Customer:	**Royston Woodchip Limited**
Address	c/o Fluid Ice Limited 1 Beauchamp Court, Victors Way, Barnet, Hertfordshire, EN5 5TZ

Air Quality Screening Assessment

Units 4 and 8 Five House Farm, Sandon Road, Therfield. Royston Herts SG8 9RE



24.06.16

027/RoystonWoodchip.002

ENVIROCONSULT
Environmental and acoustic consultancy

☎ 01952 730455 / 07908 026221

✉ enviroconsult2013@gmail.com

www.enviroconsultltd.com

Executive Summary

Royston Woodchip Limited is seeking to carry out wood chip drying activities in a disused farm building.

The intention is to install 4 new Wood Energy 400-600 RRF/PRF iTA 500 kW woodchip boilers running on dry wood that will be used to dry virgin timber wood chip. The woodchip is sourced locally from sustainable sources and is dried the specification of the customer in order to support the growing market in renewable energy fuel products.

The boilers used are exempt appliances within the meaning of the Clean Air Act 1993 and are considered low polluting boilers.

The purpose of this report is to provide a screening assessment to determine whether detailed air quality impact is required for installation of the 4 boilers in the disused farm building.

Unit 8 is fully enclosed, and will be modified to include an appropriate drying floor. The building is fully insulated as its former use was as a potato cold store. Unit 4 is currently vacant in its previous use is B8 (Storage & Distribution). It will be used a storage.

North-Herts District Council (NHDC) advised that they would require, a memorandum chimney height calculation in addition to a screening assessment air quality report.

There is a specific requirement for details on the calculation of chimney heights in accordance with the biomass requirements, and a general need to demonstrate that air quality impact is not adversely impacted by the proposal. There is also a need to address the potential acoustic impact of the proposal. This report addresses the air quality impacts and confirms the chimney heights calculated are acceptable in air quality terms.

In accordance with the general procedures listed in the Local Air Quality Management Guidance document (TG16), a screening assessment for air quality impact has been carried out.

The screening assessment indicates that no detailed assessment is required. The screening assessment utilises the emissions data from the boilers and nomograms produced by Ricardo-AEA on behalf of DEFRA, to conduct a screening assessment. Calculations have been carried out to determine a worst case scenario by considering the emissions of all four boilers occurring continually. In practice the boilers are operated at 60-70% capacity and will have less impact than predicted. The Biomass air quality tool has been used to determine acceptable chimney heights based on DEFRA background concentrations of key pollutants. That height was determined to be 8.5m above ground level. This height was then used to calculate overall pollution burden at the nearest sensitive receptor based on projected increases

The results conclude that introduction of 4 new woodchip boilers into the area will not cause an unacceptable air quality impact and there is no need to carry out a detailed assessment, subject to:

- The emission stacks serving the boilers, being located at least 5.15m from each other (see chimney height calculation report 027/RoystonWoodchip/001)
- The emission stacks **should not be less than 8.5m above ground level** (as measured from the concrete slab of the building).
- The emission stacks should discharge vertically and not be fitted with any caps, cowls or other restrictive plates.

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Appendix 1 – Industrial NOx and PM10 nomograms

1 Introduction

The applicant (Royston Wood Chip Ltd.) is seeking to change the use of Units 4 and 8 Five House Farm, Sandon Road, Therfield. Royston Herts SG8 9RE, from B8 and agricultural use to Wood Chip Drying B2 (General Industry). Royston Woodchip Limited (RWC) intends to produce high quality dried wood chip fuel, logs and briquettes for both the commercial and residential biomass markets. This assessment relates specifically to Unit 8 where the boilers are intended to be located.

The purpose of this air quality statement is to carry out a screening assessment for air quality in line with broad guidelines laid out in guidance supplied by North Hertfordshire District Council (NHDC) Environmental Health on the website (ref: http://www.north-herts.gov.uk/home/environmental-health/pollution/air-quality/air-quality-and-planning) noted below:

> ***Air Quality and Planning***
> *We aim to help sustainable development by working to achieve the best possible public health outcomes in relation to air quality.*
>
> *In doing so the EP&H Team has regard to the following:*
>
> - *National Planning Policy Framework (NPPF)*
> - *NHDC Local Plan policies in particular the Air Quality Policy and the Transport Policy*
> - *NHDC Air Quality Planning Guidance Document (see below)*
>
> *The Guidance document below is intended to provide clarity and consistency for developers, planners and local communities in considering the air quality impacts of developments within North Hertfordshire.*

According to the criteria laid out in the guidance document a suitable impact assessment is required in order to demonstrate acceptability environmental terms.

