Site-Specific Hazard Mitigation Analysis

Jerry Smith Storage
339 Jerry Smith Rd.,
Lansing, NY 14882

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Introduction

On behalf of Jerry Smith Storage, Nexamp has developed a Site-specific Hazard Mitigation Analysis (HMA) for the Lithium-ion Battery Energy Storage System (BESS) sited on 339 Jerry Smith Rd., Lansing, NY 14882. This study includes a comprehensive analysis of hazards and risks associated with the BESS to assess the overall effectiveness of its capability in mitigating various battery failure scenarios.

The HMA consists of this report, a Failure Modes, and Effects Analysis (FMEA) in MS excel format (ref.1), An FMEA is one of several methods of conducting an HMA.

Applicable Codes and Standards

This report and the overall HMA package for the Jerry Smith Storage Energy Storage site was developed in alignment with the following applicable codes:

- 2025 Fire Code of New York State (2025 FCNYS) & 1207 Electrical Energy Storage Systems (ESS)
- New York State Electric Code
- New York State Building Code
- NEC
- NFPA 855 *Standard for the Installation of Stationary Energy Storage,* 2023 Edition
- UL 9540 *Standard for Energy Storage Systems and Equipment, 3rd Edition,* 2023
- UL 9540A *Standard for Test Method for Evaluation Thermal Runaway Fire Propagation in Battery Energy Storage Systems*, 4th edition
- IEC 60812 *Failure Modes and Effects Analysis*
- NFPA 72 *National Fire Alarm and Signaling Code*, 2016 Edition
- UL 1642 *Standard for Lithium Batteries,* 2020 Edition
- UL 1741 *Standard for Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources*
- UL 1973 *Standard for Batteries for Use in Stationary, Vehicle Auxiliary Power and Light Electric Rail (LER) Applications*

The Town of Lansing is the Authority Having Jurisdiction (AHJ) and has the responsibility for reviewing and approving BESS siting in Lansing, NY. The Hazard Mitigation Analysis has been requested to comply with the requirements of 2025 FCNYS.

NFPA 855 Section 4.4.2 states that the hazard mitigation analysis shall evaluate the consequences of the following failure modes:

1. A thermal runaway or mechanical failure condition in a single ESS unit
2. Failure of an energy management system or protection system that is not covered by the product-listing failure modes and effects analysis (FMEA)

3. Failure of a required protection system including, but not limited to, ventilation (HVAC), exhaust ventilation, smoke detection, fire detection, fire suppression, or gas detection

NFPA 855 Section 4.4.3 states that the AHJ shall be permitted to approve the hazard mitigation analysis as documentation of the safety of the ESS installation if the consequences of the analysis demonstrate the following:

1. Fires will be contained within unoccupied ESS rooms for the minimum duration of the fire resistance rating specified in Section 9.6.4
    a. *Not applicable, as this is an outdoor system and is a pre-engineered and pre-certified cabinet-style ESS enclosure*
2. Fire and products of combustion will not prevent occupants from evacuating to a safe location
    a. *Not applicable as this is a non-occupied outdoor ESS.*
3. Deflagration hazards will be addressed by an explosion control or other system

Site

The Jerry Smith Storage Battery Energy Storage (BESS) Project consists of a 5 MW / 23.5 MWh (4-hour duration) battery energy storage system. The project is located on the southeast portion of the property at 339 Jerry Smith Rd., Lansing, NY 14882. The project will use advanced lithium-ion battery and control technology that are contained in environmentally rated enclosure ("BESS Unit" or "Tesla Megapack 2XL"). The BESS will consist of Six (6) Tesla Megapack 2XL with associated wiring, cabling, meters, and site controller and data acquisition equipment. The Megapack 2XL will be located at grade on concrete pads and provided site access via a main gate on the northeast side of the site fenced in area. As such, the Megapack 2XL enclosure (the BESS) will be protected from unwarranted access.

Fire department staging and apparatus access is accommodated outside the primary vehicle gate, allowing emergency responders to establish operations without entering the project fence line.

