



Connah's Quay Low Carbon Power Station

Environmental Permit Application Response to Schedule 5 Letter

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Prepared for:
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Prepared by:
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Glossary

Abbreviation	Term
AGI	Above-Ground Installation
BAT	Best Available Techniques
BAT AEL	Best Available Technique-Associated Emission Level
BAT-AEEL	Best Available Technique Associated Energy Efficiency Level
BATc	Best Available Technique Conclusions
BRef	Best Available Techniques Reference Document
CCGT	Combined Cycle Gas Turbine
CCP	Carbon Capture Plant
CCS	Carbon Capture Storage
CEMs	Continuous Emissions Monitoring System
CO	Carbon Monoxide
CO ₂	Carbon Dioxide
CQPS	Connah's Quay Power Station
DCC	Direct Contact Cooling
DCO	Development Consent Order
DLN	Dry Low-Nox
ELV	Emission Limit Value
EMS	Environmental Management System
ENI	Operator of the CO ₂ transport and storage network.
EPR	Environmental Permitting Regulations
FEED	Front-End Engineering Design
g	Gram
GT	Gas Turbine
GTP	Gas Treatment Plant
GW	Gigawatt
ha	hectare
HP	High Pressure
HRSGs	Heat Recovery Steam Generators
HVO	Hydrotreated Vegetable Oil
IED	Industrial Emissions Directive
LCP	Large Combustion Plant
LNB	Low NOx Burners
MCERTs	Monitoring Certification Scheme
MCP	Medium Combustion Plant
MW	Megawatt
MWe	Megawatt Electrical
MWth	Megawatt Thermal
N ₂	Nitrogen

Abbreviation	Term
NH ₃	Ammonia
NO _x	Oxides of Nitrogen
NRW	Natural Resources Wales
O ₂	Oxygen
OEM	Original Equipment Manufacturer
SCR	Selective Catalytic Reduction
T&S	Transport and Storage

1. Introduction

1.1 Report Context

This report has been prepared by AECOM Limited ('AECOM') on behalf of Uniper UK Limited, referred to as 'the Operator', in support of the new bespoke Environmental Permit application for the proposed Connah's Quay Combined Cycle Gas Turbine (CCGT) with Carbon Capture Plant (CCP) ("Proposed Installation").

1.2 The Proposed Installation

The design of the Proposed Installation is subject to ongoing technical studies, to provide flexibility and to align with the current grid connection, but it is expected to comprise the development of up to two CCGT units achieving a net electrical output capacity of up to 1,380 megawatts (MW; referred to as MWe for electrical output) (with CCP operational) onto the national electricity transmission network.

The Proposed Installation will generate electricity from combustion of natural gas within a CCGT. Hot exhaust gas from the combustion process will be used to drive the gas turbine (GT), and steam which will be generated from the heat of the exhaust gas, in the heat recovery steam generator (HRSG), will be used to drive the steam turbine (ST). The exhaust gas will then pass through pre-treatment stages, including selective catalytic reduction (SCR) using ammonia (NH₃) to reduce oxides of nitrogen (NO_x) in the gas and be subsequently cooled via a direct contact cooler (DCC), in the CCP. The CCP will use an amine-based solvent to absorb carbon dioxide (CO₂) from the exhaust gas within a packed column (absorber), via a weak acid-base reaction. The CO₂-depleted exhaust gas then passes through water and acid wash sections and is released to atmosphere via a stack. Continuous Emissions Monitoring System (CEMs) equipment will be located within the stack to monitor pollutants to air.

The CO₂-rich solvent exits the absorber, and passes through a lean/rich heat exchanger, and then into the desorber. The CO₂ is liberated from the solvent by heat, supplied by low pressure steam from the HRSG in normal operation. This steam is supplied to the desorber reboiler. The now lean/rich solvent will be recirculated within the plant. The CO₂ rich vapour exits the top of the desorber, and passes through a reflux stage to maximise solvent-CO₂ separation. The CO₂ vapour is conditioned to reduce water and oxygen to transport and storage network's specifications after entering a low-pressure compressor to compress the gas to export pipeline pressure (8-43 Bara). The CO₂ is then metered and exported to transport and storage network's CO₂ pipeline which is operated by ENI. The solvent will accumulate impurities over time, and these will be removed via a solvent reclaiming process which will be a thermal process, either continuously via a slipstream or as a batch process.

The CCP emissions will be residual pollutants from the combustion and treatment processes, including NO_x, NH₃ and carbon monoxide (CO). The CCP will be designed to capture a minimum of 95% of the CO₂ emissions from the CCP as an annual average of all normal operating conditions. There may also be trace pollutants within the flue gas, including trace levels of solvent and solvent break-down products from within the process. Emissions will be minimised using the water and acid wash steps on the absorber and monitored at the emission point within the abated flue gas stack prior to release. In addition to the CCP emission point, there will be an intermittent-use emission point from the stack, serving the HRSG exhaust. Emissions from the CCP emissions stack, and HRSG stack will meet the emission limits for LCP under the Industrial Emissions Directive.

Other supporting infrastructure and plant to the Proposed Installation will include the storage of solvent, caustic soda, sulphuric acid and water-treatment chemicals, demineralisation water treatment plant to produce high-purity water for use in boilers, blending, closed loop cooling and other processes. It will include an electric auxiliary boiler for start-up and dispatchability support, emergency diesel generators for safe shutdown during a power failure scenario, closed surface water drainage and appropriate treatment facilities, and infrastructure for natural gas import and conditioning and CO₂ conditioning and export. The number and thermal rating of the emergency generator(s) will be determined during detailed design and will be classed as medium combustion plant (MCP).

The Proposed Installation will also be supported by natural gas supply, existing potable water supply, existing water abstraction and discharge, electrical connections, utilities, access works and CO₂ export connection. The water abstraction for the Proposed Installation's cooling system will be in line with the extraction at the existing Connah's Quay Power Station and is not expected to exceed the current abstraction permit requirements. Process water and/or wastewater from the site will also be discharged to the existing Connah's Quay Power Station lagoon before being purged into the River Dee.

The Proposed Installation will make use of CO₂ transport and storage networks owned and operated by Liverpool Bay CCS Limited, currently under development as part of the HyNet Carbon Dioxide Pipeline Project (referred to as the 'HyNet CO₂ Pipeline Project'), which will transport CO₂ captured from existing and new industries in North Wales and North-West England, as well as from new hydrogen production facilities that are proposed as part of HyNet North West Project. The captured CO₂ will be stored in depleted offshore gas reservoirs in Liverpool Bay.

The Proposed Installation will be designed to optimise the capture of CO₂ when operating in dispatchable mode, while minimising emissions and waste generation and maximising energy efficiency. BAT assessments have been prepared to demonstrate the Proposed Installation will be designed and operated in accordance with BAT for Large Combustion Plant (LCP), Energy Efficiency (EE), Post-Combustion Carbon Capture (PCC) plant design and Cooling.

1.3 Scope of this Response

The application for an environmental permit was submitted on the 30th January 2026 to Natural Resources Wales (NRW).

As a result of the determination process NRW has issued a request for additional information (ref Letter dated 16/06/2026) under the Environmental Permitting Regulations 2016, as amended.

This report provides the response to the questions: raised by NRW namely:

- Question 1.2 – Amine Solvent Environmental Assessment Levels
- Question 2 – Ecological Receptors
- Question 4 – Noise Impact Assessment and Modelling
- Question 5 – Black Start Generation Plant Under Grid Code Requirement GC0156.

Information contained in this report will form part of the application information. The report is supported by updated application documents which are provided in the appendices of the report. Where relevant the updated application documents will supersede the original submitted documents.

A further response will be provided by the 25th September 2026 providing:

- An updated Air Quality assessment in response to cumulative assessment requirements in response to Questions 1.3 and question 3.
- A separate Appendix detailing the Air Quality Assessment of the back-up generators in response to Question 1.2.

2. Responses to Schedule 5 Questions

2.1 Question 1: Air Quality Impact Assessment and Modelling

2.1.1 Q1.1 Emergency Diesel Generators 5 x 6.25MWth

The Environmental Permit Application Volume 3 Air Quality Assessment and associated modelling files do not include any predicted emission concentrations for the 5 x 6.25 MWth emergency diesel generators.

Please explain the testing frequency and duration for the emergency generators and the proposed testing (and operating) regime (e.g. one engine at a time, all engines tested at the same time etc.)

Update the air quality impact assessment and modelling to ensure that the estimated contribution of emissions to air from the generator testing and operating regime is included. This is required so that the overall impact of proposed site emissions can be assessed.

Uniper Response

A separate air quality dispersion assessment of the emergency back-up generators both for testing/maintenance and for all the generators operating simultaneously for 72 hours as a reasonable worst-case scenario is currently being progressed.

The completed dispersion assessment report and associated modelling files will be provided by the 25th September 2026 as a separate appendix to the Updated Dispersion Modelling Report.

2.1.2 Question 1.2 Amine Solvent Environmental Assessment Levels (EALs)

- i. *The air quality assessment is supported by document “Annex F – Feed 1 Contractor Supporting Information for the Assessment of Amines and Amine Degradation Products” This document explains that the FEED 1 contractor proposes to use an Amine (Amine 1) called 2-amino-2-methyl-1-propanol (AMP) (CAS No. 124-68-5). There is no published Environmental Assessment Level (EAL) for AMP, and the consultant has used the EAL for Monoethanol Amine (MEA) (CAS No. 141-43-5). The justification for this in Section 2.1.3 of the document indicates that the calculated AMP EAL is higher than the published MEA EAL.*

“Please confirm if the AMP EAL in the Annex F document was calculated using the Tolerable Concentrations In Air method detailed in the Environment Agency’s “Methodology for the scientific derivation of environmental assessment levels” as referenced in the Environment Agency Air Emissions Risk Assessment for your Environmental Permit webpage.

If the above Environment Agency method has been used, please provide a sufficiently detailed explanation of how you have derived the AMP EAL (as required by the guidance) to enable an audit of the value proposed. Otherwise please propose an EAL for AMP in accordance with this guidance, also with sufficiently detailed explanation of derivation to enable verification of the value used”.

Please also provide further justification on the use of the MEA EAL as a surrogate for assessing Amine 1 process contributions, in terms of chemical structure and similarity. Please outline if other surrogates were considered and why MEA is the most appropriate.

- ii. *The Annex F document contains Table 2 – “FEED 1 Contractor Solvent Degradation Products”. The table includes four possible amine degradation products, specifically:*

- Methylamine (MA) (CAS No. 74-89-5)*
- Dimethylamine (DMA) (CAS No. 124-40-3)*
- Diethylamine (DiEA) (CAS No. 109-89-7)*
- Ethylamine (EA) (CAS No. 75-04-7)*

These individual amine degradation products have not been assessed against individual EALs. Please therefore provide an assessment of these four amine degradation products against their associated EAL where available. Where there is no published EAL, one should be derived using the Environment Agency’s methodology mentioned above. A full written justification shall be provided if these four amine degradation products are not included in the assessment.

- iii. *Table 5-6 of the Environmental Permit Application Volume 3 Air Quality Assessment presents the “Predicted Process Contribution 1-hour Maximum Total Amines Concentrations (assessed against ES based on NDMA (CAS No. 62-75-9)) for the proposed Abated FEED 1 Scenario”. Although the title of the table refers to the N-nitrosodimethylamine (NDMA) EAL, this does not match the information presented in the table. The Environment Agency EAL for NDMA is 2 ng/m³ (annual mean), whereas the table indicates that the predicted process contributions have been assessed against an environmental standard of 400 µg/m³.*

Please provide written clarification of how the table should be interpreted or provide an amended table if necessary.

- iv. *The Environmental Permit Application Volume 3 Air Quality Assessment contains Tables 5.8 and 5.20. Table 5.8 presents the Predicted Process Contribution Annual Mean Total*

N-Amines Concentrations (assessed against ES based on NDMA) for the proposed Abated FEED 1 Scenario. Table 5-20 presents the Predicted Process Contribution Annual Mean N-Amines Concentrations (assessed against ES based on NDMA) for the proposed Abated FEED 2 Scenario.

Please confirm if the results presented in these tables include both direct and indirect N-amine emissions, as our check modelling predicts higher N-amine contributions.

Uniper Response

- i. The AMP EAL in the Annex F document was calculated using the EA "Methodology for the scientific derivation of environmental assessment levels". An explanation of how the AMP EAL was derived has been provided by the FEED contractor and is presented in Appendix A to this document.
- ii. In relation to the individual amine degradation products, a justification of why these species were not included in the air dispersion assessment has been prepared and is presented in Appendix B to this document.
- iii. We can confirm that the assessment of NDMA was completed using the correct EAL of 0.2 ng/m³ (annual mean) and that the report contained a typographical error. This will be corrected in the air dispersion assessment reports which will be provided to respond to questions 1.3 and 2.
- iv. We can confirm that the results presented in Tables 5-8 and 5.20 of the Air Quality Assessment Report include both direct and indirect N-amine emissions.

2.1.3 Question 1.3 Assessment of cumulative impact of amines on human health

The Environmental Permit Application Volume 3 Air Quality Assessment, Annex D explains that a cumulative assessment has been conducted both considering background air quality data for the area and emission sources that are yet to operate. The cumulative assessment against human health environmental standards is presented for amines and N-amines. At the time of submission, information for some of the proposed developments identified within scope of the assessment was not available (e.g. ID 38: Enfinium Parc Adfer ERF Carbon Capture, SCO/000970/23). However, we are now aware of several active applications for EPR Environmental Permits, which may also be associated with amine emissions to air.

Please update the cumulative assessment for amines and associated degradation products N-amines to include the following for Feed 1 and Feed 2:

- *PAN-026621 Castle Cement Limited – emissions related to this application to add a carbon capture plant to the permit;*
- *PAN-030272 Enfinium Parc Adfer Operations Limited – emissions related to this application to add a carbon capture plant to the permit; and*
- *PAN-033018 Knauf Insulation Limited – application for a new rock mineral wool installation.*

Uniper Response

An in-combination assessment of the impact of amines from the above identified developments on human receptors is being progressed. The completed dispersion assessment report and associated modelling files will be provided by the 25th September 2026.

