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BATTERY RECYCLING AND BATTERY SAFETY: WHAT YOUR NEED TO KNOW FOR YOUR RECYCLING PROGRAM

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Tim Warren, Regional Account Manager

Agenda

1. Batteries in the waste stream - the Good, the Bad and the Ugly
2. Call2Recycle's role in battery recycling
3. Understanding battery safety risks
4. Advancing safety in battery recycling
5. Education/Outreach and Safety Best Practices

Batteries power the modern world, whether it's your cellphone, tablet, power tool or digital camera.




When batteries lose their charge or ability to recharge,

it's time to recycle them.

Batteries: The Good & The Bad (and Ugly?)

1. More than 3 billion batteries sold annually in the US
   - 80% single use; 20% rechargeable
   - Nearly ten batteries per person in the US

2. Battery Chemistries continue to evolve in the marketplace:
   - Rechargeable batteries: Li-Ion now powers most consumer products; NiCd has been replaced.
   - Environmental concerns for EOL management (cadmium, lead) have been largely replaced with safety concerns (Lithium Ion).
   - Alkaline batteries are more recyclable. However, they are also being replaced in the market by Lithium Primary/single use lithium (9V, AA, AAA, C, D and coin cell) that are more expensive to recycle than alkaline.

Batteries: The Good & The Bad (and Ugly?)

3. Issues with batteries are pervasive and, in fact, increasing:

- Increasingly, rechargeable batteries are embedded in products, the removal of which is difficult, increasing safety risks and proper reuse and recycling.
- Because of sheer volume of battery sales, we see more rather than less “damaged, defective and recalled (DDR)” lithium batteries in the waste stream.
- The energy density (power per gram) continues to rapidly increase, creating more powerful yet smaller batteries, making them harder to identify and potentially more of a safety risk.
- Batteries heavily rely on small amounts of scarce natural resources mined under less than ideal conditions.
- Local government information on battery recycling (website, literature) may be out of date or incomplete. Many do not even list accepting Lithium Ion or Ni-MH

Call2Recycle's Role in Battery Recycling

- Not-for-profit, industry-funded battery stewardship organization operating in the US and Canada.
  - 1st household battery recycling program in the US.
  - Founded by battery manufacturers in 1994 to deal with emerging state and federal regulation.
  - More than 300 product and battery manufacturers fulfill state, provincial and federal recycling requirements through Call2Recycle.
- Operate a reliable, cost-efficient and customer-focused national recycling network.
  - More than 16,000 collection partners, including 6,500 local government sites
  - 86% of US population lives with 10 miles of an active Call2Recycle drop-off collection site
  - More than 115 million lbs. of dry cell rechargeable and single use batteries collected and recycled through our program in the US since 1994.
- RBRC = Call2Recycle

Batteries Accepted in the Call2Recycle Program

Nickel Metal Hydride
(Ni-MH)

Nickel Cadmium
(Ni-Cd)

Nickel Zinc
(Ni-Zn)

Small Sealed
Lead Acid
(SSLA/Pb)

Lithium Ion
(Li-Ion)

Alkaline/Lithium Primary
(for a fee)

Cellphones

The Call2Recycle Battery Recycling Journey

Safety is important during every step of the journey.

Lithium Batteries in the Market

- Li-Ion batteries are replacing most other rechargeable battery chemistries

- Lithium batteries have a much higher energy density than other rechargeable chemistries
  - Li-Ion — up to 180 watt hours/kilogram
  - Ni-MH — 60-70 watt hours/ kilogram
  - Lead Acid — 25 watt hours/kilogram

- Versatility for high energy demand uses in electronics- smart phones, cordless power tools, laptop computers/tablets/e-readers

- Lithium batteries require terminal protection to avoid thermal runway or sparking risks

Lithium Batteries in the Market

Lithium Primary Batteries

- 9V, AA, AAA, C, D, Coin/Button cell
- MAY be marked: ‘Lithium’ or ‘Lithium cells’; coin cells marked as (CR###)

Lithium-Ion Rechargeable Batteries

- MAY be Marked “Rechargeable”
- MAY Have a Battery Chemistry Name (Lithium Ion) or Abbreviation (LI-ION, Li-ion, LiPo (lithium polymer)
- It MAY Just Have Battery Seal, other or no marking

Understanding Battery Safety Risks

- **Design** (Batteries with Products) – “spontaneous” combustion of a battery in a product. TYPICALLY involves the design relationship of the battery with the product.
- **Abuse** (Batteries Removed from Products) – some batteries were not designed to be replaced by consumers. Off-the-shelf replacement batteries jeopardizes safety.
- **Shipment** (Batteries in Transport) – when transported at end-of life, improperly packaged batteries (e.g., exposed battery terminals) can create friction or a short circuit causing a fire.

Understanding Battery Safety Risks

- **Storage** (Batteries Waiting for Management) – occurs when material is stored with other flammable material and is exposed to the elements.
- **Disposal** (Including Recycling) – difficulty in identifying and separating batteries or products with batteries. Shredding, crushing, puncturing or otherwise causing damage to a lithium-based battery create fires.

Understanding Battery Safety Risks

- **Damaged Lithium Batteries:** Watch for lithium ion or lithium primary batteries that show signs of damage such as swelling, smoking, leaking or overheating.
- Do NOT place damaged lithium batteries in a standard collection kit. Immediately put them in an absorbent, non-flammable material (sand or cat litter) in a cool, dry area.
- The US DOT requires special packaging for damaged, defective or recalled (DDR) lithium batteries.




