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Stack Emissions Testing Report Commissioned by
Potter Group

Installation Name & Address
Potter Group
Rudbaxton
Haverfordwest
Pembrokeshire
SA62 4DB

EPR Permit: GP3630HT/V003

Stack Reference
Engine 1514

Dates of the Monitoring Campaign
24th August 2021

Job Reference Number
ERE-21338

Report Written by
Yu Shen Senior Team Leader MCERTS Level 2 MM06 727 TE1 TE2 TE3 TE4

Report Approved by
David Littlewood Operations Manager MCERTS Level 2 MM06 772 TE1 TE2 TE3 TE4

Report Date
31st August 2021

Version
Version 1

Signature of Report Approver


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Executive Summary

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MONITORING OBJECTIVES

Potter Group, Withyhedge Landfill Site (Phase 2)

Engine 1514

24th August 2021

Overall Aim of the Monitoring Campaign

Element were commissioned by Potter Group to carry out stack emissions testing on the Engine 1514 at Withyhedge Landfill Site (Phase 2).

The aim of the monitoring campaign was to demonstrate compliance with a set of emission limit values (ELVs) as specified in the Site's Permit.

Special Requirements

There were no special requirements.

Target Parameters

Total VOCs (as Carbon), Oxides of Nitrogen (as NO₂), Carbon Monoxide

MONITORING RESULTS

Potter Group, Withyhedge Landfill Site (Phase 2)
Engine 1514
24th August 2021

where MU = Measurement Uncertainty associated with the Result

Concentration				
Parameter	Units	Result	MU +/-	Limit
Total VOCs (as Carbon)	¹ mg/m ³	1232.58	61.67	1000
Oxides of Nitrogen (as NO ₂)	¹ mg/m ³	479.76	25.27	500
Carbon Monoxide	¹ mg/m ³	743.07	39.14	1400
Oxygen	% v/v	Dry 6.35	0.28	
Water Vapour	% v/v	13.8	0.7	

¹ Reference Conditions (REF) are: 273K, 101.3kPa, dry gas, 5% oxygen.

Executive Summary

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MONITORING DATE(S) & TIMES

Potter Group, Withyhedge Landfill Site (Phase 2)

Engine 1514

24th August 2021

Parameter	Units	Concentration		Sampling Date(s)	Sampling Times	Duration mins
Total VOCs (as Carbon)	R1 mg/m ³	1232.6		24/08/2021	12:19 - 13:19	60
Oxides of Nitrogen (as NO ₂)	R1 mg/m ³	479.8		24/08/2021	12:19 - 13:19	60
Carbon Monoxide	R1 mg/m ³	743.1		24/08/2021	12:19 - 13:19	60
Oxygen	R1 % v/v	6.35		24/08/2021	12:19 - 13:19	60
Water Vapour	R1 % v/v	13.8		24/08/2021	12:19 - 13:19	60

All results are expressed at the respective reference conditions.

PROCESS DETAILS

Potter Group, Withyhedge Landfill Site (Phase 2)
Engine 1514
24th August 2021

Standard Operating Conditions

Parameter	Value
Process Status	Normal Operation
Capacity (of 100%) and Tonnes / Hour	790kWe Output @ 1136kWe
Continuous or Batch Process	Continuous
Feedstock (if applicable)	Landfill Gas
Abatement System	None
Abatement System Running Status	N/A
Fuel	Landfill Gas
Plume Appearance	None Visible

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MONITORING & ANALYTICAL METHODS

Potter Group, Withyhedge Landfill Site (Phase 2)

Engine 1514

24th August 2021

Parameter	Monitoring				Analysis				Overall Status	LOD (Average)
	Standard	Technical Procedure	Sampling Status	Testing Lab	Analytical Procedure	Analytical Technique	Analysis Status	Analysis Lab		
Water Vapour	EN 14790	SP14790	MCERTS	EET	SP14790	Gravimetric	MCERTS	EET	MCERTS	0.10 % v/v
Total VOCs (as Carbon)	EN 12619:2013	SP12619	MCERTS	EET	Flame Ionisation Detection by Signal 3010HM FID				MCERTS	0.32 mg/m ³
Oxides of Nitrogen (as NO ₂)	EN 14792	SP14792	MCERTS	EET	Chemiluminescence by Horiba PG-250				MCERTS	1.33 mg/m ³
Carbon Monoxide	EN 15058	SP15058	MCERTS	EET	NDIR by Horiba PG-250				MCERTS	0.75 mg/m ³
Oxygen	EN 14789	SP14789	MCERTS	EET	Dry Zirconia Cell by Horiba PG-250				MCERTS	0.1 %

ANALYSIS LABORATORIES

(with short name reference as appears in the table above)

SUMMARY OF SAMPLING DEVIATIONS

Parameter	Run	Deviation
All	All	There are no deviations associated with the sampling employed.

SUITABILITY OF SAMPLING LOCATION

Duct Characteristics

Parameter	Units	Value
Type	-	Circular
Depth	m	0.30
Width	m	-
Area	m ²	0.07
Port Depth	cm	-
Orientation of Duct	-	Vertical
Number of Ports	-	1
Sample Port Size	-	1/2 inch

Location of Sampling Platform

General Platform Information	Value
Permanent / Temporary Platform	On Ground
Inside / Outside	Inside

Platform Details

EA Technical Guidance Note M1 / EN 15259 Platform Requirements	Value
Sufficient working area to manipulate probe and operate the measuring instruments	Yes
Platform has 2 levels of handrails (approx. 0.5m & 1.0m high)	N/A
Platform has vertical base boards (approx. 0.25m high)	N/A
Platform has chains / self closing gates at top of ladders	N/A
There are no obstructions present which hamper insertion of sampling equipment	Yes
Safe Access Available	Yes
Easy Access Available	Yes

Sampling Location / Platform Improvement Recommendations

Due to the nature of the access into the duct, it is not possible to conduct a full velocity profile, however no particulate phase sampling was required and all gaseous species were considered to be mixed sufficiently for the purposes of these tests. There is also no requirement to undertake a homogeneity test as per EN 15259 and as such the location cannot be compared against that or the criteria within TGN M1. The sampling location used in this instance has been approved for use by the Environment Agency.

