Rosefield Solar Farm

Applicant's Response to Action Point 45 from ISH1

EN010158/APP/8.26
Revision 01
Deadline 4
June 2026
Rosefield Energyfarm Limited

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1. Introduction

1.1. Purpose of the Note

1.1.1. This technical note has been prepared on behalf of Rosefield Energyfarm Limited (the Applicant) in response to Action Point 45 from Issue Specific Hearing 1 (ISH1) to 'provide a technical note explaining the further analysis it has done in respect of its plume assessment and model to respond to Preston Farms/TCS Bioscience'.

1.1.2. This Note sets out the Applicant's response to the question raised, building on information contained in documents already submitted to the Examination. Including **BESS Plume Assessment Summary [EN010158/APP/7.13.3] [REP3-042]** and **Outline Battery Safety Management Plan (Outline BSMP) [EN010158/APP/7.9.5]**.

2. Scope of Plume Study and Atmospheric Dispersion Modelling

2.1.1. In the **Examining Authority's Written Questions 1 (ExQ1) [PD-010]**, the Examining Authority asked Q1.7.4:

"National Policy Statement (NPS) EN-1

Paragraph 4.6.16 of NPS EN-1 states that applicants should make use of available guidance and tools for measuring natural capital assets and ecosystem services, such as the Natural Capital Committee's 'How to Do it: natural capital workbook', the government's guidance on Enabling a Natural Capital Approach, and other tools that aim to enable wider benefits for people and nature. Explain how you met this requirement."

2.1.2. In the **Applicant's Response to the Examining Authority's First Written Questions [EN010158/APP/8.13] [REP2-087]** the following response was provided:

"The Applicant has considered a Natural Capital Approach, alongside good design outcomes that support sustainable development. Good design has been embedded into the Proposed Development through a clear design framework from the outset of the design process. The ***Design Approach Document [EN010158/APP/5.8.2] [REP1-018]*** *and* ***Outline LEMP [EN010158/APP/7.6.3]*** *set out the approach to the design of the Proposed Development, including how good design has principles have been implemented to take advantage, where possible, of opportunities to deliver wider environmental net gains. This includes enhancements contributing to biodiversity net gain such as:*

- *Habitat creation and management;*
- *New and improved species rich hedgerows;*
- *Enhancement of field margins; and*
- *Sowing of land under and between panels with legume rich grassland mix.*

Alongside the above, enhancements to the community and environment including enhancing access and connectivity to the countryside including the creation of new permissive footpaths and interpretation boards and wayfinding signage."

2.1.3. As recorded in the **Written Summary of Applicant's Oral Submissions at Issue Specific Hearing 1 (ISH1) [EN010158/APP/8.16] [REP3-049]**, the Applicant considers that the principles of the Natural Capital Committee and government guidance are met in the **Design Approach Document [EN010158/APP/5.8.3] [CR1-014]** and **Outline Landscape**

and Ecological Management Plan (Outline LEMP) [EN010158/APP/7.6.5]. The Applicant acknowledges that this is not expressed as clearly as it could be in the response to Q1.7.4, so remainder of this note sets out what the relevant natural capital guidance indicates should be done and cross-references where those matters are addressed in the documents submitted into the Examination.

3. Further Analysis for Preston Farms/TCS Biosciences Holdings

3.1.1. Due to the concerns raised by TCS Biosciences/Preston Farms in their written submissions to Examination, the Applicant has further investigated emission levels in the fields closest to the BESS where horses and livestock from the TCS Biosciences/Preston Farms could be located. Figure 1 shows the closest fields in the Preston Land Holdings that are indicated with a blue star. Extracted from **REP1-133**.

