



## Guidance on Handling Dangerous Goods Incidents and Lithium Battery Fires in the Passenger Cabin

### Cancelled Document

The following document is cancelled: *Guidance for Portable electronic Devices Fires in Aircraft Cabin* (February 2008) Version 1. The publication of: *Guidance on Handling Dangerous Goods Incidents and Lithium Battery Fires in the Passenger Cabin - Version 2* automatically renders the earlier version null and void.

### Background

Lithium batteries are classified as dangerous goods and are regulated for transport by air. For air transport, the provisions of the UN Model Regulations are incorporated into the Technical Instructions for the Safe Transport of Dangerous Goods by Air published by ICAO. IATA publishes the Dangerous Goods Regulations (DGR), which incorporate all of the provisions of the ICAO Technical Instructions (ICAO TI's) together with additional operational requirements developed by the IATA Dangerous Goods Board.

Lithium batteries can be divided into two groups:

- Primary (non-rechargeable) lithium **metal** batteries; and
- Secondary (rechargeable) lithium **ion** batteries.

Batteries pose a unique hazard during transport because they contain stored energy, which if released through a short circuit is capable of causing a fire. Because of their chemistry, lithium batteries also pose a chemical hazard due to the presence of metallic lithium or flammable liquid electrolyte. Typically:

- Primary (non-rechargeable) lithium metal and secondary (rechargeable) lithium ion batteries are widely used in various consumer electronic devices.
- Primary (non-rechargeable) lithium *metal* batteries are used in smaller devices such as watches, calculators and cameras, or as a back-up power supply.

Secondary (rechargeable) lithium *ion* batteries tend to be larger and are used in devices such as laptop computers and mobile phones.



## **Carriage by Passengers and Crew**

There is widespread usage of lithium batteries in consumer electronic devices such as laptop computers, mobile phones, portable electronic tablets, readers and games. The provisions in the IATA DGR permit crewmembers and passengers to carry lithium battery powered equipment in checked or carry-on baggage. Crewmembers and passengers are also permitted to carry spare lithium batteries for such devices. Spare lithium batteries must be in carry-on baggage.

To be permitted in crew and passenger baggage lithium batteries must:

- Lithium metal batteries: have a lithium content of not more than 2 g. Lithium metal batteries larger than AA exceed this allowance
- Lithium ion batteries: have a Watt-hour rating of not more than 100 Wh.

For the most part, lithium ion batteries in such consumer electronic devices will not exceed a capacity of 100 Watt hours (Wh). As an indication a typical laptop computer battery has a Watt-hour rating of approximately 53 Wh. All new lithium ion batteries will be marked with the Wh rating.

Exceptionally, with the approval of the airline, crew members and passengers may have lithium ion batteries larger than 100 Wh up to a maximum of 160 Wh. If installed in equipment, the equipment may be placed in either checked or carry-on baggage.

However, spare batteries must be in carry-on baggage and no more than two spare batteries are permitted per person.

### **Recommended Practice**

Airlines should have documented procedures in their operations manuals or in other appropriate company documentation available to flight crew, cabin crew and ground staff. The documented procedures should identify if crew members and passengers are permitted to have in baggage lithium ion batteries over 100 Wh, but not exceeding 160 Wh. These procedures should also indicate if there are any specific requirements associated with the carriage of these larger batteries.

The airline should also have clear procedures for both ground staff and cabin crew to alert passengers to remove spare lithium batteries from their carry-on baggage if it cannot be accommodated for stowage in the passenger cabin.

Where passengers advise cabin crew that they have spare lithium batteries in their checked baggage this must be brought to the attention of the ground staff if the aircraft has not yet



departed. If the aircraft has pushed back or is in flight, the cabin crew should report the spare lithium batteries to the flight crew. This must be followed-up by submission of an appropriate incident report as per airline procedures.

Almost all portable electronic equipment will use rechargeable lithium “ion” batteries. Lithium “metal” batteries are generally not rechargeable and are disposable. However, both are capable of ignition and overheating.

A substantial risk is posed by counterfeit batteries, which are not properly tested and may not be manufactured to the required standards. There is also a risk from portable electronic devices that are not repaired by an authorized repair facility.

