Light Valley Solar

Outline Battery Safety Management Plan (oBSMP)

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Light Valley Solar

DCO Submission

Outline Battery Safety Management Plan

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Contents

1 Introduction

1.1 Overview and purpose of the document

1.1.1 Light Valley Solar Limited (the 'Applicant') has prepared this Outline Battery Storage Management Plan (oBSMP) in relation to an Application for a Development Consent Order (DCO) for the construction, operation, maintenance, and decommissioning of Light Valley Solar (the 'Proposed Development').

1.1.2 The Proposed Development is being led by the Applicant, Light Valley Solar Limited, which is a subsidiary of Island Green Power (IGP) UK Limited. IGP is a leading international developer of renewable energy projects, established in 2013.

1.1.3 The aim of this oBSMP is to outline the key fire safety provisions for the Battery Energy Storage System (BESS) proposed to be installed as part of the Proposed Development, including measures to reduce BESS failure risks and mitigate credible failure incident scenarios. The BESS is intended to store surplus electricity generated by the solar PV system and/or energy from the grid. This document provides a summary of the safety related information requirements which will be provided in advance of construction of the BESS. The purpose of this oBSMP is to identify how the Applicant will use good industry practice to reduce risk to life, property, and the environment from the BESS.

1.1.4 This management plan incorporates embedded and good practice measures, as well as any further mitigation that arises out of the EIA process. An outline version of this management plan is submitted alongside the ES as part of this DCO Application to secure relevant commitments. A Requirement is included in the Draft DCO [**EN0110012/APP/LVS/03.01**] to ensure a detailed management plan will be prepared to full version by the appointed Contractor(s), substantially in accordance with this outline management plan, and will be submitted for approval by North Yorkshire Council, in consultation with North Yorkshire Fire and Rescue Service (NYFRS) and the Environment Agency, in advance of starting the relevant phase of works. The Applicant must operate the BESS in accordance with the approved plan.

1.1.5 While the operational phase is anticipated to commence no earlier than Q4 of 2030, reference to current measures and guidelines are included here. However, this document will be updated prior to construction of the BESS to take account of prevailing standards, certifications, guidance, and testing requirements.

1.1.6 Nothing in this oBSMP would prevent the modification or omission of the control measures set out within the ES. This will be confirmed (including confirming that the absence or change to such control measures would not lead to any materially new or materially different effects than those reported in the ES) at the time of the submission of the detailed Battery Storage Management Plan. Any detailed BSMP(s) which follow a first BSMP to be approved will set out how battery storage will be managed across the different works covered by the respective management plans.

1.2 The Order Limits and Proposed Development

Order Limits

1.2.1 The Order Limits outline the maximum extent of the land that will be required to facilitate the construction, operation and maintenance, and decommissioning of the Proposed Development and are shown on the Site Location and Order Limits Plan (Volume 2) [**EN0110012/APP/LVS/06.02.01.01**]. The Order Limits are described in Chapter 2: The Proposed Development (Volume 1) [**EN0110012/APP/LVS/06.01.02**] of the Environmental Statement (ES).

1.2.2 The Order Limits cover an area of approximately 1,270 hectares (ha) located within the administrative area of North Yorkshire Council, near Selby. It is possible that some temporary works may be required for construction access within the jurisdiction on York City Council. The Order Limits comprises four broad areas:

1) Solar Development Sites (total area of 900 ha);
2) Cable Route Corridor (total area of 328.5 ha)
3) Highways Improvement Areas (HIA) (total area of 17.1 ha); and
4) Solar Development Site 8 Access (total area of 24.1 ha).

The Proposed Development

1.2.3 The Proposed Development comprises a solar photovoltaic (PV) electricity generating station of over 100 megawatts (MW) and 'associated development' comprising a Battery Energy Storage System (BESS), grid connection infrastructure and other infrastructure integral to the construction, operation and maintenance, and decommissioning phases.

1.2.4 The main element of the Proposed Development comprises seven Solar Development Sites (Solar Development Sites 1-4 and 6-8) that will accommodate the Solar PV Panels. A BESS Compound will be located within Solar Development Site 2.

1.2.5 The Cable Route Corridor is the area within which the export connection cables (hereafter referred to as the 'Grid Connection Cables') would be located to connect the Solar PV Sites to the National Grid at the existing Monk Fryston Substation (hereafter referred to as the 'Existing National Grid Monk Fryston Substation') and the area within which cables connecting the Solar Development Sites would be located (hereafter referred to as 'Interconnecting Cables') (refer to Figure 2.1: Illustrative Site Layout Plans (ES Volume 2) [**EN0110012/APP/LVS/06.02.02.01**].

1.2.6 Further details of the Proposed Development are presented in Chapter 2: The Proposed Development (ES Volume 1) [**EN0110012/APP/LVS/06.01.02**] and the design envelope for the Proposed Development is set out in the Design Parameters and Commitments Document [**EN0110012/APP/LVS/05.06**] and the limits of deviation shown on the Works Plans [**EN0110012/APP/LVS/02.03**].

1.3 The BESS

1.3.1 For the purposes of this oBSMP a concept design has been considered that uses a BESS system based upon Lithium Iron Phosphate (LFP) battery technology that is currently used on other solar projects being developed by the Applicant. This is considered a reasonable worst-case for the purposes of the assessment in terms of safety (toxic and explosive gas production risks).

1.3.2 The Design Parameters and Commitments [**EN0110012/APP/LVS/05.05.06**] also contains controls over the design of the BESS Compound.

1.3.3 The BESS design and system chemistry type is still to be determined, and the final battery chemistry will be confirmed as part of the detailed design prior to the commencement of construction.

1.3.4 The concept design consists of the BESS enclosures and the associated transformers, circuit breakers and conversion units with an onsite control room. BESS Enclosures, and auxiliary systems, such as cooling, uninterruptible power supply (UPS), fire and gas detection, explosion protection mechanisms, suppression system, monitoring and control, will be designed in accordance with internationally recognised standards and good practice guidance available at the time.

1.3.5 Once operational, the plant will be designed to operate unmanned with access required for maintenance only, and with an operational life of up to 60 years.

Potential BESS failure

1.3.6 Causes of battery cell failure which could lead to a thermal runaway event include manufacturing defects (contaminants / imperfections), electrical abuse (overcharging / over-discharging), and physical or mechanical damage (puncture / crushing).

1.3.7 BESS hazards for first responders in the unlikely situation of a battery failure and thermal runaway event depend on the BESS design but are typically defined as:

1) Fire hazards;
2) Explosion hazards;
3) Electrical hazards (shock or arc flash); and
4) Chemical hazards (i.e. the release of toxic gases).

1.3.8 Regardless of the type of failure or the cause, the main potential hazard is thermal runaway where a battery cell enters an uncontrolled self-heating state and ultimately, if not controlled, a significant flaming or battery gas venting incident. Therefore, this plan focusses on reducing fire and explosion risks associated with the BESS and managing the hazard in the unlikely event that it occurs.

1.3.9 Other electrical systems which form part of the BESS can also carry fire risks. However, due to the extensive historic long-term deployment of other technology such as transformers, conversion units, and switchgear, 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 report.

Safety Objectives

1.3.10 The safety objectives for the design of the BESS are:

1) To minimise the likelihood of a failure event (this is an overriding priority);
2) To minimise the consequences should an event occur;
3) To restrict any event to the BESS site and minimise any impact on the surrounding areas;
4) To automatically detect and begin to fight a fire as soon as possible;
5) To ensure any personnel on site are able to escape safely away from the BESS Compound; and
6) To ensure that firefighters can operate in reasonable safety, where necessary.

1.3.11 Final BESS design and site layout should minimise the requirement for direct NYFRS intervention in a thermal runaway incident i.e. direct hose streams or spray directly on BESS battery systems. NYFRS intervention in worst-case scenarios would typically be limited to boundary cooling of adjacent BESS and Energy Storage System (ESS) units to prevent the fire from spreading. This strategy should be finalised with NYFRS and be clearly communicated in the Emergency Response Plan (ERP) to be produced as part of the detailed BSMP.

1.3.12 If the BESS system does not incorporate an automatic fire suppression system and is designed to safely burn out to remove the risk of stranded energy in the battery systems, then full scale free burn testing will be conducted to demonstrate that loss will be safely limited to one enclosure without the intervention of the NYFRS.

1.3.13 Final BESS design and site layout must be validated through mandatory Large Scale Fire Testing (LSFT) and rigorous consequence modelling to minimise the requirement for any NYFRS intervention in a thermal runaway incident. LSFT will establish minimum equipment spacing distances that demonstrate there is no fire propagation to adjacent BESS enclosures or Energy Storage System (ESS) equipment. Consequence modelling will quantify operational buffer zones for NYFRS to ensure Overhead Power lines will not impede incident response protocols; spacing will be agreed with NFRS prior to construction of the BESS. NYFRS intervention in worst-case scenarios would typically be limited to boundary cooling of adjacent BESS and ESS units to prevent the fire from spreading. This strategy will be finalised in consultation with NYFRS prior to operation and be clearly communicated in the ERP, including measures:

1) To ensure that fire, smoke, and any release of toxic gases do not significantly impact site operatives, first responders, and the local community; and
2) To ensure that firewater run-off is contained and tested before release or, if necessary, removed by tanker and treated offsite.

1.4 Relevant guidance

1.4.1 There is currently limited UK specific guidance for the design of BESS, however the Applicant has incorporated global good practice and best available technology.

