Springwell Solar Farm

7.14.2 Outline Battery Safety Management Plan

EN010149/APP/7.14.2
Revision 2
Deadline 1
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Springwell Energyfarm Ltd

APFP Regulation 5(2)(q)
Planning Act 2008
Infrastructure Planning
(Applications: Prescribed Forms
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1. Introduction

1.1. Purpose of this document

1.1.1. This outline Battery Safety Management Plan sets out the key fire safety provisions for the Battery Energy Storage System (BESS) proposed to be installed at Springwell Solar Farm including measures to reduce fire risk and fire protection measures.

1.1.2. This document has been updated at Deadline 1 to respond to the Examining Authority's First Written Questions, Issue Specific Hearing 1 and discussions held to agree the **Draft Statement of Common Ground - UK Health Security Agency [EN010149/APP/8.6]**. The document references have not been updated from the original submission. Please refer to the **Guide to the Application [EN010149/APP/1.2]** for the list of current versions of documents.

1.1.3. This document provides a summary of the safety related information requirements which would be provided in advance of construction of the BESS. The purpose of this outline Battery Safety Management Plan is to identify how the Applicant would use good industry practice to reduce risk to life, property, and the environment from the BESS.

1.1.4. Prior to the commencement of construction of the BESS, the Applicant would be required to prepare a Battery Safety Management Plan which must be in substantial accordance with this outline Battery Safety Management Plan. As part of preparation of this Battery Safety Management Plan, the Applicant would take into account the latest good practices for battery fire detection and prevention, along with the emergency response plan, as guidance continues to develop in the UK and around the world.

1.1.5. Given the timescale between the Application and the operational phase of the Proposed Development, the approved Battery Safety Management Plan may be updated prior to the Proposed Development's operational phase to ensure the most current guidance is incorporated and to demonstrate how final design of the BESS would accord with guidance in place at that time.

1.1.6. For the purpose of this document, the following terms are defined as below:

- BESS Enclosure: The container that is storing the battery cells and racks/ modules.

- BESS Equipment: The equipment that makes up the BESS, including but not limited to the BESS enclosures, power conversion systems (PCS), transformers and switchgears.
- BESS Facility: The entire designated area allocated for the BESS project including the associated infrastructure such as roads and buildings.

1.2. Structure of this Outline Battery Safety Management Plan (oBSMP)

1.2.1. This oBSMP is structured as follows:

- Section 1 – this Introduction;
- Section 2 – Safety Objectives and Guidance;
- Section 3 – Consultation;
- Section 4 – BESS Safety Commitments;
- Section 5 – Firefighting;
- Section 6 – Pre-Construction Information Requirements;
- Section 7 – Conclusions.

1.3. The Proposed Development

1.3.1. A summary of the description of the Proposed Development can be found in Section 3.1 of the **Environmental Statement (ES) Volume 1, Chapter 3: Proposed Development Description [EN010149/APP/6.1].** The terminology used in this document is defined in the **Glossary [EN010149/APP/6.1].**

1.4. The Order Limits

1.4.1. The extent of the Proposed Development is shown in **ES Volume 2, Figure 1.2: Order Limits [EN010149/APP/6.2]** and is described in full in **ES Volume 1, Chapter 3: Proposed Development Description [EN010149/APP/6.1].** The **Illustrative Layout Plans & Sections [EN010149/APP/2.5]** show one way in which the different areas of the Proposed Development can be accommodated within the Order Limits, within the parameters shown on the **Works Plans [EN010149/APP/2.3]** and in accordance with the **Design Commitments [EN010149/APP/7.4]** and **ES Volume 3, Appendix 3.1: Project Parameters [EN010149/APP/6.3].**

2. Safety Objectives and Guidance

2.1. Safety objectives

2.1.1. Safety objectives for the design of the BESS are:

- To minimise the likelihood of a thermal runaway event. This is the overriding priority.
- To minimise the consequences should a thermal runaway event occur.
- To restrict any thermal runaway event to the site and minimise any impact on the surrounding areas.
- To automatically detect and begin to control and mitigate thermal runaway as soon as possible.
- To ensure any personnel on site are able to escape safely away from the site.
- To ensure that firefighters can operate in reasonable safety where necessary.
- To minimise the requirement for direct Lincolnshire Fire and Rescue Service (LFRS) intervention in a thermal runaway incident through BESS design and site layout.
- To demonstrate the system supports LFRS strategies for tackling the event, for instance and if applicable at the time:
  - Boundary cooling of adjacent BESS and equipment to prevent the fire from spreading.
  - Allowing the BESS to burn out to remove the risk of stranded energy in the battery systems.
- To ensure that any firefighting water run-off can be safely contained and tested for pollutants before release, reuse or, if necessary, removed by tanker and treated offsite.
- To ensure that fire, smoke, and the spread of gasses do not significantly affect occupants in surrounding buildings and areas, first responders, and the local community.

2.1.2. The following sections set out the design responses incorporated into the Proposed Development in order to achieve these objectives.

2.2. Legal Requirements and Relevant Guidance

2.2.1. The Applicant is a joint venture between EDF Renewables and Luminous Energy. EDF Renewables owns and operates a number of lithium-ion BESS with an exemplary safety track record. Guidance documents and standards considered by the Applicant in the design and selection of these systems have been used to inform the design of the Proposed Development. There is currently limited UK specific guidance for BESS, however the Applicant operates globally and incorporates good practice from around the world.

