Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
N01	F2 is determined by arithmetically subtracting the "naphthalene" value from the ">C10-C16" value. The naphthalene value used in this calculation is obtained from volatiles (Purge & Trap analysis).
N02	Where we have reported both volatile (P&T GCMS) and semivolatile (GCMS) naphthalene data, results may not be identical. Provided correct sample handling protocols have been followed, any observed differences in results are likely to be due to procedural differences within each methodology. Results determined by both techniques have passed all QAQC acceptance criteria, and are entirely technically valid.
N04	F1 is determined by arithmetically subtracting the "Total BTEX" value from the "C6-C10" value. The "Total BTEX" value is obtained by summing the concentrations of BTEX analytes. The "C6-C10" value is obtained by quantitating against a standard of mixed aromatic/aliphatic analytes.
N07	Please note:- These two PAH isomers closely co-elute using the most contemporary analytical methods and both the reported concentration (and the TEQ) apply specifically to the total of the two co-eluting PAHs
Q08	The matrix spike recovery is outside of the recommended acceptance criteria. An acceptable recovery was obtained for the laboratory control sample indicating a sample matrix interference.
Q15	The RPD reported passes Eurofins Environment Testing's QC - Acceptance Criteria as defined in the Internal Quality Control Review and Glossary page of this report.

Authorised By

Michael Morrison	Analytical Services Manager
Emily Rosenberg	Senior Analyst-Metal (VIC)
Harry Bacalis	Senior Analyst-Volatile (VIC)
Joseph Edouard	Senior Analyst-Organic (VIC)
Scott Beddoes	Senior Analyst-Inorganic (VIC)

Glenn Jackson
General Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.

Greencap VIC P/L
Level 1, 677 High St
Kew East
VIC 3102

Attention: **Luke Richards**

Report **745197-W**
Project name
Project ID J169564
Received Date Sep 18, 2020

Client Sample ID			**QC03**	**QC04**	**QC05**
Sample Matrix			**Water**	**Water**	**Water**
Eurofins Sample No.			**M20-Se33597**	**M20-Se33598**	**M20-Se33599**
Date Sampled			**Sep 18, 2020**	**Sep 18, 2020**	**Sep 18, 2020**
Test/Reference	LOR	Unit			
Heavy Metals					
Arsenic	0.001	mg/L	< 0.001	< 0.001	-
Cadmium	0.0002	mg/L	< 0.0002	< 0.0002	-
Chromium	0.001	mg/L	< 0.001	< 0.001	-
Copper	0.001	mg/L	< 0.001	< 0.001	-
Lead	0.001	mg/L	< 0.001	< 0.001	-
Mercury	0.0001	mg/L	< 0.0001	< 0.0001	-
Molybdenum	0.005	mg/L	< 0.005	< 0.005	-
Nickel	0.001	mg/L	< 0.001	< 0.001	-
Selenium	0.001	mg/L	< 0.001	< 0.001	-
Silver	0.005	mg/L	< 0.005	< 0.005	-
Tin	0.005	mg/L	< 0.005	< 0.005	-
Zinc	0.005	mg/L	< 0.005	< 0.005	-
Total Recoverable Hydrocarbons - 2013 NEPM Fractions					
TRH C6-C10	0.02	mg/L	-	-	< 0.02

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.
A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Metals IWRG 621 : Metals M12	Melbourne	Sep 18, 2020	28 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
Total Recoverable Hydrocarbons	Melbourne	Sep 18, 2020	7 Days
- Method: LTM-ORG-2010 TRH C6-C40			

eurofins | Environment Testing

ABN: 50 005 085 521 web: www.eurofins.com.au email: EnviroSales@eurofins.com

Australia

Melbourne
6 Monterey Road
Dandenong South VIC 3175
Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

Sydney
Unit F3, Building F
16 Mars Road
Lane Cove West NSW 2066
Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane
1/21 Smallwood Place
Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Perth
2/91 Leach Highway
Kewdale WA 6105
Phone : +61 8 9251 9600
NATA # 1261
Site # 23736

Newcastle
4/52 Industrial Drive
Mayfield East NSW 2304
PO Box 60 Wickham 2293
Phone : +61 2 4968 8448

New Zealand

Auckland
35 O'Rorke Road
Penrose, Auckland 1061
Phone : +64 9 526 45 51
IANZ # 1327

Christchurch
43 Detroit Drive
Rolleston, Christchurch 7675
Phone : 0800 856 450
IANZ # 1290

Company Name: Greencap VIC P/L
Address: Level 1, 677 High St
Kew East
VIC 3102

Project Name:
Project ID: J169564

Order No.:
Report #: 745197
Phone: 9890 8811
Fax: 9890 8911

Received: Sep 18, 2020 3:31 PM
Due: Sep 25, 2020
Priority: 5 Day
Contact Name: Luke Richards

Eurofins Analytical Services Manager : Michael Morrison

Sample Detail						HOLD	pH (units)(1:5 soil:CaCl2 extract at 25°C as rec.)	TRH C6-C10	Polycyclic Aromatic Hydrocarbons	Metals IWRG 621 : Metals M12	Moisture Set	R20A: NEPM Basic Suite plus VIC EPA IWRG 621 Suite
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217												
Brisbane Laboratory - NATA Site # 20794												
Perth Laboratory - NATA Site # 23736												
Newcastle Laboratory												
External Laboratory												
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**							
1	QC01	Sep 18, 2020		Soil	M20-Se33596					X	X	
2	QC03	Sep 18, 2020		Water	M20-Se33597					X		
3	QC04	Sep 18, 2020		Water	M20-Se33598					X		
4	QC05	Sep 18, 2020		Water	M20-Se33599			X				
5	BH01_0.1	Sep 18, 2020		Soil	M20-Se33600		X		X	X	X	
6	BH01_1.0	Sep 18, 2020		Soil	M20-Se33601						X	X
7	BH02_0.1	Sep 18, 2020		Soil	M20-Se33602		X		X	X	X	
8	BH02_0.9	Sep 18, 2020		Soil	M20-Se33603		X			X	X	
9	BH03_0.1	Sep 18, 2020		Soil	M20-Se33604						X	X

eurofins | Environment Testing

ABN: 50 005 085 521 web: www.eurofins.com.au email: EnviroSales@eurofins.com

Australia

Melbourne
6 Monterey Road
Dandenong South VIC 3175
Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

Sydney
Unit F3, Building F
16 Mars Road
Lane Cove West NSW 2066
Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane
1/21 Smallwood Place
Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Perth
2/91 Leach Highway
Kewdale WA 6105
Phone : +61 8 9251 9600
NATA # 1261
Site # 23736

Newcastle
4/52 Industrial Drive
Mayfield East NSW 2304
PO Box 60 Wickham 2293
Phone : +61 2 4968 8448

New Zealand

Auckland
35 O'Rorke Road
Penrose, Auckland 1061
Phone : +64 9 526 45 51
IANZ # 1327

Christchurch
43 Detroit Drive
Rolleston, Christchurch 7675
Phone : 0800 856 450
IANZ # 1290

Company Name: Greencap VIC P/L
Address: Level 1, 677 High St
Kew East
VIC 3102

Project Name:
Project ID: J169564

Order No.:
Report #: 745197
Phone: 9890 8811
Fax: 9890 8911

Received: Sep 18, 2020 3:31 PM
Due: Sep 25, 2020
Priority: 5 Day
Contact Name: Luke Richards

Eurofins Analytical Services Manager : Michael Morrison

Sample Detail						HOLD	pH (units)(1:5 soil:CaCl2 extract at 25°C as rec.)	TRH C6-C10	Polycyclic Aromatic Hydrocarbons	Metals IWRG 621 : Metals M12	Moisture Set	R20A: NEPM Basic Suite plus VIC EPA IWRG 621 Suite
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217												
Brisbane Laboratory - NATA Site # 20794												
Perth Laboratory - NATA Site # 23736												
10	BH03_1.0	Sep 18, 2020		Soil	M20-Se33605		X			X	X	
11	BH04_0.1	Sep 18, 2020		Soil	M20-Se33606		X		X	X	X	
12	BH04_0.5	Sep 18, 2020		Soil	M20-Se33607		X			X	X	
13	BH05_0.1	Sep 18, 2020		Soil	M20-Se33608		X		X	X	X	
14	BH05_0.5	Sep 18, 2020		Soil	M20-Se33609		X			X	X	
15	BH01_0.5	Sep 18, 2020		Soil	M20-Se33610	X						
16	BH01_1.5	Sep 18, 2020		Soil	M20-Se33611	X						
17	BH02_0.5	Sep 18, 2020		Soil	M20-Se33612	X						
18	BH03_0.5	Sep 18, 2020		Soil	M20-Se33613	X						
Test Counts						4	8	1	4	11	11	2

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follows guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013 and are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid results are reported on a dry basis, unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. Information identified on this report with blue colour, indicates data provided by customer, that may have an impact on the results.
9. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

****NOTE:** pH duplicates are reported as a range NOT as RPD

Units

mg/kg: milligrams per kilogram

mg/L: milligrams per litre

ug/L: micrograms per litre

ppm: Parts per million

ppb: Parts per billion

%: Percentage

org/100mL: Organisms per 100 millilitres

NTU: Nephelometric Turbidity Units

MPN/100mL: Most Probable Number of organisms per 100 millilitres

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery.
CRM	Certified Reference Material - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
QSM	US Department of Defense Quality Systems Manual Version 5.3
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
TEQ	Toxic Equivalency Quotient

QC - Acceptance Criteria

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries: Recoveries must lie between 20-130% Phenols & 50-150% PFASs

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.3 where no positive PFAS results have been reported have been reviewed and no data was affected.