This report provides a screening impact assessment based on the emission stack height required by the Chimney Height Calculation submission (see Enviroconsult Report 027/RoystonWoodchip/001) and revises that report by ensuring that the proposed wood-drying installation and ensure that pollutants will have no unacceptable impact on the area. This air quality statement will focus on nitrogen dioxide (NO_2) and particulate matter (PM_{10}) and use the DEFRA guidance methodology for the screening assessment.

The application building is constructed from a concrete blocks base, and steel frame with corrugated metal sheets with a duo pitched roof to each bay. The building has been significantly insulated due to its former use as a potato cold store (see fig.1 below), this has both thermal and acoustic benefits. It requires minor amendments to include the 4 chimneys.

Figure 1. Building design and construction.



2 Site and surroundings

The proposed wood-drying installations will be located at Five House Farm, Sandon Road, Therfield. Royston Herts SG8 9RE, approximately between the hamlets of Green End and Buckland, and nearly 3miles from the nearest major urban centre Royston. It is located in open countryside. The site lies approximately 1 mile from the A10 main road which is to the east of the site.

Five House Farm Business Park comprises a mix of agricultural and business uses including; grain stores, furniture manufacture & joinery workshop, catering and event management, a flooring company, design and manufacturing of gaming accessories, and an industrial cleaning company.

The business park is situated to the north of the farm house which is located on Sandon Road and has a separate vehicular access. There are 3 dwellings located on the opposite side of Sandon Road which are between 70 - 100 m south west of unit 4 and between 85 - 112m of unit 8. There is a further dwelling located between 250-300m to the east. The nearest dwelling is the farm house.

There are extensive agricultural uses surrounding the site in all directions.

The nearest residential building is 50m away to the south west, other sensitive receptors are noted to be 250m to the east, 380m to the north east and 450m to the north east respectively and over 1km to the west.

Unit 4 measures approximately 40.9m x 13.2m and is 3.6 m to the eaves 5.96m to the ridge. The building is constructed from steel stations and concrete blockwork with steel profile sheets and has a duo pitched fibre cement sheet roof. There is a roller shutter door and a personnel door on the front (east) elevation, and a personnel door on the rear (west) elevation. Unit 4 is intended for storage only.

Unit 8 measures approximately 44.5m x 17.2m and is approximately 4.5m to the eaves and 7.3m to the ridge. The building is constructed from steel stations with 180mm insulated concrete panels and steel profile sheets and has a duo pitched insulated fibre cement sheet roof. There is a roller shutter door and a personnel door on both gable ends front (east and west elevations). This unit was previously used as the cold store for potatoes. Unit 8 is intended for drying and occasional chipping of wood.

3 Description of the wood-drying installation

The proposed development contemplates the installation of up to 4 Wood Energy 400-600 RRF/PRF iTA 500 kW woodchip boilers running on dry wood. The boilers provide the primary heat energy to dry the woodchip, and utilise the dried woodchip as a primary fuel source. The wood is intended to be a high quality specification from sustainable sources to the local area, suitable for use in small or large scale biomass installations as a primary fuel.

The facility will comprise delivery, chipping, and storage of wet wood and wood chip, additionally there will be internal drying drums onto which the wet wood will be introduced. Heat form the boilers is used to reduce moisture content to below 15% and hence make it suitable for use in clean woodchip boilers. The boilers consume woodchip dried within the facility as their primary fuel source.

The photograph below shows a typical drying facility.



Moisture generated by drying the wood is condensed and discharged to sewer.

The dried wood is then collected and held in storage prior to dispatch to customers.

No waste wood is processed.

It is intended to install al equipment connected to drying operations inside unit 8. All chipping of virgin timber will also be carried out in Unit 8.

Unit 4 will be used for storage.

4 Legal aspects

The Wood Energy 400-600 RRF/PRF iTA 500 kW boiler is classified as “Exempt Appliances” in respect of the Clean Air Act 1993. Additionally, an Environment Permit issued by the Environment Agency is not required for the chipping, and drying of wood, as no waste is involved.

