

## Annual Performance Report 2007

### **Sheffield Energy Recovery Facility PPC Permit: BM4082**

#### **1. Introduction.**

This report fulfils the requirements of Article 12(2) of the Waste Incineration Directive regarding the:

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

Further copies of this report are available at [www.veolia/Sheffield.co.uk](http://www.veolia/Sheffield.co.uk) or the address above

The Sheffield Energy Recovery Facility (ERF) is operated by Veolia ES Sheffield Ltd under a PPC 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 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. Currently the ash is used as intermediate cover at landfill but recycling options are being actively pursued

Ferrous metals are removed from the ash by a magnet and stored separately prior to transport off site for recycling.

#### 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 21MWe, 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 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 225,000 tonnes per year, but 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 2007 the facility processed 196,505 tonnes of waste, of this 67.85% was domestic waste collected by Veolia from the residents of Sheffield, the remaining 32.15% came from commercial premises. Appendix A Lists the amount waste disposed of by European Waste Catalogue Number.

Plant Operational details for 2007 are included in the table below.

Operating Hours	7,182	Hours
Waste Incinerated	196,505	Tonnes
Electricity Produced	106,080	MWh
Energy exported to Community District Energy network	86,222	MWh
Metals Recovered	6314	Tonnes
Incinerator Bottom Ash	45,220	Tonnes
APC residues	5,013	Tonnes

The availability for 2007 was lower than that of 2006. There were two main reasons for the reduced availability.

1. A design fault was discovered with the grab crane running rails. This resulted in the immediate shutdown of the plant in April while temporary repairs took place. In the September outage modified steel supports were erected, the running rails are now adequate for the life of the plant.
2. In the last quarter of the year problems started to emerge with the superheaters, resulting in significant lost availability. The manufacturers of the plant and Veolia are working towards replacing the superheaters in April or May 2008.

The site generated 106,080 MWh of electricity during 2007. After subtracting on site usage, 91,870 MWh of electricity was exported to the National Grid. This is enough to provide 23,856 homes in Sheffield with electricity for 1 year. This displaces up to 49,500 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 heating network now supplies low carbon energy to over 140 buildings in Sheffield including 3 hotels, a hospital, leisure facilities and 2 Universities. In 2007 109,086 MWh of thermal energy was sold to the users of the system, of which 79% was supplied by the ERF. 3 additional buildings were connected to the network during 2007 and it is anticipated that more buildings will be connected during 2008. Conventional oil fired boilers would use approximately 13.6 million litres of oil to generate an equivalent amount of thermal energy.

Ash residues (known as Incinerator Bottom Ash or IBA): The option of recycling the IBA is being actively pursued in partnership with an experienced operator. It is hoped that a site could be operational during 2009.

Ferrous metal removed from the IBA is sent to a 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 specialised treatment works where it is used to treat spent acid wastes prior to disposal at a licensed land fill site.

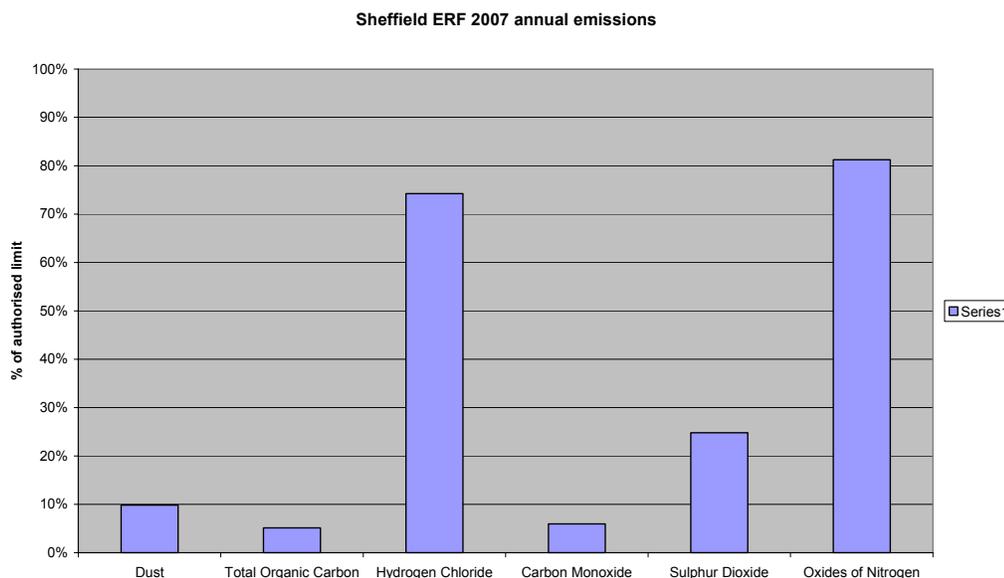
#### **4. Summary of plant emissions.**

All emissions to air from the 76m high chimney are controlled to meet the emission limits included in the PPC 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 2007 for 100% 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 listed below.

