LITHIUM ION ENERGY STORAGE SYSTEM (OUTDOOR AND ROOFTOP INSTALLATIONS)

1. INTRODUCTION

1.1 The basic purpose of Energy Storage Systems (ESS) is to store energy so it can be used at a future time. While there are many different types of ESS the particular one addressed in this document uses Lithium-ion batteries (Li-ion) to store energy. The hazards and Incident Response Procedures are specific to Lithium Ion Energy Storage Systems
(Li-ion-ESS) and may not be applicable to other ESS due to varying hazards. Some applications of Li-ion-ESS include peak shaving, load shifting, UPS, frequency regulation, grid support, emergency back-up. The use of this technology will bring the much needed relief to the NYC electrical grid infrastructure and help satisfy the emerging sustainability requirements.

2. TERMINOLOGY

- **Lithium Ion Energy Storage Systems (Li-ion-ESS):** A system comprise of one or more lithium ion batteries assembled together, capable of storing energy in order to supply electrical energy at a future time.

- **Fire Department Connection (FDC):** supplies water to a fixed system. FDNY refer to them as a "Siamese connection".

- **ESTOP:** Emergency stop device that will shut down the entire system.

- **Danger Zone:** The distance that should be maintained from the affected Cabinet or Container LIon-ESS.

- **BMS:** Battery Management System is a device that constantly monitors the health of the batteries and shuts down the affected battery module or rack when it detects a problem.

  Note: The rest of the system can still be running even though it may have shut down a section of the system. The BMS DATA should be available for the IC at the location. The BMS data will show any "trending" rising temperatures within the ESS that may not be seen by the thermal imaging camera.

- **Cell (battery):** The basic electrochemical unit, characterized by an anode and a cathode, used to receive, store, and deliver electrical energy. It is the smallest component of the Li-ion-ESS.

- **Module (battery):** A subassembly consisting of a group of cells connected together either in a series and/or parallel configuration, with or without protective devices and monitoring circuitry.

- **Rack (battery):** A group of modules interconnected together in order to provide a greater energy capacity. There can be numerous racks inside a battery container/ cabinet.

- **Inverter\Rectifier:** A device that changes DC power to AC power or AC power to DC power.

- **Container:** A large size storage enclosure used to store the components of the ESS. Resembles a maritime ISO container.

- **Cabinet:** A small to medium size storage enclosure used to store the components of the ESS. Resembles a commercial sized refrigerator.

- **Clean Agent:** A fire suppression system that releases an inert gas to extinguish fire.

- **Subject Matter Expert (SME):** A person that is familiar with the Li-ion-ESS and can be called for additional information about the incident or special called to the scene to assist the Fire Department.

- **Stored/Standed Energy:** A condition where the system has been electrically isolated but there is still residual charge in the batteries.

- **Hazardous Materials Response:** Haz-Mat Battalion, Haz-Mat Company 1 and a Haz-Mat Technician Unit.

3. LIon-ESS APPLICATIONS

- **Peak Shaving:** Is a method used to help alleviate the demand for energy during peak hours of the day. The Li-ion-ESS charges during less expensive off peak times for later use during peak demand. This in turn saves the customer money.

- **Grid Support:** Is a method used to store a tremendous amount of energy that supports the utility electrical grid. Shutting down these types of Energy Storage Systems can have a cascading effect on the grid and cause significant damage to the utility electrical grid. These systems should NOT be shut down without consultation.

- **Load Shifting:** Is a method used in demand-side management. It involves moving the consumption of high wattage loads to different times within a day.

- **UPS (Uninterruptible Power Supply):** Provides battery backup when the electrical power fails or drops to an unacceptable voltage level. Some of these systems are used for critical infrastructure, such as financial data centers, and should not be shut down without consultation with a building engineer. ESS that are currently being used as a UPS and installed within buildings will mostly use lead acid batteries. In the future it is expected that they will be converted to lithium ion batteries as replacement is required.

- **Frequency Regulation:** Is a method used to smooth out the uneven voltage from the grid that comes into the building. This helps to maintain expensive equipment against power surges or power reduction.

- **Emergency Backup:** Provides energy to vital systems in the event of an emergency situation within a building (examples: fire pump, fire alarm systems, communications, etc.)

4. LITHIUM ION-ESS GENERAL HAZARDS

- **Stored\Stranded Energy:** Even after the batteries are severely burned they may still retain a high voltage electrical charge (STRANDED ENERGY)

- **Flammable Electrolyte:** The release of the ESS batteries' material in a vapor form can potentially create an explosive atmosphere. The flammable electrolyte is integrated into other materials within the battery cell. Therefore, there is no spill hazard with this type of batteries.

- **Re-ignition after extinguishment:** Even after final extinguishment seems to have been accomplished, Li-ion-ESS may re-ignite hours to days after being involved in a fire.

- **Electrical arc flashes during shut down:** Li-ion-ESS may possess high voltage which could result in an electrical arc flash during shut down operations.

- **Deep Seated Fire:** Fire in these systems may be deep seated within the system. This heat signature may result in it not being picked up by a Thermal Imaging Camera.

- **Delayed Ignition:** If these systems are subject to some kind of external stress event (mechanical damage or exposure to excessive heat) then there may be a delayed ignition of the battery cells. This may occur from hours to days after the event.