The boiler units individually (and in aggregate), fall below the threshold requirement (20 MW) for permitting under the Environmental Permitting (England and Wales) Regulations 2010 (as amended) as a boiler (i.e. it is not a Part B activity listed in section 1.1 Part B Schedule 1 Environmental Permitting (England and Wales) Regulations 2012) – EPR, and does not use waste wood hence is not required to be permitted as a small waste incineration plant (SWIP) under section 5.1 Schedule 1 of the same legislation. A permit is therefore not required to operate the installation.

Section 6 of the Cleaner Air Act 1993 requires arrestment plant to deal with particulates for furnaces designed to burn pulverised fuel, solid matter at a rate of 45.4 kg/h or more (the proposed unit burns 188.6 kg/h of woodchips with a 15% moisture content) or liquid or gaseous matter at a rate equivalent to 366.4 kW or more. This unit would therefore need appropriate arrestment plant or treatment (which is already built into the plant). Certain exemptions exist to the requirement to fit arrestment plant, e.g. some temporary mobile furnaces; furnaces burning liquid matter or gas where the matter being heated does not contribute to the emission; furnaces designed to burn solid matter at a rate of less than 1.02 tonnes per hour and 11.3 kg per hour per square foot of grate area where the matter being heated does not contribute to the emission. The exemptions do not apply to furnaces for the incineration of refuse. The boiler being considered for the application site meets the criteria for exemption from full chimney height calculation.

Extant guidance (Biomass and Air Quality Guidance for Local Authorities – (England and Wales June 2009) prepared on behalf of LACORs and EPUK helpfully provides clarity on regulatory issues surrounding combustion of biomass. From Figure 3 (below) it is clear that the device proposed falls into category 1 of the Clean Air Act provisions only and regulation by the Local Authority and this is helpfully confirmed by NHDC Environmental Health.

Figure 3. Regulation of biomass plants from the Biomass and Air Quality Guidance for LAs.

Table 3.1: Regulation of biomass plant

Fuel Scenario	Plant size	Pollution regulation applicable	Regulator
1. Biomass fuels e.g. coppice willow, and fuel residues of a similar nature arising from the manufacture of these fuels	<20 MW_{th} 20 - 50 MW_{th} > 50 MW_{th}	Clean Air Act LA-PPC (Part B PPC) EPR (Part A1); PPC Part A Sc & NI LCPD also applies	Local authority Local authority; SEPA/NIEA Environment Agency/SEPA/NIEA
2. Waste or waste derived biomass exempted from WID, and fuel residues of a similar nature arising from their manufacture	<0.4 MW_{th} and <50 kg/hr 0.4 - 3 MW_{th} or 50 - 1000 kg/hr >3 MW_{th} and/ or 1000 kg/hr > 50 MW_{th}	Clean Air Act LA-PPC (Part B PPC) EPR (Part A1); PPC, Part A Sc & NI EPR (Part A1); PPC Part A Sc & NI. LCPD applies	Local authority; SEPA Local authority; SEPA/ NIEA Environment Agency/SEPA/NIEA Environment Agency/SEPA/NIEA
Waste or waste derived biomass to which WID applies	< 3 MW_{th} >3 MW_{th}	WID applies LA-PPC (Part A2) WID Applies. PPC (Part A)	Local Authority; SEPA; NIEA Environment Agency/SEPA/NIEA

Notes:
a) The above is true for stand-alone combustion plant and incinerators. However, if the combustion is associated with an activity that is subject to LA control, then the waste burning plant will remain under LA control provided it is below 50 MW.

b) All plant rating is thermal capacity.

The only significant issues are the potential impact of the device on Air Quality and ensuring that the correct chimney height is applied to adequately disperse residual pollutants. The determination of the legal framework for control of the boiler then informs the screening method to be used. Technical Guidance Note 16 (TG16) recommends a screening assessment methodology in paragraph 3.38:

> *“The ASR/APR still requires such changes in air pollution to be identified, and if deemed necessary, screened to determine whether their impact on air quality is deemed significant.”*

Appropriate screening techniques for biomass incineration, include use of the online web tools provided by DEFRA. These tools are limited to single emission stacks, and therefore multiple stacks require the use of other appropriate screening assessments. The assessments to be used are not prescribed, however, the one outlined in the methodology is considered to fall in line with the principles in TG16 as well as the primary guidance issued by LACORS and EPUK specifically addressing biomass installations.

5 Methodology

LAQM.TG(16) (DEFRA, 2016) provides no specific metric for conducting AQ assessments for biomass other than the reference Ricardo-AEA tools provided on the DEFRA website. This in turn cross references Ricardo work identifying nomograms for biomass incineration.