A lithium battery fire should not be treated as a Class D fire. Fighting a fire that contains lithium batteries requires:

1. Removing external electrical power from device (if applicable)
2. Extinguishing the fire, and
3. Cooling of the remaining cells to stop the thermal runaway.

Halon or Halon replacement and/or water fire extinguishers can be used to control the fire and prevent its spread to surrounding flammable materials. This should be followed by immediate dousing with water or other non-flammable liquid from any available source to douse the fire. Monitor for re-occurrence and continue to pour non-flammable liquids to cool cells until cooled.

Examples of non-flammable liquids: water, juice, coffee, tea, etc.

Do not use flammable liquids: alcohol, oils, or products containing alcohol and/or oils.

Dousing with non-flammable liquids prevents adjacent cells from overheating. A battery pack involved in a fire can reignite multiple times as the heat is transferred to other cells in the pack. The device should be continually cooled with non-flammable liquids.

Use caution to ensure not to use liquids on, or in the immediate vicinity of any other piece of electrical equipment.

Remember to always inform and follow up with flight crew on actions being taken and complete required report or paperwork as per company policy.

It is important:

- Not to pick up and attempt to move a burning device or a device that is emitting smoke.



- Not to cover the device or use ice to cool the device. This would insulate the device increasing the overheating of device and resulting thermal runaway.

In case of a fire involving a portable electronic device in which a passenger or crew member sustains a burn, it should be treated as a *chemical burn*. (Refer to first aid training). For more information please consult the IATA Medical Manual at the following link: <http://www.iata.org/ps/publications/Pages/medical-manual.aspx>

The following video by the US Federal Aviation Administration: *Extinguishing In-Flight Laptop Computer Fires* may be considered for viewing during cabin crew training. It demonstrates a laptop battery fire and resulting thermal runaway. Another video to consider for viewing during cabin crew training is *Cabin Crew Fire Fighting Training Video*. Both are available for viewing at the following link: [http://www.fire.tc.faa.gov/2007Conference/session\\_details.asp?sessionID=26](http://www.fire.tc.faa.gov/2007Conference/session_details.asp?sessionID=26)

The cabin crew manual should reflect the *Cabin Crew Checklist* and *Amplified Cabin Crew Checklist* information below. These checklists are recommended guidance from the 2011-2012 edition of the International Civil Aviation Organization's (ICAO) Emergency Response Guidance for Aircraft Incidents Involving Dangerous Goods (Doc 9481 AN/926).



## CABIN CREW CHECKLIST

### INITIAL ACTION

- Notify Pilot-in-Command
- Identify the item

### In case of fire:

- Use standard procedure / check use of water

### In case of fire involving a portable electronic device:

- Use standard procedure / obtain and use fire extinguisher
- Remove external electrical power from device (if applicable)
- Douse device with water (or other non-flammable liquid) to cool cells and prevent ignition of adjacent cells
- Do not move device
- Remove power to remaining electrical outlets until the aircraft's system can be determined to be free of faults, if the device was previously plugged in

### In case of spillage or leakage:

- Collect emergency response kit or other useful items
- Don rubber gloves and smoke hood or smoke mask – portable oxygen
- Move passengers away from area and distribute wet towels or cloth
- Place dangerous goods item in polyethylene bags
- Stow polyethylene bags
- Treat affected seat cushions / covers in the same manner as dangerous goods item
- Cover spillage on carpet / floor
- Regularly inspect item stowed away / contaminated furnishings

### AFTER LANDING

- Identify to ground personnel dangerous goods item and where stowed
- Make appropriate entry in maintenance log



## AMPLIFIED CABIN CREW CHECKLIST – In Case of Fire

### IN CASE OF FIRE

#### USE STANDARD PROCEDURE / CHECK USE OF WATER

Standard emergency procedures must be used to deal with any fire. In general, water should not be used on a spillage or when fumes are present since it may spread the spillage or increase the rate of fuming. Consideration should also be given to the possible presence of electrical components when using water extinguishers.

