Denison Environmental Services
a division of Denison Mines Inc.

MEMORANDUM

Faro Mine Closure

TO: Roy Morrell, Jon Bronson, Kaori Torigai, Karen Furlong, Bill Slater, Leslie Gomm and Patricia Randell
DATE: 30 December 2010
FROM: Jay Cherian, Environmental Coordinator
SUBJECT: Nitrogen Monitoring – Downgradient of Cross Valley Dam – 4Nov2010

Background

An ammonia–N concentration of 2.1 mg/L was observed at X13, located downgradient of the Cross Valley Pond, downstream of where seepage has converged, on September 2, 2010. This result was higher than the effluent discharge standard for this site of 1.3 mg/L. This was also a new maximum concentration for this site (based on data from 2004 to present).

In follow-up monitoring on October 7, 2010, an ammonia-N concentration of 1.2 mg/L was observed at this site. While this concentration was below the effluent discharge standard, it was the second sample from this site with a concentration above 1.0 mg/L.

The following describes further nitrogen-related monitoring, including ammonia, at sites downgradient of the Cross Valley Pond.

Water Quality Monitoring

Seeps samples were collected on November 4, 2010 from X11, X12, Weir 3 and X13 (See Figure 1, attached for site plan), and water quality testing of the water samples for ammonia-N, nitrate and nitrite was undertaken. Lab results are included in Appendix A, attached. A summary table is attached (Table 1), including field parameters.

The results of November 2010 nitrogen testing show that:

- November 4, 2010 ammonia-N concentration at X13 was 0.89 mg/L, which met the effluent discharge standard for this site;
- Ammonia concentrations of 0.78 mg/L were detected at both X11 and Weir 3.
- Ammonia was not detected at X12;
- Nitrite is detected at X12, but not at any other tested site; and
- Nitrates are not detected at any of the tested sites.

At the time of this review, monthly testing results were available for ammonia-N at X13 from December 2, 2010: a concentration of 0.99 mg/L was observed.

Historic results for ammonia-N were reviewed at all the above sites and results are shown in graphic form in Figure 2, attached. The historic data shows that ammonia-N concentrations have remained relatively stable at X11, Weir 3 and X13, in a range of

approximately 0.4 to 0.9 mg/L since 2004, with the exception of the September and October 2010 results at X13.

The range of ammonia concentrations observed at X5, the discharge from the Cross Valley Pond, is 0.070 to 1.670 mg/L based on data from 2004 to the present. In August 31 to December 2, 2010 the concentration ranged from 1.0 to 0.85 mg/L.

Discussion of Nitrogen Monitoring Results

When results from December 2010 monitoring are included in the review, it appears likely that the ammonia-N concentrations observed at X13 are not transient.

As X11 and Weir 3 were not tested in September, October, and December, it is not clear if the ammonia-N observed at X13 originated upstream of X11 and Weir 3. Ammonia-n at Weir 3 was slightly higher than the historic range in November, and within the historic range, but at the upper end of the historic range at X11, in November 2010. It is possible that the ammonia observed at X13 originate upstream of X11 and Weir 3.

As nitrogen species were not detected at X12, it is unlikely that the ammonia-N originated from the southern extents of the area downstream of the Cross Valley Dam.

Historically at the Faro Mine Complex, ammonia concentrations were monitored, at least in part, due to use of explosives in the Vangorda Creek catchment. This was especially relevant at the time when explosives were in use at the site. This potential source of ammonia is unlikely currently, and downgradient of the Cross Valley Dam.

At X13, a potential source of ammonium / ammonia is hydrolysis of organic nitrogens. Nitrification, where nitrites/nitrates are formed from ammonia / ammonium through bacterial processes, may also be taking place, where nitrites are generally considered an intermediate species. While this can occur through both aerobic and anaerobic processes, anaerobic processes are favoured as less energy is required. While waters classified as seeps are generally thought to be low in oxygen, the oxidation reduction potential (ORP) results (see Table 1) show that aerobic reactions are possible at all of the sites tested. As nitrates were not detected, it is possible that nitrification is in early stages at X13.

Cross Valley Pond and Down Valley Care and Maintenance Activities 2010 Review
Care and maintenance activities undertaken in the area downgradient of the Cross Valley Pond in 2010 through to October 10, 2010 were reviewed:

- New power lines were installed to the Down Valley area in the summer of 2010;
- Soil Sement was applied in August to the tailings area, with application equipment (D5) returned to storage on August 23,, after field cleaning;
- On August 31, 2010 the Cross Valley Pond discharge siphon was turned off, and then turned again on September 1, 2010;

- On September 9, the Cross Valley Pond discharge siphon was turned off;
- Groundwater monitoring, including wells purging, was undertaken from September 8 to 22;
- September 20 to 21, the pipelines to and from the Faro Mill to and from the two tailings area ponds were drained in preparation for winter;
- On October 7, 4" piping was brought to the Cross Valley Discharge culvert and North Wall Interceptor Ditch culvert to install a secondary thaw pipe in preparation for use of steamer snake in winter.

None of the above activities are readily apparent as a source of nitrogens or ammonia. Soil Sement composition and groundwater wells purging are further considered below.

The material safety data sheet (MSDS) for Soil Sement is included in Appendix B. It is not evident, based on the material presented, that Soil Sement is a source of nitrogens. A summary of environmental testing provided by the Soil Sement manufacturer, including metals and toxicity testing, is also included in Appendix B. Based on the information from the manufacturer, there is no evidence of the release of nitrogen species in association with Soil Sement application. In addition, a pathway from the application site to the Down Valley area is not evident.

While groundwater testing may have disturbed soils and organic materials through run-off from wells purging, the groundwater testing in the Down Valley area took place on and around September 21, i.e. after September 2, when the highest ammonia-N concentration was measured.

From the above review, ammonia-N observed at X13, X11 and Weir 3 did not originate with care and maintenance activities.

Acute Ammonia Toxicity Review

Ammonia toxicity depends on pH and temperature. The change in temperature is less significant than the change in pH. The attached Figure 3 shows the pH versus ammonia-N concentration X13 from September 2010 plotted against the Canadian Environmental Protection Act Acute Ammonia Toxicity Threshold (2004)[1], which is defined as follows:

$$y = 306132466.34 \times (2.7183^{(-2.0437 \times pH)}) \qquad \text{Equation 1}$$

where y represents the maximum allowable ammonia concentration.

[1] *Guideline for the Release of Ammonia Dissolved in Water Found in Wastewater Effluents – Appendix A: Acute Ammonia Toxicity.* Pursuant to subsection 54(1) of the Canadian Environmental Protection Act (1999); Canada Gazette, Volume 138, No. 49 – December 4, 2004.

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The September 2010 results are below the threshold. All results from X13 since 2004 are also under this threshold. This comparison indicates that at the concentrations and pH observed at X13, the ammonia-N level was not acutely toxic.

In addition, a September 7 sample from X13 tested for toxicity had a result of >100% v/v or non-toxic.

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TABLE

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Table 1: Nitrogen Testing Downgradient of the Cross Valley Pond (November 4, 2010)

				Field Parameters				Maxxam Nitrogen Parameters (mg/L)			
Station	Water Type	Date	Time	Temp (°C)	pH	EC (µmho/cm)	ORP (mV)	NH_3	NO_2	NO_3	NO_2/NO_3
X11	Seepage	04/11/2010	12:18	3.5	7.00	2582	4	0.78	<0.02	<0.005	<0.02
X12	Seepage	04/11/2010	12:04	5.1	7.12	1333	5	<0.005	0.35	<0.005	0.35
X13	Seepage	04/11/2010	12:11	3.8	7.17	2165	2	0.89	<0.005	<0.02	<0.02
Weir 3	Seepage	04/11/2010	12:07	4.5	7.25	1964	1	0.78	<0.02	<0.005	<0.02

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Faro Mine Closure

FIGURES

Figure 1: Down Valley Seeps Site Plan

0 m 100 m 200 m 300 m 400 m

Faro Mine Complex - DES - Nitrogen Study

Denison Environmental Services

Figure 2: Ammonia-N Downgradient of the Cross Valley Dam

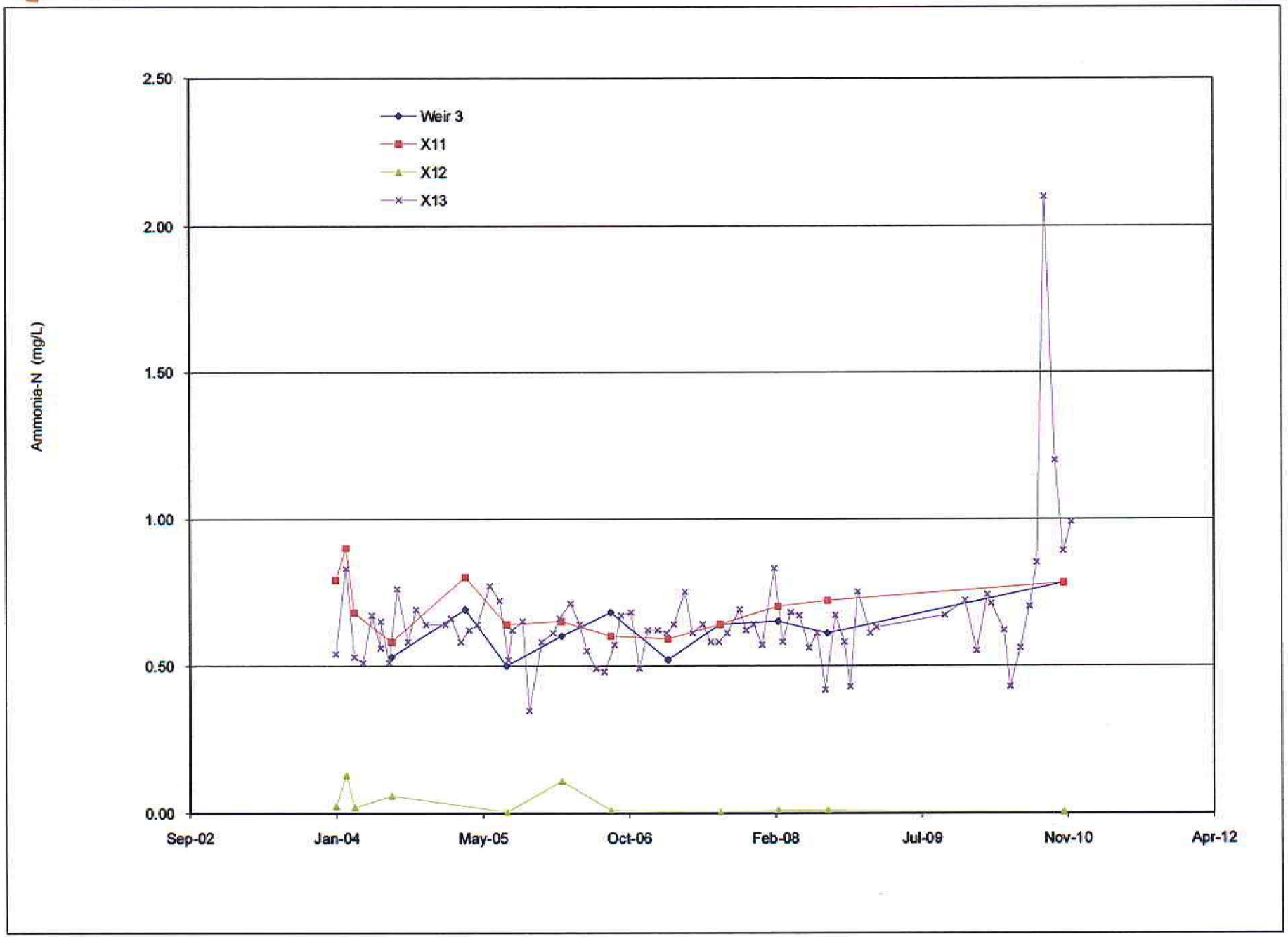
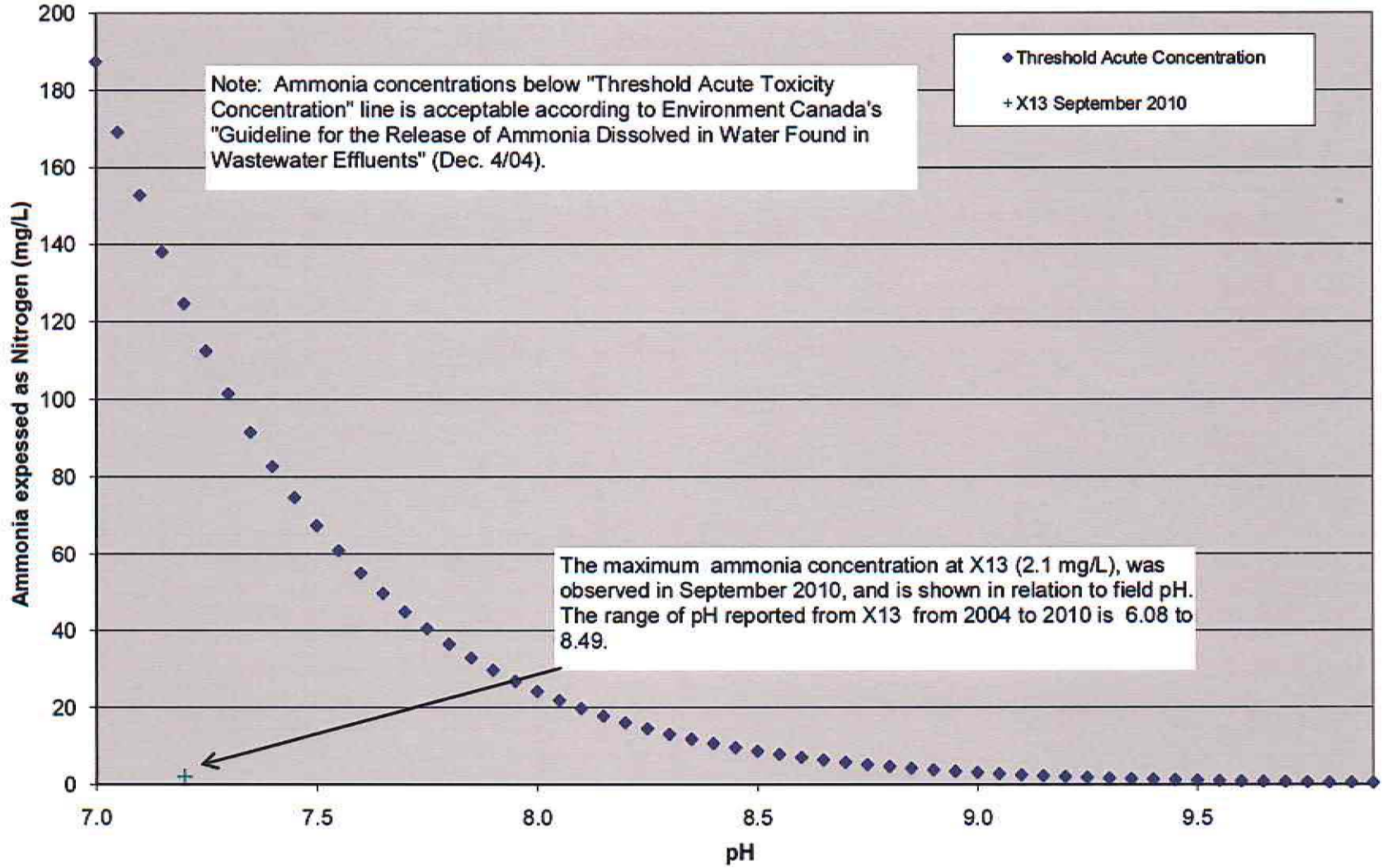


