# Appendix 11A Air Quality Assessment

# 11A. INTRODUCTION

## 11A.1. Scope

11A.1.1. This Technical Appendix describes the detailed dispersion modelling of point source emissions and the detailed dispersion modelling of traffic emissions undertaken in support of the Air Quality chapter, including determination of future baseline and Proposed Development contributions.

11A.1.2. Section 11A.2 describes the methodology and data assumptions used in process emissions modelling; Section 11A.3 describes the methodology and data assumptions used in traffic emissions modelling; Section 11A.4 presents the results of the future baseline and impact assessment on human health receptors; Section 11A.5 presents the results of the habitats air quality impact assessment.

11A.1.3. The emissions envisaged from the FM1 plant now under construction have been modelled and the predicted process contributions (PCs) have been added to the traffic contributions (TC) associated with the operation of the power station and the existing baseline concentrations, to establish the modified baseline concentrations at off-site and sensitive receptor locations.

11A.1.4. Emissions from the Proposed Development point source and associated traffic have been modelled to determine the likely worst-case PC and TC for FM2 and these have been added to the modified baseline to determine the Predicted Environmental Concentration (PEC) at sensitive receptor locations for assessment against air quality standards. Full commissioning of the Proposed Development is assumed to have been completed by 2018.

## 11A.2. Process emissions modelling

### Air Quality Standards

11A.2.1. The assessment has been made with reference to the air quality standards and objectives defined in legislation (Refs 11A-1 – 11A-3). In addition, where legislative limits are not specified for the pollutant species potentially released from the Proposed Development, Environmental Assessment Levels (EALs), published in the Environment Agency's Environmental Permitting Regulations - H1 Environmental Risk Assessment document (EPR H1) (Ref. 11A-4), have been used to assess the potential health effects on the general population. These are provided in Tables 11a.1 and 11a.2 below.

**Table 11A.1 Air Quality Strategy Objectives**

| Pollutant | Objective (µg/m$^3$) | Averaging period | Percentile | To be met by |
|---|---|---|---|---|
| Nitrogen dioxide ($NO_2$) | 200 | 1 hour | $99.8^{th}$ or 18 exceedances/year | 31 Dec 05 |
| | 40 | Annual | Mean | 31 Dec 05 |
| Oxides of nitrogen ($NO_x$, as $NO_2$) [2] | 75 | Daily | Mean | - |
| | 30 | Annual | Mean | 31 Dec 00 |
| Particulate matter ($PM_{10}$) | 50 | 24 hour | $90.4^{th}$ or 35 exceedances/year | 31 Dec 04 |
| | 40 | Annual | Mean | 31 Dec 04 |
| Particulate matter ($PM_{2.5}$) | 25 | Annual | Mean | 1 Jan 15 |
| Carbon monoxide (CO) | 10,000 | 8-hour | $100^{th}$ | 31 Dec 03 |
| Benzene | 5 | Annual | Mean | 31 Dec 10 |
| 1,3 butadiene | 2.25 | Annual | Mean | 31 Dec 03 |
| Lead | 0.25 | Annual | Mean | 31 Dec 08 |
| Sulphur dioxide ($SO_2$) | 266 | 15 minute | $99.9^{th}$ or 35 exceedances/year | 31 Dec 05 |
| | 350 | 1 hour | $99.7^{th}$ or 24 exceedances/year | 31 Dec 04 |
| | 125 | 24 hour | $99.2^{nd}$ or 3 exceedances/year | 31 Dec 04 |
| | 20 [2] | Annual | Mean | 31 Dec 00 |
| Polycyclic Aromatic Hydrocarbons (PAH) [1] | 0.25 ng/m$^3$ | Annual | Mean | 31 Dec 10 |

Table Notes
1. This objective applies to benzo(a)pyrene only but this has been used as a surrogate species for all PAHs in this assessment.
2. Critical Level for Vegetation and Ecosystems

**Table 11A.2 Environmental Assessment Levels for Other Identified Study Species**

| Pollutant | EAL (µg/m$^3$) | Averaging period |
|---|---|---|
| Cadmium (Cd) and Thallium (Tl) (Cd used as worst-case) | 0.005 | Annual |
| Mercury (Hg) | 7.5 | 1 hour |
| | 0.25 | Annual |
| Other Heavy Metals (Sb, As, Pb, Cr, Co, Cu, Mn, Ni and V) [1] | 5 | Annual |
| | 150 | 1 hour |
| Hydrogen Chloride (HCl) | 750 | 1 hour |
| Hydrogen Fluoride (HF) | 160 | 1 hour |
| | 16 | Annual |
| | 5 [2] | Daily |
| | 0.5 [2] | Weekly |
| Ammonia ($NH_3$) | 2,500 | 1 hour |
| | 180 | Annual |
| | 1 [3] | Annual |
| Dioxins | N/A | N/A |

Table Notes:

1. Sb, Cr (II) and Cr (III) have the most stringent EALs therefore their use allows a conservative assessment to be carried out.
2. Critical Level for Vegetation and Ecosystems
3. Critical Level for Vegetation and Ecosystems, Lichens and Bryophytes

11A.2.2. The AQS does not contain objectives for heavy metals and local authorities have currently no statutory obligation to review and assess air quality against them. In addition, the Air Quality Standards Regulations 2010 (Ref. 11A-1) includes annual mean target values for arsenic (6 ng/m$^3$), cadmium (5 ng/m$^3$) and nickel (20 ng/m$^3$) which only apply to the content of the relevant pollutant in the PM10 fraction, in ambient air. The target values are intended to be attained by 31st December 2012, "in so far as is possible". The target values are derived from the Fourth Air Quality Directive (Council Directive 2004/107/EC) (Ref. 11A-3), which states that these values would not require any control measures entailing disproportionate costs. For industrial installations, this would not involve measures beyond the application of Best Available Techniques (BAT). In particular, the Directive states that these target values are not to be considered as environmental quality standards.

## Dispersion Model Selection

11A.2.3. Dispersion modelling calculates the predicted ground level concentrations arising from the emissions to atmosphere, based on Gaussian approximation techniques. The model employed has been developed for UK regulatory use and its use in such assessments is approved by the Environment Agency.

11A.2.4. ADMS5 uses a continuous calculation method to determine the conditions of the receiving atmosphere based on the Monin-Obukhov length, which represents the height of the boundary layer and the degree of turbulence within the atmosphere. This is generally regarded as a more comprehensive modelling approach than that employed by older models such as ISC, which use discrete approximations to the atmospheric conditions known as Pasquill stability classes. The degree of turbulence in the atmosphere affects the rate at which pollutants from point sources are dispersed in the environment. The more unstable the atmosphere, for example due to high solar insolation, the greater the degree of mixing. While this is in principle the desired effect for the release of pollutants through stacks at elevated heights, this can also lead to localised peak concentrations if the plume is rapidly brought to ground level.

11A.2.5. ADMS5 utilises site-specific hourly sequential meteorological data to enable a realistic assessment of dispersion from point sources to be conducted for meteorological conditions that are directly applicable to the site.

11A.2.6. Various parameters can affect the degree of dispersion from a source, and these are accounted for in the modelling scenario where appropriate. The presence of elevated or complex terrain in the vicinity of the source can affect the flow pattern of the wind field, which can in turn bring a plume to ground more rapidly. Buildings of sufficient height located close to the emissions sources can affect dispersion – inducing downwash in the emitted plume and entraining pollutants towards ground level.

11A.2.7. Sensitivity of the predicted concentrations to variations in these model representations has been undertaken to ensure that the reported results provide a realistic worst-case assessment.

## Modified Baseline - FM1 Emission Parameters

11A.2.8. The FM1 plant includes two boilers, each venting to atmosphere via a dedicated flue, contained within a common windshield. These have been modelled as a single emission source.

11A.2.9. The relevant stack and emission parameters are provided in Table 11A.3 and 11A.4 below.

**Table 11A.3 FM1 Stack Release Parameters**

| Parameter | Value |
|---|---|
| Number of Stacks | 1 |
| Stack Location | 447243, 424992 |
| Stack Height (m) | 100 |
| Efflux Velocity (m/s) | 20.8 |
| Emission Temperature (°C) | 140 |
| Combined Volumetric Flow (Nm$^3$/hr) | 412,800 |
| Effective Combined Flue Diameter | 3.3 |
| Pollutant Emission Rates | See Table 11A.4 below. |

11A.2.10. The assessment of the emissions has been based on Emission Limit Values (ELVs), as defined in the Environmental Permit for the plant (Ref: EPR/SP3239FU). The ELVs used in the assessment are presented in Table 11A.4 below, together with the mass release rates from the operational Proposed Development when the volumetric flow from the two boilers is taken into account.

11A.2.11. It is assumed that both boilers are operating concurrently at maximum load (peak emission flow rate) and at the ELVs. The model therefore represents the worst-case estimation of FM1 process contributions to the modified baseline.

**Table 11A.4 FM1 Emission Limit Values and Release Rates**

| Pollutant | Daily Average ELV (mg/Nm$^3$) | FM1 Release Rates (g/s) |
|---|---|---|
| Oxides of Nitrogen | 200 | 23.3 |
| Sulphur Dioxide | 50 | 5.8 |
| Particulates | 10 | 1.2 |
| Carbon Monoxide | 50 | 5.8 |
| Hydrogen Chloride | 10 | 1.2 |
| Hydrogen Fluoride | 1 | 0.12 |
| Volatile Organic Compounds[1] | 10 | 1.3 |
| Cadmium and Thallium | 0.05 | 0.0060 |
| Mercury | 0.05 | 0.0060 |
| Other Metals[2] | 0.5 | 0.060 |
| Ammonia[3] | 10 | 1.2 |
| Dioxins and furans | $1 \times 10^{-7}$ | $1.2 \times 10^{-8}$ |

Table Notes:
1. VOCs conservatively assumed to be 100% benzene
2. Includes Sb, As, Pb, Cr, Co, Cu, Mn, Ni and V
3. Emission rate derived for SNCR abatement from the Best Available Technique Reference Document for Waste Incineration.

### Proposed Development Emission Parameters

11A.2.12. The Proposed Development includes two boilers, each venting to atmosphere via a dedicated flue, contained within a common windshield. These have been modelled as a single emission source assuming both boilers are operational concurrently, therefore representing a worst-case impact assessment.

11A.2.13. The relevant stack and emission parameters are provided in Tables 11A.5 and 11A.6.

