ESD EHS Alert
Regulatory Interpretation Update

Packaging of Dry Batteries for Transportation

Background

While it has long been an accepted practice to individually package lithium, nickel-metal hydride, and other high-tech batteries prior to transport, there hasn't been a great deal of concern regarding the shipment of so-called "dry batteries". These are the ubiquitous AAA through D-size alkaline and carbon-zinc batteries that power everyday items from flashlights to CD players. Spent "dry batteries" are generated in significant numbers by HHW collections and retail locations, and when offered for transport, have typically been bulked within a container and shipped without regard for segregation of individual units. Due to a number of transportation incidents however, the DOT had expanded the packing requirement to include batteries not previously affected.

Regulation

The Federal Register published on January 14, 2009 (Vol. 74, No. 9) adopted an amendment that requires all types of batteries, including "dry batteries", to be packaged in accordance with 49CFR173.159.
Because of this ruling, the DOT Hazardous Materials Table (HMT) includes a Special Provision (SP-130) in the entry for **"Batteries, dry, sealed, n.o.s."**. SP-130 states the following:

> **"Dry batteries not specifically covered by another entry in the §172.101 Table must be described using this entry. . ."Batteries, dry, sealed, n.o.s." (and) are not subject to any other requirements of this subchapter except for the following:**
> **(2) Batteries and battery-powered device(s) containing batteries must be prepared and packaged for transport in a manner to prevent:**
> **(i) A dangerous evolution of heat;**
> **(ii) Short circuits, including but not limited to the following methods:**
> **(a) Packaging each battery or each battery-powered device when practicable, in fully enclosed inner packagings made of non-conductive material;**
> **(b) Separating or packaging batteries in a manner to prevent contact with other batteries, devices or conductive materials (e.g. , metal) in the packagings; or**
> **(c) Ensuring exposed terminals or connectors are protected with non-conductive caps. . ."**

Recent Developments

Multiple parties including Alameda County Household Hazardous Waste and Kinsbursky Brothers, Inc. recyclers viewed this shipping requirement as overkill with respect to 1.5-volt alkaline batteries. It is their assertion that there is negligible to no risk of fire as a result of excessive heat generation by these types of batteries shorting out during shipment. This assertion was verified in multiple experiments where batteries in various states of charge were connected end-to-end, shorted by a conductor, and the subsequent temperature measured and recorded. The temperatures attained in a worst-case experiment, that is using 12 new D-cell alkaline batteries (which have the greatest current [mA] availability of the subject batteries), were reasoned to be insufficient to initiate a fire.

Given the unlikelihood that these maximum temperatures could result in a fire, there were also other factors that preclude the generation of such heat. One test measured the amount of voltage remaining in a random group of alkaline batteries received from HHW collections. Of the batteries tested, ~74% had less than 40% of their original charge and ~58% were for all intents and purposes dead. Given the random arrangement of batteries normally

packed in drums, the chance of batteries lining up with opposite poles contacting in a significant series is essentially nil. Also, there is the fact that no transportation incidents have been attributed to such cells.

This reasoning, supported by the data, was submitted to the Department of Transportation with the intent of relaxing the packaging requirements for 1.5v alkaline batteries. Alameda County Household Hazardous Waste et al. were requesting relief through issuance of a Special Permit exempting these batteries from Special Provision 130. Kinsbursky on the other hand was seeking a letter of (favorable) interpretation by the DOT which would likewise provide an exemption from SP-130.
While the status of the Special Permit is not known at this time, the DOT did respond to Kinsbursky (along with other entities seeking similar interpretation) with the following,

> ***"Based on the test data provided with your letter, it is the opinion of this Office (US DOT) that spent 1.5-volt alkaline dry cell batteries are not likely to generate a dangerous quantity of heat nor are they likely to short circuit or create sparks when they are transported in a packaging with no other battery types or chemistries present. Therefore, when transported by highway or rail and separated from other types of batteries of different sizes or chemistries, spent 1.5-volt alkaline batteries do not pose an unreasonable risk in transportation and are not subject to regulation under the HMR."***

The term 'spent' has been interpreted to denote that which is no longer of use to its owner. Kinsbursky considers "batteries being shipped for disposal or recycling as being spent. It is assumed that if they worked they would be in service".

"Once batteries are taken out of service or are disposed of, irrespective of the reason, and sent for recycling and reclamation they should be considered spent, [see United States v. Ilco Inc., 996 F. 2d 1126 (11th Cir. 1993)], where the court held that all batteries sent to a secondary lead smelter for recovery were "spent materials" without regard for the reason the batteries were taken out of service[1]."

Compliance
Consequently, it appears that 1.5-volt alkaline batteries (which make up approximately 80% of the total collected for disposal / recycling) are now exempt from special packaging requirements described in SP-130.

There are still some types of alkaline cells that are not exempt including 9-volt and lantern batteries. Those batteries along with batteries using other chemistries (lithium, Ni-Cd, etc.) must be segregated and the terminals insulated prior to shipment.
Methods of terminal insulation could include:

- taping the terminals,
- individual bagging,
- spray or dip non-conductive coatings, etc.

Batteries should be removed from any/all devices before packaging. All debris such as wire, clips, paper, etc. must be removed prior to packaging. Original manufacturer's packaging is acceptable and does not need to be removed. All batteries shall be sorted and packaged in accordance with 49 CFR and it is forbidden to package and offer for transport any battery of unknown type. Always use a plastic liner if packaging in a metal container.

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[1] Demystifying Battery Recycling, (paper) J. Allen Byrne, Engineering, Training and Technical Support Manager Interstate PowerCare presented at Battcon (International Stationary Battery Conference) 2008, Marco Island, FL.