2.2 Question 2 Ecological Receptors

2.2.1 Question 2.1 Halkyn Mountain (Special Area of Conservation)

Ecological Receptors OE18 (Halkyn Mountain SAC, SSSI) and OE28 (Herward Smithy SSSI) have been selected as the modelling points representative of the overall Halkyn Mountain SAC. Receptor OE18 is located approximately 10.3km to the northwest of the proposed installation, whilst receptor OE28 is located approximately 7.9km to the northwest. However, the closest point of the SAC to the proposed installation is located just under 6km to the southwest.

This eastern portion of the SAC contains features that are sensitive to the pollutants being assessed. Therefore, please either:

- *Provide justification to explain why the features at receptors OE18 and OE28 can be considered to be the most precautionary of the entire SAC;*

Or

- *update and resubmit the Air Quality Assessment report (and associated modelling files) to ensure that the most sensitive features and / or those which may be exposed to the highest predicted pollutant concentrations at the SAC are represented.*

Uniper Response

Although figure 3 appears to only show the above two points for the overall Halkyn Mountain SAC, we can confirm that several different receptor points were modelled (see the receptor file for the list). An updated figure 3 will be provided with the Air Dispersion Assessments being prepared for this response to ensure this is clearer.

2.2.2 Question 2.2 Sites of Special Scientific Interest (SSSIs)

Glaswelltiroedd Eryrys (Eryrys Grasslands) SSSI is identified on the plan of ecological receptors provided ("CQ_EPA_Fig6...0119_01.pdf") but is not included as a modelled receptor in the "Environmental Permit Application Volume 3 Air Quality Assessment" and associated modelling files. Please update the air quality assessment and associated modelling files to include this receptor for completeness.

Uniper Response

Both Bryn Alyn SSSI and Glaswelltiroedd Eryrys (Eryrys Grasslands) SSSI were represented by OE15 as they are located next to each other and present the same sensitivity to ammonia and nitrogen according to APIS

This will be clarified in the updated Air Dispersion Assessments that will be provided by the 25th September 2026.

2.2.3 Question 2.3 Non-Statutory Sites Habitats Screen

National Nature Reserves, Local Nature Reserves, Local Wildlife Sites (SINCS), and Ancient woodland are defined as non-statutory protected sites for the purposes of environmental permitting. There are no National Nature Reserves or Local Nature Reserves within the 2km screening distance used. However, there are 3 x Local Wildlife Sites and 17 x Ancient Woodlands within this radius.

The Local Wildlife Sites are:

- *Top-y-Fron Dingle and Kelsterton Brook*
- *Leadbrook Wood*
- *Cheshire Farm Wood*

These have been identified on "CQ_EPA_Fig6...0119_01.pdf" but are not listed as modelled receptors in the "Environmental Permit Application Volume 3 Air Quality Assessment" and associated modelling files.

Also, none of the 17 x Ancient Woodlands within 2km of the proposed installation have been included as modelled receptors in the "Environmental Permit Application Volume 3 Air Quality Assessment" and associated modelling files. The only Ancient Woodland(s) identified in Table 3.5 of the Air Quality Assessment are located approximately 3.6 km from the proposed installation stacks which is outside the screening radius for this type of site.

Please update and resubmit the Air Quality Assessment report and associated modelling files to ensure that the most impacted Local Wildlife Sites and Ancient Woodlands within 2km of the proposed installation are assessed.

Uniper Response

The local wildlife sites and ancient woodland have been captured and represented in the modelling assessment by OE30 (highest impact from all the grid points located within the sites). We have included an explanation of this within the modelling assessments being produced in response to this Schedule 5.

2.3 Question 3 European Habitats Sites – In-Combination Assessment

The Environmental Permit Application Volume 3 Air Quality Assessment, Annex D presents an assessment of the predicted cumulative impacts of pollutant species from other “plans or projects” that may act in-combination with the proposed installation at the ecological sites identified within a 15km screening radius.

The Annex D assessment considers the following “plans or projects” whose emissions may combine with those from the proposed installation to cause a potential impact at the habitats sites:

- *Shotton Paper Mill*
- *Padeswood Cement Works*
- *New Paper Processing Mill.*

However, we are aware of several other environmental permit applications for developments in proximity to the proposed installation which must be included in the in-combination assessment. On this basis, please update and resubmit the air quality assessment report and associated modelling files to include a full in-combination assessment for the ecological features located at all European Habitats sites (i.e. SAC, SPA and Ramsars) identified within the 15km screening distance of the proposed installation and potentially also impacted by aerial emissions in the same area from other projects with reference to their own screening distances.

The in-combination assessment shall consider the Critical Levels (CL_e) for:

- *nitrogen oxides expressed as nitrogen dioxide (annual mean),*
- *nitrogen oxides expressed as nitrogen dioxide (daily mean), and*
- *ammonia (annual mean).*

The in-combination assessment must also consider the relevant Critical Loads (CL_o) for nutrient nitrogen deposition and acid deposition. The CL_o's for both are expressed as annual means.

The in-combination assessment shall include all modelled process contributions (PCs) that ‘screen out’ as insignificant (i.e. they are less than 1% or 10% of the corresponding critical levels / loads) and all modelled Predicted Environmental Concentrations (PECs), which though not adverse on their own, could be significant when considered in combination with the effects of other plans or projects.

The permit applications which need to be included are listed below with their NRW “PAN” numbers which enable them to be searched on our online public register at [this link](#). You will need to locate the associated Air Quality Impact Assessments for these applications (some of which have already been included in your analysis):

- *PAN-021584 - Industrie Cartarie Tronchetti UK Limited - emissions related to this application for Phases 1 and 2 of the development only. (The site has not yet been constructed, and so emissions are not considered to form part of the background concentration);*
- *PAN-026621 Castle Cement Limited – emissions related to this application to add a carbon capture plant to the permit;*
- *PAN-029803 Shotton Mill Limited – emissions related to this application to convert the site to the production of containerboard and tissue paper;*
- *PAN-028894 Deeside SPV Limited – emissions related to this application for a new anaerobic digestion plant permit;*

- ***PAN-028461 Deeside Power UK Limited – emissions related to this application to convert the operation from a baseload power plant to a peaking power plant***
- ***PAN-030272 Enfinium Parc Adfer Operations Limited – emissions related to this application to add a carbon capture plant to the permit; and***
- ***PAN-033018 Knauf Insulation Limited – application for a new rock mineral wool installation.***

You shall also determine whether there any other plans or projects (within a 15km radius of the proposed Connah's Quay Low Carbon Power Station) that may be relevant, such as other applications for planning permission with an air quality / nitrogen emission potential (i.e. same pollutants modelled as for the proposed installation).

Uniper Response

An in-combination assessment of the impact of the above identified developments on ecological receptors is being progressed. The completed dispersion assessment report and associated modelling files will be provided by the 25th September 2026.

2.4 Question 4 Noise Impact Assessment Modelling

The Environmental Permit Application Volume 3, Appendix I: Noise Impact Assessment (March 2026) and associated modelling files do not include any predicted sound levels for the 5 x 6.25 MWth emergency diesel generators. Please update the Noise Impact Assessment and Modelling to ensure that the predicted sound contribution from the generator testing and reasonable worst case operating regime is included. This is required so that the overall impact of proposed noise levels can be assessed.

Uniper Response

Noise modelling of the operation of the emergency diesel generators for both testing/maintenance and to cover a black start capability period of 72 hours as a reasonable worst case has been completed. The assessment report is presented in Appendix C and the modelling files are presented separately with this response.

2.5 Question 5 Black-start Generation Plant Under Grid Code Requirement GC0156

We are aware that the National Energy System Operator (NESO) Grid Code modification GC0156 requires certain energy generation sites to provide sufficient back up generation capability for a minimum of 72 hours. The purpose of this requirement is to keep power stations operationally ready in the event of a partial or total shutdown of the electricity network. We understand that this is a mandatory requirement that must be met by 31st December 2026.

In view of this, please explain how this capability will be provided at the proposed installation and specifically if it will be achieved by using the auxiliary boiler and / or 5 x emergency diesel generators (item 1.1 above) or by different means. If it will be achieved via the emergency diesel generators, this may be an example of a reasonable worst case operating scenario that is considered under items 1.1 and 4 above. If the requirement will be met by different means, the contribution to air quality impact and sound levels at sensitive receptors must be included in the respective modelling reports and associated files.

Uniper Response

It can be confirmed that the back-up generation capability will be provided from the operation of the 5 emergency generators. In terms of the assessments:

- The separate dispersion assessment prepared for the diesel generators in response to question 1.1 in section 2.1.1 above will include the assessment of all generators operating simultaneously for 72 hours as a reasonable worst case scenario. The dispersion assessment report will be provided by the 25th September 2026.
- The separate noise modelling assessment of the operation of the emergency diesel generators for a black start capability period of 72 hours as a reasonable worst case has been completed. The assessment report is presented in Appendix C and the modelling files are presented separately with this response.

Appendix A Derivation of the AMP EAL



Memorandum: Uniper Connah's Quay Low Carbon Power

To: Stephen Griffiths, Uniper UK Limited
From: Andrew Kong, SLB Capturi Limited
Copy: Jacob Nygaard Knudsen, Muhammad Zeeshan, Nadya Leviana, Daniel Kunisch Eriksen, Jonathan Spence, Andrew Bethell, Lisa Gough
Date: 9th July 2026
Subject: Derivation and Justification of AMP Environmental Assessment Levels (EALs)

Disclaimer:

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Background and Purpose

This memorandum provides the derivation and justification of 2-amino-2-methylpropanol (AMP) proposed Environmental Assessment Levels (EALs):

- AMP Long-term EAL: 0.1 mg/m³
- AMP Short-term EAL: 0.7 mg/m³

2-amino-2-methylpropanol (AMP) is not currently included within the UK Environment Agency's (EA) published EAL dataset. In the absence of a defined value, Long Term and Short Term EAL values have been derived following the general approach outlined in EA guidance [1], using available toxicological information from the European Chemical Agency (ECHA) registration dossier [2].

1. Toxicological Basis

The ECHA dossier contains several toxicological studies on AMP. The following studies have been assessed as the most relevant points of departure for exposure to AMP ([2], see Attachment 2):

- **For Short-term exposure:** Sullivan (2017) [2a] Inhalation study:
 - o Nose-only exposure of rats to AMP aerosol (10% AMP solution in water) for 6 hours/day for 5 days at 700 to 2000 mg AMP/m³. Determined a Lowest Observed Adverse Effect Concentration (LOAEC) for both sexes of rats of 700mg/m³.¹
- **For Long-term exposure:** No long-term systemic inhalation studies are available. There are several oral repeat dose animal studies dosing AMP-HCl² to rats and dogs investigating long-term systemic effects. The two longest key studies which successfully determined a No Observed Adverse Effect Level (NOAEL) and investigated liver histopathology (the key end-point systemic effect of AMP) at all dose levels are ([2], see Attachment 2):
 - o Millard (2021) [2c], rats dosed over 18 weeks daily: NOAEL: 71 mg AMP / kg bw/day
 - o Lankas (1981) [2b], dogs dosed over 14 weeks daily: NOAEL: 17 mg AMP / kg bw/day

2. Long-term EAL Derivation for AMP

The Lankas (1981) [2b] study with long term repeat-dosing of dogs is selected as the more conservative point of departure: a NOAEL of 17 mg / kg bw/day oral dose is used as the initial basis. The following derivation steps following EA guidance [1] are then applied (see method flow in Attachment 1).

1. Route-route extrapolation to air inhalation:

Assuming no difference in bioavailability between inhalation and oral dose and:

- using the average body weight of beagle dogs used in the Lankas (1981) study (9.35kg) ([2b], see Attachment 2)³,
- assuming a beagle dog respiratory inhalation rate of 6m³/day (approx. 4L/min, see [3]) the No Observed Adverse Effect Concentration (NOAEC) is determined:

$$NOAEC = \frac{NOAEL (mg / kg bw/day) \times Body Weight (kg)}{Inhalation Rate (m^3/day)} = \frac{17 \times 9.35}{6} = 26.5mg/m^3$$

¹ For the short-term repeat dose inhalation toxicity study, it was found that pH-related corrosion of the respiratory tract and skin was the most sensitive general toxic effect of inhalation of AMP at higher concentrations (rather than liver pathology which has been observed more extensively in oral tests) [2].

² AMP is alkaline and highly soluble in water. For studies involving oral / dietary dosing, neutralising AMP with HCl better replicates actual exposure conditions at low dosage levels and removes the non-specific alkaline toxic effect to determine the AMP-specific systemic toxic effects. Neutralisation enables maximal AMP dosage to identify long term systemic effects. Direct high-pH exposure to un-neutralised AMP would lead to corrosion toxicity due to high alkalinity rather than AMP-specific systemic toxicity. AMP exposure at very low concentrations via inhalation is expected to be closer to pH neutral as the alkalinity of AMP will not increase pH significantly at low air concentrations [2].

³ Beagle dog body weight and inhalation rates aligned with the test subject of the point of departure (Lankas 1981) [2b] are used for route-route extrapolation. This is aligned with the EA guidance [1] example for route-route extraction for piperazine, which used child inhalation and weight for route-route conversion where the point of departure was a clinical case study which observed children as the subject.

Note the above NOAEC is based on testing on dogs, interspecies variability is accounted for by a factor of 10 as part of the uncertainty factor below. Allometric scaling or species-specific AMP sensitivity comparisons between the dog and human are not used as the factor of 10 is considered to be reasonably conservative compared to the combination of allometric scaling and interspecies variability conversions used in ECHA Derived No-Effect Level (DNEL) derivations.