Figure 3: Ammonia in Seepage Downgradient of the Cross Valley Dam in Comparison with Environmental Protection Act (2004) Acute Ammonia Toxicity Concentrations



Note: The Guidelines apply to wastewater discharges averaging 5,000 m^3/d or greater.

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APPENDIX A

Analytical Results – Nitrogen Testing

November 4, 2010

Maxxam

Success Through Science®

Your Project #: NOV 3, 2010-SPECIAL PROJECT
Site: AMMONIA SAMPLING
Your C.O.C. #: 08325000

Attention: Jay Cherian
DENISON ENVIRONMENTAL SERVICES
FARO CARE AND MAINTENANCE PROJ
BOX 280
FARO, YT
CANADA Y0B 1K0

Report Date: 2010/11/10

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B0A8622
Received: 2010/11/05, 14:00

Sample Matrix: Seepage
Samples Received: 3

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Ammonia-N	1	N/A	2010/11/08	BBY6SOP-00044	Based on EPA 350.1
Ammonia-N	2	N/A	2010/11/09	BBY6SOP-00044	Based on EPA 350.1
Nitrate + Nitrite (N)	3	N/A	2010/11/06		Based on USEPA 353.2
Nitrite (N) by CFA	3	N/A	2010/11/06	BRN SOP-00233 R1.0	EPA 353.2
Nitrogen - Nitrate (as N)	3	N/A	2010/11/08	BBY6SOP-00010	Based on EPA 353.2

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

TABITHA RUDKIN, Project Manager
Email: TRudkin@maxxam.ca
Phone# (604) 638-2639

==========

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Total cover pages: 1

Maxxam Job #: B0A8622
Report Date: 2010/11/10

DENISON ENVIRONMENTAL SERVICES
Client Project #: NOV 3, 2010-SPECIAL PROJECT
Site Reference: AMMONIA SAMPLING
Sampler Initials: BB

RESULTS OF CHEMICAL ANALYSES OF SEEPAGE

Maxxam ID		Y25524			Y25525			Y25526		
Sampling Date		2010/11/04 12:18			2010/11/04 12:04			2010/11/04 12:07		
COC Number		08325000			08325000			08325000		
	Units	**X11**	**RDL**	**QC Batch**	**X12**	**RDL**	**QC Batch**	**WEIR #3**	**RDL**	**QC Batch**
ANIONS										
Nitrite (N)	mg/L	<0.005	0.005	4405675	<0.005	0.005	4405675	<0.005	0.005	4405675
Calculated Parameters										
Nitrate (N)	mg/L	<0.02	0.02	4405155	0.35	0.02	4405155	<0.02	0.02	4405155
Nutrients										
Ammonia (N)	mg/L	0.78	0.01	4411931	<0.005	0.005	4407863	0.78	0.01	4411931
Nitrate plus Nitrite (N)	mg/L	<0.02	0.02	4405674	0.35	0.02	4405674	<0.02	0.02	4405674

RDL = Reportable Detection Limit

Maxxam Job #: B0A8622
Report Date: 2010/11/10

DENISON ENVIRONMENTAL SERVICES
Client Project #: NOV 3, 2010-SPECIAL PROJECT
Site Reference: AMMONIA SAMPLING
Sampler Initials: BB

General Comments

Results relate only to the items tested.

DENISON ENVIRONMENTAL SERVICES
Attention: Jay Cherian
Client Project #: NOV 3, 2010-SPECIAL PROJECT
P.O. #:
Site Reference: AMMONIA SAMPLING

Quality Assurance Report

Maxxam Job Number: VB0A8622

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	Units	QC Limits
4405674 CB9	Matrix Spike	Nitrate plus Nitrite (N)	2010/11/06		NC	%	80 - 120
	Spiked Blank	Nitrate plus Nitrite (N)	2010/11/06		100	%	80 - 120
	Method Blank	Nitrate plus Nitrite (N)	2010/11/06	<0.02		mg/L	
	RPD	Nitrate plus Nitrite (N)	2010/11/06	NC		%	25
4405675 CB9	Matrix Spike	Nitrite (N)	2010/11/06		NC	%	80 - 120
	Spiked Blank	Nitrite (N)	2010/11/06		101	%	80 - 120
	Method Blank	Nitrite (N)	2010/11/06	<0.005		mg/L	
	RPD	Nitrite (N)	2010/11/06	NC		%	20
4407863 SF1	Matrix Spike	Ammonia (N)	2010/11/08		NC	%	80 - 120
	Spiked Blank	Ammonia (N)	2010/11/08		103	%	80 - 120
	Method Blank	Ammonia (N)	2010/11/08	<0.005		mg/L	
	RPD	Ammonia (N)	2010/11/08	0.6		%	20
4411931 SF1	Matrix Spike	Ammonia (N)	2010/11/09		NC	%	80 - 120
	Spiked Blank	Ammonia (N)	2010/11/09		97	%	80 - 120
	Method Blank	Ammonia (N)	2010/11/09	<0.005		mg/L	
	RPD	Ammonia (N)	2010/11/09	1.3		%	20

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.
Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.
Spiked Blank: A blank matrix to which a known amount of the analyte has been added. Used to evaluate analyte recovery.
Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.
NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was not sufficiently significant to permit a reliable recovery calculation.
NC (RPD): The RPD was not calculated. The level of analyte detected in the parent sample and its duplicate was not sufficiently significant to permit a reliable calculation.

Maxxam Analytics Inc

8577 Commerce Court
Burnaby, BC V5A 4N5
www.maxxamanalytics.com
Phone: (604) 444-4808
Fax: (604) 444-4511
Toll-Free: 1-800-440-4808

CHAIN-OF CUSTOI 08325000 **IS REQUEST**

PAGE 1 OF 1

MAXXAM JOB #: B0A8622

ANALYSIS REQUEST

COC #:

COMPANY NAME: #4337 Denison Environmental Services

CLIENT PROJECT NO.: November 3, 2010 - Special Project - Ammonia Sampling -

COMPANY ADDRESS: Box 280, Faro, Yukon, Y0B 1K0

TEL.: (867)994-2600 Ext. 106 - Lab

E-MAIL: jcherian@denisonenvironmental.com

FAX:

SAMPLER NAME (PRINT): N. Gardiner / B. Bekk / T. Parkin

PROJECT MANAGER: Jay Cherian

LABORATORY CONTACT: Ashley Nivison

	FIELD SAMPLE ID	MATRIX: GROUNDWATER	SURFACE WATER	DRINKING WATER	SOIL	OTHER	SAMPLING: DATE DD/MM/YY	TIME	# CONTAINERS	Nitrates/Nitrites	Ammonia
1	X11					X	04/11/2010	12:18	2	X	X
2	X12					X	04/11/2010	12:04	2	X	X
3	Weir #3					X	04/11/2010	12:07	2	X	X
4											
5											
6											
7											
8											
9											
10											
11											
12											

TAT (Turnaround Time)
LESS THAN 5 DAY TAT MUST HAVE PRIOR APPROVAL

* Some exceptions apply - please contact laboratory

STANDARD	5 BUSINESS DAYS	X
RUSH	3 BUSINESS DAYS	
RUSH	2 BUSINESS DAYS	
URGENT	1 BUSINESS DAY	

OTHER BUSINESS DAYS

CUSTODY RECORD

PO NUMBER OR QUOTE NUMBER:

SPECIAL DETECTION LIMITS / CONTAMINANT TYPE:

ACCOUNTING CONTACT:

SPECIAL REPORTING OR BILLING INSTRUCTIONS:

- CCME
- CSR
- AB TIER 1
- OTHER

JARS USED: 6

ARRIVAL TEMPERATURE °C: 7.6 8 7.7 7

DUE DATE:

LOG IN CHECK:

RELINQUISHED BY SAMPLER: B. Bekk	DATE: DD/MM/YY 04/11/2010	TIME: 2:00 PM	RECEIVED BY: Small's Expediting
RELINQUISHED BY:	DATE: DD/MM/YY	TIME: 1400	RECEIVED BY:
RELINQUISHED BY:	DATE: DD/MM/YY	TIME: 10 1105	RECEIVED BY LABORATORY: C Rosen

COCFORM - BC - 2009/07

Your Project #: NOV 4, 2010-MONTHLY-FARO-SEP
Your C.O.C. #: 08324998

Attention: Jay Cherian
DENISON ENVIRONMENTAL SERVICES
FARO CARE AND MAINTENANCE PROJ
BOX 280
FARO, YT
CANADA Y0B 1K0

Report Date: 2010/11/15

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B0A8619
Received: 2010/11/05, 14:00