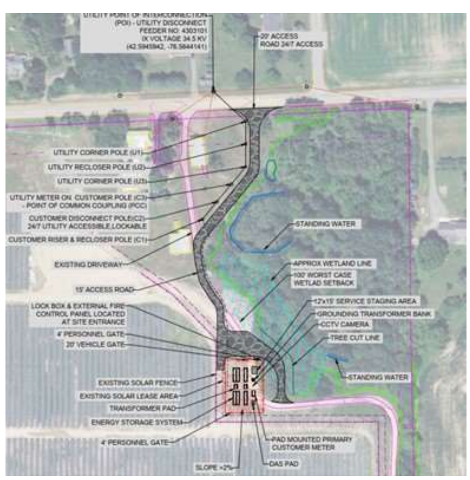

Figure 1 - Site location and layout

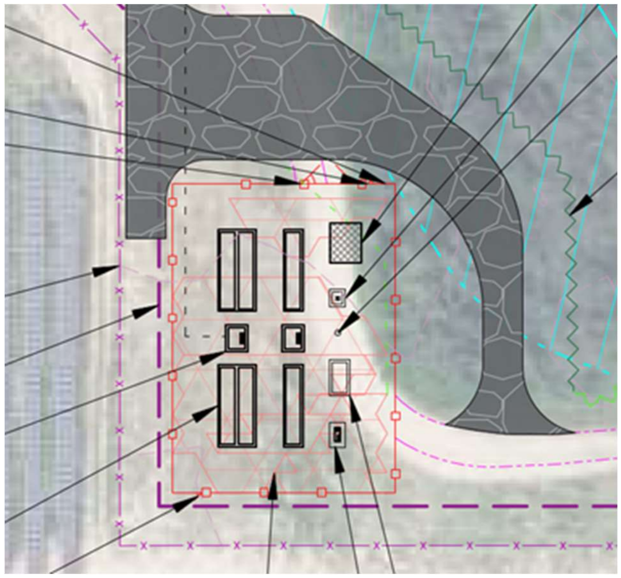

Figure 2 BESS Area - Zoomed In

Nearby Exposures

The site is located with few exposures in the nearby vicinity. Nearby exposures include:

1. Residences to the North and Northwest
    a. Location: ~300 - 600 ft from BESS
    b. Construction: To be identified
2. Existing PV Array to the East, South, and West
    a. Location: ~50 – 500 ft from BESS (portion to the West closes section of PV array)
    b. Construction: Steel and PV modules

Fire Department Access and Water Supply

The nearest fire station (Lansing Fire Department Station 3) is located approximately 2.3 miles from the BESS site (1235 Ridge Road, Lansing, NY 14882).

In the event of an emergency on-site, primary fire department staging should be used. The staging area will be defined upon discussions with Lansing Fire Department

No fire hydrants or permanent water supplies for firefighting operations are noted in the immediate area. Water supply is assumed to be delivered by Lansing Fire Department via the available fire trucks to maintain the surrounding units and exposures cool and moist. It is not recommended to apply lots of water directly to a unit during a thermal event.

Energy Storage System

The BESS consists of six (6) Tesla Megapack 2XL (MP2XL) cabinet-style ESS unit, with a system rating of 979.2 kW/ 3916.8 kWh power and energy capacity, respectively. Each MP2XL unit consists of nine (9) bays, which are designed as follows:

- Eight (8) battery bays – each consisting of three (3) battery modules for a maximum of 24 battery modules
- One (1) bay containing the thermal cabinet and customer interface bay with Battery Management System (BMS).

The MP2XL is a design evolution of Megapack 2 (MP2), which leverages the same core technology platform (cells, vents, sparker system, etc.). Each MP2XL unit contains up to 24 battery modules and has a slightly greater footprint than the MP2 (which contains up to 19 modules), and also uses identical components including batteries, converters, and explosion protection system.

Each battery module is composed of 336 prismatic Lithium-iron-phosphate (LFP) battery cells. The MP2XL is nearly fully populated with battery racks, electrical components, safety systems, and thermal management systems – making it a non-walk-in BESS unit. As such, the MP2XL cannot be physically entered by site personnel, first responders, or members of the public at any time. The MP2XL is secured and can only be accessed with a key or access code.

The MP2XL is equipped with several protective safety system including the BMS, thermal management system, and Tesla site controller (connected to Tesla's and Nexamp's Network Operating Centers), connected to a fire alarm system, and Tesla's proprietary deflagration control system. Each safety system provides an additional layer of protection against different failure modes/conditions attributed to lithium-ion incidents or failures and provides an immense contribution to the overall safety of the MP2XL and the site.

The MP2XL and constituent components are tested and certified to UL 9540, UL 1642, UL 1973, IEC 62619, and IEC 62933-5-2. UL 9540A (4th Edition) large-scale fire testing was performed at the Cell, Module, and Unit level (Installation level testing was not required, as all Unit level performance criteria were met). From the UL 9540A Unit level report by TUV:

> *Based on the limited module propagation observed during MP2 testing (7 cells in runaway) the behavior would be the same with MP2XL. With the increase in volume and sparker count, the deflagration risk is minimized. The testing performed on MP2 is considered harsher with higher gas concentrations, and fundamental engineering analysis for MP2XL shows comparable behavior as worst case.*