2.2.2. The Applicant would develop the BESS in accordance with all relevant legislation and good practice in force at the time. The primary guidance to be used is the NFCC guidance "NFCC Grid Scale Battery Energy Storage System planning – Guidance for FRS". Other guidance and good practice documentation would also be used where permissible under the NFCC guidance, including:

- NFPA 855 (United States of America) – Standard for the Installation of Stationary Energy Storage Systems
- NFPA 68 – Standard on Explosion Protection by Deflagration Venting
- NFPA 69 – Standard on Explosion Prevention Systems
- BS EN 14797 (2006): Explosion venting devices.
- NFPA 2010 – Standard for Fixed Aerosol Fire-Extinguishing Systems
- UL 9540A Testing Compliance - Standard for Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems
- UL 1973 (2022) - Batteries for Use in Stationary and Motive Auxiliary Power Applications.
- UL 9540 3rd Edition (2023) - Standard for Energy Storage Systems and Equipment.
- BS EN IEC 62619 (2017) Secondary cells and batteries containing alkaline or other non-acid electrolytes. Safety requirements for secondary lithium cells and batteries, for use in industrial applications.
- FM Global Property Loss Prevention Data Sheets: 5-33 Lithium-Ion Battery Energy Storage Systems (United States of America).
- DNV GL-Recommended Practice-0043: Safety, Operation and Performance of Grid-Connected Energy Storage Systems, 2017.
- BS 5839 Part 1 2017: Fire Detection and Fire Alarm Systems for Buildings.
- The Regulatory Reform (Fire Safety) Order (RRO) 2005.
- IEC 61936, Power installations exceeding 1 kV AC and 15 kV DC – AC.
- The Buildings Regulations 2010, Approved Document B (Fire Safety) – Volume 2. Adopted provisions can be found within section 2.4.

- UN 38.3: Recommendations on the Transport of Dangerous Goods – Manual of Tests and Criteria – (Lithium Metal and Lithium-Ion Batteries).
- Appropriate air quality guidelines and standards e.g. AEGLs (Acute Exposure Guideline Levels) and AQGs (Air Quality Guidelines)

2.3. Potential BESS Failure

2.3.1. Failure modes for BESS developments can be generally split into electrical, mechanical, chemical or thermal. The causes for failure could include issues such as: manufacturing defects, overcharging, over dis-charging, mechanical damage, overheating or abuse and short circuits; whether internal or external. Regardless of the type of failure or the cause, the main potential hazard is thermal runaway and ultimately, if not controlled, a significant flaming or explosive gas venting incident. This management plan focusses on reducing fire and explosion risks associated with the BESS and managing the hazard in the unlikely event that it occurs.

2.3.2. Potential failures associated with the BESS would be assessed through a Failure Modes and Effects Analysis (FMEA) process and mitigations established through the Hazard Mitigation Analysis (HMA) process. As per HSE's hierarchy of controls, where possible, all failure modes and hazards would be eliminated or substituted. Due to the nature of lithium-ion BESS equipment, methods of elimination and substitution may not be possible and instead, engineering controls would be required.

2.3.3. Other electrical systems than the batteries which form part of the BESS can carry fire risks, however due to the extensive historic long-term deployment of other technology such as transformers, inverters and switchgears, these risks are better understood and regulated, through longstanding industry guidance and codes. Therefore, only the battery component of the BESS is addressed in this oBSMP.

3. Consultation

3.1. Fire and Rescue Service

3.1.1. The Applicant has consulted the local fire and rescue service, Lincolnshire Fire and Rescue Service (LFRS) as part of developing the BESS element of the Proposed Development. An introductory meeting was held with Lincolnshire FRS on 24 August 2023 to provide initial information about the Proposed Development and to seek early feedback. This was followed by two meetings on 23 January 2024 and 09 July 2024 when further details of the Proposed Development were shared including the preliminary design. An earlier draft of this outline Battery Safety Management Plan was shared with Lincolnshire FRS on 9 August 2024.

3.1.2. The outcomes of the discussion between the Applicant and Lincolnshire FRS are detailed in **Statement of Common Ground - Lincolnshire Fire and Rescue Service [EN010149/APP/7.24]**.

3.2. UK Health Security Agency

3.2.1. The Applicant has consulted the UK Health Security Agency (UKHSA) as part of the DCO process. An introductory meeting was held with the UKHSA 18 March 2025 to respond to the Relevant Representation letter and a follow up meeting was held 28 April 2025 where agreement was made on the **Statement of Common Ground – UK Health Security [EN010149/APP/8.6].** The Applicant and the UKHSA concur that at the detailed design stage (after battery system selection) a plume assessment would be commissioned based on atmospheric dispersion modelling; this would give an understanding of what would be emitted and the impact on Sensitive Receptors in comparison with air quality standards.

3.3. Other Consultees

3.3.1. As set out in the **Consultation Report [EN010149/APP/5.1]** submitted with the Application, the following statutory consultees made substantive comments on the BESS:

- Ashby de la Launde Parish Council;
- Health and Safety Executive;
- Lincolnshire County Council;
- Natural England;
- North Kesteven District Council;
- Scopwick and Kirkby Green Parish Council;
- UK Health Security Agency.

3.3.2. The matters raised by the above consultees included the below, which are addressed in this **oBSMP**:

- Location of the BESS;
- Request for more information about how fire risk would be managed and monitored;
- Request for continued engagement with Lincolnshire FRS;
- Suggestions for fire safety measures that could be implemented within the BESS;

- Request for confirmation that the Proposed Development would not impact on human health.

