FIELD

OUTLINE BATTERY SAFETY MANAGEMENT PLAN

Field Beauly

DECEMBER 2024

Document Control Record

Document Information				
Title:	Outline Battery Safety Management Plan			
Project:	Field Beauly			
Code:	BTGBBEA02			
Author:	Emma Devlin			
Revision History				
Revision No.	**Description**	**Date**	**Reviewed**	**Approved**
01	Draft for Issue	13/11/24	ED	RS
02	Final Draft	17/12/2024	ED	RS, AR

Contents

Appendices

Table of Acronyms

Acronym	Definition
AC	Alternating Current
ALARP	As Low As Reasonably Practicable
BESS	Battery Energy Storage System
BMS	Battery Management System
DC	Direct Current
DSEAR	Dangerous Substances and Explosive Atmospheres Regulations
ECU	Energy Consents Unit
FAT	Factory Acceptance Testing
FRS	Fire and Rescue Service
HAZID	Hazard Identification
HSE	Health and Safety Executive
IEC	International Electrotechnical Commission
LFRS	Local Fire and Rescue Service
LPA	Local Planning Authority
MV	Medium Voltage
MW	Megawatt
NFCC	National Fire Chiefs Council (UK)
NFPA	National Fire Protection Association (USA)
O&M	Operations and Maintenance
OBSMP	Outline Battery Safety Management Plan
OEM	Original Equipment Manufacturer
PCS	Power Converter System
PSSR	Pressure Systems Safety Regulations
QHSE	Quality, Health, Safety and Environment
SAFOP	Operational Safety
SAT	Site Acceptance Testing
SCADA	Supervisory Control and Data Acquisition
THC	The Highland Council

Executive Summary

This Outline Battery Safety Management Plan (OBSMP) has been prepared to support a planning application for the installation and operation of a Battery Energy Storage System (BESS) and associated infrastructure with a capacity of up to 100 megawatts (MW) (the Proposed Development). The Proposed Development is located on land at Dunballoch Farm, Beauly, Inverness, IV4 7AY (the Site). The plan outlines key safety measures and design principles adopted for the Proposed Development, focusing on fire safety and prevention, and emergency response. Key features of the safety management approach which have been embedded into the site's design include:

- Adherence to industry standards and best practices, including the most recent National Fire Chiefs Council (NFCC) *Grid scale battery energy storage system planning guidance for FRS* (April 2023) and subsequent draft guidance on consultation at the time of writing;
- Commitment to selecting BESS suppliers that meet all relevant international and UK standards;
- Implementation of appropriate setbacks within the project design between on-site infrastructure including electrical equipment and combustible materials including vegetation and nearby occupied buildings;
- Safe access arrangements to accommodate emergency vehicles and allow multiple points of access and egress from the BESS compound;
- On-site drainage infrastructure designed to contain potentially contaminated water run-off associated with any site or perimeter cooling if required during a fire event; and
- Commitment to the development of a comprehensive Emergency Response Plan pre-construction in consultation with local fire and rescue service (LFRS).

Although the risk of a BESS safety incident in the UK is very low, within acceptable levels set by the UK Health and Safety Executive (HSE), this OBSMP has been created to address potential hazards such as thermal runaway, fire propagation, flammable gas buildup, and electrical risks. Embedded mitigation measures within the project design include:

- Advanced monitoring and control systems, including isolation of battery units;
- Fire detection and suppression systems;
- Proper spacing between battery units and other infrastructure;
- Regular maintenance and testing procedures; and
- Comprehensive staff training and emergency response protocols

The plan ensures that fire safety is embedded into the overall design of the Proposed Development from the outset, minimising both the risk of fire events and their potential impact. Through the implementation of these prevention, management, and emergency response measures, the OBSMP demonstrates that fire safety risk has been reduced to as low as reasonably practicable.

Following consent, Field will continue to work closely with the LFRS to refine and implement the safety management strategy, thereby ensuring the safe operation of the Proposed Development.

1 Introduction

This Outline Battery Safety Management Plan (OBSMP) has been prepared by Field Beauly Ltd (Field) to support an application for consent under section 36 of the **Electricity Act 1989** for the installation and operation of a Battery Energy Storage System (BESS) and associated infrastructure with a capacity of up to 100 megawatts (MW) (the Proposed Development). The Proposed Development is located on land at Dunballoch Farm, Beauly, Inverness, IV4 7AY (the Site).

1.1 Purpose

The purpose of this document is to:

- Identify the reasonably foreseeable risks associated with battery energy storage system (BESS) technology; and
- Describe the key measures that will be implemented in the design and operation of the Proposed Development to reduce risks to life, property and the environment in line with industry guidance and best practice.

Prior to the commencement of construction of the Proposed Development, Field will prepare a Battery Safety Management Plan (BSMP) based on the key principles outlined in this OBSMP. The final BSMP will be prepared in consultation with the LFRS and will consider the final selected technology and take into account the latest industry guidance and best practices in relation to battery fire detection prevention and response.

1.2 The Applicant

Field is a leading renewable energy developer, owner and operator of grid-scale BESS across the UK and Europe. Field's aim is to develop, manage and operate BESS that reduce climate change emissions, support stable grid operation, increase energy security and bring down electricity prices for consumers.

Field has an extensive portfolio of BESS across the UK and Europe. In the UK, Field currently owns and operates three BESS, with two more projects in construction (one of which is in Scotland, close to the Fort Augustus substation) and a further 1.4 GW of projects progressing through the pre-construction and design stage. By 2030, Field plans to own and operate 3.1 GW of batteries and emerging storage technologies.

Field is responsible for all stages of project delivery, from initial site identification and landowner engagement through design, planning, construction and operation. As long-term operators, Field is committed to developing projects that are safe, environmentally sustainable and have minimal impacts on local communities; achieved through careful site design and stakeholder engagement.

