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# Fire Safety Compliance Plan for Outside Ground Mounted Battery Energy Storage Systems: Voyager BESS Facility, Saline Township, Michigan

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**Revision Control Sheet**

<b>Revision</b>	<b>Section</b>	<b>Change Noted</b>

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## 1.0 INTRODUCTION

Fire and Risk Alliance, LLC (FRA) conducted an installation level code review and prepared a fire safety compliance plan (FSCP) for the Voyager BESS facility in accordance with the requirements of the 2021 Edition of the International Fire Code, with amendments. The analysis evaluates the Hithium Infinity Block Generation 2 (Hithium) battery energy storage system (BESS) intended for installation at the Voyager facility in Saline Township, Michigan. The Hithium BESS is a pre-assembled, non-walk-in (NWI) style lithium-ion BESS container. The Voyager BESS facility has a total site capacity of 100 MW/ 400 MWh.

This FSCP is intended to be used as a tool by the Authority Having Jurisdiction (AHJ) to assist in their review of the Voyager BESS. It was also prepared in accordance with the Saline Township Zoning Ordinance Section 11.10 – Battery Energy Storage Systems. The FSCP has determined that the Voyager BESS complies with the IFC 2021 and Saline Township Zoning Ordinance when installed in accordance with the manufacturer’s instructions, its listing, and the approved drawings.

### 1.1 Applicable Codes and Standards

The minimum codes and standards that apply to this project include:

#### Saline Township

- International Fire Code (IFC) – 2021 Edition (as adopted/amended by Saline Township)
- Saline Township Zoning Ordinance – Section 11.10 – Battery Energy Storage Systems, As Amended November 13, 2024.

#### National Fire Protection Association (NFPA)

- NFPA 69, *Standard on Explosion Prevention Systems* – 2019 Edition
- NFPA 70, *National Electrical Code* – 2020 Edition

#### Underwriters Laboratories (UL)

- UL 1973, *Batteries for Use in Stationary and Motive Auxiliary Power Applications* – 2022 Edition
- UL 9540, *Energy Storage Systems and Equipment* – 2023 3rd Edition
- UL 9540A, *Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems* – 2019 4th Edition

