NON-TECHNICAL AIR QUALITY SUMMARY

1. Introduction

This addendum will provide:

Additional levels of detail to allow a comprehensive understanding of how the plant is preventing emissions in its design.

Additional details of how the plant will prevent emissions through its regulation, monitoring and operating process.

What the effect of emissions are on local air quality standards through the use of sophisticated dispersion modelling.

Provide comparative information of the air quality impacts of the plant against National Air Quality standards and local recorded air quality.

2. Combustion

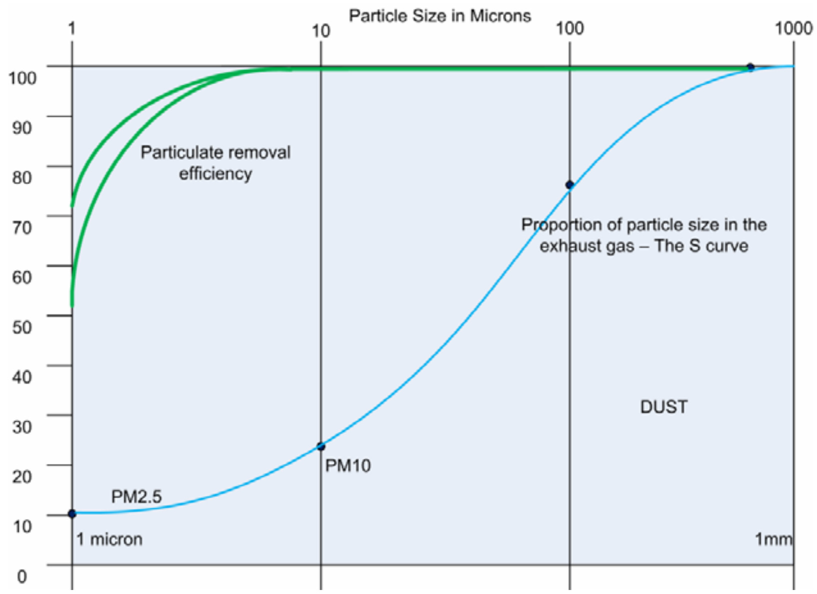
Air quality is primarily defined by the technical quality of the combustion process and air pollution control equipment. The first stage in preventing emissions is the combustion process. The proposed plant uses a two stage combustion process. Firstly a lower temperature combustion process separates the fuel into mostly volatile airborne components and ash (which is collected at this stage); the second combustion stage provides a high temperature (850°C) and a long residence time of 2 seconds. This second stage is key to preventing emissions as it destroys all organics and odours and leaves very low particulate levels in the exhaust gas. This addresses the issues usually raised in the burning of Biomass fuels:

PAHs – (polycyclic aromatic hydrocarbons) these are fully destroyed during the high temperature long residence combustion.

Dioxin-Furans – These are produced during the burning of wood at temperatures much lower than used in this project e.g. home fireplaces and bonfires. In this case they are controlled by preventing the thermo-chemical conditions which allow their creation. These conditions are avoided through the high temperature and long residence time combustion and also by providing a rapid temperature fall through the 400-300°c range in the boiler. If any Dioxin-Furans are present in the fuel at the start they are destroyed at the high temperature combustion. Currently Dioxin-Furans found in the environment are dominantly generated by low temperature coal and wood fires, bonfires, fireworks and similar uncontrolled combustion.

3. Filtration

After the combustion process the exhaust gas is subjected to a filtration process - a high efficiency multi cyclone filter or equivalent providing better removal efficiency. This removes >99% of particulates at PM10. A recovery curve for the filtration process is shown below.



The project are well aware of the issues of PM2.5 and, as shown in Figure 1 above, have good recovery of PM1 & PM2.5 particulates relative to PM10. Current UK and EU practice is to limit and monitor PM10 and to use PM10 as an indicator for PM2.5. It should be noted that due to the combustion and filtration process PM2.5s are held well below levels of concern. It should also be noted that the chemical composition of these particulates is also important. European studies have shown that the make up of the particulate emissions from these types of plant are more than 90% inert salts, in contrast particulates from other sources have high levels of insoluble organic compounds which are of concern to health; for example, low temperature wood fires, fuel oil boilers, low temperature coal fires.

4. Monitoring and Operation

The stack emissions will be automatically monitored on a 24hour 7day basis. The real time monitoring will provide feedback to the control of the plant. The feedback will allow plant operation to prevent exceedences of the agreed permitted emission limits including automatic shutdown at permitted limits. This will prevent the plant from operating over its agreed permitted limits. These emission limits have been set at a level to prevent impact to local air quality.