1.4.2 The Applicant has developed the BESS in accordance with all relevant legislation and good practice. This oBSMP takes into account the recommendations of the following good practice documentation used in the UK for similar solar sites, including:

1) National Fire Chiefs Council (NFCC) Grid-Scale Battery Energy Storage System planning – Guidance for FRS (2026) (Ref 1);
2) National Fire Protection Agency (NFPA) 855 (2026): Standard for the Installation of Stationary Energy Storage Systems (Ref 3);
3) NFPA 68 (2023): Standard on Explosion Protection by Deflagration Venting (Ref 8);
4) BS EN 14797 (2006): Explosion venting devices (Ref 13);
5) NFPA 69 (2024): Standard on Explosion Prevention Systems (Ref 7);
6) Underwriters Laboratories (UL) 9540A (2026) Standard for Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems (Ref 6);
7) UL 1642 (2020): Standards for Lithium Batteries (Ref 56);
8) UL 1973 (2022): Batteries for Use in Stationary and Motive Auxiliary Power Applications (Ref 11);
9) UL 9540 3rd Edition (2023): Standard for Energy Storage Systems and Equipment (Ref 4);
10) UL 2941 (2023) Outline of Investigation for Cybersecurity of Distributed Energy and Inverter-Based Resources (Ref 57);
11) IEEE 2686 (2025) standard: Recommended Practice for Battery Management Systems in Stationary Energy Storage Applications (Ref 26);
12) FM DS 5-33 (2023) FM Global Datasheet. Lithium-Ion Battery Energy Storage Systems (Ref 15);

13) UN 38.3: Recommendations on the Transport of Dangerous Goods – Manual of Tests and Criteria – (Lithium Metal and Lithium-Ion Batteries) (Ref 22);
14) United Kingdom Power Networks (UKPN) Engineering Design Standard 07-0116: Fire Energy Storage Systems, 2016 (Ref 42);
15) DNV GL-Recommended Practice-0043: Safety, Operation and Performance of Grid-Connected Energy Storage Systems, 2017 (Ref 41);
16) Scottish and Southern Energy TG-PS-777: Limitation of Fire Risk in Substations, Technical Guide, 2019 (Ref 40);
17) BS 5839 Part 1 2017: Fire Detection and Fire Alarm Systems for Buildings (Ref 43);
18) BS 9990: 2015: Non-automatic firefighting systems in buildings - Code of practice (Ref 9);
19) The Regulatory Reform (Fire Safety) Order (RRO) 2005 (Ref 44);
20) The Dangerous Substances and Explosive Atmospheres Regulations 2002 (DSEAR) Assessment (Ref 39);
21) BS EN IEC 61936, Power installations exceeding 1 kV AC and 1,5 kV DC – AC (Ref 55);
22) BS EN IEC 62619 (2022) Secondary cells and batteries containing alkaline or other non-acid electrolytes. Safety requirements for secondary lithium cells and batteries, for use in industrial applications (Ref 12);
23) BS EN IEC 62933-5-2 (2020) Electrical Energy Storage (EES) systems. Part 5-2: Safety requirements for grid integrated EES systems. Electrochemical-based systems (Ref 5);
24) BS EN IEC 62281: 2019 + A2:2023: Safety of primary and secondary lithium cells and batteries during transport (Ref 45);
25) BS EN IEC 62477-1 (2022) Safety requirements for power electronic converter systems and equipment. General (Ref 46);
26) BS EN 16009 (2011) Flameless Explosion Venting Devices (Ref 47);
27) BS EN 14373 (2021) Explosion Suppression Systems (Ref 48);
28) BS EN IEC 61000-6-2 (2016) Electromagnetic compatibility (EMC). Generic standards. Immunity standard for industrial environments (Ref 49);
29) BS EN IEC 61000-6-4 (2018) Electromagnetic compatibility (EMC). Generic standards. Emission standard for industrial environments (Ref 50);
30) CSA / ANSI C800:25: Testing protocol for energy storage system reliability and quality assurance program (Ref 51);

31) Clean Energy Associates (2025): BESS Quality Risks. A summary of the most common Battery Energy Storage System manufacturing defects of 2024 (Ref 52);

32) European Association for Storage of Energy (2025): EASE Guidelines on Safety Best Practices for Battery Energy Storage Systems (Ref 53); and

33) Department for Energy Security and Net Zero (2024): Health and Safety Guidance for Grid Scale Electrical Energy Storage Systems (Ref 54).

2 Consultation

2.1 North Yorkshire Fire and Rescue Service

2.1.1 The local fire and rescue service, NYFRS has been consulted during pre-application discussions and as part of the statutory consultation period. Engagement with NYFRS will continue across the project lifecycle to ensure all key site safety and emergency response requirements are delivered.

2.1.2 The Applicant and a representative from NYFRS held an online Teams Meeting on 27 February 2025 to introduce the Proposed Development and share preliminary site plans.

2.1.3 NYFRS advised that Draft NFCC Grid Scale Energy Storage System Planning – Guidance for Fire and Rescue Services (July 2024 Revision) (Ref 1) should be incorporated into site design and safety documentation.

2.1.4 The Applicant shared a range of BESS safety materials for fire service training and education purposes, and a number of full-scale BESS destruction testing reports, with NYFRS on 27 and 28 February 2025. The Applicant confirmed that NFCC guidance will be followed, and that any deviations will be fully discussed and agreed with NYFRS.

2.1.5 The Applicant and a representative from NYFRS held an online Teams Meeting on 19 January 2026 to discuss NYFRS site access and operations requirements, discuss new BESS testing requirements, and to share illustrative BESS site plans.

2.1.6 The Applicant emailed NYFRS with an illustrative BESS site plan integrating features discussed in the Teams Meeting and shared presentations covering NFPA 855 revisions and Large Scale Fire Testing (LSFT).

2.1.7 The Applicant confirmed that they will share all requisite BESS safety and design documentation for the Proposed Development with NYFRS, once submitted to the Planning Inspectorate (PINS).

2.1.8 The Applicant has complied with the aforementioned NFCC guidelines (Ref 1) and as noted above engaged with NYFRS, and will ensure that the Detailed BSMP accounts for any subsequent revisions made to NFCC guidelines. Close consultation will continue with NYFRS throughout the development process.

3 BESS safety requirements

3.1 Safe BESS design

3.1.1 The BESS will be designed to address prevailing industry standards and good practice at a time of design and implementation. BESS system and components used to construct the facility will be certified to UL 9540 (2023) (Ref 4) and/or BS EN IEC 62933-5-2 (2020) (Ref 5) standards (or any future standards which supersede this).

3.1.2 As a minimum, the battery system will have completed unit or installation level UL 9540A (6th Edition) testing (Ref 6), the BESS enclosure will have completed large scale fire testing (LSFT) to demonstrate that loss will be safely limited to one BESS enclosure without the intervention of firefighters. UL 9540A unit or installation test heat flux test data can establish safe distances between BESS enclosures and ESS equipment but will not be conclusive if full propagation of the battery system does not occur in the test. UL 9540A (6^{th} Edition) now integrates LSFT into their testing program as mandated by NFPA 855 (2026), only LSFT heat flux data where the full battery system is consumed can be used in consequence modelling to establish site-specific equipment spacing.

3.1.3 NFPA 855 (2026) (Ref 3) currently provides the most comprehensive guidelines for BESS design and site installation specifications. BESS design structural integrity will be demonstrated through full-scale destruction performance testing and / or by integrating rigorously tested NFPA 69 (explosion prevention) and NFPA 68 (explosion protection through deflagration venting) features. NFPA 855 (Ref 3) mandates that LSFT (which is full scale burn testing of the BESS system to validate safe equipment spacing) will be conducted and the BESS selected at detailed design will as a minimum have completed this testing under the UL 9540A test program or an accredited 3rd Party LSFT test program (for example CSA, DNV, TUV SUD, etc.

3.1.4 If the BESS design integrates hybrid systems, sparker system, Active Ignition Mitigation System (AIMS), or performance design explosion protection systems, these should be validated through BESS full-scale destruction testing, lean gas mixture testing and requisite pressure testing required by NFPA and EN standards. Full-scale destruction testing validates all active and passive protection system integrated into a BESS enclosure.

3.1.5 If a BESS automatic fire suppression system or Thermal Runaway Propagation Prevention (TRPP) system (engineered to directly access cells within battery modules) is integrated within each BESS enclosure, this will be tested to a minimum of UL 9540A unit level testing protocols or through significant scale third party fire and explosion testing. The suppression or TRPP system will be capable of operating effectively in conjunction with a gas exhaust / ventilation system to minimise deflagration risks. The system design must be capable to control or fully suppress a fire, without the direct intervention of NYFRS. Fire suppression system performance should be benchmarked against free burn testing. An independent Fire Protection Engineer specialising in BESS will review all UL 9540A test results plus any additional fire and explosion test data which has been provided and validate the suppression system design.

3.1.6 BESS enclosure single use (noncontinuous operation) fire protection systems or systems without applicable codes and standards will be tested to UL 9540A installation level testing or through significant scale third party fire and explosion testing. The system design must be capable to control or fully suppress a fire, without the direct intervention of NYFRS. Fire suppression system performance will be benchmarked against free burn testing. An independent Fire Protection Engineer specialising in BESS will review all UL 9540A test results plus any additional fire and explosion test data which has been provided and validate the suppression system design.

3.1.7 If the BESS design does not integrate automatic fire suppression systems and a dry pipe sprinkler or spray system is integrated, then NFCC (2026) (Ref 1) guidance will be followed. Connections to any dry pipe systems that are required to be installed on the BESS Compound should installed in accordance with *BS 9990 Non-automatic firefighting systems in buildings code of practice (Current Edition)* (Ref 9) and should be identified in accordance with *BS 3251 Indicator Plates for Fire Hydrants (Current Edition)* (Ref 10). If a dry pipe system is integrated for the Proposed Development, NYFRS instantaneous connection points will be located at a safe distance from enclosures and clearly signed for NYFRS response, in accordance with NFCC guidelines. Water supply for this type of system will be separate from the water supply designated for NYFRS boundary cooling firefighting requirements.

3.1.8 If the BESS enclosure is a walk-in design (this is a very low probability because most BESS designs are cabinet systems that can be fully serviced without entering the enclosure), an automatic water fire suppression system will be installed. The suppression system must be capable to operate effectively in conjunction with a gas exhaust / ventilation system to minimise deflagration risks. System design and water supply requirements will be fully agreed with NYFRS.

3.1.9 If the BESS system is designed to safely burn out without internal fire suppression systems (to remove the risk of stranded energy in the battery systems), LSFT and / or full-scale destruction performance testing will be conducted to demonstrate that loss will be safely limited to one BESS enclosure without the intervention of NYFRS. UL 9540A unit or installation level heat flux test data can also establish safe distances between enclosures and ESS equipment but will not be conclusive if full propagation of the battery system does not occur in the test.

3.1.10 As best practice, additional third-party fire and explosion testing should be utilised by the BESS Original Equipment Manufacturer to demonstrate that structural integrity is maintained and toxic gas emissions to the closest receptors are below relevant public health exposure limits when the battery system is fully consumed (burnt out). An independent Fire Protection Engineer specialising in BESS will review all UL 9540A test results and any additional 3rd Party fire and explosion test data which has been provided and share conclusions with NYFRS (for example the need for additional water supply for boundary cooling or a dry pipe sprinkler system).

3.1.11 In addition to this, good practice guidance for electrical sites within the UK has been consulted with regards to BESS Compound layouts and separation distances for the transformers and conversion units.

3.1.12 Safety certifications and mitigation features typically found within battery module design, which the Applicant will commit to for the Proposed Development, include:

1) Internal fuses;
2) Liquid cooling system;
3) Active thermal management system (TMS);
4) Contactor at rack/string and bank level;
5) Overcharge safety device;
6) Internal passive protection products;
7) Venting systems and gas channels; and
8) Thermal or multi-sensor monitoring devices.