The devices proposed are relatively small biomass boilers. Guidance issued by Ricardo-AEA on behalf of DEFRA, Abbott, J "Technical Guidance: screening assessment for biomass boilers" AEA Report reference AEA/ED48673005/R2655- Issue 1, prepared for Defra and the Devolved Administrations, July 2008 - http://uk-air.defra.gov.uk/reports/cat18/0806261519_methods.pdf recommends a screening assessment. The screening assessment uses a spreadsheet calculator to indicate whether a device is likely to cause PM10 or NO2 exceedances

For single devices the biomass tool readily provides an assessment, (see appendix 1) based on inputs of stack to determine compliance with target emission, however, multiple devices require a cumulative impact assessment approach.

Chart 4.1, page 20 of the guidance LACORs guidance document indicates a sequential approach to determining impact. The following methodology has been adopted to demonstrate the requirements of the screening assessment which is required by TG16.

	Task	Comment
1	Gather information on device	acquired and provided (see separate document)
2	Check to see if the device falls into the Waste Incineration Directive	no waste is being incinerated
3	Is the device operation covered by a permit?	It is not covered by a permit – see above
4	Check Clean Air Act Compliance	The device requires a chimney height assessment and grit and dust provisions. (see separate Chimney Height calculation report)
5	Check boiler is exempt appliance	It is exempt – screening for NO_x and PM_{10} required (see separate Chimney Height calculation report)
6	Is the device situated within or likely to contribute to an AQMA	No (see section 6 of this report)
7	Are the site parameters suitable for screening assessment?	yes – see below
8	Use appropriate screening tools	the LAQM screening nomograms developed by Ricardo-AEA (spreadsheets) indicate minimum stack height of 8.5m required based on background concentrations (see Appendix 1)
9	Integrated screening assessment	The calculations based on AEA nomograms for cumulative impact of multiple devices (see section 6).

Parameters for the screening assessment. The screening assessment identified used to determine the appropriate tool are the nomograms developed by Ricardo-AEA. The nomograms provide a simplified tool for screening assessment and are provided in the Local Air Quality Management Technical Guidance. For use of these nomograms, the following information was required:

- Height of the tallest building within 5 stack heights of the stack – [Process building 7.3m].
- Stack diameter. [350mm]
- Stack height. [8.5m from spreadsheet tool]
- Location (either Scotland or the rest of UK). [Rest of UK]
- NO_2/PM_{10} annual mean background concentration, including roadside contribution at relevant receptors. [Mean concentrations 18.01µg/m^3 and 10.64µg/m^3 respectively (source DEFRA background maps) http://uk-air.defra.gov.uk/data/laqm-background-maps?year=2011]

6 Calculations

According to the boiler's specification sheet, the emission factors of the proposed boiler model at full load are 56g/GJ for Total Suspended Particles (TSP) and 132g/GJ for nitrogen oxides (NO_x). According to the EMEP/EEA Guidebook for Emission Inventories, the ratio of PM_{10} to TSP for biomass installations is 0.95, hence the emission factor for PM_{10} is 53.2g/GJ.

Combining this information with the fuel consumption and the gross heating value of wood chips, the emissions of **one** boiler under the before mentioned conditions are 0.0033 g/s for PM_{10} and 0.0822g/s. The emissions of the proposed development (consisting in 4 boilers) will be **0.013g/s** for PM_{10} and **0.331g/s** for NO_x.

Technical guidance issued by DEFRA in the form of spreadsheets provides tools to evaluate potential increases in key pollutants based on maximum discharge rates. These are derived from nomograms produced by Ricardo-AEA on behalf of DEFRA.

The nomograms of the Local Air Quality Management Technical Guidance that were chosen for the estimation of target emission rates are the following:

- Emissions of nitrogen oxides (tonnes per annum) which will give rise to an annual mean ground-level nitrogen dioxide concentration of 1µg/m_3 at receptor locations up to 2 km from fugitive and low-level sources (stack <10 metres)
- PM_{10} emissions (tonnes per annum) from low temperature sources (<100ºC) which will give a 90th percentile of daily 24-hour mean ground-level concentration of 1µg/m^3 (stack <10 metres).

Based on the nomograms above (see Appendix 2), the predicted level of emission to increase concentrations of PM10 by 1µg/m3 is 0.005g/s, and the predicted level of emission for NOx is 0.013g/s. Comparing these results to the actual (worst case) emissions provides a screening assessment for installation of the 4 boilers.

