6	2.3
Co, ug/g	8	9	6	< 2	< 2
Cu, ug/g	15	83	13	13	34
Fe, ug/g	7000	10,000	5700	1100	680
Pb, ug/g	2.3	2.3	3.5	1.3	0.4
Mn, ug/g	190	460	160	200	10
Hg, ug/g **	< 0.05	< 0.10	< 0.10	< 0.09	< 0.08
Mo, ug/g	130	160	180	< 110	< 110
Ni, ug/g	10	13	10	1.0	0.8
Se, ug/g	< 0.15	< 0.15	< 0.15	< 0.15	< 0.15

comments: Results reported as ug/g dry weight unless otherwise noted.
 ** Reported as ug/g as received.

Signed: David Turriff Date: August 1, 1988

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 Engineers/Architects
 2737 S. Ridge Road
 P.O. Box 19012
 Green Bay, Wisc. 54307-9012

LABORATORY ANALYSIS RESULTS
 W.D.N.R. LAB CERT. NO. 405051240

Client: Kennecott
 Address: [blank]
 Name of Rep.: [blank]
 Telephone No.: (000) 000-0000
 Sampled By: [blank]
 Scope I.D.: 87K10
 Billing Line No.: [blank]
 Liaison: D. Turriff
 Supply Order No.: 21
 Result Sheet No.: 37950.02

Sample I.D.	Sand (C)	Saprolite ML
Date Collected	11-12/87	11-12/87
Date Received	5/13/88	5/13/88

Parameters, units	Results	
Al, ug/g	7530	34,800
As, ug/g	0.2	1.9
Ba, ug/g	2.1	15
Be, ug/g	< 4	< 4
Cd, ug/g	< 0.5	< 0.5
Cr, ug/g	1.7	9.2
Co, ug/g	< 2	6
Cu, ug/g	3	160
Fe, ug/g	430	12,000
Pb, ug/g	0.6	29
Mn, ug/g	67	310
Hg, ug/g **	< 0.10	0.14
Mo, ug/g	< 110	137
Ni, ug/g	3.1	5.1
Se, ug/g	< 0.15	< 0.15

comments: Results reported as ug/g dry weight unless otherwise noted.
 ** ug/g as received.

Signed: David Turriff Date: August 1, 1988

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 Engineers/Architects
 2737 S. Ridge Road
 P.O. Box 19012
 Green Bay, Wisc. 54307-9012

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 Engineers/Architects
 2737 S. Ridge Road
 P.O. Box 19012
 Green Bay, Wisc. 54307-9012

LABORATORY ANALYSIS RESULTS
 W.D.N.R. LAB CERT. NO. 405051240

Client Address: Kennecott
 Name of Rep. Telephone No.: (000) 000-0000

Sampled By: D. Turriff
 Scope I.D.: 87K10
 Billing Line No.:
 Liaison:
 Supply Order No.:
 Result Sheet No.: 37950.03

Client Address: Kennecott
 Name of Rep. Telephone No.: (000) 000-0000

Sampled By: D. Turriff
 Scope I.D.: 87K10
 Billing Line No.:
 Liaison:
 Supply Order No.:
 Result Sheet No.: 37950.04

Sample I.D.	Till (E)	Till (W)	Till (C)	Sand (E)	Sand (W)
Date Collected	11-12/87	11-12/87	11-12/87	11-12/87	11-12/87
Date Received	5/13/88	5/13/88	5/13/88	5/13/88	5/13/88
Parameters, units	Results				
Ag, ug/g	< 0.02	0.05	< 0.02	0.04	0.02
Na, ug/g	14	9	6	6	6
Tl, ug/g	0.10	0.10	< 0.10	< 0.10	0.10
Ti, ug/g	2400	4100	1800	180	630
Sn, ug/g	1900	1600	620	570	710
U, ug/g	0.5	1.9	0.4	< 0.1	0.5
Zn, ug/g	22	21	18	10	3
Ca, ug/g	1700	2600	1800	560	110
Mg, ug/g	2000	3000	1400	77	190
K, ug/g	170	310	240	27	69
Si, ug/g	318,000	344,000	336,000	376,000	437,000
Sulfur, %	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10

comments: Results reported as ug/g dry weight unless otherwise noted.