WA DWER (n=10): PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxaphene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxaphene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling.Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Aroclor 1260 in Matrix Spikes and LCS.
9. For Matrix Spikes and LCS results a dash " -" in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Heavy Metals							
Arsenic	mg/L	< 0.001			0.001	Pass	
Cadmium	mg/L	< 0.0002			0.0002	Pass	
Chromium	mg/L	< 0.001			0.001	Pass	
Copper	mg/L	< 0.001			0.001	Pass	
Lead	mg/L	< 0.001			0.001	Pass	
Mercury	mg/L	< 0.0001			0.0001	Pass	
Molybdenum	mg/L	< 0.005			0.005	Pass	
Nickel	mg/L	< 0.001			0.001	Pass	
Selenium	mg/L	< 0.001			0.001	Pass	
Silver	mg/L	< 0.005			0.005	Pass	
Tin	mg/L	< 0.005			0.005	Pass	
Zinc	mg/L	< 0.005			0.005	Pass	
Method Blank							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
TRH C6-C10	mg/L	< 0.02			0.02	Pass	
LCS - % Recovery							
Heavy Metals							
Arsenic	%	112			80-120	Pass	
Cadmium	%	100			80-120	Pass	
Chromium	%	114			80-120	Pass	
Copper	%	105			80-120	Pass	
Lead	%	92			80-120	Pass	
Mercury	%	83			80-120	Pass	
Molybdenum	%	98			80-120	Pass	
Nickel	%	107			80-120	Pass	
Selenium	%	101			80-120	Pass	
Silver	%	95			80-120	Pass	
Tin	%	107			80-120	Pass	
Zinc	%	110			80-120	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
TRH C6-C10	%	95			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
Heavy Metals				Result 1					
Arsenic	M20-Se32830	NCP	%	99			75-125	Pass	
Cadmium	M20-Se32830	NCP	%	88			75-125	Pass	
Chromium	M20-Se32830	NCP	%	100			75-125	Pass	
Copper	M20-Se32830	NCP	%	92			75-125	Pass	
Lead	M20-Se32830	NCP	%	90			75-125	Pass	
Mercury	M20-Se32830	NCP	%	93			75-125	Pass	
Molybdenum	M20-Se32830	NCP	%	94			75-125	Pass	
Nickel	M20-Se32830	NCP	%	93			75-125	Pass	
Selenium	M20-Se32830	NCP	%	94			75-125	Pass	
Silver	M20-Se32830	NCP	%	85			75-125	Pass	
Tin	M20-Se32830	NCP	%	99			75-125	Pass	
Zinc	M20-Se32830	NCP	%	94			75-125	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1					
TRH C6-C10	M20-Se32971	NCP	%	106			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Arsenic	M20-Se32830	NCP	mg/L	0.002	0.002	4.0	30%	Pass	
Cadmium	M20-Se32830	NCP	mg/L	< 0.0002	< 0.0002	<1	30%	Pass	
Chromium	M20-Se32830	NCP	mg/L	0.004	0.004	2.0	30%	Pass	
Copper	M20-Se32830	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Lead	M20-Se32830	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Mercury	M20-Se32830	NCP	mg/L	< 0.0001	< 0.0001	<1	30%	Pass	
Molybdenum	M20-Se32830	NCP	mg/L	< 0.005	< 0.005	<1	30%	Pass	
Nickel	M20-Se32830	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Selenium	M20-Se32830	NCP	mg/L	0.003	0.003	13	30%	Pass	
Silver	M20-Se32830	NCP	mg/L	< 0.005	< 0.005	<1	30%	Pass	
Tin	M20-Se32830	NCP	mg/L	< 0.005	< 0.005	<1	30%	Pass	
Zinc	M20-Se32830	NCP	mg/L	0.014	0.015	8.0	30%	Pass	
Duplicate									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1	Result 2	RPD			
TRH C6-C10	M20-Se32933	NCP	mg/L	< 0.02	< 0.02	<1	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Authorised By

Michael Morrison	Analytical Services Manager
Emily Rosenberg	Senior Analyst-Metal (VIC)
Harry Bacalis	Senior Analyst-Volatile (VIC)

Glenn Jackson
General Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.

Envirolab Services Pty Ltd
ABN 37 112 535 645 - 002
25 Research Drive Croydon South VIC 3136
ph 03 9763 2500 fax 03 9763 2633
melbourne@envirolab.com.au
www.envirolab.com.au

CERTIFICATE OF ANALYSIS 22578

Client Details

Client	Greencap
Attention	Luke Richards
Address	Level 1, 677 High st, Kew, VIC, 3102

Sample Details

Your Reference	**J169564**
Number of Samples	1 Soil
Date samples received	18/09/2020
Date completed instructions received	21/09/2020

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Report Details

Date results requested by	28/09/2020
Date of Issue	24/09/2020

NATA Accreditation Number 2901. This document shall not be reproduced except in full.

Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By
Chris De Luca, Operations Manager

Authorised By

Pamela Adams, Laboratory Manager

Acid Extractractable metals in soil		
Our Reference		22578-1
Your Reference	UNITS	QC02
Date Sampled		18/09/2020
Type of sample		Soil
Date digested	-	24/09/2020
Date analysed	-	24/09/2020
Arsenic	mg/kg	11
Boron	mg/kg	<3
Barium	mg/kg	34
Beryllium	mg/kg	<1
Cadmium	mg/kg	<0.4
Chromium	mg/kg	12
Cobalt	mg/kg	4
Copper	mg/kg	7
Manganese	mg/kg	96
Nickel	mg/kg	8
Lead	mg/kg	41
Selenium	mg/kg	<2
Vanadium	mg/kg	30
Zinc	mg/kg	58
Mercury	mg/kg	<0.1

Moisture		
Our Reference		22578-1
Your Reference	UNITS	QC02
Date Sampled		18/09/2020
Type of sample		Soil
Date prepared	-	23/09/2020
Date analysed	-	24/09/2020
Moisture	%	13

Method ID	Methodology Summary
Inorg-008	Moisture content determined by heating at 105 deg C for a minimum of 12 hours.
Metals-020 ICP-AES	Determination of various metals by ICP-AES.
Metals-021 CV-AAS	Determination of Mercury by Cold Vapour AAS.

QUALITY CONTROL: Acid Extractractable metals in soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date digested	-			24/09/2020	[NT]	[NT]	[NT]	[NT]	24/09/2020	[NT]
Date analysed	-			24/09/2020	[NT]	[NT]	[NT]	[NT]	24/09/2020	[NT]
Arsenic	mg/kg	4	Metals-020 ICP-AES	<4	[NT]	[NT]	[NT]	[NT]	109	[NT]
Boron	mg/kg	3	Metals-020 ICP-AES	<3	[NT]	[NT]	[NT]	[NT]	85	[NT]
Barium	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	[NT]	[NT]	102	[NT]
Beryllium	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	[NT]	[NT]	109	[NT]
Cadmium	mg/kg	0.4	Metals-020 ICP-AES	<0.4	[NT]	[NT]	[NT]	[NT]	104	[NT]
Chromium	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	[NT]	[NT]	101	[NT]
Cobalt	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	[NT]	[NT]	105	[NT]
Copper	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	[NT]	[NT]	102	[NT]
Manganese	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	[NT]	[NT]	104	[NT]
Nickel	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	[NT]	[NT]	101	[NT]
Lead	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	[NT]	[NT]	107	[NT]
Selenium	mg/kg	2	Metals-020 ICP-AES	<2	[NT]	[NT]	[NT]	[NT]	104	[NT]
Vanadium	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	[NT]	[NT]	101	[NT]
Zinc	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	[NT]	[NT]	102	[NT]
Mercury	mg/kg	0.1	Metals-021 CV-AAS	<0.1	[NT]	[NT]	[NT]	[NT]	99	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

Appendix E: Quality Assurance / Quality Control

Quality Assurance / Quality Control

The data quality assurance and control (QA/QC) procedures adopted by Senversa provide a consistent approach to evaluation of whether the data quality objectives (DQO's) required by the project have been achieved. The process focuses on assessment of the useability of the data in terms of accuracy and reliability in forming conclusions on the condition of the element of the environment being investigated. The approach is generally based on guidance from the following sources:

- Australian Standard (AS) 4482.1-2005: *Guide to the investigation and sampling of sites with potentially contaminated soil, Part 1: Non-volatile and semi-volatile compounds.*
- National Environment Protection Council (NEPC), *National Environment Protection (Assessment of Site Contamination) Amendment Measure No. 1 2013 (NEPM), Schedule B2: Guideline on Site Characterisation*.
- NEPC – *National Environment Protection (Assessment of Site Contamination) Amendment Measure No. 1 2013 (NEPM), Schedule B3: Guideline on Laboratory Analysis of Potentially Contaminated Soils*.
- United States Environmental Protection Agency (USEPA) – *Guidance on Systematic Planning Using the Data Quality Objectives Process* (EPA QA/G-4).
- USEPA – *Guidance on Environmental Data Verification and Data Validation* (EPA QA/G-8).

Quality Assurance Procedure

The following data quality objectives, measures and acceptance criteria were adopted to verify compliance with the planned QA procedures:

Quality Assurance Process	Data Quality Element	Objectives and Measure	Acceptance Criteria
Standard Procedures	Comparability, Reproducibility, Representativeness	Standard field sampling procedures and forms used	No deviation from standard procedure and forms used
Equipment Calibration	Accuracy	All equipment calibrated in accordance with manufacturers specifications	All equipment calibrated in accordance with manufacturers specifications
Testing Method Accreditation	Accuracy and Comparability	NATA accredited methods used for all analyses determined	Primary and secondary laboratories to use NATA accredited methods for all analytes determined
Quality Control Sampling Frequency	Precision and Repeatability	Field QC sampling frequency in accordance with AS4482.1-2005	Field Duplicates – ≥ 1 in 20 primary samples Secondary Duplicates – ≥ 1 in 20 primary samples Rinsate Blanks – ≥ 1 per day, per matrix per equipment Trip Blanks – ≥ 1 per esky containing samples for volatile analyses

Quality Assurance Process	Data Quality Element	Objectives and Measure	Acceptance Criteria
	Accuracy, Precision and Comparability	Laboratory QC analysis frequency in accordance with NEPC (2013), Schedule B3	Laboratory Duplicates – at least 1 in 10 analyses or one per process batch Method Blanks – at least 1 per process batch Surrogate Recoveries – all samples spiked where appropriate (e.g. chromatographic analysis of organics) Laboratory Control Samples – at least 1 per process batch Matrix Spikes – at least 1 per matrix type per process batch
Sample Preservation, Handling and Holding Times	Accuracy	Samples appropriately preserved upon collection , stored and transported, and analysed within holding times	Sample containers, holding times and preservation in accordance laboratory specific method requirements.
Data Management	Accuracy	No errors in data transcription	Entry of field data verified by peer.
Data Useability	Completeness	Limits of reporting less than adopted beneficial use investigation levels. Sample volumes and analytical methods selected to enable required limits of reporting to be achieved	Limits of reporting less than investigation levels.

