THREATSPOSED TO THE RECYCLING COMMUNITYBY LITHIUM ION FIRES

Washington MRW Managers Meeting
Ellensburg, Washington

Presented by:
Eric Frederickson
Director, Quality & Process Excellence

May 16, 2019
When did your views on lithium battery safety change?
June 5, 2017

Reference: https://youtu.be/AIff-fKTBYE
OVERVIEW: the Call2Recycle® Program

- Non-profit founded in 1994 by industry to address the emergence of EPR legislation.

- In the U.S., funded primarily by rechargeable battery stewards and, more recently, fee-based services.

- In the U.S., we’re primarily a voluntary program except in certain states (e.g., Vermont, Minnesota, New York) where collections of some (but not always all) chemistries are mandated.

- Collected over 144 million pounds of consumer batteries since from over 30,000 publicly accessible sites; collected over 30 million pounds of lithium ion (Li-Ion) since inception.
What Makes the Call2Recycle® Program Different

• Four things make the Call2Recycle® program different than any other EPR program in the world:

  - Our “customers” are those who generate batteries for collections and not the stewards who pay our bills.

  - We run a national program with over 300 participating manufacturers despite the fact that almost no jurisdiction requires manufacturers to participate.

  - We have successfully developed and now offer fee-based, battery-related services, primarily to manufacturers, that generate as much financial support for the program as our stewardship fees.

  - Our education efforts are not solely tied to collections; we have staked out a thought leadership position on zero waste, recycling, EPR and battery recycling safety that no other similar program has chosen to pursue.
Call2Recycle® Program in Washington
45 Participating Local Government / HHW Sites

<table>
<thead>
<tr>
<th>Asotin County Regional Landfill</th>
<th>Horn Rapids Landfill</th>
<th>Orchards Medical Office</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cascade Park Medical Office</td>
<td>Jefferson County MRW Facility</td>
<td>Pacific County</td>
</tr>
<tr>
<td>City of Port Angeles Solid Waste</td>
<td>Kaiser Permanente</td>
<td>Port of Seattle</td>
</tr>
<tr>
<td>City of Seattle</td>
<td>King County - WasteWise Program</td>
<td>Seattle Police Department</td>
</tr>
<tr>
<td>City of Seattle Communications Shop</td>
<td>King County Clean Harbors</td>
<td>Skagit County Recycling and Transfer Station</td>
</tr>
<tr>
<td>City of Seattle South HW Facility</td>
<td>King County Fire District 20</td>
<td>Snohomish County Fire District #1</td>
</tr>
<tr>
<td>City of Vancouver Fire Department</td>
<td>King County Sheriff’s Office</td>
<td>Snohomish County Solid Waste</td>
</tr>
<tr>
<td>City Of Walla Walla MRWF</td>
<td>King County/Factoria Hazardous Waste Drop Off</td>
<td>Tacoma HHW Facility</td>
</tr>
<tr>
<td>Clark College</td>
<td>Kitsap County Household Hazardous Waste Facility</td>
<td>Thurston County Waste and Recovery Center</td>
</tr>
<tr>
<td>Countywide Solid Waste Programs</td>
<td>Kittitas County Solid Waste</td>
<td>Valley Transfer/Recycling Station</td>
</tr>
<tr>
<td>Federal Bureau of Investigation</td>
<td>Lewis County Central Transfer Station</td>
<td>Waterville Community Recycling Center</td>
</tr>
<tr>
<td>Grant County Public Utility District # 2</td>
<td>Lopez Solid Waste Disposal District</td>
<td>Whatcom County Disposal of Toxics Facility</td>
</tr>
<tr>
<td>Grant County Public Works</td>
<td>Mt. Baker Ranger District Headquarters</td>
<td>Whitman County Landfill</td>
</tr>
<tr>
<td>Grant County Solid Waste</td>
<td>North County Transfer/Recycling Station</td>
<td>WM SMaRT Center</td>
</tr>
<tr>
<td>Grays Harbor County Central Transfer Station</td>
<td>Okanogan County Sheriff’s Office</td>
<td>Yakima County WA Public Svcs</td>
</tr>
</tbody>
</table>

Call2Recycle had 405 actively participating collection sites in the state of Washington in 2018.