4. BESS Safety Commitments

4.1. Overview

4.1.1. This section identifies the BESS lifecycle stages and outlines the requirements for control and safety during:

- Procurement and testing;
- Safe BESS design;
- Safe BESS construction;
- Safe BESS operation;
- End of life/BESS disposal.

4.2. Procurement and Testing

Procurement

4.2.1. The Applicant is a joint venture between EDF Renewables and Luminous Energy. EDF Renewables has operated different battery technologies across a number of fields, including nuclear power. It operates with a stringent three stage prequalification process that leverages the global technological capabilities of EDF Renewables in the selection of all components, with particular focus on the battery technology and inverter manufacturers. This limits the selection of manufacturers to only those which are approved by EDF Renewables.

4.2.2. EDF Renewables has a world class Research and Development (R&D) team and facilities that support this process. In 2020, EDF invested €685 million in R&D. EDF Renewables has undertaken a range of studies as part of the development of its global battery portfolio. As part of this work EDF Renewables New Technologies Team along with EDF R&D work with manufacturers and integrators to develop world leading battery systems.

4.2.3. EDF Renewables only considers and engages with suppliers and products that conform to ISO 9001, UN 38.3, CE and local regulation, auditing both technical and financial aspects. The manufacturing facilities are inspected and production lines are monitored. Production quality documentation is checked and on the production line it is verified that the quality requirement is correctly respected and implemented. The following aspects are specifically checked:

- Material management.

- Procurement and supplier management.
- Manufacturing processes.
- Quality system.
- Reliability program.
- Training.
- Corrective action and non-confirming process and process improvements.
- Corporate social responsibility, environmental, health and safety.

4.2.4. Battery samples are also randomly selected from factories and tested in the EDF R&D laboratory in order to validate the reliability, safety and performance of products.

4.2.5. It is recognised within EDF Renewables that a robust quality process is a wise investment at the development and procurement stages that pays large dividends in terms of safe, continuous operation.

Testing

4.2.6. The system selected would be tested and certified in accordance with UL 1973 (2022 edition), UL 9540, UL 9540A, IEC 62619 and UN 38 or equivalent. This would determine the propensity of the system to suffer from thermal runaway at either cell, module or rack level. The electrochemistry in the example design of the BESS used to inform the ES is LFP (Lithium-ion Phosphate).

4.2.7. The example BESS modules used to inform the ES have been assessed to UL 9540 and UL 9450A. The system satisfied UL 9540A criteria at Module level.

4.2.8. The module tests showed that during testing, no fire or explosion occurred and the thermal runaway did not propagate to the adjacent cells. Other testing certificates are to be requested from the supplier.

4.2.9. As a minimum, the future battery system will have completed unit or installation level UL 9540A testing, demonstrating that thermal runaway propagation will not spread between modules or between battery racks and the generation of explosive gases will not threaten container structural integrity. This offers a high level of protection against fire and explosion risk. The Applicant would only consider bids from suppliers that demonstrate no module-to-module propagation during testing (also taking into account the evolving testing requirements).

4.2.10. The Applicant conducts testing of cells under abusive conditions to further analyse the off gases produced during cell venting in the event of thermal runaway. This testing provides critical input in understanding the volume of off gases which are likely to be produced. Once the battery modules for the Proposed Development have been selected, appropriate steps to mitigate the impacts would be identified. In addition, the Applicant has carried out a **BESS Plume Assessment [EN010149/APP/7.19]** to assess the impacts of a thermal runaway event for an example battery cell.

4.2.11. Another plume assessment would be completed once the battery modules for the Proposed Development have been selected at Detailed Design to demonstrate that the risk of thermal runaway and impacts from such thermal runaway will be no worse than as assessed in the plume assessment submitted with the Application. This informs the design prior to construction and ensure specific battery chemistries are considered along with all appropriate safety mitigation measures being put in place.

4.3. Safe BESS Design

4.3.1. The BESS would be designed to address prevailing industry standards and good practice at the time of design and implementation. BESS system and components used to construct the facility will be certified to UL 9540 (2023) and/or BS EN IEC 62933-5-2 standards (or any future standards which supersede this).

4.3.2. The current industry standard is NFPA 855, Standard for the Installation of Stationary Energy Storage System and the Applicant also requires any system selected to comply with UL 9540A, Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems which demonstrates the fire propagation for lithium-ion batteries at cell, module and unit level.

4.3.3. In addition to this, the NFCC's "Grid Scale Battery Energy Storage System planning – Guidance for FRS" has been reviewed with regards to site layout and separation distances for the transformers and inverters.

4.3.4. Fire safety provisions typically found within battery system design are as follows:

- Battery modules with safety features designed into the cell level such as:
  - Internal fuses.
  - Protection devices to isolate BESS at rack/ string and bank level.
  - Overcharge safety device.
  - Internal separating layers
  - Venting systems and gas channels
  - Thermal Monitoring.

4.4. System Location

4.4.1. Within the Site the selection of the location of the BESS has been based on a number of factors. The most pertinent factor being the minimisation of the proximity to receptors of any nuisance with the distance to properties maximised where possible. This has the benefit of reducing the visual and noise impacts but also minimises any potential impacts on the local population should an event occur. The location of the proposed BESS is shown on the **Works Plans [EN010149/APP/2.3].**

4.5. System Layout

4.5.1. An illustrative layout for the BESS Facility is included in the **Illustrative Layout Plans & Sections [EN010149/APP/2.5]**.