Quality Control Sampling and Analysis

The following data quality objectives, measures and acceptance criteria were adopted to evaluate the validity of the analytical data produced.

Quality Control Process	Data Quality Element	Objectives and Measure	Acceptance Criteria
Field Duplicate Sampling and Analysis	Precision and Field Repeatability	Field duplicate samples used assess the variability in analyte concentration between samples collected from the sample location and the reproducibility of the laboratory analysis. Where required, resubmission of previously analysed samples for chemicals within their holding times may be undertaken to further assess level of precision.	Analysed for same chemicals as primary sample RPD1 <30% of mean concentration where both concentrations >20 x limit of reporting RPD <50% of mean concentration where higher concentration 10 – 20 x limit of reporting RPD - No limit where both concentrations < 10 x limit of reporting
Secondary Duplicate Sampling and Analysis	Accuracy	Results are accurate and free from laboratory error. Secondary duplicate samples sent to a secondary laboratory to assess the accuracy of the analyte concentrations reported by the primary laboratory	Analysed for same chemicals as primary sample RPD <30% of mean concentration where both concentrations >20 x limit of reporting RPD <50% of mean concentration where higher concentration 10 – 20 x limit of reporting RPD - No limit where both concentrations < 10 x limit of reporting

[1] Relative Percent Difference (%): Calculated as: (Result No.1 – Result No. 2/Mean Result)*100

Quality Control Process	Data Quality Element	Objectives and Measure	Acceptance Criteria
Field Rinsate Blank Preparation and Analysis	Accuracy and Representativeness	Cross contamination of samples does not occur between sampling locations due to carry-over from sampling equipment. Rinsate blank samples prepared for each sampling procedure. Where possible the rinsate blanks are prepared immediately after sampling locations known to contain concentrations of the chemicals of concern above the limit of quantification and / or before sampling locations where the chemicals being targeted in the laboratory analysis are to be compared to investigation levels near the limit of quantification of the chemical.	Analyte concentrations below limits of reporting
Trip Blank Sampling and Analysis	Accuracy and Representativeness	Cross contamination between samples does not occur in transit or as an artefact of the sample handling procedure. Trip blank samples prepared by the laboratory which accompany the empty sampling containers from the laboratory to the sampling site, and return with the samples to the laboratory to assess whether cross contamination occurs between samples or as an artefact of the sampling procedure.	Analyte concentrations below limits of reporting
Laboratory QC Analysis	Laboratory Precision and Accuracy	Laboratory duplicates	As specified by the laboratory.
		Laboratory control spike	Dynamic recovery limits as specified by the laboratory.
		Certified reference material	As specified by the laboratory (generally dynamic recovery limits).
		Surrogate recovery	Dynamic recovery limits as specified by the laboratory.
		Matrix spike recovery	Recovery 70% – 130% or dynamic recovery limits specified by laboratory. However note that recovery of phenols is generally significantly lower and a recovery in the range 20% to 130% is considered acceptable by most laboratories.
		Matrix spike recovery duplicate	RPD < 30%, or as specified by the laboratory.

Data Verification and Validation

The data validation process involved the checking of analytical procedure compliance with acceptance criteria and an assessment of the accuracy and precision of analytical data from the range of quality control indicators generated from both the sampling and analytical programmes.

The checks undertaken are summarised in the attached data validation checklist table (one column per sample batch/delivery group). Field replicate analytical results relevant to the project are summarised in the attached table.

Instances where the data quality acceptance criteria were not achieved are discussed below:

Trip Blanks and Rinsate Blanks

No trip blanks or rinsate blanks were taken as a part of the soil investigation. This is not considered to impact overall data reliability, as the risk of cross-contamination between samples during transit and between individual sample locations is considered to be low. More specifically, volatile organic compounds were not a key contaminant of concern, and the sampling hand auger was washed thoroughly between each sampling location.

Sample Temperature and Extraction Times

The laboratory noted for batches 762416-S, EM2021988 and EM2100608 the average sample temperature was marginally above the recommended holding temperature for the preservation of volatiles (<6 ºC). The laboratory noted that attempts to cool the samples were present (e.g. ice). This is not considered to have affected the laboratory results as the primary contaminants of concern are non-volatile and no volatile contaminants were detected in the primary samples during this round of sampling.

Field Duplicate RPDs (Blind and Split Samples)

Field duplicate RPDs were generally within Senversa's adopted acceptance criteria with the exception of some samples where the %RPDs were marginally outside the adopted acceptance criteria. These included:

- Some PAHs (acenaphthylene, anthracene, benzo(g,h,i)perylene, dibenz(a,h)anthracene, fluoranthene, indeno(1,2,3-c,d)pyrene, phenanthrene, pyrene, benzo(a)anthracene, benzo(a)pyrene, benzo(b+j)fluoranthene and chrysene).
- Some TRH fractions (TRH C15-C28, TRH C29-C36, TRH >C16-C34 and TRH >C34-C40).
- Some metals (lead, zinc, arsenic and chromium).

Additionally, RPD exceedances existed for summed compounds (total PAH and Benzo(a)pyrene TEQ), meaning that RPDs within the acceptable range for individual compounds have summed together to create an RPD exceeding acceptance criteria for the summed compound. These exceedances were considered to be attributed to the heterogeneous nature of the fill soils and did not affect the data interpretation, which assumes that elevated PAH concentrations are sporadically present across the site.

Internal Laboratory Quality Control Outliers

Laboratory report 767787 stated that some laboratory method blank RPDs for cation exchange capacity and calcium (exchangeable) were outside of the general laboratory acceptance criteria. Given that these analytes are physical parameters and not contaminants of concern, this is not considered to impact overall data quality.

Laboratory report 767787 stated that some matrix spike recoveries for lead, chromium, copper, mercury, nickel, tin, zinc and arsenic were outside the laboratory acceptance criteria. As acceptable recoveries were obtained for the laboratory control samples in the same batch, these poor recoveries can be likely attributed to a sample matrix interference rather than variations in analytical procedure. This is therefore not considered to impact overall data quality.

Data Suitability

While a small number of QC results were outside specified acceptance criteria, these were not considered to significantly impact on the quality or representativeness of the data, and majority of results indicated that the precision and accuracy of the data was within acceptable limits. The results are therefore considered to be representative of chemical concentrations in the environmental media sampled at the time of sampling, and to be suitable to be used for their intended purpose in forming conclusions relating to the contamination status of soil at the site.

Data Validation Checklist

Job Number:	M18310
Report Title:	Detailed Site Investigation: East Portion of Elwood Foreshore
Client:	City of Port Phillip
Completed By:	MoH
Date:	1-Apr-21
Verified By:	RG
Date:	7-Apr-21

SAMPLE DELIVERY GROUP (SDG):	**762416-S**	**SAMPLE DELIVERY GROUP (SDG):**	**EM2021988**	**SAMPLE DELIVERY GROUP (SDG):**	**767787-S**	**SAMPLE DELIVERY GROUP (SDG):**	**EM2100608**
Laboratory:	Eurofins	**Laboratory:**	ALS	**Laboratory:**	Eurofins	**Laboratory:**	ALS
Sample Dates:	8-Dec-20	**Sample Dates:**	8-Dec-20	**Sample Dates:**	12-13-Jan-21	**Sample Dates:**	12-13-Jan-21
Sample Media:	Soil	**Sample Media:**	Soil	**Sample Media:**	Soil	**Sample Media:**	Soil
Area:	Stage 1 area	**Area:**	Stage 1 area	**Area:**	Stage 2 area	**Area:**	Stage 2 area

Quality Assurance Process	**Objectives & Measure**	**Acceptance Criteria**	**Source of Information**	**Acceptance Criteria Met?**	**Notes/Details of Nonconformance**	**Acceptance Criteria Met?**	**Notes/Details of Nonconformance**	**Acceptance Criteria Met?**	**Notes/Details of Nonconformance**	**Acceptance Criteria Met?**	**Notes/Details of Nonconformance**
Standard Procedures	Standard field sampling procedures and forms used	No deviation from standard procedure and forms used.	Borelogs, field sheets, COCs, data tables	Yes		Yes		Yes		Yes	
Equipment Calibration	All equipment calibrated in accordance with manufacturers specifications	All equipment calibrated in accordance with manufacturers specifications.	Calibration Certificates / Records	N/A	No PID used	N/A		N/A		N/A	
Testing Method Accreditation	NATA accredited methods used for all analyses determined	Primary and secondary laboratories to use NATA accredited methods for all analytes determined.	Laboratory Report	Yes		Yes		Yes		Yes	
Quality Control Sampling Frequency	Field QC sampling frequency in accordance with AS4482.1-2005	Field (Intra-laboratory) Duplicates - ≥ 1 in 20 primary samples. (note that PFAS NEMP recommends 1 in 10 for PFAS investigations)	QA/QC register (within field book)	Yes		N/A		Yes		N/A	
		Secondary (inter-laboratory) duplicates - ≥ 1 in 20 primary samples. (note that PFAS NEMP recommends 1 in 10 for PFAS investigations)	QA/QC register (within field book)	N/A		Yes		N/A		Yes	
		Rinsate Blanks - ≥ 1 per day, per matrix per equipment.	QA/QC register (within field book)	N/A	No rinsate blanks collected	N/A		N/A	No rinsate blanks collected	N/A	
		Trip Blanks - ≥ 1 per esky containing samples for volatiles.	QA/QC register (within field book)	N/A	No trip blanks collected	N/A		N/A	No trip blanks collected	N/A	
	Laboratory QC analysis frequency in accordance with NEPC 2013	Laboratory Duplicates - at least 1 in 10 analyses or 1 per process batch.	Laboratory Reports	Yes		Yes		Yes			
		Method Blanks - at least 1 per process batch.	Laboratory Reports	Yes		Yes		Yes			
		Surrogate Recoveries - all samples spiked where appropriate (e.g. chromatographic analysis of organics).	Laboratory Reports	Yes		Yes		Yes			
		Laboratory Control Samples - at least 1 per process batch.	Laboratory Reports	Yes		Yes		Yes			
		Matrix Spikes - at least 1 per matrix type per process batch.	Laboratory Reports	Yes		Yes		Yes			
Sample Preservation, Handling and Holding Times	Samples appropriately preserved upon collection, stored and transported, and analysed within holding times	In accordance with laboratory specific method requirements. Unless specific method indicates otherwise, soil and water samples should be stored, transported and received by the laboratory at < 6°C.	Laboratory Reports	No	6.8°C - Attempt to chill was evident	No	6.2°C - Ice present	Yes	2.8°C - Attempt to chill evident	No	13.2°C - Ice bricks present
Data Management	No errors in data transcription	Entry of field data verified by peer.	10% check of electronically imported data (e.g. ESDAT). 100% check of manually entered data (e.g. field parameters, gauging data).	Yes		Yes		Yes		Yes	
Data Useability	Limits of reporting less than investigation levels	Limits of reporting less than relevant investigation levels.	Results Tables	Yes		Yes		Yes		Yes	