Field has achieved certification in the following relevant standards, demonstrating that the organisation operates in accordance with internationally recognised quality and health and safety management standards:

- ISO 9001 Quality management systems;
- ISO 14001 Environmental management systems;
- ISO 45001 Occupational health and safety management systems; and
- ISO 45003 Occupational health and safety management – Psychological health and safety at work.

Field is involved in several working groups that support the development of relevant UK safety regulations and standards. Field is committed to adhering to UK and international standards, recognised best practice guidance and codes of practice.

For all projects, Field requires any selected technology to demonstrate compliance to the National Fire Protection Association's (NFPA) industry standard, NFPA 855 Standard for the Installation of Stationary Energy Storage Systems and the testing requirements of UL9540A Test Method as a minimum.

1.3 Proposed Development

1.3.1 Description

The Proposed Development principally comprises a battery energy storage system (BESS) with a capacity of up to 100 megawatts (MW) which will charge and discharge electricity from the existing Beauly substation.

The site for the Proposed Development is located on agricultural land at Dunballoch Farm, Beauly, Inverness, IV4 7AY. The site is immediately east of the River Beauly and approximately 400 metres south of the A839.

Whilst the exact specifications of the Proposed Development, including the final battery manufacturer, will be subject to detailed design post-planning consent, the principal components for the purpose of this application for consent include:

- Battery storage units arranged into pairs;
- Medium-voltage (MV) skids and ancillary low-voltage (LV) equipment;
- High-voltage (HV) grid transformers;
- Air insulated switchgear;
- A substation building comprising welfare facilities, a switch room and control room;
- Access arrangements, a temporary construction access is proposed as a part of the Development, connecting to the A862. The operational site access will utilise the existing farm access off the A862.
- Site-wide supporting infrastructure including cabling, access tracks, fencing, attenuation basins, and landscaping measures.

The indicative site layout for the Proposed Development is included in Figure 1.

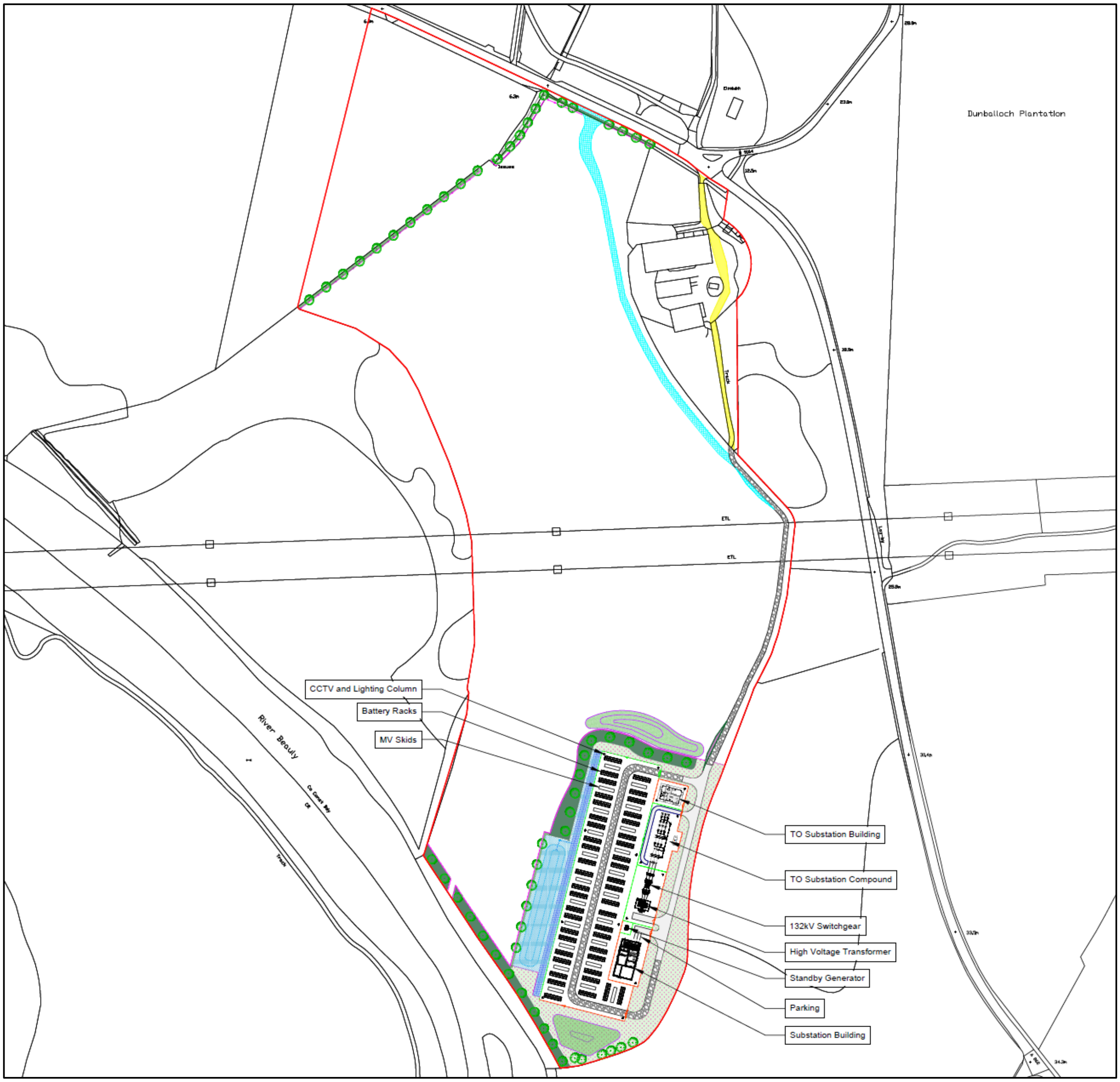

Figure 1: Indicative site layout for the Proposed Development

2 Introduction to Battery Energy Storage System Technology

Large-scale battery systems are an emerging technology in the UK, however these battery systems are generally based on lithium-ion technology which is a common feature of modern technologies including smartphones, laptops and electric vehicles.