4.5.2. The layout of the system would provide separation between key components or groups of key components. Separation would follow the NFCC guidance in place at the time, with amendments (where permitted under the NFCC guidance) to align with other guidance such as NFPA 855:

- The BESS would be arranged into discrete groups consisting of battery enclosures and other infrastructure such as switchgears and transformers.
- BESS Enclosure groups would be separated from each other by a minimum separation distance which would be determined by manufacturer requirements and the guidance in place at the time. The example design which has been used to inform the ES uses a minimum separation of 3m which is in line with NFPA 855 guidance for a “Remote Installation”.
- The distance between the battery enclosures and Order Limits boundary in the example layout used to inform the ES is a minimum of 40m. This exceeds the current NFCC guidance of 30 metres.
- The separation of the inverters and transformers would, depending on the architecture, be optimised at detailed design stage to minimise the likelihood of any spread of fire between adjacent components. The example design used to inform the ES employs a distance of 10 metres between each Medium Voltage Power Station (MVPS), and 3 metres between the MVPS and BESS Enclosures.
- Note that inverters & transformers could be placed on adjustable legs or metal skids, in which case the separation of the group from the BESS would be considered.
- NFPA 855 recommends that areas within 3m of the BESS equipment are kept free of vegetation or other combustible material that could act to spread a fire. In contrast, NFCC guidance recommends that the

BESS equipment maintains a 10-metre clearance from vegetation or other combustible materials. Design of the Proposed Development would comply with NFCC guidance by specifying that areas within 10m of BESS equipment would be finished with gravel or other non-combustible surfacing.

4.5.3. NFPA 855 recommends the following separation distances for BESS located outdoors:

- BESS should be separated by a minimum of 3m from the following:
  - Site boundaries (described as “Lot lines” in NFA 855).
  - Public ways.
  - Buildings.
  - Stored combustible materials.
  - Hazardous materials.
  - High-piled stock.
  - Other exposure hazards not associated with electrical grid infrastructure.

4.5.4. FM Global Datasheet “5-33 Lithium-ion Battery Energy Storage Systems” recommends a separation distance of 1.5 metres between BESS enclosures.

4.5.5. This means that in the unlikely event that all of the system design mitigations and preventative measures fail that should a fire occur, it should be limited to the part of the system that is on fire, i.e., the overall size of the battery system is inconsequential to the outcome; an event should be limited in size to only that equipment within a group, whether there are one or any number of groups.

4.5.6. The example BESS compound layout that has been used to inform the ES allows for large articulated HGV and fire rescue vehicles, including suitable road widths, turning radii and at least two suitable access points, with one of the access point in the prevailing wind direction. The layout is shown in **Illustrative Layout Plans & Sections [EN010149/APP/2.5]**. A vehicle tracking assessment has been carried out to validate the layout’s compliance.

4.5.7. The Applicant has carried out a **BESS Plume Assessment [EN010149/APP/7.19]** to understand how, in the event of a thermal runaway event, site access would be affected. Access for fire rescue vehicles has been discussed between the Applicant and Lincolnshire FRS as detailed in **Statement of Common Ground - Lincolnshire Fire and Rescue Service [EN010149/APP/7.24]**, which would be incorporated into the detailed design. Details of the plume assessment findings relating to air quality at nearby receptors have been discussed with UKHSA as detailed in **Statement of Common Ground – UKHSA [EN010149/APP/8.6]** which will be incorporated within the detailed design.

4.6. BESS Enclosures

4.6.1. BESS Enclosures house the energy storage electrochemical components and associated equipment. The example design used to inform the ES uses multiple enclosures closely coupled to form a complete system. They would be mounted on a concrete pad or directly on compacted hardcore.

4.6.2. The BESS Enclosures would be designed and constructed by the manufacturer in accordance with good practice and standards available at the time, such as UL 9540 and/or BS EN IEC 62933-5-2 certificated and align with guidance outlined in the NFPA 855 - Standard for the Installation of Stationary Energy Storage Systems.

4.6.3. The BESS Enclosures would be locked to prevent unauthorised access and would have a minimum internal fire rating of one hour (according to NFPA 855, BR 187 and FM Global Datasheet 5-33).

4.7. Fire Detection and Suppression

4.7.1. In order to achieve the safety objectives, the BESS Facility would employ detection and monitoring equipment that would help identify any abnormal operation and safely shutdown the affected BESS equipment before the conditions develop further. Detection and monitoring equipment would be independent of the control systems that can cause abnormal events and avoid the use of Safety Integrated Level (SIL) rated risk controls. At the detailed design stage, once BESS equipment has been selected, the Applicant would develop the management plan in accordance with relevant standards and guidance to define measures applicable to the selected BESS Enclosures. These may include:

- Thermal monitoring of the BESS enclosures and automated cut-out beyond safe parameters.
- Battery cooling systems with automated fail-safe operation.
- Emergency Stop – both remote and local. This includes at BESS Facility, BESS Enclosure and MVPS level.
- Fire detection suitable to the architecture such as:
    - Very early smoke detection by aspiration (VESDA) system.
    - Gas detection such as H_2 and CO, as an early indication of cell failure.
    - Standard heat and smoke detection system.

- Fire suppression such as:
    - Thermally activated aerosol canisters. When the temperature adjacent to the canister reaches 140° C, the suppression compound is released. The suppression compound acts to remove heat from the flame.

4.8. Explosion Detection and Protection

4.8.1. The Proposed Development would meet required safety objectives for explosion detection and protection specified in NFPA 855 incorporating in NFPA 68 – Standard on Explosion Protection by Deflagration Venting and NFPA 69 Standard on Explosion Prevention Systems. Together, these standards provide comprehensive guidelines and standards to manage and mitigate explosion risks in BESS facilities. BESS equipment and site design compliance with NFPA 68 and NFPA 69 are crucial for protecting both site personnel and property from incidents relating to explosions.