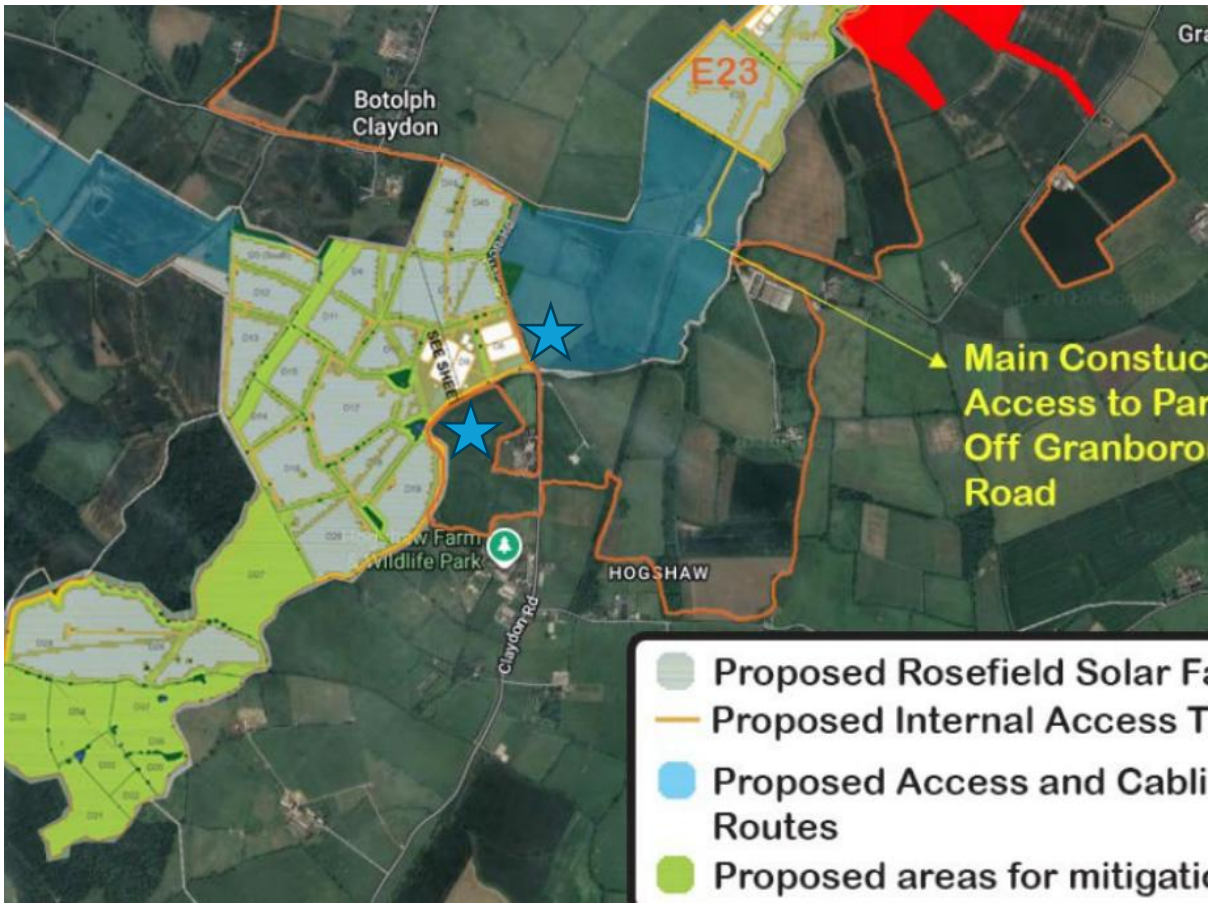

Figure 1- Plan showing the fields investigated for Exposure Levels

3.1.2. It is not practical to include and report results for sensitive receptors at each location within a modelling domain (i.e., at locations within a field that are not commonly assumed to be sensitive). However, the use of a receptor grid has allowed predictions at all downwind areas and all of TCS Biosciences/Preston Farms holdings that are close to the BESS fields D8/D9. In this case, impacts across a 5km x 5km with a 20m resolution grid centred on the Site have been predicted. Furthermore, the use of an advanced Gaussian model, such as ADMS 6, allows concentrations to be predicted at each receptor for every hour of the year (and sub-hourly, if

required), thus accounting for all conditions provided within the five-year meteorological file.

3.1.3. Figure 5.1 within the **BESS Plume Assessment Summary [EN010158/APP/7.13.3] [REP3-042]** presents contoured concentrations for the 100th percentile 1-hour hydrogen fluoride (HF) concentrations across the modelling domain, including the entire Preston Farms holdings area. Two additional contours of the 100th percentile 1-hour hydrogen fluoride concentrations in higher resolution around the adjacent TCS Biosciences/Preston Farm fields are also presented for clarity in Figure 2 and Figure 3 of this document.

3.1.4. The contours presented in Figure 2 and Figure 3, and in the BESS Plume Assessment Summary, demonstrate that the predicted 1-hour HF impacts during a BESS incident are below the assessed Air Quality Levels (i.e., the US EPA AEGLs), and this is the case across the entire modelled grid (including all Preston's Farm holdings), with no predicted 1-hour concentration exceeding the 1-hour HF AEGL1 of 860 ug/m^3.

