POWER FOR GOOD

Steeple Renewables Project

Appendix 4.3: Outline Fire Risk Management Plan

Environmental Statement - Volume 2

January 2026

Document Reference: EN010163/EX/6.3.4

Revision: 2 (Clean)

The Infrastructure Planning (Examination Procedure) Rules 2010

Rule 8(1)(b)

Appendix 4.3: Outline Fire Risk Management Plan

Document Properties		
Prepared By	The Steeple Renewables Project Consultant Team	
Version History		
Version	**Date**	**Version Status**
Application Version	April 2025	Rev 1
Examination Version	January 2026	Rev 2

Outline Fire Risk Management Plan

Steeple BESS

Ref	04954-9829732

Revision History

Issue	Date	Name	Latest changes
01	11/04/2025	Felix Klenner	First Created
02	18/12/2025	Felix Klenner	Updates in 3.3.6 and Appendix B (items 9 and 12) following feedback from the Environment Agency

Contents

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 Scale Battery Energy Storage System planning – Guidance for 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 each pair of 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 January 2024). The layout allows minimum distance of 3m between pairs of battery enclosures and any other infrastructure.

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 25m 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 10m 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.

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 at this early stage.

While water supply provisions will be determined during detailed design in consultation with the fire service, allowance has been made in the preliminary design for a water supply of 1,900 litres per minute for at least two hours in line with current NFCC guidance.

Water supply options are identified within this preliminary assessment; the final supply solution will be determined through development of the detailed fire risk management plan.

An existing fire hydrant is located approx. 1 kilometre from site, which the fire service could connect to in the event of a fire. Alternatively, a piped hydrant could be constructed within / adjacent to site, that connects either to the existing fire hydrant, or to an existing water main that runs along Gainsborough Road. Should the detailed assessment determine that connecting to existing water infrastructure is not viable, provision has been made within preliminary BESS layout for potential water tank locations.

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

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 NFCC Recommendations Cross-Referenced to the BESS Layout and Design

Item	NFCC 2022 BESS Guidance Recommendation	Design factors / mitigations	Impact of Draft 2024 NFCC BESS Guidance
1	Access - Minimum of two separate access points to the site	The site benefits from two distinct access points connected to Gainsborough Road and Common Lane. The primary site access is located approximately 740 meters west of the proposed BESS compound, while the secondary access is situated approximately 80 meters south of the compound. A wind frequency rose acquired by Global Wind Atlas website presented in Appendix C, 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 access points, as well as the prevailing wind direction, it is unlikely that both site access points would simultaneously experience obscuration due to adverse conditions at the same time.	No change
2	Roads/hard standing capable of accommodating fire service vehicles in all weather conditions. As	The proposed access track and BESS internal compound access corridor geometry have been designed to facilitate fire response vehicle access, with a minimum width of 4m, incorporating wider sections at bends. The tracks	No change

	such there should be not extreme grades.	will be designed and constructed to provide a minimum carrying capacity of 12.5t per axle. The proposed access tracks will be designed and constructed in line with appropriate industry guidance and in agreement with the fire and risk services to ensure an appropriate surface and gradient for the intended use.	
3	A perimeter road with passing place suitable for service vehicles	The BESS compound layout allows circular routes including internal compound hardstandings and the access track on the west. The routes run around the compound and between electrical equipment allowing access to all BESS units as indicated in Appendix C. There is adequate space within the BESS compound for vehicles to pass.	No change
4	Access tracks and BESS internal compound corridors must enable unobstructed access to all areas of the facility	The BESS internal compound corridors run around the BESS units, thus allowing access to all BESS units. The site meets requirements of Building Regulations Approved Document B Vol 2 allowing all points on site to be within 45m of a fire appliance when required.	No change
5	Turning circles, passing places etc. size to be advised by FRS depending on fleet	The BESS internal compound corridors allow access to all BESS units (see Appendix C) in two different directions and allow for FRS vehicles to drive in and drive out without need to reverse. In case that the FRS need to manoeuvre, the layout has allowed several turning points, which achieve the minimum width and bend radius	No change

		outlined in Building Regulations Approved Document B Vol 2 Table 15.2.	
6	Distances from BESS units to occupied buildings and site boundaries.	There are no premises within 25m of BESS units, the nearest residential dwelling is more than 350m. The site boundary is minimum 150m distance from BESS units.	Guidance increases initial min distance to boundary to 30m **Response:** While the new guidance suggests 30m, the design remains safe, with no sensitive receptors nearby in a rural area. No impact from change in guidance.
7	Access between BESS units – minimum of 6.0m suggested.	The suggested 6.0m separation is based on a 2017 Issue of the FM Global Loss and Prevention Datasheet 5-33 (footnote 9 in the NFCC Guidance). This Datasheet has been revised in July 2023 and again in Jan 2024 and it now details the following items: • For containerized LIB-ESS comprised of Lithium iron phosphate (LFP) cells, provide aisle separation of at least 5ft (1.5m) on sides that contain access panels, doors, or deflagration vents. The current site layout has been developed to include adequate spacing between the battery storage enclosure (BSE) (3m when side to side - 0.3m when end-to-end) to mitigate against the risk of fire spread in the event of a fire within one BSE. The layout allows minimum distance of 3m between batteries enclosures and any other infrastructure.	Recommended spacing distance of 6.0m removed from guidance. New spacing recommendation is reduced to approx. 1m assuming that the BESS will be fire certified to UL9540A or equivalent. BESS units are not to be vertically stacked. **Response:** The current site layout does not allow for vertical stacked BESS. No impact from change in guidance.