BESS play a crucial role in facilitating the integration of renewable energy into the electricity grid by efficiently storing excess electricity generated during peak periods and releasing it during times of high demand, thus helping to stabilise and balance the grid. The UK's Committee on Climate Change has signalled battery storage as a vital technology for the UK's plans to reach net zero carbon emissions.

BESS are being widely deployed in the UK, and worldwide, to provide a range of electrical services to the electricity grid network. These systems are primarily lithium-ion (li-ion) rechargeable batteries housed in battery units fitted with electrical and safety management equipment.

The individual battery units are arranged into strings and connected to associated distribution equipment, including the Power Conversion Systems (PCS) and transformers. The PCS units convert the electricity supply between Direct Current (DC) from the battery and Alternating Current (AC) from the grid. The transformers decrease / 'step down' the voltage of the electricity from the gird when charging, or increase / 'step up' the voltage when discharging back to the grid. A high-level system diagram is shown in Figure 2 below.

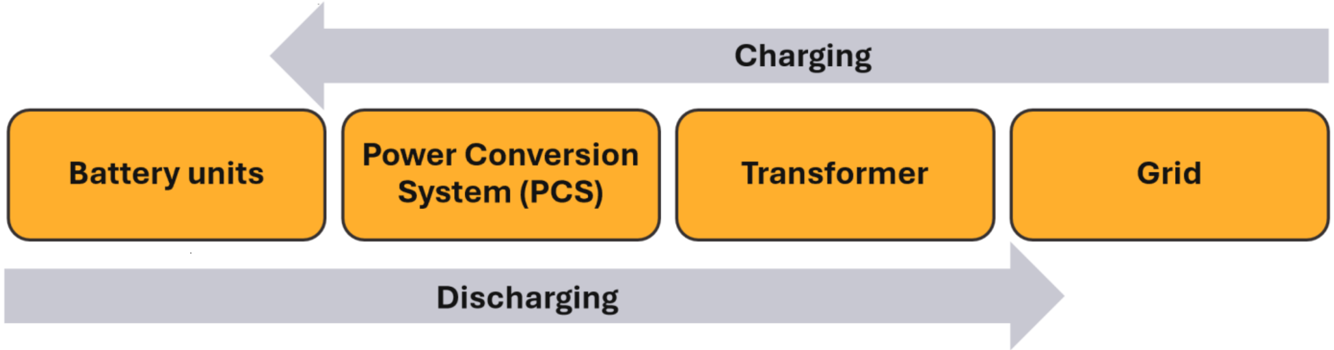

Figure 2 High level battery system diagram

2.1 Lithium-ion batteries

Li-ion batteries are the most common category of rechargeable batteries and are used in a vast range of applications including portable electronics, battery electric vehicles, aerospace, and large-scale stationary applications. At its most basic level, a li-ion cell contains a cathode (positive electrode), an anode (negative electrode), and an electrolyte, all of which is held within a container (typically a cylindrical cell). The chemical process by which energy is stored involves lithium ions moving from the negative electrode to the positive electrode during discharge, and back again when charging – this reversible reduction-oxidation (redox) reaction chemically stores electrical energy for use later.

There are many possible combinations when choosing the materials for li-ion batteries. Therefore, a "li-ion battery" is the umbrella term referring to any electrochemical energy storage system which uses li-ions as the charge carrier between the cathode and anode during charging and discharging cycles. The types of li-ion batteries are usually differentiated by the chemical structures, cathode or anode materials. Changes in the chemistry of the cathode and anode give rise to large variations in properties such as specific energy, peak power, cycle life, cost, safety and thermal stability.

Li-ion cells are integrated into battery modules, which are stacked in a shelving unit to form a rack as shown in Figure 3. A single rack or multiple racks can be housed in a unit; which is typically either a shipping container or a bespoke cabinet. Units are fitted with electrical and safety management equipment. Whilst the exact specifications for the Proposed Development will be determined at detailed design, the typical arrangement of the interior of a battery unit is shown in Figure 3.