EN 15259 Homogeneity Test Requirements

There is no requirement to perform a EN 15259 Homogeneity Test on this Stack.

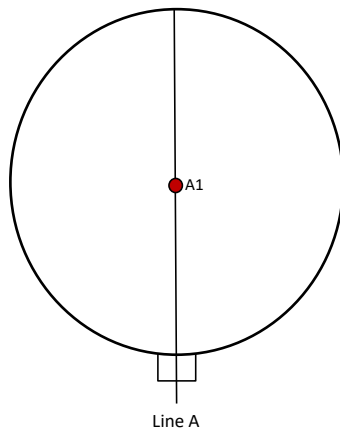
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PLANT PHOTOS



SAMPLE POINTS



where

- = isokinetic point sampled at
- = isokinetic point not sampled at
- = combustion gases sample point
- = non-isokinetic sample point

APPENDICES

APPENDIX CONTENTS

APPENDIX 1 - Stack Emissions Monitoring Personnel, List of Equipment & Methods and Technical Procedures Used

APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

STACK EMISSIONS MONITORING PERSONNEL

Position	Name	MCERTS Accreditation	MCERTS Number	Technical Endorsements
Team Leader	Yu Shen	MCERTS Level 2	MM06 727	TE1 TE2 TE3 TE4
Trainee	Niall Kester	MCERTS Trainee	MM19 1573	None

LIST OF EQUIPMENT

Extractive Sampling		Instrumental Analysers		Miscellaneous Items	
Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.	Equipment Type	Equipment I.D.
DGM (Apex)	DGM#02	Horiba PG-250	PGA#02	Digital Manometer (1)	-
Manometer ('Apex' Orange)	MAN#12	SELECT Horiba Model (2)	-	Digital Manometer (2)	-
Manometer ('Apex' Red)	MAN#13	Servomex 4900	-	Digital Temperature Meter	-
Thermocouple (Apex)	TC#46	Eco Physics CLD 822Mh	-	Stopwatch	15.56
Timepiece (Apex)	TP#20	ABB AO2020-URAS26	-	Barometer	13.64
Thermocouple Reader (Apex)	TCR#24	Testo 350 XL	-	Stack Thermocouple (1)	TC#60
Thermocouple Reader (Apex)	TCR#25	Signal 200SM	COND#01	Stack Thermocouple (2)	-
Thermocouple Reader (Apex)	TCR#26	Signal	CONV#02	Stack Thermocouple (3)	-
Heated Probe (1)	-	Gasmeter Sampling System	-	1m Heated Line (1)	-
Heated Probe (2)	-	Signal 3010HM	FID#05	1m Heated Line (2)	-
Heated Probe (3)	-	M&C PSS	12.966	1m Heated Line (3)	-
S-Pitot (1)	PT-02	Mass Flow Controller (1)	-	5m Heated Line (1)	-
S-Pitot (2)	-	Mass Flow Controller (2)	-	15m Heated Line (1)	HL#10
L-Pitot	-	Mass View (1)	-	20m Heated Line (1)	-
Site Balance	BAL#06	Mass View (2)	-	20m Heated Line (2)	-
500g / 1Kg Check Weights	CW#02	Squirrel 2020	DL#03	Dual Channel Heater Controller	-
Last Impinger Arm	TC#08	Easylogger EN-EL-12 Bit	-	Single Channel Heater Controller	HLC#01
Callipers	-	Bioaerosols Temperature Logger	-	Laboratory Balance	-
Tubes Kit Thermocouple	-	Electronic Refrigerator	-	Tape Measure	16.106

METHODS & TECHNICAL PROCEDURES USED

Parameter	Standard	Technical Procedure
Water Vapour	EN 14790	SP14790
Total VOCs (as Carbon)	EN 12619:2013	SP12619
Oxides of Nitrogen (as NO ₂)	EN 14792	SP14792
Carbon Monoxide	EN 15058	SP15058
Oxygen	EN 14789	SP14789

WATER VAPOUR: RESULTS SUMMARY

Potter Group, Withyhedge Landfill Site (Phase 2)

Engine 1514

Sample Runs

Parameter	Units	Run 1	Mean
Concentration	% v/v	13.82	13.82
Uncertainty	±% v/v	0.69	0.69

General Sampling Information

Parameter	Value
Standard	EN 14790
Technical Procedure	SP14790

WATER VAPOUR: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1
Sampling Times	-	12:19 - 13:19
Sampling Dates	-	24/08/2021
Sampling Device	-	DGM
Duration	mins	60
DGM Start Volume	m ³	455.7670
DGM End Volume	m ³	456.3980
DGM Start Temperature	°C	20.0
DGM End Temperature	°C	24.0
Start ΔH	mmH ₂ O	10.0
End ΔH	mmH ₂ O	10.0
DGM Y _d	-	1.0166
Barometric Pressure	kPa	104.0
Volume Sampled (STP, Dry)	m ³	0.6098
Volume Sampled (STP, Wet)	m ³	0.7076
Sample Flow Rate	l/min	10.69
Liquid Trap Start Mass	g	2200.6
Liquid Trap End Mass	g	2270.2
Silica Trap Start Mass	g	867.6
Silica Trap End Mass	g	876.5
Total Mass Of Water Vapour	g	78.5
Calculated Water Vapour	% v/v	13.82

Where: DGM stands for Dry Gas Meter

WATER VAPOUR: QUALITY ASSURANCE

Sample Runs

Leak Test Results	Units	Run 1	
Mean Sampling Rate	l/min	10.7	
Pre-Sampling Leak Rate	l/min	0.10	
Post-Sampling Leak Rate	l/min	0.10	
Allowable Leak Rate	l/min	0.21	
Leak Test Acceptable	-	Yes	
Water Droplets	Units	Run 1	
Are Water Droplets Present	-	No	
Measurement Uncertainty	Units	Run 1	
Measurement Uncertainty (MU)	%	5.0	
Allowable MU	%	20.0	
MU Acceptable	%	Yes	
Silica Gel	Units	Run 1	
Less than 50% Faded	%	Yes	
Test Conditions	Units	Run 1	
Ambient Temperature Recorded?	-	Yes	

