Annual performance report for: SRCL, Knostrop Clinical Waste Incinerator

Permit Number: EPR/CP3930XL/V004

Year: 2022

This report is required under the Industrial Emissions Directive's Article 55(2) requirements on reporting and public information on waste incineration plants and co-incineration plants, which require the operator to produce an annual report on the functioning and monitoring of the plant and make it available to the public.

1. Introduction

Name and address of plant	Stericycle – Knostrop, Leeds Knostrop Treatment Works Knowsthorpe Lane Leeds LS9 0PJ
Description of waste input	Clinical waste
Operator contact details if members of the public have any questions	Darren Powell Facility Manager 07736 270068

2. Plant description

The Leeds incinerator consists of two streams, known as the East and West streams, each with a nominal throughput of one tonne of clinical waste per hour. The permit sets an annual throughput limit of 8500 tonnes on each stream, with lower limits on specific waste types. The two streams are independent of each other, so that one stream can still be operated while the other stream is shut down for maintenance.

The two incinerators are of stepped hearth design, with three main combustion hearths and an ash box. Clinical waste is loaded mechanically direct from the wheeled bins used to deliver the waste, onto the first hearth, and the combustion process commences. Hydraulic rams operate at intervals to push the waste along the first hearth, until it falls off the end onto the second hearth where the waste burns vigorously at a temperature of between 1000 and 1100 degrees Centigrade. The waste is then pushed from the second hearth onto the third hearth, where it burns out to produce an ash. This bottom ash is then pushed into an ash box, where the fixed carbon in the ash is further burned out. The retention time on the hearths is approximately 12 hours, with the bottom ash being retained in the ash box for up to 8 hours before being dropped into a skip. Ram movements are programmed in relation to the number of bins fed.

The flue gases from the incineration process then pass through a secondary chamber, or afterburner, where any gaseous products of combustion are burned out under oxygen rich conditions. This stage is designed to destroy any Carbon Monoxide, Volatile Organic Compounds, and dioxins and furans produced by the combustion process.

The flue gases are then cooled by passing through a waste-heat boiler and economiser, before passing into the final, abatement section of the process. Powdered lime (Calcium Hydroxide) and powdered activated carbon are added to the flue gases entering the

abatement process to remove acid gases, heavy metals and residual dioxins and furans before discharge to atmosphere from the stack. The flue gases being discharged from the stack are continuously monitored for Hydrogen Chloride, Sulphur Dioxide, Carbon Monoxide, Oxides of Nitrogen, particulate matter (dust), Volatile Organic Compounds, oxygen and moisture content. The incineration process produces two residues; bottom ash and spent lime. The bottom ash is sent to a recycling transfer station for reprocessing, the bulk of the material ultimately ending up as a landfill cover material. The spent lime, which is the residue from the flue gas abatement process, went to a site in Leeds where it is used to neutralise acidic wastes.

3. Summary of Plant Operation

Municipal waste received	5.54 tonnes
Commercial and industrial waste received	175.58 tonnes
Hazardous waste received	10,981.25 tonnes
Clinical waste received	13,017.34 tonnes
Waste wood (biomass) received	N/A
Refuse-derived fuel received	N/A
Solid recovered fuel received	N/A
Other waste received Radioactive	16.54 tonnes
Total waste received (processed)	13,215 tonnes
Total plant operational hours	K1 (East) – 7,500 K2 (West) – 7143
Total hours of “abnormal operation” (see permit for definition)	K1 (East) – 0 Occurrences K2 (West) – 0 Occurrences K1 (East) – 0 Hours K2 (West) – 0 Hours
Total quantity of incinerator bottom ash (IBA) produced	1920.64 tonnes
Disposal or recovery route for IBA	Disposal – LSS Waste Management Ltd, Industrial Park, Recycling House, Knowsthorpe Ln, Leeds LS9 0PF
Did any batches of IBA test as hazardous? If yes, state quantity	None
Total quantity of air pollution control (APC) residues produced	799.24 tonnes
Disposal or recovery route for APC residues	Disposal – Cleansing Service Group Ltd, Liverpool Road, Cadishead, Manchester M44 5DT
Total electricity generated for export to the National Grid	N/A
Total heat produced for export (e.g. to hospital or district heating scheme)	24,672 kWh (electricity generated and used on site)

4. Summary of Plant Emissions

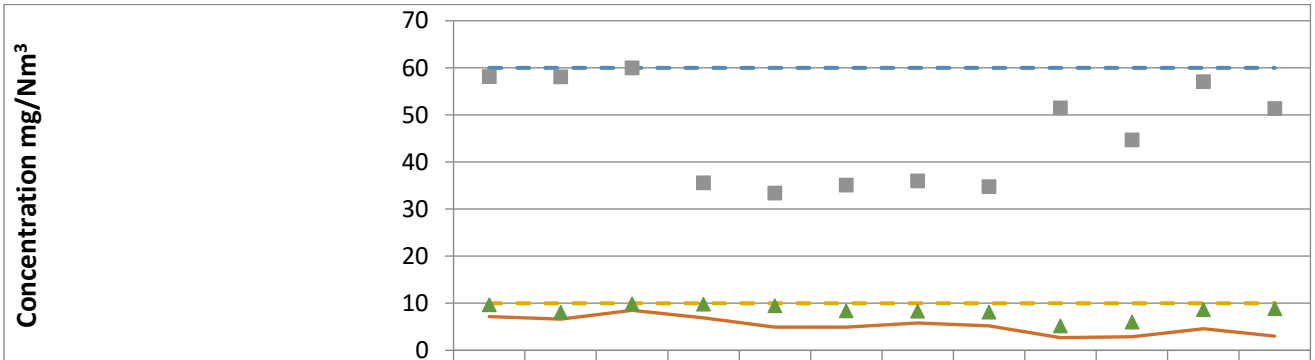
4.1 Summary of continuous emissions monitoring results for emissions to air

The following charts show the performance of the plant against its emission limit values (ELVs) for substances that are continuously monitored.

