

# **Annual Performance Report**

## **For**

# **Veolia Bio-energy Biomass Plant**

## **Permit No: EPR/BP 3736HA**

## **Year – 2016**

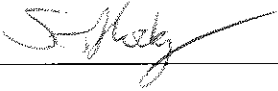

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Veolia Bio-energy Operations

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Veolia Bio-energy Annual Report 2016  
Permit EPR/BP 3736HA

## Document Control Sheet

Document Title: 2016 Annual Performance Report

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|                 |                               |                              |
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## **Contents**

|   |         |
|---|---------|
| Document Control Sheet                      | Page 2  |
| Plant Description                           | Page 4  |
| Summary of Plant Operation                  | Page 5  |
| Total Plant Operational Hours.              | Page 7  |
| Residue Production                          | Page 10 |
| Chilton Water Usage and Effluent Disposal   | Page 11 |
| Summary of Plant Emissions                  | Page 12 |
| Control of emissions                        | Page 13 |
| Periodical Monitoring                       | Page 13 |
| Summary of Plant Compliance                 | Page 16 |
| Compliance with Continuous Emissions to Air | Page 16 |
| Emissions to Water                          | Page 19 |
| Summary of Plant Improvements               | Page 20 |

## Plant Description

Chilton Bio-energy site is located on Chilton Way, Chilton Industrial Estate in County Durham, DL17 0PB at approximate national grid reference 428267 530295.

Chilton bio-energy incinerates life expired waste wood to raise steam to generate electricity for export to the national grid.

Chilton Bio Energy has a nominal design capacity of 13 tonnes of wood per hour, with a maximum annual consumption of 120,000 tonnes. This is at a continuous rating of approximately 312 tonnes per day based on an average net calorific value of 15 Mega Joules per kg (15 MJ/kg).

The anticipated availability of the Plant is 7,800 – 8,000 hours per annum (89% availability).

The Plant is a single line reciprocating grate process and is fuelled by road deliveries of waste wood. Heat from combusting the fuel is converted to energy through the generation of steam at 491°C, 84 bar absolute pressure and at a flow rate of 67 tonnes per hour. The high pressure 54 MW thermal input boiler incorporates a superheater pass. The steam is expanded through a steam turbine. Exhaust steam is condensed and re-circulated via a water-cooled condenser.

Chilton Bio-energy can generate 17.45 megawatts of electricity (17.45 MWe gross) of which 15.45 MWe net is available for export to the National Grid.

The incinerator can supply heat to the adjacent pellet mill using a turbine steam bleed to heat water via an intermediate heat exchanger. This process enables Chilton to be deemed a CHP plant.

Flue gases leaving the boiler are treated in an air pollution control system consisting of selective non-catalytic reduction system (SNCR), lime and minisorb injection and an electrostatic precipitator (ESP). The cleaned flue gases are emitted to atmosphere via a 44m high stack.

Bottom ash is collected in hoppers beneath the combustion grate and transported via covered screw conveyor to a waste skip. Residues from the air pollution control system such as fly ash will be collected in hoppers and transferred pneumatically into an ash storage silo.

The installation generates emissions to air from the combustion process, emissions to sewer from boiler blowdown, emissions to land of uncontaminated rainwater and waste residues of bottom ash and fly ash.

The main component activities of the installation are:-

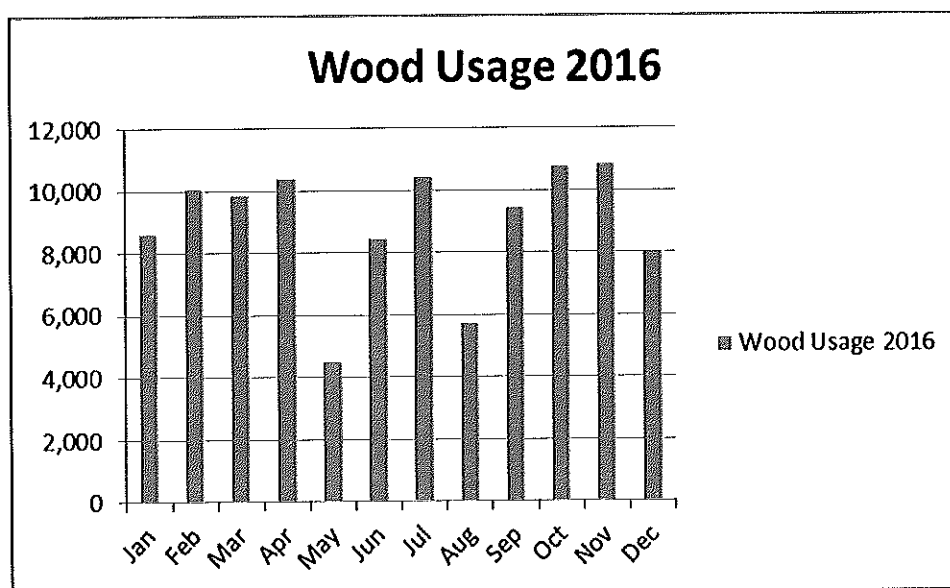
1. Waste wood fuel receipt, handling, processing and storage areas;
2. The main Chilton Bio – energy 1 plant building that house the combustion grate, boiler, bottom ash bunker and turbine house;
3. The flue gas cleaning equipment, chimney stack and residue ash storage area;
4. The electrical distribution switchgear area;
5. The water treatment plant and cooling towers.
6. The site has 250 Tonne of main fire water system on site for fire fighting capabilities.

## SUMMARY OF PLANT OPERATION

Veolia Bio-energy Chilton power station was commissioned on 9<sup>th</sup> December 2011 and therefore 2016 was the fifth full year of operation. The principle challenges in relation to the fifth year of operation of Chilton power station have been associated with regular outages every 6 weeks in order to clean the air pre-heater tube bundles due to hygroscopic salts dropping out of the flue gas stream and blocking the tube bundles. The air heater bypass system was installed to achieve a maximum bypass of 10000Nm<sup>3</sup> of primary air away from the air heater tube bundles to help raise the flue gas exit temperature closure to the 150 Deg C required to prevent the salts forming. During a routine air heater inspection it was noted that some of the tubes had failed and had suffered corrosion from acid dew point. It was decided to completely change the APH No 2 tube bundle with stainless steel tubes to remove the issues. This was completed in August 2016 outage.