Method Deviations

Nature of Deviation	Run Number
(x = deviation applies to the associated run)	1
There are no deviations associated with the sampling employed.	x

WATER VAPOUR: MEASUREMENT UNCERTAINTY CALCULATIONS

Measured Quantities	Value		Standard uncertainty		
	Symbol	Run 1	Symbol	Units	Run 1
Sampled Volume (Actual)	V_m	0.6310	uV_m	m ³	0.0126
Sampled Gas Temperature	T_m	295.0	uT_m	K	2.00
Sampled Gas Pressure	p_m	104.0	up_m	kPa	0.50
Sampled Gas Humidity	H_m	0.00	uH_m	% v/v	1.00
Repeatability of Weighing	R_w	78.50	uR_w	g	0.10
Reading of Balance	R_b	78.50	uR_b	g	0.39
Leak	L	0.94		%	-

Uncertainty as a Percentage			
Measured Quantities	Units	Run 1	Requirement of Standard
Sampled Volume (Actual)	%	2.00	≤2%
Sampled Gas Temperature	%	0.68	≤1%
Sampled Gas Pressure	%	0.48	≤1%
Sampled Gas Humidity	%	1.00	≤1%
Repeatability of Weighing	%	0.13	No Requirement
Reading of Balance	%	0.50	No Requirement
Leak	%	0.94	≤2%

Uncertainty in Measurement Units				Sensitivity Coefficient	
Measured Quantities	Symbol	Units	Run 1	Run 1	
Sampled Volume (STP)	V_m	m ³	0.6098	22.67	
Repeatability of Weighing	R_w	g	78.50	0.18	
Reading of Balance	R_b	g	78.50	0.18	
Leak	L	% v/v	0.07	1.00	

Uncertainty in Result		
Measured Quantities	Units	Run 1
Sampled Volume (STP)	% v/v	0.338
Repeatability of Weighing	% v/v	0.018
Reading of Balance	% v/v	0.069
Leak	% v/v	0.075

Parameter	Units	Run 1
Combined uncertainty	% v/v	0.35
Expanded uncertainty (95% confidence)	% v/v	0.69
Expanded uncertainty (95% confidence), estimated with Method Deviations	% v/v	0.69
Uncertainty if Water Droplets are present	% v/v	N/A
Reported Uncertainty	% v/v	0.69
Expanded uncertainty (95% confidence)	%	5.0
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	5.0
Uncertainty if Water Droplets are present	%	N/A
Reported Uncertainty	%	5.0

TOTAL VOCs (as CARBON): RESULTS SUMMARY

Potter Group, Withyhedge Landfill Site (Phase 2)
Engine 1514

Sample Runs

Parameter	Units	Run 1	Mean
Concentration	mg/m ³	1232.58	1232.58
Uncertainty	±mg/m ³	61.67	61.67
Mass Emission	g/hr		
Uncertainty	±g/hr		

General Sampling Information

Parameter	Value
Standard	EN 12619:2013
Technical Procedure	SP12619
Probe Material	Titanium
Filtration Type / Size	0.1µm Glass Fibre
Heated Head Filter Used	Yes
Heated Line Temperature	180°C
Span Gas Type	Propane In Synthetic Air (5 Grade)
Span Gas Reference Number	VC8050321
Span Gas Expiry Date	26/04/2022
Span Gas Start Pressure (bar)	120
Gas Cylinder Concentration (ppm)	601
Span Gas Set Point (ppm)	601.00
Span Gas Uncertainty (%)	N/A
Zero Gas Type	Synthetic Air (5 Grade)
Number of Sampling Lines Used	1/1
Number of Sampling Points Used	1/1
Sample Point I.D.'s	A1

FORMAT: Number Used / Number Required

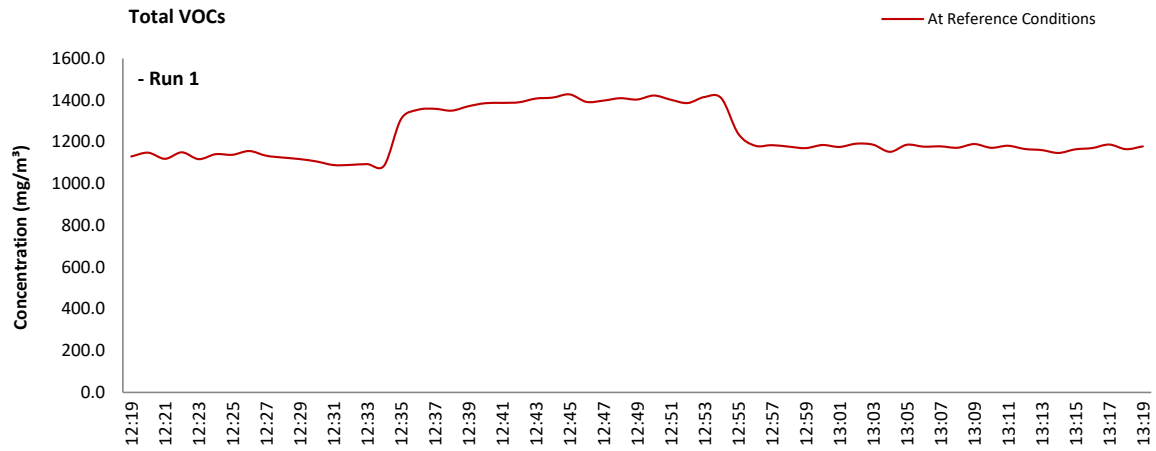
FORMAT: Number Used / Number Required

Reference Conditions

Reference Conditions are: 273K, 101.3kPa, dry gas, 5% oxygen.