Monthly emissions summary daily ELVs o

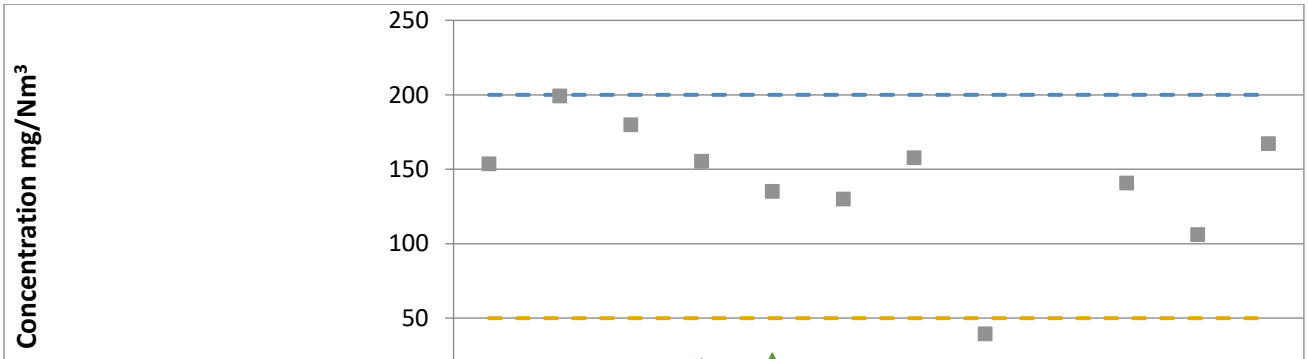
Monthly emissions summary incl half-hou

Line 1 (East) - Hydrogen chloride



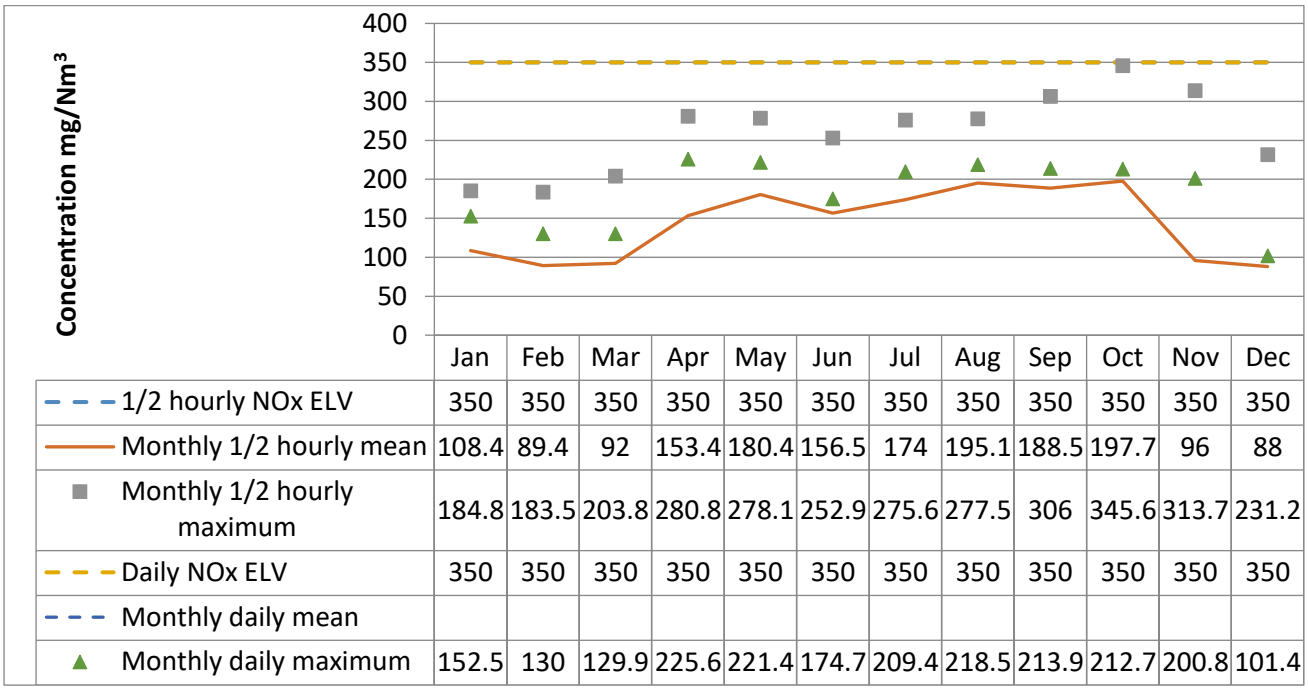
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1/2 hourly HCl ELV	60	60	60	60	60	60	60	60	60	60	60	60
Monthly 1/2 hourly mean	7.2	6.6	8.5	6.9	4.9	4.9	5.8	5.2	2.7	2.9	4.6	3
Monthly 1/2 hourly maximum	58.2	58.1	60	35.6	33.4	35.1	36	34.8	51.5	44.7	57.1	51.4
Daily HCl ELV	10	10	10	10	10	10	10	10	10	10	10	10
Monthly daily mean												
Monthly daily maximum	9.7	8.1	9.9	9.8	9.5	8.4	8.3	8.1	5.2	6	8.7	8.9

