



05 July 2019

Richard Pittard
Head of Environment and Regulatory Compliance
Cleanaway Solid Waste Pty Ltd
Level 4, 441 St Kilda Road
Melbourne Victoria 3004

Our ref: 613646200-81999
Your ref:

Dear Richard

Cleanaway - Banksia Rd Waste Disposal Site; 2018 Annual Groundwater Monitoring Report (Premise License L8904/2015/1)
ADDENDUM 1: Resample and Analysis of Monitoring Bore SE10S for PFAS

GHD are currently commissioned by Cleanaway Solid Waste Pty Ltd (Cleanaway) to undertake biannual groundwater monitoring at the Banksia Road Waste Disposal Site, located at Lot 2, Banksia Road, Crooked Brook, WA (the Site). The monitoring at the Site is required under Prescribed Premise Licence No. L8904/2015/1, issued by the Department of Water and Environmental Regulation (DWER).

In 2019, GHD prepared the 2018 Annual Groundwater Monitoring Report for the Site entitled: *Cleanaway Solid Waste Pty Ltd, Banksia Road Waste Disposal Site, 2018 Annual Groundwater Monitoring Report – Prescribed Premise License L8904/2015/1 (March 2019) (GHD 2019)*. The report was submitted to the DWER licensing section on the 29 March 2019 with a revised version resubmitted on the 15 April 2019 (to supersede the previous version).

This report should be read in conjunction with the GHD 2018 Annual Report document (GHD 2019).

This addendum was prepared following the identification of per- and polyfluoroalkyl substances (PFAS) in groundwater above the limits of reporting (LOR) in the October 2018 monitoring round (GHD 2019). While no distinguishing spatial observations were noted, concentrations of PFAS were generally detected in groundwater above the LOR. One monitoring well, SE10S, located near the southern site boundary and to the west of the leachate evaporation ponds, recorded a result (sum of PFHxS and PFOS) marginally above the drinking water value (HEPA, 2018). All remaining concentrations were below the relevant human health and environmental screening values as presented in HEPA 2018 (*Heads of EPAs Australia and New Zealand: PFAS National Environmental Management Plan, January 2018*).

The validity of this isolated exceedance of PFAS was questioned within the GHD report (GHD 2019) given the following lines of evidence:

- PFAS had not been detected at concentrations above the LOR at SE10S previously comprising monitoring events in 2016 and 2017.

- The adjacent monitoring wells, also constructed within the shallow aquifer (comprising SE9S and the newly installed well GW9S (installed to replace SE9S and SE10S)), did not report PFAS concentrations above the LOR during the same monitoring round.

In June 2019, GHD were commissioned to undertake further PFAS sampling at SE10S to further assess the validity of PFAS data previously recovered from this well. Sampling was undertaken by GHD field staff on the 25 June 2019. The sampling event also included the collection and analysis of a blind field duplicate and a rinsate blank, which was recovered from decontaminated (non-disposable) equipment used during the groundwater monitoring event. Sampling was undertaken using a dedicated PFAS approved disposable water bailer.

The laboratory results associated with the resampling of SE10S indicated that concentrations of all PFAS compounds (full suite of 28 analytes) were below the LOR for the primary sample (SE10S), the field duplicate (FD01) and the rinsate blank (RB01). The laboratory certificates of analysis and associated quality control and chain of custody documentation are provided with this addendum letter as Attachment 1.

The results obtained through the resampling event support the assertion that PFAS previously detected at SE10S, above the drinking water guidelines, is likely to have been anomalous. While the source of the anomaly has not been determined (i.e. introduced through sampling or a laboratory error) the groundwater results indicate that it is not representative of PFAS concentrations in groundwater.