		Average emission result for 2007	
Parameter	Limit mg/m <sup>3</sup>		
<b>Continuous Emission Monitoring Results</b>			
Particulate	10	1.01	mg/Nm <sup>3</sup>
Total organic carbon	20	0.49	mg/Nm <sup>3</sup>
Hydrogen Chloride	10	7.43	mg/Nm <sup>3</sup>
Ammonia	no limit	3	mg/Nm <sup>3</sup>
Carbon monoxide	50	3.03	mg/Nm <sup>3</sup>
Nitrogen oxides	180	146	mg/Nm <sup>3</sup>
Sulphur dioxide	50	12.67	mg/Nm <sup>3</sup>
<b>Extractive Sampling Results</b>			
Hydrogen Fluoride	2	Non detected	mg/Nm <sup>3</sup>
Nitrous oxide	no limit	0.22	mg/Nm <sup>3</sup>
Cadmium & thallium	0.05	0.0023	mg/Nm <sup>3</sup>
Mercury	0.05	0.00085	mg/Nm <sup>3</sup>
other metals	0.5	0.045	mg/Nm <sup>3</sup>
Dioxins/Furans (I-TEQ)	0.1 ng/Nm <sup>3</sup>	0.011	ng/Nm <sup>3</sup>
<i>upper and lower levels</i>		0.011	ng/Nm <sup>3</sup>
Dioxin-like PCBs (WHO-TEQ Humans/mammals)	no limit	0.0025	ng/Nm <sup>3</sup>
<i>upper and lower levels</i>		0.0025	ng/Nm <sup>3</sup>
Dioxin-like PCBs (WHO-TEQ Fish)	no limit	0.00013	ng/Nm <sup>3</sup>
<i>upper and lower levels</i>		0.00013	ng/Nm <sup>3</sup>
Dioxin-like PCBs (WHO-TEQ Birds)	no limit	0.0056	ng/Nm <sup>3</sup>
<i>upper and lower levels</i>		0.0056	ng/Nm <sup>3</sup>
Dioxins/Furans (WHO-TEQ Humans/Mammals)	no limit	0.012	ng/Nm <sup>3</sup>
<i>upper and lower levels</i>		0.012	ng/Nm <sup>3</sup>
Dioxins/Furans (WHO-TEQ Fish)	no limit	0.012	ng/Nm <sup>3</sup>
<i>upper and lower levels</i>		0.012	ng/Nm <sup>3</sup>
Dioxins/Furans (WHO-TEQ Birds)	no limit	0.029	ng/Nm <sup>3</sup>
<i>upper and lower levels</i>		0.029	ng/Nm <sup>3</sup>
Poly-cyclic aromatic hydrocarbons (PAHs) Total	no limit	0.088	ug/Nm <sup>3</sup>
Anthanthracene	no limit	0.0034	ug/Nm <sup>3</sup>
Benzo(a)anthracene	no limit	0.0028	ug/Nm <sup>3</sup>
Benzo(b)fluoranthene	no limit	0.0031	ug/Nm <sup>3</sup>
Benzo(k)fluoranthene	no limit	0.0031	ug/Nm <sup>3</sup>
Benzo(b)naph(2,1-d)thiophene	no limit	0.0029	ug/Nm <sup>3</sup>
Benzo(c)phenanthrene	no limit	0.0037	ug/Nm <sup>3</sup>
Benzo(ghi)perylene	no limit	0.0034	ug/Nm <sup>3</sup>
Benzo(a)pyrene	no limit	0.0031	ug/Nm <sup>3</sup>
Cholanthrene	no limit	0.0031	ug/Nm <sup>3</sup>
Chrysene	no limit	0.0028	ug/Nm <sup>3</sup>
Cyclopenta(c,d)pyrene	no limit	0.0028	ug/Nm <sup>3</sup>
Dibenzo(ah)anthracene	no limit	0.0034	ug/Nm <sup>3</sup>
Dibenzo(a,i)pyrene	no limit	0.0037	ug/Nm <sup>3</sup>
Fluoranthene	no limit	0.0086	ug/Nm <sup>3</sup>
Indo(1,2,3-cd)pyrene	no limit	0.0034	ug/Nm <sup>3</sup>
Naphthalene	no limit	0.034	ug/Nm <sup>3</sup>

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 and ISO 14001 and is independently and externally audited.

During 2007 the Sheffield ERF operated within the Permitted Emission Limit Values (ELV) for 100% of the operational time.

Table of plant compliances.

Breach of Permit Conditions	None
Enforcement Actions	None
General Complaints	None

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 PPC 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/sheffield.co.uk](http://www.veolia/sheffield.co.uk) . This site also contains details of average emissions for the full year. A community liaison group exists but only one meeting was held in 2007 due to lack of interest by the community representatives.

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 at:

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

Useful web addresses:

[www.veolia.co.uk](http://www.veolia.co.uk)  
[www.environment-agency.gov.uk](http://www.environment-agency.gov.uk)

Registered Office : Veolia ES Sheffield Limited,  
154a, Pentonville Road,  
London,  
N1 9PE.

Compiled on behalf of the Operator by:

P Pagdin  
Operations Manager  
Veolia Sheffield ES Ltd

15<sup>th</sup> January 2008.

## Appendix A

### List of waste disposed of during 2007 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	1,634
Healthcare waste – wastes where collection and disposal is not subject to special requirements in order to prevent infection	180104	273
Waste from waste and water treatment – other wastes from mechanical treatment of wastes other than those mentioned in 191211	191212	198
Waste packaging – adsorbents, filters and protective clothing not contaminated by dangerous substances.	150203	0
Waste packaging – paper and cardboard packaging	150101	9
Waste packaging – mixed packaging	150106	0
Waste packaging – textile packaging <sup>(1)</sup>	150109	0
Municipal Wastes – paper and cardboard	200101	233
Municipal Wastes – biodegradable kitchen waste	200108	8
Municipal Wastes – clothes	200110	11
Municipal Wastes – textiles	200111	0
Municipal Wastes – wood	200138	0
Municipal Wastes – plastics	200139	19
Garden and Park waste – biodegradable waste	200201	0
Other municipal waste – mixed municipal waste	200301	192,061
Other municipal waste – waste from markets	200302	1,119
Other municipal waste – street cleaning residues	200303	796