



# Arctic Gold and Silver Tailings Site

## Monitoring Report 2003



Prepared by:  
**Indian and Northern Affairs  
Waste Management Program  
Yukon Region**

## Location

The Arctic Gold and Silver mill and tailings impoundment is located approximately 4 km south of the Village of Carcross on the road to both the Arctic Caribou and Big Thing mines on Montana Mountain (60° 08' 00" N, 134° 43' 20" W).



Figure 1: Location of Arctic Gold and Silver Tailings

## **Background**

The Arctic Gold and Silver mill was in operation during the late 1960's. It is estimated that about 50,000 tonnes of ore were processed, using a basic flotation method (without cyanide) and leaving nearly 27,000 m<sup>3</sup> of tailings.

A phase III environmental assessment was commissioned By DIAND, Waste Management in August, 1997. It was found that the tailings were acid generating and that seepage into a small lake adjacent to the tailings impoundment contained significant concentrations of metals. Several health and safety concerns and environmental risks were identified and it was recommended to clean up the site and assess remedial measures for the tailings (Public Works and Government Services Canada, 1998).

Geotechnical and geochemical testing and delineation of the tailings were initiated in 1998 and options for remediation were presented in a report prepared by Steffen Robertson and Kirsten Inc. (1999).

Clean up of the site and preparations to secure and cap the tailings were carried out in 1999 according to specifications prepared by Public Works and Government Services Canada (1999). The contract for the excavation of previously submerged tailings from the unnamed lake, adjacent to the tailings impoundment, took place during winter 1999/2000. The recovered tailings were expected to dry during the summer 2000 to be placed in the impoundment and covered with clay capping material. Due to a wet and cool summer, the tailings had not dried enough to the satisfaction of the engineer. The final work, including the seeding and fertilizing of the entire capped tailings pond, had therefore be postponed to the summer of 2001. Completion of all components of the remediation effort was achieved in September, 2001 (EBA Engineering Consultants Ltd., 2001).

## **Monitoring Program**

DIAND Waste Management personnel carried out the annual site monitoring for 2003. This included:

- Visual inspection of capped tailings impoundment.
- State of vegetation and signs of erosion on all re-seeded areas.
- Inspection of tailings dam, drainage channels and diversion ditch.
- Inspection of the newly constructed spillway and dam of the unnamed lake.
- Sampling of surface water at various locations and analysis at an accredited laboratory.

## **Observations**

The site was visited by Waste Management personnel on June 23, 2003. Weather conditions: partly cloudy, 16 °C and light wind SW.

The overall state of the impoundment, tailings dam, drainage channels, diversion ditch, spillway

and dam of the unnamed lake were satisfactory. The vegetation on the tailings cover is for the most part doing very well (**Photo 1**).



**Photo 1:** Vegetation on tailings cover

## Surface Water Sampling

Surface water samples were taken from Tank Creek at the inflow (AGS-1) and outflow (AGS-2) of the unnamed lake. Water quality data as recorded on site is shown in **Table 1** and sampling locations on **Figure 2**. The samples were sent for dissolved metals analysis to an accredited laboratory.

Sample ID	Time	Temperature (°C)	Diss. Oxygen (mg/L)	pH	Conductivity (mV)
AGS-1	13:40	6.4	10.8	7.03	178
AGS-2	12:55	9.9	10.6	6.8	105

