TRANSPORTATION OF USED LITHIUM BATTERIES

A WORKSHOP ORGANISED BY
RECHARGE, PRBA and EBRA

Brussels
August 31st and Septembre 1st, 2010
BACKGROUND

• DISCUSSION AT THE UN SUB-COMMITTEE MEETING OF JUNE 2010

• INTEREST FROM INDUSTRY and FROM COMPETENT AUTHORITIES TO IMPROVE THE REGULATION ON THE TRANSPORT OF USED LITHIUM BATTERIES
REPORT OF THE UN SUB-COMMITTEE MEETING OF JUNE 2010

2 DOCUMENTS were presented

Transport of used or damaged lithium cells or batteries

Documents:

1. ST/SG/AC.10/C.3/2010/7 (GERMANY)
   “Transport of used or damaged lithium batteries”

2. ST/SG/AC.10/C.3/2010/36 (PRBA and RECHARGE)
   Informal document: INF.88 (PRBA and RECHARGE)
   “Transport of used Lithium cells and batteries for disposal or recycling” – P903
46. The discussions revealed the relative complexity of the issue, as various cases had to be covered, in particular: the transport of used but undamaged cells or batteries for reuse, disposal or recycling; of used cells or batteries in organized waste collection; and of damaged cells or batteries.

47. Some solutions had already been foreseen, but with no coordination, as such transport was subject to specific national or regional regulations. However, the demands of recycling, and specifically the fact that not all countries were equipped with recycling facilities, for instance in the islands of a given country, meant that the carriage of such used or damaged lithium cells or batteries in international and multimodal transport would only increase in the future. A solution must therefore be found for harmonizing conditions of transport using the Model Regulations.
48. It was noted that it would be difficult to find solutions to all those problems during the current biennium. The Chairman therefore proposed that, to begin with, the Sub-Committee should take stock of the situation. He invited all delegations to submit documents indicating:

(a) A list of practical problems encountered at the national level, or for industry, encountered in disposal and recycling;
(b) Local or regional measures already taken in the context of transport regulations;
(c) Possible interference with other legal frameworks, for example environmental protection regulations governing waste disposal and recycling.

52. The representatives of RECHARGE and PRBA were invited to submit a new proposal for the next session, taking into account comments made by the delegations. The Sub-Committee would then decide whether it was appropriate to introduce such provisions into the Model Regulations.
OBJECTIVES

Review the existing UN Transport Regulation for used Lithium Batteries

List practical problems encountered in the transport of used lithium batteries for recycling or disposal (re-use and repair will also be considered)

Identify local, regional or national measures taken in the context of Transport Regulation of these batteries

Identify any potential area of improvement of the current UN Transport Regulation on used lithium batteries
PARTICIPANTS

BATTERY MANUFACTURING INDUSTRY

AUTOMOTIVE INDUSTRY

USED BATTERY COLLECTION ORGANISATIONS

USED BATTERY COLLECTION & RECYCLING INDUSTRY

BATTERY INDUSTRY ASSOCIATIONS

COMPETENT AUTHORITIES EXPERTS
(Transport of Dangerous Goods)
USED LITHIUM – BATTERIES
Primary and Rechargeable

SMALL / PORTABLE
From CONSUMER

LARGE / INDUSTRIAL
From B2B

UNDAMAGED or DAMAGED

USED LITHIUM – BATTERIES
MIXED WITH OTHERS

USED LITHIUM - BATTERIES
SELECTIVE COLLECTIONS

TRANSPORTED for RE-USE, REPAIR, RECYCLING, DISPOSAL....