45 of these are classified as “public agencies”, including HHW’s and MRW’s.

In the last three years, Call2Recycle collected over 358,000 lbs through those public agencies in the state of Washington.
The Dynamic Lithium Battery Market

**Electric dreams**

Manufacturing capacity
Gigawatt-hours per year

- Panasonic* (Japan)
- CATL (China)
- BYD (China)
- LG Chem (South Korea)
- Samsung SDI (South Korea)

Sources: Cairn ERA; US Department of Energy

---

**Battery cost**
Worldwide, $/kWh

**Battery energy density**
Watt-hours per litre

FORECAST

*Includes Tesla gigafactory

---

5.6 Billion Lithium Ion Cells Sold in 2016
The Dynamic Lithium Battery Market

• **More Products with Batteries.** As more products using batteries (e.g. toys, tools, electronics) are sold, more batteries flood the recycling market.

• **Identifying Battery Types.** Battery chemistries can be hard to identify so it’s hard to protect the most hazardous ones.

• **Increasing Energy Density.** As the power of batteries increases and their size shrinks, the chances for severe incidents goes up.

• **More Non-OEM Batteries Sold.** The sale of counterfeit batteries, which are more likely to cause safety incidents, are increasing.
What’s At Risk
(Besides Direct Costs of Damage)

• **Infrastructures drops us** – FedEx embargoed our boxes until we made several operational changes.

• **Collection sites don’t want the hassle** – participation in the program is voluntary and sites increasingly don’t want to incur the costs, hassle or risk in generating batteries.

• **Escalating costs “break” the program** – whether the increased costs are borne from increased regulation, insurance premium increases, shipping surcharges or other factors, they may not be recoverable from stewards financing a voluntary program.

• **Reputational damage** – the goodwill built over two decades is lost.

• **Government intervention** – states will choose to further regulate collection due to risks incurred by local government collections.
Recycling Lithium-Based Batteries

Four Important Lessons for Consumers

1. **A Spent Battery Isn’t.** Used lithium batteries can often maintain 80%+ of their original charge.

2. **Don’t Remove Non-Removable Batteries.** Lithium polymer batteries, without hard cases, are susceptible to damage.

3. **Tape or Bag.** The positive terminal must be protected either by tape or place in a clear and sealable bag.

4. **Curb Side Is Seldom Wise.** While some municipal governments have effective programs to mitigate safety issues, most do not. Find a dedicated collection container / site.
Recycling Lithium-Based Batteries

Four Additional Lessons for the Scrap Industry

1. **Running with Scissors.** Shredding or stabbing the batteries will cause lithium-based batteries to explode.

2. **Stormy Weather.** Exposure to the weather generally makes batteries more susceptible to incident.

3. **Fire and Ice (or Water and Sand).** A potential bad battery is best kept in sand. You can never put too much water on a battery that is in flames.

4. **Separate for Safety.** Keeping them separate and letting them burn separately is a reasonable strategy to mitigate damage and loss.
Do NOT place damaged Lithium Ion or Lithium primary batteries in normal collection bins. Immediately place in absorbent, non-flammable material (sand or cat litter) in a cool, dry area.
# Damaged, Defective or Recalled Batteries

<table>
<thead>
<tr>
<th>Kit</th>
<th>Small Kit</th>
<th>Large Kit</th>
</tr>
</thead>
</table>
| **Kit Contents** | • Overpack box  
• Metal can with affixed labeling  
• Metal lid and locking ring  
• Treated Cotton Fiber  
• Tape  
• Plastic bags  
• Permit and caution labels  
• Return shipping label  
• Instructions | • Overpack box  
• Metal bucket with affixed labeling  
• Metal lid and locking ring  
• Inner box  
• Treated Cotton Fiber  
• Tape  
• Plastic bags  
• Permit and caution labels  
• Return shipping label  
• Instructions |

**Note**: US Special Permit allows for no more than 4.4 lbs. (2kgs) of lithium cells and batteries to be contained in a single package. However, a single cell or battery may be shipped within one package provided the cell or battery has a mass of 5 kg or less.

