ATTACHMENT 7
(Emergency Response Plan)

ESRG

ENERGY SAFETY RESPONSE GROUP

CANADIAN SOLAR [redacted]

EMERGENCY RESPONSE PLAN

Summary

This document serves as the “as-designed” emergency response plan for the Canadian Solar [redacted] Energy Storage Facility located at [redacted]. This ERP provides information and instructions to guide first responders in preparing for and safely responding to an accident, fire, or other emergency associated with the [redacted] facility.

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PROJECT INFORMATION

Project Name	[redacted]
ESRG Project No.	[redacted]
Prepared For	**Canadian Solar SSES (US) Inc.** c/o 545 Speedvale Avenue Guelph, Ontario, Canada NIK 1E6
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Revision History

Revision No.	Date of Issue	Substance of Change	Prepared By	Approved By
[redacted]				
[redacted]				
[redacted]				
[redacted]				
[redacted]				

EMERGENCY RESPONSE PLAN

Site Location: [redacted]

Local and State Emergency Response Agencies

Emergency	911
Kings County Fire Department	**Non-Emergency Number:** (559) 584-9276
Kings County Sheriff's Office	(559) 584-9276
General Hospital – Adventist Health Hanford	(559) 582-9000
Burn Center – Grossman Burn Center at Memorial Hospital Bakersfield	(661) 323-2876

Table 1 - Local and State Emergency Response Agencies

Owner and Operator Contacts

Project Owner	[redacted]
Operations	[redacted]
Operations Emergency Line	[redacted]
Site Contacts	[redacted]
[redacted]	[redacted]

Table 2 - Owner and Operator Contacts

EQUIPMENT ON SITE

- This battery energy storage system (BESS) is comprised of 145 BYD Cube Pro CP32-B2800-U-R4M01 energy storage enclosures. These containers are non-enterable with the only access to the system being through exterior doors which open directly to battery modules and other internal components. The system also comprises all necessary power electronics including inverters, transformers, and switch gear to sustain power operations and will be connected to the local switch yard. Each container is comprised of 625 kW, 2.5 MWh of lithium-ion phosphate (LFP) batteries manufactured by BYD.
- Water will not pose a reactivity risk with the batteries, but it should be noted that high voltage electricity risks are present. Battery system peak voltage is 1231 V DC. AC system voltages may reach 34,500 V AC upstream of the inverters.
- DC power from the BESS enclosure is transferred via underground cables to the inverter. All major cabling is below grade. Overhead lines from other systems may be present.
- None of the enclosures are intended to be entered.
- The only on-site personnel present will be for maintenance purposes only. Staff may be on site multiple days a week. An accountability board will be maintained in the Operations and Maintenance building, also known as the first responder station.
- On-site disconnections will be done automatically, by maintenance personnel on or offsite, or at the first responder station.
- KCFD has added their own lock to the main gate and the BESS gates. Maintenance personnel on-site or in the area will NOT be needed grant Fire Department access.
- Fire Department Connections (FDCs) provided on the units are not to be used as part of initial response but may be utilized once discussed with Subject Matter Experts (SMEs)