TOTAL VOCs (as CARBON): DATA TREND

Graphical Trend of Data



TOTAL VOCs (as CARBON): SAMPLING DETAILS & QUALITY ASSURANCE

Sampling Details

Parameter	Units	Run 1
Sampling Times	-	12:19 - 13:19
Sampling Dates	-	24/08/2021
Instrument Range	ppm	1000
Span Gas Value	ppm	601.0

Quality Assurance

		Units	Run 1
CAL 1	Zero Down Sampling Line (Pre)	ppm	-2.00
	Zero Down Sampling Line (Post)	ppm	2.00
	Zero Drift	ppm	4.00
CAL 2	Zero Down Sampling Line (Pre)	ppm	
	Zero Down Sampling Line (Post)	ppm	
	Zero Drift	ppm	
CAL 3	Zero Down Sampling Line (Pre)	ppm	
	Zero Down Sampling Line (Post)	ppm	
	Zero Drift	ppm	
	Allowable Zero Drift	± ppm	30.05
	Zero Drift Acceptable	-	Yes

		Units	Run 1
CAL 1	Span Down Sampling Line (Pre)	ppm	604.00
	Span Down Sampling Line (Post)	ppm	600.00
	Span Drift	ppm	-4.00
CAL 2	Span Down Sampling Line (Pre)	ppm	
	Span Down Sampling Line (Post)	ppm	
	Span Drift	ppm	
CAL 3	Span Down Sampling Line (Pre)	ppm	
	Span Down Sampling Line (Post)	ppm	
	Span Drift	ppm	
	Allowable Span Drift	± ppm	30.05
	Span Drift Acceptable	-	Yes

Test Conditions	Units	Run 1
Run Ambient Temperature Range	°C	20 - 25

Method Deviations

Nature of Deviation	Run Number
(x = deviation applies to the associated run)	1
There are no deviations associated with the sampling employed.	x

TOTAL VOCs (as CARBON): MEASUREMENT UNCERTAINTY CALCULATIONS

Performance characteristics	RUN 1	Units
Limit value	1000.0	mg/m ³ (REF)
Allowable MU	15.0	%
Measured concentration	1128.27	mg/m ³ (STP, dry)
Range Used	1000.0	ppm
Range Used [A]	1606.1	mg/m ³
Cal gas conc.	601.0	ppm
Conversion	1.61	ppm to mg/m ³
MCERTS Range [B]	15.0	mg/m ³
Lower of [A] or [B]	15.0	mg/m ³
Cal gas conc.	965.3	mg/m ³

Performance characteristics	RUN 1	Units
Response time	15	seconds
Number of readings in measurement	60	-
Repeatability at zero	0.15	% full scale
Repeatability at span level	0.80	% full scale
Deviation from linearity	0.20	% of value
Zero drift	0.66	% full scale
Span drift	-0.66	% full scale
Volume or pressure flow dependence	2.00	% of full scale
Atmospheric pressure dependence	0.80	% of value/kPa
Ambient temperature dependence	1.00	% full scale/10K
Combined interference	1.20	% range
Dependence on voltage	0.10	% full scale/10V
Losses in the line (leak)	0.00	% of value
Uncertainty of calibration gas	2.00	% of value

Performance characteristic	RUN 1	Units
Standard deviation of repeatability at zero	use rep at span	mg/m ³
Standard deviation of repeatability at span level	0.10	mg/m ³
Lack of fit	0.02	mg/m ³
Drift	0.00	mg/m ³
Volume or pressure flow dependence	0.00	mg/m ³
Atmospheric pressure dependence	0.03	mg/m ³
Ambient temperature dependence	0.14	mg/m ³
Combined interference (from MCERTS Certificate)	0.10	mg/m ³
Dependence on voltage	0.01	mg/m ³
Losses in the line (leak)	0.00	mg/m ³
Uncertainty of calibration gas	13.03	mg/m ³

Measurement uncertainty	Result	RUN 1	Units
Combined uncertainty		1128.27	mg/m ³
Expanded uncertainty	k = 1.96	13.03	mg/m ³
Expanded uncertainty		25.54	mg/m ³
Uncertainty corrected to std conds. (O ₂)		27.90	mg/m ³ (REF)

	RUN 1	Units
Expanded uncertainty (no O ₂) - at 95% Confidence	2.26	% of Value
Expanded uncertainty (no O ₂) - at 95% Confidence	2.55	% at ELV
Overall Allowable uncertainty (no O ₂) - at 95% Confidence	15.0	% at ELV
Result of Compliance with Uncertainty Requirement	N/A	-

	RUN 1	Units
Expanded uncertainty (with O ₂) - at 95% Confidence	5.00	% of Value
Expanded uncertainty (with O ₂) - at 95% Confidence	5.26	% at ELV
Overall Allowable uncertainty (with O ₂) - at 95% Confidence	15.6	% at ELV
Result of Compliance with Uncertainty Requirement	COMPLIANT	-

Requirement for SRM is that Uncertainty should be <15% of the value at the ELV, on a dry gas basis, or if O₂ correction is applied less than 15% + the uncertainty associated with the O₂ correction (using sqrt of sum squares to add uncertainty components).

OXIDES OF NITROGEN (as NO₂): RESULTS SUMMARY

Potter Group, Withyhedge Landfill Site (Phase 2)
Engine 1514

Sample Runs

Parameter	Units	Run 1	Mean
Concentration	mg/m ³	479.76	479.76
Uncertainty	±mg/m ³	25.27	25.27
Mass Emission	g/hr		
Uncertainty	±g/hr		