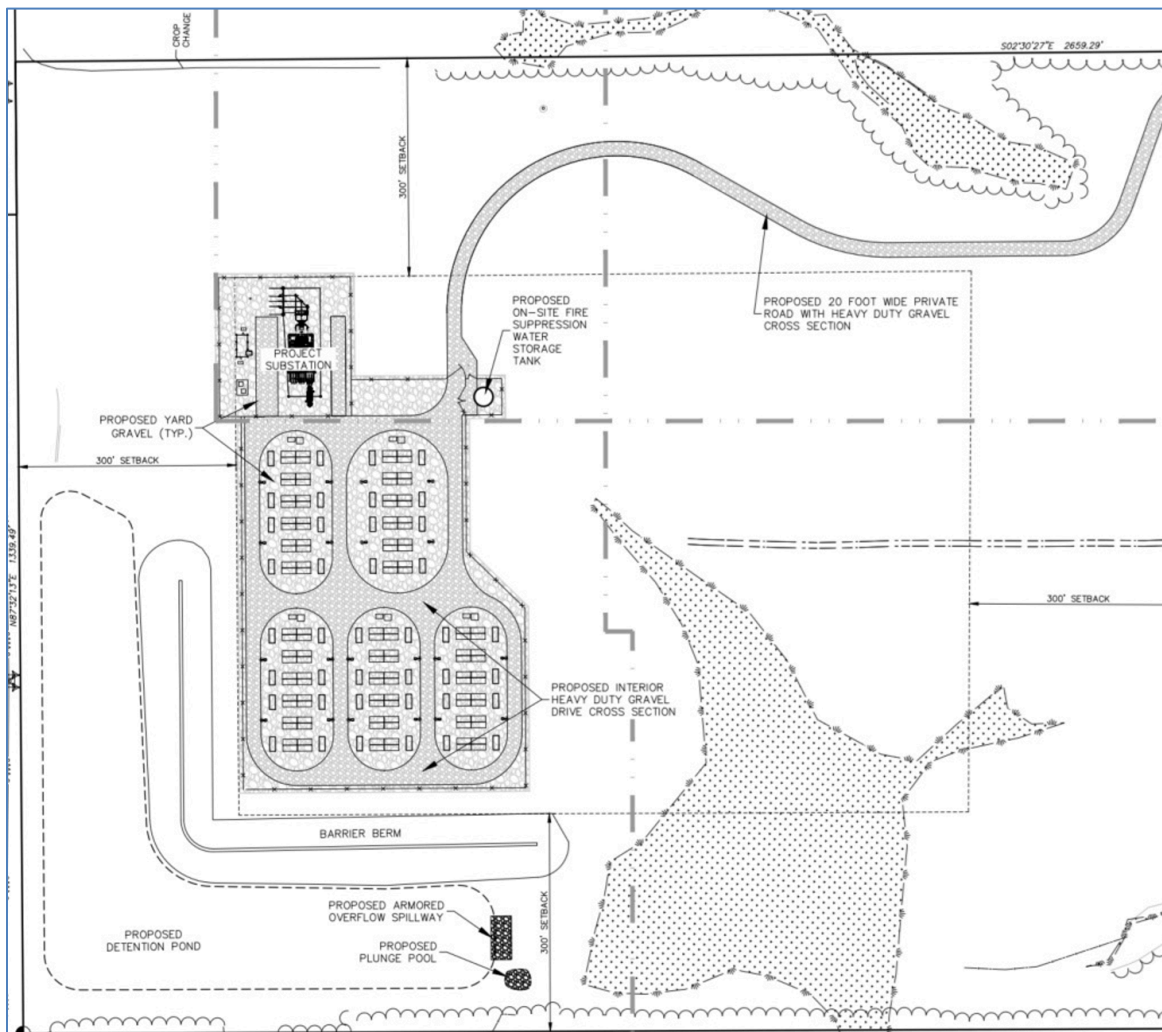
### 1.2 Reference Materials

The following reference materials were reviewed as part of this analysis:

- Voyager BESS Preliminary Site Plan, Dated 2024.12.19
- Voyager Battery Storage Facility with Gen-Tie Preliminary Site Plan, Dated 2024.12.19
- Voyager BESS Site Signage and Battery Specification Plans, Dated 2025.01.31.
- UL 9540A Cell Level Test Report #CN23F118 001, TÜV Rheinland (Shenzhen) Co., Ltd, Dated 2023.12.06

- UL 9540A Module Level Test Report #CN23XXY9 003, TÜV Rheinland (Shenzhen) Co., Ltd, Dated 2024.05.11
- UL 9540A Rack Level Test Report #CN244DBX 001, TÜV Rheinland (Shenzhen) Co., Ltd, Dated 2024.04.26
- Hithium User Manual, V2.6
- Hithium Maintenance Manual, V1.1
- Hithium\_TI\_ESS Container Venting Area Calculation\_20230925\_V1.0, Calculation Sheet for Mechanical Exhaust Ventilation, Dated 2023.08.01
- Fire Protection Device and Equipment Product Data and UL Listing
- Hithium TR ESS Container 5015kWh\_NFPA 69 Test Report, TUV Rheinland, Report #CN24Q0JQ 001, Dated 2024.04.11
- Voyager BESS Water Supply Letter Rev0, Dated 2025.01.10
- Voyager BESS Emergency Operations Plan Rev0, Dated 2025.02.07
- UL 9540 Listing Certificate, Date of Issue 2024.05.31
- UL 1973 Listing Certificate, Date of Issue 2024.06.20

## 2.0 VOYAGER BESS FACILITY ARRANGEMENT



**Figure 1. Voyager BESS Facility Overall Site Plan**

The 100 MW/400 MWh Voyager BESS facility is located off Michigan Avenue in Saline Township, Michigan. The BESS facility uses the Hithium BESS, a pre-assembled, NWI style lithium-ion BESS container with an energy capacity of 5,015 kWh. The Voyager BESS facility, illustrated in Figure 1, is approximately 54 acres and includes 120 Hithium BESS containers.