3.1.13 Battery cell certified to UL 1973 (Ref 11) and/or BS EN 62619 (Ref 12) and tested to UL 9540A unit or installation level for BESS designs (Ref 6)

3.1.14 Module design will be certified to UL 1973 (Ref 11) and/or BS EN 62619 (Ref 12) and tested to UL 9540A unit or installation level (Ref 6).

System location

3.1.15 The BESS Compound is situated at Field 2.4 as shown on Figure 2.3: Field Numbering Plan (ES Volume 2) [**EN0110012/APP/LVS/06.02.02.03**]. The final layout of the BESS Compound will be determined during detailed design. The precise number of individual battery storage Enclosures will depend upon the level of power capacity and duration of energy storage that the Proposed Development will require.

Site layout

3.1.16 The final detailed site design of the BESS Compound will provide separation between key system components or groups of key system components.

3.1.17 The BESS Compound will be broken into discrete groups consisting of battery enclosures and conversion units, and transformers, and each group will have a separation to 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 responder access in case of an intervention.

3.1.18 NFPA 855 (2026) (Ref 3) defines basic operation Health and Safety (H&S) protocols for all BESS site designs which should be incorporated into emergency response plans:

1) Potential debris impact radius is defined as 100 feet (ft) or 30.5 metres (m) i.e. this is a typical explosion risk safe exclusion zone radius as modelling and previous BESS incidents typically show 25 m to be maximum radius; and
2) Automatic building evacuation area is defined as 200 ft or 61 m from the affected BESS enclosure.

3.1.19 NFPA 855 (2026 (Ref 3) also defines five BESS hazard categories – hazards are assessed under both normal operating conditions and emergency/abnormal conditions:

1) Fire and explosion hazards;
2) Chemical hazards;
3) Electrical hazards;
4) Stored/stranded energy hazards; and
5) Physical hazards.

3.1.20 The indicative minimum separation distance between the BESS enclosures and Order Limits is 35.01 metres at the nearest point.

3.1.21 The separation of the conversion units 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.

3.1.22 The layout of the Proposed Development provides adequate separation between enclosures, additional ESS (Energy Storage System) equipment, and other key site structures and infrastructure. The UK NFCC 'Grid Scale Battery Energy Storage System planning – Guidance for FRS (2026)' (Ref 1) will be adhered to, including:

1) To protect BESS enclosures from exterior risks, they shall be provided with impact protection to prevent damage to battery enclosures by vehicles or construction equipment and use Damage Limiting Construction (DLC) techniques;
2) The indicative BESS layout conforms to NFPA 855 (2026) (Ref 3) standard allowing a separation distance of 2.5 m between BESS blocks and 3.5 m to ESS equipment, and 2.5 m between adjacent and back-to-back BESS enclosures. This conforms to NFPA 855 equipment spacing requirements both from UL 9540A (Ref 6) test results (if propagation does not occur), and also in compliance with equipment spacing which exceeds the minimum equipment spacing distances from the illustrative BESS 5 MWh design

validated through LSFT in 2025. This evidence based spacing is considered safe practice by the NFCC;

3) NFCC guidelines allow reduced separation distances if suitable design features can be introduced. The BESS system selected at detailed design will have undertaken LSFT and utilised rigorous site-specific consequence modelling reports to demonstrate that in the event of a BESS failure loss will be safely limited to one BESS enclosure without the intervention of NYFRS. BESS enclosures will not be located within a 10 m radius of Overhead Power Lines at the request of NYFRS, and final buffer zone spacing will be agreed with NYFRS at detailed based upon test data and consequence modelling reports;
4) LSFT of the selected BESS design to establish minimum equipment spacing distances and site-specific consequence modelling will provide a clear, evidence-based case for the final BESS Compound installation plans at the detailed design phase and will be agreed with NYFRS. An independent Fire Protection Engineer specialising in BESS will validate all UL 9540A, LSFT, and / or third-party test data and site-specific consequence modelling data which has been provided;
5) The separation of the conversion units 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;
6) If acoustic barriers are brought forward to provide a noise attenuation solution for the BESS Compound, the structure will be non-combustible, and its materials and positioning will be set out in the detailed BSMP to ensure that NYFRS are satisfied that there is no impedance of emergency response operations. If required, Fire Dynamics Simulator (FDS) consequence modelling will be conducted to specify equipment distances and barrier positioning, an independent Fire Protection Engineer will review all data and validate final BESS Compound layout. The indicative BESS layout integrates a minimum 2 m spacing between BESS enclosures and acoustic barriers.
7) Areas within 10 m of BESS enclosures do not contain combustible vegetation and will not be planted with any new combustible vegetation, wherever possible. Where this is not feasible a full risk assessment will be conducted, and mitigation features applied if required by the NYFRS. Any other vegetation onsite will be kept in a condition such that they do not increase the risk of fire on-site;
8) The BESS enclosures will have an internal fire resistance rating of at least one hour (according to NFPA 855, BR 187 and FM Global Datasheet 5-33);
9) The BESS Compound will be designed to integrate pressure fed (pump driven) fire hydrants fed from water tanks and / or water tanks depending on site topography and final site design layout for firefighting. Water tanks will be located at least 10 m from the nearest BESS enclosure. Water

access points, whether hydrants or tank connections, will be located in consultation with the NYFRS to provide redundancy and safe operating distances for firefighters; and

10) Tanks and water outlets will be clearly labelled with appropriate signage and marked on site plans. Additionally, to avoid any mechanical damage, outlets and hard suction points will be safeguarded with bollards.

3.1.23 By adhering to the separation distances noted above, risk should be adequately minimised to limit a fire event to a single BESS or ESS structure.

Battery system enclosures

3.1.24 Battery enclosures will house the battery systems, electrochemical components and associated equipment. Being either one, or multiple enclosures joined, or close coupled to each other. They will be mounted on a concrete slab.

3.1.25 Each BESS enclosure will be installed by a certified and qualified installer. Each BESS enclosure will be UL 9540 (Ref 4) and / or BS EN IEC 62933-5-2 (Ref 5) certificated. Ingress protection testing of BESS enclosures is conducted under UL9540 and / or IEC62933-5-2 certification of any BESS system. IEC Factory Acceptance Testing (FAT) or an independent manufacturing audit will be carried out to ensure the supplied BESS enclosures comply with the requisite certified ingress protection levels.

3.1.26 Ingress Protection (IP) ratings of BESS enclosures will be shared with NYFRS at the detailed design stage so that risks associated with boundary cooling can be understood and implemented into the ERP. Potential boundary cooling water ingress points such as Heating, Ventilation and Air Cooling (HVAC) systems and deflagration vents will be considered as part of an incident response strategy.

3.1.27 BESS enclosure gas exhaust vents and deflagration panels will direct flaming or toxic gases away from site personnel or first responders in line with NFCC guidance and NFPA 68 (Ref 8) and BS EN 14797 (Ref 13) standards, doors cannot be used as sole deflagration vents.

3.1.28 The BESS enclosures will be locked to prevent unauthorised access and will have an internal fire resistance rating of at least one-hour (according to NFPA 855 (Ref 3), BR 187 (Ref 14) and FM Global Datasheet 5-33 (Ref 15).

3.1.29 Where required, BESS enclosure walls will have a minimum one-hour fire resistance rating to BS EN 13501-2 (Ref 16) and BS EN 1364-1 (Ref 17) standards.

Detection and suppression systems

3.1.30 In order to achieve the safety objectives, the Proposed Development will employ monitoring systems that will help identify any abnormal operation and safely shut down the system before it 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. Other measures include:

1) Thermal monitoring of the battery enclosures and automated cut-out beyond safe parameters;
2) Battery liquid cooling systems with automated fail-safe operation (air cooling systems will not be considered for the Proposed Development);
3) Emergency Stop – both remote and local;
4) 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 BESS enclosure. However, the batteries within the BESS enclosures 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 BESS enclosures, and this will inform the strategy for firefighting in the ERP, drafted at the detailed design stage;
5) The fire and gas detection system for the Proposed Development will comply with NFPA 855 (2026) (Ref 3) and NFPA 69 (Ref 7) standards. This means that smoke, fire and gas detection equipment will be installed onsite. BESS multi-sensor equipment which measures combinations of air temperature, hydrogen, volatile organic compounds, overpressure, shock and vibration, and moisture ingress will also be considered if fully tested with the specific BESS design. The gas detection systems should have an external BESS beacon and audible alert facility and annunciate at an approved remote 24/7 control centre. All fire detection systems should be installed and commissioned to BS EN 54 (Ref 18), BS EN 9999 (Ref 19), NFPA 855 (Ref 3), NFPA 850 (Ref 20). The final BESS failure detection design will be validated by an independent Fire Protection Engineer under the responsibility of the Operations, Engineering and Maintenance Contractor prior to construction, and will be approved by NYFRS;
6) If the BESS design does not integrate internal fire and gas detection equipment in alignment with NFPA standards and instead monitors failure parameters through a local Supervisory Control and Data Acquisition (SCADA) system, then fire and explosion mitigation protection systems will be validated through full scale destruction testing and deflagration modelling i.e. Tesla Megapack 2XL design. The final fire detection design (BESS enclosure and BESS site) will be validated by an independent Fire Protection Engineer prior to construction and will be approved by NYFRS;
7) NFPA 855 (2026) (Ref 3) confirms that water is the most effective battery fire suppression agent, therefore a dedicated water-based suppression system may be provided within each BESS enclosure designed to control or fully suppress a fire, without the intervention of NYFRS. The suppression system must be capable of operating effectively in conjunction with a gas exhaust / ventilation system to minimise deflagration risks;
8) If a BESS automatic fire suppression system or Thermal Runaway Propagation Prevention (TRPP) system (engineered to directly access cells

within battery modules) is integrated within each BESS enclosure, this will conform to NFPA 855 (Ref 3) standards and be tested to UL 9540A (Ref 6) protocols or through significant scale third-party fire and explosion testing. The suppression or TRPP system will be capable of operating effectively in conjunction with a gas exhaust / ventilation system to minimise deflagration risks. The system design will be capable of controlling or fully suppressing a fire, without the direct intervention of NYFRS. Fire suppression system performance should be benchmarked against free burn testing. An independent Fire Protection Engineer specialising in BESS will review all UL 9540A test results plus any additional fire and explosion test data which has been provided and validate the suppression system design. System design and water supply requirements will be fully agreed with NYFRS;