Line 1 (East) – Sulphur dioxide



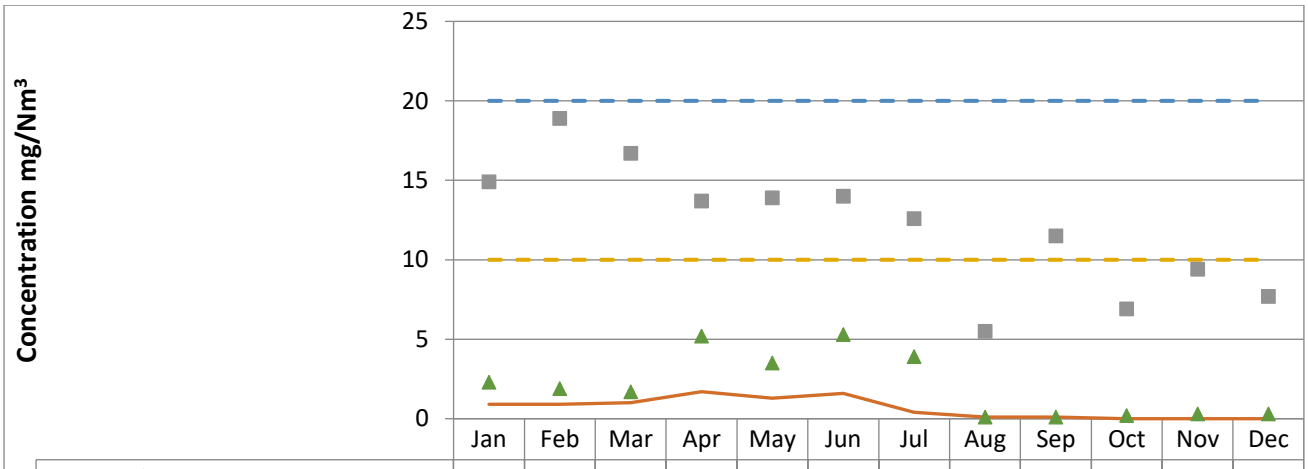
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1/2 hourly SO2 ELV	200	200	200	200	200	200	200	200	200	200	200	200
Monthly 1/2 hourly mean	5.1	5.8	5.9	6	6.7	3.9	3.7	3.5	1.5	1.9	3.8	4
Monthly 1/2 hourly maximum	153.7	199.3	180	155.5	135.2	130	157.8	39.5	17.2	140.9	106.2	167.3
Daily SO2 ELV	50	50	50	50	50	50	50	50	50	50	50	50
Monthly daily mean												
Monthly daily maximum	15.8	12.3	16.1	18.2	22.1	9.5	7.8	6.6	1.8	4.4	10.3	11.6

Line 1 (East) – Oxides of nitrogen



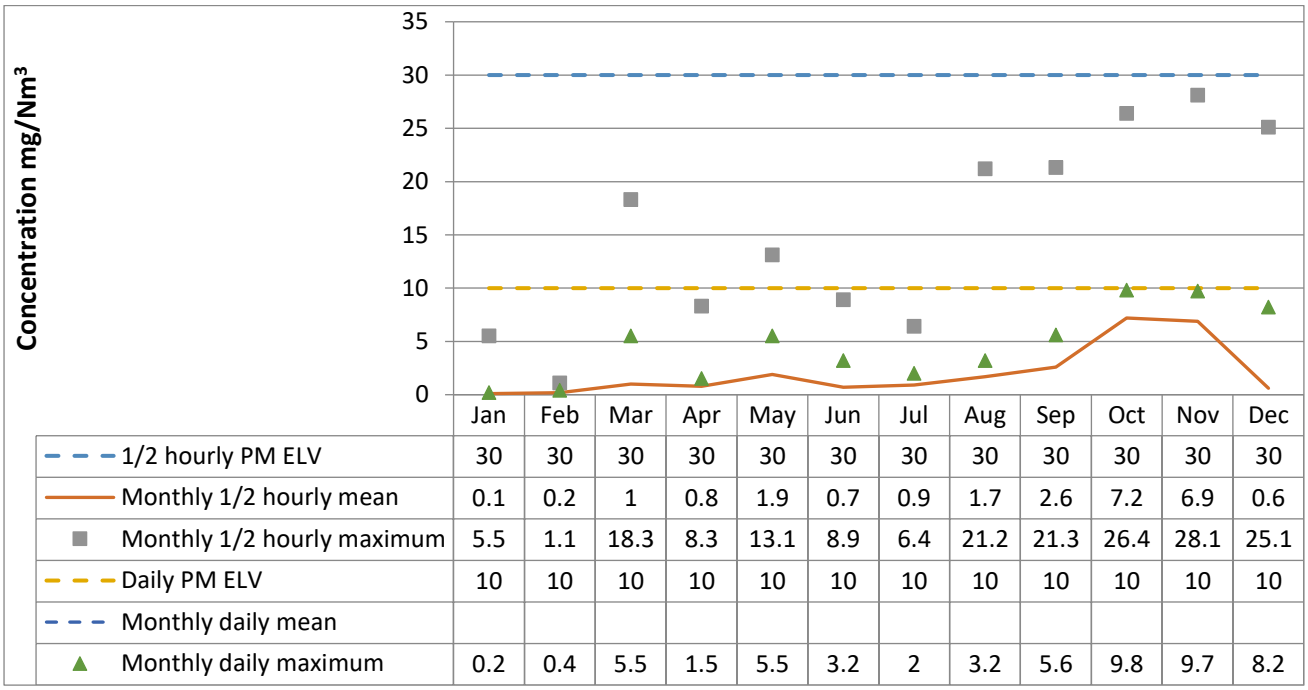
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1/2 hourly NOx ELV	350	350	350	350	350	350	350	350	350	350	350	350
Monthly 1/2 hourly mean	108.4	89.4	92	153.4	180.4	156.5	174	195.1	188.5	197.7	96	88
Monthly 1/2 hourly maximum	184.8	183.5	203.8	280.8	278.1	252.9	275.6	277.5	306	345.6	313.7	231.2
Daily NOx ELV	350	350	350	350	350	350	350	350	350	350	350	350
Monthly daily mean												
Monthly daily maximum	152.5	130	129.9	225.6	221.4	174.7	209.4	218.5	213.9	212.7	200.8	101.4