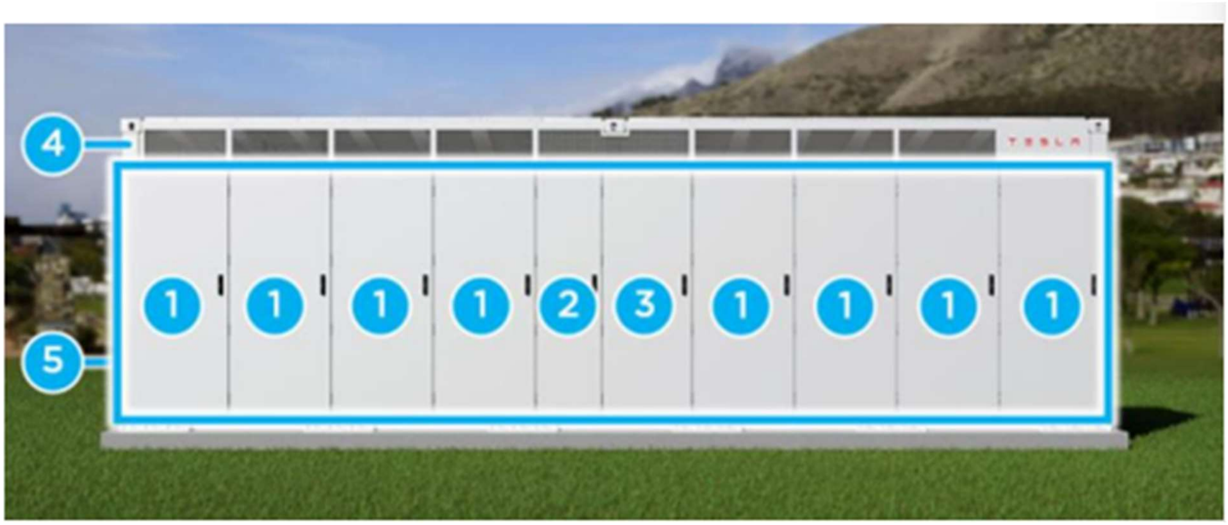

Figure 3 – MP2XL Internal components: (1) Battery Modules Bays, (2) Thermal Cabinet, (3) Customer Interface Bay, (4) IP20 Thermal Roof Enclosure, (5) IP65 enclosure

Tesla Site Controller and Monitoring

Each Tesla MP2XL project includes a Tesla Site Controller where the Site Controller is designed to communicate, monitor, and control all the equipment within the energy storage system. The Site Controller communicates via ethernet connection and built-in cellular modem to communicate on-site and off-site, respectively. Off-site communications are directed toward Nexamp and Tesla's Network Operations Centers (NOC).

Thermal Management System

The thermal management system is a cooling and heating system that is independent of other systems within the MP2XL and consists of a closed loop liquid cooling system that circulates coolant. This coolant is a 50/50 mixture of ethylene glycol and water, and R-134a refrigerant throughout the battery module bays to maintain safe and correct operating temperatures. The BMS allows for battery and ambient temperatures to be monitored. If the temperature within the battery modules exceeds or drops below required temperature range, the BMS will either temporarily or permanently disconnect the battery module or even the MP2XL (depending on the fault condition). The Site Controller provides Tesla and Nexamp control and monitoring of the BMS. An overview of the notifications is provided below:

- Tesla Site Controller provides an alert (Warning or Alarm) to the local operations center and can directly communicate via text alert that the BESS has faulted, and which fault or warning has specifically been triggered
- If the temperatures fall back within the operating limits, the system and/or effected battery module will reintegrate into the system operation and the Tesla Site Controller will communicate this reintegration via text alert that the system warning or fault has been cleared

Battery Management System

The Tesla MP2XL is pre-engineered and delivered with a BMS that is designed and tested to UL standards and industry best practices by the battery manufacturer, Tesla. The BMS is capable and responsible for monitoring the status of numerous system parameters and fault conditions, which includes but is not limited to loss of communications, over/under voltage, over/under temperature, etc. The BMS protects the system by initially isolating the effected battery module and determine if preset systems parameter thresholds have been breached. If system parameter thresholds have been breached, the BMS will permanently disconnect battery module level contactors that will physically disconnect (electrically isolate) the battery modules from the rest of the system. Note that if a BMS disconnect a battery module, it will be required to be manually reengaged and cannot be done remotely.

Fire (flame) Detection Systems

The MP2XL does not have an internal fire detection system.

Coordination of MP2XL control during a fire event and response would be reliant upon trained staff either remotely or on-site as defined by the Emergency Response Plan.

Deflagration Protection

The MP2XL is pre-engineered and delivered with an explosion control system designed to mitigate the risk of uncontrolled deflagration. The explosion control system consists of twenty-six (26) overpressure vents and twelve (12) sparkers/igniters. The sparkers are evenly distributed throughout the MP2XL enclosure and are designed to quickly ignite flammable gases before they become a deflagration hazard. The sparkers will ignite gases as they are generated and then they are vented through the exterior of the MP2XL using the overpressure ventes located at the top of the MP2XL enclosure.

Electrical Fault Protection Devices

Multiple levels of passive and active electrical protections are provided for the MP2XL. At the battery module level, overcurrent protection is provided for each module in the form of single-use fusible links, providing interruption of overcurrent in the battery module in the case of an abnormal electrical event. Inverter modules, which are installed at each of the battery modules, are equipped with both DC protection via high-speed pyrotechnic fuse for passive or active isolation of battery modules, as well as dedicated AC contactor and AC fuses should an abnormal electrical event occur at the inverter module on the AC side of the circuit. Additionally, the MP2XL is equipped with DC ground fault detection system and AC circuit breaker with ground fault trip settings for distribution system protection.

Hazard Mitigation Analysis

As per 2025 FCNYS, one format for an HMA is an FMEA that adheres to IEC 60812 (ref. 3) and UL 9540. As such, IEC 60812 serves as the guide for the FMEA developed for the Jerry Smith Storage project. The FMEA represents a robust set of failure modes associated with the BESS. As such, Nexamp has assessed the failure modes with a numerical scale shown in Figure 4.