8	Areas within 10m of BESS units to be cleared of combustible vegetation	There is no existing vegetation or proposed in the design within 10m of BESS units.	No change
9	Water supply	While water supply provisions will be determined during detailed design in consultation with the fire service, allowance has been made in the preliminary design for a water supply of 1,900 litres per minute for at least two hours in line with current NFCC guidance. Water supply options are identified within this preliminary assessment; the final supply solution will be determined through development of the detailed fire risk management plan. An existing fire hydrant is located approx. 1 kilometre from site, which the fire service could connect to in the event of a fire. Alternatively, a piped hydrant could be constructed within / adjacent to site, that connects either to the existing fire hydrant, or to an existing water main that runs along Gainsborough Road. Should the detailed assessment determine that connecting to existing water infrastructure is not viable, provision has been made within preliminary BESS layout for potential water tank locations.	Guidance water supply recommendation has a reduced requirement of 25 l/s (1500 l/m). **Response:** The current requirement is less onerous than the proposed in the draft NFCC 2024. No impact from change in guidance.

		The existing potential firefighting water sources and the provisioned water storage areas are identified in Appendix C.	
10	Signage	Signage will be positioned at the entrance to the Site, including a site layout plan and details of the key personnel.	Guidance notes that adherence to the dangerous substances (Notification and marking of Sites) Regulations 1990 (NAMOS) should be considered where the total quantity of dangerous substances exceeds 25 tonnes. **Response:** It is understood that lithium-ion batteries are Class 9 dangerous goods under the European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR) which is applicable under NAMOS via Carriage of Dangerous Goods (CDG). NAMOS will be adhered to, and the emergency response plan will detail the location, description and quantity of dangerous goods and appropriate precautions for dealing with them.
11	Emergency Plan	An emergency response plan will be developed for the site prior construction that will be adopted during construction and operation phases.	1. Guidance recommends identification of sensitive receptors within 1km to allow appropriate emergency planning. **Response:** There are numerous receptors identified within 1km due to premises on north of Sturton le Steeple. A sample of representative, likely

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<td>habited properties, most sensitive are described below:
<table><tr><th>Receptor</th><th>Distance (m)</th><th>Direction</th></tr><tr><td>Low Holland Lane</td><td>450</td><td>South</td></tr><tr><td>Manor Farm</td><td>400</td><td>South</td></tr><tr><td>Caddow View</td><td>600</td><td>Southwest</td></tr><tr><td>4 Brickings Way</td><td>700</td><td>Southwest</td></tr><tr><td>North Street</td><td>850</td><td>West</td></tr><tr><td>Watkins Lane</td><td>520</td><td>West</td></tr><tr><td>Gainsborough Road</td><td>800</td><td>West</td></tr></table>2. Guidance recommends wind rose to be included showing north and prevailing wind direction.

Response: A wind rose is shown with the site layout and north direction at Appendix C.

No impact from change in guidance</td>
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<td>12</td>
<td>Environmental Impacts</td>
<td>The use of water in the firefighting process risks mobilising combustion contaminants.

The surface water drainage infrastructure proposed for site has been designed to contain</td>
<td>1. Suitable environmental protection measures should be provided. This should include systems for</td>
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		such contaminated firefighting water runoff, preventing it from entering any existing above and below-ground water sources. The contained firefighting runoff can be pumped out into a tanker and disposed of safely off-site. The preliminary firefighting runoff containment design is detailed within the project Surface Water Drainage Strategy (Appendix 8.2, doc ref EN010163/APP/6.3.8).	containing and managing water runoff. **Response**: As noted, the drainage scheme includes allowance for firefighting runoff attenuation. 2. Sites located in flood zones should have details of flood protection or mitigation measures. A Flood Risk Screening and Drainage Management Plan has been submitted as part of the planning application. **Response:** 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. No impact from change in guidance
13	System design, construction, testing and decommissioning	Testing and decommissioning information will only be available at detailed design stage.	No change
14	Deflagration Prevention and venting	Details will be available at detailed design stage, but equipment will be in line with NFPA855 which includes requirements for explosion prevention and venting.	No change

Appendix C Outline Fire Risk Management Layout