2022 Hawai'i Chemical Safety Days

Lithium Batteries Transportation and Storage

Presented by:
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Why Lithium Batteries?

- High energy densities
- Potential short circuiting leading to thermal runaway
- Past recycling-related, landfill incidents
- Expected exponential increases volumes

Thermal Runaway

Battery and Electronics Recycling, Inc. - Mt. Horeb, WI

- ~ 420,000 lbs of batteries
- Clean-up Mar. 2020 - Jun. 2021
- Total cost > $2.8M
- High % of inventory were damaged lithium batteries ("DDR")

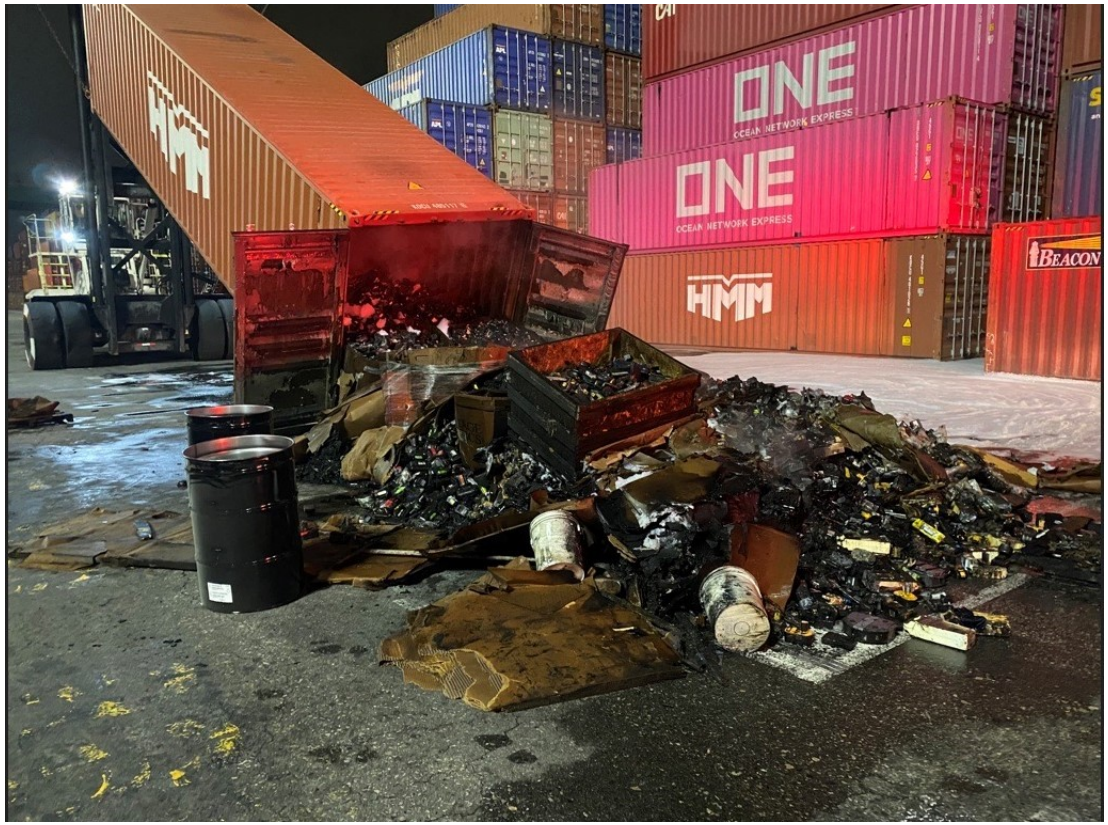
Superior Battery - Morris, IL

- Fire began on Jun. 29, 2021
- ½ mile evacuation
- Gov. Pritzker issues disaster proclamation
- Fire extinguished Jul. 10, 2021
- Estimated 550,000 lbs of batteries with 140, 000 lbs of them being lithium batteries
- Cement poured on batteries
- Clean-up continuing April 2022