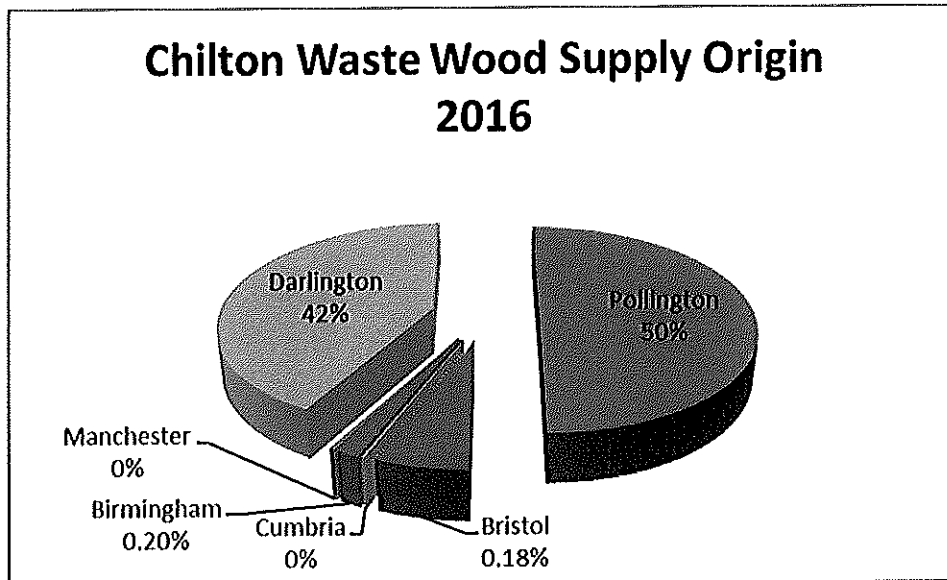
During this fifth year of operation Chilton power station processed 107080T of waste wood to generate 123,204MW of electricity.

A breakdown of the waste wood received by month:-



As required through the industrial emission directive IED Article 4(4) the permit identifies the types of waste by European Waste Catalogue (EWC) code. All waste wood received at Chilton has a EWC code of 170201.

### Chilton Waste Wood Supply Origin



### Total Plant Operational Hours.

Chilton Power station maintenance is scheduled with the aid of a computerised maintenance management system. This system allows the scheduling of maintenance activities to prevent unexpected failures.

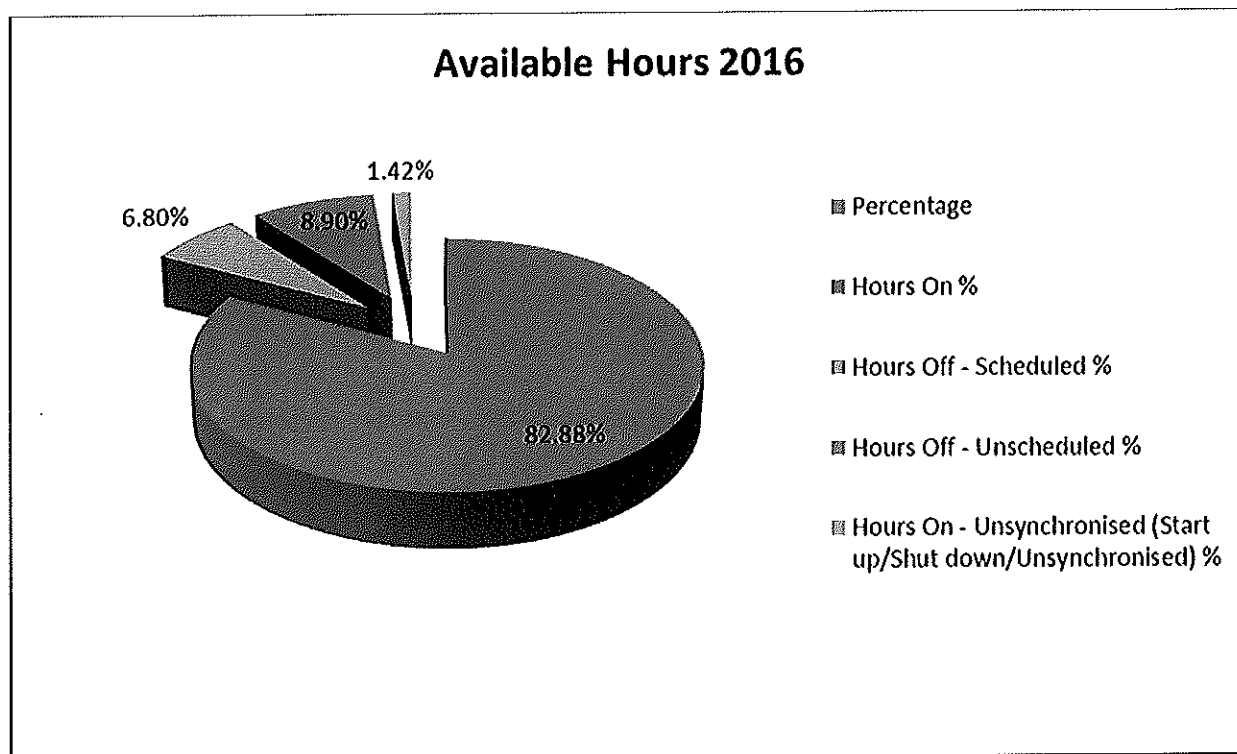
In the third year of operation unscheduled outages restricted the generation produced by the station.

#### Available Hours

**8760**

|  |             |
|--|-------------|
| Hours On   | 7379.07     |
| Hours Off - Scheduled  | 600         |
| Hours Off - Unscheduled  | 780.93      |
| Hours On – Un-synchronised (Start up/Shut down/Unsynchronised) | 124.63      |
|  | <b>8760</b> |

| <u>Percentage</u>   |        |
|---|--------|
| Hours On %  | 82.88% |
| Hours Off - Scheduled %   | 6.8%   |
| Hours Off - Unscheduled %                                       | 8.9%   |
| Hours On - Unsynchronised (Start up/Shut down/Unsynchronised) % | 1.42%  |



Chilton power station provides heating steam to the adjacent Pellet Mill by heating process water using steam drawn from the steam turbine bled steam system.