June 2017 – A Defining Moment for Call2Recycle

Reference: https://youtu.be/AIff-fKTBYE

Advancing Safety in Battery Recycling

Charge Up Safety!™ Campaign

1. **Foster Employee Leadership**. Improve our knowledge, culture and commitment to safety to enable us to serve as leaders and influencers with customers.

2. **Improve Collection Site & Sorter Performance**. Increase visibility, accountability and behaviors surrounding safe handling, storage and transport of batteries.

3. **Drive Consumer Awareness.** Improving the visibility and knowledge of safe practices.

4. **Engage Stakeholders**. Build relationships with other like-minded organizations to influence public and government debate on relevant safety issues.

Advancing Safety In Battery Recycling

- Required safety training for program participants.
- Increased Auditing / Monitoring.
- Non-compliant collection sites are suspended from program.
- Innovative, safe & compliant recycling solutions.
    - Flame Retardant Box Liners
    - Cellblock Fire Containment Systems
    - 300WH solutions
- Educational Safety Campaigns

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CellBlock® Fire Containment Systems

Flame Retardant Liners (FRB)

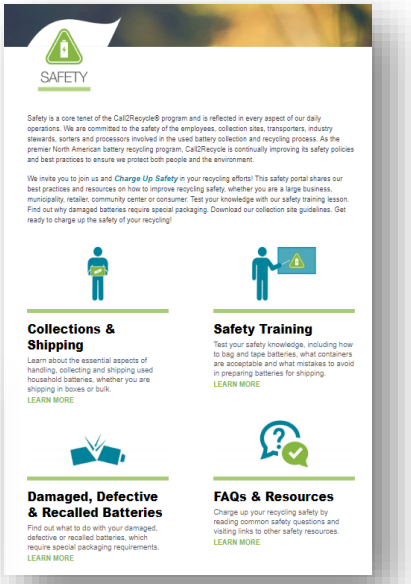
- Patent pending flame retardant box liner.
- Third-Party Tested - Extensive testing by independent laboratory (withstood up to 1,100 degrees F).
- Containment - Prevents flames & heat from spreading outside the shipping container.
- Recyclable & Reusable - Made of polyester material manufactured from used plastic bottles and can be reused multiple times.

Cellblock Fire Containment Systems

- Revolutionizing the handling, storage and transport of lithium batteries – for safe and compliant end-of-life battery management.
- Fire preventions and suppression solutions utilizing CellBlockEX technology.
- 300Wh Special permit allowing up to 800-watt hours in aggregate to be placed in the same container.
- Enhanced DDR capabilities
- Call2Recycle is the exclusive distributor of CellBlock fire suppression solutions.
- Cellblock vs. Vermiculite (1 Minute Mark)
- PED-Pad Application (35 Second Mark)

Advancing Safety In Battery Recycling

- **Education is key**
  - Charge Up Safety ™. Education campaign directed at employees, collection sites, battery sorters, consumers and other like-minded organizations to increase safety and reduce battery related incidents.
  - Avoid the Spark… Be Battery Safety Smart ™. 2018 campaign in San Francisco Bay area counties aimed at heightening consumer awareness on battery safety and related issues. Materials available for nationwide use at www.avoidthespark.com



What Can You do for your Operations?

- Designate a Storage Area. Determine where and how collected batteries will be stored at your facility
    - Isolate away from other materials (i.e., recyclables = fuel)
    - limit exposure to the elements (i.e., extreme temperature, rain, etc.).
- Develop Standard Operating Procedures.
    - Used Batteries. Identify the battery, terminal protection, take to the storage area, add to correct storage container.
    - Damaged or Defective Batteries. Isolate the battery (i.e., kitty litter or sand in its own container), ship using US DOT approved DDR container and process.
    - Thermal Event. If possible, a battery on fire should be isolated from all other combustible materials. Call 911 and then fight the fire. Can use water to saturate the fire and impacted batteries. Follow established emergency protocol.

- Train Employees. Train, train and train again. Use visuals to show examples of what to look for and review SOPs, and then train again. www.call2recycle.org/safety-training
- Update your website and consumer materials on batteries- inform residents on identifying battery chemistries and how and where to drop off lithium batteries for recycling

Closing thoughts/Wrap up

- Batteries will continue to be a visible and growing part of the consumer solid waste stream in the future
- Lithium Ion and Lithium Primary (single use) batteries will continue to replace other battery chemistries
- Lithium ion batteries will continue to grow more powerful and replace conventional gasoline and corded products- power tools, lawn mowers, chain saws, etc.
- Lithium ion batteries without a flammable electrolyte are still a few years away from commercial introduction
- Lithium ion batteries are generally safe and perform without incident for their intended use.

Closing Thoughts/Wrap up

- Many local government recycling programs need to actively promote battery recycling with their education messaging (or update messaging to address accepted battery chemistries)
- Many local government recycling programs may have limited collection sites or may not promote batteries as part of what are accepted at electronics or HHW events.
- Call2Recycle is here to help local governments and the solid waste industry address both safe and compliant recycling of dry cell batteries (both rechargeable and single use), and partner to provide the educational messaging needed to motivate consumers to recycle

Call2Recycle wants to assist your community to compliantly and safely recycle all consumer batteries

- Partner with a trusted, reliable and compliant organization that can customize a solution to meet your local needs.

R2 2013 Responsible Recycling™

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thank you!

Tim Warren
Regional Account Manager
twarren@call2recycle.org

Corporate headquarters:
1000 Parkwood Circle, Suite 200
Atlanta, GA 30339