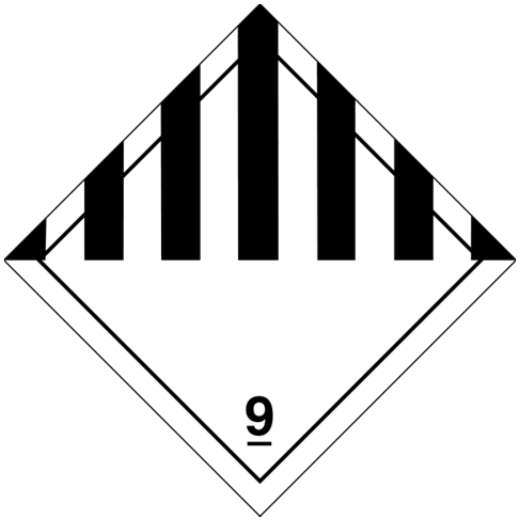
Air Transport



Lithium Battery Incident Guide

Rev. 2016-APR-15

DISCLAIMER – All references and quotes are based on the 2015-2016 ICAO Technical Instructions, the Supplement to the 2013-2014 ICAO Technical Instructions, and Annex 18 (Fourth Edition 2011, Amendment 11). As the above documents change every two years, always consult the current versions.

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CHAPTER 1

GENERAL INFORMATION

1.1 SCOPE

This guide is intended to support State Inspectors involved in investigating a consignment/shipment of lithium batteries in air transportation which has been involved in a dangerous goods (DG) incident. The focus is an investigation of an air consignment/shipment of lithium batteries that has been involved in a fire, smoke, heat, or fume event or has been offered as an undeclared shipment. For purposes of this guide, the use of the term "incident" refers to a "dangerous goods incident" as defined in Section 1.4 Definitions.

1.2 STATE STANDARDS, RECOMMENDATIONS AND GUIDANCE ON DG INCIDENTS

Annex 18: The Safe Transport of DG by Air sets forth the Standards for all States to follow regarding the safe transport of DG.

In Annex 18, Chapter 11: Compliance, 11.1 Inspection Systems, it states:

> "Each Contracting State shall establish inspection, surveillance and enforcement procedures for all entities performing any function prescribed in its regulations for air transport of dangerous goods with a view of achieving compliance with those regulations."

It goes on to state that the inspection system should cover the following three provisions:

- Inspecting DG Consignments
- Inspecting the Practices of the Entities Performing the DG Functions
- Investigating Alleged Violations

The Supplement to the 2013-2014 International Civil Aviation Organization (ICAO) Technical Instructions contains information and guidance, primarily applicable to States that generally supplements or explains in greater depth the basic information contained in the Technical Instructions and Annex 18.

Part 7, Chapter 4 of the Supplement to the Technical Instructions has information to the States involving DG Incidents and undeclared or misdeclared DG in cargo. It substantially states:

> "…State[s] must carry out an investigation into the circumstances of the incident such as is considered appropriate to its seriousness."

With the increase in the number and frequency of lithium battery related air consignments/shipments involved in a fire, smoke, heat, or fume incident, it is critical that States are prepared to conduct an investigation appropriate to the seriousness. Each State is required to fulfill the standards in Annex 18 and the appropriate information in the Supplement to the Technical Instructions to conduct a thorough investigation of a lithium battery incident.

1.3 DG REPORTING SYSTEM

Annex 18: The Safe Transport of DG by Air sets forth the Standards for all States to follow regarding the safe transport of DG.

In Annex 18, Chapter 12: DG Accident and Incident Reporting states:

> With the aim of preventing the recurrence of DG accidents, DG incidents, and instances of undeclared and misdeclared "…each Contracting State should establish procedures for investigating and compiling information concerning such accidents and incidents which occur in its territory…"

Part 7, Chapter 4 of the Supplement to the Technical Instructions contains information to the States involving DG Incidents and Undeclared or Misdeclared DG in Cargo. It states:

> "Each State must establish procedures for investigating and compiling information concerning dangerous goods accidents and incidents, and discoveries and undeclared or misdeclared dangerous goods in cargo…"

DG related reports of accidents, incidents, undeclared or misdeclared dangerous goods in cargo, and any non-compliance are critical data components for the analysis and mitigation of potential DG risks and hazards in air transportation.

1.4 DEFINITIONS

The following is a list of definitions of commonly used terms mostly sourced from the Technical Instructions.

Appropriate national authority. Any authority designated, or otherwise recognized, by a State to perform specific functions related to provisions contained in the Technical Instructions.

Note.— For purposes of this guide, "appropriate national authority" and "national authority" are the same.

Consignment. One or more packages of dangerous goods accepted by an operator from one shipper at one time and at one address, receipted for in one lot and moving to one consignee at one destination address.

Dangerous goods incident. An occurrence, other than a dangerous goods accident, associated with and related to the transport of dangerous goods by air, not necessarily occurring on board an aircraft, which results in injury to a person, property or environmental damage, fire, breakage, spillage, leakage of fluid or radiation or other evidence that the integrity of the packaging has not been maintained. Any occurrence relating to the transport of dangerous goods which seriously jeopardizes the aircraft or its occupants is also deemed to be a dangerous goods incident.

Freight forwarder. A person or organization who offers the service of arranging the transport of cargo by air.

ICAO. Acronym that stands for the International Civil Aviation Organization. ICAO is a specialized agency of the United Nations (UN) with headquarters in Montréal, Canada.

Inner packaging. Packagings for which an outer packaging is required for transport.