Han Metal - Lawrenceville, GA

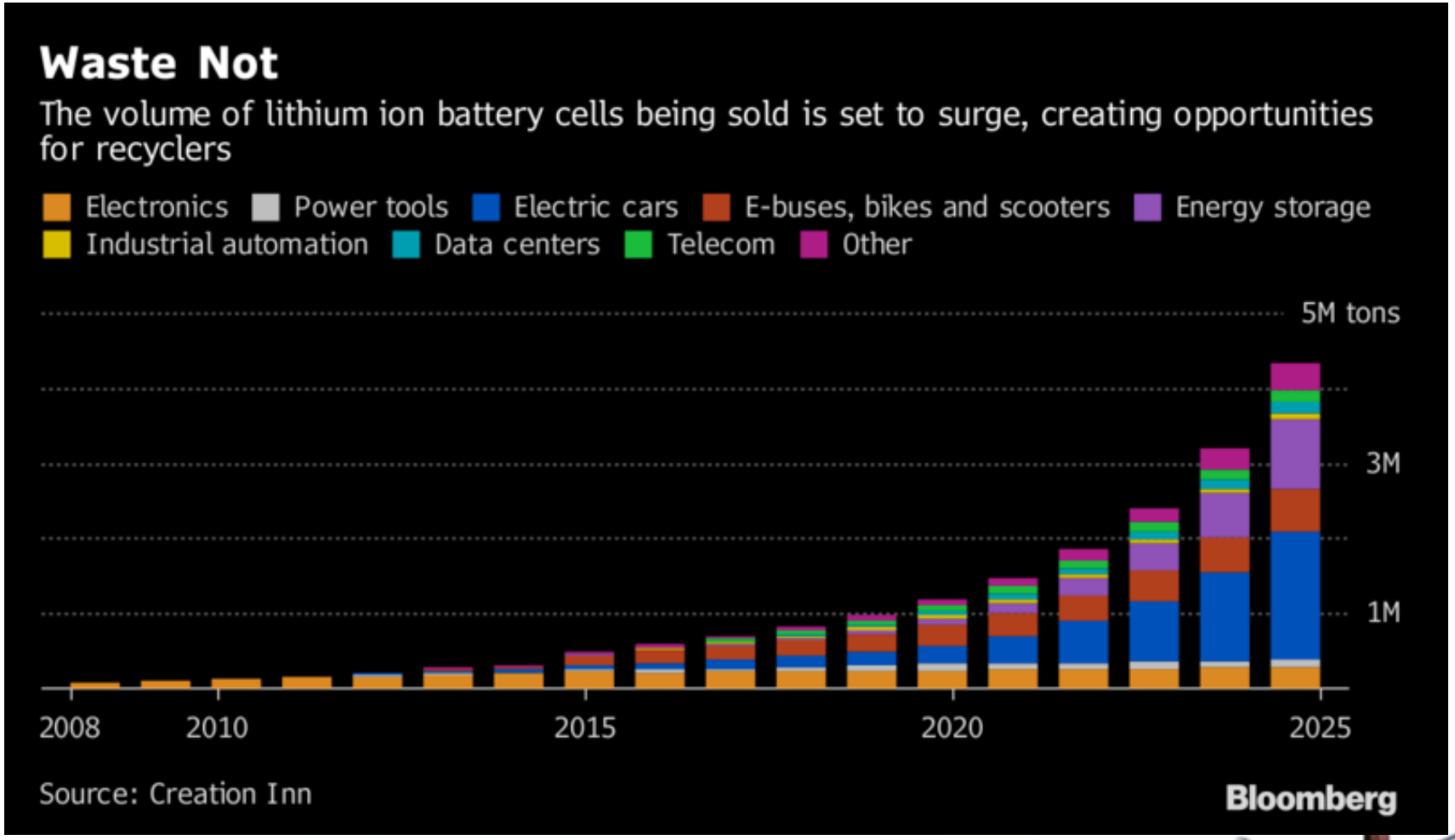
- Recycler fire on Dec. 8, 2021
- Mostly electric scooter batteries
- Intended to be shipped to Korea
- Batteries continued to reignite after being observed and re-packaged
- Used salt water bath to make inert before continuing removal

Port of Long Beach, CA



- On March 4, a shipping container was reported to Coast Guard Sector Los Angeles-Long Beach
- Container was on board vessel bound for China
- Batteries were undeclared, and on the bill of lading as “synthetic resins” and “computer parts”
- De-vanning containers delayed response significantly

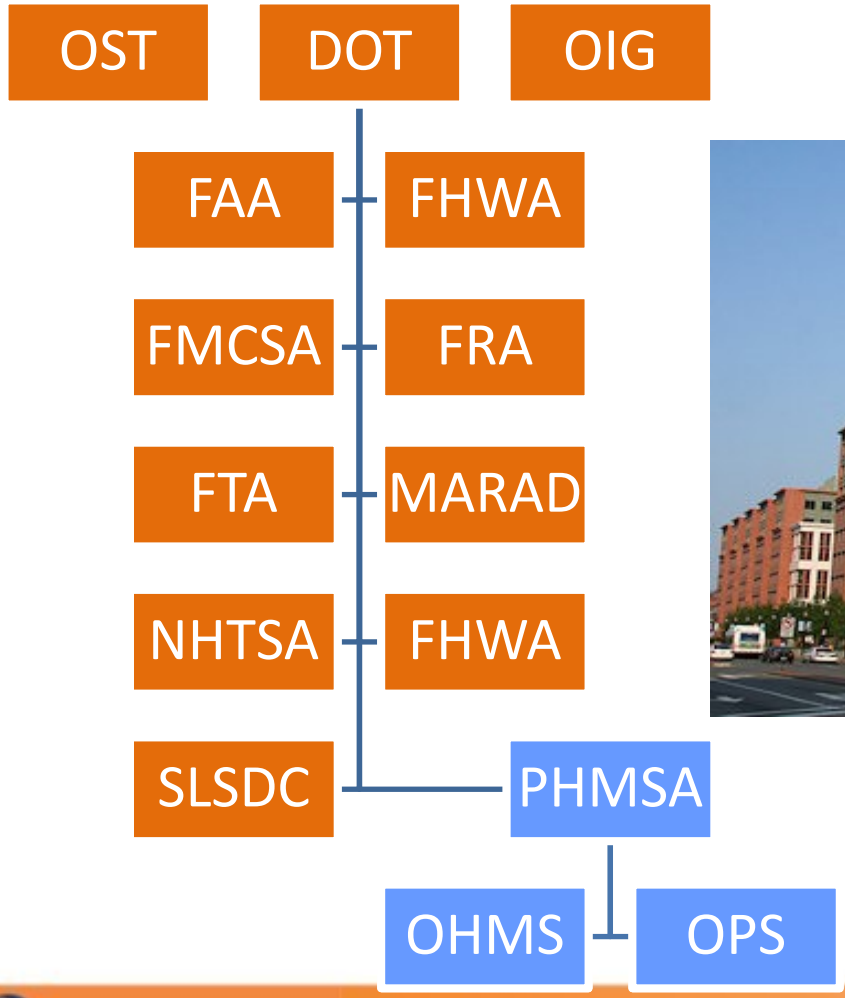
End of Life Implications



Danger to Waste Mgmt Facilities

Overview of DOT/PHMSA

DOT Operating Administrations



U.S. Department of Transportation Headquarters – Washington, DC

PHMSA Responsibilities

Regulations

- Rulemakings
- Letters of Interpretation

Special Permits and Approvals

- Approvals for Fireworks or Self-Reactive materials
- Special Permits for packaging (ex: DDR Kits)

