AQMAU Acoustics & Air Quality Modelling & Assessment Unit

Environment Agency

Air quality audit report

AQMAU reference:	AQMAU-C2824 & H4516- RP02
Site name:	Swadlincote Energy Recovery Facility
Permit reference:	EPR/LP3327SK/A001
Date requested:	25th September 2024
AQMAU response date:	28th March 2025

AQMAU recommendation	Conditions / noted
• The consultant's conclusions and numerical predictions for human health can be used for permit determination.	• For all pollutants, the proposed facility is unlikely to significantly contribute to the exceedances of an environmental standard. • Predicted intakes from dioxins and furans, and dioxin-like polychlorinated biphenyl emissions are not considered a risk to health.
• The consultant's conclusions and numerical predictions for ecological receptors can be used for permit determination.	• At all sites, the proposed facility is unlikely to contribute significantly to any exceedances of the critical levels and critical loads set for the protection of the habitats.

Detailed response and evidence starts on Page 2.

1 Summary of work request

1.1 The Environment Agency's Installations Regime of the National Permitting Services (NPS) asked the Acoustics and Air Quality Modelling and Assessment Unit (AQMAU) to audit an air quality assessment[1,2] (AQA) for a permit application for the Swadlincote Energy Recovery Facility (the installation). A Human Health Risk Assessment[3] (HHRA) was submitted along with the AQA. The air quality assessment was completed by Air Quality Consultants (the consultant) on behalf of R&P Clean Power Ltd (the applicant).

1.2 The proposed single-line facility would recover energy and produce combined heat and power from over 230,000 tonnes of non-hazardous residual (post-recycled) waste including Refuse Derived Fuel (RDF) each year. There is also a back-up diesel generator on site used for start-up and shut-down operations and emergencies.

1.3 This report supersedes 'C2824-RP01' and reflects the final audit outcome based on additional research and information provided from the consultant.

2 Conclusions that lead to AQMAU recommendations

2.1 In the case of human health, the consultant concluded that:

- Either process contributions (PCs) are below 1% and 10% of the long-term (LT) and short-term (ST) environmental standards (ES) or predicted environmental concentrations (PECs) are below the ES for all pollutants.
- There are no predicted exceedances of LT or ST ES associated with abnormal operations.
- For HHRA, the risks to health due to emissions of dioxins and furans, and dioxin-like PCBs are not significant.

2.2 In the case of protected conservation sites, the consultant concluded that:

- At local nature sites, the PCs are less than 100% of the relevant critical levels and loads.
- At Special Area of Conservation (SACs), Special Protection Area (SPAs), Ramsar sites and Sites of Special Scientific Interest (SSSIs)
    - PCs are insignificant or there is predicted to be no exceedance of critical levels and loads at River Mease SAC/SSSI, Carver's Rocks SSSI, Ticknall Quarries SSSI and Calke Park SSSI.

2.3 We have audited the consultant's assessment and have made observations relating to their methods and assumptions. We have conducted our own check modelling and have analysed model sensitivities. Whilst we do not agree with the absolute numerical values, the consultant's conclusions for human health and protected conservation sites can be used for permit determination,

2.4 The potential impact of daily NO_X PCs at Cadley Railway Area LWS can be ruled out as not significant against critical level of 75 or 200 µg/m^3. See paragraph 3.31 for further information.

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[1] Air Quality Assessment: Swadlincote Energy Recovery Facility, South Derbyshire, 11th December 2023. Air Quality Consultants, Report No: J10-14601A-10-R02-01/1/F2.

2 Air Quality Assessment: Swadlincote Energy Recovery Facility, South Derbyshire, 14th February 2025. Air Quality Consultants, Report No: J10-14601A-10-R02-01/1/F3.

3 Human Health Risk Assessment: Swadlincote Resource and Recovery Park, September 2022. Air Quality Consultants, Report No: J10/12240A/10.

3 Evidence for conclusions

Air quality assessment

3.1 Air dispersion modelling software ADMS 6 has been used.

3.2 The installation has been modelled to operate at maximum capacity for 8,760 hours per year. The stack height is 60 m. Additionally, the backup diesel generator has been modelled at a stack height of 6 m and assumed to be operating for 168 hours per year.