Lithium battery. Two or more cells which are electrically connected together and fitted with devices necessary for use, for example, case, terminals, marking and protective devices. A single cell battery is considered a "cell" and must be tested according to the testing requirements for "cells" for the purposes of these Instructions and the UN *Manual of Tests and Criteria* (see also the explanation for "lithium cell").

Note.— Units that are commonly referred to as "battery packs", "modules" or "battery assemblies" having the primary function of providing a source of power to another piece of equipment are, for the purposes of these Instructions and the UN Manual of Tests and Criteria, *treated as batteries.*

Lithium cell. A single encased electrochemical unit (one positive and one negative electrode) which exhibits a voltage differential across its two terminals. Under these Instructions and the UN *Manual of Tests and Criteria*, to the extent the encased electrochemical unit meets the definition of "cell" herein, it is a "cell", not a "battery", regardless of whether the unit is termed a "battery" or a "single cell battery" outside of these Instructions and the UN *Manual of Tests and Criteria*.

Manual of Tests and Criteria. The fifth revised edition [Amendment 2] of the United Nations publication entitled Recommendations on the Transport of Dangerous Goods, Manual of Tests and Criteria (ST/SG/AC.10/11/ Rev.5 and Amend.2).

Misdeclared dangerous goods. Dangerous goods, subject to the Technical Instructions, offered as declared dangerous goods in a manner that does not properly classify, describe, package, mark, and label the dangerous goods being offered.

Operator. A person, organization or enterprise engaged in or offering to engage in an aircraft operation.

Outer packaging. The outer protection of a composite or combination packaging together with any absorbent materials, cushioning and any other components necessary to contain and protect inner receptacles or inner packagings.

Package. The complete product of the packing operation, consisting of the packaging and its contents prepared for transport.

Packaging. One or more receptacles and any other components or materials necessary for the receptacles to perform their containment and other safety functions.

Shipment. The specific movement of a consignment from origin to destination.

Technical Instructions. Phrase that stands for the International Civil Aviation Organization Technical Instructions for the Safe Transport of Dangerous Goods by Air, Doc 9284. The document is published every two years and is effective at the beginning of an odd year (e.g. 2013-2014, 2015-2016, etc.).

Undeclared dangerous goods[1]. Dangerous goods, subject to the Technical Instructions, offered for air transportation without any visible indication to the person accepting the dangerous goods for transportation that dangerous goods are present, on either an accompanying document, or the outside of a transport vehicle, freight container, or package.

Watt-hour rating. Expressed in watt-hours, the watt-hour rating is calculated by multiplying a cell's or battery's rated capacity, in ampere-hours, by its nominal voltage.

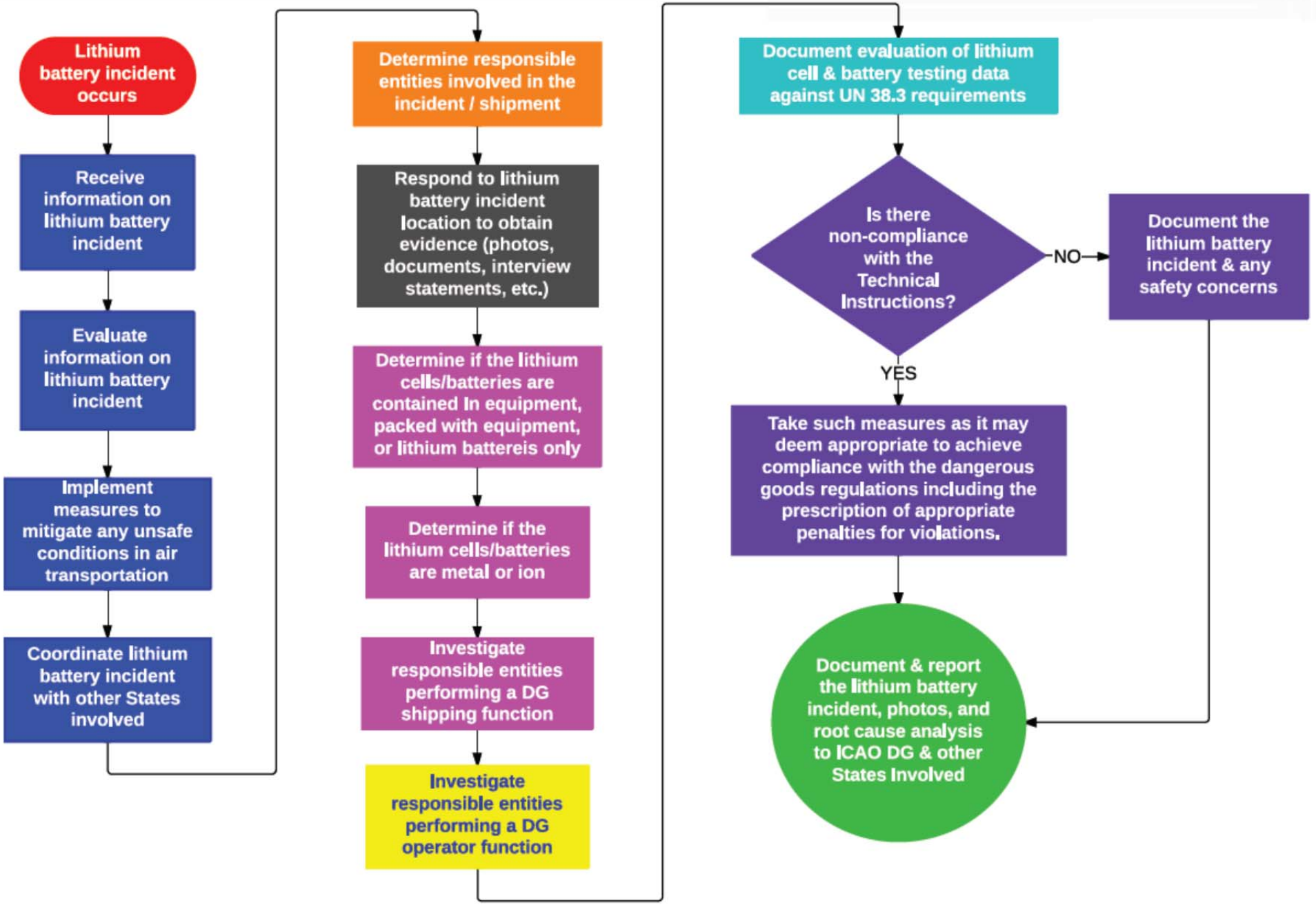
Witness[1]. A person, other than the subject, who possesses information concerning the matter under investigation.

