BATTERIES IN EVERYTHING!

MINIMIZING LEGAL RISKS RELATED TO LI-ION BATTERY HANDLING, RECYCLING, AND DISPOSAL

Midwest Environmental Compliance Conference

September 24, 2024

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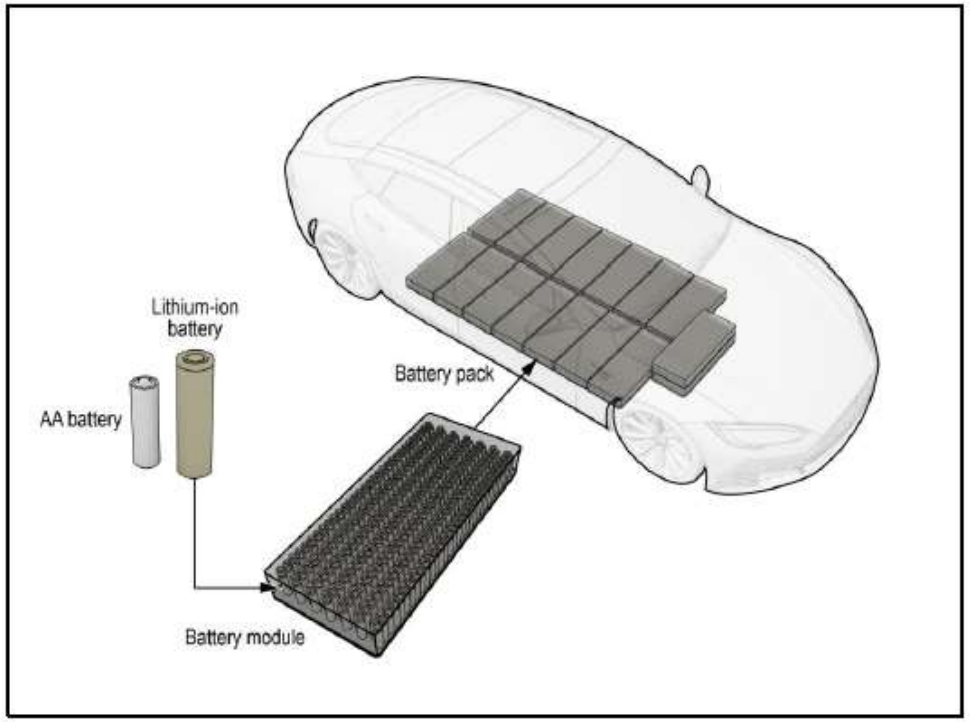
BRIEF HISTORY OF LI-ION BATTERY DEVELOPMENT

- Lithium was discovered as part of petalite ore in the early 1800s and isolated in 1821
- The oil crisis of the 1970s spurred development, including an attempt by Exxon to commercialize a form of Li-Ion battery in the mid-1970s
- Three scientists pioneered discoveries that are credited with creating the modern rechargeable Li-Ion battery:
  - Stanley Whittingham, John B. Goodenough, Akira Yoshino
  - Awarded the Nobel Prize for Chemistry in 2019

- Sony Corporation produced and sold the first rechargeable Li-Ion battery in 1991

LITHIUM-ION BATTERIES

- Rechargeable battery made of one or more cells
- “Battery” can refer to a cell, module, or pack
- Ubiquitous – EVs, smartphones, consumer electronics



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LITHIUM-ION BATTERIES

- Made up of **anode (-)**, **cathode (+)**, separator, **electrolyte**, and positive and negative current collectors
  - Anode - typically graphite or similar carbon compound
  - Cathode - typically lithium cobalt oxide
  - The liquid electrolyte carries charged lithium ions between the anode and cathode through the separator
  - Movement of the ions creates a charge

SAFETY & ENVIRONMENTAL ISSUES

- **Interrelated risks**
  1. Fires
  2. Explosions/Thermal runaway
  3. Health and environmental impacts from fires and explosions
  4. End of life recycling and disposal issues
- **Contributors**
  1. Internal short circuit that leads to heating and ignition
  2. Flammable electrolyte
  3. External damage
- **Common Causes**
  1. Overcharging
  2. Extreme temperatures and physical damage

UL Standards & Engagement

Press Release — April 10, 2024

New Report Highlights Safety Risks of Lithium-Ion Batteries in Aviation

Passengers' lack of awareness resulting in increased risk — and incidents — on board

Where do passengers store their lithium-ion batteries?