Sample Matrix: Seepage
Samples Received: 4

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Acidity pH 4.5 & pH 8.3	4	N/A	2010/11/08	BRN SOP-00281 R3.0	Based on SM-2310
Alkalinity - Water	4	2010/11/06	2010/11/06	BRN SOP-00264 R4.0	Based on SM2320B
Chloride by Automated Colourimetry	4	N/A	2010/11/08	BRN-SOP 00234 R3.0	Based on EPA 325.2
Cyanide (Total)	1	N/A	2010/11/09	BRN SOP-00226 R2.0	Based on EPA 9012AR1
Colour (True)	1	N/A	2010/11/06	BRN SOP-00247 R1.0	Based on SM-2120B
Conductance - water	4	N/A	2010/11/06	BRN SOP-00264 R2.0	Based on SM-2510B
Hardness (calculated as CaCO3)	4	N/A	2010/11/15		
Ion Balance	4	N/A	2010/11/15	Calc	
Na, K, Ca, Mg, S by CRC ICPMS (diss.)	3	N/A	2010/11/15	BRN SOP-00206	Based on EPA 200.8
Na, K, Ca, Mg, S by CRC ICPMS (diss.)	1	N/A	2010/11/15	BRN SOP-00206	Based on EPA 200.8
Elements by ICPMS Low Level (dissolved)	1	N/A	2010/11/15	BRN SOP-00206	Based on EPA 200.8
Elements by CRC ICPMS (dissolved)	3	N/A	2010/11/12	BRN SOP-00206	Based on EPA 200.8
Ammonia-N	1	N/A	2010/11/09	BBY6SOP-00044	Based on EPA 350.1
Nitrate + Nitrite (N)	1	N/A	2010/11/09		Based on USEPA 353.2
Nitrite (N) by CFA	1	N/A	2010/11/09	BRN SOP-00233 R1.0	EPA 353.2
Nitrogen - Nitrate (as N)	1	N/A	2010/11/10	BBY6SOP-00010	Based on EPA 353.2
Filter and HNO3 Preserve for Metals	4	N/A	2010/11/06	BRN WI-00006 R1.0	Based on EPA 200.2
pH Water	4	N/A	2010/11/06	BRN SOP-00264 R4.0	Based on SM-4500H+B
Sulphate by Automated Colourimetry	1	N/A	2010/11/08	BRN-SOP 00243 R1.0	Based on EPA 375.4
Sulphate by Automated Colourimetry	3	N/A	2010/11/09	BRN-SOP 00243 R1.0	Based on EPA 375.4
Total Suspended Solids-LowLevel	4	N/A	2010/11/08	BRN SOP-00277 R5.0	Based on SM-2540 D
Turbidity	1	N/A	2010/11/06	BRN SOP-00265 R6.0	SM - 2130B

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

../2

Your Project #: NOV 4, 2010-MONTHLY-FARO-SEP
Your C.O.C. #: 08324998

Attention: Jay Cherian
DENISON ENVIRONMENTAL SERVICES
FARO CARE AND MAINTENANCE PROJ
BOX 280
FARO, YT
CANADA Y0B 1K0

Report Date: 2010/11/15

CERTIFICATE OF ANALYSIS

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

TABITHA RUDKIN, Project Manager
Email: TRudkin@maxxam.ca
Phone# (604) 638-2639

==========

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Total cover pages: 2

Maxxam Job #: B0A8619
Report Date: 2010/11/15

DENISON ENVIRONMENTAL SERVICES
Client Project #: NOV 4, 2010-MONTHLY-FARO-SEP

Sampler Initials: NG

RESULTS OF CHEMICAL ANALYSES OF SEEPAGE

Maxxam ID		Y25518			Y25519		Y25520		
Sampling Date		2010/11/04 12:11			2010/11/04 11:26		2010/11/04 11:10		
COC Number		08324998			08324998		08324998		
	Units	**X13**	**RDL**	**QC Batch**	**X23**	**RDL**	**A30**	**RDL**	**QC Batch**
Misc. Inorganics									
Acidity (pH 4.5)	mg/L	<0.5	0.5	4408036	<0.5	0.5	<0.5	0.5	4408036
Acidity (pH 8.3)	mg/L	24.3	0.5	4408036	1030	0.5	15.8	0.5	4408036
ANIONS									
Nitrite (N)	mg/L	<0.005 (1)	0.005	4412287		0.005		0.005	4412287
Calculated Parameters									
Filter and HNO3 Preservation	N/A	FIELD	N/A	ONSITE	FIELD	N/A	FIELD	N/A	ONSITE
Ion Balance	N/A	1.0	0.01	4405432	0.94	0.01	NC	0.01	4405432
Nitrate (N)	mg/L	<0.02	0.02	4405155		0.02		0.02	4405155
Misc. Inorganics									
Cyanide + Thiocyanate	mg/L	0.0033	0.0005	4414035		0.0005		0.0005	4414035
Alkalinity (Total as CaCO3)	mg/L	340	0.5	4405291	90	0.5	30	0.5	4405291
Alkalinity (PP as CaCO3)	mg/L	<0.5	0.5	4405291	<0.5	0.5	<0.5	0.5	4405291
Bicarbonate (HCO3)	mg/L	410	0.5	4405291	110	0.5	37	0.5	4405291
Carbonate (CO3)	mg/L	<0.5	0.5	4405291	<0.5	0.5	<0.5	0.5	4405291
Hydroxide (OH)	mg/L	<0.5	0.5	4405291	<0.5	0.5	<0.5	0.5	4405291
Anions									
Dissolved Sulphate (SO4)	mg/L	1200	5	4410947	7600	50	75	0.5	4414796
Dissolved Chloride (Cl)	mg/L	1.3	0.5	4410945	14	0.5	<0.5	0.5	4410945
MISCELLANEOUS									
True Colour	Col. Unit	20	5	4405666					
Nutrients									
Ammonia (N)	mg/L	0.89	0.01	4411931					
Nitrate plus Nitrite (N)	mg/L	<0.02 (1)	0.02	4412156					
Physical Properties									
Conductivity	uS/cm	2200	1	4405287	7740	1	221	1	4405287
pH	pH Units	7.80		4405274	6.81		7.40		4405274
Physical Properties									
Total Suspended Solids	mg/L	10	1	4405673	170	1	1	1	4405673
Turbidity	NTU	41.1	0.1	4405664					

RDL = Reportable Detection Limit
(1) Sample analysed past recommended hold time

Maxxam Job #: B0A8619
Report Date: 2010/11/15

DENISON ENVIRONMENTAL SERVICES
Client Project #: NOV 4, 2010-MONTHLY-FARO-SEP

Sampler Initials: NG

RESULTS OF CHEMICAL ANALYSES OF SEEPAGE

Maxxam ID		Y25521		
Sampling Date		2010/11/04 11:32		
COC Number		08324998		
	Units	**GRAYLING POND**	**RDL**	**QC Batch**
Misc. Inorganics				
Acidity (pH 4.5)	mg/L	<0.5	0.5	4408036
Acidity (pH 8.3)	mg/L	1080	0.5	4408036
Calculated Parameters				
Filter and HNO3 Preservation	N/A	FIELD	N/A	ONSITE
Ion Balance	N/A	1.0	0.01	4405432
Misc. Inorganics				
Alkalinity (Total as CaCO3)	mg/L	90	0.5	4405291
Alkalinity (PP as CaCO3)	mg/L	<0.5	0.5	4405291
Bicarbonate (HCO3)	mg/L	110	0.5	4405291
Carbonate (CO3)	mg/L	<0.5	0.5	4405291
Hydroxide (OH)	mg/L	<0.5	0.5	4405291
Anions				
Dissolved Sulphate (SO4)	mg/L	7100	50	4414796
Dissolved Chloride (Cl)	mg/L	15	0.5	4410945
Physical Properties				
Conductivity	uS/cm	7710	1	4405287
pH	pH Units	6.75		4405274
Physical Properties				
Total Suspended Solids	mg/L	190	1	4405673

RDL = Reportable Detection Limit

Maxxam Job #: B0A8619
Report Date: 2010/11/15

DENISON ENVIRONMENTAL SERVICES
Client Project #: NOV 4, 2010-MONTHLY-FARO-SEP

Sampler Initials: NG

CSR DISSOLVED METALS IN WATER (SEEPAGE)

Maxxam ID		Y25519		Y25520		Y25521		
Sampling Date		2010/11/04 11:26		2010/11/04 11:10		2010/11/04 11:32		
COC Number		08324998		08324998		08324998		
	Units	**X23**	**RDL**	**A30**	**RDL**	**GRAYLING POND**	**RDL**	**QC Batch**
Misc. Inorganics								
Dissolved Hardness (CaCO3)	mg/L	5770	0.5	93.1	0.5	5820	0.5	4405151
Dissolved Metals by ICPMS								
Dissolved Aluminum (Al)	ug/L	<60	60	19	3	<60	60	4417603
Dissolved Antimony (Sb)	ug/L	<10	10	<0.5	0.5	<10	10	4417603
Dissolved Arsenic (As)	ug/L	<2	2	<0.1	0.1	<2	2	4417603
Dissolved Barium (Ba)	ug/L	<20	20	19	1	<20	20	4417603
Dissolved Beryllium (Be)	ug/L	<2	2	<0.1	0.1	<2	2	4417603
Dissolved Bismuth (Bi)	ug/L	<20	20	<1	1	<20	20	4417603
Dissolved Boron (B)	ug/L	<1000	1000	<50	50	<1000	1000	4417603
Dissolved Cadmium (Cd)	ug/L	75.7	0.2	2.66	0.01	77.2	0.2	4417603
Dissolved Chromium (Cr)	ug/L	<20	20	<1	1	<20	20	4417603
Dissolved Cobalt (Co)	ug/L	1310	10	<0.5	0.5	1340	10	4417603
Dissolved Copper (Cu)	ug/L	6	4	8.0	0.2	5	4	4417603
Dissolved Iron (Fe)	ug/L	177000	100	<5	5	173000	100	4417603
Dissolved Lead (Pb)	ug/L	<4	4	1.9	0.2	<4	4	4417603
Dissolved Lithium (Li)	ug/L	223	100	10	5	214	100	4417603
Dissolved Manganese (Mn)	ug/L	105000	20	5	1	108000	20	4417603
Dissolved Mercury (Hg)	ug/L	<0.4	0.4	0.04	0.02	<0.4	0.4	4417603
Dissolved Molybdenum (Mo)	ug/L	<20	20	<1	1	<20	20	4417603
Dissolved Nickel (Ni)	ug/L	1410	20	13	1	1440	20	4417603
Dissolved Selenium (Se)	ug/L	<2	2	0.2	0.1	<2	2	4417603
Dissolved Silicon (Si)	ug/L	8340	2000	5880	100	7930	2000	4417603
Dissolved Silver (Ag)	ug/L	0.5	0.4	<0.02	0.02	0.5	0.4	4417603
Dissolved Strontium (Sr)	ug/L	4140	20	81	1	4200	20	4417603
Dissolved Thallium (Tl)	ug/L	2	1	<0.05	0.05	2	1	4417603
Dissolved Tin (Sn)	ug/L	<100	100	<5	5	<100	100	4417603
Dissolved Titanium (Ti)	ug/L	<100	100	<5	5	<100	100	4417603
Dissolved Uranium (U)	ug/L	13	2	0.2	0.1	13	2	4417603
Dissolved Vanadium (V)	ug/L	<100	100	<5	5	<100	100	4417603
Dissolved Zinc (Zn)	ug/L	665000	100	4140	5	688000	100	4417603
Dissolved Zirconium (Zr)	ug/L	<10	10	<0.5	0.5	<10	10	4417603
Dissolved Calcium (Ca)	mg/L	500	1	18.8	0.05	486	1	4405215

RDL = Reportable Detection Limit

Maxxam Job #: B0A8619
Report Date: 2010/11/15

DENISON ENVIRONMENTAL SERVICES
Client Project #: NOV 4, 2010-MONTHLY-FARO-SEP

Sampler Initials: NG

CSR DISSOLVED METALS IN WATER (SEEPAGE)

Maxxam ID		Y25519		Y25520		Y25521		
Sampling Date		2010/11/04 11:26		2010/11/04 11:10		2010/11/04 11:32		
COC Number		08324998		08324998		08324998		
	Units	**X23**	**RDL**	**A30**	**RDL**	**GRAYLING POND**	**RDL**	**QC Batch**
Dissolved Magnesium (Mg)	mg/L	1100	1	11.2	0.05	1120	1	4405215
Dissolved Potassium (K)	mg/L	18	1	0.71	0.05	18	1	4405215
Dissolved Sodium (Na)	mg/L	71	1	2.53	0.05	73	1	4405215
Dissolved Sulphur (S)	mg/L	2470	60	27	3	2510	60	4405215

RDL = Reportable Detection Limit

Maxxam Job #: B0A8619
Report Date: 2010/11/15

DENISON ENVIRONMENTAL SERVICES
Client Project #: NOV 4, 2010-MONTHLY-FARO-SEP

Sampler Initials: NG

LOW LEVEL DISSOLVED METALS IN WATER (SEEPAGE)