1.5 Lithium Battery Incident Flowchart

This guide is designed to help a national authority prepare for the ever increasing possibility that they will have an air transportation lithium battery fire, smoke, heat, or fume event in their State. To better understand the general structure and process of this guide, a one page flowchart was created.

[1] This term is not defined in the Technical Instructions.

Lithium Battery Incident Flowchart



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CHAPTER 2

NOTIFICATION & EVALUATION OF A LITHIUM BATTERY INCIDENT

2.1 REPORTING A LITHIUM BATTERY INCIDENT

Lithium battery incident information may be reported to the national authority in many ways. The incident reporting requirements in place by the State at the time the incident is discovered should be followed in addition to any other requirements such as the State of Registry for an Operator. The transport entity in possession of the lithium battery package at the time of the incident will generally have the most accurate information for reporting. Since this guide covers the transport of lithium batteries by air, the most common entity to discover and report an incident will be an Operator or their agent. Other entities in the transport chain may discover and report an incident as recommended by the Technical Instructions.

A written incident report may be required by the national authority but in some States a phone report is also required. If the lithium battery incident involves a fire, smoke, heat, or fume event, it is appropriate for the entity in possession of the package to report in a timely manner to ensure safety is not compromised with additional shipments in transportation. Any requirements for a written incident report should emphasize the importance of timely reporting options. This may be taken into account when a State is developing reporting requirements.

2.2 EVALUATING THE LITHIUM BATTERY INCIDENT INFORMATION

A report received in a timely manner regarding a lithium battery incident to the national authority, , provides an opportunity to make a timely safety evaluation of the conditions. Even though the reporting entity may not have all information required to report initially, they will usually have enough information available so that critical next steps can be determined. This can assist in determining immediate actions necessary to gauge what immediate actions and/or response will be required.

During the initial report, if possible, the national authority should request all the transport documentation to be emailed or faxed over for review. The documents to expect may include the: master air waybill, house air waybill, customs import/export documents, operator tracking information on the shipment, any data sheets accompanying the package, DG transport document (if applicable), etc.

The following list is not all encompassing, but these specific questions may be used to gather the necessary information from the reporting entity to start the investigation. Additional information may be required depending on circumstances:

How many packages were involved in the incident?	Are all the packages in the shipment accounted for?
How many cells/batteries are in the package(s)?	Are there any other shipments from this shipper in air transportation that have not been delivered?
Are the cells/batteries lithium ion, metal, or both?	
Was there any fire, smoke, heat, or fumes associated with the package(s) involved in the incident?	Has the package(s) involved in the incident been altered from fire-fighting measures, moving, or clean-up?
Was anyone injured due to the incident?	Did the reporting entity take any pictures of the incident?
How many packages were in the entire shipment?	Does the location where the incident occurred have video surveillance of the incident? If yes, then save video(s).
How was the incident discovered?	

It should be made clear to the reporting entity if a national authority representative intends to respond to the lithium battery incident location. This is to assist the entity reporting in taking measures to preserve and protect any and all information related to the lithium battery incident upon request.

2.3 DETERMINATION OF UNSAFE CONDITIONS

The evaluation as to whether an unsafe condition exists will typically revolve around the shipper and the specific lithium battery package that was involved in the incident. As the national authority, the goal is to work with the reporting entity and any operators or freight forwarders to ensure there are not additional shipments of the same batteries in air transportation that could cause a similar event.

The first specific area to focus on is the tracking and accountability of the shipment that was involved in the incident. If it was a one piece shipment, then the additional package threat would not be of concern. But if the package involved in the lithium battery incident contained multiple pieces, then the other packages could pose the same threat in transportation as the one involved in the incident. Sometimes a multi-piece shipment does not travel all together at the same time on the same flight. If it is discovered that the additional pieces offered by the shipper in this shipment are not accountable at the location of the lithium battery incident, then immediate action should be taken by the reporting entity, operators, freight forwarders, etc. to track down the other pieces to ensure they are not transported on an aircraft. Depending on the circumstances of the lithium battery incident, those packages may also need to be inspected for potential non-compliance with the Technical Instructions.

The second area to focus on is the tracking of any and all shipments by that particular shipper that offered the lithium battery package involved in the incident. If the reporting entity is an operator, they should be able to query their system to determine if any additional shipments have been accepted from the same shipper. In some cases this may take the consultation of the operator's sales agent and multiple freight forwarders if the operator does not have a direct account or relationship with the actual shipper that offered the lithium batteries.

2.4 COORDINATION OF LITHIUM BATTERY INCIDENTS BETWEEN STATES

Annex 18: The Safe Transport of DG by Air sets forth the Standards for all States to follow regarding the safe transport of DG.

In Annex 18, Chapter 11: Compliance, 11.2 Cooperation between States, it states:

> "Each Contracting State should participate in cooperative efforts with other States concerning violations of dangerous goods regulations, with the aim of eliminating such violations. Cooperative efforts could include coordination of investigations and enforcement actions; exchanging information on a regulated party's compliance history; joint inspections and other technical liaisons, exchange of technical staff, and joint meetings and conferences."

