Steeple Renewables Project

Appendix 4.3: Outline Fire Risk Management Plan

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Appendix 4.3: Outline Fire Risk Management Plan

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Outline Fire Risk Management Plan

Steeple BESS

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04	16/03/2026	[redacted]r	Update in 3.3.6 to confirm refill of water tank prior to recommissioning of the site. Updates to align with ~~latest~~ 2025 NFCC guidance in 3.2, 3.3.1, 3.3.4 and new sections 3.4 and accompanying Appendix D.

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1 Introduction

This document forms the Steeple BESS Outline Fire Risk Management Plan. The document indicates how the project has been developed to address fire risk in several ways. It contains key mitigation measures against the risk of fire ignition and propagation within the Battery Energy Storage System (BESS) site.

Fire safety of BESS is governed by regulation and international standards out with the planning system. While this report and its appendices do cover some of those standards, the focus of this report is on the location and design considerations as they are relevant for the planning application.

Battery technology and associated understanding of fire risk is continually evolving within the industry. As such, this document sets out key principles and mitigation measures based on the current understanding of battery fire risk but does not include a detailed Fire Risk Management Plan. A detailed Fire Risk Management Plan would be developed during detailed design, following battery selection.

2 Project Description

2.1 General Project Information

Renewable Energy Systems Ltd (RES) is developing a 150MW BESS facility near West Burton Substation as part of the Steeple Renewables project. The BESS will consist of Battery Storage Enclosures (BSEs), Power Conversion Systems (PCSs), transformers, electrical infrastructure, foundations, access track, crane hardstanding, and spares storage containers. The grid connection will be made via a 400kV substation that serves the wider Steeple Renewables project as well as the BESS facility.

2.2 Battery Selection

The proposed battery technology for the development is anticipated to be lithium iron phosphate (LFP). LFP has better thermal stability and enters thermal runaway at higher temperatures compared to some other battery chemistries. This is demonstrated by the UL 9540A test results of RES' preferred battery system which show that, at a unit level following deliberate initiation of thermal runaway:

- No flaming outside the initiating battery rack was observed.
- Surface temperatures of modules within the target battery rack adjacent to the initiating battery rack do not exceed the temperature at which thermally initiated cell venting occurs.
- Wall surface temperature rise does not exceed 97°C above ambient.
- Explosion hazards were not observed during the test.

Data from UL9540A testing can also be used to inform detailed design of the site and safety systems.

Each BSE has an approximate footprint of 6.1 x 2.4m. The exact battery form factor and capacity will be determined during detail design phase and would be documented within the detailed Fire Risk Management Plan.

3 Design Factors

3.1 RES Internal BESS Safety Best Practice Principles

Based on available standards, construction and operation experience, RES has developed internal best practice to manage the safety of battery energy storage systems. A document summary of these principles can be found in Appendix A.

3.2 Fire Response Strategy

It is the intention that the site would be self-sufficient during a potential battery-based fire event and would not require fire service intervention to prevent fire spread or any other significant risks to people or property. Key principles of the NFCC Grid Sscale Battery Eenergy Sstorage Ssystem planning – Guidance for fire and rescue services, 2025 FRS, 2023 ("the NFCC Guidance") are addressed through the mitigations identified within this report, as these pertain to the fire risk management strategy set out below.

The overarching fire risk management strategy would adopt the following controls:

1. Implement measures that result in a very low risk of fire ignition and any suitable environment for sustaining fire.
2. Implement measures that result in a very low risk of fire propagation and spread within a fire source (e.g. BSE).
3. Ensure fire spread between significant elements of the project is not expected, through application of design standards and use of calculations / modelling as necessary.
4. Include adequate provisions to allow the fire service to monitor a fire event, intervening only if there is a failure of the controls above.

Due to the risks associated with lithium-ion fires, transformer fires, and high-power equipment, there are significant safety benefits to minimising fire service intervention and consequential firefighter hazard exposure.

During detailed design, following battery product selection this Outline Fire Risk Management Plan will be developed into a detailed plan, in liaison with the Fire Service and with due consideration of the NFCC Guidance. The detailed Fire Risk Management Plan will include:

- A fire risk appraisal that details how the fire response strategy above will be achieved, including the identification and design of any further mitigations required to achieve the strategy above.
- An emergency response plan.

