

Appendix B - Record of Consultation with SWFRS

From / Date / Time

Correspondence Received.

From: [REDACTED] <[REDACTED]@southwales-fire.gov.uk>
Sent: Tuesday, December 17, 2024 08:50

Hi [REDACTED]

I have copied in [REDACTED] as he is the local Station Commander. If you can liaise with him and arrange a suitable date and time for the crews to visit should they wish to.

As far as us in Business Fire Safety are concerned, we just deal with the planning guidance/Building Regulations etc and not the operational activities.

Regards

[REDACTED]

From: [REDACTED] <[REDACTED]@southwales-fire.gov.uk>
Sent: Monday, January 13, 2025 08:39

I'm wondering if it would be possible to confirm if our planned visit for 17/01/2025 is still convenient and if so would 10:30 be an appropriate time for us to meet you at site?

Thank you for all your help

Kind regards

[REDACTED]
WDS Watch Manager

From: [REDACTED] <[REDACTED]@southwales-fire.gov.uk>
Sent: Saturday, March 1, 2025 1:36:53 PM

[REDACTED] visit at Uskmouth Power Station today we have sufficient areas that we can now go ahead with the training exercise on Monday 10th March. We are looking to start operations at 1400hrs therefore have been asked to be at Uskmouth Power Station by 1330hrs to attend site briefing and sign in procedures prior to the exercise commencing. I have requested for all trucks to be off the run but for Maindee pump (46P1) to remain available from incident in case of life risk calls nearby.

Image - SWFRS Training
Date Taken 10th March 2025





From: [REDACTED]@southwales-fire.gov.uk>
Sent: Thursday, March 6, 2025 2:00:45 PM

With the Uskmouth Risk assessment being sent to Health and Safety I just wanted to give you a design sent to me by Uskmouth power themselves to show what access we have on the day.

From: [REDACTED]@private-energypartners.com>
Sent: 26 April 2025 09:50

Following on from the previous correspondence and successful training exercise I was wondering if you could please provide a summary of how the training went and how SWFRS would manage any scenarios if the unfortunate event of a fire occurred.

From: [REDACTED]y@southwales-fire.gov.uk>
Sent: Monday, May 5, 2025 10:05:59 am

The training itself was a success for us and hopefully for your staff as well. Initially we set up the HVP module next to the reservoir you have on site and deployed it just behind the security building. This was the best access for us as the slope going to the reservoir was not too steep and would be easy to deploy HVP whenever needed. The ALP set up just on the junction of the first turning and operations for your vehicles were not stopped due to this. This also meant that the ring road around the main building was clear and vehicle access could be diverted that way if a fire call was present. The ALP can also be set up closer to the battery packs to allow us to get closer and full coverage of the battery storage site with water delivery from the ALP. All in all it took us about 30 minutes to get everything set up and water working from the ALP. I have adjusted the Attendance plan for Uskmouth for an extra fire appliance to attend to be initial water attack on the fire to prevent escalation while the HVP and ALP are being set up.

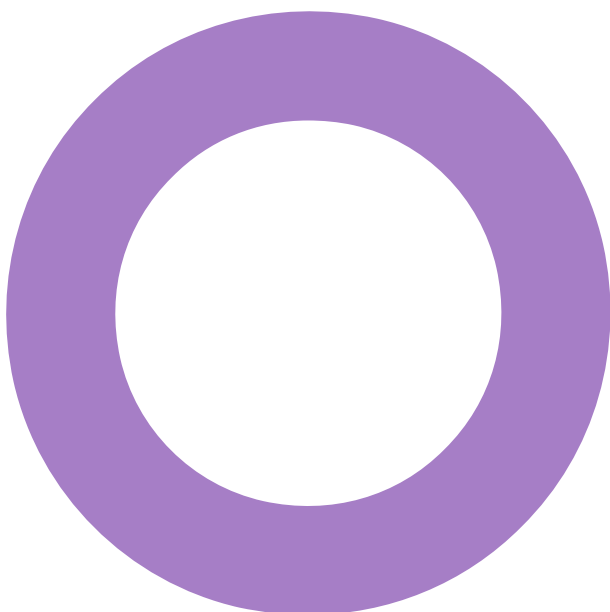
From: [REDACTED]@southwales-fire.gov.uk>
Sent: Wednesday, May 7, 2025 6:39:21 pm

However we would also like to complete further training with yourselves as we hear there are a number of hydrants being installed with a significant amount of water stored at the site? If this is true then we may not need the HVP and will only need fire appliances and the ALP but would need permission to access your water sources from the hydrants if that was the case. Which in turn lends itself to further training between the two parties as long as you're okay with that?
Perfect will do our best to get down to you in June sometime

Uskmouth BESS. Newport. Uskmouth Energy Storage Limited.

AIR QUALITY
BATTERY FIRE PLUME ASSESSMENT

REVISION 01 – 02 MAY 2025



Audit sheet.

Rev.	Date	Description of change / purpose of issue	Prepared	Reviewed	Authorised
00	31/01/2025	First Draft	AJ	JJ / LB	CE
01	02/05/2025	First Issue	JJ	LB	LB

This document has been prepared for Uskmouth Energy Storage Limited only and solely for the purposes expressly defined herein. We owe no duty of care to any third parties in respect of its content. Therefore, unless expressly agreed by us in signed writing, we hereby exclude all liability to third parties, including liability for negligence, save only for liabilities that cannot be so excluded by operation of applicable law. The consequences of climate change and the effects of future changes in climatic conditions cannot be accurately predicted. This report has been based solely on the specific design assumptions and criteria stated herein.

Project number: 34/22701

Document reference: 3422701-HLE-RP-AQ-Uskmouth BESS Battery Fire Plume Assessment_Rev01.docx

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Executive summary.

