

AQMAU Reference: AQMAU-C1745-WD01

Project Title: Industrial Power Limited 2nd follow-up

Work title: Audit of air quality impact assessment

Date Requested: 18 December 2018

AQMAU Response Date: 17 January 2019

AQMAU Recommendation	Conditions/Noted
<ul style="list-style-type: none">The consultant's predictions and conclusions can be used for permit determination.	<ul style="list-style-type: none">At the MCPD existing plant ELV of 190 mg/Nm³ for natural gas engines.With a 35 m stacks for the tri-generation plant the site is not likely to make significant contribution to an exceedance.Where PCs are not insignificant at habitat sites the designated species are unlikely to be sensitive to site emissions.

Detailed response and evidence starts on Page 2.

1. Summary of Work Request

- 1.1. The Environment Agency's Installations team of the National Permitting Services (NPS) in Solihull asked the Air Quality Modelling and Assessment Unit (AQMAU) to audit a revised air quality assessment¹. The assessment was completed by WYG (the consultant) on behalf of Industrial Power Ltd (the applicant) and is an update to their previous air quality assessment².
- 1.2. The applicant is applying for a permit to operate a tri-generation power plant, which is a directly associated activity to a chemicals works.
- 1.3. This audit report is a follow-up to the AQMAU audit reports AQMAU-C1727-RP01³ and AQMAU-C1684-RP01⁴. C1727 identified that the impacts were underestimated at the nearby Thurrock Air Quality Managements Areas (AQMA) and not insignificant impacts were predicted at West Thurrock Lagoon & Marshes SSSI.

2 Conclusions that lead to AQMAU recommendations

- 2.1 The consultant concludes that: "the predicted concentrations of the modelled pollutants from the power plant operations are considered acceptable for the protection of human health, vegetation and habitats."
- 2.2 We have audited the applicant's revised air quality assessment and have made observations with regard to their modelling methods and assumptions. We have conducted our own check modelling and sensitivity analysis to our observations. As a result of the audit checks, we find that:
 - The annual NO₂ process contributions (PCs) are not insignificant at some receptors where the background is likely to be approaching the environmental standard.
 - We do not agree with the exact numerical predictions. However, the proposed site is not likely to make a significant contribution to an exceedance.
 - The annual NO_x PCs are not insignificant at West Thurrock Lagoon & Marshes SSSI. However, the designated species are not sensitive to NO_x, nutrient nitrogen and acid impacts on the broad habitat.
 - The proposed gas engines emission concentration complies with the existing plant Emissions Limit Value (ELV) from the Medium Combustion Plant Directive⁵ (MCPD) of 190 mg/Nm³ (at 273.15 K, dry and 15% oxygen). Existing plant are those operational before 20 December 2018. The proposed engines qualify as existing engines under the MCPD.

¹ Industrial Power Limited, New Tri-Generation Power Plant at Stoneness Road, West Thurrock RM 20 3AG – Air Quality Assessment in Response to Environment Agency Schedule 5 Notice – Report Update to Respond to the EA's comments, December 2018 (WYG)

² Industrial Power Limited, New Tri-Generation Power Plant at Stoneness Road, West Thurrock RM 20 3AG – Air Quality Assessment in Response to Environment Agency Schedule 5 Notice, November 2018 (WYG)

³ AQMAU-1727-RP01, Industrial Power Limited follow-up, Audit of air quality impact assessment, AQMAU response date: 04 December 2018

⁴ AQMAU-1684-RP01, Industrial Power Limited, Audit of air quality impact assessment, AQMAU response date: 02 October 2018

⁵ DIRECTIVE (EU) 2015/2193 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 25 November 2015 on the limitations of emissions of certain pollutants into the air from medium combustion plants