3.1.5. The prevailing wind direction at the Site, as assumed to be as at RAF Benson meteorological station between 2020 and 2024, is southerly (180°), with there also being a high frequency of south-southwesterly, southwesterly and north-northeasterly winds. Therefore, the Preston Holding to the south of the BESS site, which is the closest potential transient receptor location, is not in the prevailing wind direction. Based on the data from RAF Benson, the probability of the wind blowing in a single 10-degree sector between 340° and 20° in this field direction is no greater than 5% over a 5-year period.

3.1.6. There are Preston field holdings situated North/North-East of the BESS site that could be influenced by near-prevailing winds. Therefore, under any BESS thermal runaway event, it would be more probable that these locations would be impacted. However, they are positioned further away from the BESS than the holdings to the South, as there is a highway (Claydon Road) separating the fields. All these locations have been included in the modelling.

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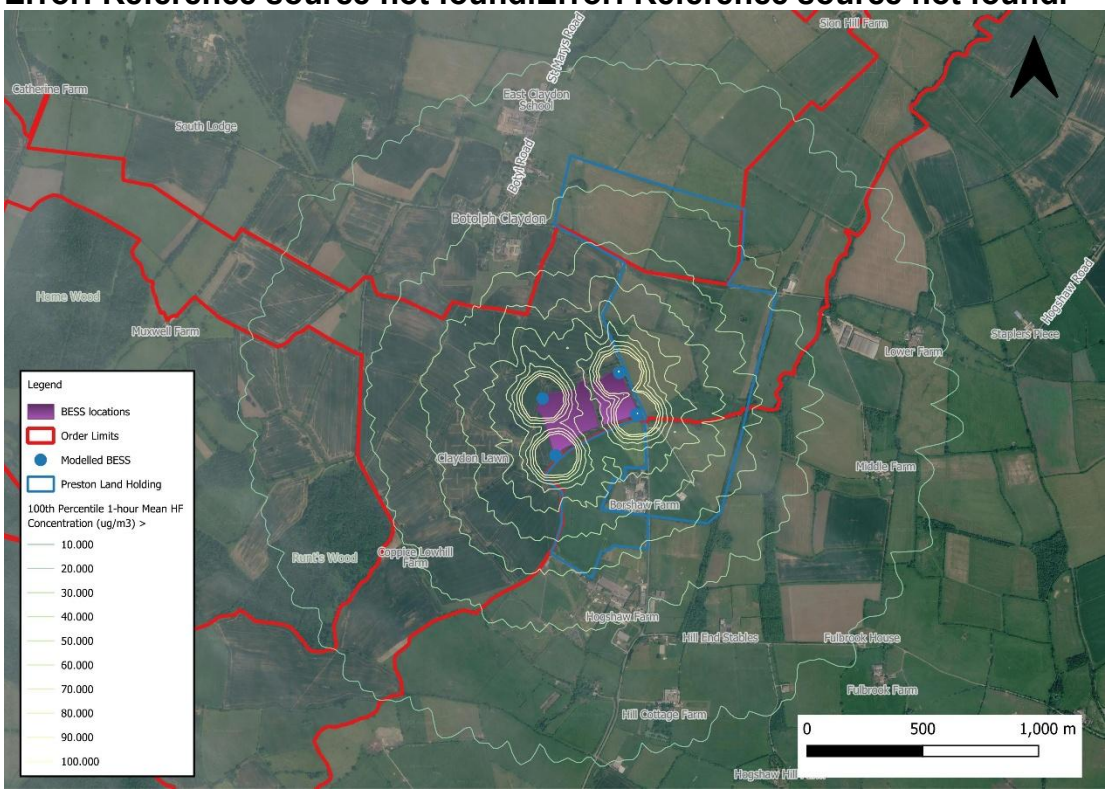

Figure 2- 100th Percentile 1-hour HF Concentrations (ug/m3)

