Foth & Van Dyke
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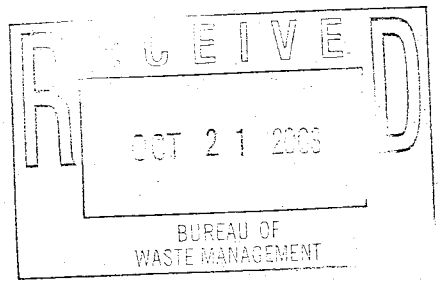
October 20, 2003

Mr. Lawerence J. Lynch
Wisconsin Department of Natural Resouirces
Bureau of Solid and Hazardous Wastes
101 South Webster Street, GEF II, P.O. Box 7921
Madison, WI 53707-7921



Dear Mr. Lynch:

RE: Final Soil Sampling Results and Remediation Plan for the Flambeau Mining Company Railroad Spur West of STH 27, Ladysmith, Wisconsin

The purpose of this letter is to present the results of the field and laboratory investigations completed on the railroad spur west of STH 27 on the Flambeau Mining Company (Flambeau) property hereafter referred as the railroad spur west. In addition, a remediation plan is presented which proposes the methods and extent of excavation to remove the source of elevated copper concentrations in surface runoff from soil material within the railroad spur west area.

Background Information

In August 1998 six soil samples were collected along the railroad spur west, the industrial outlet and the drainage areas adjacent to where ore handing had taken place. Sample S-4 had a copper (Cu) concentration of 230 mg/l. Subsequently, a soil sampling plan was submitted to the Wisconsin Department of Natural Resources (WDNR) dated July 9, 2003 that proposed additional soil sampling and analyses to characterize and delineate soils to be removed as part of the railroad spur west area reclamation. This plan proposed using shallow test pits to sample the sand and gravel soil over the railroad ballast and complete laboratory tests on the soils in the upper foot. In a letter dated July 18, 2003 the WDNR made the following comments on the sampling plan: that 1) soils be sampled deeper than the upper one foot for possible future analysis; 2) the fine fraction be collected along with the coarse during soil sampling; 3) test pits be excavated to a depth which exposes the underlying coarse ballast stone; 4) soil samples be analyzed for Cu, Sulfur (S) and pH; 5) WDNR expressed a preference that contaminated soils be disposed of at a licensed off-site landfill; and 6) that Flambeau develop criteria to delineate the extent of removal of contaminated soils from the railroad spur area. The WDNR's comments were incorporated into the field sampling plan. The railroad spur soil investigation was started and completed on July 24, 2003. Ron Poppie, engineering technician from Foth and Van Dyke and

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Associates, Inc. (F&VD) completed the soil investigation and sampling which was observed by Mr. Ken Markart and Mr. Larry Lynch of the WDNR and Ms. Jana Murphy of Flambeau. The sampling methods and results of the investigation are described below.

Field Investigation Methods and Findings

On July 24, 2003 Ron Poppie logged test pits and collected soil samples along the north and south side of the railroad spur. Figure 1 shows the location of the soil samples. Attachment 1 contains a copy of Mr. Poppie's field notes which describe the sample depth and sample collection methods. A skid-steer loader equipped with a backhoe attachment was used to excavate the sand and gravel and ballast along the railroad spur. A listing of the depths of soil samples collected is as follows:

At locations S-7 through S-10 and S-12 through S-15 samples of the sand and gravel were collected at 6 inches, 12 inches and 18 inches below the top of the railroad ties. The sample at 18 inches was collected at the interface between the coarse ballast rock and the lower sand and gravel fill.

At sample location S-11 (which is adjacent to sample point S-4 that had a Cu concentration of 230 mg/kg at a six-inch depth) sand and gravel were sampled at depths of 6, 12, 18 and 24 inches measured from the top of the existing grade.

At sampling locations S-16 through S-18 sand and gravel do not overlie the ballast. These soils were sampled at 12, 18 (ballast sand and gravel interface) and 24 inches.

Attachment 1 contains Mr. Poppie's field notes which include sketches of the sample locations described above along with the elevations shot at the sample locations. The soil samples were obtained from the test pit walls by scraping the fine soil materials (i.e. P200 fraction and the sand fraction) into a plastic Ziplock™ bag with a stainless steel spoon. The sampling tools were decontaminated after each sample by washing the sampling tool in an Alconox/water solution followed by a deionized water rinse. Attachment 1 also contains photographs of several of the areas excavated along the railroad spur to obtain soil samples. After soil sampling was completed, Mr. Poppie transported samples to the Foth & Van Dyke laboratory in Green Bay, WI. On July 25, 2003 the samples selected for laboratory analysis were relinquished to En Chem, Inc. The remaining samples were stored in the cooler at Foth & Van Dyke's Green Bay office.

