Hawai‘i Chemical Safety Days
2022
Responding to Battery Fires
Fires Related to Lithium Ion

• Surprise Arizona, ESS Installation April 2019

• Lime Scooter warehouse fire October 2019

• An explosion occurred as firefighters were dealing with a fire in a 25 MWh lithium-iron phosphate battery associated with a 1.4 MW rooftop array at a shopping mall April 2021

• Morris, IL, June 2021 Warehouse Fire of New Batteries

• Remi Miguel Gomez-Hernandez Killed When E-Scooter Battery Catches Fire Inside Queens Home, New York September 2021
Recent lithium-ion battery incidents

Over the last year, there have been several major lithium-ion battery ESS incidents.

• September 15, 2020 — Liverpool (20 MW)

• December 1, 2020 — France

• June 19, 2021 Morris IL Storage of batteries in warehouse

• April 6, 2021 — South Korea

• April 16, 2021 — Beijing (25 MWh)*

*Two firefighters died in suppression efforts.
Battery Fires

- Brighton MI, 2020 Semi Trailer Carrying batteries head to recycling center
- Victorian Big Battery in Australia, A single pre-manufactured 3MWh Megapack unit caught fire on 30 July 2021, spreading to a neighbouring Megapack. The spread stopped there and the fire burned itself out over a six hour period.
- Moss Landing Scorched Rack September 4, 2021
- Moss Landing (CA) February 13, 2022
- Felicity Ace off the coast of Portugal's Azores islands, February 2022
- Storey County ESS Fire 2022, Utility Grid installation
- Storey County 2022, Outside battery recycling, storage fire
- Chandler AZ, April 18 2022, ESS Battery Building, 3 week incident
- Honolulu HI, May 3, 2022 Recycling facility
Cycle Of Batteries!

- Raw Materials -> ...Make Batteries
- Test Batteries
- ...Put Batteries Together (Car/ESS)?
- Make Different Chemistries!
- Collect
- Store Awaiting Recycle
- End of Life, what's Next?
- New Tech
- Raw Products?
- Recycle
- Transfer to Recycling Facility
Not All Batteries Create Fire

• What is the fire department use of batteries
  • New apparatus
  • Vehicles
  • Extrication Equipment
  • Lighting
  • Portable Equipment
  • Backup power at our Fire Stations
Battery Stuff

- Discuss lessons learned in battery response
- ESS Battery systems
- Battery Manufacture
- Battery Storage
- Recycling of Batteries
- Transport Between
Batteries have been around a long time

So what is going on with lithium Ion?

• Evolving technologies and uses
• Respect for the listing and the use
• High energy capacity
Making the Batteries

- Dust
- Ovens
- Testing
- Storage
- Raw to Finished Materials
- What is the State of Charge?
- What are the Codes doing to protect firefighters?
- What is our response plan?
EV Response

- Joint meeting with SHS/FLSS
- Discussion on training/SOP
- When to let it burn
- Post incident
Pre Response

- Training for First Responders
- General understanding
- Burn or not burn
- Extinguishing methods
- Vehicle Extrication resources
Let it Burn or Water

- Entrapment
- Compartment vs battery pack
- Exposures
- Limited involvement
- Charger shutdown
- Vehicle from roll away
Post Incident

- Storage for Police
- Inside or outside
- Fire or just an accident
- Discussion with towing yards
- Recycle?
ESS DRAFT position

Response

- Difficulty due to complexity of events
- Utility support vs residential
- Understanding technical response from manufacture
- Safety to first responders
Energy Storage Response

- Quality plan check and installation
- Work with code officials on what is right and where they go
- Pre 2015 standards do not meet industry safe guards
- Pre-plan, training of our first responders
- Isolate
  - Turning off power to the unit may not be the answer
- Protect Exposures
- Contact Technical Support of unit
- Long term incident
4 In Case of Emergency

**WARNING:** In case of emergency, severe physical impact, or transportation accident, do not approach the product or open any of its doors.

**WARNING:** In case of severe physical impact or transportation accident, it may take time before any visible indication of an abnormal and hazardous condition (e.g. smoke or fire) can be observed. Contact Tesla Energy Technical Support for guidance (Identification of Company and Contact Information on page 4).

**CAUTION:** Response should only be performed by trained professionals.

4.1 During Storage or Operation

During storage or operation, cases of emergency include but are not limited to:

- Suspicious odor observed near a Tesla Energy Product
- Smoke or fire emanating from a Tesla Energy Product
- Severe physical impact on a Tesla Energy Product

In case of emergency, the following should be performed:

1. If possible, shut off the unit/system (see Shutting Down in an Emergency on page 25).
2. Evacuate the area.
3. If not already present, notify appropriately trained first responders, the local fire department, and any appointed subject matter expert (SME) if available.
5 Firefighting Measures

WARNING: Response should only be performed by trained professionals. In the event of a response to a Tesla product fire or hazardous event, contact Tesla Energy Technical Support for guidance (identification of Company and Contact Information on page 4).