Hoare Lea have been commissioned by Uskmouth Energy Storage Limited to assess the potential air quality impacts on the local area in the event of battery failure and potential risk of fire, resulting in the plume dispersion of hazardous gas emissions at the proposed Battery Energy Storage System (BESS) at Uskmouth Power Station (the 'Proposed Facility'), within the administrative boundary of Newport City Council (NCC). The Proposed Facility is located south of Simec Uskmouth Power and Severn Power Station (the 'Site').

The aim of the study is to provide preliminary information to support the discharge of a planning condition to inform the Battery Safety Management Plan (BSMP) by identifying the impact and dispersion of the hazardous gas plume and to quantify air quality concentrations within the local area in the event of a battery failure at the BESS. For the assessment approach, robust and reasonable worst-case assumptions have been made.

The risk of fire during a battery failure event could potentially result in the plume dispersion of hazardous gas emissions, including the highly toxic hydrogen fluoride (HF). As such, the plume dispersion of a potential toxic gas plume emitted during the rare event of a battery fire scenario must be studied in order to consider the potential impact on sensitive receptors in the vicinity of the Site.

Due to the high toxicity of HF and because its emission rates, although limited, are available in the literature, the emissions of HF have been assessed to represent the worst-case impact of a battery fire scenario. Therefore, this assessment has only considered HF air pollutant emissions dispersion to identify the risk to the local area.

In addition, the results are based on other worst-case assumptions including that the fire will occur on worst-case meteorological conditions for that wind direction. The in-combination possibility of a fire event taking place during the worst-case meteorological conditions is considered to be extremely low. This methodology has been used to provide robust results for consideration by the Project's Emergency Response team and Emergency Response Planning.

The results of the battery fire assessment indicate that there will be exceedances of AEGL Level 1 for HF for all exposure periods, however there was no exceedances for AEGL Levels 2 and 3 for HF at any of the exposure periods considered. It is important to note that health impacts associated with AEGL Level 1 values are transient and reversible upon cessation of exposure. As such, a worst-case battery fire is unlikely to lead serious or long-term health impacts on receptors at any distance from the Site.

The maximum area of exceedance around the single Container of Interest is 190 m. It is associated with the 10-minute exposure period for AEGL Level 1 following a potential worst-case incidence. For the remaining exposure periods, the AEGL Level 1 distances of exceedance decrease down to 109 m for the 8-hour averaging period. This area includes existing sensitive receptors such as the power station to the north and public pathways within the Newport Wetlands to the south.

Overall, the key findings of this assessment are that it is unlikely that there will be serious/permanent health impacts predicted at any distance under worst-case battery fire conditions. The AEGL Level 1 maximum area of exceedance of 190 m only reaches a small number of existing sensitive receptors under a worst-case fire (extremely unlikely) and worst-case meteorological conditions. Therefore, under the vast majority of battery failure scenarios it is unlikely there would be any long-term impact on surrounding receptors.

Nonetheless, in the event of the described battery fire occurring at the Site, as a precautionary measure, the areas within the AEGL Level 1 maximum area of exceedance, downwind of the fire (to the north east of the Site) should be avoided by the general public where possible, and a safety management plan suitable for the level of risk put in place as part of the facility's emergency response plan.

1. Introduction.

Hoare Lea have been commissioned by Uskmouth Energy Storage Limited to assess the potential air quality impacts on the local area in the event of battery failure and potential risk of fire, resulting in the plume dispersion of hazardous gas emissions at the proposed Battery Energy Storage System (BESS) at Uskmouth Power Station (the 'Proposed Facility'), within the administrative boundary of Newport City Council (NCC). The Proposed Facility is located south of Simec Uskmouth Power and Severn Power Station (the 'Site').

The aim of the study is to provide preliminary information to support the discharge of a planning condition to inform the Battery Safety Management Plan (BSMP) by identifying the impact and dispersion of the hazardous gas plume and to quantify air quality concentrations within the local area in the event of a battery failure at the BESS. For the assessment approach, robust and reasonable worst-case assumptions have been made.

In reality, the direction of the plume will depend on the wind direction, while the dispersion will also depend on wind speed and atmospheric turbulence at the time of battery failure. To ensure a robust approach, the impacts presented within this report are independent of specific wind direction.

1.1 Location context.

The location of the Site is presented in Figure 1 for context. The Site is located in close proximity to Simec Uskmouth Power and Severn Power Station, within the Newport Wetlands. The most sensitive existing receptors in the vicinity of the Site consist of a residential property approximately 590 m to the east. In addition, the power station to the north and the publicly accessible footpaths to the south have been considered.



Figure 1: Location of the approximate site boundary. Contains Google Satellite Data (Retrieved 22/01/2025).

1.2 Proposed facility.

The proposed layout for the BESS is presented in Figure 2. The BESS consists of 192 battery containers with a total capacity of 4.073 MWh.

