Air Quality Modelling & Assessment Unit (AQMAU)

Environment Agency

AQMAU reference: AQMAU-C2165-RP02

Permit reference: EPR/CP3308TD/V002

Project title: Wealden Works 3Rs facility

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

Date requested: 16th March 2021

AQMAU response date: 24th May 2021

AQMAU updated report: 19th January 2022

AQMAU recommendation	Conditions / noted
• The consultant's conclusions regarding human health can be used for permit determination.	• The proposed facility is not likely to cause an exceedance of any environmental standard at human health receptors. • Predicted impacts as a consequence of dioxins and furans emissions are well within the screening criteria for the protection of human health.
• The consultant's conclusions regarding ecological receptors can be used for permit determination.	• Contributions from the proposed facility are unlikely to exceed any critical level or critical loads at local nature sites.

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1. Summary of work request

1.1 The National Permitting Services (NPS) Installations Bristol team have asked the Air Quality Modelling and Assessment Unit (AQMAU) to audit an air quality assessment[1] and a human health risk assessment[2]. The assessments support an application from Britaniacrest Recycling Limited to add an incinerator to their already existing waste site at Langhurstwood Road, Horsham, West Sussex.

1.2 RPS group Limited (the consultant) conducted the air quality assessment (AQA) and the abnormal emission assessment on behalf of the applicant. Gair Consulting limited has undertaken the Human health risk assessment[3] (HHRA) on behalf of the applicant.

2. Conclusions that lead to AQMAU recommendations

2.1 The consultant's conclusions for human health and ecological receptors are as follows:

- "The results of dispersion modelling reported in the assessment indicate that predicted contributions and resultant environmental concentrations of all pollutants considered would be of 'negligible' significance".
- Under abnormal operations, all air quality impacts are considered to have an insignificant effect.
- Exposure to dioxins, furans and dioxins-like Polychlorinated Biphenyls (PCBs) is not significant.

2.2 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. We agree with their conclusions regarding abnormal emissions and exposure to dioxins, furans and dioxin like PCBs.

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 Charlwood between 2011 and 2015, approximately 9 km north-east the proposed facility. We have conducted sensitivity analysis using our own meteorological data. We have UK Met Office licensed meteorological data from 2003 to 2007 (5 years of data). Changes in land use at meteorological stations, such as urbanisation, and technological advances in meteorological observation equipment are the main factors that lead to some meteorological datasets becoming outdated. There are no such issues with our meteorological data. Our modelling checks with our own meteorological data indicates agreement with applicant's conclusions.

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 facility is industrial and rural and, therefore, a mix of surface roughness values are likely to be reasonably representative. The consultant considered a surface roughness for the meteorological site of 0.5 m which it is unlikely to be appropriate. We have performed sensitivity to different surface roughness at both the dispersion and meteorological site. Our checks considered sensitivity to a value of 0.3 m for the dispersion site to represent the agricultural area to the east and west of the site. For the meteorological site, we

[1] Environmental Statement Chapter 7 Air Quality and Odour, March 2018 (RPS) Wealden 3R's Facility
[2] Air Quality Assessment of Abnormal Operations (RPS), September 2020
[3] Wealden Works Recycling, Recovery and Renewable Energy Facility; Human Health Risk Assessment, Gair Consulting Limited, September 2020

considered values of 0.2 m to represent the agricultural (minimum) likely to be representative.

3.3 The consultant's modelled emissions presented in table 7.8 correspond to the Emission Limit Values (ELVs) from the Annex VI Part 3 Waste Incineration of the Industrial Emissions Directive (IED) and the upper range emission concentrations mentioned in the Reference Document on the Best Available Techniques (BREF) 2006 for Waste Incineration. They have considered emission concentrations from the BREF published in 2019 in the appendix 7.7, based on the maximum values of the best available technique (BAT) associated emission levels (AELs). We were able to replicate their emission rates for most pollutants and where not, we have tested sensitivity assuming the highest pollutant mass emissions.

3.4 The consultant has used background pollutant concentrations from a variety of data sources: local authority monitoring, Defra background maps, heavy metals and polycyclic aromatics networks, acid gas and aerosol networks and toxic organic micro pollutants network. Their selected background data indicate that there is headroom for most pollutants. We have reviewed the applicant's background and selected reasonably conservative background concentrations, based on the data available. There are currently two Air Quality Management Areas (AQMA) declared by Horsham District Council. However, the closest AQMA declared in 2011 is located 12 km south of the site, unlikely to be affected by the emissions from the facility. We have evaluated whether this is the case.

