ALS Group

Environmental Division

CERTIFICATE OF ANALYSIS

Work Order	: **EB1225794**	Page	: 1 of 4
Client	: **MIKE SCOTT**	Laboratory	: Environmental Division Brisbane
Contact	: MR MIKE SCOTT	Contact	: Customer Services
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Project	: ----	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: ----		
C-O-C number	: ----	Date Samples Received	: 25-SEP-2012
Sampler	: ----	Issue Date	: 10-OCT-2012
Site	: ----		
		No. of samples received	: 1
Quote number	: ----	No. of samples analysed	: 1

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA

WORLD RECOGNISED ACCREDITATION

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Stephen Hislop	Senior Inorganic Chemist	Brisbane Inorganics

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Client sample ID	1	---	---	---	---
				Client sampling date / time	20-SEP-2012 15:00	---	---	---	---
					EB1225794-001	---	---	---	---
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		**0.19**	---	---	---	---
Dysprosium	7429-91-6	0.001	mg/L		<0.001	---	---	---	---
Silver	7440-22-4	0.001	mg/L		<0.001	---	---	---	---
Arsenic	7440-38-2	0.001	mg/L		<0.001	---	---	---	---
Bismuth	7440-69-9	0.001	mg/L		<0.001	---	---	---	---
Erbium	7440-52-0	0.001	mg/L		<0.001	---	---	---	---
Boron	7440-42-8	0.05	mg/L		<0.05	---	---	---	---
Europium	7440-53-1	0.001	mg/L		<0.001	---	---	---	---
Strontium	7440-24-6	0.001	mg/L		**0.020**	---	---	---	---
Barium	7440-39-3	0.001	mg/L		**0.011**	---	---	---	---
Gadolinium	7440-54-2	0.001	mg/L		<0.001	---	---	---	---
Titanium	7440-32-6	0.01	mg/L		<0.01	---	---	---	---
Beryllium	7440-41-7	0.001	mg/L		<0.001	---	---	---	---
Gallium	7440-55-3	0.001	mg/L		<0.001	---	---	---	---
Cadmium	7440-43-9	0.0001	mg/L		**0.0392**	---	---	---	---
Hafnium	7440-58-6	0.01	mg/L		<0.01	---	---	---	---
Tellurium	22541-49-7	0.005	mg/L		<0.005	---	---	---	---
Cobalt	7440-48-4	0.001	mg/L		<0.001	---	---	---	---
Holmium	7440-60-0	0.001	mg/L		<0.001	---	---	---	---
Uranium	7440-61-1	0.001	mg/L		<0.001	---	---	---	---
Caesium	7440-46-2	0.001	mg/L		<0.001	---	---	---	---
Chromium	7440-47-3	0.001	mg/L		<0.001	---	---	---	---
Indium	7440-74-6	0.001	mg/L		<0.001	---	---	---	---
Copper	7440-50-8	0.001	mg/L		**0.003**	---	---	---	---
Lanthanum	7439-91-0	0.001	mg/L		<0.001	---	---	---	---
Rubidium	7440-17-7	0.001	mg/L		<0.001	---	---	---	---
Lithium	7439-93-2	0.001	mg/L		<0.001	---	---	---	---
Lutetium	7439-94-3	0.001	mg/L		<0.001	---	---	---	---
Thorium	7440-29-1	0.001	mg/L		<0.001	---	---	---	---
Cerium	7440-45-1	0.001	mg/L		<0.001	---	---	---	---
Manganese	7439-96-5	0.001	mg/L		**0.028**	---	---	---	---
Neodymium	7440-00-8	0.001	mg/L		<0.001	---	---	---	---
Molybdenum	7439-98-7	0.001	mg/L		<0.001	---	---	---	---
Praseodymium	7440-10-0	0.001	mg/L		<0.001	---	---	---	---

