

OUTLINE BATTERY SAFETY MANAGEMENT PLAN



GREENFIRE SOLUTIONS

SUPPORTING RENEWABLE ENERGY

**FEN DYKE FARM, BARDLING'S DROVE,
SUTTON ST JAMES, SPALDING
PE12 0JN**

October 2024

Greenfire Solutions

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Version	Date	Description of changes	Person responsible
0.9	11 June 2024	Initial document for GS discussion and quality assurance review.	DE
1.0	17 June 2024	Draft document for discussion with Integrum.	MB
2.0	27 June 2024	Final document following consultation with Integrum.	MB
3.0	16 July 2024	Appendix 1 updated.	MB
4.0	17 th Oct 2024	Updated issue following addition to the layout.	MB

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1 Introduction and Project Overview

1.1 Greenfire Solutions is led by former Senior Officers from the UK Fire and Rescue Service.

1.2 Greenfire Solutions work with fire and rescue services across the UK, Local Authorities and private sector clients. We pride ourselves on providing a wide range of high-quality, bespoke, and ethically sound advice and support including:

- Operational Advice and Assurance
- Fire Safety Strategies including Protection and Prevention
- Legal Advice in Relation to UK Fire Legislation
- Liaison with Local Authority Fire and Rescue Services on behalf of Third Parties
- Liaison with Parish, District and County Councils including Elected Members and Officers on behalf of Third Parties
- Liaison with Insurers and Investors

1.3 Since the launch of Greenfire Solutions, we have enjoyed considerable growth, built upon the foundations of a solid reputation for delivering high quality outcomes. We have been working with multiple energy companies helping to shape projects from inception through to delivery on the ground. Our extensive strategic, operational experience of the fire service and local authorities enables Greenfire Solutions to support planners and designers by:

- Reviewing designs and plans to prepare for fire service consultation in line with the new requirements of the Planning Practice Guidance (PPG) which now includes the current (2023) and new draft (2024) National Fire Chiefs Council (NFCC) guidance document on Battery Energy Storage Systems and the new Health and Safety Guidance for Grid Scale BESS.
- Generating solutions for site specific challenges through working alongside planners and engineers when in discussions with third parties such as fire and rescue services.
- Support liaison during engagement with fire and rescue services to create a positive and open collaborative approach.
- Provide challenge and feedback from learning that emerges from national and international incidents to feed into future design.
- Support the creation of bespoke Integrated Fire Risk Management Strategies (IFRMS).
- Creating bespoke Fire Risk and Emergency Response Plans plus Outline and Detailed Battery Safety Management Plans.
- Creation of site-specific fire risk assessments and environmental fire risk assessments.
- Creating bespoke Environmental Impact Assessments in compliance with The Town and Country Planning (Environmental Impact Assessment) Regulations 2017.
- Working with Scientific Advisors (who provide advice to UK Fire and Rescue Services) to provide a Smoke Plume Analysis Reports (SPAR) .
- Support to local fire and rescue services to obtain and gather Site Specific Risk Information (SSRI) as required under Section 7iid of the Fire and Rescue Services Act 2004.
- Liaison with Local Resilience Forums (as required by the new NFCC Guidance).
- Provide ongoing support to energy companies and local fire and rescue services through the regular testing of procedures and stimulated exercises.

- Working with other professional institutions and associations such as the National Fire Chiefs Council, Institute of Fire Engineers and the Fire Industry Association.

- 1.4 Our experience shows that to work effectively with fire and rescue services and local planning authorities, a collaborative and cohesive approach works best. As a company, we find that working alongside our clients' planners and engineers when in discussions with third parties works best. This approach enables quick decision making and consensus to be achieved in an efficient and expedient manner.
- 1.5 Our focus is to build trusting relationships with our clients to become their preferred partner of choice into the future.

Author

- 1.6 Along with colleagues from Integrum, this Outline Battery Safety Management Plan (OBSMP) was authored by Martin Blunden. This joint expertise ensures that a holistic and systematic approach to the management of the battery's within the energy storage site is thorough and comprehensive.
- 1.7 Martin Blunden QFSM MIFireE M.ISRM AIFSM, a former Chief Fire Officer of the UK's largest fire services with over 32 years' experience in the UK Fire and Rescue Service. His career experience also includes roles as the strategic lead for the National Fire Chiefs Council on Health and Safety, National Operational Learning, and the Joint Emergency Services Interoperability Programme, as well as secondments to UK Government to deliver large elements of national projects.