5.1 Responding to a Venting Tesla Energy Product

WARNING: Odors emanating from a Tesla Energy Product can be an indication of an abnormal and hazardous condition. Battery thermal runaway fires are preceded by a period of smoke. The smoke is likely to be light, white, and may float away from the source. In some instances, smoke emanating from a Tesla Energy Product at any time may be hazardous.

1. If possible, shut off the unit/system (see Shutting Down in an Emergency on page 20).

2. Evacuate the area.

3. If not already done, contact Tesla Energy Technical Support for assistance (identification of Company and Contact Information on page 4).

4. Maintain a safe distance from the unit and monitor (identification of product) for evidence of potential disaster arising from the fire.

5. If a Tesla has not developed and only smoke is visible, take a defensive stance toward the fire and respond to apply water spray to extinguish exposing and neighboring battery modules.

6. If a Tesla has fully vented and a fire is visible, take a defensive stance toward the fire and respond to apply water spray to extinguish exposing and neighboring battery modules.

6.2 Defensive Firefighting

Teza's recommendation is to fight a Tesla Energy Product fire defensively. The fire crew should maintain a safe distance in any direction of at least:

- 5 m (16 ft) from the Powerpack
- 10 m (33 ft) from Powerwall
- 20 m (66 ft) from Tesla Energy Products

WARNING: Depending on the conditions of the event, the location of the battery, wind and general direction, a safe distance may be further than those provided above.

As outlined in the procedure above, the fire crew should allow the battery to burn itself out. To further quench the spread of the hazards, Tesla recommends application of water spray to neighboring battery enclosures, and fire departments may apply water spray to neighboring enclosures. Avoiding water directly to the affected enclosures will not stop the thermal runaway event, as the fire within localized behind nevror types of metallic conduits, and direct application of water has shown to only delay the eventual collapse of the unit.

WARNING: In confined areas, water is used directly on the enclosure that is burning; therefore, the amount of water spraying into areas and nearby areas may contribute to the flame gas mixture formed by burning cells, burning plastic, and burning of other combustibles. Water spray has been used as a fire extinguishing agent for use on exposed Tesla Energy Products. Water is considered a preferred agent for extinguishing Tesla Energy Products. Sufficient water such as river, lake, or pond water may suppress the flame gas mixture formed by burning cells, burning plastic, and burning of other combustibles. Water spray used in confined areas must be applied to the fire-affected area to extinguish the fire. Firefighters must be aware of the potential for water to contribute to the flame gas mixture formed by burning cells, burning plastic, and burning of other combustibles. Water spray used in confined areas must be applied to the fire-affected area to extinguish the fire. Firefighters must be aware of the potential for water to support the fire-affected area to extinguish the fire. Firefighters must be aware of the potential for water to support the fire-affected area to extinguish the fire. Firefighters must be aware of the potential for water to support the fire-affected area to extinguish the fire.

7. Allow the battery pack to cool down by a minimum of 12 hours after the fire and smoke has visibly subsided.

6 Shutting Down in an Emergency

6.1 Powerpack System

1. If an external emergency stop (ES) button or remote shutdown command is applied to the Powerpack, engage it. If the Powerpack is servicing an external AC breaker or disconnect, the breaker or disconnect.

6.2 Megapack

1. If an external emergency stop (ES) button or remote shutdown command is applied to the Megapack, engage it. If the Megapack is servicing an external AC breaker or disconnect, the breaker or disconnect.
What is the Decommissioning Plan
Mobility Device Incidents

- Hoverboard incidents, non-listed products
- Vancouver, “Batteries leading cause of Fatal fires”
- New York City Incidents
- India and Scooter Related Issues

Tips from Training

Revel E-Bike Battery Transport Vans

Lyn units recently encountered a Revel e-bike van transporting numerous lithium-batteries. According to the van’s driver, this is one of approximately 15 vans citywide rive around the city replacing batteries on these e-bikes when they are showing a large. The vans hold approximately 60 batteries. All members should recognize vans and understand the dangers posed by lithium-ion batteries.

Tech companies Lime, Bird and Veo were picked for a pilot program involving 3,000 e-scooters for rental from selected sidewalks in the Bronx. It can be assumed that these companies have similar battery transport vans for the
Community Risk Reduction

- Educate home owners on listed equipment and using the right charger for consumer electronics and mobility devices

- Educate business owners on related business to mobility and charging of electrical equipment

- Utilize newest codes and standards on charging in commercial occupancies

- Educate on how to charge, where to charge and when to stop using a product
Battery Storage Best Practices

- New vs used batteries and State of Charge
- Only in buildings provided with automatic sprinkler systems
- Early notification, Utilization of new thermal detection, smoke sensing detectors
- Sort by chemistry, store used product outside. Caution on storage in buildings and product of off-gassing
Research Opportunities/Lessons Learned

• Used battery shipping/storage

• Code changes referenced the above

• Extinguishing methods
  • Special items F500/Blanket/Cell Block Etc.

• Others
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