**Table 1:** Water Quality Field Measurements

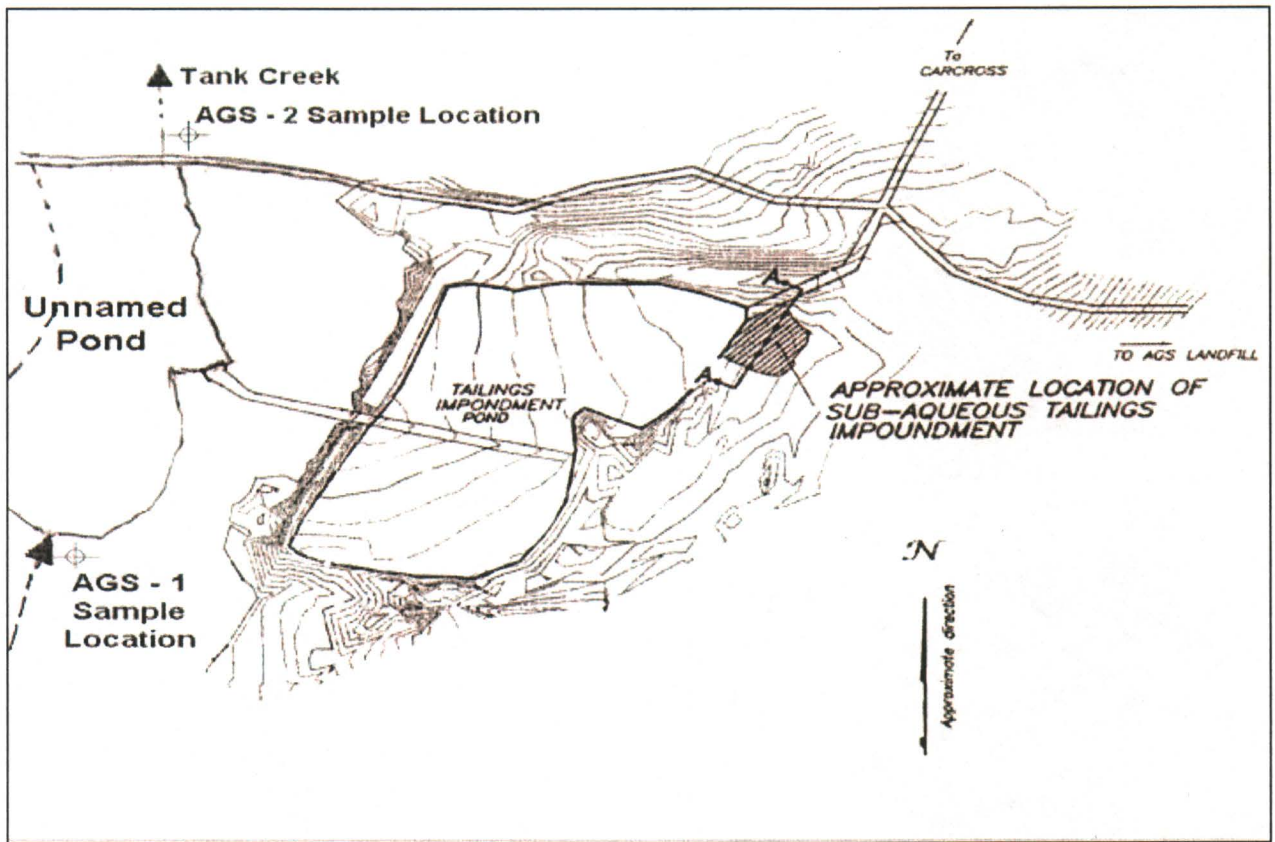


Figure 2: Surface Water Sampling Locations

## Analytical Results

The analysis of the surface water samples for dissolved metals indicated a slight but insignificant increase in metal content in the outflow sample compared to the inflow (see **Appendix** for analytical report). All concentrations are well below the Yukon Contaminated Sites Regulations and CCME guidelines for the protection of aquatic life (YCSR 2002, CCME 2002).

The annual monitoring will be continued.

## References

- CCME. 2002. *Canadian Environmental Quality Guidelines*. Canadian Council of Ministers of the Environment, Winnipeg, Manitoba.
- EBA Engineering Consultants Ltd. 2001. *Arctic Gold & Silver Tailings Site Remediation Near Carcross, Yukon*. Prepared for Public Works and Government Services Canada, Environmental Services, Western & Northern Region and DIAND Waste Management, Yukon Region. EBA Whitehorse, Yukon.
- EBA Engineering Consultants Ltd. 2001. *Monitoring of Low Permeability Cover Performance: Arctic Gold and Silver Mine Site, Carcross Yukon*. Prepared for the Mining Environment Research Group (MERG). EBA Whitehorse, Yukon.
- Indian and Northern Affairs. 2002. *Arctic Gold and Silver Tailings Site: Monitoring Report 2002*. Waste Management Program, Yukon Region, Whitehorse, Yukon.
- Public Works and Government Services Canada. 1998. *Phase III Environmental Assessment of the Arctic Gold and Silver Mill and Tailings Impoundment*. Environmental Services, Western & Northern Region, Edmonton, Alberta.
- Public Works and Government Services Canada. 1999. *Specifications: Arctic Gold and Silver, Environmental Clean Up of Mine Tailings Site*. Environmental Services, Western & Northern Region, Edmonton, Alberta.
- Steffen Robertson & Kirsten. 1999. *Final Report: Assessment of Remedial Measures for Arctic Gold & Silver Tailings Site*. SRK Consulting, Vancouver, B.C.
- YCSR. 2002. *Contaminated Sites Regulations: Generic Numerical Water Standards*. Environment Act. Yukon Territorial Government, Whitehorse, Yukon.

DIAND Waste Management and Northern Contaminants Programs  
Arctic Gold and Silver Tailings Site - Monitoring Report, 2003

## **Appendix** **(Analytical Report)**

**ANALYTICAL REPORT**

D.I.A.N.D. CONTAMINATES

DATE: 30-JUN-03 04:14 PM

ATTN: WERNER LIEBAU

300 300 MAIN ST

WHITEHORSE YT Y1A 2B5

Lab Work Order #: L117235

Sampled By: W.L.

Date Received: 26-JUN-03

P.O. #:

Job #:

Comments:

APPROVED BY: \_\_\_\_\_

  
RICK ZOLKIEWSKI

Project Manager

THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE WRITTEN AUTHORITY OF THE LABORATORY.  
ANY REMAINING SAMPLES WILL BE DISPOSED OF AFTER 30 DAYS FOLLOWING ANALYSIS. PLEASE CONTACT THE LAB IF YOU  
REQUIRE ADDITIONAL SAMPLE STORAGE TIME.

