



OUTLINE BATTERY SAFETY MANAGEMENT PLAN

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1. Introduction

Background

This Outline Battery Safety Management Plan (OBSMP) has been prepared to support the planning application for the installation and operation of a Battery Energy Storage System (BESS), and associated infrastructure, with a storage capacity of up to 249 megawatts (MW) (the Proposed Development). The Proposed Development is located on land at the former Uskmouth Power Station, Newport.

Purpose

The purpose of this document is to:

- Identify at this early stage the reasonably foreseeable risks that may be associated with battery energy storage system technology; and
- Describe the key measures that will be implemented in the design and operation of the Proposed Development to reduce identified risks, informed by best practice BESS system design and safety guidance.

This Outline BSMP provides a summary of the proposed approach to battery safety management by reference to the safety systems available and best practice procedures today. It may be likely that by the time of construction other battery technologies or risk reduction approaches may have advanced, and the BSMP produced prior to construction will be updated to include these as appropriate.

2. Legislation, Compliance and Guidance

Legislation and Compliance

The Proposed Development will demonstrate compliance with the UK Health and Safety at Work Act (HSAWA) 1974 and the appropriate underlying legislation enacted through the HSAWA. The following legislation has been determined as applicable to the Proposed Development:

- Health and Safety at Work etc. Act 1974 – UKSI1974/0037
- Control of Noise at Work Regulations 2005 – UKSI 2005/1643
- Control of Substances Hazardous to Health Regulations 2002 – UKSI 2002/2677
- Control of Vibration at Work Regulations 2005 – UKSI2005/1093
- Electrical Equipment (Safety) Regulations SI 1994/3260
- Electro-magnetic Compatibility Regulations SI 2006/3418
- Fire Safety (Employees’ Capabilities) (England) Regulations SI 2010/471
- Fire Safety Order 2023
- Fire Safety Act 2021
- Lifting Operations and Lifting Equipment Regulations 1998 – UKSI1998/2307.
- Management of Health and Safety at Work Regulations 1999 – UKSI1999/3242.
- Manual Handling Operations Regulations 1992 – UKSI1992/2793.
- Personal Protective Equipment Regulations 2002 – UKSI2002/1144.
- Provision and Use of Work Equipment Regulations 1998 – UKSI1998/2306.
- Reporting of Injuries, Diseases and Dangerous Occurrences Regulations SI2013/1471.
- Supply of Machinery (Safety) Regulations 2008 – UKSI2008/1597.
- Workplace (Health, Safety and Welfare) Regulations 1992 – UKSI1992/3004.
- Registration, Evaluation, Authorisation & Restriction of Chemicals Regulations (REACH) – 1907/2006
- Restriction of Hazardous Substances Directive (RoHS) – 2011/65/EU
- Dangerous Substances and Explosive Substances Regulations 2002 - SI 2002/2776
- Construction (Design and Management) Regulations - SI 2015/51
- Health and Safety (Safety Signs and Signals Regulations 1996)
- Waste Batteries and Accumulators Regulations 2009

Relevant Guidance

The Applicant will develop the BESS in accordance with relevant legislation and guidance on best practice. Safety guidance for the BESS procurement, installation and operation will be demonstrated by alignment with prevailing industry guidance, both in the UK and globally. The following industry guidance / best practice has been determined as applicable to the Proposed Development:

- Department for Energy Security and Net Zero (DESNZ) Health and Safety Guidance for Grid Scale Electrical Energy Storage Systems (2024)
- National Fire Chiefs Council ('NFCC') Grid-Scale Battery Energy Storage System planning – Guidance for FRS (2023) ('NFCC Guidance')
- National Fire Chiefs Council ('NFCC') Draft Grid-Scale Battery Energy Storage System Planning Guidance (2024)
- NFPA 855 Standard for the Installation on Stationary Energy Storage Systems
- UL 9540, Standard for Energy Storage Systems and Equipment
- Underwriters Laboratories ('UL') 9540A Standard for Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems
- UL 1642 – Standard for Lithium Batteries (Cells)
- DNV GL-Recommended Practice-0043: Safety, Operation and Performance of Grid-Connected Energy Storage Systems, 2017

Detailed design for the Proposed Development will be in accordance with the DESNZ (2024) Health and Safety Guidance for Grid Scale Electrical Energy Storage Systems. The document focuses on the health and safety aspects of grid scale battery system development, drawing on both national and international standards and guidance documents to highlight current good practice. The guidance is not intended to be exhaustive, but it should act as a checklist, to simplify navigation of the complex standards landscape.