The total heat used by the Pellet mill in 2016 was 1434.54 MW

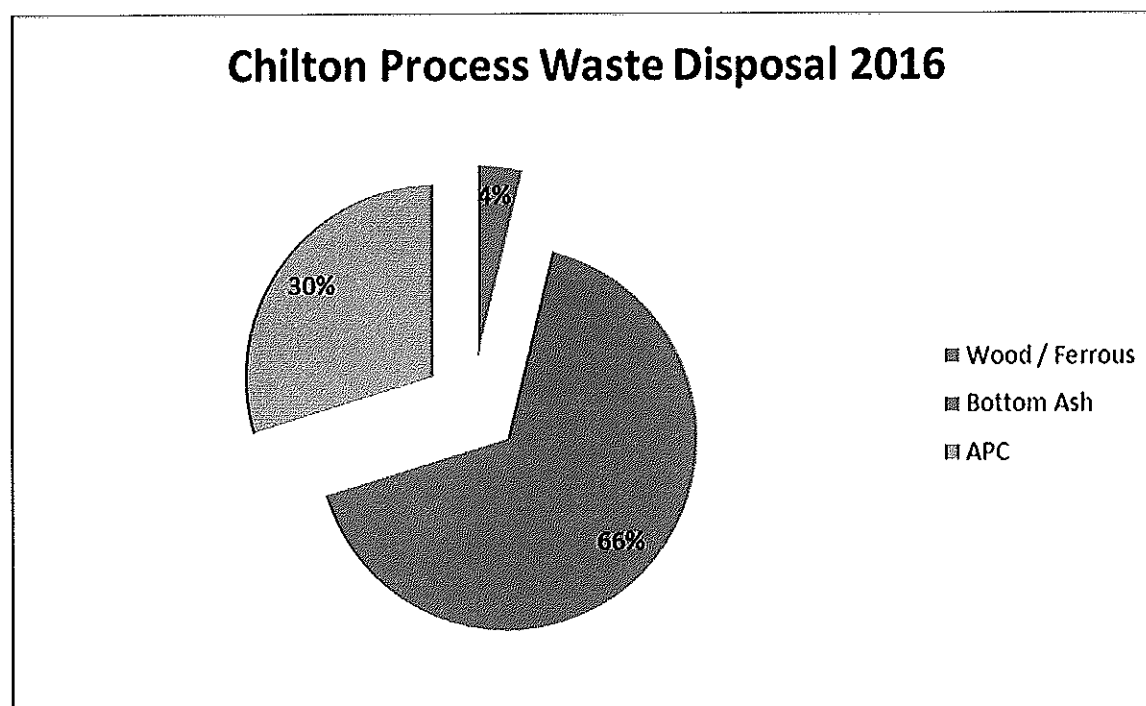
## Electricity Generation Efficiency

Electricity generation efficiency (Excluding parasitic use) was 27.5% during 2016. This efficiency is based on fuel consumed when generating electricity and supplying heat

## Residue Production

Veolia Bio-energy Chilton power station produces three types of residue

- Bottom ash - an inert material resulting from the combustion process. Due to the caustic nature of this ash and the absence of site storage capability this ash is transported in covered skips to a hazardous landfill site for disposal. Options for the utilisation of this ash are currently ongoing.
- Air pollution control residue – a mixture of hydrated lime, minisorb and other particles captured by the waste gas treatment facilities. This material requires to be treated prior to landfill. During the year the routing of the treated APC residues from hazardous landfill to non – hazardous landfill has been undertaken due to reduced heavy metal content. The assessment of this material for use in the cement industry is at the beginning of the acceptance process.
- Ferrous metal captured from the waste wood screening process at chilton is able to be reclaimed by a third party.



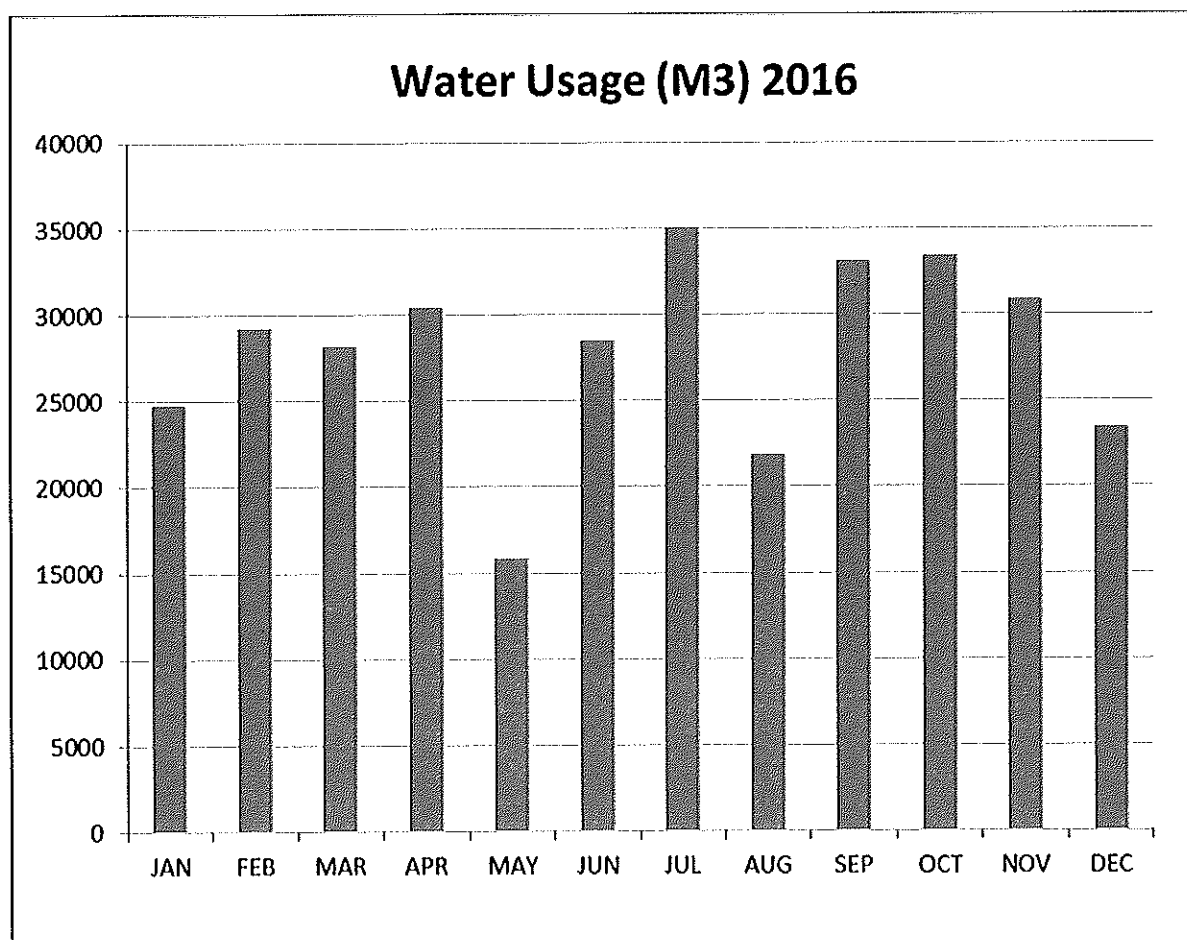
| Waste                 | Yearly total tonnes |
|-----------------------|---------------------|
| Wood / Ferrous (3.8%) | 235.42              |
| Bottom Ash (66.49%)   | 4176                |
| APC (29.71%)          | 1865                |



