

AQMAU reference: AQMAU-C2117-RP01

Permit reference: EPR/SP3904SR/A001

Project title: Doncaster Energy Recovery Facility (ERF)

Work title: Audit of air quality impact assessment and Human Health Risk Assessment

Date requested: 06th October 2020

AQMAU response date: 1st April 2021

AQMAU recommendation	Conditions / noted
<ul style="list-style-type: none"> • The consultant's conclusions regarding human health can be used for permit determination 	<ul style="list-style-type: none"> • Contributions from the proposed facility are unlikely to exceed any Environmental Standard (ES) set for the protection of human health. • Predicted risks as a consequence of dioxins and furan emissions are well within the screening criteria for the protection of human health. • PCs at the AQMA are insignificant for all pollutants.
<ul style="list-style-type: none"> • We recommend the permitting officer consults with a habitats lead on: <ul style="list-style-type: none"> • Potential exceedance of the acid deposition critical loads at the Hatfield Moor SPA/SAC • Appropriateness of the ecological interpretation presented in the appendix E of the air quality assessment. 	<ul style="list-style-type: none"> • Acid deposition PCs are just above the insignificance threshold criteria (i.e. 1.5 % of a critical load of 0.487 keq/ha/y, indicatively) over an area of the Hatfield Moor SAC/SPA, where backgrounds already exceed critical levels and critical loads. • The consultant concludes that impact of process emissions from the facility can be screened out as 'not significant'.

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1. Summary of work request

- 1.1 The National Permitting Services (NPS) Installations Warrington Team asked the Air Quality Modelling and Assessment Unit (AQMAU) to audit an air quality assessment¹ and human health risk assessment². The assessments support an application from BH EnergyGap (Doncaster) Limited (the applicant) to operate their proposed energy recovery facility located at Sandall Stones Road in Doncaster. The emission data is based on the combustion of 37.6 tonnes per hour and a waste net calorific value of 11.5 MJ/kg.
- 1.2 Fichtner Consultant Engineers Limited (the consultant) conducted the air quality assessment (AQA) and the human health risk assessment on behalf of the applicant. Fichtner Consultant Engineers limited instructed Ecological Solutions to produce a technical note on the ecological interpretation of the Air Quality Assessment.

2. Conclusions that lead to AQMAU recommendations

- 2.1 The consultant's conclusions for human health receptors are that:
- "The assessment has shown that emissions from the Facility would not result in a breach of any Air Quality Assessment Levels (AQAL), and would not have a significant impact on local air quality, the general population or the local community, either alone or in-combination with other plans and projects".
- 2.2 The consultant's conclusions for ecological receptors are as follows:
- "The impact of process emissions from the Facility can be screened out as 'insignificant' in the year of meteorological data resulting in the highest process contribution, with the exception of acid deposition at the Hatfield Moor SAC/SPA.
 - The deposition analysis at ecological sites presented in the appendix D of the air quality assessment allows the consultant to conclude that there will be no adverse effect resulting from emissions from the Facility.
- 2.3 We have audited the consultant's assessments and conducted our own check modelling and sensitivity analysis to our observations. As a result of our checks, although we do not agree with the exact consultant's numerical predictions, we agree with their conclusions for all human health and ecological receptors, with the exception of Hatfield Moor SAC/SPA. Note that we cannot comment on the suitability of the ecological interpretation and we recommend consultation with the habitats lead on the significance of the predicted impacts on acid deposition at Hatfield Moor SAC/SPA, however, we agree that their numerical predictions can be used for consultation, indicatively.

3. Evidence for Conclusions

Air Quality Assessment

- 3.1 The consultant carried out the air quality assessment using air dispersion modelling software ADMS (Version 5.2). They used 5 years of meteorological data observed at Doncaster Sheffield between 2015 and 2019, approximately 10 km to the south east of the proposed facility. The selected meteorological data is likely to be representative of the region. We have conducted sensitivity analysis using our own meteorological data observed at Finningley RAF which is 10 km south east of the site, and Church Fenton which is 32 km North West of the site. We have tested sensitivity to various met stations to ensure potential worse case conditions are captured.

