

AQMAU reference: AQMAU-C2108-WP01

Permit reference: EPR/CP3803LV/A001

Project title: NorthAcre Facility

Work title: Audit of Air Quality and Human Health Risk Assessments

Date requested: 6th October 2020

AQMAU response date: 23rd March 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 set for the protection of human health from both regular and abnormal operations. Predicted risks as a consequence of dioxins and furans emissions are well within the screening criteria for the protection of human health. Contributions at the AQMA are insignificant for all pollutants. PM_{2.5} concentrations are insignificant at all receptors. PM_{0.1} has no environmental standard and considered within the PM_{2.5} size fraction.
<ul style="list-style-type: none"> We recommend the permitting officer consults with a habitats lead on the following: <ul style="list-style-type: none"> Potential exceedance of the ammonia critical level at both the Salisbury Plain SAC and the Picket and Clanger Wood SSSI. Potential exceedances of the nutrient nitrogen deposition critical load at the Picket and Clanger Wood SSSI. Appropriateness of the ecological interpretation of the impacts at the Picket and Clanger Wood SSSI. 	<ul style="list-style-type: none"> PCs of the annual ammonia critical level of 1µg/m³ at Salisbury Plain SAC and Picket and Clanger Wood SSSI are not insignificant at locations where backgrounds already exceed the critical level. Nitrogen deposition PCs are not insignificant at Picket and Clanger Wood SSSI (i.e. 1.9% of the critical load of 15 kgN/ha/y). Backgrounds already exceed the maximum critical load. The consultant presents an ecological interpretation of the impacts, concluding that the process will not cause significant harm to the SSSI or inhibit its recovery to favourable conditions.

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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 Northacre Renewable Energy Limited to operate their proposed energy recovery facility near Westbury in Wiltshire. The emission data is based on the combustion of 32.5 tonnes per hour of residual waste with a net calorific value of 10.5 MJ/kg¹.
- 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. The consultant complements the AQA with an ecological interpretation³ of the potential impacts at ecological sites conducted by Argus ecology.
- 1.3 Wiltshire Council have produced a document outlining observation and comments from the Wiltshire Council Environmental Control and Protection Team. This document outlines concerns with regards to local air quality, areas of concern include the following, which we have addresses throughout the report;
- Impacts on the Air Quality Management Area (AQMA)
 - Abnormal emissions
 - Local residents have raised issue with regards to plume grounding
 - Control of emissions of ultrafine particulates, specifically PM_{2.5} and PM_{0.1}
- 1.4 A number of concerns were raised during the extended consultation which have been addressed in this report:
- Concern over the selection of the meteorological data from Lyneham
 - Concern over the impact of the local topography, particularly the escarpment at Bratton Camp, just above the Westbury White Horse which is located 3.9km east of the proposed site
 - Concern that the modelling has not identified the most relevant receptors.

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 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 at the ecological sites can be screened out as insignificant for all sites with the exception of ammonia critical levels and nutrient nitrogen deposition at Picket and Clanger Wood SSSI.
 - Further analysis has been undertaken by the ecology consultant for the project, which concluded that the predicted process contribution would not cause significant harm to the SSSI or inhibit its recovery to favourable conservation status.
- 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 human health and ecological receptors, with the exception of Salisbury Plain SAC and Picket and Clanger Wood SSSI. At these ecological sites, predictions are

¹ Dispersion Modelling Assessment for EP application, August 2020 (Fichtner) Northacre Facility

² Human Health Risk Assessment, July 2020 (Northacre Renewable Energy Limited)

³ Ecological interpretation of Air quality Assessment for Northacre Energy Recovery Facility June 2020. (Argus Ecology).

not insignificant at locations where ammonia critical levels and nutrient nitrogen critical loads are already exceeded. Note that we cannot comment on the suitability of the ecological interpretation and we recommend consultation with the habitats lead on the significance of these predicted impacts.

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 RAF Lyneham between 2015 and 2019, approximately 30 km west of the proposed facility, where local topography is likely to influence recorded conditions. We have evaluated alternative met stations surrounding the facility, conducting sensitivity analysis using our own meteorological data. We have used 10 years of meteorological data to ensure worst case met conditions are captured.
- 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 considered 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 considered the dispersion site with a value of 0.3 m to represent the agricultural maximum as to represent the agricultural land to the south west, and the meteorological site with value of 0.2 m.
- 3.3 The consultant's assessment is based on the upper range Best Available Technique Associated Emission Limits (BAT-AELs) from the BAT conclusions for waste incineration document⁴, 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 Directive⁵ (IED) for waste incineration plant 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. Their selected background data indicate that there is headroom for most pollutants. We have selected appropriate background concentrations for our check modelling and sensitivity analysis, based on the data available. There is currently one Air Quality Management Area (AQMA) declared by Wiltshire Council. The AQMA is located 1.6 km east of the site and was declared in 2001 for exceedances of the annual mean NO₂ objective. This AQMA has 2 Roadside diffusion tubes located within it showing variable annual NO₂ concentrations from 35-42 µg/m³. We have evaluated contributions from the facility at locations of exposure within the AQMA⁶.
- 3.5 The consultant appropriately modelled the effect of buildings on the dispersion of stack emissions. Modelling incorporated the use of 10 buildings with 7 buildings that could affect dispersion. There are no receptors located within the building cavity. Sensitivity