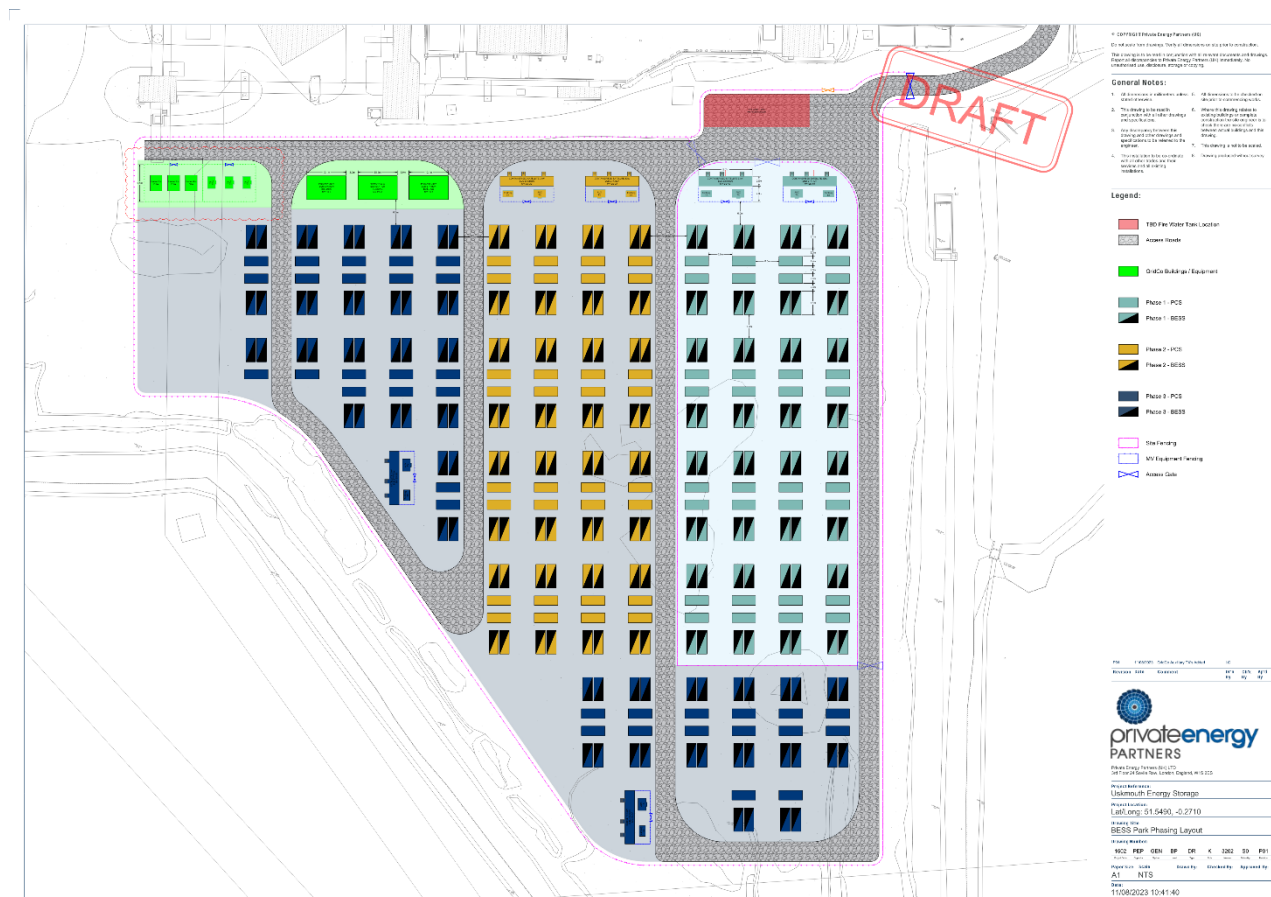


Figure 2: Layout of the Proposed Facility. Drawing provided by Private Energy Partners (Drawing No. 1602-PEP-GEN-BP-DR-K-3202-S0-P01).

The batteries for the Proposed Facility will be the EnerC+ model provided by CATL. These batteries utilise Lithium Iron Phosphate (LFP) chemistry and will be contained within 6058mm (length) x 2438mm (width) x 2896mm (height) containers.

It is important to note that battery failure is an unlikely event and there is an explosion control system to mitigate deflagration hazards in case of a failure scenario. To ensure a robust approach, this assessment considers the burn out of an entire container. Due to the project's spacing, specialist battery safety systems and fire suppression systems within the containers, the fire is considered extremely unlikely to propagate from one container to another.

1.3 Scope of the assessment.

It is understood that a battery failure at the Proposed Facility has the potential to result in thermal runaway. Thermal runaway occurs when the battery cells enter an uncontrolled self-heating state, resulting in high temperature and the emission of potentially hazardous gases. In the worst-case event that ignition occurs during thermal runaway, one fire scenario has been assessed, which involves the quantitative analysis of the gases emitted from the Proposed Facility during a fire scenario.

A dispersion modelling assessment has been undertaken to consider the dispersion of hydrogen fluoride (HF) gases emitted from the Proposed Facility in one fire scenario. The thermal runaway event itself has not been modelled as typically only traces of HF gases are observed during the thermal runaway event and the impact of gas emissions during the thermal runaway event are anticipated to be within close distance to the batteries and unlikely to impact sensitive receptors in the area. The dispersion modelling of HF during a fire scenario is considered the worst-case scenario in the event of battery failure.

The Client has provided technical documentation from the battery manufacturer (CATL)¹ in relation to the EnerC+ model BESS container. These technical documents provide useful information to determine some of the parameters for a fire scenario that have been included within the assessment. However, the technical documents do not provide comprehensive information required to calculate the emissions for modelling the fire scenario. Therefore, only emissions of HF have been considered and were sourced from existing literature. HF is considered highly toxic and because emission rates, although limited, are available in literature.

It is acknowledged that there will be levels of nitrogen oxides (NO_x), carbon monoxide (CO), particulate matter (PM₁₀ & PM_{2.5}), hydrogen chloride (HCl) and hydrogen cyanide (HCN) emitted as a result of a fire event. However, NO_x levels are expected to not have a significant effect, with HCl and HCN emissions expected to be lower than HF emissions. As such, these pollutants will not be considered further within the assessment, with HF being assessed as the worst pollutant, due to the criteria stated above. This is considered to be a robust approach.

The dispersion of the HF emissions associated with the fire scenario has been modelled to predict the spread of the gas plume, predict HF concentrations and to determine the maximum areas of exceedance and exclusion zones (if required) around the battery containers in comparison to the relevant assessment criteria. The results associated with the dispersion modelling will support the planning application for the Proposed Facility.