2. Uncertainty factor of 200 is derived, including:
 - a. 10 for interspecies variability (dog to human);
 - b. 10 for intraspecies variability within the human population;
 - c. 2 for extrapolation of sub-chronic duration of the study (14 weeks) to chronic for a long-term EAL.

No uncertainty factor is added for gaps in the dataset / point of departure because:

- Per commentary in ECHA [2], the database is extensive and the dose response is clear for the endpoint of concern (liver). Furthermore, the more conservative point of departure was selected from two options for sub-chronic AMP oral repeat dose studies investigating liver histopathology.

3. The Long-term EAL is calculated using the NOAEC and the uncertainty factor:

$$\text{Long term EAL} = \frac{\text{NOAEC (mg/m}^3\text{)}}{\text{Uncertainty Factor}} = \frac{26.5}{200} = 0.13 \text{ mg/m}^3$$

This is rounded to a Long-Term EAL for AMP of 0.1 mg/m³.

3. Short-term EAL Derivation for AMP

The Lowest Observed Adverse Effect Concentration (LOAEC) of 700 mg/m³ was selected as the point of departure for derivation of the short-term EAL based on the repeat-dose 5-day nose-inhalation exposure of rats [2a].

A composite uncertainty factor of 1000 is applied. This comprises:

- Factor of 10 for interspecies extrapolation (rat to human);
- Factor of 10 for intraspecies variability within the human population;
- Factor of 10 to account for residual uncertainty associated with the available toxicological dataset and the use of a LOAEC-based point of departure.

No adjustment for experimental exposure period is included for the short-term EAL derivation because:

- the most sensitive effects observed for inhalation (local toxicity observable as lesions to the skin and respiratory tract) were observable as concentration dependent during daily 6-hour doses over a short 5-day exposure duration [2a],
- these effects were not AMP-specific long-term systemic effects, they were a result of pH-related local corrosion [2a],



- the long-term EAL derivation in Section 2 addresses the long-term systemic toxicity effects specific to AMP.

Short-term EAL = $700 \text{ mg/m}^3 / 1000 = 0.7 \text{ mg/m}^3$

This value is higher than the Long-term EAL 0.1 mg/m^3 which was derived based on oral dose studies investigating systemic liver toxicology effects (Lankas 1981, [2b]). This indicates the AMP Long-term EAL of 0.1 mg/m^3 will also protect against respiratory effects of AMP, as the Short-term EAL is derived based on an inhalation study (Sullivan 2017, [2a]) in which respiratory tract irritation and corrosion caused by AMP was the most sensitive toxic effect of AMP.

4. Comparison to Monoethanolamine (MEA) Long-term EAL

The MEA Long-term EAL is also 0.1 mg/m^3 [4]. MEA, like AMP, is an amino-alcohol. Both contain the key amine and hydroxy functional groups, resulting in high water solubility and alkalinity in water solutions for both compounds. AMP is heavier and contains the methyl group.

The EAL guidance for MEA states it has an irritation and corrosive effect on skin / respiratory tract [4]. AMP is known to have a similar effect, due to its alkalinity [2]. EAL guidance also states repeat continuous MEA exposure leads to pathological lesions to the lung, liver, kidneys, spleen and testes of dogs, guinea pigs, and rats exposed for up to 90 days [2]. Liver toxicity of MEA has been observed in multiple animal studies [2]. Sub-chronic liver toxicity effects have been observed for AMP studies on rats, rabbit and dogs which are available in ECHA (such as (Lankas 1981), used for the above long-term derivation) [2].

The Long-term EAL derivation for AMP in Section 2, and the similarities noted between MEA and AMP, support the case for aligning the Long-term EAL for AMP with the existing Long-term EAL value for MEA of 0.1 mg/m^3 [4].

5. Comparison to the Danish EPA C-value

The Danish Environmental Protection Agency (EPA) has derived a C-value⁴ of approximately 0.07 mg/m^3 for AMP, based on a Danish EPA reference for a LOAEL which investigated toxicity to the liver [5]. This is close to the proposed 0.1 mg/m^3 long-term EAL value in this document. The Danish EPA C-value was determined using route-route conversion, and uncertainty factors as well [5], but the point of departure and factors considered differ from UK EA guidance [1]. Despite this, the resulting C-value is close to the proposed Long-term EAL value derived in this document.

The Danish EPA C-value for MEA (0.07 mg/m^3 , [5]) is equal to the Danish EPA C-value for AMP (0.07 mg/m^3 , [5]). Both are lower than the UK EAL value for MEA (0.1 mg/m^3) [4].

⁴ The Danish EPA C-value is the total maximum approved contribution from an installation to the concentration of a pollutant in the air at ground level. The C-value is defined such that hourly average concentrations of a pollutant at ground level (computed with a plume dispersion model) cannot exceed the C-value for more than 1% of the time, i.e. for more than 7 hours during a single month [6]. The C-values are determined by the Danish EPA based on toxicology and eco-toxicology data to protect humans and the environment.

Conclusion

The AMP EAL values have been derived using:

- Valid available points of departure:
 - o LOAEC value from a short-term repeat dose nose inhalation study on rats for the Short-term EAL (Sullivan 2017, [2a]),
 - o In the absence of a long-term inhalation study, a NOAEL value from a sub-chronic oral repeat dose study on dogs for the Long-term EAL (Lankas 1981, [2b]);
- For the Long-term EAL: Route-route extrapolation following UK EA guidance [1];
- Uncertainty factors determined and applied according to UK EA guidance [1].

The resulting EAL values for AMP are:

- **Long-term EAL: 0.1 mg/m³**
- **Short-term EAL: 0.7 mg/m³**

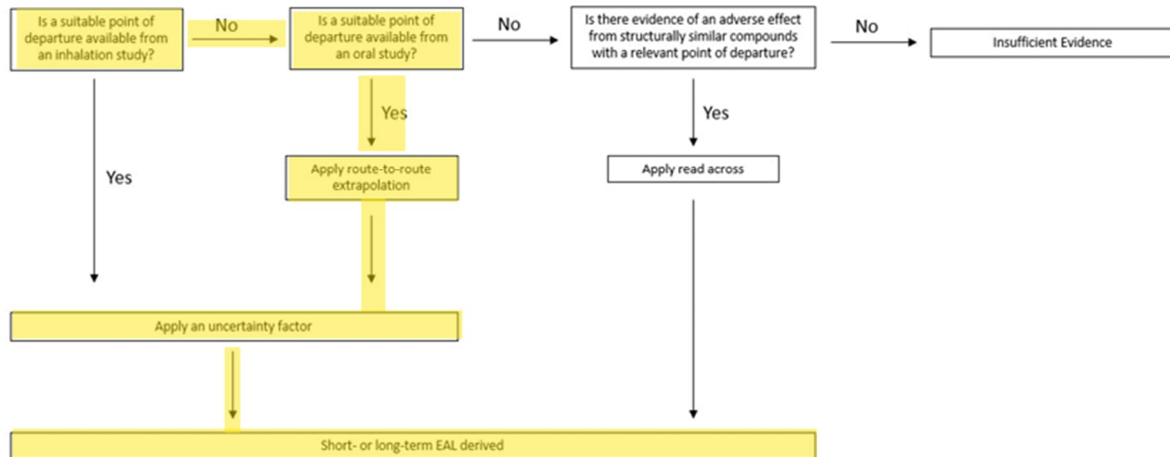
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- [2] ECHA Chemicals Data Base Dossier Publication: 2-amino-2-methylpropanol EC# 204-709-8, CAS# 124-68-5, [2-amino-2-methylpropanol 100.004.282 - ECHA CHEM](#) and supporting references contained in the database:
 - [2a] Sullivan, 2017, Short-Term repeated dose toxicity: inhalation study [ECHA 2-amino-2-methylpropanol 100.004.282 Section 7.5.2, 001 Supporting Experimental Study](#)
 - [2b] Lankas, 1981, Repeated dose sub-chronic toxicity: 14-week oral study of beagle dogs [ECHA 2-amino-2-methylpropanol 100.004.282 Section 7.5.1, 003 Key Experimental Study](#)
 - [2c] Millard, 2021, Repeated dose sub-chronic toxicity: 18-week oral study of rats [ECHA 2-amino-2-methylpropanol 100.004.282 Section 7.5.1, 004 Key Experimental Study](#)
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Attachment 1: Extract from Methodology for the scientific derivation of EALs [1]

The below highlighted method path was used for the AMP Long-term EAL derivation (where no suitable long-term air inhalation departure point was available):

Figure 1: Derivation of a short- or long-term EAL based on threshold effects from inhalation studies.



Attachment 2: Extracts from ECHA Database: 2-amino-2-methylpropanol

Section 7 Toxicology Information [2]

Key Extracts from Section 7.5: Repeated dose toxicity:

A) ORAL ROUTE

I. Selection of key animal oral studies for long-term systemic DNEL:

15 animal studies are available on the repeated dose oral toxicity of AMP or AMP-HCl (including via reproduction and developmental toxicity studies) so the **AMP toxicological database is of unprecedented quality and allows a highly robust assessment**. Studies are outlined in Table 1 below. AMP was tested under multiple forms with variable pH (as highly alkaline AMP, pH-adjusted AMP, or AMP-HCl where pH is also artificially reduced), variable purity (industrial or high-purity grade) and dosing regimen (in diet or by gavage), in multiple species (rat, mouse, rabbit, dog, monkey) and over multiple dosing periods (5 days to 1 year). NB: Clinical data are also available and summarized in next sections.

The liver was AMP's target organ in all animal studies which included suitable investigations. Generally, this was evidenced by increased liver enzymes and liver weight and hepatocyte vacuolation. Only in two dog studies were irreversible liver effects noted (hepatocyte necrosis and fibrosis). The only other toxic effect was local toxicity caused by the alkalinity of the test material, in studies with no or partial pH adjustment. There was no clear trend concerning relative sensitivity of males and females.

Table 1 (note some data has been excluded in this extract, see [2] for full table):

Study N°	Reference	Species	Duration (weeks)	AMP grade tested	AMP form tested
1	Pittz 1977	Rat	0.7 (5d)	Industrial	As is
2	Carney 2005	Rat	2	High-purity	Neutralized
3	Carney 2005	Rat	5 to 8	High-purity	Neutralized
4	Goldenthal 1976	Rat	8	Industrial	Neutralized ?
5	Lankas 1981	Rat	13	Industrial	Neutralized
6	Pittz 1977/1979	Rat	13	Industrial	As is
7	Pittz 1977/1979	Rat	13	Industrial	Neutralized
8	Millard 2021	Rat	18	High-purity	Neutralized
9	Goldenthal 1976	Dog	4	Industrial	Neutralized ?
10	Lankas 1981	Dog	14	Industrial	Neutralized
11	Griffin 1990/1993	Dog	26	Industrial	Neutralized
12	Griffin 1990/1993	Dog	52	Industrial	Neutralized
13	Pittz 1977	Monkey	0.7 (5d)	Industrial	As is
14	Murphy 2020	Rabbit	3	Industrial	Neutralized
15	Goldenthal 1976	Mouse	8	Industrial	Neutralized ?

Following selection criteria were used to select the two key studies to derive a long-term DNEL:

- studies shorter than 4 weeks are excluded;
- studies which failed to identify a LOAEL (too low dose-levels) are excluded;
- studies which did not investigate liver histopathology at all dose-levels are excluded, as liver is the target organ and histopathology the best way to determine adversity of effects;
- as above exclusion criteria pre-select 5 robust studies in two species (rats: 5-8, 8 and 18 weeks; dogs: 4 and 14 weeks), the study of longest duration in rat and dog is selected.



As a consequence:

- for rats, the key study is the OECD 443 study (Millard 2021, 18 weeks);
- for dogs, the key study is similar to OECD 409 (Lankas 1981, 14 weeks).

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III. Description of key studies on AMP-HCl:

a) Rat 18-week study (Millard, 2021):

In an OECD 443 study, groups of 19 to 30 CD rats/sex/dose were fed diets containing AMP-HCl over two generations. Toxicologically relevant effects were limited to liver toxicity in male rats of F0 and F1A generations (doses converted into AMP):

- At 142 mg AMP/kg bw/day, liver weights were 12% increased in F0 only, and minimal to moderate (adverse) hepatocellular vacuolation was seen in 24/30 F0 rats and 8/20 F1A rats;
- At 71 mg AMP/kg bw/day, non-adverse hepatocellular vacuolation was seen in 11/25 F0 rats (minimal to mild) and 7/22 F1A rats (minimal);
- At 35 mg AMP/kg bw/day, non-adverse minimal hepatocellular vacuolation was seen in 4/25 F0 rats and 1/22 F1A rats.

The **NOAEL for parental/general toxicity was 71 and 142 mg AMP/kg bw/day in males and females**, resp. The absence of irreversible liver lesions means effects **do not warrant STOT RE (Specific Target Organ Toxicity – Repeated Exposure) classification**.

At the LOAEL (males: 142 mg AMP/kg bw/day), diet contained 0.224-0.341 % w/w AMP, allowing to estimate that diet pH would range 10.9-11.1 (see Fernandes 2023 under IUCLID §4.20) if AMP hadn't been neutralized. Turner *et al*, 2011 (see IUCLID § 4.20) indicate that oral dosage above pH 9 may result in tissue necrosis and vascular thrombosis. Thus, if AMP had been tested as is instead of its neutralized form AMP-HCl, the study's LOAEL could not have been reached due to dose-limiting, pH-mediated toxicity and no other toxic effects would have been noted. Since OECD guidelines referenced by REACH do NOT require any neutralization or pH adjustment, **this study represents artificial dose maximization in excess of REACH principles, removing AMP's critical toxic effect which is pH-dependent non-specific toxicity**. This bias introduced by neutralization, also affecting the two other key studies below, is discussed in more details below (part C)).