5. Dispersion

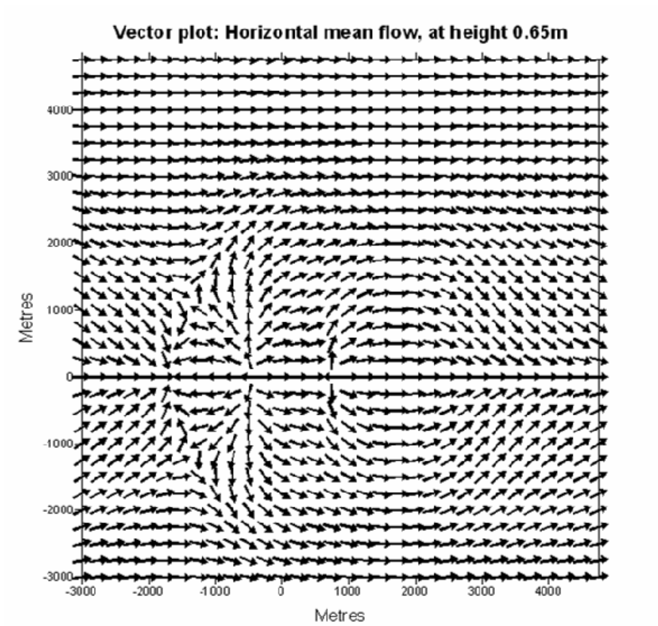
The plant is operating with a stack of 16m, the gas is exiting the stack at 15m/s and has a temperature of 150ºC which assures the gas will loft well particularly on calm days when there is little wind to aid dispersion and mixing. This plant is not using dispersion as a primary aid in the process of preventing impacts to air quality. Pollution prevention is primarily achieved through preventing the emission of pollutants and not in simply dispersing them through a higher stack. The following dispersion modelling demonstrates this to be an effective overall approach for the prevention of any impact on air quality.

Air Quality Modelling

The air quality modelling process uses the industry standard Cambridge Environmental Research Consultants ADMS4 application to model the dispersion of the gases from the stack (refer to www.cerc.co.uk for more information). The model takes the known stack outputs, the stack parameters, the local meteorology, the local topography and the building dimensions to provide detailed air quality information. The output is a grid of short term maximum concentrations and a grid of annual average concentrations of each of the emissions.

The outputs below are a summary of the complete results which have been presented to SSDC EHO. The results are shown here to demonstrate the comprehensive nature of the modelling and how the model is able to account for local meteorology from local topography. We have included models for a different emission for each of 5 years showing the influence of varying meteorology on the outputs. The models clearly show a non significant impact on local air quality.

Below is an example of how the model calculates the effect of air flow from local terrain. A calculation of the air flows as per below is calculated for the recorded meteorology for each of hour of the year and for a large number of heights from the ground allowing the model to predict exactly where the plume will travel for each hour of the year. These thousands of results are then reviewed by the application/model to give an annual average and a maximum value for the year.

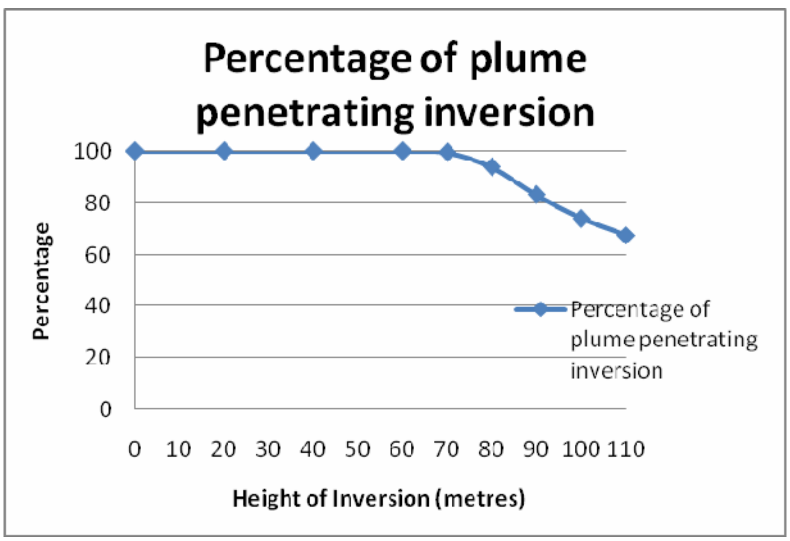


Inversion Case

The plant is situated in a valley where a low level inversion layer will sometimes be seen in cold calm conditions. The inversion layer is a pocket of cold air trapped in the valley under a warmer layer of air above. The cold air being denser does not mix with the warm air above. A common situation which has quite visible consequences is for smoke to be trapped at the boundary between the cold and warm air producing a blanket of smoke at the height of the inversion layer. This occurs because, as the warm smoke laden air rises through the cold air it is cooled to ambient temperatures. Thus, once it reaches the top of the cold air it is colder than the warm air above the inversion and, therefore, denser than the air above, which means it does not rise any further and forms a layer. It has been requested we look in detail at how an inversion in the valley will affect the dispersion of the plume from the plant. Particularly looking at whether the plume would be trapped below an inversion.

The inversion issue is addressed in the fact that the exit gas from the plant, in contrast to residential heating exhausts, is much hotter at 150ºC and has a much greater momentum with a velocity of 15m/s. This assists in the emissions punching through an inversion as the gas has enough inertia to carry it very quickly to the height of the inversion layer and is hot enough, that by the time it reaches the inversion layer, it is still hotter than the warm air above and continues to rise.