Sincerely
GHD



Jon Cramer
Senior Environmental Engineer
+61 8 9840 5102



Kylie Skippings
Principal Environmental Engineer
+61 8 6222 8812

Attachments

1. Laboratory documentation

CHAIN OF CUSTODY RECORD
AND ANALYSIS REQUEST



GHD
Level 10, 999 Hay Street
Perth WA 6000

PO Box 3106
Perth WA 6832

Reception Ph: 08 6222 8222

Page 1 of 1

Project ID (as per ESdat set up; no spaces) 613646200		PO Number (to be Invoiced) 613646200		Laboratory: ALS laboratory														
Laboratory Quote No. EP/609/18		Turnaround Time Standard		Address: 26 Rigali Way, Wangara														
Job Manager (Invoice) & GHD accounts Jon Cramer		Email Address (Results) ian.oglesby@ghd.com		Laboratory Contact: Marnie Thomsett														
GHD Sample ID	Lab Sample ID	Date	Time	Sample Matrix S-Soil/SL Sludge/W-Water/A-Air	Container Type B Bottle/L-Jar/V- Via/Bag/C-Glass/P-Plastic	Preservative Unpreserved/HCl/ H2SO4/HNO3/Other	No	PFAS full suite (optional)	Nutrients (NH ₃ , NO ₃ , N (total) N (total oxidised) P (total))	Major Ions Ca, Mg, K, Na, Chloride	Analyses						HOLD	Remarks
RBO1	1	24/6/19		W	B		1	X										
SE10S	2	25/6/19		W	B		5	X	X	X								
FD01	3	25/6/19		W	B		1	X										
SE7D	4	24/6/19		W	B		1										X	
GW1D	5	24/6/19															X	
GW1S	6	24/6/19															X	
SE6D	7	24/6/19															X	
GW7S	8	25/6/19															X	
SE10D	9	25/6/19															X	
SE8	10	25/6/19															X	
GW7D	11	25/6/19															X	
SE3D	12	24/6/19															X	
SE4D	13	24/6/19															X	
GWSS	14	24/6/19						X										
SE9D	15	24/6/19															X	
GW9D	16	24/6/19															X	

Environmental Division
Perth

Work Order Reference
EP1906239



Telephone : +61-8-9406 1301

Sampled by: **ian oglesby + Dom Shuttleworth**

Date/Time: **24-25/6/19**

Relinquished by: **IO + DS**

Date/Time: **25/6/19**

Received by: **LUFFY**

Date/Time: **12/0 26/6**

Relinquished by:

Date/Time:

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : EP1906239

<p>Client : GHD PTY LTD</p> <p>Contact : MR JON CRAMER</p> <p>Address : 999 HAY STREET PERTH WA, AUSTRALIA 6000</p> <p>E-mail : jon.cramer@ghd.com</p> <p>Telephone : +61 08 6222 8222</p> <p>Facsimile : +61 08 9429 6555</p> <p>Project : 613646200</p> <p>Order number : 613646200</p> <p>C-O-C number : ----</p> <p>Site : ----</p> <p>Sampler : DOMINIQUE SHUTTLEWORTH, Ian Oglesby</p>	<p>Laboratory : Environmental Division Perth</p> <p>Contact : Marnie Thomsett</p> <p>Address : 26 Rigali Way Wangara WA Australia 6065</p> <p>E-mail : marnie.thomsett@alsglobal.com</p> <p>Telephone : 08 9406 1311</p> <p>Facsimile : +61-8-9406 1399</p> <p>Page : 1 of 3</p> <p>Quote number : EP2018GHDSE0047 (EP/690/18)</p> <p>QC Level : NEPM 2013 B3 & ALS QC Standard</p>
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Dates

Date Samples Received : 26-Jun-2019 12:10	Issue Date : 27-Jun-2019
Client Requested Due : 02-Jul-2019	Scheduled Reporting Date : 02-Jul-2019
Date	

Delivery Details

Mode of Delivery : Carrier	Security Seal : Not Available
No. of coolers/boxes : 5	Temperature : 3.1 - Ice present
Receipt Detail :	No. of samples received / analysed : 16 / 3