4.8.2. The selected BESS enclosure used would feature a ventilation system to expel vented flammable gasses that are produced in abnormal operating conditions (for example thermal runaway). An in-built hydrogen sensor would trigger the ventilation system to purge the gases within the enclosure.

4.8.3. NFCC guidance is that BESS enclosures should be fitted with explosion protection or deflagration venting appropriate to the hazard and battery technology deployed. The Proposed Development would consider the option of using roof mounted deflagration panels that are compliant with the design, installation and maintenance requirements of NFPA 68. This would reduce the risk of injury to site personnel and reduce the risk of damage to the affected BESS enclosure, surrounding BESS equipment and infrastructure. Where emergency ventilation is used to mitigate an explosion hazard, the isolation for the ventilation system would be clearly marked to notify personnel or first responders to not disconnect the power supply to the ventilation system during an evolving incident. Additionally, the remaining unaffected cells would continue to be maintained within their operating temperature.

4.9. Safe BESS Construction

4.9.1. The BESS would be constructed in two distinct phases. Firstly, the civil works and balance of plant equipment would be started. Then at a suitable point the BESS equipment would be delivered to be installed on the foundations and connected up to the balance of plant.

4.9.2. The installation would be subject to pre-requisites such as a contractor emergency protocol detailing the actions to be taken in an emergency, including an emergency response plan that would be coordinated with the relevant stakeholders and emergency services. In addition, installation would not take place until practical provisions were completed such as the water tanks and associated water delivery system being installed and filled for use in an emergency.

4.9.3. The transportation of the system from the factory would be a combination of sea and land freight. The system would be certified for transportation in all potential environmental conditions. The equipment would be certified for transport to UN 38.3. Transportation would be managed in accordance with the European Agreement Concerning the International Carriage of Dangerous Goods by Road (ADR) 2019 and the UK guidance on the transport of dangerous goods “Moving dangerous goods, Guidance” webpage.

4.9.4. The equipment supplied would be fully tested including Factory Acceptance Testing (FAT). By definition the FAT testing would be undertaken away from site reducing the risks during on site construction with visual inspections and functional testing undertaken before any Site Acceptance Testing (SAT). The Site installation would be supervised by the Original Equipment Manufacturer and carried out in a hierarchical way to ensure that all necessary systems are available before the next step is required. By following a logical sequence of works with each step being built upon the preceding one, the system can be safely assembled without risk and all mitigations against issues in place before the next step.

4.10. Safe BESS Operation

Control Room

4.10.1. The BESS would be monitored by the onsite control systems as well as 24/7 monitoring by a remote-control room.

- All staff would be fully trained and familiar with the technology.
- The control room would also be responsible for the security of the BESS site with state-of-the-art detection and monitoring systems. These can be repurposed in an emergency to support first responders.
- The control room would have the ability and authority to immediately shut the system down should the need arise.
- The control room would be responsible for the implementation of the emergency plan acting as a point of contact to emergency services.
- The BESS facility would have signage in accordance with the relevant Electrical Regulations but would also have the control room emergency telephone number should a member of the public or emergency services need to make contact.

Control Architecture

4.10.2. Different battery systems have different topologies of control and safety systems that extends all the way to, in some measures, cell level however it is likely that the final selected system would have:

- A module monitoring system.
- Each rack or string would typically have a rack / string monitoring system, receiving information from each module.
- Each bank would have a monitoring system, receiving information from each rack / string.
- A battery management system (BMS) with built in fail-safe automated algorithms.

4.10.3. The battery system components communicate with a master controller(s) that reads and records this information and uses algorithms to enable the safe operation of the system within these parameters.

4.10.4. These control systems would be failsafe by design with automatic shutdown of parts, or of the whole system, depending on circumstance.

4.10.5. The BMS would identify any failed cells and disconnect them, reducing the risk of a minor cell failure escalating to a failure of cell electrolyte containment. Individual cells would also be enclosed in battery banks, providing secondary containment, with the battery banks then enclosed in 'cubes' or shipping container, providing tertiary containment against pollution.

4.11. Security

4.11.1. The site security profile would be assessed by the Applicant's dedicated security team and the output from this assessment would inform the level of security measures used.

4.11.2. The BESS area will have security fencing with a minimum of two points of ingress/egress for first responders and will be clearly signed, with incident emergency response contact details, clear identification of BESS Area hazards, details of site access arrangements such as key codes, which will be provided to LFRS.

4.11.3. The site would also have high quality CCTV with video analytics to identify issues and detect unauthorised access. This enables the correct security response to be undertaken by the control room.

4.11.4. Suitable lighting and sensors would be implemented around the Springwell Substation and BESS compound.

4.11.5. Cybersecurity would form a fundamental part of the system design and architecture. Standards such IEC 62443 and guidance from sources such as National Cybersecurity Centre would inform the implementation and protection measures, reference shall be made to the HSE Operational Guidance document OG86.

4.12. Maintenance

4.12.1. The BESS facility would be maintained and operated by skilled personnel ensuing that the system is in optimal condition and that all parts of the system are fully serviced and functional at all times.

4.12.2. Maintenance is likely to be undertaken on the BESS equipment twice a year. This typically consists of a major maintenance period and a minor maintenance period. The major is relatively non-intrusive and involves checking connections and inspections from the transformer down to the module level. This would encompass all BESS equipment supplied by the original Equipment Manufacturer including the fire system. The minor maintenance is typically a visual inspection and rectification of any accumulated non-critical defects.