The proposed development of four boilers **equate to increases of 0.38µg/m^3 in the target emission rates for PM10** and **20.5µg/m^3 for NOx** (based on 0.013g/s for PM_{10} and 0.331g/s for NO_x). This suggests that the background concentrations of PM_{10} and NO_2 could both be increased when the proposed development is in full operation. NB: the equipment operational time is normally 60-70% of maximum which reduces annual emissions accordingly.

According to the NO_2 and PM_{10} background concentration data for 2011, the annual mean concentration of PM10 and highest daily NO2 concentration in the area is of 10.64µg/m^3 and 18.01µg/m^3 respectively. With the increases predicted above, the resulting annual concentrations in the area will be of **11.02µg/m^3** for PM_{10} and **38.5µg/m^3** for NO_2. Both concentrations are below the annual limit value for NO_2 (40 µg/m^3) and the daily limit value for PM_{10} (50µg/m^3).

7 Conclusions

Subject to a number of caveats (below), the appropriate chimney height for boilers has been calculated to be 8.5**m** above the ground level of the installation building (see chimney height calculation report ref: 027/RoystonWoodchip/001).

The suggested chimney height of 8.5m above the ground level of the unit has been assessed in terms of acceptability for dispersion of residual pollutants and the potential impact using the screening assessment module consistent with TG16 and LACORS/EPUK guidance. *This figure overrides the Chimney Height calculation using the Chimney Height Memorandum where a lesser height of 8m was identified as acceptable. Using the Biomass calculator tool* for a stack of 8m with a building height of 7.3m the device exceeded the acceptable individual target emission.*

*biomass calculator tool is provided by DEFRA as a ready reckoner for individual biomass installations at:
http://laqm.defra.gov.uk/review-and-assessment/tools/emissions.html

Based on use of 8.5m emission stacks that are located more than 5.15m from each other, the proposed development may produce a negligible increase on the background concentrations of PM_{10} and more significant

20µg/m3 increase in levels for NO_2, (worst case) resulting in mean annual concentrations below existing air quality objectives.

Both are below the limit values stipulated in Directive 2008/50/EC. The installation would not trigger the declaration of an Air Quality Management Area.

A detailed assessment is not required for the proposed development. However, it should be noted that this depends on the fact that only clean woodchip is to be burned, ideally to a specified quality and that maintenance and cleaning schedules be put in place as per the manufacturer's instructions.

These biomass devices are relatively small, they burn clean fuel of known composition, generated on site. The devices operate on 60-70% of the time, though one or more devices operate continually. The assessment carried out assumes 24hour per day, 7 day per week operation for all units. It is therefore considered a worst case scenario.

Prepared by:



Tony Higgins
Director

8 References

- Abbott, J., 2008. Technical Guidance: Screening assessment for biomass boilers. Report to the Department of Environment, Food, and Rural Affairs and the Devolved Administrations. AEA/ED48673005/R2655-Issue.
- Local Air Quality Management Technical Guidance LAQM.TG(09) February 2009 (DEFRA).
- Local Air Quality Management Technical Guidance LAQM.TG(16) February 2009 (DEFRA).
- Biomass and Air Quality Guidance for Local Authorities England and Wales June 2009 (LACORS/EPUK)

Appendices

Appendix 1 – outputs from AQ tools
Appendix 2 – process nomograms (TG09)

Appendix 1 – Tool outputs

Review and Assessment Tool for PM_{10} from biomass combustion stacks

The maximum emissions of PM_{10} in g/s from biomass combustion source emissions are calculated for your given stack details. Greater emission rates may result in exceedence of the 24 hour objective for PM10 in England, Wales and Northern Ireland or the annual mean objective in Scotland.

Enter required information in Cream Cells
Resulting Emission in Red Bold

Building height	7.3	m
Stack diameter	0.35	m
Stack height	8.5	m
Location {Scotland, Rest of UK}	Rest of UK	
PM_{10} Annual mean background concentration (include roadside contribution at relevant receptors)	18.01	µg/m^3
Calculated Effective stack height	2.0	m
Target Emission Rate	0.0154	g/s

If the maximum stack emission rate is less than the target above then it is not likely that the most stringent objective for PM_{10} will be exceeded

The PM10 background concentration from DEFRA background maps was 18.01µg/m^3.