Checked Luggage	
27%	**E-Cigarette**
27%	**Portable Charger**
15%	Laptop
15%	Tablet
3%	Smartphone

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DAMAGED, DEFECTIVE, RECALLED (DDR)

Swelling, relative to the same battery in its original state (Fig. 2)

Pictured: a swollen pouch cell battery, placed on top of an undamaged battery for comparison.

- **Damaged / Defective**
  - Acute hazards: gas, fire, visibly leaking electrolyte
  - Swelling
  - Discoloration of battery casing
  - Smell
  - Corrosion
  - Loose or damaged wires
  - Known conditions of use or misuse (i.e., water exposure)
- Pose a greater fire and thermal runaway risk

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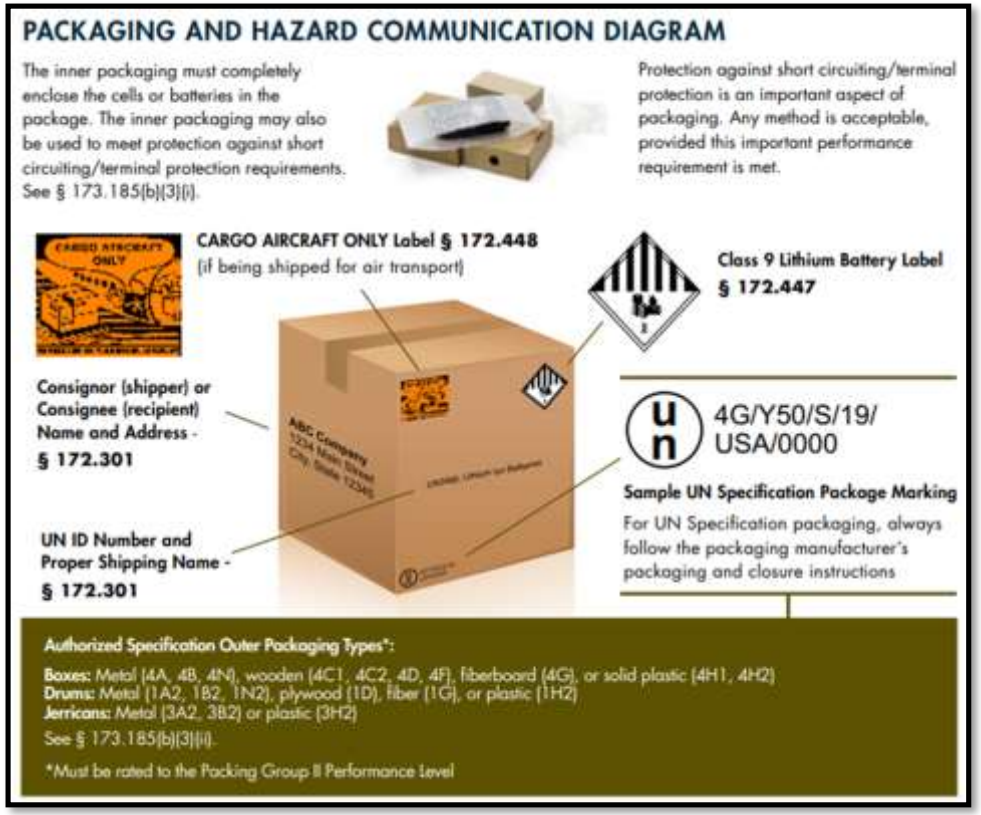
REGULATORY FRAMEWORK

- **US DOT**
  - Hazardous Materials Regulations
  - 49 C.F.R. part 173
- **US EPA**
  - RCRA Hazardous Waste Regulations
  - Universal Waste under 40 C.F.R. part 273
- **State Regulations and Initiatives**
  - State universal waste regulations
  - Storage and Extended Producer Responsibility Laws (“EPR”)

FEDERAL REGULATIONS – DOT
HAZARDOUS MATERIALS REGULATIONS – 49 CFR PARTS 171-180

- Lithium cells and batteries – §173.185
  - Packaged to prevent short circuits and damage:
    - Completely enclosed in non-metallic inner packaging
    - When enclosed in equipment, packaged to prevent accidental operation during transport
  - Exceptions for smaller cells (>20 Wh) and batteries (>100 Wh)
- Labeling requirements – §172.447
- Hazmat employee training - §172.704