3.3 The assessment is predominantly based on the Best Available Techniques Associated Emission Levels (BAT-AELs) obtained from the 2019 waste incineration BAT conclusions (BATC) document[4]. The modelled emissions are presented in table 18 of the AQA. We observe:

- All TVOC are assumed to be benzene and 1,3-butadiene for assessment against the ES.
- All polycyclic aromatic hydrocarbons (PAHs) are assumed to be benzo[a]pyrene (B[a]P) and are assessed against the B[a]P ES. An emission concentration of 0.00015 mg/Nm^3 was used, based on the average reported emission concentration of PAHs at a UK plant. This is based on figure 8.121 of the 2019 Waste Incineration BREF[5].
- For polychlorinated biphenyls (PCBs), an emission concentration of 0.08 ng/Nm^3 was used, this was not referenced. We believe this is based on table 5.7 of the 2019 Waste Incineration BREF.
- Group 3 metal emissions have been modelled following our guidance[6]. Where the PCs are predicted to be not insignificant in step 1, the consultant followed step 2 and assumed that they would emit at the maximum concentrations.
- For mercury (Hg) a concentration of 0.01 mg/Nm^3 was used. We note this is lower compared to the BAT-AEL of 0.02 mg/Nm^3.
- For hydrogen chloride (HCl) no LT annual mean emission concentration was provided.
- All other emission concentrations are consistent with the BAT-AELs for a new plant.
- The emission rates for NO_2 and particulate matter (PM) for the diesel generator could be replicated.
- The cumulative impacts of NO_2 and PM from the main ERF stack and back-up Diesel generator (168 hours per annum) operating together has been modelled.

3.4 Meteorological data observed at Sutton Bonnington for 5 years 2017 to 2021. This site is 24.7 km northeast of the installation.

[4] Commission Implementing Decision (EU) 2019/2010 of 12 November 2019 establishing the best available techniques (BAT) conclusions, under Directive 2010/75/EU of the European Parliament and of the Council, for waste incineration.

[5] Neuwahl, F., Cusano, G., Gómez Benavides, J., Holbrook, S. and Roudier, S. Best Available Techniques (BAT) Reference Document for Waste Incineration: Industrial Emissions Directive 2010/75/EU (Integrated Pollution Prevention and Control), EUR 29971 EN, Publications Office of the European Union, Luxembourg, 2019, ISBN 978-92-76-12993-6 (online), doi:10.2760/761437 (online), JRC118637.

[6] Waste incinerators: guidance on impact assessment for group 3 metals stack - GOV.UK (www.gov.uk) [Accessed November 2024]

3.5 A fixed surface roughness of 0.2 m, representing agricultural (low) for the meteorological site has been used and a spatially varying surface roughness file has been used to represent the land use characteristics around the dispersion site.

3.6 A minimum M-O length of 10 m for the dispersion site and 1 m and for the meteorological site has been assumed.

3.7 A terrain file has been used to model terrain effects because there are areas with gradients greater than 1:10.

3.8 Nine buildings, as shown in table 22 of the AQA have been modelled.

3.9 A 1 km x 1 km Cartesian grid with a spatial resolution of 25 m and 5 km x 5km cartesian grid with a spatial resolution of 100m has been used.

3.10 The consultant has modelled eight discrete receptor locations to represent of relevant public exposure.

3.11 The background data used is reported in tables 7 to 16 of the AQA. A variety of sources have been used, including diffusion tubes managed by South Derbyshire and East Staffordshire councils, annual status report[7][8], air quality networks spread across the UK[9] and Defra background maps for the pollutants assessed. We note that the consultant assumed that Cr (VI) backgrounds were 8% of total Cr backgrounds. This differs from our approach which assumes 20%.

3.12 The assumed Oxides of nitrogen (NO_X) to nitrogen dioxide (NO_2) conversion has not been stated.

3.13 LT and ST PCs and PECs are reported in tables 28 to 39, 48 to 51 and 55 to 58 of the AQA. We observe:

- All pollutant PCs are either insignificant (less than 1% for LT or 10% for ST) or the PECs do not exceed the relevant ES.
- Of the group 3 metals annual arsenic (As) and Cr (VI) progressed to step 2 before showing acceptable impacts.
    - The updated AQA rectified an error within table 38 which presented Cr(VI) results. The consultant's step 2 Cr (VI) PC is 0.8% of the ES and therefore insignificant.
    - At Step 2, LT As PCs is about 6.3% of the ES using the maximum measured concentration and PECs do not exceed.