Maxxam ID		Y25518		
Sampling Date		2010/11/04 12:11		
COC Number		08324998		
	Units	**X13**	**RDL**	**QC Batch**
Misc. Inorganics				
Dissolved Hardness (CaCO3)	mg/L	1490	0.5	4405151
Dissolved Metals by ICPMS				
Dissolved Aluminum (Al)	ug/L	6	1	4417866
Dissolved Antimony (Sb)	ug/L	<0.1	0.1	4417866
Dissolved Arsenic (As)	ug/L	2.0	0.1	4417866
Dissolved Barium (Ba)	ug/L	55.1	0.1	4417866
Dissolved Beryllium (Be)	ug/L	<0.05	0.05	4417866
Dissolved Bismuth (Bi)	ug/L	<0.03	0.03	4417866
Dissolved Boron (B)	ug/L	<300	300	4417866
Dissolved Cadmium (Cd)	ug/L	0.20	0.03	4417866
Dissolved Chromium (Cr)	ug/L	<0.5	0.5	4417866
Dissolved Cobalt (Co)	ug/L	18.0	0.03	4417866
Dissolved Copper (Cu)	ug/L	<0.3	0.3	4417866
Dissolved Iron (Fe)	ug/L	4470	5	4417866
Dissolved Lead (Pb)	ug/L	0.34	0.03	4417866
Dissolved Lithium (Li)	ug/L	17	3	4417866
Dissolved Manganese (Mn)	ug/L	23900	0.3	4417866
Dissolved Mercury (Hg)	ug/L	<0.05	0.05	4417866
Dissolved Molybdenum (Mo)	ug/L	0.8	0.3	4417866
Dissolved Nickel (Ni)	ug/L	32.3	0.1	4417866
Dissolved Selenium (Se)	ug/L	<0.2	0.2	4417866
Dissolved Silicon (Si)	ug/L	8370	500	4417866
Dissolved Silver (Ag)	ug/L	<0.03	0.03	4417866
Dissolved Strontium (Sr)	ug/L	1090	0.3	4417866
Dissolved Thallium (Tl)	ug/L	0.03	0.01	4417866
Dissolved Tin (Sn)	ug/L	<0.05	0.05	4417866
Dissolved Titanium (Ti)	ug/L	<3	3	4417866
Dissolved Uranium (U)	ug/L	7.93	0.01	4417866
Dissolved Vanadium (V)	ug/L	<1	1	4417866
Dissolved Zinc (Zn)	ug/L	42.9	0.5	4417866
Dissolved Zirconium (Zr)	ug/L	<0.5	0.5	4417866
Dissolved Calcium (Ca)	mg/L	438	0.3	4405153

RDL = Reportable Detection Limit

Maxxam Job #: B0A8619
Report Date: 2010/11/15

DENISON ENVIRONMENTAL SERVICES
Client Project #: NOV 4, 2010-MONTHLY-FARO-SEP

Sampler Initials: NG

LOW LEVEL DISSOLVED METALS IN WATER (SEEPAGE)

Maxxam ID		Y25518		
Sampling Date		2010/11/04 12:11		
COC Number		08324998		
	Units	**X13**	**RDL**	**QC Batch**
Dissolved Magnesium (Mg)	mg/L	95.4	0.3	4405153
Dissolved Potassium (K)	mg/L	6.9	0.3	4405153
Dissolved Sodium (Na)	mg/L	36.7	0.3	4405153
Dissolved Sulphur (S)	mg/L	446	50	4405153
RDL = Reportable Detection Limit				

Maxxam Job #: B0A8619
Report Date: 2010/11/15

DENISON ENVIRONMENTAL SERVICES
Client Project #: NOV 4, 2010-MONTHLY-FARO-SEP

Sampler Initials: NG

General Comments

Sample Y25520-01: Ion Balance: NC = Not Calculable due to low ion sum [< 3 meq/L].

CSR DISSOLVED METALS IN WATER (SEEPAGE) Comments

Sample Y25519-03 Elements by CRC ICPMS (dissolved): RDL raised due to sample matrix interference.

Sample Y25521-03 Elements by CRC ICPMS (dissolved): RDL raised due to sample matrix interference.

LOW LEVEL DISSOLVED METALS IN WATER (SEEPAGE) Comments

Sample Y25518-03 Elements by ICPMS Low Level (dissolved): RDL raised due to sample matrix interference.

Results relate only to the items tested.

DENISON ENVIRONMENTAL SERVICES
Attention: Jay Cherian
Client Project #: NOV 4, 2010-MONTHLY-FARO-SEP
P.O. #:
Site Reference:

Quality Assurance Report

Maxxam Job Number: VB0A8619

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	Units	QC Limits
4405287 MM3	Spiked Blank	Conductivity	2010/11/06		101	%	80 - 120
	Method Blank	Conductivity	2010/11/06	<1		uS/cm	
	RPD [Y25521-02]	Conductivity	2010/11/06	0		%	20
4405291 MM3	Matrix Spike	Alkalinity (Total as CaCO3)	2010/11/06		NC	%	80 - 120
	Spiked Blank	Alkalinity (Total as CaCO3)	2010/11/06		101	%	80 - 120
	Method Blank	Alkalinity (Total as CaCO3)	2010/11/06	<0.5		mg/L	
		Alkalinity (PP as CaCO3)	2010/11/06	<0.5		mg/L	
		Bicarbonate (HCO3)	2010/11/06	<0.5		mg/L	
		Carbonate (CO3)	2010/11/06	<0.5		mg/L	
		Hydroxide (OH)	2010/11/06	<0.5		mg/L	
	RPD [Y25521-02]	Alkalinity (Total as CaCO3)	2010/11/06	1.3		%	20
		Alkalinity (PP as CaCO3)	2010/11/06	NC		%	20
		Bicarbonate (HCO3)	2010/11/06	1.3		%	20
		Carbonate (CO3)	2010/11/06	NC		%	20
		Hydroxide (OH)	2010/11/06	NC		%	20
4405664 TW2	Spiked Blank	Turbidity	2010/11/06		101	%	80 - 120
	Method Blank	Turbidity	2010/11/06	<0.1		NTU	
	RPD	Turbidity	2010/11/06	NC		%	20
4405666 TW2	Method Blank	True Colour	2010/11/06	<5		Col. Unit	
	RPD	True Colour	2010/11/06	NC		%	N/A
4405673 TM8	Spiked Blank	Total Suspended Solids	2010/11/08		102	%	80 - 120
	Method Blank	Total Suspended Solids	2010/11/08	<1		mg/L	
4408036 WAY	Spiked Blank	Acidity (pH 8.3)	2010/11/08		110	%	80 - 120
	Method Blank	Acidity (pH 4.5)	2010/11/08	<0.5		mg/L	
		Acidity (pH 8.3)	2010/11/08	<0.5		mg/L	
	RPD	Acidity (pH 4.5)	2010/11/08	NC		%	20
		Acidity (pH 8.3)	2010/11/08	NC		%	20
4410945 KCG	Matrix Spike	Dissolved Chloride (Cl)	2010/11/08		NC	%	80 - 120
	Spiked Blank	Dissolved Chloride (Cl)	2010/11/08		98	%	80 - 120
	Method Blank	Dissolved Chloride (Cl)	2010/11/08	<0.5		mg/L	
	RPD	Dissolved Chloride (Cl)	2010/11/08	0.9		%	20
4410947 KCG	Matrix Spike	Dissolved Sulphate (SO4)	2010/11/08		NC	%	80 - 120
	Spiked Blank	Dissolved Sulphate (SO4)	2010/11/08		102	%	80 - 120
	Method Blank	Dissolved Sulphate (SO4)	2010/11/08	<0.5		mg/L	
	RPD	Dissolved Sulphate (SO4)	2010/11/08	1.8		%	20
4411931 SF1	Matrix Spike	Ammonia (N)	2010/11/09		NC	%	80 - 120
	Spiked Blank	Ammonia (N)	2010/11/09		97	%	80 - 120
	Method Blank	Ammonia (N)	2010/11/09	<0.005		mg/L	
	RPD [Y25518-04]	Ammonia (N)	2010/11/09	0.2		%	20
4412156 IC4	Matrix Spike	Nitrate plus Nitrite (N)	2010/11/09		100	%	80 - 120
	Spiked Blank	Nitrate plus Nitrite (N)	2010/11/09		98	%	80 - 120
	Method Blank	Nitrate plus Nitrite (N)	2010/11/09	<0.02		mg/L	
	RPD	Nitrate plus Nitrite (N)	2010/11/09	NC (1)		%	25
4412287 IC4	Matrix Spike	Nitrite (N)	2010/11/09		109	%	80 - 120
	Spiked Blank	Nitrite (N)	2010/11/09		99	%	80 - 120
	Method Blank	Nitrite (N)	2010/11/09	<0.005		mg/L	
	RPD	Nitrite (N)	2010/11/09	NC (1)		%	20
4414035 TS1	Matrix Spike	Cyanide + Thiocyanate	2010/11/09		97	%	80 - 120
	Spiked Blank	Cyanide + Thiocyanate	2010/11/09		97	%	80 - 120
	Method Blank	Cyanide + Thiocyanate	2010/11/09	<0.0005		mg/L	
	RPD	Cyanide + Thiocyanate	2010/11/09	NC		%	20
4414796 KCG	Matrix Spike	Dissolved Sulphate (SO4)	2010/11/09		NC	%	80 - 120
	Spiked Blank	Dissolved Sulphate (SO4)	2010/11/09		105	%	80 - 120
	Method Blank	Dissolved Sulphate (SO4)	2010/11/09	<0.5		mg/L	
	RPD	Dissolved Sulphate (SO4)	2010/11/09	2.0		%	20

DENISON ENVIRONMENTAL SERVICES
Attention: Jay Cherian
Client Project #: NOV 4, 2010-MONTHLY-FARO-SEP
P.O. #:
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Quality Assurance Report (Continued)

Maxxam Job Number: VB0A8619

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	Units	QC Limits
4417603 JSW	Matrix Spike	Dissolved Arsenic (As)	2010/11/12		97	%	80 - 120
		Dissolved Beryllium (Be)	2010/11/12		104	%	80 - 120
		Dissolved Cadmium (Cd)	2010/11/12		100	%	80 - 120
		Dissolved Chromium (Cr)	2010/11/12		99	%	80 - 120
		Dissolved Cobalt (Co)	2010/11/12		98	%	80 - 120
		Dissolved Copper (Cu)	2010/11/12		105	%	80 - 120
		Dissolved Lead (Pb)	2010/11/12		98	%	80 - 120
		Dissolved Lithium (Li)	2010/11/12		99	%	80 - 120
		Dissolved Nickel (Ni)	2010/11/12		95	%	80 - 120
		Dissolved Selenium (Se)	2010/11/12		102	%	80 - 120
		Dissolved Uranium (U)	2010/11/12		103	%	80 - 120
		Dissolved Vanadium (V)	2010/11/12		101	%	80 - 120
		Dissolved Zinc (Zn)	2010/11/12		98	%	80 - 120
	Spiked Blank	Dissolved Arsenic (As)	2010/11/12		98	%	80 - 120
		Dissolved Beryllium (Be)	2010/11/12		102	%	80 - 120
		Dissolved Cadmium (Cd)	2010/11/12		103	%	80 - 120
		Dissolved Chromium (Cr)	2010/11/12		99	%	80 - 120
		Dissolved Cobalt (Co)	2010/11/12		100	%	80 - 120
		Dissolved Copper (Cu)	2010/11/12		100	%	80 - 120
		Dissolved Lead (Pb)	2010/11/12		103	%	80 - 120
		Dissolved Lithium (Li)	2010/11/12		102	%	80 - 120
		Dissolved Nickel (Ni)	2010/11/12		99	%	80 - 120
		Dissolved Selenium (Se)	2010/11/12		102	%	80 - 120
		Dissolved Uranium (U)	2010/11/12		103	%	80 - 120
		Dissolved Vanadium (V)	2010/11/12		98	%	80 - 120
		Dissolved Zinc (Zn)	2010/11/12		101	%	80 - 120
	Method Blank	Dissolved Aluminum (Al)	2010/11/12	<3		ug/L	
		Dissolved Antimony (Sb)	2010/11/12	<0.5		ug/L	
		Dissolved Arsenic (As)	2010/11/12	<0.1		ug/L	
		Dissolved Barium (Ba)	2010/11/12	<1		ug/L	
		Dissolved Beryllium (Be)	2010/11/12	<0.1		ug/L	
		Dissolved Bismuth (Bi)	2010/11/12	<1		ug/L	
		Dissolved Boron (B)	2010/11/12	<50		ug/L	
		Dissolved Cadmium (Cd)	2010/11/12	<0.01		ug/L	
		Dissolved Chromium (Cr)	2010/11/12	<1		ug/L	
		Dissolved Cobalt (Co)	2010/11/12	<0.5		ug/L	
		Dissolved Copper (Cu)	2010/11/12	<0.2		ug/L	
		Dissolved Iron (Fe)	2010/11/12	<5		ug/L	
		Dissolved Lead (Pb)	2010/11/12	<0.2		ug/L	
		Dissolved Lithium (Li)	2010/11/12	<5		ug/L	
		Dissolved Manganese (Mn)	2010/11/12	<1		ug/L	
		Dissolved Mercury (Hg)	2010/11/12	0.02, RDL=0.02		ug/L	
		Dissolved Molybdenum (Mo)	2010/11/12	<1		ug/L	
		Dissolved Nickel (Ni)	2010/11/12	<1		ug/L	
		Dissolved Selenium (Se)	2010/11/12	<0.1		ug/L	
		Dissolved Silicon (Si)	2010/11/12	<100		ug/L	
		Dissolved Silver (Ag)	2010/11/12	<0.02		ug/L	
		Dissolved Strontium (Sr)	2010/11/12	<1		ug/L	
		Dissolved Thallium (Tl)	2010/11/12	<0.05		ug/L	
		Dissolved Tin (Sn)	2010/11/12	<5		ug/L	
		Dissolved Titanium (Ti)	2010/11/12	<5		ug/L	
		Dissolved Uranium (U)	2010/11/12	<0.1		ug/L	
		Dissolved Vanadium (V)	2010/11/12	<5		ug/L	
		Dissolved Zinc (Zn)	2010/11/12	<5		ug/L	
		Dissolved Zirconium (Zr)	2010/11/12	<0.5		ug/L	

