Managing End-of-Life Batteries: EPA Regulations and Critical Minerals Recovery

Battery Recycling Conference

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Why Does Battery Collection Matter?

- Batteries power many products that make modern life possible.
- The global battery recycling market is projected to grow from $2.3 billion in 2023 to $17 billion by 2030.
- Improperly disposed lithium batteries cause fires.
- Improving battery collection and recycling can:
  - ✓ **Strengthen the domestic battery supply chain**
  - ✓ **Keep workers safe and reduce battery fires**
  - ✓ **Protect energy security**



Battery collection kiosk at Tribal-run bowling alley. Source: Morongo Band of Mission Indians

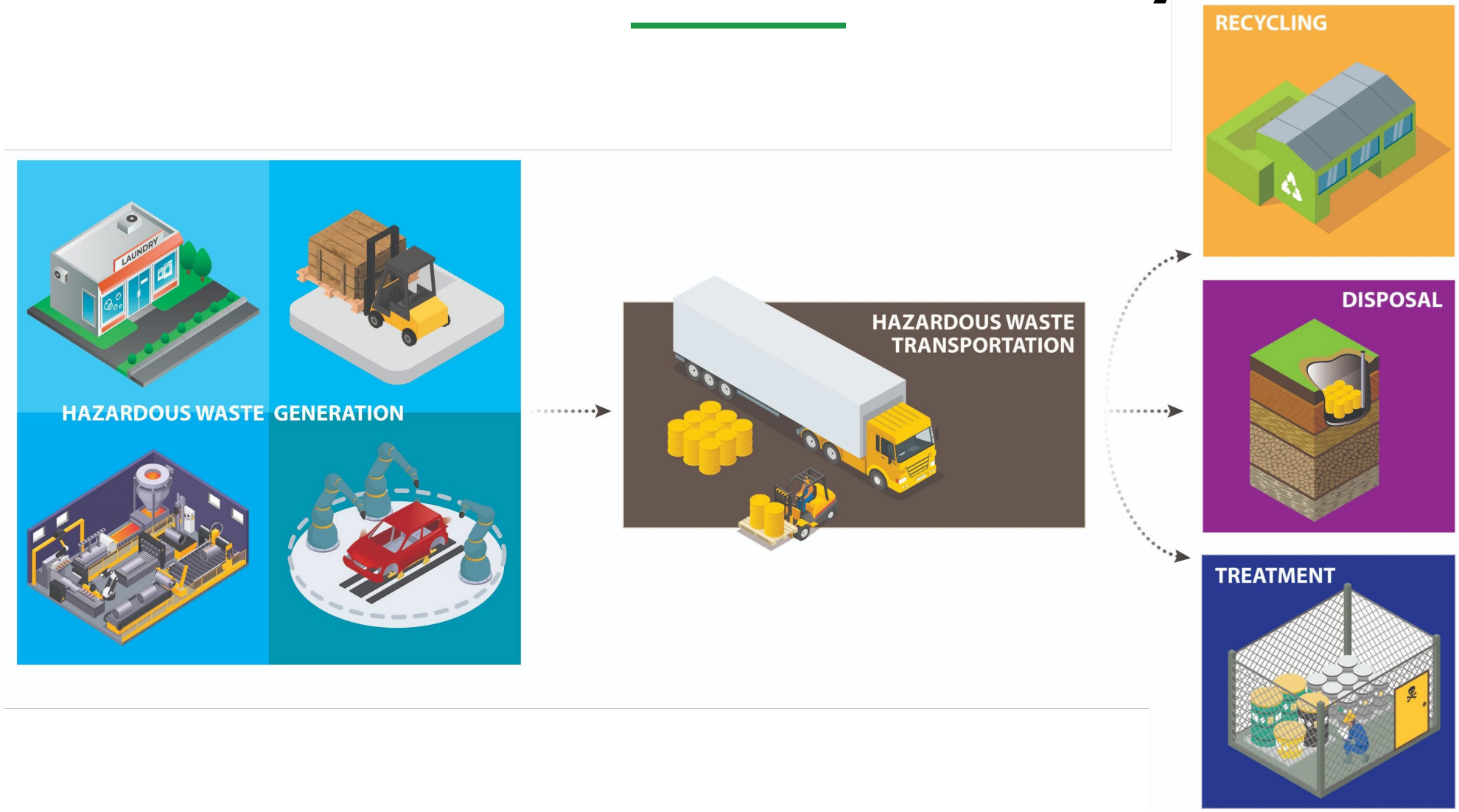
Lithium Battery Fire Risk



Mesa, AZ firefighters responding to a lithium battery incident

- Lithium batteries exhibit greater risk of fires or other thermal events compared to other types of batteries
  - Greater energy density means a short circuit generates more heat
  - Prone to thermal runaway: a vicious cycle of heating -> damage -> even more heating
- Lithium batteries have caused many fires at end-of-life
  - EPA's 2021 damage case report documented publicly-reported fires caused by lithium batteries in the waste stream

Regulation of Hazardous Waste Under The Resource Conservation and Recovery Act (RCRA)



Universal Waste: Facilitating Recycling

- The universal waste regulations at 40 CFR part 273 streamline the hazardous waste management standards for certain wastes commonly generated by a wide variety of establishments
- The five existing types of federal universal wastes:
  1. **Batteries**
  2. Pesticides
  3. Mercury-containing equipment
  4. Lamps
  5. Aerosol cans



Universal Waste Regulations

- Handlers
  - Subject to streamlined requirements (e.g., not required to use a manifest, may accumulate UW for up to one year and ship UW to and receive UW from other handlers, and other requirements)
  - Small quantity handlers accumulate < 5,000 kg of UW at one time
  - Large quantity handlers accumulate ≥ 5,000 kg of UW at one time