**Table 11A.5 FM2 Stack Release Parameters**

| Parameter | Value |
|---|---|
| Number of Stacks | 1 (twin flue) |
| Stack Location | 447272, 425342 |
| Stack Height (m) | 120 |
| Efflux Velocity (m/s) | 15.3 |
| Emission Temperature (°C) | 140 |
| Combined Volumetric Flow ($Nm^3$/hr) for 2 process lines | 482,000 |
| Effective Combined Flue Diameter within single stack | 4.0 |
| Pollutant Emission Rates | See Table 11a.6 below. |

Table Notes:
1. Reference conditions 273K, 0% $O_2$, dry

**Table 11A.6 FM2 Emission Limit Values and Release Rates**

| Pollutant | Daily Average ELV ($mg/Nm^3$) | FM1 Release Rates (g/s) |
|---|---|---|
| Oxides of Nitrogen | 200 | 26.8 |
| Sulphur Dioxide | 50 | 6.7 |
| Particulates | 10 | 1.3 |
| Carbon Monoxide | 50 | 6.7 |
| Hydrogen Chloride | 10 | 1.3 |
| Hydrogen Fluoride | 1 | 0.13 |
| Volatile Organic Compounds[1] | 10 | 1.3 |
| Cadmium and Thallium | 0.05 | 0.0067 |
| Mercury | 0.05 | 0.0067 |
| Other Metals[2] | 0.5 | 0.067 |
| Ammonia[3] | 10 | 1.3 |
| Dioxins and furans | $1 \times 10^{-7}$ | $1.3 \times 10^{-8}$ |

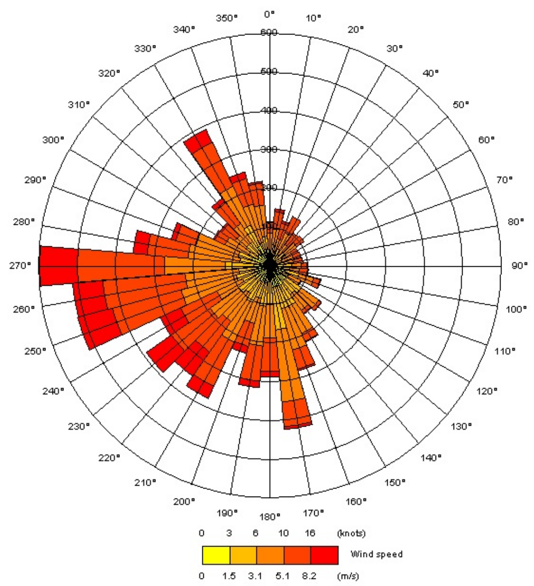
Table Notes:
1. VOCs conservatively assumed to be 100% benzene
2. Includes Sb, As, Pb, Cr, Co, Cu, Mn, Ni and V
3. Emission rate derived for SNCR abatement from the Best Available Technique Reference Document for Waste Incineration.

## 11A.3. Meteorological Data

11A.3.1. Actual measured hourly-sequential meteorological data is available for input into dispersion models, and it is important to select data as representative as possible for the site that is modelled. This is usually achieved by selecting a meteorological station as close to the site as possible, although other stations may be used if the local terrain and conditions vary considerably, or if the station does not provide sufficient data.

11A.3.2. The meteorological site that was selected for the assessment was Church Fenton, located approximately 15 km northeast of the site, at a flat airfield. The modelling for this assessment has utilised meteorological data for the period 2007-2011, with 2007 providing the worst-case results, and therefore this year has been used to generate the reported results provided below. The wind rose for Church Fenton in 2007 is provided in Figure .11A.1.

**Figure 11A.1: Church Fenton Wind Rose (2007)**




## 11A.4. Buildings and Terrain

11A.4.1. The presence of buildings or structures near to the emission points can have a significant effect on the dispersion of emissions. The wind field can become entrained into the wake of buildings, which causes the wind to be directed to ground level more rapidly than in the absence of a building. If an emission is entrained into this deviated wind field, this can give rise to elevated ground-level concentrations. Building effects are typically considered where a structure of height greater than 40% of the stack height is situated within 8-10 stack heights of the emissions source.

11A.4.2. Buildings associated with the Proposed Development considered to be of sufficient height and volume to potentially impact on the dispersal of emissions from the stack include the Boiler Hall and Bunker Hall. At this stage, while the final dimensions of the buildings for the process are determined, the air quality assessment is conservatively based on the proposed worst case building dimensions from the different technology providers. In reality, the building dimensions may be smaller than the ones used in the assessment, however, this would be expected to reduce the significance of building impacts on the dispersion of emissions from the main stack; the results presented in this report are therefore considered to be conservative with respect to building effects.

11A.4.3. The FM1 plant buildings that could affect dispersion from the FM1 stack, for modified baseline determination, include the boiler hall and bunker hall.

11A.4.4. In addition, the existing Ferrybridge 'C' cooling towers have the height potential to affect dispersion from the Proposed Development stack and are situated within 8-10 stack heights of the Proposed Development.

11A.4.5. It is recognised that when in use, the hot cooling tower plumes will generate a thermal up-draught, which could potentially increase the buoyancy and hence dispersion from the Proposed Development stack, and consequently reduce the ground level concentrations. In this way, it could be argued that any impacts arising from the effects of the cooling tower structures would be offset by the increased buoyancy of the gases, which is a modelling approach frequently used in the assessment of emissions from thermal power stations. However, the coal-fired plant cooling towers may not always be in operation when the Proposed Development is running and any up-draught effect from the cooling towers cannot be adequately represented in the dispersion model, due to the model limitations; consequently the cooling towers have been included as structures within the modelling assessment in order to present a worst-case assessment. Parameters representing the buildings and cooling towers included in the model are shown in Table 11A.7 and a plan showing the buildings used in the ADMS simulations is also shown in Figure 11A.2 below.

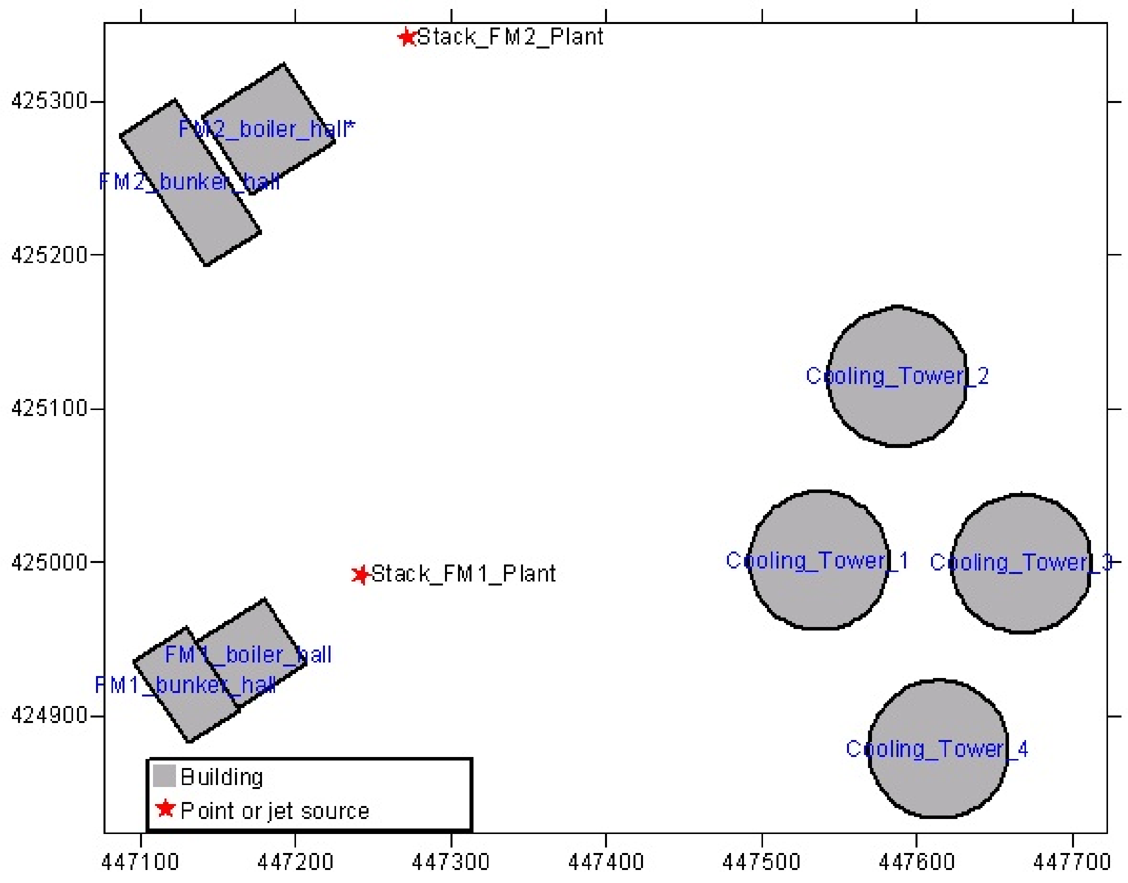
**Table 11A.7 Buildings Incorporated into the Modelling Assessment**

| Building | Grid Reference (x,y) | Height (m) | Length (m) | Width (m) | Angle [1] |
|---|---|---|---|---|---|
| FM2 Boiler House | 447182, 425282 | 58 | 63 | 60 | 57 |
| FM2 Bunker | 447132, 425252 | 48 | 42 | 102 | 57 |
| Cooling Tower 1 | 447537, 425001 | 113 | 90 | -[2] | -[2] |
| Cooling Tower 2 | 447588, 425119 | 113 | 90 | -[2] | -[2] |
| Cooling Tower 3 | 447668, 424999 | 113 | 90 | -[2] | -[2] |
| Cooling Tower 4 | 447614, 424878 | 113 | 90 | -[2] | -[2] |
| FM1 Boiler Hall | 447170, 424940 | 49 | 55 | 50 | 57 |
| FM1 Bunker Hall | 447130, 424920 | 42 | 40 | 64 | 57 |

Table Notes:
1. The angle between the building length and grid north.
2. The existing cooling towers have been modelled as circular structures of 90 m diameter and therefore have no designated 'width' or 'angle'.