3.3 Mitigation Measures

The following points define the key preliminary design mitigations against the risk of fire ignition and propagation within the BESS site. For a detailed assessment of how the layout meets the recommendations of current NFCC guidance, please refer to Appendix B.

3.3.1 Equipment spacing

The site has been developed to include adequate spacing between BSEs to mitigate against the risk of fire spread in the event of a fire within one BSE. The site layout aligns with applicable NFPA 855 spacing criteria as well as the spacing recommendations outlined in FM Global Property Loss Prevention Datasheet 5-33 (Interim revision April~~January~~ 2024~~5~~).

The current layout is based on a minimum distance of 3m between battery enclosures side-to-side and 0.3m end-to-end. As per latest NFPA 855 guidance, a separation of less than 0.914m can be justified based on large-scale fire testing. Although a particular battery enclosure product hasn't been specified at this stage, there are several products currently on the market that have passed a large-scale fire test with BSEs being separated by 0.3m or less. Whichever product is specified during detailed design, it will have passed a large-scale fire test to inform and confirm the final spacing between BSEs.

3.3.2 Protection systems

Each BSE will have a dedicated fire protection system, comprising flammable gas detection and venting, fire detection and alarm, and an automatic fire suppression system. Additionally, key battery health and environment parameters will be continuously monitored with alarms sent to a control centre. Automatic electrical disconnection will be enacted by the battery management system should operational temperature, current or voltage limits be breached. There will be levels of alarms prior to protection limits which warn the operator of proximity to safe operating limits. BSEs will be fitted with deflagration venting and explosion protection appropriate to the hazard.

3.3.3 Access to battery storage enclosure

All BSEs will be accessed via external doors only, i.e. no internal corridor to eliminate the risk of people being inside an enclosure during a fire or thermal runaway gas venting incident.

3.3.4 Location of BESS facility

The location of the facility has been selected considering the distances from existing nearby premises. There are no premises nearby site, with the nearest one to site to be more than 350m in distance. A distance of at least 30~~25~~m is achieved between BSEs and the Steeple Renewables project site boundary~~, in line with NFPA 855 (2023)~~, and there are no existing or planned bushes or trees within 3~~10~~m of any BSE.

3.3.5 Access for emergency services

Should the fire services need to attend the site, the fenced BESS compound has a wide access route through east corridor and through centre, allowing the fire service to access the site during an incident. In addition, two site access points are proposed to ensure that fire services have an alternative option for approaching site if the combination of wind direction and smoke makes one direction particularly onerous.

A wind frequency rose acquired by Global Wind Atlas website indicates that the prevailing wind direction for the area is from the southwest. Given the relative distances between the proposed BESS compound and the site entrances, as well as the prevailing wind direction, it is assessed as unlikely that both site access points will simultaneously experience obscuration due to adverse conditions at the same time. The wind rose is also shown in Appendix C.

Turning locations for emergency response vehicles are available within the site hardstandings and at the main entrance gates.

The proposed access tracks geometry has been designed to facilitate fire response vehicle access, with a minimum width of 4m, incorporating wider sections at bends. The tracks will be designed and constructed to provide a minimum carrying capacity of 12.5t per axle.

Environment Agency (EA) surface water flood mapping identifies areas of surface flood risk—defined as having a 1% annual probability of reaching a flood depth of 200 mm—within the eastern and southern sections of the BESS facility compound, as well as along parts of the access tracks. Two isolated areas of higher risk are also identified: one along the northern access track and another in the northeastern part of the compound, both with a 3.3% annual probability of reaching the same flood depth.

The preliminary design of the BESS facility incorporates a range of mitigation measures to address these risks. Surface water drainage infrastructure is included throughout the site, and earthworks will raise the finished compound level by a minimum of 200 mm above existing ground levels. Access tracks will be designed with a cross-fall to promote surface water runoff.

In the event of surface water flooding, a flood depth of 200 mm is not expected to compromise access to the site, including for emergency response vehicles. Furthermore, an alternative access route—located outside of identified flood risk zones—will be available to ensure uninterrupted access for fire and rescue services if required.