General Sampling Information

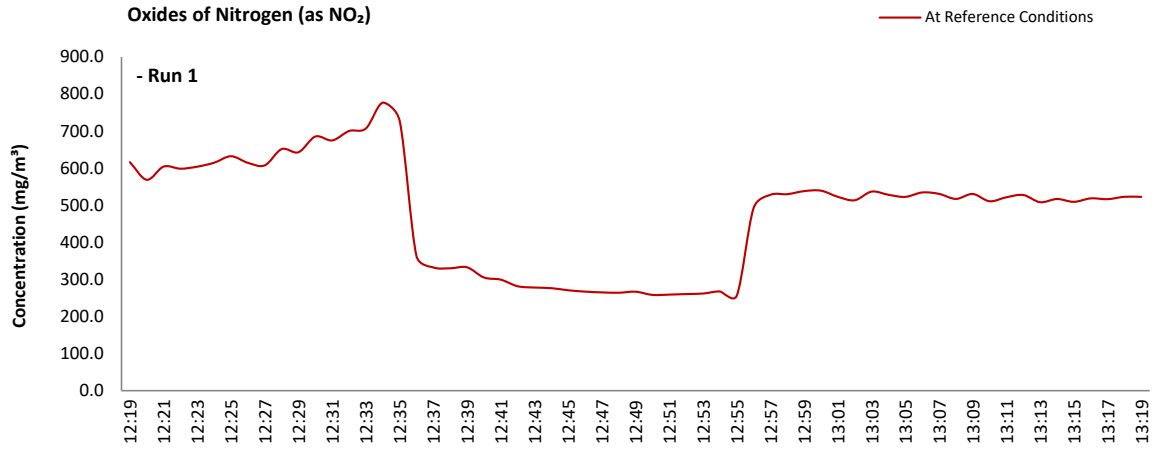
Parameter	Value	
Standard	EN 14792	
Technical Procedure	SP14792	
Probe Material	Titanium	
Filtration Type / Size	0.1µm Glass Fibre	
Heated Head Filter Used	Yes	
Heated Line Temperature	180°C	
Date & Result of Last Converter Check	05/11/2020 - 95%	
Span Gas Type	Nitrogen Monoxide	
Span Gas Reference Number	VCD500555	
Span Gas Expiry Date	26/04/2022	
Span Gas Start Pressure (bar)	150	
Gas Cylinder Concentration (ppm)	262.8	
Span Gas Uncertainty (%)	2	
Zero Gas Type	Nitrogen (5 Grade)	
Number of Sampling Lines Used	1/1	FORMAT: Number Used / Number Required
Number of Sampling Points Used	1/1	FORMAT: Number Used / Number Required
Sample Point I.D.'s	A1	

Reference Conditions

Reference Conditions are: 273K, 101.3kPa, dry gas, 5% oxygen.

OXIDES OF NITROGEN (as NO₂): DATA TREND

Graphical Trend of Data



OXIDES OF NITROGEN (as NO₂): SAMPLING DETAILS & QUALITY ASSURANCE

Sampling Details

Parameter	Units	Run 1
Sampling Times	-	12:19 - 13:19
Sampling Dates	-	24/08/2021
Instrument Range	ppm	500
Span Gas Value	ppm	262.8

Quality Assurance

Conditioning Unit Temperature	Units	Run 1
Average Temperature	°C	2.2
Allowable Temperature	< °C	4.0
Temperature Acceptable	-	Yes

Zero Drift	Units	Run 1
Zero at Analyser (Pre)	ppm	0.00
Zero at Analyser (Post)	ppm	0.00
Zero Drift	ppm	0.00
Zero Drift	%	0.00
Drift Correction Applied	2-5%	No

CAL 1	Zero at Analyser (Pre)	ppm	0.00
	Zero at Analyser (Post)	ppm	0.00
	Zero Drift	ppm	0.00
	Zero Drift	%	0.00
	Drift Correction Applied	2-5%	No
CAL 2	Zero at Analyser (Pre)	ppm	
	Zero at Analyser (Post)	ppm	
	Zero Drift	ppm	
	Zero Drift	%	
	Drift Correction Applied	2-5%	
CAL 3	Zero at Analyser (Pre)	ppm	
	Zero at Analyser (Post)	ppm	
	Zero Drift	ppm	
	Zero Drift	%	
	Drift Correction Applied	2-5%	
	Allowable Zero Drift	± %	5.00
	Zero Drift Acceptable	-	Yes

Span Drift	Units	Run 1
Span at Analyser (Pre)	ppm	262.80
Span at Analyser (Post)	ppm	258.50
Span Drift	ppm	-4.30
Zero Adj. Span Drift	%	1.64
Drift Correction Applied	2-5%	No

CAL 1	Span at Analyser (Pre)	ppm	
	Span at Analyser (Post)	ppm	
	Span Drift	ppm	
	Zero Adj. Span Drift	%	
	Drift Correction Applied	2-5%	
CAL 2	Span at Analyser (Pre)	ppm	
	Span at Analyser (Post)	ppm	
	Span Drift	ppm	
	Zero Adj. Span Drift	%	
	Drift Correction Applied	2-5%	
CAL 3	Span at Analyser (Pre)	ppm	
	Span at Analyser (Post)	ppm	
	Span Drift	ppm	
	Zero Adj. Span Drift	%	
	Drift Correction Applied	2-5%	
	Allowable Span Drift	± %	5.00
	Span Drift Acceptable	-	Yes

Test Conditions	Units	Run 1
Run Ambient Temperature Range	°C	20 - 25

Method Deviations

Nature of Deviation	Run Number
(x = deviation applies to the associated run)	1
There are no deviations associated with the sampling employed.	x

OXIDES OF NITROGEN (as NO₂): MEASUREMENT UNCERTAINTY CALCULATIONS

Performance characteristics	RUN 1		Units
Limit value	500.0		mg/m ³ (REF)
Allowable MU	10.0		%
Measured concentration	439.16		mg/m ³ (STP, dry)
Ratio NO / NO ₂	5		%
Range Used	500.0		ppm
Range Used [A]	1026.1		mg/m ³
Cal gas conc.	262.8		ppm
Conversion	2.05		ppm to mg/m ³
MCERTS Range [B]	125.0		mg/m ³
Lower of [A] or [B]	125.0		mg/m ³
Cal gas conc.	539.3		mg/m ³

Performance characteristics	RUN 1		Units
Response time	60		seconds
Number of readings in measurement	60		-
Repeatability at zero	0.40		% full scale
Repeatability at span level	0.40		% full scale
Deviation from linearity	0.70		% of value
Zero drift	0.00		% full scale
Span drift	-1.64		% full scale
Volume or pressure flow dependence	0.40		% of full scale
Atmospheric pressure dependence	0.30		% of value/kPa
Ambient temperature dependence	0.18		% full scale/10K
Combined interference	0.60		% range
Dependence on voltage	0.40		% full scale/10V
Converter efficiency	95.0		%
Losses in the line (leak)	0.00		% of value
Uncertainty of calibration gas blending	1.40		% of value
Uncertainty of calibration gas	2.00		% of value

