

Outline Battery Safety Management Plan

Installation and operation of Battery Energy Storage System (BESS)

**Land at Mitchells Industrial Park, Bradberry Balk Lane, Wombwell,
Barnsley, S73 8HR**

Prepared By

Mercia Power Response



Report Reference: Battery Safety Management Plan - Mitchells BESS

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SITE ADDRESS:

Land at Mitchells Industrial Park
Bradberry Balk Lane
Wombwell
Barnsley
S73 8HR

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REPORT PREPARED BY:

Mercia Power Response (MPR)

APPROVED AND AUTHORISED FOR SUBMISSION BY

Peter Ford
Mercia Power Response
Strelley Hall,
Main Street,
Nottingham,
NG8 6PE

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Abbreviations

ARC	Allianz Risk Consulting
BESS	Battery Energy Storage System
BMS	Battery Management System
DNO	District Network Operator
LFP	Lithium Iron Phosphate
LFRS	Local Fire and Rescue Service
LPA	Local Planning Authority
MPR	Mercia Power Response
NFCC	National Fire Chiefs Council
NFPA	National Fire Protection Association
NMC	Nickel Manganese Cobalt
OBSMP	Outline Battery Safety Management Plan
OEM	Original Equipment Manufacturer

1 INTRODUCTION

- 1.1.1 This Outline Battery Safety Management Plan (OBSMP) has been prepared by Mercia Power Response (MPR) to accompany a full planning application (ref: 2024/1091) submitted to Barnsley Metropolitan Borough Council for a proposed 26 MW Battery Energy Storage System (BESS) at Land at Mitchells Industrial Park, Bradberry Balk Lane, Wombwell, Barnsley, S73 8HR.
- 1.1.2 Mercia Power Response Limited (MPR) was formed in 2015 and is a specialist electrical power generation company that contracts to the National Grid.
- 1.1.3 We currently operate 38 no. sites with a combined capacity of 284 MW and have a number of other sites under development and construction. We aim to grow our gas-fuelled power station capacity to about 300 MW by 2025.
- 1.1.4 We are also developing grid-scale battery storage sites to complement our existing gas-fueled power stations. These batteries will be used to store electricity when there is excess power, to be used during periods when the grid is short of power. We have a strong pipeline of sites, with a combined capacity of over 400 MW in the later stages of pre-construction development.

More details are available on our website - <https://www.merciapr.co.uk/>

1.1 Background

- 1.1.1 The OBSMP details the current regulatory guidance reviewed by MPR to ensure that all safety concerns around the BESS are understood, accounted for, and mitigated, in consultation with stakeholders where required.
- 1.1.2 Before the construction commencement, this outline plan will be developed further in consultation with the preferred battery supplier and relevant stakeholders, including the Local Fire and Rescue Service (LFRS) and the Local Planning Authority (LPA).

1.2 Document Structure

- 1.2.1 The OBSMP is structured as follows:
- Introduction
 - Description of the Proposed Development
 - BESS Guidance
 - BESS Design
 - Emergency Planning
 - Summary

2 THE PROPOSED DEVELOPMENT

2.1.1 In summary, the installation will comprise the following elements:

- 13 no. battery storage units
- 7 no. electrical transformers
- 1 no. high voltage DNO electrical switchgear compound
- 1 no. high voltage DNO 66kV transformer
- 1 no. electrical switchroom building
- 1 no. welfare/control kiosk
- Low level lighting fixed to battery containers, kiosks and the 3 No. CCTV poles
- Ancillary infrastructure including cabling and trenching, concrete plinths/bases, 2.4m height wire mesh entrance gate and boundary fencing.

2.2 Risk Mitigation Philosophy

2.2.1 The MPR philosophy toward risk reduction during the design phase of a project is hierarchical and is to eliminate, then reduce, isolate and finally control.

2.2.2 This is consistent with the duties outlined in the Construction (Design and Management) Regulations 2015, Guidance document L153 which states:

- *The principal designer must, as far as reasonably practicable, ensure that the design team:*
- *(a) eliminate the risks associated with design elements. If this is not possible (for instance because of competing design considerations such as planning restrictions, specifications, disproportionate costs or aesthetics):*
- *(b) reduce any remaining risks; or*
- *(c) control them,*

3 BATTERY ENERGY STORAGE SYSTEM GUIDANCE

3.1.1 MPR has reviewed several guidance documents listed below during the preparation of this OBSMP to ensure the range of potential risks are identified, understood and mitigated. MPR will ensure that the detailed design of the BESS will comply with any future amendments to UK (or other relevant) legislation, at the time of construction.