Line 1 (East) – Total organic carbon



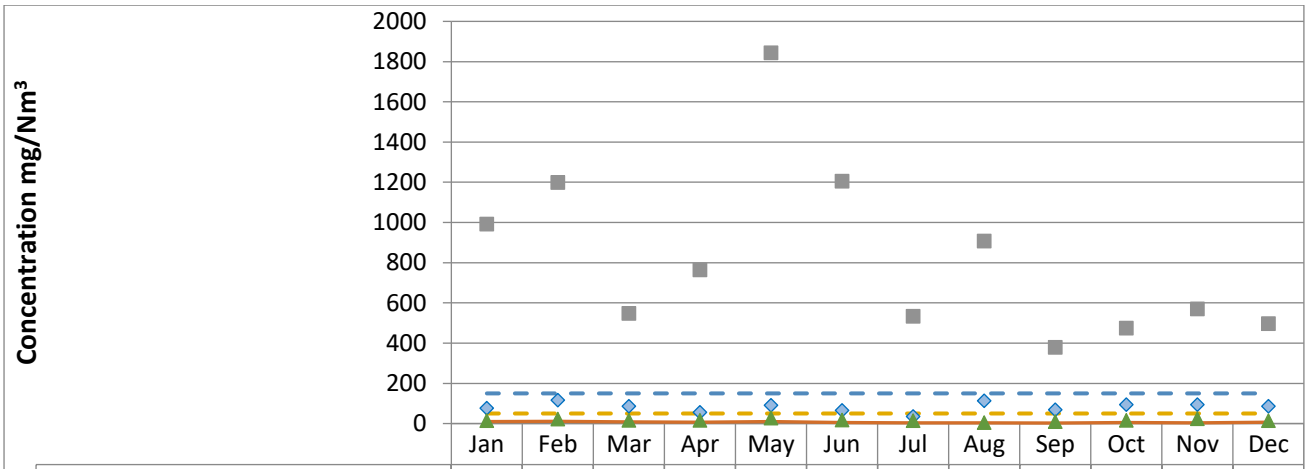
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1/2 hourly TOC ELV	20	20	20	20	20	20	20	20	20	20	20	20
Monthly 1/2 hourly mean	0.9	0.9	1	1.7	1.3	1.6	0.4	0.1	0.1	0	0	0
Monthly 1/2 hourly maximum	14.9	18.9	16.7	13.7	13.9	14	12.6	5.5	11.5	6.9	9.4	7.7
Daily TOC ELV	10	10	10	10	10	10	10	10	10	10	10	10
Monthly daily mean												
Monthly daily maximum	2.3	1.9	1.7	5.2	3.5	5.3	3.9	0.1	0.1	0.2	0.3	0.3

Line 1 (East) – Particulates



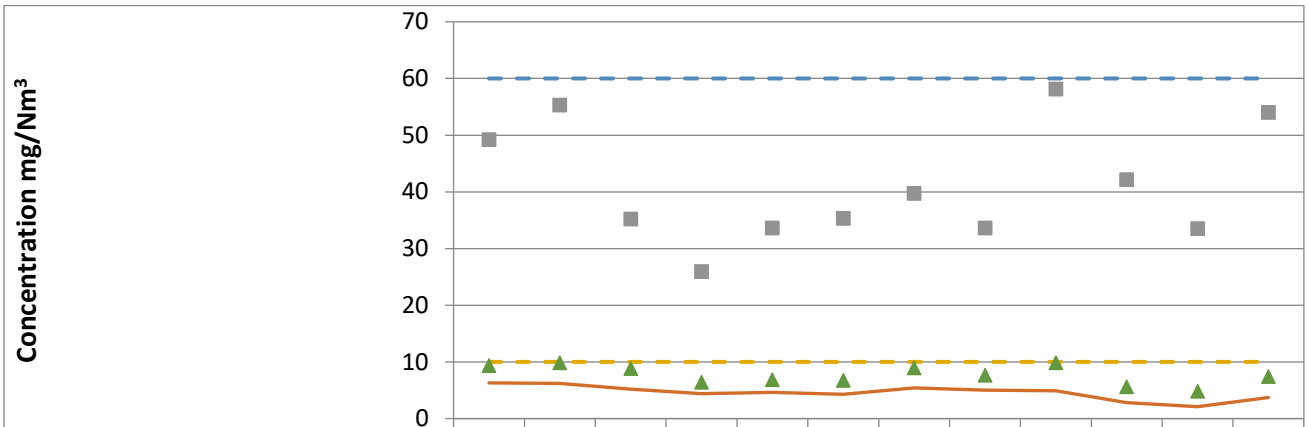
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1/2 hourly PM ELV	30	30	30	30	30	30	30	30	30	30	30	30
Monthly 1/2 hourly mean	0.1	0.2	1	0.8	1.9	0.7	0.9	1.7	2.6	7.2	6.9	0.6
Monthly 1/2 hourly maximum	5.5	1.1	18.3	8.3	13.1	8.9	6.4	21.2	21.3	26.4	28.1	25.1
Daily PM ELV	10	10	10	10	10	10	10	10	10	10	10	10
Monthly daily mean												
Monthly daily maximum	0.2	0.4	5.5	1.5	5.5	3.2	2	3.2	5.6	9.8	9.7	8.2