Indirect **proof of reversibility** of liver effects observed in rats can be inferred by comparing LOAEL/NOAEL values in OECD 443 vs. OECD 421 on AMP-HCl: much longer exposure at same dose-level (71 mg AMP/kg/day) resulted in **less frequent and pronounced liver effects** at the time of histopathological examination.

b) Dog 14-week study (Lankas, 1981):

In a 14-week repeated-dose study similar to OECD 409, groups of 4 beagle dogs/sex/dose were fed diets containing AMP-HCl. Following effects were noted (doses converted into AMP):

- At 81 mg AMP/kg bw/day: Lower body weight gain and hemoglobin concentration. Multiple indications of liver toxicity: higher serum liver enzyme activities, lower cholesterol, increased liver weights, discoloration and mottling of liver, microscopic lesions including vacuolization, periportal cirrhosis (lipid deposition, hepatocellular necrosis and fibrosis) and bile duct hyperplasia. Also some local irritation: minimal to moderate chronic gastritis.

- At 17 mg AMP/kg bw/day: Non-adverse liver effects (increased weight, minimal to moderate reversible lesions) and local irritation (gastric inflammation).
- At 0.78 (males)/0.85 (females) mg AMP/kg bw/day: local irritation (gastric inflammation).

The **systemic NOAEL was 17 mg AMP/kg bw/day in both sexes**. STOT RE classification does not apply, as discussed under "Justification for classification or non-classification".

At the tested dietary concentrations, pH would range 10.1-11.1 if AMP hadn't been neutralized. Thus, as the OECD 443 study, this study represents **artificial and non-guideline dose maximization by orders of magnitude, removing of AMP's critical toxic effect, which is pH-dependent non-specific toxicity**. This bias introduced by neutralization is discussed in more details below (part C)).

When comparing liver lesions with those observed in the 4-week study by Goldenthal 1976, **3.5 times longer exposure at similar LOAEL values only lead to a marginal increase in grading of liver cirrhosis** (see Table 1: moderate vs. slight fibrosis, necrosis stayed slight) at the time of histopathological examination. This again shows absence of accumulation of the test material in liver.

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V. Selection of final study for human long-term oral DNEL calculation:

Key NOAEL values are available in rats and dogs as summarized below and both may in principle be used to derive a long-term human DNEL. However, interim calculations (simplified calculations not down to the actual DNEL value) are sufficient to demonstrate that a single NOAEL value can be selected to derive the long-term human DNEL values:

(note some data has been excluded in this extract, see [2] for full table):

Species	Study	Test item	Study duration (weeks)	Assessment factor for extrapolation to chronic exposure (1)	Systemic NOAEL in most sensitive sex (mg AMP/kg bw/day)	Actual body weight at NOAEL, week 1 to last study week, mean
Rat	Millard, 2021	AMP-HCl	18	1 (1)	71 (males)	443g to 717g, mean: 580g (males)
Dog	Lankas, 1981	AMP-HCl	14	2	17 (both sexes)	8.5kg to 10.6kg, mean 9.55kg (males) 8.4kg to 9.9kg, mean 9.15kg (females) overall mean: 9.35 kg

(1): assessment factor not required because OECD 443 showed less frequent/pronounced liver effects than OECD 421 study, showing no dependency upon exposure duration in rats

This table demonstrates that **the worst-case starting point to derive the human long-term systemic DNEL is the dog 14-week study** (Lankas, 1981). Corrected NOAELs confirm that **dogs are more sensitive than rats** to AMP effects.

B) OTHER ROUTES

I. Dermal route (Carney 2006):

This OECD 414 study cannot be used to derive repeat-dose toxicity DNELs because:



- AMP was adjusted to pH 9.5 (limiting the potential to express local effects);
- The study did not include liver histopathology (leaving systemic effects unexplored).

II. Inhalation route (Sullivan 2017):

Nose-only exposure of rats to AMP aerosol (10% AMP solution in water) for 6 hours/day for 5 days at 700 to 2000 mg AMP/m³ resulted in:

- Significant local irritation/corrosion on **skin** (scabs, crusts, epidermal hyperplasia, mixed cell infiltrates, necrosis and ulceration);
- Significant local irritation/corrosion in **nasal cavities** (atrophy of goblet cells and olfactory epithelium, epithelium hyperplasia, mixed cell infiltrates, squamous metaplasia of respiratory epithelium, ulceration of turbinates);
- Minimal systemic toxicity in **liver** (increased aspartate aminotransferase, decreased albumin, higher liver weight, hepatocyte vacuolation).

Based on Fernandes, 2023 (see IUCLID § 4.20), pH of a 10% AMP solution would be 12.3, confirming that the observed skin and respiratory tract lesions represent corrosive effects (local toxicity).

The study conclusion did not distinguish local and systemic NOAEC/LOAEC values. Based on corrosion to skin/respiratory tract, the **local LOAEC was <=700 mg/m³** in both sexes. Based on minimal liver vacuolation, the **systemic NOAEC and LOAEC were 700 and 1400 mg/m³** in both sexes, resp. Minimal liver vacuolation being a reversible effect, **STOT RE classification is not required**. This study shows that the **most sensitive general toxic effect upon inhalation of high airborne AMP concentrations is not liver toxicity but pH-related corrosion of respiratory tract and skin**.

Appendix B Amine Solvent EALs

Schedule 5 section 1.2 (ii) comment from NRW

1.2 Amine Solvent Environmental Assessment Levels (EALs)

The Annex F document contains Table 2 – “FEED 1 Contractor Solvent Degradation Products”. The table includes four possible amine degradation products, specifically:

- Methylamine (MA) (CAS No. 74-89-5)
- Dimethylamine (DMA) (CAS No. 124-40-3)
- Diethylamine (DiEA) (CAS No. 109-89-7)
- Ethylamine (EA) (CAS No. 75-04-7)

These individual amine degradation products have not been assessed against individual EALs. Please therefore provide an assessment of these four amine degradation products against their associated EAL where available. Where there is no published EAL, one should be derived using the Environment Agency’s methodology mentioned above. A full written justification shall be provided if these four amine degradation products are not included in the assessment.

Response

Table 3-3 of the air quality assessment report included in the Environmental Permit application [1] lists the emission parameters for amine 1 and amine 2 for each of the two absorber stacks. The data is shown in Table R1 below.

Table R1: Amine emission concentrations and release rates per absorber stack for FEED 1 abated scenario

Pollutant	Emission Concentration (mg/Nm ³)	Release Rate (g/s)
Amine 1	0.99	0.662
Amine 2	0.01	0.007
Total	1.00	0.669

The grid maximum long-term (long-term 24-hour which is modelled as the annual average) and short-term (maximum 1 hour) total amine concentrations associated with the release of Amine 1 and Amine 2 are tabulated in Table 5-5 and Table 5-6 of the air quality assessment report [1] and assessed against the Environmental Assessment Levels (EALs) based on Monoethanolamine (MEA) as shown in Table R2:

Table R2: Predicted Long-term and Short-term Process Contribution (PC) from Total Amines (assessed against EALs for total amines based on MEA) – Abated FEED 1 Scenario

	Predicted Process Contribution (PC) 24-hour Long Term Mean Total Amines			Predicted Process Contribution (PC) 1 Hour Maximum Total Amines		
Receptor	PC (ug/m ³)	EAL (ug/m ³)	PC/EAL	PC (ug/m ³)	EAL (ug/m ³)	PC/EAL
Grid Max	0.03	100	<0.1%	0.63	400	0.2%

It can be seen that the PC/EAL values are well below the significance screening thresholds of 1% and 10% of the EALs for long-term and short-term air quality impacts, respectively, as set out in the regulatory guidance on air quality risk assessment [2].

The FEED 1 contractor additionally provided details of four emission species which had been detected in previous measurement campaigns detailed in Annex F of the air quality assessment report [3].

Table R3: Trace amine emission concentrations from FEED 1 measurement campaigns

Abbreviation	Chemical Name	Emission Concentration (mg/Nm ³)
MA	Methylamine	<0.005
DMA	Dimethylamine	<0.001
DiEA	Diethylamine	<0.0001
EA	Ethylamine	<0.01

These four trace amines were not explicitly modelled in the air quality assessment as (i) they were emitted at trace levels (<1% of the total amine concentration) and (ii) no degradation species unique to these amines were detected in the FEED1 contractor's previous measurement campaigns. As such it was deemed that any air quality impacts associated with these species were more than adequately assessed by the assessment of the two amines included, in particular in relation to the amine 1 and the total amines assessments where release rates were a minimum of 99 times higher compared to each of the four trace amines and impacts were a fraction of the screening thresholds for significance.

In order to provide further confidence that the exclusion of the four trace amine species from the assessment can be justified, appropriate EALs have been derived and the potential impacts calculated using the existing air quality modelling results.

The Carbon Capture and Storage Association (CCSA), in conjunction with a range of industry members and UK regulators produced a position statement on the hierarchy for deriving EALs in 2023 [4], setting out the following approach.

1. Use of EALs published by the Environment Agency (Env A), Scottish Environment Protection Agency (SEPA), Natural Resources Wales (NRW), or Northern Ireland Environment Agency (NIEA);
2. Use of an EAL published by recognised international agency, including USEPA, Agency for Toxic Substances and Disease Registry (ATSDR), World Health Organisation, International Agency for Research on Cancer, other national environmental agencies;
3. Using an EAL derived from published occupational health data (i.e. EH40, MSDSs, scientific literature etc.) using the Environment Agency 2012 derivation methodology;
4. Use of an EAL derived from primary collected toxicology data provided by a carbon capture technology licensor;
5. Read across of toxicology data from appropriate surrogate species based on and health end points;
6. Use of appropriate surrogate species based on chemical structure similarities and properties.

Working through the above hierarchy, 24-hour long-term and 1 hour maximum EALs for DiEA were available from the Environment Agency Air Emissions Risk Assessment Guidance [2], meeting the Tier 1 hierarchy level.

The following sources were reviewed for the Tier 2 hierarchy level:

- United States Environmental Protection Agency (USEPA) Chronic Dose-Response Values [5]
- USEPA Acute Dose-Response Values [5]
- Agency for Toxic Substances and Disease Registry (ATSDR) Toxic Substances Portal [6]
- New York State DAR-1 Guidelines for the Evaluation and Control of Ambient Air Contaminants [7]

Whilst no suitable information was available from the USEPA and ATSDR sources, the New York State DAR-1 Guidelines included short-term (1-hour) and long-term (annual average) EALs (referred to as annual and short-term guideline concentrations in the DAR-1 document) for MA, DMA and EA.

The results of the EAL review are shown in Table R4, which also includes the EALs based on MEA used to assess Amine 1 and total amine concentrations in the air quality assessment report [1].

Table R4: EALs derived using the CCSA 2023 hierarchy

Abbreviation	Long term EAL (24-hour long term / annual mean) (ug/m ³)	Short-term EAL (1 hour max) (ug/m ³)	Source
MA	15	1900	New York State DAR-1 [7]
DMA	22	2800	New York State DAR-1 [7]
DiEA	33	330	Env A Risk Assessment Guidance [5]
EA	22	2800	New York State DAR-1 [7]
MEA	100	400	Env A Risk Assessment Guidance [5]

It can be seen that the short-term EAL for MEA is more stringent than the short-term EALs for MA, DMA and EA and similar for DiEA. The long-term EAL for MEA is around five times higher than the EALs for the four trace amines. Given that the emission rate for total amines was at least 99 times higher than the emission rate for any of the trace amine species and the impacts were still below the significance thresholds, it is evident that even accounting for the more stringent long-term EALs for the trace amine species relative to the MEA EAL, the assessment results would still be insignificant.

For complete clarity, an assessment has been carried out against the derived EALs for the four trace amine species using the existing air quality modelling results. The PCs for each trace amine species have been calculated by multiplying the long-term and short term PCs in Table R2 (which result from the total amine emissions in Table R1) by the ratio of the emission concentrations in Table R3 to the total emission concentration of 1 mg/Nm³ in Table R1).

The results are shown in Table R5.

Table R5: Assessment of calculated trace amine PCs at the grid maximum against their corresponding EALs

	Predicted Process Contribution (PC) 24-hour Long Term Mean Total Amines			Predicted Process Contribution (PC) 1 Hour Maximum Total Amines		
Species	PC (ug/m ³)	EAL (ug/m ³)	PC/EAL	PC (ug/m ³)	EAL (ug/m ³)	PC/EAL
MA	0.00015	15	0.001%	0.00315	1900	0.00017%
DMA	0.00003	22	0.00014%	0.00063	2800	0.000023%
DiEA	0.000003	33	0.000009%	0.000063	330	0.000019%
EA	0.0003	22	0.0014%	0.0063	2800	0.00023%

It can be seen that the calculated impacts are at least three orders of magnitude below the significance thresholds for air quality assessment providing a strong justification for excluding the four trace amine species from detailed assessment.

It is noted that the Environment Agency published guidance on the derivation of EALs in March 2025 [8]. Whilst the New York DAR-1 document [7] does not include information on the derivation of the individual species EALs, Appendix 1 of the document sets out the general approach to deriving EALs.

The New York DAR-1 Appendix A guidance utilises an approach broadly similar to that set out in the Environment Agency EAL derivation guidance, notably:

- Guideline values are derived based on dose-response data from human or animal studies.
- The results of inhalation studies should take precedence over studies involving other routes of exposure
- Factors to consider in the data evaluation include route, duration and timing of exposure, species, strain, tumour types and sites, target organs/systems, nature and severity of effects, pharmacokinetics, pharmacodynamics mode-of-action, study quality, and statistical significance.
- The same conversion factors for converting non-inhalation exposure to inhalation exposure are applied in terms of adult bodyweight and daily breathing rates
- The approach requires the application of uncertainty factors where necessary to address (i) variation in susceptibility among the members of the human population (ii) uncertainty in extrapolating animal data to humans (i.e., interspecies uncertainty); (iii) uncertainty in extrapolating from sub-chronic to chronic exposure; (iv) uncertainty in extrapolating from a lowest observed adverse effect level (LOAEL) rather than from a no observed adverse effect level NOAEL; and (v) uncertainty associated with extrapolation when the toxicological database is incomplete. The total overall uncertainty factors used in the derivations usually range from 10 to 1000.

