

**ANN ARBOR FIRE DEPARTMENT** 





**BATTERY ENERGY STORAGE SYSTEM FIRES** 

Effective:	April 4, 2025
Scheduled Review:	April 4, 2028
Approved:	Fire Chief Mike Kennedy

### I. PURPOSE

This procedure describes the hazards associated with battery energy storage system fires and addresses size-up, operational awareness and procedures.

### II. BACKGOUND

A battery energy storage system (BESS) or energy storage system (ESS) is a type of system that uses an arrangement of batteries and other electrical equipment to store electrical energy. BESS have been increasingly used in residential, commercial, industrial, and utility applications for peak shaving or grid support. Installations vary from large-scale outdoor sites, indoor sites, e.g., warehouse type buildings, as well as modular systems. Containerized systems, which are one form of a modular design, have become a popular means of integrating BESS projects efficiently.

BESS project sites can vary in size significantly ranging from about one Megawatt hour to several hundred-Megawatt hours in stored energy. Due to the fast response time, lithium-ion BESS can be used to stabilize the power grid, modulate grid frequency, provide emergency power or industrial scale peak shaving services reducing the cost of electricity for the end user. This makes it attractive to use BESS for short-term peak compensation and frequency control to minimize the chance of power outages. However, high powered and rapid charge cycles result in electrical transients that can generate heat quickly. This is generally true when the batteries approach a high state of charge when charging and / or a low state of charge when discharging. This phenomenon may also be amplified with battery degradation. Overheat is not beneficial to the safety, performance, and lifespan of lithium-ion batteries. The desired range of optimal operating temperatures is often narrow and can be difficult to maintain, especially during electrical transient. Allowing a lithium-ion battery to perform outside its intended operating temperature range can have detrimental effects on safety possibly leading to fire or explosion.



Standard Operating Procedures – 3.25 Battery Energy Storage Systems





(above) Layout of BESS.



(above) Picture of BESS at carport photovoltaic installation.



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### III. OPERATIONS

Stage apparatus upwind of the event. Upon arrival at the scene all non-essential personnel shall be evacuated from the area to a minimum safe distance of 150'. upwind. Greater distance may be required due to conditions within and immediately around the structure.

Only fire response personnel in full protective PPE including SCBA should be allowed within the immediate area of the structure.

Activate the BESS or ESS emergency stop, if located a safe distance from the affected unit to isolate battery from charging or discharging. Note: Electrical energy will still be present within the BESS or ESS due to stored energy within the battery system. For stationary BESS incidents determine if any provided exhaust systems are operating.

Do **not** open any door to an ESS or attempt to make entry upon initial arrival. Toxic and combustible gases may be present inside the structure. Entry should only be attempted following appropriate monitoring for flammable and explosive atmospheres within the structure. BESS / ESS have a variety of safety mechanisms. Some are designed to maintain the doors in a close position, and some have automatic doors designed to aid in ventilation. Priority should be assigned to exposure protection and evacuation of personnel and residents in danger from toxic smoke and fire gases escaping the structure. Exposure protection should be the primary means of containing fires within an energy storage system.

Direct extinguishment is not recommended and is only appropriate given a very narrow set of circumstances. Direct extinguishment may be appropriate if BESS or ESS cabinet doors are already open due to an explosion, or automatic release system where the battery racks are able to be directly impacted by fire streams. The decision to attempt direct extinguishment is at the discretion of the incident commander.

If direct extinguishment is chosen as the safest option for mitigation the following considerations should be taken:

- Extinguishment should only be attempted from the exterior of the structure. At no time should entry to the structure be made for extinguishment of a lithium battery fire.
- Extinguishment should be performed via unmanned master streams when possible. When direct suppression is attempted fire suppression run off must be considered and accounted for due to contaminants present within the water.

Significant quantities of water are required to control lithium-ion battery fires. Consideration should be given to the available water supply prior to attempting direct suppression.

Care should be taken to avoid direct water application to unaffected BESS to limit water intrusion and potential additional electrical fires.

Incidents involving lithium-ion batteries and BESS can last for long durations over multiple operational periods. Consideration should be given to the long-term monitoring of the incident.



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### IV. SAFETY

Full PPE with a donned facepiece must be worn at all times with lithium-ion batteries or mobility devices that have been involved in fire or subjected to elevated temperatures. Due to the rapid re-ignition danger when involved in fire or subjected to elevated temperatures, full PPE with a donned facepiece must also be worn at all times during the following:

- Whenever members are operating in the immediate area / same room.
- When handling or removing from an area to the bathtub, sink or bucket.
- When securing a mobility device with a rope for removal via window.
- Physical damage (impacted, crushed or pierced) to the mobility device or battery.

### V. POST INCIDENT ACTIONS

Use a thermal imaging camera to aid in determining if battery temperature is maintaining ambient temperature, reducing or increasing.

Companies involved in direct suppression of a BESS fire shall be removed from service until the following occur.

- Personnel shall use medical gloves to remove and handle gear turnout gear. If environmental conditions allow, gear should be placed in garbage bags on the scene. All turnout gear and SCBA involved in suppression efforts must be immediately washed. Personnel shall switch into their back-up turnout gear.
- Personnel shall shower and change into a clean uniform.

### VI. NOTIFICATION and DISPOSAL

For all fires where the origin was potentially a BESS, the on-duty battalion chief shall be notified. An assistant chief or fire chief will likely need to be consulted.