¹ Air Quality (BH EnergyGap (Doncaster) limited, ,August 2020, (Fichtner) Doncaster ERF,

² Human Health Risk Assessment, July 2020 (BH EnergyGap (Doncaster) Limited)

- 3.2 The consultant has used a surface roughness length for the dispersion site of 0.5 m, representative of parkland and open suburbia. The land use around the proposed facility is a mix between industrial and rural and therefore is likely to be a mix of surface roughness values. They consider a surface roughness for the meteorological site of 0.3 m. We have performed sensitivity to variable surface roughness at both the dispersion and the meteorological site. Our checks consider the dispersion site with a value of 0.3 m to represent the open grassland adjacent to the river located to the south west of the site, and the meteorological site with a value of 0.2 m.
- 3.3 The consultant's assessment is based on continuous emissions at the upper range Best Available Technique Associated Emission Limits (BAT-AELs) from the BAT conclusions for waste incineration document³, as presented in Table 1 of the air quality assessment. They have also conducted assessment at half-hourly Emission Limit Values (ELVs) as set out in Annex VI, Part 3 of the Industrial Emissions Directive⁴ (IED) for waste incineration plants in section 6.3 of the air quality assessment. We are able to replicate the consultant's emissions rates based on the stack emission parameters detailed in Table 18 of the air quality assessment.
- 3.4 The consultant has used background pollutant concentrations from a variety of data sources: local authority monitoring, Defra modelled background maps; rural heavy metals and polycyclic aromatics networks, acid gas and aerosol network and toxic organic micro pollutants network. The selected background data indicate that there is likely to be headroom for most pollutants. We have selected appropriate background concentrations for our check modelling and sensitivity analysis, based on the data available. There are two Air Quality Management Areas (AQMA) within 5 km of the site. These are 'Doncaster AQMA NO.1' which is 4.1 km to the south west and 'Doncaster No.3 AQMA' located 4.6 km to the south. Both AQMAs were designated in 2001 for exceeding the annual mean NO₂ environmental standard.
- 3.5 The consultant appropriately modelled the effect of buildings on the dispersion of stack emissions. The consultant has included 6 buildings within their modelling, four of these buildings can influence dispersion, however, there are no receptors located within the cavity. Sensitivity has been considered with and without buildings to evaluate the influence of downwash.
- 3.6 The consultant has not included terrain in their modelling. The site is located in an area that is relatively flat. We have conducted a review of the area and note that the terrain is relatively flat within the area of influence of the plume so deem the consultant's approach appropriate.
- 3.7 The consultant has modelled predictions across a 9 km by 9 km grid with a resolution of 90 m. We have performed sensitivity to more granulated grids with 50 m and 10 m resolution to ensure worst case predictions at the grid is captured.
- 3.8 The consultant has included 46 discrete receptors to represent human exposure. We have checked both the maximum in the grid and at relevant sensitive human receptors for all pollutants.
- 3.9 The consultant has selected 70% long-term and 35% short-term NO_x to NO₂ conversion. These are in line with our 'worst case' recommended conversion ratios for combustion sources.

³ COMMISSION IMPLEMENTING DECISION (EU) 2019/2010 of 12 November 2019 establishing the best available technique (BAT) conclusions, under Directive 2010/75/EU of the European Parliament and the Council, for waste incineration

⁴ DIRECTIVE 2010/77/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 24 November 2010 on industrial emissions (integrated pollution prevention and control) (Recast)

- 3.10 The consultant has reported maximum off-site and receptor predictions for the assessed pollutants in Table 23. When Process Contributions (PCs) exceed the relevant environmental standard further analysis has been conducted in Table 25 through to Table 28 to compare the Predicted Environmental Concentrations (PECs) against the Environmental Standards (ES). Maximum predicted short-term predictions at the half-hourly ELVs are reported in Table 24. We note:
- The consultant has assessed emissions of PM_{2.5} against an annual mean environmental standard of 25 µg/m³. However, the environmental standard changed to 20 µg/m³ in 2020⁵. We have conducted our checks against the lower environmental standards.
 - The consultant has modelled group 3 metal emissions following the latest version of our guidance⁶, presenting in Tables 30 and 31 the predicted metal concentrations. They conclude that metals have no risk of exceeding the long-term or short term ES as a result of emissions from the facility there is no potential for significant pollution. We have evaluated this.
 - The consultant predicted that for most pollutants the process contributions (PCs) are insignificant. For the pollutants where the PCs are not insignificant the predicted environmental concentrations (PECs) are below the relevant environmental standard.
- 3.11 The consultant has assessed abnormal emissions scenarios in relation to Article 46(6) of the Industrial Emissions Directive (IED) for waste incineration plant. Their anticipated abnormal emission concentrations during abatement failure are reported in Table 1 of the Abnormal Emissions Assessment⁷. We note that the consultant has not reported annual impacts of this scenario. However, short term impacts are the main concern from abnormal emissions because the scenario is limited to up to 60 hours per year (less than 0.7% of the year) and will only operate for a maximum of four hours uninterrupted, therefore, contributions to the annual PCs are likely to be significantly lower than the regular operation. We have performed an assessment of short term impacts using more conservative abnormal emission concentrations.
- 3.12 The consultant's predicted short term PCs are reported in Table 24 of their air quality assessment. With the exception of NO₂ hourly objective and SO₂ 15 minute and hourly objective, the PCs are insignificant. PECs are below 100% for both pollutants so the impacts will not be significant. Taking into account the worst case assumptions and low frequency of abnormal operations, they conclude that abnormal emissions would not have a significant impact on local air quality. We have conducted checks on abnormal emissions against all the relevant short-term environmental standards.