Purpose

- 1.8 The purpose of Greenfire Solutions working with Integrum is to review the potential scheme for changes/improvements with reference to the NFCC Guidance and other relevant material; comprehensively identify potential fire hazards, control measures and residual risk response; and define the proposed safety strategy, requirements, and processes necessary to demonstrate how best industry practice will be incorporated to reduce risk to life, property, and the environment from the BESS.

Key details of the site:

- 10MW lithium-ion battery storage capacity
- Consists of:
 - 6no battery storage cabinets
 - 2no AC transformer skids
 - 1no Auxiliary transformer and DNO connection
 - 2no control rooms and other associated equipment

2 What is an Outline Battery Safety Management Plan?

- 2.1 This Outline Battery Safety Management Plan (OBSMP) document outlines the key fire safety provisions, including measures to reduce fire risk, and fire protection measures and systems, for the 10MW Battery Energy Storage System (BESS) proposed at Fen Dyke Solar Farm, Bardling's Drove, Sutton St. James, Lincolnshire, as shown in *Appendix 1*.
- 2.2 This document sets out the key regulations and guidance and provides a summary of the safety related information requirements which will be provided in advance of construction of the Fen Dyke Farm BESS. The purpose of this OBSMP is to identify how Integrum will use good industry practice to reduce risk to life, property, and the environment from the BESS.
- 2.3 This is a live document and, as such, will continually develop. During the entire life cycle of the scheme from procurement to decommissioning, Integrum will consider new, or the latest guidance, technologies and good practices for battery fire detection and prevention as they develop in the UK and around the world. This will ensure integrated risk management is a fundamental element of all aspects of the facility, supporting and enabling:
 - Procurement, design and project proposals
 - Post-planning consent, logistics and construction
 - General operational and maintenance considerations
 - Development, testing and implementation of responses to unplanned or emergency events
 - Coherent and trusted public, political and industry engagement
- 2.4 This document seeks to formalise Integrum's commitment to keep Lincolnshire Fire & Rescue Service (LFRS) up to date about the proposed BESS earlier in the development process, as advised in the National Planning Practice Guidance (NPPG) update 14 August 2023. Consultation with the Fire & Rescue Service will be undertaken in line with the National Fire Chief's Council Grid Scale planning guidance plus and the Health and Safety Guidance for Grid Scale BESS. This document highlights applicable key design considerations as recommended by the above guidance.

3 Safety Standards, Building Regulations and Guidance

Safety Standards and Building Regulations

- 3.1 The relevant building regulations includes BS 9999 'Fire safety in the design, management and use of buildings, Code of practice'. This has been considered in the preparation of this OBSMP.
- 3.2 The minimum safety standards proposed by this OBSMP are non-exhaustive and are based on experience from other projects of a similar nature for life safety purposes. These safety standards will be updated in the *Detailed* Battery Storage Safety Management Plan, which Integrum accept as a conditioned document to be submitted for approval post determination of the full planning application and prior to the BESS being operational.
- 3.3 There are also several pieces of statutory Health & Safety (H&S), electrical and fire safety legislation that govern working practices in the UK that must be adhered to when installing a BESS. A non-exhaustive list of the key guidance and regulations is provided below:
- Health & Safety at Work Act 1974
 - Management of Health & Safety at Work Regulations 1999
 - The Regulatory Reform (Fire Safety) Order 2005
 - Construction Design and Management Regulations 2015
 - The Electricity at Work Regulations 1989
 - Provision and Use of Work Equipment Regulations 1998
- 3.4 Integrum is committed to keeping and adhering to the highest H&S standards and regulations. As such, frequent reviews will be undertaken to establish any changes in industry standards that need to be considered when proposing, designing, installing and maintaining BESS sites, and this document will be updated accordingly. Where material changes are made these will be shared with the relevant authorities.

Pre-Construction Procurement and Information Requirements

- 3.5 The detailed design phase will determine the approach to addressing the following specific requirements, which will be refreshed prior to construction of the BESS and submitted to the local planning authority as a DBSMP prior to the commencement of construction. The DBSMP will include:
- A detailed procurement exercise to ensure that the battery technology selected conforms to current UK and international standards, with the detailed design, including drawings of the BESS.
 - A statement on the battery system specifications,
 - A statement on the 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 all applicable legislation.
 - A statement on governance, general site management and maintenance.
 - A fire risk assessment which evaluates potential ignition sources, fuel loads, and fire spread scenarios. It will also assess the adequacy of existing fire detection, suppression, and evacuation measures.