9) If a BESS enclosure design does not integrate automatic fire suppression systems and a dry pipe sprinkler or spray system is integrated, then NFCC (2026) (Ref 1) revised guidance will be followed. Connections to any dry pipe systems that are required to be installed on the BESS Compound should be installed in accordance with *BS 9990 Non-automatic firefighting systems in buildings code of practice (Current Edition)* (Ref 9) and should be identified in accordance with *BS 3251 Indicator Plates for Fire Hydrants (Current Edition)* (Ref 10). If a dry pipe system is integrated for the Proposed Development, NYFRS instantaneous connection points will be located at a safe distance from enclosures and clearly signed for NYFRS response, in accordance with NFCC guidelines. Water supply for this type of system will be separate from the water supply designated for NYFRS boundary cooling requirements;

10) NFPA 855 (2026) prohibits the use of clean agent or aerosol fire suppression systems (FSS) within BESS enclosures unless a sprinkler or spray system is also integrated into a BESS enclosure. Clean agent and aerosol fire suppression systems cannot be the primary fire suppression method unless fire and explosion testing with the specific BESS design can demonstrate that use of such systems does not present a deflagration hazard. If an aerosol fire suppression system (FSS) is integrated into each BESS enclosure, then the system will be designed and certified to discharge specifically for an ‘electrical fault’ fire and shall not discharge in any thermal runaway scenario ensuring a gas exhaust system can remain in operation;

11) BS EN 15276-1 and BS EN 15276-2 also state that aerosols are not to be used on fires involving a range of chemicals and materials including:

    a) Chemicals capable of undergoing autothermal decomposition (e.g. some organic peroxides); and
    b) Oxidising agents (e.g. nitric oxides and fluorine).

12) The above substances are applicable to BESS Lithium-ion battery systems and preclude aerosols from consideration for BESS fire suppression systems;

13) NFCC (2026) (Ref 1) revised guidance acknowledges that it is increasingly common for BESS enclosures to be designed without integrated automatic fire suppression systems because high levels of thermal insulation are integrated which allows enclosures to be closely spaced whilst preventing propagation of fire to adjacent BESS. As mandated in NFPA 855 (2026), LSFT and / or full-scale destruction testing to establish minimum equipment spacing distances coupled with rigorous site-specific consequence modelling will be conducted for the selected BESS design, validating site equipment spacing to demonstrate that loss will be safely limited to one enclosure without the intervention of NYFRS;

14) BESS LSFT as defined in NFPA 855 (2026) (Ref 3) and conducted to UL or accredited third-party testing protocols (such as CSA C800:25, TUV SUD, DNV) may only establish minimum safe equipment distances. Additional third-party fire and explosion testing may be required to also demonstrate that BESS structural integrity can be maintained and toxic gas emissions to the closest receptors are below relevant public health exposure limits when the battery system is fully consumed (burnt out). An independent Fire Protection Engineer specialising in BESS will review all UL 9540A test results and any additional third-party fire and explosion test data which has been provided; and

15) A post-incident recovery plan shall be developed, as recommended by the NFCC guidance that addresses the potential for reignition of BESS battery systems, as well as removal and disposal of damaged equipment. A fire watch will be present until all potentially damaged BESS equipment batteries are removed from the area following a fire event. The water supply for suppression systems and / or firefighting will be replenished as quickly as feasible.

3.1.31 Other measures to minimise the risk and consequences of a BESS failure event that could be implemented include:

1) As a minimum, a BESS Combustible Concentration Reduction (CCR) system will comply with NFPA 855 (2026) (Ref 3) / NFPA 69 (Ref 7) guidelines which require activation at no more than 10% of the Lower Explosive Limit (LEL) of the explosive gas(es). The CCR will ensure the prevention of a dangerous build-up of explosive gases (on average 25% LEL within the BESS). The CCR system shall be suitable for its intended use and the temperatures to which it will be exposed to during a thermal runaway event. The CCR is considered a critical safety system and must comply with Section 4.10 of NFPA 855 concerning Emergency Power Supply Systems (EPSS) which requires emergency back-up power and system redundancy. Heating and cooling of the battery modules will be

provided by an independent liquid cooling system which is separate to any HVAC system providing climate control for the BESS enclosure. Backup power for the gas detection system will have a 24-hour duration in standby and two hours in alarm, as demonstrated via NFPA 72 (Ref 21) compliant battery calculations and required by NFPA 855 (Ref 3);

2) Where suppression systems other than water-based systems are contained within a BESS enclosure, the detection, logic solvers, and sequence of events for discharge shall not impede the CCR system performance. An independent Fire Protection Engineer will validate all requisite suppression system test and CCR performance reports and demonstrate no impact on CCR performance. The activation of a suppression system will not interfere with CCR system operation or inhibit its performance;

3) When mechanical ventilation (CCR system) is required to maintain concentrations below the required limits, it shall be interlocked, so that the system shuts down upon failure of the ventilation system. Where emergency ventilation is used to mitigate an explosion hazard, the disconnect for the ventilation system should be clearly marked to notify personnel or first responders to not disconnect the power supply to the ventilation system during an evolving incident;

4) The CCR system shall also be designed to exhaust flames and gases safely outside the BESS enclosure, without compromising the safety of first responders. The CCR system shall be provided with suitable ember protection to prevent embers from penetrating BESS enclosures (HVAC, gas exhaust and deflagration panels). An NFPA 69 (Ref 7) compliance report should be provided to demonstrate the compliance of the CCR with NFPA 855 (Ref 3) explosion prevention system requirements;

5) Explosion protection systems not covered directly by NFPA 68 (Ref 8) and NFPA 69 (Ref 7) standards are commonly referred to as performance design explosion mitigation systems; these include automatic doors or vents which open to ventilate explosive gas mixtures and / or relieve pressure. If the BESS design integrates hybrid systems, sparker system, Active Ignition Mitigation System (AIMS), or performance design explosion protection systems it should be validated through BESS free burn testing, lean gas mixture testing and requisite pressure testing required by NFPA and EN standards. Further, the BESS enclosure should have completed full UL 9540A testing or large-scale third-party fire and explosion testing without pressure waves occurring or shrapnel being ejected. An independent Fire Protection Engineer specialising in BESS should review all UL 9540A (Ref 6) test results and any additional fire and explosion test and modelling data which has been provided;

6) The BESS enclosure will be designed to withstand overpressures generated by the battery system during thermal runaway. As a minimum, an explosion prevention system to NFPA 69 (Ref 7) standards will be

integrated which should be complimented by an explosion protection system to NFPA 68 (Ref 8) and BS EN 14797 (Ref 13) standards. NFPA 68 critical design performance requirements are:

a) The enclosure strength shall exceed the vent opening pressure by a safety factor of over two (including the doors); and
b) The total vent size shall be selected such that the reduced deflagration pressure (Pred) is below two thirds (2/3) of the enclosure strength.

7) Most LSFT test programs do not performance test BESS active protection systems, therefore any BESS explosion prevention or control / protection system will be validated through additional full scale BESS destruction testing, lean gas mixture testing and requisite pressure testing required by NFPA and EN standards. An independent Fire Protection Engineer specialising in BESS should review all UL 9540A (Ref 6) test results and any additional fire and explosion test and modelling data which has been provided.

3.2 Safe BESS construction

3.2.1 The BESS will be constructed in two distinct phases. Firstly, the civil works and balance of non-BESS plant and equipment construction will be started. Then at a suitable point the BESS equipment will be delivered to be installed on the foundations and connected to the balance of plant.

3.2.2 The installation will be subject to pre-requisites such as a contractor emergency protocol detailing the actions to be taken in an emergency, and the Emergency Response Plan. In addition, installation will not take place until practical provisions are completed, such as the water tanks being installed and filled for use in an emergency.

3.2.3 The transportation of the system from the factory will be a combination of sea and land freight. The system is certified for transportation in all potential environmental conditions. The equipment will be certified for transport to UN 38.3 (Ref 22). Transportation will be managed in accordance with the European Agreement Concerning the International Carriage of Dangerous Goods by Road (ADR) 2019 (Ref 23) and the UK guidance on the transport of dangerous goods “Moving dangerous goods, Guidance” Government webpage (Ref 24).

3.2.4 The appointed contractor will ensure the transported BESS equipment will be pre-populated with batteries and will have undergone Factory Acceptance Testing (FAT) to IEC 62933-5-2 (Ref 5) standards. Site Acceptance Tests (SAT) will follow IEC 62933-5-2 and IEEE 2962 (Ref 25) (in development) standards and protocols.

3.2.5 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 occurs.

3.3 Safe BESS operation

Control room

3.3.1 The BESS will be monitored by an on-site control facility within the BESS Compound, as well as 24/7 monitoring by a remote-control facility provided by the BESS manufacturer or operator:

1) The control room (when operational) will be responsible for the security of the BESS Compound with state-of-the-art detection and monitoring systems. These can be repurposed in an emergency to support first responders;
2) The control room will have the ability and authority to immediately shut the system down should the need arise;
3) The control room (when operational) will be responsible for the implementation of the emergency plan acting as a point of contact to emergency services;
4) Staff will be fully trained and familiar with the BESS technologies and will be responsible for alerting NYFRS and if required, for connecting NYFRS with BESS incident Subject Matter Experts (SMEs);
5) The 24/7 remote control facility will monitor the security of the BESS site, and monitoring and detection systems will be repurposed in an emergency to support first responders. NFPA 855 (2026) (Ref 3) defines the minimum monitoring and control standards;
6) The 24/7 remote control facility will have the capability to immediately shut the system down should an incident occur, and the need arise. It can also implement the ERP, acting as a point of contact to the emergency services;
7) In some circumstances it will be necessary to discharge the batteries to enable the first / second responders to deal with the incident. This capability could potentially be achieved through the 24/7 remote control facility. The precise methodology in this regard will be agreed in the ERP once the detailed design of the BESS is known. This will be prepared in conjunction with NYFRS and is secured through this document; and
8) Signage should be installed in a suitable and visible location on the outside of the BESS units, identifying the presence of a BESS system. Signage would be as per NFCC guidelines and will also include details of:
    a) Relevant hazards posed (for example, the presence of High Voltage DC Electrical Systems is a risk, therefore their location should be identified);
    b) The type of technology associated with the BESS;
    c) Any suppression system fitted;
    d) 24/7 Emergency Contact Information; and

e) Signs on the exterior of a building or enclosure will be sized such that at least one sign is legible at night at a distance of 30 m or from the Order Limits, whichever is closer.