1.4 Planning policy.

1.4.1 Newport Replacement Local Development Plan.

The Newport Replacement Local Development Plan² was adopted by NCC in 2023 to cover the period from 2021 to 2036. It provides the planning policy framework on which planning decisions within the NCC administrative area will be determined. A review of the NCC Replacement Local Plan identified the following policies relevant to the Proposed Facility:

- PS4 Climate Change; and
- PS17 Renewable Energy.

1.4.2 Newport's Local Area Energy Plan.

Newport's Local Area Energy Plan³ was adopted by NCC in 2022 to support the area's ambition of net zero carbon by 2050. It outlines NCC's plans to grow the renewable energy and storage infrastructure, and the steps required to implement this. This document states the requirements for new developers involved in energy projects in the NCC administrative area.

2. Methodology.

A dispersion modelling assessment has been undertaken to consider the dispersion of HF gases emitted from the Proposed Facility during a fire scenario.

2.1 Model inputs, emissions and scenario.

2.1.1 Model parameters.

Research of LFP battery fire events and evidence in the CATL technical documentation¹ indicated that during a fire event, traces of HF gases can be found. The emissions rate of HF has been sourced from the following reports:

- Larsson *et al.* (2016) report '*Gas emissions from Lithium-ion battery cells undergoing abuse from external fire*⁴'; and
- Larsson *et al.* (2017) report '*Toxic fluoride gas emissions from lithium-ion battery fires*⁵'.

These reports provide HF emission rates (mg/Wh) for LFP batteries with varying geometries at specified state of charge (SOC) during test conditions. An average of the HF emissions reported for cylindrical LFP batteries at 50-100% SOC under fire abuse has been utilised for the dispersion modelling. There is limited availability of emissions data for prismatic LFP cells in the literature, as such, these could not be included in the average HF emission rate calculation. Emissions data for pouch cells have not been included as their properties are not considered to be representative of the specified battery model proposed for this Site in the event of a battery failure. This approach is considered to provide the most comprehensive data on HF emissions for the battery storage used on Site based on available data at the time of writing.

The fire scenario has considered one entire container flaming during a battery failure event. To calculate the HF emission rates representative for the fire, information on the battery capacity and dimensions, as provided by the Client were used. This information and the emission rates from publications outlined above were used to calculate the hourly HF emission rate. To ensure a robust assessment, the emissions rate was assumed to be constant throughout the fire scenario.

The location of the modelled container is in the north west corner of the Proposed Facility (the 'Container of Interest'). This container was selected as the container is within closest proximity to the power station, the closest existing sensitive receptor. The area of exceedance determined for the Container of Interest will be applied to all BESS containers within the Proposed Facility. This ensures a robust approach for the estimation of the zone of exceedances.

Due to the limited available data, in the existing literature, on the velocity of the gas release to the atmosphere during the fire event, a low velocity of 0.1 m/s has been utilised in order to account for thermal buoyancy effects in the model. This is considered a robust approach as the velocity of HF emissions to air is likely to be quicker, particularly during the peak release.

Fire temperature has been sourced from the CATL technical documentation¹. An external fire temperature of 1,200 °C has been used and assumed to be constant throughout the entire fire scenario.

The container has been modelled as an area source to represent the emissions distributing equally across the top of the container at the peak flame height. In absence of information in the literature, an assumption that the peak flame height (i.e. emissions release) is 1 m above the container top has been made. This is considered a robust assumption for the modelled fire scenario.

Further information on the fire scenario emissions is detailed in Appendix 1.

2.1.2 Fire scenario.

The model has been run considering all modules within a singular container being on fire.

In order to ensure a robust approach has been undertaken, the model was run for a full calendar year at the 100th percentile for HF at all exposure periods considered. The 100th percentile represents the worst-case period average of the year when concentrations are predicted to be at their greatest. This approach results in

predicting concentrations for the worst-case meteorological conditions and subsequently, predicted HF concentrations can be considered conservative.

The likelihood of a fire event occurring during the worst-case meteorological conditions is very low. Numerical weather prediction (NWP) data from the vicinity of the Site has been used for dispersion modelling. The NWP meteorological data has been provided by Enviro Data Services⁶ and were extracted from the NWP model with a resolution of 3 km x 3 km. Enviro Data Services NWP meteorological data has been used by regulators and part of various studies into NWP data for use in dispersion modelling in the UK. The centre point of the NWP data used is approximately 1.8 km north east of the Site and is considered to be the most representative meteorological conditions in the area.

Data for 2021, 2022 and 2023 has been utilised and the results presented within the report outline the predicted concentrations associated with the worst-case meteorological year for the relevant averaging period. The predominating wind direction in the NWP data for all three years of meteorological data was south westerly, indicating that the area's most at risk to exposure during the unlikely event of battery failure, are those located to the north east of the container, as the worst-case meteorological conditions are more likely to capture wind originating from the south westerly direction. Wind roses for this data are presented in Appendix 1, Figure 4.

Based on information provided in the CATL technical documentation¹, the burn out of a battery container has been indicated to occur for approximately 7 hours. As the model has been ran for a full calendar year of data, this covers any type of length a full container could be on fire.

The Container of Interest used in the assessment is located in the north of the Site. This container has been selected due to its proximity to the power station where the closest existing sensitive receptors are present. However, the calculated areas of exceedances and exclusion zones (if required) have been applied at other battery container locations.

Further information on the fire scenario emissions is detailed in Appendix 1.

2.2 Assessment criteria.

Acute Exposure Guideline Levels (AEGLs) are used as guidance to support the handling of rare, usually accidental, releases of chemicals into the air. AEGLs are used worldwide by emergency planners and responders to support guidance and responses during an emergency event. Due to the unlikely event of a thermal runaway and subsequently of a fire at the Proposed Facility, the use of AEGLs as the assessment criteria is considered to be the most representative.