- An environmental risk assessment to ensure that the potential for indirect risks (e.g., through leakage or other emissions) is understood and mitigated.
- A Smoke Plume Analysis Report
- An Emergency Response Plan covering construction, operation and decommissioning phases developed in consultation with Lincolnshire Fire and Rescue, to include the adequate provision of firefighting equipment on-Site.

3.6 Provision of the above information will demonstrate prior to construction that all of the considerations and requirements in this document have been addressed and the BESS installation will be safe and appropriately monitored 24/7 to enable immediate action is instigated on the detection of a fault or abnormal signal/reading.

Safe Design

3.7 Integrum ensures that BESS are procured, designed, installed and operated to conform to the latest industry standards and good practice at the time of implementation.

3.8 The current industry standard is NFPA 855, Standard for the Installation of Stationary Energy Storage System (Ref 1-1) and any system selected will also comply with the non-exhaustive list shown in *Appendix 2*.

Site Layout

3.9 The BESS will be broken into discrete groups consisting of battery cabinets, inverters and transformers. Each group will be appropriately separated from the next. This separation will limit any fire that is not able to be contained to the affected group or part of the battery system, and also allow emergency access in case of an intervention.

3.10 The separation distance between the battery containers meet current NFPA 855 guidance as the batteries will be tested to UL9540A.

3.11 The new Draft NFCC Guidance allows for spacing of 3ft (0.914m) if it can be proven that fire resistant materials will prevent direct flame impingement or radiated heat affecting adjacent BESS and allowing the incident to develop beyond BESS of origin. However, the 0.914m is predicated on the NFPA 855 standard which states separation can be reduced to at least 3 feet or 0.914m between BESS if tests such as UL 9540A shows propagation does not occur.

3.12 The battery cabinet spacing is as shown in *Appendix 3*.

3.13 The BESS units have 4m high metal acoustic fencing on 3-sides, as shown in *Appendix 1*, for noise mitigation which are set 3m away from any BESS equipment.

3.14 The separation of the inverters and transformers will, depending on the architecture, be optimised at detailed design stage to minimise the likelihood of any spread of fire between adjacent components. Transformers will be banded to ensure any leakage of the cooling solution (such as mineral oil) is contained.

3.15 The areas between and around equipment will be finished with a permeable grade 3 compound and kept free of vegetation or other material that could act to spread a fire.

3.16 NFPA 855 recommends that a BESS should be separated by a minimum 3m (10 ft) from the following exposures:

- Site boundaries;
- Public rights of way;
- Buildings;
- Stored combustible materials;
- Hazardous materials;
- High-piled stock; and,
- Other exposure hazards not associated with electrical grid infrastructure.

External fire spread: building separation and boundary distances

3.17 Separation distances in England are generally calculated based on the recommendations of BR 187 External Fire Spread: Building Separation and Boundary Distances (Ref 1-3). Although the BESS containers are not classified as buildings, the separation requirements of BR 187 is easily satisfied by the construction of the containers, when they achieve 60 minutes fire resistance for integrity and insulation.

3.18 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 therefore be limited in size to only that equipment within a group, whether there are one or any number of groups.

Site Context of Electrical Equipment

3.19 The BESS will comprise battery cabinets, civil and electrical balance of plant. Electrical balance of plant primarily comprises transformers, switchgear, cabling and control equipment. Apart from the battery cabinets, civil and electrical equipment used are considered standard and are the same as those used in most grid-scale renewable energy projects and substations across the UK, including in urban environments. This equipment has a low fire risk and failure rate. Through the procurement exercise, equipment selected will meet or exceed the relevant standards and legislation as required by UK law.

BESS Design & Construction

3.20 Integrum is an experienced developer of BESS projects across the UK. All BESS projects have been developed using equipment from reputable manufacturers with excellent safety track records. All battery systems on Integrum sites will comprise of Lithium-ion Iron Phosphate (LFP) battery cells.

3.21 The cells used within the BESS containers employ prismatic sealing with thermal insulation design to prevent them from catching fire in the event of a thermal runaway. Moreover, a vent valve with oriented gas release installed in the batteries prevents them from igniting or exploding.