Enforcement

- Inspections
- Multi-Agency Strike Force Operations
- Accident Investigation

Outreach and Engagement

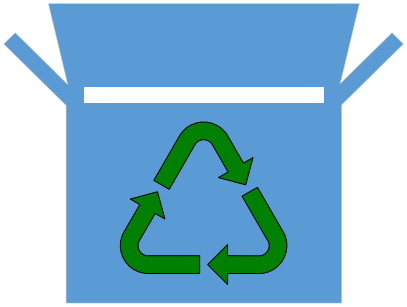
- Publications
- Community Liaisons
- Workshops or conferences

DOT in the Battery Supply Chain

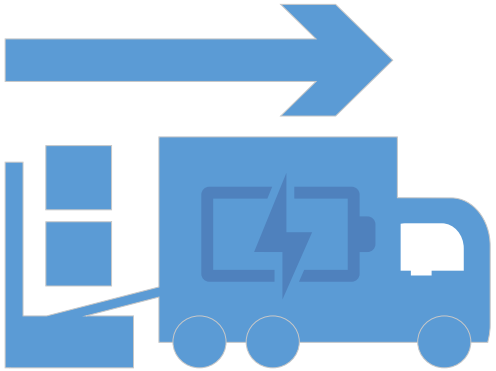
Oversight Over the Transportation Process

Identification and Classification (collection/ sorting)

Packaging and Hazard Communication



Movement



DOT Hazard Classes

Explosives

Gases

Flammable Liquids

Flammable Solids

Oxidizers and Organic Peroxides

Poison and Infectious Substances

Radioactive

Corrosive

Miscellaneous

Class 9 Lithium Battery

Hazardous Materials Regulations

- 49 CFR Section 173.185 addresses requirements for lithium batteries, including the exceptions for recycling lithium batteries:

1. Classification/ UN 38.3 Testing
   Paragraph (a)

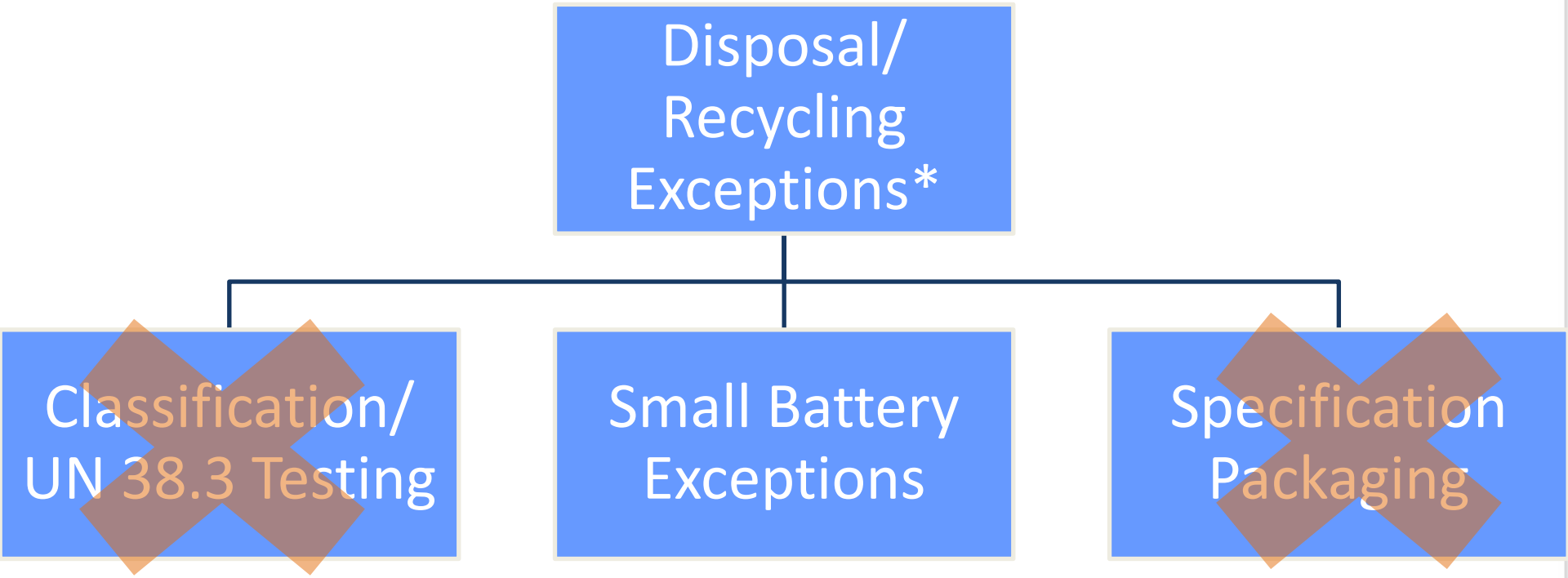
2. Packaging
   Paragraph (b)

3. "Small" battery exceptions
   Paragraph (c)

