



Annual Performance Report for Boiler 7 Renewable Energy Process at Shotton Mill during 2022

This report has been written to meet the requirements of Article 12 (2) of the Waste Incineration Directive 2000/76/EC(WID)

"For incineration or co-incineration plants with a nominal capacity of two tonnes or more per hour and notwithstanding Article 15(2) of Directive 96/61/EC, an annual report to be provided by the operator to the competent authority on the functioning and monitoring of the plant shall be made available to the public. This report shall, as a minimum requirement, give an account of the running of the process and the emissions into air and water compared with the emission standards in this Directive."

For any further enquiries or requests for information please contact:

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Registered in England and Wales. No. 13074427



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1. Introduction

The principle of Boiler 7 design of the plant was to burn all the site sludge produced from the de-inking and effluent treatment processes on site. Since the cessation of sludge production in September 2021, sludge has been imported to facilitate continued operation of the plant for power generation.

Due to the low calorific value of the sludge, Boiler 7 requires an additional support fuel to maintain the combustion process. This support fuel comprises of recycled wood and arboricultural arisings, with the higher percentage being recycled wood

All the biomass is supplied to site by Tilhill who source the materials from various outlets, with the majority of recycled waste wood being prepared on site.

2. Plant description

The Boiler 7 plant comprises of the following equipment:

- Wood Bio-fuel reception and processing
- Waste Wood Processing Plant
- Imported waste sludge and wood bio-fuel storage
- Conveyor systems
- Boiler 7 furnace with High Pressure and Low Pressure steam turbines and all other associated equipment

Control of the combustion process remains highly automated with several layers of safeguards and interlocks built into the control strategy and hardware to ensure the operation is stable and conforms to the requirements of WID.

The use of the combustion optimisation package has continued in ensuring that combustion remains stable and maintain a good thermal efficiency and reduces the potential for environmental noncompliance.

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3. Summary of Plant Operations

During the year the plant was operational for 7947 hours, with outages totalling 813 hours giving an overall availability of 90.72%

Boiler 7 continued at high operating rate (90.72%) and at the design load (32kg/s) throughout 2022. Fuel mix consisted of waste wood, virgin biomass and imported papermaking sludge. The plant saw four total shutdowns and start-ups. Two took place in January and April to allow safe isolation of boiler 7 from the site demolition area.

The major annual shut took place between July and August for pressure part maintenance.

Finally, there was a short shutdown in December to repair a safety valve defect. The combustion control remained under the automated OEM system, ensuring stable combustion and emissions.

Fuel Inputs

Fuel description	EWC code	Tonnes used
Site Waste Sludge	03 03 05	36849.7 T
Recovered bio-fuel	15 01 03 17 02 01 19 12 07 19 12 10 20 01 38	221,296 T

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Energy outputs

Description	Energy MWh	End Use
Electricity	125127	Supply of a portion of the electrical energy consumption for the site.
Process steam	0	Supplied primarily to the pulp de-inking and paper manufacturing processes.
Process water heating	0	Process water from the paper machine was heated through plate heat exchangers by re-circulated Flue gas scrubber shower water.

Waste outputs

Waste description	EWG code	Tonnes produced	End Use
Bottom Ash	19 01 11	8303	Hazardous waste landfill
Fly ash	19 01 13	15151	Blended with other wastes for various cement replacement products.
Fly ash	19 01 13	0	Landfill

Non Waste Recycled Outlets	Tonnes produced	End Use
Fly Ash	1291	Block Industry

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4. Summary of Plant Monitoring

The following air emissions from the plant have been measured and reported continuously:

- Carbon Monoxide (CO)
- Sulphur Dioxide (SO₂)
- Total Organic Carbon (TOC)
- Hydrogen Chloride (HCl)
- Particulates
- Oxides of Nitrogen (NO_x)
- Ammonia

In addition to the continuous monitoring the following air emissions were measured and reported bi-annually as required by permitted conditions

- Mercury
- Cadmium and Thallium
- Other Metals (Sb, As, Pb, Cr, Co, Cu, Mn, Ni and V)
- Hydrogen Fluoride (HF)
- Dioxins and Furans

The Continuous Emissions Monitoring System (CEMs) operated within the specified WID availability criteria throughout the year as follows