Line 1 (East) – Carbon monoxide



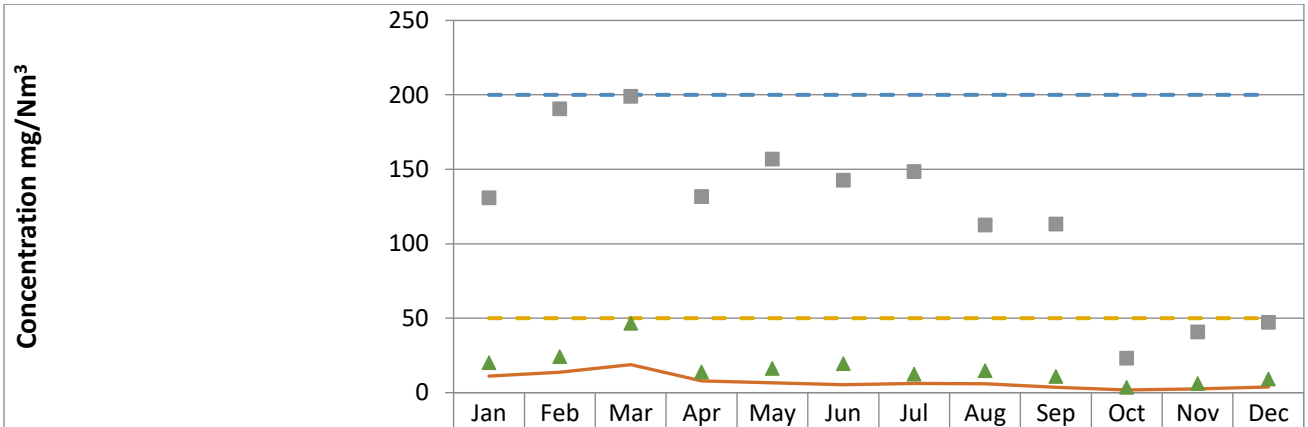
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
10 minute CO ELV (95%)	150	150	150	150	150	150	150	150	150	150	150	150
Monthly 95% 10 minute maximum	77	116.6	86.1	56.1	90.3	64.9	35.1	113.7	68.3	94.6	94.3	86.6
Monthly 10 minute mean	9.3	11	8	6.9	10	5.4	2.9	4.1	2.5	5.6	4	6.2
Monthly 10 minute maximum	992.5	1199.2	548.3	765.2	1844.4	1206.1	533.8	907.7	378.6	475.5	570.6	496.7
Daily CO ELV	50	50	50	50	50	50	50	50	50	50	50	50
Monthly daily mean												
Monthly daily maximum	15	23	15.7	16.8	27.1	17.6	14.8	5.4	9.6	15.6	23.5	14

Line 2 (West) - Hydrogen chloride



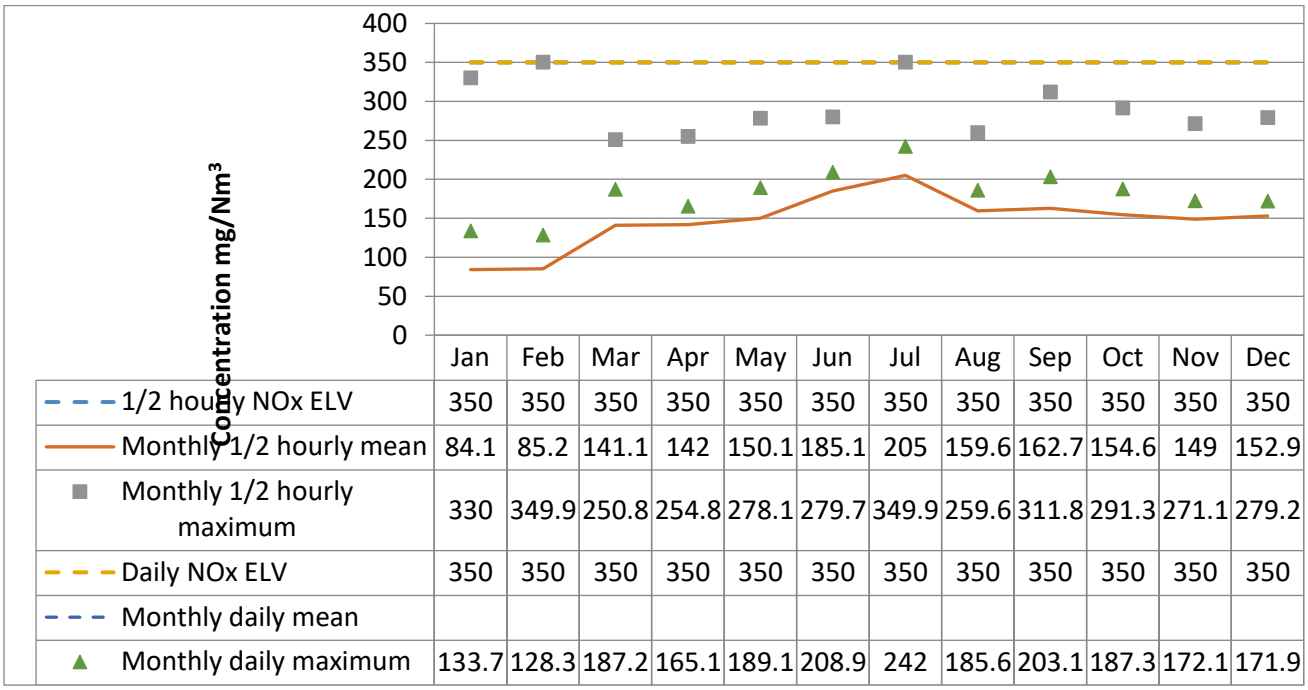
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1/2 hourly HCl ELV	60	60	60	60	60	60	60	60	60	60	60	60
Monthly 1/2 hourly mean	6.3	6.2	5.2	4.4	4.6	4.3	5.4	5	4.9	2.8	2.1	3.7
Monthly 1/2 hourly maximum	49.2	55.3	35.2	25.9	33.6	35.3	39.7	33.6	58.1	42.1	33.5	54
Daily HCl ELV	10	10	10	10	10	10	10	10	10	10	10	10
Monthly daily mean												
Monthly daily maximum	9.3	9.8	8.8	6.4	6.8	6.7	8.9	7.6	9.8	5.6	4.8	7.4

