Transport Requirements for Lithium Batteries
(and battery-containing devices)

Aaron H. Goldberg

October 4, 2017
**Why Focus on Lithium Battery Transport?**

- Lithium batteries are ubiquitous in electronics, and the market is expanding rapidly.
- There have been several high-profile incidents/recalls, and the numbers keep increasing.
- No clear consensus on the best way to minimize risks during transport.
- Rules for transport are complex and change almost every year (*if not more frequently*).
- Requirements can be hard to keep up with, and have the potential to disrupt existing supply chains.
Overview

• Basic Hazmat/DG requirements.

• Hazmat/DG requirements for Special Cases:
  – Damaged/defective lithium batteries.
  – Lithium batteries for recycling/disposal.
  – “Normal” reverse logistics.

• Hazardous waste requirements.
• This is only a high-level overview.
  – Doesn’t cover all requirements.
  – Doesn’t cover all situations.
• Rules can vary in different jurisdictions.
• Rules change frequently.
Basic Requirements for Lithium Batteries
Requirements Vary Based on Several Factors

- Type of battery (e.g., lithium metal, lithium ion).
- Size of battery or cell (based on lithium content or Watt-hour rating).
- Battery alone, packed with or contained in equipment.
- Number of batteries in package.
- Mode of transportation.
- Countries involved – despite efforts to harmonize.
The Focus Here

- “Small” lithium batteries, which are subject to reduced requirements and are most common in consumer electronics.
  - Lithium metal:
    - <1 g lithium (cell) or <2 g (battery)
  - Lithium ion:
    - <20 Wh (cell) or <100 Wh (battery)

- Batteries alone or in/with equipment.

- Two regulatory regimes:
  - DOT/PHMSA (US domestic ground and air)
  - ICAO/IATA (international air)
## Small Lithium Ion Batteries Ground (US Domestic)

### BATTERIES ALONE

- Packages must be marked with:

  ![CAUTION! Lithium Ion Battery]

  *(Until 1/1/19)*

- Weight limit: 30 kg (66 lbs) (gross)

### PACKED WITH EQUIPMENT

- Packages must be marked with:

  ![CAUTION! Lithium Ion Battery]

  *(Until 1/1/19)*

### CONTAINED IN EQUIPMENT

- If consignment has >2 packages, OR if package contains >4 cells or >2 batteries (not counting button cells), must mark:

  ![CAUTION! Lithium Ion Battery]

  *(Until 1/1/19)*
## Small Lithium Ion Batteries

### Air (US Domestic)

<table>
<thead>
<tr>
<th><strong>BATTERIES ALONE</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Packages must be marked with:</td>
</tr>
<tr>
<td><img src="image1.png" alt="Lithium Ion Battery Label" /> or <img src="image2.png" alt="Lithium Ion Battery Label" /></td>
</tr>
<tr>
<td>Weight limit: 30 kg (66 lbs) (gross)</td>
</tr>
<tr>
<td>Also need Class 9 label in following cases:</td>
</tr>
<tr>
<td>If battery/cell &lt; 2.7 Wh, and package &gt; 2.5 kg net</td>
</tr>
<tr>
<td>If battery/cell &gt; 2.7 Wh, and more than 8 cells or 2 batteries in package</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>PACKED WITH EQUIPMENT</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Packages must be marked with:</td>
</tr>
<tr>
<td><img src="image1.png" alt="Lithium Ion Battery Label" /> or <img src="image2.png" alt="Lithium Ion Battery Label" /></td>
</tr>
<tr>
<td>Weight limit: 5 kg (net)</td>
</tr>
<tr>
<td>No more than 2 spares (plus the number needed to power the equipment)</td>
</tr>
<tr>
<td>(Until 1/1/19)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>CONTAINED IN EQUIPMENT</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>If consignment has &gt; 2 packages, OR if package contains &gt; 4 cells or &gt; 2 batteries (not counting button cells), must mark:</td>
</tr>
<tr>
<td><img src="image1.png" alt="Lithium Ion Battery Label" /> or <img src="image2.png" alt="Lithium Ion Battery Label" /></td>
</tr>
<tr>
<td>Weight limit: 5 kg (net)</td>
</tr>
<tr>
<td>(Until 1/1/19)</td>
</tr>
</tbody>
</table>

