

AQMAU reference: AQMAU-C2059-RP01
Project title: Kingmoor Energy Recovery Facility
Permit reference: EPR/SP3609BX/A001
Work title: Audit of Noise Impact Assessment
Date requested: 5th May 2020
AQMAU response date: 5th November 2020

AQMAU recommendation	Conditions / Noted
Applicant's conclusions can be used for permit determination.	Based on the acoustic data provided and the attenuation measures described in section 5.1.1 of the consultant's report and detailed in Appendix 3 of the NIA report.

Detailed response and evidence starts on Page 2.

1 Summary of the work request

- 1.1 The Warrington Installations Team in National Permitting Services (NPS) asked the Air Quality Modelling and Assessment Unit (AQMAU) to audit a noise impact assessment¹ (NIA) submitted by Noise & Vibration Consultants Ltd (the consultant) on behalf of Fortum Carlisle Ltd (the applicant).
- 1.2 The assessment supports an environmental permit application to operate an Energy Recovery Facility (ERF) located at Kingmoor, Carlisle. The site will process a maximum capacity of up to approximately 274,000 tonnes per annum of non-hazardous waste. The facility is designed to recover energy from waste, to export heat and/or electricity with a steam boiler-turbine/generator system.

2 Conclusions that lead to AQMAU recommendation

- 2.1 The consultant undertook a noise assessment and concluded that “the residential receptors are located at a relatively large distance from the site and therefore the noise contribution from site is relatively low”. Applying the BS4142² methodology, they conclude that rating levels are below the background sound levels during day (07:00 – 23:00) and night periods (23:00 – 07:00).
- 2.2 We have checked the consultant’s modelling assumptions, numerical predictions and conclusions regarding impact in accordance with BS4142. As a result of our analysis, we agree with the consultant’s conclusions provided the proposed attenuation schemes described in the report are implemented. This refers to the proposed sound insulation performance of building envelope elements such as external façades, roofs, doors, windows and ventilation openings/louvres.

3 Evidence for conclusions

Consultant’s noise impact assessment

- 3.1 The proposed ERF will be located approximately 4km to the north-west of Carlisle within the Kingstown Industrial Estate. The majority of industrial uses associated with the industrial estate are located immediately to the east of the site, with additional industrial buildings to the north and south. The area to the west of the site is relatively rural, but the Carlisle Traction Maintenance Depot (TMD) is located to the north-west, which is subject to cargo and freight train movements and other activities. The closest residential receptors are approximately 650 m to the north-west (i.e. R1 Cargo Beck) and 730 m to the south-east (i.e. R2 Lowry Hill Road). The receptors located at Cargo Beck are likely to be exposed to noise from activities associated with the Carlisle TMD, while the receptors at Lowry Hill Road are subject to activity noise from the Kingstown Industrial Estate.
- 3.2 The consultant used the acoustic modelling software CadnaA to estimate sound pressure levels at the nearest local receptors. CadnaA incorporates the ISO 9613-2³ methodology for the calculation of outdoor sound propagation. However, in the general calculation settings, the consultant has assumed no reflections (i.e. order of reflection of 0). This is unlikely and therefore we have tested sensitivity to multiple reflections (i.e. order of reflection of 3). This increases the sound levels at receptors.
- 3.3 Section 1.3 of the NIA report¹ includes a list of the equipment to be installed at the ERF. The site layout is included in Figure 2, however, we have evaluated a more detailed

¹ Noise Assessment Review for Environmental Permit for the proposed Energy from Waste (EfW) facility at Kingmoor Park, Carlisle. Report No.: R19.1109/DRK, November 2019.

² Methods for rating and assessing industrial and commercial sound, BS 4142:2019

³ ISO 9613-2:1996 Acoustics Attenuation of sound during propagation outdoors – Part 2: General method of calculation

and higher resolution site drawing⁴ that was provided to us. The period of operation for each source is presented in Appendix 3. According to the CadnaA modelling files provided by the consultant, they have considered the following sources to assess the noise impacts from the facility:

- The main building divided into ERF and Incineration Bottom Ash (IBA). These include various areas: the tipping hall, the bunker, the boiler room, the flue gas treatment, turbine hall and compressor room (i.e. ERF building) and the incineration bottom ash handling and storage areas (i.e. IBA building).
- The main stack with attenuator (silencer), modelled as a point source for the discharge of gases.
- Two additional exhausts with attenuators (silencers) at the top of the main building modelled as point sources.
- Air condensers modelled as area sources, which include wind screens above the location of the fans.
- One transformer modelled as an area source.
- Heavy Good Vehicles (HGV) for the reception, transportation and movement of waste (only during daytime operations). The site is assumed to have HGVs moving around the site 20 times per hour as a worst-case, while doors into the buildings are closed.