The BESS facility includes power conversion systems (PCS), a piece of equipment that provides an inverter, transformer, and switchgear in a single skid, each connected between two (2) to four (4) Hithium BESS. Auxiliary transformers are provided to supply auxiliary power loads to Hithium BESS containers. The parcel includes a BESS substation that includes the grid transformer and substation control house.

The Hithium BESS is equipped with 2 smoke detectors, 2 combustible gas detectors, and 2 heat detectors. Explosion protection is provided by a deflagration prevention exhaust system that is activated upon 10% LFL combustible gas detection. Site fire alarm control panel(s) (FACP) will be installed at the substation control enclosure for the monitoring and control of the fire alarm

devices for the BESS. In addition, a fire alarm annunciator will be installed at the first responder station (FRS) located at the main gate. The annunciator panel will be capable of illustrating smoke, gas, and heat alarms along with the activation of the deflagration prevention system. An emergency responder water supply utilizing a 32,000-gallon water supply tank (with adjacent supply well) and dry firewater hydrant main are provided for the facility.

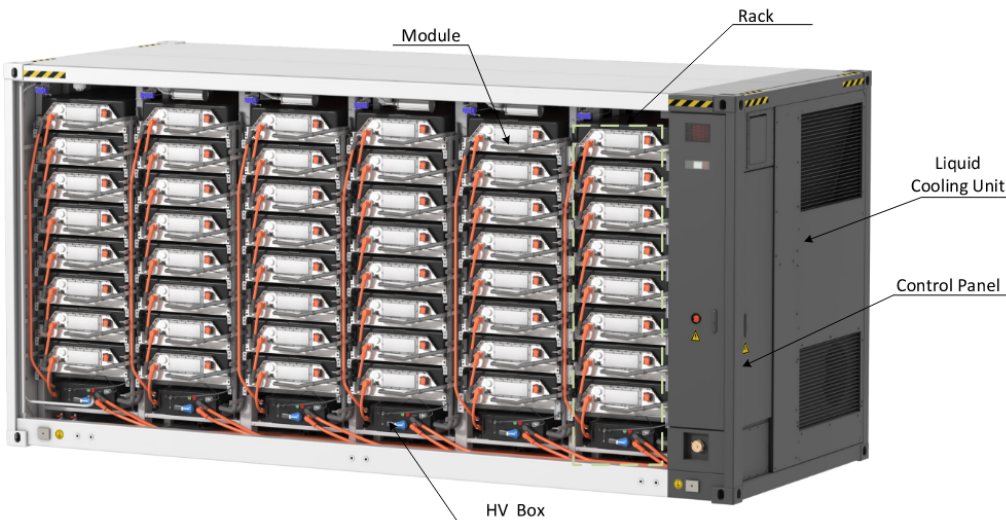
The Lithium BESS container is provided with a battery management system (BMS) that can identify possible risks to the battery system by monitoring battery cell temperature, voltage, and current, and provide system shutdown and isolation capability. The BMS is monitored by the Energy Storage Management System (ESMS), which provides remote monitoring and system shutdown capability. The BMS function is intended to mitigate the risk of thermal runaway by preventing the risks of over-charge, over-discharge, over-temperature, and over-current.

### 3.0 HITHIUM BESS SYSTEM INFORMATION

The Hithium is a fully integrated BESS with battery modules, power electronics, control systems, BMS, thermal management system (TMS), fire detection and notification system, and deflagration prevention system all pre-assembled within a single container. It is meant for outdoor installations, mounted to the ground.

