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DANGEROUS GOODS PANEL (DGP)

MEETING OF THE WORKING GROUP OF THE WHOLE

Abu Dhabi, 4 to 8 October 2004

Agenda Item 5: Discussion of miscellaneous dangerous goods issues

INCIDENTS INVOLVING BATTERIES

(Presented by R. Richard)

Introduction

Since 1991, there have been at least forty air transport incidents involving electrical storage batteries or batteries contained in equipment of all types that have resulted in the production of smoke, fire or the generation of dangerous amounts of heat (see attached summary). The majority of these incidents have occurred either aboard aircraft or in ground transport facilities associated with air transport. Slightly more than half of these incidents have involved shipments of batteries as cargo. The remainder has involved shipments of electrically powered vehicles, equipment or apparatus containing electrical storage batteries. These incidents involved batteries of all types.

At least 7 of the incident involved lithium batteries including a recent incident in August 2004 where a fire started within a unit load device and fortunately the burning batteries were discovered during loading prior to departure. One of the most serious incidents involved the shipment of two hundred thousand small lithium batteries which caught fire at the Northwest Airlines cargo storage area at Los Angeles International Airport on April 28, 1999 involved total damages of $500,000 or more. A recent report conducted on behalf of the US DOT (June 2004) highlights the hazards posed by lithium batteries in cargo compartments and the inability of aircraft fire suppression systems to extinguish fires involving multiple lithium batteries. Copies of this report will be distributed during the working group meeting. Other tests have been performed that indicate that rechargeable lithium cells and batteries (a.k.a. lithium-ion) present similar self-reactivity characteristics as non-rechargeable lithium cells and batteries when subjected to severe thermal and physical abuse conditions.

As a result of the initial incidents, the US DOT issued a number of public safety and airline advisories on July 7, 1999, July 2, 1999 and again on May 23, 2002, and has discussed it concerns at numerous public outreach events to remind persons of the hazards posed by batteries and that batteries and electrical devices that contain batteries are forbidden for transport unless properly packaged to prevent the likelihood of creating sparks or generating dangerous heat. We have also sent letters of concern to battery manufacturers and trade organizations expressing our concern that incidents continue to occur in air transport and asking them to expeditiously impose safety measures beyond those in the existing regulations to prevent air transport incidents. Despite these efforts the incidents have continued to occur.

We consider these incidents and particularly those involving lithium batteries to pose a serious safety concern for air transport. Therefore, we are considering a number of actions that can be taken to address these concerns. We welcome comments from other DGP members on appropriate actions that can be taken on an international level.

The purpose of this paper is to

- inform the Panel of our safety concerns based on the incidents that have been documented in the U.S.;

- determine if others are experiencing similar incidents;

- initiate discussions and share views on potential ways to prevent future incidents.

BATTERIES & BATTERY-POWERED DEVICES
Aviation Incidents Involving Smoke, Fire or Explosion
(Updated 9-21-04)

DATE/ SOURCE	TYPE OF BATTERY	DEVICE	AIRCRAFT	INCIDENT SUMMARY
9/14/04 FAA field agent initial report	Two 12-volt, nonspillable, sealed rechargeable lead-acid batteries		Cargo	One of the batteries was packaged so that its terminals were able to come into contact with metallic sensor tape that was packed with it. This resulted in a short circuit and fire discovered at the Greenville-Spartansburg FedEx facility after the flight. More info to come.
9/4/04 FAA incident summary statement	Dry, Alkaline, C-cell, (four)	Diving flashlight	Passenger	Diving flashlight exploded at LAX as it was removed from checked baggage by TSA personnel during the CTX screening process. Minor injuries to nine people. The incident occurred prior to the baggage being loaded on the passenger aircraft. A 1996 NIOSH report indicates that exploding flashlights are not uncommon—particularly among airtight flashlights with old, damaged, or improperly installed batteries. One of these batteries (Exp. Date: MAR 2005) may have been improperly installed according to the FAA summary.
8/7/04 FAA incident summary statement	Lithium-ion	Lithium-ion batteries assembled together in a plastic case	Cargo	Prototype lithium batteries shipped under a competent authority approval from California to Europe apparently started a fire in a ULD during the loading process at the FedEx Memphis hub. Shipment may have been in violation of the approval. Details to come.