1 SITE LAYOUT

1.1 Site Map

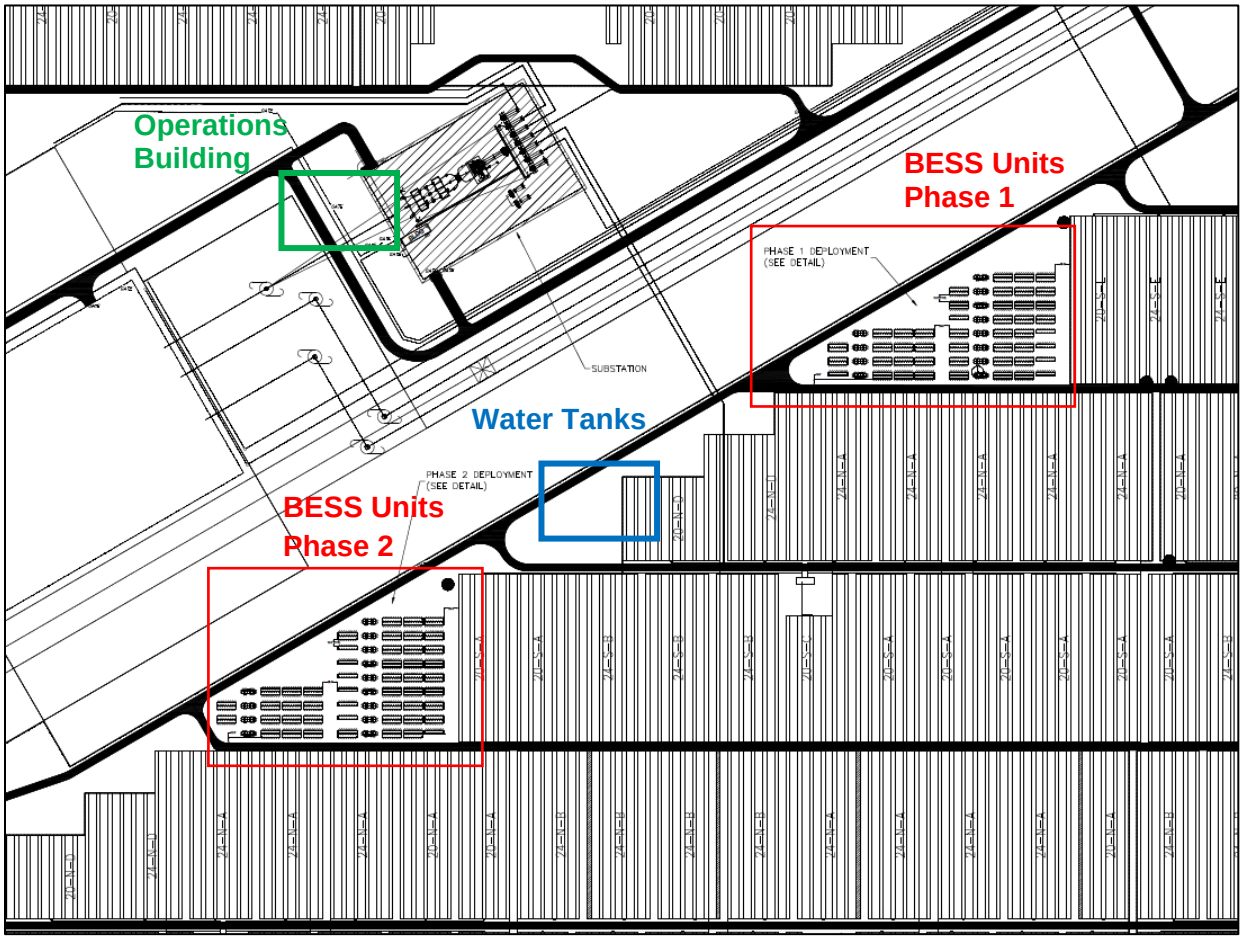

Figure 1 – BESS Layout. Note Water Tanks Are Inside Fence Line. Note operations building shall serve as incident command post