The Supplement to the 2013-2014 ICAO Technical Instructions contains information and guidance primarily of interest to States that generally supplements or explains in greater depth the basic information contained in the Technical Instructions.

Part 7, Chapter 4 of the Supplement to the Technical Instructions has information to the States involving DG Incidents and it substantially states:

> "A report of the incident must be forwarded to ICAO and **to the other States concerned** when an investigation shows that the requirements of the Technical Instructions were inadequate or when it is desirable to prevent the recurrence of similar incidents. Reports of dangerous goods incidents…should contain sufficient information so that the reasons for the incident(s) are included and any areas of special interest to other States are identified."

Annex 18, Chapter 2 states that each contracting State to ICAO shall designate and specify an authority within its administration to be responsible for ensuring compliance with the standards in Annex 18. To this end the DG Secretariat at ICAO has been emphasizing the importance to ensure contracting State contacts are keeping this information up to date. For the current list of contracting States contacts for DG, go to ICAO's website at:

http://www.icao.int/safety/DangerousGoods/Pages/Dangerous-Goods-National-Authority.aspx

If there is no hyperlink for the State you are interested in contacting, then specific information has not been provided. In such instances, please contact dgp@icao.int for the relevant civil aviation authority contact information.

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CHAPTER 3

DETERMINATION OF RESPONSIBLE ENTITIES INVOLVED IN THE LITHIUM BATTERY INCIDENT

3.1 THE LITHIUM BATTERY INCIDENT INVESTIGATION

The initial incident report is generally the source of detailed information to begin collecting additional information from other entities. The entity in possession of the shipment should be able to provide details to who they initially acquired the lithium battery incident package involved in the incident. Keep contacting entities involved until you reach the entity that packaged the lithium battery into the package(s). The transport of air cargo can be very complicated and have many entities involved in its path from the original shipper through the operator to the consignee.

It is beneficial when determining the entities involved in the transport of a package to ask for delivery documents and computer tracking information, if available. These will usually have the date and time information and possibly the company, truck/trailer number, and the name of the driver that transported the package.

3.2 DETERMINATION OF RESPONSIBILITY

The identification and contact information of all entities involved in the transport of the incident package(s) may be difficult to determine immediately. In instances where information about entities is delayed or absent, it is best to contact the original shipper to ensure additional lithium battery shipments are not offered during the investigation. In that situation when you contact the shipper, you can query about transport entities and work forward in the transport chain. As you complete the gathering of information, you will have a complete record of the entities in the transport chain of the lithium battery package involved in the incident.

3.3 CONFIRM ALL ENTITIES INVOLVED WITH THE PACKAGE

At this point if you cannot completely determine all the entities involved in the lithium battery incident package, it may be helpful to solicit additional support. If the last entity or lead that you have collected is located in another part of the State or outside the area of coverage for the national authority, determine if there is anyone else in your State government that could help. There may be another State agency that has authority over the area of concern. An investigation lead should be sent to request a follow-up with an entity that you may not be able to visit in person.

Additionally, this same concept may apply to an entity in another State. If you have not yet reached out to that State, it would now be a good time to brief them on the lithium battery incident and request support in collecting information in the investigation regarding any of the transport entities or Operators located in their State. It is critical to provide the necessary information to the other State's

national authority to be able to follow-up and collect the information that you need to complete your investigation of the incident. Also make certain to provide all background information you have at this time to the national authority.

CHAPTER 4

LITHIUM BATTERY INCIDENT INVESTIGATION

4.1 PRELIMINARY ACTIVITIES / SITE VISIT PREPARATION

Contact the responsible entity that reported the incident to inspect the package(s). When you call ensure the following details: the package is still in their possession; confirm the exact location of the package; instruct them to secure the package in a safe manner; request any additional documentation and photographs; request that any personnel involved make note of any details regarding the incident; ask about any additional information that they may have collected; obtain contact information, including mobile telephone numbers, for any person who will be on site during your date and time of arrival; and obtain any site specific information (i.e. parking, security procedures, entrances, etc.).

4.2 INVESTIGATION AT SITE OF INCIDENT – DATA COLLECTION

Once at the lithium battery incident location, discuss the sequence of events of the incident and what took place with the reporting entity. Identify the individuals involved in the incident and list their name(s), position(s), and contact information. Then check to see their availability for discussion while you are there.

It does not matter in which order you proceed, simply cover all the investigation information collection goals to be able to complete the investigation. If necessary, you may need to return to the facility to interview employees that were not available or collect additional information.

After interviews are completed, conduct the inspection and photograph the package(s) involved in the incident. The objective is to be able to gather all the necessary information, statements, and photographs during your visit. It may expedite the process if you inform them ahead of time as the facility may need to get trained dangerous goods employees to prepare the package and its contents. While taking photographs, note and photograph specific details of the shipment such as: the number of packages; the number of damaged packages; dimensions and weight of each package; inner package configuration; types of inner and outer packaging; markings, labels, and documents (dangerous goods related or information that could indicate other responsible entities) affixed to the outer package; and markings, labels, and documents (dangerous goods related or information that could indicate other responsible entities) discovered within the package.

When looking at the contents of the packages, make sure to note and photograph the detailed contents of each package such as: type(s) of lithium battery; brand name and model number of each type of lithium battery; number of each type of lithium battery; physical size of each type of lithium battery; watt-hour rating of each type of lithium battery; any protection used for the lithium battery terminals; presence (or lack) of cushioning material; and any damage to the lithium battery.