**NOTE:** Whenever the lithium battery label is required, the air waybill *(if used)* must indicate compliance with applicable rules.
# Small Lithium Ion Batteries

**Air (ICAO/IATA – International)**

<table>
<thead>
<tr>
<th>BATTERIES ALONE</th>
<th>PACKED WITH EQUIPMENT</th>
<th>CONTAINED IN EQUIPMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ Same as US domestic PLUS the following:</td>
<td>▪ Same as US domestic.</td>
<td>▪ Same as US domestic.</td>
</tr>
<tr>
<td>▪ PROHIBITED from passenger aircraft.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>▪ Allowed on cargo aircraft only if State of Charge (&quot;SoC&quot;) is less than 30%.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>▪ Limit of 1 package per consignment.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>▪ Packages must be marked with:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Small Lithium Metal Batteries

**Ground (US Domestic)**

<table>
<thead>
<tr>
<th>BATTERIES ALONE</th>
<th>PACKED WITH EQUIPMENT</th>
<th>CONTAINED IN EQUIPMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ Packages must be marked with:</td>
<td>▪ Packages must be marked with:</td>
<td>▪ If consignment has &gt;2 packages, OR if package contains &gt;4 cells or &gt;2 batteries (not counting button cells), must mark:</td>
</tr>
<tr>
<td><img src="image1.png" alt="Image" /> or <img src="image2.png" alt="Image" /> (Until 1/1/19)</td>
<td><img src="image3.png" alt="Image" /> or <img src="image4.png" alt="Image" /> (Until 1/1/19)</td>
<td><img src="image5.png" alt="Image" /> or <img src="image6.png" alt="Image" /></td>
</tr>
<tr>
<td>▪ Weight limit: 30 kg (gross)</td>
<td>▪ If package contains &gt;5 kg net weight lithium metal batteries:</td>
<td>▪ If package contains &gt;5 kg net weight lithium metal batteries:</td>
</tr>
<tr>
<td><img src="image7.png" alt="Image" /> or <img src="image8.png" alt="Image" /></td>
<td><img src="image9.png" alt="Image" /> or <img src="image10.png" alt="Image" /></td>
<td><img src="image11.png" alt="Image" /> or <img src="image12.png" alt="Image" /></td>
</tr>
</tbody>
</table>

**ITI Environmental Leadership Council | October 4, 2017**
Small Lithium Metal Batteries

Air (US domestic and ICAO/IATA international)

### BATTERIES ALONE
- Packages must be marked:
  - [Image: Lithium Metal Battery - Forbidden for Transport Aboard Passenger Aircraft]
  - [Image: Cargo Aircraft Only]
- Weight limit: 30 kg (gross)
- Also need Class 9 label in following cases:
  - If battery/cell <0.3 g Li, and package >2.5 kg net weight
  - If battery/cell >0.3 g Li, and more than 8 cells or 2 batteries in package

### PACKED WITH EQUIPMENT
- Packages must be marked with:
  - [Image: Lithium Metal Battery - Do Not Load on Aircraft if Damaged]
  - [Image: UN 3009 (XXX) XXX-XXX]
- Weight limit: 5 kg (net)
- No more than 2 spares (plus the number needed to power the equipment)

### CONTAINED IN EQUIPMENT
- If consignment has >2 packages, OR if package contains >4 cells or >2 batteries (not counting button cells), must mark:
  - [Image: Lithium Metal Battery - Do Not Load on Aircraft if Damaged]
  - [Image: UN 3009 (XXX) XXX-XXX]
- Weight limit: 5 kg (net)

NOTE: Whenever the lithium battery label is required, the air waybill (if used) must indicate compliance with applicable rules.
# General Requirements

## UN TESTING
- All lithium batteries must be of a type that passes UN tests.
- Manufacturer must keep records of tests.
- Applies to both individual cells and whole batteries (e.g., battery packs).
- ICAO/IATA requires manufacturers to have a quality management program.

## PACKAGING
- Must be packaged to prevent:
  - Short circuits.
  - Movement within outer package.
  - Accidental activation of equipment.
  - Dangerous evolution of heat.
  - Release of contents.
- For packages containing batteries alone or packed with equipment (not installed), the package must be capable of withstanding a 1.2 meter drop test.

