Top Safety Concerns Regarding Li-Ion Batteries in General Industry and Construction

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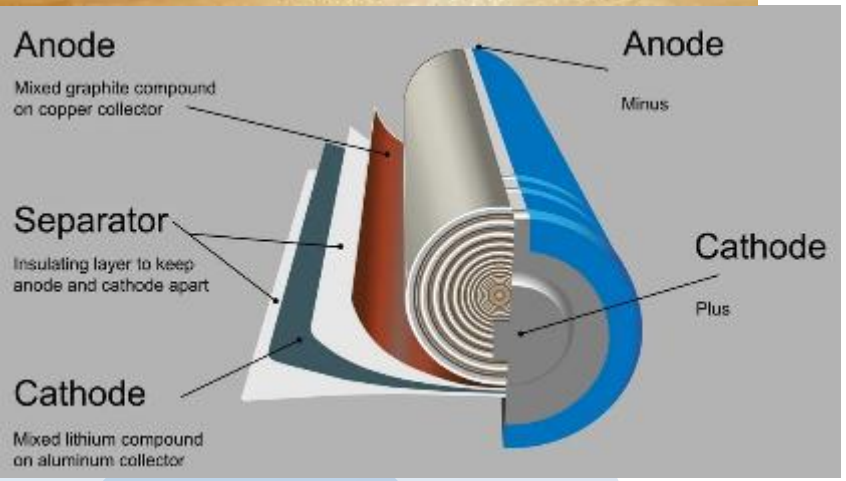
Session Overview

We will take a comprehensive look at how Li-ion batteries work, where they are used, and the primary hazards they present, such as thermal runaway, physical damage, electrical faults, chemical exposures, and the dangers of improper storage and counterfeit products.

- ***Objectives:***
  - Highlight major safety concerns
  - Review real-world incidents
  - Share practical controls and best practices

Lithium-Ion Battery Basics

Li-ion Battery Basics



- *What is a lithium-ion battery?*
  - Basic chemistry and structure:
    - ***Anode***- Negative electrode and typically made of graphite
    - ***Cathode***- Positive electrode and consists of lithium metal oxides
    - ***Separator***- made of non-woven materials or polymer films installed between the electrodes. The separator is permeable to lithium ions and can absorb large quantities of the ions
    - ***Electrolyte***- This contains salts such as lithium hexafluorophosphate dissolved in an aprotic (incapable of acting as a proton) solvent. This allows the lithium ions to move as charge carriers in the cell

Li-ion Battery Basics

- *Where we see Li-Ion batteries on the job*
  - Cordless power tools and hand-held equipment
  - Mobile machinery, forklifts, and material-handling equipment
  - Portable electronics (radios, tablets, phones used on site)
  - Temporary power packs and backup systems

Li-ion Battery Basics

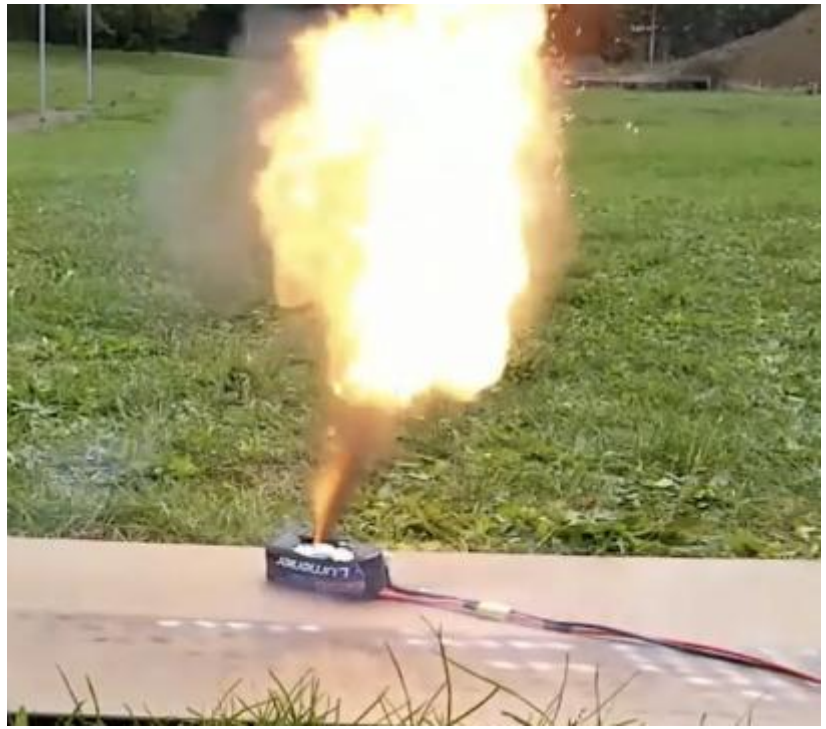
- *Why they are widely used in industry and construction*
  - High energy density- High power in a small package
  - Light weight and portable
  - Rechargeable design
    - Long life cycle- can be recharged hundreds of times
    - Fast Charging and less maintenance than legacy batteries
    - Consistent, more reliable performance
    - Low self-discharging- can be left unused for long periods of time