**LABORATORY ACCREDITATIONS:**

- STANDARDS COUNCIL OF CANADA IN COOPERATION WITH THE CANADIAN ASSOCIATION FOR ENVIRONMENTAL ANALYTICAL LABORATORIES (CAEAL) FOR SPECIFIC TESTS AS REGISTERED BY THE COUNCIL (EDMONTON, CALGARY, GRANDE PRAIRIE, SASKATOON, WINNIPEG, THUNDER BAY, WATERLOO)
- AMERICAN INDUSTRIAL HYGIENE ASSOCIATION (AIHA) IN THE INDUSTRIAL HYGIENE PROGRAM (EDMONTON, WINNIPEG)
- STANDARDS COUNCIL OF CANADA IN COOPERATION WITH THE CANADIAN FOOD INSPECTION AGENCY (CFIA) FOR FERTILIZER AND FEED TESTING (SASKATOON) AND FOR MICROBIOLOGICAL TESTING IN FOOD (WINNIPEG)

**LABORATORY RECOGNITIONS:**

- STANDARDS COUNCIL OF CANADA - GLP COMPLIANT FACILITY (EDMONTON, OTTAWA)

9936 - 67 Avenue, Edmonton, Alberta T6E 0P5, Tel. (780) 413-5227, Fax (780) 437-2311  
Canada Wide Tel. 1-800-668-9878 [www.envirotest.com](http://www.envirotest.com)

(Edmonton, Calgary, Grande Prairie, Saskatoon, Winnipeg, Thunder Bay, Ottawa, Waterloo, Montreal)

## ENVIRO-TEST ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier	D.L.	Units	Extracted	Analyzed	By	Batch
L117235-3 V0-2 Sample Date: 20-JUN-03 15:50 Matrix: WATER <b>Dissolved Metals</b> <b>Dissolved Major Metals</b> Manganese (Mn)	0.003		0.001	mg/L		26-JUN-03	HAS	R129619
L117235-4 AGS-1 Sample Date: 23-JUN-03 12:45 Matrix: WATER <b>Dissolved Metals</b> <b>Dissolved Trace Metals (Low Level)</b>								
Silver (Ag)	<0.0002	RAMB	0.0002	mg/L		26-JUN-03	JY	R129633
Aluminum (Al)	0.02		0.01	mg/L		26-JUN-03	JY	R129633
Arsenic (As)	0.0006		0.0004	mg/L		26-JUN-03	JY	R129633
Boron (B)	<0.002		0.002	mg/L		26-JUN-03	JY	R129633
Barium (Ba)	0.0046		0.0001	mg/L		26-JUN-03	JY	R129633
Beryllium (Be)	<0.0005		0.0005	mg/L		26-JUN-03	JY	R129633
Bismuth (Bi)	<0.00005		0.00005	mg/L		26-JUN-03	JY	R129633
Cadmium (Cd)	<0.0001		0.0001	mg/L		26-JUN-03	JY	R129633
Cobalt (Co)	<0.0001		0.0001	mg/L		26-JUN-03	JY	R129633
Chromium (Cr)	<0.0004		0.0004	mg/L		26-JUN-03	JY	R129633
Copper (Cu)	<0.0006		0.0006	mg/L		26-JUN-03	JY	R129633
Molybdenum (Mo)	0.0005		0.0001	mg/L		26-JUN-03	JY	R129633
Nickel (Ni)	0.0002		0.0001	mg/L		26-JUN-03	JY	R129633
Lead (Pb)	<0.0001		0.0001	mg/L		26-JUN-03	JY	R129633
Antimony (Sb)	<0.0004		0.0004	mg/L		26-JUN-03	JY	R129633
Selenium (Se)	<0.0004		0.0004	mg/L		26-JUN-03	JY	R129633
Tin (Sn)	<0.0002		0.0002	mg/L		26-JUN-03	JY	R129633
Strontium (Sr)	0.0234		0.0001	mg/L		26-JUN-03	JY	R129633
Titanium (Ti)	0.0006		0.0003	mg/L		26-JUN-03	JY	R129633
Thallium (Tl)	<0.00005		0.00005	mg/L		26-JUN-03	JY	R129633
Uranium (U)	<0.0001		0.0001	mg/L		26-JUN-03	JY	R129633
Vanadium (V)	0.0001		0.0001	mg/L		26-JUN-03	JY	R129633
Zinc (Zn)	0.002		0.002	mg/L		26-JUN-03	JY	R129633
<b>Dissolved Major Metals</b> Calcium (Ca)	6.0		0.5	mg/L		26-JUN-03	HAS	R129619
Potassium (K)	0.5		0.1	mg/L		26-JUN-03	HAS	R129619
Magnesium (Mg)	1.47		0.01	mg/L		26-JUN-03	HAS	R129619
Sodium (Na)	1.1		0.5	mg/L		26-JUN-03	HAS	R129619
Iron (Fe)	0.035		0.005	mg/L		26-JUN-03	HAS	R129619
Manganese (Mn)	0.001		0.001	mg/L		26-JUN-03	HAS	R129619
L117235-5 AGS-2 Sample Date: 23-JUN-03 13:40 Matrix: WATER <b>Dissolved Metals</b> <b>Dissolved Trace Metals (Low Level)</b>								
Silver (Ag)	<0.0002	RAMB	0.0002	mg/L		26-JUN-03	JY	R129633
Aluminum (Al)	0.02		0.01	mg/L		26-JUN-03	JY	R129633
Arsenic (As)	0.0007		0.0004	mg/L		26-JUN-03	JY	R129633
Boron (B)	<0.002		0.002	mg/L		26-JUN-03	JY	R129633
Barium (Ba)	0.0053		0.0001	mg/L		26-JUN-03	JY	R129633
Beryllium (Be)	<0.0005		0.0005	mg/L		26-JUN-03	JY	R129633
Bismuth (Bi)	<0.00005		0.00005	mg/L		26-JUN-03	JY	R129633



## Reference Information

**Sample Parameter Qualifier key listed:**

Qualifier	Description
RAMB	Result Adjusted For Method Blank

**Methods Listed (if applicable):**

ETL Test Code	Matrix	Test Description	Preparation Method Reference(Based On)	Analytical Method Reference(Based On)
MET1-DIS-LOW-ED	Water	Dissolved Trace Metals (Low Level)		EPA 6020
MET2-DIS-ED	Water	Dissolved Major Metals		EPA 200.7

\*\* Laboratory Methods employed follow in-house procedures, which are generally based on nationally or internationally accepted methodologies.