Having reviewed the information on site layout and description of proposed operations, we note the following:

- The additional exhausts with attenuators (silencers) at the top of the ERF building were modelled at fixed levels of 95 dB(A) at 500 Hz, which consistent with the table presented in Appendix 3 of the NIA report¹. According to the consultant's partial levels, these are the most significantly contributing sources to the overall sound levels at receptors. We have evaluated partial levels within our sensitivity.
- The consultant did not model external pumps for the tanks i.e. ammonia, water and oil tanks. According to the site layout, the water tanks are located on the northern façade of the ERF building, whereas the ammonia and oil tanks are located in an enclosed area at the south façade. We have evaluated the potential contribution of these pumps considering indicative worst-case levels from our database for similar size facilities.
- The model includes the water circuit air coolers for the water circuit inside the IBA building, adjacent to the slag area, however, these are not reflected on the site layout³. We have evaluated whether this would affect conclusions, and have determined this to be a conservative approach.

3.4 As described in the previous point, we interpret that the consultant has modelled two main sound emitting buildings, which are subdivided into areas. The subdivisions represent the variable internal sound levels inside the main buildings, according to the site layout drawing. The internal levels and insulation of the buildings are listed in Appendix 3 of the NIA report in single values, whereas their octave bands are detailed in Table 5.1 of the NIA report. We observe the following:

- The consultant modelled the internal reverberant sound pressure levels of all rooms within the main buildings assuming 85 dB(A), except for the bottom ash area, turbine and tipping halls. The upper exposure action level set out in the Control of Noise at Work Regulations⁵ at which employers must provide hearing protection

⁴ Drawing reference S2856-8000-0002 R1.0

⁵ Health and Safety Executive (HSE) available at <https://www.hse.gov.uk/noise/regulations.htm> [Accessed on October 2020]

and hearing protection zones is 85 dB(A), so this is a reasonably representative internal sound pressure level for these spaces.

- The tipping hall has been modelled as 80 dB(A) internally for daytime. During the night-time period, the consultant has assumed that the tipping hall would not be used to offload material, assuming internal levels to be 5 dB lower than during the daytime i.e. 75 dB(A).
- The bottom ash area has been modelled using 75dB(A) internally for daytime and night-time.
- For the turbine hall, although the internal levels within the turbine hall are above 85 dB(A), it is reasonable to assume low occupancy.
- We have tested sensitivity to assuming internal sound pressure levels of 85 dB(A) for the tipping hall and bottom ash area.
- In section 5.1.1 of the NIA report, the consultant refers to external building façade areas fitted with cladding. All building façades were modelled with minimum sound reductions R_w of 25 dB for roofs and 38 dB for walls, except for the turbine hall walls, which were modelled with a R_w of 41 dB. These R_w values are within reasonable values for industrial buildings.

3.5 Single values of sound pressure/sound power levels for sources at the site and sound insulation performance (R_w , dB) for cladding and other external building envelope elements (roofs, doors, windows and ventilation openings/louvres) are presented in the appendix 3. The consultant states that these noise levels are based on data from “Technology Providers on other similar projects in the UK”. Although the source of data is not fully evidenced, we consider the values are within expected ranges for this type of facility, indicatively.

3.6 The consultant carried out background sound level monitoring at three locations selected to be representative of the receptors included in the assessment: One position was used at Woodvilla and two positions were used at Lowry Hill Road. Continuous measurements at these locations were taken between Tuesday 26th and Thursday 28th April 2016 as part of their planning submission. They carried out an additional 5-day survey from Thursday 7th to Monday 11th November 2019, presenting results in Appendix 2 of the NIA report. We consider their selected LA_{90} values appropriate for daytime and night-time assessment at the selected receptors (i.e. 45 dB(A) and 40 dB(A), respectively), noting that they are based on the measured levels from the 2019 survey, which are overall lower than in 2016. We consider this to be a conservative approach.

