Springwell Solar Farm

Plume Assessment Addendum: Air Quality Assessment

APFP Regulation 5(2)(q)

Planning Act 2008

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

EN010149/APP/8.24
August 2025
Deadline 3
Springwell Energyfarm Ltd

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Executive Summary

An air quality assessment has been undertaken to support the operation of a Battery Energy Storage System (BESS) at the Springwell Solar Farm. This has been carried out in addition to a BESS air quality assessment that will be carried out at the detailed design stage and secured in the **Outline Battery Safety Management Plan [EN010149/APP/7.14.2] [REP1-048]**, as agreed with the UK Health Security Agency.

A BESS does not produce routine emissions; however, there is the potential for a battery thermal runaway heating incident to produce high short-term emissions. The risk of a thermal runaway event has been determined at 1 in 7,700 years (an aggregate figure which accounts for all example BESS enclosures within the compound), with any event being appropriately managed by the **Outline Battery Safety Management Plan [EN010149/APP/7.14.2]** [REP1-048] and the future Emergency Response Plan. This is on the assumption that other preventative safety measures and mitigation built into the system have failed.

The assessment has been undertaken to be deliberately conservative, accounting for five years of meteorological data, a number of possible locations of a battery thermal runaway heating incident, several release scenarios and predicting concentrations at nearby residential receptors, footpaths and the nearby A15 road.

The main findings when considering the results from all modelling scenarios and sensitivity tests (including **Springwell Solar Farm BESS Plume Assessment [EN010149/APP/7.19.2]** [REP1-052]) were:

- Hazards of toxic gas concentrations are shown to be confined to the immediate surroundings of the BESS under thermal runaway (using the PHAST and ALOHA models).
- Total concentrations at all nearby receptors during a BESS thermal runaway event are predicted to be well below all applicable Air Quality Standards, with the impacts from such an incident generally below 1% of these standards (using the ADMS 6 dispersion model).
- Visibility on the A15 is not predicted to be significantly impacted during an incident.

For certain air quality standards to which the largest contributions from the BESS incident are predicted, the results at all receptors within 1 km are presented in the tables below. However, all results are shown in **Annex 3: Full Results for Residential Receptors within 1km of a BESS.**

As such, the effects of a very unlikely BESS thermal runaway incident on the defined receptors are judged to be insignificant using industry standard definitions.

Methods to protect personnel and first responders in the vicinity of the event will be detailed in the future Emergency Response Plan, where it is likely that full Personal Protective Equipment will be worn by the first responders. However, residential, PROW, and highway receptors are sufficiently far away from the event so as not to be impaired by toxicity or visibility.

Summary of the Worst Case Impacts against the Hydrogen Fluoride 1-hour Environmental Assessment Level (EAL).

Receptor ID	Receptor Name	Total Concentration (µg/m3) (Receptor)	% of Standard (EAL)	Impact Descriptor*	Receptor Distance (km)
R1	Gorse Hill Bungalow	4.55	2.8%	Insignificant	0.6
R2	Gorse Hill Farm	4.49	2.8%	Insignificant	0.6
R3	Toll Bar Cottages	4.76	3.0%	Insignificant	0.5
R4	Ashby Lodge Cottages	2.38	1.5%	Insignificant	0.9
R5	Thompsons Bottom Farm	3.90	2.4%	Insignificant	0.7
R6	Thompsons Bottom Cottages	3.66	2.3%	Insignificant	0.7
Hydrogen Fluoride 1-hour (EAL)	**160 µg/m³**				

* Short-term impacts of less than 10% of the HF 1-hour mean Environmental Assessment Level are considered insignificant, based on the Environment Agency Criteria [Ref. 1-10].

Summary of the Worst Case Impacts against the PM_{10} 24-hour Air Quality Standard (AQS).

Receptor ID	Receptor Name	Total Concentration (µg/m³) (Receptor)	% of Standard (AQS)	Impact Descriptor*	Receptor Distance (km)
R1	Gorse Hill Bungalow	0.94	1.9%	Insignificant	0.6
R2	Gorse Hill Farm	0.93	1.9%	Insignificant	0.6
R3	Toll Bar Cottages	1.55	3.1%	Insignificant	0.5
R4	Ashby Lodge Cottages	0.53	1.1%	Insignificant	0.9
R5	Thompsons Bottom Farm	0.79	1.6%	Insignificant	0.7
R6	Thompsons Bottom Cottages	0.68	1.4%	Insignificant	0.7
PM_{10} 24-hour (AQS)			**50 µg/m³**		

* Short-term impacts of less than 10% of the PM_{10} 24-hour mean Air Quality Objective are considered insignificant, based on the Environment Agency Criteria [Ref. 1-10].

Summary of the Worst Case Impacts against the PM_{10} Annual Air Quality Standard (AQS).

Receptor ID	Receptor Name	Total Concentration (µg/m³) (Receptor)	% of Standard (AQS)	Impact Descriptor*	Receptor Distance (km)
R1	Gorse Hill Bungalow	0.0027	<0.1%	Insignificant	0.6
R2	Gorse Hill Farm	0.0027	<0.1%	Insignificant	0.6
R3	Toll Bar Cottages	0.0049	<0.1%	Insignificant	0.5
R4	Ashby Lodge Cottages	0.0015	<0.1%	Insignificant	0.9

R5	Thompsons Bottom Farm	0.0023	<0.1%	Insignificant	0.7
R6	Thompsons Bottom Cottages	0.0020	<0.1%	Insignificant	0.7
PM_{10} Annual (AQS)			**40 µg/m^3**		

* Long-term impacts of less than 0.5% of the PM_{10} annual mean Air Quality Objective are considered negligible/insignificant, based on the IAQM guidance [Ref. 1-9].

Summary of the Worst Case Impacts against the $PM_{2.5}$ Annual Air Quality Standard (AQS).

Receptor ID	Receptor Name	Total Concentration (µg/m^3) (Receptor)	% of Standard (AQS)	Impact Descriptor*	Receptor Distance (km)
R1	Gorse Hill Bungalow	0.0027	<0.1% (<0.1%)	Insignificant	0.6
R2	Gorse Hill Farm	0.0027	<0.1% (<0.1%)	Insignificant	0.6
R3	Toll Bar Cottages	0.0049	<0.1% (<0.1%)	Insignificant	0.5
R4	Ashby Lodge Cottages	0.0015	<0.1% (<0.1%)	Insignificant	0.9
R5	Thompsons Bottom Farm	0.0023	<0.1% (<0.1%)	Insignificant	0.7
R6	Thompsons Bottom Cottages	0.0020	<0.1% (<0.1%)	Insignificant	0.7
$PM_{2.5}$ Annual (AQS)			**20 (10**) µg/m^3**		

* Long-term impacts of less than 0.5% of the $PM_{2.5}$ annual mean Air Quality Objective are considered negligible/insignificant, based on the IAQM guidance [Ref. 1-9].

** The legally binding target to be achieved by 2040

1. Introduction

1.1.1. RSK Environment Ltd (RSK) has been commissioned to undertake an air quality assessment to support the operation of a Battery Energy Storage System (BESS) at the Springwell Solar Farm. The full description of the Proposed Development is provided in **ES Volume 1, Chapter 3: Proposed Development Description [EN010149/APP/6.1.2]** [REP1-022].

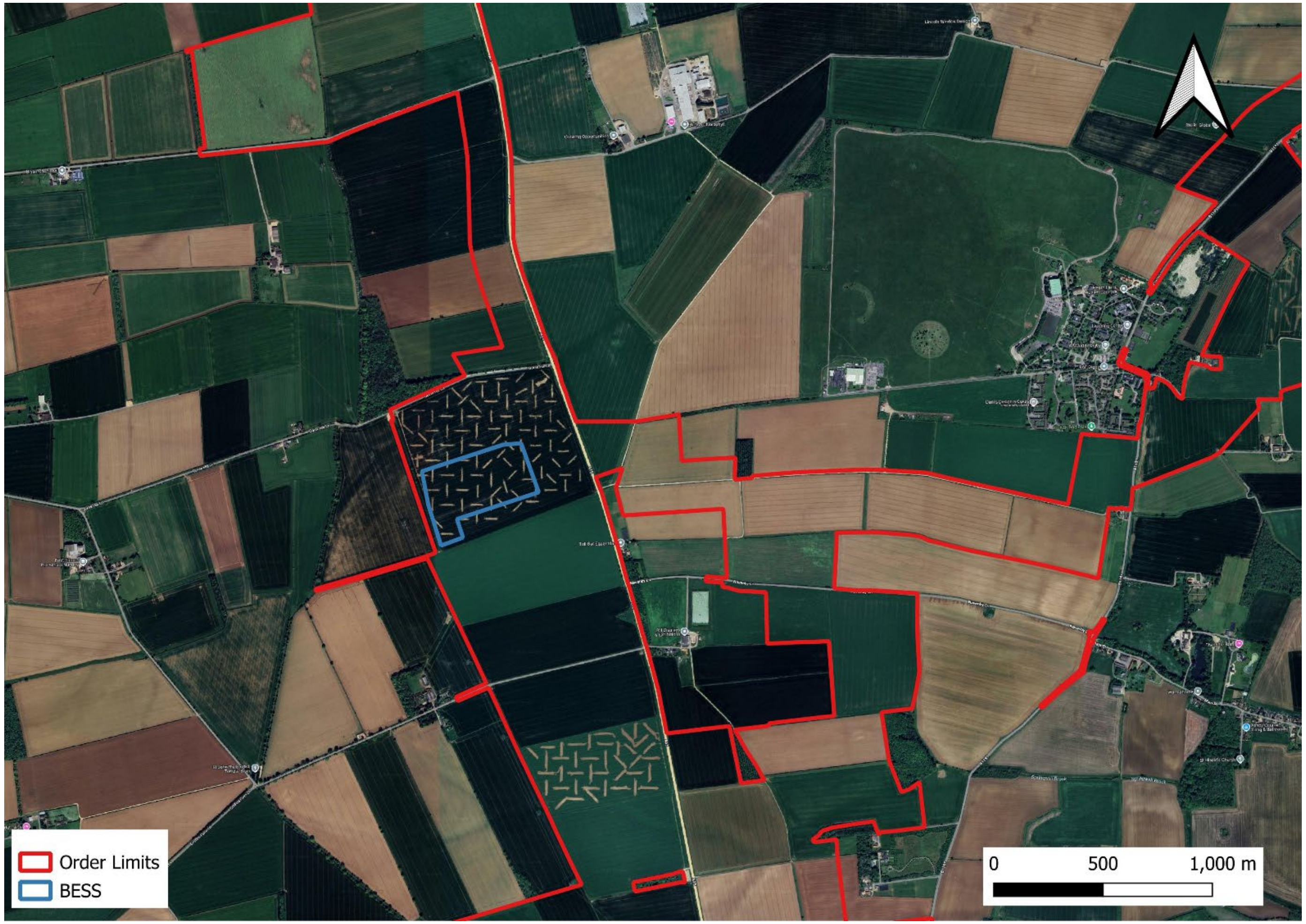
1.1.2. This assessment has been produced to support the application for the wider Springwell Solar Farm. It is recommended that this assessment be read alongside the **BESS Plume Assessment [EN010149/APP/7.19.2]** [REP1-052] and the **Outline Battery Safety Management Plan (oBSMP) [EN010149/APP/7.14.2]** [REP1-048], which outlines the assessment of other risks, such as explosive risk or immediate risk to life, and key safety provisions.

1.1.3. The BESS site covers an area of 5.2ha and would contain multiple 5MWh battery containers. The installation of a BESS allows excess solar energy to be balanced and utilised during peak times when required by the national grid, rather than simply not being collected. The site lies within the administrative area of North Kesteven District Council (NKDC), which has not declared any Air Quality Management Area (AQMA). The BESS area is located within the east of the Proposed Development, with the BESS location in relation to the surrounding area presented in **Figure 1.1: Site Location**.

1.1.4. A BESS does not produce routine emissions; however, there is the potential for a battery thermal runaway heating incident to produce high short-term emissions that have the potential to impact nearby human receptors. The following report presents the findings of the impact assessment from emissions of nitrogen dioxide (NO_2), carbon monoxide (CO), particulate matter (PM_{10} and $PM_{2.5}$), hydrogen fluoride (HF), hydrogen chloride (HCl), hydrogen cyanide (HCN) and benzene. All other measured emissions (such as hydrogen bromide) from a BESS battery thermal runaway incident are judged to have a smaller emissions release to Air Quality Standard (AQS) ratio and have not been assessed further.

1.1.5. This assessment has considered both the long- and short-term air quality impacts on human receptors of any BESS battery thermal runaway incident utilising dispersion modelling. Furthermore, at the request of the UK Health Security Agency (UKHSA), consideration of particulate matter emissions on road visibility at the nearby A15 has been considered. As no significant traffic or construction emissions are anticipated, they have not been considered further.

Figure 1.1 Site Location



Imagery @2025 Airbus, Maxar Technologies Map data @2025

2. Legislation and Guidance

2.1. Legislation

Air quality standards and objectives

2.1.1. The air quality standards (AQSs) and air quality objectives (AQOs) in the United Kingdom are derived from EC directives and are adopted into English law via the Air Quality (England) Regulations 2000 **[Ref. 1-1]** and Air Quality (England) Amendment Regulations 2002 **[Ref. 1-2]**. Directive 2008/50/EC **[Ref. 1-3]** set limits values, and was translated into UK law in 2010 via the Air Quality Standards Regulations 2010 **[Ref. 1-4]**. The European Union (Withdrawal) Act retains existing EU environmental provisions in the UK.