- Transporters
  - Common carriers that do not have to ship waste under a hazardous waste manifest
  - Must comply with DOT requirements for hazardous materials
- Destination facilities
  - Permitted TSDFs or recyclers who do not store prior to recycling
- Imports and Exports
  - Requirements for exporters and importers of universal waste are very similar to those for hazardous waste
  - For more information, see EPA's Requirements for Transboundary Shipments of Specific Wastes webpage

Universal Waste Lithium Battery Proposed Rulemaking Effort

- EPA is working to adjust US hazardous waste regulations for lithium batteries to better address their unique safety hazards but still promote recycling



Rule Webpage: https://www.epa.gov/hw/improving-recycling-and-management-renewable-energy-wastes-universal-waste-regulations-solar

Need to Adjust the Universal Waste Standards

- Original universal waste battery category predates widespread LIB use
  - Lithium-ion technology was still fairly new in 1995
  - Existing regulations are not tailored to lithium battery-specific managment issues, including the fire risk



Power tool battery. Source: EPA

Universal Waste Proposed Rule Overview

- Adjust the universal waste regulations to address the safety concerns associated with managing EOL lithium batteries, while still promoting recycling
  - New category specific to lithium batteries, separate from the existing broad UW batteries category
  - Housed within the existing UW program
  - However, handler requirements and allowed activities are subject to change relative to the existing UW battery category
- As part of the changes in the upcoming proposal, we are considering:
  - Including provisions for small items with embedded lithium batteries, including e-cigarettes
  - Specifically addressing DDR management at end of life
  - Additional regulatory changes to promote critical mineral recovery through battery recycling

EPA's Voluntary Battery Projects

Separate but complementary requirements in the Infrastructure Investment and Jobs Act (IIJA):