General Comments

- This report contains the following information:
 - Sample Container(s)/Preservation Non-Compliances
 - Summary of Sample(s) and Requested Analysis
 - Proactive Holding Time Report
 - Requested Deliverables
- Please see scanned COC for sample discrepancies: extra samples , samples not received etc.
- PFAS conducted by ALS Sydney, NATA accreditation no. 825, site no 10911.
- EP231X conducted by ALS Sydney, NATA accreditation no. 825, site no 10911.
- Please direct any queries related to sample condition / numbering / breakages to Sample Receipt (Samples.Perth@alsglobal.com)
- Analytical work for this work order will be conducted at ALS Environmental Perth.
- Please direct any turnaround / technical queries to the laboratory contact designated above.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months) from receipt of samples.
- **pH analysis should be conducted within 6 hours of sampling.**
- Please be aware that APHA/NEPM recommends water and soil samples be chilled to less than or equal to 6°C for chemical analysis, and less than or equal to 10°C but unfrozen for Microbiological analysis. Where samples are received above this temperature, it should be taken into consideration when interpreting results. Refer to ALS EnviroMail 85 for ALS recommendations of the best practice for chilling samples after sampling and for maintaining a cool temperature during transit.



Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

- No sample container / preservation non-compliance exists.

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process necessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.

If no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component

Matrix: **WATER**

Laboratory sample ID	Client sampling date / time	Client sample ID	(On Hold) WATER No analysis requested	WATER - EP231X PFAS - Full Suite (28 analytes)	WATER - NT-01 & 02 Ca, Mg, Na, K, Cl, SO ₄ , Alkalinity	WATER - NT-08 Total Nitrogen + NO ₂ + NO ₃ + NH ₃ + Total P
EP1906239-001	24-Jun-2019 00:00	RB01		✓		
EP1906239-002	25-Jun-2019 00:00	SE10S		✓	✓	✓
EP1906239-003	25-Jun-2019 00:00	FD01		✓		
EP1906239-004	24-Jun-2019 00:00	SE7D	✓			
EP1906239-005	24-Jun-2019 00:00	GW1D	✓			
EP1906239-006	24-Jun-2019 00:00	GW1S	✓			
EP1906239-007	24-Jun-2019 00:00	SE6D	✓			
EP1906239-008	25-Jun-2019 00:00	GW7S	✓			
EP1906239-009	25-Jun-2019 00:00	SE10D	✓			
EP1906239-010	25-Jun-2019 00:00	SE8	✓			
EP1906239-011	25-Jun-2019 00:00	GW7D	✓			
EP1906239-012	24-Jun-2019 00:00	SE3D	✓			
EP1906239-013	24-Jun-2019 00:00	SE4D	✓			
EP1906239-014	24-Jun-2019 00:00	GW5S	✓			
EP1906239-015	24-Jun-2019 00:00	SE9D	✓			
EP1906239-016	24-Jun-2019 00:00	GW9D	✓			

Proactive Holding Time Report

Sample(s) have been received within the recommended holding times for the requested analysis.

CERTIFICATE OF ANALYSIS

Work Order : **EP1906239**
Client : **GHD PTY LTD**
Contact : **MR JON CRAMER**
Address : **999 HAY STREET**
PERTH WA, AUSTRALIA 6000
Telephone : **+61 08 6222 8222**
Project : **613646200**
Order number : **613646200**
C-O-C number : **----**
Sampler : **DOMINIQUE SHUTTLEWORTH, Ian Oglesby**
Site : **----**
Quote number : **EP/690/18**
No. of samples received : **16**
No. of samples analysed : **3**

Page : 1 of 6
Laboratory : Environmental Division Perth
Contact : Marnie Thomsett
Address : 26 Rigali Way Wangara WA Australia 6065
Telephone : 08 9406 1311
Date Samples Received : 26-Jun-2019 12:10
Date Analysis Commenced : 26-Jun-2019
Issue Date : 02-Jul-2019 17:14



Accreditation No. 825
 Accredited for compliance with
 ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Chris Lemaitre	Laboratory Manager (Perth)	Perth Inorganics, Wangara, WA
Franco Lentini		Sydney Organics, Smithfield, NSW



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.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

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

Ø = ALS is not NATA accredited for these tests.