4.12.3. All maintenance would be undertaken in a carefully controlled manner following the site safety rules and in accordance with the Operational Environmental Management Plan (OEMP) which would be prepared in accordance with the **Outline Operational Environmental Management Plan [EN010149/APP/7.10]**

4.12.4. During operation all works on the site would be controlled under safe systems of work. This would mean all work is risk assessed to protect both personnel and equipment. Therefore, safety systems such as fire systems would not be stopped or taken out of service without appropriate mitigation, following the system being made safe so far reasonably practicable, and only for the minimum time required to undertake any specific maintenance tasks.

4.12.5. The operation of the BESS facility would be managed in accordance with the OEMP.

4.13. Battery Augmentation

4.13.1. During the operational phase, from time to time there may be a requirement to replace or augment the battery system due to equipment failure or degradation of the system capacity. Note the planned design life may require replacement or augmentation of the battery systems on more than one occasion depending on use case.

4.13.2. The risks associated with any wholesale replacement with similar or any new technological developments would also be considered before any works commence. It is also possible that any replacement or augmentation of the system may use a contemporary equivalent of the original BESS equipment. Any modifications would be subject to the Applicant's Management of Change process applying the same or similar principles to those laid out in this document.

4.14. Decommissioning

4.14.1. All BESS Facility decommissioning would be undertaken in a carefully controlled manner following the site safety rules and in accordance with the Decommissioning Environmental Management Plan (DEMP) which would be prepared in accordance with the **Outline Decommissioning Environmental Management Plan [EN010149/APP/7.13]**

5. Firefighting

5.1. Overview

5.1.1. This section sets out information on the firefighting strategy, including:

- Fire service access.
- Fire water (inc. runoff and safeguarding of water bodies/ land quality and groundwater).
- Fire equipment.
- Emergency planning.
- Firefighting consequences.

5.1.2. The Applicant has engaged with Lincolnshire FRS throughout the pre-application phase on the topics discussed in this section. Outcomes of this engagement are detailed in the **Statement of Common Ground - Lincolnshire Fire and Rescue Service [EN010149/APP/7.24]**.

5.2. Fire Service Guidance

5.2.1. Guidance for the Fire Service for dealing with sites such as powerplants, substations etc is contained in the National Operational Guidance(NOG), under Utilities and Fuel.

5.2.2. The Fire Service Manual stipulates that in all cases involving electrical apparatus, it is essential to ensure, on arrival, that the apparatus is electrically isolated and safe to approach. This should be carried out by the operator at the premises concerned. It is strongly advised that electrical or associated equipment should not be touched or even approached unless it is confirmed to be isolated and safe.

5.2.3. In the event of a fire, the battery system and the transformers serving the BESS would be automatically electrically isolated when a fire is detected within an enclosure. However, the batteries within the enclosures would still hold charge in the event of a fire, even after the electrical system is isolated. It would not be possible to confirm that there is no residual risk from the energised batteries within the container, and this would inform the strategy for firefighting in the emergency response plan.

5.3. Emergency Response Plan

5.3.1. Prior to commencement of the construction of the BESS, an emergency response plan would be prepared by the Applicant in consultation with Lincolnshire FRS and other relevant stakeholders. This would be maintained and reviewed regularly throughout the operating life of the BESS. The plan would be developed in accordance with NFCC guidance and other guidance and best practice in place at the time. In response to the Examining Authority questions, the Applicant has listed current UK National Fire Chiefs Council (NFCC) and NFPA 855 recommended ERP minimum content guidelines:

- How the fire service will be alerted and incident communications and monitoring capabilities.
- Facility description, including infrastructure details, operations, number of personnel, and operating hours.
- Site plan depicting key infrastructure:
    - i. Site access points, internal roads, agreed access routes, observation points, turning areas, etc.
    - ii. Firefighting facilities (water tanks, pumps, booster systems, fire hydrants, fire hose reels etc).
    - iii. Water supply locations and capacity.
    - iv. Drainage and water capture design and locations.
- Up-to-date contact details of the emergency response co-ordinator including the subject matter expert (SME) for the Order limits.
- Safe access to and within the facility for emergency vehicles and responders, including to key site infrastructure and fire protection systems
- Details and explanation of warning systems and alarms on site and locations of alarm annunciators with alarm details (smoke, gas, temperature).
- Hazards and potential risks at the facility and details of their proposed management.

- The role of the FRS at incidents involving a fire, thermal event or fire spreading to the Order limits.
- Emergency shutoff or isolator locations.
- A list of dangerous goods stored on site.
- Site evacuation procedures.
- Site operation Emergency Management protocols - 4 phases: discovery, initial response / notification, incident actions, resolution and post incident actions / responses
- Emergency procedures for all credible hazards and risks, including building, infrastructure and vehicle fire, wildfires, impacts on local respondents, impacts on transport infrastructure.
- The operator will develop a post-incident recovery plan that addresses the potential for reignition of the BESS and de-energizing the system, as well as removal and disposal of damaged equipment.