Line 2 (West) – Sulphur dioxide



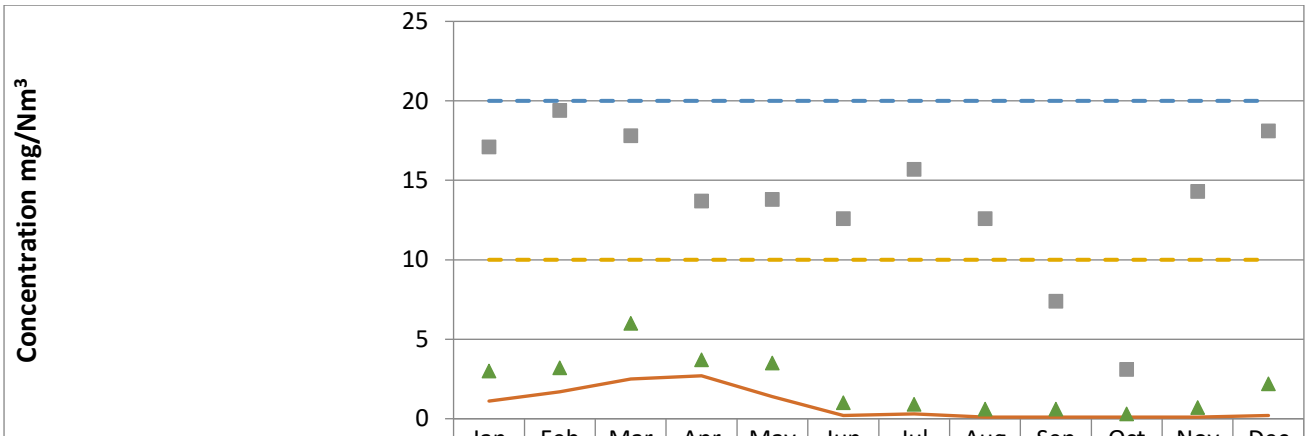
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1/2 hourly SO2 ELV	200	200	200	200	200	200	200	200	200	200	200	200
Monthly 1/2 hourly mean	11.1	13.6	18.8	7.8	6.7	5.4	6.2	6	3.6	1.8	2.6	3.8
Monthly 1/2 hourly maximum	130.8	190.6	199.1	131.7	156.8	142.6	148.5	112.5	113.2	23.2	40.7	47.2
Daily SO2 ELV	50	50	50	50	50	50	50	50	50	50	50	50
Monthly daily mean												
Monthly daily maximum	20.1	24.3	46.5	13.9	16.3	19.5	12.5	14.7	10.8	3.6	6.2	9.1

Line 2 (West) – Oxides of nitrogen



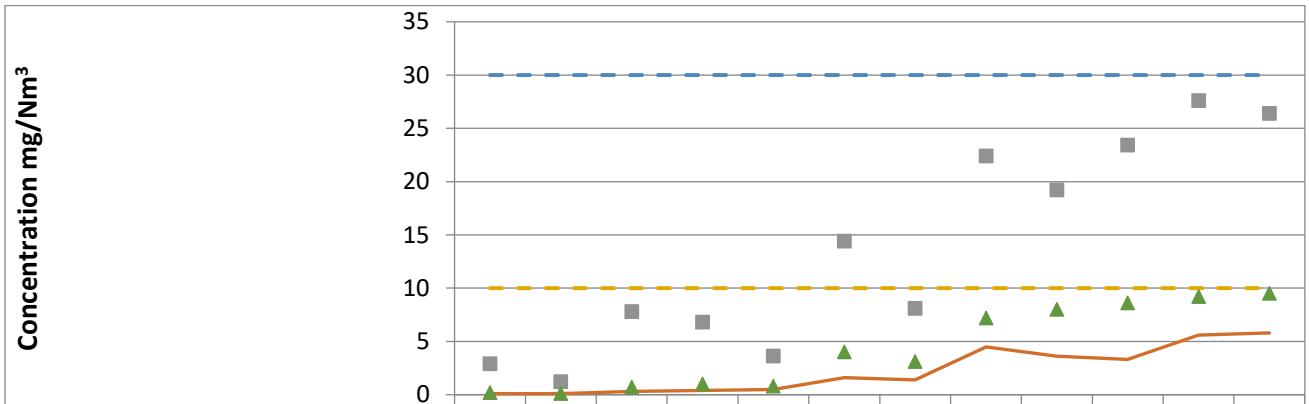
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1/2 hourly NOx ELV	350	350	350	350	350	350	350	350	350	350	350	350
Monthly 1/2 hourly mean	84.1	85.2	141.1	142	150.1	185.1	205	159.6	162.7	154.6	149	152.9
Monthly 1/2 hourly maximum	330	349.9	250.8	254.8	278.1	279.7	349.9	259.6	311.8	291.3	271.1	279.2
Daily NOx ELV	350	350	350	350	350	350	350	350	350	350	350	350
Monthly daily mean												
Monthly daily maximum	133.7	128.3	187.2	165.1	189.1	208.9	242	185.6	203.1	187.3	172.1	171.9