The DESNZ guidance recognises that complexity of the landscape, with a plethora of standards (some with overlapping requirements), can be a barrier to the development of BESS in line with appropriate regulations and health and safety (H&S) standards. This highlights the need for robust, clear guidelines for grid-scale battery systems so that all stakeholders can understand good-practice and are implementing the correct health & safety measures throughout the BESS lifecycle.

Further, the Proposed Development has been designed with consideration to the NFCC 2023 Guidance – initially 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 2024) which would subsequently supersede the NFCC 2023 Guidance once finalised. Whilst the draft guidance is not yet in effect, the Applicant has considered this guidance and implemented it into the design of the Proposed Development where it is considered practical to do so.

3. Project Overview

The Proposed Development is located at the Uskmouth Power Station site at the mouth of the River Usk, Newport. The Proposed Development is for the installation of a BESS including the raising of land levels to create an elevated engineered platform designed to support the new infrastructure and mitigate flood risk.

The Proposed Development would comprise the following BESS and related infrastructure elements:

- Raising the ground level for the electrical infrastructure above predicted flood levels.
- Laying out of containerised battery storage units along with associated inverters mounted on concrete slabs/piers.
- A HV substation with associated electrical infrastructure.
- Palisade fence around the BESS facility with access gates to the compound entrance from the internal road network.
- 2 x O & M buildings.
- PCS & MV skid containers.



Figure 1: Indicative design layout

4. Battery Energy Storage System Technology

The need for BESS

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.

Lithium-ion batteries

For the purposes of this document, it is assumed that the BESS system will be based upon lithium-ion ('LFP') battery technology that is commonly used on other sites being developed in the UK. 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 rechargeable batteries housed in battery units fitted with electrical and safety management equipment.

Most grid-scale battery-based energy storage systems use rechargeable lithium iron phosphate battery technology. The chemistry of LiFePO_4 provides enhanced safety features compared to other lithium-ion chemistries, such as nickel, manganese, cobalt ("NMC").

The presence of iron, phosphorous, and oxygen atoms in the cathode creates strong covalent bonds. The result is that the battery is more stable and less prone to thermal runaway and overheating issues.

Safety management is a fundamental feature of all lithium-ion energy storage systems with the purpose of preventing, mitigating and protecting against potential hazards and it is within the site operator's interest to construct and operate a site which is safe for operational purposes. Safety incidents are, on the whole, extremely rare.

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.

Battery Monitoring Systems (BMS)

The safety systems for a BESS operate on multiple layers from the individual battery cell right up to the whole storage system. The first layer is monitoring, whereby every individual cell is constantly monitored by automated systems that track current, voltage, temperature and other critical information to ensure the system is kept within safe operating limits.

These systems are generally known as Battery Management Systems (“BMS”) and are designed to ensure that the batteries are continually monitored and protected to prevent hazards occurring and to maintain the reliability of the batteries, so they are ready to deliver power to the grid when needed.

If the BMS detects any anomalies, it can reduce the flow of electricity through the cell, switch it off or disconnect it completely from the power supply. The BMS also works to identify problems before they occur. It allows the operators to know the state of health of individual battery cells so that any deterioration or fault can be detected, and appropriate maintenance carried out.

The operating temperature of the cells is a key parameter and it is very important the battery cells are kept at a relatively low temperature.

This is to ensure they are operating safely, and it also improves the performance and operating life of the battery. Energy storage systems contain cooling and ventilation systems, which maintain the batteries at a stable operating temperature and remove excess heat in the event of potential overheating. These systems may use ventilation, air conditioning or liquid cooling to help prevent batteries from overheating.

In the unlikely event of a problem occurring and the BMS failing to prevent it, energy storage systems have additional design measures such as alarms, fire detection and suppression systems. These suppression systems use techniques such as inert gas, foam suppression, fire sprinklers or water mist etc. to control fires. This particular system for the Proposed Development will employ automated fire suppression technology.

The European Advanced Rechargeable and Lithium Batteries Association (RECHARGE) provides technical and legislative expertise on lithium batteries and works to ensure best practices and standards for the use of this technology. They carry out work on lithium-ion battery safety and have published a rescue and training manual for first responders and fire services regarding lithium batteries in storage facilities. This guidance is incorporated into the design mitigation strategies for the BESS units.

5. Safety Controls and Good Practice

System Design Approach

The Proposed Development will minimise fire risk by:

- I. The BESS will be designed, selected and installed in accordance with related standards, international guidance and good practice. This includes procuring components and using construction techniques which comply with all relevant legislation.
- II. The BESS will be designed with multiple layers of protection to minimise the chances of a fire or thermal runaway. This will include integrated fire detection with automated suppression systems to deal with electrical fires. Following Best Practice (e.g., NFPA 8551) the build-up of explosive gases will be avoided by gas venting. Further, the BESS design will include automatic fire suppression systems in the development design.
- III. Risk assessments will be carried out for the entire system during construction and for the operational life of the BESS.
- IV. Separation distances between components will be in accordance or exceed best practice requirements, currently as per NFPA 855.
- V. All equipment will be monitored, maintained and operated in accordance with manufacturer instructions, with the local fire rescue service ('FRS') alerted in the event of an incident.
- VI. Recommendations and requirements from the FRS are addressed in order to enable effective emergency response in the event of an incident.