The emission rate for the device was noted to be 0.0033gs-1, An 8.5m stack was sufficient to meet the target emission rate.

Review and Assessment Tool for oxides of nitrogen emissions from biomass combustion stacks
Annual mean NO_2 objective

The target emissions of NO_x in g/s from biomass combustion source emissions are calculated for your given stack details. Greater emission rates may result in exceedence of the annual mean objective for NO_2

Enter required information in Cream Cells
Resulting Emission in Red Bold

Building height	7.3	m
Stack diameter	0.35	m
Stack height	8.5	m
Location {Scotland, Rest of UK}	Rest of UK	
NO_2 Annual mean background concentration (include roadside contribution at relevant receptors)	10.64	µg/m^3
Calculated Effective stack height	2.0	m
Target Emission Rate	0.0957	g/s

If the maximum stack emission rate is less than the target above then it is not likely that the annual mean limit value for NO_2 will be exceeded

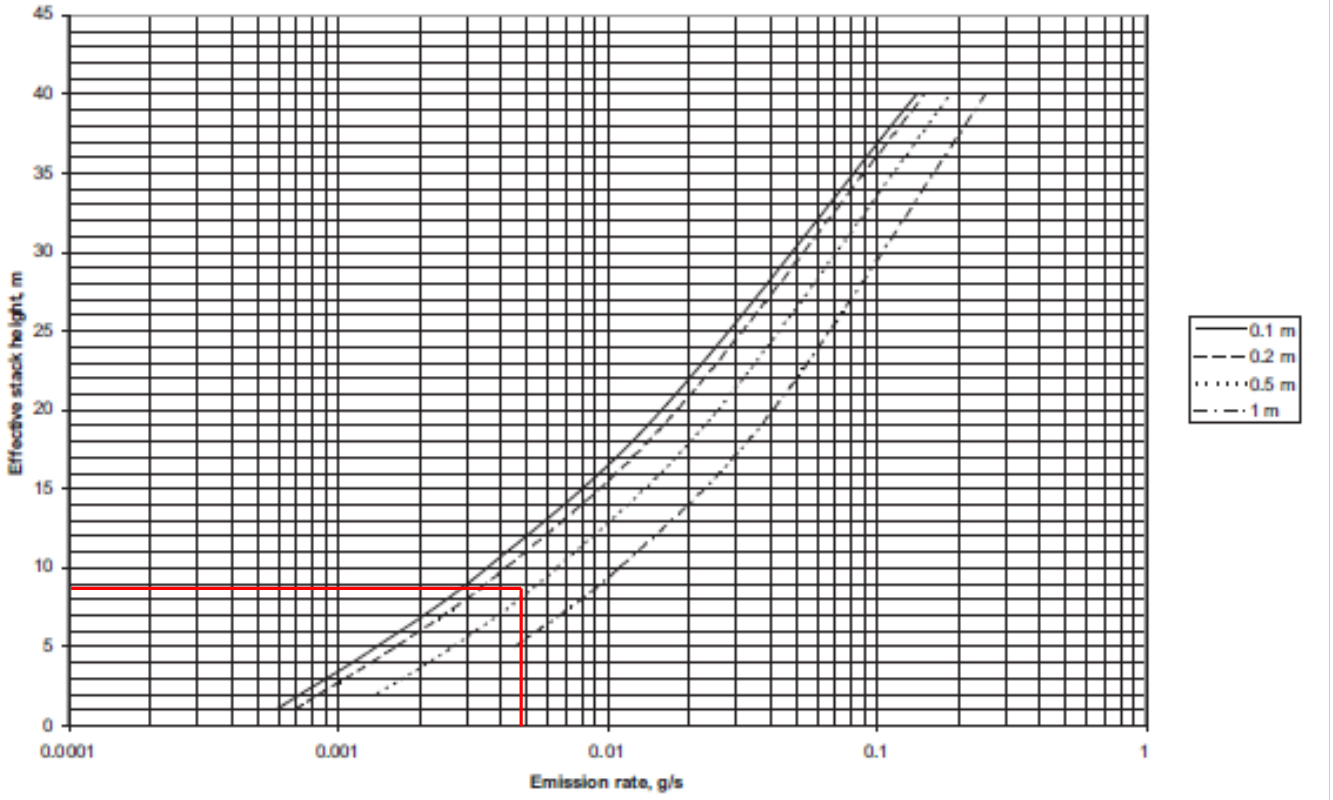
The Annual Mean NO2 result from DEFRA background maps was 10.64µg/m^3.