AEGLs are calculated for five short exposure periods:

- 10-minutes;
- 30-minutes;
- 1-hour;
- 4-hours; and
- 8-hours.

They are expressed as specific concentrations at which health effects may occur. AEGLs for a specific pollutant can be categorised to Level 1, 2 or 3, with Level 1 being the least and Level 3 being the most severe. The levels are summarised below:

- **Level 1:** Notable discomfort, irritation, or certain asymptomatic non-sensory effects. However, the effects are not disabling and are transient and reversible upon cessation of exposure;
- **Level 2:** Irreversible or other serious, long-lasting adverse health effects or an impaired ability to escape; and
- **Level 3:** Life-threatening health effects or death.

For the fire scenario Levels 1, 2 and 3 AEGL values for HF have been used to represent the assessment criteria for comparison against the modelled HF concentrations. The AEGLs for HF are provided in Table 1.

Table 1: Acute Exposure Guideline Levels for Hydrogen Fluoride.

Exposure Period	AEGL level 1 (ppm)	AEGL level 2 (ppm)	AEGL level 3 (ppm)
10-minute	1	95	170
30-minute	1	34	62
1-hour	1	24	44
4-hour	1	12	22
8-hour	1	12	22

Outdoor areas in which exceedances of AEGL level 1 occur should be avoided by the general public downwind of the emissions released, and a suitable safety management plan for the level of risk should be put in place in case of the fire event.

For the purpose of the assessment maximum areas of exceedance will be discussed for AEGL Level 1 given the transient nature of the effects, whereas zones of exclusion are discussed for AEGL Levels 2 and 3 due to the higher risk of adverse health impacts.

2.3 Model.

Impacts associated with the fire scenario have been modelled using the ADMS 6 (v.6.0.0.1) dispersion modelling software. ADMS 6 is an extensively validated Gaussian plume air dispersion model, and is used by regulators, government departments, consultancies and industry. The model is able to simulate the entrainment of the plume in the wake of buildings.

Concentrations of HF emissions from the modelled scenarios have been predicted within a 1 km by 1 km grid at a 10 m resolution in order to predict the spread of the fire plume, predict pollutant concentrations and to determine the required maximum areas of exceedance and exclusion zones (if required) around the battery Container of Interest for the modelled scenario in comparison to the relevant AEGL values. The size of the grid will ensure that all nearby existing receptors have been captured.

2.4 Assumptions and limitations of the study.

Modelling the impact of air emissions during a potential battery failure and subsequent fire event is complex because each event is different. It depends on many factors including the number and type of battery modules failing, their SOC, whether/how they are damaged, the weather at the time of the event. Therefore, a number of assumptions have been made to represent robust and worst-case assessment in a reasonable manner.

Any dispersion modelling study involves a range of uncertainties, including the model inputs, assumptions, the model and post-processing of model results. The dispersion model used in the assessment is dependent upon emission rates, flow rates, exhaust temperatures and other parameters for each source, all of which are variable in reality. There are then additional uncertainties, as models are required to simplify real-world conditions into a series of algorithms. The model used for this assessment has been validated for this type of modelling studies.

Assumptions and considerations made to ensure a robust approach are listed below:

- Only HF emissions will be assessed to represent the worst-case impact of a battery failure scenario, due to its high toxicity and because its emission rates, although limited, are available in the literature;
- Emission rates for HF are based on average of the HF emissions in mg/Wh reported from the literature for cylindrical LFP batteries at 50-100% SOC – an average of 33.88 mg/Wh has been used for this assessment. The mass emitted is spread uniformly across the total length the flaming event was observed. The entire container has been assumed to be flaming within the seven hour duration;
- Due to limited available data on the velocity of the gas release to the atmosphere during the fire event, a low velocity of 0.1 m/s has been utilised in order to account for thermal buoyancy effects in the

model. This is considered a robust approach as the velocity of HF emissions to air is likely to be quicker, particularly during the peak release;

- A flame temperature of 1200°C, sourced from the CATL technical documentation¹, has been used for this assessment;
- For the modelling process, a full calendar year of NWP meteorological data has been used to predict the peak concentration for each gas assessed per hour. The worst-case meteorological year out of three years of 2021, 2022 and 2023 for each exposure period has been used;
- The model has assumed that the 4-hour and 8-hour exposure periods are considering continuous and consistent emission release during these periods. This takes account of the possibility of continuous fire propagation between modules within a single container; and
- As the resolution of the ADMS pollutant grids was 10 m in X and Y directions, an additional 10 m has been added on to the area of exceedances to account for the uncertainty due to the grid resolution of the model used to predict areas of exceedance.

3. Results.

The potential for air quality impacts from the fire scenario in the Proposed Facility are assessed in this section.

As previously mentioned in Section 2, the model has been run for a full calendar year at the 100th percentile for the exposure periods considered. The 100th percentile represents the worst-case averaging period of the year when concentrations are predicted to be at their greatest. In the unlikely event that a fire scenario occurs, it is considered very low risk that this would coincide with the worst-case meteorological conditions. Subsequently, the results provided below are considered conservative.

The maximum concentration of pollutants in each scenario has been provided for the 10-minute, 30-minute, 1-hour, 4-hour and 8-hour exposure periods. Where the limit concentrations, provided in Table 1 have been exceeded; the maximum distance from the source where these exceedances occur have been provided. These can be used to determine the maximum areas of exceedance and exclusion zones (if required) surrounding the battery Container of Interest during the fire event for the relevant averaging period.

Table 2 shows the HF results for the fire scenario. AEGL Level 1 was exceeded for all exposure periods. AEGL Levels 2 and 3 were not exceeded for any of the exposure periods.