⁴ 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

⁵ 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)

⁶ 2020 Air Quality Annual Status Report, July 2020, Wiltshire Council

has been considered with and without buildings to evaluate the influence of downwash and plume grounding.

- 3.6 The consultant has included terrain data in their modelling taking data from the Ordnance Survey which includes Bratton camp and Escarpment. The site is located in an area that is relatively flat, however, there are gradients above 1 in 10 located 3.3 km southeast the site that can influence dispersion of pollutants. We have conducted sensitivity analysis using our own terrain data from the Ordnance Survey. Our terrain includes features in Bratton camp and escarpment specifically raised as a potential cause of concern.
- 3.7 The consultant has modelled predictions across a 9 km by 9 km grid with resolution of 90 m, based on the stack height of 75 m. We have performed sensitivity to more granulated grids with 50 m and 10 m resolution to ensure the worse-case prediction at the grid is captured. All receptors identified as areas of concern by consultees are captured within the grid.
- 3.8 The consultant has used 32 discrete receptors to represent human exposure. Our checks indicate that there are human health receptor locations to the west (Storrige Road) and to the south east (Westbury AQMA) which have not been included by the consultant we have added additional receptors. We have checked both the maximum in the grid and at relevant sensitive human receptors for all pollutants.
- 3.9 The consultant has assumed 70% long-term and 35% short-term NO_x to NO₂ conversions. These are in line with our 'worst case' recommended conversion ratios for combustion sources.
- 3.10 The consultant has reported maximum off-site and receptor predictions for the assessed pollutants in Table 26, Table 28 of the air quality assessment. Maximum predicted short-term predictions at the half-hourly ELVs are reported in Table 27. We have also assessed against the half hourly ELVs for the short term ES. We note the following:
- We note that the consultant has assessed emissions of PM_{2.5} against an annual mean environmental standard of 25 µg/m³. The environmental standard changed to 20 µg/m³ in 2020⁷. We have conducted our checks against the lower environmental standard.
 - The consultant has modelled group 3 metal emissions following the latest version of our guidance⁸.The consultant presents in Table 32 and Table 33 the metal concentrations. The consultant concludes that metals have no risk of exceeding the long-term AQAL as a result of emissions from the facility there is no potential for significant pollution.
 - 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 Assessment⁹. We note that the consultant has not reported

⁷ 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]

⁸ Releases from waste incinerators – Guidance on assessing group 3 metal stack emissions from incinerators, Version 4

⁹ Abnormal Emission Assessment, August 2020, Fichtner

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.

- 3.12 The consultant's predicted short term PCs are reported in Table 26 and Table 27 of their abnormal emissions assessment. With the exception of the SO₂ 15 minute environmental standard, PCs are insignificant. However, when PCs are not insignificant, PECs are well below the Environmental Standards. Taking into account the worst case assumptions and low frequency of abnormal operations, the consultant conclude that abnormal emissions would not have a significant impact on local air quality.

Ecological Assessment

- 3.13 The consultant has identified 9 ecological receptors consisting of special areas of conservation (SACs), sites of special scientific interest (SSSI), ancient woodlands (AW) and 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.
- 3.15 The consultant's emission modelling identified two predicted exceedances of screening thresholds at Picket and Clanger Wood SSSI, where background levels significantly exceed the relevant environmental quality standards. The consultant's PCs at Picket and Clanger Wood SSSI are as follows:
- Ammonia levels (2.8% of the critical level for sensitive lichen communities),
 - Nitrogen deposition rate (1.9% of the lower critical load for woodland community)
- 3.16 We have conducted detailed modelling to evaluate ammonia concentrations across the ecological designation and have checked the critical levels and backgrounds in Air Pollution Information Service (APIS).
- 3.17 The consultant makes the following conclusions for ecological sites: "The impact of process emissions at the local ecological sites can be screened out as insignificant for all sites with the exception of Picket and Clanger Wood SSSI. A further ecological interpretation of the AQA concluded that the predicted process contribution would not cause significant harm to the SSSI or inhibit its recovery to favourable conservation status".