3.22 Below is a summary of the key embedded safety measures included in Integrum sites.

Battery Cabinets

- 3.23 The proposed scheme design will minimise fire risk using leading safety features that are becoming well established within the industry, and these features will be applied throughout the schemes lifecycle. Many of the features focus on the cell level fire hazards. Regardless of the size, the safety of LFP batteries is intrinsically related with the safety at the cell level where several phenomena can occur at cell level, such as chemical imbalance or internal short-circuit, resulting in failures.
- 3.24 The battery cabinets will be hermetically sealed LFP battery cells, inverters and associated electrical equipment, thermal management systems (coolant and refrigerant) and thermal insulation, designed to avoid any propagation of fire beyond an individual battery cabinet. The main fire risk associated with a battery container is a thermal runaway event where the battery cells generate more heat than can be dissipated by their surroundings, eventually leading to fire. The main mitigation to thermal runaway is careful management of the cells, in terms of voltage levels, temperatures and charge states. Battery cabinets include a sophisticated Battery Management System (BMS) designed to monitor the cells and ensure they are kept within safe operational limits, with the addition of cooling fans embedded within the battery cabinet design.
- 3.25 Battery cabinets are monitored 24/7 which would detect if there was any fault within the battery resulting in the battery being immediately shutdown to mitigate risk of a thermal runaway event.
- 3.26 Battery cabinets include a cooling system to manage the temperature of the battery packs and the internal temperature of the enclosure. This cooling system is designed to operate from -30 to +50 °C ambient conditions and is designed to provide equal temperature to each battery.

Battery Management System (BMS)

- 3.27 The BMS will be compliant with safety standards UL1973 and UL9540A, which are discussed further below under 'Testing of Fire safety Systems'. As such, the risk of a thermal runaway event is extremely low.
- 3.28 In the unlikely instance of a thermal runaway event leading to a fire, battery cabinets are designed to ensure the fire does not spread to neighbouring units. Moreover, the cells are designed to ensure fire does not propagate between cell modules within the same container. This is achieved by the BMS diagnosis and protection control of over temperature, over voltage, under voltage and over current, and accurate thermal management control, thermal runaway diagnosis and early warning. The design also includes a unique over-pressure vent and sparker system. In the event of a thermal runaway event, flammable gases are ignited early to mitigate any risk of pressure or gas build-up and pressure vents open safely releasing the product.
- 3.29 Whilst the risk of a thermal runaway event is extremely low, Integrum takes the risk very seriously. In addition to the thermal probes inside the battery containers, designs include infrared cameras on CCTV columns which surround the site and monitor the battery system 24/7. Any sudden change in temperature would alert the control room and the system would be immediately shut down.

- 3.30 A main control unit/power conversion system (MCBU/PCS) provides overall management of all battery strings. The battery racks are listed per UL 1973 and validated for thermal runaway controls.
- 3.31 It should be noted that all equipment is rigorously tested prior to installation onsite. Additionally, sites are tested to check their compliance against NFPA 855, which is an industry standard for the installation of energy storage systems developed to define the design, construction, installation, commissioning, operation, maintenance and decommissioning of energy storage systems.

Fire Detection and Suppression

- 3.32 The fire detection and suppression system is compliant with NFPA 855. NFPA 855 fire detection and suppression systems serve two purposes which are to protect buildings and exposure to fire initiating in the BESS and to protect the BESS from external exposure to fire.
- 3.33 To achieve the safety objectives, the BESS will employ monitoring systems that will help identify any abnormal operation and safely shutdown the system before fire develops. These systems will be independent of the control systems and equipment that can cause the abnormal event and avoid the use of Safety Integrity Level (SIL) rated risk controls. Measures include:
- Thermal monitoring of the battery containers and automated cut-out beyond safe parameters.
 - Battery cooling systems with automated fail-safe operation.
 - Emergency stop – both remote and local.
 - Fire detection suitable to the architecture such as:
 - Very early smoke detection by aspiration (VESDA) system.
 - Gas detection such as H₂ and CO; as early indication of cell failure.
 - Standard heat and smoke detection system.
 - Fire suppression equipment such as an aerosol, gas, automatic sprinkler or water mist system.
- 3.34 For each of the batteries the following fire detection and suppression components is provided:
- Fire control panel.
 - Smoke detector.
 - Heat detector.
 - Audio/visual alarm.
 - Combustible gas detector (H₂).
 - Ventilation device (electric louvre).
 - Exhaust device (electric louver, fan, control module).
 - Aerosol, including hoop and bracket.
- 3.35 Figure 1 (below) shows the fire suppression system topology diagram typically applied in BESS equipment.