3.5 The consultant appropriately modelled the effect of buildings on the dispersion of stack emissions. Modelling incorporated the use of four buildings, however, our checks indicate that these are unlikely to affect dispersion of pollutants due to their height relative to the 95 m the stack. Sensitivity has been considered with and without buildings to evaluate the influence of building downwash.

3.6 The consultant has included terrain data from the Ordnance Survey. The site is located in an area that is relatively flat, however, there are gradients above 1 in 10 that can influence dispersion of pollutants. These locations are approximately 700 m north and approximately 1.2 km north east of the site. We have conducted sensitivity analysis using our own terrain data.

3.7 The consultant has modelled impacts from the facility across two grids. The first grid is a 10 km by 10 km with a resolution of 100 m, based on the stack height of 95 m. The second grid is a 3 km by 3 km grid with a resolution of 30 m. We consider this a reasonable approach.

3.8 The consultant has used eight discrete receptors to represent human exposure. We have included a total of nine additional receptors to ensure that the worst case receptors are captured.

3.9 The consultant has assumed 70% long-term and 35% short-term NO_X to NO_2 conversions. These are in line with our 'worst case' recommended conversion ratios for combustion sources.

3.10 The consultant has reported maximum off-site predictions for the pollutants emitting at the IED ELVs in tables 7.18 to 7.20 of the air quality assessment, whereas the assessment of pollutants emitting at the BAT-AELs is presented in the Appendix 7.7. They present predictions at human receptors in the Appendix 7.5. We note the following:

- The consultant predicted that for all pollutants the process contributions are either insignificant or Predicted Environmental Concentrations (PECs) are below the

Environmental Standards (ES) at areas of relevant exposure for both long-term and short-term.

- The consultant has assessed emissions of $PM_{2.5}$ against an annual mean environmental standard of 25 µg/m^3. The environmental standard changed to 20 µg/m^3 in 2020[4]. We have included assessment against the lower value in our checks.
- The consultant has modelled group 3 metal emissions following the latest version of our guidance[5]. Their predictions do not indicate exceedances of either the ST or LT ES as a result of emissions from the facility. We note that chromium VI was only assessed at the grid, therefore, we considered predictions at sensitive receptors in our checks.
- New Environmental Assessment Levels (EALs) have been published for arsenic (changing from 3 to 6 ng/Nm^3 annual average), benzene (changing from 195 µg/m^3 hourly to 30 µg/m^3 daily) and chromium VI (changed from 0.0002 to 0.00025 µg/m^3 annual averages). The consultant has not considered assessed the impacts of benzene against any ES. We have considered these in our checks.
- We note the consultant has assessed Benzo[a]pyrene (B[a]p) at an emission concentration that is likely to represent the group of poly aromatic hydrocarbon (PAH), which is conservative. The consultant's BaP assessment at the BAT-AELs presented in the appendix 7.7 does not indicate exceedances.
- We note the consultant has not assessed ammonia (NH_3) emissions against the environmental standards. We have conducted our own checks against an assumed the maximum ammonia slip of 10 mg/Nm^3 (at 273K, 101kPa, 11% oxygen, dry).

3.11 The consultant has assessed abnormal emissions scenarios in relation to Article 46(6) of the Industrial Emissions Directive (IED) for waste incineration plants. This 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.

3.12 The consultant's predicted short term PCs for abnormal emissions are reported in Table 2.1 for NO_2 and Table 2.3 for all other pollutants. With the exception of arsenic and nickel, PCs are insignificant. When PCs are not insignificant, PECs are below the Environmental Standards. The consultant's predicted long term PCs for abnormal emissions are reported in table 2.2 and 2.4 of their abnormal emissions assessment. PCs are not insignificant however PECs are not predicted to exceed any of the long term ES.

3.13 Taking into account the worst case assumptions and low frequency of abnormal operations, the consultant concludes that abnormal emissions would have an "insignificant effect on air quality".

3.14 The consultant has conducted a cumulative assessment with Brookhurst Wood Mechanical Biological Treatment (MBT) which is a facility that undertakes anaerobic digestion located approximately 100m north of the Facility. Brookhurst Wood has a single CHP stack which is 15m tall and has emission rates of 0.46 g/s and 0.29 g/s for NO_2 and SO_2, respectively. The consultant concludes that the cumulative effects are not significant. We have evaluated whether the surrounding facilities would affect conclusions.