3.1.2 The following documents have been reviewed as part of this OBSMP:

Guidance

- NFPA 855, Standard for the Installation of Stationary Energy Storage Systems [1]
- Allianz Risk Consulting, Tech Talk Volume 26. BESS using Li-ion batteries [2]
- The Energy Institute: Battery Storage Guidance Note 1 - Battery Storage Planning [3]
- NYSERDA, Considerations for ESS Fire Safety [4]
- Technical Reference for Li-ion Battery Explosion Risk and Fire Suppression [5]
- Grid Scale Battery Energy Storage System planning – Guidance for Fire and Rescue Services [6] & Draft NFCC Grid Scale Energy Storage System Planning – Guidance for Fire and Rescue Services. July 2024 Revision [6a].
- Energy Storage & Flexibility Innovation. Health and Safety Guidance for Grid Scale BESS [7]

Incident Reports

- Hazard Assessment of Battery Energy Storage Systems [8]
- McMicken Battery Energy Storage System Event Technical Analysis and Recommendations [9]
- Accident analysis of Beijing Jimei Dahongmen 25 MWh DC solar-storage-charging integrated station project Certification and Standards [10]
- Four Firefighters Injured In Lithium-Ion Battery Energy Storage System Explosion – Arizona [11]

3.1.3 The equipment forming the BESS will be certified to all relevant standards which requires on-site testing and extensive diligence of the cell, module, and system-level limits. The relevant industry best practices and the latest guidance also need to be considered in the design of the BESS.

3.1.4 The BESS should be listed to the following standards by Nationally Recognized Testing Laboratories:

- UL 1642 (cell-level certification)
- UL 1973 and IEC 62619 (battery module-level certification)
- UL 9540, IEC 62933-5-2, IEC 62109-1 (system-level certification)
- UL 1741, CSA C22.2 #107.1 (power electronics)
- UL 1998 and IEC 60730 Annex H (functional safety of software)
- IEC 61000-6-2, and EN 55011 (EMC)

- UN 38.3 (transportation, self-certified)
- IEEE 693 (seismic safety)
- UL 9540A (large-scale fire testing): Tested at the cell, module, and unit level

UL9540A

- 3.1.5 A key fire safety standard is UL9540A – “Test Method for Evaluating Thermal Runaway Propagation in Battery Energy Storage Systems”.
- 3.1.6 The standard describes destructive test methods for forced initiation of thermal runaway and seeks to identify if and how quickly thermal runaway propagates between cells, modules, and enclosures. To positively pass these tests, the batteries need to show no propagation of thermal runaway between cells, modules and racks.
- 3.1.7 All cells, modules and racks to be installed at the proposed BESS Site will have passed the UL9540A evaluations for thermal runaway fire propagation.

4 BATTERY ENERGY STORAGE SYSTEM DESIGN

4.1 Technology Selection

- 4.1.1 It is proposed that the BESS will use Lithium-Ion battery technology, more specifically Lithium Iron Phosphate (LFP) chemistry. This is considerably lower risk of fire when compared to Nickel Manganese Cobalt (NMC) battery technology.
- 4.1.2 LFP batteries can deliver rapid discharge and recharge while generating very little heat. They require little ventilation or cooling and can withstand high temperatures without decaying.
- 4.1.3 The cells are capable of meeting rated power in ambient temperatures between -30°C and 50°C. Each cell will be continually monitored to ensure that they stay within this range.
- 4.1.4 The 13 no. battery storage units consist of battery cells aggregated into modules, and power electronics modules. Both are thermally managed by an integrated liquid cooling and heating system for thermal safety, enhanced performance, and reliability. The design also includes sensors supporting embedded monitoring and controls, electrical interface equipment, and an industry-standard breaker for AC protection.