4. Disposal/ Recycling Exceptions
   Paragraph (d)

5. Damaged, Defective, Recalled (DDR) Requirements
   Paragraph (f)

Disposal/Recycling Exceptions



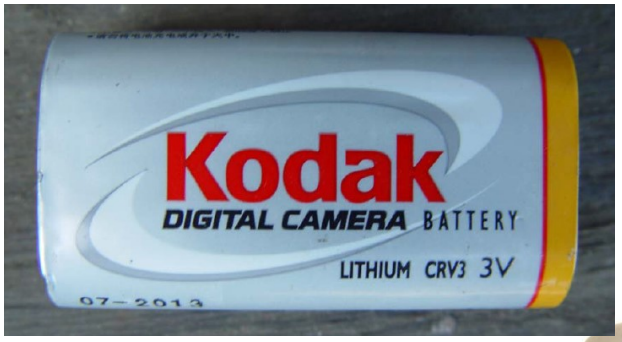
***For motor vehicle transportation ONLY**

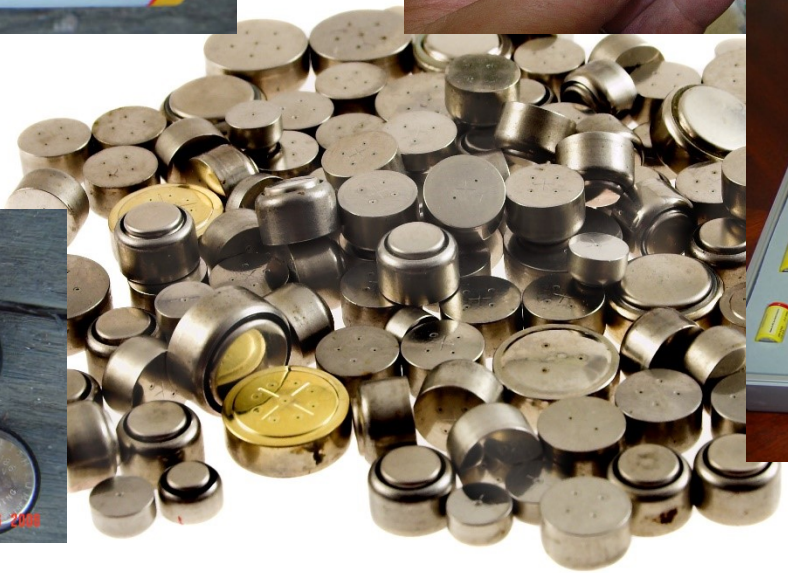
49 CFR § 173.185(d)

Classify the Hazard – Type of Lithium Batteries

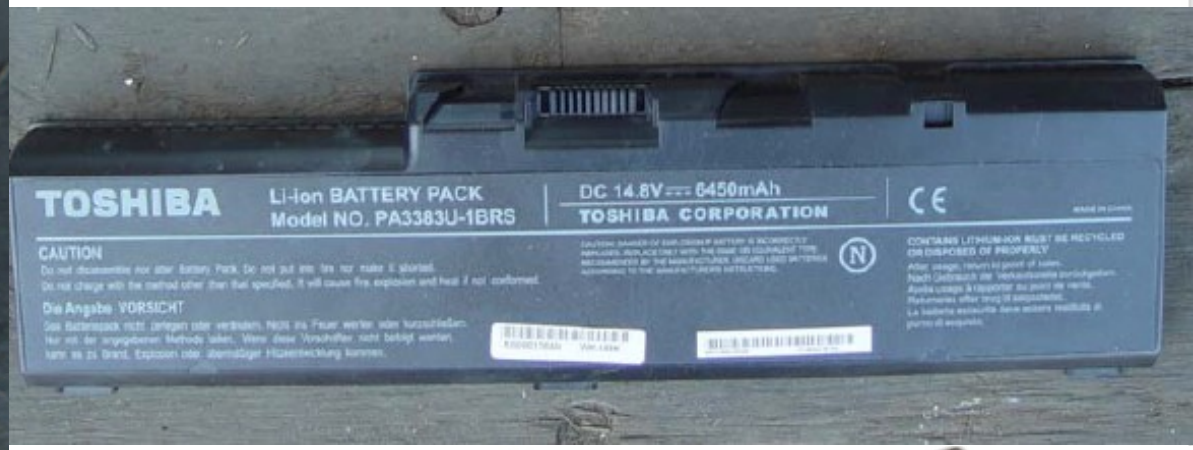
- Lithium Metal
  - Metallic lithium or alloy
  - Size measured in grams
  - Generally not rechargeable (single-use)
  - Typical configurations : coin cell, cylindrical, and rectangular
  - Examples: watches, thermometers
- Lithium Ion
  - Lithium compound
  - Size measured in Watt-hours (Wh)
  - Generally rechargeable
  - Typical configurations: cylindrical, rectangular, and pouch packs
  - Examples: laptops, tablets, cell phones, power tools