The Environment Act 2021

2.1.2. The Environment Act 2021 **[Ref. 1-5]** amends the Environment Act 1995 **[Ref. 1-6]** to establish the use of local air quality management frameworks in order to encourage cooperation at the local level and broaden the range of organisations that play a role in improving local air quality. The Act requires the government to have an Environmental Improvement Plan (EIP) covering at least 15 years and setting out steps it intends to take to improve the environment. Part 1 of The Environment Act requires targets to be set for fine particulate matter $PM_{2.5}$, and these were introduced in The Environmental Targets (Fine Particulate Matter) (England) Regulations 2023 **[Ref. 1-7]**, as follows:

- $PM_{2.5}$ concentration interim target, annual mean of 12µg/m^3 by 2028;
- $PM_{2.5}$ exposure reduction interim target of 22% reduction compared to 2018 by 2028;
- $PM_{2.5}$ concentration binding target of annual mean of 10µg/m^3 by 2040;
- $PM_{2.5}$ exposure reduction binding target of 35% reduction compared to 2018 by 2040.

2.2. Guidance

Local Air Quality Management Technical Guidance

2.2.1. The Department for Environment, Food and Rural Affairs (Defra) has published technical guidance for use by local authorities in their air quality review and assessment work. This guidance, referred to in this document as the Local Air Quality Management Technical Guidance ('Local Air Quality Management Technical Guidance 22') **[Ref. 1-8]**.

Land-Use Planning & Development Control: Planning for Air Quality

2.2.2. Environmental Protection UK (EPUK) and the Institute of Air Quality Management (IAQM) jointly published a revised version of the guidance note 'Land-Use Planning & Development Control: Planning for Air Quality' in 2017 (herein the 'Environmental Protection UK-IAQM 2017 guidance') **[Ref. 1-9]** to facilitate consideration of air quality within local development control processes. It provides a framework for air quality considerations, promoting a consistent approach to the treatment of air quality issues within development control decisions.

2.2.3. The guidance includes methods for undertaking an air quality assessment and an approach for assessing the significance of effects, which has been used within this assessment. The guidance note is widely accepted as an appropriate reference method for this purpose.

Environment Agency Guidance

2.2.4. The Environment Agency has published multiple documents relating to the assessment of emissions to air under the Environmental Permitting Regulations (EPR). While this development does not currently fall within the scope of EPR, the assessment techniques contained in these documents are suitable and have been used for assessing pollutants commonly regulated under EPR (such as those addressed in this assessment). These documents include:

- Air emissions risk (AER) assessment for your environmental permit **[Ref. 1-10]**; and
- Environmental permitting: air dispersion modelling reports **[Ref. 1-11]**.

3. Assessment Criteria

3.1.1. As described in Section 2, the air quality standards (AQSs) and air quality objectives (AQOs) in the United Kingdom are derived from EC directives and are adopted into English law.

3.1.2. Furthermore, as part of their regulatory position, the Environment Agency (EA) and Defra have produced environmental assessment levels (EALs) to regulate hazardous pollutants produced by industry that are not captured within the Air Quality Regulations. These are non-statutory guideline values and are contained within its AER guidance **[Ref. 1-10]**.

3.1.3. Based on the current UK regulations, the AQSs for the pollutants proposed for assessment are presented in **Table 3.1**.

Table 3.1: Air Quality Standards Relevant to the Assessment

Pollutant	Averaging period	Exceedances allowed per year	Ground level concentration limit (µg/m^3)	Designation
Nitrogen dioxide (NO_2)	calendar year mean	-	40	AQO*
	1-hour mean	18	200	AQO*
Benzene	Annual	-	5	AQO*
	24-hour mean	-	30	EAL
Carbon Monoxide (CO)	Maximum 8-hour running mean in any daily period	-	10,000	AQO*
	1-hour mean	-	30,000	EAL
Hydrogen Chloride (HCl)	1-hour mean	-	750	EAL
Hydrogen Cyanide (HCN)	24-hour mean	-	2	EAL
Hydrogen Fluoride (HF)	1-hour mean	-	160	EAL
	Monthly-mean****	-	16	EAL
PM_{10}	Annual	-	50	AQO*
	24-hour mean	35	40	AQO*
$PM_{2.5}$	Annual	-	10**/20***	AQS

* The limit value is the same as the AQO.

** The legally binding target to be achieved by 2040.

*** There is no AQO; therefore, the limit value has been used.

**** Defra 2008 Consultation on Addendum to Guidelines for halogen an hydrogen halides in ambient air for protecting human health against acute irritancy effects states **[Ref. 1-12]**: “It is unlikely that he ambient monthly mean would approach this value if the 1-hour guideline value for irritancy for hydrogen fluoride is not exceeded as an air pollutant emitted from a chimney stack” Based on the result in section 5, it is not necessary to consider the hydrogen fluoride monthly EAL.

3.1.4. In addition to the UK regulations, and due to the short-term nature of any BESS battery thermal runaway incident, impacts have also been compared to the United States Environmental Protection Agency’s (US EPA) Acute Exposure Guidelines Levels (AEGLs) **[Ref. 1-13]**. These are used by emergency planners and responders worldwide as guidance in dealing with rare or accidental releases. AEGLs are calculated for five relatively short exposure periods – 10 minutes, 30 minutes, 1 hour, 4 hours, and 8 hours – as differentiated from air standards based on longer or repeated exposures. AEGL “levels” are dictated by the severity of the toxic effects caused by the exposure, with Level 1 being the least (discomfort) and Level 3 being the most severe (Life-threatening health effects or death). The AEGLs for the pollutants proposed for assessment are presented in **Table 3.2**. There are no AEGLs for PM_{10} or $PM_{2.5}$.

Table 3.2: AEGLs Relevant to the Assessment

Pollutant	AEGL Level	Concentration (µg/m^3)*				
		10min	30min	60min	4hr	8hr
CO	AEGL1	-	-	-	-	-
	AEGL2	507,849	507,849	181,375	100,361	39,902
	AEGL3	2,055,581	2,055,581	725,499	399,025	181,375
HCL	AEGL1	2,833	2,833	2,833	2,833	2,833
	AEGL2	157,394	157,394	67,680	34,627	17,313
	AEGL3	975,845	975,845	330,528	157,394	40,923
HF	AEGL1	864	864	864	864	864
	AEGL2	82,062	82,062	29,370	20,732	10,366
	AEGL3	146,848	146,848	53,556	38,008	19,004
HCN	AEGL1	2,917	2,917	2,917	2,333	1,517
	AEGL2	19,833	19,833	11,667	8,283	4,083
	AEGL3	31,500	31,500	24,500	17,500	10,033
NO_2	AEGL1	993	993	993	993	993
	AEGL2	39,724	39,724	29,793	23,834	16,287

	AEGL3	67,531	67,531	49,655	39,724	27,807
Benzene	AEGL1	438,352	246,151	175,341	60,695	30,347
	AEGL2	6,743,870	3,709,128	2,697,548	1,348,774	674,387
	AEGL3	32,707,769	18,882,835	13,487,740	6,743,870	3,338,216

* The AEGLs are presented in ppm on the USEPA website. The conversion from ppm to µg/m^3 applied in this table assumes an ambient temperature of 9.3°C, taken from the UK Met Office's annual mean temperature between 1990 and 2024 for East and North East England.

4. Assessment Methodology

4.1. Overall Scope

4.1.1. The BESS example design includes the installation and operation of multiple 5MWh BESS containers. These BESS allow excess solar energy to be balanced and utilised during peak times when required by the national grid, rather than simply not being collected.

4.1.2. A BESS does not produce routine emissions; however, there is the potential for battery thermal runaway heating or fire events to produce high short-term emissions. These are the effects that have been assessed as part of this assessment.

4.1.3. The assessment will utilise dispersion modelling to predict concentrations of the identified pollutants in **Section 3** at nearby human receptors. The predictions will be made for short- and long-term time periods where there are applicable standards (see **Table 3.1** and **Table 3.2** in **Section 3**).

4.1.4. Furthermore, at the request of the UKHSA, consideration of particulate matter emissions on road visibility at the nearby A15 has been considered, as per the National Fire Chiefs Council's guidance.

4.2. Dispersion Modelling Methodology

Understanding of the BESS Operations

4.2.1. An example design could include the operation of multiple 5MWh BESS containers. Each of these 5MWh BESS containers could be made up of 4,991 314Ah (3.2V) Lithium Iron Phosphate cells (batteries). These 4,991 cells are typically organised into 48 104-cell deep racks split across six compartments.

4.2.2. An example container could operate 24 hours a day, 365 days a year, with the batteries being in various states of charge (SOC).

Modelling Scenarios

4.2.3. As discussed, there could be multiple 5MWh BESS containers onsite; the design of the containers prevents rapid fire/heating progression, and it is unlikely that more than one BESS container will experience a thermal runaway incident at any one time. Therefore, the assessment assumes that only one container could experience a thermal runaway incident at any one time.

4.2.4. However, as it is not known which of the BESS containers will experience a thermal runaway incident, emissions have been modelled from four separate BESS containers, one at each corner of the site. This allows the worst-case impact at each receptor to be identified. The location of each modelled BESS container is shown in **Figure 4.1.**

4.2.5. Estimates from the BESS manufacturers indicate that any BESS battery thermal runaway heating or fire incident would last between 4 and 8 hours before burning out. Therefore, as a conservative assumption, emission estimates (see **Section 4.29** onwards) assume that all pollutants from the burning of an entire 5MWh battery container will be released across a 4-hour period. However, the sensitivity to the emissions being released across 6- and 8-hour periods has been undertaken, with impacts likely to be less, due to the slower heat propagation through the cells and a slower emissions release.

4.2.6. While any thermal runaway incident is assumed to last between 4 and 8 hours before burning out, the weather conditions under which such an incident will occur cannot be known. Therefore, as best practice, the model has been run based on 5 years' worth of meteorological data, with the worst-case results presented. This allows the worst-case conditions to be identified, and it does not suggest that any incident would last 5 years.

Modelling Software

4.2.7. The model used in this study is the Atmospheric Dispersion Modelling System (ADMS) Version 6, developed by the Cambridge Environmental Research Consultants (CERC). ADMS is a steady-state new-generation Gaussian plume atmospheric dispersion model; that being, it characterises the atmospheric boundary layer properties using the boundary layer depth and Monin-Obukhov length rather than the Pasquill-Gifford stability classes.

4.2.8. The ADMS model can include the treatment of both surface and elevated sources, complex terrain, buildings and chemistry effects. The model calculates downwind pollutant concentrations in the surrounding area for each hour of the day and night. Statistics on the frequency and concentration of pollutants at the receptor sites are based on hourly calculations.

4.2.9. Along with the AERMOD dispersion model, ADMS is commonly used within the UK for regulatory purposes and is judged fit for purpose for this assessment.

Figure 4.1 BESS Source Locations

Imagery @2025 Airbus, Maxar Technologies Map data @2025

Emission Parameters

Emission Concentrations

4.2.10. As detailed above, the modelling scenarios assume that only one 5MWh BESS container will experience a battery thermal runaway heating/fire incident.

4.2.11. In order to estimate the total emissions released during a BESS battery thermal runaway incident, information from a PowerTitan 2 battery fire container test, a Gridsolv Quantum BESS thermal runaway test, individual cell fire testing data, US EPA AP-42 emission factors **[Ref. 1-14]**, and data provided by EDF have been used.

4.2.12. To ensure a robust assessment, the maximum concentrations measured above a whole container thermal runaway test have been used within this assessment. In this case, pollutant concentrations have been taken from the maximum concentrations measured during fire testing of a Gridsolv Quantum BESS, undertaken in 2023. This test lasted 9 hours, and concentrations were measured above and adjacent to the BESS container. While this unit's capacity was 1.49MWh, the CO concentrations recorded were substantially higher than the large-scale burn test of a Titan 2 container; thus, the Gridsolv Quantum have been used to provide a conservative assessment.

4.2.13. The concentrations used in this assessment are presented in **Table 4.1**. Emissions of benzene and particulate matter were not recorded directly above any container fire test (only in ambient air away from a container). Therefore, concentrations have been derived by using the ratio between the benzene (as total organics)/particulate matter (as PM) and CO concentrations from an automobile fire emissions testing measurement study, detailed within the USEPA AP-42 emissions factor database **[Ref. 1-14]**. Based on single battery thermal runaway data, the concentrations of benzene used are judged to be very conservative.

Table 4.1: Maximum Emission Concentrations

Pollutant	Maximum Emission Concentrations (PPM)
CO	3,061
HCl	114.4
HCN	54.5
HF	575.6
NOx	59.4
$PM_{10}/PM_{2.5}$	2,449 *
Benzene	1,039

* Total particulate matter emissions were assumed to be both PM_{10} and $PM_{2.5}$

Emission Rates

4.2.14. Total emissions rates have been calculated using the discussed maximum emission concentrations (converted to mg/L) multiplied by the estimated gas produced by a 5MWh BESS container fire.

4.2.15. The gas production estimate for a 5MWh BESS container has been upscaled from the gas production data from a single 314Ah (3.2V) cell. Testing indicates that this cell, when heated, produces 202.9L of gas. This upscaled for a 5MWh BESS container would release 5,671,962L of gas.

4.2.16. The uncertainties associated with the above assumption on the conclusions of this assessment have been discussed in **Section 5**.

Physical Parameters

4.2.17. The height of the emissions has been estimated based on the height of a PowerTitan 2 (2.896m) and the estimated flame height. This was reported in the PowerTitan 2 fire test as being between one and four metres. A one metre flame height has been used for conservatism purposes, but also because a 4m flame height was only reported to occur when the fire was at its most vigorous and would not be representative of the entire heating/fire incident.

4.2.18. An area source has been used to model the fire within ADMS, with the area of the emissions assumed to be the size of a PowerTitan 2 BESS ($14.7m^2$).

4.2.19. The model requires a gas exit temperature in order to account for the thermal buoyancy of the plume. A temperature of 342°C has been used as it represents an average of container roof temperatures recorded during the PowerTitan 2 battery fire container test. However, as considerably higher temperatures were recorded, sensitivity to exhaust temperatures of 500°C and 1300°C has been undertaken.