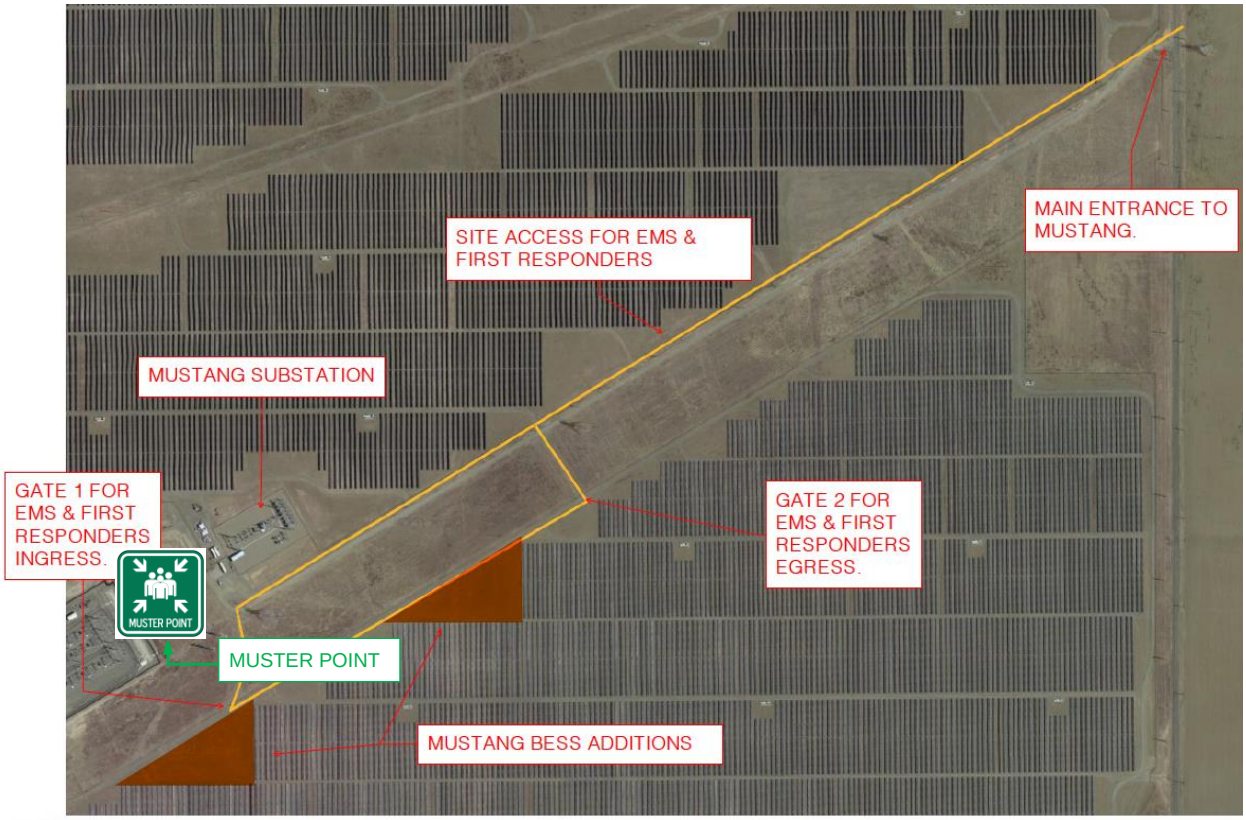

Figure 2 - Emergency Response Locations

The primary muster point for staff in the BESS area is located [redacted]

1.2 Energy Storage System

Figure 3 - BYD Cube Pro Enclosure

2 FIRE PROTECTION AND SAFETY CONTROLS

2.1 Safety Controls

- **Site Alarm Panel:** A first responder station, which will house an HMI (human machine interface) control panel will be on site at the primary Incident Command post (IC) location (denoted in Figure 1 as the operations building). This panel will allow first responders and SMEs to access information about the entire site, including alarm conditions and the status of every individual container.

- **Audible and Visual Alarms:** The Cube Pro contains both an audible fire alarm bell and visual fire strobe located at the end of each container. If the smoke or heat sensors are triggered, both fire alarms will activate, and corresponding alarms will be sent to the BESS Energy Management System (EMS).

  - **Level 1:** Detection of failure by a single smoke or thermal detector will trigger Level 1 alarm, sounding the audible alarm bell on the Cube Pro and stopping battery operation. A digital alarm is passed through the EMS system to SCADA (operator), notifying the control room and UI of the operator.

  - **Level 2:** Detection of failure of one of each alarm type will trigger the Level 2 alarm, triggering both audible alarm and visual alarm strobe on the Cube Pro.

Event	Fire Protection System Action	Alarm Bell Program	Fire Strobe Program
Detection from one sensor (smoke or heat)	Trigger Level 1 alarm, alarm bell activated	Constant bell alarming	Fire strobe does not alarm
Detection from both sensors	Trigger Level 2 alarm, alarm bell and fire strobe both activated	Constant bell alarming	Constant flash alarming
Detection from gas sensor	Trigger Level 2 alarm, alarm bell and fire strobe both activated	Bell alarming with 3 seconds, and 1 second interval	Constant flash alarming

Table 3 - Audible and Visual Alarms

- **Interior Sensors:** Heat, smoke, and gas detectors are provided within the enclosure. The temperature threshold of the heat sensor is 57.2°C.

- **Suppression System:** A remote fire department connection (FDC) feeding an internally installed deluge system shall be present in every enclosure. When approaching the FDC, consider emergency guidance on container approach as described in Section 6. The FDC should not be used during an emergency without guidance from the SME and agreement by all parties.

- **Emergency Stop (E-Stop):** Not readily available to first responders besides at the first responder station. This should not be actively sought by the Fire Department. Only use at the direction of the SME and if the buttons may be pressed easily and safely by personnel outside the blast radius of an enclosure.