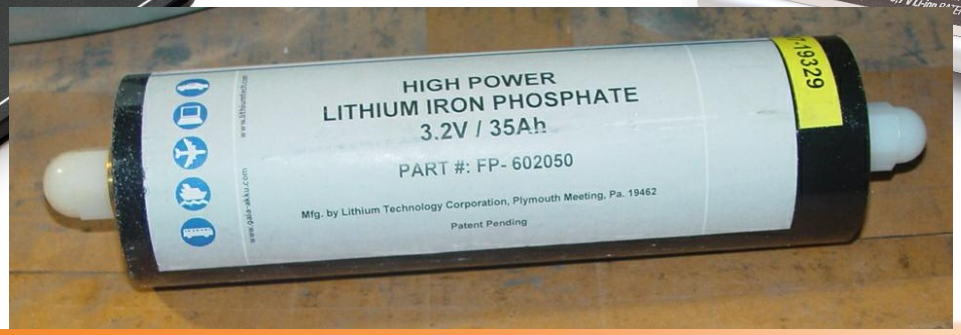
Classify the Hazard – Lithium Metal





Classify the Hazard – Lithium Ion





Communicate the Hazard – Small Batteries

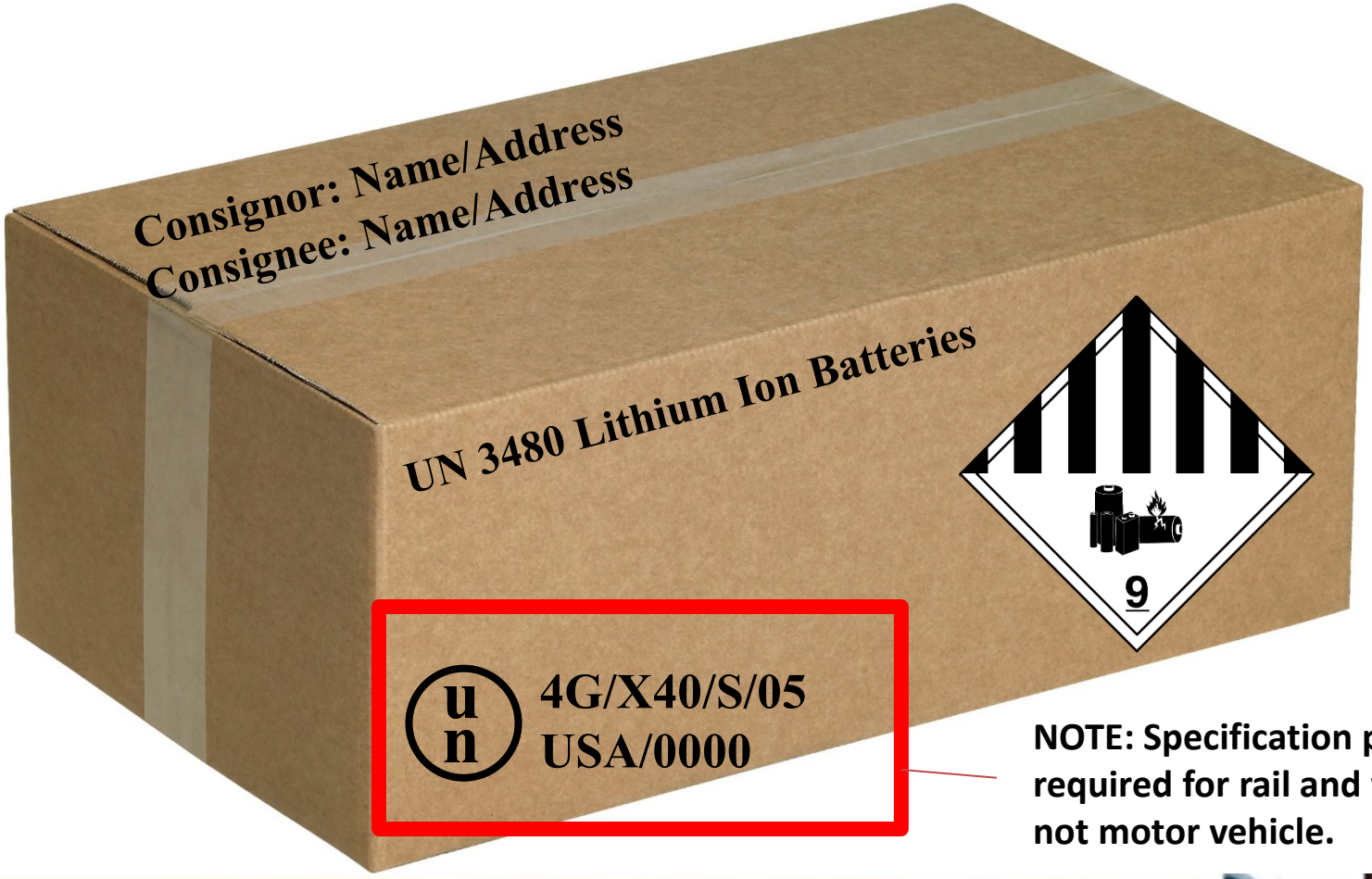
Cargo Aircraft Only Label (DOT)

Universal Waste Label OR Marking (EPA)

Lithium Battery Handling Mark (DOT)

[49 CFR § 173.185(c)(3)](#) & [40 CFR §§ 273.14](#), [273.34](#)

Communicate the Hazard – Larger Batteries and Quantities



NOTE: Specification package required for rail and vessel – not motor vehicle.