During this facility review, view all physical areas that the package involved in the incident was located (incident location, salvage drum location, area where suspected damage occurred, etc.) to determine if any physical hazards may have contributed to the outcome. From the current location of the package, go to the start of the fire/smoke/heat/fume event. If the package was not accepted at the current

location, then receive detailed information about the acceptance station and routing of the shipment. Observe the overall process regarding any future discussions on the possible prevention of other incidents.

Previously, the individuals that needed to be interviewed were established. If not already accomplished, it would be beneficial to interview the employees aware of information, responding to, or cleaning up the lithium battery incident package.

When collecting information in the form of documents, it is always best to collect the original document. If this is not possible, then a photocopy or scanned image is perfectly acceptable. Another possibility is to take a picture of the document with a digital camera.

See APPENDIX 1 for additional guidance on: Interviews and Statements; Document Collection Examples; Photographic Evidence Guide; and Suggestions for a DG Incident Kit.

4.3 A SUCCESSFUL INCIDENT INVESTIGATION

Remember to take your time in collecting information involved in a lithium battery incident. Proper lithium battery transportation is critical to air transportation safety so the prevention of future incidents can depend on conducting a thorough and complete investigation. Training, proper planning and preparedness go a long way in completing a proper investigation.

CHAPTER 5

INSPECTION ACTIVITIES

If possible, additional research should be conducted prior to contacting any entities potentially responsible for preparing and offering the subject shipment. This research will assist in the inspections outlined in Chapters 6 and 7.

5.1 BACKGROUND RESEARCH OF KNOWN ENTITIES

Once the incident facility visit is conducted and all available information is collected, a background check of dangerous goods activities and compliance should be conducted for all entities identified as possibly being involved in the preparation and offering of the subject shipment. This check could include: past inspections; violation history; government registrations, certifications or permits; company website information; corporate status; research information from the internet; location of address(es) (i.e. business or residential areas, located near each other); and directions to locations of planned inspections.

5.2 RESEARCH SPECIFIC LITHIUM BATTERY TYPE(S) IN THE INCIDENT PACKAGE

Research technical data specific to the type(s) of lithium batteries observed in the incident package. Entities, not subject to this investigation, may be able to provide additional information on the lithium battery such as: manufacturer; representative for the manufacturer; licensed distributor for the manufacturer; reputable wholesaler; and battery industry association(s).

Some of the lithium battery information you will need to obtain through additional contacts are as follows: UN Manual of Tests and Criteria, Part III, Subsection 38.3 testing data; technical data sheet; specification sheet; Material Safety Data Sheet (MSDS); and any information known about the lithium batteries.

5.3 RESEARCH SPECIFIC PACKAGING INVOLVED IN THE SUBJECT SHIPMENT

If the United Nations (UN) specification packaging was present in the incident package, then use the UN specification marking (i.e. UN 4G/Y145/S/14/USA/M9999) to obtain the UN Specification package testing report. If the packaging was manufactured in a State other than your own, it may be necessary to send an investigative lead request to that State's national authority to gather that information more easily. But check on the internet first, as it will usually contain the package manufacturer's or third party tester's information. To learn more about what each aspect of the UN Specification marking means, go to the Technical Instructions Part 6, Chapter 2. To learn more about what is required in the packaging performance test, go to the Technical Instructions Part 6, Chapter 4. Contact the appropriate manufacturer, approval administration, or third party tester to request a copy of the package test report, including closure instructions, and any photographs. If applicable, copies of additional documentation provided to the user of the packaging should also be requested.

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CHAPTER 6

INVESTIGATION OF ENTITIES PERFORMING A DG SHIPPER FUNCTION

6.1 CONDUCT INSPECTIONS OF ALL RESPONSIBLE ENTITIES

2015-2016 Technical Instructions, Part 1, Chapter 1 states:

> "Except as otherwise provided for in the Technical Instructions, no person may offer or accept dangerous goods for international civil transport by air unless those goods are properly classified, documented, certificated, described, packaged, marked, labelled and in the condition for shipment required by the Technical Instructions. **If a person performs a function required by the Technical Instructions on behalf of the person who offers the dangerous goods for transport by air** or on behalf of the operator, **that person must perform that function in accordance with the requirements of the Technical Instructions.**"

6.2 LIST OF POSSIBLE ENTITIES RESPONSIBLE FOR OFFERING THE SHIPMENT

Note: Entities inspected as a result of an incident may be less willing to participate than normal. It is important that these entities fully participate.

The shipper or person that physically packaged the incident package may come from a company other than the shipper of record. It is essential that all entities involved in the pre-packaging, packaging, and final closure are included in the investigation. Here is a list of possible entities responsible for the preparation and offering of the subject shipment: Physical shipper; Freight forwarder / Logistics / Trading Company; Packer; Shipper; Packaging manufacturer; and any other entity that was discovered to have handled the subject shipment.

6.3 CONDUCTING THE ON-SITE DG SHIPPER FUNCTION INSPECTION

An inspection of the entities involved in the incident should take place, if possible. There are specific things relating to lithium batteries that you will need to focus on, but the completion of a standard non-incident based shipper inspection should be accomplished at a minimum. Information to support the inspection of a shipper offering lithium batteries by air are located in the following Appendices and references:

- Current Edition of the ICAO Technical Instructions (Doc 9284) for the Safe Transport of Dangerous Goods by Air (http://www.icao.int/safety/DangerousGoods/Pages/technical-instructions.aspx)
- APPENDIX 2: The Supplement to the Technical Instructions: DG Audit Form – Shipper (Part S-5)
- APPENDIX 3: UN Manual of Test & Criteria, Part III, Subsection 38.3 (5th Rev. Edition, Amend. 2)

Even though you may have received some documents or information from other entities, the same information should be requested during each inspection to verify authenticity of a document or information.