- **Exhaust Ventilation System:** Two exhaust fans are installed in each cabinet to keep gas concentrations from reaching flammable levels in the case of cell off-gassing. The exhaust system is triggered by any of the following conditions:

  - Flammable gas detector detects concentration of flammable gas within enclosure
  - Second-level fire alarm (ambient temperature and smoke)
  - BMS measures cell temperature > 100°C and cell voltage < 1.5V in the same pack

2.2 Condition Monitoring and Alarming

The System is set up to measure temperature, current, and voltage of the battery which may provide real-time indication of the conditions inside the container. In addition, the system is equipped with two (2) smoke detectors, two (2) heat detectors, and two (2) gas detectors to monitor atmospheric conditions. These conditions and data may be reported in real-time to an asset management team who may be able to interpret the conditions inside the cabinets to the fire department. It will also be available on a custom-designed software platform available in an “emergency response station” on-site which is intended to act as the command center.

2.3 Fire Safety System Alarm Activation

The system is set up for a single stage alarm notification based on detection of smoke from one smoke detector or 25% or greater LEL measurement, based on catalytic detection, from one of the gas detectors. A thermal alarm based on battery temperatures may also be utilized but set points and alarm conditions for this detection have not yet been finalized and a truly failing cell should trigger the smoke detector at some point.

Upon trigger of the alarm, an alarm signal is sent to the operator of the system who will then assess the situation and notify emergency response and fire service personnel. The Cube Pro contains both an audible fire alarm bell and visual fire strobe located at the end of each container. If the smoke or heat sensors are triggered, both fire alarms will activate, and corresponding alarms will be sent to the BESS Energy Management System (EMS).

3 POTENTIAL HAZARDS

3.1 Hazards Associated with Energy Storage Systems

There are five major risks posed by lithium-ion battery failures: **fire**, **explosion**, **electric shock**, **arc flash**, and **toxicity of by-products from off-gassing**. Off-gassing of flammable gas from damaged cells is also a unique characteristic of lithium-ion battery failures and should be looked for when arriving at the scene of a battery incident.

- **BESS Battery Fire –** Battery fires present unique hazards, including stranded energy and re-ignition risk. Fire growth can be slow, fast, or explosive in nature. Flames may sometimes arise violently and resemble jet flames.

- **BESS Off-Gassing –** Lithium-ion batteries release flammable and toxic chemicals when subjected to electrical or physical damage, including fire. Chemicals released can also pose an inhalation hazard.

- **BESS Explosion –** Accumulated flammable gasses inside a BESS enclosure may result in an explosion, if ignited. Given the size of the batteries in this system versus the volume of the container, even a single cell may create a flammability or explosion hazard inside the battery container. Therefore, responders should assume that any failure in the battery may create an explosive situation.

- **Electric Shock** – Even though a battery may look to be destroyed by fire and/or other means, there is great potential that the battery still has stranded energy and remains energized.

- **Arc Flash** – An electrical explosion due to a fault condition or short circuit when either a phase-to-ground or phase-to-phase conductor is connected and current frows through the air.

- **By-Products of Off-Gassing** – During a failure event, a lithium-ion battery may emit tens to hundreds of liters of off-gas, and larger failures may emit thousands of liters of gas. Typical composition of a lithium-ion off-gassing event may include:

High Concentrations (>10%)	▪ Carbon Monoxide ▪ Carbon Dioxide ▪ Hydrogen
Medium Concentrations (1-10%)	▪ Methane ▪ Ethane / Ethanol / Ethylene ▪ Other Hydrocarbons
Low Concentrations (<1000 ppm)	▪ Hydrogen Fluoride ▪ Hydrogen Chloride ▪ Hydrogen Cyanide ▪ Benzene, Toluene

Table 4 - Typical Off-Gas Concentrations

Indicators which may provide insight into what is happening or about to happen during an event may include:

- Smoke or flaming coming from the battery enclosure or related equipment
- Change in smoke color
- Change in velocity or volume of smoke production
- Sounds – popping (many times caused by venting cells) and / or hissing sounds
- Smell – sweet smell

Electrical hazards may also be present from associated electrical equipment such as those listed below. **All BESS systems and related electrical equipment shall always be treated as energized (Energetic Hazardous Material).**

- **BESS Electrical Equipment –** BESS electrical equipment including batteries shall always be treated as energized. A BESS does not have a single point of disconnect to electrically isolate all components from each other. There are disconnects that will

de-energize select parts of the system, but the batteries themselves will remain energized.

- **Electrical Equipment –** Electrical equipment shall always be treated as energized. Associated hazards include electric shock, arc flash, and fire.