**Chain of Custody numbers:**

*The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:*

Laboratory Definition Code	Laboratory Location	Laboratory Definition Code	Laboratory Location
ED	Enviro-Test Laboratories - Edmonton, Alberta, Canada		

**GLOSSARY OF REPORT TERMS**

*Surr - A surrogate is an organic compound that is similar to the target analyte(s) in chemical composition and behavior but not normally detected in environmental samples. Prior to sample processing, samples are fortified with one or more surrogate compounds.*

*The reported surrogate recovery value provides a measure of method efficiency. The Laboratory warning units are determined under column heading D.L.*

*mg/kg (units) - unit of concentration based on mass, parts per million*

*mg/L (units) - unit of concentration based on volume, parts per million*

*< - Less than*

*D.L. - Detection Limit*

*N/A - Result not available. Refer to qualifier code and definition for explanation*

*Test results reported relate only to the samples as received by the laboratory.*

*UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.*

*UNLESS OTHERWISE STATED, SAMPLES ARE NOT CORRECTED FOR CLIENT FIELD BLANKS.*

*Although test results are generated under strict QA/QC protocols, any unsigned test reports, faxes, or emails are considered preliminary.*

*Enviro-Test Laboratories has an extensive QA/QC program where all analytical data reported is analyzed using approved referenced procedures followed by checks and reviews by senior managers and quality assurance personnel. However, since the results are obtained from chemical measurements and thus cannot be guaranteed, Enviro-Test Laboratories assumes no liability for the use or interpretation of the results.*

**ENVIRO-TEST QC REPORT**

Workorder: L117235

Client: D.I.A.N.D. CONTAMINATES  
300 300 MAIN ST  
WHITEHORSE YT Y1A 2B5

Contact: WERNER LIEBAU

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>MET1-DIS-LOW-ED</b>		<b>Water</b>						
Batch	R129633							
<b>WG123037-4</b>	<b>DUP</b>	<b>L116837-10</b>						
Aluminum (Al)		<0.01	<0.01	RPD-NA	mg/L	N/A	9	26-JUN-03
Antimony (Sb)		0.0007	0.0007	J	mg/L	0.0000	0.0012	26-JUN-03
Arsenic (As)		0.0007	0.0007	J	mg/L	0.0000	0.0012	26-JUN-03
Barium (Ba)		0.0219	0.0215		mg/L	1.7	5.9	26-JUN-03
Beryllium (Be)		<0.0005	<0.0005	RPD-NA	mg/L	N/A	18	26-JUN-03
Bismuth (Bi)		<0.00005	<0.00005	RPD-NA	mg/L	N/A	18	26-JUN-03
Boron (B)		0.083	0.084		mg/L	2.2	11	26-JUN-03
Cadmium (Cd)		<0.0001	<0.0001	RPD-NA	mg/L	N/A	9.8	26-JUN-03
Cobalt (Co)		<0.0001	<0.0001	RPD-NA	mg/L	N/A	7	26-JUN-03
Copper (Cu)		0.0082	0.0083		mg/L	0.91	8.6	26-JUN-03
Lead (Pb)		<0.0001	<0.0001	RPD-NA	mg/L	N/A	11	26-JUN-03
Molybdenum (Mo)		0.0031	0.0030		mg/L	2.9	7.9	26-JUN-03
Nickel (Ni)		0.0007	0.0009	G	mg/L	23	10	26-JUN-03
Phosphorus (P)		<0.01	<0.01	RPD-NA	mg/L	N/A	13	26-JUN-03
Selenium (Se)		0.0022	0.0022		mg/L	3.6	15	26-JUN-03
Silver (Ag)		<0.0002	<0.0002	RPD-NA	mg/L	N/A	20	26-JUN-03
Strontium (Sr)		2.00	1.99		mg/L	0.60	5.4	26-JUN-03
Thallium (Tl)		<0.00005	<0.00005	RPD-NA	mg/L	N/A	39	26-JUN-03
Tin (Sn)		<0.0002	<0.0002	RPD-NA	mg/L	N/A	7.3	26-JUN-03
Titanium (Ti)		0.0013	0.0014	J	mg/L	0.0002	0.00092	26-JUN-03
Uranium (U)		0.0600	0.0599		mg/L	0.16	7.6	26-JUN-03
Vanadium (V)		0.0003	0.0003	J	mg/L	0.0000	0.00031	26-JUN-03
Zinc (Zn)		0.010	0.009	J	mg/L	0.000	0.0061	26-JUN-03
<b>WG123037-8</b>	<b>DUP</b>	<b>L117183-8</b>						
Aluminum (Al)		0.03	0.02	J	mg/L	0.01	0.031	26-JUN-03
Antimony (Sb)		0.0005	0.0005	J	mg/L	0.0000	0.0012	26-JUN-03
Arsenic (As)		0.0050	0.0049		mg/L	1.8	9	26-JUN-03
Barium (Ba)		0.0950	0.0980		mg/L	3.2	5.9	26-JUN-03
Beryllium (Be)		<0.0005	<0.0005	RPD-NA	mg/L	N/A	18	26-JUN-03
Bismuth (Bi)		<0.00005	<0.00005	RPD-NA	mg/L	N/A	18	26-JUN-03
Boron (B)		0.023	0.022		mg/L	5.4	11	26-JUN-03
Cadmium (Cd)		<0.0001	<0.0001	RPD-NA	mg/L	N/A	9.8	26-JUN-03
Chromium (Cr)		0.0005	0.0005	J		0.0000	0.0012	