Control architecture

3.3.2 NFPA 855 (2026) (Ref 3) stipulates that a Battery Management System (BMS) should at a minimum provide the following safety functions:

1) High cell temperature trip to isolate the module or rack when detecting cell temperatures that exceed limits;
2) Thermal runaway trip to isolate the battery system when a cell is detected to have entered a thermal runaway condition;
3) Rack switch fail-to-trip to disconnect the rack if any failure is detected. Conversion unit / charger fail-to-trip to isolate the BESS enclosure at the breaker if the conversion unit / charger fails to respond to a trip command; and
4) Conversion unit / charger fall-to-trip (supervisor level). This function initiates a trip command to an upstream breaker to isolate the ESS if the conversion unit / charger fails to respond to a trip command. The 'supervisor' control system controls the entire system, including the combination of racks, the environmental support systems, and the charging/discharging status. The supervisor level should isolate the ESS if the conversion unit / charger fails to trip on an appropriate signal, or if communication is disrupted between the conversion unit / charger and the supervisor control.

3.3.3 Energy Management Systems (EMS) / BMS controls should as a minimum incorporate NFPA 855 (2026) (Ref 3) monitoring and control features and conform to the *IEEE 2686 (2025) Standard: Recommended Practice for Battery Management Systems in Stationary Energy Storage Applications*. Additional IEEE standards in development (IEEE P2688 (Ref 26) and IEEE P2962 (Ref 25)) should also be adopted by the BESS system provider, these cover BESS data analytics, electrical controls and maintenance / replacement of battery components / systems.

3.3.4 If data analytics are not directly integrated by the BESS Original Equipment Manufacturer or BESS integrator, the Applicant will ensure a Data Analytics package is integrated to provide a greater range of performance and safety data (for example, to predict ageing of the cells in battery systems, alert BMS faults or malfunctions, identify electrical abuse during operations, alert the operator when modules need maintenance or decommissioning). Data Analytics facilitate more accurate assessment of operating temperature variations, voltage anomalies, State of Charge (SOC), and State of Health (SOH). Data Analytics can also monitor complimentary BESS safety features (for example, smoke and gas sensors, BESS multi-sensor equipment, ground fault detectors, etc.

3.3.5 Cybersecurity will form a fundamental part of the system design and architecture as there is an increasing focus in this area from national and international regulatory bodies. International standards such as IEC 62443-2-1 (Ref 29), UL 1741 (Ref 28), IEEE 1815 (Ref 31), and IEEE 1547.3 (Ref 32) will be consulted and guidance from national sources such as National Cybersecurity Centre inform the implementation and protection measures. Reference should be made to the Health and Safety Executive (HSE) Operational Guidance document OG86 (Ref 33).

3.3.6 UL 2941 (2023) 'Outline of Investigation for Cybersecurity of Distributed Energy and Inverter-Based Resources' (Ref 34) provides testable requirements for photovoltaic inverters (conversion units), electric vehicle chargers, wind turbines, fuel cells and other resources essential to advancing grid operations. These new requirements prioritise cybersecurity enhancements for power systems that deal with high penetration conversion unit-based resources, including those interfacing with bulk power systems for periods of instantaneous high wind, solar and hybrid/storage generation. UL 2941 promotes the necessity to have cybersecurity designed into new conversion unit-based resources (IBR) and distributed energy resource (DER) systems, and the BESS system supplier at the detailed design stage will conform to these requirements.

Security

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

3.3.8 Where practical and required by NYFRS or within the risk assessment, the BESS Compounds 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 site hazards, details of site access arrangements such as key codes, which will be provided to the NYFRS.

3.3.9 The site will also have Thermal Imaging Cameras to alert and locate onsite fire risks and integrate high-definition CCTV with video analytics to alert and respond to unauthorised site access.

Maintenance

3.3.10 The BESS will be maintained and operated by skilled personnel ensuring that the system is in optimal condition and that all parts of the system are fully serviced and functional at all times.

3.3.11 Routine maintenance will be undertaken on the BESS equipment every 6-12 months depending on the risk profile of equipment. This typically consists of a major maintenance period and a minor maintenance period. This will encompass all BESS and supporting equipment supplied by the Original Equipment Manufacturer including the fire protection and explosion prevention system. Minor maintenance is typically a visual inspection and rectification of any accumulated noncritical defects. All maintenance will be undertaken in a carefully controlled manner following the site safety rules and in accordance with the measures set out in the Outline Operational Environmental Management Plan (oOEMP) [**EN0110012/APP/LVS/07.03**] submitted as part of the DCO Application.

3.3.12 During operations all works on the site will be controlled under safe systems 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.

3.3.13 The operations of the BESS will be managed in accordance with the oOEMP [**EN0110012/APP/LVS/07.03**].

End of life replacement / disposal (during operational phase of BESS)

3.3.14 Regarding the decommissioning of the BESS, the requirements will be determined at the procurement contract stage, with the contractor remaining clear that they are the producer of the battery components and the party placing the battery components on the UK market pursuant to the Waste Batteries and Accumulators Regulations 2009 (Ref 35) (or such equivalent regulations in force at the time of decommissioning) it has certain obligations in respect of battery disposal.

3.3.15 In the event of a defective battery module or cell being identified, the defective module shall be immediately placed out of service and be electrically disconnected from the system. A specific risk assessment shall be conducted prior to the removal of the defective module to ensure the safety of employees and contractors. Specific protocols for storage and removal will fully align with the supplier’s maintenance, decommissioning, and warranty stipulations. Protocols will ensure that all credible pollution, fire and explosion protection safety risks are fully mitigated.

3.3.16 Once a defective module is safely discharged or removed in accordance with the specific risk assessment, it shall be stored in an approved protective container suitable for the safe storage of BESS battery components prior to being transported from the defective unit to a dedicated safe location for inspection by an authorised manufacturer’s representative. The EA will be informed of the design of the storage location and protective container design before they are utilised, and detailed safety protocols in relation to this issue will be included in the final BSMP.

3.3.17 All components replaced during the defects notification and warranty period will be taken back and recycled.

3.3.18 The Applicant will follow the hierarchy of waste management throughout the life of the Proposed Development, as follows:

1) Reduce – the lithium-ion batteries have finite life based on a number of factors, primarily the total number of cycles undertaken. The operation will attempt to manage the degradation by the selection of services and cycling that maximises the overall life. Consideration will be given to supplementation of the equipment or operation at a lower output;
2) Recycle – The supplying manufacturer will have obligations under the Waste Batteries and Accumulators Regulations 2009 (as amended) (or such equivalent regulations in force at the time of decommissioning) and will be contractually obliged to offer a recycling service;
3) Recovery – The recycling should allow any useful materials to be recovered and re-enter the supply chain; and
4) Disposal – Any disposal of batteries shall be undertaken in compliance with all applicable laws and all regulatory requirements, product stewardship, registration disposal and recycling or take back requirement.

4 Firefighting

4.1 Fire Service guidance

4.1.1 Guidance for the Fire Service for dealing with sites such as powerplants and substations is contained in the Fire Service Manual Volume 2 Fire Services Operations – Electricity (Ref 36).

4.1.2 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.

4.1.3 BESS hazards for first responders and site operatives once a BESS failure event occurs depend on both the failure scenario and the BESS design but are typically defined as: fire, explosion, chemical hazards, carbon monoxide, carbon dioxide, hydrocarbon gases, and hydrogen. Full Personal Protective Equipment (PPE) should be worn, and operations should not generally be conducted within any identified blast exclusion zones (close proximity to doors and deflagration vents).

4.1.4 In the event of a BESS failure, the battery system and the transformers serving the BESS will be automatically electrically isolated when a burning or venting thermal runaway incident is detected within an enclosure. However, the batteries within the enclosures 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 enclosure, and this will inform the strategy for firefighting in the emergency plan.

4.1.5 Fire hydrants and connections to any dry pipe systems that are required to be installed on the BESS Compounds should be installed in accordance with *BS 9990: Nonautomatic firefighting systems in buildings - Code of Practice* (current edition) (Ref 9) and should be identified in accordance with *BS 3251: Indicator Plates for Fire Hydrants (*current edition) (Ref 10).

4.1.6 If a dedicated automatic water-based suppression system or TRPP system (engineered to directly access cells within battery modules) is provided within each BESS enclosure this will be tested at UL 9540A (Ref 6) installation level or through significant scale third-party fire and explosion testing. The suppression or TRPP system will be capable of operating effectively in conjunction with a CCR system to minimise deflagration risks. The system design must be capable to control or fully suppress a fire, without the direct intervention of NYFRS.

4.1.7 The Applicant has consulted NFCC guidelines and engaged with NYFRS in the pre-application phase and will ensure that the Detailed BSMP will include any subsequent revisions made to NFCC guidelines. Close consultation will continue with NYFRS throughout the planning process.

4.2 Fire Service access

4.2.1 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 following:

1) The proposed access-route width around the BESS Compound will be 5 m and there are no dead-end access routes or extremes of grade (accessible in all weather conditions);
2) Road networks within the Order Limits will be 6 m width with 8 m width at passing places, this will enable unobstructed access to all areas of the BESS Compound, three separate NYFRS access points to the BESS Compound have been integrated to ensure firefighters do not have to drive through a smoke or gas plume to access the BESS;
3) Signage will be installed in a suitable and visible location on the outside of BESS enclosures identifying the presence of a BESS system. Safety signage will be installed in accordance with Health and Safety (Safety Signs and Signals) Regulations 1996 (Ref 37). Signage will include details of:
    a) Relevant hazards posed;
    b) The type of technology associated with the BESS;
    c) Any suppression system fitted; and
    d) 24/7 Emergency contact information.

4.2.2 Signs on the exterior of a building or enclosure should be sized such that at least one sign is legible at night at a distance of 30 m or from the Order Limits, whichever is closer.

4.2.3 A swept path analysis for emergency vehicles has been undertaken, and the roads have been confirmed as suitable for emergency vehicle access.

4.2.4 In accordance with latest NFCC revised guidance (2026) (Ref 1) the Detailed BSMP will include a site plan that shows all sensitive receptors within a 1 km radius of the Order Limits that could be affected by a fire. The plan will have a compass rose showing north and the prevailing wind direction.

4.2.5 A site plan will be provided at the detailed design stage to NYFRS that will include, as relevant:

1) The layout of structures;
2) Any areas where hazardous and flammable materials are stored on site (location of gas cylinders, process areas, chemicals, piles of combustible wastes, oil and fuel tanks);
3) All permanent ignition sources on the site and show they are a minimum of 6m away from combustible and flammable waste;
4) Any areas where combustible waste is being treated or stored, including non-waste material;

5) All separation distances;
6) Any areas where combustible liquid wastes are being stored;
7) Main access routes for fire engines and any alternative access;
8) Access points around the site perimeter to assist firefighting;
9) Hydrants and water supplies;
10) Areas of natural and unmade ground;
11) The location of fixed plant or storage location of mobile plant when not in use;
12) The location of spill kits;
13) Any other relevant site-specific information; and
14) Drainage runs, pollution control features such as automatic drainage isolation devices, and fire water containment systems such as bunded or kerbed areas (this may be easier to show on a separate drainage plan).