## CHILTON WATER USAGE AND EFFLUENT DISPOSAL

Chilton Power station is supplied with town water at a maximum rate of 50T/Hr  
The majority of Chilton water use is by evaporation from the site cooling towers and by the treatment of water for steam generation. Total water usage for 2016 is 334399m<sup>3</sup>

Chilton discharges effluent within Northumbrian water consents  
The majority of Chilton effluent is derived from the control of water basin water hardness



## Summary of plant emissions

The monitoring requirements are set out in Section 3 and schedule 3 of the permit.  
Chilton power station is required to carry out continuous and periodic monitoring of the emission to air from Emission point A1

## Measured emissions

| Measured emissions  | Continuously | Periodically |
|---|--------------|--------------|
| Sulphur dioxide   | X            | x            |
| Carbon dioxide  | X            | x            |
| Hydrogen chloride   | X            | x            |
| Oxides of Nitrogen  | X            | x            |
| Particulates  | X            | x            |
| Total organic Carbon  | x            | x            |
| Particulate matter  | X            | x            |
|   |              |              |
| Hydrogen fluoride   |              | x            |
| Ammonia   |              | x            |
| Nitrous oxide   |              | x            |
| Cadmium & Thallium and their compounds (total)  |              | x            |
| Mercury and its compounds   |              | x            |
| Sb, As, Pb, Cr, Co, Cu, Mn, Ni and V and their compounds (total)                          |              | x            |
| Dioxins / furans (I-TEQ)  |              | x            |
| Dioxin-like PCBs (WHO-TEQ Humans / Mammals)   |              | x            |
| Dioxin-like PCBs (WHO-TEQ Fish)   |              | x            |
| Dioxin-like PCBs (WHO-TEQ Birds)  |              | x            |
| Specific individual poly-cyclic aromatic hydrocarbons (PAHs), as specified in Schedule 6. |              | x            |
| Dioxins / furans (WHO-TEQ Humans / Mammals)   |              | x            |
| Dioxins / furans (WHO-TEQ Fish)   |              | x            |
| Dioxins / furans (WHO-TEQ Birds)  |              | x            |

## Control of emissions

Measures to control of pollutants can be summarised as:

- The acidic gases (Sulphur dioxide and Hydrogen chloride) are controlled by the addition of hydrated lime to the flue gases
- Carbon monoxide and Total Organic Carbons are controlled through combustion air and combustion control systems

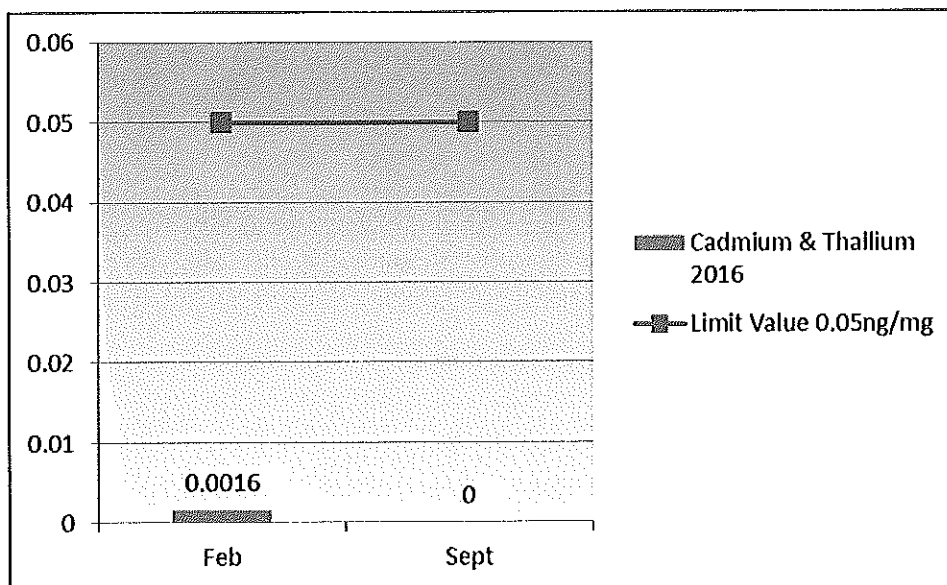
- 
- Oxides of Nitrogen are controlled by recirculating waste gas and by the controlled injection of Urea into the combustion chamber
- Particulates are captured by the electrostatic precipitator which is over 99% effective for particles generated from the process
- The formation of dioxins and furans is inhibited by the removal of tramp metal in the fuel and by the injection of Minsorb with the lime. The Minsorb is a 90/10% mix to increase dioxin capture and heavy metal abatement. Additional Minsorb was also injected via a temporary dosing rig at a rate of approximately 42kg/hr to reduce the emissions further.