TRANSPORT REGULATION (UN, AIR, MARITIME, ROAD and RAIL)
THE MARKET EVOLUTION

Increasing market share of Li-Ion Batteries

Increasing number of applications / commercial actors

Increasing quantity of weight & energy per battery

THE END OF LIFE EXPECTATIONS

Increasing number of actors at End of Life

Increasing quantity of used batteries transported

Uncertainty about the « integrity » of the battery (mechanical and electrical properties)
THE MARKET TRENDS
LITHIUM PRIMARY
UN 3090
UN 3091

LITHIUM RECHARGEABLE
UN 3480
UN 3481

1. EEEqt

CELLS & BATTERIES PACKS (INCORPORATED)

2. E-MOBILITY

MODULES
E-BIKES
SCOOTERS
HEV
EV

1. BUTTON CELLS
2. CYLINDRICAL CELLS
3. PRISMATIC CELLS

For PORTABLE and INDUSTRIAL APPLICATIONS
THE EUROPEAN BATTERY MARKET

- Lithium-Ion (Li-Ion)
- Zinc-based
- Lithium Primary (Li-Primary)
- Nickel-Metal Hydride (Ni-MH)
- Lead-Acid (Pb-Ac) & Nickel-Cadmium (Ni-Cd)
- Lead-Acid (Pb-Ac)

EU market in kTonnes/year

- Rechargeable
  - Portable
  - Industrial

- Primary
  - Lithium-Ion (Li-Ion)
  - Zinc-based
  - Nickel-Metal Hydride (Ni-MH)
  - Lead-Acid (Pb-Ac) & Nickel-Cadmium (Ni-Cd)
  - Lead-Acid (Pb-Ac)

EU 2010:
- 0.25 million HEV - 30 kg battery - 7.5 kT (Ni-MH)
EU 2020

1.0 million HEV - 30 kg battery - 30 kTonnes/year
1.0 million EV - 200 kg battery - 200 kTonnes
PORTABLE BATTERIES MARKET SEGMENTS

Estimated EU Market for Rechargeable Batteries Powered Appliances
(Reference Year 2007 - Basis 25 % of WW market)

<table>
<thead>
<tr>
<th>Application</th>
<th>Estimated Yearly Total</th>
</tr>
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<tbody>
<tr>
<td>Note Book PC</td>
<td>5'800 Tonnes (18.4 % by w.)</td>
</tr>
<tr>
<td>Mobile Phone</td>
<td>22'600 Tonnes (70.3 % by w.)</td>
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<tr>
<td>Cordless Power Tools</td>
<td></td>
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<tr>
<td>Home Cordless Phone</td>
<td></td>
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<tr>
<td>Movie Camera</td>
<td></td>
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<tr>
<td>Digital Still Camera</td>
<td></td>
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<tr>
<td>Audio</td>
<td></td>
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<tr>
<td>Game</td>
<td></td>
</tr>
<tr>
<td>Other HH Applic.</td>
<td></td>
</tr>
<tr>
<td>Individual Cells</td>
<td></td>
</tr>
</tbody>
</table>

**Estimated Yearly Total of 32’130 Tonnes of Batteries / Packs**

Li-Ion, Ni-MH & Ni-Cd

In Tonnes of Rechargeable Batteries per year per application
Estimated EU Market for Rechargeable Batteries Powered Appliances
(Reference Year 2007 - Basis 25 % of WW market)

Average weight of equipment versus average battery weight (in g)

- **Note Book PC**: 2'500 vs < 300
- **Mobile Phone**: 2'500 vs < 1’000
- **Cordless Power Tools**: 2'500 vs < 1’000
- **Home Cordless Phone**: 300 vs 45
- **Movie Camera**: 120 vs 50
- **Digital Still Camera**: 300 vs 20
- **Audio**: 100 vs 20
- **Game**: 300 vs 50
- **Other HH Applic.**: 500 vs 40
- **Individual Cells**: 30 - 50

Million of Units of Equipment per year
THE END OF LIFE
END OF LIFE

FROM < 100 Wh
100 million units / y
< 1.0 kg / unit

NEW CHALLENGES

TO > 10.0 KWh
1 million units / y
Up to X00 kg/unit
EXPERIENCE IN EUROPE: TRANSPORT OF SPENT BATTERIES

Cumulative quantities of spent batteries transported to recycling plants in EU
Figure 2

Market Data – Historical by chemistry –
NB data by weight Portable Batteries

Data for Germany: consolidated from GRS + Bosch Rec. Centre + VfW.
Collection Data (GERMANY)
Quantities of Portable Rechargeable Batteries collected per year

Data for Germany: consolidated from GRS + Bosch Rec + VfW.
FROM COLLECTION

KEEP IT SAFE!