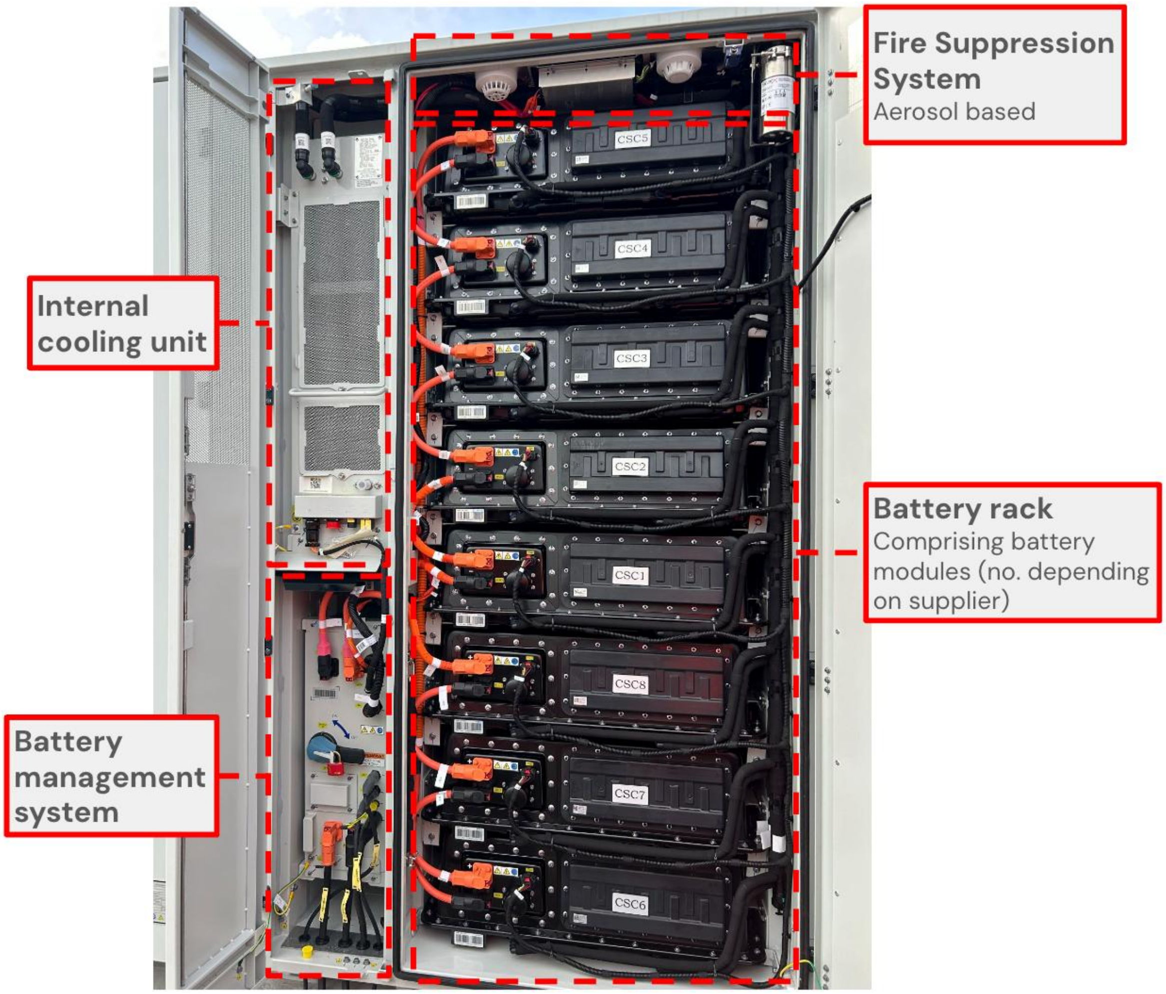

Figure 3 Battery cabinet including key components, photograph taken at Field's Auchteraw site.

2.1.1 Safety features

A critical aspect of battery systems is safety. The battery's function is to store chemical energy; a failure can result in the uncontrolled release of said energy. A cell failure begins with an initial cause (such as an electrical short circuit or improper use), which often results in an increase of the cell temperature due to exothermic reaction(s) inside the cell. There is a risk that the increase in cell temperature may cause a thermal runaway event (increase of temperature in turn releasing energy, which further increases the temperature, thus triggering a chain reaction) which can lead to gas formation, pressure build-up, cell venting and/or rupture, and possibly fire and/or explosion. If one battery cell experiences thermal runaway, it can potentially rapidly spread to adjacent cells, potentially leading to a high heat release fire event. Overheating may also be caused by manufacturing defects or poor design.

Thermal runaway risks can be mitigated through incorporating safety features such as cooling, ventilation and heat detectors to ensure that any fault is quickly detected, isolated, and managed. Appropriate separation between cells, as well as liquid cooling, monitoring systems and smoke and heat detectors will all be included as part of the unit design for the Proposed Development to help mitigate the potential for a thermal runaway event.

Quality assurance measures such as Factory Acceptance Testing (FAT) and Site Acceptance Testing (SAT) will also be carried out for the Proposed Development, ensuring no mechanical damage is present with the equipment that could lead to faults. Once the battery site is operational, further mitigations of maintenance at regular intervals and continuous monitoring will ensure the equipment remains operating as expected.

It should be noted that along with rapid technological advancement, safety and regulation has become a crucial element in battery technology, with a focus on producing batteries with a higher threshold for thermal runaway as well as higher scrutiny placed on battery thermal management fire detection systems and the battery monitoring systems. Through constant monitoring and implementing emergency procedures, the risk of thermal runaway and its associated hazards is reduced.

2.1.2 Battery Management System

The Battery Management System (BMS) is to ensuring the safe operation of the battery site, by monitoring battery performance parameters and ensuring that the battery voltage, temperature, and current are kept within safe operating limits. The BMS gathers status data from cells, modules and racks, and exchanges information with other components. Some of the key functions of the BMS include controlling the charge and discharge of the battery system, monitoring the voltage, current and temperature, and calculating the state of charge and state of health. The BMS will raise an alarm in the case of any abnormal conditions in the BESS and, if required, will disconnect a relevant battery from the wider system.

2.2 Other system infrastructure

2.2.1 Power Conversion System

The primary function of the PCS is to convert current from one form to another. Electricity networks tend to be Alternating Current (AC), whilst batteries charge or discharge energy in Direct Current (DC). The role of a PCS is to convert AC to DC for storage, and invert DC to AC for transmission. The PCS also provides safety functions to protect a battery from unsafe energy loads, promote long-term health of the battery and reduce the risk of equipment failure.

2.2.2 Transformers

The primary function of transformers is to step-up and step-down voltages. Electricity networks tend to operate at high voltage levels as this creates less electrical current in the power lines, which in turn reduces resistance and subsequent energy losses. Conversely, batteries are charged slowly at lower voltages to avoid damage and promote longevity. Transformers, also known as Medium Voltage (MV) transformers, allow for AC voltage to be stepped up or down between the electricity network and battery systems so that electrical power can be stored and transmitted effectively.

Also present on a typical UK BESS site is an auxiliary transformer, this steps down electricity from the high-voltage network to feed into the low-voltage system required for the powering of on-site auxiliary systems; including the thermal management system, fire suppression system, communications, security and welfare systems.

2.2.3 Energy Management System

The energy management system (EMS) is a control system that manages the charge and discharge of batteries by controlling the flow of energy between the electricity network and the battery system. The EMS interfaces with the electricity network and the BMS, logs the performance data, and monitors the state of charge and the state of health of the batteries. With this information the EMS optimises the BESS performance for safety, efficiency and longevity.

2.2.4 Thermal Management System

The thermal management system (TMS) monitors the temperature via sensors within the BESS and uses liquid or forced air cooling to ensure the system remains within the defined, safe operational range. It is important for the battery to be kept within a suitable operating temperature range to reduce degradation, malfunction and the risk of thermal runaway.