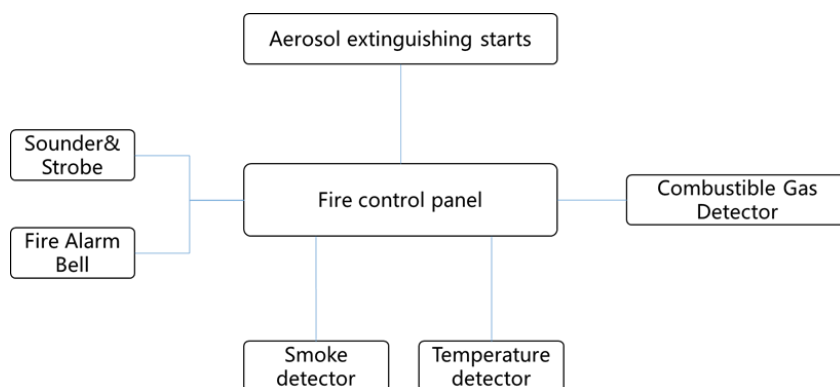


Figure 1 – Indicative topology diagram

Control Logic

3.36 The fire detection and suppression system control logic is shown in Figure 2 (below).

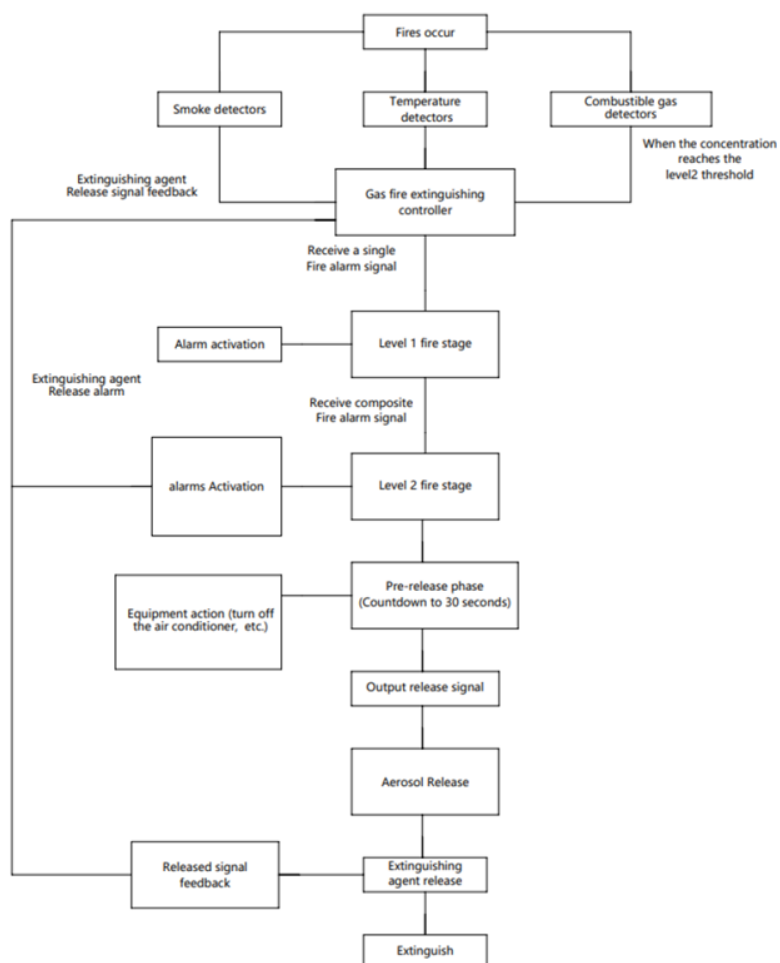


Figure 2 – Fire detection and suppression system control logic

3.37 When either a smoke or heat detector, or level 2 flammable (zone) is triggered, a first-level fire alarm will activate the strobe light and notify personnel on site and remote of an alarm.

- 3.38 When both a smoke and heat detector, or level 2 flammable (zone) are triggered simultaneously, a second-level fire alarm will activate the horn and the pre-release phase of the fire suppression system. The BMS will receive a signal from the Fire Alarm Control Panel (FACP) to initiate a system shutdown and activate a 30-second countdown until the two aerosol agents within each cabinet are activated.
- 3.39 When the aerosol agent is released, the release-signal-feedback device will send an “activated” notification to the BMS, notifying personnel that the agent has been released.