4.3 Fire water

4.3.1 The BESS Compounds will be designed to integrate pressure fed (pump driven) fire hydrants fed from water tanks and / or water tanks, depending on site topography and final site design layout. Water access points, whether hydrants or tank connections, will be located in consultation with NYFRS to provide redundancy and safe operating distances for firefighters. They will be clearly marked with appropriate signage. They will be easily accessible to NYFRS vehicles, and their siting will be considered as part of a risk assessed approach that considers potential fire development/impacts. Outlets and connections will be agreed with NYFRS. Any outlets and hard suction points will be protected from mechanical damage (such as through use of bollards). Other requirements will include:

1) The firefighting water requirement will be fully assessed at the detailed design stage based upon analysis of LSFT of the BESS design plus any additional fire and explosion test data provided by an independent Fire Protection Engineer, water storage volumes will be fully agreed with NYFRS;
2) The BESS Compound will contain a minimum of two firefighting water storage units of no less than 230,000 litres in capacity, capable of delivering 1900 litres per minute for 4 hours (exceeding NFCC guidance);
3) Water storage will either be in sectional panel tanks, or cylindrical tanks, above;
4) Where above ground, tanks will be supported on structural concrete slab foundations to a maximum depth of 1 m;

5) Fire hydrants and connections to any dry pipe systems that are installed on the BESS Compound will be installed in accordance with *BS 9990: Non-automatic firefighting systems in buildings code of practice* (current edition) (Ref 9) and should be identified in accordance with *BS 3251: Indicator Plates for Fire Hydrants* (current edition) (Ref 10);

6) Site and BESS Design Principles and ERP content will ensure that the NYFRS are expected to employ a defensive strategy i.e. only boundary cooling should be employed for cooling of adjacent BESS or associated supporting equipment, this ensures that environmental pollution risks are minimised. Boundary cooling typically involves firefighters directing water fog or spray pattern discharge to ensure the incident does not spread to adjacent BESS enclosures. NFCC guidance states: "*If it can be confirmed that the recommended firefighting tactic for the BESS is to defensively fire fight and boundary cool whilst allowing the BESS to consume itself, this will reduce the water requirements, and thus the drainage/environmental protection requirements significantly*." A BESS design which may require direct NYFRS firefighting engagement tactics will not be selected for this facility;

7) The BESS Compound will integrate an external firefighting water capture drainage system, which is classified as a secondary containment system. In the event of a fire a system of automatic drainage isolation devices at the outfalls from the BESS Compounds will be closed, isolating the BESS Compounds drainage from the wider environment and the BESS drainage will be fully sealed (during normal operation, controlled positive discharge will occur from the drainage system). Fire water runoff may contain particles from a fire; the runoff will be contained and tested before being allowed to discharge to the local watercourses. The water contained by the valves will be tested and released or, if necessary, removed by tanker and treated offsite (in consultation with the relevant consultees at the time). Pollution analysis will always be conducted before removing from site (if polluted) or releasing into drainage systems, if safe to do so. Regular checking and maintenance of drainage isolation devices associated with fire water containment will be undertaken to ensure they are operational when needed and not seized; and

8) If an internal BESS water based fixed suppression system (automatic or dry pipe) is integrated in the BESS enclosures a separate water supply and primary water containment system will be integrated, water runoff is likely to contain higher levels of pollutants compared to water used for external boundary cooling of BESS and ESS equipment. All process water used in the system shall be prevented from contaminating potable water sources in accordance with local regulations, through the use of check valves or other means as part of the system design. Pollution analysis will be conducted before removing and treating offsite.

4.3.2 Figure 2.1: Illustrative Site Layout Plans (ES Volume 2) [**EN0110012/APP/LVS/06.02.02.01**] show the potential location of the water storage tanks, but this will be confirmed in the detailed BSMP.

4.4 Emergency planning

4.4.1 The BESS Compound will have a robust and validated Emergency Response Plan, developed in consultation with NYFRS. The ERP will provide for, where an incident has the potential to affect surface water or groundwater, priority notification and escalation procedures for the Environment Agency (EA) and, where applicable, downstream receptors such as licensed abstractors. All relevant incident response parties, including the EA, the lead local flood authority and the site operator, will be made aware of the ERP and will have immediate access to it. Notification procedures will be activated at the earliest practicable stage of any incident with the potential to affect controlled waters.

4.4.2 Some example BESS and site design information which is anticipated to be shared with NYFRS to establish a risk profile for first responders is listed below:

1) Battery chemistry integrated into BESS – can provide fire and explosive risk profile;
2) Battery form factor (cylindrical, pouch, prismatic);
3) Battery energy Wh / kWh – confirmation of new battery cell (second life cells will not be accepted);
4) Battery module cooling system details (e.g. liquid cooling design, air cooling design) – cooling system capability assessment to stop or reduce battery cell thermal runaway propagation. Air cooled designs will not be accepted;
5) Battery module vent or gas exhaust specifications;
6) Battery module kWh energy + number of cells contained in the module + battery circuitry details (number of cells in series vs number of cells in parallel);
7) Direct suppression system details – direct module TRPP or rack level FSS integration;
8) Rack design – number of modules and kWh energy, spacing between modules, passive protection features, gas exhaust features, electrical isolation functions, heat or thermal runaway sensor integration, etc;
9) Rack configuration – spacing to adjacent racks, number of racks in BESS, spacing to walls, doors, gas vents and roof;
10) Type of BESS enclosure design e.g., container or cabinet, CCR system gas exhaust / ventilation features, deflagration vent design features, BESS enclosure level fire protection and suppression system details (proof of testing with BESS design and test data), additional fire or explosion protection features i.e., thermal barriers;

11) EMS / BMS data monitoring capabilities and incident response integration capacity;

12) Number of BESS enclosures onsite;

13) Size and MWh capacity of each BESS enclosure;

14) BESS and ESS equipment spacing; spacing to other equipment, boundaries, vegetation, roads or access routes, fire hydrants / water tanks, site building structures, etc;

15) Access routes, observation points, turning areas, FRS equipment and assets, water supply locations and capacity, drainage, and water capture design; and

16) Definition and frequency of BESS equipment testing and maintenance requirements.

4.4.3 Digital provision of safety information and procedures will be provided to site operatives, first responders and Subject Matter Experts (SMEs) during a BESS failure incident response – hard copy printed materials will be available onsite (location agreed with NYFRS). As a minimum content should include:

1) Digital emergency response plans;

2) Remote emergency shutoff procedures;

3) Safety Data Sheets (SDS) / Hazardous material documentation;

4) Maps or design drawings;

5) Gas detection capabilities; could include multi-sensor data metrics e.g., Carbon Dioxide (CO2), Carbon Monoxide (CO), Hydrogen (H2), VOC off gas + overpressure + local temperatures;

6) Fire protection system or TRPP system data e.g., temperature, alarming, suppression status, etc. – establish discharge warrantee clauses, emergency BESS venting procedures, discharge times, impact on ventilation and detection systems, etc;

7) ERP training drills for site operatives + FRS engagement (site familiarisation + training drills) + SME engagement (fire protection experts or battery experts); and

8) Other documentation as required by specific BESS project i.e., local response stipulations, contact information for nominated response personnel, community contacts, etc.

4.4.4 An ERP will be developed post planning consent to facilitate effective and safe emergency response. It will follow UK National Fire Chiefs Council (NFCC) (Ref 1) and NFPA 855 (Ref 3) guidelines and will include as a minimum:

1) How the fire service will be alerted and incident communications and monitoring capabilities;

2) Facility description, including infrastructure details, operations, number of personnel, and operating hours;

3) Site plan depicting key infrastructure;

   a) Site access points, internal roads, agreed access routes, observation points, turning areas, etc;
   b) Firefighting facilities (water tanks, pumps, booster systems, fire hydrants, fire hose reels etc);
   c) Water supply locations and capacity; and
   d) Drainage and water capture design and locations.

4) Up-to-date contact details of the emergency response co-ordinator including the SME for the Order Limits;

5) Safe access to and within the facility for emergency vehicles and responders, including to key site infrastructure and fire protection systems;

6) Details and explanation of warning systems and alarms on site and locations of alarm annunciators with alarm details (smoke, gas, temperature);

7) Hazards and potential risks at the facility and details of their proposed management;

8) The role of the FRS at incidents involving a fire, thermal event or fire spreading to the Order Limits;

9) Emergency shutoff or isolator locations;

10) A list of dangerous goods stored onsite;

11) Site evacuation procedures;

12) Site operation Emergency Management protocols - Four phases: discovery, initial response / notification, incident actions, resolution and post incident actions / responses;

13) Emergency procedures for all credible hazards and risks, including building, infrastructure and vehicle fire, wildfires, impacts on local respondents, impacts on transport infrastructure; and

14) 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.

4.4.5 The site owner during design development, as well as the operator once appointed, will work closely with NYFRS to provide all relevant information on BESS and site design features to inform all necessary hazard and risk analysis studies and assist in the development of the Risk Management Plan (RMP) and ERP.

4.4.6 Information will be supplied as early as possible in the detailed design stage to allow an initial appraisal of the BESS to be made. This information will be provided to NYFRS with appropriate evidence provided to support any claims made on performance, and with appropriate standards cited for installation. Such information should also be made available to NYFRS for inclusion in Site Specific Risk Information (SSRI) records.

4.4.7 A Risk Management Plan shall be developed with NYFRS post consent at the detailed design stage and as part of the detailed BSMP which, as a minimum, will provide advice in relation to potential emergency response implications including:

1) The hazards and risks to the facility and their proposed management;
2) Any safety issues for firefighters responding to emergencies at the BESS facility;
3) Safe access to and within the facility for emergency vehicles and responders, including to key site infrastructure and fire protection systems. Establishment of response times and site arrival protocols;
4) The adequacy of proposed fire detection and suppression systems e.g., water supply on site; and
5) Natural and built infrastructure and on-site processes that may impact or delay effective emergency response i.e., firefighting water runoff capture.

4.5 Firefighting consequences

4.5.1 As the BESS will not have personnel access into the battery enclosures, there is unlikely to be any immediate threat to life, only property which forms part of the Proposed Development.