Local fire rescue services will be given the ability to gain access to the BESS compound even if the site is unmanned. Details of the access procedure will be developed as part of the detailed fire risk management plan, and will be included in the emergency response plan, but the procedure is anticipated to comprise the inputting of a key code.

3.3.6 Water supply

As outlined in Section 3.2, there are significant safety benefits to minimising fire service intervention during lithium-ion fires, transformer fires, and high-power equipment fires. Notwithstanding this, the need for fire service intervention cannot be ruled out; an on-site water supply will therefore be made accessible in line with current NFCC guidance.

Current NFCC guidance states a water supply of 1,500 litres per minute for a least two hours should be accessible on site, equating to a minimum volume of 180m^3. Whilst the final water supply solution will be determined through development of a detailed fire risk management plan, two solutions to comply with this guidance are identified in this preliminary assessment.

Utility records indicate the nearest public water mains to site are within North Street ~470m to the southwest, or Gainsborough Road ~860m to the northwest. A piped hydrant could be constructed on site that is served by one of these public mains. Should this option be found not to be viable during detailed assessment, fire

water can instead be stored in tanks on site. Two spatial provisions for water tanks have been included in the preliminary BESS layout, both measuring 17m x 13m.

If onsite storage is opted for as the supply solution, a storage tank product will be specified during development of the detailed fire risk management plan. There are numerous tank products currently on the market that can store 180m^3 water whilst fitting within a 17m x 13m area.

Tanks would be filled with clean water from water tankers before site operation. In the event of a fire, the tanks would be refilled from water tankers once safe to do so following the event. Site operation will not recommence until the tanks have been refilled with 180m^3 of water.

The tank spatial provisions are located adjacent to tracks such that fire tender vehicles can easily extract water during a fire event, and a vehicular tanker can easily refill the tanks following an event.

The existing potential firefighting water sources and the provisioned water storage areas are identified in Appendix C.

3.4 Sensitive Receptors Assessment

Sensitive receptors within 1km of the site which could be affected by a fire have been assessed in Appendix D. This includes their identification on a plan in Appendix D1 and a risk assessment in Appendix D2. The following receptors were considered in the assessment:

- Schools, hospitals, nursing and care homes, residential areas, and workplaces.
- Protected habitats, watercourses, groundwater, boreholes, wells, and springs supplying water for human consumption.
- Roads, railways, bus stations, pylons (on or immediately adjacent to the site only), utilities, and airports.

4 Operational Factors

As well as mitigations to make the site inherently safer by design and the inclusion of active and passive controls, operational mitigations will be implemented to manage fire risk. This section states the operational factors which will be addressed in the detailed Fire Risk Management Plan.

4.1 Emergency Response Plan

The Emergency Response Plan will be developed in line with the detailed Fire Risk Management Plan. It will outline how the operator will respond to incident and accident scenarios on site including clear guidance for first responder organisations.

4.2 Hazard Identification and Mitigation Analysis

During detailed design, project and equipment specific hazards will be identified. Actions taken to mitigate those hazards will also be identified and residual risks will be communicated as part of the emergency response plan.

4.3 Hazardous Material

Any hazardous materials stored at the BESS facility will be fully justified and detailed in the emergency response plan. This will detail the location, description, quantity and appropriate precautions.

4.4 Safety Management Structure

The BESS safety management structure is yet to be fully defined but will include a formal top-down management structure that has the authority and responsibility to make decisions in design, procurement, construction and operation that places safety and environmental risk at forefront.

4.5 Staff Competence

The detailed Fire Risk Management Plan will ensure that all personnel who have responsibility for safety or activities which could impact the surrounding environment are competent to discharge those responsibilities.

5 Conclusion

During the preliminary design, efforts have been made to mitigate fire hazards on site by incorporating specific design factors as described in this Outline Fire Risk Management Plan.

During detailed design and following battery product selection, a detailed Fire Risk Management Plan will be developed. This will include a project specific fire risk appraisal, which will be used to verify and finalise the strategy presented in this document, and an emergency response plan, which will be developed through liaison with the local fire service.

Appendix A RES BESS safety best practice principles

Appendix B Project Specific NFCC Recommendations Assessment

Appendix C Outline Fire Risk Management Layout

Appendix D Sensitive Receptors Assessment