Performance characteristic	RUN 1		Units
Standard deviation of repeatability at zero	use rep at span		mg/m ³
Standard deviation of repeatability at span level	0.05		mg/m ³
Lack of fit	0.51		mg/m ³
Drift	0.00		mg/m ³
Volume or pressure flow dependence	0.00		mg/m ³
Atmospheric pressure dependence	0.11		mg/m ³
Ambient temperature dependence	0.03		mg/m ³
Combined interference (from MCERTS Certificate)	0.43		mg/m ³
Dependence on voltage	0.05		mg/m ³
Converter efficiency	0.63		mg/m ³
Losses in the line (leak)	0.00		mg/m ³
Uncertainty of calibration gas blending	3.55		mg/m ³
Uncertainty of calibration gas	5.07		mg/m ³

Measurement uncertainty	Result	RUN 1	Units
Combined uncertainty		439.16	mg/m ³
Expanded uncertainty	k = 1.96	6.27	mg/m ³
Expanded uncertainty		12.30	mg/m ³
Uncertainty corrected to std conds. (O ₂)		13.43	mg/m ³ (REF)

	RUN 1	Units
Expanded uncertainty (no O ₂) - at 95% Confidence	2.80	% of Value
Expanded uncertainty (no O ₂) - at 95% Confidence	2.46	% at ELV
Overall Allowable uncertainty (no O ₂) - at 95% Confidence	10.0	% at ELV
Result of Compliance with Uncertainty Requirement	N/A	-

	RUN 1	Units
Expanded uncertainty (with O ₂) - at 95% Confidence	5.27	% of Value
Expanded uncertainty (with O ₂) - at 95% Confidence	5.21	% at ELV
Overall Allowable uncertainty (with O ₂) - at 95% Confidence	11.0	% at ELV
Result of Compliance with Uncertainty Requirement	COMPLIANT	-

Requirement for SRM is that Uncertainty should be <10% of the value at the ELV, on a dry gas basis, or if O₂ correction is applied less than 10% + the uncertainty associated with the O₂ correction (using sqrt of sum squares to add uncertainty components).

CARBON MONOXIDE: RESULTS SUMMARY

Potter Group, Withyhedge Landfill Site (Phase 2)
Engine 1514

Sample Runs

Parameter	Units	Run 1	Mean
Concentration	mg/m ³	743.07	743.07
Uncertainty	±mg/m ³	39.14	39.14
Mass Emission	g/hr		
Uncertainty	±g/hr		

General Sampling Information

Parameter	Value
Standard	EN 15058
Technical Procedure	SP15058
Probe Material	Titanium
Filtration Type / Size	0.1µm Glass Fibre
Heated Head Filter Used	Yes
Heated Line Temperature	180°C
Span Gas Type	Carbon Monoxide
Span Gas Reference Number	VCD500555
Span Gas Expiry Date	26/04/2022
Span Gas Start Pressure (bar)	150
Gas Cylinder Concentration (ppm)	1202
Span Gas Uncertainty (%)	2
Zero Gas Type	Nitrogen (5 Grade)
Number of Sampling Lines Used	1/1
Number of Sampling Points Used	1/1
Sample Point I.D.'s	A1

FORMAT: Number Used / Number Required

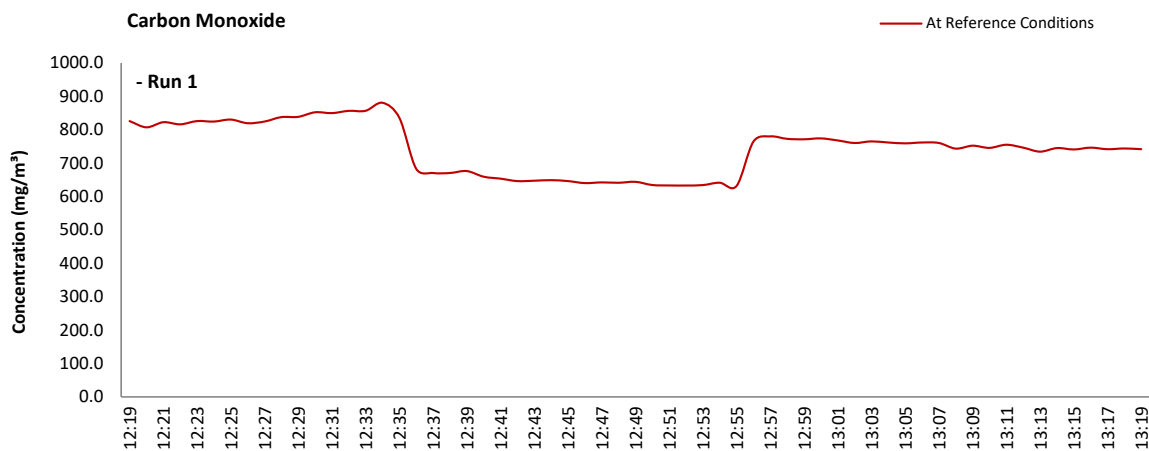
FORMAT: Number Used / Number Required

Reference Conditions

Reference Conditions are: 273K, 101.3kPa, dry gas, 5% oxygen.