Safety implication: *more energy in smaller packages increases potential severity of failures!*

Key Safety Concerns

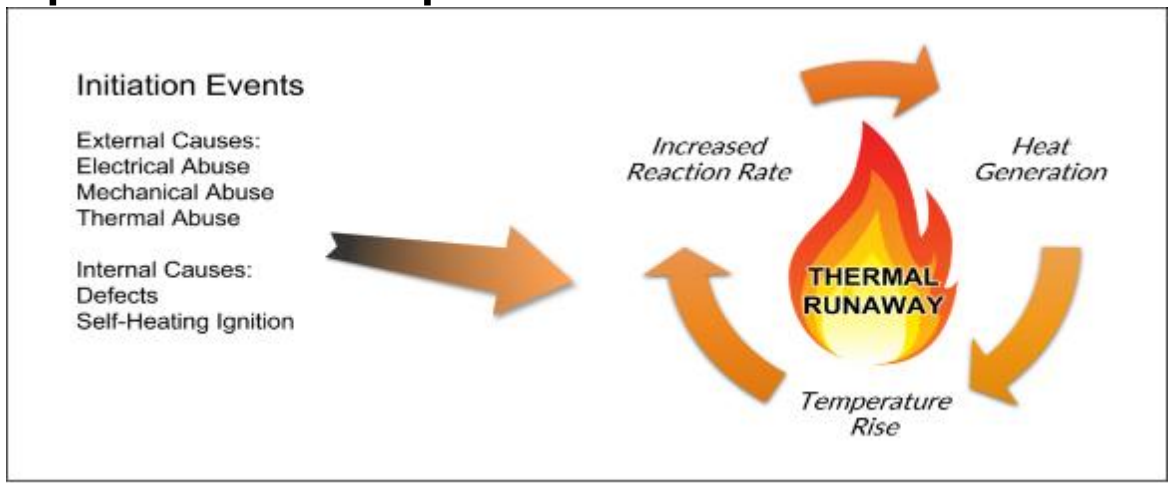
Key Safety Concerns- Overview

- Thermal runaway
- Physical damage and abuse
- Electrical hazards
- Chemical hazards
- Environmental factors
- Improper storage and transport
- Counterfeit and low-quality batteries



Key Safety Concerns

- *Thermal runaway- What is it?*
  - Uncontrolled self-heating reaction inside the cell
  - Common triggers: overheating, internal short circuits, manufacturing defects, physical damage
  - Outcomes: rapid temperature rise, venting, fire, and possible explosion



Key Safety Concerns

- *Thermal runaway: warning signs and triggers*
  - Warning signs: unusual heat, swelling, hissing, odor, discoloration
  - Triggers in the field:
    - Blocking vents, covering packs with materials
    - Charging in hot environments or near heat sources
    - Internal short circuits

Once thermal runaway starts, it is incredibly difficult to stop!

This is what thermal runaway looks like

Physical Damage and Abuse

- Common damage on job sites: drops, crushing, punctures, impacts
- Risks from using batteries as “step stools,” hammering, or forcing into tools
- Consequences: internal shorts, case breaches, and fire potential

If physical damage occurs, it is best to take the battery out of service and let your supervisor know

Electrical Hazards

- Overcharging and deep discharge
- Using non-approved or incompatible chargers and power supplies
- Short circuits from loose metal tools, debris, or damaged terminal

Chemical Hazards

- Potential release of toxic gases (e.g., hydrogen fluoride) during malfunctions or fires
- Risks from leaking electrolyte contacting skin, eyes, or clothing
- Need for appropriate PPE and decontamination procedures

If you encounter a leaking battery—one that is weeping fluid, has crystalline deposits around cracks, or has obvious wet spots—treat it as both a chemical and electrical hazard

Environmental Factors

- High temperatures: parked vehicles, direct sun, proximity to hot work
- Cold temperatures: reduced performance, potential damage when charging cold packs
- Water and dust ingress: compromised seals, corrosion, and short circuits