EnChem Inc. Laboratory Test Results

EnChem, Inc. analyzed the samples submitted on July 25, 2003 for total Cu, S, pH and percent solids. The laboratory data sheets and chain of custody forms are included in Attachment 2. Table 1 lists the results for the soil samples analyzed for Cu, S and pH along

with the sample identification (ID) and soil sample depth in feet. Soil samples from locations S-8, S-11 and S-14 were composited at depths of six inches (0.5') and 12 inches (1') to 18 inches (1.5') and tested for TCLP semivolatiles (SVOC's), inorganics including RCRA metals, free liquids, chlorine, percent solids, pH, specific gravity, sulfide and Volatiles (VOC's). The laboratory reports for these analyses are included in Attachment 2 and the results are summarized in Table 2.

Table 1 summarizes the extract sampling results. Typically the sample at the 0.5-foot depth had the highest Cu and S concentrations. At the 0.5-foot depth Cu ranged from 200 mg/kg in S-12 to 1600 mg/kg in S-11 and for S ranged from 352 mg/kg in S-15 to 15,490 mg/kg in S-9. Samples obtained along the west railroad spur where sand and gravel did not overlie the ballast (i.e. S-16 through S-18) were taken at depths of 1.5 feet and 2.0 feet at the sand and gravel/ ballast interface and below. Table 1 again shows that for these samples the highest concentrations for both Cu and S were in the upper or 1.5 foot depth. In general it can be concluded that the greatest concentrations of Cu and S occur at the 0.5 foot to 1 foot depth and, in the case of locations S-16 through S-18, the greatest concentrations of Cu and S occur at the 1.5 foot to 2.0 foot depth. Photographs (Attachment 1) of the excavations from which the soil samples were taken also provide an indication of the presence of high S content in the soil horizons discussed above. The photographs of the excavations of the sand and gravel and ballast at sample locations S-9, S-10 and S-16 have evidence of yellowish staining in the upper most sand and gravel layers and yellowish staining is evident directly below the ballast at sample location S-16.

In review of the data in Table 1 it is important to note that the fine soil sizes (i.e. P200 and sand size particles) were selected for laboratory analyses as requested by the WDNR. So the Cu, S and pH total analyses were run on the sand and other fine particles in the soil since it is believed that these fine particles would contain the greatest concentrations of Cu and S in the soil. Since the fines in the soil were selectively sampled the concentrations of Cu and S presented in Table 1 are likely two or more times greater than the actual concentrations in the total sand and gravel mass since the gravel and coarse fraction was purposely excluded from the sampling so that the contaminated horizons could be more easily identified.

It was recognized that soil removal at the railroad spur should be based on the total copper/sulfur/pH results coupled with the potential for the soils to leach copper rather than the extract values presented in Table 1. Table 2 and the laboratory analytical reports (Attachment 2) contain the results of the TCLP (an acid leaching procedure) completed on composite samples. The results are low Cu concentrations (i.e. 8.0 mg/l in the shallow soil sample and 2.1 mg/l in the deep composite soil sample).

In an attempt to mimic actual field conditions Flambeau completed EPA 1312 SPLP testing (SPLP testing). The SPLP testing estimated the *leachability* of copper during a

precipitation event for the range of concentrations exposed along the railroad spur. The WDNR was informed of the SPLP laboratory testing in a letter dated August 29, 2003 which is included in Attachment 3. The letter in Attachment 3 includes a copy of an internal Foth & Van Dyke memorandum that lists the samples selected for SPLP testing. These samples were selected since they represent the range of Cu and S values that have been identified along the railroad spur. The results of the SPLP testing is provided and discussed below.

EnChem EPA 1312 SPLP Testing Results

EnChem Inc. completed the SPLP tests and the test data are included in Attachment 4. Table 3 summarizes the results of the EPA 1312 SPLP testing and includes the total values for Cu and S determined during the testing completed earlier that is summarized in Table 1. The soil samples selected for SPLP testing represent a range of the values for total Cu and S that were measured during earlier testing. Table 3 shows that the total Cu and S values are typically two to three orders of magnitude higher than the SPLP values.