To model the plume rise in these conditions we have used ADMS4's output of "percentage of plume penetrating inversion" which is based on a Runge-Kutta solution to the integral conservation equations to model plume rise. These equations account for the boundary layers and temperature variations in the plume and the surrounding air with height. A minimum wind speed of 0.75m/s has to be included as the calculations are unable to handle zero wind speeds. It should be noted that including a wind speed in the plume rise calculation gives a much reduced plume rise vs. empirically recorded results. As such these results are very conservative in their prediction of the plume rise for still conditions.



The valley is about 80 metres in depth. From observation inversions usually occur somewhere between about 40 and 60 metres above the valley floor at which height it can be seen from the graph in Figure 2 above that 100% of the plume will penetrate the inversion. Even in the cases of an inversion occurring at the tops of the surrounding hills this model still predicts over 80% of the plume penetrating this inversion. It should be re-iterated at this point that this model is using wind speeds of 0.75 m/s which vastly reduces the calculated plume rise in comparison to the still conditions which are cited as of concern.

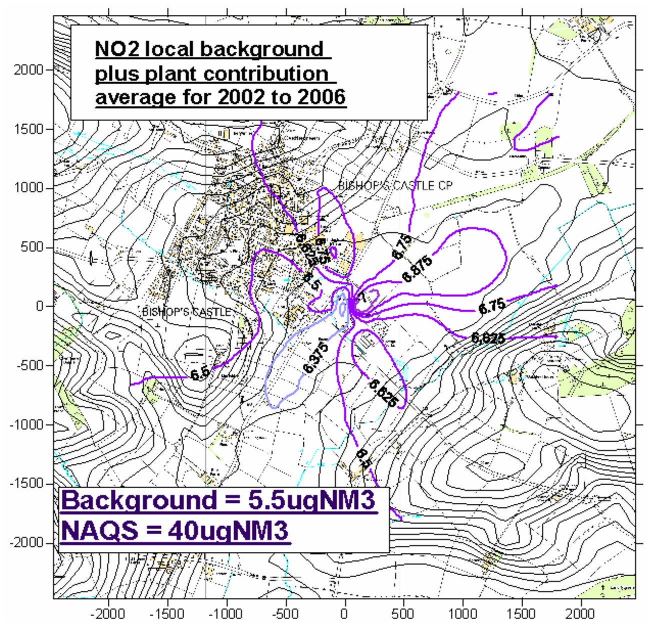
The model gives concentration results in the above cases well below recordable levels.

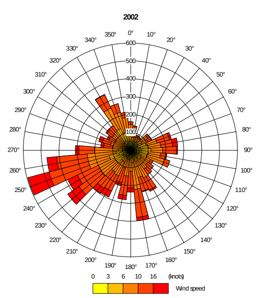
Annual Averages

Nitrogen Dioxide 2002

The annual average NAQS for NO_2 is 40µg/m³.The annual average background for the area is 5.5µg/m³.

As can be seen below the impact from the plant will be insignificant vs either NAQS or local air quality standards.

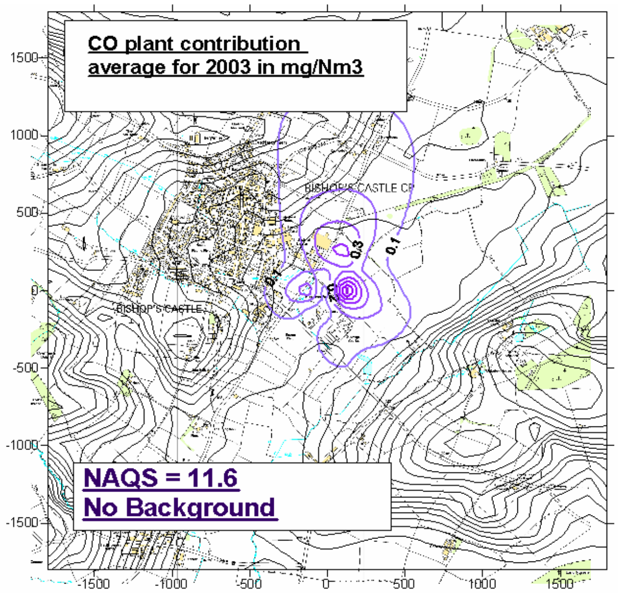


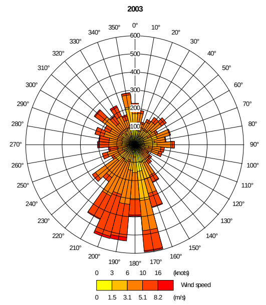


Carbon Monoxide

The annual average NAQS for C is 11.6mg/m³.The annual average background for the area is not recorded.

As can be seen below the impact from the plant will be insignificant vs NAQS.





Particulates

The annual average NAQS for PM10 is 40µg/m3.The annual average background for the area is 19µg/m^3.

As can be seen below the impact from the plant will be insignificant vs either NAQS or local air quality standards