Charging a very cold battery can also cause internal damage that might not be obvious immediately but can show up later as reduced life or failure

Improper Storage and Transport

- Storing large numbers of packs in unventilated or cluttered spaces
- Stacking batteries or tools in ways that can crush or damage packs
- Transport issues: unsecured batteries, exposed terminals, mixed with metal objects

Improper storage and transport are common problem areas because they often develop gradually as operations grow

Counterfeit and Low-quality Batteries

- Unapproved or “knock-off” batteries may lack critical safety features
- Risks: poor cell quality, inadequate protection circuits, thin casings
- Importance of buying from reputable suppliers and avoiding unknown online sources

Improper storage and transport are common problem areas because they often develop gradually as operations grow

Recent Incidents

Recent Incidents: Overview

- 118,400-square-foot warehouse fire in Tarnowo Podgórne, Poland on January 13, 2026
- Moss Landing Vistra power plant energy storage fire on January 16, 2025, in Monterey County, CA
- Pool Specialists fire in Raleigh, NC in August of 2022

Recent Incidents:

- *Warehouse fire in Tarnowo Podgórne, Poland- January 13, 2026.*

Recent Incidents:

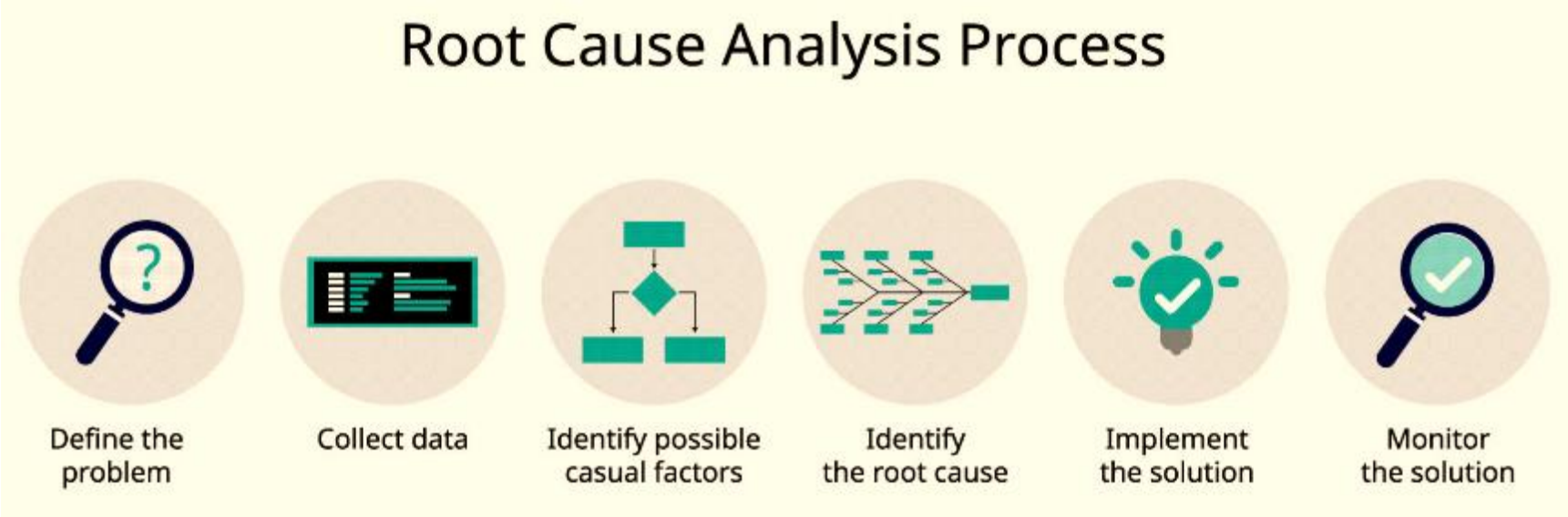
- *Moss Landing Vistra Power Plant - January 16-18, 2025*
  - The 300-megawatt system held about 100,000 lithium-ion batteries. It was the largest battery energy storage system in the world.
  - About 55 percent of the batteries were damaged by the fire.
  - Took three days for the fire to extinguish. Fire crews let it burn out naturally. Community had to be evacuated.
  - Fire Cause: The official cause remains under investigation. Reports have referenced potential contributing factors, including thermal runaway.
  - The fire produced toxic metal fallout, depositing an estimated 55,000 pounds of nickel, manganese, and cobalt across surrounding wetlands.