Summary of Laboratory Test Results

Table 1, which summarizes the extract or total laboratory values for Cu and S, must be viewed realizing the results represent testing of only the sand and fines (P200) portions of the sand and gravel in place. So on a total sample basis the actual total Cu and S concentration are likely to be a least half of the values listed in Table 2.

Table 2 summarizes the TCLP testing completed on shallow (0.5 ft) and deep (1.0-1.5 ft) composite samples. The TCLP tests resulted in no detects of RCRA metals, SVOC's or VOC's. Only lower concentrations of copper (i.e., 2.1 to 8.0 mg/l) were detected. TCLP results are used by most Municipal Solid Waste Landfill as the criteria for accepting special wastes. Waste Management of Wisconsin was contacted regarding their acceptance standards which for copper are < 100 mg/l and for reactive sulfur 200 ppm. Therefore, the soils tested meet these standards.

Table 3 summarizes the EPA 1312 results for the range of Cu and S concentrations identified in the fine soil fraction around the railroad spur. These results indicate that leaching by water from precipitation is unlikely to produce water with high Cu or S concentrations.

40,500E

41,000E

41,500E

N

39,500N

39,000N

1170'

55'

20'

A

A'

S-7

S-8

S-9

S-10

S-11

S-12

S-13

S-14

S-15

S-16

S-17

S-18

S-4

ZONE A1

ZONE A1

1140

1130

HWY. 27

Water

SOUTHEAST

2' PROPOSED TOPSOIL
(MATCHES EXISTING GRADE AT EDGE)

POST EXCAVATION TOP OF SAND
AND GRAVEL OR BALLAST

RAILROAD RECLAMATION SECTION A-A'

NOT TO SCALE

DEPTH OF EXCAVATION = 2 FEET

LEGEND

⊗ S-4 PREVIOUSLY SAMPLED

× S-13 PROPOSED SAMPLE LOCATIONS

ZONE A1

NOTES:

1. TOPSOIL GRADED TO MINIMUM 2% SLOPE.
2. SEED, FERTILIZE AND MULCH.

FLAMBEAU MINING CO.

FIGURE 1

RAILROAD SPUR WEST OF HWY 27
SOIL REMEDIATION

Scale: 0 50' 100' | Date: OCTOBER, 2003

Prepared By: Foth & Van Dyke | By: JRB2 | 03F002

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10/20/2003 jrb2

Plan for Remediation of Railroad Spur

Excavation of Two Feet of Potentially Contaminated Materials and Disposal at an Off-Site Landfill

Figure 1 shows the proposed extent of excavation along the railroad spur. Flambeau is proposing to excavate two feet over the entire area shown shaded. The entire shaded area has been designated as Zone A-1. The total volume of in-place material to be excavated has been estimated at approximately 4,120 cubic yards or 7,510 tons (at an estimated 135 pounds per cubic foot in-place).

Waste Management of Wisconsin's Timberline Trials Landfill site in Bruce, Wisconsin (Timberline) was contacted regarding landfilling the excavated material and has agreed to dispose of this material.

Excavation and Reclamation Methods and Materials

Flambeau intends to complete the railroad spur west area reclamation before the first snowfall of 2003. It is expected that the work will be underway in late October or early November 2003 and be competed in approximately 10 working days.

The railroad tracks and ties will be removed and salvaged prior to the start of excavation. Zone A-1, as shown on Figure 1, will be excavated using a rubber tire loader. The sand and gravel or ballast will be loaded directly on trucks, the trucks tarped and each load hauled for disposal at the Timberline Trails Landfill. The excavated area will be regraded either this fall or next spring, (2004), as shown on the reclamation Section A-A' on Figure 1. The regraded area will then be covered with topsoil. The topsoil will have a minimum thickness of six inches and have a minimum slope of two percent. The topsoiled area will be seeded, fertilized and mulched. A seed mix the same as that used for the industrial out lot will be applied at an appropriate rate. Any areas of bare ground will be reseeded.