11A.4.6. The site is situated on a glacial flood plain adjacent and to the west of the River Aire. The nearest residential and commercial developments are in the hamlet of Ferrybridge, approximately 1 km to the south east of the site, and Castleford town approximately 1 km west of the site. A surface roughness of 0.5 m, corresponding to parkland and open suburbia, has been selected to represent the local terrain. Site-specific terrain data has not been used in the model, as typically terrain data will only have a marked effect on predicted concentrations where hills with gradient of more than 1 in 10 are present in the vicinity of the source, which is not the case at this site.

**Figure 11A.2: Visualisation of Buildings in ADMS**




## Modelled Domain and Receptors

11A.4.7. The model has been based on a grid (54 x 54) extending 4 km from the point source. The grid resolution therefore provides output at 150 m intervals from the source. The nearest sensitive receptor to the source is located approximately 400 m from the source, therefore this resolution is considered appropriate. A lower resolution grid has also been used to assess impacts on ecological receptors up to 10 km from the plant. In addition, the nearest sensitive human and ecological receptors have been identified and represented as specified points for the model output, as detailed in Tables 11A.8 and 11A.9 below.

**Table 11A.8 Sensitive Human Health Receptors**

| Receptor Number | Sensitive Receptor | Type of Receptor | In AQMA? | Grid Reference | Location from Plant |
|---|---|---|---|---|---|
| R1 | Manor Farm Ferrybridge | Residences | Yes | 447975, 424560 | 1.1km SE |
| R2 | Pollard's Fields Ferrybridge | Residences / School | Yes | 447705, 424365 | 1.1km S |
| R3 | Limetrees Pontefract | Residences | Yes | 447395, 423733 | 1.6km S |
| R4 | Pontefract Road | Residences | Yes | 447613, 423920 | 1.5km S |
| R5 | Sunny Nook, Stranglands Lane | Residence | Yes | 448152, 424575 | 1.2km SE |

| Receptor Number | Sensitive Receptor | Type of Receptor | In AQMA? | Grid Reference | Location from Plant |
|---|---|---|---|---|---|
| R6 | The Elms, The Square | Residence | Yes | 448288, 424502 | 1.3km SE |
| R7 | Holmfield Farm | Residence | Yes | 446845, 424820 | 0.7km SW |
| R8 | Kirkhaw Bungalow | Residence | Yes | 447989, 424591 | 1.0km SE |
| R9 | Brotherton School | School | No | 448355, 425363 | 1.1km East |
| R10 | Oakland Hill – Fryston Lane | Residences | Yes | 446745, 425020 | 0.6km West |
| R11 | Low Street | Residences | No | 448400, 425270 | 1.1km East |
| R12 | Castleford Lane | Residences | Yes | 447885, 424446 | 1.1km SE |
| R13 | Wentcliffe Cottage | Residences | Yes | 448337, 424253 | 1.5km SE |
| R14 | Pinfold Close | Residences | Yes | 448339, 424122 | 1.6km SE |
| R15 | Doncaster Road | Residences | Yes | 448384, 423821 | 1.9km SE |
| R16 | The Square | Residences | Yes | 448400, 424430 | 1.5km SE |
| R17 | Kirkhaw Lane | Residences | Yes | 447969, 424722 | 0.8km SE |

**Table 11A.9 Sensitive Ecological Receptors**

| Receptor Number | Sensitive Receptor | Type of Receptor[2] | Grid Reference[1] | Location from Plant |
|---|---|---|---|---|
| E1 | Fairburn and Newton Ings | SSSI | 447379, 427282 | 1.9km N |
| E2 | Madbanks and Ledsham Banks | SSSI | 446010, 429770 | 4.6km NW |
| E3 | Sherburn Willows | SSSI | 448760, 432275 | 7.1km NE |
| E4 | Wentbridge Ings | SSSI | 447700, 418215 | 7.1km S |
| E5 | Brockadale | SSSI | 450065, 417680 | 8.2km S |
| E6 | Forlorn Hope Meadow | SSSI | 454250, 417210 | 7.5km SW |
| E7 | Townclose Hills | SSSI | 440850, 430300 | 8.1km NW |
| E8 | Roach Lime Hills | SSSI | 441995, 431330 | 8.0km NW |
| E9 | Micklefield Quarry | SSSI | 444600, 432410 | 7.6km NW |
| E10 | Mickletown Ings | SSSI | 440725, 427320 | 6.8km NW |
| E11 | Well Wood | LNR | 445700, 426600 | 2.0km NW |
| E12 | Fryston Wood | LWS | 447100, 425500 | 0.2km N |
| E13 | Fryston Park | LWS | 446905, 425570 | 0.4km NW |
| E14 | Bank of River Aire | LWS | 447547, 426240 | 0.9km N |
| E15 | Byram Park, Burton Salmon | LWS | 448687, 426237 | 1.7km NE |
| E16 | Woodland, western edge of Byram Park | LWS | 448497, 426417 | 1.6km NE |
| E17 | Orchard Head | LWS | 446250, 423697 | 1.9km SW |

Table Notes:
1. Taken as the nearest point to the Proposed Development
2. SSSI = Site of Special Scientific Interest, LNR = Local Nature Reserve, LWS = Local Wildlife Site

### Sensitivity Analysis

11A.4.8. Sensitivity analysis has been conducted on the model input variables to determine the effects on predicted results, and to ultimately identify the realistic worst-case results for inclusion in the assessment. These variables include:

- meteorological data;
- buildings and structures; and
- emissions parameters.

11A.4.9. Five years of meteorological data from Church Fenton have been assessed, with 2007 data providing the worst-case long term and short term predicted results. The highest predicted results from all five years met data have been used to provide a worst-case assessment, in accordance with H1 guidance.

11A.4.10. In order to ensure that a worst-case assessment of the emissions from the Proposed Development has been carried out, numerous model runs have been undertaken for different building configurations as part of the model sensitivity analysis, and it was found that, of these additional structures, only the four cooling towers nearest the Proposed Development affected the predicted ground level concentrations arising from the emissions, and therefore were included in the final model run. The worst-case buildings representation, as indicated in section 2.5, has been used in this assessment.

11A.4.11. Emission parameters for a number of scenarios, including alternative emission temperatures and flow rates, have been assessed through modelling to determine the parameters that result in the worst-case predicted concentrations for the proposed plant design. These have been used in the assessment to provide the worst-case impact assessment for the proposed development.

## 11A.5. Traffic Emissions Modelling

### Introduction

11A.5.1. The impacts from road traffic emissions associated with the Proposed Development have been considered in addition to point source combustion emissions.

11A.5.2. To undertake the assessment of road traffic emissions during the operational phases of the Proposed Development, the latest version of dispersion model software 'ADMS-Model' (v3.1) has been used to quantify pollution levels at selected receptors. ADMS-Roads is a modern dispersion model that has an extensive published track record of use in the UK for the assessment of local air quality impacts, including model validation and verification studies

11A.5.3. This section outlines the methodology and results of the road traffic emissions assessment.

### Study Pollutants

11A.5.4. The incomplete combustion of fuel in vehicle engines results in the presence of hydrocarbons (HC) such as benzene and 1,3-butadiene, and sulphur dioxide ($SO_2$), carbon monoxide (CO), $PM_{10}$ and $PM_{2.5}$ in exhaust emissions. In addition, at the high temperatures and pressures found within vehicle engines, some of the nitrogen in the air and fuel is oxidised to form $NO_x$, mainly in the form of nitric oxide (NO), which is then converted to $NO_2$ in the atmosphere. $NO_2$ is associated with adverse effects on human health. Better emission control technology and fuel specifications are expected to reduce emissions per vehicle in the long term.

11A.5.5. Although $SO_2$, CO, benzene and 1,3-butadiene are also present in motor vehicle exhaust emissions, detailed consideration of the associated impacts on local air quality is not considered relevant in the context of this Proposed Development. This is because road traffic emissions of these substances have been reviewed by the local authority and nowhere within Wakefield Metropolitan Borough Council administrative area is at risk of exceeding these objectives. The Proposed Development would not be capable of compromising the achievement of the relevant air quality objectives for the protection of human health. Emissions of $SO_2$, CO, benzene and 1,3-butadiene from road traffic are therefore not considered further within this assessment.

11A.5.6. During operation, the Proposed Development has the potential to change vehicle movements on the surrounding road network. An increase in vehicle emissions can increase the exposure at sensitive receptors to concentrations of $NO_2$ and particulate matter ($PM_{10}$ and $PM_{2.5}$). This assessment will quantify the concentration of the pollutants most commonly associated with vehicle emissions at the worst affected receptor locations.

### Dispersion Model Input Data and Model Conditions

11A.5.7. The general model conditions used in the assessment of road traffic emissions are summarised in Table 11A.10. Other more detailed aspects needed to model the dispersion of emissions are considered within the following sub-sections.

**Table 11A.10 General ADMS-Roads Model Conditions**

| Variable | Model Input |
|---|---|
| Surface roughness at source | 0.5 |
| Minimum Monin-Obukhov length for stable conditions | 30 |
| Terrain types | Flat |
| Receptor location | X,Y coordinates determined by GIS |
| Emissions | $NO_X$, $PM_{10}$ and $PM_{2.5}$ |
| Emission factors | EFT Version 5.2 emission factor database. |
| Meteorological data | 1 year (2011) hourly sequential data from Church Fenton 2011 |
| Emission profiles | No emission profile has been used. |
| Receptors | Selected Receptors Only (No grid points) |
| Model output | Long-term annual mean $NO_x$ concentrations<br>Long-term annual mean $PM_{10}$ concentrations<br>Long-term annual mean $PM_{2.5}$ concentrations |

## 11A.6. Traffic Data

11A.6.1. The traffic data used within this assessment has been sourced from the URS Transportation Team (URS, 2013) and is set out in Table 11A.11 and Table 11A.12 below.

11A.6.2. Emission rates have been taken from the latest emission factor toolkit (5.2c). As there is some doubt over year on year improvements in emission rates, it has been conservatively assumed that there will not be any improvement in emissions between the current situation and opening year of the Proposed Development.