**ENVIRO-TEST QC REPORT**

Workorder: L117235

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>MET1-DIS-LOW-ED</b>		<b>Water</b>						
Batch	R129633							
<b>WG123037-8</b>	<b>DUP</b>	<b>L117183-8</b>						
Chromium (Cr)		0.0005	0.0005	J	mg/L	0.0000	0.0012	26-JUN-03
Cobalt (Co)		0.0001	0.0001	J	mg/L	0.0000	0.00031	26-JUN-03
Copper (Cu)		<0.0006	<0.0006	RPD-NA	mg/L	N/A	8.6	26-JUN-03
Lead (Pb)		<0.0001	<0.0001	RPD-NA	mg/L	N/A	11	26-JUN-03
Molybdenum (Mo)		0.0005	0.0005	J	mg/L	0.0000	0.00031	26-JUN-03
Nickel (Ni)		<0.0001	<0.0001	RPD-NA	mg/L	N/A	10	26-JUN-03
Phosphorus (P)		<0.01	<0.01	RPD-NA	mg/L	N/A	13	26-JUN-03
Selenium (Se)		<0.0004	<0.0004	RPD-NA	mg/L	N/A	15	26-JUN-03
Silver (Ag)		<0.0002	<0.0002	RPD-NA	mg/L	N/A	20	26-JUN-03
Strontium (Sr)		0.122	0.121		mg/L	0.77	5.4	26-JUN-03
Thallium (Tl)		<0.00005	<0.00005	RPD-NA	mg/L	N/A	39	26-JUN-03
Tin (Sn)		<0.0002	<0.0002	RPD-NA	mg/L	N/A	7.3	26-JUN-03
Titanium (Ti)		0.0026	0.0021		mg/L	21	25	26-JUN-03
Uranium (U)		0.0002	0.0002	J	mg/L	0.0000	0.00031	26-JUN-03
Vanadium (V)		0.0006	0.0006		mg/L	7.2	16	26-JUN-03
Zinc (Zn)		<0.002	<0.002	RPD-NA	mg/L	N/A	6.2	26-JUN-03
<b>WG123037-1</b>	<b>MB</b>							
Aluminum (Al)			<0.01		mg/L		0.05	26-JUN-03
Antimony (Sb)			<0.0004		mg/L		0.002	26-JUN-03
Arsenic (As)			<0.0004		mg/L		0.002	26-JUN-03
Beryllium (Be)			<0.0005		mg/L		0.0025	26-JUN-03
Cadmium (Cd)			<0.0001		mg/L		0.0005	26-JUN-03
Chromium (Cr)			<0.0004		mg/L		0.002	26-JUN-03
Cobalt (Co)			<0.0001		mg/L		0.0005	26-JUN-03
Copper (Cu)			<0.0006		mg/L		0.003	26-JUN-03
Lead (Pb)			<0.0001		mg/L		0.0005	26-JUN-03
Phosphorus (P)			<0.01		mg/L		0.01	26-JUN-03
Selenium (Se)			<0.0004		mg/L		0.002	26-JUN-03
Thallium (Tl)			<0.00005		mg/L		0.00025	26-JUN-03
Tin (Sn)			<0.0002		mg/L		0.001	26-JUN-03
Titanium (Ti)			<0.0003		mg/L		0.0015	26-JUN-03
Uranium (U)			<0.0001		mg/L		0.0005	26-JUN-03
Vanadium (V)			<0.0001		mg/L		0.0005	26-JUN-03
Barium (Ba)			<0.0001		mg/L		0.0005	26-JUN-03
Bismuth (Bi)			0.00011		mg/L		0.00025	26-JUN-03
Boron (B)			0.003		mg/L		0.01	26-JUN-03
Molybdenum (Mo)			<0.0001		mg/L		0.0005	26-JUN-03