- **Overhead Power Lines –** Overhead power lines shall always be treated as energized. Associated hazards include electric shock, arc flash, and fire. For locations see facility site plan, Appendix C.

- **Photovoltaic Array (Solar Panels) –** PV arrays shall always be treated as energized. Associated hazards include electric shock, arc flash, and fire. In this system, the AC output of the PV panels is tied into the AC output of the BESS inverter. The circuits are energized and controlled separately. There is no additional DC circuit besides the single BESS enclosure.

3.2 Potential Site-Specific Hazards

Potential site risks are minimal due to the remote location and nature of the site. Though there are camping locations nearby, they are remote and sufficiently distant such that smoke or off-gas from the battery container should not pose a risk.

ESRG recommends the fire department only drive an apparatus into the fenced area (if necessary) from the first gate on the east end of the site. ESRG recommends against bringing an apparatus into the site when conditions are muddy, as an apparatus may be stuck in the mud. There is no turnaround at the end of the road, and trucks will need to be turned around using the first gate during an emergency as the second gate is too close to the battery container.

3.3 Life Safety Risks

It is anticipated that maintenance personnel may be on site multiple days a week and may also be by themselves. For that reason, when personnel are on site, whether alone or in groups, they will check in via an accountability board in the first responder station. The board will list everyone on site and their approximate location on site. When the fire department arrives on site, they should check the accountability board to ensure all personnel have safely evacuated and that personnel may not be down on site and not visible from outside the fence line.

4 Required Personal Protective Equipment

Full firefighter protective gear shall be worn in any response to a fire and/or explosion event or any indication a fire may be present. This shall include proper use of Self-Contained Breathing Apparatus (SCBA).

If no fire or explosion risk is present, AR protective clothing to protect against arc flash and shock shall be worn. Jewelry such as necklaces shall be removed to avoid contact with any electrical hazard.

5 Emergency Response Recommendations

Initiation of emergency response shall be activated per current protocol. If there is any threat or potential threat to life or safety, 911 shall be called immediately to summon the aid of public safety responders. An initial scene assessment shall be conducted from all sides (360-degree scene size-up) if at all possible, and a clear concise assessment shall be given to incoming responders. Hazards and facility safety concerns such as high voltage areas or other electrical concerns shall be announced to all responders. The scene assessment shall include the following in plain language (No code or terms):

- Where the incident is located
- What has happened
- What is occurring
- Any injuries or unaccounted for individuals
- What the needs/resources are

An Incident Command System (ICS) shall be established immediately and shall include designation of roles. If Public Safety is summoned to the incident, the ICS shall be a Unified Incident Command System. Onsite staff and visitors shall immediately go to a designated muster point for accountability. Incident command shall designate the individual in charge of accountability. Accountability shall be reported as soon as possible. Another individual shall control any traffic and guide first responders into the scene.

At the same time as these activities are occurring the [redacted] Contact shall immediately establish available data from the Battery Management System (BMS) and communicate this to the appropriate incident command individual.

6 Specific Recommendations by Type of Emergency

6.1 Fire

When sensors within the BESS enclosures detect conditions that indicate a fire, an audible alarm will sound, and a visual strobe will flash on the enclosure exterior. Smoke and flame may be visible from the outside of the BESS enclosure. Fire growth can be slow, fast, or explosive in nature.

A minimum of seventy-five feet (75') shall be maintained between individuals and the BESS enclosure exhibiting fire conditions. Personnel and resources should not be positioned parallel to the sides of the BESS enclosure. In order to minimize exposure to the potential blast radius, these resources should be positioned on the corners of the BESS enclosure. Any attempts to approach the BESS enclosure should adhere to the same recommendations. Attempt to extinguish the fire only if imminent threat to life safety exists.

If there is no immediate threat to life safety:

- Allow the BESS to burn in a controlled fashion until all fuel sources inside are depleted.
- If incipient stage fire is present and it is safe and possible to do so, use copious amounts of water to extinguish the fire, and continue to cool to reduce the chances of re-ignition. This covers small fires that may not include the batteries, fires outside the battery containers, or small fires inside the battery container if the doors are open.
- Fire department connections on the units should not be used during an emergency unless guided by SME and all parties agree deflagration risk inside the container is not present.
- A defensive approach should be considered utilizing water to cool and protect adjacent exposures and mitigate the spread of fire. Remove or protect adjacent vegetation to avoid providing an additional fuel source which may aid the spread of fire. SME shall provide guidance on conditions inside the adjacent battery containers and whether defensive cooling is needed.