#### 3.1 BESS Container

The Hithium container is a rigid metal (steel) enclosure designed to house the batteries, associated controllers, and appurtenances, Figure 2. The container supports the safe operation of the BESS through its exterior rigid housing structure that helps to protect the batteries from mechanical damage and weather conditions. It is 8 ft (2,438 mm) wide, 9.5 ft (2,896 mm) tall, and 19.9 ft (6,058 mm) long and is intended for outdoor installations, with an IP-55 rating, ground-mounted. The Hithium includes battery racks, electrical controls, fire alarm devices, an emergency ventilation system designed in accordance with NFPA 69, a thermal management system, and string BMU (string level BMS).



**Figure 2. BESS Container**

The thermal management unit is composed of a chiller system with a liquid cooling system using 50/50 water and glycol mixture. The thermal management system is monitored by the SBMU.

The Hithium BESS is equipped with 2 smoke detectors, 2 combustible gas detectors, and 2 heat detectors. Site FACP's will be provided at the first responder station for the monitoring and control of the fire alarm devices for the BESS site.

The Hithium BESS container is equipped with a combustible gas concentration reduction system (deflagration prevention system) designed to maintain the flammable gas concentration below 25% LEL, thereby minimizing the deflagration potential. It consists of gas detection, an explosion proof 820 cfm exhaust fan (outlet), and a make-up air louver. The exhaust system is activated upon 10% LFL H<sub>2</sub> gas detection. The exhaust system is designed in accordance with NFPA 69. TUV Rheinland performed computational fluid dynamics (CFD) modeling to analyze the capabilities of the system. The study considered a three-cell failure scenario using gas composition data obtained



from the UL 9540A cell level test. The analysis concluded that, for the scenario and assumptions modeled, the exhaust system is capable of maintaining an average combustible gas concentration below 25% LFL. Note, if the gas release scenario differs from the design basis, such as a larger release volume or smaller free air volume, the hazard may not be addressed with the current exhaust system configuration. To mitigate the hazards associated with a more severe scenario, the Hithium BESS is equipped with fire detection and notification. These systems can detect and notify local site personnel, should anyone be in the area, of a thermal event so that they can evacuate to a safe location. Additional mitigation measures include emergency response procedures and training that will advise site personnel and first responders to stand at a safe distance, upwind from a distressed Hithium container.

## 4.0 IFC FIRE SAFETY COMPLIANCE

Table 1 below includes a summary of the BESS requirements applicable to the Voyager project and statement of compliance related to the Hithium BESS and Voyager facility.

**Table 1. IFC Fire Safety Compliance**

Code Section	Code Text Summary	Compliance Method
§1207.1.3	<p><b>Construction Documents.</b> The following information shall be provided with permit application:</p> <ol style="list-style-type: none"> <li>1. Location and layout diagram of the room or area in which the ESS is to be installed.</li> <li>2. Details on the hourly fire-resistance ratings of assemblies enclosing the ESS.</li> <li>3. The quantities and types of ESS to be installed.</li> <li>4. Manufacturer’s specifications, ratings and listings of each ESS.</li> <li>5. Description of energy (battery) management systems and their operation.</li> <li>6. Location and content of required signage.</li> <li>7. Details on fire suppression, smoke or fire detection, thermal management, ventilation, exhaust and deflagration venting systems, if provided.</li> <li>8. Support arrangement associated with the installation, including any required seismic restraint.</li> <li>9. A commissioning plan complying with Section 1207.2.1.</li> <li>10. A decommissioning plan complying with Section 1207.2.3</li> </ol>	<p><b>Compliant.</b></p> <p>Construction documents submitted as comprehensive application package.</p>
§1207.1.4	<p><b>Hazard mitigation analysis.</b> A failure modes and effects analysis (FMEA) or other approved hazard mitigation analysis shall be provided in accordance with under any of the following conditions:</p> <ol style="list-style-type: none"> <li>1. Where ESS technologies not specifically identified in Table 1207.1 are provided.</li> <li>2. More than one ESS technology is provided in a room or enclosed area where there is potential for adverse interaction between technologies.</li> <li>3. Where allowed as a basis for increasing maximum allowable quantities.</li> </ol>	<p><b>Compliant.</b></p> <p>FRA has prepared a Hazard Mitigation Analysis for the Voyager BESS to serve as a basis for increasing maximum allowable quantities.</p>
§1207.3.1	<p><b>Energy storage system listings.</b> ESS shall be listed in accordance with UL 9540.</p>	<p><b>Compliant.</b></p> <p>The Hithium is listed to UL 9540.</p>

