

Annual Performance Report 2016

Sheffield Energy Recovery Facility

Permit No. BM4082IY

1. Introduction.

This report fulfils the requirements of the Industrial Emissions Directive regarding the:

Veolia ES Sheffield Limited
Sheffield Energy Recovery Facility
Bernard Road,
Sheffield
S4 7YX

Further copies of this report are available the address above.

The Sheffield Energy Recovery Facility (ERF) is operated by Veolia ES Sheffield Ltd under an Environmental Permit issued and regulated by the Environment Agency.

In August 2001, Veolia Environmental Services (formally Onyx) were awarded a 35 year integrated waste management contract by Sheffield City Council. As part of this contract, Veolia Environmental Services were required to replace the old Energy Recovery Facility constructed in the 1970s with a new modern Energy Recovery Facility. The new facility had to continue electricity & heat generation, improve performance and meet the stricter European Environmental Regulations that came into force in December 2005. Construction for the new facility began in August 2003. In December 2005 the old Energy Recovery Facility was decommissioned and the new facility commenced hot commissioning. Commissioning was completed in April 2006.

The Facility recovers heat from the incineration of the waste, producing steam which is used to generate up to 19MW of electricity to the National Grid and up to 60MW_(t) to the Community District Energy network.

2. Plant Description

The main purpose of the Facility is to incinerate Municipal Solid Waste (MSW), recovering energy in the form of steam for export to the Community District Energy network and electricity for export to the National Grid. The permitted Facility covers the site and the entire facility including incineration, waste reception and storage, waste-fuel and air supply systems, boilers, facilities for the treatment of exhaust gases, on-site facilities for handling and storage of residues and operations, recording and monitoring conditions.

Waste Reception & Storage:

Waste is delivered into the tipping hall in covered vehicles. The tipping hall is maintained under negative pressure to minimise the escape of odours, dust or litter. The vehicles tip into a waste storage bunker from where the grab cranes transfers waste as required to the feed hopper of the combustion plant.

Combustion Process:

Waste is gravity fed onto the incinerator grate. The grate is continually moving thus promoting continuous mixing of the waste with the combustion air, extracted from the tipping hall and introduced from beneath the grate into the heart of the fire eliminating any odours. Further air is injected just above the fire to promote mixing and complete combustion of the gases.

Fuel gas burners are installed for start-up and to maintain the furnace temperature, if required. However, during normal operation no support fuel is required to maintain the minimum 850°C.

Ash from the grate is discharged into a water filled quench pit from where it is moved by conveyor to the enclosed ash storage bunkers prior to being transported off site. All incinerator bottom ash is sent to a local Recycling Facility.

Ferrous metals are removed from the ash by a magnet and stored separately and sent to a local Recycling Facility.

Energy Recovery:

Hot gases from the combustion of waste pass through a steam boiler. The temperature of the gases is reduced from over 850°C to around 140°C. The gases heat up the water in the boiler and produce steam at 45barG. This steam is fed to a steam turbine driven generator capable of generating up to 21MW_(e), this supplies electricity to the National Grid after first satisfying the site parasitic load. Steam is also fed into the District Energy System using heat exchangers; this can be up to 60MW_(t) of energy.

Gas Cleaning:

Urea solution is injected into the combustion gas path to reduce the formation of oxides of nitrogen. Downstream of the boiler hydrated lime is injected to neutralise acid gases. Powdered activated carbon is injected to adsorb dioxins, furans and dioxin like PCBs and heavy metals.

Prior to release into the air the gases pass through a fabric filter which removes the particulate matter, spent lime and carbon from the gas stream. Once the gases have been cleaned they are discharged into the atmosphere via two flues in the 76 metre high stack.

Water Usage:

The plant uses mains water for steam generation. After electricity generation in the turbine the steam is cooled and condensed back to water for reuse in the boiler.

The facility also uses mains water in various ways for internal wash downs, tipping bay floor cleaning, but mostly for human domestic use, cooking, showering and sanitation. Any water that is used within the Facility for washing and cleaning is captured in dedicated drains and directed into an interceptor pit where heavy sediments are removed from the water.

The cleaned water is then re-used within the Facility principally for ash quenching, thus limiting the amount of fresh water used and minimising water discharge from the site. External uncontaminated rainwater runoff is allowed to enter the sewer network unchecked along with normal domestic waste water.

