Cambridgeshire Fire and Rescue Service
Hinchingbrooke Cottage
Brampton Road
Huntingdon
PE29 2NA
01480 444500

The Planning Inspectorate

Ref: Kingsway Solar Farm
PINS Ref ENO10165

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Cambridgeshire FRS Response to Kingsway Solar Farm

To whom it may concern,

On behalf of Cambridgeshire Fire and Rescue Service I formally provide our consultation response regarding the Kingsway solar farm application. It must be noted that Cambridgeshire Fire and Rescue received this consultation at relatively short notice and therefore were unable to respond before the closure of the consultation window. However, I am submitting this response to be added to the document library if possible.

This document relates to Battery Energy Storage Systems (BESS) which are deployed in open air environments with an energy capacity of 1 megawatt (MWh) or greater using lithium variant batteries. The principles contained within this document may also be relevant to other battery technologies, advice should however also be sought from a competent person.

This document identifies key areas regarding the prevention of fire in BESS installations and the actions and protective measures for fire service personnel, employees and the public in the event of a fire occurring.

1. **Effective identification and management of hazards and risks specific to the siting, infrastructure, layout, and operations at the facility.**

1.1 Containers

The type of BESS container will make a difference to the Fire Service's ability to fight fires and ensure the protection of BESS site workers. The older design takes the form of shipping containers that staff enter to carry out their work. The newer style is a cabinet-based approach with doors on the outside of the unit to allow access to the battery trays and electrical components. This reduces the risk to employees and Fire staff who would not need to enter the container to search for employees. This information should be submitted as early as possible to allow an initial appraisal to be made.

1.2 Spacing Between Cabinets

The National Fire Chief's Council (NFCC) does not support the vertical stacking of containers or units on top of each other based on the level of risk from the vertical fire spread between the BESS, the fire loading and the difficulty in gaining access.

The emergency response plan should be predicated on the scenario of the fire will not spread beyond the BESS container of origin. Fire and rescue operations should be limited to boundary cooling of surrounding BESS and monitoring the BESS involved in the thermal event.

This outcome can be achieved through several different routes including:

- Adequate separation between the BESS enclosures to ensure that radiant heat from a thermal event in one BESS will not trigger a secondary event.
- Provision of fire-resistant materials that will prevent direct flame impingement or radiated heat affecting adjacent BESS and allowing the incident to develop beyond BESS of origin.

The provision of a suppression system to the BESS is unlikely to provide a compensatory feature to allow reduced spacing between BESS. If the developer cannot demonstrate that a thermal event / fire can be contained to the BESS of origin, then the developer should be referred to guidance such as the separation distances within NFPA 855 (current edition - 2023).

1.3 Batteries

It should be determined what style of batteries are to be used and that the appropriate testing has been carried out. Whilst there are different characteristics of lithium-ion batteries (e.g. NMC, LFP and other chemistry types) involved in a fire, the overall risks

they present to firefighters are similar. Specifically, they may all involve toxic, flammable and / or explosive vapour clouds. They may also result in intense flaming combustion.

1.4 Detection

An effective and appropriate method of early detection of a fault within the batteries should be in place, with immediate disconnection of the affected battery / batteries remotely. This may be achieved through the provision of an effective battery management system (BMS). Specific electrolyte vapour detection systems are available and may be helpful but should not be relied on in isolation as a precursor to a thermal event.

Detection systems should also be in place as part of the risk management process to alert the operator of an event at the site. Appropriate automatic detection such as smoke, gas or radiant heat detectors, as well as continuous combustible gas monitoring within units should be provided in all ESS. Gas detectors should alarm at the presence of flammable gas, shut down the ESS, and cause the switch over to full exhaust of the ventilation system. Sensor locations should be appropriate for the response times, and types of gas detected e.g. hydrogen, carbon monoxide and other volatile organic compounds. External audible and visual warning devices, as well as addressable identification at control and indicating equipment, should be linked to:

1. Battery management system (when a thermal runaway event is identified)
2. Detection and suppression system activation

This will enable first responders to understand what the warning is in relation to, aiding their decision-making and the formation of an incident plan.