5.3.2. The emergency response plan would also cover these eventualities;

- The duration of dwell for any site personnel, responder or member of the public would be controlled (minimized) to reduce the exposure time & concentration.
- This may include installation of visual e.g. beacons and/or audible e.g. klaxons alarms to alert onsite & offsite personnel of a venting event. The site is remote (with few members of the general public in the vicinity), therefore beacons/klaxons may be of limited value for those not aware of the hazards the site may present.
- This may include permanent installation of a met mast or other relevant system on the site to measure wind speed and direction so that this can be shared in real-time with emergency responders and others to inform relevant and effective emergency response.
- As would be the case in any fire event, relevant nearby properties in the downwind direction would receive recommendations for people to remain indoors and keep doors and windows closed to further reduce any impact. Note the prevailing wind direction is typically south-westerly and the nearest property being approximately 440m south east of the Site.
- A site cordon / exclusion zone would be in place;
- This may extend to the Public Rights of Way (PRoW) to the south however dwell times in the smoky plume would need to be reasonable for any impact on receptors and the smoke would serve to encourage people to avoid the area.
- The immediate downwind areas would be investigated for casualties.

- It is anticipated that the emergency response would take no more than a few minutes to attend site, meaning that only incapacitated people in the immediate vicinity (within the site) would be at significant risk during this time. Discussions regarding the emergency response are ongoing.
- The Highways Agency would be alerted in the event of a fire (or other major incident) at the BESS location and take appropriate actions.
- A Risk Management Plan would be developed with LFRS post consent at the detailed design stage which, as a minimum, will provide advice in relation to potential emergency response implications including:
- The hazards and risks to the facility and their proposed management.
- Any safety issues for firefighters responding to emergencies at the BESS facility.
- Safe access to and within the facility for emergency vehicles and responders, including to key site infrastructure and fire protection systems. Establish response times and site arrival protocols.
- The adequacy of proposed fire detection and suppression systems e.g. water supply on-site.
- Natural and built infrastructure and on-site processes that may impact or delay effective emergency response i.e. firefighting water runoff capture.

5.4. Fire Service Access

5.4.1. Access would be designed such that emergency services are able to access the site easily with site roads being clearly laid out and signed in accordance with the following:

5.4.2. Firefighting access would be designed in accordance with guidance of Approved Document B (ADB). Although ADB is not applicable as this site is not covered under the building regulations it provides useful access road specifications which are outlined in **Table 1: Typical Fire and Rescue Service vehicle access route specification** below. It should be noted that vehicles differ across the UK for different fire and rescue services and access specifications would be considered in detail with Lincolnshire FRS.

5.4.3. Turning facilities would be provided in any dead-end access route that is longer than 20m.

Table 1: Typical Fire and Rescue Service vehicle access route specification

Appliance Type	Minimum width of road between kerbs (m)	Minimum width of gateways (m)	Minimum turning circle between kerbs (m)	Minimum turning circle between walls (m)	Minimum clearance height (m)	Minimum carrying capacity (tonnes)
Pump	3.7	3.1	16.8	19.2	3.7	14.0
High Reach	3.7	3.1	26.0	29.0	4.0	23.0

5.4.4. The example design used to inform the ES uses a minimum proposed access road width to reach the BESS Facility of 4m, i.e. in excess of the minimum value in **Table 1: Typical Fire and Rescue Service vehicle access route specification**.

5.5. Firefighting Water

5.5.1. The example design used to inform the ES includes four large water tanks, each with approximately 113,000 litres (l) of water. This would provide 1,900 litres per minute for approximately 4 hours of water which is approximately double the 2 hour minimum duration stated in current NFCC guidance.

5.5.2. Water storage tanks will be located at least 10 m away from any BESS enclosure. They would be clearly marked with appropriate signage. They would be easily accessible to LFRS vehicles and their siting would be considered as part of a risk assessed approach that considers potential fire development/impacts. Outlets and connections would be agreed with LFRS. Any outlets and hard suction points would be protected from mechanical damage (e.g. through use of bollards).

5.6. Fire Equipment

5.6.1. Additional firefighting equipment would also be provided on the site to assist with emergency operations.

5.6.2. Weather stations would be installed to identify the weather conditions in an emergency situation. This would allow the fire service to approach from a safe direction; communication with the FRS would be agreed and described within the Emergency Response Plan.

5.6.3. Other firefighting or emergency equipment such as additional fire hose to be stored onsite would be agreed with Lincolnshire FRS prior to the commencement of construction.

5.6.4. As the BESS Facility would only have occasional limited access into the battery enclosures (for maintenance), there is unlikely to be any immediate threat to life, only to property which forms part of the Proposed Development.

5.6.5. Following liaison with Lincolnshire FRS and Anglian Water Services Limited, water required by the emergency services would be brought to site by tanker or bowser (initially during the construction phase) and stored in dedicated tanks ready for use in an event. Details can be found in the **Statement of Common Ground - Lincolnshire Fire and Rescue Service [EN010149/APP/7.24]**. and in the **Statement of Common Ground - Anglian Water Services Ltd [EN010149/APP/7.21].**

5.6.6. Lincolnshire FRS are most likely to fight any BESS Enclosure fire by using water on neighbouring areas such as battery enclosures, trees and structures to cool down and prevent further fire spread. Therefore, it is not anticipated that firefighting techniques would involve direct jets of water onto burning equipment and would be limited to containment and cooling of adjacent units to prevent the fire from spreading. This strategy would be finalised with the local fire authority and would be made clear in the emergency plan.

5.6.7. As set out in the Outline Drainage Strategy (which forms an appendix to the **Flood Risk Assessment [EN010149/APP/7.16]**), an example approach to Springwell Solar drainage could include a separate system around the BESS to collect water runoff into an attenuation/ storage pond. This would have automatic and manual isolation systems to ensure that any firewater runoff is captured for analysis prior to disposal. This trapped water could then be reused as a potential source of firefighting water. This follows the management plan process as detailed in “Protocol for the disposal of contaminated water and associated wastes at incidents 2018” jointly issued by the Environment Agency, Northern Ireland Environment Agency, Water UK and Chief Fire Officers Association.