Ecological Assessment

- 3.13 The consultant has identified 24 ecological receptors consisting of special areas of conservation (SACs), special protection areas (SPAs), and local nature sites within relevant screening distances.
- 3.14 The consultant has assessed the NO_x, SO₂, NH₃ and HF impacts against their respective critical levels. We observe from the consultant's AQA that all PCs are insignificant. We have conducted our own ecological assessment using worst case backgrounds and PCs

⁵ Guidance Air emissions risk assessment for your environmental permit. Available at <https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit#environmental-standards-for-air-emissions> [Accessed on February 2021]

⁶ Releases from waste incinerators – Guidance on assessing group 3 metal stack emissions from incinerators, Version 4

⁷ Abnormal Emission Assessment, August 2020, Fichtner

3.15 The consultant's emission modelling identified two predicted exceedances at Hatfield Moor SAC/SPA, where background levels significantly exceed the acid critical loads. The consultant's PCs at Hatfield Moor SAC/SPA are as follows:

- Acid deposition (1.5% of the maximum critical load 0.487 keq/ha/y for bogs)

3.16 We have conducted detailed modelling to evaluate acid deposition across the ecological designation and have checked the critical levels and backgrounds presented at Air Pollution Information Service (APIS)⁸.

3.17 The consultant makes the following conclusions for ecological sites: "At all of the identified designated sites, the impact of process emissions from the facility can be screened out as 'insignificant' in the year of meteorological data resulting in the highest process contribution with the exception of acid deposition at the Hatfield moor SAC/ SPA. Further detail is provided in the ecological interpretation which concludes that there will be no adverse effect resulting from the Facility and therefore the effect is 'not significant'."

Human Health Risk Assessment

3.18 The consultant has used 'industrial risk assessment program Human Health' Software (IRAP-h View – Version 5.0, IRAP) to conduct their Human Health Risk Assessment (HHRA) to predict intake of dioxins and furans and dioxin-like PCBs. IRAP-h View implements the United States Environmental Protection Agency (US EPA) Human Health Risk Assessment Protocol⁹ (HHRAP). The consultant has assessed emissions of dioxins and furans and dioxin-like polychlorinated biphenyls (PCBs). Dioxin-like PCBs have been modelled in IRAP-h using Aroclor 1016 and Aroclor 1254.

3.19 The human health risk assessment (HHRA) investigates the potential for long term health effects of dioxins and furans and dioxin-like PCBs through routes of exposure other than direct inhalation. The consultant has considered direct inhalation, ingestion of soil, drinking water, home-grown produce (i.e. eggs, milk, poultry, chickens, beef, and pork) and ingestion of breast milk as the potential exposure pathways differentiating between residential, agricultural receptors and allotments. The pathways considered are presented in Table 2 whereas the receptors are presented in Table 3 of the report. The intake of dioxins via dermal adsorption, groundwater and surface water and fish consumption have been excluded from the assessment. Having consulted a number of sources to evaluate the potential exposure via fish intake, we consider this to be an unlikely pathway of exposure. We have evaluated the other potential pathways in our assessment.

3.20 The consultant's modelled emissions profile is shown in Table 6 of the HHRA report. These have been calculated on the basis of the Her Majesty's Inspectorate of Pollution (HMIP) 1996¹⁰ congener profile factored by International Toxic Equivalency Factors (TEF) at the IED emission concentration. We have evaluated emissions in our checks.

3.21 Table 7 of the HHRA shows the consultant's assessment at the point of maximum impact. These are based on deposition velocities and assumptions presented in Table 5 which are considered conservative. We have conducted our own HHRA screening using the US EPA HHRAP with more representative dry deposition velocities.