Quality Control Process	**Objectives & Measure**	**Acceptance Criteria**	**How? (i.e. ESDAT output, review lab reports, review data**								
Field (Intra-laboratory) Duplicate Sampling and Analysis	Field Duplicate samples used assess the variability in analyte concentration between samples collected from the sample location and the reproducibility of the laboratory analysis. Where required, resubmission of previously analysed samples for chemicals within their holding times may be undertaken to further assess precision level of precision.	Analysed for same chemicals as primary sample. RPD <30% of mean conc. where both conc. >20 x LOR RPD <50% of mean conc. where both conc. 10-20 x LOR RPD No limit where both conc. < 10 x LOR	ESDAT generated summary of relative percent difference (RPD) results for field duplicate samples.	No	Some RPD exceedances exist for acenaphthylene, anthracene, benzo(g,h,i)perylene, dibenz(a,h)anthracene, fluoranthene, indeno(1,2,3-c,d)pyrene, phenanthrene and pyrene as shown in attached Table.	N/A		No	Some RPD exceedances exist for lead, benzo(a)pyrene, chrysene, pyrene and fluoranthene as shown in attached Table.	N/A	
Secondary Inter-laborator) Duplicate Sampling and Analysis	Results are accurate and free from laboratory error. Secondary duplicate samples sent to a secondary laboratory to assess the accuracy of the analyte concentrations reported by the primary laboratory.	Analysed for same chemicals as primary sample. RPD <30% of mean conc. where both conc. >20 x LOR. RPD <50% of mean conc. where both conc. 10-20 x LOR. RPD no limit where both conc. < 10 x LOR.	ESDAT generated summary of relative percent difference (RPD) results for field duplicate samples.	N/A		No	Some RPD exceedances exist for benzo(a)anthracene, benzo(a)pyrene, benzo(b+j)fluoranthene, benzo(g,h,i)perylene, fluoranthene, phenanthrene, and pyrene as shown in attached Table.	N/A		No	Some RPD exceedances exist for moisture %, zinc, benzo(k)fluoranthene and chrysene as shown in attached Table.
Field Rinsate Blank Preparation & Analysis	Cross contamination of samples does not occur between sampling locations due to carry-over from sampling equipment.	Analyte concentrations below LORs.	ESDAT generated summary of field blank analytical results.	N/A	No rinsate blanks collected	N/A		N/A		N/A	
Trip Blank Sampling and Analysis	Cross contamination between samples does not occur in transit or as an artefact of the sampling handling procedure.	Analyte concentrations below LORs.	ESDAT generated summary of field blank analytical results.	N/A	No trip blanks collected	N/A		N/A		N/A	
Laboratory Duplicates	Laboratory duplicates are used to test the precision of the laboratory measurements.	As specified by laboratory.	Laboratory reports	Yes		Yes		No	RPD exceedances exist for benzo(g.h.i)perylene, benzo(k)fluoranthene, arsenic, zinc, chromium, % moisture, TRH C15-C28, TRH C29-C36, TRH >C16-C34, and TRH >C34-C40 as shown in attached table. RPDs reported pass internal laboratory acceptance criteria.	Yes	
Laboratory Control Samples	Laboratory control samples (LCS) are used to assess overall method performance. In general these samples are similar in composition to environmental samples, and contain known amounts of the analytes of interest.	Dynamic recovery limits as specified by laboratory.	Laboratory reports	Yes		Yes		Yes		Yes	
Certified Reference Material	CRM samples are used to monitor the accuracy of analyses performed by the laboratory.	As specified by laboratory (generally dynamic recovery limits). Usually not performed and assessed based on LCS results.	Laboratory reports	Yes		Yes		Yes		Yes	
Surrogate Recovery	Surrogates are organic compounds that are similar in chemical composition to analytes of interest and are spiked into environmental samples prior to sample preparation and analysis. Surrogate recoveries are used to evaluate matrix interference on a sample-specific basis.	Dynamic recovery limits as specified by laboratory.	Laboratory reports	Yes		Yes		Yes		Yes	
Matrix Spike Recovery	A matrix spike is an aliquot of a sample spiked with a known concentration of target analyte(s). Spiking occurs prior to sample preparation and analysis, and the results are used to assess the bias of a method in a given sample matrix.	Recovery 70 - 130% or dynamic limits if specified by laboratory.	Laboratory reports	Yes		Yes		No	Matrix spike outliers exist for lead, chromium, copper, mercury, nickel, tin, zinc and arsenic. An acceptable recovery was obtained for the laboratory control sample, indicating sample matrix interference.	Yes	
Laboratory Method Blanks	Method blanks are prepared to represent the sample matrix as closely as possible and prepared/extracted/digested and analysed exactly like field samples. These blanks are used by the laboratory to assess contamination introduced during sample preparation activities.	Analyte concentrations below LORs.	Laboratory reports	Yes		Yes		No	Laboratory method blank outliers exist for cation exhange capacity and calcium (exchangeable).	Yes	
Potentially Anomalous Data	No discrepancies between field, laboratory and/or expected results are identified	Analytical results are internally consistent, consistent with field measurements, and consistent with expected and/or historical results based on CSM	Multiple sources								

Data Validation Checklist

Job Number:	M18310
Report Title:	Detailed Site Investigation: East Portion of Elwood Foreshore
Client:	City of Port Phillip
Completed By:	MoH
Date:	1-Apr-21
Verified By:	RG
Date:	7-Apr-21

SAMPLE DELIVERY GROUP (SDG):	**771075**	**SAMPLE DELIVERY GROUP (SDG):**	**773807**	**SAMPLE DELIVERY GROUP (SDG):**	**778664**
Laboratory:	Eurofins	**Laboratory:**	Eurofins	**Laboratory:**	Eurofins
Sample Dates:	2-Feb-21	**Sample Dates:**	12-Feb-21	**Sample Dates:**	5-Mar-21
Sample Media:	Soil	**Sample Media:**	Soil	**Sample Media:**	Soil
Area:	Stage 2 area	**Area:**	Stage 2 area	**Area:**	Stage 2 area

Quality Assurance Process	**Objectives & Measure**	**Acceptance Criteria**	**Source of Information**	**Acceptance Criteria Met?**	**Notes/Details of Nonconformance**	**Acceptance Criteria Met?**	**Notes/Details of Nonconformance**	**Acceptance Criteria Met?**	**Notes/Details of Nonconformance**
Standard Procedures	Standard field sampling procedures and forms used	No deviation from standard procedure and forms used.	Borelogs, field sheets, COCs, data tables	Yes		Yes		Yes	
Equipment Calibration	All equipment calibrated in accordance with manufacturers specifications	All equipment calibrated in accordance with manufacturers specifications.	Calibration Certificates / Records	N/A		N/A		N/A	
Testing Method Accreditation	NATA accredited methods used for all analyses determined	Primary and secondary laboratories to use NATA accredited methods for all analytes determined.	Laboratory Report	Yes		Yes		Yes	
Quality Control Sampling Frequency	Field QC sampling frequency in accordance with AS4482.1-2005	Field (Intra-laboratory) Duplicates - ≥ 1 in 20 primary samples. (note that PFAS NEMP recommends 1 in 10 for PFAS investigations)	QA/QC register (within field book)	N/A		N/A		N/A	
		Secondary (inter-laboratory) duplicates - ≥ 1 in 20 primary samples. (note that PFAS NEMP recommends 1 in 10 for PFAS investigations)	QA/QC register (within field book)	N/A		N/A		N/A	
		Rinsate Blanks - ≥ 1 per day, per matrix per equipment.	QA/QC register (within field book)	N/A	No rinsate blanks collected	N/A	No rinsate blanks collected	N/A	No rinsate blanks collected
		Trip Blanks - ≥ 1 per esky containing samples for volatiles.	QA/QC register (within field book)	N/A	No trip blanks collected	N/A	No trip blanks collected	N/A	No trip blanks collected
	Laboratory QC analysis frequency in accordance with NEPC 2013	Laboratory Duplicates - at least 1 in 10 analyses or 1 per process batch.	Laboratory Reports	Yes		Yes		Yes	
		Method Blanks - at least 1 per process batch.	Laboratory Reports	Yes		Yes		Yes	
		Surrogate Recoveries - all samples spiked where appropriate (e.g. chromatographic analysis of organics).	Laboratory Reports	Yes		Yes		Yes	
		Laboratory Control Samples - at least 1 per process batch.	Laboratory Reports	Yes		Yes		Yes	
		Matrix Spikes - at least 1 per matrix type per process batch.	Laboratory Reports	Yes		Yes		Yes	
Sample Preservation, Handling and Holding Times	Samples appropriately preserved upon collection, stored and transported, and analysed within holding times	In accordance with laboratory specific method requirements. Unless specific method indicates otherwise, soil and water samples should be stored, transported and received by the laboratory at < 6°C.	Laboratory Reports	Yes	4.0°C - Attempt to chill evident	Yes		Yes	
Data Management	No errors in data transcription	Entry of field data verified by peer.	10% check of electronically imported data (e.g. ESDAT). 100% check of manually entered data (e.g. field parameters, gauging data).						
Data Useability	Limits of reporting less than investigation levels	Limits of reporting less than relevant investigation levels.	Results Tables						