Design Safety Controls and Good Practice

Item	Control	Commitments
1	Site access	The site includes two separate vehicular access points to the BESS compound to account for varying wind conditions / direction and incident location. This includes a main access point to the east and a western secondary access point from the HV substation area, ensuring the LFRS always have access to the site if required. The site layout has been configured to provide suitable junction and turning radii 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 required.

2	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. The Proposed Development complies with this by ensuring a minimum separation of 3.5-4.5 m between battery enclosures. Therefore the illustrative design is compliant to the updated standard and compliant to the NFCC 2024 Guidance, subject to finalisation.
3	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 times. 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.
4	Engagement with the local fire department	The Applicant will engage with South Wales Fire and Rescue Service (SWFRS) as required to provide the necessary information for this document before the commencement of construction of the BESS. Information will be updated during operation as required by SWFRS. It is understood that SWFRS have visited the wider development site and have not raised any major concerns, subject to the adequacy of the site design and BSMP. The expected firefighting approach from SWFRS during the unlikelyhood of a fire event is to manage a 'controlled burn', with details to be developed and confirmed in an emergency response plan. This means in the unlikely event of a fire, the primary strategy is not to directly apply water to battery units, but to allow the battery to burn out with the distances between the units helping to avoid spread between blocks of battery units.
5	Fire water run-off and drainage design	Potential impacts associated with the management of fire water run-off have been considered as part of the drainage design for the Proposed Development. Potentially contaminated fire water run-off, from perimeter cooling application, and foam run-off will be prevented from infiltrating into the ground by impermeable lining and all run-off contained within the site via penstock chambers or a HydroValve solution at the outfall. This approach

		compartmentalises run-off containing potential contamination to ensure it does not enter the surrounding environment.
6	System 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.
7	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.
8	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. All enclosures will include adequate Heating Ventilation and Air Conditioning (HVAC) installations incorporating redundancy. The behaviour of HVAC and air circulation in the event of a pre alarm and main alarm will be defined by the manufacturer (and, if applicable, the certifier) with due regard to the extinguishing agent used (typically aerosol).
9	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. The Applicant will engage with SWFRS to agree the best possible sources of water supply, for example through access to existing mains pressure hydrants.
10	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.
11	Emergency Plans	Emergency plans will be developed in close consultation with the SWFRS, 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. The firefighting strategy is expected to apply a 'controlled burn' approach to a battery fire. This means in the unlikely event of a fire, the primary strategy is not to directly apply water to battery units, but to allow the battery to burn out with the distances between the units helping to avoid spread between blocks of battery units. Perimeter cooling may be used to avoid fire propagation, depending on the circumstance.
12	Maintenance	Maintenance of the Proposed Development will follow the original equipment manufacturer recommendations for the inspection, testing and maintenance of BESS.

6. Conclusions

The Applicant is committed to developing safe BESS that will enable dependable operation over the long term, minimise any risks and ensure safe operation. It is considered that through adhering to the design safety principles, controls, and good practice guidance outlined in this OBSMP, the following safety objectives for the design of the Proposed Development would be enabled:

- To minimise the likelihood of an event. This is the priority for mitigating the risk.
- To minimise the consequences should an event occur.
- To confine any event to the individual compound and minimise any impact on the surrounding areas.
- Automatically detect and activate the automatic fire fighting systems as soon as possible, and alert South Wales FRS.
- Ensure any personnel on Site can escape safely away from the area of the fire.
- Ensure that firefighters can operate in reasonable safety and have sufficient water resources.
- Ensure that fire, smoke, and the spread of toxic/explosive gasses do not affect occupants in surrounding buildings and areas.

A final Battery Safety Management Plan will include the following:

- I. Detailed design (including drawings showing the location, arrangement and schematic of the BESS);
- II. BESS specification (including battery specification and chemistry and fire detection and suppression system);
- III. Operational procedure and training requirements (including emergency operating procedures);
- IV. Statement of compliance to applicable legislation;
- V. Environmental Risk Assessment (including the potential for indirect risk and mitigation using the best available techniques for the specific battery chemistry); and
- VI. An emergency plan covering construction, operation and decommissioning of the Project (should be developed in consultation with SWFRS and include a firefighting strategy).