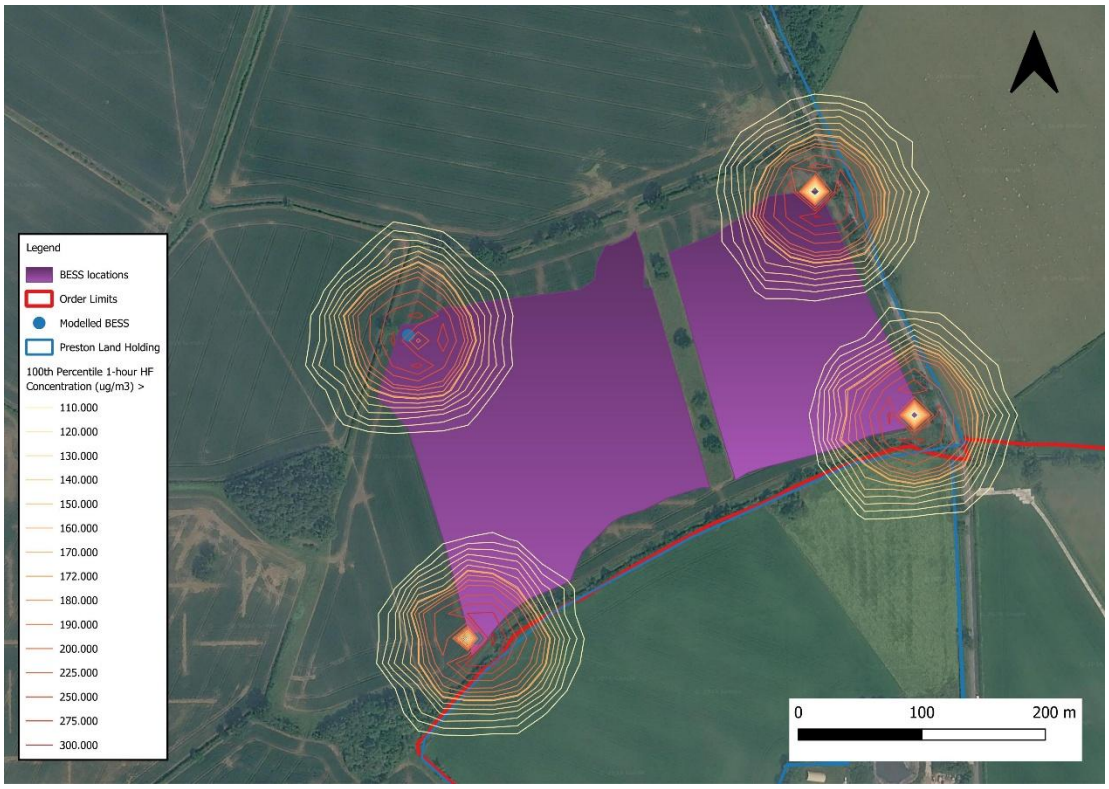

Figure 3- Higher resolution 100th Percentile 1-hour HF Concentrations (ug/m3) – starred areas show locations of the Preston Farms/TCS Biosciences field holdings.

3.1.7. **Error! Reference source not found.Error! Reference source not found.**Based on the results presented within the **BESS Plume Assessment Summary [EN010158/APP/7.13.3] [REP3-042]**, the only standard where there is a potential for an exceedance within the Preston Farm holdings is the 10-minute HF AEGL 1. This is based on the assumption that the maximum predicted impact of 78% of the HF AEGL 1 at R14, 50m away from the BESS, could be higher at locations within 50m. Due to the fields associated with the Prestons Farms holdings not commonly assumed to be sensitive, this was not investigated further as part of the **BESS Plume Assessment Summary [EN010158/APP/7.13.3] [REP3-042]**

3.1.8. However, due to concerns regarding the impacts on workers and animals within these nearby fields, this has been further investigated using the same dispersion modelling as in the **BESS Plume Assessment Summary [EN010158/APP/7.13.3] [REP3-042]**. The maximum 10-minute HF concentrations across 5 years from the SE corner BESS have been modelled across a smaller refined grid to demonstrate the distance where the 10-minute HF AEGL 1 might be exceeded during an incident. The contour in Figure 4 demonstrates that the 10-minute HF AEGL 1 (860 ug/m^3) would not be exceeded more than 50m away.

Figure 4- Zoomed in 100th Percentile 10-minute HF Concentration (ug/m^3)

3.1.9. To address the additional concerns from the interested party, the Applicant has included an additional commitment in the **Design Commitments**

[EN010158/APP/5.9.6] document to ensure that BESS containers will be offset at least 50m from the southern boundaries of Fields D8 and D9 and the eastern boundary of Field D9, to provide further comfort that the HF 10 minute levels would be below the 10-minute AEGL-1 limit threshold within the surrounding livestock fields in the event of a thermal runaway occurrence.

3.2. Applicability of the AQSs used

3.2.1. While the above assumes that livestock have similar tolerances to HF as humans, concerns have been raised that the AEGLS cannot be applied to livestock within the Preston's Farm holdings.