6.4 LIST OF GENERAL SHIPPER FUNCTIONS IN THE TECHNICAL INSTRUCTIONS

The Technical Instructions include the functions and responsibilities for use by those entities that are performing a shipper function. In general, here is a list of sections in the Technical Instructions that cover a shipper function:

Part 1: General
Part 2: Classification of Dangerous Goods
Part 3: Dangerous Goods List, Special Provisions and Limited and Excepted Quantities
Part 4: Packing Instructions
Part 5: Shipper's Responsibilities
Part 6: Packaging Nomenclature, Marking, Requirements and Tests

6.5 LIST OF LITHIUM BATTERY SHIPPER FUNCTIONS IN THE TECHNICAL INSTRUCTIONS

The areas of the Technical Instructions specific to lithium batteries that should be focused on regarding a lithium battery incident would be:

- Part 1, Chapter 1: Notes that incorporate by reference the UN Manual of Tests and Criteria
- Part 1, Chapter 4: Training
- Part 2, Chapter 9, Paragraph 9.3: Lithium Batteries
- Part 3, Chapter 2: Table 3-1 Dangerous Goods List (This is specific to the Lithium Battery entries.)
- Part 3, Chapter 3: Special Provisions
- Part 4, Chapter 11: Class 9 Packing Instructions
- Part 5: Shipper's Responsibilities
- Part 6: Packaging Nomenclature, Marking, Requirements and Tests (Chapters 1-4)

6.6 DETERMINATION OF THE TYPE OF LITHIUM BATTERIES

It is critical at this point to gather the necessary information to determine if the lithium batteries involved in the shipment are lithium ion cells or batteries or if they are lithium metal cells or batteries. Some batteries may be marked in such a way that they indicate if they are lithium ion or lithium metal batteries.

A good indication that they are lithium ion batteries would be the fact that they can be rechargeable. Some examples of lithium ion battery chemistries are:

- Lithium Nickel Manganese Cobalt
- Lithium Manganese Oxide ($LiMn_2O_4$)
- Lithium Iron Phosphate ($LiFePO_4$)

A good indication that they are lithium metal batteries would be the fact that it is not rechargeable. Some examples of lithium metal battery chemistries are:

- Lithium Manganese Dioxide (Li-MnO_2)
- Lithium Iron Disulfide ($LiFeS_2$)
- Lithium Thionyl Chloride (Li-$SOCl_2$)
- Lithium Sulfur Dioxide ($LiSO_2$)

Often the lithium battery incident package has some representative examples of the lithium batteries involved in the incident that are not damaged. If so, then a great deal of investigative knowledge can usually be obtained from the printed material on the lithium batteries themselves. If a representative lithium battery is present in the shipment, care should be taken to ensure that it is the exact cell or battery that was involved in the incident.

If the lithium cells or batteries were burned, damaged or destroyed in the incident due to fire or heat, then you will only be able to gather limited information from them. Even if they are burned and damaged, for cylindrical cells, they usually will stay intact so that the general size and number of cells in the battery can be documented.

Additional information on burned, damaged or destroyed cells and batteries would need to come from either paperwork accompanying the shipment or the original shipper or packer, manufacturer or consignee.

In many cases, you may need to rely on paperwork to make a determination on the type of lithium batteries involved in the incident. Between the documentation included in the shipment, the shipper's information provided on a website, and focused internet searches utilizing the known information in the incident you will normally be able to confirm the type of lithium battery involved. If none of those prove successful, usually the next best location could be the consignee, especially, if the package has flown and the consignee is located in the same State as the location of the incident. The shipper is an obvious choice as a contact to query for more clarification on the types of batteries involved in the shipment. But it is best to make sure that you are prepared and have more information regarding the incident prior to contacting the shipper. The reason for this is that a shipper could take measures to destroy evidence or be difficult to contact if they know a national authority is investigating their involvement in a package they tendered that was involved in a fire, smoke, heat, or fume event.

The manufacturer of the lithium battery or piece of equipment containing the lithium battery involved in the incident may be a more appropriate source of information on the type of lithium batteries in the package. Even though the manufacturer may not be the shipper involved in the lithium battery incident, the news of such an event could make them more hesitant to cooperate with a national authority. It is best to keep the details of the investigation as confidential and merely state that an investigation into an incident is being conducted.

6.7 BULK, WITH EQUIPMENT, OR IN EQUIPMENT

After determining what types of lithium batteries were involved in the incident (lithium ion batteries, lithium metal batteries, or both), the next step is to determine if the lithium batteries are packaged by themselves, with equipment, or in equipment.

The manufacturers of lithium batteries can package several hundred lithium batteries into a relatively small fiberboard box. The term lithium battery "bulk" shipment is traditionally used to reflect a package of ONLY lithium batteries when it is packaged without equipment inside. But essentially, a "bulk" shipment could be just one or more cells or batteries in a package. What makes a specific "bulk" shipment is not the quantity of lithium batteries in the shipment, but the fact that equipment that requires the lithium battery for operation is not packed inside the package and that the lithium battery is not contained in a piece of equipment.

So if it can be determined that equipment that requires the power of the lithium batteries is not contained in the package involved in the incident, then this would be a “bulk” shipment of lithium batteries. The “bulk” packages are classified as either: UN3480, **Lithium ion batteries** (including lithium ion polymer batteries), Class 9, Packing Instruction 965 or UN3090, **Lithium metal batteries** (including lithium alloy batteries), Class 9, Packing Instruction 968.