2.2.5 Fire Suppression System

The fire detection and suppression system consist of two main functions: firstly, detecting any fire hazard and secondly, suppressing that hazard if detected. Early off-gas detectors detect hazardous gases that are emitted under abuse conditions which may lead to thermal runaway. Aerosol-based suppression systems are triggered when a fire hazard is detected and seeks to suffocate the hazard.

Field require that all technology procured for our projects have heat, smoke and off-gas detectors and aerosol-based suppression systems.

2.2.6 Operational monitoring

Once operational, the Proposed Development will be remotely monitored and controlled 24/7 by Field's Asset Manager and an Alarm Response Centre, with alarms raised upon detection of a hazardous condition or fault. A Site Manager will be assigned to the site by the Asset Manager and will be local to the site.

Onsite CCTV will be monitored by an accredited Alarm Receiving Centre (ARC) who will be able to contact the emergency services immediately in the event of an incident. Field also carries out practice drills with the local emergency services at each of our sites to ensure all parties are able to respond effectively should the need ever arise.

The remote monitoring and safety systems have two separate power supplies, one via the Proposed Development's HV grid connection (used to charge the BESS) and one via a secondary LV auxiliary supply to the distribution network (much like the connection to a property or commercial unit). The Proposed Development will also have an Uninterruptible Power Supply (UPS) unit on site which would provide up to 72hr supply to our monitoring systems; our asset manager would attend site within this period to install temporary backup generation in an extreme event if required.

See also Section 3.3 for more details on the emergency response strategy for the Proposed Development.

3 Fire Safety

3.1 Safety record of BESS in the UK

To contextualise the safety record of UK BESS installations, reference is made to the Department for Energy Security and Net Zero (DESNZ), Renewable Energy Planning Database, dated April 2024 and published 01 July 2024[1]. This database provides concise information on all UK BESS in operation, when they were commissioned and how long they have been operational.

The following points are clear:

- As of April 2024, there are 113 BESS sites in operation across the UK.
- The total energy capable of being delivered to the electricity grid at any one point in time by these projects is estimated at 2,279MW (2.27GW).
- Since 2006 UK based BESS have operated for approximately 5.8 million hours (data details 5,809,133 hours) which is equivalent to 663 years of operation.
- To date, there has been only one reported UK BESS fire that required FRS attendance, this occurred at Carnegie Road, Liverpool in September 2020. The fire was contained and there was no 3rd party collateral damage or injury to firefighters or the public.
- This equates to 1.7E-07 (0.000000172) failures per hour (fph) for BESS fires in the UK, which aligns with Health and Safety Executive (HSE) expectations and an acceptable level of risk as detailed in the HSE publication 'Reducing Risk Protecting People' (R2P2).
- To date, nobody in the UK has been harmed or killed in a BESS incident, be this a first responder or a member of the public.
- No third-party property has been affected by a UK BESS incident.

3.2 Assessment against the National Fire Chiefs Council Guidance

The Proposed Development has been designed in accordance with the *Grid scale battery energy storage system planning guidance for FRS* (NFCC, April 2023)[2] (the NFCC 2023 Guidance). The NFCC 2023 Guidance has been developed to ensure that BESS developments are designed to allow for a safe and effective response in the unlikely event of a fire incident.

In August 2024, the NFCC carried out a public consultation for an update to the NFCC Guidance, including the release of the *Draft Grid Scale Energy Storage System Planning Guidance* (NFCC, August

[1] *Renewable Energy Planning Database,* Department for Energy Security and Net Zero (DESNZ), dated April 2024 and published 01 July 2024: https://www.gov.uk/government/publications/renewable-energy-planning-database-monthly-extract

[2] *Grid scale battery energy storage system planning guidance for FRS* (NFCC, April 2023): https://nfcc.org.uk/wp-content/uploads/2023/04/Grid-Scale-Battery-Energy-Storage-System-planning-%E2%80%93-Guidance-for-FRS-April-2023.pdf

2024)[3] which would subsequently supersede the NFCC 2023 Guidance once finalised. Whilst the draft guidance is not yet in effect, Field has considered this guidance and implemented it into the design of the Proposed Development where it is considered practical to do so. Field is also involved in a technical working group to assist with the development of updates to the NFCC Guidance.

A summary of how Field has considered the NFCC 2023 Guidance is included in Table 3.1.

Table 3.1 Summary of Field's response to the NFCC Guidance

NFCC	Field response
Detection and monitoring	BESS units will include a battery management system (BMS) for monitoring of, and fault detection on, the system on a 24/7 basis to ensure the batteries are operating within safe operating limits. Once the site is fully tested and operational, maintenance will be undertaken on the BESS equipment at regular intervals recommended by the Original Equipment Manufacturer (OEM). This will encompass all BESS equipment supplied by the OEM including the fire detection and monitoring system.
Suppression systems	Fire suppression systems will be installed within battery units which will be compliant with all relevant fire safety standards. If a fire does occur, the battery unit system will employ an automatic fire detection and suppression process, typically in the form of internal aerosol-based fire suppression systems housed inside the battery units. As above, maintenance will be undertaken at regular intervals recommended by the OEM to ensure suppression systems are functioning correctly.
Deflagration prevention and venting	BESS equipment will be fitted with deflagration venting which conforms to the standard NFPA 68; this will activate to safely direct energy externally from the battery unit in the unlikely event that an explosive atmosphere is created inside a battery unit.
Site access	The site includes two separate vehicular access points to the BESS compound to account for varying wind conditions / direction. This includes a northern, main access point and a southern secondary access point ensuring the LFRS always have access to the site if required. A pedestrian emergency access point has also been included on the western boundary of the BESS compound to further facilitate safe access and egress in the case of an incident. It is not viable to provide a secondary access from the highways within the site without unduly occupying a significant additional area of agricultural land. However, the site layout has been configured to provide a junction immediately at the site entrance to allow emergency vehicles to travel in either direction around the site depending on the fire location and weather conditions on the day. Roads and hardstanding areas have been designed to accommodate fire service vehicles, including the avoidance of any extremes of grade. All access tracks have been designed to ensure adequate spacing is provided for emergency vehicles to access all areas of the site if