Concluding Remarks

Flambeau has characterized the shallow soils below the railroad spur and discovered low leachable concentrations of Cu and S. Remedial measures have been proposed to minimize Cu and S from impacting surface water quality. The remedial measures include removing two feet of material, some of which does not have significant concentrations of Cu and S and disposing the excavated material at a licensed landfill. Despite significant evidence that indicates leaving some of these materials in-place would not impact surface waters, Flambeau proposes to remove the entire two feet of material. In light of Flambeau's cooperation and the fact that the great majority of the contaminated material

will be removed, it is requested that WDNR take this into account regarding post-reclamation environmental monitoring for the railroad spur west area. Flambeau desires to complete this work during the 2003 construction season so time is of the essence for WDNR's approval of the proposed remedial measures. Your prompt attention to this matter would be most appreciated.

Sincerely,

Foth & Van Dyke and Associates, Inc.

James B. Hutchison, P.E.
Project Manager

Attachments

cc: Al Christianson, City of Ladysmith
Fred Fox, Kennecott Minerals Company
Ken Markart, WDNR
Randy Tatur, Rusk Co.
Tom Portle, WDNR
Tom Riegel, Town of Grant
Bill Stoll, Applied Ecological Services
Rusk Co. Zoning

Table 1
Extract Sampling - Total Cu and S Results*

INORGANICS

Field ID	Depth	Copper (mg/Kg)	pH (su)	Sulfur (mg/kg)
S-7	0.5	220	4.5	1306
	1.0	130	4.6	46
	1.5	150	5.6	17
S-8	0.5	410	2.5	15040
	1.0	370	3.8	733
	1.5	270	3.9	105
S-9	0.5	600	2.5	15490
	1.0	260	3.5	740
	1.5	250	3.6	96
S-10	0.5	240	2.7	2904
	1.0	290	3.6	274
	1.5	220	3.9	147
S-11	0.5	1600	4.6	10650
	1.0	40	6	26
	1.5	110	5.7	155
	2.0	56	5.9	123
S-12	0.5	200	2.6	1628
	1.0	77	5.3	85
	1.5	170	3.4	343
S-13	0.5	240	3.2	1338
	1.0	92	4.5	150
	1.5	200	4.2	293
S-14	0.5	290	4	793
	1.0	93	4.8	207
	1.5	120	3.8	95
S-15	0.5	220	3.3	352
	1.0	88	5.9	58
	1.5	130	4.9	38
S-16	1.5	800	3.1	3991
	2.0	170	3.4	180
S-17	1.5	3400	3.8	19400
	2.0	210	4.6	253
S-18	1.5	860	4.8	12990
	2.0	540	5.6	363