CARBON MONOXIDE: DATA TREND

Graphical Trend of Data



CARBON MONOXIDE: SAMPLING DETAILS & QUALITY ASSURANCE

Sampling Details

Parameter	Units	Run 1
Sampling Times	-	12:19 - 13:19
Sampling Dates	-	24/08/2021
Instrument Range	ppm	2000
Span Gas Value	ppm	1202.0

Quality Assurance

Conditioning Unit Temperature	Units	Run 1
Average Temperature	°C	2.2
Allowable Temperature	< °C	4.0
Temperature Acceptable	-	Yes

Zero Drift	Units	Run 1
CAL 1	Zero at Analyser (Pre)	ppm
	Zero at Analyser (Post)	ppm
	Zero Drift	ppm
	Zero Drift	%
	Drift Correction Applied	2-5%
CAL 2	Zero at Analyser (Pre)	ppm
	Zero at Analyser (Post)	ppm
	Zero Drift	ppm
	Zero Drift	%
	Drift Correction Applied	2-5%
CAL 3	Zero at Analyser (Pre)	ppm
	Zero at Analyser (Post)	ppm
	Zero Drift	ppm
	Zero Drift	%
	Drift Correction Applied	2-5%
	Allowable Zero Drift	± %
	Zero Drift Acceptable	-

Span Drift	Units	Run 1
CAL 1	Span at Analyser (Pre)	ppm
	Span at Analyser (Post)	ppm
	Span Drift	ppm
	Zero Adj. Span Drift	%
	Drift Correction Applied	2-5%
CAL 2	Span at Analyser (Pre)	ppm
	Span at Analyser (Post)	ppm
	Span Drift	ppm
	Zero Adj. Span Drift	%
	Drift Correction Applied	2-5%
CAL 3	Span at Analyser (Pre)	ppm
	Span at Analyser (Post)	ppm
	Span Drift	ppm
	Zero Adj. Span Drift	%
	Drift Correction Applied	2-5%
	Allowable Span Drift	± %
	Span Drift Acceptable	-

Test Conditions	Units	Run 1
Run Ambient Temperature Range	°C	20 - 25

Method Deviations

Nature of Deviation	Run Number
(x = deviation applies to the associated run)	1
There are no deviations associated with the sampling employed.	x

CARBON MONOXIDE: MEASUREMENT UNCERTAINTY CALCULATIONS

Performance characteristics	RUN 1	Units
Limit value	1400.0	mg/m ³ (REF)
Allowable MU	6.0	%
Measured concentration	680.18	mg/m ³ (STP, dry)
Range Used	2000.0	ppm
Range Used [A]	2498.4	mg/m ³
Cal gas conc.	1202.0	ppm
Conversion	1.25	ppm to mg/m ³
MCERTS Range [B]	95.0	mg/m ³
Lower of [A] or [B]	95.0	mg/m ³
Cal gas conc.	1501.6	mg/m ³

Performance characteristics	RUN 1	Units
Response time	60	seconds
Number of readings in measurement	60	-
Repeatability at zero	0.40	% full scale
Repeatability at span level	0.40	% full scale
Deviation from linearity	1.20	% of value
Zero drift	0.50	% full scale
Span drift	-0.25	% full scale
Volume or pressure flow dependence	0.40	% of full scale
Atmospheric pressure dependence	0.30	% of value/kPa
Ambient temperature dependence	0.05	% full scale/10K
Combined interference	0.73	% range
Dependence on voltage	0.40	% full scale/10V
Losses in the line (leak)	0.33	% of value
Uncertainty of calibration gas blending	1.40	% of value
Uncertainty of calibration gas	2.00	% of value

Performance characteristic	RUN 1	Units
Standard deviation of repeatability at zero	use rep at span	mg/m ³
Standard deviation of repeatability at span level	0.05	mg/m ³
Lack of fit	0.66	mg/m ³
Drift	0.00	mg/m ³
Volume or pressure flow dependence	0.00	mg/m ³
Atmospheric pressure dependence	0.08	mg/m ³
Ambient temperature dependence	0.01	mg/m ³
Combined interference (from MCERTS Certificate)	0.40	mg/m ³
Dependence on voltage	0.05	mg/m ³
Losses in the line (leak)	1.31	mg/m ³
Uncertainty of calibration gas blending	5.50	mg/m ³
Uncertainty of calibration gas	7.85	mg/m ³

Measurement uncertainty	Result	RUN 1	Units
Combined uncertainty		680.18	mg/m ³
Expanded uncertainty		9.71	mg/m ³
Expanded uncertainty	k = 1.96	19.04	mg/m ³
Uncertainty corrected to std conds. (O ₂)		20.80	mg/m ³ (REF)

	RUN 1	Units
Expanded uncertainty (no O ₂) - at 95% Confidence	2.80	% of Value
Expanded uncertainty (no O ₂) - at 95% Confidence	1.36	% at ELV
Overall Allowable uncertainty (no O ₂) - at 95% Confidence	6.0	% at ELV
Result of Compliance with Uncertainty Requirement	N/A	-

	RUN 1	Units
Expanded uncertainty (with O ₂) - at 95% Confidence	5.27	% of Value
Expanded uncertainty (with O ₂) - at 95% Confidence	4.70	% at ELV
Overall Allowable uncertainty (with O ₂) - at 95% Confidence	7.5	% at ELV
Result of Compliance with Uncertainty Requirement	COMPLIANT	-

Requirement for SRM is that Uncertainty should be <6% of the value at the ELV, on a dry gas basis, or if O₂ correction is applied less than 6% + the uncertainty associated with the O₂ correction (using sqrt of sum squares to add uncertainty components).

OXYGEN: RESULTS SUMMARY

Potter Group, Withyhedge Landfill Site (Phase 2)
Engine 1514

Sample Runs

Parameter	Units	Run 1	Mean
Concentration	% v/v	6.35	6.35
Uncertainty	±% v/v	0.28	0.28