Line 2 (West) – Total organic carbon



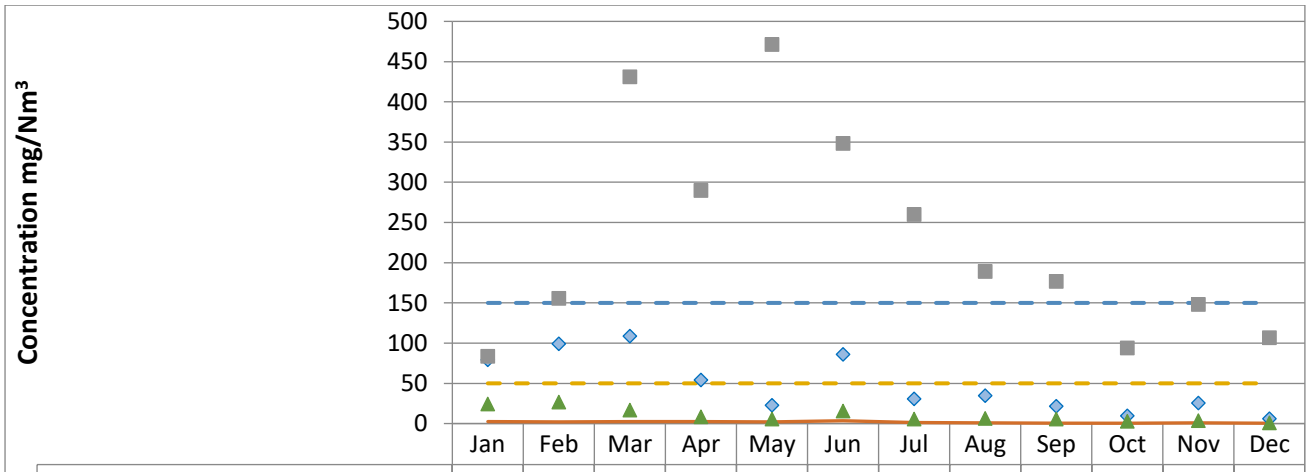
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1/2 hourly TOC ELV	20	20	20	20	20	20	20	20	20	20	20	20
Monthly 1/2 hourly mean	1.1	1.7	2.5	2.7	1.4	0.2	0.3	0.1	0.1	0.1	0.1	0.2
Monthly 1/2 hourly maximum	17.1	19.4	17.8	13.7	13.8	12.6	15.7	12.6	7.4	3.1	14.3	18.1
Daily TOC ELV	10	10	10	10	10	10	10	10	10	10	10	10
Monthly daily mean												
Monthly daily maximum	3	3.2	6	3.7	3.5	1	0.9	0.6	0.6	0.3	0.7	2.2

Line 2 (West) – Particulates



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1/2 hourly PM ELV	30	30	30	30	30	30	30	30	30	30	30	30
Monthly 1/2 hourly mean	0.1	0.1	0.3	0.4	0.5	1.6	1.4	4.5	3.6	3.3	5.6	5.8
Monthly 1/2 hourly maximum	2.9	1.2	7.8	6.8	3.6	14.4	8.1	22.4	19.2	23.4	27.6	26.4
Daily PM ELV	10	10	10	10	10	10	10	10	10	10	10	10
Monthly daily mean												
Monthly daily maximum	0.2	0.1	0.7	1	0.8	4	3.1	7.2	8	8.6	9.2	9.5

Line 2 (West) – Carbon monoxide



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
10 minute CO ELV (95%)	150	150	150	150	150	150	150	150	150	150	150	150
Monthly 95% 10 minute maximum	79.2	99	108.8	54.4	22.9	86.2	30.6	34.6	21.7	9.5	25.6	6.2
Monthly 10 minute mean	2.3	2.1	2.4	2.3	2	3.5	1.4	0.9	0.6	0.4	0.7	0.4
Monthly 10 minute maximum	83.8	155.7	431.3	289.8	471.5	348.2	260.1	189	176.7	93.9	148	106.6
Daily CO ELV	50	50	50	50	50	50	50	50	50	50	50	50
Monthly daily mean												
Monthly daily maximum	24.5	26.6	16.8	8.6	5.6	15.5	5.8	6.3	5.5	2.8	3.8	1

4.2 Summary of periodic monitoring results for emissions to air

The table below shows the results of periodically monitored substances.