Quality Control Process	**Objectives & Measure**	**Acceptance Criteria**	**How? (i.e. ESDAT output, review lab reports, review data**						
Field (Intra-laboratory) Duplicate Sampling and Analysis	Field Duplicate samples used assess the variability in analyte concentration between samples collected from the sample location and the reproducibility of the laboratory analysis. Where required, resubmission of previously analysed samples for chemicals within their holding times may be undertaken to further assess precision level of precision.	Analysed for same chemicals as primary sample. RPD <30% of mean conc. where both conc. >20 x LOR RPD <50% of mean conc. where both conc. 10-20 x LOR RPD No limit where both conc. < 10 x LOR	ESDAT generated summary of relative percent difference (RPD) results for field duplicate samples.	N/A		N/A		N/A	
Secondary Inter-laborator) Duplicate Sampling and Analysis	Results are accurate and free from laboratory error. Secondary duplicate samples sent to a secondary laboratory to assess the accuracy of the analyte concentrations reported by the primary laboratory.	Analysed for same chemicals as primary sample. RPD <30% of mean conc. where both conc. >20 x LOR. RPD <50% of mean conc. where both conc. 10-20 x LOR. RPD no limit where both conc. < 10 x LOR.	ESDAT generated summary of relative percent difference (RPD) results for field duplicate samples.	N/A		N/A		N/A	
Field Rinsate Blank Preparation & Analysis	Cross contamination of samples does not occur between sampling locations due to carry-over from sampling equipment.	Analyte concentrations below LORs.	ESDAT generated summary of field blank analytical results.	N/A		N/A		N/A	
Trip Blank Sampling and Analysis	Cross contamination between samples does not occur in transit or as an artefact of the sampling handling procedure.	Analyte concentrations below LORs.	ESDAT generated summary of field blank analytical results.	N/A		N/A		N/A	
Laboratory Duplicates	Laboratory duplicates are used to test the precision of the laboratory measurements.	As specified by laboratory.	Laboratory reports	Yes		No	RPD exceedances exist for zinc as shown in attached table. RPDs reported pass internal laboratory acceptance criteria.	Yes	
Laboratory Control Samples	Laboratory control samples (LCS) are used to assess overall method performance. In general these samples are similar in composition to environmental samples, and contain known amounts of the analytes of interest.	Dynamic recovery limits as specified by laboratory.	Laboratory reports	Yes		Yes		Yes	
Certified Reference Material	CRM samples are used to monitor the accuracy of analyses performed by the laboratory.	As specified by laboratory (generally dynamic recovery limits). Usually not performed and assessed based on LCS results.	Laboratory reports	Yes		Yes		Yes	
Surrogate Recovery	Surrogates are organic compounds that are similar in chemical composition to analytes of interest and are spiked into environmental samples prior to sample preparation and analysis. Surrogate recoveries are used to evaluate matrix interference on a sample-specific basis.	Dynamic recovery limits as specified by laboratory.	Laboratory reports	Yes		Yes		Yes	
Matrix Spike Recovery	A matrix spike is an aliquot of a sample spiked with a known concentration of target analyte(s). Spiking occurs prior to sample preparation and analysis, and the results are used to assess the bias of a method in a given sample matrix.	Recovery 70 - 130% or dynamic limits if specified by laboratory.	Laboratory reports	Yes		Yes		Yes	
Laboratory Method Blanks	Method blanks are prepared to represent the sample matrix as closely as possible and prepared/extracted/digested and analysed exactly like field samples. These blanks are used by the laboratory to assess contamination introduced during sample preparation activities.	Analyte concentrations below LORs.	Laboratory reports	Yes		Yes		Yes	
Potentially Anomalous Data	No discrepancies between field, laboratory and/or expected results are identified	Analytical results are internally consistent, consistent with field measurements, and consistent with expected and/or historical results based on CSM	Multiple sources						