The maximum areas of exceedance around the battery Container of Interest for all exposure periods at the relevant AEGL Level 1 to protect the general public from hazardous health issues and harm have been specified in the event of a fire. The maximum areas of exceedance around the Proposed Facility (AEGL 1 exceedances) are shown in Figure 3.

The AEGL Level 1 maximum area of exceedance has been predicted under both robust assumptions of a fire scenario (although extremely unlikely) and worst-case meteorological conditions. It is important to note that the Container of Interest reported on in this assessment is considered the worst-case container location that a battery failure event could occur at, since it is located in the closest proximity to nearby existing sensitive receptors.

However, a battery failure event could happen at any container location across the Site (192 containers in total). As such, the area of exceedance surrounding the Container of Interest should be applied to all battery containers within the Proposed Facility to represent the potential of any individual battery container catching fire in a battery failure event.

The maximum area of exceedance around the Container of Interest is 190 m. It is associated with the 10-minute averaging period for AEGL Level 1. AEGL Level 1 refers to notable discomfort, irritation, or certain asymptomatic non-sensory effects. It is important to note that health impacts associated with AEGL Level 1 values are transient and reversible upon cessation of exposure.

The maximum area of exceedance around the Container of Interest reaches existing sensitive receptors including the power station to the north and public pathways within the Newport Wetlands to the south. However, these results are based on the assumptions the fire will occur on worst-case meteorological conditions for that wind direction. The probability of this event occurring is low.

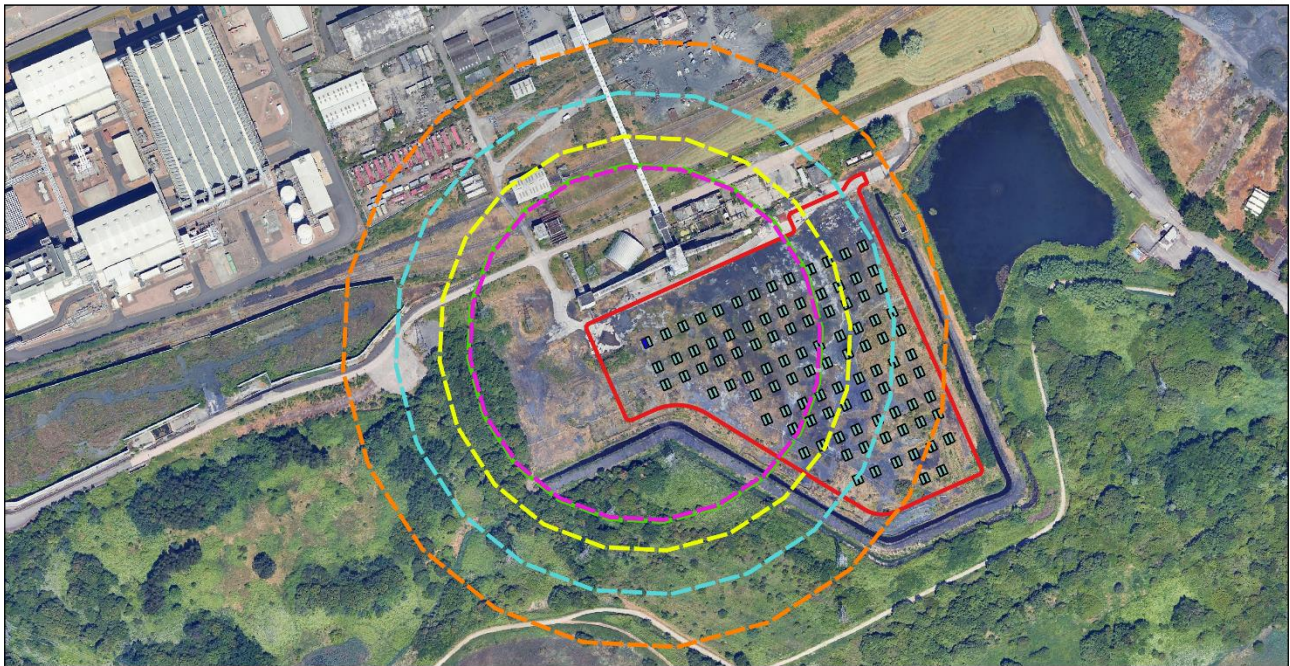
There is no requirement for exclusion zones surrounding the Proposed Facility, as no exceedances of the AEGL Levels 2 and 3 were predicted for any averaging period.

These areas of exceedance are expected to occur downwind of the Proposed Facility, however the maximum area of exceedance (AEGL Level 1) surrounding the Proposed Facility has been stated to account for all possible wind conditions.

Table 2: Fire Scenario Results

AEGL level	AEGL		Maximum Distance of Exceedance (m)
	Averaging Period	Value (ppm)	
1	10-min	1	190
	30-min	1	156
	1-hour	1	128
	4-hour	1	110
	8-hour	1	109
Notes: Maximum Distance of Exceedance (m) values were rounded up to the nearest whole number. No exceedances of AEGL 2 or AEGL 3 were modelled.			

0 100 200 300 400 m



Legend

- Approximate Site Boundary
- 10-minute exposure period
- 4-hour exposure period
- Battery Containers
- 30-minute exposure period
- 8-hour exposure period
- Container of Interest
- 1-hour exposure period

Figure 3: The maximum distance of exceedance zones for AEGL 1 exceedances (dashed line) for the exposure periods considered. Contains Google Satellite Data (Retrieved 28/01/2025).

4. Conclusion.

Hoare Lea have been commissioned by Uskmouth Energy Storage Limited to assess the potential air quality impacts on the local area in the event of battery failure and potential risk of fire, resulting in the plume dispersion of hazardous gas emissions at the proposed BESS at Uskmouth Power Station.