Scale	Occurrence	Detection	Severity
1	Remote	Certain	Very Low
2	Low	High	Low
3	Moderate	Medium	Moderate
4	High	Low	High
5	Very High	Impossible	Very High

Figure 4 - Numerical scales for FMEA table

The site-level HMA is built upon the product-specific FMEA developed by the Original Equipment Manufacturer, Tesla. The product-specific FMEA is confidential in nature and cannot be shared without a direct NDA with Tesla. As such, the focus of this report and the HMA package is the site-specific HMA (in the form of an FMEA). The site-specific FMEA develops the product-specific FMEA further to include local hazards and failures specific to this facility such maintenance, vehicular traffic, and nearby exposures.

In leveraging BESS OEM documentation, safety manuals, test data, and industry best practices, Nexamp utilized the following two-staged method to develop Jerry Smith Storage FMEA:

1. Assessing the severity and likelihood of each failure mode without the safeguards in place to identify risk rankings.
2. Assessing the severity, likelihood, and detectability of the same failure modes with safeguards in place to calculate the Risk Priority Number (RPN)
    a. The RPN is a numeric risk assessment that is a result of the product of severity, likelihood, and detectability of a given failure mode. This supports a scale associated with the potential risks of the BESS.

This two-staged approach supports a comprehensive assessment of the effectiveness of the safeguards Tesla (BESS OEM) and Nexamp have incorporated into the Jerry Smith Storage project.

For the site-level HMA, Nexamp defined low, medium, and high-risk rankings for the failure modes based on corresponding risk priority number (RPN) that are inclusive of safeguard considerations. The RPN designations are as follows:

- Low risk if RPN <12
- Medium risk if 12 ≤ RPN < 25
- High risk if RPN ≥ 25

UL 9540A Testing

The Tesla MP2XL has been tested to UL 9540A 4th edition at the cell, module, and unit levels. The UL 9540A test was conducted by TUV Rhineland a well-reputable and certified Nationally Recognized Testing Laboratory (NRTL). The UL 9540A results are summarized in a separate report commissioned by Tesla and an independent consultant. Through unit level testing determined to be conducted in accordance with the UL 9540A testing standard where thermal runaway was initiated in a single module located towards the bottom of the rack. This location was selected as it was determined to be the best location to analyze both vertical and horizontal thermal runaway propagation. For the test, both BMS and thermal management system were disabled as to not interfere with the results of the test (which the test standard requires).

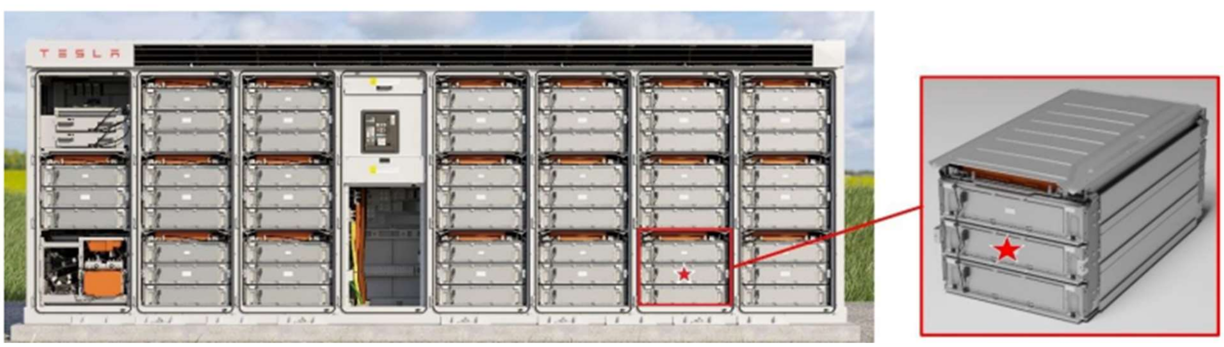

Figure 5 - UL 9540A Unit Level Test, Initiation location

Thermocouples were placed across several areas of the battery module, battery cells, and enclosure, an instrumented wall, and other M2XL units. In addition, heat flux sensors were installed at several distances ranging from 3-30ft. The test set up is displayed in Figure 6.