Extended Battery Producer Responsibility Framework

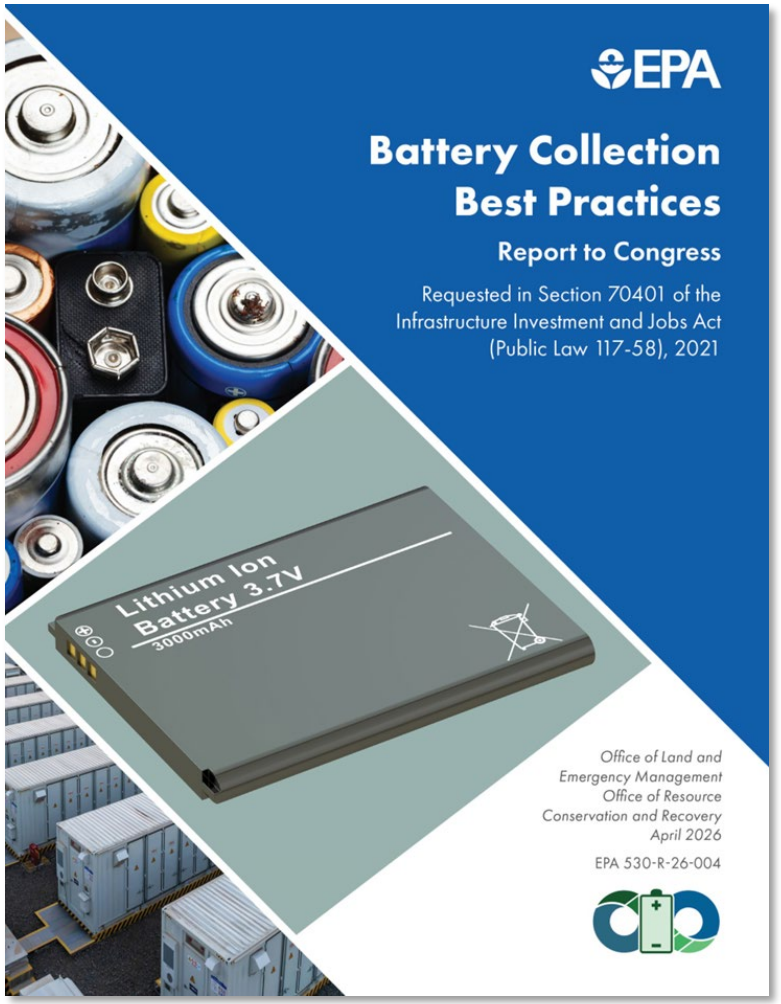
Battery Collection Best Practices

Education Materials

Voluntary Battery Labeling Guidelines



Battery Collection Report to Congress



- Fulfills Section 70401(b) of the **Infrastructure Investment and Jobs Act (IIJA)** to identify battery collection best practices.
- Provides **best practices** for state, Tribal, and local governments to improve battery collection, increase safety, and support a circular economy.
- Includes **resources and case studies** about collection approaches, collection site safety, consumer education, policy options, and more.

Key Messages

- Collecting batteries for recycling:
  - protects public safety,
  - conserves critical minerals, and
  - preserves energy security.
- Collection challenges exist across all battery types.
- Best practices improve collection and safety:
  - Policies, programs, and access to infrastructure drive higher collection rates.
  - Consumer education on importance of recycling increases participation.



Education Helps Consumers Make Informed Decisions

- **Messages for all batteries:**
  - Do not place batteries in curbside recycling bins or household trash bins
  - Properly store batteries at home
  - Look for warning signs of battery damage
  - Choose certified devices
  - Return products to a retailer or battery takeback program





South Carolina (left) and Larimer County, CO (right) have implemented large scale educational programs to raise consumer awareness.

Common Themes: Collection Best Practices for Consumer Batteries



Enhance point of sale information and messaging

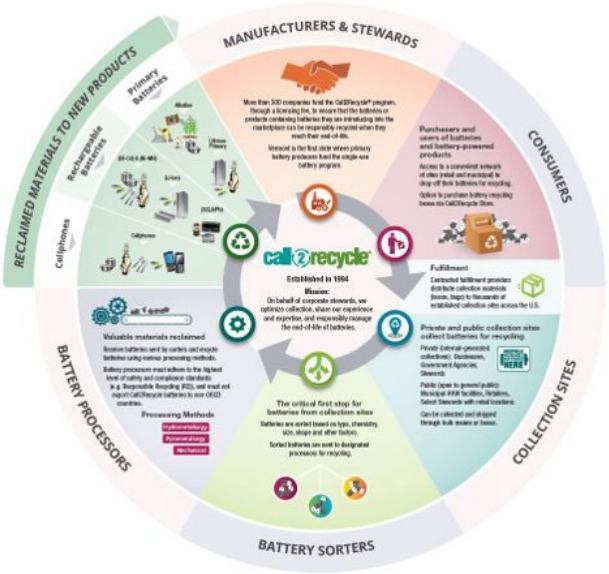
Convenient and well-marked collection locations; consistent and wide-spread outreach