Testing of Fire Safety Systems

- 3.40 Fire safety systems, as well as other systems on the BESS will be tested both at the factory and on site as part of our commissioning and quality assurance process.
- 3.41 The concept design includes BESS equipment prepopulated with batteries and will have undergone Factory Acceptance Testing (FAT). By definition the FAT testing is 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 will be supervised by the Original Equipment Manufacturer and done in a hierarchical way to ensure that all necessary systems are available before the next step is required. All equipment is rigorously tested prior to the installation onsite and sites are checked for compliance against NFPA 855 (January 1, 2023). As described earlier, this is the ‘Universal Standard for the Installation of Stationary Energy Storage Systems’ and applies to the design, construction, installation, commissioning, operation, maintenance, and decommissioning of energy storage systems.
- 3.42 NFPA 855 includes various codes with which any BESS scheme must comply including UL9540A and UL1973, both of which will be complied with.
- 3.43 Integrum will also have a proactive programme of testing and maintenance throughout the operational life of the site to ensure optimal performance of equipment and schedule maintenance as required.
- 3.44 All maintenance will be undertaken in a carefully controlled manner following the site safety rules, and in accordance with the Operational Environmental Management Plan (OEMP), or similar document, which will be drafted during construction.
- 3.45 Operational works on the site will be controlled under an approved safe system of work. This will mean all work is risk assessed to protect both personnel and equipment. Therefore, safety systems such as fire systems will not be stopped or taken out of service without appropriate mitigation, following the system being made safe so far as is reasonably practicable, and only for the minimum time required to undertake any specific maintenance tasks.

4 Information for Fire & Rescue Services

Fire Service Guidance

- 4.1 Guidance for the Fire Service for dealing with sites such as powerplants, substations etc. is contained in the NFCC Guidance “Grid Scale Battery Energy Storage System planning.”
- 4.2 Fire and Rescue Service National Operational Guidance 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.
- 4.3 In the event of a fire, the battery system and the transformers serving the BESS will be automatically electrically isolated when a fire is detected within a container. However, the batteries within the containers will still hold charge in the event of a fire, even after the electrical system is isolated. It will not be possible to confirm that there is no residual risk from the energised batteries within the container, and this will inform the strategy for firefighting in the emergency plan.
- 4.4 When developing BESS projects Integrum actively engages with the Fire & Rescue Service (FRS) with area jurisdiction over the site. Integrum will also provide site familiarisation visits for Lincolnshire FRS (LFRS) during construction and prior to the site being operational. A full risk management and emergency response plan will be jointly developed with Lincolnshire FRS once operational details become defined.
- 4.5 Integrum will also create a Site-Specific Risk Information (SSRI) Pack, fully agreed and endorsed with LFRS, which will be housed in a Premises Information Box (PIB) at the main gate. The SSRI will contain immediate information for attending fire and rescue resources. The PIB should be of a type recommended by the FRS for which they have a universal key.

Fire Service Access

- 4.6 Access will 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 relevant British Standard.
- 4.7 Turning facilities will be provided in any dead-end access route that is longer than 20m. The minimum proposed access-route width to reach the BESS will be 4m.
- 4.8 A swept path analysis for emergency vehicles has been undertaken and the roads have been confirmed as suitable for emergency vehicle access.

Water For Firefighting

- 4.9 The Site Layout Plan Detail [IRE004-PL-02_rev16], for the Scheme include the following for water storage structures for the purposes of fire fighting.
- 4.10 External firefighting water storage structures which is located no less than 40m and no more than 300m from the battery containers. The external firefighting water storage units will be no less than 228,000 litres in capacity.

4.11 Water storage will either be in sectional steel panel tanks, or cylindrical steel tanks, above ground. Where above ground, tanks will be supported on appropriate structural concrete slab foundations.

