



Stat-X[®] Aerosol Fire Suppression

Fire Suppression in Battery Energy Storage Systems

Fire Suppression

Fire suppression is the last line of defense. The discharge of agent means that all other interventions have failed. However, the nature in which batteries fail and their very design make total extinguishment challenging.

After gas detection, the next opportunity for fire detection is by the detection of smoke. In this instance, a smoke detector alarms, and the signal triggers a fire suppression system that activates.

But as we mentioned and was highlighted at the Arizona Public Service (APS) explosion, thermal runaway that produces smoke can occur and slowly build up for hours. At the APS incident, the smoke detection system operated as designed and activated a clean-agent fire suppression system.

However, even after discharge of the clean agent, thermal runaway continued. For three hours before the fire crews opened the container doors (initiating an explosion), large quantities of flammable smoke continued to be produced.

So, what went wrong at the APS incident? From a fire suppression agent perspective, the chosen clean agent system utilizing a fluoroketone agent, was not designed correctly. The system did operate and discharged a 10% concentration of agent.¹¹

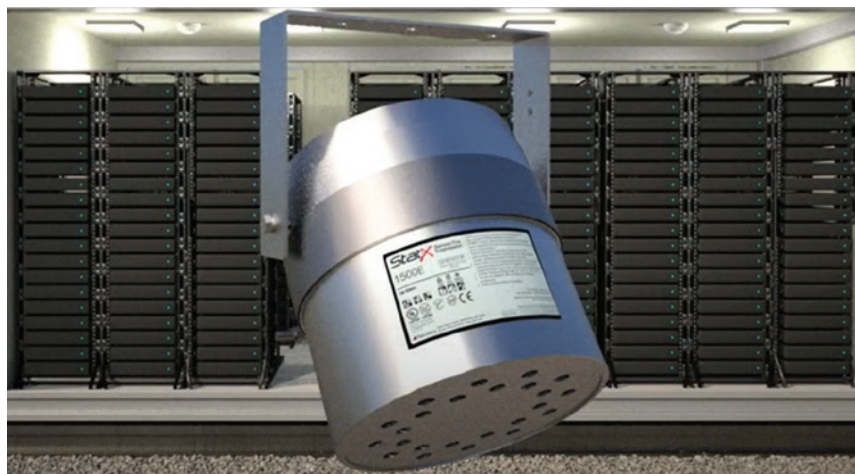
According to an investigative report produced by DNV GL (now known as DNV), an international leader in battery testing, “The {fluoroketone} clean agent was inadequate and inappropriate to stop or prevent cascading thermal runaway of multiple battery cells or modules.”

The report went on to cite the agent manufacturer where they stated in comments to a draft of NFPA 855 Standard for the Installation of Stationary Energy Storage Systems®: “Clean agents are demonstrably ineffective in preventing and stopping thermal runaway, as are foam and dry chemical.”¹²

Since the clean agent was designed for extinguishing incipient fires, it was unsuccessful at stopping the non-flaming thermal runaway. Thirty minutes

after discharge, there was no agent in suspension and the space was completely vulnerable to explosion and fire. The failure to use an appropriately designed fire suppression system including failure to completely seal the enclosure thus allowing early depletion of agent concentration and reduced hold time was cited as one of the primary contributing factors to the severity of the incident.

With clean agents being ineffective for BESS incidents, then what about using a sprinkler system? Traditional sprinklers are not a good choice. The confined nature of battery cells effectively prevents the water from reaching the heated area. Sprinkler systems also require a dedicated water supply which can be problematic



Stat-X® photo courtesy of Fireaway Inc.

in many areas. Lastly, the water discharge can damage the BESS components and raise environmental concerns due to water runoff.

To provide superior fire protection for BESSs, a specialized agent is required. The ideal agent in this case is one that will:

- Limit propagation of thermal runaway
- Suppress any fire present
- Limit damage to components
- Does not require significant infrastructure

Despite the difficult nature of providing these “must haves,” there is an agent that does exactly this. The Stat-X[®] condensed aerosol fire suppression system is the ideal agent for BESS fire suppression.

Stat-X has been tested extensively, resulting in verification of its performance in these categories. First, Fireaway contracted DNV—the same organization that investigated the APS incident—to conduct trials of Stat-X on lithium-ion battery cell fires. The results were extremely positive:

- Stat-X was proven effective at extinguishing single- and double-cell lithium-ion battery fires.
- Residual Stat-X airborne aerosol in the hazard provides

additional extended protection against reflash of the fire.

- Stat-X reduced oxygen in an enclosed environment during a battery fire to 18%.
- The residence time of gases and aerosols during Stat-X deployment is a function of when the atmosphere is ventilated.

Second, Fireaway contracted PVEL, a leader in renewable energy product and regulatory testing, to perform full-scale testing in compliance with UL 9540A. These results were also positive. During the period of Stat-X discharge and agent retention time:

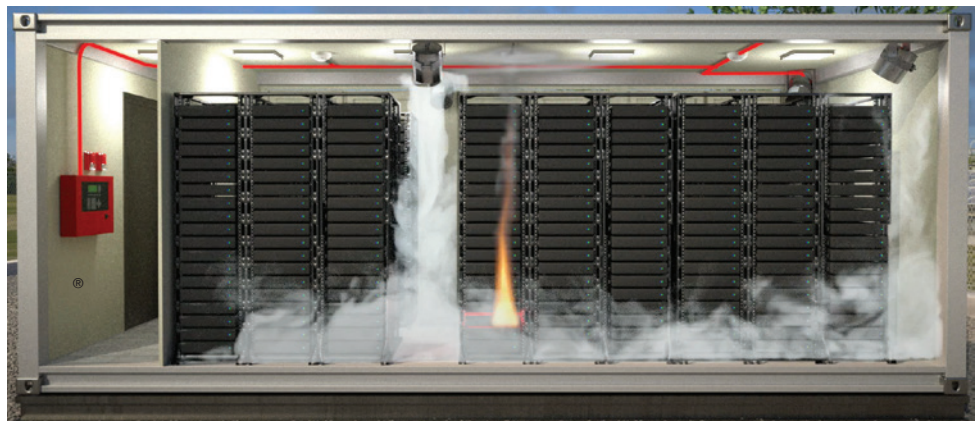
- Thermal runaway did not propagate to adjacent battery racks
- No flames were observed
- No significant increase in temperature was observed

- No deflagration or explosion was observed

The Stat-X total flooding system offers the unique combination of limiting thermal runaway propagation while also suppressing and knocking down the fire. The self-contained units can be connected to any type of detection system or can be

specified to activate at a pre-determined temperature or gas concentration level. And the virtually maintenance-free and compact units require no piping or other infrastructure requirements.

It is also important to note that condensed aerosol fire suppression agents have no global warming or ozone depletion properties. The agent is rated for normally occupied areas.



Stat-X photo courtesy of Fireaway Inc.