DENISON ENVIRONMENTAL SERVICES
Attention: Jay Cherian
Client Project #: NOV 4, 2010-MONTHLY-FARO-SEP
P.O. #:
Site Reference:

Quality Assurance Report (Continued)

Maxxam Job Number: VB0A8619

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	Units	QC Limits
4417603 JSW	RPD	Dissolved Aluminum (Al)	2010/11/12	2.3		%	20
		Dissolved Antimony (Sb)	2010/11/12	NC		%	20
		Dissolved Arsenic (As)	2010/11/12	NC		%	20
		Dissolved Barium (Ba)	2010/11/12	0.7		%	20
		Dissolved Beryllium (Be)	2010/11/12	NC		%	20
		Dissolved Bismuth (Bi)	2010/11/12	NC		%	20
		Dissolved Boron (B)	2010/11/12	NC		%	20
		Dissolved Cadmium (Cd)	2010/11/12	NC		%	20
		Dissolved Chromium (Cr)	2010/11/12	NC		%	20
		Dissolved Cobalt (Co)	2010/11/12	NC		%	20
		Dissolved Copper (Cu)	2010/11/12	7.1		%	20
		Dissolved Iron (Fe)	2010/11/12	1.4		%	20
		Dissolved Lead (Pb)	2010/11/12	NC		%	20
		Dissolved Lithium (Li)	2010/11/12	NC		%	20
		Dissolved Manganese (Mn)	2010/11/12	1.0		%	20
		Dissolved Mercury (Hg)	2010/11/12	NC		%	20
		Dissolved Molybdenum (Mo)	2010/11/12	0.1		%	20
		Dissolved Nickel (Ni)	2010/11/12	NC		%	20
		Dissolved Selenium (Se)	2010/11/12	4.7		%	20
		Dissolved Silicon (Si)	2010/11/12	5.0		%	20
		Dissolved Silver (Ag)	2010/11/12	NC		%	20
		Dissolved Strontium (Sr)	2010/11/12	0.04		%	20
		Dissolved Thallium (Tl)	2010/11/12	NC		%	20
		Dissolved Tin (Sn)	2010/11/12	NC		%	20
		Dissolved Titanium (Ti)	2010/11/12	NC		%	20
		Dissolved Uranium (U)	2010/11/12	1.6		%	20
		Dissolved Vanadium (V)	2010/11/12	NC		%	20
		Dissolved Zinc (Zn)	2010/11/12	NC		%	20
		Dissolved Zirconium (Zr)	2010/11/12	NC		%	20
4417866 AA1	Matrix Spike	Dissolved Arsenic (As)	2010/11/15		101	%	80 - 120
		Dissolved Beryllium (Be)	2010/11/15		106	%	80 - 120
		Dissolved Cadmium (Cd)	2010/11/15		105	%	80 - 120
		Dissolved Chromium (Cr)	2010/11/15		97	%	80 - 120
		Dissolved Cobalt (Co)	2010/11/15		101	%	80 - 120
		Dissolved Copper (Cu)	2010/11/15		100	%	80 - 120
		Dissolved Lead (Pb)	2010/11/15		97	%	80 - 120
		Dissolved Lithium (Li)	2010/11/15		104	%	80 - 120
		Dissolved Nickel (Ni)	2010/11/15		101	%	80 - 120
		Dissolved Selenium (Se)	2010/11/15		98	%	80 - 120
		Dissolved Uranium (U)	2010/11/15		70 (2)	%	80 - 120
		Dissolved Vanadium (V)	2010/11/15		98	%	80 - 120
		Dissolved Zinc (Zn)	2010/11/15		115	%	80 - 120
	Spiked Blank	Dissolved Arsenic (As)	2010/11/15		102	%	80 - 120
		Dissolved Beryllium (Be)	2010/11/15		105	%	80 - 120
		Dissolved Cadmium (Cd)	2010/11/15		102	%	80 - 120
		Dissolved Chromium (Cr)	2010/11/15		102	%	80 - 120
		Dissolved Cobalt (Co)	2010/11/15		101	%	80 - 120
		Dissolved Copper (Cu)	2010/11/15		103	%	80 - 120
		Dissolved Lead (Pb)	2010/11/15		105	%	80 - 120
		Dissolved Lithium (Li)	2010/11/15		105	%	80 - 120
		Dissolved Nickel (Ni)	2010/11/15		101	%	80 - 120
		Dissolved Selenium (Se)	2010/11/15		105	%	80 - 120
		Dissolved Uranium (U)	2010/11/15		107	%	80 - 120
		Dissolved Vanadium (V)	2010/11/15		101	%	80 - 120
		Dissolved Zinc (Zn)	2010/11/15		97	%	80 - 120

DENISON ENVIRONMENTAL SERVICES
Attention: Jay Cherian
Client Project #: NOV 4, 2010-MONTHLY-FARO-SEP
P.O. #:
Site Reference:

Quality Assurance Report (Continued)

Maxxam Job Number: VB0A8619

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	Units	QC Limits
4417866 AA1	Method Blank	Dissolved Aluminum (Al)	2010/11/15	<0.2		ug/L	
		Dissolved Antimony (Sb)	2010/11/15	<0.02		ug/L	
		Dissolved Arsenic (As)	2010/11/15	<0.02		ug/L	
		Dissolved Barium (Ba)	2010/11/15	<0.02		ug/L	
		Dissolved Beryllium (Be)	2010/11/15	<0.01		ug/L	
		Dissolved Bismuth (Bi)	2010/11/15	<0.005		ug/L	
		Dissolved Boron (B)	2010/11/15	<50		ug/L	
		Dissolved Cadmium (Cd)	2010/11/15	<0.005		ug/L	
		Dissolved Chromium (Cr)	2010/11/15	<0.1		ug/L	
		Dissolved Cobalt (Co)	2010/11/15	<0.005		ug/L	
		Dissolved Copper (Cu)	2010/11/15	<0.05		ug/L	
		Dissolved Iron (Fe)	2010/11/15	<1		ug/L	
		Dissolved Lead (Pb)	2010/11/15	<0.005		ug/L	
		Dissolved Lithium (Li)	2010/11/15	<0.5		ug/L	
		Dissolved Manganese (Mn)	2010/11/15	<0.05		ug/L	
		Dissolved Mercury (Hg)	2010/11/15	0.01, RDL=0.01		ug/L	
		Dissolved Molybdenum (Mo)	2010/11/15	<0.05		ug/L	
		Dissolved Nickel (Ni)	2010/11/15	<0.02		ug/L	
		Dissolved Selenium (Se)	2010/11/15	<0.04		ug/L	
		Dissolved Silicon (Si)	2010/11/15	<100		ug/L	
		Dissolved Silver (Ag)	2010/11/15	<0.005		ug/L	
		Dissolved Strontium (Sr)	2010/11/15	<0.05		ug/L	
		Dissolved Thallium (Tl)	2010/11/15	<0.002		ug/L	
		Dissolved Tin (Sn)	2010/11/15	<0.01		ug/L	
		Dissolved Titanium (Ti)	2010/11/15	<0.5		ug/L	
		Dissolved Uranium (U)	2010/11/15	<0.002		ug/L	
		Dissolved Vanadium (V)	2010/11/15	<0.2		ug/L	
		Dissolved Zinc (Zn)	2010/11/15	<0.1		ug/L	
		Dissolved Zirconium (Zr)	2010/11/15	<0.1		ug/L	
	RPD	Dissolved Aluminum (Al)	2010/11/15	18.1		%	20
		Dissolved Antimony (Sb)	2010/11/15	NC		%	20
		Dissolved Arsenic (As)	2010/11/15	NC		%	20
		Dissolved Barium (Ba)	2010/11/15	0.2		%	20
		Dissolved Beryllium (Be)	2010/11/15	NC		%	20
		Dissolved Bismuth (Bi)	2010/11/15	NC		%	20
		Dissolved Boron (B)	2010/11/15	NC		%	20
		Dissolved Cadmium (Cd)	2010/11/15	NC		%	20
		Dissolved Chromium (Cr)	2010/11/15	NC		%	20
		Dissolved Cobalt (Co)	2010/11/15	NC		%	20
		Dissolved Copper (Cu)	2010/11/15	2.0		%	20
		Dissolved Lead (Pb)	2010/11/15	NC		%	20
		Dissolved Lithium (Li)	2010/11/15	NC		%	20
		Dissolved Manganese (Mn)	2010/11/15	NC		%	20
		Dissolved Molybdenum (Mo)	2010/11/15	NC		%	20
		Dissolved Nickel (Ni)	2010/11/15	NC		%	20
		Dissolved Selenium (Se)	2010/11/15	NC		%	20
		Dissolved Silver (Ag)	2010/11/15	NC		%	20
		Dissolved Strontium (Sr)	2010/11/15	0.3		%	20
		Dissolved Thallium (Tl)	2010/11/15	NC		%	20
		Dissolved Tin (Sn)	2010/11/15	NC		%	20
		Dissolved Uranium (U)	2010/11/15	NC		%	20
		Dissolved Vanadium (V)	2010/11/15	NC		%	20
		Dissolved Zinc (Zn)	2010/11/15	NC		%	20

N/A = Not Applicable
Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

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Quality Assurance Report (Continued)

Maxxam Job Number: VB0A8619

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.
Spiked Blank: A blank matrix to which a known amount of the analyte has been added. Used to evaluate analyte recovery.
Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.
NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was not sufficiently significant to permit a reliable recovery calculation.
NC (RPD): The RPD was not calculated. The level of analyte detected in the parent sample and its duplicate was not sufficiently significant to permit a reliable calculation.
(1) Sample analysed past recommended hold time
(2) Matrix Spike exceeds acceptance limits for U due to matrix interference. Reanalysis yields similar results.