1.5 Suppression

The primary role of a fire suppression system in a BESS is to prevent a fire in the ancillary electrical equipment spreading to the battery modules. It may have a limited effect to protect the BESS from external fire spreading to it. All claims of performance of suppression systems need to be supported with appropriate evidence for that specific use case.

The suppression system, regardless of type, will have little effect on a thermal event within the battery cell. Any effectiveness they have will be in preventing cell to cell propagation, rather than fully extinguishing a fire in the cell.

Where the developer proposes that suppression systems are not required in the design, the FRS needs to be satisfied that alternative controls are in place to prevent a fire or other thermal event in the BESS of origin, from propagating to adjacent equipment.

1.6 Explosion Control

BESS containers should be fitted with explosion protection or deflagration venting appropriate to the hazard and battery technology deployed. Designs should be developed by competent persons, with design suitability able to be evidenced. Exhaust systems designed to prevent deflagration should keep the environment below 25% of the lower explosive limit (LEL).

Flames and materials discharged because of any venting should be directed outside to a safe location and should not contribute to any further fire propagation beyond the unit involved or prevent further risk to persons. The likely path of any vented gases or materials should be identified in emergency response plans to reduce the risk to responders.

Likewise, the position of any venting should take account of the likelihood of weather-related ingress of water, to minimise the risk of water damage during the ordinary functioning of the BESS.

2. Safe access for emergency responders in and around the facility, including to renewable energy and firefighting infrastructure.

2.1 Site Access

Suitable facilities for safely accessing and egressing the site should be provided. Designs should be developed in close liaison with the local FRS as specific requirements may apply due to variations in vehicles and equipment.

In achieving adequate access for the FRS, firefighters should not have to enter the BESS site and drive through a vapour / gas cloud to reach the scene of operation. It is therefore preferable to have an alternative access point taking account of the likely wind direction.

The principles contained within Approved Document B in support of B5 may assist in providing a proportionate and adequate provision of access and facilities for the FRS. It must, however, be acknowledged by all, the guidance referenced below is for ‘common building situations’ which BESS are clearly not, therefore it is cited only as potential broad principles.

Table 15.2 from Approved Document B – Typical FRS vehicle access route specification

Table 15.2 Typical fire and rescue service vehicle access route specification

Appliance type	Minimum width of road between kerbs (m)	Minimum width of gateways (m)	Minimum turning circle between kerbs (m)	Minimum turning circle between walls (m)	Minimum clearance height (m)	Minimum carrying capacity (tonnes)
Pump	3.7	3.1	16.8	19.2	3.7	12.5
High reach	3.7	3.1	26.0	29.0	4.0	17.0

NOTES:

1. Fire appliances are not standardised. The building control body may, in consultation with the local fire and rescue service, use other dimensions.
2. The roadbase can be designed to 12.5 tonne capacity. Structures such as bridges should have the full 17-tonne capacity. The weight of high reach appliances is distributed over a number of axles, so infrequent use of a route designed to accommodate 12.5 tonnes should not cause damage.