Signed: David Turriff Date: August 1, 1988

Sample I.D.	Sand (C)	Saprolite ML
Date Collected	11-12/87	11-12/87
Date Received	5/13/88	5/13/88
Parameters, units	Results	
Ag, ug/g	0.03	0.47
Na, ug/g	7	6
Tl, ug/g	< 0.10	0.10
Ti, ug/g	430	1300
Sn, ug/g	960	560
U, ug/g	< 0.1	1.4
Zn, ug/g	3	110
Ca, ug/g	140	2100
Mg, ug/g	46	1000
K, ug/g	16	130
Si, ug/g	395,000	347,000
Sulfur, %	< 0.10	< 0.10

comments: Results reported as ug/g dry weight unless otherwise noted.

Signed: David Turriff Date: August 1, 1988

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 Engineers/Architects
 2737 S. Ridge Road
 P.O. Box 19012
 Green Bay, Wisc. 54307-9012

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FOTH AND VAN DYKE
 Engineers/Architects
 2737 S. Ridge Road
 P.O. Box 19012
 Green Bay, Wisc. 54307-9012

LABORATORY ANALYSIS RESULTS
 W.D.N.R. LAB CERT. NO. 405051240

Client: Kennecott
 Address: [Redacted]
 Name of Rep.: [Redacted]
 Telephone No.: (000) 000-0000
 Sampled By: [Redacted]
 Scope I.D.: 87K10
 Billing Line No.: [Redacted]
 Liaison: D. Turriff
 Supply Order No.: 21
 Result Sheet No.: 38008.01

Client: Kennecott
 Address: [Redacted]
 Name of Rep.: [Redacted]
 Telephone No.: (000) 000-0000
 Sampled By: [Redacted]
 Scope I.D.: 87K10
 Billing Line No.: [Redacted]
 Liaison: D. Turriff
 Supply Order No.: 21
 Result Sheet No.: 38008.02

Sample I.D.	WR-1 D1	WR-2 D1	WR-3 D1	WR-4 D1	WR-5 D1
Date Collected	5/25/88	5/25/88	5/25/88	5/25/88	5/25/88
Date Received	5/25/88	5/25/88	5/25/88	5/25/88	5/25/88

Sample I.D.	WR-1 D1	WR-2 D1	WR-3 D1	WR-4 D1	WR-5 D1
Date Collected	5/25/88	5/25/88	5/25/88	5/25/88	5/25/88
Date Received	5/25/88	5/25/88	5/25/88	5/25/88	5/25/88

Parameters, units	Results				
Al, ug/g	109,000	122,000	124,000	108,000	109,000
As, ug/g	14	16	38	47	21
Ba, ug/g	14	14	7	6	< 4
Be, ug/g	< 4	< 4	< 4	< 4	< 4
Cd, ug/g	0.7	0.7	< 0.5	< 0.5	< 0.5
Cr, ug/g	24	29	25	17	2.3
Co, ug/g	18	28	60	35	23
Cu, ug/g	540	2700	3900	5000	6400
Fe, ug/g	33,000	38,000	42,000	45,000	38,000
Pb, ug/g	9	16	60	24	7
Mn, ug/g	310	160	130	180	19
Hg, ug/g **	0.62	1.0	1.8	0.94	0.23
Mo, ug/g	270	< 110	< 110	< 110	330
Ni, ug/g	7.1	14	31	11	6.1

Results reported as ug/g dry weight unless otherwise noted.
 ** Reported as ug/g as received.

Signed: David Turriff Date: August 1, 1988

Parameters, units	Results				
Se, ug/g	< 3.0 *	< 3.0 *	< 3.0 *	< 3.0 *	< 3.0 *
Ag, ug/g	1.9	2.4	160	58	4.9
Na, ug/g	45	62	43	38	22
Tl, ug/g	0.20	0.25	0.60	0.55	< 0.1
Ti, ug/g	2600	3000	2900	2600	2000
Sn, ug/g	2600	< 300	680	< 300	460
U, ug/g	0.87	0.82	0.82	0.61	0.53
Zn, ug/g	1200	98	7900	830	41
Ca, ug/g	5200	1500	2300	1800	190
Mg, ug/g	9400	6400	7100	8900	340
K, ug/g	700	590	360	870	110
Si, ug/g	357,000	330,000	375,000	349,000	277,000
Sulfur, %	< 0.10	0.49	0.70	2.0	4.8

comments: Results reported as ug/g dry weight unless otherwise noted.
 * High detection limit due to sample matrix problem.