Maxxam Analytics Inc
8577 Commerce Court
Burnaby, BC V5A 4N5
www.maxxamanalytics.com
Phone: (604) 444-4808
Fax.: (604) 444-4511
Toll-Free: 1-800-440-4808

CHAIN-OF CUSTODY RECORD AND ANALYSIS REQUEST

08324998

MAXXAM JOB #: B0A8619

COC #:

ANALYSIS REQUEST

COMPANY NAME: #4337 Denison Environmental Services	CLIENT PROJECT NO.: November 4, 2010 - MONTHLY - FARO - SEP
COMPANY ADDRESS: Box 280, Faro, Yukon, Y0B 1K0	TEL: (867)994-2600 Ext. 106 - Lab E-MAIL: jcherian@denisonenvironmental.com FAX:
SAMPLER NAME (PRINT): N.Gardiner/B.Bekk/T.Parkin/K.Ramsay	PROJECT MANAGER: Jay Cherian
LABORATORY CONTACT: Ashley Nivison	

	FIELD SAMPLE ID	MATRIX: GROUNDWATER	SURFACE WATER	DRINKING WATER	SOIL	OTHER	SAMPLING: DATE DD/MM/YY	TIME	# CONTAINERS	Acidity	Alkalinity	Chloride	pH	Conductance (EC)	Sulphate	Total Suspended Solids (TSS)	LDL - Dissolved Metals (Field Filtered)	CSR - Dissolved Metals (Field Filtered)	Turbidity	Colour	Cyanide	Ammonia	LDL - Dissolved Mercury	Nitrates/Nitrites
1	X13					X	04/11/2010	12:11	5	X	X	X	X	X	X	X	X		X	X	X	X	X	X
2	X23					X	04/11/2010	11:26	3	X	X	X	X	X	X	X		X						
3	A30					X	04/11/2010	11:10	3	X	X	X	X	X	X	X		X						
4	Grayling Pond					X	04/11/2010	11:32	3	X	X	X	X	X	X	X		X						
5																								
6																								
7																								
8																								
9																								
10																								
11																								
12																								

TAT (Turnaround Time)

LESS THAN 5 DAY TAT MUST HAVE PRIOR APPROVAL

* Some exceptions apply - please contact laboratory

STANDARD	5 BUSINESS DAYS	X
RUSH	3 BUSINESS DAYS	
RUSH	2 BUSINESS DAYS	
URGENT	1 BUSINESS DAY	

OTHER BUSINESS DAYS: _____

CUSTODY RECORD

PO NUMBER OR QUOTE NUMBER:

SPECIAL DETECTION LIMITS / CONTAMINANT TYPE:

ACCOUNTING CONTACT:

SPECIAL REPORTING OR BILLING INSTRUCTIONS:

- CCME
- CSR
- AB TIER 1
- OTHER

JARS USED: 14

ARRIVAL TEMPERATURE °C: 7.68, 7.77

DUE DATE:

LOG IN CHECK:

RELINQUISHED BY SAMPLER: B. Bekk	DATE: DD/MM/YY 04/11/2010	TIME: 2:00 PM	RECEIVED BY: Small's Expediting
RELINQUISHED BY:	DATE: DD/MM/YY Page 15 of 15	TIME: 1400	RECEIVED BY:
RELINQUISHED BY:	DATE: DD/MM/YY	TIME: 01105	RECEIVED BY LABORATORY: C. Rosen

Denison Environmental Services
a division of Denison Mines Inc

MEMORANDUM

Faro Mine Closure

APPENDIX B

Soil Sement:

MSDS

And

Results of Water Quality and Toxicity Testing

MATERIAL SAFETY DATA SHEET

Midwest Dust Control

Soil-Sement®

SECTION I — IDENTIFICATION OF SUBSTANCE/PREPARATION AND COMPANY/ UNDERTAKING

TRADE NAME:	Soil-Sement®
CHEMICAL NAME:	Polymer Emulsion
SYNONYMS:	Dust Retardant
CHEMICAL FAMILY:	N/A
MOLECULAR WEIGHT:	N/A
FORMULA:	Aqueous Acrylic Vinyl Acetate Polymer Emulsion
CAS REGISTRY NO.:	Product A Blend - No Number Assigned

SECTION II — COMPOSITION/INFORMATION ON INGREDIENTS

NAME	CAS REG NO.	WT. %
Acrylic & Vinyl Acetate Polymer	Non-hazardous	5-50
Water	7732-18-5	95-50

SECTION III — HAZARDS IDENTIFICATION

ACRYLIC & POLYVINYL ACETATE POLYMER	Non-hazardous
Water	Non-hazardous

SECTION IV — FIRST AID MEASURES

EYES:	Flush eyes with flowing water at least 15 minutes, get medical attention.
INHALATION:	Move subject to fresh air.
SKIN:	Flush with large amount of water or wash with soap and water.
INGESTION:	Give water to drink. Call a physician

NEVER GIVE FLUIDS OR INDUCE VOMITING. IF PATIENT IS UNCONSCIOUS OR HAVING CONVULSIONS.

SECTION V — FIRE FIGHTING MEASURES

FLASH POINT (TEST METHOD):	Non-Combustible
AUTOIGNITION TEMPERATURE:	N/A
EXTINGUISHING MEDIUM:	N/A
SPECIAL FIREFIGHTING PROCEDURES:	N/A
UNUSUAL FIRE AND EXPLOSION HAZARDS:	Material can splatter above 212°F. Dried polymer film can burn but will not support combustion.

SECTION VI - ACCIDENTAL RELEASE MEASURES

SPILL AND LEAK PROCEDURES:	Dike and control spill. Transfer liquid to containers for recovery or disposal. Keep spills out of sewers and open bodies of water.

SECTION VII — HANDLING AND STORAGE

STORAGE:	Keep in a cool, dry, ventilated storage area and in closed containers. Minimize contact with the air to prevent microorganism contamination and reduce the formation of skins on the surface. KEEP FROM FREEZING
HANDLING:	Handle in a well-ventilated workspace.

SECTION VIII — EXPOSURE CONTROL/PERSONAL PROTECTION

RESPIRATORY PROTECTION:	None required if good ventilation is maintained.
VENTILATION:	Mechanical exhaust at point of contaminant.
EYE PROTECTION:	Chemical splash goggles recommended.
PROTECTIVE CLOTHING:	Impervious gloves recommended.
OTHER:	Under normal handling conditions, the risk of exposure to residual monomer is negligible.

SECTION IX — PHYSICAL AND CHEMICAL PROPERTIES

BOILING/MELTING POINT @ 760 mm Hg:	212°F
VAPOR PRESSURE mm Hg @ 20°C:	17
SPECIFIC GRAVITY OR BULK DENSITY:	1.01 to 1.15
SOLUBILITY IN WATER:	Dilutable
APPEARANCE:	Milky White Liquid
ODOR:	Characteristic Acrylic odor
pH:	4.0 to 9.5

SECTION X — STABILITY AND REACTIVITY

STABILITY:	Stable
CHEMICAL INCOMPATIBILITY:	No hazardous reactions are expected to occur under normal industrial conditions.
HAZARDOUS DECOMPOSITION PRODUCTS:	Thermal decomposition in the presence of air may yield carbon monoxide and/or carbon dioxide and water.
HAZARDOUS POLYMERIZATION:	Does not occur
CONDITIONS TO AVOID:	N/A
CORROSIVE TO METAL:	No
OXIDIZER:	No

SECTION XI — TOXICOLOGICAL INFORMATION

EFFECTS OF OVEREXPOSURE

INHALATION:	Vapor from stored, undiluted product can cause headache and nausea.
SKIN:	Stored, undiluted product is slightly irritating to skin.
EYES:	Slightly irritating to eyes.
INGESTION:	May be irritating to digestive tract.

SECTION XII — ECOLOGICAL INFORMATION

Toxicological evaluation of Soil Sement® utilized EPA methods for both acute and chronic toxicity determination for aquatic organisms. LC50 values were determined for each of the species. The table below contains a synopsis of the results.

SOIL SEMENT AQUATIC TOXICITY TEST RESULT

- Methods for Measuring the Acute Toxicity of Effluents and Receiving Water to Freshwater and Marine Organisms, EPA/600/4-90/027F.
- Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms, EPA/600/4-91/002.
- Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Water to Marine and Estuarine Organisms, EPA/600/4-91/003.

Midwest Industrial Supply, Inc.
1101 3rd Street Southeast
Canton, Ohio 44711

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Tel 330.456.3121
Fax 330.456.3247
Emergency Phone Number 1.800.321.0699

MIDWEST

SECTION XII — ECOLOGICAL INFORMATION - continued

	Ceriodaphnia dubia	Fathead minnow	Americamysis bahia	Rainbow trout
ACUTE/SURVIVAL (mg/L)				
LC50	>1000	>1000	>1000	320
NOEC	1000	1000	1000	
LOEC	>1000	>1000	>1000	
CHRONIC/SURVIVAL (mg/L)				
LC50	>1000	>1000	>1000	510
NOEC	1000	1000	1000	340
LOEC	>1000	>1000	>1000	700
CHRONIC/GROWTH/ REPRODUCTION (mg/L)				
LC50	>1000	>1000	>1000	540
NOEC	1000	1000	1000	340
LOEC	>1000	>1000	>1000	700

See attached test results:

1. ABC Laboratories, Inc. Americamysis bahia, Fathead minnow, Ceriodaphnia dubia.
2. BAR Invironmental, Inc. Rainbow trout
3. EnviroScience Inc. Rainbow Trout, Chronic (New Data)

LC50 - Lethal Concentration, 50%
NOEC - No Observable Effects Concentration
LOEC - Lowest Observable Effects Concentration

Comparison of the EPA guidelines to the LC50 levels of all species show that Soil Sement® is practically non-toxic to all species.

SECTION XIII — DISPOSAL CONSIDERATIONS

WASTE DISPOSAL METHOD: Coagulate the emulsion by the stepwise addition of ferric chloride and lime or the addition of sand or other absorbent material. Remove the clear supernatant liquid and flush to a chemical sewer or landfill. Incinerate solids and the contaminated diking material according to local, state and federal regulations.

CONTAINER DISPOSAL: Do not re-use containers. Do not weld on metal containers.

SECTION XIV — TRANSPORTATION INFORMATION

D.O.T. PROPER SHIPPING NAME (49CFR172.101): None
HAZARDOUS SUBSTANCE (40CFR116): N/A
REPORTABLE QUANTITY (RQ): N/A
D.O.T. HAZARD CLASSIFICATION (49CFR172.101): Non-regulated
D.O.T. PLACARDS REQUIRED: None
POISON CONSTITUENT (49CFR173.343): N/A
BILL OF LADING DESCRIPTION: Liquid plastic, NOS
C NO.: N/A
UN/NA CODE: N/A

SECTION XV— REGULATORY INFORMATION

SOIL-SEMENT® is not a restricted article according to the Department of Transportation and International Air Transport Association regulations.

EPA SARA Title III hazard class: None
OSHA HCS hazard class: Non-OSHA hazardous (29CFR1910.1200)
Toxic Chemicals present in quantities greater than the "de minimus" level are: None
TSCA: All ingredients are on the TSCA (Toxic Substance Control Act) inventory or are not required to be listed on the TSCA inventory.
California Proposition 65: This product contains no trace amount of chemical(s) known to the state of California to cause cancer of birth defects.
Canadian DSL: All ingredients are in the Canadian DSL (Domestic Substance List) or are not required to be on the list.
Canadian WHMIS: This product is not a "controlled product" under the Canadian Workplace Hazardous Material Information System (WHMIS)

SECTION XVI — OTHER INFORMATION

ABBREVIATIONS AND SYMBOLS:

N.D.	-	Not Determined
N.A.	-	Not Applicable
N.T.	-	Not Tested
<	-	Less Than
>	-	Greater Than

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SOIL-SEMENT®
ENVIRONMENTAL PERSPECTIVE

Dust Control,
Erosion Control,
Stabilization

Midwest Industrial Supply, Inc. is committed to providing comprehensive and relevant environmental information about our products. Working with various testing laboratories and regulatory organizations enables us to provide unbiased environmental and toxicity data that we use to develop the best dust control and stabilization programs for our customers.

Choosing the right product for an application is more than picking the product with good or sufficient dust control efficiency. It means evaluating the application and understanding all the needs of the customer including environmentally sensitive areas, regulatory constraints, aesthetics, customer preferences, operational or process concerns, and climate. Understanding the environmental and toxicity data and relating it to typical applications and site-specific needs is an important aspect of what Midwest does when working with our customers.

The conclusion of the information presented herein is that all testing shows Soil Sement®, when applied properly, will not negatively impact soil quality or water quality in terms of toxicity. Generic risk assessment will not replace a conscientious site-specific evaluation, but the data used in this perspective is a necessary component for all risk assessments

The US EPA Environmental Technology Verification (ETV) Program protocol for Dust Suppression Products evaluated bulk constituents as well as aquatic toxicity on Soil Sement®. The purpose of the program was to accumulate environmental data, however, the US EPA protocol did not allow for commentary on the environmental data.

The US EPA does however have regulatory guidelines that enable us to assess the potential impact of Soil Sement® on the environment. The test results used for this Environmental Impact Perspective can be found in Appendix A and B of the US EPA ETV report on Soil Sement® or on the Midwest Website.