**Table 11A. 11 Traffic Data**

| Link Description | 2011 Baseline | | | 2018 Do-Minimum | | | 2018 Do-Something | | |
|---|---|---|---|---|---|---|---|---|---|
| | AADT (veh/day) | %HDV | Speed (mph) | AADT (veh/day) | %HDV | Speed (mph) | AADT (veh/day) | %HDV | Speed (mph) |
| Hinton Lane | 417 | 0% | 20 | 455 | 0% | 20 | 455 | 0% | 20 |
| Kirkhaw Lane | 874 | 29% | 20 | 1295 | 43% | 20 | 1637 | 51% | 20 |
| Stranglands Lane - West of Hinton lane | 10012 | 3% | 30 | 10911 | 3% | 30 | 10925 | 3% | 30 |
| Stranglands Lane - Between Hinton Lane & Kirkhaw Lane | 11066 | 6% | 30 | 12060 | 6% | 30 | 12073 | 6% | 30 |
| Stranglands Lane - Kirkhaw Lane & OGNR | 11077 | 7% | 30 | 12401 | 9% | 30 | 12730 | 11% | 30 |
| The Square - Between OGNR & High Street | 113373 | 5% | 30 | 14614 | 5% | 30 | 14653 | 5% | 30 |
| A162 North of New Roundabout (Two-Way Flows) | 14552 | 2% | 70 | 15859 | 2% | 70 | 15859 | 2% | 70 |
| OGNR - Between Stranglands lane & A1 | 7033 | 5% | 70 | 7954 | 9% | 70 | 8243 | 12% | 70 |
| Northbound A162 South of B6136 | 6350 | 7% | 70 | 7072 | 9% | 70 | 7223 | 10% | 70 |
| Southbound A162 South of B6136 | 6404 | 3% | 70 | 7130 | 5% | 70 | 7282 | 7% | 70 |
| Northbound A162 North of B6136 to new Rdb | 7276 | 2% | 70 | 8068 | 3% | 70 | 8206 | 5% | 70 |
| Southbound A162 North of B6136 from new Rdb | 7276 | 2% | 70 | 8068 | 3% | 70 | 8206 | 5% | 70 |
| NB On Slip A162 | 2857 | 1% | 70 | 3252 | 5% | 70 | 3390 | 9% | 70 |
| NB Off Slip A162 | 2949 | 11% | 70 | 3365 | 15% | 70 | 3517 | 18% | 70 |
| SB On Slip A162 | 2688 | 9% | 70 | 2942 | 9% | 70 | 2956 | 9% | 70 |
| SB Off Slip A162 | 3040 | 2% | 70 | 3313 | 2% | 70 | 3313 | 2% | 70 |
| A162 South of Knottingley | 18282 | 7% | 70 | 20226 | 9% | 70 | 20528 | 10% | 70 |
| A162 between OGNR & Sowgate Lane | 3401 | 3% | 70 | 3706 | 3% | 70 | 3706 | 3% | 70 |
| New Low Street Roundabout | - | - | - | 15859 | 2% | 30 | 15859 | 2% | 30 |

## 11A.7. Background Data

11A.7.1. For each receptor considered in this study a receptor-specific background concentration has been determined, based on the receptor Defra grid square concentration (Defra 2010 background maps for 2013). Where the road component has been explicitly modelled for this assessment, contributions to annual mean $NO_2$, $PM_{10}$ and $PM_{2.5}$ from Primary A Roads and motorway road sources in the modelling domain were removed from the background (sector removal as per LAQM TG(09) guidance (Ref 11A-5) and the modelled road contribution has been added.

11A.7.2. Due to the uncertainty in the assumption that year on year background concentrations will decrease, the 2012 mapped background data has been used for both the baseline and future year assessment.

### Bias Adjustment of Road Contribution Pollutant Concentrations

11A.7.3. There is one monitoring location (diffusion tube site 51) within the road traffic model study area. Following the model verification methodology described in LAQM TG(09) (Defra, 2009), modelled predictions were made of annual mean $NO_2$ concentrations at the location of the diffusion tube. A comparison of the unadjusted predictions and the measured concentrations at this location was undertaken. This showed that the model under-predicted annual mean concentrations of $NO_2$. As described in LAQM TG(09), the adjustment was made to predicted road $NO_x$ contributions. An adjustment factor of 1.99 was used to correct bias across the study area.

11A.7.4. In the absence of measured or monitored $PM_{10}$ and $PM_{2.5}$ data that is suitable for use in model verification, the same road $NO_X$ factor has also been applied to their road contributions, as per the methodology described in LAQM TG(09).

### NOx to $NO_2$ Conversion

11A.7.5. To accompany the publication of the guidance document LAQM TG(09), a $NO_X$ to $NO_2$ converter was made available as a tool to calculate the road $NO_2$ contribution from modelled road $NO_X$ contributions. The tool comes in the form of an MS Excel spreadsheet and uses borough specific data to calculate annual mean concentrations of $NO_2$ from dispersion model output values of annual mean concentrations of $NO_X$. This tool was used to calculate the total $NO_2$ concentrations at receptors from the modelled road $NO_X$ contribution and the associated background concentration. Due to the location of the proposed development, the ‘All Other Urban Traffic’ setting was selected.

### Predicting the Number of Days in which the $PM_{10}$ 24-hr Mean Objective is Exceeded

11A.7.6. The guidance document LAQM TG(03) set out the method by which the number of days in which the $PM_{10}$ 24-hr objective is exceeded can be obtained based on a relationship with the predicted $PM_{10}$ annual mean concentration. The most recent guidance (Defra, 2009) suggests no change to this method. As such, the formula used within this assessment is:

$$\text{No. of } Exceedances = 0.0014 * C^3 + \frac{206}{C} - 18.5$$

Where C is the annual mean concentration of $PM_{10}$.

### Predicting the Number of Days in which the NO2 hourly Mean Objective is Exceeded

11A.7.7. Research projects completed on behalf of Defra and the Devolved Administrations (Laxen and Marner (2003) and AEAT (2008)) have concluded that the hourly mean $NO_2$ objective is unlikely to be exceeded if annual mean concentrations are predicted to be less the 60 µg/m$^3$.

11A.7.8. In 2003, Laxen and Marner concluded:

11A.7.9. “…*local authorities could reliably base decisions on likely exceedances of the 1-hour objective for nitrogen dioxide alongside busy streets using an annual mean of 60 µg/m$^3$ and above*.”

11A.7.10. The findings presented by Laxen and Marner (2003) are further supported by AEAT (2008) who revisited the investigation to complete an updated analysis including new monitoring results and additional monitoring sites. The recommendations of this report are:

11A.7.11. “*Local authorities should continue to use the threshold of 60 µg/m$^3$ $NO_2$ as the trigger for considering a likely exceeaence of the hourly mean nitrogen dioxide objective*.”

11A.7.12. Therefore this assessment will evaluate the likelihood of exceeding the hourly mean $NO_2$ objective by comparing predicted annual mean $NO_2$ concentrations at all receptors to an annual mean equivalent threshold of 60 µg/m$^3$ $NO_2$. Where predicted concentrations are below this value, it can be concluded with confidence that the hourly mean NO2 objective (200 µg/m$^3$ $NO_2$ not more than 18 times per year) will be achieved.

### Method for Assessment of Significance

11A.7.13. EPR H1 indicates that for the assessment of point source emissions, long term ground level concentrations arising from point sources which are less than 1% of an air quality objective or EAL can be treated as insignificant (or negligible). Similarly, short term ground level concentrations arising from point sources which are less than 10% of an air quality objective or EAL can also be treated as insignificant (or negligible). Where emissions are not screened as negligible, the descriptive terms for the significance of the effect outlined in Table 11A.12 below have been applied.

11A.7.14. The significance of effects of point source emissions on ecological receptors, through deposition of nutrient nitrogen or acidity, has been evaluated using the Environment Agency insignificance criterion of 1% of the long term objective, as above.

11A.7.15. With regard to road traffic, the change in pollutant concentrations with respect to baseline concentrations has been quantified at receptors that are representative of exposure to impacts on local air quality within the study area. The absolute magnitude of pollutant concentrations in the baseline and with development scenario is also quantified and this is used to consider the risk of the air quality limit values being exceeded in each scenario.

11A.7.16. For a change of a given magnitude, the Institute of Air Quality Management (IAQM, 2009) have published recommendations for describing the magnitude of impacts at individual receptors and describing the significance (Table 11A.13) of such impacts. For example a change in predicted annual mean concentrations of $NO_2$ or $PM_{10}$ of less than 0.4 µg/m$^3$ is considered to be so small a to be imperceptible. A change (impact) that is imperceptible, given normal bounds of variation, would not be capable of having a direct effect on local air quality that could be considered to be significant. The magnitude of change is divided into four classes as defined in Table 11A.13.

**Table 11A.12 Magnitude of Changes in Ambient Pollutant Concentrations of $NO_2$ and $PM_{10}$**

| Magnitude of Change | Annual Mean Concentrations of $NO_2$ (µg/m³) | Annual Mean Concentrations of $PM_{10}$ (µg/m³) | Exceedances of the 24-hr mean objective for $PM_{10}$ (days) |
|---|---|---|---|
| Large | Increase/decrease >4 | Increase/decrease >4 | Increase/decrease >4 |
| Medium | Increase/decrease 2 - 4 | Increase/decrease 2 - 4 | Increase/decrease 2 to 4 |
| Small | Increase/decrease 0.4 - 2 | Increase/decrease 0.4 - 2 | Increase/decrease 1 to 2 |
| Imperceptible | Increase/decrease < 0.4 | Increase/decrease < 0.4 | Increase/decrease < 1 |

11A.7.17. The magnitude of the change in the predicted number of exceedances of the 24-hour objective is directly derived from the predicted annual mean value using the relationship defined in the DMRB Screening Tool. The magnitude descriptors for 24-hour mean $PM_{10}$ in the table above are as proposed by Environmental Protection UK (EPUK, 2010).

11A.7.18. All relevant receptors that have been selected to represent locations where people are likely to be present are based on impacts on human health. The air quality objective values have been set at concentrations that provide protection to all members of society, including more vulnerable groups such as the very young, elderly or unwell. As such the sensitivity of receptors was considered in the definition of the air quality objective values and therefore no additional subdivision of human health receptors on the basis of building or location type is necessary.

11A.7.19. For receptors that are predicted to experience a perceptible change, the effect of the change on local air quality and the risk of exceeding the air quality objective value is summarised in Table 11A.14 for annual mean concentrations of $NO_2$ and $PM_{10}$.