3.2.2. Publicly available literature regarding the air quality risks to horses or livestock primarily focuses on ammonia and particulate matter due to animal housing conditions. Furthermore, while there is literature on the effects of HF, it is primarily associated with longer-term effects associated with ingestion, or animal LC50[1] values for inhalation, which are less relevant here. Furthermore, an Environment Agency[2] report has reported a sub chronic No Observed Adverse Effect Level (NOAEL) for blood changes of 1 ppm (or 860 ug/m^3 [3]) for hydrogen fluoride within rats, and while blood changes were noted in the mid-dose males, these changes were not statistically or biologically significant. Other literature cites higher values for NOAELs in rats depending on time frames, with lower HF values down to 1 µg/m^3 also cited for the protection of livestock; however, this relates to long-term exposure to prevent the ingestion of contaminated forage and is not relevant here.

3.2.3. As AEGL1 limits are designed to ensure reversible or prevent more minor effects in the most sensitive human populations, they are judged most applicable for comparison against animals. While it is acknowledged the unique nature of the livestock in question and their health importance to a business, in the absence of evidence on the levels that would harm the specific horses to the level that would have an effect on the business, it is not possible to conduct a further assessment beyond the comparison with the strictest human standards and available animal NOAELs.

3.3. Summary of Current Position

3.3.1. The current modelling determines that within the surrounding fields, the HF 1-hour levels are below AEGL1 (notable discomfort) and with an applied 50m buffer between the BESS units and the Preston Farms

[1] The concentration in air that is lethal to 50% of a test population
[2] https://www.fluoridealert.org/wp-content/uploads/uk.hf_.2006.pdf
[3] Within the plume assessment, 1ppm of HF is converted to 860 ug/m^3, assuming an ambient temperature of 10°C.

holdings, would be below all HF AEGL1s. This new commitment has been included to provide further comfort to the interested party, which is additional to the current scope of the Plume and Atmospheric Dispersion Modelling Study.

3.3.2. Therefore, this ensures that even if the horses or workers were standing at the very edge of the adjacent fields to the BESS, Fields D8 and D9, and weren't evacuated away during a BESS fire incident, their exposure to any contaminants would still be below the AQO and AEGL guidance limit. It is highly likely that if there were a BESS fire event, workers and livestock would move away from the noise/fire to another part of the field away from the incident, which would further limit their exposure to contaminant levels.

3.4. Residual Effects

3.4.1. The study of the effects of BESS fires is an emerging field, but emission data captured in real-world BESS fires have demonstrated that environmental impacts did not have significant off-site impacts. Emissions profiles from BESS systems are highly variable and dependent on design and system components; the risks of emissions caused by them (including particulate matter, aerosols and ultrafine particles) must be defined by large scale fire testing to quantify what is released outside a BESS enclosure and not contained within the structure and BESS system architecture. While it is acknowledged that BESS fires represent a source of environmental pollution, this is the case for other types of accidental fires. While a fire from a BESS may have elevated risks associated with metals and HF, there is evidence that the risks are broadly similar to other fires, as highlighted in a recent paper[4] produced by the National Fire Protection Association.

3.4.2. The impacts and risks, in comparison to other fires, will therefore likely depend on the magnitude and dispersion profile of a BESS incident. Based on the design of the battery system to limit the spread of fire to multiple BESS units, in high probability an incident will be small and at a magnitude of complete destruction of a single BESS unit; it has been demonstrated to disperse the pollutants to below levels where the effects are reversible or minor (i.e., AEGL 1).

3.4.3. While residual risk still exists, and that risk profile is different to a normal fire, when considering the risk assessment balance (probability vs severity), with a very low probability of the event even occurring (1 in 5804-year event) and the risks of effects of any severity likely to be low (this considering the short-term nature of any event and the receptor

[4] https://www.nfpa.org/education-and-research/research/fire-protection-research-foundation/projects-and-reports/environmental-impact-of-li-ion-incidents-compared-to-other-types-of-fires

distance demonstrating suitable dispersion of known emissions), the risk of health effects as a results of a BESS fire is low. The Emergency Response Plan (ERP) produced at the detailed design stage will incorporate all necessary emergency response procedures and actions based upon thermal runaway test data supplied by the BESS system provider and additional internal EDF testing. The Applicant will engage with Preston Farms/TCS Biosciences once the final plume analysis study has been conducted to ensure that emergency procedures for all credible hazards and risks at their receptor locations are included in the ERP i.e. the BESS area weather station will identify the prevailing wind direction, air emission monitoring at site boundaries will establish required ERP protocols, etc. This has been added to the **Outline BSMP [EN010158/APP/7.9.5]** at Deadline 4.