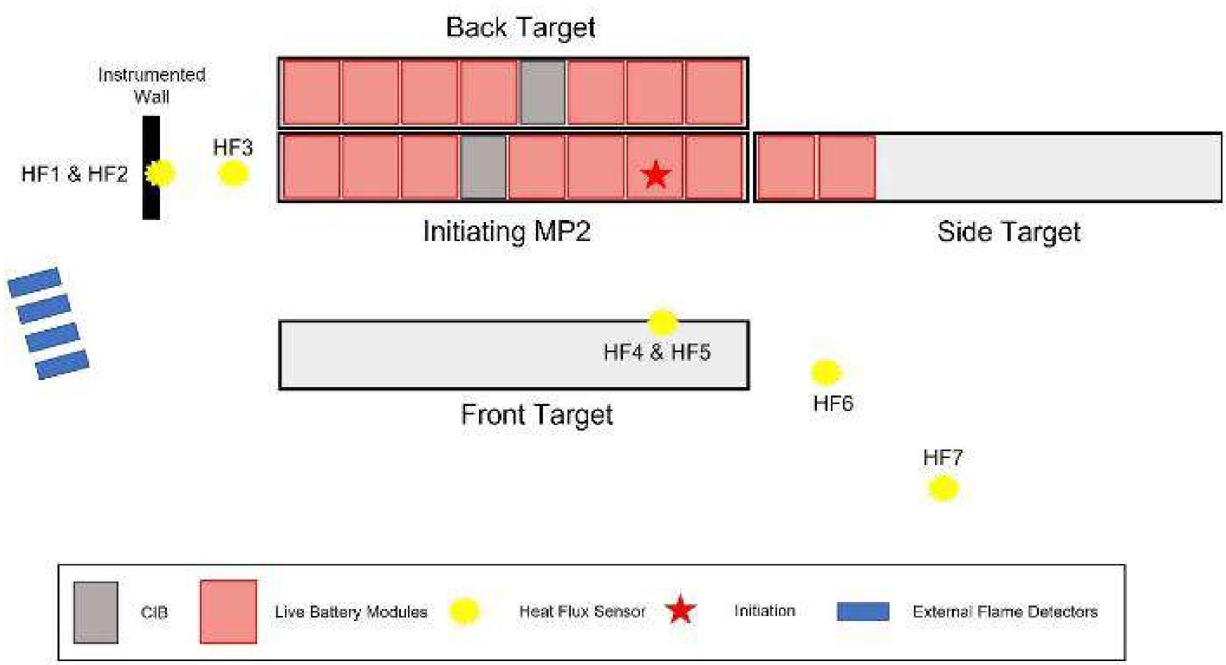

Figure 6 - UL 9540A Unit Level Test, Test Arrangement

Upon heating of the initiating battery cell, thermal runaway was achieved at a temperature of 462°F at 78 minutes into the test. A second cell entered thermal runaway at 93 minutes into the test (15 minutes after the first). Cell venting was observed at the 99-minute mark of the test.

During testing, thermal runaway did not propagate through the initiating module and no significant temperature was observed in adjacent modules. In addition, no external flaming, flying debris, re-ignitions, or explosions were observed during the test. The maximum unit temperature was measured at 9.9 °F over ambient conditions. The maximum heat flux at the target wall was measured at 0.0 kW/m^2. Lastly, light smoking or off-gassing was observed, with no free-flowing electrolyte leakage or runoff observed as well.

Failure Mode and Effects Analysis (FMEA)

Per 2025 FCNYS Section 1207.1.6, the analysis shall evaluate the consequences of the following failure modes and others deemed necessary by the AHJ:

1. A thermal runaway or mechanical failure condition in a single ESS unit
2. A mechanical failure of a nonelectrochemical ESS unit (not applicable)
3. Failure of any battery (energy) management system or fire protection system within the ESS equipment that is not covered by the product listing failure mode effects analysis (FMEA)
4. Failure of any required protection system external to the ESS, including but not limited to ventilation (HVAC), exhaust ventilation, smoke detection, fire detection, gas detection or fire suppression system

For this analysis, Nexamp has considered only a single failure mode at a time. The following table provides a summary of the HMA findings, with each failure mode prescribed by NFPA 855 and FCNYS assessed in the site-level FMEA:

Table 1 - NFPA 855 and FCNYS HMA Failure Modes

Compliance Requirement	Nexamp Assessment
1. A thermal runaway condition in a single electrochemical ESS unit	A number of passive and active measures are implemented to reduce the potential of a thermal runaway event from occurring including BMS control and active cooling to internal components. Battery modules and cells have been listed to UL 1973 and UL 1642. Should a thermal runaway event occur, additional mitigative measures are provided to prevent further propagation of failure throughout the system.
2. A mechanical failure of a nonelectrochemical ESS unit	Not applicable, as the Tesla MP2XL is an electrochemical ESS unit.
3. Failure of any battery (energy) management system or fire protection system within the ESS equipment that is not covered by the product listing failure more effects analysis (FMEA).	In the event of a failure of module-level BMS, the Megapack-level BMS (which may be considered the Energy Management System (EMS) or Energy Storage Management System (ESMS)) shall isolate effected modules, mitigating against further propagation of failure across the system. Should a failure of the Megapack-level BMS occur, each module is equipped with a dedicated BMS to provide corrective actions in case of detection of abnormal operation outside of set parameters. To further isolate any failure stemming from a failure of the energy storage management system, passive and active electrical fault protections are provided at multiple levels, as described in respective sections of this report. The Tesla BMS and Site Controller alongside Nexamp’s EMS and NOC, provide active monitoring of temperature, voltage, current, and other parameters. The BMS and Site Controller will take corrective action to isolate failures. In addition, several layers of