[3] *Draft Grid Scale Energy Storage System Planning Guidance* (NFCC, August 2024): https://nfcc.org.uk/consultation/draft-grid-scale-energy-storage-system-planning-guidance/

NFCC	Field response
	required, including a minimum width of 4 m. A circuitous / looped internal access arrangement is also provided to ensure emergency vehicles can traverse the site in forward gear. Copies of site layout plans including access arrangements will be shared with the LFRS as soon as practicable to ensure they are familiar with access requirements for the site.
Spacing between battery units	The NFCC 2023 Guidance prescribes a standard minimum spacing between units of 6 metres, however the NFCC 2023 Guidance references FM Global 5-33 (2017) which was updated in 2024 to prescribe a minimum separation distance of 1.5 m for LFP battery units. Therefore, the guidance is out of date and should be updated. Furthermore, the NFCC 2024 Guidance does not reference a spacing requirement. Instead, it references NFPA 855, which requires separation of 3 feet between battery units. Field complies with this by ensuring a minimum separation of 3 m between battery enclosures. Field is therefore compliant to the updated standard and compliant to the NFCC 2024 Guidance, subject to finalisation.
Distance from occupied buildings	The NFCC 2023 Guidance notes that battery units should be at least 25 m away from occupied buildings. The site's operations building is 7 m from the nearest battery units, fireproof fencing will be installed along the southern and western boundaries of the welfare compound (as shown on the Fire Safety Plan in Appendix C) as a safety barrier, in place of the 25 m separation distance. The nearest off-site occupied buildings include residential dwellings all of which are over 350 m from the nearest proposed battery unit, well in excess of 25 m.
Site conditions	The Proposed Development has been designed to ensure that no combustible materials are stored adjacent to battery units and accesses can be kept clear and maintained at all time. The areas between and around the equipment will be finished with gravel and kept free of vegetation or other combustible material. This includes the avoidance of combustible vegetation within 10 m of battery units. Surrounding vegetation, including that proposed as part of the landscape design, will also be maintained regularly to ensure it does not impede on access to the site.
Water supplies	The NFCC 2023 Guidance advises that sites should be capable of delivering no less than 1,900 litres per minute for at least 2 hours. The draft NFCC 2024 Guidance states that if it can be confirmed that the recommended firefighting tactic for the BESS is to defensively firefight and boundary cool whilst allowing the BESS to consume itself, this will reduce the water requirements, and thus the drainage / environmental protection requirements significantly. The intended firefighting strategy for the Proposed Development incorporates a 'controlled burn' strategy, which comprises allowing an individual battery unit that catches fire to consume itself rather than applying water to the unit, therefore reducing the need for water in a fire event, per the draft NFCC 2024 Guidance. Water supplies may be provided for a site in the following order of hierarchy: existing hydrant within suitable proximity, existing watercourse within suitable proximity or water storage facility provided on site in order to provide for up to 1,900 litres per minute for 2 hours.

NFCC	Field response
	Field is currently in consultation with the LFRS to agree the intended fire fighting strategy associated with the Proposed Development.
Signage	Signage will be provided throughout the site and will be designed and sized in accordance with relevant industry standards. This will include signage relating to hazards, 24/7 emergency contact information and other relevant information, as required. The exact locations of signage will be determined at the post-consent / detailed design stage.
Emergency Plans	Emergency plans will be developed in close consultation with the LFRS, including a Risk Management Plan and Emergency Response Plan. The Risk Management Plan will provide advice in relation to emergency response, including the identification of hazards and risks and how these are to be mitigated. The Emergency Response Plan will outline the procedures to be followed in the event of an emergency, comprising relevant site information including an up-to-date site layout, relevant on-site emergency resources, how the fire services will be alerted, evacuation procedures and emergency contact information. Lessons learned from other fires involving battery storage has highlighted the need to ensure the attending emergency services are aware of the exact location of the fire without entering those battery units. This comprises the remote monitoring of battery units and thus reduces the risks of flame blow back and chemical risks to the attending fire services. Field has already worked closely with the Scottish Fire and Rescue Service on another of its site near Fort Augustus which is due to be operational in Q4 2024, to ensure suitable emergency response procedures are in place, including a Battery Fire Safety Management Plan. Field is also part of an industry working group tasked with reviewing and informing industry guidance regarding battery fire safety. Field will continue to liaise with the LFRS and request their participation in fire safety planning at the post-consent stage, including regular site familiarisation visits at appropriate intervals.
Environmental impacts	Site selection for the Proposed Development ensured that the site is not located in an area at high-risk of flooding. Potential impacts associated with the management of fire water run-off have been considered as part of the drainage design for the Proposed Development, including ensuring that the drainage system is capable of collecting and holding contaminated water run-off associated with potential site perimeter cooling for a maximum volume of up to 1,900 l/min for up to two hours. The Proposed Development uses infiltration drainage via the infiltration basing on the Site. In order to capture and hold any potentially contaminated water run-off, a two-basin drainage strategy has been implemented. Run-off will be collected in a clay-lined attenuation basin, with capacity for the NFCC specified maximum of 1,900l/min for two hours, before draining via the infiltration basing. Therefore, through the use of penstock valves on the attenuation basin, Field can ensure contaminated water does not enter surrounding environment.

NFCC	Field response
Recovery	The development of an Emergency Response Plan will consider post-incident recovery procedures to ensure damaged equipment is removed and disposed of safely, and the site is de-energised / re-energised in a controlled and safe manner.