### IN CASE OF FIRE INVOLVING A PORTABLE ELECTRONIC DEVICE

#### USE STANDARD PROCEDURE / OBTAIN AND USE FIRE EXTINGUISHER

Standard emergency procedures must be used to deal with any fire. Although Halon has been shown to not be effective against lithium metal fires, Halon will be effective in fighting the subsequent fire of surrounding materials, or in fighting lithium ion battery fire.

#### REMOVE EXTERNAL ELECTRICAL POWER FROM DEVICE (IF APPLICABLE)

A battery has a higher likelihood of catching fire through thermal runaway during or immediately following a charging cycle, although the effects of thermal runaway may be delayed for some period of time. By removing external power from the device, it will be assured that additional energy is not being fed to the battery to promote a fire.

#### DOUSE DEVICE WITH WATER (OR OTHER NON-FLAMMABLE LIQUID) TO COOL CELLS AND PREVENT IGNITION OF ADJACENT CELLS

If available, a water extinguisher should be used to cool the cells in a battery that have ignited, preventing the spread of heat to adjacent cells. If a water extinguisher is not available, any non-flammable liquid may be used to cool the cells and device.

#### DO NOT MOVE DEVICE

A battery pack involved in a fire has been shown to reignite and emit flames multiple times as heat is transferred to other cells in the pack. It is preferable to cool the device using water (or other non-flammable liquid); injuries may occur if the device reignites while it is being moved.

#### REMOVE POWER TO REMAINING ELECTRICAL OUTLETS UNTIL THE AIRCRAFT'S SYSTEM CAN BE DETERMINED TO BE FREE OF FAULTS, IF THE DEVICE WAS PREVIOUSLY PLUGGED IN

By removing power to the remaining electrical outlets it can be assured that a malfunctioning aircraft system does not contribute to additional failures of passenger portable electronic device.



## AMPLIFIED CABIN CREW CHECKLIST – In Case of Spillage or Leakage

### IN CASE OF SPILLAGE OR LEAKAGE

#### COLLECT EMERGENCY RESPONSE KIT OR OTHER USEFUL ITEM

Collect emergency response kit, if provided, or collect for use in dealing with the spillage or leakage:

- A supply of paper towels or newspapers or other absorbent paper or absorbent fabric (e.g. seat cushion covers, head rest protectors);
- Oven gloves or fire-resistant gloves, if available
- At least two large polyethylene waste bin bags; and
- At least three smaller polyethylene bags, such as those used for duty-free or bar sales or, if none available, airsickness bags.

#### DON RUBBER GLOVES AND SMOKE HOOD OR SMOKE MASK – PORTABLE OXYGEN

The hands should always be protected before touching suspicious packages or items. Fire-resistant gloves or oven gloves covered by polyethylene bags are likely to give suitable protection.

Gas-tight breathing equipment should always be worn when attending to an incident involving smoke, fumes fire.

#### MOVE PASSENGERS AWAY FROM AREA

The use of therapeutic masks with portable oxygen bottles or the passenger drop-out oxygen system to assist passengers in a smoke or fume-filled passenger cabin should not be considered since considerable quantities of fumes or smoke would be inhaled through the valves or holes in the masks. A more effective aid to passengers in a smoke or fume-filled environment would be the use of a wet towel or cloth help over the mouth and nose. A wet towel or cloth aids in filtering and is more effective at doing this than a dry towel or cloth. Cabin crew should take prompt action if smoke or fumes develop and move passengers away from the area involved and, if necessary, provide wet towels or cloths and give instructions to breathe through them.

#### PLACE DANGEROUS GOODS ITEM IN POLYETHYLENE BAGS

*Note. – In the case of a spill of known or suspected dangerous goods in powder form:*

- *Leave everything undisturbed;*
- *Do not use fire agent or water;*
- *Cover area with polyethylene or other plastic bags or blankets;*
- *Keep isolated until after landing.*



## AMPLIFIED CABIN CREW CHECKLIST – In Case of Spillage or Leakage (Cont'd.)

### With emergency response kit

If it is absolutely certain that the item will not create a problem the decision may be made not to move it. In most circumstances, however, it will be better to move the item and this should be done as suggested below. Place the item in a polyethylene bag as follows:

- Prepare two bags by rolling up the sides and placing them on the floor;
- Place the item inside the first bag with the closure of the item, or point from which it is leaking from its container, at the top;
- Take off the rubber gloves while avoiding skin contact with any contamination on them;
- Place the rubber gloves in the second bag;
- Close the first bag while squeezing out the excess air;
- Twist the open end of the first bag and use a bag tie to tie it sufficiently tight to be secure but not so tight that pressure equalization cannot take place;
- Place the first bag (containing the item) in the second bag, which already contains the rubber gloves and secure the open end in the same manner as that used for the first bag.