4.2.20. There will be no associated mechanical buoyancy associated with the plume, which is common for air being forced from a stack; therefore, the exit velocity has been set at 0.01 m/s.

4.2.21. All physical parameters entered into the model have been presented in **Table 4.2**, with the emission rates for each scenario presented in **Table 4.3**.

Table 4.2: Physical and Flow Parameters

Parameter	Values	Assumption and Source
Battery Type	314Ah LFP cells	Provided by EDF
Cell power output (Wh)	1004.8	Provided by EDF
Number of Cells per container	4991	Provided by EDF
Container Capacity (MWh)	5.01552	Provided by EDF
Height (m)	3.896	Top of container (2.896m) + plus a 1m flame height.
Area (m^2)	14.769404	Based on information provided in the PowerTitan 2.0 specification sheet.
Exit Velocity (m/s)	0.01	Assumes no mechanical buoyancy
Exit Temperature (°C)	342/500/1300	See **Paragraph 4.2.20**
L/Wh	0.4	Based on 202L from a 1004.8Wh Cell at 342°C, assuming 202L was measured at 20°C.
CO Emission Concentration (ppm)	3,061	Taken from the Gridsolv Quantum BESS thermal runaway testing report.
HCl Emission Concentration (ppm)	114.4	
HF Emission Concentration (ppm)	575.6	
HCN Emission Concentration (ppm)	54.5	
NOx Emission Concentration (ppm)	59.4	
PM_{10} Emission Concentration (ppm)	2,449	Assumed to be 80% of the CO emissions concentration based on the US EPA AP-42 Emission Factors.
$PM_{2.5}$ Emission Concentration (ppm)	2,449	Assumed to be 80% of the CO emissions concentration based on the US EPA AP-42 Emission Factors.
Benzene Emission Concentration (ppm)	1,039	Assumed to be 34% of the CO emissions concentration based on

the US EPA AP-42 Emission Factors.

Table 4.3: Modelled Emissions Rates

Parameter	Modelling Scenario Emission Rates			Notes
	4-hour	6-hour	8-hour	
CO Emission Limit (g/s)	0.2507	0.1672	0.1254	Emission concentration (PPM) converted to g/L, assuming an exhaust temperature of 342 °C*, multiplied by total exhaust gas volume (L) per 5MWh Bess and divided by the incident time frame.
HCl Emission Limit (g/s)	0.0122	0.0081	0.0061	
HF Emission Limit (g/s)	0.0337	0.0225	0.0168	
HCN Emission Limit (g/s)	0.0043	0.0029	0.0022	
NOx Emission Limit (g/s)	0.0052	0.0035	0.0026	
PM_{10} Emission Limit (g/s)	0.2006	0.1337	0.1003	
$PM_{2.5}$ Emission Limit (g/s)	0.2006	0.1337	0.1003	
Benzene Emission Limit (g/s)	0.0851	0.0567	0.0425	

* Emission rates for the 500°C and 1,300°C scenarios are assumed to be the same as above. This is due to the total mass of pollutants from the 5MWh BESS assumed to be released in each scenario.

Meteorological Data

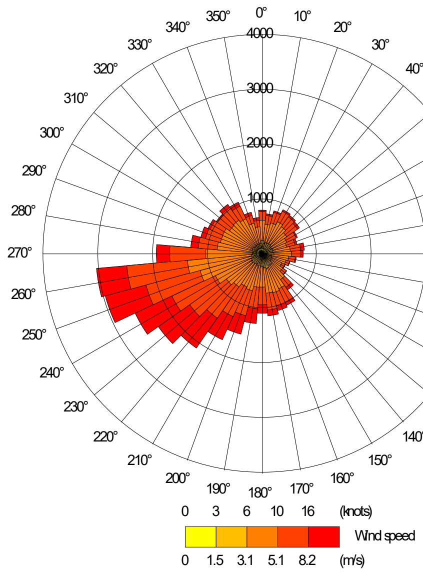
4.2.22. Hourly sequential meteorological data[1] from the Cranwell meteorological station from between 2020 and 2024 have been used within the model. The Cranwell Airport station is 8 km to the southeast of the BESS site and is judged to be the nearest suitable meteorological station to the site with valid data capture; both the meteorological station and the proposed development are located in areas of flat-lying topography.

4.2.23. Each year has been modelled separately, with the worst-case prediction presented at each receptor presented within the report.

[1] Sources from ADM Ltd.

4.2.24. Examination of the wind roses indicates that the winds are predominantly from the directions of between 215° and 270, i.e., predominantly south-westerly winds. This is typical of the conditions generally experienced in this part of the UK. The wind rose diagram for the entire modelled period (2020 – 2024) is presented in **Figure 4.2**.

Figure 4.2: Wind Rose for Cranwell Meteorological Station (2020 - 2024)



4.2.25. The Monin-Obukhov Length is the height above ground where mechanically produced (by vertical shear) turbulence is in balance with the dissipative effect of negative buoyancy. The minimum Monin-Obukhov Length parameter is an important component of the ADMS model, which allows the user to account for the heat production of cities and can have significant effects on the modelling results. For this assessment, the minimum Monin-Obukhov Length of 1m was used for the meteorological site location and the dispersion site location (representing rural areas).

Buildings

4.2.26. Buildings have the potential to disrupt atmospheric flow. In the case of emissions from a stack, they can entrain pollutants into the leeward side of the building (known as a cavity region). This cavity region is highly turbulent, often bringing pollutants rapidly towards ground level, increasing their concentrations. These concentrations will then reduce with diminishing turbulent wake. ADMS does not have the capability to model the impacts of pollutants being emitted from an area source. As such, the effects of buildings have not been included. However, given the distance to the closest receptors, the effects of buildings (i.e. any proposed onsite containers) on pollutant concentrations are likely to be minimal and not considered to affect the conclusions of this study.

Terrain and Land Use

4.2.27. The topographical features surrounding a site will have an influence on the dispersion of pollution within the area. This is accounted for in the surface roughness length (z0) specified in the model input.

4.2.28. A z0 surface value of 0.1m was used for the land use around the site, which the model guidance indicates is appropriate for 'root crops'. Furthermore, a surface roughness length of 0.3m has been used to represent the land use around the meteorological site. Furthermore, model default values were used for surface albedo (0.23) and the Priestley-Taylor parameter (1).

4.2.29. The model author (CERC) **[Ref. 1-15]** advises that slopes with a gradient of greater than 1:10 can affect dispersion. In this case, there are no significant terrain gradients between the BESS and chosen discrete receptors; however, terrain heights have been included within the model due to elevated terrain in the wider model domain.

Time-Averages and the Fluctuation Model

4.2.30. The model concentration outputs have been configured to align with the time periods for the short-term air quality standards (as described in **Section 3**). These time periods include 10-minute, 30-minute, 1-hour, 4-hour and 8-hour periods; however, for completeness, concentration outputs for 24-hour and annual periods have also been produced.

4.2.31. Furthermore, ADMS's fluctuation module has been used in this assessment. This option allows the user to account for variations in concentrations caused by short-term scale turbulence in the lower atmosphere. As such, the meteorological conditions are kept constant with changes in concentration due to predicted changes in boundary layer turbulence. For this assessment, the fluctuation averaging time has been set at 600 and 1800 seconds (10 and 30 minutes) to compare against the 10- and 30-minute AEGLs, and the 100th percentile concentration predicted across the hour.

Model Output Grid

4.2.32. A uniform Cartesian grid measuring 5km x 5km with 20m increments, centering over the BESS container, was used. The receptor heights were set at 1.5m.

Human Receptors

4.2.33. The discrete receptors considered were chosen based on where people may be located and judged in terms of the likely duration of their exposure to pollutants and proximity to the site, following the guidance given in

Section 2.3.2. Furthermore, consideration was given to the National Fire Chiefs Council's examples of sensitive receptors[2], who requested that all receptors within a 1 km area of any potential BESS area be considered. As in some directions there are no receptors within 1 km of the potential BESS area, additional receptors at greater distances have been considered.

4.2.34. **Table 4.4** details the discrete human receptors included within the model, which are presented in **Figure 4.3.** It is noted that R1 – R22 is classified as residential receptors while FR1 – FR13 represents the receptors for public rights of way (PROW).

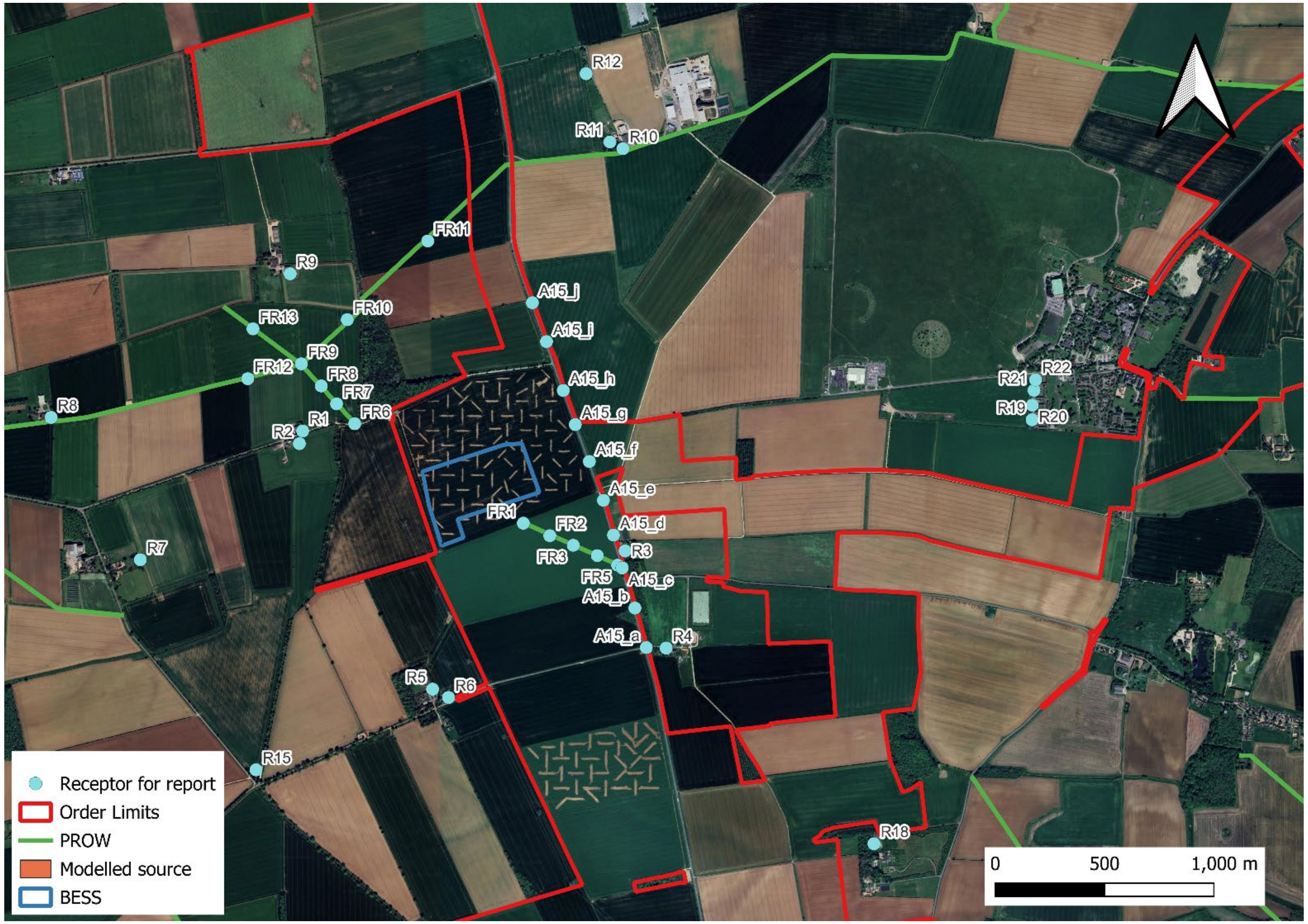
Table 4.4: Discrete Human Receptors Included in the Model

Receptor ID	X (m)	Y (m)	Height (m)	Distance from BESS (km)
R1	501213	356275	1.5	0.6
R2	501198	356217	1.5	0.6
R3	502687	355726	1.5	0.5
R4	502875	355282	1.5	0.9
R5	501807	355094	1.5	0.7
R6	501880	355056	1.5	0.7
R7	500471	355686	1.5	1.4
R8	500063	356337	1.5	1.7
R9	501156	356994	1.5	1.1
R10	502677	357566	1.5	1.4
R11	502618	357597	1.5	1.4
R12	502509	357909	1.5	1.7
R13	499380	357177	1.5	2.6
R14	499371	357247	1.5	2.6
R15	501000	354725	1.5	1.3
R16	500909	353745	1.5	2.2
R17	500789	353830	1.5	2.2
R18	503825	354387	1.5	2.2
R19	504548	356326	1.5	2.3

[2] Draft Guidance on Grid Scale Battery Energy Storage Systems (BESS) - NFCC

R20	504549	356393	1.5	2.3
R21	504557	356461	1.5	2.3
R22	504564	356509	1.5	2.3
R23	503594	356483	1.5	2.3
FR1	502222	355853	1.5	0.1
FR2	502343	355796	1.5	0.2
FR3	502450	355752	1.5	0.3
FR4	502560	355705	1.5	0.4
FR5	502653	355661	1.5	0.5
FR6	501451	356308	1.5	0.4
FR7	501368	356399	1.5	0.5
FR8	501298	356481	1.5	0.6
FR9	501207	356582	1.5	0.7
FR10	501417	356784	1.5	0.8
FR11	501785	357144	1.5	1.1
FR12	500962	356514	1.5	0.9
FR13	500986	356742	1.5	1.0

Figure 4.3 Receptor Locations



Imagery @2025 Airbus, Maxar Technologies Map data @2025

Baseline Data

4.2.35. Hydrogen fluoride or hydrogen cyanide are not routinely monitored in ambient air due to its specialised nature and limited emission sources. A literature review reveals no sources of relevant baseline data within the UK; therefore, the baseline is assumed to be zero.

