Enemalta plc

Delimara Power Station

Auxiliary Boiler

Introduction

The auxiliary boiler is a fire tube horizontal type boiler.

This boiler was brought over to Delimara during the installation of the Phase 1 (D1) steam turbines and boilers in the late 1980s. This was used during the initial startup of Phase 1 since this was a black start, and hence no steam was available. The auxiliary boiler was used to produce enough steam for the evaporators to set the steam cycle going.

With the decommissioning of Phase 1 in 2017, the steam generation capacity was lost when the two boilers of Phase 1 were dismantled. Certain processes in Enemalta's remaining plant still required steam for their operation and hence an alternative source for steam generation had to be used. The auxiliary boiler came back into operation for this purpose.

Section 1

Use of auxiliary boiler

The auxiliary boiler is being used for steam generation. Steam is used in Enemalta's plant for the following processes:

(i) Heating of HFO tanks which are currently being used for the storage of Heavy Fuel Oil for 3rd parties

(ii) The steam turbine of Enemalta's combined cycle gas turbine when this is operating in combined cycle mode

(iii) The evaporator

Section 2

Location of Auxiliary Boiler

The auxiliary boiler has been installed near the evaporator tanks opposite the area which was previously occupied by the D1 steam turbine plant as shown in the photo hereunder:

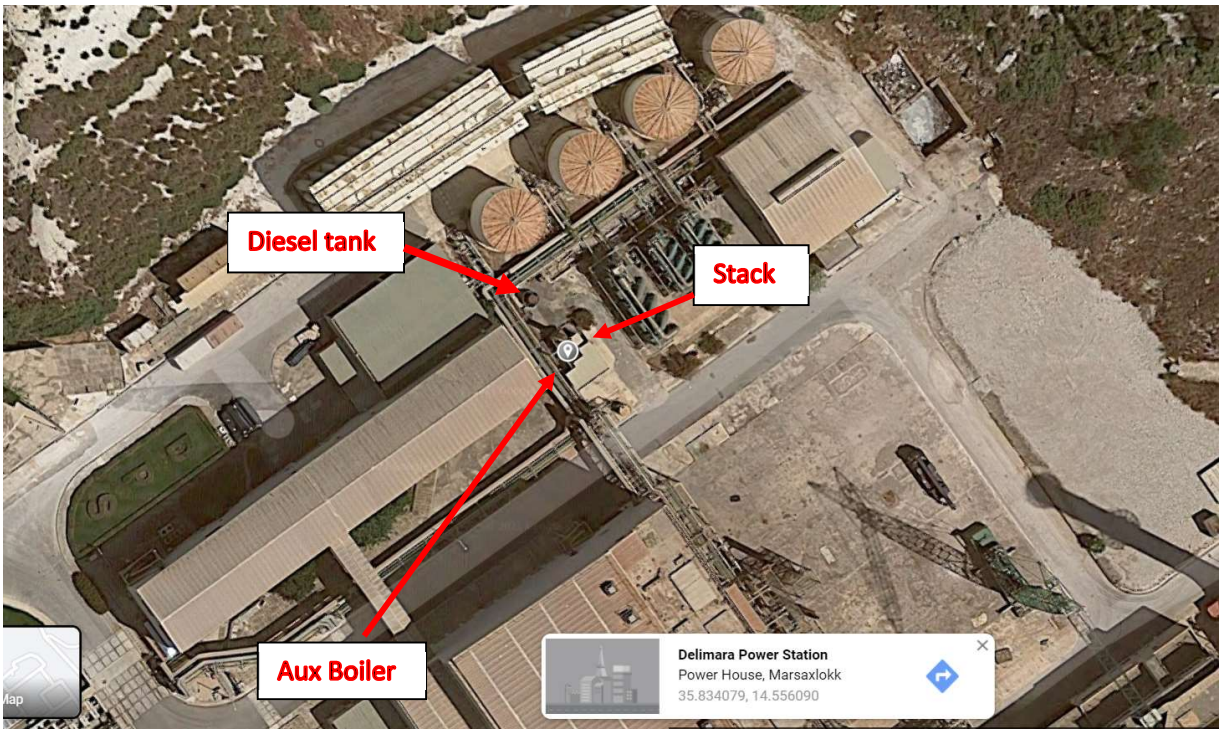

Fig 1

Section 2

Auxiliary boiler setup

The auxiliary boiler setup is made up of the following components:

- Fire tube boiler
- Isolator and control panel
- Chimney
- Small day tank capacity 3.5m^3

Section 3

Auxiliary boiler specifications

Fire Tube Boiler (Part of Phase 1 Plant Construction)

Type	**:**	**Steambloc 600 R (Fire Tube Horizontal Type)**
Date of Manufacture	:	**Not available**
Fuel	**:**	**Diesel Oil**
Output	**:**	**6 tonnes per hour of Dry Saturated Steam at 13 bar gauge**
Stack Height	**:**	**5.18m**
Emission point Reference	**:**	**CP1**
Annual fuel Consumption (By Calculation)	**:**	**564.5m^3**
Energy at output	**:**	**4650kJ/s**
Thermal rating:		**4.15MW$_{TH}$**

Calculation for Thermal rating of Auxiliary Boiler

From Steam Tables,
the Enthalpy of Dry Saturated Steam (h_g) at 13 bar gauge is equal to 2790 kJ/kg,

therefore,
2,790 [kJ/kg] x 6,000 [kg/hr]x 1/3600[hrs/s] = 4,650 [kJ/s] = 4.65 MW_{TH}

Boiler Steam Output is equivalent to 4.65 MW_{TH}.