## TRAINING
- For air shipments, each person preparing a package for transport must receive “adequate instruction” on requirements, commensurate with their responsibilities.
- For ground shipments, no formal training requirement. But, some degree of training may be advisable to ensure compliance.
Carrier Restrictions (examples)

- Lithium ion batteries shipped alone (without equipment) are prohibited from US Air Mail.
- Shipments required to bear the new Class 9 lithium battery label are prohibited from the entire US Mail system.

- Effective January 1, 2017, all shipments of lithium batteries alone must bear the Class 9 lithium battery label (and meet other Class 9 requirements for packaging, documents, training, etc.).
- Effective July 1, 2017, packages with the old lithium battery label must have the UN number marked nearby.

- Effective January 1, 2017, all air shipments of lithium batteries alone must bear the Class 9 lithium battery label (and meet other Class 9 requirements for packaging, documents, training, etc.).
- In many cases, must complete UPS Lithium Battery Safety Document and attach to package in a pouch.
Changes on the Horizon

- DOT/PHMSA rulemaking to align rules for air transport of lithium ion batteries alone with ICAO/IATA rules *(imminent?):*
  - Prohibit aboard passenger aircraft.
  - Require SoC <30%.
  - Limit of 1 package per consignment.

- Phase out of old lithium battery handling label: December 31, 2018.

- ICAO considering additional changes to the rules for 2019-20, including:
  - Segregation of lithium batteries from flammable or oxidizing materials.
  - Enhanced training requirements for personnel involved in lithium battery shipments.
Damaged or Defective Lithium Batteries
Introduction to Damaged/Defective Batteries

- US and international rules impose extremely stringent requirements on lithium batteries that are “damaged or defective.”
  - “Lithium cells or batteries, that have been damaged or identified by the manufacturer as being defective for safety reasons, that have the potential of producing a dangerous evolution of heat, fire, or short circuit (e.g., those being returned to the manufacturer for safety reasons).”
  - “[A] lithium cell or battery is considered to be damaged or defective if it is in such a condition that it has the potential of producing a dangerous evolution of heat, fire or short circuit while in transport.”
How to Determine If a Battery Is Damaged/Defective

• What if the following have been reported:
  – Malfunctioning?
  – Overheating?
  – Scorching?
  – Smoking?
  – Swelling?
  – Leaking?
  – Rupture?
  – Burning?

• What if hazards exist only during operation or recharging?

• What if there are no hazards after the battery has been discharged? Can you just discharge before transport?
Key Requirements Applicable to Damaged/Defective Batteries

• **DO NOT SHIP BY AIR!!!!**

• Special packaging:
  – Inner packaging that surrounds the item.
  – Metal, wood, or solid plastic outer packaging that meets PG I specifications – *not fiberboard*.
  – Non-combustible, non-conductive, and absorbent cushioning material in between.
  – Only 1 item per inner and outer packaging.

• Special labeling/marking.

• Full hazmat training for employees.

• Hazmat shipping papers.

• Incident reporting (also applicable to non-damaged/defective batteries, even if “small”).
Special Permits for Damaged/Defective Batteries

• DOT regulations provide a mechanism to apply for modified requirements, as long as they ensure a level of protection equivalent to the regulations.

• Several “special permits” have been issued for damaged/defective lithium batteries.
  – Most are for a single company/situation.
  – Some allow other companies to apply to become “parties” to the special permit.
  – Some allow limited relief to non-parties.
  – Special permits issued to packaging manufacturers generally allow others to use the packagings, subject to conditions.
Types of Relief in Special Permits for Damaged/Defective Batteries

- Different packagings.
- Different labeling/marking.
- Modified training requirements.
- Generally limited to truck/rail (and sometimes vessel) – *not aircraft*.
- Sometimes impose additional requirements.
- Sometimes provide partial relief for international shipments (by vessel).
Minimally Damaged Batteries

- Damage/defects that don’t relate to safety of the battery (during transport) don’t trigger the more stringent requirements.
  - Cosmetic damage (e.g., scratches).
  - LED indicator on the battery not working.
  - Label error or misprint.
  - Battery doesn’t hold sufficient charge.
  - Damage to a device unrelated to the battery (e.g., cracked screen).