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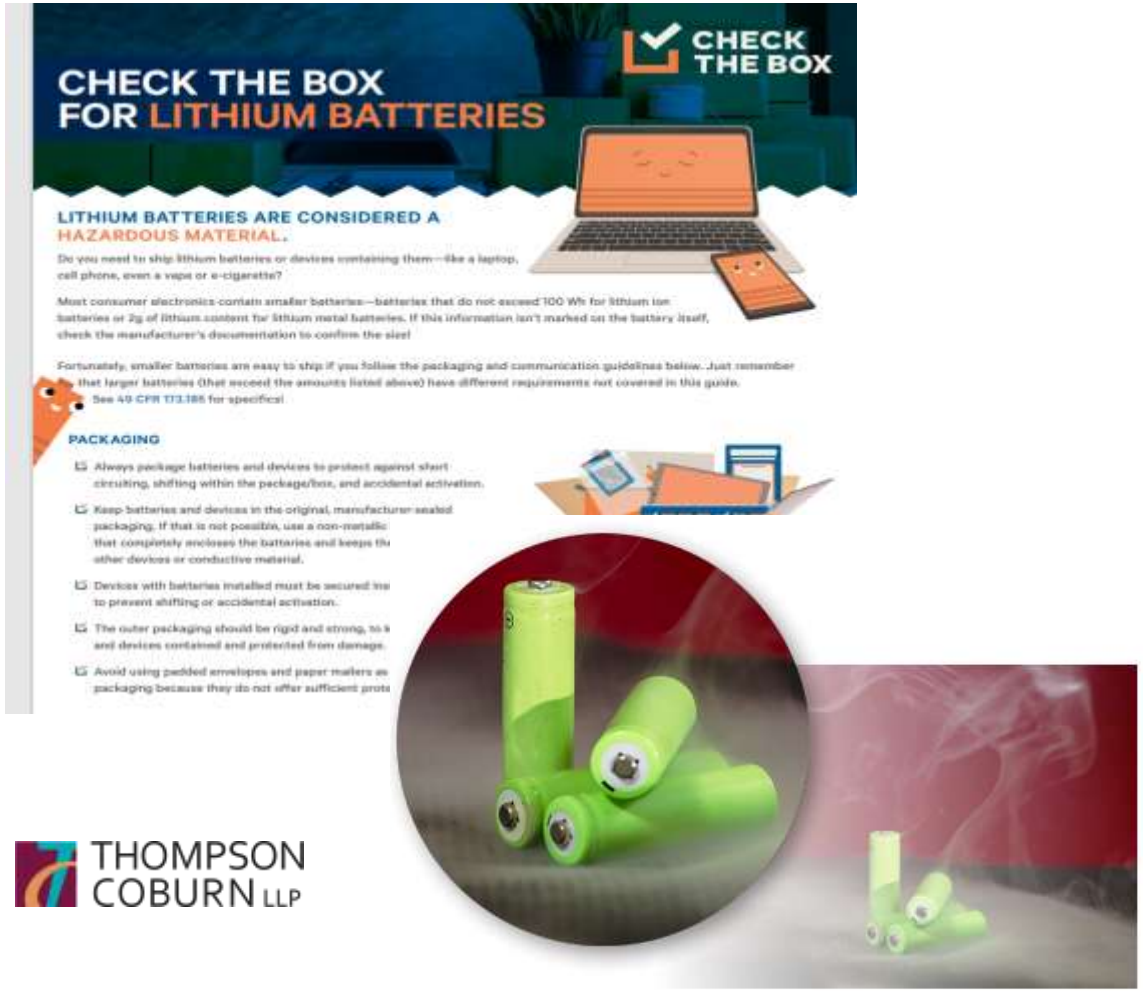
FEDERAL REGULATIONS – DOT (CONT.)