- “Damaged, Defective or Recalled” (DDR) batteries are a designation coined by the US Department of Transportation.
- DDR batteries require unique (and expensive) packaging in order to ship. (no more vermiculite)
- We’re selling customized product return services to stewards to mitigate their risk and bolster revenue.
Charge Up Safety!™ Campaign

Four Main Objectives

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.
✓ Flame Retardant Box Liner - Patent pending.

✓ 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.

We Know It Works – Pictures Are From Actual Returned Boxes
### Charge Up Safety!™: Safety Training Results

#### Number of Sites Trained and % Compliant

<table>
<thead>
<tr>
<th>Group</th>
<th>Number of Sites Trained</th>
<th>% Compliant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major Retailers (Big Box Stores)</td>
<td>5,579</td>
<td>100% compliant</td>
</tr>
<tr>
<td>Traditional “Free” Collection Sites (Stewards, Muni’s, etc.)</td>
<td>3,848</td>
<td>73% compliant</td>
</tr>
<tr>
<td>Fee-based Collection Sites</td>
<td>5,966</td>
<td>92% compliant</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>15,393</strong></td>
<td><strong>90% compliant sites</strong></td>
</tr>
</tbody>
</table>

**TOTAL (trained and stakeholder engagements)**: >20,000

#### Number of Sites Not Yet Trained and % Non-Compliant

<table>
<thead>
<tr>
<th>Group</th>
<th>Number of Sites Not Yet Trained</th>
<th>% Non-Compliant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traditional “Free” Collection Sites (Stewards, Muni’s, etc.)</td>
<td>1,405</td>
<td>27% non-compliant</td>
</tr>
<tr>
<td>Fee-based Collection Sites</td>
<td>523</td>
<td>8% non-compliant</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>1,928</strong></td>
<td><strong>10% non-compliant sites</strong></td>
</tr>
</tbody>
</table>
Charge Up Safety!™ Campaign

Four Main Objectives

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.
2019 Harris Poll – Wishful Recycling

Items Placed In Curbside Recycling

- Plastic containers: 79%
- Paper/Cardboard: 77%
- Glass bottles/jars: 70%
- Metal containers: 62%
- Plastic bags: 42%
- Empty greasy...: 31%
- Food wrappers: 28%
- Styrofoam: 27%
- Batteries: 16%
- Light bulbs: 14%
- None of these: 3%
Charge Up Safety!™ : Site Education

- Shipping Guidelines.
- Required Safety Training.
- Stakeholder Engagement.
Charge Up Safety!™: Consumer Education

- Safety Video.
- Safety Portal.
- Consumer Outreach Events.
Example of Consumer Education: 
*Avoid the Spark™ Campaign (Phase 1)*

- With support of industry groups devoted to batteries, electronics and power tools, Call2Recycle piloted the *Avoid the Spark. Be Battery Safety Smart.™* campaign in the Bay Area in May 2018 to generate awareness with stakeholders and residents on battery safety.

- The first phase of the campaign focused on the Bay Area due to the progressive market, high concentration of technology and leadership of green initiatives in the region.

- The campaign zoned in on five counties: Alameda, Marin, San Francisco, San Mateo and Santa Clara. Each county offers curbside battery recycling and has high recycling collection rates.
Avoid the Spark™ Campaign Phase 1 Results

Results

- 177 total media mentions including print, online and radio
- 196.7M+ total reach
- $257K+ total publicity value
- YOY July unprotected terminal rates down across the five California counties
Avoid the Spark™ …Campaign Results

‘At Risk’ boxes from the Bay Area declined by 88% from July-Dec year-over-year
In Summary

• **With Mobility, Comes Risks (& Responsibilities)**
  - Safety must remain a top priority otherwise the potential for further incidents will only increase.
  - Education, both internally and with consumers, is the most effective way to reduce safety risks and optimize recycling.
  - From a public policy perspective, EPR for battery recycling and battery safety prevention should be treated separately.

• **It’s Not Just About Batteries**
  - There is a huge void in leadership on broader waste management issues.
  - Effective consumer education on recycling requires adoption of broader messaging that touches upon all types of material (e.g., plastics, sharps, etc.).
Thank you!

Eric Frederickson
efrederickson@call2recycle.org

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