- Products with these types of issues can be shipped in accordance with general rules for lithium batteries.
Extremely Damaged Batteries

• “[I]f a lithium battery or cell ... has been damaged (e.g., burned, crushed, cut, etc.) to a degree that it no longer meets the definition of a battery or cell, as [defined by] the United Nations,” it is no longer subject to any lithium battery rules.
  
  - The UN defines a cell as “a single encased electrochemical unit (one positive and one negative electrode) which exhibits a voltage differential across its two terminals.”

• Potential Test: Is the damaged cell/battery capable of holding a charge?

• Question: Could an extremely damaged battery be hazardous for other reasons?
Summary of Rules for Damaged/Defective Batteries

- **Slight Damage**: Regulated as normal lithium batteries?
- **Moderate to Severe Damage**: Subject to much more stringent requirements for damaged or defective lithium batteries?
- **Extreme Damage**: Unregulated?
Lithium Batteries for Recycling or Disposal
General Requirements for Lithium Batteries Shipped for Recycling/Disposal

• ICAO/IATA:
  - Lithium batteries (metal or ion) shipped alone for recycling/disposal are \textit{prohibited} from transport by aircraft.

• DOT/PHMSA:
  - Lithium batteries (metal or ion, alone or in/with equipment) shipped by motor vehicle to an authorized storage, recycling, or disposal facility are not subject to UN testing and related requirements.
    - Must be in a strong outer packaging.
    - Small batteries may otherwise be handled in accordance with the small battery rules discussed above.
A couple of battery recycling companies have obtained special permits for lithium (and other) batteries destined for recycling:

- Different packagings.
- Different markings, including an indication that the packages “may” contain lithium batteries.
Reverse Logistics for Lithium Batteries
General Requirements for Reverse Logistics of Lithium Batteries

• The rules for reverse shipments of lithium batteries are generally the same as the rules for forward shipments, except:
  – Batteries shipped for recycling/disposal.
  – Damaged/defective batteries.

• Lithium batteries are *not* eligible for the 2016 DOT rule on reverse logistics.

• Reverse shipments of batteries may be difficult to handle under the rules for forward shipments:
  – May be more of a hodge-podge of products.
  – Information on the batteries may be missing or hard to locate.
Special Permits for Reverse Logistics of Lithium Batteries

Several retailers and reverse distributors have obtained special permits for reverse shipments of lithium batteries:

- Allow marking of overpacks only, rather than individual packages.
- Allow overpacks to be “over-marked” for batteries they don’t contain, if there is a reasonable expectation that such batteries might be present.
- Allow shipment of “legacy” lithium ion batteries without the Watt-hour rating marked on the outside casing.
Hazardous Waste Rules
Potential Classification as Hazardous Wastes

- Some lithium batteries (and battery-containing products) may qualify as wastes.
  - Spent batteries.
  - Damaged/defective batteries.
  - Used products going for recycling or disposal.

- May also be classified as hazardous wastes.
  - Based on presence or high levels of hazardous constituents (e.g., nickel, cobalt, lead).
  - Based on Class 9 hazmat/DG classification.
  - Based on battery or e-waste listing.
  - Based on reactivity (especially for damaged/defective lithium batteries).

- Classification varies between/within countries – rules not harmonized.
Requirements for Transport of Hazardous Waste Batteries/Devices

• In-Country Transport:
  – Hazardous waste manifest or similar tracking document.
  – Authorized hazardous waste transporter.
  – Deliver to authorized hazardous waste facility.
  – In some countries, may require pre-approval for transport.
Requirements for Transport of Hazardous Waste Batteries/Devices

- Transport Between Countries:
  - Governed by the Basel Convention framework, as implemented through national laws and related international agreements.
  - Restrictions on which shipments are allowed:
    - General prohibition on shipments between Basel Parties and non-Parties like the U.S. (unless covered by an “Article 11” agreement).
    - When shipments are allowed, must follow notice-and-consent procedures for countries of export, import, and transit.
Questions?

Aaron H. Goldberg  
Beveridge & Diamond, P.C.  
1350 I Street, N.W., Suite 700  
Washington, D.C. 20005  
+1.202.789.6052  
agoldberg@bdlaw.com