Code Section	Code Text Summary	Compliance Method
§1207.3.4	<b>Energy storage management system.</b> Where required by the ESS listing, an approved energy storage management system that monitors and balances cell voltages, currents, and temperatures within the manufacturer’s specifications shall be provided. The system shall disconnect electrical connections to the ESS or otherwise place it in a safe condition if potentially hazardous temperatures or other conditions such as short circuits, over voltage, or under voltage are detected.	<b>Compliant.</b> The Hithium is equipped with a battery management unit (BMS) that functions in conjunction with an ESMS.
§1207.3.5	<b>Enclosures.</b> Enclosures of ESS shall be of noncombustible construction.	<b>Compliant.</b> The Hithium consists of a noncombustible steel enclosure with an IP-55 ingress rating.
<b>General Installation Requirements</b>		
§1207.4.1	<b>Electrical disconnects.</b> Where the ESS disconnecting means is not within sight of the main electrical service disconnecting means, placards or directories shall be installed at the location of the main electrical service disconnecting means indicating the location of stationary storage battery system disconnecting means in accordance with NFPA 70.	<b>Signage by others.</b> Refer to Voyager signage plans.
§1207.4.2	<b>Working clearances.</b> Access and working space shall be provided and maintained about all electrical equipment to permit ready and safe operation and maintenance of such equipment in accordance with NFPA 70 and the manufacturer’s instructions.	<b>Compliant.</b> The Hithium requires working clearances of 9.8 ft to the side aisles and 11.5 ft to the front aisles. The Voyager BESS site design complies with these clearances.
§1207.4.4	<b>Seismic and structural design.</b> Stationary ESS shall comply with the seismic design requirements in Chapter 16 of the International Building Code and shall not exceed the floor loading limitation of the building.	<b>Foundations by others.</b>

Code Section	Code Text Summary	Compliance Method
§1207.4.5	<b>Vehicle impact protection.</b> Where ESS are subject to impact by a motor vehicle, including forklifts, vehicle impact protection shall be provided in accordance with Section 312.	<b>Compliant.</b> There are no public roads near the facility. Only certified personnel will be allowed on site for maintenance. As an added safety feature, protective bollards will be provided for the BESS facility.
§1207.4.6	<b>Combustible Storage.</b> Combustible materials shall not be stored in ESS rooms, areas, or walk-in units. Combustible materials in occupied work centers covered by Section 1207.4.10 shall be stored at least 3 feet from ESS cabinets.	<b>Compliant.</b> The Hithium is not intended for indoor installation and is a NWI style ESS that is unoccupiable. It does not have free open space within the container to store additional combustible materials.
§1207.4.7	<b>Toxic and highly toxic gases.</b> ESS that have the potential to release toxic and highly toxic gas during charging, discharging, and normal use conditions shall be provided with a hazardous exhaust system in accordance with section 502.8 of the International Mechanical Code.	<b>Compliant.</b> The Hithium utilizes listed lithium-ion cells that do not release toxic gas during charging, discharging, or normal use conditions.
§1207.4.8	<b>Signage.</b> Approved signs shall be provided on or adjacent to all entry doors for ESS rooms or areas and on enclosures of ESS cabinets and walk-in units located outdoors.	<b>Signage by others.</b> Refer to Voyager signage plans.