North Kesteven District Council

4.2.36. North Kesteven District Council has not declared any Air Quality Management Area. Therefore, the proposed BESS site is not located within an Air Quality Management Area.

4.2.37. According to the North Kesteven District Council 2024 Air Quality Annual Status Report **[Ref. 1-16]**, there were no automatic monitoring stations in the District in 2023. However, North Kesteven District Council undertook non-automatic NO_2 diffusion tube monitoring at 22 locations, with the closest location in Navenby, 3.8 km to the north-east of the development. As this location is not likely to be representative of the study area (being a Kerbside location), Defra background data has been used within the assessment.

Defra Background Data

4.2.38. Estimated background air quality data is available from the Local Air Quality Management website operated by Defra **[Ref. 1-17]**.

4.2.39. This website provides estimated annual average background concentrations of NO_2, PM_{10}, $PM_{2.5}$, CO and Benzene on a 1 km^2 grid basis. **Table 4.5** reproduces the 2025 estimated annual average background concentrations for the grid square containing the BESS site.

Table 4.5: Estimated 2025 Background Annual Average Concentrations at the Proposed Development Site (from the 2021 base maps for NO_2, PM_{10}, $PM_{2.5}$ and 2001 for CO and Benzene)

Pollutant	Annual Concentration ($\mu g/m^3$)	AQS ($\mu g/m^3$)
NO_2	5.20	40
PM_{10}	12.57	40
$PM_{2.5}$	5.85	20
CO	0.23*	-
Benzene	0.19*	5

* 2001 predicted concentrations

UKEAP: Acid Gases & Aerosol Network

4.2.40. Concentrations of gaseous hydrogen chloride were monitored by the UKEAP: Acid Gases & Aerosol Network **[Ref. 1-18]** until 2016. The latest available annual mean concentration (from 2015) from the nearest monitoring stations (Caenby, located 34km from Springwell BESS) was recorded as 0.17 µg/m^3 and has been assumed to be the baseline concentration.

Conversion of NO to NO_2

4.2.41. NOx emitted to the atmosphere as a result of combustion will consist largely of nitric oxide (NO). Once released into the atmosphere, NO is oxidised to NO_2, which is of concern with respect to health and other impacts. The proportion of NO converted to NO_2 depends on a number of factors, including wind speed, distance from the source, solar irradiation and the availability of oxidants, such as ozone (O_3). The dispersion modelling exercise predicts concentrations of NOx, which subsequently require conversion to NO_2 for comparison with objectives for human health.

4.2.42. Based on Environment Agency recommendations, NOx Process Contributions (PCs) have been converted to the respective NO_2 concentrations using 70% for long-term emissions and 35% for short-term emissions based on ‘worst case’ conversion criteria.

Results Post-processing

4.2.43. With the exception of the above NOx to NO_2 conversion, no results processing has been undertaken on the short-term raw modelled results. For the annual modelled predictions, the output concentration has been multiplied by a factor of 0.0114 (100/8760) to reflect a very conservative assumption that an incident could occur for 100 hours of the year.

4.2.44. As previously mentioned, each year has been modelled separately, with the worst-case prediction from any of the modelled BESS locations presented at each receptor.

Plume Visibility

4.2.45. The impact of the smoke plume on visibility has been calculated based on the mass concentration of particulate matter, using the following equation developed in the Principles of Smoke Management **[Ref. 1-19]**:

$$S = K / \alpha_m m_p$$

Where:

S = visibility through smoke (m)

K = proportionality constant; a value of 3 has been used in the assessment which is applicable to the observation of a non-light emitting object in smoke.

α_m = specific extinction coefficient (m^2/g); a value of 7.6 m^2/g has been used in the assessment and is based on flaming combustion of wood and plastics.

m_p= mass concentration of particulate matter (g/m^3); value has been calculated using the modelled PM_{10} concentration associated with the BESS thermal runaway incident.

4.2.46. The visibility through smoke equation presented above is based on a number of assumptions and has inherent limitations. These include the particle size distribution and optical properties of the particulates. The visibility calculations are therefore a best guess only that have inherent uncertainties and should be used as a guide only.

Interpretation of Modelled Results

4.2.47. There is no official guidance on how to determine the significance of air quality impacts; therefore, recommendations from the Institute of Air Quality Management's (IAQM) planning guidance **[Ref. 1-9]** have been used. This guidance highlights that the significance of air quality impacts should be based on professional judgement, which should be transparent and logically set out.

4.2.48. In this case, as we are primarily interested in the short-term impacts, and due to the majority of pollutants emitted from a BESS incident similar to those emitted by facilities regulated by the Environment Agency (i.e., less commonly considered under the LAQM regime), the Environment Agency's screening criteria[3] to assess whether a or facility's Process contribution (PC) is insignificant has been used as the starting point, using the following criteria:

- if the short-term PC is less than 10% of the short-term environmental standard, then a PC can be considered insignificant; and

[3] Relavent to the H1 screening tool, but commonly applied to modelling assessments.

- if the long-term PC is less than 1% of the long-term environmental standard, then a PC can be considered insignificant.

4.2.49. To assist in the determination of whether ambient air quality impacts are significant, the modelled long- and short-term Predicted Environmental Concentration (process contribution + baseline) (PECs) at the discrete receptors and across the modelled grid have been compared against the relevant EALs/AQSs/AEGLs. If ground-level concentrations caused by a BESS thermal runaway incident cause an exceedance of the EALs/AQSs/AEGLs, the effects are considered significant.

4.2.50. Furthermore, the annual impact on each human receptor has also been described using the criteria in Environmental Protection UK and IAQM's Land-Use Planning & Development Control: Planning For Air Quality guidance. The method in this guidance derives the magnitude of impacts using the percentage of change in annual pollutant concentration relative to an Air Quality Assessment Level (AQAL) (AQS/EAL/AEGL etc.) and long-term average pollutant concentration at the receptor, as presented in **Table 4.6.** It is common for moderate or greater impacts to be considered significant; however, this is normally considered alongside the likelihood of an AQAL exceedance and the number of receptors impacted.

Table 4.6: Impact Descriptors for Individual Receptors

Long term average concentration at receptor in assessment year	% Change in concentration relative to Air Quality Assessment Level (AQAL)			
	1	2-5	6-10	>10
75% or less of AQAL	Negligible	Negligible	Slight	Moderate
79 – 94% of AQAL	Negligible	Slight	Moderate	Moderate
95 – 102% of AQAL	Slight	Moderate	Moderate	Substantial
103 – 109% of AQAL	Moderate	Moderate	Substantial	Substantial
110% or more of AQAL	Moderate	Substantial	Substantial	Substantial

4.3. Sensitivity

4.3.1. In line with best modelling practice, and to account for the higher than usual uncertainty when deriving emission rates, modelling sensitivity has been undertaken to understand the likely uncertainty with the modelling parameters chosen. Sensitivity to certain parameters has been based on professional judgement.

4.3.2. The following sensitivity tests have been undertaken using the worst-case meteorological year (2022):

- a model run setting the exhaust exit temperature at 500°C and 1,000°C, instead of 342°C;
- assuming all pollutant concentrations are released over 6- and 8-hours, instead of 4-hours.

4.3.3. A comparison of the maximum impacts at modelled receptors for all sensitivity scenarios is presented in **Annex 1**. The results demonstrate that the model is not overly sensitive to realistic changes to the emission assumptions, as described in **Section 4**, and these changes are not likely to affect the conclusions of this assessment. As such, the model is judged to be suitable for this assessment.

4.4. Uncertainties and Assumptions

4.4.1. The following uncertainties and assumptions have been made in the air quality assessment:

- There will be uncertainties introduced because the modelling has simplified real-world processes into a series of algorithms. For example, it has been assumed that wind conditions measured at Cranwell meteorological monitoring station for the years 2020 to 2024 were representative of wind conditions at the site. This is the case for all dispersion modelling studies and is not specific to this assessment;
- It is unlikely that a single cell will behave in the same way as a container of cells when heated/on fire. A literature review shows that there is a large variation in emission release rates during such incidents; even considering the difference in available emissions rates, there would not be any exceedances in the Air Quality Objectives. The current study used the emissions data discussed in Section 4.2;
- The BESS emissions have been calculated assuming a total of gas produced from the cells and an emission concentration measured above the BESS, therefore, assumes a finite source of pollutant; and
- There is an element of uncertainty in all measured and modelled data. All values presented within the report are the best possible estimates. This is the case for all dispersion modelling studies, and why conservatism in chosen data/modelling parameters has been used where appropriate.

5. Assessment of Impacts

5.1.1. This section sets out a summary of the dispersion modelling results, and is based on the results presented in **Annex 2**, which represent the worst-case concentrations across five years of meteorological data and the worst-case location of any of the four BESS container scenarios modelled, at any receptor.

5.1.2. Results for all sensitivity tests and all receptors within 1 km of the BESS area have been presented in **Annex 1** and **Annex 3**, respectively. Furthermore, the dispersion profile of the maximum predicted HF 1-hour average concentrations are shown in **Figure 5.1** as a contour plot.

5.2. Carbon Monoxide (CO)

5.2.1. The results present in **Annex 2** demonstrate that all impacts are less than 10% at all nearby modelled receptors, with all concentrations well below the AEGLs, AQS and EAL. Therefore, the impacts are insignificant.

5.3. Hydrogen Chloride (HCl)

5.3.1. The results present in **Annex 2** demonstrate that all impacts are less than 10% at all nearby modelled receptors, with all concentrations well below the AEGLs and EALs. Therefore, the impacts are insignificant.

5.4. Hydrogen Fluoride (HF)

5.4.1. The results present in **Annex 2** demonstrate that all impacts are less than 10% at all nearby modelled receptors, with all concentrations well below the AEGLs and EALs. Therefore, the impacts are insignificant.

5.5. Hydrogen Cyanide (HCN)

5.5.1. The results present in **Annex 2** demonstrate that all impacts are less than 10% at all nearby modelled receptors, with all concentrations well below the AEGLs and EALs. Therefore, the impacts are insignificant.

5.5.2. No assessment has been made against the 24-hour EAL at PROW receptors. It is judged reasonable to assume that walkers would not be at this location for a 24-hour period, as supported by LAQM TG.22 **[Ref. 1-8]**.

5.6. Nitrogen Dioxide (NO_2)

5.6.1. The results present in **Annex 2** demonstrate that all impacts are less than 1% (for the annual mean objective) and 10% (short-term objectives) at all nearby modelled receptors, with all concentrations well below the AEGLs and UK AQSs. Furthermore, all impacts are negligible based on the IAQM's Impact Descriptors. Therefore, the impacts are insignificant.

5.6.2. No assessment has been made against the annual NO_2 AQS at PROW receptors. It is judged reasonable to assume that walkers would at most be here for short periods each day, and is therefore not representative of annual exposure, as supported by LAQM TG.22 **[Ref. 1-8]**.

5.7. Particulate Matter (PM_{10} and $PM_{2.5}$)

5.7.1. The results present in **Annex 2** demonstrate that all impacts are less than 1% (for the annual mean objective) and 10% (short-term objectives) at all nearby modelled receptors, with all concentrations well below the UK AQSs. Furthermore, all impacts are negligible based on the IAQM's Impact Descriptors. Therefore, the impacts are insignificant.

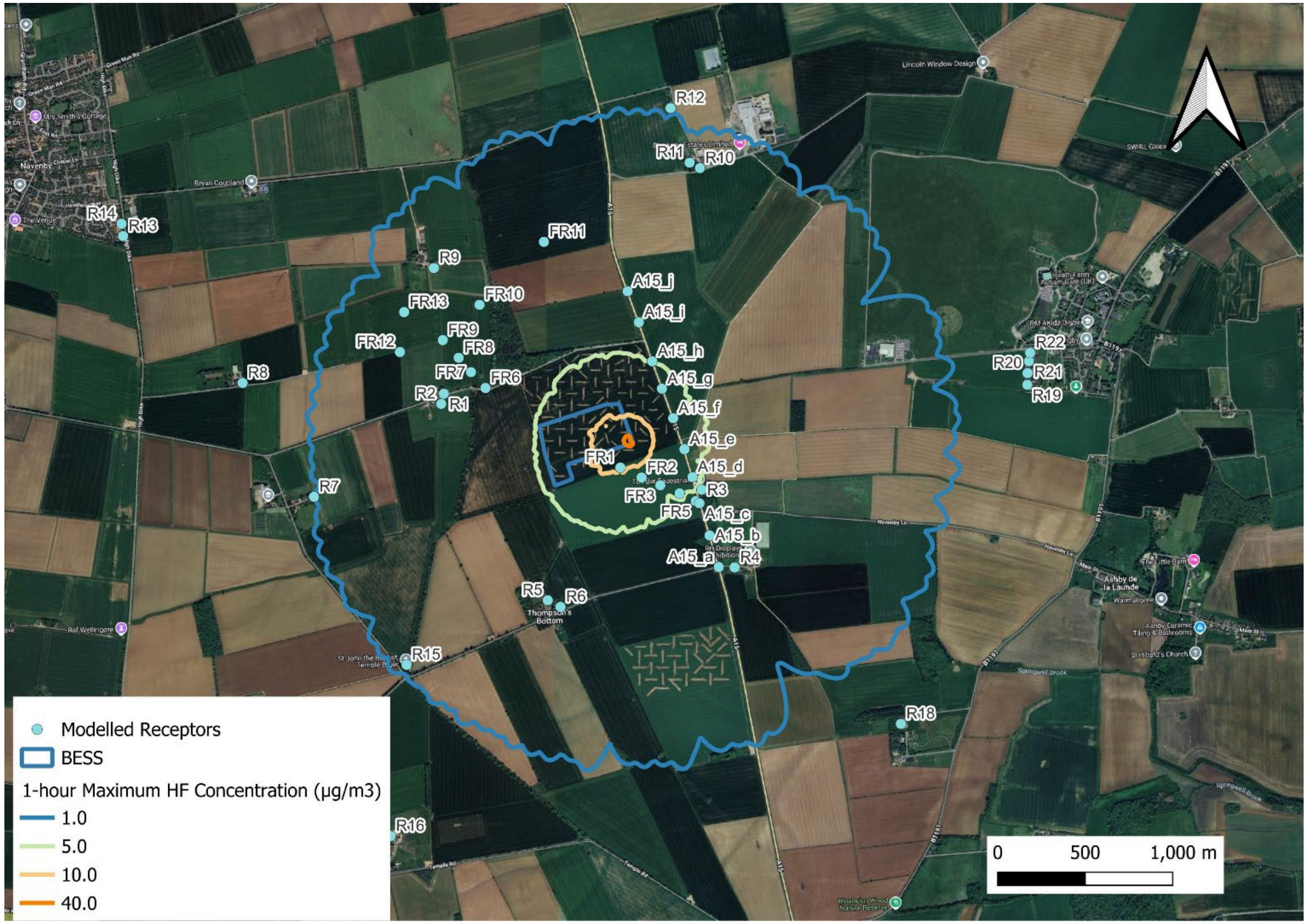
5.7.2. No assessment has been made against the annual and 24-hour PM_{10} and annual $PM_{2.5}$ AQSs at PROW receptors. It is judged reasonable to assume that walkers would at most be here for short periods each day, and is therefore not representative of annual exposure, as supported by LAQM TG.22 **[Ref. 1-8]**.