## Periodical Monitoring

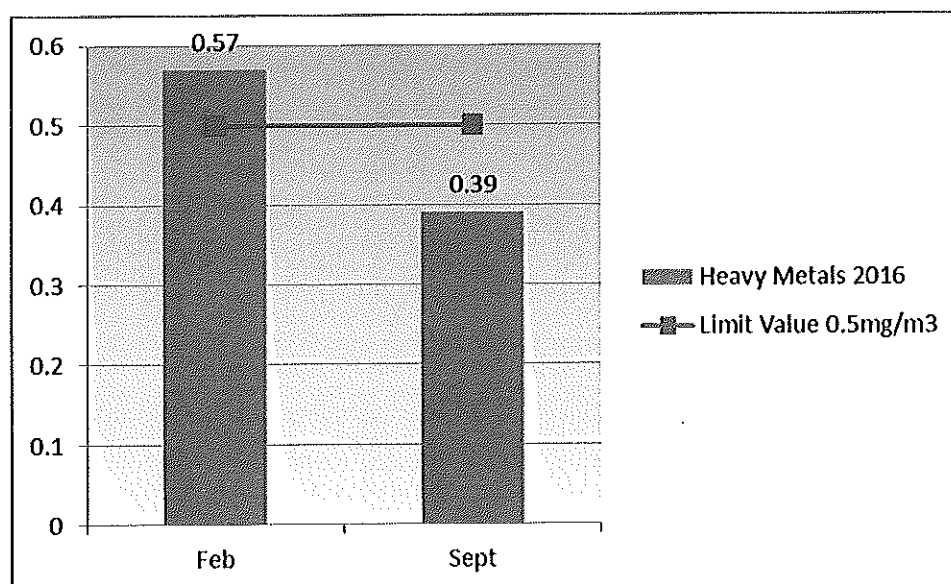
Within the permit there is an obligation to carry out extractive tests on the substances emitted from the incinerator chimney.

During the second year of operation bi-annual testing and reporting is carried out for Heavy Metals and their compounds, Cadmium and Thallium and their compounds, PCBs, Dioxins and Furans, Mercury and its compounds, PAHs, Hydrogen Fluoride, Ammonia and Nitrous oxide.

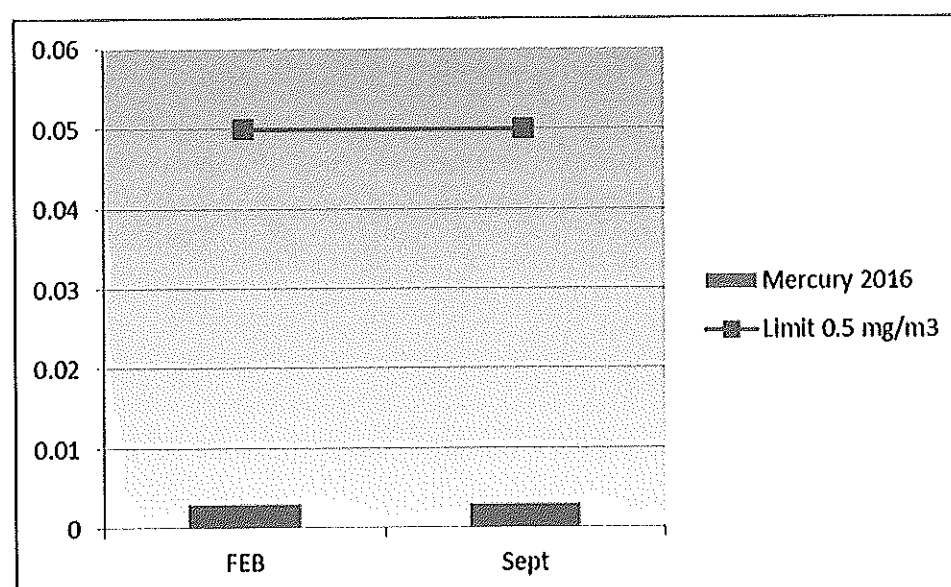
### Cadmium and Thallium Extractive results



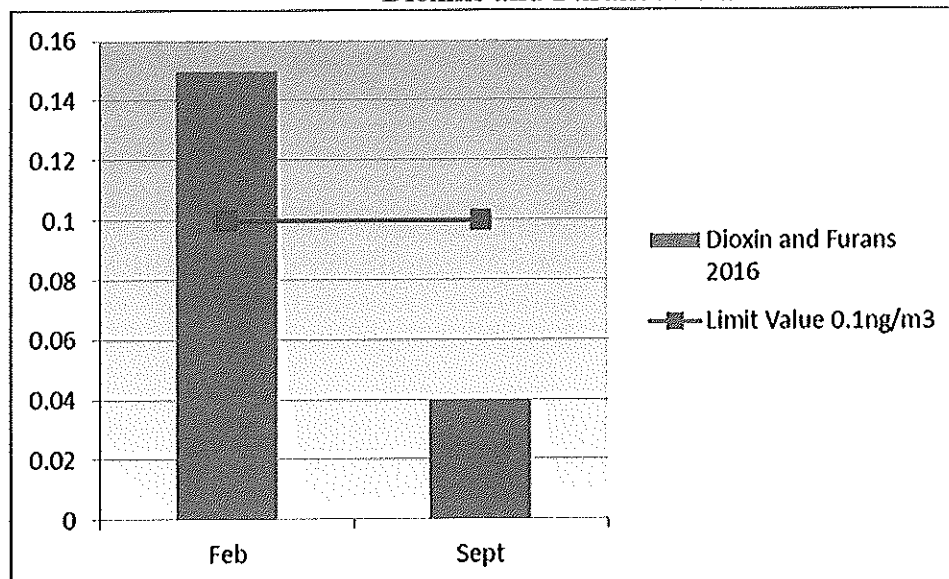
### Heavy Metals Extractive results



### Heavy Metals Extractive results



**Dioxins and Furans Extractive results**



The blend of this product was changed from 95/5% to 90/10% at the beginning of 2015 in order to give better performance in capturing heavy metals, Dioxins & Furans.

In 2015, the plant passed the February test using additional dosing equipment, injecting 100% Minsorb after the boiler. These tests were only conducted with the additional dosing rig to prove if the economiser bypass could be placed in service whilst meeting the site permitting limits. After the tests it was conclusive that the economiser bypass could not be used going forward and the injection regime was increased to the 90/10 mix moving forward. However in August 2015 the emission failed again. This failure was attributed to a problem with the grate failing during the test (abnormal operation). After discussions with the local enforcing authority it was decided that the test would be conducted again without the additional dosing rig to prove if the grate failure was indeed the contributing factor to the dioxin breach. In order to establish whether the grate problem was a contributing factor to the August failure, the February 2016 planned test was conducted under the same conditions; without the additional dosing equipment.