4.5.2 NYFRS in foreseeable and credible emergency response scenarios would most likely adopt a defensive firefighting strategy by using water on neighbouring areas such as battery enclosures and structures to cool down and prevent further fire spread. The Proposed Development will select a BESS design that has undertaken full scale free burn testing to demonstrate thermal insulation protection capabilities of the BESS enclosure design, validate equipment spacing distances, and demonstrate that deflagrations do not occur and/or can be safely constrained. In accordance with NFCC guidance (Ref 1), the Order Limits will be maintained to prevent a fire spreading to the BESS or inadvertently fire loading, by providing a ‘bridge’ or path between BESS enclosures to transmit flaming or radiant heat.

4.5.3 As recommended in NFCC revised guidance (2026) (Ref 1) it is not anticipated that firefighting techniques will require direct hose streams or spray directly on battery systems and will be limited to boundary cooling of adjacent BESS enclosures and supporting equipment to prevent the fire from spreading. IP ratings of BESS enclosures will be shared with NYFRS so that risks associated with boundary cooling can be understood. This strategy will be finalised with the NYFRS at the detailed design stage and be clearly communicated in the ERP.

4.5.4 The emergency services would most likely commit to fighting fire by using water on neighbouring areas such as battery enclosures, trees, and structures to cool down and prevent further fire spread.

A fire affecting the BESS has the potential to mobilise pollutants in surface water runoff. As set out in Chapter 15: Water Resources and Flood Risk (ES Volume 1) [**EN0110012/APP/LVS/06.01.15**] of the Environmental Statement, the BESS drainage system will be designed to isolate and contain such flows to prevent pollution of the surrounding environment. Outfalls from the BESS drainage system will be fitted with automatically actuated valves, which are connected to the BESS fire alarm system. In the event of a fire, these drainage isolation devices will automatically close, isolating the BESS drainage system and containing firewater runoff locally. Water levels and the available containment capacity will be monitored following an incident, taking into account forecast rainfall. Following an incident, sampling will be undertaken as soon as practical and, where the removal of retained firewater is required to maintain adequate available containment capacity prior to receipt of testing results, any contained water will be managed as potentially contaminated and removed by tanker for disposal. The detailed BSMP and drainage design will define any operational trigger levels and procedures for managing this residual risk.

4.5.5 The firewater containment strategy is defined by the following principles:

1) All firefighting water and incident runoff is retained on site during an incident with no uncontrolled discharge.
2) The drainage system transitions automatically to containment mode through isolation of outfalls on activation of the fire alarm.
3) Containment is achieved within engineered drainage and storage features designed to provide full containment forming part of the BESS drainage design.
4) The system accommodates firefighting water volumes together with rainfall during the incident.
5) The design does not rely on infiltration or uncontrolled overflow during incident conditions.
6) Retained water is subject to inspection and testing prior to disposal.
7) Provision is made for active management of retained water, including tanker removal where required.

4.5.6 There is a low risk that the water used for boundary cooling may become contaminated, in the event of any leaks from the BESS enclosures. It is therefore proposed that a secondary containment system is provided on the external surface water drainage system, allowing isolation of the system and sufficient storage to contain any water used in the boundary cooling process. Secondary containment systems may take the form of impermeable lagoons or tanks that are fitted with automated shut-off valves that are linked to the BESS fire alarm system. During standard operation, the drainage isolation devices will be open to allow surface water runoff to discharge to the downstream network under normal operation. A manual back-up shut-off valve system allowing for redundancy will be integrated.

4.5.7 Fire water runoff will be managed as a discrete drainage catchment and controlled via a drainage isolation device upstream of the outfall or an equivalent point of connection. Isolation will be capable of automatic activation (from the BESS fire alarm system) during an incident, with manual override provided as a secondary control. Drainage isolation devices will be designed to operate on a failsafe basis, such that in the event of power loss, system fault or damage during an incident, the default position is closed to maintain containment. Power supply arrangements may include independent or solar-backed systems where appropriate, ensuring that valve operation is resilient and not reliant solely on the primary site power infrastructure.

4.5.8 The approach is performance based, focused on impermeability where required, isolation capability and controlled management of runoff, including incident response and firewater, with the detailed configuration to be confirmed at detailed design stage. Isolation controls shall be subject to a documented inspection, testing and maintenance regime. This shall include defined test frequency in the approved Battery Safety Management Plan (BSMP), an inspection checklist, record keeping of tests and inspections, defined remedial actions where defects are identified, and an escalation procedure where a test failure is recorded.

4.5.9 The proposed containment system must be appropriately sized for additional peak rainfall modelled in a 1 in 100-year plus climate change design event to prevent the untreated discharge of contaminated firewater to surface or groundwaters. The indicative BESS area design integrates a total allowance of four hours of boundary cooling water usage is required as containment storage.

4.5.10 Following a fire event, when safe to do so, samples of the contained firewater runoff will be taken by a suitably competent person and submitted to a UKAS accredited laboratory for analysis using UKAS and MCERTS accredited methods, where applicable. The samples will be analysed to determine the presence and concentration of contaminants and checked against the hazardous substances listed in the ‘surface water pollution risk assessment for your environmental permit’ guidance Ref 1). The contained runoff will not be removed or discharged until the results have been reviewed and the appropriate disposal route is confirmed. In the event of contamination, the drainage isolation device will not be reopened until appropriate cleaning of the drainage system has been undertaken.

4.5.11 If contaminated (polluted), the water will be removed from site by licensed tankers for treatment at an appropriately licensed offsite facility. As the discharge of contaminated firewater to the environment is not permitted without an

Environmental Permit, only water confirmed as uncontaminated and safe for release would be discharged in a controlled manner to the local drainage network in consultation with the relevant regulators. This approach ensures that environmental protection is maintained under both normal and emergency conditions.

4.5.12 Appendix 16.5: BESS Fire Emissions Modelling Technical Note (ES Volume 3) [**EN0110012/APP/LVS/06.03.16.05**] assesses the battery fire emission impact in five worst case fire locations (using the concept BESS design) on sensitive receptors within a 1 km radius of the BESS Compound. The closest residential receptor is located 331 m from a worst case BESS fire location, the closest Public Right of Way (PROW) is 774 m from a worst case BESS location, and the closest distance from a worst case BESS location to the A63 is 24 m. Typically, a BESS fire would be a relatively short-term incident, the plume study therefore compared predicted concentrations against Acute Exposure Guidance Levels (AEGLs), which have higher threshold concentrations than the national air quality objectives and are relevant to short-term releases. AEGLs are expressed as concentrations of a substance above which it is predicted that the general population could experience, including susceptible individuals:

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

4.5.13 The predicted maximum PM_{10} concentrations were all well below the 8-hour HSE WEL and the predicted maximum CO concentrations were well below the relevant WHO guideline values for all exposure periods. All other pollutant maximum concentrations were well below AEGL level 1 (notable discomfort, irritation, or certain asymptomatic non-sensory effects) for all exposure periods. No significant visibility impacts were modelled at any Road locations within a 1 km radius of the BESS Compound.

4.5.14 Based on the factors of distance to the nearest property and the anticipated short-term nature of a fire incident, the assessment concludes that there will not be adverse effects at the closest receptor locations because of a BESS fire incident. Notwithstanding, at the detailed design stage 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 will be below relevant public health exposure limit guidelines when the battery system of a BESS is fully consumed (burnt out), production of Particulate Matter (PM) and a visibility impact assessment on any transport links within a 1 km radius of the BESS Compound will also be included. The ERP produced at the detailed design stage (template outlined in paragraph 4.4.4) will incorporate all necessary emergency response procedures and actions based upon thermal runaway test data supplied by the BESS system provider.

4.5.15 The ERP could contain the following measures or protocols relating to air quality for sensitive receptors located downwind from a fire plume. As part of preparation of the BSMP and ERP, the Applicant will incorporate the latest good practices for battery storage safety, failure detection and prevention, along with the emergency response planning, as guidance continues to develop in the UK and internationally:

1) Notification of potentially affected residents including advice on the health effects of smoke and ways to reduce exposure (e.g. close windows and stay indoors) in the event of a BESS fire;
2) Should there be a BESS fire in close proximity to the A63 road, the site operator is to determine wind direction from the BESS Compound weather station and seek to close the road if deemed necessary. The Plume Analysis Study submitted for the DCO Application has confirmed that a BESS fire impacting the road visibility is a low probability occurrence because of the general prevailing wind directions directing smoke away from the A63. In addition, if the plume was directed towards the A63 from a worst-case BESS fire location, stopping distances are highly unlikely to be impacted by poor visibility from a smoke plume; and
3) Notification of potentially affected members of the public to move to a cleaner air location in the event of a BESS fire.

5 Pre-construction information requirements

5.1 Summary

5.1.1 The detailed design phase of the Proposed Development will consider the lifecycle of the battery system from installation to decommissioning. At the detailed design stage, the selected BESS design will have completed Large Scale Fire Testing (LSFT) 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 which will be agreed with NYFRS.

5.1.2 The battery system mitigation measures adopted in the Detailed BSMP, will reflect the latest BESS safety codes and standards applicable at that stage. Mitigation measures will be discussed and coordinated with NYFRS. The detailed BSMP will be updated should the battery technology change during the operational replacement period. Existing control measures and mitigation will not be amended without prior agreement with NYFRS.

5.1.3 As stipulated in NFPA 855 (2026) (Ref 3), a Failure Modes and Effects Analysis (FMEA) of the BESS (BS EN IEC 60812 (Ref 38)) or Layer of Protection Analysis (LOPA) of the BESS will be conducted to lay the foundation for predictive maintenance requirements and complement the fault indicator capabilities of the BMS data analytics system. This key analysis minimises the probability of a BESS failure in relation to the specific BESS system and site design and analyses key mitigation solutions to minimise the impact of a BESS failure in the unlikely event that this would occur. These types of risk analysis provide confidence to demonstrate that under day-today operation there is a low risk of a BESS failure incident, and in the event of an incident the credible hazards are understood and have been evaluated both at the illustrative and detailed design stages to demonstrate that the risk to site operatives, first responders, and the local population remains very low.

5.1.4 Comprehensive Hazard Mitigation Analysis (HMA) will be conducted by a BESS specialist independent Fire Protection Engineer following NFPA 855 (2026) (Ref 3) guidelines and recommendations to cover BESS system and site-specific safety issues. Typically, the main components of an HMA are:

1) BESS Information (design and site layout);
2) Code Analysis (BESS safety and fire standards);
3) UL 9540A testing (Ref 6), LSFT, third-party fire and explosion test results, consequence modelling (heat flux analysis, NFPA 68 (Ref 8) deflagration analysis) reports; and
4) Failure Modes and Effects Analysis (FMEA).