	electrical protections are included in the MP2XL and at the site-level. Should failure of an energy management system result in a thermal runaway event, a number of mitigative barriers are in place to prevent further propagation of failure.
4. Failure of any required protection system external to the ESS, including but not limited to ventilation (HVAC), exhaust ventilation, smoke detection, fire detection, gas detection, or fire suppression system.	**Failure of Exhaust Ventilation System** Not applicable, as the Megapack 2 XL does not utilize an exhaust ventilation system, instead using sparker system and overpressure vents for explosion control. **Failure of Smoke, Fire, or Gas Detection System** The Tesla Megapack 2 XL does not utilize smoke or gas detectors, instead opting for external IR detection for fire detection. Should IR detection systems fail, it is anticipated that BMS fault notifications shall be transmitted to remote 24/7 Network Operations Center (NOC), alerting system owner to abnormal conditions. Data from the BMS may be communicated to project SMEs to provide guidance to the fire department in case of emergency. **Failure of Fire Suppression System** The Megapack 2 XL does not utilize fire suppression (either water-based or non-water-based), instead using sparker system to burn off-gasses before an explosive condition is allowed to accumulate within the enclosure. Furthermore, UL 9540A Unit level testing indicates that no flaming occurred and that no propagation of heat from the initiating unit to adjacent units / modules reached levels capable of initiating cell venting or thermal runaway.

The subsections below provide an overview of the assessment of each of the failure modes includes in Table 1. The site-level FMEA attachment of the HMA package provides greater detail in the form of an FMEA all major failure modes noted above and the mitigations implemented to reduce the potential propagation of a failure or hazard. Please refer to the site-level FMEA for a more comprehensive overview of these failure modes.

Failure mode -1: A thermal runaway condition in a single electrochemical ESS unit

Thermal Runaway is defined as follows by NFPA 855:

> "The condition when an electrochemical cell increases its temperature through self-heating in an uncontrollable fashion and progresses when the cell's heat generation is at a higher rate than it can dissipate, potentially leading to off-gassing, fire, or explosion"

The MP2XL incorporated multiple layers of safety protections to reduce the overall potential for thermal runaway as well as limit the spread of thermal runaway across adjacent battery cells and/or modules. The battery cells have been listed to UL 1642 and tested to UL9540A. The battery modules and racks have been listed to UL 1973 and tested to UL 9540A. The MP2XL has been listed to UL 9540 and tested to UL 9540A.

In the event of thermal runaway propagated from a single cell, several barriers are in place to limit the spread of heat, off-gas accumulation, fire spread, or other hazards. The BMS and other communications and controls systems transmit information that could indicate a potential thermal runaway allowing for the MP2XL controls or system operators to attempt to prevent the thermal runaway failure entirely. The information relayed through the Site Controller can be accessed by site-personnel and remote operators 24/7.

The consequence of accumulation of flammable gases from a thermal runaway failure is addressed by the Tesla MP2XL effectively doing the following:

1. Preventing the accumulation of flammable gases with the sparker system
2. Safely exhausting the products of combustion through overpressure vents that are on the top of the MP2XL

The fire department is expected to respond during a BESS thermal runaway incident. The fire department will be trained to respond to the hazard and will have an Emergency Response Plan that is developed well before the construction and operation of the BESS. The Emergency Response Plan will be reviewed annually, and regular training will be provided by the BESS owner.

Mechanical failure conditions can be both caused by internal and external factors. The Tesla Megapack 2XL has several mitigations to mechanical failures such as impact protection. The MP2XL enclosure is IK09 impact rated, and the site is designed with a site boundary wall (sound barrier) and bollards to further prevent impact protection.

The MP2XL can detect Thermal Management System mechanical failures such as coolant leaks or blockages and has passive containment areas for coolant. The BMS and site controller will trigger an alarm and notify Nexamp/Tesla of the need for repair/replacement.

Unauthorized access and vandalism are prevented by the site fence line. Access is restricted by a locked gate in which only authorized personnel and first responders are allowed to access.

Mechanical failure caused by misuse or mishandling is mitigated by robust training and focus to adhering to the manufacturer's O&M manuals. Furthermore, only certified personnel can partake in O&M activities. Similarly, so for installation, commissioning, and decommissioning.

Failure mode -2: Failure of any battery (energy) management system or fire protection system within the ESS equipment that is not covered by the product listing failure more effects analysis (FMEA).

The Tesla MP2XL is pre-engineered and equipped with module, rack, and system level BMS functionality alongside the Tesla Site Controller, both of which provide robust monitoring and control of the MP2XL. Upon detection of any temperature, voltage, or current measurements beyond the manufacturer's predefined setpoints, protective corrective action will be initiated by both the Site Controller and BMS. This continuous monitoring and control ensure that abnormal conditions are prevented and if they occur, they are prevented from cascading throughout the system.

The Site Controller sends a text alert that system has a warning or that it has reached a fault condition. These notifications will be sent to Tesla and Nexamp directly. Nexamp will communicate these conditions to the Moyers Corners Fire Department.

Failure mode -3: Failure of any required protection system external to the ESS, including but not limited to ventilation (HVAC), exhaust ventilation, smoke detection, fire detection, gas detection, or fire suppression system.

The explosion/deflagration protection system is designed with redundancies such that not all sparkers and/or overpressure vents are required, and the failure of a portion of the sparkers or overpressure vents will not impact the overall performance of the combined safety system. This is due to the protection system being overdesigned as to avoid the worst-case scenario. If all sparkers fail, the overpressure vents are sized accordingly to relieve all potential overpressure from the accumulated gases within MP2XL.