Train employees at collection sites; ensure materials are properly packaged and labeled

Partner for program implementation; employ a hub and spoke model of collection for rural areas



Battery Collection Best Practices Tool Kit

Battery format

- [ ] Large Format (Motive)
- [ ] Large Format (Stationary Storage)
- [ ] Mid-Format
- [x] Small Format

Reset

Resource Type

- [x] Case Study
- [ ] Educational Material
- [ ] How-to Guide
- [ ] Infographic
- [ ] Report
- [ ] Standards
- [ ] Tip Sheet
- [ ] Webinar

Reset

Focus Area

- [ ] Collection Sites
- [ ] Curbside Collection
- [ ] Damaged and Defective Batteries
- [ ] E-cigarettes
- [ ] Education/Outreach
- [ ] Extended Battery Producer Responsibility
- [ ] End-of-Life Management
- [ ] Fire Management

Reset

Community Characteristics

- [ ] All
- [ ] Tribal

Reset

Show 10 entries Export to Excel Search:

Title	Description	Organization	Battery Format	Resource Type	Focus Area	Community Characteristics
Leading the Charge: Marion County's Battery Collection and Recycling Program	Case study that highlights battery collection and recycling in Marion County, focused on the challenges and successes of an established curbside collection and drop-off program, and the importance of education and outreach in fostering community awareness and support.	U.S. Environmental Protection Agency	Mid-Format; Small Format	Case Study	Collection Sites; Education/Outreach	All
Onondaga County Resource Recovery Agency's Community-Centered Battery Collection	Case study that describes an evolving community-centered battery collection program in Onondaga County, New York, highlighting strategies for public engagement, fire safety, and infrastructure over three decades.	U.S. Environmental Protection Agency	Small Format	Case Study	Collection Sites; Education/Outreach; End-of-Life Management; Fire Prevention; Hazardous Waste; Recycling; Storage	All
Seattle Bans Batteries from the Bin	Case study that highlights Seattle's battery disposal ban, which was enacted to reduce battery-caused fires and prepare customers for an upcoming statewide disposal ban.	U.S. Environmental Protection Agency	Mid-Format; Small Format	Case Study	Collection Sites; Education/Outreach; Recycling	All

Vision for EPA's Voluntary Battery Labeling Guidelines

- EPA is developing guidelines for labels that will:
  - Identify battery collection locations
  - Educate consumers about recycling opportunities
  - Reduce safety concerns from improper disposal
- EPA webpage on voluntary labeling guidelines

Common Themes: Labeling Guidelines

It's a battery!

Do recycle it if you can! Don't put it in your bins!

State/condition?



Chemistry

Link to more information

Color?

What's Next?

In progress IIJA projects:

- EPR Framework And Labeling Guidelines
- Additional web-based resources in Battery Collection Toolkit

Scan to access the Toolkit!