Considering that the Enthalpy of water at inlet to boiler (assuming 20^{o}C) is 0.5MW_{TH}

Hence Thermal output of Phase 1 Aux boiler is 4.65MW - 0.5MW = 4.15MW_{TH}

Section 4

Auxiliary boiler emissions and changes in the proposed variation to IPPC permit

The operation of the auxiliary boiler will only generate emissions to air.
The auxiliary boiler operates on gasoil. The consumption of the auxiliary boiler has been calculated to be approximately 564.5m^3 per annum.

The burning of fuel by the auxiliary boiler will result in the generation of air emissions, mainly SOx, NOx, CO, CO_2, and dust (TSP).

The calculation method will be used to calculate these emissions.

SO2 will be calculated using the formula based on the quantity of fuel burnt which will be the fuel consumed by the auxiliary boiler and the percentage sulphur content in the fuel burnt.

CO2 emissions generated by the burning of fuel in the auxiliary boiler will be calculated using the same formula for the calculation of CO2 emissions for the verification of greenhouse gas emissions based on the quantity of fuel burnt, net calorific value and carbon content of the fuel burnt. These parameters will be obtained from the laboratory analysis of the fuel burnt.

NOx and Dust (TSP) will be calculated according to the EMEP-EEA air pollutant emission inventory guidebook (latest edition) based on the quantity of fuel burnt, net calorific value (NCV) and an emission factor for NOx and dust respectively.

Tier 1 will be used for this calculation. The emission factor for this tier is based on the type of fuel burnt. In the case of the auxiliary boiler, this will be the emission factors pertaining to gasoil.

The auxiliary boiler does not emit any emissions to water.

Section 5

Measures to prevent and reduce emissions and leakages

The environmental aspects affected by the operation of the auxiliary boiler are the following:

- Fuel consumption
- Air emissions
- Fuel leakages

Excess fuel consumption which will result in the generation of emissions are addressed through regular maintenance of the boiler and monitoring of its operation.

Leakages of fuel and oil have been addressed through the bunding of the area where the auxiliary boiler has been installed. Besides the ground where the boiler is installed is made of concrete hence preventing any leakages to ground.

The small day tank having a capacity of 3.5m^3 which supplies diesel to the auxiliary boiler lies within the same area and is surrounded by a secondary containment. This will contain any fuel spills and prevent any fuel from spilling onto the concrete ground.

Enemalta's Emergency plan addresses the procedure which is to be followed when there is an oil or chemical spill.

Further to this, In the land and groundwater monitoring schedule a soil borehole has been identified in the area of the auxiliary boiler. Monitoring of this area during the land and groundwater monitoring will identify any contaminants which might have leached through the soil.

Section 6

Estimated air emissions generated per annum

From the records of fuel consumption from July 2017 till December 2020 when the auxiliary boiler was in operation it was calculated that the average fuel consumption is 564.5m^3.

Considering a density of 835.231kg/m^3 (latest weighted average density calculated for 2020)

Total consumption of auxiliary boiler = Mass = 835.231kg/m^3x 564.5m^3 = 4714.9kgs = **4.715MT**

Hence taking this amount of fuel as the total annual fuel burnt, the estimated emissions for this auxiliary boiler will be as follows:

CO_2 emissions

Using the formula

CO_2 = Fuel burnt*NCV*EF*Oxidation factor

Were

NCV is the net calorific value

Emission factor EF is calculated from the formula:

Total Carbon content/total fuel imported*3.664*1/NCV

Oxidation factor for gasoil is 1

NCV and carbon content of the gasoil as calculated for 2020, which records were verified by external verifiers will be used

NCV = 42.790GJ/T or 42.79TJ/kT

Carbon content = 73.653 tCO_2/TJ

CO_2 generated = (4.715/1000) (kT) * 42.79(TJ/kT) * 73.653(tCO2/TJ) * 1 = **14,860tCO_2**

SO_2 emissions

SO_2 = 2*(%S/100) * Fuel burnt (MT)

taking the sulphur content to be 0.1%

Then SO_2 generated = 2* (0.1/100) * 4.715(MT) = **0.009 tonnes**

NO_x emissions

NO_x = Fuel Burnt * NCV* Emission factor $_{NOx}$

Using EMEP/EEA air pollutant emission inventory guidebook (latest edition) tables for Tier 1 for Gasoil give:

NO_x emission factor = 65g/GJ

NO_x emissions = 4.715 (MT)*42.79(GJ/MT) * 65(g/GJ) = 13114.06g = **0.013tonnes**

Dust emissions

Dust emissions = Fuel Burnt (MT)*NCV (GJ/MT) * EF_{Dust} (g/GJ)

Using EMEP/EEA air pollutant emission inventory guidebook (latest edition) tables for Tier 1 for gasoil give:

Dust emission factor = 6.5g/GJ

Dust emissions = 4.715(MT)*42.79(GJ/MT) * 6.5(g/GJ)= 1311.406g = **0.0013tonnes**

CO emissions

CO emissions = Fuel Burnt (MT) * NCV (GJ/MT) * EF_{CO} (g/GJ)

Using EMEP/EEA air pollutant emission inventory guidebook (latest edition) tables for Tier 1 for Gasoil give:

CO emission factor = 16.2g/GJ

CO emissions = 4.715(MT)*42.79(GJ/MT) *16.2(g/GJ) = 3268.428g = **0.0033tonnes**