- **Explosion Potential:** The materials used in the lithium ion batteries when heated can produce flammable gases that can create an explosive atmosphere in an enclosed area. Cabinets and containers are considered enclosed areas.

- **Toxic Potential:** The materials used in the lithium ion batteries when heated can produce toxic gases that can create a toxic atmosphere in an enclosed area. The Department SCBA policy must be adhered to during operations to such events.

5. LITHIUM ION-ESS INCIDENT RESPONSE PROCEDURES

The following Incident Response Procedures are for Li-ion-ESS that are housed in **CONTAINERS/CABINETS** located and installed **OUTDOORS** or on **ROOFTOPS**.

No Fire or Smoke Showing from the Container/Cabinet on Arrival

First Alarm Fire Units

- Determine if ESS battery type is a Li-ion (signage usually at FDC if available)

- Establish an initial Danger Zone (to reduce explosion exposure risks)
  - ALL FDNY personnel must stay behind any physical barrier surrounding the ESS (e.g. fencing)
  - Minimum of 50 ft radius from container(s)/cabinet(s)
  - Minimum of 100 ft from container/cabinet exhaust fan opening (usually located on the container's/cabinet's side opposite FDC). Cabinets may not have exhaust systems.

- Engine companies secure water source, stretch a precautionary handline and stretch supply lines to supply FDC of the water extinguishing system of the container/ cabinet if available. Cabinets may not have FDC serving the installation.
- Transmit a 10-80 code 1 radio signal for a Haz-Mat Response.

Hazardous Material Response
(Haz-Mat Battalion, Haz-Mat Company 1, Haz-Mat Technician Unit)

- Check panel or BMS information if available or call REACHBACK number (signage usually at FDC if available). If a **rising temperature** of the battery or module exists, comply with the following:
    - Request IC to order a water supply line(s) connected to the FDC and charge the water extinguishing system if available (signage for pressures and flow rates at the FDC).
    - ESS owned by Con Ed (White Hat: meet at designated area).
    - ESS not owned by Con Ed (SME: call for response).
    - Shut down ESS under direction of SME or Con Ed White Hat representative.
        - ESS may supply a **Grid Support System.**
        - E STOP at FDC or inside the electrical room if ESS is supplying a building.
    - Ensure the initial Danger Zone is enforced and maintained.
    - Exhaust the container/cabinet (exhaust override switch at the FDC). Cabinet may not have exhaust systems.
- If there is **no rise in temperature** of the battery or module, comply with the following:
    - **DO NOT** charge the FDC water extinguishing system.
    - **DO NOT** shut down ESS.
    - Ensure the initial Danger Zone is enforced and maintained.
    - Exhaust the container/cabinet (exhaust override switch at the FDC). Cabinet may not have exhaust systems.
    - Ask for SME for guidance via telephone.

Note 1: If the FDC is located closer than 50 feet from the nearest container/cabinet then personnel shall only enter this area under the order of the IC.

Note 2: Battery cell failure is possible with no propagation in the ESS (the ESS can continue to run with no adverse effects). Also, a component fire can be extinguished and no extension to the battery cells (Clean Agent deployed to extinguish component fire.

Confirmed Fire or Smoke Showing from the Container/Cabinets on Arrival

First Alarm Fire Units

- Determine if ESS battery type is Li-ion-ESS (signage usually at FDC if available)
- Establish an initial Danger Zone
  - All FDNY personnel must stay behind any physical barrier surrounding the ESS (e.g. fencing).
  - Minimum of 50 ft from cabinet(s).
  - Minimum of 100 ft from container exhaust fan opening (usually located on the container's side opposite FDC). Cabinets may not have exhaust systems.
- Shut down the ESS (ESTOP) at FDC or inside the electrical room if ESS is supplying a building.
- Engine Company shall connect to the FDC supplying fire extinguishing system of the container/cabinet if available.
- Charge water extinguishing system (signage for pressures and flow rates at the FDC).
- Exhaust the container/cabinet (exhaust override switch at the FDC). Cabinet may not have exhaust systems.
- Use exterior lines to cool adjacent cabinets and exposures if present and necessary. Use narrow fog or straight stream application and maximum reach of streams if possible.
- Transmit a 10-80 code 1 radio signal for a Haz-Mat Response.

Hazardous Material Response

(Haz-Mat Battalion, Haz-Mat Company 1, Haz-Mat Technician Unit)

- Ensure Danger Zone is enforced and maintained.
- Call the reach back number and ask for SME to respond.
  - SME will determine if battery cells are involved or a component.

Note: If the FDC is located closer than 50 feet from the nearest container/cabinet then personnel shall only enter this area under the order of the IC.

6. POST FIRE Considerations Containers/Cabinets

- Consult SME on scene – SME is required to be on scene within 2 hours.
- FDNY personnel may open container/cabinet doors after consultation with SME and the fire is extinguished.
- FDNY PERSONNEL SHALL NOT ENTER ANY CONTAINER.
- NO OVERHAULING SHALL BE PERFORMED ON ANY ESS.
- Incident Commander should transfer responsibility to subject matter expert for decommissioning\fire watch.

BY ORDER OF THE FIRE COMMISSIONER AND CHIEF OF DEPARTMENT