**Table 11A.13. Magnitude of Changes in Ambient Pollutant Concentrations of $NO_2$ and $PM_{10}$**

| Absolute Concentration in Relation to Objective/Limit Value | Change in Concentration | | |
|---|---|---|---|
| | Small | Medium | Large |
| **Increase with Scheme** | | | |
| Above Objective/Limit Value *With* Scheme (>40 µg/m³) | Slight Adverse | Moderate Adverse | Substantial Adverse |
| Just Below Objective/Limit Value *With* Scheme (36 - 40 µg/m³) | Slight Adverse | Moderate Adverse | Moderate Adverse |
| Below Objective/Limit Value *With* Scheme (30 - 36 µg/m³) | Negligible | Slight Adverse | Slight Adverse |
| Well Below Objective/Limit Value *With* Scheme (<30 µg/m³) | Negligible | Negligible | Slight Adverse |

| Absolute Concentration in Relation to Objective/Limit Value | Change in Concentration | | |
|---|---|---|---|
| | Small | Medium | Large |
| **Increase with Scheme** | | | |
| **Decrease with Scheme** | | | |
| Above Objective/Limit Value *Without* Scheme (>40 µg/m³) | Slight Beneficial | Moderate Beneficial | Substantial Beneficial |
| Just Below Objective/Limit Value *Without* Scheme (36 - 40 µg/m³) | Slight Beneficial | Moderate Beneficial | Moderate Beneficial |
| Below Objective/Limit Value *Without* Scheme (30 - 36 µg/m³) | Negligible | Slight Beneficial | Slight Beneficial |
| Well Below Objective/Limit Value *Without* Scheme (<30 µg/m³) | Negligible | Negligible | Slight Beneficial |

11A.7.20. The criteria in Table 11.1 relate to air quality statistics that are elevated about the objective values in many urban locations: this is not the case with $PM_{2.5}$. A change in the annual mean concentration of $PM_{2.5}$ equivalent to 1% of the objective value is 0.25 µg/m³. Changes above 0.25 µg/m³ would be considered to be a small change (up to 1.25 µg/m³).

11A.7.21. A small increase in annual mean concentrations of $NO_2$ and $PM_{10}$, at receptors exposed to baseline concentrations that are just below the objective value (36 µg/m³ to 40 µg/m³) is considered to have a minor adverse effect as the minor increase in the risk of exceeding the objective value is significant. However, a small increase in annual mean concentrations of $NO_2$ and $PM_{10}$ at receptors exposed to baseline concentrations that are below or well below (< 36 µg/m³) is not likely to affect the achievement of the objective value and is therefore not a significant effect (negligible).

11A.7.22. The equivalent values for just below the annual mean $PM_{2.5}$ objective value where a small increase would cause a minor adverse effect on air quality is 22.5 to 25 µg/m³. Where baseline annual mean $PM_{2.5}$ concentrations at a receptor are well below the objective (< 18.75 µg/m³), a small increase is not likely to have a significant effect on air quality.

## Assessment of Significance

11A.7.23. The significance of all the reported impacts is then considered for the development in overall terms. The potential for the scheme to contribute to or interfere with the successful implementation of policies and strategies for the management of local air quality are considered if relevant, but the principal focus is any change to the likelihood of future achievement of the air quality objective values set out in Table 11A.1 for the following pollutants:

- Annual mean nitrogen dioxide ($NO_2$) concentration of 40 µg/m³;
- Annual mean particulate matter ($PM_{10}$) concentration of 40 µg/m³;
- Annual mean fine particulate matter ($PM_{2.5}$) concentrations of 25 µg/m³; and
- 24-hour mean $PM_{10}$ concentration of 50 µg/m³ not to be exceeded on more than 35 days per year.

11A.7.24. The achievement of local authority goals for local air quality management are directly linked to the achievement of the air quality objective values described above and as such this assessment focuses on the likelihood of future achievement of the air quality objective values.

11A.7.25. In terms of the significance of the consequences of any adverse impacts, an effect is reported as being either 'not significant' or as being 'significant'. Effects found to be 'minor' are considered to be 'not significant', although they may be a matter or local concern. 'Negligible' effects are considered to be 'not significant'.

## 11A.8. Results and Discussion

### Modified Baseline Calculations - FM1 Process and Road Contributions

11A.8.1. It is considered that the modelled parameters used will result in a conservative estimation of the FM1 process contribution to the modified baseline. These include:

- Use of the worst-case meteorological year (2011) for the reported results;
- Assessment of emission concentrations at the WID limits, when average concentrations are likely to be below these values;
- Assumption that 70% of $NO_x$ emissions are converted to $NO_2$ in the stack vicinity in the long term;
- Assumption that 100% of particulate emissions are $PM_{10}$ or below;
- 100% plant availability and operation per year;
- Inclusion of buildings within the model, especially the inclusion of the existing Ferrybridge 'C' cooling towers and excluding potential up-draught effects from the cooling tower thermal plumes in the assessment.

11A.8.2. The assessment undertaken for 2018 assumes that there has been no improvement in either background pollutant concentrations for $NO_2$ or $PM_{10}$ or vehicle emission factors. This is considered to be a conservative approach for 2018 as some improvements are anticipated in both background pollutant concentrations and also vehicle emissions by this date.

11A.8.3. The modelled FM1 traffic data for 2018, including 2018 background, has been added to the FM1 annual process contributions of $NO_2$ to give the modified baseline at each sensitive receptor. These values are presented in Table 11A.14 below.

**Table 11A.14 Modified $NO_2$ Baseline Calculations**

| Sensitive Receptor | 2011 Annual $NO_2$ Baseline (µg/m$^3$) | 2018 Annual $NO_2$ Baseline (µg/m$^3$) | 2018 Annual $NO_2$ Baseline with FM1 traffic (µg/m$^3$) | FM1 $NO_2$ Process Contribution (µg/m$^3$) | Modified 2018 $NO_2$ Baseline (µg/m$^3$) |
|---|---|---|---|---|---|
| R1 | 28.1 | 28.7 | 29.0 | 0.25 | 28.9 |
| R2 | 27.6 | 27.9 | 28.0 | 0.30 | 28.2 |
| R3 | 30.2 | 30.2 | 30.2 | 0.30 | 30.5 |
| R4 | 30.2 | 30.2 | 30.2 | 0.43 | 30.6 |
| R5 | 30.9 | 33.2 | 34.7 | 0.43 | 33.7 |
| R6 | 29.1 | 30.4 | 30.9 | 0.37 | 30.7 |
| R7* | 24.9 | 24.9 | 24.9 | 0.41 | 25.3 |
| R8 | 27.3 | 28.1 | 28.6 | 0.32 | 28.4 |
| R9* | 18.7 | 18.7 | 18.7 | 1.02 | 19.7 |
| R10* | 20.3 | 20.3 | 20.3 | 0.68 | 21.0 |
| R11 | 19.4 | 20.1 | 20.2 | 1.06 | 21.2 |
| R12 | 27.8 | 28.2 | 28.2 | 0.15 | 28.3 |
| R13 | 27.9 | 28.9 | 29.5 | 0.17 | 29.1 |
| R14 | 31.3 | 32.8 | 33.5 | 0.15 | 33.0 |
| R15 | 24.9 | 25.7 | 26.1 | 0.18 | 25.9 |
| R16 | 31.0 | 32.0 | 32.3 | 0.32 | 32.3 |
| R17 | 26.3 | 27.3 | 28.2 | 0.75 | 28.1 |
| R18* | 18.7 | 18.7 | 18.7 | 0.69 | 19.4 |

Table Notes:
*Denotes location not within 200m of road traffic study area.

11A.8.4. Similarly, the FM1 annual process contributions of PM10 have been added to the modelled $PM_{10}$ traffic baseline with Fm1 traffic contribution to give the modified baseline at each sensitive receptor. These values are presented in Table 11A.15 below.

**Table 11.A.15 Modified $PM_{10}$ Baseline Calculations**

| Sensitive Receptor | 2011 Annual $PM_{10}$ Baseline (µg/m$^3$) | 2018 Annual $PM_{10}$ Baseline (µg/m$^3$) | 2018 Annual $PM_{10}$ Baseline with FM1 traffic (µg/m$^3$) | FM1 $PM_{10}$ Process Contribution (µg/m$^3$) | Modified 2018 $PM_{10}$ Baseline (µg/m$^3$) |
|---|---|---|---|---|---|
| R1 | 20.6 | 20.6 | 20.7 | 0.015 | 20.7 |
| R2 | 20.6 | 20.6 | 20.6 | 0.024 | 20.6 |
| R3 | 20.9 | 20.9 | 20.9 | 0.017 | 20.9 |
| R4 | 20.9 | 20.9 | 20.9 | 0.028 | 21.0 |

| Sensitive Receptor | 2011 Annual $PM_{10}$ Baseline ($\mu g/m^3$) | 2018 Annual $PM_{10}$ Baseline ($\mu g/m^3$) | 2018 Annual $PM_{10}$ Baseline with FM1 traffic ($\mu g/m^3$) | FM1 $PM_{10}$ Process Contribution ($\mu g/m^3$) | Modified 2018 $PM_{10}$ Baseline ($\mu g/m^3$) |
|---|---|---|---|---|---|
| R5 | 20.3 | 20.6 | 20.8 | 0.027 | 20.6 |
| R6 | 20.1 | 20.3 | 20.4 | 0.023 | 20.3 |
| R7* | 19.1 | 19.1 | 19.1 | 0.027 | 19.1 |
| R8 | 20.4 | 20.5 | 20.5 | 0.019 | 20.5 |
| R9* | 17.2 | 17.2 | 17.2 | 0.063 | 17.2 |
| R10* | 18.6 | 18.6 | 18.6 | 0.045 | 18.7 |
| R11 | 17.4 | 17.5 | 17.5 | 0.065 | 17.6 |
| R12 | 20.5 | 20.6 | 20.6 | 0.009 | 20.6 |
| R13 | 19.9 | 20.0 | 20.1 | 0.010 | 20.1 |
| R14 | 20.5 | 20.7 | 20.8 | 0.009 | 20.7 |
| R15 | 21.2 | 21.3 | 21.4 | 0.011 | 21.4 |
| R16 | 20.5 | 20.7 | 20.7 | 0.020 | 20.7 |
| R17 | 20.2 | 20.3 | 20.4 | 0.051 | 20.4 |
| R18* | 17.2 | 17.2 | 17.2 | 0.048 | 17.2 |

11A.8.5. The FM1 annual process contributions of other WID species have been added to the existing baseline concentration, where available, to give the modified baseline at the location of maximum predicted concentration (on- or off-site). These values are presented in Table 11A.16 below. Existing baseline concentrations have been obtained for the nearest representative Defra or CEH monitoring stations.

