

UPM-Kymmene (UK) Ltd
Shotton Paper
EPR Permit No. BT4885 IT



Environment Agency Report 1 (7)
February, 2014

Performance Report for the Boiler 7 Waste Incineration
process at Shotton Paper during 2013

Peter Walmsley
Safety and Environment Manager

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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1. Introduction

2013 was the eighth operational year for Boiler 7. The design of the plant was to burn all the waste sludge produced from the de-inking and effluent treatment processes on site. This fuel is being augmented with imported sludge from another local paper product manufacturer. Boiler 7 also requires support fuel for the combustion process due to the low calorific value of the waste sludge. The support fuel is supplied as biomass in various forms i.e. round wood logs, brash bales, recycled wood and woodchips. All the biomass is supplied to site by another UPM company, Tilhill Forestry, who source the materials from various local forests and wood processors where available. Local authority waste wood is prepared for use, on site, and sustains the boiler operation.

2013 saw the introduction of refuse derived fuel some of which originated from the on-site material recovery and recycling facility and is burned after processing in an off-site treatment plant.

2. Plant description

The Boiler 7 plant comprises of the following equipment:

- Wood bio-fuel reception and processing;
- Site-derived waste sludge and wood bio-fuel storage;
- Conveyor systems; and
- Boiler 7 furnace with steam turbine and other associated equipment

MONITORING RETURNS N. WALMSLEY

CHECKED	INITIALS	DATE
VIA AUTHORIZATION	JS	3/3/14
TRACKING	JB	3-3-14
OK FOR PUBLIC REGISTER	JS	25/3/14
TYPE TO EPR'S PUBLIC REGISTER	JB	EORM

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Control of the combustion process is highly automated and several layers of safeguard or interlocks are built into the control strategy and hardware to ensure the operation is stable and conforms to the WID requirements. The recent introduction of fuzzy logic has improved the stability and thermal efficiency has been enhanced by installation of soot-blower optimisation package.

3. Summary of Plant Operations

The plant was operational for 7369 hours. There were outages of 1391 hours. The blockage of the fluidised bed brought the planned April shutdown forward and delay in completion of the steam turbine extended that shutdown. There was an unplanned outage in July to repair the leaking economiser and a further planned shutdown in October to clean the gas passages.

APC residues and bottom ash have been classified as hazardous and now leave site as such for recycling or disposal.

Fuel Inputs

Wood bio-fuel	N/A	85,181
Site Waste Sludge	03 03 05	149,436
Recovered bio-fuel	15 01 03 17 02 01 19 12 07 19 12 10 20 01 38	117,178
Waste not otherwise specified	03 03 05	6,204

Energy outputs

Description	Energy MWh	End Use
Electricity	133,602	Supply of a portion of the electrical energy consumption for the site.
Process steam	584,358	Supplied primarily to the pulp de-inking and paper drying processes.
Process water heating	49,837	Process water from the paper machines was heated through plate heat exchangers by re-circulated Flue gas scrubber shower water.

Waste outputs

Waste description	EWC code	Tonnes produced	End Use
Bottom Ash	10 01 01	4,354	Combined with stone waste from the wood bio-fuel receiving equipment for use as an aggregate replacement
Fly ash	19 01 13	11,390	Blended with other wastes for neutralisation and creating cement products.
Fly ash	19 01 13	60,603	Landfill

4. Summary of Plant Monitoring

The following air emissions from the plant were 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 periodically (twice per year):

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 (CEM) equipment operated throughout the year. On Monday 26th of August the FTIR continuous emissions monitoring unit failed. It was replaced with the site spare and the unit was returned to service after an outage of approximately three hours.

There was no repeat of the previous years' problem of computer failure when the time changed from BST to GMT.

Monthly mean readings from CEMs are recorded below:

Pollutants	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Mean
CO	21.8	22.5	56.0	0.0	20.4	33.3	27.0	33.0	33.0	27.0	27.0	22.8	29.4
SO ₂	4.6	4.3	4.1	0.0	5.1	4.4	3.5	4.9	5.3	5.5	5.1	5.6	4.8
HCL	1.5	1.7	1.3	0.0	1.3	1.4	1.1	1.5	1.4	1.5	1.5	1.4	1.4
TOC	0.5	0.6	3.2	0.0	0.4	0.8	0.9	0.4	1.0	2.4	0.6	0.7	1.0
NO _x	150.3	153.3	145.0	0.0	167.9	169.0	174.9	157.0	153.0	169.7	171.7	177.6	162.7
Particulates	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Ammonia	0.5	0.5	0.8	0.0	0.8	0.8	0.5	0.6	0.1	0.1	0.2	0.2	0.5