3.3 Fire safety and firefighting strategy

In addition to the design features summarised in Table 3.1, the following measures will be implemented for the Proposed Development to ensure a safe approach in the unlikely event of a fire:

1. If a fire is detected, the battery system will be automatically electrically isolated.
2. The access has been designed so that emergency services will be able to access the site safely and efficiently. All internal access tracks are at least 4 m wide, ensuring the route is wide enough to allow emergency service access. The site includes two separate vehicular access points to the BESS compound to account for varying wind conditions / direction.
3. Thermal runaway may occur under certain circumstances, resulting in the release of hazardous and flammable gases. A 25 m exclusion zone is typically considered for a major incident on BESS sites, ensuring that the concentration of harmful gases outside of the exclusion zone is within acceptable limits. It should be noted that the nearest residential receptors are over 350 m away from the Proposed Development, as shown in Appendix C. Field will implement an access control system to ensure that it is always clear who, if anyone, is inside the site area and whether there is a need to evacuate someone from the site in case of an incident occurring. The BESS will not have emergency responders physically enter the battery units hence there is unlikely to be any immediate threat to life to the responders.
4. Field will continue to liaise with the LFRS and request their participation in fire safety planning once the Proposed Development has received planning permission. Field will consult them in matters regarding fire safety and mitigation, including bringing members of the LFRS to the Proposed Development to walk them through important features of the site, the site layout and to present the type of fire safety equipment that will be stored on site.
5. An emergency response plan will be developed using guidance from the HSE, consultation from the LFRS and will include recommendations from the Fire Safety Order. The firefighting strategy is expected to be apply a "controlled burn" approach to a battery fire. This means that in the unlikely event of a fire, the primary strategy will be to not apply water directly to the battery units and instead allow the battery to burn out naturally, all of which would be contained within the unit.
6. The use of perimeter cooling may be used to avoid fire propagation in a limited set of circumstances, for example, in case the LFRS considers there to be a life at risk inside the compound. Such an event shall be discussed with the LFRS.

7. Run-off from the BESS area (as a result of perimeter cooling) will be contained by surface level filter drains and a clay lined attenuation basin. A penstock valve is in place to facilitate the containment of any potentially contaminated water within the attenuation basin, in the case of an incident. Any run-off would only be a result of perimeter cooling given the 'controlled burn' approach to battery unit fires as discussed above.
8. Field will also liaise with local medical facilities, police service and other emergency services in the development of the emergency response plan. The response will also incorporate a protocol on alerting the local residents near the site in the event of a fire including a statement of events and recommendations to mitigate risks proposed to them.
9. Based on the distance of the Proposed Development from nearest properties, it is not anticipated that there will be adverse effects at the closest receptor locations in the unlikely event of a fire event. Whilst there is a low risk of adverse effects at the closest receptors, the emergency response plan will incorporate mitigation to reduce the magnitude of risk associated with any incident.
10. A post event action plan will be drawn up that will determine any immediate and follow up actions required to an event.
11. There are several factors which would inform the design of an investigation following an incident. In the case of a fire to a BESS unit, variables to be considered include:
    - Extent of the fire: including duration, number of BESS units impacted, number of adjacent assets impacted;
    - Firefighting method: techniques may vary depending on the nature of the incident. Measures employed will be in accordance with emergency response plan;
    - Location of the fire: adjacent to drainage or close to soft ground; and
    - Existing site conditions: recent weather and precipitation levels.

3.4 Emergency Response Plan

As identified in Table 3.1, an Emergency Response Plan will be developed in collaboration with the LFRS and following guidance from the HSE. The plan will be maintained and regularly reviewed throughout the operation of the Proposed Development.

The Emergency Response Plan will be readily available for operations and maintenance personnel. In the case of an emergency, critical alarms will likely be raised from the contracted 24/7 control room and emergency services contacted and the local O&M team will be notified. The Emergency Response Plan will be followed and the site will be isolated. An Emergency Response Plan would include, but not necessarily be limited to the following feature:

- Alarm information;
- Contact information: subject matter expert, system owner, first responders etc;

- Flow chart of emergency procedures for all credible hazards and risks, including building, infrastructure and vehicle fire;
- Shut down/emergency stop sequence (sub and full system);
- Images of site and design, including access, emergency access, internal roads, firefighting facilities and evacuation routes;
- Highlights of hazards that are system and site specific;
- Setback and exclusion zones; and
- Firefighting guidance and details of how the LFRS will be alerted and incident communications and monitoring capabilities.

4 Conclusion

This OBSMP sets out the key safety management features and principles adhered to as part of the design for the Proposed Development. The OBSMP will be further developed and agreed in consultation with the LFRS and other relevant stakeholders prior to the commencement of construction.

The site layout adheres to industry standards and best practice guidance, including consideration being given to the NFCC 2023 Guidance and draft NFCC 2024 Guidance. Key safety features incorporated into the Proposed Development include:

- The commitment to only select a final BESS supplier that adheres to relevant international and UK standards;
- Appropriate separation between battery units, nearby combustible material including vegetation, and nearby occupied buildings including residential properties;
- Safe access arrangements, including two separate access points into the site and ensuring that all access roads are capable of accommodating emergency vehicles throughout the site; and
- On-site drainage infrastructure designed to store potentially contaminated fire water run-off from any perimeter cooling to prevent dispersion into the wider environment;

An Emergency Response Plan will be produced for the Proposed Development pre-construction which will be prepared in close consultation with the LFRS.

The fire management strategy for the Proposed Development will allow a thermal runaway event to run its course as recommended by BESS suppliers following real-life testing, thereby removing the risks associated with contaminated fire water run-off. Fire water would therefore only be used to cool surrounding vegetation if deemed necessary.

The OBSMP establishes that fire safety has been embedded into the overall design of the Proposed Development from the outset to firstly minimise the risk of a fire event occurring, and then further reduce the impact of such an event should it occur. It is demonstrated that through the implementation of the fire safety prevention, management and emergency response measures outlined in this OBSMP, fire safety risk has been reduced to as low as reasonably practicable.