Abnormal emissions assessment (AEA)

3.14 Modelled abnormal emissions are reported in section 6.12 to 6.18 of the AQA. We observe:

- The ST emission concentration for Hg, Cadmium (Cd), Group 3 metals, PCDD/F, HCl and Sulphur Dioxide (SO_2), are within the ranges specified for raw flue-gas in table 3.6 of the 2019 Waste Incineration BREF[10]. The emission concentration for pollutants including hydrogen fluoride (HF), TVOC and NO_2 are outside the expected range.

[7] South Derbyshire District Council (2023) 2023 Air Quality Annual Status Report.
[8] East Staffordshire Borough Council (2023) 2023 Air Quality Annual Status Report.
[9] https://uk-air.defra.gov.uk/interactive-map [Accessed November 2024]
[10] Best Available Technique (BAT) reference Document for Waste Incineration, Industrial Emissions Directive 2010/75/EU (Integrated Pollution Prevention Control), 2019

- The emission concentration for PM is consistent with the 150 mg/Nm^3 half-hourly average ELV specified in IED Annex VI Part 3 (2)[11].
- Abnormal emissions assessment has been carried out only for pollutants with an ES or Environmental Assessment Level (EAL) averaging period of 1-hour or less.
- For dioxins and furans, annual impacts have been factored by 60 hours at the abnormal emission concentration and 8700 hours at the normal daily permitted ELV.

3.15 The consultant reported ST PCs and PECs in tables 43-47 of the AQA. We observe:

- At the location of maximum impact, the predicted abnormal 1- hour/ 15-minute PCs for all pollutant considered are either insignificant (less than 10%) or the PECs do not exceed the relevant ES.
- We note that the LT PCs for abnormal emissions of dioxins and furans are incorrectly assessed against the ES instead of including them in the Human Health Risk Assessment (HHRA).

Human health risk assessment (HHRA)

3.16 Proprietary software Lakes IRAP-h View (version not stated) has been used to conduct the HHRA. IRAP-h View implements the United States Environmental Protection Agency (US EPA) Human Health Risk Assessment Protocol (HHRAP)[12].

3.17 Nine discrete receptors have been assessed.

3.18 Direct inhalation and ingestion of soil, home grown produce, drinking water, eggs from home reared chickens, home grown poultry, beef, pork, cow's milk, locally caught fish and consumption of breast milk for infants are the pathways that have been considered. The consultant has included the ingestion of locally caught fish as a potential pathway only for the 'fisher' receptor. They have assumed that this receptor has the likelihood of sourcing a large proportion of their diet from a fishery. However, they have excluded this pathway for other receptors (farmer and resident) even though there are relevant receptors within 10 km of the stack.

3.19 The congener profile and emission rates are presented in table 1 of the HHRA. The emissions for each congener in terms of toxic equivalent (I-TEQ) have been based on a standard congener profile for municipal waste incinerators from HMIP 1996[13]. As a worst case, the raw emissions presented in table 1 of the HHRA have been scaled to the IED ELV[10] of 0.1 ng TEQ N/m^3 instead of the BAT-AEL for new plants of 0.04 ng I-TEQ N/m^3.

3.20 The dioxin-like PCB concentration used for the calculation of their emission rate of 9.61 x 10^{-9} g/s is not mentioned. They state that as a worst-case, the entire dioxin-like PCB emission has been modelled as Aroclor 1254 in IRAP-h View.

[11] Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control). EUR-Lex - 02010L0075-20110106 - EN - EUR-Lex (europa.eu) [Accessed November 2024]
[12] Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities, EPA 2005.
[13] Table 7.2a DOE (1996) Risk Assessment of Dioxin Releases from Municipal Waste Incineration Processes Contract No. HMIP/CPR2/41/1/181.

3.21 The deposition assumptions are shown in section 3.8 to 3.10 of the HHRA. We observe:

- The dry vapour deposition velocity of 0.5 cm/s is the value recommended in HHRAP for organic contaminants. The consultant refers to a deposition range of 0.1 cm/s to 1 cm/s.
- The dry particle and particle-bound deposition velocities of 0.11 cm/s and the dry to wet deposition ratio of 1 to 2 are conservative values from our guidance[14]. The consultant uses a particle bound deposition velocity of 1 cm/s but there is no reference to dry to wet deposition ratio.

3.22 The consultant has provided justification for not including a metals assessment at Foremark Reservoir and Caldwell Pool Fishpond which are nearby fisheries which were identified as receptors.