2.3 We therefore agree with the consultant's conclusions.

3 Evidence for recommendations

Air quality impact assessment

- 3.1 The consultant used air dispersion modelling software Breeze AERMOD, version 7.11. They used 2015 US EPA AERMOD executable (version 15181). We have conducted checks using the most up to date version of Breeze AERMOD, version 8.1 and implementing the 2018 US EPA AERMOD executable (version 18081). We agree with the consultant that there will be no significant difference in predictions between the two versions for the proposed site.
- 3.2 The consultant used 3 years of meteorological data observed at Gravesend, Broadness, between 2014 and 2016. This met site is located approximately 8 km southeast of the proposed tri-generation plant and is likely to be reasonably representative of the meteorological conditions.
- 3.3 There are six natural gas fired reciprocating engines proposed. They state that all six engines would only run between November and February under Triad avoidance. Their electric consumption records checks indicates Triad operations to be infrequent (up to 20 hours in 2016-17) and only for a single hour per day. They have therefore not considered all six engines operating and instead have assessed the following scenarios:
- Scenario 1 - average electricity consumption scenario with 4 engines in use.
 - Scenario 2 - maximum electricity consumption scenario with 5 engines in use.
- 3.4 The waste gasses from groups of 3 engines are sent to a waste heat recovery boiler, of which there are two. The emissions are then emitted through a stack on each boiler. The stacks are 4.6 m apart with a diameter of 1.2 m. The consultant has assumed the plumes from the two stacks will combine into a single point source. We agree with this approach. The stacks have been increased from a height of 13 m to 35 m in the revised assessment to aid dispersion of the tri-generation plant emissions.
- 3.5 The consultant has also modelled the Ferric Sulphate Plant NO_x emissions, based on measured annual mean concentration of 85.9 mg/m³.
- 3.6 The consultant has assumed the NO_x engine emission concentration is 500 mg/Nm³ at 273.15 K, dry and 5% oxygen. This emission concentration complies with the MCPD existing natural gas engine ELV of 190 mg/Nm³ at 273.15 K, dry and 15% oxygen. Existing plant in MCPD are those which are operational before 20 December 2018. The proposed engines are refurbished and therefore qualify for the existing plant ELV, despite the site operating after 20 December 2018.
- 3.7 We have checked the consultant's emission and stack parameters and find that the derived emission rates are internally consistent.
- 3.8 The consultant modelled the effects of buildings on the dispersion of emissions because there are a number of buildings and storage tanks nearby that could cause building downwash effects.
- 3.9 The consultant has assumed flat terrain. The gradients are less than 1:10 around the site. We agree with this approach.

- 3.10 The consultant has assumed sectorised surface roughness lengths of 0.5 m to represent industrial land and 0.0001 m to represent the water of the Mersey Estuary. Surface roughness is a parameter used in dispersion modelling to express the land surface characteristics that influences the mechanical turbulence. The site is located in mixed urban and industrial location on the outskirts of London. Typically a surface roughness of 1.0 m is used to represent urban locations. We have conducted sensitivity analysis to a value of 1.0 m and 0.1 m, as well as the same sectorised values as the consultant.
- 3.11 The consultant has increased the number of discrete receptors from 39 to 53 in their revised assessment. These include 39 human receptors, 20 of which are located in the nearby AQMAs. 14 receptors represent conservation sites within the relevant screening distances⁶. We note that Lion Pit SSSI is designated for its geological features and therefore is not sensitive to air quality impacts.
- 3.12 The consultant has reviewed NO₂ background data from a number of sources, including, nearby continuous monitors, Defra Local Air Quality Management 1 km² background maps and local diffusion tube measurements. They have used these data along with ADMS Roads modelling of traffic emissions to calculate bespoke background concentrations for each discrete receptor, see Table 6.1 of their assessment. Their background concentrations range from 27.97 to 37.56 µg/m³, with higher values in the range approaching the annual mean standard at receptors in the AQMAs. Their approach is comprehensive, but it is not possible to have complete confidence in the exact numerical values due to the uncertainties associated with monitoring and modelling concentrations. However, we do agree that the background is likely to be at or approaching the annual NO₂ standard within the AQMA. The Local Authority (LA) 2018 Air Quality Annual Status Report⁷ (ASR) also indicates this is the case. The LA diffusion tube measurements at WT and LRSS when adjusted to relevant public exposure locations are 35.7 and 37.8 µg/m³ respectively (Table B.1 of ASR).
- 3.13 The consultant has assumed 35% of the NO_x will be converted to NO₂ for short-term hourly assessment. A revised case specific long-term ratio of 50% conversion for annual assessment has been assumed. Their long-term conversion ratio is based on evidence presented in an Environment Agency Science Report: SC030171/SR2⁸. We agree that urban areas such as London are likely to be ozone (O₃) limited due to the large NO_x concentrations, mainly from road traffic sources. We have conducted sensitivity analysis to consultant's assumed long-term ratio and conducted chemistry modelling using hourly data from the Thurrock urban background monitoring site. The 2017 annual mean data from Thurrock monitoring site are 28.3, 49.7 and 37.2 µg/m³ for NO₂, NO_x and ozone respectively. The ozone is likely to be lower in the nearby AQMAs as a result of road traffic emissions. The Thurrock urban background data is therefore still likely to lead to conservative NO_x to NO₂ conversion ratios.
- 3.14 The consultant's highest predicted PC under Scenario 2 at human health receptor is up to 6.6% of the annual NO₂ standard of 40 µg/m³. At receptors within the AQMA the predicted PCs for scenario 1 and 2 are up to 4.8%. Their