5.8. Benzene

5.8.1. The results present in **Annex 2** demonstrate that all impacts are less than 1% (for the annual mean objective) and 10% (short-term objectives) at all nearby modelled receptors, with all concentrations well below the AEGLs, EALs and UK AQSs. Furthermore, all impacts are negligible based on the IAQM's Impact Descriptors. Therefore, the impacts are insignificant.

5.8.2. No assessment has been made against the annual and 24-hour benzene AQS/EAL at PROW receptors. It is judged reasonable to assume that walkers would at most be here for short periods each day, and is therefore not representative of annual or 24-hour exposure, as supported by LAQM TG.22 **[Ref. 1-8]**.

Figure 5.1: Predicted 100th percentile 1-hour Average Maximum HF Concentrations (µg/m³) - Maximum across 5 years at the Southeast BESS Container Location



Imagery @2025 Airbus, Maxar Technologies Map data @2025

5.9. Plume Visibility

5.9.1. Due to the BESS facilities' location next to the A15, there is the potential for visibility issues to affect road traffic if smoke plumes cross the road. **Table 5.24** presents the predicted maximum one-hour PM_{10} concentrations at the modelled points along A15 and the predicted visibility in metres, using the equation presented in **Section 4.2.44.**

Table 5.2: Maximum Modelled One-Hour PM_{10} Concentrations With and Without Background and Predicted Visibility

Receptor	Maximum PM_{10} Hourly Concentration without Background (µg/m3)	Maximum PM_{10} Hourly Concentration with Background (µg/m3)	Predicted Approximate Visibility (m)
A15_a	15.85	40.99	9629
A15_b	24.62	44.83	8804
A15_c	31.99	50.73	7781
A15_d	40.78	57.76	6834
A15_e	48.69	64.09	6159
A15_f	46.92	62.67	6298
A15_g	44.46	60.71	6502
A15_h	37.53	55.16	7156
A15_i	27.94	47.49	8312
A15_j	21.54	42.37	9317

5.10. Results Discussion

5.10.1. Based on the above predicted concentrations from a modelled 5MWh 4-hour BESS incident, the short-term impacts on nearby human receptors are insignificant (i.e., less than 10% of the Air Quality Standard) at all receptors for all pollutants. In the vast majority of occasions, the impacts are well below 1%.

5.10.2. The long-term impacts are also insignificant, being less than 1% of the Air Quality Standard.

5.10.3. When considering the baseline concentrations provided in **Table 4.4**, PECs are also well below the applicable objectives for all pollutants at all receptors.

5.10.4. In addition, when using the formula provided in **Section 4.2.45,** visibility alongside the A15 will still be very good even in the case of an incident.

5.10.5. The sensitivity tests in **Annex 1** confirm that the results in the main body of the report (above) are the worst-case across the sensitivity test runs, with impacts predicted to be lower if you assume a longer incident time or a higher emission temperature.

5.10.6. Furthermore, there is judged to be sufficient headroom between the predicted impacts and the air quality objectives to account for any highlighted uncertainties.

5.10.7. As such, the effects of a Battery Energy Storage System incident on local air quality are judged to be not significant. This is based on the results above, which represent the maximum predicted impacts at modelled discrete receptor locations across five modelled meteorological years and four BESS locations. This is the case even when considering the following conservative assumptions:

- Sensitivity testing to five years of meteorological data to ensure that all meteorological conditions are considered;
- Sensitivity testing to four BESS thermal runaway incident locations;
- Sensitivity testing to account for different release temperatures;
- The use of ADMS 6's fluctuations module for sub hourly predictions;
- The use of maximum monitored emissions concentrations continuously through the entire thermal runaway incident; and
- The assumption that all cells within the 5MWh BESS container go into thermal runaway.

6. Mitigation

6.1.1. Mitigation measures have been accounted for as far as practically possible in this assessment, mainly within the assumption that a fire in a single BESS container will not be allowed to spread to multiple containers. This risk will be managed by good practice safety measures detailed in the implemented Battery Safety Management Plan.

7. Conclusion

7.1. Overview

7.1.1. An assessment of the air quality impacts of a 5MWh BESS thermal runaway incident at the Springwell Solar Farm has been undertaken, with reference to existing air quality in the area and relevant air quality legislation, policy and guidance.

7.1.2. This assessment has considered both the long- and short-term air quality impacts on human receptors of a four, six or eight-hour 5MWh BESS thermal runaway incident utilising dispersion modelling. Furthermore, at the request of the UK Health Security Agency (UKHSA), consideration of particulate matter emissions on road visibility at the nearby A15 has been considered.

7.1.3. The maximum predicted impacts at modelled discrete receptor locations across five modelled meteorological years and four BESS locations have been reported and compared to the relevant UK Air Quality Objectives, Environmental Assessment Levels and US EPA AEGLs. Where appropriate, the modelling methodology used has been a conservative methodology, in line with industry guidance.

7.2. Results

7.2.1. There are no predicted exceedances of the 1% or 10% screening thresholds at nearby human receptors due to emissions from a 4-hour BESS thermal runaway incident. Furthermore, no total concentrations (baseline + concentrations from the facility) are predicted to exceed any Air Quality Standards at any assessed location, including PROWs/footpaths. Furthermore, all impacts are negligible based on the IAQM's Impact Descriptors.

7.2.2. Furthermore, traffic visibility is still predicted to be good on the nearby A15, following a BESS thermal runaway incident.

7.3. Significance of Effects

7.3.1. Overall, the air quality effects of a BESS thermal runaway incident from a single 5MWh BESS container are predicted to be not significant. This is the case even when considering a number of conservative assumptions, which are detailed further in **Section 5.10.7.**

8. References

- **Ref. 1-1**: Air Quality (England) Regulations 2000. Available online: https://www.legislation.gov.uk/uksi/2000/928/contents/made
- **Ref. 1-2**: Air Quality (England) (Amendment) Regulations 2002. Available online: https://www.legislation.gov.uk/uksi/2002/3043/contents/made
- **Ref. 1-3**: Directive 2008/50/EC of the European Parliament and of the Council of 21st May 2008 on Ambient Air Quality and Cleaner Air for Europe. Available online: https://faolex.fao.org/docs/pdf/eur80016.pdf
- **Ref. 1-4**: Air Quality Standards Regulations 2010. Available online: https://www.legislation.gov.uk/uksi/2010/1001/contents/made
- **Ref. 1-5**: Environment Act 1995. Available online: https://www.legislation.gov.uk/ukpga/1995/25/contents
- **Ref. 1-6**: Environment Act 2021. Available online: https://www.legislation.gov.uk/ukpga/2021/30/contents/enacted
- **Ref. 1-7**: Environment Targets (Fine Particulate Matter) (England) Regulations 2023. Available online: https://www.legislation.gov.uk/uksi/2023/96/contents/made
- **Ref. 1-8**: Department for Environment, Food and Rural Affairs (2022) Local Air Quality Management Technical Guidance (TG22). Available online: https://laqm.defra.gov.uk/wp-content/uploads/2022/08/LAQM-TG22-August-22-v1.0.pdf
- **Ref. 1-9**: Environmental Protection UK and Institute of Air Quality Management (2017) Land-Use Planning and Development Control: Planning for Air Quality. Available online: https://www.iaqm.co.uk/text/guidance/air-quality-planning-guidance.pdf
- **Ref. 1-10**: Environment Agency (2025) Air emissions risk assessment for your environmental permit. Available online: https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit
- **Ref. 1-11**: Environment Agency (2023) Specified generators: dispersion modelling assessment. Available online: https://www.gov.uk/guidance/specified-generators-dispersion-modelling-assessment
- **Ref. 1-12**: Defra (2008) Consultation on Addendum to Guidelines for halogen an hydrogen halides in ambient air for protecting human health against acute irritancy effects states Available online: https://uk-air.defra.gov.uk/assets/documents/reports/cat11/0805151602_Halogen_and_Hydrogen_Halides_Addendum.pdf

- **Ref. 1-13**: US EPA (2025) Acute Exposure Guideline Levels for Airborne Chemicals. Available online: https://www.epa.gov/aegl
- **Ref. 1-14**: US EPA (2025) AP-42: Compilation of Air Emissions Factors from Stationary Sources. Available online: https://www.epa.gov/air-emissions-factors-and-quantification/ap-42-compilation-air-emissions-factors-stationary-sources
- **Ref. 1-15**: CERC (2025) ADMS 6 User Guide. Available online: https://www.cerc.co.uk/environmental-software/assets/data/doc_userguides/CERC_ADMS_6_User_Guide.pdf
- **Ref. 1-16**: North Kesteven District Council (2024) Annual Status Report 2024. Available online: https://www.n-kesteven.gov.uk/environment/environmental-protection/pollution-nuisance/air-quality-enforcement/air-quality-annual-status-report-2024/air-quality-annual-status/local
- **Ref. 1-17**: Department for Environment, Food and Rural Affairs (2021). Background Mapping Data for Local Authorities-2018. Available online: https://uk-air.defra.gov.uk/data/laqm-background-maps?year=2018
- **Ref. 1-18**: Department for Environment, Food and Rural Affairs (2025). UKAIR AURN. Available online: https://uk-air.defra.gov.uk/networks/network-info?view=aurn
- **Ref. 1-19**: John Klote and James Milke (2002) Department for Environment, Food and Rural Affairs (2025). Principles of Smoke Management.

Annex 1: Model Sensitivity Test Results

This Annex presents the results of the modelling sensitivity described in Section 4, which has been undertaken to understand the modelling uncertainty associated with the more uncertain emission parameters.

Table A1.1 and A1.2 below show the NO_2 concentrations for the year 2022 across all modelled time periods for the following modelling scenarios:

- Exhaust exit temperature at 342°C and released over 4 hours (Main);
- Exhaust exit temperature at 500°C and released over 4 hours (T1);
- Exhaust exit temperature at 1000°C and released over 4 hours (T2);
- Exhaust exit temperature at 342°C and released over 6 hours (T3); and
- Exhaust exit temperature at 342°C and released over 8 hours (T4).

The maximum impacts at any modelled receptor have been presented, with the results indicating that the scenario presented in the main report produced the highest results, with impacts reducing as the emissions exit temperature was increased (due to increased thermal buoyancy) or the emission rate was reduced (due to a prolonged incident time).

Table A1.1: Predicted Maximum 100th %ile NO_2 Impacts at the Worst-case Residential Receptor against the AEGLs

Average Period	Receptor	Concentration (µg/m^3)				
		Main	T1	T2	T3	T4
10 min	R3	0.53	0.47	0.43	0.34	0.25
30 min	R3	0.35	0.32	0.29	0.23	0.17
60 min	R3	0.26	0.24	0.22	0.17	0.13
4 hr	R1	0.16	0.16	0.14	0.11	0.08
8 hr	R3	0.10	0.10	0.09	0.07	0.05

Table A1.2: Predicted NO_2 Impacts at the Worst-case Residential Receptor against the against the UK AQSs

Average Period	Receptor	Concentration (µg/m^3)				
		Main	T1	T2	T3	T4
1hr (99.79%ile)	R1	0.18	0.17	0.16	0.12	0.09
Annual	R3	0.00009	0.00009	0.00008	0.00006	0.00005

Annex 2: Results for Worst-Case Residential and PROW Receptors

This section sets out the dispersion modelling results and represents the worst-case concentrations across five years of meteorological data and the worst-case location of any of the four BESS container scenarios modelled, at any receptor. The modelling was undertaken in line with the methodology described in **Section 4**

Where the PCs do not exceed the Environment Agency's (EA) 1% and 10% screening criteria, PECs have not been presented. However, the likelihood of any PEC exceedances has been considered within the discussion section below.

The results have been compared against the ambient AQSs, EALs and AEGLs, as well as the IAQM's Impact Descriptors. The results presented in this section. It is noted that the results presented are for the main 342°C exit temperature and 4-hour emissions scenario, as it reflects the worst-case.

Carbon Monoxide (CO)

Table B.1 – Table B.4 shows the maximum 100th %ile CO concentrations for different averaging periods at residential receptors and PROW receptors.