It is noted that the DAR-1 approach applies a more stringent approach where carcinogenic effects are considered to be linear at low doses, extrapolating unit risks to an upper bound excess human cancer risk of one in a million for lifetime exposure. This compares with the 1 in 100,000 risk applied in the Environment Agency EAL derivation guidance.

To provide further comfort that the New York DAR-1 EALs are a reasonable comparator to EALs derived using the Environment Agency EAL derivation methodology, the long-term and short-term EALs for the amine and amine degradation species for which both the risk assessment guidance [2] and New York DAR-1 guidelines [7] have derived EALs are compared in Table R6.

Table R6: Comparison between EALs derived using the EA and New York DAR-1 methodologies.

Species	CAS-No	Env A long-term (ug/m ³)	DAR-1 long-term (ug/m ³)	DAR-1/Env A long-term	Env A short-term (ug/m ³)	DAR-1 short-term (ug/m ³)	DAR-1/Env A short-term
2-(diethylamino) ethanol (DEELA)	100-37-8	110	23	0.21	-	-	-
Diethanolamine (DEA)	111-42-2	3	3	1.00	-	-	-
Diethylamine (DiEA)	109-89-7	33	36	1.09	330	4500	13.6
Morpholine (MOR)	110-91-8	-	170	-	40	-	-
N-nitrosomorpholine (NMOR)	59-89-2	0.005	0.00053	0.11	0.037	-	-
Piperazine (PZ)	110-85-0	15	0.25	0.02	-	-	-
Monoethanolamine (MEA)	141-43-5	100	18	0.18	400	1500	3.75
N-nitrosodimethylamine (NDMA)	62-75-9	0.0002	0.000043	0.22	-	-	-

It can be seen that the DAR-1 long-term EALs are either similar to or more stringent than the EALs derived using the Environment Agency methodology. Although there are only two comparable values, the short-term EALs from the Environment Agency methodology could be an order of magnitude more stringent than the DAR-1 EALs. However, even if the EALs in Table R5 were reduced by a factor of ten, the resulting PC/EAL figures would still be three orders of magnitude below the 10% significance screening threshold for short-term effects.

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Appendix C Generators Noise Assessment Report



Connah's Quay Low Carbon Power Station

Environmental Permit Application, Volume 3
Appendix F: Noise Impact Assessment-
Addendum

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1. Synopsis

This Noise Impact Assessment (NIA) addendum has been prepared by AECOM on behalf of Uniper, referred to as 'the Operator', in response to the Schedule 5 letter dated 16/6/26 for further information in relation to the new Environmental Permit application for the proposed Connah's Quay Combined Cycle Gas Turbine (CCGT) with Carbon Capture Plant (CCP), referred to as the 'Proposed Installation'. The Proposed Installation is positioned on the south bank of the River Dee in northeast Flintshire.

The Schedule 5 letter requested an updated assessment to include the emergency diesel generators during testing and reasonable worst case operating regime.

The scenarios considered in this addendum are:

- Routine daytime testing of emergency generators (Proposed Installation operational)
 - Fortnightly testing (once every 2 weeks)
 - 30 minutes duration per test
 - 100% load
 - Generators tested independently (one at a time for a total duration of 30 minutes and only one generator tested per hour period)
- Blackout Event/Emergency (worst-case operation)
 - All emergency generators operating simultaneously
 - 100% load
 - 72 hours continuous operation
 - Proposed Installation not operational

As the final design layout for the plant is still to be finalised, there are currently two front end engineering designs (FEED) which have different locations for the emergency diesel generators. Therefore, the sound propagation model (CadnaA) has been updated to include the proposed emergency diesel generator locations from both FEED layouts. Due to uncertainty in their locations, the Proposed Installation buildings and plant have been removed from the model to avoid these structures incorrectly influencing the predicted specific sound levels from the emergency diesel generators, hence providing a worst-case prediction for noise from the generators. The predicted sound levels from the emergency generators have been logarithmically added to the specific sound levels from the Proposed Installation for the routine testing scenario.

As such, some worst-case assumptions have been applied to the assessment, which may lead to an over-prediction of the potential impacts. At the detailed design stage, Best Available Techniques (BAT) for noise mitigation control will be identified and applied to the plant design. Following detailed design, it is proposed that the NIA assessment be reviewed, updated, and resubmitted to Natural Resources Wales (NRW), if required, through a pre-operational condition to be included in the Environmental Permit.

The NIA addendum has been prepared following NRW's *Noise and Vibration Management: Environmental Permits* guidance and Method implementation document (MID) for BS 4142¹. The BS 4142:2014+A1:2019 'Methods for rating and assessing industrial and commercial sound' (BS 4142)²

¹ Environment Agency, Natural Resources Wales and Northern Ireland Environment Agency, (2023) Method implementation document (MID) for BS 4142

² British Standards Institute (2014) BS 4142:2014+A1:2019 – Methods for rating and assessing industrial and commercial sound

assessment has considered the existing Power Station, the Proposed Installation and the combined existing Power Station and Proposed Installation, as requested by NRW.

The focus of the NIA addendum has been on the potential effects of operational sound from testing and reasonable worst case operating scenario of the emergency diesel generators upon the nearest residential Noise Sensitive Receptors (NSRs) to the Proposed Installation.

This addendum should be read in conjunction with the NIA (CQ-WPCC15718-APP-NIA-2026-03-16)

In accordance with BS 4142, the representative *background sound levels* at NSRs have been compared against the predicted operational *rating levels* (the *specific sound levels* with character correction).

The initial BS 4142 assessment for the Proposed Installation including the concurrent routine testing of a generator, indicates potential for significant adverse impacts at NSR R23 with potential adverse impacts at NSRs R19, R20, R21, R22, R24 on FEED 1 layout and potential adverse impacts at NSRs R20, R21, R22 and R23, based on FEED 2 layout. The initial impacts are based on the rating level compared to the background sound level without contribution from the existing Power Station, before the context considerations.

For the scenario of the existing Power Station and Proposed Installation operating simultaneously including concurrent routine testing of a single diesel generator, there is potential for significant adverse impacts at NSRs for FEED 1 and FEED 2 scenarios. However, this is a very worst-case scenario with all plant operating at maximum capacity, whereas in reality both the existing Power Station and Proposed Installation will not be both fully operational at the same time. It is probable that the number of generating units on the existing Power Station would reduce significantly once the first unit of the Proposed Installation becomes operational. At this stage the final combined operations are not yet confirmed.

The routine testing of the generators will only take place for up to 30 minutes on a fortnightly basis, with only one generator tested in an hour period, therefore does not form part of everyday typical operation. Also, the highest specific sound level from a single generator (typically the closest generator) at each receptor has been used in the assessment as a worst case, therefore lower sound levels may be experienced when testing generators further away from the receptors.

The context of the noise from the operations has also taken into consideration. This includes the existing industrial and road traffic sound, which contribute to the overall acoustic environment, as well as short duration of routine testing. The testing operations would also be during daytime only to ensure reliability and readiness for operation during a blackout emergency when external electrical supplies are unavailable.

Once adjusted for context, the initial indication of significant adverse impact for the routine testing during operation of the Proposed Installation has been changed to having the potential to give rise to a temporary adverse, but not significant impact at the nearest NSR.

A worst-case scenario for emergency use of all generators simultaneously during a blackout event, gives a BS 4142 assessment showing the potential for significant adverse impacts at all NSRs assessed during the night-time period for both FEED layouts. There is also the potential for significant adverse impacts at NSRs R19, R20, R21, R22, R23 and R24 during daytime for FEED 1 layout and NSRs R21, R22 and R23 during daytime for FEED 2 layout.

However, the use of the generators during a national blackout event or other emergency situation is not a typical operating scenario, and there should be allowance for higher noise levels for emergency use.

The diesel generators are an essential infrastructure mandated by the National Energy System Operator (NESO) to enable resilience during a blackout restoration event. Without the generators the Proposed Installation may not have the necessary resilience for restoration following a blackout event affecting external supplies. Energy blackouts are nationally significant events and the diesel generators will only be used when required for system security / restoration.

During detailed design, opportunities to reduce the predicted specific sound levels along with BAT to minimise and manage the impact for the emergency diesel generators will be investigated.

2. Introduction

2.1 Background

AECOM has been commissioned by Uniper to undertake a Noise Impact Assessment (NIA) addendum, in response to the Schedule 5 letter dated 16/6/26 for further information in relation to the new Environmental Permit application for the proposed Connah's Quay Combined Cycle Gas Turbine (CCGT) with Carbon Capture Plant (CCP), referred to as the 'Proposed Installation'. The Proposed Installation will be located to the west of the existing Connah's Quay Power Station.

The Schedule 5 letter requested an updated assessment to include the emergency diesel generators during testing and reasonable worst case operating regime.

The NIA addendum has been prepared following NRW's *Noise and Vibration Management: Environmental Permits* guidance and Method implementation document (MID) for BS 4142³. The BS 4142:2014+A1:2019 'Methods for rating and assessing industrial and commercial sound' (BS 4142)⁴ assessment has considered the existing Power Station, the Proposed Installation and the combined existing Power Station and Proposed Installation, as requested by NRW.

It is recognised that at the time of writing, there are currently two competitive FEED designs under consideration by the Applicant, and the design of the Proposed Installation will continue to be refined until the completion of the detailed design stage.

The two FEED designs have different locations for the emergency diesel generators. Therefore, the sound propagation model (CadnaA) has been updated to include the proposed emergency diesel generator locations from both FEED layouts. Due to uncertainty in their locations, the Proposed Installation buildings and plant have been removed from the model to avoid these structures incorrectly influencing the predicted specific sound levels from the emergency diesel generators, hence providing a worst-case prediction for noise from the generators. The predicted sound levels from the emergency generators have been logarithmically added to the specific sound levels from the Proposed Installation for the routine testing scenario.

This addendum for additional short duration testing or emergency blackout operation should be read in conjunction with the March 2026 NIA (CQ-WPCC15718-APP-NIA-2026-03-16) which provided full details of the normal operation of the Proposed Installation.

2.2 Schedule 5 letter

The Schedule 5 letter stated:

3. Noise Impact Assessment & Modelling

The Environmental Permit Application Volume 3, Appendix I: Noise Impact Assessment (March 2026) and associated modelling files do not include any predicted sound levels for the 5 x 6.25 MWth emergency diesel generators. Please update the Noise Impact Assessment and Modelling to ensure that the predicted sound contribution from the generator testing and reasonable worst case operating regime is included. This is required so that the overall impact of proposed site noise levels can be assessed.

4. Black-start Generation Plant under Grid Code Requirement GC0156

We are aware that the National Energy System Operator (NESO) Grid Code modification GC0156 requires certain energy generation sites to provide sufficient back up generation capability for a minimum of 72 hours. The purpose of this requirement is to keep power stations operationally ready

³ Environment Agency, Natural Resources Wales and Northern Ireland Environment Agency, (2023) Method implementation document (MID) for BS 4142

⁴ British Standards Institute (2014) BS 4142:2014+A1:2019 – Methods for rating and assessing industrial and commercial sound

in the event of a partial or total shutdown of the electricity network. We understand that this is a mandatory requirement that must be met by 31st December 2026.

In view of this, please explain how this capability will be provided at the proposed installation and specifically if it will be achieved by using the auxiliary boiler and / or 5 x emergency diesel generators (item 1.1 above) or by different means. If it will be achieved via the emergency diesel generators, this may be an example of a reasonable worst case operating scenario that is considered under items 1.1 and 4 above. If the requirement will be met by different means, the contribution to air quality impact and sound levels at sensitive receptors must be included in the respective modelling reports and associated files.'

2.3 Scope of Assessment

The focus of the NIA addendum has been on the potential effects of operational sound from testing and reasonable worst case operating scenario of the emergency diesel generators upon the nearest residential Noise Sensitive Receptors (NSRs) to the Proposed Installation.

The Schedule 5 letter requested an updated assessment to include the emergency diesel generators during testing and reasonable worst case operating regime.

The scenarios considered in this addendum are:

- Routine daytime testing of emergency generators (Proposed Installation operational)
 - Fortnightly testing (once every 2 weeks)
 - 30 minutes duration per test
 - 100% load
 - Generators tested independently (one at a time for a total duration of 30 minutes and only one generator tested per hour period).
- Emergency/ Blackout Event (worst-case operation)
 - All emergency generators operating simultaneously
 - 100% load
 - 72 hours continuous operation
 - Proposed Installation not operational.

3. Assessment Locations

The same representative NSRs have been used in this addendum which are shown in Table 1 along with the distance to the Proposed Installation. (see also map in Appendix A).

Table 1 Key Representative Noise Sensitive Receptors

Receptor ID	Name	Receptor Type	Distance to the Installation Boundary (m)
R19	Glantraeth Farm	Residential	50
R20	Rockcliffe Lane Properties	Residential	95
R21	Kelsterton Road Properties (west)	Residential	22
R22	Wenlo / The Sheiling, Kelsterton Road	Residential	67
R23	Cae Coch Cottages, Kelsterton Road	Residential	33
R24	Kelsterton Farm	Residential	190
R25	The Coach House / Kelsterton Hall	Residential	82
R26	Perenna Court Properties	Residential	185
R28	Kelsterton Lodge / 85-105 Kelsterton Road	Residential	160
R29	66-102 Kelsterton Road	Residential	110
R30	36-64 Kelsterton Road	Residential	400
R31	2-34 Kelsterton Road	Residential	620

Note: Receptor ID is retained from DCO ES Chapter 9. R1-R18 are further away from the proposed installation. R27 and R32 are education facilities and have not been included in the BS 4142 assessment as BS 4142 states it is for assessing premises for residential use only.

The closest NSRs to the Installation are R19, R21, R22 and R23. The existing noise climate at these NSRs consists of road traffic noise from A548, the current operations at the existing Connah's Quay Power Station, contributions from other industrial uses in the area (Tata Steel, Deeside Industrial Estate, Oakenholt Recycling centre and Essity UK (paper mill), and railway noise. The surrounding ground type and cover between the Proposed Installation and the receptors primarily comprises local roads, railway line and open space (gardens and fields).