Signed: David Turriff Date: August 1, 1988

FOTH AND VAN DYKE
Engineers/Architects
2737 S. Ridge Road
P.O. Box 19012
Green Bay, Wisc. 54307-9012

LABORATORY ANALYSIS RESULTS
W.D.N.R. LAB CERT. NO. 405051240

Client Kennecott
Address
Sampled By
Scope I.D. 87K10
Billing Line No.
Liaison D. Turriff
Name of Rep.
Supply Order No.
Telephone No. (000) 000-0000
Result Sheet No. 38598.01

Sample I.D.	Till-E	Till-W	Till-C	ML	Sandstone
Date Collected	8/5/88	8/5/88	8/5/88	8/5/88	8/5/88
Date Received	8/5/88	8/5/88	8/5/88	8/5/88	8/5/88

Parameters, units	Results				
Total Carbon, mg/kg*	510	590	630	280	190
Total Moisture, %	8.4	8.3	9.7	13	13

comments: * mg/kg dry weight.

Signed: David Turriff Date: September 21, 1988

FOTH AND VAN DYKE
Engineers/Architects
2737 S. Ridge Road
P.O. Box 19012
Green Bay, Wisc. 54307-9012

LABORATORY ANALYSIS RESULTS
W.D.N.R. LAB CERT. NO. 405051240

Client Kennecott
Address
Sampled By
Scope I.D. 87K10
Billing Line No.
Liaison D. Turriff
Name of Rep.
Supply Order No.
Telephone No. (000) 000-0000
Result Sheet No. 38598.02

Sample I.D.	Sandstone	Sandstone	WR-3 D1	WR-5
Date Collected	8/5/88	8/5/88	8/5/88	8/5/88
Date Received	8/5/88	8/5/88	8/5/88	8/5/88

Parameters, units	Results			
Total Carbon, mg/kg*	200	1700		
Total Moisture, %	13	13		
Silicon, mg/kg *			296,400	260,700

comments: * mg/kg dry weight.

Signed: David Turriff Date: September 21, 1988

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 Engineers/Architects
 2737 S. Ridge Road
 P.O. Box 19012
 Green Bay, Wisc. 54307-9012

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 2737 S. Ridge Road
 P.O. Box 19012
 Green Bay, Wisc. 54307-9012

LABORATORY ANALYSIS RESULTS
 W.D.N.R. LAB CERT. NO. 405051240

Client: Kennecott
 Address: [Redacted]
 Name of Rep.: [Redacted]
 Telephone No.: (000) 000-0000
 Sampled By: [Redacted]
 Scope I.D.: 87K10
 Billing Line No.: [Redacted]
 Liaison: D. Turriff
 Supply Order No.: [Redacted]
 Result Sheet No.: 38353.01

Client: Kennecott
 Address: [Redacted]
 Name of Rep.: [Redacted]
 Telephone No.: (000) 000-0000
 Sampled By: [Redacted]
 Scope I.D.: 87K10
 Billing Line No.: [Redacted]
 Liaison: D. Turriff
 Supply Order No.: [Redacted]
 Result Sheet No.: 38353.02

Sample I.D.	TS-E Chem A	TS-C Chem A	TS-W Chem A
Date Collected	8/2/88	8/2/88	8/2/88
Date Received	8/2/88	8/2/88	8/2/88

Sample I.D.	TS-E Chem A	TS-C Chem A	TS-W Chem A
Date Collected	8/2/88	8/2/88	8/2/88
Date Received	8/2/88	8/2/88	8/2/88