Table B.1: Predicted Maximum 100th %ile CO Impacts at the Worst-case Residential Receptor Against the AEGLs

Average Period	Concentration (µg/m³) (Receptor)	AEGL1	% of AEGL1	AEGL2	% of AEGL2	AEGL3	% of AEGL3
10 min	72.86 (R3)	-	-	507,849	<0.1%	2,055,581	<0.1%
30 min	48.61 (R3)	-	-	507,849	<0.1%	2,055,581	<0.1%
60 min	35.41 (R3)	-	-	181,375	<0.1%	725,499	<0.1%
4 hr	22.54 (R1)	-	-	100,361	<0.1%	399,025	<0.1%
8 hr	14.40 (R3)	-	-	39,902	<0.1%	181,375	<0.1%

Table B.2: Predicted Maximum 100th %ile CO Impacts at the Worst-case PROW Receptor (Receptor FR1) against the AEGLs

Average Period	Concentration (µg/m³)	AEGL2	% of AEGL2	AEGL3	% of AEGL3
10 min	226.18	507,849	<0.1%	2,055,581	<0.1%
30 min	147.68	507,849	<0.1%	2,055,581	<0.1%
60 min	78.34	181,375	<0.1%	725,499	<0.1%

Table B.3: Predicted Maximum 100th %ile CO Impacts at the Worst-case Residential Receptor (Receptor R3) against the against the UK AQS and EAL

Average Period	Concentration (µg/m³)	EAL/AQS	% of EAL/AQS
1 hr	35.41	30,000	0.1
8 hr	14.40	10,000	0.1

Table B.4: Predicted Maximum 100th %ile CO Impacts at the Worst-case PROW Receptor (Receptor FR1) against the UK AQS and EAL

Average Period	Concentration (µg/m³)	EAL/AQS	% of EAL/AQS
1 hr	78.34	30,000	0.3

Hydrogen Chloride (HCl)

Table B.5 – Table B.8 shows the maximum 100th %ile HCl concentrations for different averaging periods at residential receptors and PROW receptors.

Table B.5: Predicted Maximum 100th %ile HCl Impacts at the Worst-case Residential Receptor against the AEGLs

Average Period	Concentration (µg/m³) (Receptor)	AEGL1	% of AEGL1	AEGL2	% of AEGL2	AEGL3	% of AEGL3
10 min	3.55 (R3)	2,833	0.1%	157,394	<0.1%	975,845	<0.1%
30 min	2.37 (R3)	2,833	<0.1%	157,394	<0.1%	975,845	<0.1%
60 min	1.72 (R3)	2,833	<0.1%	67,680	<0.1%	330,528	<0.1%
4 hr	1.10 (R1)	2,833	<0.1%	34,627	<0.1%	157,394	<0.1%
8 hr	0.70 (R3)	2,833	<0.1%	17,313	<0.1%	40,923	<0.1%

Table B.6: Predicted Maximum 100th %ile HCl Impacts at the Worst-case PROW Receptor (Receptor FR1) against the AEGLs

Average Period	Concentration (µg/m³)	AEGL1	% of AEGL1	AEGL2	% of AEGL2	AEGL3	% of AEGL3
10 min	11.01	2,833	0.4%	157,394	<0.1%	975,845	<0.1%
30 min	7.19	2,833	0.3%	157,394	<0.1%	975,845	<0.1%
60 min	3.81	2,833	0.1%	67,680	<0.1%	330,528	<0.1%

Table B.7: Predicted Maximum 100th %ile HCl Impacts at the Worst-case Residential Receptor (Receptor R3) against the against the UK EAL

Average Period	Concentration (µg/m^3)	EAL	% of EAL/AQS
1 hr	1.72	750	0.2%

Table B.8: Predicted Maximum 100th %ile HCl Impacts at the Worst-case PROW Receptor (Receptor FR1) against the UK EAL

Average Period	Concentration (µg/m^3)	EAL	% of EAL/AQS
1 hr	3.81	750	0.5%

Hydrogen Fluoride (HF)

8.1.1. **Table B.9 – Table B.12** shows the maximum 100th %ile HF concentrations for different averaging period at residential receptors and PROW receptors.

Table B.9: Predicted Maximum 100th %ile HF Impacts at the Worst-case Residential Receptor against the AEGLs

Average Period	Concentration (µg/m^3) (Receptor)	AEGL1	% of AEGL1	AEGL2	% of AEGL2	AEGL3	% of AEGL3
10 min	9.79 (R3)	863.8	1.1%	82,062	<0.1%	146,848	<0.1%
30 min	6.53 (R3)	863.8	0.8%	82,062	<0.1%	146,848	<0.1%
60 min	4.76 (R3)	863.8	0.6%	29,370	<0.1%	53,556	<0.1%
4 hr	3.03 (R1)	863.8	0.4%	20,732	<0.1%	38,008	<0.1%
8 hr	1.94 (R3)	863.8	0.2%	10,366	<0.1%	19,004	<0.1%

Table B.10: Predicted Maximum 100th %ile HF Impacts at the Worst-case PROW Receptor (Receptor FR1) against the AEGLs

Average Period	Concentration (µg/m^3)	AEGL1	% of AEGL1	AEGL2	% of AEGL2	AEGL3	% of AEGL3
10 min	30.40	864	3.5%	82,062	<0.1%	146,848	<0.1%
30 min	19.85	864	2.3%	82,062	<0.1%	146,848	<0.1%
60 min	10.53	864	1.2%	29,370	<0.1%	53,556	<0.1%

B.11: Predicted Maximum 100th %ile HF Impacts at the Worst-case Residential Receptor (Receptor R3) against the against the UK EAL

Average Period	Concentration (µg/m^3)	EAL	% of EAL/AQS
1 hr	4.76	160	3.0%

Table B.12: Predicted Maximum 100th %ile HF Impacts at the Worst-case PROW Receptor (Receptor FR1) against the UK EAL

Average Period	Concentration (µg/m^3)	EAL	% of EAL/AQS
1 hr	10.53	160	6.6%

Hydrogen Cyanide (HCN)

Table B.13 – Table B.16 shows the maximum 100th %ile HCN concentrations for different averaging period at residential receptors and PROW receptors.

Table B.13: Predicted Maximum 100th %ile HCN Impacts at the Worst-case Residential Receptor against the AEGLs

Average Period	Concentration (µg/m^3) (Receptor)	AEGL1	% of AEGL1	AEGL2	% of AEGL2	AEGL3	% of AEGL3
10 min	1.25 (R3)	2,917	<0.1%	19,833	<0.1%	31,500	<0.1%
30 min	0.84 (R3)	2,917	<0.1%	19,833	<0.1%	31,500	<0.1%
60 min	0.61 (R3)	2,917	<0.1%	11,667	<0.1%	24,500	<0.1%
4 hr	0.39 (R1)	2,333	<0.1%	8,283	<0.1%	17,500	<0.1%
8 hr	0.25 (R3)	1,517	<0.1%	4,083	<0.1%	10,033	<0.1%

Table B.14: Predicted Maximum 100th %ile HCN Impacts at the Worst-case PROW Receptor (Receptor FR1) against the AEGLs

Average Period	Concentration (µg/m^3)	AEGL1	% of AEGL1	AEGL2	% of AEGL2	AEGL3	% of AEGL3
10 min	3.89	2,917	0.1%	19833	0.0%	31500	0.0%
30 min	2.54	2,917	0.1%	19833	0.0%	31500	0.0%
60 min	1.35	2,917	0.0%	11667	0.0%	24500	0.0%

Table B.15: Predicted Maximum 100th %ile HCN Impacts at the Worst-case Residential Receptor (Receptor R3) against the against the UK EAL

Average Period	Concentration (µg/m^3)	EAL/AQS	% of EAL/AQS
24 hr	0.09	2	4.4%

Nitrogen Dioxide (NO_2)

Table B.16 – Table B.19 shows the maximum NO_2 concentrations for different averaging periods at residential receptors and PROW receptors

Table B.16: Predicted Maximum 100th %ile NO_2 Impacts at the Worst-case Residential Receptor against the AEGLs

Average Period	Concentration (µg/m^3)	AEGL1	% of AEGL1	AEGL2	% of AEGL2	AEGL3	% of AEGL3
10 min	0.53 (R3)	993	0.1%	39,724	<0.1%	67,531	<0.1%
30 min	0.35 (R3)	993	<0.1%	39,724	<0.1%	67,531	<0.1%
60 min	0.26 (R3)	993	<0.1%	29,793	<0.1%	49,655	<0.1%
4 hr	0.16 (R1)	993	<0.1%	23,834	<0.1%	39,724	<0.1%
8 hr	0.10 (R3)	993	<0.1%	16,287	<0.1%	27,807	<0.1%

Table B.17: Predicted Maximum 100th %ile NO_2 Impacts at the Worst-case PROW Receptor (Receptor FR1) against the AEGLs

Average Period	Concentration (µg/m^3)	AEGL1	% of AEGL1	AEGL2	% of AEGL2	AEGL3	% of AEGL3
10 min	1.65	993	0.2%	39,724	<0.1%	67,531	<0.1%
30 min	1.08	993	0.1%	39,724	<0.1%	67,531	<0.1%
60 min	0.57	993	0.1%	29,793	<0.1%	49,655	<0.1%

Table B.18: Predicted Maximum NO_2 Impacts at the Worst-case Residential Receptor (1hr for Receptor R1 and Annual for Receptor R3) against the against the UK AQSs

Average Period	Concentration (µg/m^3)	AQS	% of EAL/AQS
1 hr (99.79%ile)	0.18	200	0.1%
Annual	0.0001	40	<0.1%

Table B.19: Predicted Maximum NO_2 Impacts at the Worst-case PROW Receptor (Receptor FR1) against the UK AQSs

Average Period	Concentration (µg/m³)	AQS	% of EAL/AQS
1 hr (99.79%ile)	0.51	200	0.3%

Particulate Matter (PM_{10} and $PM_{2.5}$)

Table B.20 shows the maximum PM_{10} and $PM_{2.5}$ concentrations for different averaging periods at residential receptors.

Table B.20: Predicted Maximum PM_{10} and $PM_{2.5}$ Impacts at Any Point at Residential Receptors against UK EAL and AQS

Pollutant	Average Period	Concentration (µg/m³)	EAL/AQS	% of EAL/AQS
PM_{10}	24 hr (90.4th %ile)	1.55	50	3.1%
	Annual	0.0049	40	<0.1%
$PM_{2.5}$	Annual	0.0049	20 (10)[1]	<0.1% (<0.1%)

Note [1] The Environmental Targets (Fine Particulate Matter) (England) Regulations 2023 require that by 2040 in England an annual average of 10 µg/m³ for $PM_{2.5}$ is not exceeded at any monitoring station.

Benzene

Table B.21 – Table B.23 shows the maximum benzene concentrations for different averaging periods at residential receptors and PROW receptors

Table B.21: Predicted Maximum 100%ile benzene Impacts at the Worst-case against the AEGLs

Average Period	Concentration (µg/m³)	AEGL1	% of AEGL1	AEGL2	% of AEGL2	AEGL3	% of AEGL3
10 min	24.72 (R3)	438,352	<0.1%	6,743,870	<0.1%	32,707,769	<0.1%
30 min	16.49 (R3)	246,151	<0.1%	3,709,128	<0.1%	18,882,835	<0.1%
60 min	12.01 (R3)	175,341	<0.1%	2,697,548	<0.1%	13,487,740	<0.1%
4 hr	7.65 (R1)	60,695	<0.1%	1,348,774	<0.1%	6,743,870	<0.1%
8 hr	4.89 (R3)	30,347	<0.1%	674,387	<0.1%	3,338,216	<0.1%

Table B.22: Predicted Maximum 100%ile benzene Impacts at the Worst-case PROW Receptor (Receptor FR1) against the AEGLs

Average Period	Concentration (µg/m³)	AEGL1	% of AEGL1	AEGL2	% of AEGL2	AEGL3	% of AEGL3
10 min	76.74	438,352	<0.1%	6,743,870	<0.1%	32,707,769	<0.1%
30 min	50.10	246,151	<0.1%	3,709,128	<0.1%	18,882,835	<0.1%
60 min	26.58	175,341	<0.1%	2,697,548	<0.1%	13,487,740	<0.1%

Table B.23: Predicted Maximum benzene Impacts at Worst-case Residential Receptor against UK EAL and AQS

Average Period	Concentration (µg/m³)	EAL/AQS	% of EAL/AQS
24 hr (100th %ile)	1.98 (R1)	30	6.6%
Annual	0.002 (R2)	5	<0.1%

Annex 3: Full Result for Residential Receptors within 1km of a BESS

This section sets out full dispersion modelling results at each receptors within 1 km of the BESS. These results represent the worst-case concentrations across five years of meteorological data and the worst-case location of any of the four BESS container scenarios modelled, at any receptor. The modelling was undertaken in line with the methodology described in **Section 4**

Where the PCs do not exceed the Environment Agency's 1% and 10% screening criteria, PECs have not been presented. However, the likelihood of any PEC exceedances has been considered within the discussion section below.

The results have been compared against the ambient AQSs, EALs and AEGLs, as well as the IAQM's Impact Descriptors. The results presented in this section. It is noted that the results presented are for the main 342°C exit temperature and 4-hour emissions scenario, as it reflects the worst-case.