5.6.8. A post event action plan would be drawn up that would determine any immediate and follow up actions required to an event including an assessment in general accordance with LCRM (Land Contamination: Risk Management) and BS 10175:2011+A2:2017 (Investigation of potentially contaminated sites – Code of practice).

5.6.9. There are many factors which would inform the design of an investigation following an incident which ultimately account for the volume and concentration of the loss. In the case of a fire to a BESS unit, variables to be considered include:

- Extent of the fire: including duration, number of BESS units impacted, number of adjacent assets impacted.

- Firefighting method: whilst defensive techniques are anticipated, larger volumes of water may be required to dampen and cool adjacent assets, alternative techniques to fight any adjacent fires.
- Location of fire: adjacent to drainage or close to soft ground.
- Existing site conditions: recent weather and precipitation levels.

5.6.10. The proposed design allows for potential evolutions on the best practices or technologies which might require different firefighting techniques to be used by the time the development is built (e.g. replacing firefighting water with another product/technique).

6. Pre-Construction Information Requirements

6.1.1. 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.

6.1.2. As recommended in NFCC guidelines (2024) a BESS system and site specific Plume Analysis study will be conducted to assess the environmental impact of a site incident to sensitive receptors within a 1 km radius. Toxic gas emissions to sensitive receptors must be below Public Health England (PHE) guidelines when the battery system of a BESS is fully consumed (burnt out). In addition to toxic gas emissions, production of Particulate Matter (PM) in a BESS fire should also be included in the assessment. The plume study will also include a visibility impact assessment on any transport links within a 1 km radius of the BESS area.

6.1.3. The detailed design phase would determine the approach to addressing the following specific requirements, which would be updated prior to construction of the BESS facility and submitted to the local planning authority as a detailed BSMP prior to the commencement of construction. The detailed BSMP must include:

- The detailed design, including drawings of the BESS facility.
- A statement on the battery system specifications, including fire detection and suppression systems.
- A statement on operational procedures and training requirements, including emergency operations.
- A statement on the overall compliance of the system with applicable legislation.
- An environmental risk assessment to ensure that the potential for indirect risks (e.g., through leakage or other emissions) is understood and mitigated using methods consistent with Best Available Techniques (BAT) in relation to the specific battery chemistry selected.
- An emergency response plan covering construction, operation and decommissioning phases developed in consultation with Lincolnshire

FRS and other relevant stakeholders, to include the adequate provision of firefighting equipment onsite.

6.1.4. Provision of the above information would demonstrate prior to construction that all of the considerations and requirements in this document have been addressed and the BESS installation is safe.

6.1.5. Safe decommissioning of the BESS facility would be addressed prior to decommissioning of the Proposed Development in the final version of the Decommissioning Environmental Management Plan (DEMP) approved in accordance with the **Outline Decommissioning Environmental Management Plan [EN010149/APP/7.13].**

7. Conclusion

7.1.1. The Applicant is committed to developing a safe BESS facility that would provide long dependable operation. It is in everyone's interest that the selected BESS technology is robust, in particular with regards to safe operation.

7.1.2. This outline plan demonstrates that as well as the Applicant having significant internal expertise and robust processes in BESS development, the relevant stakeholders have been consulted and their responses have informed the design of the Proposed Development, and therefore safety would be inherent in the overall design, minimising the risk of a fire event occurring, and reducing the impact of such an event should it occur.

7.1.3. This outline plan provides a clear list of pre-construction information requirements (Section 5) to enable the Applicant to demonstrate prior to construction that the Proposed Development would be implemented and operated safely.

References

- NFPA 855 (United States of America) - Standard for the Installation of Stationary Energy Storage Systems.
- BS EN 14797 (2006): Explosion venting devices
- NFPA 68 – Standard on Explosion Protection by Deflagration Venting
- NFPA 69 – Standard on Explosion Prevention Systems
- NFPA 2010 – Standard for Fixed Aerosol Fire-Extinguishing Systems
- UL 9540A Testing Compliance - Standard for Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems.
- NFPA 2010 – Standard for Fixed Aerosol Fire-Extinguishing Systems
- UL 1973 (2022) - Batteries for Use in Stationary and Motive Auxiliary Power Applications.
- UL 9540 3rd Edition (2023) - Standard for Energy Storage Systems and Equipment.
- BS EN IEC 62619 (2017) Secondary cells and batteries containing alkaline or other non-acid electrolytes. Safety requirements for secondary lithium cells and batteries, for use in industrial applications.
- National Fire Chiefs Council (NFCC): Grid Scale Battery Energy Storage System Planning – Guidance for FRS (United Kingdom).
- FM Global Property Loss Prevention Data Sheets: 5-33 Lithium-Ion Battery Energy Storage Systems (United States of America).
- DNV GL-Recommended Practice-0043: Safety, Operation and Performance of Grid-Connected Energy Storage Systems, 2017.
- BS 5839 Part 1 2017: Fire Detection and Fire Alarm Systems for Buildings.
- The Regulatory Reform (Fire Safety) Order (RRO) 2005.
- IEC 61936, Power installations exceeding 1 kV AC and 15 kV DC – AC.
- The Buildings Regulations 2010, Approved Document B (Fire Safety) – Volume 2. Adopted provisions can be found within section 2.4.
- UN 38.3: Recommendations on the Transport of Dangerous Goods – Manual of Tests and Criteria – (Lithium Metal and Lithium-Ion Batteries).

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