Prepared by: TLB1
Checked by: NAJ

Notes:
*refer to Attachment 2 for EnChem, Inc. Laboratory analytical reports

Table 2
Characteristic Sampling

Inorganics	Shallow Composite[1]	Deep Composite[2]				Analysis	Prep	Analysis	
Test	Results	Results	LOD	LOQ	Units	Date	Method	Method	Laboratory
Arsenic	ND	ND			mg/L	07/31/2003	SW846 3010A	SW846 6010B	En Chem Inc.
Barium	ND	ND			mg/L	07/31/2003	SW846 3010A	SW846 6010B	En Chem Inc.
Cadmium	ND	ND			mg/L	07/31/2003	SW846 3010A	SW846 6010B	En Chem Inc.
Chromium	ND	ND			mg/L	08/01/2003	SW846 3010A	SW846 6010B	En Chem Inc.
Copper	8.0	2.1			mg/L	07/31/2003	SW846 3010A	SW846 6010B	En Chem Inc.
Lead	ND	ND			mg/L	07/31/2003	SW846 3010A	SW846 6010B	En Chem Inc.
Mercury	ND	ND			mg/L	08/07/2003	SW846 7470A	SW846 7470A	En Chem Inc.
Nickel	ND	ND			mg/L	07/31/2003	SW846 3010A	SW846 6010B	En Chem Inc.
Selenium	ND	ND			mg/L	07/31/2003	SW846 3010A	SW846 6010B	En Chem Inc.
Silver	ND	ND			mg/L	07/31/2003	SW846 3010A	SW846 6010B	En Chem Inc.
Zinc	ND	ND			mg/L	07/31/2003	SW846 3010A	SW846 6010B	En Chem Inc.
Cyanide	ND	ND			mg/kg	08/05/2003	SW846 MET	SW846 MET	En Chem Inc.
Free Liquids	0.0	0.0			%	07/31/2003	SW846 9095A	SW846 9095A	En Chem Inc.
Percent Chlorine	0.032	0.027	0.005	0.017	% wt.	08/01/2003	ASTM D808	ASTM D808	En Chem Inc.
Percent Solids	98.5	96.9			%	07/25/2003	SM 2540G M	SM 2540G M	En Chem Inc.
pH	3.3	4.4			su	07/31/2003	SW846 9045C	SW846 9045C	En Chem Inc.
Specific Gravity	2.4	2.4			g/mL	08/01/2003	SM 2710F	SM 2710F	En Chem Inc.
Sulfide	ND	ND			mg/kg	08/05/2003	SW846 MET	SW846 MET	En Chem Inc.
Total Solids	980000	970000			mg/Kg	07/25/2003	SM-2540G	SM-2540G	En Chem Inc.
TCLP Volatiles									
Analyte									
1,1-Dichloroethene	ND	ND			mg/L	07/31/2003	SW846 5030B	SW846 8260B	En Chem Inc.
1,2-Dichloroethane	ND	ND			mg/L	07/31/2003	SW846 5030B	SW846 8260B	En Chem Inc.
2-Butanone	ND	ND			mg/L	07/31/2003	SW846 5030B	SW846 8260B	En Chem Inc.
Benzene	ND	ND			mg/L	07/31/2003	SW846 5030B	SW846 8260B	En Chem Inc.
Carbon Tetrachloride	ND	ND			mg/L	07/31/2003	SW846 5030B	SW846 8260B	En Chem Inc.
Chlorobenzene	ND	ND			mg/L	07/31/2003	SW846 5030B	SW846 8260B	En Chem Inc.
Chloroform	ND	ND			mg/L	07/31/2003	SW846 5030B	SW846 8260B	En Chem Inc.
Tetrachloroethene	ND	ND			mg/L	07/31/2003	SW846 5030B	SW846 8260B	En Chem Inc.
Trichloroethene	ND	ND			mg/L	07/31/2003	SW846 5030B	SW846 8260B	En Chem Inc.
Vinyl Chloride	ND	ND			mg/L	07/31/2003	SW846 5030B	SW846 8260B	En Chem Inc.
Semivolatiles - TCLP									
Analyte									
1,4-Dichlorobenzene	ND	ND			mg/L	08/08/2003	SW846 3510C	SW846 8270C	En Chem Inc.
2,4,5-Trichlorophenol	ND	ND			mg/L	08/08/2003	SW846 3510C	SW846 8270C	En Chem Inc.
2,4,6-Trichlorophenol	ND	ND			mg/L	08/08/2003	SW846 3510C	SW846 8270C	En Chem Inc.
2,4-Dinitrotoluene	ND	ND			mg/L	08/08/2003	SW846 3510C	SW846 8270C	En Chem Inc.
Cresol	ND	ND			mg/L	08/08/2003	SW846 3510C	SW846 8270C	En Chem Inc.
Hexachlorobenzene	ND	ND			mg/L	08/08/2003	SW846 3510C	SW846 8270C	En Chem Inc.
Hexachlorobutadiene	ND	ND			mg/L	08/08/2003	SW846 3510C	SW846 8270C	En Chem Inc.
Hexachloroethane	ND	ND			mg/L	08/08/2003	SW846 3510C	SW846 8270C	En Chem Inc.
Nitrobenzene	ND	ND			mg/L	08/08/2003	SW846 3510C	SW846 8270C	En Chem Inc.
Pentachlorophenol	ND	ND			mg/L	08/08/2003	SW846 3510C	SW846 8270C	En Chem Inc.
Pyridine	ND	ND			mg/L	08/08/2003	SW846 3510C	SW846 8270C	En Chem Inc.

Notes:

[1] Shallow Composite - S-8, S-11 and S-14 - 0.5 feet

[2] Deep Composite - S-8, S-11 and S-14 - 1.0 - 1.5 feet

Prepared by: TLB1

Checked by: NAJ

Table 3

EPA 1312 SPLP Test Results

Sample No.	Depth (ft.)	Total Cu (mg/kg)	SPLP Cu (mg/l)	Total S (mg/kg)	SPLP S (mg/l)
S-11	1	40	0.096	26	3.0*
S-9	1	260	0.94	740	7.0*
S-16	1.5	800	1.4	3991	7.9*
S-11	0.5	1600	1.0	10,650	4.9*

Notes:

* The background sulfur in the SPLP blank was 2.9mg/l