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Results from the periodic air testing on Boiler 7 are given below:

Pollutants	Q1 results mg/m3	Q3 results mg/m3	Mean mg/m3
Mercury	0.0004	0.0002	0.0003
Cadmium & Thallium	0.003	0.009	0.006
Tin, Arsenic, Lead, Chromium, Cobalt, Copper, Manganese, Nickel, Vanadium	0.03	0.10	0.065
HF	0.05	0.27	0.16
Dioxins / Furans (ITEQ)	0.002×10^{-6}	0.0044×10^{-6}	0.0032×10^{-6}

The ash residues produced by the process were also subject to a rigorous 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 Weight Loss on Ignition (LOI) testing of Bottom Ash are given below

Parameter	Q1	Q2	Q3	Q4
Bottom Ash LOI %	<0.5	0.15	1.0	0.2

Heavy metals, dioxins and furans results were low for both bottom and fly ash streams.

The bleed water from the Boiler 7 wet scrubber water circulation, which is taken to a heavy metal removal plant before discharge to the on-site effluent treatment plant, was sampled and tested.

Daily: Total suspended solids and pH
Quarterly: Metals (Hg, Cd, Tl, As, Cu, Pb, Cr, Ni, Zn)
Bi-annually: Dioxins

Total suspended solids levels in the bleed water have been high for some periods in the year. Heavy metals and Dioxins analysis results have been low which confirmed that the increased bleed water solids were again due to ash leakage from the baghouse filters.

5. Summary of Plant Compliance

Air Pollutants	EU Directive ELV (mg/Nm ³)	Percentage compliance
Particulates	10	100
NO _x	200	100
SO ₂	50	100
CO	100	99.98
HCl	10	100
HF	1	100
Volatile organic compounds (TOC)	10	100
Mercury	0.05	100
Cadmium and thallium	0.05	100
Sum of heavy metals (Sb+As+Pb+Cr+Co+Cu+Mn+Ni+V)	0.5	100
Dioxins + furans	0.1 x 10 ⁻⁶	100
Ammonia	No Limit (Warranty max. 5 ppm slip if in use)	N/A
CEMs operational		99.96

There were periods of abnormal operation where continuous monitoring failed and periods where emissions exceeded consented values as detailed below.

16th and 22nd March

Non-consented emission

Half hourly CO emission of 153.8 and 119.2 mg/Nm³

Circumstance

On starting up the boiler following a tube repair a high CO emission was experienced. The boiler was taken out of service again and the sand bed changed. The boiler was restarted and another high CO emission was experienced.

Corrective action

The boiler was taken down again and a planned shutdown was started early. It was found that many of the air nozzles feeding the boiler were damaged. 1300 primary air nozzles were changed during the shutdown.

26th August

CEMs failure

The CEMs unit on boiler 7 failed at 03:20

Circumstance

The unit stopped reading.

Corrective action

The site spare was fitted and the unit was back on line by 05:10

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21th September

Non-consented emission

Half hourly CO emission of 108.8 mg/Nm³ at 06:00

Circumstance

The combustion optimisation software was in control of furnace conditions. No manual interventions were made to any control parameters by the operator. We have been unable to identify why, on this occasion, the software did not maintain control.

Corrective action

No faults found and the system has subsequently maintained control.

Furnace combustion performance

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

Flue gas scrubber performance

Scrubber bleed water parameters	Unit	EU Directive ELV	Percentage compliance
Total solids	mg/l	45	82.4
Hg	µg/l	30	100
Cd	µg/l	50	100
Tl	µg/l	50	100
As	µg/l	150	100
Cu	µg/l	500	100
Pb	µg/l	200	100
Cr	µg/l	500	100
Ni	µg/l	500	100
Zn	µg/l	1500	100

6. Summary of Plant Improvements

Bag changing regime

Based on experience a new bag filter changing regime has been introduced. Bags are changed at a set frequency which has largely pre-empted failures.

Soot-blower optimisation

Soot-blower optimisation software has been commissioned which starts the soot-blower cycle on falling heat transfer coefficients in the boiler.

Turbine rotor

The turbine and generator was overhauled in April and the turbine rotor was changed. During the same outage the boiler tube bank was renewed.