Damage, Defective, and Recalled (DDR)

- Shippers must identify and separate batteries that pose an increased risk of producing a dangerous evolution of heat, fire, and short circuit

Classify the Hazard - DDR

- Batteries to Look For:
  - Defective
  - Leaked or vented
  - Sustained physical or mechanical damage
  - Cannot be diagnosed (i.e., cannot say for sure they are not damaged)

- Consider:
  - Risk of acute hazards (e.g., gas, fire, electrolyte leaking)
  - Known misuse of the battery
  - Signs of physical damage
  - Damage to safety features, components, or short circuit protection

Source: 21st Revised Edition of the UN Model Regulations 3.3.1, Special Provision 376

2. Contain the Hazard – DDR

- Batteries must be **individually** packaged as follows:
  - Non-metallic, inner packaging that completely encloses the battery
  - Inner packaging surrounded by non-combustible, non-conductive, and absorbent cushioning material
  - Single inner packaging must be placed in **performance-oriented packaging at the Packing Group I performance level.**

Example DDR Kits

Disclaimer: images are examples of DOT Special Permit packaging and not an endorsement of any particular product or company

Pictured L-R: DOT-SP 20549, DOT-SP 20432, DOT-SP 20910

DDR Kits

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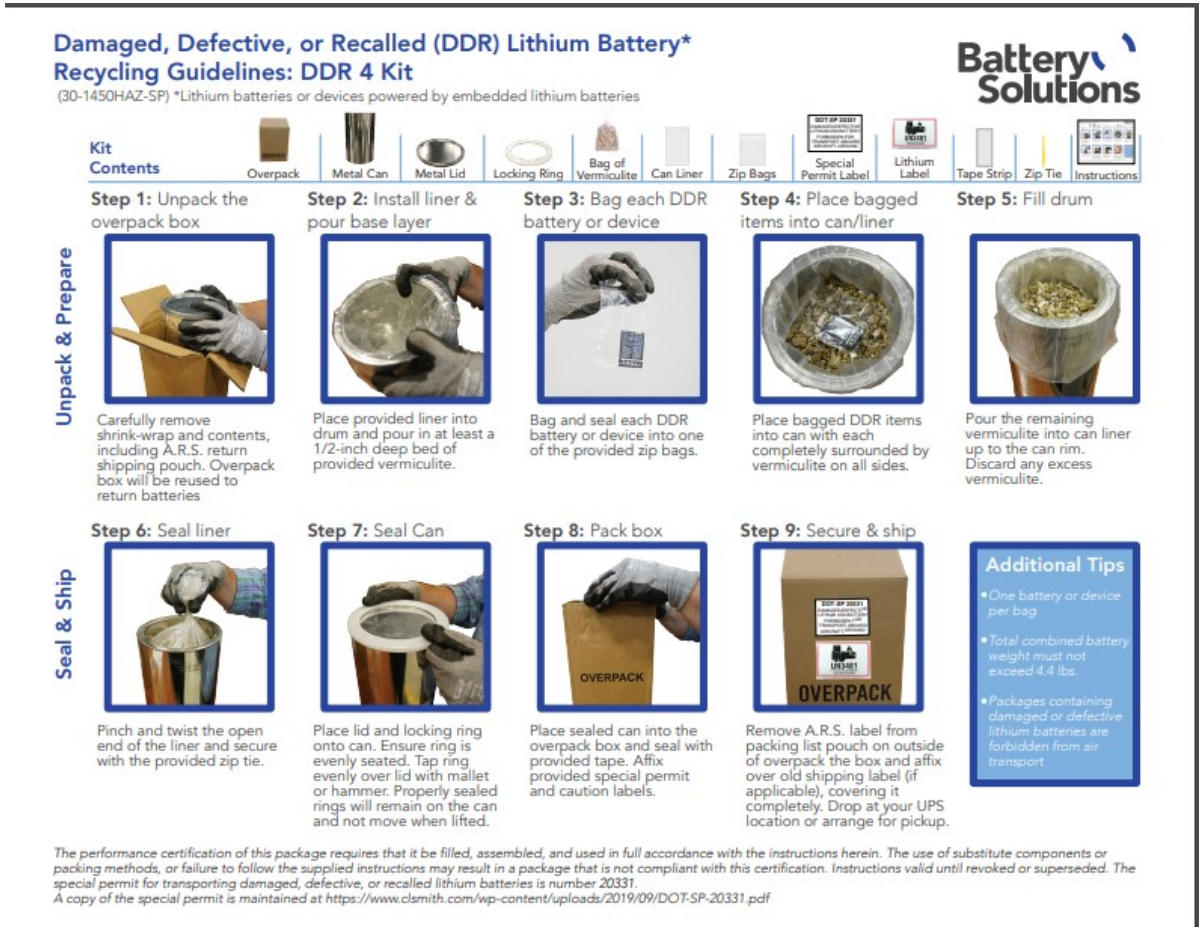


Damaged, Defective, or Recalled (DDR) Lithium Battery*
Recycling Guidelines: DDR 4 Kit
(30-1450HAZ-SP) *Lithium batteries or devices powered by embedded lithium batteries

Battery Solutions

Kit Contents: Overpack, Metal Can, Metal Lid, Locking Ring, Bag of Vermiculite, Can Liner, Zip Bags, Special Permit Label, Lithium Label, Tape Strip, Zip Tie, Instructions

Unpack & Prepare

Step 1: Unpack the overpack box
Carefully remove shrink-wrap and contents, including A.R.S. return shipping pouch. Overpack box will be reused to return batteries

Step 2: Install liner & pour base layer
Place provided liner into drum and pour in at least a 1/2-inch deep bed of provided vermiculite.

Step 3: Bag each DDR battery or device
Bag and seal each DDR battery or device into one of the provided zip bags.

Step 4: Place bagged items into can/liner
Place bagged DDR items into can with each completely surrounded by vermiculite on all sides.

Step 5: Fill drum
Pour the remaining vermiculite into can liner up to the can rim. Discard any excess vermiculite.

Seal & Ship

Step 6: Seal liner
Pinch and twist the open end of the liner and secure with the provided zip tie.