### With no emergency response kit

Pick up the item and place it in a polyethylene bag. Ensure the receptacle containing the dangerous goods is kept upright or the area of leakage is at the top. Using paper towels, newspaper, etc., mop up the spillage, after having ascertained there will be no reaction between what is to be used to mop up and the dangerous goods. Place the soiled towels, etc., in another polyethylene bag. Place the gloves and the bags used to protect the hands either in a separate small polyethylene bag or with the soiled towels. If extra bags are not available, place the towels, gloves, etc., in the same bag as the item. Expel excess air from the bags and close tightly so as to be secure but not so tight that the pressure equalization cannot take place.

### STOW POLYETHYLENE BAGS

If there is a catering or bar box on board, empty any contents and place the box on the floor, with the door upward. Place the bag(s) containing the item and any soiled towels etc., in the box and close the door. Take the box or, if there is no box, the bag(s) to a position as far away as possible from the flight deck and passengers. If a galley or toilet is fitted, consider taking the box or bag(s) there, unless it is close to the flight deck. Use rear galley or toilet wherever possible, but do not place the box or bags against the pressure bulkhead or fuselage wall. If a galley is used, the box or bags(s) can be stowed in an empty waste container. The toilet door should be locked from the outside. In a pressurized aircraft, if a toilet is used, any fumes will be vented away from passengers. However, if the aircraft is unpressurized there may not be positive pressure in a toilet to prevent fumes from entering the passenger cabin.





## **AMPLIFIED CABIN CREW CHECKLIST – In Case of Spillage or Leakage (Cont'd.)**

Ensure when moving a box that the opening is kept upward or when moving a bag that either receptacle containing the dangerous goods is kept upright or the area of leakage is kept at the top.

Wherever the box or bag(s) have been located, wedge them firmly in place to prevent them from moving and keep the item upright. Ensure that the position of the box or bags will not impede disembarkation from the aircraft.

### **TREAT AFFECTED SEAT CUSHIONS / COVERS IN THE SAME MANNER AS DANGEROUS GOODS ITEM**

Seat cushions, seat backs or other furnishings which have been contaminated by a spillage should be removed from their fixtures and placed in a large bin bag or other polyethylene bag, together with any bags used initially to cover them. They should be stowed away in the same manner as the dangerous goods item causing the incident.

### **COVER SPILLAGE ON CARPET / FLOOR**

Cover any spillage on the carpet or furnishings with a waste bag or other polyethylene bags, if available. If not, use airsickness bags opened out so that the plastic side covers the spillage or use the plastic covered emergency information cards.

Carpet which has been contaminated by a spillage and which is still causing fumes despite being covered, should be rolled up, if possible, and placed in a large bin bag or other polyethylene bag. It should be placed in a waste bin and stowed, when possible, either in the rear toilet or rear galley. If the carpet cannot be removed it should remain covered by a large bin bag or polyethylene bags, etc., and additional bags should be used to reduce the fumes.

### **REGULARLY INSPECT ITEMS STOWED AWAY / CONTAMINATED FURNISHINGS**

Any dangerous goods, contaminated furnishings or equipment which have been removed and stowed away or covered for safety should be subject to regular inspection.

## **AFTER LANDING**

### **IDENTIFY TO GROUND PERSONNEL DANGEROUS GOODS ITEM AND WHERE STOWED**

Upon arrival, take the necessary steps to identify to the ground staff where the item is stowed. Pass on all information about the item.

### **MAKE APPROPRIATE ENTRY IN MAINTENANCE LOG**

Make an entry in the aircraft maintenance log so that proper maintenance action is undertaken and that the emergency response kit or any aircraft equipment used is replenished or replaced when appropriate.