DATE/ SOURCE	TYPE OF BATTERY	DEVICE	AIRCRAFT	INCIDENT SUMMARY
4/18/04	Ni-Cad, 18-volt, rechargeable	DeWalt cordless power drill	Passenger	A power drill with battery attached was activated in checked baggage. Drill generated heat, setting fire to the bag and other bags on the luggage cart while waiting to be loaded on to the passenger aircraft.
4/1/04 Transport Canada	CR123 lithium batteries	Flashlight	Passenger	A flight attendant lent a passenger a flashlight which was recently purchased in Beijing. The passenger dropped the flashlight while it was on. Later the passenger put the flashlight in a seatback pocket. A few minutes later, the flashlight began to emit smoke and noxious fumes. The flashlight became so hot it could only be handled with oven mitts.
11/02/03	Ni-Cad, Ni-Methyl Hydride, and/or Lithium (according to label on computer)	Notebook computer – Toshiba Satellite model # 815-S129	Passenger	At security screening, a passenger's bag contained a computer bearing a warning label on the bottom near the battery compartment: "Warning: Hot base may cause burn. Avoid prolonged contact with bare skin." Battery compartment was extremely warm to the touch. Screener had passenger turn off computer.
10/25/03	PowerSonic Nonspillable, Lead Acid gel-cell, 12-volt, 35 AMP hours	Powered hand truck	Passenger	Powered hand truck accidentally switched on. Motor and battery generated heat and smoke in cargo compartment of pax aircraft forcing aircraft to return to gate.

DATE/ SOURCE	TYPE OF BATTERY	DEVICE	AIRCRAFT	INCIDENT SUMMARY
06/09/03	Ni-Cad, 18-volt, rechargeable	Battery for DeWalt cordless drill –unattached	Passenger	As part of routine baggage screening it was noticed that the battery, packed loosely in a toolbox, was hot. The unattached drill battery with unprotected terminals had come in contact with metal objects in the toolbox.
06/04/03 Incident report # 2003060805	Non-spillable batteries	None	Cargo	Package burst into flames at FedEx sort facility. Terminals not protected from short circuit, arced and started fire.
04/12/02 Incident report #2002050519	Lithium batteries	None	Cargo	Lithium batteries shipped under exception by Abbott Labs did not have terminals protected from short circuit. Started fire inside package at FedEx Indy sort facility.
3/25/02	Hawker Cyclon, sealed lead, rechargeable, nonspillable batteries	Cyclon batteries contained in larger battery: Lucent/Hawker, sealed lead, rechargeable, 45-volt, 2.5-Amp Hour	Cargo	After the initial flight, the package containing the battery/batteries caught fire at the FedEx sort facility in Memphis.
11/03/00 EIR # 2001NM710044	Hawker lithium sulphur dioxide batteries	None	Cargo	While at a FedEx Cargo facility a lithium battery shorted and ruptured, burning its packaging. The shorted battery had long flexible protruding positive and negative terminals. Two FedEx drivers were treated at a hospital after inhaling fumes from the incident.

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10/25/00 incident report #20010043	Hawker Cyclon, 2-volt, nonspillable	None	Cargo	Eleven batteries (approx. D-size), with positive and negative terminals on the same end were packed loosely in a box. They shorted and caught their packaging on fire. Discovered at FedEx cargo sort center in Ft. Worth after first flight.
07/23/00 DOT 5800	Nonspillable wet batteries	None	Cargo	One package discovered leaking; another displayed evidence of electrical shorting. Outer packaging marked "Batteries, wet, nonspillable"
07/21/00	Four AA or AAA batteries	None	Passenger	During unloading of checked baggage off flight from Miami to Ecuador, handlers discovered a bag containing several battery-powered gifts destroyed by fire started by pack of small batteries. Bag also contained broken bottle of cologne.
07/06/00 DOT 5800	20 nonspillable lead acid batteries	Cables attached to terminals; related power supply equipment	Cargo	Ramp personnel handling the shipment noticed that several of the batteries were sparking or arcing while being moved and that the terminals on the batteries were not sealed properly. Subsequently discovered that some of the cables normally interconnecting batteries still attached to terminals. Also, related equipment, switching panel and controller placed directly on top of batteries. Outer package marked "12-volt BAT-0048 Sealed, no maintenance rechargeable battery for UPS applications."