Substance	Emission limit value	Results			
		East		West	
		19/04/22 – 21/04/22	Not Completed	19/04/22 – 21/04/22	Not Completed
Mercury and its compounds	0.05 mg/m^3	0.0079 mg/m^3	- mg/m^3	0.0044 mg/m^3	- mg/m^3
Cadmium & thallium and their compounds (total)	0.05 mg/m^3	0.0011 mg/m^3	- mg/m^3	0.0012 mg/m^3	- mg/m^3
Sb, As, Pb, Cr, Co, Cu, Mn, Ni and V and their compounds (total)	0.5 mg/m^3	0.05 mg/m^3	- mg/m^3	0.18 mg/m^3	- mg/m^3
Dioxins and furans (I-TEQ)	0.1 ng/m^3	0.0142 ng/m^3	- ng/m^3	0.0097 ng/m^3	- ng/m^3

4.3 Summary of monitoring results for emissions to water

No emissions to water are monitored from the process.

5. Summary of Permit Compliance

5.1 Compliance with permit limits for continuously monitored pollutants

The plant met its emission limits as shown in the table below.

Substance	Percentage time compliant during operation			
	East		West	
	Half-hourly limit	Daily limit	Half-hourly limit	Daily limit
Particulates	100 %	100 %	100 %	100 %
Oxides of nitrogen	100%	100 %	100 %	100 %
Sulphur dioxide	100 %	100 %	100 %	100 %
Carbon monoxide	100 %	100 %	100 %	100 %
Total organic carbon	100 %	100 %	100 %	100 %
Hydrogen chloride	100 %	100 %	100 %	100 %

5.2 Summary of any notifications or non-compliances under the permit

East

Date	Summary of notification or non-compliance	Reason	Measures taken to prevent reoccurrence
28/03/22	ERV Opening	Boiler low low due to boiler control system failure (modulating valve)	Modulating valve repaired
18/05/22	ERV Opening	Power failure triggering plant trip due to UPS failure	Batteries on UPS changed. Upgrade of UPS units planned into the capex programme (23/24).
02/08/22	ERV Opening	Blowdown valve blocked triggering boiler drain and low low alarm tripping the plant	Increased checks on strainers, bypass valve fitted
19/08/22	ERV Opening	Boiler low low due to boiler control system failure	Due to repeat occurrence, replaced controller, probes and all wiring between the probes and the controller

West

Date	Summary of notification or non-compliance	Reason	Measures taken to prevent reoccurrence
17/07/2022	TOC IBA Failure	Poor combustion	Repairs to the rams, ram housings, combustion hearths, under fire air grates and under fire air ductwork

5.3 Summary of any complaints received and actions to taken to resolve them.

Date of complaint	Summary of complaint	Reason for complaint including whether substantiated by the operator or the EA	If substantiated, measures to prevent reoccurrence
	None		

6. Summary of plant improvements

Summary of any permit improvement conditions that have been completed within the year and the resulting environmental benefits.
None
Summary of any changes to the plant or operating techniques which required a variation to the permit and a summary of the resulting environmental impact.
None
Summary of any other improvements made to the plant or planned to be made and a summary of the resulting environmental benefits.
Completed 2022 • Incinerator Hearths completed replaced including all associated air controls on East & West Stream. • East Bag house (Bags) changed. • Installation of a Lime Recirculation system to maximise utilisation of the lime and reduce overall APC residue. • Carbon load cells installed. • Intercoolers and clarifiers changed on East and West Streams. • Boiler controllers, probes and wiring changed on East & West Streams. • New water treatment installed. • Structured shutdown scheduling started in January. • Additional high temperature probes installed to improve emission controls. Planned for 2023 • SNCR to both streams to abate NOx emissions to new BAT-AEL coming into force in Dec 23. • Improvements to carbon dosing system to better monitor and control carbon dosing rates. • Upgrades to the lime dosing system and motors to increase lime supply to the abatement plant to meet new BAT-AEL on HCL and SO2 coming into force in Dec 23. • Automation of under fire air controls on West as a primary NOx reduction measure. • UPS upgrades to boiler, MCC and PLC for both streams to improve resilience (potentially 2024). • New liners in the emission stacks for both streams. • New MCC and PLC/SCADA system on both streams.

7. Details of any public liaison planned for 2023

Date and time	Description	Location
	None	

8. Other Permit form Information

Below are a summary of the information contained within forms required by permit conditions 1.2.3 and 4.2.2.

Form	Parameters	Location/Result
Old annual report	Practicability of CHP Implementation	The Heliex system did function within 2022 and produced 24.6MWh of electricity for use on site. It is intended that the Heliex technology will continue to be implemented at Knostrop as the most feasible technology for energy recovery. An alternative CHP installation would not be practical.
Performance 1	Operating hours for the year Number of periods of abnormal operations Cumulative hours of abnormal operations	See section 3
Performance indicators	Total waste incinerated Electrical energy imported to site/tonne incinerated Gas consumption/tonne incinerated IBA produced/tonne incinerated APC produced/tonne incinerated Lime consumption/tonne incinerated Carbon consumption/tonne incinerated Water used/tonne incinerated	See section 3 106.25 kWh/tonne 53.41 kWh/tonne 145.33 kg/tonne 60.48 kg/tonne 47.20 kg/tonne 3.18 kg/tonne 10.08 m3/tonne
Energy 1	Electricity (primary energy & CO2) Natural Gas (primary energy & CO2) Cumulative primary energy, CO2 and CO2/tonne incinerated	3651 MWh, 603 tonnes CO2 705 MWH, 134 tonnes CO2 3650 MWH, 738 tonnes CO2, 0.056 tonnes CO2/tonne
Water 1	Mains water (total & per tonne incinerated)	133,199 m3, See Performance indicators
Disposal and Recovery	Haz wate incinerated Clinical waste incinerated Cytotoxic/cytostatic waste incinerated Total waste incinerated Total waste per unit output (IBA & APC)	See section 3 See section 3 783.24 tonnes See section 3 See Performance indicators