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 predict intake of dioxins and furans and dioxin-like PCBs. IRAP-h View implements the United States Environment Protection Agency (US EPA) Human Health Risk Assessment Protocol¹⁰ (HHRAP). The consultant has assessed emissions of dioxins and furans and dioxin-like Polychlorinated biphenyl (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 just direct inhalation. The consultant has considered direct inhalation,

¹⁰ United States Environmental Protection Agency – Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities. Sept 2005 www.epz.gov/osw

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 and agricultural receptors. 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 of groundwater and surface water and fish has been excluded from the assessment. Having consulted a number of sources to evaluate the potential exposure via fish intake¹¹, 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) 1996¹² congener profile factored by International Toxic Equivalency Factors (TEF) at the IED emission concentration. Consultant's total emission concentration is 0.04 ng i-TEF/Nm³ which it is lower than the BAT-AELs of 0.06 ng i-TEF ng/Nm³. We have considered this 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.
- 3.22 The consultant has not considered abnormal emissions in their HHRA. 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.
- 3.23 The threshold level for toxicity is the Tolerable Daily Intake¹³ 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 4% 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 predicted to be negligible and the effect is not significant."

AQMAU Checks

- 3.25 We carried out check modelling using ADMS (using Version 5.2). Our checks included sensitivity of model output and results to:
- Our own meteorological data observed at Chippenham Wiltshire and Yeovilton between 2003 and 2007 (refer to point 3.1).
 - Surface roughness length of 0.5 m and 0.3 m at the dispersion site and surface roughness of 0.2 m at the meteorological site (refer to point 3.2).
 - Our own terrain data (refer to point 3.6).
 - Critical level assessment and detailed assessment against nutrient nitrogen and acidification critical loads at local nature sites.
 - HHRA screening based on worst-case congener profiles

¹¹ Centre for Fisheries and Aquaculture Science 2021, <https://www.cefas.co.uk/> Accessed on 30/03/2021

¹² Risk Assessment of Dioxin releases from Municipal Waste Incinerators, Her Majesty's Inspectorate of Pollution, March 1996

¹³ 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.

- 3.26 Our checks indicate that 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 standard. PCs at the AQMA are insignificant for all pollutants.
- 3.27 PM_{2.5} concentrations are insignificant at all receptors. PM_{0.1} has no guidelines or environmental standard to be compared to due to a lack of substantial epidemiological evidence^{14,15}.
- 3.28 Our abnormal emissions checks using plausible abnormal emissions concentrations indicate that the proposed facility is unlikely to lead to any breaches of the short-term environmental standards.
- 3.29 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.
- 3.30 Our checks indicate that the annual mean NO_x critical level PCs are insignificant at 8 of the 9 ecological receptors, for the one receptor which is 'insignificant' (Picket and Clanger wood SSSI) PEC is below 100% at the SSSI. Our checks indicate that daily NO_x and annual SO₂ is insignificant at all receptors.
- 3.31 Regarding ammonia critical levels, our checks indicate that PCs can be above 1% for Picket and Clanger Wood SSSI ecological receptor (E2) and PEC exceed 100% and therefore we cannot screen out an adverse effect at the SSSI. The extent of the exceedance covers the whole designation. We also predict that PCs can be above the insignificance criteria at some locations of the Salisbury plain SAC. We note that backgrounds are already exceeding the critical levels of 1 µg/m³.
- 3.32 Nitrogen deposition is above 1% for the Picket and Clanger Wood SSSI ecological receptor and the PEC exceed 100% and therefore we cannot screen out an adverse effect at the SSSI. We note the contribution of ammonia to the nutrient nitrogen deposition is above the critical load, influencing the nitrogen deposition and causing the PC to exceed the critical load and thus resulting in an exceedance of the PEC.
- 3.33 Our checks indicate that HF daily concentration is insignificant at 5 ecological receptors, where HF is not insignificant the PECs are well below 100% and therefore is unlikely to cause harm to the ecological receptors. Our checks indicate that HF weekly concentration is insignificant at all receptors and therefore is unlikely to cause harm to the ecological receptors.
- 3.34 Our checks indicate that acid deposition is insignificant at 8 ecological receptors. The only receptor with acid depositions above the 1% threshold criteria is the Picket and Clanger Wood SSSI. However, the PEC is below 100% and therefore is unlikely to cause harm to the ecological receptor.
- 3.35 As a result of this, we cannot fully agree with the consultant's conclusions in regards to ecological receptors and recommend consultation with the habitats lead on whether the predicted PCs can be significant. We consider that consultant's numerical predictions can be used in the consultation, indicatively.

¹⁴ Available evidence for the Future update of the WHO Global Air Quality Guidelines (AQGs) October 2015, World Health Organisation

¹⁵ Ultrafine Particles (UFP) in the UK, 2018, Department for environment, food and rural affairs and the Air Quality Expert Group