- The site contains fire department connections (FDC) leading to sprinkler heads inside the individual units. These FDCs should NOT be utilized by the fire

department unless guided to do so by the SME. The FDCs will not be marked so as to prevent confusion to this end.

WARNING: <u>The risk of battery re-ignition remains present for hours or even days after the smoke/flame was initially detected. Even if a lithium-ion battery fire has been extinguished there is still a risk of re-ignition.</u>

Chemicals released during a fire or explosion will be in a gaseous form and primarily pose an inhalation hazard. A fog pattern from a handline or monitor nozzle may be an effective way to control the off-gassing event on the exterior of the battery container from migrating to unwanted areas. However, if water is used in extinguishing flames, these gasses can become acids which may cause skin irritation.

Water curtains or hose streams may be applied to adjacent exposures for cooling purposes. If any indicators are present of damage or heat to an adjacent system, the BMS data shall be closely monitored for the adjacent system and relayed to the appropriate individual within the Incident Command System.

Following partial or complete consumption of the system by fire, batteries may continue to emit low levels of flammable gases and dangerous levels of toxic gases for an extended period of time. Continuous monitoring of gas levels in and around the incident location shall be conducted and use of mechanical ventilation may be utilized to manage gas levels. Full firefighter PPE and SCBA shall be utilized until gas levels are confirmed to be at a safe level. A fire watch shall be performed for a minimum of 24 hours after any fire incident. Any fire incident in which the fire department did not respond shall be reported to the Kings County Fire Department in a timely fashion for notification purposes.

- **Initial suppression source –** Fire Apparatus (Up to 4,000 gallon water capacity depending on fire department response)
- **Primary fire department water source –** Two (2) 10,000 gallon water tanks are provided on-site for secondary Fire Department water source. These tanks are refilled by onsite well which is supported by 500GPM pump

6.2 Explosion

<u>A minimum of seventy-five feet (75') shall be maintained between individuals and the incident battery container. Personnel and resources should not be positioned parallel to the sides of the BESS enclosure. In order to minimize exposure to the potential blast radius, these resources should be positioned on the corners of the BESS enclosure. Any attempts to approach the BESS enclosure should adhere to</u>

the same recommendations. Only attempt to extinguish fire if eminent threat to life safety exists.

Given the size of the individual battery cells and the volume of the enclosure, it should be assumed that a single cell can produce an explosive atmosphere inside the enclosure. Therefore, any failure or alarm condition should result in the assumption of an explosive risk.

Lithium batteries off-gas when heated or when subjected to electrical or physical damage. These gasses can accumulate inside the battery container at levels above the Lower Explosive Limit (LFL), especially if the fire suppression system has been discharged.

- Extreme caution shall be taken prior to any ventilation or attempts to open any compartments or doors on the system as the introduction of fresh air may bring atmospheric condition back into the explosion range and result in an explosion if fire or other ignition source is or becomes present.
- The responder preparing to open any door or compartment shall stand to the side to eliminate the risk of being directly in the path of the blast pressure if an explosion were to occur.
- Gas monitoring shall be continuously conducted at all times and gas meters shall be affixed to all responders to warn of potential atmospheric risks. If possible, gas readings from inside the battery container shall be attempted to be gathered from an exterior point prior to any entry.
- Gas readings outside the battery container, if the doors remain closed, should not be considered indicative of conditions inside the enclosure.
- Any ignition source inside or near the BESS enclosure can cause the flammable gasses to ignite and/or explode.

6.3 Electric Shock

All BESS systems and related electrical equipment shall always be treated as energized (Energetic Hazardous Material).

Even though a battery may look to be destroyed by fire and/or other means, there is great potential that the battery still has stranded energy and remains energized. De-energization of the system or any removal of the battery or battery component shall only be performed by a trained and competent individual with appropriate PPE.

Some manufacturers may suggest the removal and neutralization of damaged batteries using explosion proof containers or saltwater baths. ESRG strongly advises against the

fire department performing these actions as there are considerations for handling damaged batteries requiring equipment and expertise not readily available. Once the scene is secured, these actions may be undertaken by trained experts under close supervision.

6.4 Arc Flash

All BESS systems and related electrical equipment shall always be treated as energized (Energetic Hazardous Material).