**Table 11A.16 Modified Baseline Calculations – Other WID species, maximum PC**

| WID Species | Existing Annual Baseline ($\mu g/m^3$) | Maximum FM1 Process Contribution ($\mu g/m^3$) | Modified 2018 Baseline ($\mu g/m^3$) |
|---|---|---|---|
| $NO_2$ | 20.5[1] | 2.5 | 23.0 |
| $SO_2$ | 7.2[1] | 0.6 | 7.8 |
| $PM_{10}$ | 19.6[1] | 0.13 | 19.7 |
| $PM_{2.5}$ | 12.4[1] | 0.13 | 12.5 |
| CO | 355[1] | 0.61 | 356 |
| $NH_3$ | 2.0[4] | 0.13 | 2.1 |
| VOC (as benzene) | 0.4[1] | 0.13 | 0.5 |
| HCl | 0.3[3] | 0.13 | 0.4 |
| HF(as HCl) | 0.3[3] | 0.013 | 0.3 |
| Hg | 1.8e-5[2] | 6.4e-4 | 6.6e-4 |
| Cd and Tl (as Cd) | 2.2e-4[2] | 6.4e-4 | 8.6e-4 |
| Other Metals (as Pb) | 1.3e-2[2] | 6.4e-4 | 1.9e-2 |
| Other Metals (as Cr) | 7.7e-3[2] | 6.4e-4 | 1.4e-2 |

Table Notes:
1. Defra Background Mapping, most recent available year, grid ref [447500, 424500]
2. CEH, Sheffield Centre, Urban Heavy Metals
3. Defra, Caenby, AGANET
4. CEH, Tadcaster, NAMN

## FM2 Road and Process Contributions

### $NO_x$ (as $NO_2$) Process Contribution Impacts

11A.8.6. The long term process contribution is conservatively based on continuous operation at the WID limit for $NO_x$ and assuming 70% conversion of emitted $NO_x$ to $NO_2$ in accordance with EA guidance. In practice the conversion rate of $NO_x$ to $NO_2$ may be less than 70% as it requires ozone to be present in the ambient air; a 70% conversion is therefore conservative. Furthermore the use of the ELV for continuous long-term emissions is also considered a conservative assumption.

11A.8.7. The proposed development is located within the AQMA declared by WMDC for $NO_2$. The receptor R12 (Castleford Lane) is within the AQMA and is predicted to experience an increase in process contribution of 1% of the long term EAL, with the above conservative assumptions, and is therefore at the threshold for insignificance.

11A.8.8. The highest impacts from the process emissions are predicted in Brotherton. Residences on Church Street (R18) are predicted to experience the worst-case long term PC of 0.8$\mu g/m^3$ (2% of EAL) whilst Brotherton School (R9) is predicted to be at the threshold for insignificance. However these receptors are not located within the AQMA and are not affected by increased road traffic emissions from the Proposed Development.

11A.8.9. The short term process contribution assumes a 50% conversion of $NO_x$ to $NO_2$, as per EA H1 screening guidance. The maximum PEC of NO2 is 33% of the hourly NAQS objective, and therefore can be considered to be well below the objective. It is therefore considered very unlikely that the Proposed Development would result in a breach of the hourly average NAQS at off-site locations, and consequently is unlikely to cause significant impacts on sensitive human health receptors.

### Particulates (expressed as $PM_{10}$) Process Contribution Impacts

11A.8.10. The maximum annual average $PM_{10}$ PC is 0.1$\mu g/m^3$, representing less than 1% of the annual average NAQS objective.

11A.8.11. The PM10 maximum process contribution (as the 90.4th percentile of 24-hourly averages) is predicted to be 0.2 µg/m$^3$, representing <1% of the NAQS objective. Due to the relatively high baseline concentration (taken to be 39µg/m³, twice the annual average concentration) the predicted environmental concentration of PM10 is 79%, however it is considered very unlikely that the contribution from the Proposed Development would lead to an exceedance of the NAQS objective.

### Particulates (expressed as $PM_{2.5}$) Process Contribution Impacts

11A.8.12. The $PM_{10}$ assessment above includes the proportion of released particulates that is of $PM_{2.5}$ or less, and therefore in order to carry out a conservative assessment, it has been assumed here that the whole PM10 release occurs as $PM_{2.5}$.

11A.8.13. The maximum predicted annual concentration, of 0.1 µg/m³, represents <1% of the $PM_{2.5}$ limit value. The estimated baseline concentration is 12.5µg/m$^3$, representing 63% of the target value; it is therefore considered very unlikely that the process contribution would result in failure to achieve the limit value or national exposure reduction target.

### Sulphur Dioxide Process Contribution Impacts

11A.8.14. Short-term process contributions of $SO_2$ are screened as insignificant according to the H1 criteria since the PCs for the different averaging periods are less than 10% of the respective NAQS objectives. The PECs for $SO_2$ are 10% for the 15-minute mean, 7% for the hourly mean and 14% for the 24-hour mean, and therefore can be considered to be well below the relevant NAQS objectives.

### Carbon Monoxide Process Contribution Impacts

11A.8.15. The predicted process contribution of CO from the Proposed Development represents <1% of the NAQS 8-hour running mean objective at the location of the maximum predicted concentration.

### Ammonia Process Contribution Impacts

11A.8.16. The maximum annual average process contribution of ammonia is predicted to be 0.1 µg/m3, representing <1% of the EAL.

11A.8.17. The maximum hourly average process contribution is <1% of the short term EAL for ammonia.

### Volatile Organic Compounds Process Contribution Impacts

11A.8.18. The maximum predicted environmental concentration resulting from the Proposed Development represents 12% of the NAQS for benzene (used as a conservative surrogate assessment species) and is therefore is well below the objective. Given the conservative assumptions made in the assessment, it is considered unlikely that process contributions would result in risk to the attainment of the NAQS objective for benzene.

### Acid Gases (Hydrogen Chloride and Hydrogen Fluoride) Process Contribution Impacts

11A.8.19. The maximum hourly average process contribution of hydrogen chloride is predicted to be less than 1% of the EAL.

11A.8.20. The maximum annual average process contribution of hydrogen fluoride is predicted to be less than 1% of the EAL.

11A.8.21. The maximum hourly average process contribution of hydrogen fluoride is less than 1% of the short term EAL.

### Mercury Process Contribution Impacts

11A.8.22. The maximum annual average process contribution of mercury is predicted to be less than 1% of the EAL.

11A.8.23. The maximum hourly average process contribution is less than 1% of the short term EAL.

### Cadmium and Thallium Process Contribution Impacts

11A.8.24. The maximum annual average process contribution of the Proposed Development is predicted to be 6% of the EAL for cadmium (Cd), as a result of emissions conservatively assumed to be at WID limits continuously. An estimate of the background concentration for Cd has been obtained for this assessment from Defra's Urban Heavy Metals Monitoring Network, operated by the National Physical Laboratory. The background concentrations are measured as the particulate fraction and are taken from the nearest background site, in Sheffield Centre. The estimate for background Cd is 0.2ng/m³. The PEC, including the modified baseline with FM1 contributions, is therefore predicted to be 22% of the EAL and the process contribution is considered unlikely to present a risk of exceedance of the EAL.

### Other Metals (incl. Sb, As, Pb, Cr, Co, Cu, Mn, Ni, V) Process Contribution Impacts

11A.8.25. The maximum annual average process contribution of metals, assuming emissions at the WID limit for total heavy metals are wholly comprised of lead, is 0.003µg/m³, representing 1% of the long term NAQS objective, which means this species is screened as having an insignificant impact; given this worst case assumption it is considered that process contributions are therefore unlikely to result in risk of exceedance of the objective.

11A.8.26. The hourly average process contribution of metals resulting from the Proposed Development is <1% of the most stringent short term (hourly mean) EAL (antimony, Sb) for the above species.

11A.8.27. Further analysis of the potential impacts from arsenic, nickel and chromium (VI) has not been conducted at this design stage. In particular the proportion of total chromium in a heavy metals release, and the proportion of chromium(VI) within that, are both unknowns at this stage as they are for any plant prior to construction and commissioning. Until actual emissions monitoring can be undertaken, the situation is further complicated by the unknown split between particulate and vapour phase releases. Therefore no assessment against specific individual metals guideline values can reliably be made at this stage.

11A.8.28. More detailed assessment will be conducted in line with the revised guidance issued by the Environment Agency in June 2011, "Impact Assessment for Group 3 Metals Stack Releases," and the predicted impacts will be included in the DCO application, at a later stage of process design.

11A.8.29. The emissions of heavy metals have been assessed above based on emissions at the WID Emission Limit Value of 0.5mg/m$^3$. It should be noted that this limit is set for gaseous and the vapour forms of the relevant heavy metal emissions as well as their compounds and not the $PM_{10}$ particulate phase of heavy metals, which is likely to be lower than the WID ELV, and therefore it is considered that assessing emissions at the WID limit against particulate phase standards represents a very conservative assessment.

11A.8.30. The Proposed Development process contributions (PCs) and traffic contributions (TCs) of $NO_2$, $PM_{10}$ and $PM_{2.5}$ have been added to the modified baseline at each sensitive receptor to give the Predicted Environmental Concentration (PEC). These values are presented in Tables 11A.17, 11A.18 and 11A.19 below. The number of days that may exceed the 50 µg/m³ air quality objective with the Proposed Development against the modified baseline has also been considered.

11A.8.31. All receptor locations are predicted to comply with the $NO_2$ annual average NAQS objective. Annual average increases in concentration of $NO_2$ with the Proposed Development are predicted to range between 0.2 and 1.9 µg/m³. These changes equate to imperceptible and small magnitude changes in concentration. The biggest changes in $NO_2$ annual average concentration are predicted at Receptor R5 on Stranglands Lane close to the site.

11A.8.32. All receptor locations are predicted to comply with the $PM_{10}$ annual average NAQS objective and no locations are anticipated to exceed the 24-hour PM10 NAQS objective. Annual average increases in concentration of PM10 with the Proposed Development are predicted to range between less than 0.1 and 0.2 µg/m³. These changes in annual average and 24-hour $PM_{10}$ concentration are considered to be of an imperceptible magnitude.