TO RECYCLING
OTHER MAJOR SOURCES of PRB from WEEE

1. B2B
   * Production Rejects
   * Leasing Contracts
   * Large Offices & Administration
   * Communication Equipment

2. REFURBISHING (For Re-use)
   * Private C°
   * CHARITY
Incident Causes

Many incidents are caused by an improper preparation of batteries for shipment
THE ROLE OF THE UN MODEL REGULATION
<table>
<thead>
<tr>
<th>UN Nb.</th>
<th>UN 3090</th>
<th>UN 3091</th>
<th>UN 3480</th>
<th>UN 3481</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Lithium Metal Batteries</td>
<td>Lithium Metal Incorporated + Packed with Eqt.</td>
<td>Lithium-Ion Batteries</td>
<td>Lithium-Ion Incorporated + Packed with Eqt.</td>
</tr>
<tr>
<td>Class 9</td>
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<tr>
<td>UN ADR</td>
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<tr>
<td>NEW Batteries</td>
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<td>188 188</td>
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<td>230 230</td>
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<td>310 310</td>
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<tr>
<td>636 a</td>
<td>636 a</td>
<td>636</td>
<td>636 a</td>
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<tr>
<td>USED Batteries</td>
<td></td>
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<tr>
<td>636 b</td>
<td>636 b</td>
<td>636 b</td>
<td>636 b</td>
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</tr>
<tr>
<td>P903+ a,b</td>
<td>P903+ a,b</td>
<td>P903+ a,b</td>
<td>P903+ a,b</td>
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</tr>
</tbody>
</table>
(a) Cells contained in equipment shall not be capable of being discharged during carriage to the extent that the open circuit voltage falls below 2 volts or two thirds of the voltage of the undischarged cell, whichever is the lower.

(b) Used lithium cells and batteries with a gross mass of not more than 500g each collected and presented for carriage for disposal between the consumer collecting point and the intermediate processing facility, together with other non-lithium cells or batteries, are not subject to the other provisions of ADR if they meet the following conditions:
(i) The provisions of packing instruction P903b are complied with;
(ii) A quality assurance system is in place to ensure that the total amount of lithium cells or batteries per transport unit does not exceed 333 kg;
(iii) Packages shall bear the inscription: "USED LITHIUM CELLS".
**FINAL TEXT: ECE-TRANS-WP15-AC21**

<table>
<thead>
<tr>
<th>P903b</th>
<th>PACKING INSTRUCTION</th>
<th>P903b</th>
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<tbody>
<tr>
<td></td>
<td>This instruction applies to used cells and batteries of UN Nos. 3090 and 3091.</td>
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<tr>
<td></td>
<td>Used lithium cells and batteries, with a gross mass of not more than 500 g collected for disposal, together with other used non-lithium batteries or alone, may be carried, without being individually protected, under the following conditions:</td>
<td></td>
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<tr>
<td></td>
<td>(1) In 1H2 drums 4H2 boxes conforming to the packing group II performance level for solids or</td>
<td></td>
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<tr>
<td></td>
<td>(2) In 1A2 drums 4A boxes fitted with a PE bag and conforming to the packing group II performance level for solids. The PE bag shall:</td>
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<td>have an impact resistance of at least 480 grams in both parallel and perpendicular planes with respect to the length of the bag,</td>
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<tr>
<td></td>
<td>have a minimum of 500 microns of thickness with electrical resistivity of more than 10 M ohms and low water adsorption rate over 24 hours at 25°C lower than 0.01%</td>
<td></td>
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<tr>
<td></td>
<td>the PE bag may be used once only.</td>
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<tr>
<td></td>
<td>(3) In collecting trays with a gross mass of less than 30 kg made from non-conducting material meeting the general conditions of 4.1.1.1, 4.1.1.2 and 4.1.1.5 to 4.1.1.8.</td>
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</tbody>
</table>