This assessment has considered air pollutant emissions dispersion in a fire scenario to assess the potential impact on existing receptors in the vicinity of the Site. It is important to note that battery failure is an unlikely event, however, should this occur, there will be adequate safety systems in place to control the situation and avoid further failure. However, for the assessment approach, robust and worst-case assumptions have been made in a reasonable manner, without consideration of an emergency responder interference in a fire scenario.

The results of the fire scenario assessment indicate that there will be exceedances of AEGL Level 1 for HF for all exposure periods. No exceedances of the AEGL Levels 2 and 3 for HF were predicted for any of the exposure periods considered. The maximum area of exceedance around the Proposed Facility is 190 m. It is associated with the 10-minute averaging period for AEGL Level 1. For the remaining exposure periods, the AEGL Level 1 distances of exceedance decrease down to 109 m for the 8-hour averaging period. It is important to note that health impacts associated with AEGL Level 1 values are transient and reversible upon cessation of exposure.

The maximum area of exceedance around the Container of Interest of 190 m reaches existing sensitive receptors including the power station to the north and public pathways within the Newport Wetlands to the south. However, these results are based on worst-case assumptions including the assumptions the fire will occur on worst-case meteorological conditions for that wind direction. The probability of this combination to occur simultaneously is extremely low, as the probability of a fire on the scale modelled is already very low, which has then been combined with the worst-case meteorological conditions. Therefore, under the vast majority of battery failure scenarios there would be no long-term impact on surrounding receptors.

Nonetheless, in the event of the described battery fire occurring at the site, as a precautionary measure, the areas within the AEGL Level 1 maximum area of exceedance, downwind of the fire should be avoided by the general public where possible, and a suitable safety management plan suitable for the level of risk put in place as part of the facility's emergency response plan.

The report therefore concludes that a maximum area of exceedance of 190 m has been determined in the unlikely event should a battery fire occur, with only a transient impact on existing sensitive receptors within 190 m of the Site boundary.

5. Glossary.

AEGL	Acute Exposure Guideline Levels
BESS	Battery Energy Storage System
BSMP	Battery Safety Management Plan
CO	Carbon Monoxide
HCl	Hydrogen Chloride
HCN	Hydrogen Cyanide
HF	Hydrogen Fluoride
LFP	Lithium Iron Phosphate
NCC	Newport City Council
NO _x	Nitrogen Oxides
NWP	Numerical Weather Prediction
PM	Particulate Matter
SOC	State of Charge

References.

¹ CATL (2025) EnerC+ Technical Documentation

² Newport City Council (2023) Newport Replacement Local Development Plan 2021-2036, -[online], (Last accessed: 22/01/2025), available at: <https://democracy.newport.gov.uk/documents/s27477/05ii%20Appendix%20A%20Part%202%20-%20Easy%20Read%20Preferred%20Strategy.pdf?LLL=0>

³ Newport City Council (2022) Newport's Local Area Energy Plan, -[online], (Last accessed: 22/01/2025), available at: <https://live.newport.gov.uk/sites/default/files/media/media-documents/Newport%20City%20Council%20-%20Local%20area%20energy%20plan%20-%20March%202022.pdf>

⁴ Larsson et al. (2016) Gas emissions from Lithium-ion battery cells undergoing abuse from external fire, *Conference proceedings of Fires in vehicles*, (5)253-256

⁵ Larsson et al. (2017) Toxic fluoride gas emissions from lithium-ion battery fires, *Scientific Reports* (7)10018

⁶ Enviro Data Services (n.d.) NWP Data, -[online], (Last accessed: 28/01/2025), Available at: <https://envirodataservices.co.uk/get-nwp-data/>

Appendix 1 – Model input parameters.

An assessment has been undertaken using ADMS 6 to consider the gases emitted from the Proposed Facility in a fire scenario.

Model input and emissions parameters.

Fire scenario.

Section 2.1 within the report details the methodology and calculations behind the emissions used within the dispersion model for the fire scenario. As a robust and reasonable worst-case assumption, the fire scenario was considered for one entire container flaming during a battery failure event.

The data inputted into the model is shown in Table 3.

Table 3: Model Input Parameters used in ADMS 6

Parameter	Value
Container dimensions (length, width, height) (mm)	6058 x 2438 x 2896
Container area (top) (m ²)	14.77
Battery container energy capacity (MWh)	4.073
Fire temperature (°C)	1,200
Velocity of gas release from fire (m/s)	0.1
HF emission (mg/Wh)	33.88 *
HF emission rate (g/s)	5.48
HF emission rate (g/m ² /s)	0.37
Note: * indicates HF emission rates sourced from literature ^{4, 5} .	

Exposure periods.

Two out of the five AEGL exposure periods are below 1-hour: 10-minute and 30-minute respectively. The model used for the purpose of the dispersion modelling exercise has allowed for the calculation of peak 1-hour concentrations (100% percentile) to align with the modelling process and input parameters such as the meteorological data, which is based on hourly data.

Subsequently, two separate factors have been applied to peak 1-hour concentrations (100% percentile) to determine the concentrations for a 10-minute and 30-minute average, which are provided below:

- 1.65 to convert into a 10-minute average; and
- 1.3 to convert into a 30-minute average.

The calculation for the factor to convert to a 10-minute average has been derived from the equation specified within Section 17 of Ontario Regulation 419/05 'Air Pollution – Local Air Quality'¹. The factor to convert into a 30-minute average has been obtained from the Environment Agency (EA) document 'Air emissions risk assessment for your environmental permit'².

¹ Ministry of the Environment, Conservation and Parks (2023) Ontario Regulation 419/05 Air Pollution – Local Air Quality – [online] (Last accessed: 28/01/2025), Available at: www.ontario.ca/laws/regulation/050419

² EA (2016) Air emissions risk assessment for your environmental permit – [online] (Last accessed: 28/01/2025), Available at: www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit

Background.