3.4.4. Final risk assessments, consequence modelling, and Emergency Response Plans can only be developed once the selected BESS design is defined, including system configuration, operating parameters, and test data. Currently, most BESS suppliers introduce new designs on 12-18 month cycles, therefore the Applicant has used a current BESS design for illustrative consequence modelling to validate site location and layout for DCO Application requirements. The Applicant is not "deferring" a final Plume Analysis Study until the Detailed Design stage, rather by definition all critical risk assessments and consequence modelling can only be conducted once the BESS system is selected.

3.4.5. As now mandated under NFPA 855 (2026) the Applicant will only be able to select a BESS system that has undertaken Large Scale Fire Testing (LSFT). At the detailed design stage, the selected BESS LSFT data will be leveraged to fully inform inputs for risk assessment tools which will be utilised together with detailed consequence modelling to provide a comprehensive site operations and emergency response safety audit. This is secured in the **Outline BSMP [EN010158/APP/7.9.5]** pre-construction requirements (Section 7). The objective of the test is to evaluate the thermal exposure impacts from a developed BESS enclosure, to determine propagation risk to adjacent BESS or equipment. Testing also defines the length of burn, duration of Peak Heat Release Rate, maximum burn temperatures, etc.

3.4.6. Section 6.1.1 of the **Outline BSMP [EN010158/APP/7.9.5]** stipulates: The detailed design phase would consider the lifecycle of the battery from cradle to grave. A large number of studies would be undertaken, with a focus on fire risk including, but not limited to, studies in line with risk analysis and management tools such as Hazard and Operability Analysis and Hazard Identification (HAZOP/HAZID), failure Mode and Effects Analysis (FMEA), Bowtie risk assessments and Dangerous Substances and Explosive Atmospheres Regulations 2002 (DSEAR) to inform the overall design solution. An agile method is applied during the engineering

design phase for fire safety analysis. The analyses are updated based on any changes of the project context and during the design process from the selected contractors in case of any deviation from the initial set of technical requirements. These would be finalised before construction commences.

3.4.7. At post consent, an updated Plume Study will be commissioned using updated BESS data and infrastructure layouts to check that in the final design the exposure limits within the surrounding fields, are no worse than those included within the current Plume Modelling Outputs, this is secured within Section 5.2.10 of the **Outline BSMP [EN010158/APP/7.9.5]** .

3.4.8. At this stage the Applicant will work with Preston Farms and TCS Biosciences to also establish where their workers of Preston Farms are likely to be situated so these receptors can be analysed for a potential thermal runaway event to provide further reassurance to TCS Biosciences that the risk remains low for their workers and livestock i.e. there is no credible requirement for evacuation of workers or animals. A recent report reviewing 35 large-scale BESS fire incidents and associated environmental monitoring data "Assessment of Potential Impacts of Fires at BESS Facilities" (Fire & Risk Alliance and American Clean Power, 2025) found that, where BESS fire events have occurred, contaminant concentrations did not pose a public health concern and impacts were limited to the immediate vicinity of the fire. The report concludes: "*Air sampling from past incidents has found that contaminant concentrations beyond the immediate fire scene do not pose a public health risk. For example, monitoring at the Escondido, CA and NY incidents showed no detectable hazardous concentrations in nearby communities and initial shelter in place and evacuation orders were generally lifted shortly after the measurements were taken. The rapid dispersion of gases in outdoor BESS fires limits the potential for widespread toxic exposure. Studies show that the local concentration of gases rarely reaches flammability limits in well-ventilated environments and toxic gases are rapidly diluted.*"

3.4.9. The UKHSA is a Statutory Consultee for the Proposed Development and has declared that the Applicant's BESS fire emission risk analysis and consequence modelling: "*provides a logical approach and assesses a worst-case scenario of chemical emission concentrations during a BESS fire event at relevant receptor locations. The findings of the addendum report alongside the previous submitted plume assessment suggests that the risk to public health for nearby receptors from chemicals emitted during a BESS fire event is likely to be low.*"

3.4.10. Furthermore, evidence from real-world BESS fire incidents indicates that emissions are short-lived, highly dispersed, and localised to the vicinity of the fire, with no empirical evidence of hazardous vapour clouds forming or accumulating in low-lying areas at distances relevant to public exposure.

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