Next steps for the rulemaking:

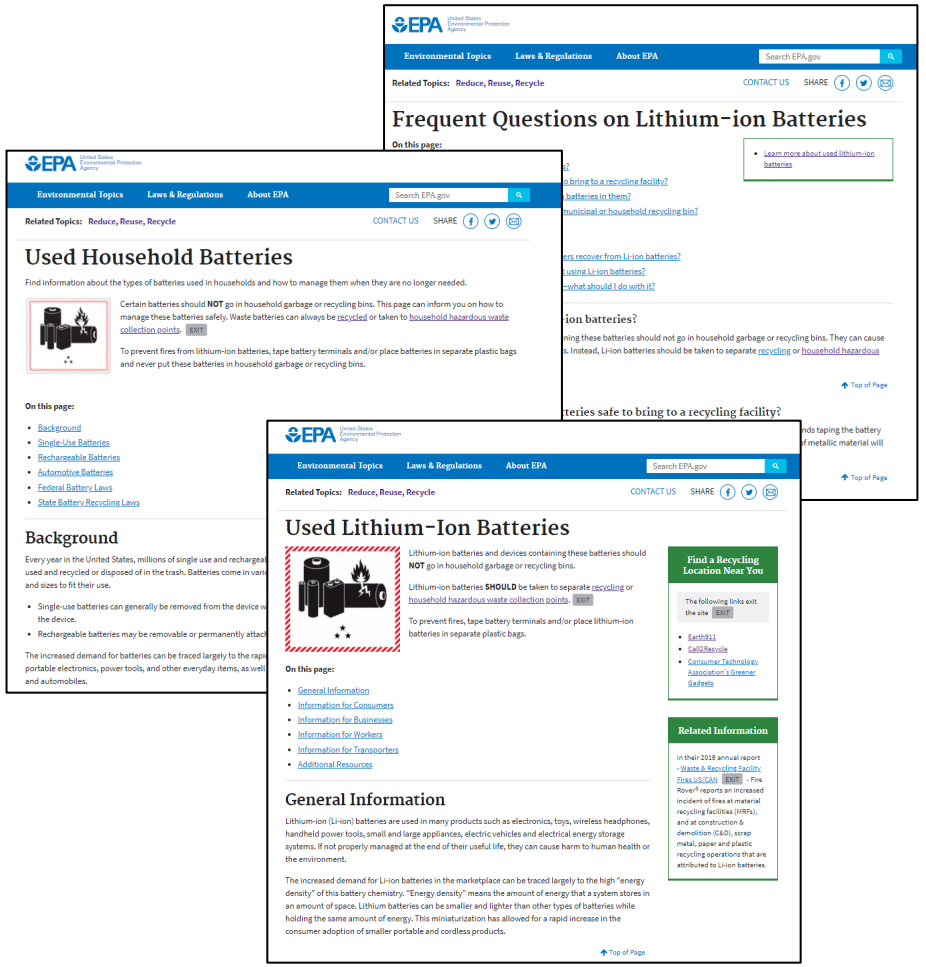
- Publish proposed rule
- Comment period

EPA Small Business Innovation Research Grants FY26

- EPA SBIR funds small businesses to develop and commercialize innovative environmental technologies in broad focus areas
- Topic 3B: Critical Mineral Recovery From Lithium-Ion Batteries and Safe Recycling/Reuse of Batteries
  - Innovative technologies to improve safety during collection and transport of end-of-life and damaged lithium-ion batteries for recycling.
  - This may include technologies:
    - (1) for packaging lithium batteries to prevent thermal runaway during accumulation;
    - (2) to evaluate batteries for damage before accumulation or transport; and
    - (3) to discharge lithium batteries that may still contain significant voltage to preemptively remove the charge, preventing thermal runaway.
- Among all topics, EPA anticipates making 25 total grants up to $100,000 each
- The solicitation is open until **November 8th**
- Resources:
  - EPA SBIR Funding Opportunities webpage
  - SBIR FY26 Phase I Broad Agency Announcement - FedConnect webpage

Resources

- EPA Battery Webpages
  - Used Lithium-ion Batteries webpage
  - Frequent Questions on Lithium-ion Batteries webpage
  - Universal Waste webpage
  - Export/Import requirements for Universal Waste
- EPA Universal Waste Rulemaking Webpage
  - Improving Recycling and Management of Renewable Energy Wastes: Universal Waste Regulations for Solar Panels and Lithium Batteries
- EPA Best Practices and Labeling Projects
  - Best Practices and Labeling webpage
  - Collection Best Practices Toolkit



Thank you!

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