The results came in at the levels shown in the **overview** table. It was conclusive that the grate failure was not the only cause of the breach.

It was decided after consultation with the local enforcing authority that the additional dosing rig would be hired from Lhoist and specific dose rates would be calculated and used to determine the dose rate required. The rig was commissioned during April 2016 and two sampling dates were booked with Catalyst environmental for the additional extractives during the two separate trials. Please refer to report **BP3635HA/0261494-140316**

The first trial took place on the 7<sup>th</sup> and 8<sup>th</sup> April. The dosing regime was to inject 100% Minsorb after the APH outlet at a known rate of 21kg/hr. The dose rate was measured every hour to guarantee the product was entering the system. The results were on a 10 day lab turnaround time and were received on 21<sup>st</sup> April.

|        | Heavy metals<br>mg/m3 | Dioxins<br>ng/m3 |
|--------|-----------------------|------------------|
| Limit  | 0.50                  | 0.100            |
| Result | 0.62                  | 0.093            |

The second trial took place on the 12<sup>th</sup> and 13<sup>th</sup> April. The dosing regime was to inject 100% minsorb after the APH outlet at a known rate of 42kg/hr. The dose rate was measured every hour to guarantee the product was entering the system. The results were on a 10 day lab turnaround time and were received on 25th April. The results came back as a pass for heavy metals and a pass for Dioxins and Furans.

|        | Heavy metals<br>mg/m3 | Dioxins<br>ng/m3 |
|--------|-----------------------|------------------|
| Limit  | 0.50                  | 0.100            |
| Result | 0.49%                 | 0.064%           |

The plant has continued to run throughout 2016 with the additional dosing rate of 42kg/hr until the bag-filter install planned for Jan 2017.

## SUMMARY OF PLANT COMPLIANCE

### *Compliance with continuous emissions to air*

Chilton Power station chimney emissions (A1) are continuously monitored by one of two sets of analysers. The display of this analysis is available to control room operators and a software package collates this information and compares it to emission limits for 1/2hr and daily average emissions.

Chilton CEMS continuously analyses for Particulates, Volatile organic carbon, Sulphur Dioxide, Oxides of Nitrogen, Carbon Monoxide and Hydrogen chloride.

These analysers are subject to weekly, quarterly and annual quality checks to ensure accuracy.

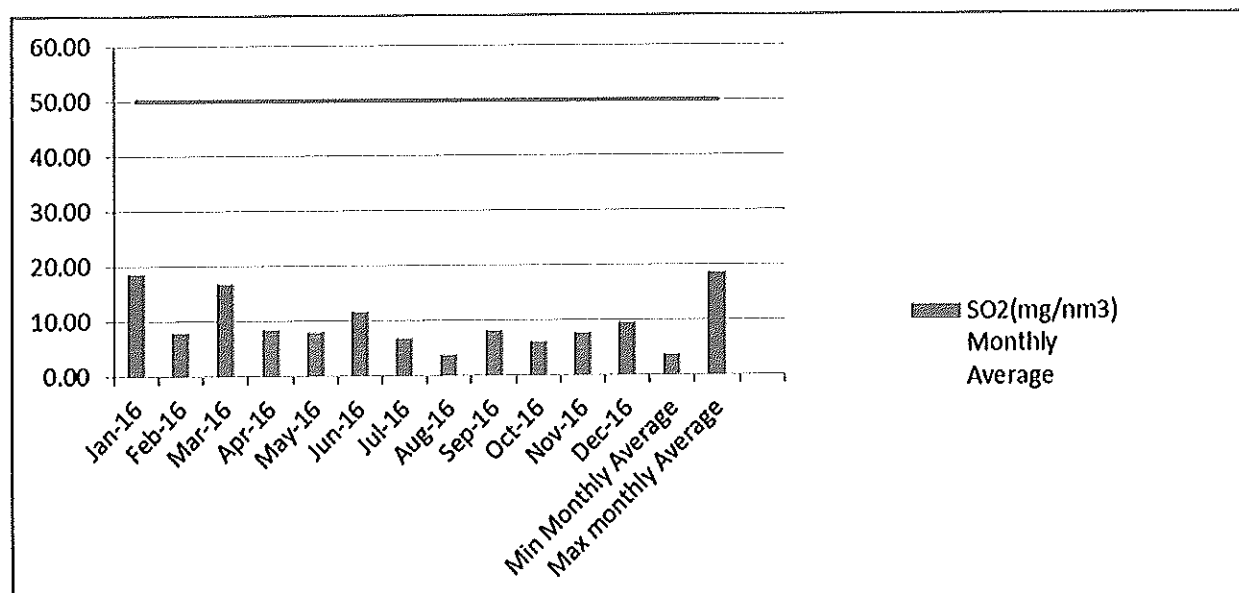
For continuous monitoring the maximum daily averages and the average daily average figures are given on the bar charts.

The daily average for CO was not exceeded in 2016

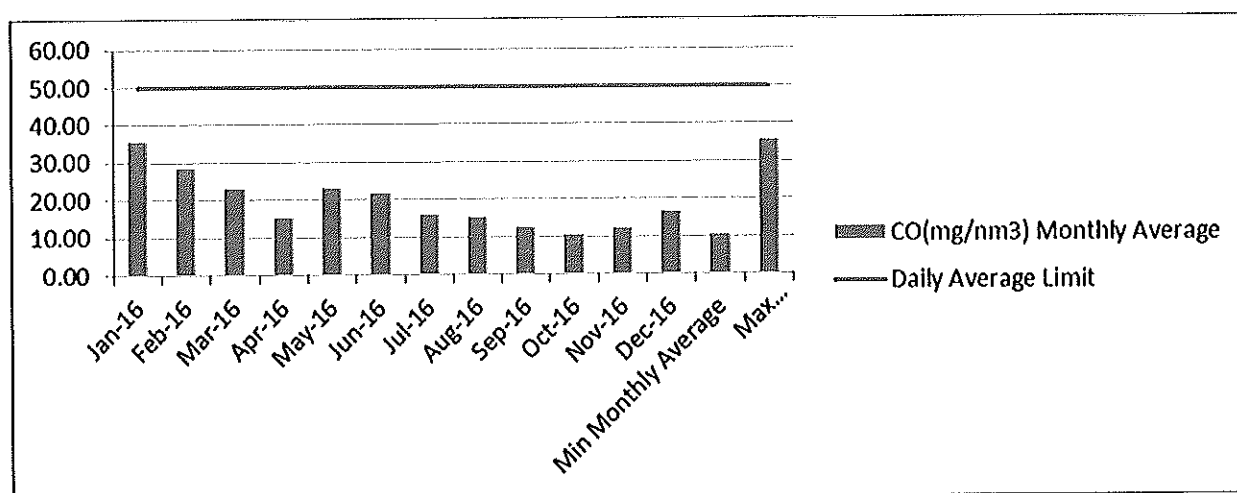
The daily averages for NOx and SO2, Particulates were not exceeded during the year 2016

During 2016 we had No incidences where WID abnormal was declared.