Appendix A – Applicable Regulations and Standards

Category	Relevant Regulations / Standards
UK Primary Legislation and Statutory Instruments	**Workplace Health and Safety** Management of Health and Safety at Work Regulations 1999 The Workplace (Health, Safety and Welfare) Regulations 1992 Provision and Use of Work Equipment Regulations **Fire Safety** The Fire Safety (Scotland) Regulations 2006 Dangerous Substances and Explosive Atmospheres Regulations 2002 **Electrical Safety** Electricity at Work Regulations 1989 The Electricity Safety, Quality and Continuity Regulations 2002 **Construction Safety** Construction (Design & Management) Regulations 2015 **Battery-specific regulations:** Batteries and Accumulators (Placing on the Market) Regulations 2008 Batteries and Accumulators (Placing on the Market) (Amendment) Regulations 2012 Waste Batteries and Accumulators (Amendment) Regulations 2015
Engineering Standards and Guidance Documents	NFPA 855, Standard for the Installation of Stationary Energy Storage Systems NFPA 69, Standard on Explosion Prevention Systems NFPA 68, Standard on Explosion Protection by Deflagration Venting British Standard BS 7671 Requirements for Electrical Installations Dangerous Substances and Explosive Atmospheres Regulations 2002 Approved Code of Practice and Guidance Battery storage guidance note 2: Battery energy storage system fire planning and response Code of Practice, Electrical Energy Storage Systems, 2nd Edition, IET IEC 61508-1:2010, Functional safety of electrical/electronic/programmable electronic safety-related systems IEC 61511-1:2016. Functional safety: Safety instrumented systems for the process industry sector 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 UL9540 and test method UL9540A Energy Storage Systems and Equipment. IEC 62933-5-2 Electrical energy storage (EES) systems Part 5–2: Safety requirements for grid integrated EES systems electrochemical based systems. IEC TS 62933-5-1 Electrical energy storage (EES) systems - Part 5-1: Safety considerations for grid-integrated EES systems - General specification

Category	Relevant Regulations / Standards
	IEC 62485-5 Safety requirements for secondary batteries and battery installations - Part 5: Safe operation of stationary lithium-ion batteries BS EN 60079-10: 2003 Electrical apparatus for explosive gas atmospheres. Classification of hazardous areas British Standards Institution Fire and Emergency Planning Directorate (1998), Fire Service Manual, Volume 2: Fire Service Operations, Electricity Grid Scale Battery Energy Storage System planning – Guidance for FRS (2023), National Fire Chiefs Council.
Note: Other legislative requirements or standards may also apply to the Proposed Development; the above lists are not to be considered as exhaustive. The Proposed Development shall incorporate the requirements and guidance in prevailing international standards and code of practices in the design, construction and operation of the BESS.	

Appendix B – Field QHSE Policy

FIELD-HSE-P-001, Revision 01, 19 March 2024

Quality, Health, Safety & Environmental Policy

Our Mission at Field is to accelerate the transition to Net Zero. We are rapidly deploying grid-scale energy storage infrastructure which will help us create a more reliable, flexible, and greener electricity system. Ensuring the health, safety and welfare of all staff, stakeholders and the public is an integral part of us doing this effectively.

To ensure Field stays at the forefront of our sector, driving efficiency and supporting our ambitions in sustainability we set high standards in Quality, Health, Safety and Environment. We are committed to delivering for our stakeholders while also fulfilling our regulatory requirements. The implementation and continual improvement of an Integrated Management System (IMS) that covers the complete lifecycle of our projects can help us achieve this goal.

Having robust Quality, Health and Safety measures during the development, construction and operational life of projects makes good business sense.

We are committed to the prevention of pollution and strive to minimise waste, promote recycling, reduce energy consumption and harmful emissions. Where possible, we will work with our suppliers and contractors to protect the environment and establish practical environmental solutions.

The person with overall and final responsibility for issues relating to Quality, Health and Safety, Environment and Psychological health and wellbeing within Field is our CEO, Amit Gudka. The day to day responsibility for ensuring that this policy is put into practise lies with our Technical Director, QHSE Manager and Head of Construction. nonetheless, this responsibility will only be fully realised by a collective company effort.

As part of our commitment we will:

<u>Overall</u>

- Empower all teams to communicate openly and honestly by providing forums to discuss actual and potential QHSE risks.
- Create specific QHSE objectives and KPIs that are reviewed across the company on a monthly basis
- Grow a culture of continuous improvement and feedback, where we learn from successes, failures, incidents and observations.
- Provide the necessary training, resources and equipment to support our employees in their development journey.
- Ensure that the integrity of the IMS is maintained at all times, particularly during periods of change.
- Report to the board on QHSE performance on at least a quarterly basis.

Quality

- Establish suitable monitoring and measuring techniques to ensure that we maintain and improve high standards of delivery and optimising efficiency.
- Ensure that our supply chain has Quality Management Systems in place appropriate to their activities. The performance of key suppliers is monitored.

Health, Safety and Wellbeing

- Create a safe and healthy workplace, including construction sites, operational projects and travel, for everyone.
- Assess, understand and manage our HSE risks and impacts during the development, pre-construction, construction and operational phases of our projects.
- Proactively seek ways to prevent work related ill health and injury by striving to eliminate hazards and reduce risk.
- Lead on HSE practices for businesses of our size / scale, not just accepting legal compliance as standard and commit to satisfy all applicable requirements to the business.
- Facilitate employees participation in a range of initiatives help to prevent mental ill health and provide support for those affected by issues relating to deterioration in their wellbeing.
- Strive to increase knowledge and awareness of mental health and wellbeing within our organisation and supply chain.
- Consult with our employees on health and safety and encourage participation in the decision making process with regards to risk reduction and continual improvement.
- Have zero tolerance for harassment of any kind.

Environment

- Comply with current and anticipated environmental legislation. In the absence of legislation, Field will implement cost effective best management practises to provide environmental protection and minimise risk.
- We incorporate biodiversity protection into our environmental management plans, aiming to achieve a net-positive impact in our project areas.
- Commit to rigorously measuring our impact, and make reasonably practicable steps to reduce it.

Amit Gudka
CEO Field

Signed..........[redacted]..................... Date:......19/03/24......

Doc Name: QHSE Policy
Doc Number: FIELD-HSE-P-001
Doc Revision: 01

Appendix C – Fire Safety Plan