1. Tri-State Laboratories, Chemical Analysis, July 2002
2. ABC Laboratories, Various Species Toxicity, September 2002
3. EnviroScience Inc., Rainbow Trout, Chronic Toxicity, June 2005

MIDWEST

Environmental Data

Soil-Sement®
Dust and Erosion Control Agent

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www.midwestind.com

Tel 330.456.3121
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Chemically, Soil Sement® is a polymer emulsion blend. The selected acrylic and vinyl acetate monomers are polymerized and emulsified. The selected polymer emulsions are formulated to achieve the desired end product properties. Soil Sement® is diluted upon application to achieve desired penetration properties specific to each site and application need.

Application rates vary with soil type and properties and the desired end result of the project. Soil Sement® is typically applied topically to the surface of the road with specially designed applicator trucks. Some applications require or specify incorporation of Soil Sement® into the soil to a depth of several inches. These types of Good Construction Practices (GCP®) applications are not typical; all calculations are based on topical rather than GCP® application techniques. Typical application rates for dust control range from 0.15 gal/yd2 to 0.30 gal/yd2. For purposes of this environmental impact analysis the application used in calculations was 0.20 gal/yd2.

A full range chemical analysis was performed on Soil Sement® by Tri-State Labs. Composition analysis included: volatile organic compounds (VOC), semi-volatile organic compounds (SVOC), metals, herbicides/herbicides and polynuclear aromatic hydrocarbons (PAH). Please see TSL, July 2002 for full analysis. The only chemicals detected in Soil Sement® are seven metals and one VOC.

The US EPA has developed Risk Based Concentrations (RBC) tables for numerous toxic chemicals. These tables list the levels in various media (i.e.: fish, tap water, ground water, ambient air, industrial soil and residential soil) that a chemical can be present in that media and impart little if any risk to humans. The October 2005 Risk Based Concentrations (RBC) Table from EPA Region III was used in this evaluation. The Soil Sement® application rate used was 0.20 gal/yd2, one (1) inch depth penetration was assumed and a soil density of 2.8 g/cm3 was used for calculations. Chemical level in the soil was compared to the RBC levels in residential soil. Analysis shows that at a heavy application of Soil Sement®, for all detected constituents, the levels are significantly lower than the RBC levels in residential soil. Therefore, Soil Sement® is safe for use in terms of environmental impact. The results are tabulated in the table below.

Chemical Constituent	Soil Sement® Level (mg/kg)	Soil Level (mg/kg)	RBC level (mg/kg)
Aluminum	2.440	0.0330	78,000.0
Barium	3.480	0.0470	16,000.0
Chromium	0.075	0.0010	230.0
Iron	1.640	0.0220	23,000.0
Mercury	0.060	0.0008	7.8
Nickel	0.100	0.0013	1,600.0
Zinc	2.610	0.0350	23,000.0
Toluene	1.555	0.0210	6,300.0

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Toxicological evaluation of Soil Sement® utilized EPA methods for both acute and chronic toxicity determination for aquatic organisms. LC50 values were determined for each of the species. The table below contains a synopsis of the results.

Soil Sement Aquatic Toxicity Test Results

*Methods for Measuring the Acute Toxicity of Effluents and Receiving Water to Freshwater and Marine Organisms, EPA/600/4-90/027F.

*Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms, EPA/600/4-91/002.

*Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Water to Marine and Estuarine Organisms, EPA/600/4-91/003.

	Ceriodaphnia dubia	Fathead minnow	Americamysis bahia	Rainbow trout
ACUTE/SURVIVAL (mg/L)				
LC50	>1000	>1000	>1000	320
NOEC	1000	1000	1000	
LOEC	>1000	>1000	>1000	
CHRONIC/SURVIVAL (mg/L)				
LC50	>1000	>1000	>1000	510
NOEC	1000	1000	1000	340
LOEC	>1000	>1000	>1000	700
CHRONIC/GROWTH/ REPRODUCTION (mg/L)				
LC50	>1000	>1000	>1000	540
NOEC	1000	1000	1000	340
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See attached test results:
1. ABC Laboratories, Inc. Americamysis bahia, Fathead minnow, Ceriodaphnia dubia.
2. BAR Invironmental, Inc. Rainbow trout
3. EnviroScience Inc. Rainbow Trout, Chronic (New Data)

LC50 - Lethal Concentration, 50%
NOEC - No Observable Effects Concentration
LOEC - Lowest Observable Effects Concentration

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The LC50 level is the lethal concentration of the chemical under test that kills 50% of the test organisms in the specified amount of time. According to the EPA-540-9-85-006, suggested toxicity criteria for materials are listed in the table below.

LC50 (mg/L)	Category Description
<0.1	Very highly toxic
0.1 – 1	Highly toxic
1 – 10	Moderately toxic
10 –100	Slightly toxic
>100	Practically non-toxic

Comparison of the EPA guidelines to the LC50 levels of all species show that Soil Sement® is practically non-toxic to all species.

In conclusion, all testing shows that Soil Sement®, when applied properly, will not negatively impact soil quality or water quality in terms of toxicity. Generic risk assessment will not replace a conscientious site-specific evaluation, but the data used in this perspective is a necessary component for all risk assessments.

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MIDWEST

ACUTE TOXICITY OF SOIL-SEMENT® TO RAINBOW TROUT (*ONCORHYNCHUS MYKISS*)

Conducted for:

Midwest Industrial Supply Inc.
1101 Third Street S.E.
P.O. Box 8431
Canton, Ohio
U.S.A. 44711

by:

B.A.R. ENVIRONMENTAL INC.

Nicholas Beaver Park, R. R. 3
Guelph, Ontario
Canada N1H 6H9

B.A.R. Project I.D.
TP960018/rbt

July 1996

ABSTRACT

A study was conducted to determine the acute toxicity of the test substance Soil-Sement® to rainbow trout (*Oncorhynchus mykiss*) under static test conditions.

Full strength and dilute solutions (9 parts water to 1 part test substance) of Soil-Sement® were tested. A range finding test was performed on the full strength and dilute solution to determine the approximate response range for trout. The results of these tests indicated that the median lethal (LC50) concentration to trout was in the range of 0.1 to 1.0 mL/L for the full strength material and in the range of 1.0 to 10.0 mL/L for the dilute solution. Based on these results two definitive tests were conducted. Nominal concentrations of 0.10, 0.18, 0.32, 0.56 and 1.0 mL/L were used for the full strength material. Nominal concentrations of 1.0, 1.8, 3.2, 5.6 and 10.0 mL/L were used for the dilute solution. Dilution water controls were included for all tests.

The 96 hour LC50's (95% confidence limits) for the full strength and dilute solution were 0.72 mL/L (0.56 - 1.0) and 7.03 mL/L (5.6-10.0), respectively. These results were based on nominal concentrations of the test material.

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LIST OF APPENDICES

LIST OF TABLES

1 INTRODUCTION

B.A.R. Environmental Inc. was contracted by Midwest Industrial Supply Inc. to determine the toxicity of the test material, Soil-Sement®, to rainbow trout (*Oncorhynchus mykiss*) based on the standardized conditions of the static, 96 hr acute lethality test.

A sample of the test material was submitted to B.A.R. on June 28, 1996 and testing commenced the same day. All tests were conducted using both full strength and dilute (1 part test substance to 9 parts dilution water) Soil-Sement®. Range finding tests were conducted initially to determine the appropriate response range for rainbow trout. Definitive tests were then conducted to estimate the median lethal concentration (LC50) or the median effective concentration (EC50). This report presents the results of the toxicity tests along with a description of the test methodology used.

2 METHODS AND MATERIALS

Acute toxicity tests with rainbow trout were conducted to comply with USEPA (1991) methods. These tests are based on survival of the test organisms during a defined period of exposure (96 hours), under static test conditions. The general test conditions are summarized in Appendix A. Additional details about the dilution water, test animals and exposure conditions are described in the following sections.

2.1 DILUTION WATER

Natural groundwater was used as a source of laboratory water in all tests. Water quality is monitored semi-annually, and prior to use, the water was filtered through a 20 micron cellulose-acetate filter and sterilized using ultra violet radiation. A continuous supply of oil-free compressed air was provided to bring the pH and concentration of dissolved oxygen and other gases into equilibrium with air and reduce oxygen demand. The concentration of dissolved oxygen in the water was maintained at >80% of the air saturation value.

Water used for the culture or holding of the test animals was identical to that used for testing purposes. Chemical characteristics of the dilution water is given in Appendix B.

2.2 TEST ORGANISMS

Rainbow trout eyed eggs were obtained from a licensed fish hatchery in Ontario (Rainbow Springs Trout Farm, Thamesford, Ontario). Eggs were incubated at 12 ± 1°C in Heath incubation trays. After hatching they were transferred to square tanks provided with a continuous supply of well aerated water at 12 ± 1°C.

Artificial lighting (50 to 100 foot-candles) was provided on a controlled lighting regime of 16 hours light and 8 hours dark. Fish were fed commercial trout chow at a rate of 4% of body weight per day.

2.3 TEST MATERIAL

A sample of the test material was submitted to B.A.R. Environmental Inc. on June 28, 1996. The sample was stored at 20 °C prior to testing. Tests were conducted using both full strength and dilute (9 parts dilution water to 1 part test substance) Soil-Sement®. The test material readily dissolved in water and did not require the use of any organic solvents, emulsifiers, or dispersants.

2.4 PREPARATION OF TEST SOLUTIONS

All test concentrations were individually prepared. Each concentration was prepared by adding a measured volume of the test substance directly to the laboratory dilution water. Test results are therefore presented on a volume/volume basis (e.g. mL/L of test substance), and estimates of the LC50 are based on nominal test concentrations.

2.5 EXPOSURE CONDITIONS

Bioassays with trout were conducted in duplicate 20 L glass aquaria containing 10 L of test solution. Ten animals were added to each test chamber for a total of twenty animals per test level. Results from the range finding tests indicated that aeration was not required (aeration is required only if the dissolved oxygen concentration falls below 6.0 mg/L in any test solution). Rainbow trout tests were conducted under static conditions with no renewal of the test solution. The tests were conducted in temperature controlled water baths held at 12 ± 1°C. Testing temperatures and photoperiod were similar to those of culture or holding conditions and kept constant between all tests. Feeding of the test fish was terminated 24 hours prior to the start of the test.

Test results were based on survival over a 96 hour period. Observations for immobility or mortality were made and recorded after 24, 48, 72 and 96 hours. A fish was considered dead if there was no evidence of opercular or other activity and no response to gentle prodding. Records were made of all other signs of stress during, and at completion of the bioassay. A test was considered to be invalid if more than ten percent (>2 out of 20 animals) of the control animals exhibited atypical/stressed behaviour and/or mortality. At the end of the bioassay all control fish were weighed and measured (fork length).

2.6 PHYSICAL AND CHEMICAL MEASUREMENTS

Measurements of hardness, temperature conductivity, pH, and dissolved oxygen levels were made at each observation period listed below (Table 1). Dissolved oxygen measurements were performed using an Orion Research model 97-08-00 electrode. pH and conductivity were measured with Radiometer digital meters, model pHM82 and CDM80 respectively. Hardness was done following the Schwartzenbach titration method.

Table 1. Summary of Water Quality Measurements.

Parameter	Frequency	Concentrations
D.O.	0, 24, 48, 72, and 96 hr	All test concentrations
pH	Start and end of test.	All test concentrations
Temperature	Daily	All test concentrations.
Hardness	Start of Test.	Control.
Conductivity	Start and end of test	All test concentrations

2.7 DATA ANALYSIS

Median lethal concentrations (LC50s) and their 95% Confidence Intervals were based on nominal test concentrations, and calculated using mortality data at the end of the exposure. The LC50 concentration is defined as the concentration of test material in water that is lethal to 50% of the test organisms after a defined period of exposure. If possible, EC50s were also calculated. The EC50 is defined as the concentration of material in water that is estimated to cause a specified non-lethal (i.e. abnormal swimming behaviour, immobility) or lethal effect within a given time period. LC50s and EC50s were estimated using a computerized program (Stephan, 1977).

SOIL-SEMENT®
ENVIRONMENTAL DATA
VOC, SEMI-VOLATILES, METALS,TCLP, PAH TESTS

PERFORMED BY: TSL, Tri-State Laboratories

REPORT DATA: July 23, 2002

SUMMARY: As part of the US EPA Environmental Technology Verification (ETV) Program SOIL-SEMENT® was tested to determine major, minor and trace constituents using various EPA test methods.