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)				Client sample ID	1	----	----	---	----
				Client sampling date / time	20-SEP-2012 15:00	—	—	---	—
Compound	*CAS Number*	*LOR*	*Unit*		**EB1225794-001**	---	---	---	---
EG020F: Dissolved Metals by ICP-MS - Continued									
Nickel	7440-02-0	0.001	mg/L		<0.001	—	---	—	—
Samarium	7440-19-9	0.001	mg/L		<0.001	---	—	—	—
Lead	7439-92-1	0.001	mg/L		**0.001**	—	—	—	—
Terbium	7440-27-9	0.001	mg/L		<0.001	---	—	—	---
Antimony	7440-36-0	0.001	mg/L		<0.001	—	—	---	—
Thulium	7440-30-4	0.001	mg/L		<0.001	—	---	—	—
Selenium	7782-49-2	0.01	mg/L		<0.01	---	—	---	—
Ytterbium	7440-64-4	0.001	mg/L		<0.001	—	—	—	—
Tin	7440-31-5	0.001	mg/L		<0.001	---	—	—	---
Yttrium	7440-65-5	0.001	mg/L		<0.001	—	---	—	—
Thallium	7440-28-0	0.001	mg/L		<0.001	---	—	---	—
Zirconium	7440-67-7	0.005	mg/L		<0.005	—	---	—	—
Vanadium	7440-62-2	0.01	mg/L		<0.01	---	—	—	---
Zinc	7440-66-6	0.005	mg/L		**0.043**	—	---	—	—
Iron	7439-89-6	0.05	mg/L		**0.07**	---	—	—	—

Matrix:	WATER	**S**
Workgroup:	EB1225794	**ALS Sam**
Project name/number:		**S**
		Client san
		Client sam
		Purc

Analyte grouping/Analyte	CAS Number	Units	LOR
EG020F: Dissolved Metals by ICP-MS			
Aluminium	7429-90-5	mg/L	0.01
Dysprosium	7429-91-6	mg/L	0.001
Silver	7440-22-4	mg/L	0.001
Arsenic	7440-38-2	mg/L	0.001
Bismuth	7440-69-9	mg/L	0.001
Erbium	7440-52-0	mg/L	0.001
Boron	7440-42-8	mg/L	0.05
Europium	7440-53-1	mg/L	0.001
Strontium	7440-24-6	mg/L	0.001
Barium	7440-39-3	mg/L	0.001
Gadolinium	7440-54-2	mg/L	0.001
Titanium	7440-32-6	mg/L	0.01
Beryllium	7440-41-7	mg/L	0.001
Gallium	7440-55-3	mg/L	0.001
Cadmium	7440-43-9	mg/L	0.0001
Hafnium	7440-58-6	mg/L	0.01
Tellurium	22541-49-7	mg/L	0.005
Cobalt	7440-48-4	mg/L	0.001
Holmium	7440-60-0	mg/L	0.001
Uranium	7440-61-1	mg/L	0.001
Caesium	7440-46-2	mg/L	0.001
Chromium	7440-47-3	mg/L	0.001
Indium	7440-74-6	mg/L	0.001
Copper	7440-50-8	mg/L	0.001
Lanthanum	7439-91-0	mg/L	0.001
Rubidium	7440-17-7	mg/L	0.001
Lithium	7439-93-2	mg/L	0.001
Lutetium	7439-94-3	mg/L	0.001
Thorium	7440-29-1	mg/L	0.001
Cerium	7440-45-1	mg/L	0.001
Manganese	7439-96-5	mg/L	0.001
Neodymium	7440-00-8	mg/L	0.001
Molybdenum	7439-98-7	mg/L	0.001
Praseodymium	7440-10-0	mg/L	0.001
Nickel	7440-02-0	mg/L	0.001
Samarium	7440-19-9	mg/L	0.001

Lead	7439-92-1	mg/L	0.001
Terbium	7440-27-9	mg/L	0.001
Antimony	7440-36-0	mg/L	0.001
Thulium	7440-30-4	mg/L	0.001
Selenium	7782-49-2	mg/L	0.01
Ytterbium	7440-64-4	mg/L	0.001
Tin	7440-31-5	mg/L	0.001
Yttrium	7440-65-5	mg/L	0.001
Thallium	7440-28-0	mg/L	0.001
Zirconium	7440-67-7	mg/L	0.005
Vanadium	7440-62-2	mg/L	0.01
Zinc	7440-66-6	mg/L	0.005
Iron	7439-89-6	mg/L	0.05

Environmental Division

INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: **EB1225794**	Page	: 1 of 5
Client	: MIKE SCOTT	Laboratory	: Environmental Division Brisbane
Contact	: MR MIKE SCOTT	Contact	: Customer Services
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Telephone	: ----	Telephone	: +61 7 3243 7222
Facsimile	: ----	Facsimile	: +61 7 3243 7218
Project	: ----	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 25-SEP-2012
Sampler	: ----	Issue Date	: 10-OCT-2012
Order number	: ----		
		No. of samples received	: 1
Quote number	: ----	No. of samples analysed	: 1