4.2 Battery Management System

- 4.2.1 A critical component of every BESS is the Battery Management System (BMS), a continuous monitoring and control system. The BMS will ensure early detection of abnormal battery conditions or deviations in normal system operation.
- 4.2.2 Immediately upon the detection of abnormal conditions, the

charging/discharging capability of the affected component will be reduced to ensure the maintenance of safe operation. If a set trigger level is breached, then the component will be electrically isolated from the BESS until inspected by an operations engineer.

- 4.2.3 The BESS will also be monitored remotely by the MPR control room, which can schedule appropriate maintenance by our in-house and external operations engineers when required. MPR currently operate 38 no. power generation Sites across the UK and these are managed by our control room team.

4.3 Layout and Separation Distances

- 4.3.1 The BESS has been designed to prevent the spread of fire between battery units. The battery units will be spaced according to the recommendations of NFPA 855 [1] at a minimum of 3m from buildings and other receptors.
- 4.3.2 One of the primary concerns that NFPA 855 [1] tries to address is the potential fire and explosion hazards associated with a BESS. To control this hazard, the codes specify very stringent limits for energy capacity and separation distances. For example, the current ICC International Fire Code (2021 IFC) limits BESS units to be installed with a one-metre separation distance between units and between units and any wall. The NFPA 855 [1] editions allow the code authority to approve larger individual BESS units and separation distances of less than one-metre based on large-scale fire testing conducted in accordance with the UL 9540A Test Method.

4.4 Deflagration Venting

- 4.4.1 In the very unlikely event of propagating thermal runaway, the release of gases from the batteries may occur. If these gases reach a threshold concentration level within the enclosures, they may become combustible and could potentially create an explosive atmosphere. This was a key contributing factor to the McMicken thermal runaway event [8].
- 4.4.2 As per NFPA 855 [1], deflagration panels within every battery enclosure are required to prevent pressure build-up within the enclosure, minimize structural and mechanical damage, and more importantly, minimize the safety risk to operators or first responders.

4.5 Fire Detection and Suppression

- 4.5.1 All battery enclosures will have an integrated fire detection and suppression system compliant with BS EN 54 - Fire detection and fire alarm systems.
- When batteries first show signs of physical distress, they release gases (such as carbon monoxide, hydrogen, ethane, and propane) created by heating and/or chemical processes in the

cells. If these gases are detected, then the system will electrically isolate the affected enclosure.

- When either the smoke or temperature detectors are triggered, an alarm is raised, and the enclosure is automatically electrically disconnected from the rest of the BESS.
- When both temperature and smoke detectors are triggered an external horn and strobe light are activated to alert nearby personnel before the fire suppression system is deployed.

5 EMERGENCY PLANNING

5.1 Fire and Rescue Service Consultation

- 5.1.1 Prior to construction of the facility, MPR will consult with LFRS to ensure that both parties are fully aware of the site-specific risks associated with firefighting in the BESS facility and that any specific design measures can be incorporated at an early stage.

Signage

- 5.1.2 Signage shall be installed in a suitable and visible location on the outside of the BESS units identifying the presence of a BESS system. Signage shall also include details of:
- Relevant hazards posed, including data sheets and COSHH
 - The type of technology associated with the BESS
 - Details of the fire suppression system fitted
 - 24/7 Emergency Contact Information
- 5.1.3 Signs on the exterior of a building or enclosure shall be sized such that at least one sign is legible at night at a distance of 30 metres or from the Site boundary, whichever is closer.
- 5.1.4 Adherence to the Dangerous Substances (Notification and Marking of Sites) Regulations 1990 (NAMOS) shall also be considered where the total quantity of dangerous substances exceeds 25 tonnes.

6 SUMMARY

- 6.1.1 The OBSMP outlines the guidance documents used by MPR to design the proposed BESS at Land at Mitchells Industrial Park, Bradberry Balk Lane, Wombwell, Barnsley, S73 8HR.
- 6.1.2 The safety concerns around the Mitchells BESS development have been reviewed and addressed in this document. MPR is implementing a variety of fire risk mitigation strategies into the design and will also carry out further work to ensure that LFRS has an adequate emergency response plan in place before the project is operational.
- 6.1.3 BESS technology continues to evolve, and MPR will continue to review regulations and manufacturers' guidelines to ensure the design meets current best practice standards.

7 REFERENCES

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