**ENVIRO-TEST QC REPORT**

Workorder: L117235

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>MET1-DIS-LOW-ED</b>		<b>Water</b>						
Batch	<b>R129633</b>							
<b>WG123037-1</b>	<b>MB</b>							
Nickel (Ni)			0.0002		mg/L		0.0005	26-JUN-03
Silver (Ag)			0.0002		mg/L		0.001	26-JUN-03
Strontium (Sr)			<0.0001		mg/L		0.0005	26-JUN-03
Zinc (Zn)			<0.002		mg/L		0.01	26-JUN-03
<b>WG123037-5</b>	<b>MS</b>	<b>L116837-10</b>						
Aluminum (Al)			104		%		80-124	26-JUN-03
Antimony (Sb)			100		%		90-113	26-JUN-03
Arsenic (As)			100		%		94-115	26-JUN-03
Barium (Ba)			101		%		87-117	26-JUN-03
Beryllium (Be)			102		%		83-123	26-JUN-03
Bismuth (Bi)			97		%		88-115	26-JUN-03
Boron (B)			108		%		80-124	26-JUN-03
Cadmium (Cd)			96		%		90-112	26-JUN-03
Chromium (Cr)			98		%		85-119	26-JUN-03
Cobalt (Co)			95		%		88-116	26-JUN-03
Copper (Cu)			93		%		84-113	26-JUN-03
Lead (Pb)			100		%		86-116	26-JUN-03
Molybdenum (Mo)			101		%		88-120	26-JUN-03
Nickel (Ni)			92		%		88-112	26-JUN-03
Phosphorus (P)			105		%		85-125	26-JUN-03
Selenium (Se)			105		%		89-120	26-JUN-03
Silver (Ag)			89		%		54-138	26-JUN-03
Strontium (Sr)			76	E	%		68-134	26-JUN-03
Thallium (Tl)			100		%		91-115	26-JUN-03
Tin (Sn)			101		%		97-112	26-JUN-03
Titanium (Ti)			97		%		84-118	26-JUN-03
Uranium (U)			104		%		90-117	26-JUN-03
Vanadium (V)			99		%		88-118	26-JUN-03
Zinc (Zn)			92		%		77-127	26-JUN-03
<b>WG123037-9</b>	<b>MS</b>	<b>L117183-8</b>						
Aluminum (Al)			96		%		80-124	26-JUN-03
Antimony (Sb)			96		%		90-113	26-JUN-03
Arsenic (As)			102		%		94-115	26-JUN-03
Barium (Ba)			92		%		87-117	26-JUN-03
Beryllium (Be)			98		%		83-123	26-JUN-03
Bismuth (Bi)			99		%		88-115	26-JUN-03
Boron (B)			97		%		80-124	26-JUN-03

**ENVIRO-TEST QC REPORT**

Workorder: L117235

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>MET1-DIS-LOW-ED</b>		<b>Water</b>						
Batch	R129633							
<b>WG123037-9</b>	<b>MS</b>	<b>L117183-8</b>						
Cadmium (Cd)			99		%		90-112	26-JUN-03
Chromium (Cr)			95		%		85-119	26-JUN-03
Cobalt (Co)			96		%		88-116	26-JUN-03
Copper (Cu)			94		%		84-113	26-JUN-03
Lead (Pb)			97		%		86-116	26-JUN-03
Molybdenum (Mo)			103		%		88-120	26-JUN-03
Nickel (Ni)			95		%		88-112	26-JUN-03
Phosphorus (P)			98		%		85-125	26-JUN-03
Selenium (Se)			108		%		89-120	26-JUN-03
Silver (Ag)			47	H	%		54-138	26-JUN-03
Strontium (Sr)			92		%		68-134	26-JUN-03
Thallium (Tl)			97		%		91-115	26-JUN-03
Tin (Sn)			102		%		97-112	26-JUN-03
Titanium (Ti)			100		%		84-118	26-JUN-03
Uranium (U)			103		%		90-117	26-JUN-03
Vanadium (V)			95		%		88-118	26-JUN-03
Zinc (Zn)			98		%		77-127	26-JUN-03
<b>MET2-DIS-ED</b>		<b>Water</b>						
Batch	R129619							
<b>WG123015-10</b>	<b>DUP</b>	<b>L116837-4</b>						
Calcium (Ca)			372		mg/L	0.37	15	26-JUN-03
Iron (Fe)		0.076	0.076		mg/L	0.0	15	26-JUN-03
Magnesium (Mg)		209	207		mg/L	0.85	15	26-JUN-03
Manganese (Mn)		0.044	0.043		mg/L	2.3	15	26-JUN-03
Potassium (K)		17.6	17.4		mg/L	1.1	15	26-JUN-03
Sodium (Na)		1340	1330		mg/L	0.71	15	26-JUN-03
<b>WG123015-12</b>	<b>DUP</b>	<b>L116970-4</b>						
Calcium (Ca)			39.1		mg/L	0.19	15	26-JUN-03
Iron (Fe)		0.705	0.709		mg/L	0.57	15	26-JUN-03
Magnesium (Mg)		10.2	10.3		mg/L	0.67	15	26-JUN-03
Manganese (Mn)		0.032	0.032		mg/L	0.0	15	26-JUN-03
Potassium (K)		0.4	0.4	J	mg/L	0.0	0.31	26-JUN-03
Sodium (Na)		4.9	4.9		mg/L	0.90	15	26-JUN-03
<b>WG123015-22</b>	<b>DUP</b>	<b>L117282-2</b>						
Calcium (Ca)			92.3		mg/L	7.8	15	26-JUN-03
Iron (Fe)		0.009	<0.005	RPD-NA	mg/L	N/A	15	26-JUN-03
Magnesium (Mg)		23.1	21.2		mg/L	8.9	15	26-JUN-03
Manganese (Mn)		<0.001	<0.001	RPD-NA		N/A	15	