Recent Incidents:

- *Pool Specialists fire in Raliegh, NC in August of 2022.*
  - The fire:
    - started at approximately 11:30 pm at Pool Specialist Warehouse.
    - Caused over $3 million in damages
    - was believed to be caused by a leaf blower battery that was left on the charger
  - It is believed there was a failure in the charger that allowed the battery to overcharge and cause thermal runaway

Recent Incidents:

- *From incidents to root cause*
  - Lack of awareness of Li-ion specific hazards
  - Inadequate training and procedures
  - Poor storage and charging practices
  - Use of damaged or non-approved batteries



Risk Mitigation

Risk Mitigation: Overview

- *Focus areas:*
  - Selection and procurement
  - Proper use
  - Handling and storage
  - Workplace training
  - Maintenance and inspection
  - End-of-life disposal

Risk Mitigation

- *Selection and procurement*
  - Purchase certified, high-quality batteries and packs
  - Use OEM or manufacturer-approved chargers and accessories
  - Verify standards/markings (e.g., UL or equivalent)

Risk Mitigation

- *Proper use*
  - Follow manufacturer instructions for charging and operation
  - Do not bypass safety features or modify packs or chargers
  - Match battery type and rating to the tool or equipment

Risk Mitigation

- *Handling and storage*
  - Store batteries at recommended temperatures, away from direct heat or sunlight
  - Keep away from flammables; use non-combustible shelving or cabinets where possible
  - Segregate damaged or suspect batteries in a designated container and area

Risk Mitigation

- *Workplace training*
  - Train workers to recognize hazards, warning signs, and unsafe conditions
  - Include emergency response steps for fires, venting, and chemical exposure
  - Reinforce reporting of damaged batteries and unsafe practices

Risk Mitigation

- *Maintenance and inspection*
  - Routine checks for cracks, swelling, leaks, or overheating during use and charging
  - Remove any suspect battery from service immediately and tag it
  - Keep inspection and incident records where feasible

Risk Mitigation

- *End-of-life and disposal*
  - Do not throw Li-ion batteries in regular trash or scrap bins
  - Use approved recycling or hazardous waste programs
  - Follow local regulations and vendor guidance for packaging and transport

Regulatory Framework, Standards, and Guidance

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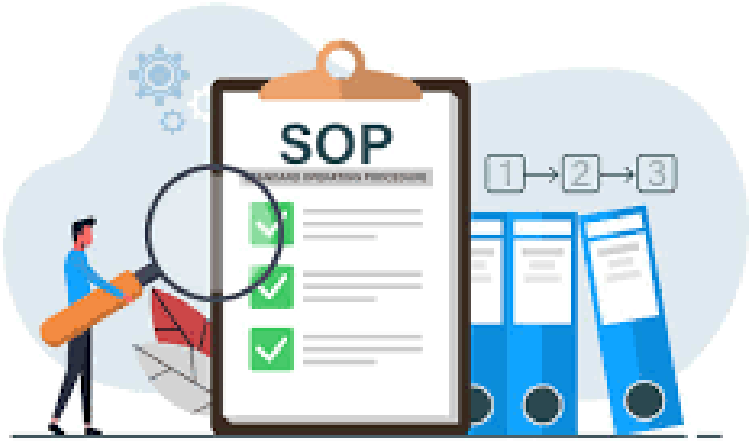
- *Regulatory framework and standards*
  - Relevant standards and guidance may include:
    - OSHA requirements
      - OSHA 1910.303- Electrical Safety
      - OSHA 1910.1200- Hazard Communication
      - OSHA 1910, Subpart I- PPE
    - NFPA and fire codes
      - NFPA -1 Fire Code
      - NFPA 101-Life Safety Code
    - UL and IEC product standards
  - Encourage consultation with EHS and regulatory resources

Regulatory Framework, Standards, and Guidance

- *Employer and site responsibilities*
  - Provide safe equipment, procedures, and training
  - Ensure proper storage and disposal systems are in place
  - Investigate incidents and near misses and act on findings

Regulatory Framework, Standards, and Guidance

- *Resources and guidance documents*
  - Manufacturer manuals and safety bulletins
  - Industry association and insurer guidance on Li-ion safety
  - Internal SOPs, checklists, and training modules



In Conclusion…

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- Li-ion battery use is expanding, and these batteries are essential to modern tools and equipment
- Key risks to focus on mitigating:
  - Thermal runaway
  - Physical damage
  - Electrical and chemical hazards
  - Storage and transport issues
- Strong controls: quality equipment, safe use, training, and inspection

Questions?