Soil Duplicate Sample RPDs - HHRA and DSI, Elwood Foreshore, Elwood

Location Code			SB35	SB35		SB35	SB35		SB16	SB16		SB16	SB16		SB31	SB31		SB31	SB31	
Field ID			SB35_0.1-0.2	QC01		SB35_0.1-0.2	QC02		SB16_0.05-0.15	QC03		SB16_0.05-0.15	QC04		SB31_0.1-0.2	QC05		SB31_0.1-0.2	QC06	
Date			12/01/2021	12/01/2021		12/01/2021	12/01/2021		13/01/2021	13/01/2021		13/01/2021	13/01/2021		13/01/2021	13/01/2021		13/01/2021	13/01/2021	
Sample Type			Normal	Field_D		Normal	Interlab_D		Normal	Field_D		Normal	Interlab_D		Normal	Field_D		Normal	Interlab_D	
Lab Report No.			767787	767787	RPD	767787	EM2100608	RPD	767787	767787	RPD	767787	EM2100608	RPD	767787	767787	RPD	767787	EM2100608	RPD
	Unit	EQL																		
Physical Parameters																				
Moisture Content	%	1	9.8	8.9	10	9.8	8.1	19	8.4	8.9	6	8.4	6.3	29	22	17	26	22	15.4	**35**
pH (aqueous extract)	pH Units	0.1	7.0			7.0														
Inorganics																				
Cyanide (Total)	mg/kg	5	<5			<5														
Fluoride	mg/kg	100	160			160														
Metals																				
Arsenic	mg/kg	2	21	26	21	21	17	21	10	12	18	10	16	46	4.9	6.6	30	4.9	<5	0
Cadmium	mg/kg	0.4	<0.4	<0.4	0	<0.4	<1	0	<0.4	<0.4	0	<0.4	<1	0	<0.4	<0.4	0	<0.4	<1	0
Chromium	mg/kg	2	26	32	21	26	20	26	12	14	15	12	15	22	15	15	0	15	14	7
Chromium(VI)	mg/kg	1	<1			<1														
Copper	mg/kg	5	17	12	34	17	15	12	50	57	13	50	79	45	24	33	32	24	20	18
Lead	mg/kg	5	100	56	**56**	100	81	21	330	250	28	330	340	3	130	170	27	130	104	22
Mercury	mg/kg	0.1	<0.1	0.1	0	<0.1	<0.1	0	<0.2	0.2	0	<0.2	0.2	0	<0.1	0.1	0	<0.1	<0.1	0
Molybdenum	mg/kg	5	<5			<5														
Nickel	mg/kg	2	16	16	0	16	15	6	17	20	16	17	23	30	14	17	19	14	11	24
Selenium	mg/kg	2	<2			<2														
Silver	mg/kg	2	<2			<2														
Tin	mg/kg	10	<10			<10														
Zinc	mg/kg	5	100	72	33	100	87	14	320	330	3	320	494	**43**	120	150	22	120	112	7
BTEX																				
Benzene	mg/kg	0.1	<0.1	<0.1	0	<0.1	<0.2	0	<0.1	<0.1	0	<0.1	<0.2	0	<0.1	<0.1	0	<0.1	<0.2	0
Toluene	mg/kg	0.1	<0.1	<0.1	0	<0.1	<0.5	0	<0.1	<0.1	0	<0.1	<0.5	0	<0.1	<0.1	0	<0.1	<0.5	0
Ethylbenzene	mg/kg	0.1	<0.1	<0.1	0	<0.1	<0.5	0	<0.1	<0.1	0	<0.1	<0.5	0	<0.1	<0.1	0	<0.1	<0.5	0
Xylene (m & p)	mg/kg	0.2	<0.2	<0.2	0	<0.2	<0.5	0	<0.2	<0.2	0	<0.2	<0.5	0	<0.2	<0.2	0	<0.2	<0.5	0
Xylene (o)	mg/kg	0.1	<0.1	<0.1	0	<0.1	<0.5	0	<0.1	<0.1	0	<0.1	<0.5	0	<0.1	<0.1	0	<0.1	<0.5	0
Total Xylene	mg/kg	0.3	<0.3	<0.3	0	<0.3	<0.5	0	<0.3	<0.3	0	<0.3	<0.5	0	<0.3	<0.3	0	<0.3	<0.5	0
Total BTEX	mg/kg	0.2					<0.2						<0.2						<0.2	
Total Petroleum Hydrocarbons																				
C6-C9 Fraction	mg/kg	10	<20	<20	0	<20	<10	0	<20	<20	0	<20	<10	0	<20	<20	0	<20	<10	0
C10-C14 Fraction	mg/kg	20	<20	<20	0	<20	<50	0	<20	<20	0	<20	<50	0	<20	<20	0	<20	<50	0
C15-C28 Fraction	mg/kg	50	230	98	80	230	170	30	300	320	6	300	280	7	180	230	24	180	<100	57
C29-C36 Fraction	mg/kg	50	280	130	73	280	180	43	310	400	25	310	340	9	170	260	42	170	110	43
C10-C36 Fraction (Sum)	mg/kg	50	510	228	**76**	510	350	37	610	720	17	610	620	2	350	490	33	350	110	104
Total Recoverable Hydrocarbons																				
C6-C10 Fraction	mg/kg	10	<20	<20	0	<20	<10	0	<20	<20	0	<20	<10	0	<20	<20	0	<20	<10	0
C6-C10 Fraction minus BTEX (F1)	mg/kg	10	<20	<20	0	<20	<10	0	<20	<20	0	<20	<10	0	<20	<20	0	<20	<10	0
>C10-C16 Fraction	mg/kg	50	<50	<50	0	<50	<50	0	<50	<50	0	<50	<50	0	<50	<50	0	<50	<50	0
>C10-C16 Fraction minus naphthalene (F2)	mg/kg	50	<50	<50	0	<50	<50	0	<50	<50	0	<50	<50	0	<50	<50	0	<50	<50	0
>C16-C34 Fraction	mg/kg	100	410	180	78	410	310	28	530	600	12	530	540	2	300	410	31	300	160	61
>C34-C40 Fraction	mg/kg	100	110	<100	10	110	<100	10	180	260	36	180	170	6	120	200	50	120	<100	18
>C10-C40 Fraction (Sum)	mg/kg	50	520	180	97	520	310	51	710	860	19	710	710	0	420	610	37	420	160	90
PAHs																				
Acenaphthene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0
Acenaphthylene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	0.6	18	<0.5	<0.5	0	<0.5	<0.5	0
Anthracene	mg/kg	0.5	<0.5	<0.5	0	<0.5	0.7	33	<0.5	0.6	18	<0.5	0.9	57	<0.5	<0.5	0	<0.5	<0.5	0
Benz(a)anthracene	mg/kg	0.5	3.1	0.9	110	3.1	2.7	14	4.4	7.2	48	4.4	4.1	7	1.3	3.2	84	1.3	1.0	26
Benzo(a)pyrene	mg/kg	0.5	5.9	1.5	**119**	5.9	3.6	48	6.6	8.1	20	6.6	7.1	7	2.3	2.9	23	2.3	1.2	63
Benzo(b+j)fluoranthene	mg/kg	0.5	4.1	1.2	109	4.1	4.1	0	5.3	7.6	36	5.3	8.0	41	1.7	2.8	49	1.7	1.4	19
Benzo(g,h,i)perylene	mg/kg	0.5	2.4	0.7	110	2.4	2.5	4	4.7	6.7	35	4.7	5.7	19	1.6	2.3	36	1.6	0.8	67
Benzo(k)fluoranthene	mg/kg	0.5	4.0	1.3	102	4.0	1.3	102	5.9	7.8	28	5.9	2.5	**81**	2.0	3.0	40	2.0	<0.5	120
Chrysene	mg/kg	0.5	6.1	1.1	**139**	6.1	2.5	**84**	4.7	7.0	39	4.7	4.2	11	1.7	2.9	52	1.7	0.9	62
Dibenz(a,h)anthracene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0	1.8	3.0	50	1.8	1.0	57	<0.5	1.1	75	<0.5	<0.5	0
Fluoranthene	mg/kg	0.5	4.9	1.7	97	4.9	5.2	6	8.0	11	**32**	8.0	7.6	5	3.0	5.9	**65**	3.0	1.7	55
Fluorene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0
Indeno(1,2,3-c,d)pyrene	mg/kg	0.5	1.4	0.6	80	1.4	1.9	30	4.7	7.4	45	4.7	4.2	11	1.3	2.1	47	1.3	0.6	74
Naphthalene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0	<0.5	<0.5	0
Phenanthrene	mg/kg	0.5	2.5	0.6	123	2.5	2.3	8	2.1	3.3	44	2.1	2.6	21	1.1	1.8	48	1.1	0.5	75
Pyrene	mg/kg	0.5	6.1	1.8	**109**	6.1	5.4	12	8.5	13	**42**	8.5	7.9	7	3.2	5.9	**59**	3.2	1.9	51
Benzo(a)pyrene TEQ (Zero)	mg/kg	0.5	7.2	1.9	**116**	7.2	4.6	44	11	14	24	11	10.1	9	3.0	5.2	**54**	3.0	1.5	67
Sum of Polycyclic aromatic hydrocarbons (PAH)	mg/kg	0.5	40.5	11.4	**112**	40.5	32.2	23	56.7	82.7	**37**	56.7	56.4	1	19.2	33.9	**55**	19.2	10.0	**63**
Phenols																				
2-Methylphenol	mg/kg	0.2	<0.2			<0.2														
2-Nitrophenol	mg/kg	1	<1			<1														
2,4-Dimethylphenol	mg/kg	0.5	<0.5			<0.5														
2,4-Dinitrophenol	mg/kg	5	<5			<5														
3-&4-Methylphenol (m&p-cresol)	mg/kg	0.4	<0.4			<0.4														
4-Chloro-3-methylphenol	mg/kg	1	<1			<1														
4-Nitrophenol	mg/kg	5	<5			<5														
4,6-Dinitro-2-methylphenol	mg/kg	5	<5			<5														
4,6-Dinitro-o-cyclohexyl phenol	mg/kg	20	<20			<20														
Phenol	mg/kg	0.5	<0.5			<0.5														
Phenols (non-halogenated)	mg/kg	20	<20			<20														
MAH																				
1,2,4-Trimethylbenzene	mg/kg	0.5	<0.5			<0.5														
1,3,5-Trimethylbenzene	mg/kg	0.5	<0.5			<0.5														
Isopropylbenzene	mg/kg	0.5	<0.5			<0.5														
Styrene	mg/kg	0.5	<0.5			<0.5														
Total Monocylic Aromatic Hydrocarbons	mg/kg	0.5	<0.5			<0.5														
Halogenated Benzenes																				
1,2-Dichlorobenzene	mg/kg	0.5	<0.5			<0.5														
1,2,4-Trichlorobenzene	mg/kg	0.5	<0.5			<0.5														
1,3-Dichlorobenzene	mg/kg	0.5	<0.5			<0.5														
1,4-Dichlorobenzene	mg/kg	0.5	<0.5			<0.5														
4-Chlorotoluene	mg/kg	0.5	<0.5			<0.5														
Bromobenzene	mg/kg	0.5	<0.5			<0.5														
Chlorobenzene	mg/kg	0.5	<0.5			<0.5														
Halogenated Hydrocarbons																				
1,2-Dibromoethane	mg/kg	0.5	<0.5			<0.5														
Bromomethane	mg/kg	0.5	<0.5			<0.5														
Dichlorodifluoromethane	mg/kg	0.5	<0.5			<0.5														
Iodomethane	mg/kg	0.5	<0.5			<0.5														
Trichlorofluoromethane	mg/kg	0.5	<0.5			<0.5														