11A.8.33. All receptor locations are predicted to comply with the $PM_{2.5}$ annual average NAQS objective. Annual average increases in concentration of $PM_{2.5}$ with the Proposed Development are predicted to range between less than 0.1 and 0.1 µg/m³. These changes are considered to be of an imperceptible magnitude.

**Table 11A.17: Proposed Development $NO_2$ Operational Contributions**

| Sensitive Receptor | Modified 2018 $NO_2$ Baseline (µg/m³) | 2018 $NO_2$ FM2 TC (µg/m³) | $NO_2$ FM2 PC (µg/m³) | PEC (µg/m³) | cumulative change (µg/m³) |
|---|---|---|---|---|---|
| R1 | 28.9 | 0.3 | 0.3 | 29.5 | 0.6 |
| R2 | 28.2 | 0.1 | 0.3 | 28.5 | 0.3 |
| R3 | 30.5 | <0.1 | 0.1 | 30.6 | 0.1 |
| R4 | 30.6 | <0.1 | 0.1 | 30.8 | 0.1 |
| R5 | 33.7 | 1.5 | 0.3 | 35.4 | 1.8 |
| R6 | 30.7 | 0.6 | 0.2 | 31.5 | 0.8 |
| R7* | 25.3 | <0.1 | 0.1 | 25.3 | 0.1 |
| R8 | 28.4 | 0.6 | 0.3 | 29.3 | 0.9 |
| R9* | 19.7 | <0.1 | 0.4 | 20.1 | 0.4 |
| R10* | 21.0 | <0.1 | 0.0 | 21.1 | <0.1 |
| R11 | 21.2 | 0.1 | 0.4 | 21.6 | 0.4 |
| R12 | 28.3 | 0.1 | 0.4 | 28.8 | 0.5 |
| R13 | 29.1 | 0.6 | 0.2 | 29.9 | 0.8 |
| R14 | 33.0 | 0.7 | 0.3 | 33.9 | 0.9 |
| R15 | 25.9 | 0.4 | 0.3 | 26.6 | 0.7 |
| R16 | 32.3 | 0.3 | 0.2 | 32.8 | 0.5 |
| R17 | 28.1 | 0.9 | 0.3 | 29.2 | 1.2 |
| R18* | 19.4 | <0.1 | 0.8 | 20.1 | 0.8 |

Table Notes:
*Denotes location not within 200 metres of road traffic study area

**Table 11A.18: Proposed Development $PM_{10}$ Operational Contributions**

| Sensitive Receptor | Modified 2018 $PM_{10}$ Baseline (µg/m³) | 2018 $PM_{10}$ FM2 TC (µg/m³) | $PM_{10}$ FM2 PC (µg/m³) | PEC (µg/m³) | cumulative change (µg/m³) |
|---|---|---|---|---|---|
| R1 | 20.7 | <0.1 | <0.1 | 20.7 | <0.1 |
| R2 | 20.6 | <0.1 | <0.1 | 20.7 | <0.1 |
| R3 | 20.9 | <0.1 | <0.1 | 21.0 | <0.1 |
| R4 | 21.0 | <0.1 | <0.1 | 21.0 | <0.1 |
| R5 | 20.6 | 0.1 | <0.1 | 20.8 | 0.26 |
| R6 | 20.3 | 0.1 | <0.1 | 20.4 | 0.1 |
| R7* | 19.1 | <0.1 | <0.1 | 19.2 | <0.1 |
| R8 | 20.5 | <0.1 | <0.1 | 20.6 | 0.1 |
| R9* | 17.2 | <0.1 | <0.1 | 17.3 | <0.1 |
| R10* | 18.7 | <0.1 | <0.1 | 18.7 | <0.1 |
| R11 | 17.6 | <0.1 | <0.1 | 17.6 | <0.1 |
| R12 | 20.6 | <0.1 | <0.1 | 20.6 | <0.1 |
| R13 | 20.1 | 0.1 | <0.1 | 20.1 | 0.1 |
| R14 | 20.7 | 0.1 | <0.1 | 20.8 | 0.1 |
| R15 | 21.4 | <0.1 | <0.1 | 21.4 | 0.1 |
| R16 | 20.7 | <0.1 | <0.1 | 20.8 | <0.1 |
| R17 | 20.4 | 0.1 | <0.1 | 20.4 | 0.1 |
| R18* | 17.2 | <0.1 | <0.1 | 17.2 | <0.1 |

**Table 11A.19: Exceedances of the 24-hr mean objective for $PM_{10}$ for the Modified Baseline and the With Development Scenario**

| Sensitive Receptor | Modified Baseline Exceedances of the 24-hr mean objective for $PM_{10}$ (days) | With Development Exceedances of the 24-hr mean objective for $PM_{10}$ (days) | Change in the Number of Exceedances of the 24-hr mean objective for $PM_{10}$ (days) |
|---|---|---|---|
| R1 | 4 | 4 | <1 |
| R2 | 4 | 4 | <1 |
| R3 | 5 | 5 | <1 |
| R4 | 5 | 5 | <1 |
| R5 | 4 | 4 | <1 |
| R6 | 4 | 4 | <1 |
| R7 | 2 | 2 | <1 |
| R8 | 4 | 4 | <1 |
| R9 | 1 | 1 | <1 |
| R10 | 2 | 2 | <1 |
| R11 | 1 | 1 | <1 |
| R12 | 4 | 4 | <1 |
| R13 | 3 | 4 | <1 |
| R14 | 4 | 4 | <1 |
| R15 | 5 | 5 | <1 |
| R16 | 4 | 4 | <1 |
| R17 | 4 | 4 | <1 |
| R18 | 1 | 1 | <1 |

**Table 11A.20: Proposed Development $PM_{2.5}$ Operational Contributions**

| Sensitive Receptor | Modified 2018 $PM_{2.5}$ Baseline ($\mu g/m^3$) | 2018 $PM_{2.5}$ FM2 TC ($\mu g/m^3$) | $PM_{10}$ FM2 PC ($\mu g/m^3$) | PEC ($\mu g/m^3$) | cumulative change ($\mu g/m^3$) |
|---|---|---|---|---|---|
| R1 | 13.3 | <0.1 | <0.1 | 13.3 | <0.1 |
| R2 | 13.3 | <0.1 | <0.1 | 13.3 | <0.1 |
| R3 | 13.5 | <0.1 | <0.1 | 13.5 | <0.1 |
| R4 | 13.5 | <0.1 | <0.1 | 13.5 | <0.1 |
| R5 | 13.5 | 0.1 | <0.1 | 13.6 | 0.1 |
| R6 | 13.3 | <0.1 | <0.1 | 13.3 | 0.1 |
| R7 | 12.5 | <0.1 | <0.1 | 12.5 | <0.1 |
| R8 | 13.2 | <0.1 | <0.1 | 13.2 | <0.1 |
| R9 | 11.5 | <0.1 | <0.1 | 11.6 | <0.1 |
| R10 | 12.1 | <0.1 | <0.1 | 12.1 | <0.1 |
| R11 | 11.7 | <0.1 | <0.1 | 11.8 | <0.1 |
| R12 | 13.2 | <0.1 | <0.1 | 13.3 | <0.1 |
| R13 | 13.1 | <0.1 | <0.1 | 13.2 | 0.1 |
| R14 | 13.5 | 0.1 | <0.1 | 13.6 | 0.1 |
| R15 | 14.8 | <0.1 | <0.1 | 14.8 | <0.1 |
| R16 | 13.5 | <0.1 | <0.1 | 13.6 | <0.1 |
| R17 | 13.1 | <0.1 | <0.1 | 13.2 | 0.1 |
| R18 | 11.5 | <0.1 | <0.1 | 11.5 | <0.1 |

Table Note:
1. Process Contribution worst case assumption that all $PM_{10}$ is in the $PM_{2.5}$ size fraction.

## 11A.9. Habitats Assessment

### Sensitive Habitat Receptors

11A.9.1. The impact of emissions of nitrogen oxides (as $NO_2$), sulphur dioxide, ammonia and hydrogen fluoride have been assessed through comparison of the maximum predicted process contributions, at any of the identified sensitive Habitat receptors, with the Critical Levels for Protection of Vegetation and Ecosystems (CLPVEs) as defined in Tables 11A.1 and 11A.2. The results of the dispersion modelling and impact assessment are provided in Table 11A.21 below for the worst case Habitats receptors (E15 –Byram Park).

**Table 11A.21 Maximum Predicted Concentrations at any Habitat Receptor**

| Pollutant | Measured as | CLPVE[1] ($\mu g/m^3$) | PC[1] ($\mu g/m^3$) | PC / CLPVE | BC[2] ($\mu g/m^3$) | PEC / CLPVE |
|---|---|---|---|---|---|---|
| $NO_x$ (as $NO_2$) | Annual mean | 30 | 0.6 | 2.0% | 21 | 72% |
| | Daily mean[4] | 75 | 4.2 | 5.6% | 44 | 65% |
| $SO_2$ | Annual mean | 10[6] | 0.2 | 1.5% | 7 | 75% |
| $NH_3$ | Annual mean | 1[6] | 0.03 | 2.9% | 2 | 204% |
| HF | Weekly mean[5] | 0.5 | 0.04 | 8.4% | 0.3 | 75% |
| | Daily mean | 5 | 0.04 | 0.8% | 0.6 | 14% |

Table Notes:
1. CLPVE=Critical Level for the Protection of Vegetation and Ecosystems, PC = Process Contribution
2. BC = Baseline Concentration (Modified with FM1 data as appropriate), annual mean concentration doubled for short term estimation
3. PEC = Predicted Environmental Concentration
4. 50% conversion of $NO_x$ to $NO_2$ assumed in short term, 100% in the long term in accordance with EA guidance in H1
5. Assessed 24-hour mean PC against weekly EAL as worst-case

6. CLPVE for Lichens and Bryophytes assumed as worst-case

11A.9.2. For other species potentially emitted from the proposed development, including those species defined in the WID, there are no defined ecological air quality environmental assessment levels and therefore no assessment has been made of these species.

11A.9.3. Deposition impacts are discussed in further below.

### $NO_x$ (as $NO_2$)

11A.9.4. The maximum annual average process contribution at the worst-case receptor (Byram Park) is predicted to be 2% of the CLPVE. Combined with the relatively high baseline concentration, this results in a PEC representing 72% of the CLPVE for $NO_2$. It is considered that, based on the conservative assumptions made in the assessment, the process contribution is unlikely to result in exceedance of the CLPVE objective.