~ = Indicates an estimated value.

- PFAS conducted by ALS Sydney, NATA accreditation no. 825, site no 10911.
- EP231X conducted by ALS Sydney, NATA accreditation no. 825, site no 10911.
- Ionic balances were calculated using: major anions - chloride, alkalinity and sulfate; and major cations - calcium, magnesium, potassium and sodium.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.



Analytical Results

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

Client sample ID

				RB01	SE10S	FD01	----	----
Client sampling date / time				24-Jun-2019 00:00	25-Jun-2019 00:00	25-Jun-2019 00:00	----	----
Compound	CAS Number	LOR	Unit	EP1906239-001	EP1906239-002	EP1906239-003	-----	-----
				Result	Result	Result	----	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	----	<1	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	----	<1	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	----	4	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	----	4	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	----	6	----	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	----	40	----	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	----	1	----	----	----
Magnesium	7439-95-4	1	mg/L	----	4	----	----	----
Sodium	7440-23-5	1	mg/L	----	31	----	----	----
Potassium	7440-09-7	1	mg/L	----	<1	----	----	----
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	----	<0.01	----	----	----
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	14797-65-0	0.01	mg/L	----	<0.01	----	----	----
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	----	4.13	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	----	4.13	----	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	----	1.0	----	----	----
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser								
^ Total Nitrogen as N	----	0.1	mg/L	----	5.1	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	----	0.11	----	----	----
EN055: Ionic Balance								
ø Total Anions	----	0.01	meq/L	----	1.33	----	----	----
ø Total Cations	----	0.01	meq/L	----	1.73	----	----	----
EP231A: Perfluoroalkyl Sulfonic Acids								
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	<0.02	<0.02	----	----



Analytical Results

Sub-Matrix: WATER
 (Matrix: WATER)

Client sample ID

				RB01	SE10S	FD01	----	----
Client sampling date / time				24-Jun-2019 00:00	25-Jun-2019 00:00	25-Jun-2019 00:00	----	----
Compound	CAS Number	LOR	Unit	EP1906239-001	EP1906239-002	EP1906239-003	-----	-----
				Result	Result	Result	----	----
EP231A: Perfluoroalkyl Sulfonic Acids - Continued								
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	<0.02	<0.02	<0.02	----	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L	<0.02	<0.02	<0.02	----	----
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	<0.02	<0.02	<0.02	----	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	<0.01	<0.01	<0.01	----	----
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	<0.02	<0.02	----	----
EP231B: Perfluoroalkyl Carboxylic Acids								
Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	<0.1	<0.1	----	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	<0.02	<0.02	<0.02	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	<0.02	<0.02	<0.02	----	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	<0.02	<0.02	----	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	<0.01	<0.01	----	----
Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.02	<0.02	<0.02	----	----
Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	<0.02	<0.02	----	----
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.02	<0.02	<0.02	----	----
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.02	<0.02	<0.02	----	----
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L	<0.02	<0.02	<0.02	----	----
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.05	<0.05	<0.05	----	----
EP231C: Perfluoroalkyl Sulfonamides								
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.02	<0.02	<0.02	----	----
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.05	<0.05	<0.05	----	----
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.05	<0.05	<0.05	----	----
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L	<0.05	<0.05	<0.05	----	----