Step 7: Seal Can
Place lid and locking ring onto can. Ensure ring is evenly seated. Tap ring evenly over lid with mallet or hammer. Properly sealed rings will remain on the can and not move when lifted.

Step 8: Pack box
Place sealed can into the overpack box and seal with provided tape. Affix provided special permit and caution labels.

Step 9: Secure & ship
Remove A.R.S. label from packing list pouch on outside of overpack the box and affix over old shipping label (if applicable), covering it completely. Drop at your UPS location or arrange for pickup.

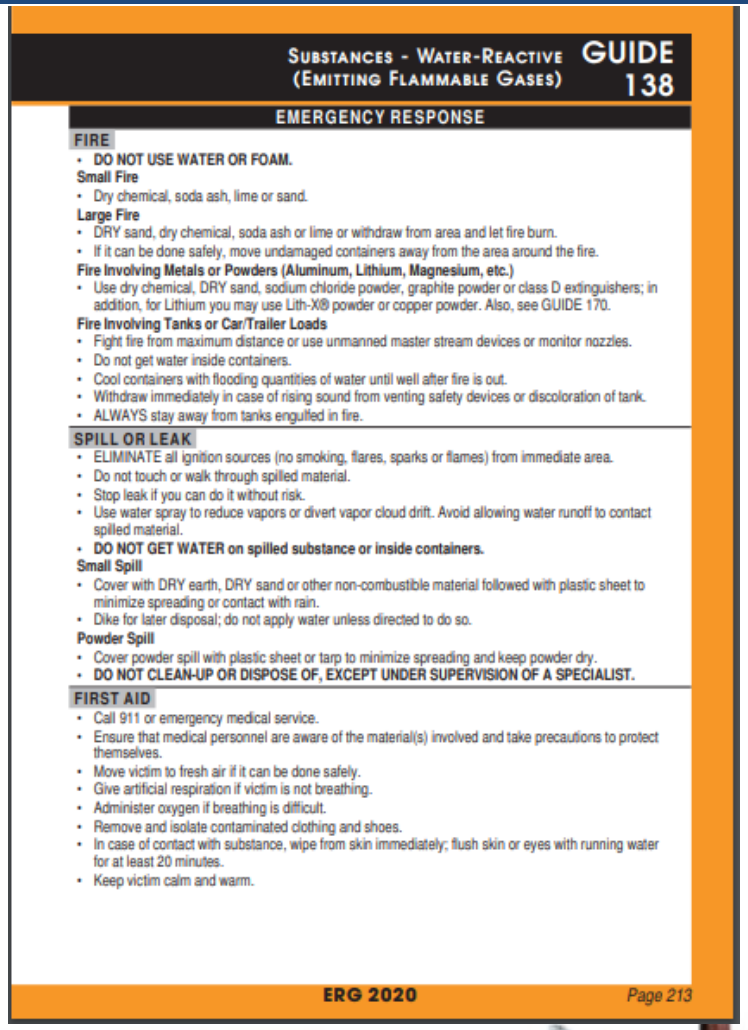
Additional Tips
- *One battery or device per bag*
- *Total combined battery weight must not exceed 4.4 lbs.*
- *Packages containing damaged or defective lithium batteries are forbidden from air transport*

The performance certification of this package requires that it be filled, assembled, and used in full accordance with the instructions herein. The use of substitute components or packing methods, or failure to follow the supplied instructions may result in a package that is not compliant with this certification. Instructions valid until revoked or superseded. The special permit for transporting damaged, defective, or recalled lithium batteries is number 20331.
A copy of the special permit is maintained at https://www.clsmith.com/wp-content/uploads/2019/09/DOT-SP-20331.pdf

Pictured: DOT-SP 20331

Next Steps?

- Regulatory changes?
- ERG 2024
- Emergency Response survey
- Inspections
- Outreach
  - Safety Advisory
  - Conferences



SUBSTANCES - WATER-REACTIVE (EMITTING FLAMMABLE GASES) GUIDE 138

EMERGENCY RESPONSE

FIRE

- **DO NOT USE WATER OR FOAM.**

Small Fire

- Dry chemical, soda ash, lime or sand.

Large Fire

- DRY sand, dry chemical, soda ash or lime or withdraw from area and let fire burn.
- If it can be done safely, move undamaged containers away from the area around the fire.

Fire Involving Metals or Powders (Aluminum, Lithium, Magnesium, etc.)

- Use dry chemical, DRY sand, sodium chloride powder, graphite powder or class D extinguishers; in addition, for Lithium you may use Lith-X® powder or copper powder. Also, see GUIDE 170.

Fire Involving Tanks or Car/Trailer Loads

- Fight fire from maximum distance or use unmanned master stream devices or monitor nozzles.
- Do not get water inside containers.
- Cool containers with flooding quantities of water until well after fire is out.
- Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.
- ALWAYS stay away from tanks engulfed in fire.

SPILL OR LEAK

- ELIMINATE all ignition sources (no smoking, flares, sparks or flames) from immediate area.
- Do not touch or walk through spilled material.
- Stop leak if you can do it without risk.
- Use water spray to reduce vapors or divert vapor cloud drift. Avoid allowing water runoff to contact spilled material.
- **DO NOT GET WATER on spilled substance or inside containers.**

Small Spill

- Cover with DRY earth, DRY sand or other non-combustible material followed with plastic sheet to minimize spreading or contact with rain.
- Dike for later disposal; do not apply water unless directed to do so.