	Q1	Q2	Q3	Q4
Number of Occasions	0	3	4	6
Cumulative Hrs	0	5	5	4

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Results from the periodic air emission testing on Boiler 7

Pollutants	H1 results ng/m3	H2 results ng/m3	Year Avg ng/m3
Mercury	0.018	0.0007	0.0012
Cadmium & Thallium	0.0011	0.0014	0.00125
Tin, Arsenic, Lead, Chromium, Cobalt, Copper, Manganese, Nickel, Vanadium	0.018	0.10	0.059
HF	0.21	0.12	0.0165
Dioxins / Furans (ITEQ)	0.00072	0.0025	0.0016

The ash residues produced by the process were also subject to a monitoring regime with analysis carried out quarterly for the following parameters:

- Bottom Ash Weight loss on Ignition (LOI) as %
- Bottom Ash heavy metals
- Fly Ash heavy metals
- Bottom Ash Dioxins and furans
- Fly Ash Dioxins and furans

Results for Loss on Ignition (LOI) testing of Bottom Ash

Parameter	Q1 %	Q2 %	Q3 %	Q4 %	Avg %
Bottom Ash LOI %	0.2	0.2	0.2	0.2	0.2

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Results for Heavy Metal APC Residues

Parameter	Q1 mg/kg	Q2 mg/kg	Q3 mg/kg	Q4 mg/kg	Avg mg/kg
Cd	3.70	1.70	0.95	1.85	2.05
Tl	0.15	0.10	0.10	0.10	0.11
Hg	0.40	0.20	0.15	0.25	0.25
Pb	1141.25	424.25	262.15	690.40	629.51
Cr	105.80	43.40	26.85	45.20	55.31
Cu	363.25	184.15	119.05	175.30	210.44
Mn	732.45	266.10	173.55	211.70	345.95
Ni	40.10	16.45	8.60	15.10	20.06
As	67.25	25.35	17.15	31.60	35.3375
Co	11.45	4.65	2.90	4.00	5.75
V	28.35	10.15	7.30	7.85	13.41
Zn	1661	669	323	937	897

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5. Summary of Plant Compliance

Air Pollutants	EU Directive ELV (mg/Nm ³)	Percentage compliance
Particulates	10	0
NO _x	200	0
SO ₂	50	0
CO	50	1
HCl	10	0
HF	1	0
Volatile organic compounds (TOC)	10	0
Mercury	0.05	0
Cadmium and thallium	0.05	0
Sum of heavy metals (Sb+As+Pb+Cr+Co+Cu+Mn+Ni+V)	0.5	0
Dioxins + furans	0.1 x 10 ⁻⁶	0
Ammonia	No Limit	N/A
CEMs operational when Boiler running	7933 hrs	99.8 %

Furnace combustion performance

Bottom Ash	Unit	EU Directive ELV	Percentage compliance
Loss on Ignition	%	5	100

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Flue gas scrubber performance

Scrubber bleed water parameters	Unit	EU Directive ELV	Percentage compliance
Total solids	mg/l	30	97.19
Hg	µg/l	30	100
Cd	µg/l	50	100
Tl	µg/l	50	100
As	µg/l	150	100
Pb	µg/l	200	100
Cr	µg/l	500	100
Cu	µg/l	500	100
Ni	µg/l	500	100
Zn	µg/l	1500	100

6. Summary of Plant Improvements

Operationally Boiler 7 ran very well during 2022. There were no unplanned shutdown for pressure part failure. There were 3 planned shutdowns to allow demolition and the maintenance outage. The only unplanned shutdown was to repair a defect on a high pressure safety valve which lasted 1 day.

Work took place to optimise combustion profile for the new sludge. This included reducing the primary air ratio during summer months when the moisture content of the fuel was very low due to the high heat. This helped to control our NOx emissions and remain compliant with our permit.

2022 saw significant isolation of the plant to remove redundant equipment and allow the site project demolition to continue safely.

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7. Summary of information made available:

The information made available in this report and the detailed monitoring returns from the site are available on the Public Register at:

Environment Agency Offices, Chester

Signed

A handwritten signature in black ink, appearing to read 'J Hill', is positioned below the 'Signed' text.

Jamie Hill
Utilities Manager,
Shotton Mill Limited,

Date 28th February 2023

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