### SO2 annual monthly average



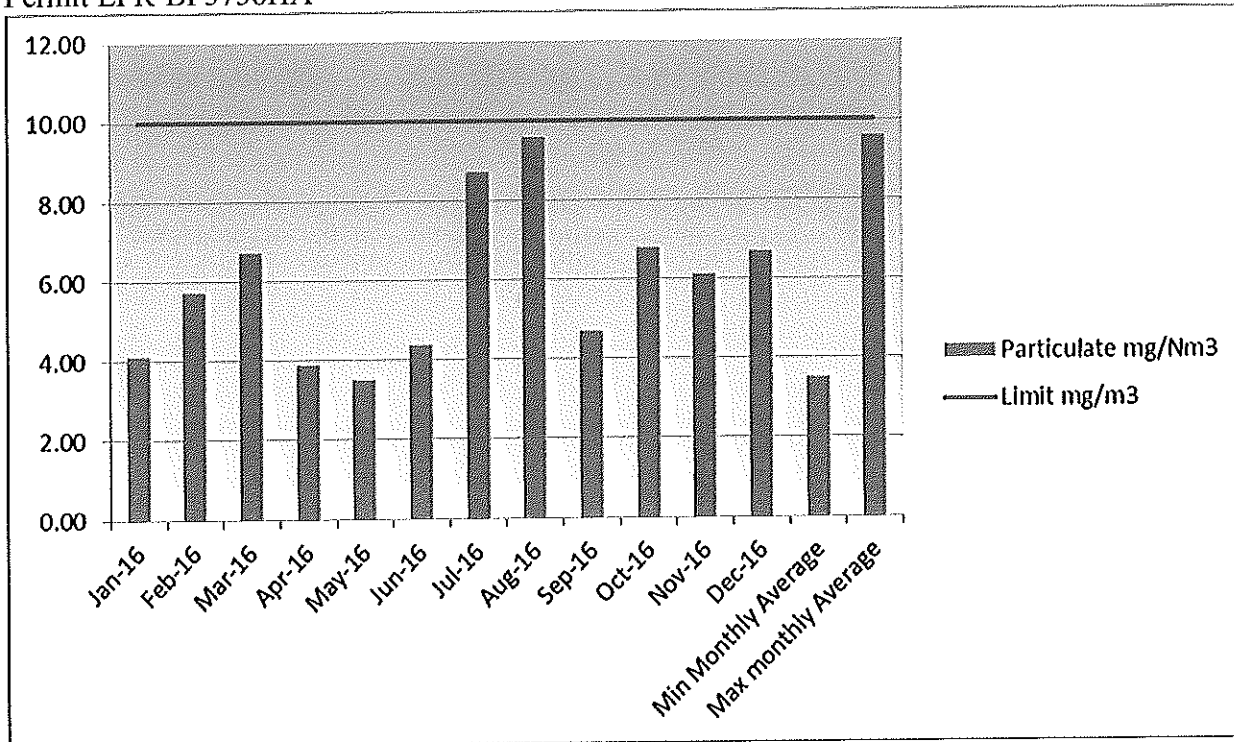
### CO annual monthly average



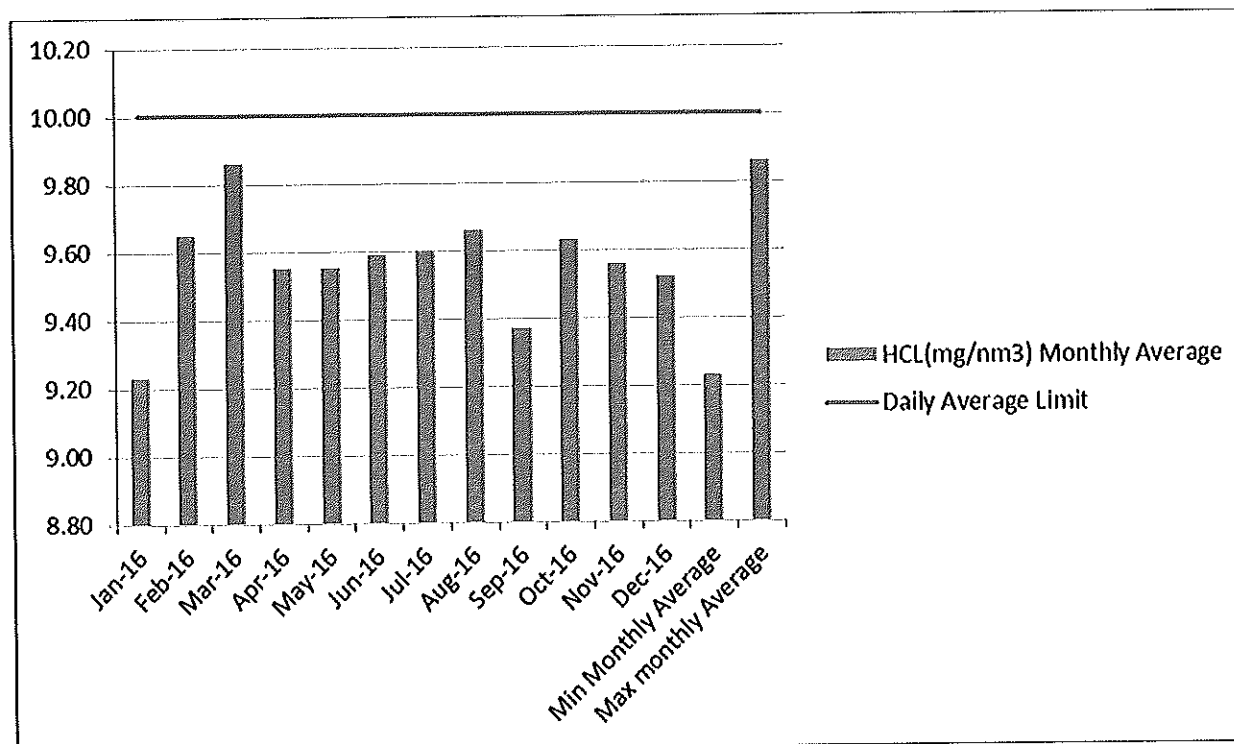




## Annual Report 2016



### HCL annual monthly average – control set point 9.6mg/m3



Log of reportable releases to the EA during 2016 operations

| Date       | Time          | Compound        | Value  | Calculated KG | Reason for Breach | Date Schedule 5 submitted | By Whome  |
|------------|---------------|-----------------|--------|---------------|-------------------|---------------------------|-----------|
| 02/01/2016 | 03:00-03:29   | Carbon monoxide | 117.59 | 5.29155       | Poor combustion   | 02/01/2016                | S.Hodgson |
|            | 03:29-04:00   | Carbon monoxide | 168.03 | 7.56135       | Poor combustion   | 03/01/2016                | S.Hodgson |
| 18/01/2016 | 15:00-15:30   | Carbon monoxide | 326.8  | 14.706        | Plant PLC trip    | 18/01/2016                | S.Hodgson |
|            |               |                 |        |               | FD fan flowmeter  |                           |           |
| 22/01/2016 | 11:00-11:29   | Carbon monoxide | 127.09 | 5.71905       | pipe failure      | 22/01/2016                | S.Hodgson |
| 04/03/2016 | 12:00-12:59   | Carbon monoxide | 146.58 | 6.5961        | Sootblower        | 04/03/2016                | S.Hodgson |
| 23/03/2016 | 00:29-00:59   | Carbon monoxide | 106.17 | 4.77765       | Poor combustion   | 23/03/2016                | S.Hodgson |
| 31/03/2016 | 21:00-21:29   | Carbon monoxide | 111.55 | 5.01975       | Poor combustion   | 01/04/2016                | S.Hodgson |
| 04/04/2016 | 20:30-20:29   | Carbon monoxide | 149.35 | 6.72075       | Poor combustion   | 04/04/2016                | S.Hodgson |