Soil Duplicate Sample RPDs - HHRA and DSI, Elwood Foreshore, Elwood

Location Code			SB35	SB35		SB35	SB35		SB16	SB16		SB16	SB16		SB31	SB31		SB31	SB31	
Field ID			SB35_0.1-0.2	QC01		SB35_0.1-0.2	QC02		SB16_0.05-0.15	QC03		SB16_0.05-0.15	QC04		SB31_0.1-0.2	QC05		SB31_0.1-0.2	QC06	
Date			12/01/2021	12/01/2021		12/01/2021	12/01/2021		13/01/2021	13/01/2021		13/01/2021	13/01/2021		13/01/2021	13/01/2021		13/01/2021	13/01/2021	
Sample Type			Normal	Field_D		Normal	Interlab_D		Normal	Field_D		Normal	Interlab_D		Normal	Field_D		Normal	Interlab_D	
Lab Report No.			767787	767787	RPD	767787	EM2100608	RPD	767787	767787	RPD	767787	EM2100608	RPD	767787	767787	RPD	767787	EM2100608	RPD
	Unit	EQL																		
Chlorinated Hydrocarbons																				
1,1-Dichloroethane	mg/kg	0.5	<0.5			<0.5														
1,1-Dichloroethene	mg/kg	0.5	<0.5			<0.5														
1,1,1,2-Tetrachloroethane	mg/kg	0.5	<0.5			<0.5														
1,1,1-Trichloroethane	mg/kg	0.5	<0.5			<0.5														
1,1,2-Trichloroethane	mg/kg	0.5	<0.5			<0.5														
1,1,2,2-Tetrachloroethane	mg/kg	0.5	<0.5			<0.5														
1,2,3-Trichloropropane	mg/kg	0.5	<0.5			<0.5														
1,2-Dichloroethane	mg/kg	0.5	<0.5			<0.5														
1,3-Dichloropropane	mg/kg	0.5	<0.5			<0.5														
1,2-Dichloropropane	mg/kg	0.5	<0.5			<0.5														
Bromochloromethane	mg/kg	0.5	<0.5			<0.5														
Bromodichloromethane	mg/kg	0.5	<0.5			<0.5														
Bromoform	mg/kg	0.5	<0.5			<0.5														
Carbon Tetrachloride	mg/kg	0.5	<0.5			<0.5														
Chlorodibromomethane	mg/kg	0.5	<0.5			<0.5														
Chloroethane	mg/kg	0.5	<0.5			<0.5														
Chloroform	mg/kg	0.5	<0.5			<0.5														
Chloromethane	mg/kg	0.5	<0.5			<0.5														
cis-1,2-Dichloroethene	mg/kg	0.5	<0.5			<0.5														
Dibromomethane	mg/kg	0.5	<0.5			<0.5														
cis-1,3-Dichloropropene	mg/kg	0.5	<0.5			<0.5														
Dichloromethane	mg/kg	0.5	<0.5			<0.5														
Hexachlorobutadiene	mg/kg	0.5	<0.5			<0.5														
Tetrachloroethene	mg/kg	0.5	<0.5			<0.5														
trans-1,2-Dichloroethene	mg/kg	0.5	<0.5			<0.5														
trans-1,3-Dichloropropene	mg/kg	0.5	<0.5			<0.5														
Trichloroethene	mg/kg	0.5	<0.5			<0.5														
Vinyl Chloride	mg/kg	0.5	<0.5			<0.5														
Total Chlorinated Hydrocarbons	mg/kg	0.5	<0.5			<0.5														
Total Other Chlorinated Hydrocarbons	mg/kg	0.5	<0.5			<0.5														
Halogenated Phenols																				
2,4,5-Trichlorophenol	mg/kg	1	<1			<1														
2,4,6-Trichlorophenol	mg/kg	1	<1			<1														
2,4-Dichlorophenol	mg/kg	0.5	<0.5			<0.5														
2,6-Dichlorophenol	mg/kg	0.5	<0.5			<0.5														
2-Chlorophenol	mg/kg	0.5	<0.5			<0.5														
Pentachlorophenol	mg/kg	1	<1			<1														
Tetrachlorophenols	mg/kg	10	<10			<10														
Phenols (Halogenated)	mg/kg	1	<1			<1														
Organochlorine Pesticides																				
a-BHC	mg/kg	0.05	<0.05			<0.05														
b-BHC	mg/kg	0.05	<0.05			<0.05														
d-BHC	mg/kg	0.05	<0.05			<0.05														
Dieldrin	mg/kg	0.05	<0.05			<0.05														
g-BHC (Lindane)	mg/kg	0.05	<0.05			<0.05														
Aldrin	mg/kg	0.05	<0.05			<0.05														
Aldrin + Dieldrin	mg/kg	0.05	<0.05			<0.05														
Chlordane	mg/kg	0.1	<0.1			<0.1														
DDT	mg/kg	0.05	<0.05			<0.05														
4,4-DDE	mg/kg	0.05	<0.05			<0.05														
DDD	mg/kg	0.05	<0.05			<0.05														
DDT+DDE+DDD	mg/kg	0.05	<0.05			<0.05														
Endosulfan I	mg/kg	0.05	<0.05			<0.05														
Endosulfan II	mg/kg	0.05	<0.05			<0.05														
Endosulfan sulfate	mg/kg	0.05	<0.05			<0.05														
Endrin	mg/kg	0.05	<0.05			<0.05														
Endrin aldehyde	mg/kg	0.05	<0.05			<0.05														
Endrin ketone	mg/kg	0.05	<0.05			<0.05														
Heptachlor	mg/kg	0.05	<0.05			<0.05														
Heptachlor epoxide	mg/kg	0.05	<0.05			<0.05														
Methoxychlor	mg/kg	0.05	<0.05			<0.05														
Toxaphene	mg/kg	0.1	<0.1			<0.1														
Organochlorine Pesticides (EPAVic)	mg/kg	0.1	<0.1			<0.1														
Other Organochlorine Pesticides (EPAVic)	mg/kg	0.1	<0.1			<0.1														
Herbicides																				
Dinoseb	mg/kg	20	<20			<20														
Fungicides																				
Hexachlorobenzene	mg/kg	0.05	<0.05			<0.05														
Polychlorinated Biphenyls																				
Aroclor 1016	mg/kg	0.1	<0.2			<0.2														
Aroclor 1221	mg/kg	0.1	<0.2			<0.2														
Aroclor 1232	mg/kg	0.1	<0.2			<0.2														
Aroclor 1242	mg/kg	0.1	<0.2			<0.2														
Aroclor 1248	mg/kg	0.1	<0.2			<0.2														
Aroclor 1254	mg/kg	0.1	<0.2			<0.2														
Aroclor 1260	mg/kg	0.1	<0.2			<0.2														
PCBs (Sum of total)	mg/kg	0.1	<0.2			<0.2														
Solvents																				
Methyl Ethyl Ketone (MEK)	mg/kg	0.5	<0.5			<0.5														
4-Methyl-2-pentanone	mg/kg	0.5	<0.5			<0.5														
Acetone	mg/kg	0.5	<0.5			<0.5														
Allyl chloride	mg/kg	0.5	<0.5			<0.5														
Carbon disulfide	mg/kg	0.5	<0.5			<0.5														

***RPDs have only been considered where a concentration is greater than 1 times the EQL.**
****Elevated RPDs are highlighted as per QAQC Profile settings (Acceptable RPDs for each EQL multiplier range are: 1000 (1 - 10 x EQL); 50 (10 - 20 x EQL); 30 (> 20 x EQL))**
*****Interlab Duplicates are matched on a per compound basis as methods vary between laboratories. Any methods in the row header relate to those used in the primary laboratory**

Appendix F: 95% $UCL_{Average}$ Calculations

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.18/04/2021 9:39:08 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead

General Statistics

Total Number of Observations	169	Number of Distinct Observations	99
Number of Detects	162	Number of Non-Detects	7
Number of Distinct Detects	98	Number of Distinct Non-Detects	1
Minimum Detect	5.3	Minimum Non-Detect	5
Maximum Detect	1200	Maximum Non-Detect	5
Variance Detects	31560	Percent Non-Detects	4.142%
Mean Detects	133.5	SD Detects	177.7
Median Detects	71	CV Detects	1.331
Skewness Detects	3.456	Kurtosis Detects	14.89
Mean of Logged Detects	4.357	SD of Logged Detects	1.01

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.625	**Normal GOF Test on Detected Observations Only**
5% Shapiro Wilk P Value	0	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.238	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.07	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	128.1	KM Standard Error of Mean	13.52
KM SD	175.3	95% KM (BCA) UCL	151.1
95% KM (t) UCL	150.5	95% KM (Percentile Bootstrap) UCL	151
95% KM (z) UCL	150.4	95% KM Bootstrap t UCL	156.5
90% KM Chebyshev UCL	168.7	95% KM Chebyshev UCL	187.1
97.5% KM Chebyshev UCL	212.6	99% KM Chebyshev UCL	262.7

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	3.727	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.782	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.12	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.0755	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.068	k star (bias corrected MLE)	1.052
Theta hat (MLE)	125	Theta star (bias corrected MLE)	126.8
nu hat (MLE)	346	nu star (bias corrected)	340.9
Mean (detects)	133.5		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	127.9
Maximum	1200	Median	63
SD	175.9	CV	1.375
k hat (MLE)	0.699	k star (bias corrected MLE)	0.69
Theta hat (MLE)	183.1	Theta star (bias corrected MLE)	185.4
nu hat (MLE)	236.1	nu star (bias corrected)	233.3
Adjusted Level of Significance (β)	0.0486		
Approximate Chi Square Value (233.26, α)	198.9	Adjusted Chi Square Value (233.26, β)	198.6
95% Gamma Approximate UCL (use when n>=50)	150	95% Gamma Adjusted UCL (use when n<50)	150.2

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	128.1	SD (KM)	175.3
Variance (KM)	30721	SE of Mean (KM)	13.52
k hat (KM)	0.534	k star (KM)	0.529
nu hat (KM)	180.7	nu star (KM)	178.8
theta hat (KM)	239.7	theta star (KM)	242.3
80% gamma percentile (KM)	210.9	90% gamma percentile (KM)	342.6
95% gamma percentile (KM)	482.5	99% gamma percentile (KM)	824.5

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (178.78, α)	148.9	Adjusted Chi Square Value (178.78, β)	148.6
95% Gamma Approximate KM-UCL (use when n>=50)	153.9	95% Gamma Adjusted KM-UCL (use when n<50)	154.1

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Approximate Test Statistic	0.982	**Shapiro Wilk GOF Test**
5% Shapiro Wilk P Value	0.508	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.0719	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.07	Detected Data Not Lognormal at 5% Significance Level

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	128.2	Mean in Log Scale	4.256
SD in Original Scale	175.7	SD in Log Scale	1.105
95% t UCL (assumes normality of ROS data)	150.6	95% Percentile Bootstrap UCL	152.3
95% BCA Bootstrap UCL	155	95% Bootstrap t UCL	154.9
95% H-UCL (Log ROS)	157.4		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	4.244	KM Geo Mean	69.66
KM SD (logged)	1.128	95% Critical H Value (KM-Log)	2.276
KM Standard Error of Mean (logged)	0.087	95% H-UCL (KM -Log)	160.4
KM SD (logged)	1.128	95% Critical H Value (KM-Log)	2.276
KM Standard Error of Mean (logged)	0.087		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	128	Mean in Log Scale	4.215
SD in Original Scale	175.9	SD in Log Scale	1.204
95% t UCL (Assumes normality)	150.4	95% H-Stat UCL	173.9

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

KM H-UCL 160.4

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

TRH_C16-C34

General Statistics

Total Number of Observations	159	Number of Distinct Observations	72
		Number of Missing Observations	3
Number of Detects	128	Number of Non-Detects	31
Number of Distinct Detects	72	Number of Distinct Non-Detects	1
Minimum Detect	66	Minimum Non-Detect	100
Maximum Detect	9500	Maximum Non-Detect	100
Variance Detects	2378167	Percent Non-Detects	19.5%
Mean Detects	853.1	SD Detects	1542
Median Detects	410	CV Detects	1.808
Skewness Detects	4.294	Kurtosis Detects	19.72
Mean of Logged Detects	6.073	SD of Logged Detects	1.049

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.467	**Normal GOF Test on Detected Observations Only**
5% Shapiro Wilk P Value	0	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.305	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.0787	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	700.7	KM Standard Error of Mean	112.5
KM SD	1413	95% KM (BCA) UCL	901.8
95% KM (t) UCL	886.7	95% KM (Percentile Bootstrap) UCL	901.2
95% KM (z) UCL	885.7	95% KM Bootstrap t UCL	952.7
90% KM Chebyshev UCL	1038	95% KM Chebyshev UCL	1191
97.5% KM Chebyshev UCL	1403	99% KM Chebyshev UCL	1820

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	5.517	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.79	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.153	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.0851	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.869	k star (bias corrected MLE)	0.854
Theta hat (MLE)	982	Theta star (bias corrected MLE)	999.4
nu hat (MLE)	222.4	nu star (bias corrected)	218.5
Mean (detects)	853.1		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	686.8
Maximum	9500	Median	290
SD	1424	CV	2.073
k hat (MLE)	0.275	k star (bias corrected MLE)	0.274
Theta hat (MLE)	2495	Theta star (bias corrected MLE)	2505
nu hat (MLE)	87.52	nu star (bias corrected)	87.2
Adjusted Level of Significance (β)	0.0485		
Approximate Chi Square Value (87.20, α)	66.68	Adjusted Chi Square Value (87.20, β)	66.51
95% Gamma Approximate UCL (use when n>=50)	898.3	95% Gamma Adjusted UCL (use when n<50)	900.5