3. Summary of plant operations.

This facility consists of one incineration line capable of processing approximately 28 tonnes of refuse per hour, allowing for a nominal refuse throughput of 245,000 tonnes per year assuming 91.9 % availability. This is dependent on two factors: actual operating hours and calorific value of the waste being burnt. The average calorific value of general municipal waste is 9200Kj/Kg.

During 2016 the facility processed 235334.24 tonnes of waste, of this 81.84% was municipal waste, the remaining 18.16% came from commercial premises. Appendix A Lists the amount waste disposed of by European Waste Catalogue Number.

Plant Operational details for 2016 are included in the table below.

Operating Hours	8071.7	Hours
Waste Incinerated	235334.24	Tonnes
Electricity Produced	123657.06	MWh
Energy exported to Community District Energy network	113132.86	MWh
Metals Recovered	6017.68	Tonnes
Incinerator Bottom Ash	43854.24	Tonnes
APC residues	5034.48	Tonnes

The availability for 2016 was 91.9%.

Planned Outage Maintenance ran for 20 days.

The site generated 123657.06 MWh of electricity during 2016. After subtracting on site usage, 107549.65 MWh of electricity was exported to the National Grid. This is enough to provide approximately 25,000 homes in Sheffield with electricity for 1 year. This displaces up to 49,000 tonnes of coal a year that would have been needed to produce an equivalent amount of electricity in a conventional coal fired power station.

(BERR Electricity Consumption Statistics: Sheffield average domestic electricity consumption for 2006 was 3,851 kWh)

The District Energy Network now supplies low carbon energy to 147 buildings in Sheffield including 5 hotels, leisure facilities, 2 Universities and several Local Government Buildings. There were three additional buildings connected to the network during 2016, with one building disconnected and one building

reconnected. 101,082 MWh of thermal energy was sold to the users of the system; conventional oil fired boilers would use approximately 14.5 million litres of oil to generate an equivalent amount of thermal energy. All Ash residues (known as Incinerator Bottom Ash or IBA) are delivered to a local Recycling Facility.

Ferrous metal removed from the IBA is collected by a local steel manufacturer for recycling.

According to the Steel Can Recycling Information Bureau, every tonne of steel packaging recycled compared to producing steel from raw materials makes the following environmental savings:

- 1.5 tonnes of iron ore.
- 0.5 tonnes of coal.
- 86% reduced air pollution
- 40% reduced water use
- 76% reduced water pollution
- 62% to 74% reduced energy usage

If all the recycled steel from the Sheffield ERF was used to build The London Eye a new London Eye could be built every 14 weeks.

Fine particulate matter, known as Air Pollution Control (APC) residue, removed from the flue gases by the fabric filter is collected and sent to a specialised treatment works where it is used to treat spent acid wastes prior to disposal at a licensed land fill site.