4. Methodology

4.1 Operational Sound Prediction and Assessment

The operational assessment methodology for BS 4142 and The Institute of Environmental Management and Assessment's (IEMA) 'Guidelines for Environmental Noise Impact Assessment', can be found in Section 4.1 of the NIA (March 2026).

Operational Sound Prediction

The predictions of operational sound from the emergency diesel generators have been based on information provided by the Operator using FEED information and indicative generator manufacturer information.

The proposed plant sound power levels and the assumptions applied to the prediction methodology are detailed in Appendix B.

As the final design layout for the plant is still to be finalised, there are currently two FEED designs which have different locations for the emergency diesel generators. The three-dimensional sound propagation model using the modelling software CadnaA® Version 2025 (which implements the prediction method in ISO 9613-2:2024 'Attenuation of sound during propagation outdoors'). has been updated to include the proposed emergency diesel generator locations from both FEED layouts. The Proposed Installation

buildings and plant have been omitted from the model to avoid these structures incorrectly influencing the predicted specific sound levels from the emergency diesel generators. The predicted sound levels from the emergency generators have been logarithmically added to the specific sound levels from the Proposed Installation for the routine testing scenario.

A digital terrain model created using publicly available ground elevation spot height data has been used to position buildings and proposed generators at the proposed heights relative to ground. Areas of acoustically soft (e.g. vegetation) and hard (e.g. concrete) ground have been identified from the Ordnance Survey (OS) MasterMap Topographic Layer and modelled accordingly.

The following sources of information have been reviewed and form the basis of the assessment:

- Surrounding area ground heights – data from the Environment Agency National LIDAR programme - downloaded from Open Survey Data;
- Ordnance Survey MasterMap Topography Layer of the Order limits and surrounding areas;
- FEED 1 and FEED 2 emergency diesel generator location, dimensions and stack height;
- Sound pressure level of indicative diesel generator with sound enclosure which has been reviewed by the Operator.

The prediction method assumes that the prevailing wind direction is always from source to receiver, which is likely to overestimate sound from the plant for much of the time at the closest NSRs which are located to the south of the Proposed Installation so more commonly upwind or crosswind from the Proposed Installation given the prevailing wind is from the west to south-west.

BS 4142 Assessment

Although the use of the emergency diesel generators is not part of the typical everyday operating scenario, NRW have requested that the noise impacts associated with the emergency diesel generators are assessed. An additional BS 4142 assessment has been undertaken and reported in this addendum.

BS 4142 requires that the *rating level* of the sound source under assessment be considered in the context of the environment when defining the overall significance of the impact. The context of the non-typical scenario of the emergency diesel generators will be taken into consideration.

5. Predictions

5.1 Representative Residual Sound Levels

The NIA provides details of baseline surveys, Table 2 is reproduced from the NIA and summarises the defined *residual sound levels* and *background sound levels* taken forward within this assessment for the NSRs in the vicinity of each noise monitoring location. The daytime residual and background sound levels have also been included as the routine testing of the generators is undertaken during the daytime period only.

Table 2 Representative Residual sound levels (L_{Aeq}) and background sound levels (L_{A90})

Receptor	Monitoring Location	Night-time Residual Sound Levels, $L_{Aeq,T}$, dB	Night-time Background Sound Levels, $L_{A90,T}$, dB	Day-time Residual Sound Levels, $L_{Aeq,T}$, dB	Day-time Background Sound Levels, $L_{A90,T}$, dB
R19	UP1	41	31	49	44
R20	UP1	41	31	49	44
R21	UP1	41	31	49	44
R22	UP1	41	31	49	44
R23	UP2	45	34	52	45
R24	UP2	45	34	52	45
R25	UP2	45	34	52	45
R26	LT1	37	29	44	43
R28	LT1	37	29	44	43
R29	LT1	37	29	44	43
R30	LT8	46	29	52	44
R31	LT8	46	29	52	44

5.2 Existing and Proposed Installation

The existing and Proposed Installation operational specific sound levels are reported in Section 5.1 of the NIA.

5.3 Emergency Diesel Generation Operational Sound Levels

As stated in Section 4, operational sound modelling has been undertaken using indicative sound data for a typical generator within a sound enclosure and exhaust stack with a silencer fitted. The locations of the emergency diesel generators have been taken from the two FEED designs and are summarised in Table 3 and Table 4 below, along with the height modelled and sound power level.

Table 3 FEED 1 Generators

Generator ID	Dimensions (height, width, length), m	Point source height, m	Location (Easting, northing)	Stack Height (point source), m	Generator Enclosure Sound Power level, L_{WA} dBA	Exhaust stack Sound Power level, L_{WA} dBA
EDG1	4.2 x 4 x 14	4.2	327598.6, 371267.1	8.1	109.7	96
EDG2	4.2 x 4 x 14	4.2	327257.4, 371609.3	8.1	109.7	96

Generator ID	Dimensions (height, width, length), m	Point source height, m	Location (Easting, northing)	Stack Height (point source), m	Generator Enclosure Sound Power level, L_{WA} dBA	Exhaust stack Sound Power level, L_{WA} dBA
EDG3	4.2 x 4 x 14	4.2	327265.7, 371603.7	8.1	109.7	96
EDG4	4.2 x 4 x 12.5	4.2	327602, 371272	7.7	109.7	96
EDG5	4.2 x 4 x 14	4.2	327591.8, 371257.2	8.1	109.7	96
EDG6	4.2 x 4 x 14	4.2	327087.3, 371519.6	7.7	109.7	96
EDG7	4.2 x 4 x 14	4.2	327595.2, 371262.1	8.0	109.7	96

Table 4 FEED 2 Generators

Generator ID	Dimensions (height, width, length), m	Point source height, m	Location (Easting, northing)	Stack Height (point source), m	Generator Enclosure Sound Power level, L_{WA} dBA	Exhaust stack Sound Power level, L_{WA} dBA
PT1	4.85 x 3.48 x 12.27	4.85	327624.1, 371275.3	7.85	109.7	96
PT2	4.85 x 3.48 x 12.27	4.85	327621.3, 371271.3	7.85	109.7	96
PT3	4.85 x 3.48 x 12.27	4.85	327618.3, 371267	7.85	109.7	96
PT4	4.85 x 3.48 x 12.27	4.85	327615.5, 371263	7.85	109.7	96
PT5	4.85 x 3.48 x 12.27	4.85	327612.5, 371258.8	7.85	109.7	96

In accordance with BS 4142 the daytime assessment considers a 1-hour period, and the night-time assessment considers a 15-minute period. As the generator may operate at any time of day or night, in an emergency scenario or over 72-hour period blackout event, the predicted specific sound levels will be the same for both day and night. No 'on-time' correction is applicable due to the continuous nature of the generators whilst in use during an emergency scenario. For the routine testing of the generators, only one generator will be operational for up to 30 minutes in a one hour period, therefore an 'on-time' correction is applied. The free-field operational *specific sound levels* are predicted at the first floor of the representative receptors. The predicted sound levels apply to both the 1-hour daytime and the 15-minute night-time BS 4142 assessment periods.

It is assumed the potential for sound of a tonal, impulsive or intermittent nature will be designed out of the generators during the detailed design phase by the selection of appropriate plant enclosure, louvres and silencers as necessary.

For the routine testing it has been assumed it will take place for a 30 minute daytime assessment period as a worst-case scenario. Routine testing will only be undertaken during the daytime period, testing one generator at a time. The highest predicted free-field specific sound level for a single generator per FEED layout is reported in Table 5 as worst case scenario for routine testing.

The total specific sound level for all the generators operating at the same time per FEED layout is reported in Table 5, representative of the worst-case scenario during a blackout or emergency power outage.

Table 5 Predicted Operational Sound Levels- Emergency Generators

Receptor	<i>Specific Sound Level $L_{Aeq,Tr}$ dB</i>			
	<i>Routine Testing</i>	<i>Routine Testing</i>	<i>Emergency/Blackout Event</i>	<i>Emergency/Blackout Event</i>
	<i>FEED 1</i>	<i>FEED 2</i>	<i>FEED 1</i>	<i>FEED 2</i>
R19	47	31	53	42
R20	44	43	55	53
R21	48	44	58	54
R22	47	45	57	55
R23	51	50	60	59
R24	45	31	55	42
R25	39	31	46	41
R26	37	29	46	37
R28	34	30	43	39
R29	33	25	41	35
R30	33	27	41	37
R31	31	30	40	39

6. Sound Impact Assessment

6.1 BS 4142 Assessment

A sound impact assessment has been undertaken for a new separate bespoke environmental permit for the operation of the Proposed Installation. However, in recognition of the presence of the existing Power Station, NRW have requested that the assessment also considers the operation of that plant when assessing the potential impact associated with the Proposed Installation. The existing Power Station and the Proposed Installation operations are presented individually and then combined to form a theoretical overall cumulative sound level in the NIA dated March 2026.

The overall combined sound level from the two installations will be a very worst-case scenario, which is unlikely to occur as both the existing Power Station and the Proposed Installation will not both operate at full capacity at the same time. It is probable that the number of generating units on the existing Power Station would reduce significantly once the first train of the Proposed Installation becomes operational.

NRW have requested that background sound levels without contributions from the existing Power Station operations are considered as part of the BS 4142 assessment. The representative background sound levels without contribution from the existing Power Station are provided in Table 2 in Section 5.

Routine daytime testing of emergency generators

The emergency generators will be tested individually on a fortnightly basis during daytime hours, whilst the Proposed Installation is operational. The highest predicted specific sound level of a single emergency generator in Table 5 at each receptor has been logarithmically added to the predicted specific sound level for the Proposed Installation. The following tables present the BS 4142 assessment summary during the day-time period. The combined predicted *specific sound level* is rounded to whole decibels. The assessment is based on the difference between the representative daytime *background sound level* and the predicted *rating level*, $L_{Ar,Tr}$ dB (i.e. the *specific sound level* $L_{Aeq, Tr}$ plus any character correction) at the NSR. Positive values in the table indicate an excess of the *rating level* over the *background sound level*.

Although tonal, impulsive or intermittent nature will be designed out, the inclusion of a +3 dB correction for other distinctive character has been included at this stage as a conservative approach. This has been applied for NSRs where the *specific sound level* is equal to or greater than the existing *background sound level*, as there is the potential to identify the new sound source in the existing acoustic environment.

Table 6 shows the initial BS 4142 assessment for the Proposed Installation with routine emergency generator testing for FEED 1 layout.

Table 6 Proposed Installation BS 4142 Assessment – Proposed Installation with routine emergency generator testing-FEED 1

NSR	Combined Specific Sound Level $L_s (L_{Aeq,Tr}),$ (dB)	Acoustic Feature Correction (dB)	Rating Level $(L_{Ar,Tr}),$ (dB)	Representative Background Sound Level $(L_{A90,T}),$ (dB)	Excess of Rating Level Over Background Sound Level $(L_{Ar,Tr} -$ $L_{A90,T}),$ (dB)	BS 4142 Impact Category
R19	48	3	51	44	7	An indication of an adverse impact, depending on the context
R20	45	3	48	44	4	An indication of an adverse impact, depending on the context

NSR	Combined Specific Sound Level $L_s (L_{Aeq,Tr}),$ (dB)	Acoustic Feature Correction (dB)	Rating Level ($L_{Ar,Tr}$), (dB)	Representative Background Sound Level ($L_{A90,T}$), (dB)	Excess of Rating Level Over Background Sound Level ($L_{Ar,Tr} -$ $L_{A90,T}$), (dB)	BS 4142 Impact Category
R21	49	3	52	44	8	An indication of an adverse impact, depending on the context
R22	47	3	50	44	6	An indication of an adverse impact, depending on the context
R23	51	3	54	45	9	An indication of a significant adverse impact, depending on the context
R24	46	3	49	45	4	An indication of an adverse impact, depending on the context
R25	41	0	41	45	-4	Indication of low impact
R26	39	0	39	43	-4	Indication of low impact
R28	36	0	36	43	-7	Indication of low impact
R29	35	0	35	43	-8	Indication of low impact
R30	35	0	35	44	-9	Indication of low impact
R31	33	0	33	44	-11	Indication of low impact

Table 7 shows the initial BS 4142 assessment for the Proposed Installation with routine emergency generator testing for FEED 2 layout.

Table 7 Proposed Installation BS 4142 Assessment – Proposed Installation with routine emergency generator testing-FEED 2

NSR	Combined Specific Sound Level $L_s (L_{Aeq,Tr}),$ (dB)	Acoustic Feature Correctio n (dB)	Rating Level ($L_{Ar,Tr}$), (dB)	Representative Background Sound Level ($L_{A90,T}$), (dB)	Excess of Rating Level Over Background Sound Level ($L_{Ar,Tr} -$ $L_{A90,T}$), (dB)	BS 4142 Impact Category
R19	36	0	36	44	-8	Indication of low impact
R20	44	3	47	44	3	An indication of an adverse impact, depending on the context
R21	46	3	49	44	5	An indication of an adverse impact, depending on the context
R22	46	3	49	44	5	An indication of an adverse impact, depending on the context
R23	50	3	53	45	8	An indication of an adverse impact, depending on the context

NSR	Combined Specific Sound Level $L_s (L_{Aeq,Tr}),$ (dB)	Acoustic Feature Correctio n (dB)	Rating Level ($L_{Ar,Tr}$), (dB)	Representative Background Sound Level ($L_{A90,T}$), (dB)	Excess of Rating Level Over Background Sound Level ($L_{Ar,Tr} -$ $L_{A90,T}$), (dB)	BS 4142 Impact Category
R24	38	0	38	45	-7	Indication of low impact
R25	37	0	37	45	-8	Indication of low impact
R26	35	0	35	43	-8	Indication of low impact
R28	34	0	34	43	-9	Indication of low impact
R29	32	0	32	43	-11	Indication of low impact
R30	32	0	32	44	-12	Indication of low impact
R31	32	0	32	44	-12	Indication of low impact

The initial BS 4142 assessment in Table 6 for the Proposed Installation with routine emergency generator testing based on FEED 1 layout shows the potential for significant adverse impacts at NSR R23, with potential adverse impacts at NSRs R19, R20, R21, R22, and R24.