The HF background concentration used for the purpose of the assessment is detailed within Table 4.

Table 4: Predicted Background Concentrations.

Pollutant	Daily Background Concentration ($\mu\text{g}/\text{m}^3$)	Source
HF	0.5*	EPAQS (February 2006), Guidelines for Halogen and Hydrogen Halides in Ambient Air for Protecting Human Health Against Acute Irritancy Effects
*A range of 0.5 – 2 $\mu\text{g}/\text{m}^3$ is outlined in the EPAQS Guidelines, with heavily polluted areas at the upper end of this range, however, according to the UK Pollutant Release and Transfer Register (PPTR) ³ , no industrial sites within 3 km vicinity of the Site have reported hydrogen fluoride pollutant release to air in any of the years 2019-2024. As such, a background HF concentration of 0.5 $\mu\text{g}/\text{m}^3$ has been used.		

Topography.

Topography data can also be added as an input to ADMS-6 model where required. Topography data can have an effect on the flow of the emissions and should be considered when a slope gradient of 1:10 is observed in the terrain surrounding the site. As the topography surrounding the site is less than a gradient of 1:10, topography data was not included in this assessment.

Meteorological data.

The ADMS-6 model includes a meteorological pre-processor developed by the UK Met Office to calculate values of meteorological parameters in the boundary-layer. The pre-processor requires a set of meteorological parameters on an hour-by-hour basis: wind speed, wind direction, temperature and cloud cover.

It is important to use meteorological data which is representative of the conditions within the Proposed Facility to simulate local weather conditions in the model. NWP data from the vicinity of the Site has been used for dispersion modelling. The NWP meteorological data has been provided by Enviro Data Services⁶ were extracted from the NWP model run with a resolution of 3 km x 3 km. The Enviro Data Services NWP data has been used by regulators and part of various studies into NWP data for use in dispersion modelling in the UK. The centre point of the NWP data used is approximately 1.8 km north east of the Site and is considered to be the most representative meteorological conditions in the area.

Meteorological analysis was conducted to assess the worst-case year of meteorological conditions, upon which 2022 was determined to be the worst case year for the 10-minute, 30-minute and 1-hour exposure periods and 2021 was determined to be the worst-case year for the worst-case year for 4-hour and 8-hour exposure periods. This is based on the highest peak HF concentrations observed in each meteorological year.

Wind roses from 2021, 2022 and 2023 are shown in Figure 4.

³ Defra (2014) UK Pollutant Release and Transfer Register – [online], (Last accessed: 28/01/2025), Available at: www.gov.uk/guidance/uk-pollutant-release-and-transfer-register-prtr-data-sets

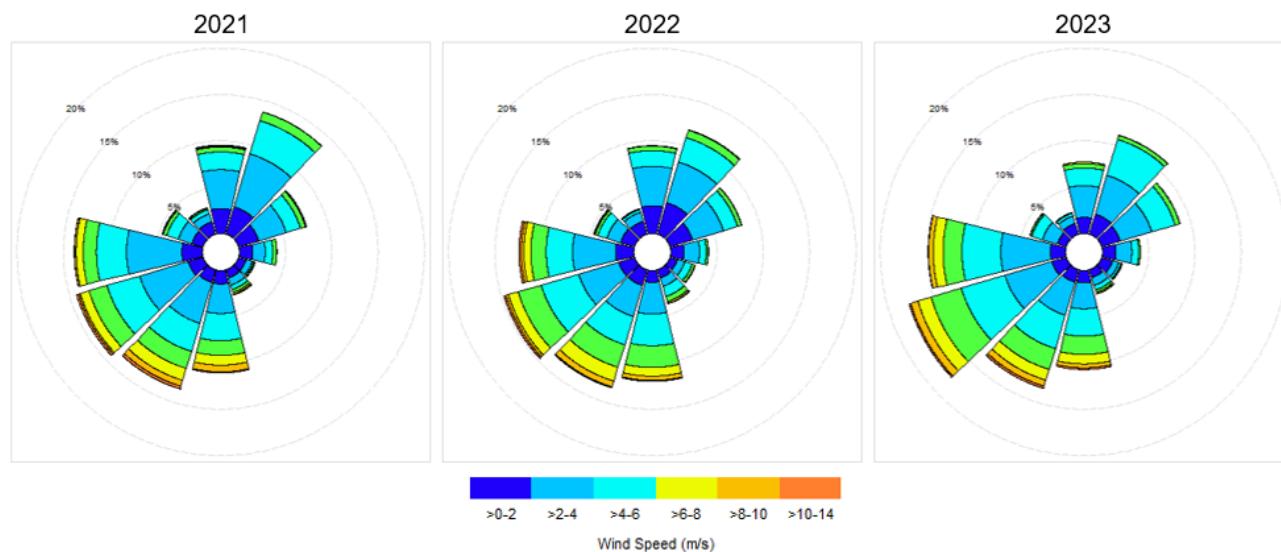


Figure 4: Wind roses from the NWP data in 2021, 2022 and 2023.

The wind roses show a south westerly prevailing wind in all three years. Table 5 shows the values for surface roughness, albedo and the Monin-Obukhov length inputs used in the model. The meteorology parameters for the NWP data were provided by Enviro Data Services⁶. The surface roughness and Monin-Obukhov length for the dispersion site have been determined based on professional judgement of the surrounding land uses, whereas the surface albedo has been set to the ADMS default value.

Table 5: Meteorological data settings used in ADMS 6.

Meteorology		Value
Monin-Obukhov Length (m)	Dispersion Site	10
	Meteorological Measurement Site	10
Surface Roughness (m)	Dispersion Site	0.3
	Meteorological Measurement Site	0.105
Surface Albedo (%)	Dispersion Site	23*
	Meteorological Measurement Site	20.2

* ADMS default value.



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