4. Summary of Plant Emissions.

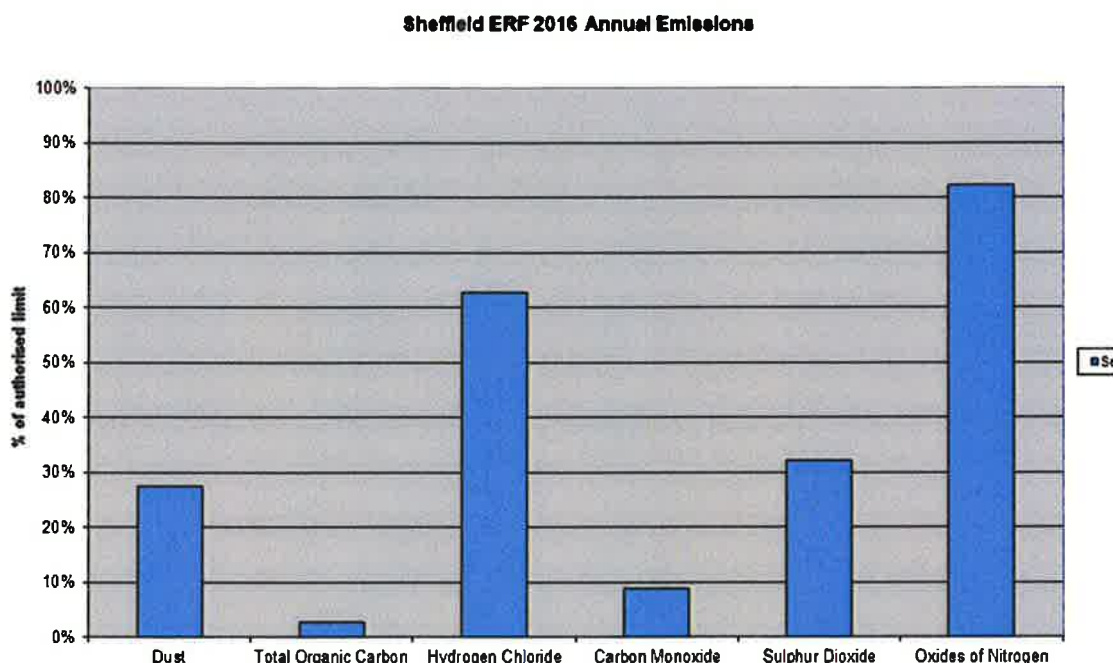
All emissions to air from the 76m high chimney are controlled to meet the emission limits included in the EPR Permit. The flue gases released into the atmosphere are continuously monitored for Particulate Matter, Hydrogen Chloride, Oxides of Nitrogen, Carbon Monoxide, Sulphur Dioxide, Total Volatile Organic Compounds and Ammonia. The monitoring equipment was in service during 2016 for whole of the plant operating time. This equipment is stringently monitored with routine calibration checks and is standardised to BS EN14181. Additionally, a full range of standby equipment is permanently in service should an unexpected failure occur.

Bi-annual check monitoring of these emissions is carried out by approved contractors using independent extractive reference methods. Emissions of metals, dioxins and other substances are also monitored as detailed overleaf.

		Average emission result for 2016	
Parameter	Limit mg/m ³		
Continuous Emission Monitoring Results			
Particulate	10	2.735	mg/Nm ³
Total organic carbon	10	0.262	mg/Nm ³
Hydrogen Chloride	10	6.275	mg/Nm ³
Ammonia	No limit	2	mg/Nm ³
Carbon monoxide	50	4.385	mg/Nm ³
Nitrogen oxides	180	148.012	mg/Nm ³
Sulphur dioxide	50	16.109	mg/Nm ³
Extractive Sampling Results			
Hydrogen Fluoride	2	0.035	mg/Nm ³
Nitrous oxide	No limit	4.2	mg/Nm ³
Cadmium & thallium	0.05	0.00033	mg/Nm ³
Mercury	0.05	0.00305	mg/Nm ³
other metals	0.5	0.01575	mg/Nm ³
Dioxins/Furans (I-TEQ)	0.1ng/Nm ³	0.0022	ng/Nm ³
<i>upper and lower levels</i>		0.0022	ng/Nm ³
Dioxin-like PCBs (WHO-TEQ Humans/mammals)	no limit	0.0005	ng/Nm ³
<i>upper and lower levels</i>		0.0006	ng/Nm ³
Dioxin-like PCBs (WHO-TEQ Fish)	no limit	0.0000	ng/Nm ³
<i>upper and lower levels</i>		0.0000	ng/Nm ³
Dioxin-like PCBs (WHO-TEQ Birds)	no limit	0.0018	ng/Nm ³
<i>upper and lower levels</i>		0.0018	ng/Nm ³
Dioxins/Furans (WHO-TEQ Humans/Mammals)	no limit	0.0022	ng/Nm ³
<i>upper and lower levels</i>		0.0022	ng/Nm ³
Dioxins/Furans (WHO-TEQ Fish)	no limit	0.0024	ng/Nm ³
<i>upper and lower levels</i>		0.0024	ng/Nm ³
Dioxins/Furans (WHO-TEQ Birds)	no limit	0.0046	ng/Nm ³
<i>upper and lower levels</i>		0.0046	ng/Nm ³
Poly-cyclic aromatic hydrocarbons (PAHs) Total	no limit	0.7639	ug/Nm ³
Anthracene	no limit	0.0116	ug/Nm ³
Benzo(a)anthracene	no limit	0.0095	ug/Nm ³
Benzo(b)fluoranthene	no limit	0.0105	ug/Nm ³
Benzo(k)fluoranthene	no limit	0.0105	ug/Nm ³
Benzo(b)naph(2,1-d)thiophene	no limit	0.0098	ug/Nm ³
Benzo(c)phenanthrene	no limit	0.0095	ug/Nm ³
Benzo(ghi)perylene	no limit	0.0116	ug/Nm ³
Benzo(a)pyrene	no limit	0.0105	ug/Nm ³
Cholanthrene	no limit	0.0106	ug/Nm ³
Chrysene	no limit	0.0095	ug/Nm ³
Cyclopenta(c,d)pyrene	no limit	0.0095	ug/Nm ³
Dibenzo(ah)anthracene	no limit	0.0116	ug/Nm ³
Dibenzo(a,i)pyrene	no limit	0.0127	ug/Nm ³
Fluoranthene	no limit	0.0254	ug/Nm ³
Indo(1,2,3-cd)pyrene	no limit	0.0116	ug/Nm ³
Naphthalene	no limit	0.5894	ug/Nm ³