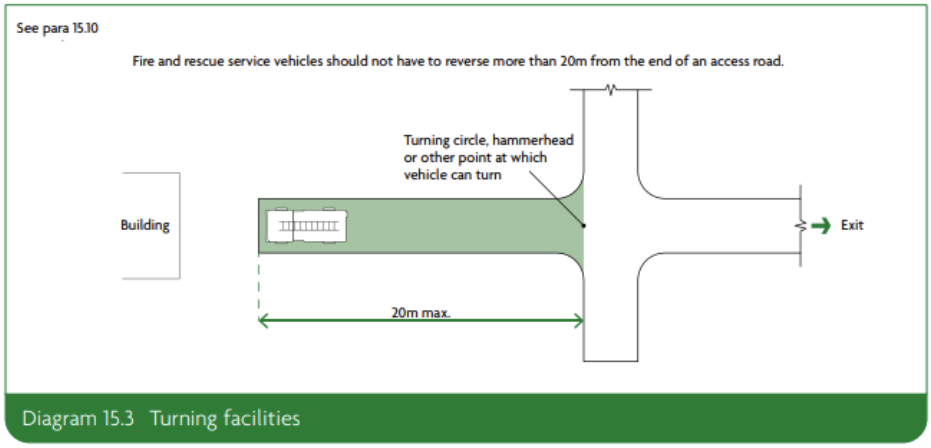

Diagram 15.3 Turning facilities

3. **Provision of adequate water supply and firefighting infrastructure to allow safe and effective emergency response. This could include the provision of water to allow for defensive firefighting to protect surrounding infrastructure.**

3.1 Water Supplies

Pumping fire appliances in the UK typically have a water storage capacity of approximately 1,800-2,000 litres of water which can be exhausted in under five minutes per appliance. Therefore, to supplement the supply of water, the site needs to be supplied with a water supply for FRS to utilise in the event of an emergency.

There must be enough water available for firefighting to take place and to manage a reasonable worst-case scenario. Depending on the site this could be water in storage tanks, lagoons on site, access to hydrants or mains water supply.

The amount of water required will vary and will be dependent on several factors including:

- The size of the incident to be dealt with e.g. 1 x BESS unit
- The principles of the emergency response plan and the expectation of the role of the FRS (firefighting strategy).

- Access and facilities for firefighters on site
- BESS location and proximity to infrastructure or areas of population.
- The requirement to supplement any on site firefighting facility such as a dry pipe sprinkler / deluge system.

3.2 Hydrants

Fire hydrants and connections to any dry pipe systems that are required to be installed on the BESS site should installed in accordance with BS 9990 Non-automatic firefighting systems in buildings code of practice (Current Edition) and should be identified in accordance with BS 3251 Indicator Plates for Fire Hydrants (Current Edition).

Fire Hydrants provided should achieve a flow rate of no less than 25 litres / second at any hydrant on the site. This figure is based on guidance produced by Water UK and the Local Government Association. The flow rate for transportation has been selected as the comparative value for flow rates, rather than that of a domestic housing development or an industrial setting.

3.3 Static Water Supplies

Where a hydrant flow of 25 litres / second cannot be achieved, it would be prudent to provide an equivalent static supply of water on site that will provide for the same flow rate for a duration of 120 minutes. This equates to approximately 180,000 litres of water. Consideration should be given, within the site design, to the management of water run-off (e.g. drainage systems, interceptors, bunded lagoons).

Water supplies for any onsite suppression system will require to be sized independently for the design fire size of the BESS by a competent fire engineer.

Any static water storage tanks designed to be used for firefighting must be located at least 10 metres away from any BESS container / cabinet to allow for safe access and usage. They must be clearly marked with appropriate signage. They must be easily accessible to FRS vehicles and their siting should be considered as part of a risk assessed approach that considers potential fire development / impacts. Outlets and connections should be agreed with the local FRS. Any outlets and hard suction points should be protected from mechanical damage (e.g. through use of bollards).

4. Vegetation sited and managed to avoid increased bushfire and grassfire risk.

4.1 Vegetation Risk

In addition to the risk of an incident occurring within the BESS, the site needs to be maintained to prevent a fire spreading to the BESS or indeed fire loading, by providing a 'bridge' or path between BESS units to transmit flaming or radiant heat.

It is important that no combustible material is adjacent to BESS units and that clear access is maintained. Areas within 10 metres of BESS units should be kept clear of combustible vegetation and all other vegetation within the curtilage of the site should be kept in a condition such that it does not increase the risk of a fire on the site.

Areas with wildfire risk or vegetation that would result in a significant size fire should be factored into the assessment. Additional separation distances should be factored in to prevent a fire spreading to the BESS or increasing the ambient temperature within the BESS above the tolerances of the safe working temperature.