Per NFPA 855 Section 4.4.3 and FCNYS states that the AHJ shall be permitted to approve the hazard mitigation analysis as documentation of the safety of the ESS installation if the consequences of the analysis demonstrate the following:

1. Fires will be contained within unoccupied ESS rooms for the minimum duration of the fire resistance rating specified in Section 9.6.4
2. Fire and products of combustion will not prevent occupants from evacuating to a safe location
3. Deflagration hazards will be addressed by an explosion control or other system

Analysis Approval

Per FCNYS Section 1207.1.6.2, the AHJ shall be permitted to approve the hazard mitigation analysis as documentation of the safety of the ESS installation if the consequences of the analysis demonstrate the following:

1. Fires will be contained within unoccupied ESS rooms or areas for the minimum duration of the fire-resistance-rated separates identified in Section 1207.7.4.
2. Fires involving the ESS will allow occupants or the general public to evacuate to a safe location
3. Deflagration hazards will be addressed by an explosion control or other system

Table 2 provides an evaluation of consequences of all failure modes required by FCNYS Section 1207.1.6.2.

Table 2 - FCNYS Analysis Approval

Compliance Requirement	Nexamp Assessment
1. Fires will be contained within unoccupied ESS rooms for the minimum duration of the fire resistance rating specified in Section 9.6.4	**Not applicable.** The Megapack 2 XL is intended for outdoor ground-mounted installations only and shall not be installed within any ESS rooms or structures
2. Fires and products of combustion will not prevent occupants from evacuating to a safe location	**Compliant.** The facility shall not be occupied except for maintenance purposes. However, in the event of a failure during maintenance, hazardous conditions are anticipated to be detected by the Megapack BMS. Additionally, voluntary testing and third-party analysis performed on products of combustion from the Megapack 2/XL at locations 20 ft and 5 ft conclude no traces of Mercury or 27 different

	metals tested for. HF was detected at values of 0.10 and 0.12 ppm over the course of the test – far below accepted NIOSH Immediately Dangerous to Life or Health (IDLH) value of 30 ppm for HF.
3. Deflagration hazards will be addressed by an explosion control or other system	**Compliant.** The Megapack 2 XL is equipped with deflagration protection in the form of pressure sensitive vents and sparker system designed to ignite any flammable gases and release in a controlled manner before they are allowed to accumulate and create an explosive atmosphere within the enclosure.

Site-Specific Exposure Assessment

To understand whether the product HMA aligns with the site-level HMA, an exposure assessment stemming from the product to external exposures must be conducted. This is performed through a comprehensive analysis of testing reports and independent review of the technology and its test results.

Tesla has commissioned several technical assessments, tests, and analyses on its MP2XL product through independent engineers and NRTLs. In the Megapack 2XL Fire Protection Engineering Report a detailed analysis of the MP2XL's UL 9540A test results is provided. In this analysis, it was demonstrated that at no point during the UL 9540A test did the heat flux generated from the thermal runaway event exceed 1.3 kW/m^2, which is a performance criteria of the UL 9540A test.

Following the UL 9540A test, Tesla conducted additional product testing and fire modeling for the MP2XL. This consisted of destructive testing that exceeded the requirements of UL 9540A and subsequently required for the UL 9540 listing (which the MP2XL is listed to). The test was performed on a fully populated MP2XL. Using the results from this test, Tesla generated a heat flux model that provided the maximum predicted heat flux at various targets, located at various distances. Figure 7 details the results of heat flux modeling.

Radiation Emitting From	Condition	Target Location and Distance		Maximum Predicted Heat Flux (W/m²)
MP2/2XL Cabinet (hot surface)	With or Without Wind	Back and Side Targets	6 in	5,125
			18 in	4,400
			3 ft	3,650
			4 ft	3,175
			8 ft	2,900
Flames: Front of the MP2/2XL Cabinet	No wind (vertical flames)	Front Target	8 ft	8,500
Flames: Front of the MP2/2XL Cabinet	Worst-case wind (45° tilted flames)		8 ft	11,765
Flames: Top of the MP2/2XL Cabinet	Worst-case wind (45° tilted flames)	Back and Side Targets	6 in	12,828

Figure 7 - Tesla Destructive Testing Heat Flux Results

Furthermore, the model was used to predict heat flux targets at distances of 8, 10, 20, 50, and 100 feet. This is further shown in Figure 8. The model demonstrates that the maximum heat flux at 20 feet is approximately 3 kW/m^2, at 50 feet is approximately 0.5 kW/m^2, and at 100 feet is less than 0.25 kW/m^2.