| 13/05/2016 | 03:00-03:29   | Carbon monoxide | 104.21 | 4.68945       | Poor combustion   | 05/04/2016                | S.Hodgson |
| 28/05/2016 | 04:30 - 04:59 | Carbon monoxide | 122.6  | 5.517         | Poor combustion   | 28/05/2016                | S.Hodgson |
| 16/09/2016 | 07:30-07:59   | VOC             | 23.15  | 1.04175       | Hydrogen pressure | 19/09/2016                | S.Hodgson |

## Emissions to Water

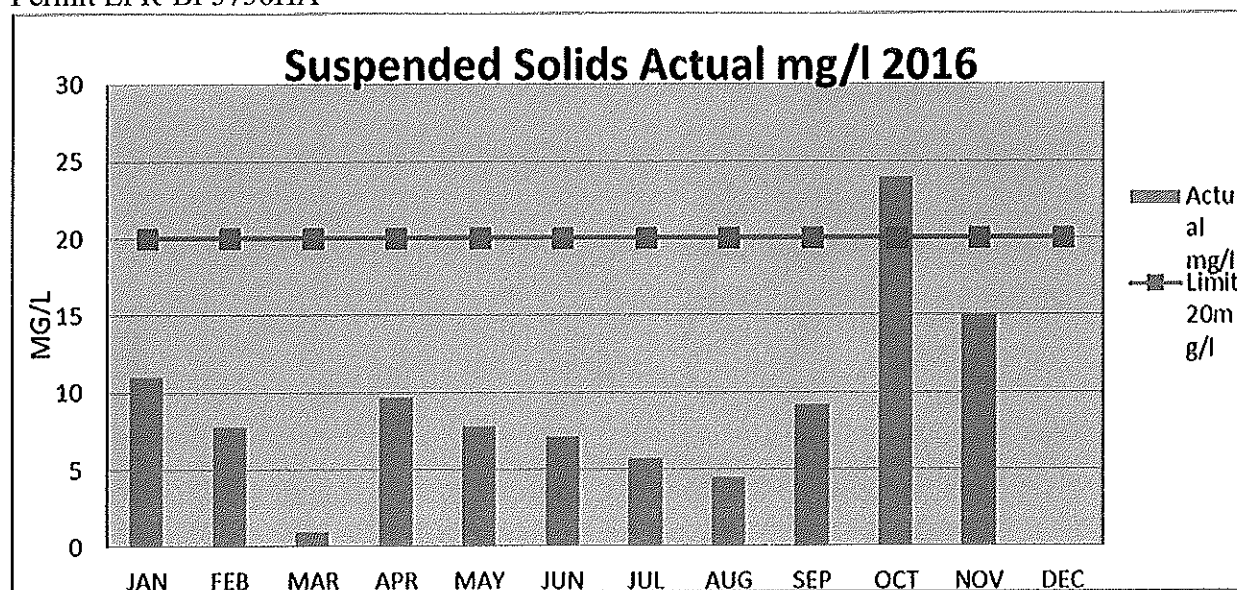
Chilton surface water is sampled and reported for suspended solids and hydrocarbons. The flow of surface water is very low as it is only the site rain run off that is emitted. We have sampled this surface water regardless of flow rate and as a result have exceeded the suspended solids permitted limit during October. This is when the sample has been taken after a major down pour. The surface leaves the site via a surface water penstock valve which can be used in the need of an emergency.

The samples for December 2016 were not available due to a nil sample at the time of collection.

Chilton analysis for hydrocarbons in surface water has remained at < 5mg/l throughout the year 2016.

## Effluent water discharge

Effluent discharge consents are monitored and regulated by the Northumberland Water Board



No Sample Available in December

## SUMMARY OF PLANT IMPROVEMENTS

Veolia group decision was made in 2016 to enhance the flue gas treatment abatement system onsite with additional further capital investment to continue to improve plant availability and efficiency these include;

1. Bag filter installation, work commenced October 2016. Commissioning/completion expected Feb 2017
2. Air pre-heater tube bundle upgraded to stainless steel
3. Air pre-heater bypass system installed to increase APH outlet temperature to 150 Deg C as per design requirements