**Additional requirement:**
The empty space in the packaging shall be filled with cushioning material. The cushioning may be dispensed when the package is entirely fitted with a plastic bag and the bag is closed.] Hermetically sealed packaging shall be fitted with a venting device according to 4.1.1.8. The venting device shall be so designed that an overpressure caused by gases does not exceed 10 kPa.
Marked with Level „indicator“, if the drum is filled up to the marking line, the lid screws in to fix the batteries in their position.

ADR label No 9 and the remark to UN 3090 and UN 3480 and “Spent batteries/ spent lithium batteries” are on the other side.

No venting device necessary because the drum is licensed without rubber gasket in the lid and it is no more sealed.

EXAMPLES OF GOOD PRACTISE
EXPERIENCE IN THE TRANSPORT OF USED INDUSTRIAL BATTERIES
UN MODEL REGULATION FOR THE TRANSPORTATION OF DANGEROUS GOODS

SHIPMENT OF USED LITHIUM BATTERIES

Shipment of spent batteries as Dangerous Goods (ADR)

- LITHIUM BATTERIES > 333 Kg per load
- Li-ION CPT ≈ 1.0 Kg (> 0.5 kg)
- Li-ION e-bike ≈ 2.0 Kg
- Batteries Damaged (for Repair)
- Batteries Damaged (after testing)
- Absence of Regulation
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<table>
<thead>
<tr>
<th>Time (am)</th>
<th>#</th>
<th>PRELIMINARY AGENDA - DAY 2 - September 1, 2010 (Meeting between Competent Authorities and Industry)</th>
<th>SPEAKERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.30</td>
<td>1</td>
<td>Introductory Remarks</td>
<td>Organizers</td>
</tr>
<tr>
<td>9.30</td>
<td>2</td>
<td>Scope and Objective of the Meeting</td>
<td>RECHARGE &amp; PRBA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Short review of the discussions between Industry Partners (Day 1)</td>
<td></td>
</tr>
<tr>
<td>10.00</td>
<td>3</td>
<td>Safety aspects of Lithium-ion cells and batteries: protection against external short circuit.</td>
<td>Mr A. AWANO (BAJ)</td>
</tr>
<tr>
<td>10.20</td>
<td>4</td>
<td>Shipment of cells and batteries with protection against external short circuit: Lithium-Ion cells and batteries</td>
<td>Mr H. SHIMA (BAJ)</td>
</tr>
<tr>
<td>10.40</td>
<td>5</td>
<td>International Transport regulation of new Portable Lithium Batteries</td>
<td>Mr G. KERCHNER (PRBA)</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>Transport of used lithium portable batteries: collected selectively or in bulk with other chemistries (current packaging, marking and labelling requirements for transport)</td>
<td></td>
</tr>
<tr>
<td>11.00</td>
<td>6.a.</td>
<td>Japan</td>
<td>JBRC</td>
</tr>
<tr>
<td>11.20</td>
<td>6.b.</td>
<td>USA and Canada</td>
<td>Mr C. SMITH (RBRC &amp; PRBA)</td>
</tr>
<tr>
<td>11.40</td>
<td>6.c.</td>
<td>Europe (ADR) - 1) Contribution of Batteriretur (Norway) 2) UK Carriage of Spent Batteries as Dangerous Goods under ADR Rules</td>
<td>Mr Miles FREEMAN (EBRA)</td>
</tr>
<tr>
<td>12.00</td>
<td>7</td>
<td>Conclusion A : Portable Batteries - Proposal for improvement of SP 903</td>
<td>PRBA &amp; Participants</td>
</tr>
<tr>
<td>12.45 to 1.30</td>
<td></td>
<td>LUNCH will be served next to the meeting room</td>
<td></td>
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</tbody>
</table>