Table C.1: Predicted 10-minute Maximum CO Impacts at the Worst-case Residential Receptors against the AEGLs

Receptor	Concentration ($\mu g/m^3$)	AEGL2	% of AEGL2	AEGL3	% of AEGL3
R1	70.28	507,849	<0.1%	2,055,581	<0.1%
R2	69.10	507,849	<0.1%	2,055,581	<0.1%
R3	72.86	507,849	<0.1%	2,055,581	<0.1%
R4	38.28	507,849	<0.1%	2,055,581	<0.1%
R5	60.84	507,849	<0.1%	2,055,581	<0.1%
R6	57.49	507,849	<0.1%	2,055,581	<0.1%

Table C.2: Predicted 30-minute Maximum CO Impacts at the Worst-case Residential Receptors against the AEGLs

Receptor	Concentration ($\mu g/m^3$)	AEGL2	% of AEGL2	AEGL3	% of AEGL3
R1	46.41	507,849	<0.1%	2,055,581	<0.1%
R2	46.40	507,849	<0.1%	2,055,581	<0.1%
R3	48.61	507,849	<0.1%	2,055,581	<0.1%
R4	24.99	507,849	<0.1%	2,055,581	<0.1%
R5	39.84	507,849	<0.1%	2,055,581	<0.1%
R6	37.50	507,849	<0.1%	2,055,581	<0.1%

Table C.3: Predicted 60-minute Maximum CO Impacts at the Worst-case Residential Receptors against the AEGLs

Receptor	Concentration (μg/m^3)	AEGL2	% of AEGL2	AEGL3	% of AEGL3
R1	33.84	181,375	<0.1%	725,499	<0.1%
R2	33.44	181,375	<0.1%	725,499	<0.1%
R3	35.41	181,375	<0.1%	725,499	<0.1%
R4	17.73	181,375	<0.1%	725,499	<0.1%
R5	28.99	181,375	<0.1%	725,499	<0.1%
R6	27.26	181,375	<0.1%	725,499	<0.1%

Table C.4: Predicted 4-hour Maximum CO Impacts at the Worst-case Residential Receptors against the AEGLs

Receptor	Concentration (μg/m^3)	AEGL2	% of AEGL2	AEGL3	% of AEGL3
R1	22.54	100,361	<0.1%	399,025	<0.1%
R2	22.10	100,361	<0.1%	399,025	<0.1%
R3	20.01	100,361	<0.1%	399,025	<0.1%
R4	9.36	100,361	<0.1%	399,025	<0.1%
R5	20.92	100,361	<0.1%	399,025	<0.1%
R6	16.30	100,361	<0.1%	399,025	<0.1%

Table C.5: Predicted 8-hour Maximum CO Impacts at the Worst-case Residential Receptors against the AEGLs

Receptor	Concentration (μg/m^3)	AEGL2	% of AEGL2	AEGL3	% of AEGL3
R1	11.73	39,902	<0.1%	181,375	<0.1%
R2	11.68	39,902	<0.1%	181,375	<0.1%
R3	14.40	39,902	<0.1%	181,375	<0.1%
R4	6.84	39,902	<0.1%	181,375	<0.1%
R5	14.39	39,902	<0.1%	181,375	<0.1%
R6	10.79	39,902	<0.1%	181,375	<0.1%

Table C.6: Predicted 1-hr Maximum CO Impacts at the Worst-case Residential Receptors against the UK EAL

Receptor	Concentration (µg/m³)	EAL	% of EAL
R1	33.84	30,000	0.1%
R2	33.44	30,000	0.1%
R3	35.41	30,000	0.1%
R4	17.73	30,000	0.1%
R5	28.99	30,000	0.1%
R6	27.26	30,000	0.1%

Table C.7: Predicted 8-hr Maximum CO Impacts at the Worst-case Residential Receptors against the UK AQS

Receptor	Concentration (µg/m³)	AQS	% of AEGL2
R1	11.73	10,000	0.1%
R2	11.68	10,000	0.1%
R3	14.40	10,000	0.1%
R4	6.84	10,000	0.1%
R5	14.39	10,000	0.1%
R6	10.79	10,000	0.1%

Table C.8: Predicted 10-min Maximum HCl Impacts at the Worst-case Residential Receptor against the AEGLs

Receptor	Concentration (µg/m³)	AEGL1	% of AEGL1	AEGL2	% of AEGL2	AEGL3	% of AEGL3
R1	3.42	2,833	0.1%	157,394	<0.1%	975,845	<0.1%
R2	3.36	2,833	0.1%	157,394	<0.1%	975,845	<0.1%
R3	3.55	2,833	0.1%	157,394	<0.1%	975,845	<0.1%
R4	1.86	2,833	0.1%	157,394	<0.1%	975,845	<0.1%
R5	2.96	2,833	0.1%	157,394	<0.1%	975,845	<0.1%
R6	2.80	2,833	0.1%	157,394	<0.1%	975,845	<0.1%

Table C.9: Predicted 30-min Maximum HCl Impacts at the Worst-case Residential Receptor against the AEGLs

Receptor	Concentration (µg/m³)	AEGL1	% of AEGL1	AEGL2	% of AEGL2	AEGL3	% of AEGL3
R1	2.26	2,833	0.1%	157,394	<0.1%	975,845	<0.1%
R2	2.26	2,833	0.1%	157,394	<0.1%	975,845	<0.1%
R3	2.37	2,833	0.1%	157,394	<0.1%	975,845	<0.1%
R4	1.22	2,833	0.0%	157,394	<0.1%	975,845	<0.1%
R5	1.94	2,833	0.1%	157,394	<0.1%	975,845	<0.1%
R6	1.83	2,833	0.1%	157,394	<0.1%	975,845	<0.1%

Table C.10: Predicted 60-min Maximum HCl Impacts at the Worst-case Residential Receptor against the AEGLs

Receptor	Concentration (µg/m³)	AEGL1	% of AEGL1	AEGL2	% of AEGL2	AEGL3	% of AEGL3
R1	1.65	2,833	0.1%	67,680	<0.1%	330,528	<0.1%
R2	1.63	2,833	0.1%	67,680	<0.1%	330,528	<0.1%
R3	1.72	2,833	0.1%	67,680	<0.1%	330,528	<0.1%
R4	0.86	2,833	<0.1%	67,680	<0.1%	330,528	<0.1%
R5	1.41	2,833	<0.1%	67,680	<0.1%	330,528	<0.1%
R6	1.33	2,833	<0.1%	67,680	<0.1%	330,528	<0.1%

Table C.11: Predicted 4-hour Maximum HCl Impacts at the Worst-case Residential Receptor against the AEGLs

Receptor	Concentration (µg/m³)	AEGL1	% of AEGL1	AEGL2	% of AEGL2	AEGL3	% of AEGL3
R1	1.10	2,833	<0.1%	34,627	<0.1%	157,394	<0.1%
R2	1.08	2,833	<0.1%	34,627	<0.1%	157,394	<0.1%
R3	0.97	2,833	<0.1%	34,627	<0.1%	157,394	<0.1%
R4	0.46	2,833	<0.1%	34,627	<0.1%	157,394	<0.1%
R5	1.02	2,833	<0.1%	34,627	<0.1%	157,394	<0.1%
R6	0.79	2,833	<0.1%	34,627	<0.1%	157,394	<0.1%

Table C.12: Predicted 8-hour Maximum HCl Impacts at the Worst-case Residential Receptor against the AEGLs

Receptor	Concentration (µg/m³)	AEGL1	% of AEGL1	AEGL2	% of AEGL2	AEGL3	% of AEGL3
R1	0.57	2,833	<0.1%	17,313	<0.1%	40,923	<0.1%
R2	0.57	2,833	<0.1%	17,313	<0.1%	40,923	<0.1%
R3	0.70	2,833	<0.1%	17,313	<0.1%	40,923	<0.1%
R4	0.33	2,833	<0.1%	17,313	<0.1%	40,923	<0.1%
R5	0.70	2,833	<0.1%	17,313	<0.1%	40,923	<0.1%
R6	0.53	2,833	<0.1%	17,313	<0.1%	40,923	<0.1%

Table C.13: Predicted 1-hr Maximum HCl Impacts at the Worst-case Residential Receptors against the UK EAL

Receptor	Concentration (µg/m³)	EAL	% of EAL
R1	1.65	750	0.2%
R2	1.63	750	0.2%
R3	1.72	750	0.2%
R4	0.86	750	0.1%
R5	1.41	750	0.2%
R6	1.33	750	0.2%

Table C.14: Predicted 10-min Maximum HF Impacts at the Worst-case Residential Receptor against the AEGLs

Receptor	Concentration (µg/m³)	AEGL1	% of AEGL1	AEGL2	% of AEGL2	AEGL3	% of AEGL3
R1	9.44	864	1.1%	82,062	<0.1%	146,848	<0.1%
R2	9.29	864	1.1%	82,062	<0.1%	146,848	<0.1%
R3	9.79	864	1.1%	82,062	<0.1%	146,848	<0.1%
R4	5.14	864	0.6%	82,062	<0.1%	146,848	<0.1%
R5	8.18	864	0.9%	82,062	<0.1%	146,848	<0.1%
R6	7.73	864	0.9%	82,062	<0.1%	146,848	<0.1%

Table C.15: Predicted 30-min Maximum HF Impacts at the Worst-case Residential Receptor against the AEGLs

Receptor	Concentration (μg/m³)	AEGL1	% of AEGL1	AEGL2	% of AEGL2	AEGL3	% of AEGL3
R1	6.24	864	0.7%	82,062	<0.1%	146,848	<0.1%
R2	6.24	864	0.7%	82,062	<0.1%	146,848	<0.1%
R3	6.53	864	0.8%	82,062	<0.1%	146,848	<0.1%
R4	3.36	864	0.4%	82,062	<0.1%	146,848	<0.1%
R5	5.35	864	0.6%	82,062	<0.1%	146,848	<0.1%
R6	5.04	864	0.6%	82,062	<0.1%	146,848	<0.1%

Table C.16: Predicted 60-min Maximum HF Impacts at the Worst-case Residential Receptor against the AEGLs

Receptor	Concentration (μg/m³)	AEGL1	% of AEGL1	AEGL2	% of AEGL2	AEGL3	% of AEGL3
R1	4.55	864	0.5%	29,370	<0.1%	53,556	<0.1%
R2	4.49	864	0.5%	29,370	<0.1%	53,556	<0.1%
R3	4.76	864	0.6%	29,370	<0.1%	53,556	<0.1%
R4	2.38	864	0.3%	29,370	<0.1%	53,556	<0.1%
R5	3.90	864	0.5%	29,370	<0.1%	53,556	<0.1%
R6	3.66	864	0.4%	29,370	<0.1%	53,556	<0.1%

Table C.17: Predicted 4-hour Maximum HF Impacts at the Worst-case Residential Receptor against the AEGLs

Receptor	Concentration (μg/m³)	AEGL1	% of AEGL1	AEGL2	% of AEGL2	AEGL3	% of AEGL3
R1	3.03	864	0.4%	20,732	<0.1%	38,008	<0.1%
R2	2.97	864	0.3%	20,732	<0.1%	38,008	<0.1%
R3	2.69	864	0.3%	20,732	<0.1%	38,008	<0.1%
R4	1.26	864	0.1%	20,732	<0.1%	38,008	<0.1%
R5	2.81	864	0.3%	20,732	<0.1%	38,008	<0.1%
R6	2.19	864	0.3%	20,732	<0.1%	38,008	<0.1%

Table C.18: Predicted 8-hour Maximum HF Impacts at the Worst-case Residential Receptor against the AEGLs

Receptor	Concentration (µg/m³)	AEGL1	% of AEGL1	AEGL2	% of AEGL2	AEGL3	% of AEGL3
R1	1.58	864	0.2%	10,366	<0.1%	19,004	<0.1%
R2	1.57	864	0.2%	10,366	<0.1%	19,004	<0.1%
R3	1.94	864	0.2%	10,366	<0.1%	19,004	<0.1%
R4	0.92	864	0.1%	10,366	<0.1%	19,004	<0.1%
R5	1.93	864	0.2%	10,366	<0.1%	19,004	<0.1%
R6	1.45	864	0.2%	10,366	<0.1%	19,004	<0.1%

Table C.19: Predicted 1-hr Maximum HF Impacts at the Worst-case Residential Receptors against the UK EAL

Receptor	Concentration (µg/m³)	EAL	% of EAL
R1	4.55	160	2.8%
R2	4.49	160	2.8%
R3	4.76	160	3.0%
R4	2.38	160	1.5%
R5	3.90	160	2.4%
R6	3.66	160	2.3%

Table C.20: Predicted 10-min Maximum HCN Impacts at the Worst-case Residential Receptor against the AEGLs

Receptor	Concentration (µg/m³)	AEGL1	% of AEGL1	AEGL2	% of AEGL2	AEGL3	% of AEGL3
R1	1.21	2,917	<0.1%	19,833	<0.1%	31,500	<0.1%
R2	1.19	2,917	<0.1%	19,833	<0.1%	31,500	<0.1%
R3	1.25	2,917	<0.1%	19,833	<0.1%	31,500	<0.1%
R4	0.66	2,917	<0.1%	19,833	<0.1%	31,500	<0.1%
R5	1.05	2,917	<0.1%	19,833	<0.1%	31,500	<0.1%
R6	0.99	2,917	<0.1%	19,833	<0.1%	31,500	<0.1%

Table C.21: Predicted 30-min Maximum HCN Impacts at the Worst-case Residential Receptor against the AEGLs

Receptor	Concentration (µg/m³)	AEGL1	% of AEGL1	AEGL2	% of AEGL2	AEGL3	% of AEGL3
R1	0.80	2,917	<0.1%	19,833	<0.1%	31,500	<0.1%
R2	0.80	2,917	<0.1%	19,833	<0.1%	31,500	<0.1%
R3	0.84	2,917	<0.1%	19,833	<0.1%	31,500	<0.1%
R4	0.43	2,917	<0.1%	19,833	<0.1%	31,500	<0.1%
R5	0.68	2,917	<0.1%	19,833	<0.1%	31,500	<0.1%
R6	0.64	2,917	<0.1%	19,833	<0.1%	31,500	<0.1%