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Interpretive Quality Control Report contains the following information:

- Analysis Holding Time Compliance
- Quality Control Parameter Frequency Compliance
- Brief Method Summaries
- Summary of Outliers

Analysis Holding Time Compliance

The following report summarises extraction / preparation and analysis times and compares with recommended holding times. Dates reported represent first date of extraction or analysis and precludes subsequent dilutions and reruns. Information is also provided re the sample container (preservative) from which the analysis aliquot was taken. Elapsed period to analysis represents number of days from sampling where no extraction / digestion is involved or period from extraction / digestion where this is present. For composite samples, sampling date is assumed to be that of the oldest sample contributing to the composite. Sample date for laboratory produced leachates is assumed as the completion date of the leaching process. Outliers for holding time are based on USEPA SW 846, APHA, AS and NEPM (1999). A listing of breaches is provided in the Summary of Outliers.

Holding times for leachate methods (excluding elutriates) vary according to the analytes being determined on the resulting solution. For non-volatile analytes, the holding time compliance assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These soil holding times are: Organics (14 days); Mercury (28 days) & other metals (180 days). A recorded breach therefore does not guarantee a breach for all non-volatile parameters.

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EG020F: Dissolved Metals by ICP-MS							
Plastic specimen jar (EG020A-F)							
1	**20-SEP-2012**	---	19-MAR-2013	—	**08-OCT-2012**	19-MAR-2013	✓
EG020F: Dissolved Metals by ICP-MS							
Plastic specimen jar (EG020B-F)							
1	**20-SEP-2012**	---	19-MAR-2013	—	**08-OCT-2012**	19-MAR-2013	✓
EG020F: Dissolved Metals by ICP-MS							
Plastic specimen jar (EG020D-F)							
1	**20-SEP-2012**	---	19-MAR-2013	—	**08-OCT-2012**	19-MAR-2013	✓

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(where) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	18	**11.1**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Dissolved Metals by ICP-MS - Suite B	EG020B-F	2	18	**11.1**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Dissolved Metals by ICP-MS - Suite D	EG020D-F	2	18	**11.1**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Laboratory Control Samples (LCS)							
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	18	**5.6**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Dissolved Metals by ICP-MS - Suite B	EG020B-F	1	18	**5.6**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	18	**5.6**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Dissolved Metals by ICP-MS - Suite B	EG020B-F	1	18	**5.6**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Dissolved Metals by ICP-MS - Suite D	EG020D-F	1	18	**5.6**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Matrix Spikes (MS)							
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	18	**5.6**	**5.0**	✓	ALS QCS3 requirement

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Dissolved Metals by ICP-MS - Suite A	EG020A-F	WATER	(APHA 21st ed., 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020): Samples are 0.45 um filtered prior to analysis. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Dissolved Metals by ICP-MS - Suite B	EG020B-F	WATER	(APHA 21st ed., 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020): Samples are 0.45 um filtered prior to analysis. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Dissolved Metals by ICP-MS - Suite D	EG020D-F	WATER	(APHA 21st ed., 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020): Samples are 0.45 um filtered prior to analysis. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.

Summary of Outliers

Outliers : Quality Control Samples

The following report highlights outliers flagged in the Quality Control (QC) Report. Surrogate recovery limits are static and based on USEPA SW846 or ALS-QWI/EN/38 (in the absence of specific USEPA limits). This report displays QC Outliers (breaches) only.

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

- **For all matrices, no Method Blank value outliers occur.**
- **For all matrices, no Duplicate outliers occur.**
- **For all matrices, no Laboratory Control outliers occur.**
- **For all matrices, no Matrix Spike outliers occur.**

Regular Sample Surrogates

- **For all regular sample matrices, no surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

This report displays Holding Time breaches only. Only the respective Extraction / Preparation and/or Analysis component is/are displayed.

- **No Analysis Holding Time Outliers exist.**

Outliers : Frequency of Quality Control Samples

The following report highlights breaches in the Frequency of Quality Control Samples.

- **No Quality Control Sample Frequency Outliers exist.**