Code Section	Code Text Summary	Compliance Method
<p>§1207.4.9</p>	<p><b>Security of installations.</b> Rooms, areas and walk-in units in which electrochemical ESS are located shall be secured against unauthorized entry and safe-guarded in an approved manner. Security barriers, fences, landscaping and other enclosures shall not inhibit the required air flow to or exhaust from the electrochemical ESS and its components.</p> <p><b>Saline Township Zoning Ordinance Supplement:</b></p> <p>Requires all BESS to be enclosed by a fence with a self-locking gate to prevent unauthorized access. A minimum of 24 feet of clearance shall be maintained on both sides of the perimeter fence to provide emergency vehicle access.</p>	<p><b>Compliant.</b></p> <p>A security fence will be provided for the Voyager BESS. Proposed perimeter fence to be 7-foot-tall chain link security fence with 1-foot-high barbed wire installed along the top of the fence.</p>
<p><b>Outdoor Installation Specific Requirements</b></p>		
<p>§1207.8.3</p>	<p><b>Clearance to exposures.</b> ESS located outdoors shall be separated by a minimum of 10 ft (3 m) from the following exposures:</p> <ol style="list-style-type: none"> <li>1. Lot lines.</li> <li>2. Public ways.</li> <li>3. Buildings.</li> <li>4. Stored combustible materials.</li> <li>5. Hazardous materials.</li> <li>6. High-piled stock.</li> <li>7. Other exposure hazards</li> </ol> <p><b>Saline Township Zoning Ordinance Supplement:</b></p> <p>Requires BESS to be separated by minimum of 300 feet from road right of way lines and all property lines.</p>	<p><b>Compliant.</b></p> <p>The Voyager BESS site design accounts for a 10 ft clearance to the exposures listed and includes a 300 feet setback from road right of way lines and all property lines.</p>

Code Section	Code Text Summary	Compliance Method
§1207.5.1	<p><b>Size and Separation.</b> Electrochemical ESS shall be segregated into groups not exceeding 50 kWh. Each group shall be separated a minimum of 3 ft (0.9 m) from other groups and from walls in the storage room or area.</p> <p>The fire code official is authorized to approve larger capacities or smaller separation distances based on large-scale fire testing complying with Section 1207.1.5.</p>	<p><b>Compliant.</b></p> <p>UL 9540A testing was performed in accordance with Section 1207.1.5 to support the ESS size and separation configuration at the Voyager BESS.</p>
§1207.5.2	<p><b>Maximum Allowable Quantities.</b> Fire areas within rooms, areas and walk-in units containing lithium-ion ESS shall not exceed the maximum allowable quantity of 600 kWh.</p> <p>Exceptions: Where approved by the fire code official, rooms, areas and walk-in units containing lithium-ion ESS that exceed 600 kWh shall be permitted based on a hazardous mitigation analysis in accordance with Section 1207.1.4 and large-scale fire testing complying with Section 1207.1.5.</p>	<p><b>Compliant.</b></p> <p>FRA has prepared a Hazard Mitigation Analysis for the Voyager BESS that includes performance criteria from the UL 9540A testing to seek approval for ESS maximum allowable quantities.</p>
§1207.5.4	<p><b>Fire detection.</b> An approved automatic smoke detection system or radiant energy-sensing fire detection system shall be installed in rooms, indoor areas and walk-in units containing electrochemical ESS. Alarm signals from detection systems shall be transmitted to a central station, proprietary or remote station service in accordance with NFPA 72, or where approved to a constantly attended location.</p>	<p><b>Compliant.</b></p> <p>The Hithium is a NWI style container and is not intended for installation in rooms or indoor areas. However, the Hithium is equipped with smoke, heat, and gas detection.</p>
§1207.5.5	<p><b>Fire suppression systems.</b> Rooms and areas within buildings and walk-in units containing electrochemical ESS shall be protected by an automatic fire suppression system.</p>	<p><b>Compliant.</b></p> <p>The Hithium is a NWI style container and is not intended for installation in rooms or indoor areas. Therefore, a fire suppression system is not required.</p>