The initial BS 4142 assessment in Table 7 for the Proposed Installation with routine emergency generator testing based on FEED 2 layout shows potential adverse impacts at NSRs R20, R21, R22 and R23.

The routine testing of the generators will only take place for up to 30 minutes on a fortnightly basis, only one generator will be tested in a one hour period therefore not part of everyday typical operation. Also, the highest specific sound level from a single generator (typically the closest generator) at each receptor has been used in the assessment as a worst case, therefore lower sound levels will be experienced when testing generators further away from the receptors. Furthermore, in-plant screening from intervening buildings, which could provide significant barrier attenuation, has been omitted from the prediction.

Existing Power Station and Proposed Installation Combined with routine emergency generator testing

Table 8 shows the initial BS 4142 assessment for the theoretical scenario of the existing Power Station and Proposed Installation operating concurrently alongside the testing of emergency generators.

Table 8 Existing Power Station and Proposed Installation combined with emergency generator testing BS 4142 Assessment FEED1

NSR	Combined Specific Sound Level $L_s (L_{Aeq,Tr}),$ (dB)	Acoustic Feature Correction , (dB)	Rating Level ($L_{Ar,Tr}$), (dB)	Representative Daytime Background Sound Level ($L_{A90,T}$), (dB)	Excess of Rating Level Over Background Sound Level ($L_{Ar,Tr} -$ $L_{A90,T}$), (dB)	BS 4142 Impact Category
R21	49	3	52	44	8	An indication of an adverse impact, depending on the context
R22	48	3	51	44	7	An indication of an adverse impact, depending on the context
R23	52	3	55	45	10	An indication of a significant adverse impact, depending on the context

NSR	Combined Specific Sound Level $L_s (L_{Aeq,Tr}), (dB)$	Acoustic Feature Correction , (dB)	Rating Level $(L_{Ar,Tr}), (dB)$	Representative Daytime Background Sound Level $(L_{A90,T}), (dB)$	Excess of Rating Level Over Background Sound Level $(L_{Ar,Tr} - L_{A90,T}), (dB)$	BS 4142 Impact Category
R24	47	3	50	45	5	An indication of an adverse impact, depending on the context
R28	39	0	39	43	-4	Indication of low impact

Table 9 Existing Power Station and Proposed Installation combined with emergency generator testing BS 4142 Assessment FEED 2

NSR	Combined Specific Sound Level $L_s (L_{Aeq,Tr}), (dB)$	Acoustic Feature Correction (dB)	Rating Level $(L_{Ar,Tr}), (dB)$	Representative Daytime Background Sound Level $(L_{A90,T}), (dB)$	Excess of Rating Level Over Background Sound Level $(L_{Ar,Tr} - L_{A90,T}), (dB)$	BS 4142 Impact Category
R21	46	3	49	44	5	An indication of an adverse impact, depending on the context
R22	47	3	50	44	6	An indication of an adverse impact, depending on the context
R23	51	3	54	45	9	An indication of a significant adverse impact, depending on the context
R24	41	3	44	45	-1	Indication of low impact
R28	38	0	38	43	-5	Indication of low impact

Table 8 and

Table 9 shows that when the operational sound levels from the existing Power Station and the Proposed Installation are combined, along with the routine testing of the generator there is the potential for significant adverse impacts at NSR R23. However, these are very worst-case scenarios with all plant operating at maximum capacity, whereas in reality the existing Power Station and Proposed Installation will not be both fully operational at the same time. At this stage the final combined operations are not yet confirmed.

The context of the area and the existing sound climate should be taken into consideration as well as the limited time period when the diesel generators are tested, when determining the overall impact.

Considerations of Context- Routine Testing

The existing Connah's Quay Power Station has been an operating industrial source in the study area since the original power station began operations in 1954, with the current plant operating since 1996. Additionally, on the Connah's Quay Power Station site there was a gas treatment plant which was an additional industrial sound source in the area until 2023. This is likely to mean that residents currently living in the area are already accustomed to the sound of a similar nature to the additional industrial plant associated with the Proposed Installation.

Relevant contextual considerations include:

- Character of the existing ambient sound environment – this is dominated by traffic on the local road network (including the A548, B5129 and Chester Road) and the existing infrastructure at and near the existing Connah's Quay Power Station (including National Grid substations), and rail traffic. The Proposed Installation is unlikely to alter the character of the area;
- Historical context of the use of the area – since 1954 there has been industrial plant on the Connah's Quay Power Station site and the current CCGT has been operating since 1996;
- Lack of complaints – Noise from day-to-day operations on the existing Power Station is well controlled and there have been no recent noise complaints. Over the operational lifetime of the existing Connah's Quay Power Station there have been a small number of complaints, which were associated with the cooling towers, these were investigated and mitigated accordingly.
- Operating scenario - an assessment based on all plant operating at full power at the same time is considered a robust worst-case scenario, and in reality, operational noise levels will be lower.
- The routine testing of the generators will only take place for up to 30 minutes on a fortnightly basis, therefore not part of everyday typical operation. Only one generator will be tested in a one hour period.
- The highest specific sound level from a single generator (typically the closest generator) at each receptor has been used in the assessment as a worst case, therefore lower sound levels may be experienced when testing generators further away from the receptors.
- The simplified sound predictions do not contain representations of other buildings and structures which could provide in-plant screening attenuation in the final layout.
- The routine testing will only take place during daytime hours on weekdays (Monday to Friday) and be planned and managed under a defined operational protocol and only as frequently as necessary and for no longer than required.
- The routine testing is to ensure reliability and readiness for operation during a blackout event or other emergency, when external electrical supplies are unavailable.

The specific sound level from routine testing of the diesel generators and Proposed Installation needs to be considered in the context of the residual environmental sound. During the day-time road traffic is the main source of sound at NSRs, and mainly responsible for the residual sound level of 52 dB $L_{Aeq,1hr}$ at the NSR nearest to the site. Following the IEMA guideline approach for assessing changes in L_{Aeq} levels (Tables 2 and 15 of March 2026 NIA) provides an indication of the potential transient impact during routine testing of each diesel generator. At R21 and R23, which are subject to the highest levels from both FEED scenarios, the 2-3 dB increase in ambient sound L_{Aeq} due to the estimated specific levels of 48-51 dB L_{Aeq} , is assessed as being of 'Low' to 'Medium' impact according to the IEMA.

Once adjusted for context, the initial indication of significant adverse impact has been revised. The routine testing of emergency generators during operation of the Proposed Installation has the potential to give rise to a short-duration adverse, but not significant, impact at the nearest NSR.

At the detailed design stage, opportunities to reduce the predicted specific sound levels for the emergency diesel generators and BAT will be investigated, as discussed in Section 7.

Blackout event /emergency use (Worst Case scenario)

The emergency generators will be used simultaneously during a blackout restoration event over a 72-hour period, whilst the Proposed Installation is not operational. The total specific sound level for all the generators operating at the same time per FEED layout is reported in Table 5, representative of the worst-case scenario during a blackout or emergency power outage.

Table 5 The following tables present the BS 4142 assessment summary during the day-time period and night-time period. The predicted *specific sound level* is rounded to whole decibels. The assessment is based on the difference between the representative *background sound level* and the predicted *rating level*, $L_{A,r,Tr}$ dB (i.e. the *specific sound level* $L_{Aeq, Tr}$ plus any character correction) at the NSR. Positive values in the table indicate an excess of the *rating level* over the *background sound level*.

Although tonal, impulsive or intermittent nature will be designed out, the inclusion of a +3 dB correction for other distinctive character has been included at this stage as a conservative approach. This has been applied for NSRs where the *specific sound level* is equal to or greater than the existing *background sound level*, as there is the potential to identify the new sound source in the existing acoustic environment.

Table 10 shows the initial daytime BS 4142 assessment for all the emergency generators operating during a blackout restoration event, based on FEED 1 layout.

Table 10 Blackout Event BS 4142 Assessment FEED 1 – Daytime

NSR	<i>Specific Sound Level</i> L_s ($L_{Aeq,Tr}$), (dB)	<i>Acoustic Feature Correction</i> (dB)	<i>Rating Level</i> ($L_{Ar,Tr}$), (dB)	<i>Representative Background Sound Level</i> ($L_{A90,T}$), (dB)	<i>Excess of Rating Level Over Background Sound Level</i> ($L_{Ar,Tr} - L_{A90,T}$), (dB)	<i>BS 4142 Impact Category</i>
R19	53	3	56	44	12	An indication of a significant adverse impact, depending on the context
R20	55	3	57	44	13	An indication of a significant adverse impact, depending on the context
R21	58	3	61	44	17	An indication of a significant adverse impact, depending on the context
R22	57	3	60	44	16	An indication of a significant adverse impact, depending on the context
R23	60	3	63	45	18	An indication of a significant adverse impact, depending on the context
R24	55	3	58	45	13	An indication of a significant adverse impact, depending on the context
R25	46	3	49	45	4	An indication of an adverse impact, depending on the context
R26	46	3	49	43	6	An indication of an adverse impact, depending on the context
R28	43	3	46	43	3	An indication of an adverse impact, depending on the context
R29	41	0	41	43	-2	Indication of low impact
R30	41	0	41	44	-3	Indication of low impact
R31	40	0	40	44	-4	Indication of low impact

Table 11 shows the initial night-time BS 4142 assessment for all the emergency generators operating during a blackout event, based on FEED 1 layout.

Table 11 Blackout event BS 4142 Assessment FEED 1 – Night-time

NSR	Specific Sound Level L_s ($L_{Aeq,Tr}$), (dB)	Acoustic Feature Correction (dB)	Rating Level ($L_{Ar,Tr}$), (dB)	Representative Background Sound Level ($L_{A90,T}$), (dB)	Excess of Rating Level Over Background Sound Level ($L_{Ar,Tr} - L_{A90,T}$), (dB)	BS 4142 Impact Category
R19	53	3	56	31	25	An indication of a significant adverse impact, depending on the context
R20	55	3	57	31	26	An indication of a significant adverse impact, depending on the context
R21	58	3	61	31	30	An indication of a significant adverse impact, depending on the context
R22	57	3	60	31	29	An indication of a significant adverse impact, depending on the context
R23	60	3	63	34	29	An indication of a significant adverse impact, depending on the context
R24	55	3	58	34	24	An indication of a significant adverse impact, depending on the context
R25	46	3	49	34	15	An indication of a significant adverse impact, depending on the context
R26	46	3	49	29	20	An indication of a significant adverse impact, depending on the context
R28	43	3	46	29	17	An indication of a significant adverse impact, depending on the context
R29	41	3	44	29	15	An indication of a significant adverse impact, depending on the context
R30	41	3	44	29	15	An indication of a significant adverse impact, depending on the context
R31	40	3	43	29	14	An indication of a significant adverse impact, depending on the context

Table 12 shows the initial daytime BS 4142 assessment for all the emergency generators operating during a blackout event, based on FEED 2 layout.

Table 12 Blackout event BS 4142 Assessment FEED 2– Daytime

NSR	<i>Specific Sound Level</i> L_s ($L_{Aeq,T}$), (dB)	<i>Acoustic Feature Correction</i> (dB)	<i>Rating Level</i> ($L_{Ar,Tr}$), (dB)	<i>Representative Background Sound Level</i> ($L_{A90,T}$), (dB)	<i>Excess of Rating Level Over Background Sound Level</i> ($L_{Ar,Tr}$ - $L_{A90,T}$), (dB)	<i>BS 4142 Impact Category</i>
R19	42	0	42	44	-2	Indication of low impact
R20	53	3	56	44	8	An indication of an adverse impact, depending on the context
R21	54	3	57	44	13	An indication of a significant adverse impact, depending on the context
R22	56	3	59	44	15	An indication of a significant adverse impact, depending on the context
R23	59	3	62	45	17	An indication of a significant adverse impact, depending on the context
R24	42	0	42	45	-3	Indication of low impact
R25	41	0	41	45	-4	Indication of low impact
R26	38	0	38	43	-5	Indication of low impact
R28	39	0	39	43	-5	Indication of low impact
R29	35	0	35	43	-8	Indication of low impact
R30	37	0	37	44	-7	Indication of low impact
R31	39	0	39	44	-5	Indication of low impact

Table 13 shows the initial night-time BS 4142 assessment for all the emergency generators operating during a blackout restoration event, based on FEED 2 layout.

Table 13 Blackout event BS 4142 Assessment FEED 2 – Night-time

NSR	<i>Specific Sound Level</i> L_s ($L_{Aeq,Tr}$), (dB)	<i>Acoustic Feature Correction</i> (dB)	<i>Rating Level</i> ($L_{Ar,Tr}$), (dB)	<i>Representative Background Sound Level</i> ($L_{A90,T}$), (dB)	<i>Excess of Rating Level Over Background Sound Level</i> ($L_{Ar,Tr} - L_{A90,T}$), (dB)	<i>BS 4142 Impact Category</i>
R19	42	3	45	31	14	An indication of a significant adverse impact, depending on the context
R20	53	3	56	31	25	An indication of a significant adverse impact, depending on the context
R21	54	3	57	31	26	An indication of a significant adverse impact, depending on the context
R22	56	3	59	31	28	An indication of a significant adverse impact, depending on the context
R23	59	3	62	34	28	An indication of a significant adverse impact, depending on the context
R24	42	3	45	34	11	An indication of a significant adverse impact, depending on the context
R25	41	3	44	34	10	An indication of a significant adverse impact, depending on the context
R26	38	3	41	29	12	An indication of a significant adverse impact, depending on the context
R28	39	3	42	29	13	An indication of a significant adverse impact, depending on the context
R29	35	3	38	29	9	An indication of a significant adverse impact, depending on the context
R30	37	3	40	29	11	An indication of a significant adverse impact, depending on the context
R31	39	3	42	29	13	An indication of a significant adverse impact, depending on the context

The results in Table 10 to

Table 13 when all the emergency generators are in use during a blackout, show a potential for significant adverse impacts when the *rating level* is compared to the *background sound level* without contribution from the existing Power Station, at:

- NSRs R19, R20, R21, R22, R23, and R24 during daytime for FEED 1 layout
- NSRs R21, R22 and R23 during daytime for FEED 2 layout.
- At all NSRs assessed during night-time period for both FEED layouts.