**ENVIRO-TEST QC REPORT**

Workorder: L117235

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>MET2-DIS-ED</b>		<b>Water</b>						
Batch	R129619							
<b>WG123015-22</b>	<b>DUP</b>	<b>L117282-2</b>						
Manganese (Mn)		<0.001	<0.001	RPD-NA	mg/L	N/A	15	26-JUN-03
Potassium (K)		1.1	0.9	H	mg/L	17	15	26-JUN-03
Sodium (Na)		10.5	9.4		mg/L	11	15	26-JUN-03
<b>WG123015-24</b>	<b>DUP</b>	<b>L117099-8</b>						
Calcium (Ca)		165	165		mg/L	0.13	15	26-JUN-03
Iron (Fe)		0.631	0.597		mg/L	5.5	15	26-JUN-03
Magnesium (Mg)		59.0	59.0		mg/L	0.010	15	26-JUN-03
Manganese (Mn)		1.45	1.45		mg/L	0.069	15	26-JUN-03
Potassium (K)		5.8	6.0		mg/L	2.9	15	26-JUN-03
Sodium (Na)		34.6	35.3		mg/L	2.2	15	26-JUN-03
<b>WG123015-8</b>	<b>DUP</b>	<b>L116771-10</b>						
Calcium (Ca)		286	287		mg/L	0.60	15	26-JUN-03
Iron (Fe)		0.191	0.206		mg/L	7.6	15	26-JUN-03
Manganese (Mn)		0.589	0.584		mg/L	0.85	15	26-JUN-03
Potassium (K)		31.2	31.5		mg/L	0.96	15	26-JUN-03
<b>WG123015-1</b>	<b>MB</b>							
Calcium (Ca)			<0.5		mg/L		2.5	26-JUN-03
Iron (Fe)			<0.005		mg/L		0.025	26-JUN-03
Magnesium (Mg)			0.01		mg/L		0.05	26-JUN-03
Manganese (Mn)			<0.001		mg/L		0.005	26-JUN-03
Potassium (K)			<0.1		mg/L		0.5	26-JUN-03
Sodium (Na)			<0.5		mg/L		2.5	26-JUN-03
<b>WG123015-11</b>	<b>MS</b>	<b>L116837-4</b>						
Calcium (Ca)			101	E	%		78-116	26-JUN-03
Iron (Fe)			96		%		84-108	26-JUN-03
Magnesium (Mg)			104	E	%		79-115	26-JUN-03
Manganese (Mn)			93		%		84-109	26-JUN-03
Potassium (K)			107	E	%		84-124	26-JUN-03
Sodium (Na)			155	E	%		83-119	26-JUN-03
<b>WG123015-13</b>	<b>MS</b>	<b>L116970-4</b>						
Calcium (Ca)			98	E	%		78-116	26-JUN-03
Iron (Fe)			102		%		84-108	26-JUN-03
Magnesium (Mg)			97	E	%		79-115	26-JUN-03
Manganese (Mn)			99		%		84-109	26-JUN-03
Potassium (K)			97		%		84-124	26-JUN-03
Sodium (Na)			99		%		83-119	26-JUN-03
<b>WG123015-23</b>	<b>MS</b>	<b>L117282-2</b>						
Calcium (Ca)			105	E	%		78-116	26-JUN-03

**ENVIRO-TEST QC REPORT**

Workorder: L117235

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>MET2-DIS-ED</b>		<b>Water</b>						
Batch	R129619							
<b>WG123015-23 MS</b>		<b>L117282-2</b>						
Iron (Fe)			101		%		84-108	26-JUN-03
Magnesium (Mg)			99	E	%		79-115	26-JUN-03
Manganese (Mn)			97		%		84-109	26-JUN-03
Potassium (K)			101		%		84-124	26-JUN-03
Sodium (Na)			101	E	%		83-119	26-JUN-03
<b>WG123015-25 MS</b>		<b>L117099-8</b>						
Calcium (Ca)			111	E	%		78-116	26-JUN-03
Iron (Fe)			102		%		84-108	26-JUN-03
Magnesium (Mg)			110	E	%		79-115	26-JUN-03
Manganese (Mn)			103	E	%		84-109	26-JUN-03
Potassium (K)			105	E	%		84-124	26-JUN-03
Sodium (Na)			102	E	%		83-119	26-JUN-03
<b>WG123015-9 MS</b>		<b>L116771-10</b>						
Calcium (Ca)			92	E	%		78-116	26-JUN-03
Iron (Fe)			93		%		84-108	26-JUN-03
Magnesium (Mg)			158	E	%		79-115	26-JUN-03
Manganese (Mn)			90	E	%		84-109	26-JUN-03
Potassium (K)			117	E	%		84-124	26-JUN-03

## Product - Batch and Sample Number Relations:

MET1-DIS-LOW-ED	1					
R129633		L117235-1	L117235-2	L117235-3	L117235-4	L117235-5
MET2-DIS-ED	1					
R129619		L117235-1	L117235-2	L117235-3	L117235-4	L117235-5

Workorder # L117235

Legend:

Limit 95% Confidence Interval (Laboratory Warning Limits)  
DUP Duplicate  
RPD Relative Percent Difference ((higher result-lower result)/Average, expressed as %)  
N/A Not Available  
LCS Laboratory Control Sample  
SRM Standard Reference Materials  
MS Matrix Spike  
MSD Matrix Spike Duplicate  
ADE Average Desorption Efficiency  
MB Method Blank  
IRM Internal Reference Material  
CRM Certified Reference Material

Qualifier:

RPD-NA Relative Percent Difference Not Available due to result(s) being less than detection limit.  
A Method blank exceeds acceptance limit. Blank correction not applied, unless the qualifier "RAMB" (result adjusted for method blank) appears in the Analytical Report.  
B Method blank result exceeds acceptance limit, however, it is less than 5% of sample concentration. Blank correction not applied.  
D Duplicate result may exceed limit due to increased variability for low level samples.  
E Matrix spike recovery may fall outside the acceptance limits due to high sample background.  
F Silver recovery low, likely due to elevated choride levels in sample.  
G Outlier - No assignable cause for nonconformity has been determined.  
H Result falls within the 99% Confidence Interval (Laboratory Control Limits)  
J Duplicate results and limit(s) are expressed in terms of absolute difference.

9936 - 67<sup>th</sup> Avenue, Edmonton, Alberta T6E 0P5  
 Edmonton Toll Free Line  
 1313 - 44<sup>th</sup> Avenue N.E., Calgary, Alberta T2E 6L5  
 9505 - 111<sup>th</sup> Street, Grande Prairie, Alberta T8V 5W1  
 General Purpose Bldg., 124 Veterinary Road, Saskatoon, Saskatchewan S7N 5E3  
 745 Logan Avenue, Winnipeg, Manitoba R3E 3L5  
 1081 Barton Street, Thunder Bay, Ontario P7B 5N3

Telephone: (780) 413-5220 Fax: (780) 437-2311  
 Telephone: 1-800-668-9878 Fax: 1-800-286-7319  
 Telephone: (403) 291-9897 Fax: (403) 291-0298  
 Telephone: (780) 539-5196 Fax: (780) 513-2191  
 Telephone: (306) 668-8370 Fax: (306) 668-8383  
 Telephone: (204) 945-3705 Fax: (204) 945-0763  
 Telephone: (807) 623-6463 Fax: (807) 623-7598

ANALYSIS REQUESTED:

**LAB USE ONLY**

*Dissolved Metals  
Met-ds-law-ed*

L117235

DATE: June 24/03 DATE REQUIRED: \_\_\_\_\_

**SERVICE REQUESTED:**

REGULAR  PRIORITY (50% SURCHARGE)  EMERGENCY (100% SURCHARGE)

**SPECIAL REQUIREMENTS / REGS**  
(CIRCLE ONE)

MISA TIER 1 CCME  
 BC MELP AB MUST  
 OTHER \_\_\_\_\_

SAMPLE ID	SAMPLED BY / DATE / TIME	LOCATION OF SAMPLING	SAMPLING METHOD	SAMPLE TYPE	LAB SAMPLE NO.															
VI-1	W.L. / June 20 / 15:10	Venus		W X																
VO-1	W.L. / " / 15:40	"		W X																
VO-2	W.L. / " / 15:50	"		W X																
AGS-1	W.L. / June 23 / 12:45	Arctic Gold		W X																
AGS-2	W.L. / June 23 / 13:40	& Silver		W X																
<p>Payment by credit card, please contact # below.</p> <p>filtered, but not preserved!</p>																				
										<p>PRESERVED FILTERED <input checked="" type="checkbox"/></p>										

**NOTES & CONDITIONS**

1. Quote number must be provided to ensure proper pricing. 2. Turnaround times will vary dependant on complexity of analysis & Lab workload at time of submission. Please contact the Lab to confirm turnaround times. 3. All hazardous samples submitted must be labeled to comply with WHMIS and TDG regulations. This must include the nature of the hazard, as well as a contact name & phone number that the Lab can contact for further information.

**NOTE:** Failure to properly complete all portions of this form may delay analysis.

**NOTE: Shaded areas MUST be completed in full by client for sample processing to occur.**

NO. BOTTLES SUBMITTED: 5

CLIENT: DIAND Waste Mgmt. Contam. PHONE: (867) 667-3272


CONTACT: Werner Liebau FAX: (867) 667-3271

REPORT ADDRESS: 300-300 Main Street QUOTE NO.: \_\_\_\_\_

Whitehorse, YT Y1A 2B5 P.O. NO.: \_\_\_\_\_

BILLING ADDRESS: \_\_\_\_\_ JOB NO.: \_\_\_\_\_

Payment by credit card LANDSITE NO.: \_\_\_\_\_

RELINQUISHED BY: <u>W. Liebau</u>	DATE: <u>June 24 / 03</u> TIME: <u>15:00</u>	RECEIVED BY: 	DATE: <u>26 - Jun - 03</u> TIME: <u>1315</u>
RELINQUISHED BY:	DATE:	RECEIVED BY:	DATE:
	TIME:	ETL LAB:	TIME:

SAMPLE CONDITION UPON RECEIPT:

FROZEN: \_\_\_\_\_ COLD:  AMBIENT: \_\_\_\_\_

OTHER: (BREAKAGE, LEAKAGE, ETC.) \_\_\_\_\_

WHITE - Report Copy  
 PINK - File Copy  
 YELLOW - Customer Copy

Revised: Aug. 2000