DATE/ SOURCE	TYPE OF BATTERY	DEVICE	AIRCRAFT	INCIDENT SUMMARY
02/11/00 ANM EIR# 2000NM-710146 DOT 5800	Two PowerSonic, sealed rechargeable, lead acid batteries, 12-volt, 7 Amp Hr.		Cargo	Ramp workers noticed a burning smell emanating from a box after aircraft unloaded. Employees opened box and discovered two sealed lead acid batteries packed together without protection from short circuiting. Terminals of both batteries were partially melted and scorch marked. Battery cases were significantly warped and cases bubbled.
01/26/00 DOT 5800	Eight nonspillable wet batteries	None	Cargo	Package broke open in cargo facility. Two batteries shorting when discovered. Little post on battery described as practically burned off. Paper packing material had black scorched spots. Terminals not protected against short circuits.
12/17/99 DOT 5800	Four batteries	Uninterruptible power source (UPS)	Passenger / Cargo	Four automotive-size batteries inside the metal cabinet, wired in sequence by battery cables. Appears batteries not adequately secured within cabinet, shifted during handling and appear to have shorted out against the metal cabinet, causing burning. Outer container, a fiberboard box on a skid, showed signs of burning.
09/12/99 DOT 5800	Nonspillable battery (non-regulated or undeclared)	None	Cargo	Box found smoking during sort process. Battery had its posts bent inside the box. Posts allegedly came into contact with the metal slide in the sort, allowing the arc to occur and resulting in fire.
09/12/99 DOT 5800	Nonspillable batteries (undeclared)	None	Cargo	During unloading of ULD, box discovered allegedly emitting smoke. Report indicates box containing 2 rechargeable, lead-acid batteries caught on fire.

DATE/ SOURCE	TYPE OF BATTERY	DEVICE	AIRCRAFT	INCIDENT SUMMARY
08/31/99 DOT 5800/ 1999EA-610653	Nonspillable battery (undeclared)	None	Cargo	During outbound package sort, battery apparently initiated and caught fire. There were holes burned completely through the fiberboard box closures.
06/07/99 DOT 5800	"Non-regulated" batteries. Actual type unknown.	None	Cargo	Package noticed during FedEx operation in Greensboro, NC to have burning smell. Inner batteries apparently arced causing batteries to burn inside th package. Incident report stated batteries had not been packaged correctly.
06/99 NASA ASRS Report	Camcorder battery	Possibly Camcorder	Passenger	During ground maintenance delay, flight attendant noticed burning smell. Passengers deplaned. Overhead bin opened to reveal smoke from a passenger bag. Upon opening, cloth items discovered to be smoldering, and a camcorder battery in the bag was extremely hot.
06/04/99 AEU and AEA msgs	Dry cell batteries	None	Cargo	U.S. cargo air carrier transported shipment containing batteries and gas cartridges to foreign destination. Fire broke out as cargo being offloaded and smoking pallet discovered. Examination of the pallet revealed steel rods placed on top of the dry batteries loosely piled on the pallet.

DATE/ SOURCE	TYPE OF BATTERY	DEVICE	AIRCRAFT	INCIDENT SUMMARY
04/28/99 AWP report/ NTSB Rec. A-99-85	Lithium batteries (non-regulated)	None	Passenger aircraft/cargo	After shipment (two pallets/120,000 batteries) transferred from passenger flight to cargo facility, fire occurred. Cargo employee possibly mishandled one of the two pallets. One pallet caught on fire, was moved, the second pallet then caught fire. Initial attempts to extinguish the blaze using water/chemical fire extinguishers failed.
10/29/98	Unknown	UPS	Cargo	Awaiting NTSB recommendation DCA-99-MZ-002 for details
10/10/98 AAL SA statement	Unknown	336 laptop computers	Cargo	Fire warning diverted cargo aircraft. Captain/flight engineer inspected cargo area. Both noted heat rising between pallets on jet flat, as well as strange odor and lung irritation. Fire fighters sprayed pallet with retardant. No further evidence of heat exposure or fire.
10/03/98 DOT 5800	Nickel cadmium batteries (non-regulated)	None	Cargo	Two batteries somehow arced and short-circuited. This malfunction started a fire inside the box. The fire self-extinguished.
07/07/98 Rapid City SD Incident Report 98-002106	9-volt battery	Baby Monitor Remote	Passenger checked bag	Fire damaged bag discovered during unloading. Carrier employee noted fire odor and bag felt warm. Fire appeared to have been caused by a short in the remote, possibly because of close proximity to luggage frame.