⁶ <https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit#screening-for-protected-conservation-areas>

⁷ 2018 Air Quality Annual Status Report (ASR) – In fulfilment of Part IV of the Environment Act 1995, Local Air Quality Management, September 2018 (Thurrock Council)

⁸ Review of methods for NO to NO₂ conversion in plumes at short ranges, Science Report:SC030171/SR2, November 2007 (Environment Agency)

Predicted Environmental Concentrations (PECs) are all below the annual mean standard, with a maximum of 96%. Their hourly mean 99.79th percentile PECs are all below the hourly NO₂ standard.

- 3.15 The consultant predicts insignificant impacts at Thames Estuary & Marshes SPA and Ramsar site. They also predict insignificant impacts, less than 100% at the nearby local wildlife sites. Their predicted Scenario 2 PCs at West Thurrock Lagoon and Marshes SSSI is up to 9% of the annual NO_x critical level of 30 µg/m³. Their PEC is up to 27.4 µg/m³, approximately 91% of the critical level. Their daily NO_x, nutrient nitrogen and acid deposition are not predicted to exceed the critical level and critical loads at West Thurrock Lagoon and Marshes SSSI.
- 3.16 They conclude that: “the predicted concentrations of the modelled pollutants from the power plant operations are considered acceptable for the protection of human health, vegetation and habitats.”

AQMAU check modelling

- 3.17 We have carried out detailed check modelling and sensitivity analysis using Breeze AERMOD, version 8.1. Our checks were based on the consultant’s modelling files and meteorological data observed at London City Airport from 1993-1997.
- 3.1 Our check modelling included sensitivity analysis to:
- Scenarios 1 and 2
 - A number of alternative surface roughness lengths
 - Long term NO_x to NO₂ conversion ratios of 50%
 - NO_x to NO₂ conversion derived from ozone chemistry modelling using AERMOD PVMRM method
- 3.18 Our checks indicate that the PCs are not insignificant within the nearby AQMAs and the PEC is approaching the standard. The PCs are conservative and likely to be less than 5% in the AQMA. The background concentrations at these receptors will be dominated by road traffic and the long-term NO_x to NO₂ conversion is likely to be less than the 50% assumed. Analysis of the LA background data indicates that there is some headroom at the relevant public exposure locations. Therefore the site impacts are not likely to make a significant contribution to an exceedance.
- 3.19 Our checks indicate that we agree that the impacts are insignificant at Thames Estuary & Marshes SPA and Ramsar site and the nearby local nature sites. We also agree annual NO_x PCs are around 10% at Thurrock Lagoon and Marshes SSSI. The PEC is likely to be high (90% or more) at the worst affected area of the SSSI. Site relevant APIS⁹ data indicates that the designated species at Thurrock Lagoon and Marshes SSSI are not sensitive to NO_x, nutrient nitrogen and acid impacts on the broad habitat. Consultation with Natural England is therefore not likely required for this permit application.

⁹ <http://www.apis.ac.uk/>