The following bar chart shows the average annual emissions from the Sheffield ERF.

5. Summary of Plant Compliance



Strict environmental controls and proven operating experience ensures that the Facility is compliant with all conditions of its Pollution Prevention Control (PPC) Permit at all times. This is achieved through constant monitoring of the incineration process during all of the stages, with detailed procedures in place to enable trained staff to carry out their work in an environmentally compliant manner. The plant operates within an Environmental Management System compliant with both ISO 9001; ISO 14001 and OHSAS 18001 and is independently and externally audited.

During 2016 the Sheffield ERF operated within the Permitted Emission Limit Values (ELV) for 99.9% of the operational time.

Table of plant compliances

Breach of Permit Conditions	1
Enforcement Actions	0
General Complaints	0

Summaries of half hourly and daily average emission data for continuously monitored emissions are supplied to the Environment Agency on a monthly basis. Other reports as required by the EPR Permit are also forwarded 6 monthly. All are available from the public register.

6. Summary of plant improvements.

The Facility was commissioned in 2006 to the latest technical and environmental standards, it is not expected that any major improvements will be required in the short term although significant effort is being expended in optimising the plant performance in order to maximise energy recovery and minimise use of raw materials.

7. Summary of information made available.

A general process description can be found on the company website at www.veolia.co.uk/sheffield/what-happens-your-waste. This site also contains details of average emissions for the full year. A community liaison group meeting is held annually.

As part of their regulatory responsibility the Environment Agency inspector visits the Facility on a regular basis. The Operating Permit is available from the Public Register at the Environment Agency's office:

The Environment Agency
Bowbridge Close
Bradmarsh Business Park,
Templeborough,
Rotherham
S60 1BY

Useful web addresses:

www.veolia.com

www.environment-agency.gov.uk

Registered Office: Veolia ES Sheffield Limited
210 Pentonville Road
London
N1 9JY

Compiled on behalf of the Operator by:

Guy Le Geyt
General Manager

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Appendix A

List of waste disposed of during 2016 at The Sheffield Energy Recovery Facility

Description	European Waste Catalogue Number	Annual Tonnage
Waste from food preparation - animal tissue waste	020202	0
Waste from food preparation – materials unsuitable for consumption/processing	020203	0
Healthcare waste – wastes where collection and disposal is not subject to special requirements in order to prevent infection	180104	749.64
Waste from waste and water treatment – other wastes from mechanical treatment of wastes other than those mentioned in 191211	191212	34451.33
Waste packaging – adsorbents, filters and protective clothing not contaminated by dangerous substances.	150203	0
Waste packaging – paper and cardboard packaging	150101	0
Waste packaging – mixed packaging	150106	0
Waste packaging – textile packaging ⁽¹⁾	150109	0
Municipal Wastes – paper and cardboard	200101	78.36
Municipal Wastes – biodegradable kitchen waste	200108	0
Municipal Wastes – clothes	200110	0
Municipal Wastes – textiles	200111	0
Municipal Wastes – wood	200138	0
Municipal Wastes – plastics	200139	0
Garden and Park waste – biodegradable waste	200201	265.24
Other municipal waste – mixed municipal waste	200301	199789.67
Other municipal waste – waste from markets	200302	0
Other municipal waste – street cleaning residues	200303	0