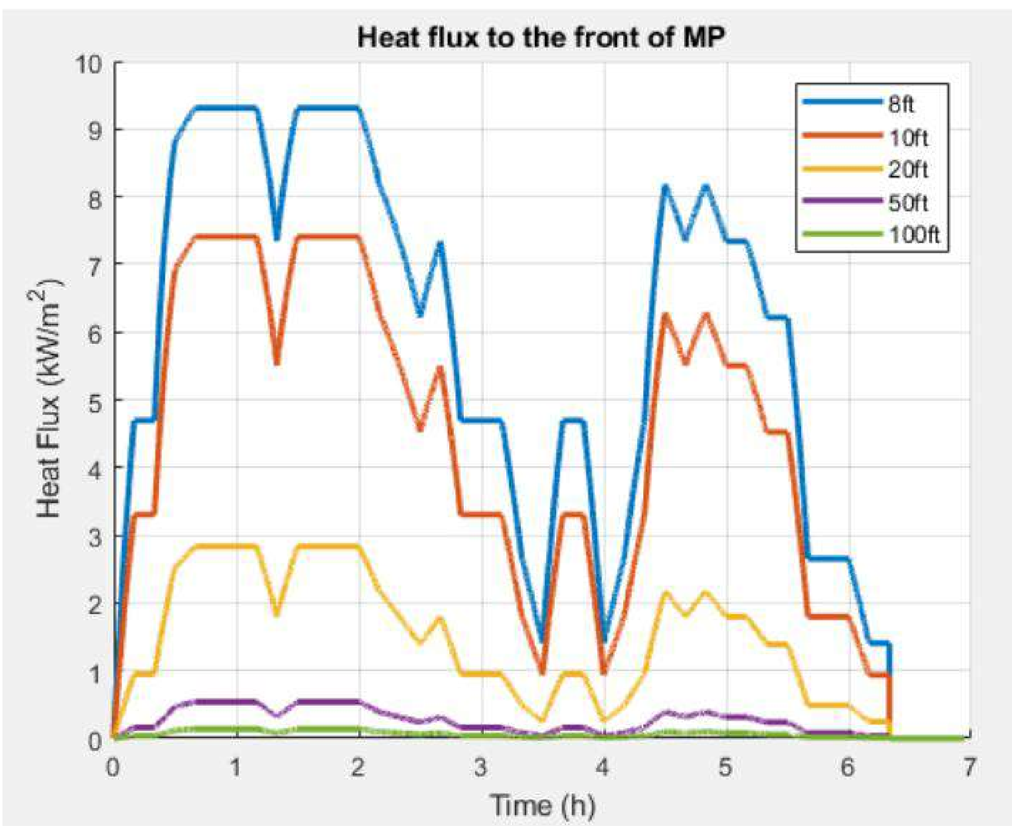

Figure 8 - Tesla Destructive Testing Heat Flux Model Prediction

Exposure Analysis

An impact of all exposures within 100 feet was assessed by Nexamp. Where exposures are negatively impacted, Nexamp is required to implement mitigation measures. Note that the analysis is based on predicted heat flux exposure to the subject locations based on the data provided through Tesla. Exposures are defined in Section 9.6.2.7.1 of NFPA 855 (2026 edition) as follows:

- Lot lines
- Public ways
- Buildings
- Stored combustible materials
- Hazardous materials
- High-piled stock
- Other exposure hazards not associated with electrical grid infrastructure

In the previous Nearby Exposures section of this document, Nexamp has identified residences and the PV array as primary site exposures. As noted earlier, the residences are approximately 300 – 600 feet from the BESS; therefore, significantly reducing heat flux risk according to data provided through Tesla. The PV array, approximately 50 feet from the BESS, as well as certain other site exposures, were analyzed as potential hazards in Nexamp's FMEA. These include, but are not limited to, vegetative/brush fire and BESS noise. Please refer to the MS Excel FMEA provided as a separate document (Ref. 1).

In assessing the site layout, it is evident that heat flux risk minimal at any point of the 100-foot radius with the heat flux anticipated to be at 0.25 kW/m^2. The exposures within a 100ft radius of the BESS include adjacent equipment associated with the BESS. Using the predicted heat flux at those distances it is anticipated that both exposures would be subject to less than 0.5 kW/m^2. It should be noted that 1 kW/m^2 is the equivalent of the nominal solar constant on a clear summer day. In treating the fire as additive to the solar exposure, conservatively the heat exposure would be less than 1.5 kW/m^2. However, at a heat flux of less than 1.5 kW/m^2 the risk is deemed to be low.

References

1. Jerry Smith Storage FMEA. "Nexamp – Jerry Smith Storage – Hazard Mitigation Analysis (FMEA) – Site specific 052626_CONFIDENTIAL.xlsx"
2. Jerry Smith Storage ERP. "Nexamp – Jerry Smith Storage – Draft BESS Emergency Response Plan_052626.pdf"
3. IEC 60812, *Analysis Techniques for System Reliability – Procedure for Failure Mode and Effects Analysis (FMEA),* 2nd Edition
4. Industrial Lithium-ion Battery Emergency Response Guide. For Tesla Industrial Energy Products including Megapack and Powerpack. Tesla. Revision 2.7, 2024
5. Fire Protection Engineering and UL 9540A Interpretation Report. Fire and Risk Alliance. Rev. 0, 2024
6. Application Note: Considerations for Hazardous Materials Business Plans. Tesla. 2024
7. Megapack 2XL Operation and Maintenance Manual. Tesla. Revision 11.13.2025
8. Megapack 2XL System Specification. Tesla. Revision 11.19.2025
9. Megapack 2XL Design and Installation Manual. Tesla. Revision 11.13.2025
10. Megapack 2XL Transportation and Storage Guidelines. Tesla Revision 11.13.2025