However, the use of the generators during a blackout event or other emergency situation is not a typical operating scenario, and there should be allowance for higher noise levels for emergency use. As required by BS 4142 the context is considered below.

Considerations of Context- Blackout Event/ Emergency

The diesel generators are an essential infrastructure required to enable the plant to be resilient against a blackout event. Without the generators, the Proposed Installation may not be resilient during a blackout restoration event when no external supplies would be available.

Blackouts are nationally significant events and the generators will only be used when required for system security / resilience during restoration. The routine operation of testing (as assessed above) will be limited to daytime periods only for the minimum time required.

During detailed design, opportunities to reduce the predicted specific sound levels for the emergency diesel generators along with BAT to minimise and manage the impact will be investigated, see Section 7.

7. Noise Control

The emergency diesel generators will be designed and selected, to avoid or minimise impacts and effects of noise and vibration through the process of design development, and by embedding measures into the design, including, increased sound insulation and enclosure of generator and silencers fitted to the stack exhaust extracts, although additional and/or alternative solutions may be identified as the design evolves.

The operational assessment has assumed that potential sound of a tonal, impulsive or intermittent nature would be designed out of the Proposed Installation including emergency diesel generators during the detailed design phase by the selection of appropriate plant enclosures, air louvres and silencers/attenuators as necessary.

Further assessment and review will be undertaken to investigate the feasibility of reducing the sound emissions from the emergency diesel generators as low as practicable through the application of BAT. These measures are summarised in Table 14.

Table 14 Mitigation Measures and Best Available Techniques

<i>Techniques</i>	<i>Description</i>	<i>Applicability</i>
Eliminate	Review if the number and location of emergency generators and design and where possible remove unnecessary items from the scope of the design	This has been considered as part of the FEED stage, and the preliminary number and location of the emergency diesel generators has been identified.
Operational Measures	These include: • Inspection and maintenance of equipment • Plant operated by experienced staff • Avoidance of noisy activities at night, if possible • Agree set time period and day for testing • Maintain a testing log (date/time/duration/load) • Maintain log during blackout restoration/ emergency use (operating times/ duration/load/ cause/ complaints)	These are part of good working practices, routine testing will be during the daytime only and for minimum period required for reliability. Communicate the test day and time periods with local residents.
Low-noise equipment	Select low noise equipment where possible	When equipment is new or being replaced. Where practicable low noise generators will be procured for the Proposed Installation.
Noise Attenuation	These include: • use of screening or bunding to shield receptors from noise sources; • reducing the breakout noise from plant through the use of enhanced enclosures, or potentially containing them within a building; • screening or enclosing the compressors or other equipment;	The generators will be inside a sound enclosure.
Noise Control Equipment	• This includes: • reducing air inlet noise emissions by the addition of in-line attenuation; • reducing stack outlet noise emissions by the addition of	To be considered during the detailed design of the Proposed Installation, silencers are assumed for the diesel generator exhaust stacks.

<i>Techniques</i>	<i>Description</i>	<i>Applicability</i>
	silencers or sound proofing panels; - reducing noise emissions by screening, re-sizing, fitting low noise fans or attenuation; - use of anti-vibration supports and interconnections for equipment;	
Appropriate Location of Equipment and buildings	Orientation of plant within the Installation to provide screening of ground level noise sources by other buildings and structures, or orientating fans and the air inlets away from sensitive receptors.	Where possible the noisiest facade of the generator (typically the inlets and exhausts) to be orientated away from sensitive receptors to west/ southwest of Proposed Installation.
Post installation verification	Once installed complete verification testing and if required review further mitigation and/or adjust the testing regime if monitoring or complaints indicate this is necessary	Allows for real-world monitoring and modification or additional mitigation if required and feasible.

Throughout the development of the Proposed Installation, practical measures to mitigate noise will be incorporated into the design as detailed above and where the implementation of mitigation on proposed plant may be prohibitive, and use of BAT will be taken in to account.

The Operator will investigate noise complaints should they arise, keeping a log of the complaint and any actions taken. In addition, an initial Noise Management Plan has been prepared to support the Environmental Permit application.

8. Assessment Uncertainty

As outlined in the NIA dated March 2026, the operational noise is assessed against the background sound levels obtained in July 2024 during a planned maintenance shut down. There are inherent uncertainties involved with the use of any measurement survey data, due to the general variation in area activities on different occasions and meteorology influenced propagation conditions. One of the BS 4142 assessments for the 72-hour resilience event has considered the *background sound levels* from the night-time, as this is the quietest period and less influenced by other external noise sources such as road and rail noise. However, for this 72-hr resilience scenario, there is considerable uncertainty associated with what background sound level might arise during an event such as a nationally significant blackout.

Any sound level predictions have an associated degree of uncertainty. Modelling processes have been carried out in such a way to reduce such uncertainty, by using indicative design layout and maximum heights for structures and noise sources. In particular, the following sources of uncertainty have been noted:

- Typical diesel generator in an acoustic enclosure has been used based on knowledge from similar projects and would be further updated during detailed design;
- The octave band spectra have not been available for the diesel generator, so data have been taken from the BS 5228; and
- Predictions of sound pressure levels according to ISO 9613-2 are based on moderate downwind propagation from sound source to receptor and can therefore be considered as a reasonable worst-case prediction with respect to wind speed and direction. The standard indicates an estimated accuracy of ± 3 dB(A) in predicted levels at the distances and heights relevant to this assessment.
- As a precaution against uncertainty associated with the FEED layouts, potential barrier attenuation due to other site buildings and structures have been omitted from the prediction of specific sound levels due to diesel generator operation.
- For the routine testing circumstances, the assessment at NSRs has been based on maximum levels that could arise, most likely occurring during operation of the nearest diesel generator. Specific levels at NSRs during testing of the other diesel generators will be lower than assumed in the assessment, particularly for the FEED 1 scenario where the diesel generators are located across the site.
- For the scenario of the existing Power Station and Proposed Installation operating simultaneously, is a very worst-case scenario with all plant operating at maximum capacity, whereas in reality both the existing Power Station and Proposed Installation will not be both fully operational at the same time. It is probable that the number of generating units on the existing Power Station would reduce significantly once the first train of the Proposed Installation becomes operational. At this stage the final combined operations are not yet confirmed.

9. Conclusions

This Noise Impact Assessment (NIA) addendum has been prepared by AECOM on behalf of Uniper, referred to as 'the Operator', in response to the Schedule 5 letter dated 16/6/26 for further information in relation to the new Environmental Permit application for the proposed Connah's Quay Combined Cycle Gas Turbine (CCGT) with Carbon Capture Plant (CCP), referred to as the 'Proposed Installation'. The Proposed Installation is positioned on the south bank of the River Dee in northeast Flintshire.

The Schedule 5 letter requested an updated assessment to include the emergency diesel generators during testing and reasonable worst case operating regime.

The scenarios considered in this addendum are:

- Routine daytime testing of emergency generators (Proposed Installation operational)
- Emergency/ Blackout (worst-case operation)

As the design layout for the plant is still to be finalised, there are currently two FEED designs which have different locations for the emergency diesel generators. Therefore, the sound propagation model (CadnaA) has been updated to include the proposed emergency diesel generator locations from both FEED layouts. The Proposed Installation buildings and plant have been omitted from the model to avoid these structures incorrectly influencing the predicted specific sound levels from the emergency diesel generators. The predicted sound levels from the emergency generators have been logarithmically added to the specific sound levels from the Proposed Installation for the routine testing scenario. As such, some worst-case assumptions have been applied to the assessment, which may lead to an over-prediction of the potential impacts.

The initial BS 4142 assessment for the Proposed Installation including the concurrent routine testing of a generator, indicates potential for significant adverse impacts at NSR R23 with potential adverse impacts at NSRs R19, R20, R21, R22, and R24, based on FEED 1 layout. And potential adverse impacts at NSRs R20, R21, R22 and R23, based on FEED 2 layout. The initial impacts are based on the rating level compared to the background sound level without contribution from the existing Power Station, before the context considerations.

For the scenario of the existing Power Station and Proposed Installation operating simultaneously including concurrent routine testing of a single diesel generator, there is potential for significant adverse impacts at NSRs for FEED 1 and FEED 2 scenarios. However, this is a very worst-case scenario with all plant operating at maximum capacity, whereas in reality both the existing Power Station and Proposed Installation will not be both fully operational at the same time. It is probable that the number of generating units on the existing Power Station would reduce significantly once the first unit of the Proposed Installation becomes operational. At this stage the final combined operations are not yet confirmed.

The routine testing of the emergency diesel generators will only take place for up to 30 minutes on a fortnightly basis, with only one generator tested in a one hour period, therefore is not part of everyday typical operation. Also, the highest specific sound level from a single generator (typically the closest generator) at each receptor has been used in the assessment as a worst case, therefore lower sound levels may be experienced when testing generators further away from the receptors.

The context of the road traffic and existing industrial sound, which all contribute to the overall acoustic environment, as well as short duration of daytime only routine testing need to be taken into consideration. The routine testing ensures reliability and readiness for emergency operation / resilience when external electrical supplies are unavailable. The emergency generators are necessary to ensure compliance with NESO rules which require that the Proposed Installation is suitably resilient during any future blackout events.

Once adjusted for context, the initial indication of significant adverse impact has been revised. The routine testing of emergency generators during operation of the Proposed Installation has the potential to give rise to a short-duration adverse, but not significant impact at the NSRs.

The worst-case scenario of emergency operation during a blackout (all generators simultaneously) BS 4142 assessment shows there is the potential for significant adverse impacts at all NSRs assessed during the night-time period for both FEED layouts. There is the potential for significant adverse impacts at NSRs R19, R20, R21, R22, R23 and R24 during daytime for FEED 1 layout and at NSRs R21, R22 and R23 during daytime for FEED 2 layout.

However, the use of the emergency generators during an energy blackout event situation cannot be considered a typical operating scenario, and there should be allowance for higher noise levels for emergency use.

The diesel generators are mandatory infrastructure required to meet future NESO resilience requirements during a blackout event. Without the diesel generators, restoration of the Proposed Installation to operation might not be possible following a blackout event. Blackouts are nationally significant events and the diesel generators will only be used when required for system security / restoration.

Opportunities to reduce the predicted specific sound levels for the emergency diesel generators along with BAT to minimise and manage the impact will be considered during detailed design.

This addendum specifically considers additional short duration testing or emergency blackout operation. Full details of the normal operation of the Proposed Installation are provided in the March 2026 NIA.

Appendix A NSR Locations

Assessment Locations.

The noise sensitive receptors used in the assessments are shown in Figure 1.



Figure 1 NSR locations.

Appendix B Operational Sound Information

Noise Model Settings

The noise model has been constructed in CadnaA (version 2025) acoustic modelling software. This software implements the sound propagation calculation methodology set out in International Organization for Standardization (ISO) (Part 2: 2024). ISO 9613 Acoustics - Attenuation of sound during propagation outdoors. Details of the sound sources and noise modelling assumptions specifically associated with the additional sound emissions from the emergency diesel generators are as follows.

Data Sources

The following data sources have been used:

- Surrounding area ground heights – data from the Environment Agency National LIDAR programme - downloaded from Open Survey Data;
- Ordnance Survey MasterMap Topography Layer of the Order limits and surrounding areas;
- FEED 1 and FEED 2 emergency diesel generator location, dimensions and stack height;
- Sound pressure level of indicative diesel generator with sound enclosure which has been reviewed by Uniper.

Modelling Assumptions

The model has been prepared with the following configurations and assumptions:

- Receptor buildings heights – taken from OS MasterMap Building Height Attribute dataset;
- Receptor heights – modelled as 4 m above ground to represent first floor;
- Ground effect – industrial areas and hardstanding 0.0, vegetation 1.0, road surfaces 0.0, water bodies 0.0. The locations of each area have been determined from the OS MasterMap Topography Layer;
- Source sound levels – taken from typical diesel generator with a sound enclosure (Rehiko KD 2500)
- Generators are running for 30 minutes during testing, with only one generator tested in a one hour period;
- For stack emission it is assumed that an acoustic silencer is fitted within the exhaust component providing 25dB reduction.
- The octave band spectrum for diesel generator has been taken from BS B228-1:2009+A1:2014.⁵ (Table C4.77)
- The emergency diesel generators and the exhaust stacks have been modelled as point sources;
- The prediction of sound pressure levels according to ISO 9613-2 is based on an atmospheric temperature of 10°C and relative humidity of 70%, which is representative of typical average UK conditions in the absence of specific local data, and are based on an assumption of moderate downwind propagation from source to receptor as a worst-case calculation.

1.

⁵ BS 5228-1:2009+A1:2014
Code of practice for noise and vibration control on construction and open sites. Noise

Table 15 Sound Power Levels of indicative emergency generators

Equipment Item	Linear Sound Power Level Each Frequency Band dB									L_{WA} dB
	31 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	
Diesel Generator	0	119.7	111.7	111.7	106.7	102.7	101.7	97.7	90.7	109.8
Generator stack	0	85.0	90.0	102.0	94.0	89.0	80.0	67.0	54.0	96.4

Note: Generic sound power level spectra for a diesel generator taken from BS 5528-1 Table C4.77, has been used to define spectrum for the 109 dB L_{WA} emergency diesel generator container.