⁸ Air Pollution Information System (APIS) available at <http://www.apis.ac.uk/> [Accessed on March 2021]

⁹ United States Environmental Protection Agency – Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities. Sept 2005 www.epz.gov/osw

¹⁰ Risk Assessment of Dioxin releases from Municipal Waste Incinerators, Her Majesty's Inspectorate of Pollution, March 1996

- 3.22 The consultant has considered abnormal emissions in their Abnormal Emissions Assessment, the PEC is not predicted to exceed the AQAL at the point of maximum impact. We have conducted our checks assuming emissions are 100 times higher than the IED ELV for 60 abnormal hours per year as a worst case scenario.
- 3.23 The threshold level for toxicity is the Tolerable Daily Intake¹¹ value published by the UK Committee on Toxicity (COT). The consultant has assessed against a Tolerable Daily Intake¹³ (TDI) of 2 pg WHO-TEQ/kg(BW)/day. Their predicted maximum contribution is 2.6% of the Committee on Toxicity (COT) Tolerable Daily Intake (TDI) of the 2 pg WHO-TEQ/kg(BW)/day which is below 10% insignificance criterion suggested by Public Health England (PHE).
- 3.24 The consultant concludes: "The impact of emissions of dioxins and dioxin like PCBs from the facility on human health is not predicted to be significant."

AQMAU Checks

- 3.25 We carried out check modelling using ADMS (using Version 5.2). Our checks included sensitivity to model inputs and results to:
- Our own meteorological data observed at Finningley RAF between 1993 and 1994 and Church Fenton between 2001 and 2005 (refer to point 3.1).
 - Surface roughness length of 0.5 m and 0.3 m at the dispersion site and surface roughness of 0.3 m and 0.2 m at the meteorological site (refer to point 3.2).
 - Maximum prediction in the grid and at discrete receptors where there is likely relevant public exposure (refer to sections 3.10 to 3.12).
 - Metals emissions from waste incinerators.
 - Abnormal emissions due to abatement failure.
 - NO_x, SO₂, NH₃, and HF critical level assessment, conservative screening and detailed assessment of ammonia critical levels, nutrient nitrogen and acid critical loads at Hatfield Moor SAC/SPA ecological site.
 - HHRA screening based on worst-case congener profiles
- 3.26 Our checks indicate the PCs at sensitive human receptors for most pollutants are likely to be insignificant. Where PCs are not insignificant the PECs are unlikely to exceed the relevant environmental standards.
- 3.27 Our abnormal emissions assessment using plausible abnormal emissions concentrations indicate that the proposed facility is unlikely to lead to any short term breaches of the environmental standards.
- 3.28 Our HHRA screening check calculations of dioxins, furans and dioxin-like PCB intakes, indicate that the PC is likely to be less than 10% of the COT TDI of 2 pgWHO-TEQ/kg(BW)/day.
- 3.29 Our checks indicate that the annual mean NO_x PCs are insignificant at all ecological receptors.
- 3.30 Our checks indicate that daily NO_x PCs are below 10% at the Hatfield SAC/SPA so will be 'insignificant', Annual SO₂ PCs are below 1% so are 'insignificant' at all receptors and therefore unlikely to damage any of the ecological receptors.
- 3.31 Our checks indicate that annual ammonia PCs are below 1% of the critical level of 1 µg/m³ for all receptors and therefore are considered 'insignificant'.

¹¹ Committee on toxicity of Chemicals in Food, Consumer Products and the Environment. Tolerable Daily Intake (TDI) of 2 picogrammes toxic equivalent (TEQ) of dioxins and dioxin-like PCBs per kilogramme human body weight per year.

- 3.32 Nitrogen deposition PCs are below 1% of the critical level for the SAC/SPA hence 'insignificant'. For the local nature sites, PCs are below 100%.
- 3.33 Acid deposition PCs are above 1% as a function of the critical load for the Hatfield Moor SAC/SPA. We have conducted detailed modelling to assess the impact of acid deposition across the ecological site. This site has a number of ecological transects across the designation and we found that the PCs are above 1% for the whole designation. It is worth noting that the backgrounds already exceed the critical loads and therefore PEC exceed 100%. As a result of this, we cannot rule out adverse effects to the SAC/SPA. For the LWS's acid deposition is below 100% of the critical load and therefore unlikely to damage to the LWS.
- 3.34 Our checks indicate that HF daily and weekly concentration are insignificant at all receptors.
- 3.35 As a result, we agree with the consultant's conclusions in regards to ecological receptors, except for impacts at Hatfield Moor SAC/SPA for which we recommend consultation with the habitats lead on whether the predicted PCs for acid deposition can be significant. We consider that consultant's numerical predictions can be used in the consultation, indicatively.