4.12 The site Layout Plans in *Appendix 1* show the potential location of the water storage tank.

Emergency Planning

4.13 The BESS will have an Emergency Response Plan and a Risk Management Plan, developed in consultation with LFRS.

4.14 The **Emergency Response Plan** will include:

- How the fire service will be alerted
- A facility description, including infrastructure details, operations, number of personnel, and operating hours.
- A site plan depicting key infrastructure: site access points and internal roads; firefighting facilities (water tanks, pumps, booster systems, fire hydrants, fire hose reels etc.); drainage; and neighbouring properties.
- Details of emergency resources, including fire detection and suppression systems and equipment; gas detection; emergency eye-wash and shower facilities; spill containment systems and equipment; emergency warning systems; communication systems; personal protective equipment; first aid.
- Up-to-date contact details for facility personnel, and any relevant off-site personnel that could provide technical support during an emergency.
- A list of dangerous goods stored on site.
- Site evacuation procedures.
- Emergency procedures for all credible hazards and risks, including building, infrastructure and vehicle fire, grassfire and bushfire

4.15 The **Risk Management Plan** will include:

- The hazards and risks at and to the facility and their proposed management.
- Any safety issues for firefighters responding to emergencies at the facility.
- Safe access to and within the facility for emergency vehicles and responders, including to key site infrastructure and fire protection systems.
- 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.

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Snip showing a 4m high non-combustible (metal) acoustic fencing set a minimum 3m away from any of the BESS

Appendix 2 – Industry Standards and UK Guidance

Outline Battery Storage Safety Management Plan January 2023

National Fire Protection Agency (NFPA) 855 (United State of America).

Underwriters Laboratories (UL)9540A Standard for Test Method for Evaluating

NFCC Grid Scale Battery Energy Storage System planning – Guidance for FRS.

Thermal Runaway Fire Propagation in Battery Energy Storage Systems

United Kingdom Power Networks (UKPN) Engineering Design Standard 07- 0116: Fire Energy Storage Systems, 2016

DNVGL-Recommended Practice-0043: Safety, Operation and Performance of Grid-Connected Energy Storage Systems, 2017.

Scottish and Southern Energy TG-PS-777: Limitation of Fire Risk in Substations, Technical Guide, 2019.

BS 5839 Part 1 2017: Fire Detection and Fire Alarm Systems for Buildings

IEC 61936, Power installations exceeding 1 kVAC and 1,5 kVDC – AC.

UL9540A – Standard for Test Method evaluating thermal runaway fire propagation in Energy Storage Systems

Firefighting

Water UK National Guidance Document on the Provision of Water for Firefighting, 2007.

BS9990, Non automatic firefighting systems in buildings. Code of practice, 2015.

Fire Detection, Alarm and Automatic Fire Protection

BS EN 54

BS 5839-1, Fire detection and fire alarm systems for buildings. Code of practice for design, installation, commissioning, and maintenance of systems in non-domestic premises, 2017.

BS 6266, Fire protection for electronic equipment installations, 2011.

BS EN 60079-29-3, Part 29-3. Gas detectors. Guidance on functional safety of fixed gas detection systems, 2014.

BS 5306-0, Fire protection installations and equipment on premises. Guide for selection, use and application of fixed firefighting systems and other types of fire equipment, 2020.

BS EN 12845, Fixed firefighting systems. Automatic sprinkler systems. Design, installation and maintenance, 2015.

BS EN 14972-1, Fixed firefighting system. Water mist Systems. Design, installation, inspection and maintenance, 2020.

BS EN 62619, Secondary cells and batteries containing alkaline or other non-acid electrolytes. Safety requirements for secondary lithium cells and batteries, for use in industrial applications, 2017.

RC61 (RiscAuthority), Recommendations for the storage, handling and use of batteries. Published by the FPA, 2014.

RC62 (RiscAuthority) Recommendations for fire safety with photovoltaic panel installations. Published by the FPA, 2016.

10209302-HOU-R-01, DNV GL McMicken Battery Energy Storage System Event Technical Analysis and Recommendations, 2020.

OAPUS301WIKO, DNV GL Considerations for ESS Fire Safety, 2017.

DNVGL-RP-0043, DNV GL Recommended Practice: Safety, Operation and Performance of Grid-connected Energy Storage Systems, 2017.

FM DS 5-33, FM Global Datasheet, Electrical Energy Storage Systems, 2020.

UL1973 – Standard Certification for Energy Storage Systems

IEC 62933-5-2:2020, the international standard for electrochemical-based EES system safety requirements.

IEC 62619:2022, specifies requirements and tests for the safe operation of secondary lithium cells and batteries used in industrial applications.

IEC 62485-5:2022 Safety requirements for secondary batteries and battery installations - Part 5: Safe operation of stationary lithium-ion batteries.

Appendix 3 – Battery Cabinet Spacing