The emission rate noted for the device was note to be 0.0822µg/m^3. An 8.5m stack was sufficient to meet the target emission rate.

Appendix 2 – Nomograms

Figure A.1. PM_{10} nomogram for one proposed boiler.

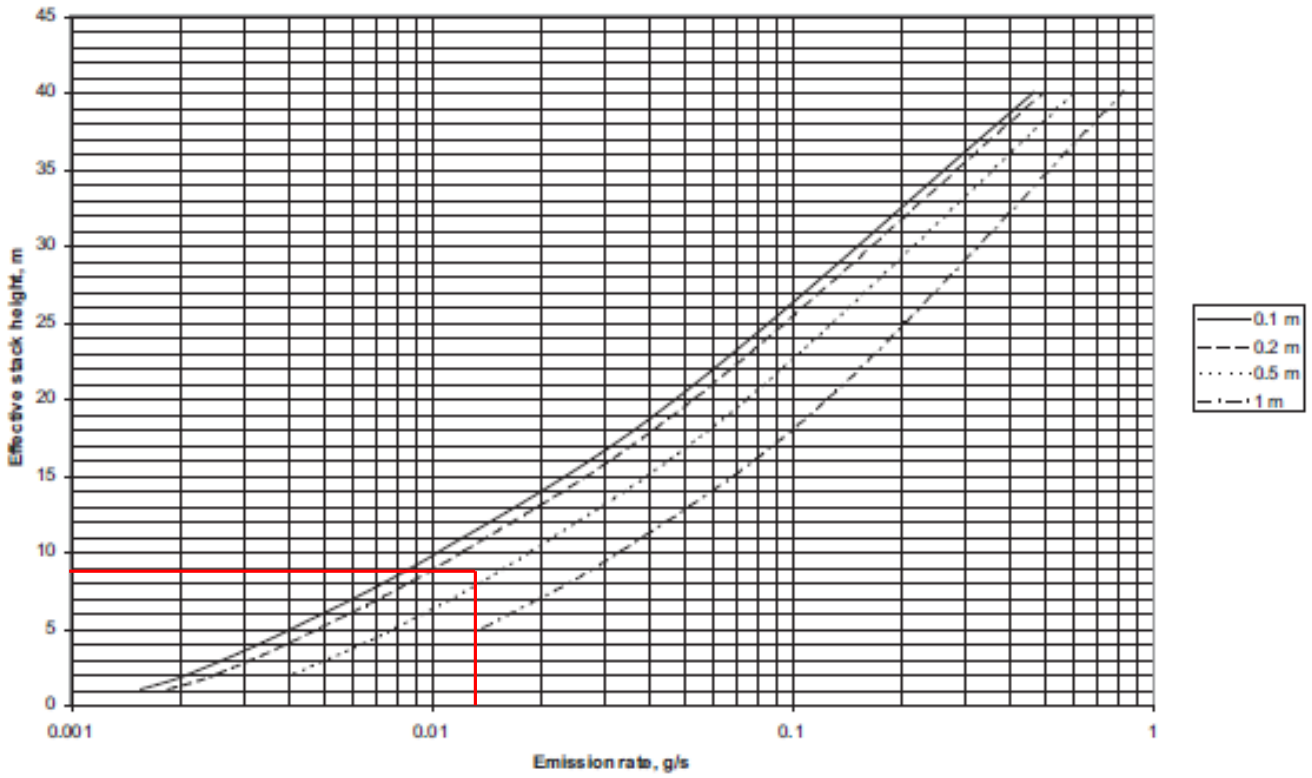
Figure 5.19: Particulate Matter emissions to give a 90th percentile of 24-hour mean ground-level PM_{10} concentrations of 1 µg/m³



Discharge rate emission of particulate matter likely to give rise to 1µg/m3 PM10 increase at 80m is ***0.005g/s***

Figure A.2. Mass emission for NOx from site likely to give rise to 1µgm/m3 increase

Figure 5.20: nitrogen dioxides emissions to give an annual mean ground-level nitrogen dioxides concentration of 1 µg/m³



Discharge rate emission of NOx likely to give rise to 1µg/m3 increase at 80m is ***0.013g/s***

ENVIROCONSULT
Environmental and acoustic consultancy
☏ 01952 730455 / 07908 026221
✉ enviroconsult2013@gmail.com
www.enviroconsultltd.com