**PORTABLE BATTERIES**
<table>
<thead>
<tr>
<th>Time (pm)</th>
<th>INDUSTRIAL BATTERIES and E-Mobility</th>
<th>PROTOTYPES and DAMAGE BATTERIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.30</td>
<td>8 1) The evolution of the Lithium Battery market for E-mobility and Energy Storage applications. 2) Safety and tests of large format batteries.</td>
<td>12 Packaging conditions for prototypes and damaged batteries - Proposal from Germany to UNSCETDG</td>
</tr>
<tr>
<td>2.00</td>
<td>9 Transport conditions of new Industrial Lithium batteries</td>
<td>13 Comments raised after the DAY 1 workshop</td>
</tr>
<tr>
<td>2.30</td>
<td>10 Transport and Storage of Used Industrial Batteries: anticipation of issues/problems</td>
<td>4.30 Conclusion C : Recommendation for Prototypes and Damaged Batteries</td>
</tr>
<tr>
<td>3.00</td>
<td>11 Conclusions B : Transport of Used Industrial/Automotive Batteries: open questions</td>
<td></td>
</tr>
<tr>
<td>3.45</td>
<td>COFFEE BREAK</td>
<td></td>
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<tr>
<td>4.00</td>
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<td>14</td>
</tr>
<tr>
<td>4.30</td>
<td></td>
<td>All Participants</td>
</tr>
<tr>
<td>5.30</td>
<td>End of the workshop (second day)</td>
<td></td>
</tr>
</tbody>
</table>
QUESTIONNAIRE or COMMENTS FORM

USED LITHIUM BATTERIES TRANSPORTATION REGULATION
In NORWAY (Batteriretur – Mr Frode Hagen)

PARTICIPANTS LIST / LIST OF PRESENCE

PARKING TICKET

PLEASE USE THE HANDY MICROPHONE / Name + Affiliaton
RECHARGE
European Portable Battery Association

PRBA
Rechargeable Battery Association
(North America)

EBRA
European Battery Recyclers Association

BAJ
Battery Association of Japan
PRBA + RECHARGE PROPOSAL

IN REFERENCE TO ADR SP 636,

QUESTIONS ABOUT THE TRANSPORT OF USED LITHIUM BATTERIES MIXED WITH « CONSUMER » BATTERIES

VARIOUS APPROACHES THAT CAN BE EVALUATED IN DEDICATED WORKING GROUP

<LIMIT OF 500 G

QUALITY CONTROL FOR 333 KG
DAMAGED BATTERIES

PROTOTYPE

>>> NOT UN TESTED
DAMAGED PROTOTYPES
SHOULD BE CONSIDERED
AS DAMAGED BATTERIES

USED BATTERIES

= NEW BATTERIES
BUT DEFINITION OF USED BATTERY?

MAY BE A NEED TO DISTINGUISHED
BETWEEN PORTABLE & INDUSTRIAL?

COMMON UNDERSTANDING OF
THE REFERENCE TO SP 230
BECAUSE SP 230 REQUIRES UN TESTING
& ADDITIONAL DESIGN REQUIREMENTS

DAMAGED

WORDING OF «ICAO TI SP A154» AS A BASIS

> WORK ON ILLUSTRATIONS
OF «DAMAGED BATTERIES» REQUIRED
FOLLOW-UP

1. INF PAPER SUBMITTED TO UN SUB-COM of Dec 2010
   INFORMING ABOUT THE RESULTS OF THIS WORKSHOP

2. INDUSTRY POSITION FIRST QUARTER 2011

   In parallel

   UN INFORMAL WORKING GROUP

3. USED Ni-MH (*) WILL BE FULLY REGULATED AS DG FOR SEA TRANSPORT FROM 2012

   (*) Above 100 kg / consignment