3.7 The consultant has identified two noise sensitive receptors at Cargo Road (R1) and Lowry Hill Road (R2), both located over 650 m northwest and southeast the facility, respectively. We are satisfied that the selected sensitive receptors are representative of the nearest residential properties to the facility. We note the following:

- The receptors at Cargo Road (i.e. Woodvilla) are located in close proximity to the Carlisle Traction Maintenance Depot (TMD). This can influence the background at times. We have considered this in our evaluation of the background sound levels and the context of the specific levels in relation to the existing ambient sound climate.
- At the time of this audit, a number of public consultation responses and concerns related to noise from this facility were submitted to the Environment Agency. In consideration of these concerns, we have calculated specific levels at additional locations surrounding the facility, to evaluate whether the sound emissions arising from the operation of the site have the potential to be significant. Despite lacking background sound level measurements at these locations to interpret context, we have considered the levels measured at the survey locations to provide an

indication of the likely range of background sound levels which may be experienced at these locations. The additional residential locations considered are over 1 km from the site: Crindledyke Farm (northwest), Crindledyke Close and Maxwell Drive (north and northeast) in close proximity to the M6, Highoak House (southeast) and Coophouse Lane (southwest).

- 3.8 There are a number of off-site buildings between the site and receptors, which are either commercial or residential. We have consulted our mapping systems and identified those structures that are likely to affect the sound propagation. The consultant assumed absorption coefficients of 0.37 (i.e. reflection loss of 2 dB), however, we have assumed reasonably conservative sound absorption properties for these obstacles (absorption coefficient of 0.1 i.e. reflection loss of 0.5 dB).
- 3.9 The consultant assumed mixed sound absorption from the ground (i.e. a ground absorption of 0.5) for most of the modelling domain, except for the area inside the site boundary at which they assumed no absorption (i.e. ground absorption of 0). This is likely to be reasonably appropriate, given the land uses surrounding the site and the fact that the site itself will comprise hard, reflecting surfaces.
- 3.10 BS4142⁶ requires rating corrections to be applied to the specific sound levels to account for acoustic features such as tonal, impulsive, intermittent or other sound characteristics that can increase the significance of impact. It is noted that for a rating correction to be applied, the acoustic feature must be audible at the receptor location, not simply on the site itself. The consultant has not included acoustic penalties to derive the BS4142 rating level. We consider this is likely to be appropriate, given the significant distance between the site and the residential receptors.
- 3.11 The consultant completed a BS4142 noise impact assessment which assesses the excess of the rating levels over the measured background sound levels:
- A difference of around +10dB or more is likely to be an indication of significant adverse impact, depending on the context.
 - A difference of around +5dB is likely to be an indication of an adverse impact, depending on the context.
 - Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.

The applicant's predicted impacts are presented in Table 5 of the NIA¹. The numerical values show that rating levels are below the background sound levels by 8 dB(A) at Cargo Road (R1) and by 13 dB(A) at Lowry Hill Road (R2), which is indicative of low impact, depending on the context.

AQMAU check modelling

- 3.12 We carried out modelling checks using CadnaA based on the consultant's sound power levels, sound reduction values and other parameters contained in both the noise impact assessment and the consultant's modelling files.
- 3.13 Our conclusions consider analysis and sensitivity to the following aspects:
- Increased order of reflections from 0 to 3 (refer to paragraph 3.2).
 - Consideration to external pumps (refer to paragraph 3.3).
 - Consideration to potential inconsistencies between the site layout and the model of the IBA building (refer to paragraph 3.3).
 - Analysis of partial levels (refer to sections 3.3).

⁶ Methods for rating and assessing industrial and commercial sound, BS 4142:2019

- Assumed internal reverberant sound pressures of 85 dB(A) for the tipping hall and the ash room (refer to paragraph 3.4).
 - Sound absorption coefficient of off-site buildings and obstacles of 0.1 (refer to paragraph 3.8).
 - Additional receptors considering responses from public consultations (refer to paragraph 3.7).
 - Analysis of the existing background and ambient sound climate (refer to paragraph 3.5 and 3.11).
- 3.14 The majority of the plant will operate during daytime and night-time periods, with the exception of the Tipping Hall automatic doors, HGVs and Front Loader, which will not operate at night. As noted, the tipping hall will not be used to offload material at night, so will generate lower sound emissions than during the day. The night-time specific levels are only marginally lower than those during the day, and the background sound levels are 5 dB(A) lower than during the day at the assessment receptors. This is consistent with our checks.
- 3.15 Provided the plant and equipment achieve the sound levels proposed with the level of attenuation specified in the consultant's NIA report, despite finding rating levels slightly higher than those from the consultant, we find that impacts from the facility are low.
- 3.16 In our consideration of the context of sound emissions from the site in relation to the existing sound climate, residual sound levels (L_{Aeq} , dB) are higher than site specific levels at sensitive receptors, suggesting that operations from the facility are not likely to be audible in relation to the existing sources which make up the existing sound climate, such as the existing industrial, railway and general road traffic sources. The receptors surrounding the facility are sufficiently far away from the site to ensure the impact from the operation of the site will be low.