3.23 The consultant reported their results in tables 11 and 12 of the HHRA. We observe:

- The Committee on Toxicity tolerable daily Intake (COT TDI)[15] of 2 pg WHO-TEQ/kg(BW)/day has been used.
- The predicted maximum contribution is 3.3% of the TDI for a farmer adult, and 4.7% of the TDI for a farmer child.
- The predicted intakes for dioxins, furans and dioxin-like PCBs have been adjusted for lifetime exposure.

Ecological assessment

3.24 A screening distance of 10 km for SACs, SPAs, Ramsar sites and SSSIs, and 2 km for local nature sites has been used. We note that the correct screening distance for SSSIs is 2 km. The assessed conservation sites are presented in table 6 of the AQA.

3.25 The consultant modelled sixteen discrete receptor locations to represent exposure to ecological impact. We note that they have not included any discrete receptor locations within Cadley Hill Railway Area LWS, Bretby Railway Line LWS, Bretby Disused Railway LWS, Castle Gresley Wetland LWS, Castle Mound, Castle Gresley LWS, White Lady's Spring LWS and Netherseal Colliery Line LWS.

3.26 The APIS website[16] has been used to establish baseline concentrations and deposition fluxes, critical levels and critical loads for the conservation sites assessed.

3.27 AQTAG06[17] guidance was followed to calculate the contribution of pollutants to nutrient nitrogen and acid deposition.

3.28 The PCs and PECs at the conservation sites are reported in tables 40 to 42, 52 to 54 and 59 to 61 of the AQA. We observe:

- At all assessed local nature sites, the LT and ST PCs are less than 100% of the critical levels and critical loads and are insignificant.

[14] Air emissions risk assessment for your environmental permit - GOV.UK (www.gov.uk) [Accessed in November 2024]
[15] Tolerable Daily Intake (TDI) of 2 picogrammes toxic equivalent (TEQ) of dioxins and dioxin-like PCBs per kilogramme human body weight per year.
[16] Air Pollution Information System www.apis.ac.uk [Accessed in November 2024]
[17] AQTAG06 Guidance on detailed modelling approach for an appropriate assessment for emissions to air. March 2014.

- At the following conservation sites LT PCs are less than 1% and ST PCs are less 10% and are insignificant, or the PECs do not exceed the relevant critical levels and critical loads: River Mease SAC/SSSI, Carver's Rocks SSSI, Ticknall Quarries SSSI and Calke Park SSSI.
- We note assessment of nutrient nitrogen or acid deposition has not been completed for River Mease SAC or Calke Park SSSI as no critical loads are provided on APIS.

AQMAU check modelling and assessment

3.29 We carried out check modelling and sensitivity analysis to several of the assumptions and input parameters made by the consultant. The checks listed in this section were deemed necessary to understand model sensitivity and uncertainties in the consultant's reported predictions:

- Five years of meteorological data observed at East Midlands Airport.
- Fixed surface roughness lengths of 0.2 and 0.3 m for the dispersion and meteorological site.
- The ADMS default minimum Monin-Obukhov length of 10 m for both the dispersion and meteorological site.
- Our own terrain file processed from 50 m resolution data.
- Effects with and without buildings due to ecological receptors located within cavity length.
- Reasonable worst-case background data from our own analysis.
- Cr (VI) being 20% of total Cr background concentration.
- The maximum concentration for Cr (VI) from the heavy metals guidance[5].
- Utilising the highest recorded B[a]P concentration of 0.0002 mg/Nm3 from the BREF (Figure 8.121, UK13.2R Eastcroft).
- Assessment against 24-hour mean ST ES of 2.25 µg/m^3 for 1,3 butadiene.
- The maximum monitored PCB concentration from EA analysis of municipal waste incinerators (MWIs) 2008-2010 of 0.0092 (ng(WHO-TEQ)/m^3).
- Impacts of the installation cumulatively with nearby facilities.
- HHRAP recommended values for deposition.
- The BAT-AEL for a new plant of 0.06 ng I-TEQ N/m^3 for PCCD/F.
- Using several sources[18][19] to investigate potential fish intake from the members of the public to verify if fish is likely to be a pathway.
- Discrete receptor points for the Cadley Hill Railway Area LWS, Bretby Disused Railway LWS and Bretby Railway LWS.
- Only assessing receptors at Cadley Railway Area LWS that fall outside of the installation boundary.
- Alternative nutrient nitrogen deposition critical loads at Castle Mound LWS and Cadley Hill Railway Area LWS.
- Impacts of NO_2 and PM from the backup diesel generator and main ERF stack operating together.