General Sampling Information

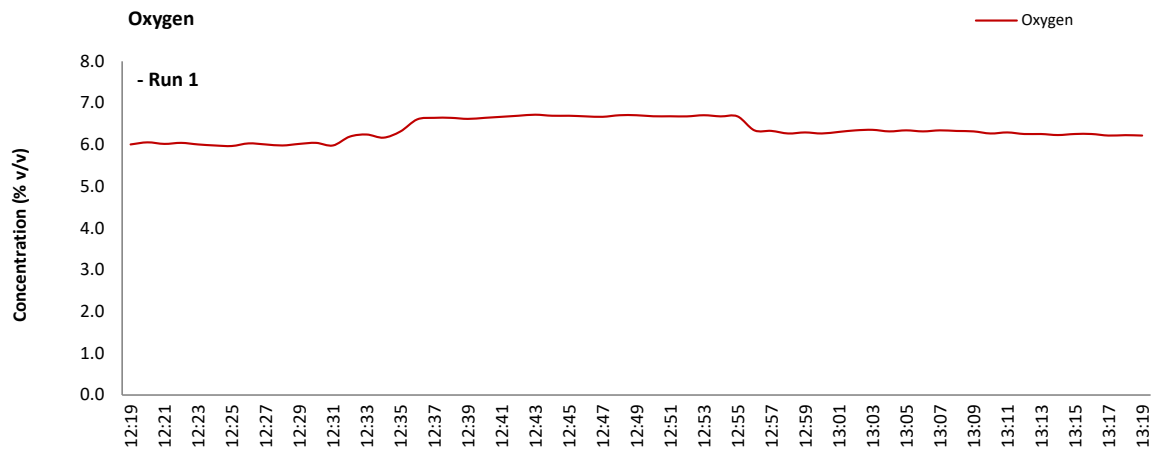
Parameter	Value
Standard	EN 14789
Technical Procedure	SP14789
Probe Material	Titanium
Filtration Type / Size	0.1µm Glass Fibre
Heated Head Filter Used	Yes
Heated Line Temperature	180°C
Span Gas Type	Synthetic Air (5 Grade)
Span Gas Reference Number	VC8050321
Span Gas Expiry Date	26/04/2022
Span Gas Start Pressure (bar)	120
Gas Cylinder Concentration (% v/v)	8.02
Span Gas Uncertainty (%)	2
Zero Gas Type	Nitrogen (5 Grade)
Number of Sampling Lines Used	1/1
Number of Sampling Points Used	1/1
Sample Point I.D.'s	A1

FORMAT: Number Used / Number Required

FORMAT: Number Used / Number Required

OXYGEN: DATA TREND

Graphical Trend of Data



APPENDIX 2

OXYGEN: SAMPLING DETAILS & QUALITY ASSURANCE

Sampling Details

Parameter	Units	Run 1
Sampling Times	-	12:19 - 13:19
Sampling Dates	-	24/08/2021
Instrument Range	% v/v	25.0
Span Gas Value	% v/v	8.0

Quality Assurance

Conditioning Unit Temperature	Units	Run 1
Average Temperature	°C	2.2
Allowable Temperature	< °C	4.0
Temperature Acceptable	-	Yes

Zero Drift	Units	Run 1
Zero at Analyser (Pre)	% v/v	0.00
Zero at Analyser (Post)	% v/v	0.00
Zero Drift	% v/v	0.00
Zero Drift	%	0.00
Drift Correction Applied	2-5%	No

CAL 1

Zero at Analyser (Pre)	% v/v	
Zero at Analyser (Post)	% v/v	
Zero Drift	% v/v	
Zero Drift	%	
Drift Correction Applied	2-5%	

CAL 2

Zero at Analyser (Pre)	% v/v	
Zero at Analyser (Post)	% v/v	
Zero Drift	% v/v	
Zero Drift	%	
Drift Correction Applied	2-5%	

CAL 3

Allowable Zero Drift	± %	5.00
Zero Drift Acceptable	-	Yes

Span Drift	Units	Run 1
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CAL 1

Span at Analyser (Pre)	% v/v	8.02
Span at Analyser (Post)	% v/v	8.08
Span Drift	% v/v	0.06
Zero Adj. Span Drift	%	0.75
Drift Correction Applied	2-5%	No

CAL 2

Span at Analyser (Pre)	% v/v	
Span at Analyser (Post)	% v/v	
Span Drift	% v/v	
Zero Adj. Span Drift	%	
Drift Correction Applied	2-5%	

CAL 3

Span at Analyser (Pre)	% v/v	
Span at Analyser (Post)	% v/v	
Span Drift	% v/v	
Zero Adj. Span Drift	%	
Drift Correction Applied	2-5%	

Allowable Span Drift	± %	5.00
Span Drift Acceptable	-	Yes

Test Conditions	Units	Run 1
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Run Ambient Temperature Range	°C	20 - 25
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Method Deviations

Nature of Deviation	Run Number
(x = deviation applies to the associated run)	1
There are no deviations associated with the sampling employed.	x

OXYGEN: MEASUREMENT UNCERTAINTY CALCULATIONS

Performance characteristics	RUN 1		Units
Limit value	N/A		%vol
Allowable MU	6.0		%
Measured concentration	6.35		%vol
Range Used	25.0		%vol
Cal gas conc.	8.0		%vol

Performance characteristics	RUN 1		Units
Response time	60		seconds
Number of readings in measurement	60		-
Repeatability at zero	0.04		% full scale
Repeatability at span level	0.04		% full scale
Deviation from linearity	0.30		% of value
Zero drift	0.00		% full scale
Span drift	0.75		% full scale
Volume or pressure flow dependence	0.20		% of full scale
Atmospheric pressure dependence	0.30		% of value/kPa
Ambient temperature dependence	-0.07		% full scale/10K
Combined interference	0.56		% range
Dependence on voltage	0.02		% full scale/10V
Losses in the line (leak)	0.00		% of value
Uncertainty of calibration gas	2.00		% of value

Performance characteristic	RUN 1		Units
Standard deviation of repeatability at zero	use rep at span		%vol
Standard deviation of repeatability at span level	0.01		%vol
Lack of fit	0.04		%vol
Drift	0.00		%vol
Volume or pressure flow dependence	0.00		%vol
Atmospheric pressure dependence	0.02		%vol
Ambient temperature dependence	-0.01		%vol
Combined interference (from MCERTS Certificate)	0.08		%vol
Dependence on voltage	0.00		%vol
Losses in the line (leak)	0.00		%vol
Uncertainty of calibration gas	0.07		%vol

Measurement uncertainty	Result	RUN 1	Units
Combined uncertainty		6.35	%vol
Expanded uncertainty		0.14	%vol
Expanded uncertainty	k = 1.96	0.28	%vol

	RUN 1	Units
Expanded uncertainty (no O ₂) - at 95% Confidence	4.46	% of Value
Result of Compliance with Uncertainty Requirement	COMPLIANT	-

Requirement for SRM is that Uncertainty should be 0.3% vol absolute or 6% relative whichever is the lower, on a dry gas basis. Source, EN 14789.



Version Number	Record of changes made within this version of the document
V1	The original document issued to the client