DGP/22-IP/10
13/10/09

DANGEROUS GOODS PANEL (DGP)

TWENTY-SECOND MEETING

Montréal, 5 to 16 October 2009

Agenda Item 5: Resolution, where possible, of the non-recurrent work items identified by the Air Navigation Commission or the panel:
Agenda Item 5.3: Review of provisions for dangerous goods relating to batteries:
- **a) lithium batteries**
- **b) battery-powered devices**
- **c) battery-powered mobility aids**

EVALUATION OF RECENT BATTERY INCIDENTS IN TRANSPORTATION

(Presented by PRBA)

June 18 - E-Bike Battery

- Large lithium ion battery (approx. 350 Wh) should be declared as Class 9 DG when offered for transport
- Battery was not declared; shipped in poor quality packaging
- UN tested?
- **Package not shipped in accordance with U.S. regulations or ICAO TI**

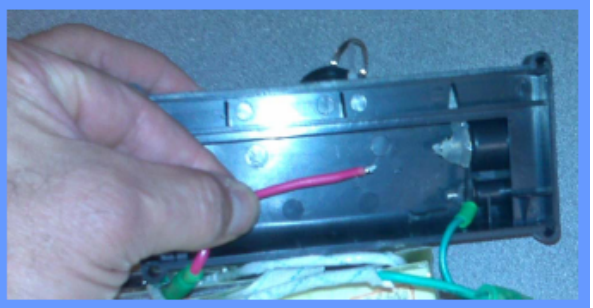
E-Bike Battery Analysis

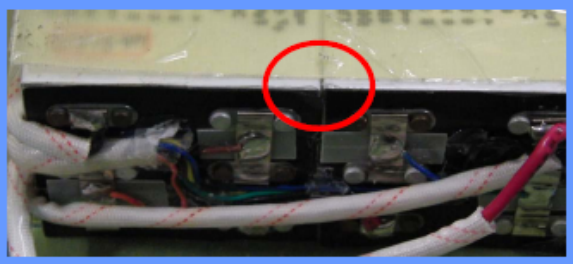
- E-Bike battery purchased
- Battery shipped from Hong Kong in poor quality packaging; product packaged loosely in bubble wrap
- Outer package contained lithium ion battery handling label (copy taped to package)
- No Class 9 label, markings, UN packaging
- **Package not shipped in accordance with U.S. regulations or ICAO TI***

* UPS notified

E-Bike Battery Analysis

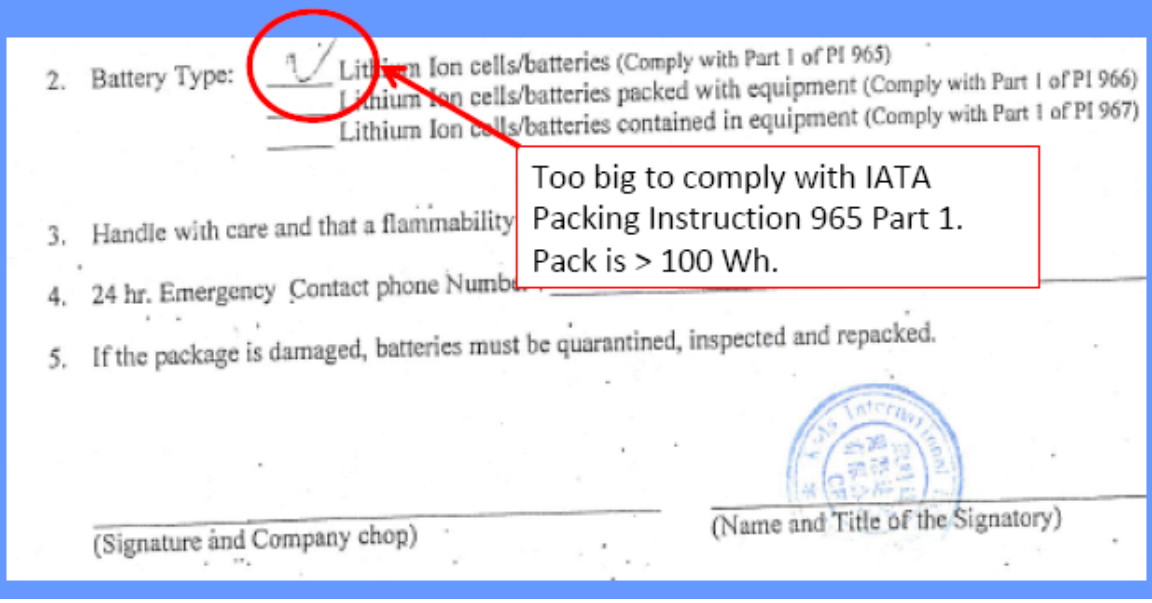
- Poor design & manufacturing
- Poor soldering quality and loose connection in sample unit
- “Live” metal in close proximity to each other and to cover
- Electronic components not well protected from short circuits and vibration
- UN tests designed to identify these types of defects