Powder Spill

- Cover powder spill with plastic sheet or tarp to minimize spreading and keep powder dry.
- **DO NOT CLEAN-UP OR DISPOSE OF, EXCEPT UNDER SUPERVISION OF A SPECIALIST.**

FIRST AID

- Call 911 or emergency medical service.
- Ensure that medical personnel are aware of the material(s) involved and take precautions to protect themselves.
- Move victim to fresh air if it can be done safely.
- Give artificial respiration if victim is not breathing.
- Administer oxygen if breathing is difficult.
- Remove and isolate contaminated clothing and shoes.
- In case of contact with substance, wipe from skin immediately; flush skin or eyes with running water for at least 20 minutes.
- Keep victim calm and warm.

ERG 2020 *Page 213*

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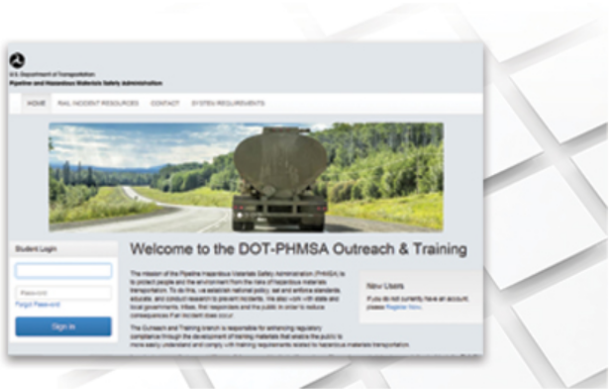
Training Modules



Hazardous Materials Transportation

Related Links

- Hazardous Materials Training Modules

Contact Us

Hazardous Materials Training Program
U.S. Department of Transportation,
Pipeline and Hazardous Materials Safety Administration
1200 New Jersey Avenue, SE
Washington, DC 20590
United States
phmsa.hm-training@dot.gov

Phone: 202-366-4900

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Publications

The Outreach and Training Branch develops materials that make it

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- Order Training Materials Online

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Washington, DC 20590
United States
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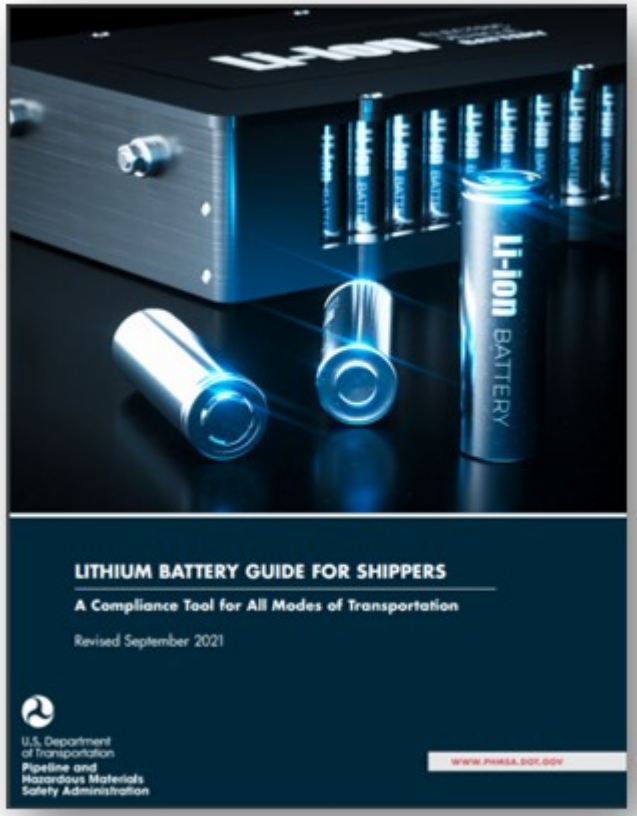
NEW: 7 Useful Tips to Help You Ship Hazardous Materials Safely in Commerce, a quick e-resource guide

Lithium Battery Guide for Shippers



Comprehensive guide for transporting all configurations and sizes of lithium batteries to include packaging and hazard communication requirements

Available digitally or in hard copy (contact training@dot.gov)

Video: How to Use the Lithium Battery Guide for Shippers

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Hazardous Materials Safety Assistance Team (HMSAT)

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About HMSAT

PHMSA's Hazardous Materials Safety Assistance Team (HMSAT) is responsible for face-to-face outreach and field compliance assistance on the Hazardous Materials Regulations (HMR). HMSAT's goal is to improve hazardous materials transportation safety and security through increased communication and education. HMSAT members are assigned to each of PHMSA's regional offices and are available to help businesses comply with the hazardous materials transportation regulations through educational and technical assistance. HMSAT also provides compliance assistance to federal, state, and local governments.

HMSAT Bios

PHMSA Hazmat Transportation Webinars: https://www.phmsa.dot.gov/hazmat/seminars/webinars

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- International Program Overview
- PHMSA's Online CFR (oCFR)
- Rulemakings
- Petitions for Rulemaking
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- Regulations
- Preemption Determinations
- Notices and Advisory

Hazardous Materials Information Center

1-800-HMR-4922
1-800-467-4922
202-366-4488
infocntr@dot.gov

Have a question about transporting hazardous materials? Need clarification on an entry in the Hazardous Materials Regulations? PHMSA's Hazmat Information Center provides live, one-on-one assistance Monday through Friday from 9 a.m. - 5 p.m.

Call the Info Center:

- for help with use of the Hazardous Materials Regulations (49 CFR

Contact Us

Hazardous Materials Standards and Rulemaking
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