Table C.22: Predicted 60-min Maximum HCN Impacts at the Worst-case Residential Receptor against the AEGLs

Receptor	Concentration (µg/m³)	AEGL1	% of AEGL1	AEGL2	% of AEGL2	AEGL3	% of AEGL3
R1	0.58	2,917	<0.1%	11,667	<0.1%	24,500	<0.1%
R2	0.57	2,917	<0.1%	11,667	<0.1%	24,500	<0.1%
R3	0.61	2,917	<0.1%	11,667	<0.1%	24,500	<0.1%
R4	0.30	2,917	<0.1%	11,667	<0.1%	24,500	<0.1%
R5	0.50	2,917	<0.1%	11,667	<0.1%	24,500	<0.1%
R6	0.47	2,917	<0.1%	11,667	<0.1%	24,500	<0.1%

Table C.23: Predicted 4-hour Maximum HCN Impacts at the Worst-case Residential Receptor against the AEGLs

Receptor	Concentration (µg/m³)	AEGL1	% of AEGL1	AEGL2	% of AEGL2	AEGL3	% of AEGL3
R1	0.39	2,333	<0.1%	8,283	<0.1%	17,500	<0.1%
R2	0.38	2,333	<0.1%	8,283	<0.1%	17,500	<0.1%
R3	0.34	2,333	<0.1%	8,283	<0.1%	17,500	<0.1%
R4	0.16	2,333	<0.1%	8,283	<0.1%	17,500	<0.1%
R5	0.36	2,333	<0.1%	8,283	<0.1%	17,500	<0.1%
R6	0.28	2,333	<0.1%	8,283	<0.1%	17,500	<0.1%

Table C.24: Predicted 8-hour Maximum HCN Impacts at the Worst-case Residential Receptor against the AEGLs

Receptor	Concentration (μg/m³)	AEGL1	% of AEGL1	AEGL2	% of AEGL2	AEGL3	% of AEGL3
R1	0.20	1,517	<0.1%	4,083	<0.1%	10,033	<0.1%
R2	0.20	1,517	<0.1%	4,083	<0.1%	10,033	<0.1%
R3	0.25	1,517	<0.1%	4,083	<0.1%	10,033	<0.1%
R4	0.12	1,517	<0.1%	4,083	<0.1%	10,033	<0.1%
R5	0.25	1,517	<0.1%	4,083	<0.1%	10,033	<0.1%
R6	0.19	1,517	<0.1%	4,083	<0.1%	10,033	<0.1%

Table C.25: Predicted 24-hr Maximum HCN Impacts at the Worst-case against Residential Receptors the UK EAL

Receptor	Concentration (μg/m³)	EAL	% of EAL
R1	0.10	2	4.9%
R2	0.10	2	5.0%
R3	0.09	2	4.4%
R4	0.04	2	2.0%
R5	0.09	2	4.6%
R6	0.07	2	3.4%

Table C.26: Predicted 10-min Maximum NO_2 Impacts at the Worst-case Residential Receptor against the AEGLs

Receptor	Concentration (μg/m³)	AEGL1	% of AEGL1	AEGL2	% of AEGL2	AEGL3	% of AEGL3
R1	0.51	993	0.1%	39,724	0.0%	67,531	0.0%
R2	0.50	993	0.1%	39,724	0.0%	67,531	0.0%
R3	0.53	993	0.1%	39,724	0.0%	67,531	0.0%
R4	0.28	993	0.0%	39,724	0.0%	67,531	0.0%
R5	0.44	993	0.0%	39,724	0.0%	67,531	0.0%
R6	0.42	993	0.0%	39,724	0.0%	67,531	0.0%

Table C.27: Predicted 30-min Maximum NO_2 Impacts at the Worst-case Residential Receptor against the AEGLs

Receptor	Concentration (µg/m³)	AEGL1	% of AEGL1	AEGL2	% of AEGL2	AEGL3	% of AEGL3
R1	0.34	993	<0.1%	39,724	<0.1%	67,531	<0.1%
R2	0.34	993	<0.1%	39,724	<0.1%	67,531	<0.1%
R3	0.35	993	<0.1%	39,724	<0.1%	67,531	<0.1%
R4	0.18	993	<0.1%	39,724	<0.1%	67,531	<0.1%
R5	0.29	993	<0.1%	39,724	<0.1%	67,531	<0.1%
R6	0.27	993	<0.1%	39,724	<0.1%	67,531	<0.1%

Table C.28: Predicted 60-min Maximum NO_2 Impacts at the Worst-case Residential Receptor against the AEGLs

Receptor	Concentration (µg/m³)	AEGL1	% of AEGL1	AEGL2	% of AEGL2	AEGL3	% of AEGL3
R1	0.25	993	<0.1%	29,793	<0.1%	49,655	<0.1%
R2	0.24	993	<0.1%	29,793	<0.1%	49,655	<0.1%
R3	0.26	993	<0.1%	29,793	<0.1%	49,655	<0.1%
R4	0.13	993	<0.1%	29,793	<0.1%	49,655	<0.1%
R5	0.21	993	<0.1%	29,793	<0.1%	49,655	<0.1%
R6	0.20	993	<0.1%	29,793	<0.1%	49,655	<0.1%

Table C.29: Predicted 4-hour Maximum NO_2 Impacts at the Worst-case Residential Receptor against the AEGLs

Receptor	Concentration (µg/m³)	AEGL1	% of AEGL1	AEGL2	% of AEGL2	AEGL3	% of AEGL3
R1	0.16	993	<0.1%	23,834	<0.1%	39,724	<0.1%
R2	0.16	993	<0.1%	23,834	<0.1%	39,724	<0.1%
R3	0.15	993	<0.1%	23,834	<0.1%	39,724	<0.1%
R4	0.07	993	<0.1%	23,834	<0.1%	39,724	<0.1%
R5	0.15	993	<0.1%	23,834	<0.1%	39,724	<0.1%
R6	0.12	993	<0.1%	23,834	<0.1%	39,724	<0.1%

Table C.30: Predicted 8-hour Maximum NO_2 Impacts at the Worst-case Residential Receptor against the AEGLs

Receptor	Concentration (µg/m^3)	AEGL1	% of AEGL1	AEGL2	% of AEGL2	AEGL3	% of AEGL3
R1	0.09	993	<0.1%	16,287	<0.1%	27,807	<0.1%
R2	0.09	993	<0.1%	16,287	<0.1%	27,807	<0.1%
R3	0.10	993	<0.1%	16,287	<0.1%	27,807	<0.1%
R4	0.05	993	<0.1%	16,287	<0.1%	27,807	<0.1%
R5	0.10	993	<0.1%	16,287	<0.1%	27,807	<0.1%
R6	0.08	993	<0.1%	16,287	<0.1%	27,807	<0.1%

Table C.31: Predicted 1-hr 99.7 Percentile NO_2 Impacts at the Worst-case Residential Receptors against the UK AQS

Receptor	Concentration (µg/m^3)	AQS	% of EAL
R1	0.18	200	0.1%
R2	0.18	200	0.1%
R3	0.18	200	0.1%
R4	0.07	200	<0.1%
R5	0.14	200	0.1%
R6	0.12	200	0.1%

Table C.32: Predicted Annual Average NO_2 Impacts at the Worst-case Residential Receptors against the UK AQS

Receptor	Concentration (µg/m^3)	AQS	% of EAL
R1	0.00005	40	<0.1%
R2	0.00005	40	<0.1%
R3	0.00009	40	<0.1%
R4	0.00003	40	<0.1%
R5	0.00004	40	<0.1%
R6	0.00004	40	<0.1%

Table C.33: Predicted 24-hr 90.41 Percentile PM_{10} Impacts at the Worst-case Residential Receptors against the UK AQS

Receptor	Concentration (μg/m^3)	AQS	% of EAL
R1	0.94	50	1.9%
R2	0.93	50	1.9%
R3	1.55	50	3.1%
R4	0.53	50	1.1%
R5	0.79	50	1.6%
R6	0.68	50	1.4%

Table C.34: Predicted Annual Average PM_{10} Impacts at the Worst-case Residential Receptors against the UK AQS

Receptor	Concentration (μg/m^3)	AQS	% of EAL
R1	0.0027	40	<0.1%
R2	0.0027	40	<0.1%
R3	0.0049	40	<0.1%
R4	0.0015	40	<0.1%
R5	0.0023	40	<0.1%
R6	0.0020	40	<0.1%

Table C.35: Predicted Annual Average $PM_{2.5}$ Impacts at the Worst-case Residential Receptors against the UK AQS

Receptor	Concentration (μg/m^3)	AQS	% of EAL
R1	0.0027	20	<0.1%
R2	0.0027	20	<0.1%
R3	0.0049	20	<0.1%
R4	0.0015	20	<0.1%
R5	0.0023	20	<0.1%
R6	0.0020	20	<0.1%

Table C.36: Predicted 10-min Maximum Benzene Impacts at the Worst-case Residential Receptor against the AEGLs

Receptor	Concentration (μg/m³)	AEGL1	% of AEGL1	AEGL2	% of AEGL2	AEGL3	% of AEGL3
R1	23.85	438,352	<0.1%	6,743,870	<0.1%	32,707,769	<0.1%
R2	23.44	438,352	<0.1%	6,743,870	<0.1%	32,707,769	<0.1%
R3	24.72	438,352	<0.1%	6,743,870	<0.1%	32,707,769	<0.1%
R4	12.99	438,352	<0.1%	6,743,870	<0.1%	32,707,769	<0.1%
R5	20.64	438,352	<0.1%	6,743,870	<0.1%	32,707,769	<0.1%
R6	19.50	438,352	<0.1%	6,743,870	<0.1%	32,707,769	<0.1%

Table C.37: Predicted 30-min Maximum Benzene Impacts at the Worst-case Residential Receptor against the AEGLs

Receptor	Concentration (μg/m³)	AEGL1	% of AEGL1	AEGL2	% of AEGL2	AEGL3	% of AEGL3
R1	15.75	438,352	<0.1%	6,743,870	<0.1%	32,707,769	<0.1%
R2	15.74	438,352	<0.1%	6,743,870	<0.1%	32,707,769	<0.1%
R3	16.49	438,352	<0.1%	6,743,870	<0.1%	32,707,769	<0.1%
R4	8.48	438,352	<0.1%	6,743,870	<0.1%	32,707,769	<0.1%
R5	13.52	438,352	<0.1%	6,743,870	<0.1%	32,707,769	<0.1%
R6	12.72	438,352	<0.1%	6,743,870	<0.1%	32,707,769	<0.1%

Table C.38: Predicted 60-min Maximum Benzene Impacts at the Worst-case Residential Receptor against the AEGLs

Receptor	Concentration (μg/m³)	AEGL1	% of AEGL1	AEGL2	% of AEGL2	AEGL3	% of AEGL3
R1	11.48	175,341	<0.1%	2,697,548	<0.1%	13,487,740	<0.1%
R2	11.34	175,341	<0.1%	2,697,548	<0.1%	13,487,740	<0.1%
R3	12.01	175,341	<0.1%	2,697,548	<0.1%	13,487,740	<0.1%
R4	6.01	175,341	<0.1%	2,697,548	<0.1%	13,487,740	<0.1%
R5	9.84	175,341	<0.1%	2,697,548	<0.1%	13,487,740	<0.1%
R6	9.25	175,341	<0.1%	2,697,548	<0.1%	13,487,740	<0.1%

Table C.39: Predicted 4-hour Maximum Benzene Impacts at the Worst-case Residential Receptor against the AEGLs

Receptor	Concentration (μg/m^3)	AEGL1	% of AEGL1	AEGL2	% of AEGL2	AEGL3	% of AEGL3
R1	7.65	60,695	<0.1%	1,348,774	<0.1%	6,743,870	<0.1%
R2	7.50	60,695	<0.1%	1,348,774	<0.1%	6,743,870	<0.1%
R3	6.79	60,695	<0.1%	1,348,774	<0.1%	6,743,870	<0.1%
R4	3.17	60,695	<0.1%	1,348,774	<0.1%	6,743,870	<0.1%
R5	7.10	60,695	<0.1%	1,348,774	<0.1%	6,743,870	<0.1%
R6	5.53	60,695	<0.1%	1,348,774	<0.1%	6,743,870	<0.1%

Table C.40: Predicted 8-hour Maximum Benzene Impacts at the Worst-case Residential Receptor against the AEGLs

Receptor	Concentration (μg/m^3)	AEGL1	% of AEGL1	AEGL2	% of AEGL2	AEGL3	% of AEGL3
R1	3.98	30,347	<0.1%	674,387	<0.1%	3,338,216	<0.1%
R2	3.96	30,347	<0.1%	674,387	<0.1%	3,338,216	<0.1%
R3	4.89	30,347	<0.1%	674,387	<0.1%	3,338,216	<0.1%
R4	2.32	30,347	<0.1%	674,387	<0.1%	3,338,216	<0.1%
R5	4.88	30,347	<0.1%	674,387	<0.1%	3,338,216	<0.1%
R6	3.66	30,347	<0.1%	674,387	<0.1%	3,338,216	<0.1%

Table C.41: Predicted 24-hr Maximum Benzene Impacts at the Worst-case Residential Receptors against the UK EAL

Receptor	Concentration (μg/m^3)	EAL	% of EAL
R1	1.93	30	6.4%
R2	1.98	30	6.6%
R3	1.75	30	5.8%
R4	0.77	30	2.6%
R5	1.80	30	6.0%
R6	1.35	30	4.5%

Table C.42: Predicted Annual Average Benzene Impacts at the Worst-case Residential Receptors against the UK AQS

Receptor	Concentration (µg/m³)	AQS	% of EAL
R1	0.0011	5	<0.1%
R2	0.0012	5	<0.1%
R3	0.0021	5	<0.1%
R4	0.0006	5	<0.1%
R5	0.0010	5	<0.1%
R6	0.0009	5	<0.1%

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