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	RB01	SE10S	FD01	----	----
Client sampling date / time					24-Jun-2019 00:00	25-Jun-2019 00:00	25-Jun-2019 00:00	----	----
Compound	CAS Number	LOR	Unit		EP1906239-001	EP1906239-002	EP1906239-003	-----	-----
					Result	Result	Result	----	----
EP231C: Perfluoroalkyl Sulfonamides - Continued									
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L		<0.05	<0.05	<0.05	----	----
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L		<0.02	<0.02	<0.02	----	----
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L		<0.02	<0.02	<0.02	----	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids									
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L		<0.05	<0.05	<0.05	----	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L		<0.05	<0.05	<0.05	----	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L		<0.05	<0.05	<0.05	----	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L		<0.05	<0.05	<0.05	----	----
EP231P: PFAS Sums									
Sum of PFAS	----	0.01	µg/L		<0.01	<0.01	<0.01	----	----
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.01	µg/L		<0.01	<0.01	<0.01	----	----
Sum of PFAS (WA DER List)	----	0.01	µg/L		<0.01	<0.01	<0.01	----	----
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.02	%		97.0	93.4	95.5	----	----
13C8-PFOA	----	0.02	%		98.3	92.2	97.0	----	----



Surrogate Control Limits

Sub-Matrix: WATER		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP231S: PFAS Surrogate			
13C4-PFOS	----	60	120
13C8-PFOA	----	60	120

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: EP1906239	Page	: 1 of 7
Client	: GHD PTY LTD	Laboratory	: Environmental Division Perth
Contact	: MR JON CRAMER	Telephone	: 08 9406 1311
Project	: 613646200	Date Samples Received	: 26-Jun-2019
Site	: ----	Issue Date	: 02-Jul-2019
Sampler	: DOMINIQUE SHUTTLEWORTH, Ian Oglesby	No. of samples received	: 16
Order number	: 613646200	No. of samples analysed	: 3

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO** Method Blank value outliers occur.
- **NO** Duplicate outliers occur.
- **NO** Laboratory Control outliers occur.
- Matrix Spike outliers exist - please see following pages for full details.
- For all regular sample matrices, **NO** surrogate recovery outliers occur.

Outliers : Analysis Holding Time Compliance

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

Outliers : Frequency of Quality Control Samples

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



Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Ar	EP1906239--002	SE10S	Nitrite + Nitrate as N	----	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for VOC in soils vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **WATER**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
ED037P: Alkalinity by PC Titrator							
Clear Plastic Bottle - Natural (ED037-P) SE10S	25-Jun-2019	----	----	----	01-Jul-2019	09-Jul-2019	✓
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA							
Clear Plastic Bottle - Natural (ED041G) SE10S	25-Jun-2019	----	----	----	26-Jun-2019	23-Jul-2019	✓
ED045G: Chloride by Discrete Analyser							
Clear Plastic Bottle - Natural (ED045G) SE10S	25-Jun-2019	----	----	----	26-Jun-2019	23-Jul-2019	✓
ED093F: Dissolved Major Cations							
Clear Plastic Bottle - Natural (ED093F) SE10S	25-Jun-2019	----	----	----	27-Jun-2019	02-Jul-2019	✓
EK055G: Ammonia as N by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK055G) SE10S	25-Jun-2019	----	----	----	26-Jun-2019	23-Jul-2019	✓
EK057G: Nitrite as N by Discrete Analyser							
Clear Plastic Bottle - Natural (EK057G) SE10S	25-Jun-2019	----	----	----	26-Jun-2019	27-Jun-2019	✓
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK059G) SE10S	25-Jun-2019	----	----	----	26-Jun-2019	23-Jul-2019	✓