E-Bike Battery Analysis

- Documentation indicates lack of knowledge of regulations



UN Manual of Tests and Criteria Required for Lithium and Lithium ion Cells and Batteries

Test 1: Altitude Simulation
Test 2: Thermal
Test 3: Vibration
Test 4: Shock
Test 5: External Short Circuit
Test 6: Impact
Test 7: Overcharge
Test 8: Forced Discharge

July 15 -
Santo Domingo, Dominican Republic

- Large number of used lithium ion cell phone batteries
- Shipped in poor quality packaging
- UN tested batteries?
- No markings on packages
- No short circuit protection
- **Package not shipped in accordance with U.S. regulations or ICAO TI**

August 14 – E-Cigarettes

- Lithium metal cells from manufacturer are all listed as UL "Technician Replaceable"
- New e-cigarette product with new cell design
  - UN testing on new cell design?
- No markings, labels or shipping document to indicate lithium metal cells in product
- **Package not shipped in accordance with ICAO TI**

August 15 - Taiwan Hub

- Large lithium ion batteries (> 100 Wh)
  - Must be declared as Class 9 DG
- Battery was not declared
- No terminal protection
- UN tested?
- **Batteries not shipped in accordance with ICAO TI**

August 25 – GPS Tracking Device

- Incident involved product (GPS?) packed with spare lithium ion batteries
- Number of spare batteries exceeded ICAO TI limits for batteries "packed with equipment"
- No inner packaging for spares
  - Rubber bands are *not* acceptable inner packaging
- No markings on packages
- Cells UN tested?
- **Package not shipped in accordance with U.S. regulations or ICAO TI**

September 9 – Personal Electronic Device (PED)

- Cells used in PED are rated at 20.35 Watt-hours (Wh)
  - Rated capacity (5.5 Ah) x nominal voltage (3.7 V)
  - Exceed 20 Wh exception limit for lithium ion cells
- According to UL, cell listed as "Technician Replaceable"
  - Cell not certified to comply with UL1642 impact, projectile, or crush tests
- Cell and battery UN tested?

PED Battery Evaluation

- Does not appear to be any protection between two parallel cells
  - If one cell shorts, there is nothing to prevent energy from both cells being dumped through the short
    - Especially important with large cells and battery packs
  - Most commercial, cylindrical lithium-ion cell design are equipped with a positive thermal coefficient (PTC) current limiting switch to provide protection against short circuits external to the cell
- Cell tabs directly soldered to battery circuit board
  - Not considered best practice because heat from solder process is conducted directly into the cell
    - Cell manufacturer recommends against this practice
    - IEEE 1625 and 1725 industry standards specifically prohibit direct soldering
    - *"Connections shall not be soldered directly to the cells."*

Cause of Incidents

1. Cause of incidents: Noncompliance with regulations
   - Large batteries that should be shipped Class 9 DG under current regulations were shipped undeclared
     - UN Testing(?)
   - Excepted products not shipped in accordance with current regulations
     - UN testing (?), no markings, improper packaging, etc.
2. Cause of incidents: Poor product design
   - Properly designed products that are tested (e.g., UN) prevent incidents from occurring
3. In the U.S., lack of harmonization with ICAO TI has caused significant confusion for shippers
4. U.S. lithium battery regulations are significantly less stringent in many areas than ICAO TI (except for lithium metal batteries, which are banned on passenger aircraft)

Lithium Metal Batteries (Small, excepted)

Lithium metal	DOT	ICAO
Package size	30 kg G	2.5 kg G
Marking/label and documentation	>24 cells/ 12 batteries	All consignments
1.2m drop test	>24 cells/ 12 batteries	All consignments
Instructions to employees	No	Yes

Lithium ion Batteries (Small, excepted)

Lithium ion	DOT	ICAO
Max li- equivalent	1.5g cell 8g battery	20 Wh 100 Wh
Package size	30 kg G	10 kg G
Marking/label and documentation	>24 cells/ 12 batteries	All consignments
1.2m drop test	>24 cells/ 12 batteries	All consignments
Instructions to employees	No	Yes

Industry Outreach

- Shanghai, October 2008 – Battery forum with airline industry, transport agencies and testing labs organized by PRBA
  - Over 300 attended forum
  - Also included full day meeting with leading lithium battery testing lab in Shanghai
- Hong Kong, December 2008 – Battery forum with airlines, freight forwarders and transport agencies organized by Battery Association of Japan
- PRBA has worked directly with U.S. DOT enforcement agencies to educate inspectors on battery technologies and regulations; meeting scheduled with Transport Canada in December
- Ongoing activities include presentations at battery conferences and publication of articles on battery safety and transport regulations

WP75 – AEDs and Lithium Batteries

- Lithium metal battery designed for use in AED
- Battery contains 6.72 g of lithium metal
- AED batteries contain less than 8 g lithium metal
- Recommend change to WP75 to allow lithium batteries with no more than 8 g lithium metal

— END —