Bulk analysis techniques were used to quantitatively determine the presence of Title 22 metals, Volatile Organic Compounds (VOC), Semi-volatiles and Polynuclear Aromatic Hydrocarbons (PAH) in SOIL-SEMENT®. Bulk analysis is performed on the sample in the "as received" form and does not consider application rates, dilution ratios or environmental conditions. The vast majority of the analytes were found to be Below Detection Limits (BDL). Ever evolving sophistication of analytical methods and techniques have made detection limits for the tested constituents below regulatory levels. Some metals and inorganics were detected at well below regulatory levels. The metals: aluminum, iron, zinc, chromium and nickel can be attributed to either the handling or storage of SOIL-SEMENT® in carbon steel, stainless steel or aluminum tanks. The trace levels of barium, mercury, and toluene are most likely from the stabilizing agents or emulsifiers used as a standard in polymer emulsions.

Toxicity Characteristic Leaching Procedure (TCLP) is a sample preparation and battery of tests that can determine the presence of various elements and chemical compounds in a landfill type situation. In this test SOIL-SEMENT® was subjected to chemical extractions to "leach" the analytes from the product. This includes metals, volatiles, semivolatiles, and pesticides and herbicides analysis. Low level detection of barium, chromium and mercury were discussed above and are all well below regulatory levels.

RESULTS: Results indicate that SOIL-SEMENT® contains no bulk analysis or TCLP elements or compounds above regulatory levels. Most materials were not detected in SOIL-SEMENT®. Please see attached for results.

SOIL-SEMENT®
ENVIRONMENTAL DATA
VOC, SEMI-VOLATILES, METALS,TCLP, PAH TESTS

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December 2005

Environmental Technology Verification

Toxicity and Chemical Analysis of a Dust Suppressant Product

Midwest Industrial Supply, Inc.'s Soil Sement

Prepared by

RTI International

Under a Cooperative Agreement with
U.S. Environmental Protection Agency

Notice

RTI International* (RTI) and Midwest Research Institute (MRI) prepared this document with funding from RTI's Cooperative Agreement No. CR829434-01-1 with the U.S. Environmental Protection Agency (EPA). Mention of corporation names, trade names, or commercial products does not constitute endorsement or recommendation for use of specific products.

* RTI International is a trade name of Research Triangle Institute.

Toxicity and Chemical Analysis of Midwest Industrial Supply, Inc's Soil Sement

The U.S. Environmental Protection Agency (EPA) created the Environmental Technology Verification (ETV) Program to facilitate the deployment of innovative or improved environmental technologies through performance verification and dissemination of information. The goal of the ETV Program is to further environmental protection by accelerating the acceptance and use of improved and cost-effective technologies. ETV seeks to achieve this goal by providing high-quality, peer-reviewed data on technology performance to those involved in the design, distribution, financing, permitting, purchase, and use of environmental technologies.

ETV works in partnership with recognized standards and testing organizations; stakeholder groups, which consist of buyers, vendor organizations, permitters, and other interested parties; and with the full participation of individual technology developers. The program evaluates the performance of innovative technologies by developing test plans that are responsive to the needs of stakeholders, conducting field or laboratory tests (as appropriate), collecting and analyzing data, and preparing peer-reviewed reports. All evaluations are conducted in accordance with rigorous quality assurance (QA) protocols to ensure that data of known and adequate quality are generated and that the results are defensible.

The Air Pollution Control Technology (APCT) Verification Center, a center under the ETV Program, is operated by Research Triangle Institute (RTI) in cooperation with EPA's National Risk Management Research Laboratory. The APCT Center evaluated the performance of dust suppressant products for control of dust on an unpaved road.

The Soil Sement product from Midwest Industrial Supply was initially included in the dust suppressant verification program but was withdrawn before the on-road testing was initiatiated. The product was, however, analyzed using an array of chemical and toxicity tests as shown in Table 1. A sample of the product was provided by the vendor since there were no samples available in the field. The performance of Soil Sement was not verified.

Table 1. Laboratory Tests Performed on Soil Sement

Factors Verified	Measurement Method	Laboratory	Results
Whole effluent toxicity 40 CFR Part 136[1] • Ceriodaphnia Dubia • Fathead minnow • Americamysis Bahia	EPA/600/4-90/027[2] Acute toxicity of product – LC_{50}	ABC Laboratories, July 2002	Table 2, Attachment A
	EPA/600/4-91/00[3] Chronic toxicity of product– LC_{50}	ABC Laboratories, July 2002	Table 2, Attachment A
Biochemical oxygen demand (BOD) of product	EPA Method 405.1[4]	Tri-State Laboratories, Inc., July 2002	It was not possible to obtain results for Soil Sement
Chemical oxygen demand (COD) of product	EPA Method 410.4[5]	Tri-State Laboratories, Inc., July 2002	It was not possible to obtain results for Soil Sement
VOC emissions	EPA Method 24[6] VOC content of product	RTI International, 2002	Table 3
Hazardous waste impacts	Toxicity Characteristics; Leaching Procedure (TCLP); (EPA Method 1311)[7] • Inorganics/metals, EPA Method 6010B[7] • Semivolatile organics, EPA Method 8270D[7] • Volatile organics, EPA Method 8260B[7] • Pesticides & herbicides, EPA Method 8270D[7]	Tri-State Laboratories, Inc., July 2002	Attachment B
Total toxics testing	• Semivolatile organics, EPA Method 8270[7] • Volatile organics, EPA Method 8260B[7] • Title 22 Metals, EPA Method 6010B[7]	Tri-State Laboratories, Inc., July 2002	Attachment B
Polycyclic aromatic hydrocarbons (PAHs)	Use tentatively identified compounds (TICs)	Tri-State Laboratories, Inc., July 2002	Attachment B

A summary of the toxicity data is presented in Table 2. Details of the ABC Laboratories results can be found in Attachment A.

Table 2. Toxicity Test Results

Species	Acute LC_{50} for survival	Chronic LC_{50} for survival	Chronic EC_{50}
Ceriodaphnia dubia	>1,000 mg/L (48-hr)	>1,000 mg/L (7-d)	>1000 mg/L (7-d), reproduction
Fathead minnow	>1,000 mg/L (96-hr)	>1,000 mg/L (7-d)	>1000 mg/L (7-d), growth
Americamysis bahia	>1,000 mg/L (96-hr)	>1,000 mg/L (7-d)	>1000 mg/L (7-d), growth, fecundity

d = day
EC_{50} = effective concentration which affects 50% of sample population
hr = hour
LC_{50} = lethal concentration which kills 50% of sample population
LOEC = lowest observed effective concentration
mg/L = milligrams per liter
NOEC = no observed effect concentration

Table 3 provides information from the RTI International Method 24 analysis.

Table 3. EPA Method 24[6] Analysis

Sample ID	ASTM D1475[8] Density (g/mL)	ASTM D2369[9] Total Volatiles (Wt%)	ASTM D3792[10] Water (Wt%)
SOIL SEMENT	1.0526	58.91%	58.54%

Attachment B provides the Tri-State Laboratories chemical analysis data.

The material safety data sheet (MSDS) for EK35 is retained in the RTI project files and is available at http://www.midwestind.com/uploads/SSMSDS-165.pdf [accessed October 2005].

Midwest Industrial Supply
Acute and Chronic Toxicity Evaluation

with Water Flea Species *Ceriodaphnia dubia*
and Rainbow Trout *Oncorhynchus mykiss*

Products RoadPro NT® & Soil-Sement®

Conducted For:

Midwest Industrial Supply, Inc.
P.O. Box 8431
Canton, OH 44711

Conducted and Prepared By:

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Stow, OH 44224

ES ENVIRO SCIENCE INCORPORATED

, Aquatic Biologist

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1.0 INTRODUCTION

The acute and chronic toxicity of Midwest Industrial Supply products RoadPro NT® and Soil Sement® were evaluated for two aquatic species common to freshwater toxicity test methods. These methods are used by the National Pollutant Discharge Elimination System (NPDES) regulatory program for monitoring discharges of industrial and municipal sources of wastewater in the United States.

One vertebrate species, *Oncorhynchus mykiss* (rainbow trout), and one invertebrate species, *Ceriodaphnia dubia* (water flea) were exposed to RoadPro NT® and Soil-Sement® in separate tests using a static, non-renewal acute range-finding, and static, renewal chronic testing procedure. This report describes the results of four toxicity tests conducted at EnviroScience Inc., 3781 Darrow Rd., Stow, OH 44224, during the period June 9-21, 2005.

2.0 METHODS

Toxicity test methods followed EnviroScience's written standard operating procedures (SOPs), which were derived from USEPA guidelines found in their documents titled *Methods for Measuring the Acute Toxicity of Effluents and Receiving waters to Freshwater and Marine Organisms* (EPA/600/4-90/027F) and *Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms* (EPA-821-R-02-013).

2.1 Test design

Table 2.1 lists testing conditions for both species, including test dates and product concentrations.

2.2 Preparation of test solutions

For the acute range-finding tests, each concentrated sample of product was diluted to a

concentration of 10 g/L with moderately hard reconstituted water (MHRW). This served as the highest concentration tested. Each 10 g/L solution was then serially diluted to four additional concentrations with MHRW: 1, 0.1, 0.01, and 0.001 g/L. For the chronic tests, each concentrated sample of product was diluted to the following concentrations with moderately hard reconstituted water (MHRW) for the water fleas and dilute mineral water (DMW) for the trout: 1.0, 0.70, 0.34,.16, and 0.08 g/L. MHRW dilution water was prepared by dissolving four reagent grade salts (KCl, $MgSO_4$, $CaSO_4 \cdot 2H_2O$, and $NaHCO_3$) in Milli-Q-UV® de-ionized water, and was continuously aerated before use. DMW dilution water was prepared by diluting Perrier® mineral water in Milli-Q-UV® de-ionized water to a final concentration of 20% mineral water, and was continuously aerated before use. Specimens exposed to an aliquot of the appropriate diluent served as the test control.

Labeled test vessels were filled with test solutions and placed in an environmental chamber set to operate at the desired test conditions until solutions reached test temperature (25±1 °C for *C. dubia*, 12±2 °C for *O. mykiss*).

Approximately 50 milliliters of each test solution was poured into a labeled plastic beaker for analysis of the initial water quality (dissolved oxygen concentration, pH, and conductivity). Temperature was measured directly in test solutions immediately prior to loading specimens into the prepared test vessels.

2.3 Data collection

Tests were initiated as organisms were randomly selected and placed into test vessels. Each chamber was monitored daily at 24 ±2 hour intervals from the time of test initiation (±1 hour at test termination). The number of mortalities and the total number of adversely affected specimens (cumulative mortality plus specimens showing a behavioral effect) were recorded on bench sheets. Solution temperature was recorded from one replicate vessel per test level. Dissolved oxygen concentration, pH, and conductivity were monitored daily in all fish and chronic water flea test solutions, and measured at test termination (48 hours) from the acute water flea test solutions. The following methods and instruments were used in chemical analysis:

Dissolved Oxygen: APHA (1992) 4500-G., YSI model 51B
pH: APHA (1992) 4500-H., Orion model 920A
Conductivity: APHA (1992) 2510-B., Orion Model 160

2.4 Data analysis

Organism survival was evaluated two ways. The first, median lethal concentration (LC_{50}), was computed from mortality data using the Binomial, Spearman-Karber, or trimmed Spearman-Karber methods with the computer program CT-TOX 1.1. The LC_{50} endpoint represents the concentration of product that would be expected to cause 50% mortality during a specified exposure period. The second was hypothesis testing using Dunnett's, Steel's, or Kruskal-Wallis with Dunn's tests using the computer program Toxstat® 3.5 to determine the NOEC (no observed effect concentration), LOEC (lowest observed effect concentration), and ChV (chronic value, equal to the square root (NOEC*LOEC)).

Organism growth (trout) and reproduction (water flea) were also evaluated two ways. The first, the 50% inhibition concentration (IC_{50}), was calculated using the ICp model on Toxstat® 3.5 that computes by linear interpolation the concentration at which there is a 50% reduction in the measured response. The second method was hypothesis testing, as described above, to determine the NOEC, LOEC, and ChV.

3.0 RESULTS

Toxicity test results and associated water quality data are summarized in Tables 3.1 through 3.5. Table 3.1 lists the initial water quality data for samples of diluent and selected concentrations of freshly prepared test solutions. Water quality data collected at 24-hour intervals and at test termination are included in the Appendix. Table 3.2 lists the percent mortality and percent adversely affected in the acute range-finding test solutions for each 24-hour period and provides the 95% confidence interval (C.I.) estimates associated with the calculated LC_{50} value. Tables 3.3 through 3.5 list the percent mortality and percent adversely affected in the chronic test solutions for each 24-hour period and provide the LC_{50}, IC_{50}, NOEC, LOEC, and ChV endpoint values.