5.1.5 A range of studies will be undertaken, with a primary focus on fire and explosion risk including (but not limited to) risk analysis and management tools to inform the overall design solution include:

1) Hazard and Operability Analysis ('HAZOP');
2) Hazard Identification ('HAZID');
3) Fire Risk Analysis;
4) Explosion Risk Analysis (ERA); and
5) Dangerous Substances and Explosive Atmospheres Regulations 2002 (DSEAR) (Ref 39).

5.1.6 Additional BESS system risk analysis reports frequently provided by Tier 1 BESS manufacturers or BESS integrators, can inform a key risk analysis studies (listed in 5.1.4 and 5.1.5) and provide NYFRS with detailed insights into capability of BESS system hazard mitigation systems (burning and venting thermal runaway scenarios) and provide guidance for evaluating site-specific equipment spacing templates. A non-exhaustive list of reports are listed below:

1) NFPA 69 Explosion Prevention Compliance report;
2) Deflagration analysis report;
3) FDS gas ventilation analysis report;
4) Heat Flux and flame tilt analysis report;
5) Large scale fire test (LSFT) or full-scale destruction test report;
6) Firefighting water analysis report;
7) UL 9540A test interpretation reports;
8) BESS design Emergency Response Plan (ERP) templates; and
9) Decommissioning Plan templates.

5.1.7 If the BESS system supplied differs from the specification considered for risk assessments and consequence modelling, then a full safety audit will be repeated for the new BESS system specification. These studies will be completed and signed off before construction commences.

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

1) The detailed design, including drawings of the BESS;
2) A statement on the battery system specifications, including fire detection and suppression systems;
3) A statement on operational procedures and training requirements, including emergency operations;

4) A statement on the overall compliance of the system with applicable legislation;
5) An environmental risk assessment to ensure that the potential for indirect risks (e.g., through leakage or other emissions) is understood and mitigated; and
6) ERP(s) covering construction, operation and decommissioning phases will be developed once a construction team, and an operator have been appointed. These plans will be developed in consultation NYFRS and other local emergency services to include the adequate provision of firefighting equipment onsite and ensure that fire, smoke, and any release of toxic gases from a thermal runaway incident does not significantly affect site operatives, first responders, and the local community.

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

5.1.10 Safe decommissioning of the BESS will be addressed prior to decommissioning of the Proposed Development in a Detailed Decommissioning Environmental Management Plan (DEMP), and in accordance with the Outline Decommissioning Environmental Management Plan (oDEMP) [**EN0110012/APP/LVS/07.04**] submitted as part of the DCO Application.

6 Conclusion

6.1.1 This oBSMP has demonstrated in a systematic way the mitigation of the safety risks posed by the BESS in the Proposed Development.

6.1.2 The Applicant is committed to developing a BESS project incorporating equipment which provides optimal levels of performance and safety during its lifecycle.

6.1.3 This oBSMP demonstrates that the Applicant has relevant experience of BESS systems; that the relevant stakeholders have been consulted, and therefore safety will be inherent in the overall design, minimising the risk of a BESS failure event occurring, and reducing the impact of such an event should it occur.

6.1.4 The implementation of the oBSMP is secured through a Requirement in Schedule 2 of the Draft DCO [**EN0110012/APP/LVS/03.01**]. This will stipulate that a Detailed BSMP will be submitted to and approved in consultation with NYFRS, the Environment Agency (EA), by North Yorkshire Council prior to the commencement of the works for the BESS. The Detailed BSMP will be substantially in accordance with this oBSMP.

References

Ref 1 National Fire Chiefs Council (NFCC) Grid-Scale Battery Energy Storage System planning – Guidance for FRS (2026).

Ref 2 HSE: Using Personal Protective Equipment (PPE) to control risks at work. Available at: https://www.hse.gov.uk/ppe/managing-risk-using-ppe.htm [Accessed December 2025].

Ref 3 NFPA 855 (2026): Standard for the Installation of Stationary Energy Storage Systems.

Ref 4 UL 9540 3rd Edition (2023): Standard for Energy Storage Systems and Equipment.

Ref 5 BS EN IEC 62933-5-2 (2020): Electrical Energy Storage (EES) systems. Part 5-2: Safety requirements for grid integrated EES systems. Electrochemical-based systems.

Ref 6 Underwriters Laboratories, UL 9540A (2026): Standard for Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems.

Ref 7 NFPA 69 (2024): Standard on Explosion Prevention Systems.

Ref 8 NFPA 68 (2023): Standard on Explosion Protection by Deflagration Venting.

Ref 9 BS 9990 (2015): Non-automatic firefighting systems in buildings - Code of practice.

Ref 10 BS 3251 (1976): Indicator Plates for Fire Hydrants.

Ref 11 UL 1973 (2022): Batteries for Use in Stationary and Motive Auxiliary Power Applications.

Ref 12 BS EN IEC 62619 (2022): Secondary cells and batteries containing alkaline or other non-acid electrolytes. Safety requirements for secondary lithium cells and batteries, for use in industrial applications.

Ref 13 BS EN 14797 (2006): Explosion venting devices.

Ref 14 Richard Chitty (2014) External fire spread: building separation and boundary distances (BR 187 2nd edition).

Ref 15 FM DS 5-33 (2023): FM Global Datasheet. Lithium-Ion Battery Energy Storage Systems.

Ref 16 BS EN 13501-2 (2023) TC: Fire classification of construction products and building elements - Classification using data from fire resistance and/or smoke control tests, excluding ventilation services.

Ref 17 BS EN 1364- 1 (2015): Fire resistance tests for non-loadbearing elements (walls).

Ref 18 BS EN 54 (2021): Fire detection & alarm systems.

Ref 19 BS 9999 (2017) TC: Fire safety in the design, management and use of buildings.

Ref 20 NFPA 850 (2020): Recommended Practice for Fire Protection for Electric Generating Plants and High Voltage Direct Current Converter Stations.

Ref 21 NFPA 72 (2025): National Fire Alarm and Signaling Code®.

Ref 22 UN 38.3 (2009): Recommendations on the Transport of Dangerous Goods – Manual of Tests and Criteria – (Lithium Metal and Lithium-Ion Batteries).

Ref 23 ADR (2019): European Agreement Concerning the International Carriage of Dangerous Goods by Road.

Ref 24 UK Government Guidance: Moving Dangerous Goods (2012). [Online] Available at: https://www.gov.uk/guidance/moving-dangerous-goods [Accessed December 2025].

Ref 25 IEEE 2962-2025 (2025): Approved Draft Recommended Practice for the Installation, Operation, Maintenance, Testing, and Replacement of Lithium-ion Batters for Stationary Applications

Ref 26 IEEE 2686 (2025): Standard: Recommended Practice for Battery Management Systems in Stationary Energy Storage Applications.

Ref 27 IEEE P2688 (2025): Recommended Practice for Energy Storage and Management Systems in Grid Applications.

Ref 28 BS EN IEC 62443-2-1:2024: Security for industrial automation and control systems - Security program requirements for IACS asset owners.

Ref 29 HSE [Online] Cyber Security. [Online] Available at: https://www.hse.gov.uk/eci/cyber-security.htm [Accessed December 2025]

Ref 30 UL 1741 (2021): Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources.

Ref 31 IEEE 1815 (2012): IEEE Standard for Electric Power Systems Communications-Distributed Network Protocol (DNP3).

Ref 32 IEEE 1547.3 (2023): IEEE Guide for Cybersecurity of Distributed Energy Resources Interconnected with Electric Power Systems.

Ref 33 HSE: Cyber Security for Industrial Automation and Control Systems (IACS) (Edition 2). [Online] Available at: https://www.hse.gov.uk/foi/internalops/og/og-0086.pdf (Accessed December 2025)

Ref 34 UL 2941 (2023): Outline of Investigation for Cybersecurity of Distributed Energy and Inverter-Based Resources.

Ref 35 UK Statutory Instruments (2009): The Waste Batteries and Accumulators Regulations 2009.

Ref 36 Fire and Emergency Planning Directorate (1998): Fire Service Manual Volume 2: Fire Service Operations, Electricity.

Ref 37 Safety Signs and Signals. The Health and Safety Regulations 1996. Guidance on Regulations (2015). [Online] Available at: https://www.hse.gov.uk/pubns/books/l64.htm [Accessed December 2025].

Ref 38 BS EN IEC 60812 (2018) TC: Failure modes and effects analysis (FMEA and FMECA).

Ref 39 The Dangerous Substances and Explosive Atmospheres Regulations (2002) (DSEAR) Assessment.

Ref 40 Scottish and Southern Energy TG-PS-777 (2019): Limitation of Fire Risk in Substations, Technical Guide.

Ref 41 DNV GL-Recommended Practice-0043 (2017): Safety, Operation and Performance of Grid-Connected Energy Storage Systems.

Ref 42 United Kingdom Power Networks (UKPN) Engineering Design Standard 07-0116 (2016): Fire Energy Storage Systems.

Ref 43 BS 5839 Part 1 (2017): Fire Detection and Fire Alarm Systems for Buildings.

Ref 44 The Regulatory Reform (Fire Safety) Order (RRO) (2005).

Ref 45 BS EN IEC 62281: 2019 + A2:2023 (2023): Safety of primary and secondary lithium cells and batteries during transport.

Ref 46 BS EN IEC 62477-1 (2022): Safety requirements for power electronic converter systems and equipment.

Ref 47 BS EN 16009 (2011): Flameless Explosion Venting Devices.

Ref 48 BS EN 14373 (2021): Explosion Suppression Systems.

Ref 49 BS EN IEC 61000-6-2 (2016): Electromagnetic compatibility (EMC). Generic standards. Immunity standard for industrial environments.

Ref 50 BS EN IEC 61000-6-4 (2018): Electromagnetic compatibility (EMC). Generic standards. Emission standard for industrial environments.

Ref 51 CSA / ANSI C800:25 (2025): Testing protocol for energy storage system reliability and quality assurance program.

Ref 52 Clean Energy Associates (2025): BESS Quality Risks. A summary of the most common Battery Energy Storage System manufacturing defects of 2024.

Ref 53 European Association for Storage of Energy (2025): EASE Guidelines on Safety Best Practices for Battery Energy Storage Systems.

Ref 54 Department for Energy Security and Net Zero (2024): Health and Safety Guidance for Grid Scale Electrical Energy Storage Systems.

Ref 55 BS EN IEC 61936 (2021): Power installations exceeding 1 kV AC and 1,5 kV DC – AC.

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