5. Provision of accurate and current information for emergency responders during emergencies.

5.1 Provision of Risk Information

To ensure the provision of risk information to the FRS, the site operator should develop and share an emergency response plan with the local FRS point of contact. There will be variance in the layout and design of each operator's emergency response plan, but it should contain the following broad subject areas:

- How the FRS will be alerted.
- A facility description, including infrastructure details, operations, number of personnel and operating hours.
- A site plan depicting key infrastructure: site access points and internal roads, firefighting facilities (water tanks, pumps, booster systems, fire hydrants, fire hose reels etc), drainage, and neighbouring properties.
- Details of the emergency response co-ordinator including the subject matter expert for the site.
- Safe access to and within the facility for emergency vehicles and responders, including to key site infrastructure and fire protection systems.
- Details and explanation of warning systems and alarms on site and locations of alarm annunciators with alarm details (smoke, gas, temperature).
- Hazards and potential risks at the facility and details of their proposed management.
- The role of the FRS at incidents involving a fire, thermal event or fire spreading to the site.
- Emergency shutoff or isolator locations.

5.2 Environmental Impact Plans

Suitable environmental protection measures should be provided. This should include systems for containing and managing water runoff. System capability / capacity should be based on anticipated water application rates, including the impact of water based fixed suppression systems.

Sites located in flood zones should have details of flood protection or mitigation measures.

6. Effective emergency planning and management, specific to the site, infrastructure and operations.

6.1 Emergency Planning

There must be plans to show all sensitive receptors within a 1km radius of the site that could be affected by a fire. Examples of sensitive receptors may include:

- Schools, hospitals, nursing and care homes, residential areas, workplaces.
- Protected habitats, watercourses, groundwater, boreholes, wells and springs supplying water for human consumption – further habitat information can be found on the Defra MAGiC map website.
- Roads, railways, bus stations, pylons (on or immediately adjacent to the site only), utilities, airports

Plans must have a compass rose showing north and the prevailing wind direction

7. Areas for Fire and Rescue Consideration.

7.1 Consultation with Local Fire and Rescue Services

It is important that early engagement is sought with local FRS's to ensure that fire safety of proposed BESS sites is considered at an early stage. Annex A provides a table of areas that FRS's will seek clarification on with regards to the fire mitigation and action plans of the developer.

Kind Regards
Group Commander Sean Hedger
Head of Protection and Cambridgeshire FRS BESS Working Group Chair
Cambridgeshire Fire and Rescue Service
[redacted]@cambsfire.gov.uk

Annex A

Areas for FRS Consideration	Clarification questions
Thermal event / Deflagration	• How will the proposed BESS perform in the event of a thermal event / deflagration and what proactive / reactive systems are proposed to mitigate this? • How will the thermal event be contained to the BESS of origin without the radiant heat to others? • How has the performance of the BESS in a thermal runaway event influenced site design?
Site plans	• What are the assumptions about active firefighting, within the emergency response plan and what measures are in place to reduce the scale of an incident? • Are the incident assumptions realistic? What is the role of the FRS at an incident? Are they realistic? What is the expectation of the FRS in terms of the fire strategy at a thermal event? • What is the provision for firefighting access to, around and within the site?
Water supply / Suppression systems	• What is the type, purpose and effect of any fire suppression system installed? • What is the purpose of the water supply provision on site? Boundary cooling / defensive firefighting or active suppression?

BESS design	• What is the size, quantity and capacity of each BESS unit? • Is the BESS design appropriate for the weather at the proposed location i.e. prevention of water ingress and impact of temperature range on cooling systems? • Does the applicant / developer have relevant competence and experience in the field of BESS design and deployment on the scale of the proposed development? • What are the arrangements for ongoing monitoring of the BESS and what is the response time for onsite technical assistance in the event of an incident?
Annunciation	• What remote annunciation panels are available for monitoring an event from the site? • What data is available from these remote annunciation panels?
Environmental receptors	• Please refer to Section15 of this guidance.