Matrix: **WATER**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK061G) SE10S	25-Jun-2019	28-Jun-2019	23-Jul-2019	✓	28-Jun-2019	23-Jul-2019	✓
EK067G: Total Phosphorus as P by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK067G) SE10S	25-Jun-2019	28-Jun-2019	23-Jul-2019	✓	28-Jun-2019	23-Jul-2019	✓
EP231A: Perfluoroalkyl Sulfonic Acids							
HDPE (no PTFE) (EP231X) RB01	24-Jun-2019	28-Jun-2019	21-Dec-2019	✓	01-Jul-2019	21-Dec-2019	✓
HDPE (no PTFE) (EP231X) SE10S, FD01	25-Jun-2019	28-Jun-2019	22-Dec-2019	✓	01-Jul-2019	22-Dec-2019	✓
EP231B: Perfluoroalkyl Carboxylic Acids							
HDPE (no PTFE) (EP231X) RB01	24-Jun-2019	28-Jun-2019	21-Dec-2019	✓	01-Jul-2019	21-Dec-2019	✓
HDPE (no PTFE) (EP231X) SE10S, FD01	25-Jun-2019	28-Jun-2019	22-Dec-2019	✓	01-Jul-2019	22-Dec-2019	✓
EP231C: Perfluoroalkyl Sulfonamides							
HDPE (no PTFE) (EP231X) RB01	24-Jun-2019	28-Jun-2019	21-Dec-2019	✓	01-Jul-2019	21-Dec-2019	✓
HDPE (no PTFE) (EP231X) SE10S, FD01	25-Jun-2019	28-Jun-2019	22-Dec-2019	✓	01-Jul-2019	22-Dec-2019	✓
EP231D: (n:2) Fluorotelomer Sulfonic Acids							
HDPE (no PTFE) (EP231X) RB01	24-Jun-2019	28-Jun-2019	21-Dec-2019	✓	01-Jul-2019	21-Dec-2019	✓
HDPE (no PTFE) (EP231X) SE10S, FD01	25-Jun-2019	28-Jun-2019	22-Dec-2019	✓	01-Jul-2019	22-Dec-2019	✓
EP231P: PFAS Sums							
HDPE (no PTFE) (EP231X) RB01	24-Jun-2019	28-Jun-2019	21-Dec-2019	✓	01-Jul-2019	21-Dec-2019	✓
HDPE (no PTFE) (EP231X) SE10S, FD01	25-Jun-2019	28-Jun-2019	22-Dec-2019	✓	01-Jul-2019	22-Dec-2019	✓



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(were) 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)							
Alkalinity by PC Titrator	ED037-P	1	7	14.29	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Ammonia as N by Discrete analyser	EK055G	1	1	100.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	1	1	100.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	1	100.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	1	100.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	4	25.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	1	100.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Alkalinity by PC Titrator	ED037-P	2	7	28.57	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Ammonia as N by Discrete analyser	EK055G	1	1	100.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	1	200.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	1	100.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	1	100.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	4	25.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	1	200.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Alkalinity by PC Titrator	ED037-P	1	7	14.29	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Ammonia as N by Discrete analyser	EK055G	1	1	100.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	1	1	100.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	1	100.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	1	100.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	4	25.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	1	100.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Ammonia as N by Discrete analyser	EK055G	1	1	100.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	1	1	100.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	1	100.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard

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 Work Order : EP1906239
 Client : GHD PTY LTD
 Project : 613646200



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	
Matrix Spikes (MS) - Continued							
Nitrite as N by Discrete Analyser	EK057G	1	1	100.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	4	25.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	1	100.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard



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
Alkalinity by PC Titrator	ED037-P	WATER	In house: Referenced to APHA 2320 B This procedure determines alkalinity by automated measurement (e.g. PC Titrate) using pH 4.5 for indicating the total alkalinity end-point. This method is compliant with NEPM (2013) Schedule B(3)
Sulfate (Turbidimetric) as SO ₄ 2- by Discrete Analyser	ED041G	WATER	In house: Referenced to APHA 4500-SO ₄ . Dissolved sulfate is determined in a 0.45um filtered sample. Sulfate ions are converted to a barium sulfate suspension in an acetic acid medium with barium chloride. Light absorbance of the BaSO ₄ suspension is measured by a photometer and the SO ₄ -2 concentration is determined by comparison of the reading with a standard curve. This method is compliant with NEPM (2013) Schedule B(3)
Chloride by Discrete Analyser	ED045G	WATER	In house: Referenced to APHA 4500 Cl - G. The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride. In the presence of ferric ions the liberated thiocyanate forms highly-coloured ferric thiocyanate which is measured at 480 nm APHA 21st edition seal method 2 017-1-L april 2003
Major Cations - Dissolved	ED093F	WATER	In house: Referenced to APHA 3120 and 3125; USEPA SW 846 - 6010 and 6020; Cations are determined by either ICP-AES or ICP-MS techniques. This method is compliant with NEPM (2013) Schedule B(3) Sodium Adsorption Ratio is calculated from Ca, Mg and Na which determined by ALS in house method QWI-EN/ED093F. This method is compliant with NEPM (2013) Schedule B(3) Hardness parameters are calculated based on APHA 2340 B. This method is compliant with NEPM (2013) Schedule B(3)
Ammonia as N by Discrete analyser	EK055G	WATER	In house: Referenced to APHA 4500-NH ₃ G Ammonia is determined by direct colorimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)
Nitrite as N by Discrete Analyser	EK057G	WATER	In house: Referenced to APHA 4500-NO ₂ - B. Nitrite is determined by direct colourimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)
Nitrate as N by Discrete Analyser	EK058G	WATER	In house: Referenced to APHA 4500-NO ₃ - F. Nitrate is reduced to nitrite by way of a chemical reduction followed by quantification by Discrete Analyser. Nitrite is determined separately by direct colourimetry and result for Nitrate calculated as the difference between the two results. This method is compliant with NEPM (2013) Schedule B(3)
Nitrite and Nitrate as N (NO _x) by Discrete Analyser	EK059G	WATER	In house: Referenced to APHA 4500-NO ₃ - F. Combined oxidised Nitrogen (NO ₂ +NO ₃) is determined by Chemical Reduction and direct colourimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	WATER	In house: Referenced to APHA 4500-Norg D (In house). An aliquot of sample is digested using a high temperature Kjeldahl digestion to convert nitrogenous compounds to ammonia. Ammonia is determined colorimetrically by discrete analyser. This method is compliant with NEPM (2013) Schedule B(3)
Total Nitrogen as N (TKN + Nox) By Discrete Analyser	EK062G	WATER	In house: Referenced to APHA 4500-Norg / 4500-NO ₃ -. This method is compliant with NEPM (2013) Schedule B(3)



Analytical Methods	Method	Matrix	Method Descriptions
Total Phosphorus as P By Discrete Analyser	EK067G	WATER	In house: Referenced to APHA 4500-P H, Jirka et al (1976), Zhang et al (2006). This procedure involves sulphuric acid digestion of a sample aliquot to break phosphorus down to orthophosphate. The orthophosphate reacts with ammonium molybdate and antimony potassium tartrate to form a complex which is then reduced and its concentration measured at 880nm using discrete analyser. This method is compliant with NEPM (2013) Schedule B(3)
Ionic Balance by PCT DA and Turbi SO4 DA	* EN055 - PG	WATER	In house: Referenced to APHA 1030F. This method is compliant with NEPM (2013) Schedule B(3)
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	WATER	In house: Direct injection analysis of fresh waters after dilution (1:1) with methanol. Analysis by LC-Electrospray-MS-MS, Negative Mode using MRM. Where commercially available, isotopically labelled analogues of the target analytes are used as internal standards for quantification. Where a labelled analogue is not commercially available, the internal standard with similar chemistry and the closest retention time to the target is used for quantification. The DQO for internal standard response is 50-150% of that established at initial calibration. PFOS is quantified using a certified, traceable standard consisting of linear and branched PFOS isomers. This method complies with the quality control definitions as stated in QSM 5.1. Data is reviewed in line with the DQOs as stated in QSM5.1
Preparation Methods	Method	Matrix	Method Descriptions
TKN/TP Digestion	EK061/EK067	WATER	In house: Referenced to APHA 4500 Norg - D; APHA 4500 P - H. This method is compliant with NEPM (2013) Schedule B(3)
Preparation for PFAS in water.	EP231-PR	WATER	Method presumes direct injection without workup. Preparation includes addition of internal standard and surrogate, and filtration prior to analysis.