If the lithium battery involved in the incident contained the piece of equipment that required the lithium batteries for operation, then this would be a package of lithium batteries packed WITH equipment. Those packages are classified as either: UN3481, **Lithium ion batteries packed with equipment** (including lithium ion polymer batteries), Class 9, Packing Instruction 966 or UN3091, **Lithium metal batteries packed with equipment** (including lithium alloy batteries), Class 9, Packing Instruction 969.

If the lithium battery involved in the incident was installed or contained in the piece of equipment, then this would be a package of lithium batteries contained IN equipment. Those packages are classified as either: UN3481, **Lithium ion batteries contained in equipment** (including lithium ion polymer batteries), Class 9, Packing Instruction 967 or UN3091, **Lithium metal batteries contained in equipment** (including lithium alloy batteries), Class 9, Packing Instruction 970.

6.8 POSSIBLE FOLLOW-UP ITEMS

The following is a list of possible follow-up items.

- Request to view the storage area of the specific batteries involved in the incident.
- Note how the batteries are stored.
- Take photographs of the batteries in the storage area.
- Have them demonstrate how they package the specific batteries.
- Take note of all packaging components.
- Take photographs of all packaging components.
- Unless it is already indicated, obtain the contact information for the entity who conducted the test required by the UN Manual of Tests and Criteria, Part III, Subsection 38.3.

CHAPTER 7

INVESTIGATION OF ENTITIES PERFORMING A DG OPERATOR FUNCTION

7.1 CONDUCT INSPECTIONS OF ALL RESPONSIBLE ENTITIES

2015-2016 Technical Instructions, Part 1, Chapter 1 states:

> "Except as otherwise provided for in the Technical Instructions, no person may offer or accept dangerous goods for international civil transport by air unless those goods are properly classified, documented, certificated, described, packaged, marked, labelled and in the condition for shipment required by the Technical Instructions. **If a person performs a function required by the Technical Instructions** on behalf of the person who offers the dangerous goods for transport by air or **on behalf of the operator, that person must perform that function in accordance with the requirements of the Technical Instructions.**"

7.2 OPERATOR FUNCTIONS IN THE TECHNICAL INSTRUCTIONS

The Technical Instructions are largely written for use by those entities that are performing shipper functions. In addition to shipper functions, there are specific areas within those shipper sections that are of importance in the Operator's acceptance evaluation of a DG packages including lithium batteries. Additionally, Part 7 of the Technical Instructions is specific to Operator Responsibilities. When conducting an investigation into a reported lithium battery incident, it is also important to make sure you inspect at any of the companies involved that performed an operator function relating to the package involve in the he incident. It is in the best interest of safety and the national authority that all aspects of the Technical Instructions are complied with surrounding the incident, even if the non-compliance did not directly cause the incident.

7.3 TECHNICAL INSTRUCTIONS, PART 7: OPERATOR'S RESPONSIBILITIES

Most of Part 7 in the Technical Instructions is predicated on the notion that the package being offered to the operator is a declared dangerous goods shipment. The two exceptions to that would be Part 7, Chapter 6: Provisions to Aid Recognition of Undeclared Dangerous Goods and the Training reference in Part 7, Chapter 4 (7;4.10). The areas of most concern regarding the compliance of Part 7 for an operator in possession of a lithium battery package involved in an incident are:

- Chapter 1: Paragraph 1.3 The Acceptance Check
- Chapter 2: Paragraph 2.4 Loading and Securing of Dangerous Goods
- Chapter 2: Paragraph 2.5 Damaged Packages of Dangerous Goods
- Chapter 2: Paragraph 2.6 Visibility of Markings and Labels
- Chapter 4: Paragraph 4.1 Information to Pilot-in-Command
- Chapter 4: Paragraph 4.8 Cargo Acceptance Areas – Provision of Information
- Chapter 4: Paragraph 4.9 Emergency Response Information
- Chapter 4: Paragraph 4.10 Training
- Chapter 4: Paragraph 4.11 Retention of Documents or Information

7.4 THE ACCEPTANCE CHECK

The acceptance check is listed above, but it is much more than just a checklist. The majority of dangerous goods training and experience to accept DG packages is focused on this one area. The acceptance check is really an inspection conducted by the operator of a shipper's package to ensure compliance with ALL aspects of the Technical Instructions. This includes the dangerous goods paperwork, package marking, package labels, the outer package, looking for damage, compliance with Competent Authority Approvals, State variations, packing instructions, and the list continues. This is a critical part of an operator's responsibility that chooses to transport DG shipments.

NOTE – a DG Audit Form for Operators as referenced from the Supplement to the Technical Instructions is in APPENDIX 4. This is not specific to lithium batteries, but may be useful in an inspection.

CHAPTER 8

DG COMPLIANCE

8.1 EVALUATING COMPLIANCE WITH THE LITHIUM BATTERY PACKING INSTRUCTIONS

The Technical Instructions have very specific and detailed packing instructions relating to the six lithium battery proper shipping names. These packing instructions are located in Part 4, Chapter 11 under PI-965-970. Reference the current Edition of the ICAO Technical Instructions (Doc 9284) for the Safe Transport of Dangerous Goods by Air (http://www.icao.int/safety/DangerousGoods/Pages/technical-instructions.aspx)

8.2 EVALUATING COMPLIANCE WITH THE UN MANUAL OF TEST & CRITERIA

In the UN Manual of Tests & Criteria (UN-MoT&C), Part III, Sub-section 38.3, it covers the Lithium Ion and Lithium Metal Cell and Battery classification procedures for transportation. Essentially it lists specific testing criteria that if the cell or battery passes, then the lithium battery or cell would be permitted in transportation. It is imperative that once a UN-MoT&C testing report is obtained for the particular lithium cells or batteries involved in the incident that the entire Sub-section 38.3 is read very closely. A copy of the latest version can be referenced in APPENDIX 3.