3.30 Our check modelling and sensitivity analysis indicates for human health:

[18] The Centre for Environment, Fisheries and Aquaculture Science (CEFAS) website available at https://cefas.cefastest.co.uk/eu-register/?filter= [Accessed on November 2024]
[19] Fish Adviser website available at: https://www.fishadviser.co.uk [Accessed February 2025]

- We agree that the proposed installation either has insignificant impacts or will not cause exceedance of the ES set for the protection of human health, for normal and abnormal operations.
- We find that step 2 LT Cr (VI) PCs are likely to be insignificant when using the maximum concentration of 0.000130 mg/Nm^3.
- The consultant did not assess ST 24-hour mean ST TVOCs as 1,3-butadiene for both normal and abnormal operation. We find that the PCs are not insignificant, however, the PECs do not exceed.
- We find the LT PAH as B[a]P PC not insignificant, however, the PECs do not exceed when utilising the maximum measured B[a]P concentration of 0.0002 mg/Nm^3.
- We agree that the combined impacts of NO_2 and PM_{10} from the backup diesel generator and main ERF stack will not cause a breach of any ES set for the protection of human health, for normal and abnormal operations.
- We agree that cumulative impacts from the proposed installation with nearby proposed developments will not cause a breach of any ES set for the protection of human health, for normal and abnormal operations.
- Our checks indicate the dioxin, furan and dioxin-like PCB intakes are below 10% of the COT TDI and are not considered a significant risk to health. This also applies to any increased emissions of dioxins, furans and dioxin-like PCBs during worst-case abnormal operations. This is based on the UKHSA advise that:
    - A total exposure including the PC from dioxins, furans and dioxin-like PCBs is without appreciable health risk if the total exposure is below the TDI.
    - If total exposure including the PC results in an exceedance of the COT TDI, if the PC from the facility is less than 10% it would be unlikely to result in a significant risk.
- We identified four waterbodies (Caldwell Pool fishpond and Foremark reservoir identified by the consultant and Willington Lake and Donkill fishery as additional receptors) located within 10 km of the installation. Based on additional research for Willington Lake and Donkill Fishery we find these waterbodies not to be open for fishing and therefore not relevant receptors. The consultant has provided sufficient evidence to discount Caldwell Pool and Foremark reservoir from requiring a metals assessment (see section 3.22). Therefore, no metals assessment is required.

3.31 Our check modelling and sensitivity analysis indicates for ecological receptors:

- At all nearby local conservation sites, the LT and ST PCs are less than 100% of the critical levels and critical loads and are considered insignificant except for Cadley Hill Railway Area LWS.
- At all conservation sites LT and ST PCs are less than 1% and 10%, respectively, and are insignificant, or the PECs do not exceed the relevant critical levels and critical loads. We note there is no comparable critical load for the habitat features at River Mease SAC. This site is considered sensitive to nutrient nitrogen and acid, but site-specific knowledge is required.
- The daily NO_X PCs from the **main ERF stack** at Cadley Hill Railway Area LWS are less than 100% of the NO_X Critical level of 75 µg/m^3 and are considered insignificant.

- The daily NO_X PCs from the **diesel generator** operating alone at Cadley Hill Railway Area LWS could exceed 100% of the daily NO_X critical level of 75 µg/m^3 and higher daily NO_X critical level of 200 µg/m^3. However, we consider the impacts as not likely to be significant due to:
    - The areas of potential exceedance are mostly limited to within or just outside the installation boundary to the north. These areas fall within the cavity region of some of the buildings and therefore downwash effects are likely to influence PCs. Due to high uncertainty with the predictions in this zone we have low confidence in the daily NOx PCs within this region.
    - The conservative assessment assuming constant operation for 24 hours which is unlikely based on the intended operation of the diesel generator.
    - The Biodiversity Net Gain report[20] presents the areas of habitat that will be retained and lost. The areas of potential exceedance do not fall within areas of retained habitat and are therefore not considered areas of relevant exposure.

[20] Biodiversity Net Gain drawing, Swadlincote Resource Recovery Park Site-baseline habitats- retention and loss, 12th June 2022, FPCR Environment and Design Ltd, reference: 7233-ES-8.10-03. Available at: https://planning.derbyshire.gov.uk/Planning/Display/CW9/1022/22#undefined