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	700.7	SD (KM)	1413
Variance (KM)	1995567	SE of Mean (KM)	112.5
k hat (KM)	0.246	k star (KM)	0.246
nu hat (KM)	78.23	nu star (KM)	78.09
theta hat (KM)	2848	theta star (KM)	2853
80% gamma percentile (KM)	1011	90% gamma percentile (KM)	2106
95% gamma percentile (KM)	3410	99% gamma percentile (KM)	6889

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (78.09, α)	58.73	Adjusted Chi Square Value (78.09, β)	58.58
95% Gamma Approximate KM-UCL (use when n>=50)	931.6	95% Gamma Adjusted KM-UCL (use when n<50)	934

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Approximate Test Statistic	0.948	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk P Value	1.9558E-4	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.0618	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.0787	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	697	Mean in Log Scale	5.634
SD in Original Scale	1419	SD in Log Scale	1.323
95% t UCL (assumes normality of ROS data)	883.2	95% Percentile Bootstrap UCL	892.3
95% BCA Bootstrap UCL	925.5	95% Bootstrap t UCL	960.5
95% H-UCL (Log ROS)	875.5		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	5.719	KM Geo Mean	304.8
KM SD (logged)	1.181	95% Critical H Value (KM-Log)	2.384
KM Standard Error of Mean (logged)	0.0945	95% H-UCL (KM -Log)	766.2
KM SD (logged)	1.181	95% Critical H Value (KM-Log)	2.384
KM Standard Error of Mean (logged)	0.0945		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	696.6	Mean in Log Scale	5.652
SD in Original Scale	1419	SD in Log Scale	1.273
95% t UCL (Assumes normality)	882.7	95% H-Stat UCL	823.4

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

KM H-UCL 766.2

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

BAP-TEQ

General Statistics

Total Number of Observations	183	Number of Distinct Observations	87
Number of Detects	141	Number of Non-Detects	42
Number of Distinct Detects	86	Number of Distinct Non-Detects	2
Minimum Detect	0.3	Minimum Non-Detect	0.1
Maximum Detect	410	Maximum Non-Detect	0.5
Variance Detects	2226	Percent Non-Detects	22.95%
Mean Detects	20.47	SD Detects	47.18
Median Detects	7.2	CV Detects	2.305
Skewness Detects	5.311	Kurtosis Detects	35.68
Mean of Logged Detects	1.855	SD of Logged Detects	1.486

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.444	**Normal GOF Test on Detected Observations Only**
5% Shapiro Wilk P Value	0	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.335	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.075	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	15.82	KM Standard Error of Mean	3.126
KM SD	42.13	95% KM (BCA) UCL	21.24
95% KM (t) UCL	20.98	95% KM (Percentile Bootstrap) UCL	21.36
95% KM (z) UCL	20.96	95% KM Bootstrap t UCL	23.84
90% KM Chebyshev UCL	25.19	95% KM Chebyshev UCL	29.44
97.5% KM Chebyshev UCL	35.34	99% KM Chebyshev UCL	46.92

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	5.398	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.816	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.161	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.0832	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.539	k star (bias corrected MLE)	0.532
Theta hat (MLE)	37.96	Theta star (bias corrected MLE)	38.44
nu hat (MLE)	152.1	nu star (bias corrected)	150.2
Mean (detects)	20.47		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	15.77
Maximum	410	Median	3.1
SD	42.27	CV	2.68
k hat (MLE)	0.29	k star (bias corrected MLE)	0.289
Theta hat (MLE)	54.3	Theta star (bias corrected MLE)	54.51
nu hat (MLE)	106.3	nu star (bias corrected)	105.9
Adjusted Level of Significance (β)	0.0487		
Approximate Chi Square Value (105.91, α)	83.16	Adjusted Chi Square Value (105.91, β)	83
95% Gamma Approximate UCL (use when n>=50)	20.09	95% Gamma Adjusted UCL (use when n<50)	20.13

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	15.82	SD (KM)	42.13
Variance (KM)	1775	SE of Mean (KM)	3.126
k hat (KM)	0.141	k star (KM)	0.142
nu hat (KM)	51.57	nu star (KM)	52.06
theta hat (KM)	112.2	theta star (KM)	111.2
80% gamma percentile (KM)	16.45	90% gamma percentile (KM)	46.52
95% gamma percentile (KM)	87.92	99% gamma percentile (KM)	209.4

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (52.06, α)	36.49	Adjusted Chi Square Value (52.06, β)	36.38
95% Gamma Approximate KM-UCL (use when n>=50)	22.57	95% Gamma Adjusted KM-UCL (use when n<50)	22.63

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Approximate Test Statistic	0.967	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk P Value	0.0304	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.0594	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.075	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	15.84	Mean in Log Scale	1.073
SD in Original Scale	42.24	SD in Log Scale	1.985
95% t UCL (assumes normality of ROS data)	21	95% Percentile Bootstrap UCL	21.56
95% BCA Bootstrap UCL	23.04	95% Bootstrap t UCL	23.86
95% H-UCL (Log ROS)	33.53		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	1.024	KM Geo Mean	2.783
KM SD (logged)	2.019	95% Critical H Value (KM-Log)	3.232
KM Standard Error of Mean (logged)	0.174	95% H-UCL (KM -Log)	34.66
KM SD (logged)	2.019	95% Critical H Value (KM-Log)	3.232
KM Standard Error of Mean (logged)	0.174		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	15.83	Mean in Log Scale	1.102
SD in Original Scale	42.25	SD in Log Scale	1.904
95% t UCL (Assumes normality)	20.99	95% H-Stat UCL	28.54

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

KM H-UCL 34.66

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

TotalPAH

General Statistics

Total Number of Observations	183	Number of Distinct Observations	139
Number of Detects	152	Number of Non-Detects	31
Number of Distinct Detects	137	Number of Distinct Non-Detects	2
Minimum Detect	1	Minimum Non-Detect	0.1
Maximum Detect	2237	Maximum Non-Detect	0.5
Variance Detects	98533	Percent Non-Detects	16.94%
Mean Detects	128.1	SD Detects	313.9
Median Detects	38.7	CV Detects	2.451
Skewness Detects	4.509	Kurtosis Detects	22.21
Mean of Logged Detects	3.442	SD of Logged Detects	1.709

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.423	**Normal GOF Test on Detected Observations Only**
5% Shapiro Wilk P Value	0	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.343	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.0723	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	106.4	KM Standard Error of Mean	21.45
KM SD	289.2	95% KM (BCA) UCL	144.4
95% KM (t) UCL	141.9	95% KM (Percentile Bootstrap) UCL	143.2
95% KM (z) UCL	141.7	95% KM Bootstrap t UCL	157.7
90% KM Chebyshev UCL	170.7	95% KM Chebyshev UCL	199.9
97.5% KM Chebyshev UCL	240.3	99% KM Chebyshev UCL	319.8

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	5.521	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.83	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.156	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.0809	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.457	k star (bias corrected MLE)	0.452
Theta hat (MLE)	280.5	Theta star (bias corrected MLE)	283.4
nu hat (MLE)	138.8	nu star (bias corrected)	137.4
Mean (detects)	128.1		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	106.4
Maximum	2237	Median	20.3
SD	289.9	CV	2.725
k hat (MLE)	0.271	k star (bias corrected MLE)	0.27
Theta hat (MLE)	392.8	Theta star (bias corrected MLE)	393.9
nu hat (MLE)	99.14	nu star (bias corrected)	98.85
Adjusted Level of Significance (β)	0.0487		
Approximate Chi Square Value (98.85, α)	76.91	Adjusted Chi Square Value (98.85, β)	76.76
95% Gamma Approximate UCL (use when n>=50)	136.7	95% Gamma Adjusted UCL (use when n<50)	137

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	106.4	SD (KM)	289.2
Variance (KM)	83608	SE of Mean (KM)	21.45
k hat (KM)	0.135	k star (KM)	0.137
nu hat (KM)	49.57	nu star (KM)	50.09
theta hat (KM)	785.7	theta star (KM)	777.6
80% gamma percentile (KM)	106.9	90% gamma percentile (KM)	310.8
95% gamma percentile (KM)	595.5	99% gamma percentile (KM)	1438

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (50.09, α)	34.84	Adjusted Chi Square Value (50.09, β)	34.74
95% Gamma Approximate KM-UCL (use when n>=50)	153	95% Gamma Adjusted KM-UCL (use when n<50)	153.4

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Approximate Test Statistic	0.969	**Shapiro Wilk GOF Test**
5% Shapiro Wilk P Value	0.0433	Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.0555	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.0723	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	106.5	Mean in Log Scale	2.787
SD in Original Scale	289.9	SD in Log Scale	2.16
95% t UCL (assumes normality of ROS data)	142	95% Percentile Bootstrap UCL	146.1
95% BCA Bootstrap UCL	151.5	95% Bootstrap t UCL	155.8
95% H-UCL (Log ROS)	288.1		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	2.469	KM Geo Mean	11.81
KM SD (logged)	2.656	95% Critical H Value (KM-Log)	4.002
KM Standard Error of Mean (logged)	0.197	95% H-UCL (KM -Log)	882.8
KM SD (logged)	2.656	95% Critical H Value (KM-Log)	4.002
KM Standard Error of Mean (logged)	0.197		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	106.4	Mean in Log Scale	2.615
SD in Original Scale	289.9	SD in Log Scale	2.41
95% t UCL (Assumes normality)	141.9	95% H-Stat UCL	482.5

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

KM H-UCL 882.8

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

senversa
tel: + 61 3 9606 0070
fax: + 61 3 9606 0074
enquiries@senversa.com.au
www.senversa.com.au
Level 6, 15 William Street, Melbourne, VIC 3000
Senversa Pty Ltd ABN 89 132 231 380