### Sulphur Dioxide

11A.9.5. Even with worst case assumption of emissions continuously at the WID limit values, the annual average $SO_2$ process contribution at the worst-case habitat receptor is only predicted to be 1.5% of the annual average CLPVE defined for the most sensitive plants (lichens and bryophytes). Combined with the relatively high estimation of baseline concentration, this results in a PEC representing 75% of CLPVE for $SO_2$. It is considered that, based on the conservative assumptions made in the assessment, the process contribution is unlikely to result in exceedance of the CLPVE objective.

### Ammonia

11A.9.6. The worst-case annual average process contribution of ammonia at any habitat site occurs is predicted to be 1% of the CLPVE defined for higher plants or 3% of the CLPVE for sensitive species.

11A.9.7. Whilst it is recognised that the predicted environmental concentrations at the Habitat Receptors represent up to 200% of the CLPVE for more sensitive lichen communities and bryophytes, this is composed almost wholly of the background concentration that was used in the assessment. As detailed in the assessment, the background ammonia concentration of 2.3 µg/m3 was obtained from passive sampling undertaken at Tadcaster, 20km north of the site, by CEH. This site is located in a largely rural area, where levels of ammonia are likely to be higher than in urban areas, due to its use in farming practices. It is therefore believed that the use of the background concentration from Tadcaster will lead to a conservative assessment of ammonia impacts for the Proposed Development.

11A.9.8. Given the conservative nature of the assessment, it is considered that the actual increase in ammonia concentration at the identified sensitive receptors as a result of the process contributions will be less than those indicated above. In addition, given the large reduction in the emissions of nitrogen oxides, which will be achieved by the use of SNCR abatement, and the resulting reduction in environmental impacts from nitrogen deposition, it is considered that the use of SNCR at the Proposed Development represents the use of Best Available Techniques, and will ensure the environmental impacts of the Proposed Development will be controlled and minimised as far as practicable.

### Hydrogen Fluoride

11A.9.9. The daily mean PEC of hydrogen fluoride at the worst-case ecological receptor is 0.04 µg/m3 representing less than 1% of the CLPVE. The daily mean PEC has also been compared with the weekly mean CLPVE for HF, and whilst this represents an overestimation of the potential impact, the PEC is only 8% of the weekly objective. Given the worst-case assumptions made in the report, it is therefore considered that emissions of HF are unlikely to result in risk to the CLPVE objectives.

## Deposition Impacts

### Nutrient Nitrogen

11A.9.10. An assessment of nutrient enrichment has been undertaken by applying deposition velocities to the predicted annual average $NO_2$ and $NH_3$ concentrations at the worst affected Statutory Habitat site, determined through dispersion modelling, to calculate nitrogen deposition rates. These deposition rates have then been compared to the critical loads for nitrogen available for the site. The deposition rates have been taken from EA guidance AQTAG06 and have been selected for the most sensitive species at the habitat receptor (grassland/woodland).

11A.9.11. Non-statutory habitat sites have not been assessed as the sensitive species present at these receptors and their associated critical loads for nutrient and acid deposition are not on public records and no critical levels are available.

11A.9.12. A review of the habitats closest to the Proposed Development has identified that the most sensitive habitat type to nitrogen deposition is ‘Fens and Marshes –Lowland Valley Mires’ present at Fairburn and Newton Ings SSSI. This habitat has a critical load range of 5-10 kg nitrogen per hectare per year (N/ha/yr).

11A.9.13. Wet deposition of nitrogen within the locality (10 km) of combustion emissions is considered to be insignificant, particularly as the $NO_x$ emissions are dominated by emissions of NO, which is relatively insoluble in water; wet deposition typically occurs over longer distances and in particular at upland locations (Ref 1). It has therefore been screened out of this impact assessment.

11A.9.14. The APIS site indicates that the Fairburn and Newton Ings site is already subject to a nitrogen deposition rate of 21.5 kg N/ha/yr, which is 6.5 kg N/yr higher than the highest critical load.

11A.9.15. Relative to the current rate of deposition, plus potential worst-case contribution from FM1, the maximum increase in nitrogen deposition predicted with the Proposed Development represents an increase of <1%.

11A.9.16. Comparing the increase in nitrogen deposition from the Proposed Development with the critical load range shows an increase of <1%. Given the worst-case assumptions made in this assessment, the process contributions are considered unlikely to result in significant impacts at this receptor.

**Table 11A.22 Nitrogen Deposition at Identified Habitat Receptors**

| Receptors | Critical Load[1] (kg N/ha/y) | Background N-Deposition, including FM1 contribution (kg N/ha/yr) | Dry Deposition | |
|---|---|---|---|---|
| | | | Predicted N-Deposition (kg N/ha/yr)[2] | Predicted N-deposition/ Critical Load |
| E1 | 10-15 | 21.5 | 0.1 | <1% |

Table Notes
1 The most stringent Critical Load has been used
2 Assumes deposition velocities of 0.0015m/s for $NO_2$ and 0.02m/s for $NH_3$ for grassland

### Acid Deposition

11A.9.17. Increases in acidity from deposition contributions of $SO_2$ and $NO_2$ from the process contribution have been considered. In this assessment, the values of nitrogen deposition (kg/N/ha/yr) and sulphur deposition (kg/S/ha/yr) have been determined from long term deposition concentrations (µg/m$^2$/s) using standard conversion factors (molar equivalents). These deposition rates have been used to derive kiloequivalents/ha/yr (keq/ha/yr), which are the units in which acidity critical loads are described. The conversion has been undertaken using standard conversion units of 1/14 for nitrogen and 1/16 for sulphur. The acidity deposition rates and background deposition rates have been used within the Critical Load Function Tool (APIS) to determine whether the contribution will result in exceedance of the defined critical levels for the most sensitive feature.

11A.9.18. The highest predicted process contribution to acid deposition is at E1 – Fairburn and Newton Ings. The most sensitive feature present at this site is 'Fens and Marshes –Lowland Valley Mires'. The background deposition at this location is currently below the critical levels for sulphur and below the upper critical level defined for nitrogen; the total acid deposition is below the critical level.

11A.9.19. The total process contribution to acid deposition is <1% of the upper critical load and the total PEC, including baseline contribution, is 39% of the upper critical load.

**Table 11A.23 Acid Deposition at Identified Habitat Receptors**

| Receptor | Acidity Critical Loads | | Total Background Deposition, incl FM1 contribution (N: S: ) (keq /ha/yr) | Process contribution to Acid Deposition | |
|---|---|---|---|---|---|
| | (keq N/ha/yr) | (keq S/Ha/yr) | | Predicted N-Deposition (keq N/ha/yr) [% of CL] | Predicted S-Deposition (keq S/ha/yr) [% of CL] |
| E1 | 0.44-4.29 | 4.07 | 1.68(N: 1.40; S: 0.28) | 0.007 [<1%] | 0.008 [<1%] |

Table Notes:
1. Deposition velocities, for $NO_2$ and $NH_3$ as before, for $SO_2$ = 0.012m/s (grassland)
2. Conversion factors for ug/m$^2$/s to kg S or N /Ha/yr = $NO_2$ (96.0), $SO_2$, (157.7), $NH_3$ (259.7); conversion factors for kg/Ha/yr to keq/Ha/yr = N (14), S(16)

### Heavy Metals

11A.9.20. The impacts resulting from deposition of emitted heavy metal species are not anticipated to result in exceedance of the Maximum Deposition Rates, defined in H1. A full assessment of heavy metal deposition impacts will be included in the DCO application, at a later stage of process design.

## 11A.10. Other Impacts

### Dioxins Statement

11A.10.1. Emissions of dioxins from the Proposed Development will be controlled to within the ELVs set out in the WID. At this design stage of the development, it is not possible to fully characterize the process emission parameters and therefore no formal assessment of dioxins impacts has yet been undertaken. However the assessment of dioxins impacts on human health through inhalation exposure and ingestion exposure for releases from the FM1 plant were determined to be insignificant. The Proposed Development is anticipated to be comparable to the FM1 plant in terms of emissions and therefore the impacts from dioxin releases also comparable. In combination, the impacts from both plants are anticipated to be insignificant. Further assessment of the potential impacts from the Proposed Development and cumulative process contributions will be made and presented for the DCO application, at a later stage of process design.

### Odour Statement

11A.10.2. Odour generation will be minimised by ensuring that the flow of fuel through the site from receipt to combustion is continuous and by managing fuel stocks so that older fuel is combusted first. Buildings will be kept at a slight negative pressure to stop odour release into the environment, with the air drawn into the plant for use as primary combustion air. The remainder of the process buildings will have suitable air extraction to air treatment equipment. Odour levels around the plant will be monitored to assess the effectiveness of the installed odour control measures. At this design stage there are not anticipated to be any odour releases that are likely to result in significant impacts. A full odour assessment will be prepared for the DCO application at a later stage of process design.

### Visible Plumes Statement

11A.10.3. There is the potential for visible plumes to occur from the multi fuel power station main stack as a result of the water content and temperature of the flue gas. The European Waste Incineration Best Available Techniques Reference Document (BREF Note) (Ref. 12), states that plume visibility can be greatly reduced by maintaining stack release temperatures above 140°C.

11A.10.4. Recovery of waste heat from the flue gas, which increases the thermal efficiency of the process, means the flue gas may be emitted below this temperature and therefore there may be potential for visible plume impacts. However at this design stage the heat balance has not been finalised and therefore this potential has not been assessed. The on-going design process will consider the potential for visible plume impacts, and in particular the potential for plume grounding, and the final process design will ensure that visible plume impacts will be minimised.

## 11A.11. References

Ref 11A-1 The Air Quality Standards Regulations 2010, *No. 1001*, The National Archives

Ref 11A-2 Council of European Communities (2008), *Directive 2008/50/EC on Ambient Air Quality and Cleaner Air for Europe*

Ref 11A-3 Council of European Communities (2004), *Directive 2004/107/EC of the European Parliament and of the Council of 15 December 2004 relating to arsenic, cadmium, mercury, nickel and polycyclic hydrocarbons in ambient air*

Ref 11A-4 Environmental Permitting Regulations Horizontal Guidance, 2011, *Environmental Risk Assessment, Annex F – Air Quality*, Environment Agency

Ref 11A-5 Air Quality Management Technical Guidance 2009, *LAQM*, Defra