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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



Date

31 January 2014

Permit Number : BT48851T

Facility : Shotton Paper Mill

Operator : UPM-Kymmene UK Ltd

Form Number : Performance 1

Reporting of WID Performance Indicators for the year 2013

Quarterly Performance Parameters (WID Plant)		Units			
Mass of bottom/fly ash produced	Kg/tonne of waste incinerated (dry basis)	Qtr 1	Qtr 2	Qtr 3	Qtr 4
Mass of combustor ash residues produced	Kg/tonne of waste incinerated (dry basis)	58.61	43.38	51.55	54.02
Water consumption	M ³ /tonne of waste incinerated (dry basis)	680.8	836.6	884.7	765.8
Ammonia / Urea consumption	Kg/tonne of waste incinerated	74.6	90.6	66.2	58.7
Electricity consumption	MW/hr/tonne of waste incinerated (dry basis)	2.01	3.61	2.54	3.28
Natural gas consumption	Tonne/tonne of waste incinerated (dry basis)	.24	.26	.26	.25
Periods of WID Abnormal Operation	Number of Occasions	0.46	0.05	0.04	0.07
	Cumulative Hours for Current Calendar Year	0	1	0	1
		0	2.5	2.5	4

Annual Production/Treatment		
RCF (De-inking sludge) waste incinerated		149436 Tonnes
Biomass incinerated		85181 Tonnes
Waste wood incinerated		117178 Tonnes
Waste not otherwise specified incinerated		6204 Tonnes
Thermal energy produced e.g. steam	LCP Plant	45505 MW/hrs
	WID Plant	584358 MW/hrs
Power Generated		133602 MW/hrs

Operator's comments : Natural gas consumption cannot be measured in tonnes calculation therefore based on MW/hrs gas / tonnes waste incinerate

Signed *[Signature]* (authorised to sign as representative of UPM-Kymmene UK Ltd)
 Date...28/2/2014.....



Permit Reference Number : BT48851T
Facility : Shotton Paper Mill

Operator : UPM-Kymmene UK Ltd
Form Number : S1



Reporting of Emissions to Sewer for the period from1st October 2013.....to31st December 2013.....

Emission Point	Substance / Parameter	Emission Limit Value	Result ⁽¹⁾	Test Method	Sample Date and Times ⁽²⁾	Uncertainty ⁽³⁾
E1	Volumetric Flow	300m ³ /day 24 hour period beginning 00:01	146.9	BS3680	Period average	
E1	pH - maximum		2.1	BS 1647-2:1984		
E1	pH - minimum		12	BS 1647-2:1984		
E1	Total suspended solids as defined by Directive 91/271/EEC	30mg/l for 95% of all measured values of periodic or flow proportional samples taken over one year.		BS EN 872		
E1	Total suspended solids as defined by Directive 91/271/EEC	45mg/l periodic or flow proportional sample	105	BS EN 872	13/12/13	
E1	Mercury and its compounds, expressed as mercury (Hg)	0.03 mg/l 24-hour flow proportional sample	0.0007	BS EN 1483	12	
E1	Cadmium and its compounds, expressed as cadmium (Cd)	0.05 mg/l 24-hour flow proportional sample	0.0012	BS 6068-2:89	14/11/13	
E1	Thallium and its compounds, expressed as thallium (Tl)	0.05 mg/l 24-hour flow proportional sample	0.001	BS 6068-2:89	14/11/13	
E1	Arsenic and its compounds, expressed as arsenic (As)	0.15 mg/l 24-hour flow proportional sample	0.007	BS 6068-2:60	12	
E1	Lead and its compounds, expressed as lead (Pb)	0.2 mg/l 24-hour flow proportional sample	0.003	BS 6068-2:60	12	
E1	Chromium and its compounds, expressed as chromium (Cr)	0.5 mg/l 24-hour flow proportional sample	0.012	BS 6068-2:60	12	
E1	Copper and its compounds, expressed as copper (Cu)	0.5 mg/l 24-hour flow proportional sample	0.009	BS 6068-2:60	14/11/13	
E1	Nickel and its compounds, expressed as nickel (Ni)	0.5 mg/l 24-hour flow proportional sample	0.008	BS 6068-2:60	14/11/13	
E1	Zinc and its compounds, expressed as Zinc (Zn)	1.5 mg/l 24-hour flow proportional sample	0.193	BS 6068-2:60	14/11/13	
E1	Dioxins / Furans (I-TEQ)	0.3 ng/l – at least one measurement every six months	0.000	BS ISO 18703	14/11/13	

1. The result given is the maximum value obtained during the reporting period, expressed in the same terms as the emission limit value.
2. The date and time of measurements and the percentage of the process operating time covered by the result shall be given.
3. The uncertainty associated with the quoted result at the 95% confidence interval, unless otherwise stated.

Signed

(authorised to sign as representative of UPM-Kymmene UK Ltd)

Date...28/2/2014.....