Although not designed for entry, if work is being performed in the battery container, wear non-melting or untreated natural fiber long-sleeve shirt, long pants, safety glasses, hearing protection, and leather gloves. AR plant clothing is also acceptable. Maintain arc flash boundary until completion of task.

*****Arc Flash Boundary: 6 ft*****

6.5 Chemical Release

The off gas can contain detectable levels of carbon monoxide (CO), hydrogen chloride (HCl), hydrogen fluoride (HF), and hydrogen cyanide (HCN) and other hydrocarbons and VOCS.

No approach shall be permitted during an off-gassing event unless there is eminent threat to life safety at which time only properly trained and equipped public safety may enter. This approach shall be with full firefighter protective gear to include self-contained breathing apparatus (SCBA). The approach in this situation shall be at the sole discretion of the officer in charge (OIC).

Chemicals released during a fire or explosion will be in a gaseous form and primarily pose an explosion hazard if gas levels accumulate inside a BESS enclosure. However, if water is used in extinguishing flames, these gasses can become acids which may cause skin irritation.

6.6 Hazmat Considerations

Runoff water from suppression shall be attempted to be contained utilizing diking, damming or other preventative measures. Barriers such as PIGS may be utilized to control runoff. If any storm drains or other drainage is present which may flow offsite and not be contained to a retention area the drains should be covered with mats or protected with barriers.

APPENDICES

Appendix A – Definitions

For the purpose of this document, the following definitions apply.

- **Authority Having Jurisdiction (AHJ)** – An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure. *(NFPA 855-2020, 3.2.2)*
- **Battery Energy Storage System (BESS)** – Stationary equipment that receives electrical energy and then utilizes batteries to store that energy to supply electrical energy at some future time. The BESS, at a minimum consists of one or more modules, a power conditioning system (PCS), battery management system (BMS) and balance of plant components. *(UL 9540A-2019, 4.2). Note:* Also commonly referred to as ESS.
- **Battery Management System (BMS)** – A system that monitors, controls, and optimizes performance of an individual or multiple battery modules in an energy storage system and has the ability to control the disconnection of the module(s) from the system in the event of abnormal conditions. This system can be completely independent of the ESMS. *(NFPA 855-2020, 3.3.3)*
- **Balance of System (BOS)** – The non-battery hardware in a battery energy storage system necessary for its operation. Includes AC inversion equipment, fire protection systems, grid controllers and other hardware.
- **Cell** – The basic electrochemical unit, characterized by an anode and a cathode, used to receive, store, and deliver electrical energy. *(UL 9540A-2019, 4.3)*
- **Energy Management System (EMS)** – A system that monitors, controls, and optimizes the performance of an energy storage system and has the ability to control the disconnection of the energy storage system in the event of abnormal conditions. *Note:* May also be referred to as Energy Storage Management System (ESMS), as defined in *NFPA 855-2020, 3.3.8.*
- **Emergency Response Plan (ERP)** – A documented set of actions to address the planning for, management of, and response to natural, technological, and man-made disasters and other emergencies. *(NFPA 72-3.3.97)*
- **Lower Flammable Limit (LFL)** – The lowest concentration of a combustible substance in a gaseous oxidizer that will propagate a flame, under defined test conditions. *(NFPA 68-2018, 3.3.12.1).* Note: This is also commonly referred to as Lower Explosive Limit (LEL).
- **Module** – A subassembly that is a component of a BESS that consists of a group of cells or electrochemical capacitors connected together either in series and / or parallel configuration (sometimes referred to as a block) with or without protective devices and monitoring circuitry. *(UL 9540A-2019, 4.12)*
- **Off-Gassing** – The event in which the cell case vents due to a rise in internal pressure of the cell. *(NFPA 855-2020, 3.3.16)*

- **Unit** – A frame, rack, or enclosure that consists of a functional BESS which includes components and subassemblies such as cells, modules, battery management systems, ventilation devices, and other ancillary equipment. *(UL 9540A-2019, 4.18)*
- **Upper Flammable Limit (UFL)** – The inverse of LFL / LEL, or the point at which the air has become too fuel rich to sustain combustion. *(NFPA 68-2018, 3.3.12.2)*
- **State of Charge (SOC)** – The stored or remaining capacity of a battery at a given time expressed as a percentage of its rated capacity. *(NFPA 72-2019, 3.3.31.2.3)*
- **Thermal Runaway** – The incident 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. *(NFPA 855-2020, 3.3.20)*