- Limited exceptions to testing and packaging specification requirements if transported by motor vehicle for disposal or recycling – 49 CFR §173.185(d)
- Specific requirements if DDR –§173.185(f)
  - Cannot be transported by aircraft
  - Packaging:
    - Individual, non-metallic inner packaging that completely encloses the cell or battery
    - Non-combustible, non-conductive, and absorbent cushioning material
    - Individually placed in appropriate outer packaging (Packing Group I performance level)
    - Marked with “damaged/defective lithium-ion battery”
  - No exceptions from training, marking, or labeling requirements

DOT CHECK THE BOX CAMPAIGN



- Are Lithium Batteries in your package? | US Department of Transportation
- Safety Advisory Notice for the Transportation of Lithium Batteries for Disposal or Recycling | PHMSA (dot.gov)
- Understanding the Risks of Damaged, Defective, or Recalled (DDR) Lithium Batteries | PHMSA (dot.gov)

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FEDERAL REGULATIONS - EPA

- Regulated at the end of life
- Most of the regulatory focus is on recycling, not disposal
- Recovery of critical minerals is paramount
  - aluminum, lithium, nickel, cobalt, manganese, and graphite
- **No EPA regulation on reuse or repurposing**
  - Not a waste

Source: U.S. Department of Energy Vehicle Technologies Office.

FEDERAL REGULATIONS - EPA

- Why are Li-Ion batteries hazardous waste under RCRA?
  - Ignitable (D001)
  - Reactive (D003)
- Must be managed as hazardous wastes or universal wastes
- Best approach is to manage as universal waste under 40 C.F.R. Part 273
  - Streamlines requirements for generators and handlers
  - Does not apply if casing is breached, rendering battery DDR
  - Once a battery has arrived at a TSD facility or hazardous waste recycler, it stops being universal waste and becomes fully regulated hazardous waste

FEDERAL REGULATIONS – EPA, CONT.

- Managing Li-ion batteries as universal waste
  - Handlers may sort batteries by type, mix battery types in a single container, discharge batteries, regenerate used batteries, disassemble batteries or battery packs, remove batteries from products, or remove electrolyte from batteries (40 CFR §273.31, 273.33(2))
    - Any waste generated from these activities (including electrolyte) must be assessed for hazardous waste characteristics
  - Recycling activities can only be undertaken by permitted destination facilities
  - Transporting does not require manifesting under RCRA, but does trigger DOT requirements

STATE REGULATIONS – USED BATTERY STORAGE

- Illinois – 2024 amendment to Environmental Protection Act
  - Battery storage sites at which 5,000 kg or more of used EV batteries are stored at any one time must:
    - Register with IEPA prior to February 2026
    - Maintain records documenting weight of volume of used batteries received, shipped away, and remaining at the site each week
  - Directs IEPA to propose and IPCB to adopt rules for battery storage sites, specifically end-of-life battery receipt, handling, storage, and transfer; standards for fire prevention; requirements for contingency planning and emergency response; recordkeeping, reporting

STATE REGULATIONS – EPR LAWS

- Extended Producer Responsibility (EPR) laws – California, New York
  - Place recycling responsibility on manufacturers
  - Require battery producers to participate in stewardship programs for collection and recycling
  - CA EPR law (not yet in effect)
    - Battery producers must create or fund stewardship programs for collecting and recycling batteries no later than April 2027
    - Retailers must charge a fee at point of sale for products with embedded batteries beginning January 2026; fees will pay for state e-waste recycling program
      - Beginning July 2027, manufacturers must notify retailers of covered products and report estimated number of covered products sold during the previous year
- Iowa EPR law only applies to Ni-Cd and sealed lead batteries

LITIGATION LANDSCAPE

- Improper Disposal
  - *Banks County Georgia v. SK Battery America, Inc.*, No. 24-cv-00138 (N.D. Ga.)
    - Suit by county alleging Li-ion battery manufacturer shipped mixed waste, including Li-ion batteries, to a facility not permitted to receive explosive waste, causing a large industrial fire
    - Remanded to state court Aug. 2024

- Product Liability
  - *Altobelli, et al., v. General Motors LLC*, No. 20-cv-13256 (E.D. Mich.)
    - Consolidated class action claiming that GM sold vehicles with defective batteries that caused fires and vehicle overheating
    - $150 million settlement approved summer 2024

LITIGATION LANDSCAPE - ENFORCEMENT

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KEYS TO MINIMIZING LEGAL RISK

- Know the sources of Li-Ion batteries in your operation
- Consult DOT Resources before shipping
- Incorporate Li-Ion batteries into universale waste program (or start one for your batteries)
- Work with an experienced recycler
- Manage DDR batteries appropriately and with caution
- Update fire prevention and response plans to address Li-ion batteries
- Check your insurance

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