Code Section	Code Text Summary	Compliance Method
§1207.5.6	<p><b>Maximum enclosure size.</b> Outdoor walk-in units housing ESS shall not exceed 53 feet by 8 feet by 9.5 feet high, not including bolt-on HVAC and related equipment, as approved. Outdoor walk-in units exceeding these limitations shall be considered indoor installations</p>	<p><b>Compliant.</b> The Hithium dimensions are 8 ft × 9.5 ft × 19.9 ft.</p>
§1207.5.7	<p><b>Vegetation control.</b> Areas within 10 ft (3 m) on each side of outdoor ESS shall be cleared of combustible vegetation and other combustible growth. Single specimens of trees, shrubbery or cultivated ground cover such as green grass, ivy, succulents or similar plants used as ground cover shall be permitted to be exempt provided that they do not form a means of readily transmitting fire.</p> <p><b>Saline Township Zoning Ordinance Supplement:</b> Requires a distance of 50 feet for vegetation control.</p>	<p><b>Compliant.</b> The Voyager BESS will be installed on foundations surrounded by gravel and access roads and will not have any combustible vegetation within 50 ft of any Hithium.</p>
§1207.5.8	<p><b>Means of egress separation.</b> ESS located outdoors and in open parking garages shall be separated from any means of egress as required by the fire code official to ensure safe egress under fire conditions, but in no case less than 10 ft (3 m). <b>Exception:</b> The fire code official is authorized to approve a reduced separation distance if large-scale fire testing is provided that shows that a fire involving the ESS will not adversely impact occupant egress.</p>	<p><b>Compliant.</b> The Voyager BESS site plan depicts no buildings within 10 ft of the nearest Hithium.</p>
<b>Technology Specific Requirements</b>		
§1207.6.3	<p><b>Explosion control.</b> Explosion control shall be provided for rooms, areas or walk-in units containing electrochemical ESS technologies.</p> <p><b>Exceptions:</b></p> <ol style="list-style-type: none"> <li>Where approved, explosion control is permitted to be waived by the fire code official based on large-scale fire testing that demonstrates that flammable gases are not liberated from electrochemical ESS cells or modules where tested in accordance with UL 9540A.</li> <li>Where approved, explosion control is permitted to be waived by the fire code official based on documentation provided that demonstrates that the electrochemical ESS technology to be used does not have the potential to release flammable gas concentrations in excess of 25 percent of the LFL anywhere in the room, area, walk-in unit or structure under thermal runaway or other fault conditions.</li> </ol>	<p><b>Compliant.</b> A combustible gas concentration reduction (deflagration prevention) system is provided for the Hithium that is designed in accordance with NFPA 69. TUV Rheinland performed computational fluid dynamics modeling to establish the performance criteria for the system.</p>

Code Section	Code Text Summary	Compliance Method
§1207.6.5	<p><b>Thermal runaway.</b> Batteries and other ESS shall be provided with a listed device or other approved method to prevent, detect and minimize the impact of thermal runaway.</p> <p>The thermal runaway protection is permitted to be part of a battery management system that has been evaluated with the battery as part of the evaluation to UL 1973.</p>	<p><b>Compliant.</b></p> <p>A BMS tested and verified during the UL 1973 certification process is provided for the Hithium.</p>

## 5.0 LIMITATIONS

At the request of Jupiter Power, FRA prepared a fire safety compliance plan for the Voyager BESS facility in accordance with the requirements of the 2021 Edition of the International Fire Code, with amendments. The analysis evaluates the Hithium BESS, which is a pre-assembled, NWI style lithium-ion BESS container. The Voyager BESS facility has a total site capacity of 100 MW/ 400 MWh. The scope of services performed during this analysis may not adequately address the needs of other users of this report, and any re-use of this report or its conclusions presented herein are at the sole risk of the user. The opinions and comments formulated during this assessment are based on observations and information available at the time of the analysis, which has been provided to FRA by others. No guarantee or warranty as to future performance of any reviewed condition is expressed or implied.