[4] 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]

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

Ecological Assessment

3.15 The consultant has identified 19 ecological receptors consisting of sites of special scientific interest (SSSI) and local nature sites i.e. ancient woodlands (AW), local wildlife sites (LWS) and local nature reserves (LNR), within relevant screening distances. The consultant claims that the SSSI is designated for geological reasons and therefore has been excluded. We have included further 37 ancient woodlands within the two kilometres screening distance.

3.16 The consultant has assessed the NO_X, SO_2, NH_3 and HF impacts against their respective critical levels. We observe that PCs at all local nature sites are below the critical levels. We have conducted our own ecological assessment using worst case critical levels presented in Air Pollution Information Service (APIS)[6].

3.17 The consultant's emission modelling shows that nutrient nitrogen and acid depositions PCs at all local nature sites are less than 100% the critical loads. We have conducted detailed modelling against the relevant critical loads presented in APIS.

3.18 The consultant concludes that impacts of the emissions from the facility can be screened out as not having a significant effect at all of the identified ecological designated sites.

Human Health Risk Assessment

3.19 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 Protocol[7] (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.

3.20 The human health risk assessment (HHRA) considers 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, home-grown produce (i.e. eggs, milk, poultry, chickens, beef, and pork) and ingestion of breast milk as potential exposure pathways differentiating between residential and agricultural receptors. 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 intake[8], we consider this to be an unlikely pathway of exposure. We have evaluated other potential pathways in our assessment.

3.21 The consultant's modelled emissions profile is shown in Table 2.1 of the HHRA report. These have been calculated on the basis of the Her Majesty's Inspectorate of Pollution (HMIP) 1996[9] congener profile factored by International Toxic Equivalency Factors (TEF) at the IED emission concentration. We were able to replicate consultant's emissions in table 2.2.

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.

[6] Air pollution information Service, May 2020, available at http://www.apis.ac.uk/
[7] United States Environmental Protection Agency – Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities. Sept 2005 www.epz.gov/osw
[8] Centre for Fisheries and Aquaculture Science 2021, https://www.cefas.co.uk/ Accessed on 11/05/2021
[9] Risk Assessment of Dioxin releases from Municipal Waste Incinerators, Her Majesty's Inspectorate of Pollution, March 1996

3.23 The threshold level for toxicity is the Tolerable Daily Intake (TDI)[10] value published by the UK Committee on Toxicity (COT). The consultant has assessed impacts of dioxins, furans and dioxin-like PCBs against the TDI of 2 pg WHO-TEQ/kg(BW)/day. Their predicted maximum contribution presented in table 4.2 is 3.3% of the TDI (adult) which is below 10% insignificance criterion suggested by Public Health England (PHE). We have conducted our own HHRA screening using the HHRAP, assuming exposure at the maximum point of impact.

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 (Version 5.2). Our checks included sensitivity of model output and results to:

- Our own meteorological data observed at Charlwood between 2003 and 2007 (refer to point 3.1).
- Surface roughness length of 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 3.7).
- Our own assessment against benzene, new EALs and Cr(VI) at sensitive receptors (refer to point 3.10).
- Critical level assessment and detailed assessment against nutrient nitrogen and acidification critical loads at ecological receptors (refer to point 3.20)
- Our own HHRA screening (refer to point 3.23).
- Cumulative assessment (refer to point 3.16)

3.26 Our checks indicate that PCs for most pollutants are likely to be insignificant at sensitive receptors. Where PCs are not insignificant, PECs are unlikely to exceed the environmental standards, including those pollutants and EALs not considered by the applicant.

3.27 Our checks indicate that the abnormal scenario is unlikely to lead to any exceedances of the short-term environmental standards.

3.28 Our HHRA of dioxins, furans and dioxin-like PCB intakes, indicate that the PCs are 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 critical level PCs are insignificant at all ecological receptors. Our checks indicate that daily NO_X, annual SO_2, weekly and daily HF and annual NH_3 PCs are insignificant at all local nature site receptors.

3.30 Nutrient nitrogen and acid deposition PCs are below 100% of conservative critical loads for all local nature sites, therefore it can be concluded that there will be no significant pollution.

3.31 Our checks indicate that the impacts from the cumulative emissions are not significant.

3.32 As a result of this, we agree with the consultant's conclusions in regards to both human health and ecological receptors.

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