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05/19/98 DOT 5800	Wet acid battery		Cargo	Sort center employee smelled unusual odor coming from container during unloading. A 70-lb package singled out and opened by emergency responder. Fanny pack burned and corroded, hot and smelled of fumes.
05/19/98 EA19980082	Unspecified batteries	UPS units (2)	Cargo at IAC warehouse	One of the UPS units exploded during offloading of a truck.
11/25/97 ASW investigation FAA press release 9/9/98	Nonspillable wet electric storage batteries	None	Intended as cargo on passenger aircraft	Courier company dispatched driver to pick up package consignment consisting of global positioning system-based survey equipment. Package self-ignited, smoked and burst into flames. An entire CO2 chemical extinguisher could not extinguish the fire, so firefighters applied dry chemical extinguisher. The FAA, NASA and the city arson bureau analyzed the fire and determined that it was caused by cables placed directly on top of battery.
11/13/97 ASO Investigation 98S0730067	Nonspillable wet batteries	UPS	Cargo	During cargo sort operation, this shipment was discovered burning. The device consisted of a battery with associated circuitry. A subsequent failure analysis report revealed that the burning initiated in a printed circuit board, with the battery acting as the source of energy.
05/15/97 AEA security Summary BUF-97-017	Dry cell batteries	None	Cargo	As cargo being offloaded from aircraft, ramp employee noticed open, empty box in cargo bin. Then the employee noted four batteries on floor, which sparked as she attempted to pick them up.

DATE/ SOURCE	TYPE OF BATTERY	DEVICE	AIRCRAFT	INCIDENT SUMMARY
01/28/97 AEA 97EA710078	Nonspillable batteries (16)	Battery backup cabinet (UPS?)	Passenger aircraft as cargo	16 nonspillable batteries were part of an extended battery cabinet used as backup power for computers. The package ignited while being delivered after transport aboard a passenger aircraft.
06/09/96 DOT 5800 960700024	Nickel cadmium battery	Power pack belt, lamp	Passenger Checked bag	One of three passenger checked bags discovered smoldering and burning in air carrier baggage make-up area. During bag handling, power pack belt had button pushed into "on" position, causing high intensity lamp in bag to power up. Heat from lamp set bag on fire.
03/19/96 DOT 5800 960401424	Hawker Cyclon, sealed-lead rechargeable batteries. (1000)	None	Cargo	Fiberboard box top came unsealed. Box contained rechargeable batteries. Terminals on loose batteries connected, causing them to arc, catching the box on fire and igniting surrounding freight. This box was one of ten pieces in the shipment. Other boxes were located and loose batteries repacked prior to movement to hazmat area. Each box contained two layers of 50 batteries each. Inner packagings consisted of batteries separated by cardboard dividers with layer of styrofoam sheeting across the top. Packaging tape on outer box failed.

DATE/ SOURCE	TYPE OF BATTERY	DEVICE	AIRCRAFT	INCIDENT SUMMARY
02/20/96 ASO investigation FAA press release 3/3/98	Lawn-mower batteries (declared)	Lawnmower	Cargo	Shipment consisting of 106 boxes (each containing a battery-powered lawn mower) was offered for transport to various destinations. Air carrier employees discovered smoke coming from one box. Lawn mower battery had become dislodged and shorted out, causing the mower's wires, plastic housing and battery to burn/melt. Subsequent recall of all boxes revealed that more than 50 of the batteries had short-circuited and several had burned enough to char the boxes in which they were being shipped.
02/07/96 DOT 5800 960300554	Wet acid batteries (undeclared)	None	Cargo	Package failure caused battery terminals to come into contact with metal slide, resulting in short circuit and sparks/fire. Heat generated melted the batteries.
05/08/94 UK CAA DG Occurrence Report Database (G. Leach)	Duracell lithium batteries (excepted from ICAO regulation by SP A45)	None	Intended to go as cargo on passenger aircraft	Consignment of lithium batteries found emitting smoke in ULD during truck transport to LHR. Fire damage. Batteries were smaller in diameter than a dime and about 5 mm high. They had been tossed loosely into a box. Positive and negative terminals had "tails" which were prone to short circuiting.
03/20/91 DOT 5800 910404294	Nonspillable battery	None	Cargo	During air transportation, a package containing a nonspillable battery was discovered smoking in the upper deck cargo area. Aircraft rerouted for emergency landing.

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