Parameters, units	Results		
Moisture, %	14	23	23
TKN, ug/g	3.4	42	28
Sulfur, % *	0.20	0.21	0.21
Hg, ug/g *	< 0.10	< 0.10	< 0.10
Al, ug/g **	32,600	28,000	30,600
As, ug/g **	2.9	2.6	3.3
Ba, ug/g **	54	47	66
Be, ug/g **	< 3	< 4	< 3
Cd, ug/g **	< 0.5	< 0.5	< 0.5
Cr, ug/g **	7.5	6.0	9.5
Co, ug/g **	4.2	3.2	6.7
Cu, ug/g **	2.8	2.7	4.0
Fe, ug/g **	6000	4400	10,000
Pb, ug/g **	10	5.0	9.0
P, ug/g **	1000	660	780

Parameters, units	Results		
Si, ug/g **	295,000	260,000	259,000
Mo, ug/g **	< 86	< 101	< 84
Mn, ug/g **	470	280	610
Ni, ug/g **	3.4	5.6	0.40
Se, ug/g **	< 0.15	< 0.15	< 0.15
Ag, ug/g **	0.03	0.04	0.05
Na, ug/g **	16	19	22
Tl, ug/g **	0.10	< 0.10	< 0.10
Ti, ug/g **	3110	3190	3100
Sn, ug/g **	< 200	< 233	< 200
U, ug/g **	0.35	0.18	0.26
Zn, ug/g **	17	19	18
Ca, ug/g **	800	1100	1200
Mg, ug/g **	780	620	840
K, ug/g **	110	180	260

comments: * As received.
 ** Dry weight.

comments: * As received.
 ** Dry weight.

Signed: David Turriff Date: September 29, 1988

Signed: David Turriff Date: September 29, 1988

Oneida Research & Technology Center
2496 West Mason Street
P. O. Box 12435
Green Bay, WI 54307-2435
Phone No.: (414)498-2222

LABORATORY ANALYSIS RESULTS

W.D.N.R. LAB CERT. NO. 405051240

Client Kennecott
Address
Name of Rep.
Telephone No. (000) 000-0000

Sampled By
P.O. #
Job # 87K10
Report to: D. Turriff
Invoice # 1071
Result Sheet No. 38700.00

Sample I.D. WR-5 D1

Date Collected
Date Received

Parameters, units

Ca, mg/kg 315
Mg, mg/kg 350
K, mg/kg 125

comments:

Signed: David Turriff Date: November 14, 1989

ORTEK
Oneida Environmental Technology Center
2496 West Mason Street
P. O. Box 12435
Green Bay, WI 54307-2435
Telephone: (414) 498-2222

LABORATORY ANALYSIS RESULTS

W.D.N.R. LAB CERT. NO. 405099530

Client Kennecott
Address
Name of Rep.
Telephone No. (000) 000-0000

Sampled By J. Thresher
P.O. #
Job # 87K10
Report to: B. Burton
Invoice # 1554
Result Sheet No. 39056.00

Sample I.D. Type 1
Soil Comp.
Date Collected 01/03/89
Date Received 01/03/89

Parameters, units

Mn, ug/g 120
Cr, ug/g 4.7
Cu, ug/g 2.2
Fe, ug/g 4100
T. Sulfur, % 0.29

Comments:

Signed: David Turriff Date: February 15, 1989

ORTEK
Oneida Environmental Technology Center
2496 West Mason Street
P. O. Box 12435
Green Bay, WI 54307-2435
Telephone: (414) 498-2222

LABORATORY ANALYSIS RESULTS
W.D.N.R. LAB CERT. NO. 405099530

Client Address Kennebecott
Name of Rep. Telephone No. (000) 000-0000

Sampled By J. Thresher
P.O. #
Job # 87K10
Report to: B. Burton
Invoice # 1270
Result Sheet No. 39020.00

Sample I.D. WR-1A
Date Collected 11/10/88
Date Received 11/11/88

Parameters, units ----- Results -----

T. Sulfur, % < 0.17

Comments:

Signed: David Turiff Date: January 10, 1989

APPENDIX 3.5-P

Acid Consumption, Production, and
Neutralization Data and Methods
Flambeau Project, Ladysmith, WI