The first thing you want to validate is that you are in possession of a UN-MoT&C lithium battery report that is more than a page and has more information on it than just PASS, PASS, PASS, etc. for each test. A quality report will have descriptions and pictures of the lithium cells or batteries that were tested. It will have dimensions of the cells or batteries. It will have the energy amounts in Watt-hours and for Lithium Metal cells or batteries it should have the lithium content in grams. Additional guidance can be referenced in APPENDIX 5 regarding the determination of the Watt-hour calculation or estimating the lithium metal content of a lithium cell or battery.

The UN-MoT&C report review for the specific T1-T8 testing results. A guide to help you determine which of the eight tests are required for lithium ion cells and batteries and lithium metal cells and batteries is referenced in APPENDIX 6. The number of cells or batteries needed in each test are described in 38.3.3 (a)-(e).

It is critical that you read and understand the definition of a cell and a battery.

> ***Battery*** means two or more cells which are electrically connected together and fitted with devices necessary for use, for example, case, terminals, marking and protective devices. A single cell battery is considered a "cell" and shall be tested according to the testing requirements for "cells" for the purposes of the Model Regulations and this Manual (see also the definition for "cell").
>
> > ***NOTE:*** *Units that are commonly referred to as "battery packs", "modules" or "battery assemblies" having the primary function of providing a source of power to another piece of equipment are for the purposes of the Model Regulations and this Manual treated as batteries.*

> ***Cell*** means a single encased electrochemical unit (one positive and one negative electrode) which exhibits a voltage differential across its two terminals. Under the Model Regulations and this Manual, to the extent the encased electrochemical unit meets the definition of "cell" herein, it is a "cell", not a "battery", regardless of whether the unit is termed a "battery" or a "single cell battery" outside of the Model Regulations and this Manual.

An item to take note of is that a single cell battery is treated as a cell, and not a battery. The Note under the battery definition clarifies that “battery assemblies”, “battery modules”, “battery packs”, etc. are still just considered a battery.

Two paragraphs to make sure you are aware are both in 38.3.3. The first is under 38.3.3 (f):

> “When testing a battery assembly in which the aggregate lithium content of all anodes, when fully charged, is not more than 500 g, or in the case of a lithium ion battery, with a Watt-hour rating of not more than 6 200 Watt-hours, that is assembled from batteries that have passed all applicable tests, one battery assembly in a fully charged state shall be tested under tests T.3, T.4 and T.5, and, in addition, test T.7 in the case of a rechargeable battery assembly. For a rechargeable battery assembly, the assembly shall have been cycled at least 25 cycles.”

This can be a little confusing because now we are back to talking about Battery Assemblies. Even though the definition directs us to treat them as batteries, this section carves out an exception that can be utilized by manufacturers regarding lithium battery testing. This paragraph was intended for large assemblies of batteries, but as long as the lithium battery manufacturer follows this paragraph, it would be permissible. The key to this section is that the battery assembly needs to be comprised of batteries (not cells) that have passed the UN-MoT&C testing in Sub-section 38.3 already.

The second paragraph to be concerned with is at the bottom of 38.3.3. It reads:

> “When batteries that have passed all applicable tests are electrically connected to form a battery assembly in which the aggregate lithium content of all anodes, when fully charged, is more than 500 g, or in the case of a lithium ion battery, with a Watt-hour rating of more than 6 200 Watt-hours, that battery assembly does not need to be tested if it is equipped with a system capable of monitoring the battery assembly and preventing short circuits, or over discharge between the batteries in the assembly and any overheat or overcharge of the battery assembly.”

This paragraph is for lithium metal batteries with lithium content more than 500 g and for lithium ion batteries with more than 6,200 watt-hours. Those are very large batteries. Many lithium ion automotive batteries are under the 6,200 watt-hour limit described here. The key here is that the batteries that make up the battery assembly have been UN-MoT&C tested. Also, that the battery assembly is equipped with a system capable of monitoring the battery assembly, etc.

8.3 COUNTERFEIT CELLS OR BATTERIES

Now counterfeit cells and batteries are a major concern to the industry, but when it comes to compliance with the Technical Instructions the fact that a lithium battery is counterfeit is absolutely irrelevant. Additional scrutiny may be needed if a cell or battery is suspected of or determined to be counterfeit, but it does not mean you can’t transport the cell or battery. What it comes down to is the classification of the lithium cell or battery utilizing the UN-MoT&C. As long as the counterfeit cell or

battery has a valid UN-MoT&C testing report and complies with the Technical Instructions, it is not a violation of the Technical Instructions for a shipper to offer them for transport. If a counterfeit cell or battery is encountered, what you should be looking at is to see if the UN-MoT&C testing report is valid and has not been falsified. Obviously if the counterfeit battery is accompanied by a UN-MoT&C testing report from the name brand lithium cell or battery, then that would be non-compliant situation.

8.4 PENALTIES

Annex 18: The Safe Transport of DG by Air sets forth the Standards for all States to follow regarding the safe transport of DG.

In Annex 18, Chapter 11: Compliance, 11.3 Penalties, it states:

> "Each Contracting State shall take such measures as it may deem appropriate to achieve compliance with its dangerous goods regulations including the prescription of appropriate penalties for violations."
>
> "Each Contracting State should take appropriate action to achieve compliance with its dangerous goods regulations, including the prescription of appropriate penalties for violations, when information about a violation is received from another Contracting State, such as when a consignment of dangerous goods is found not to comply with the requirements of the Technical Instructions on arrival in a Contracting State and that State reports the matter to the State of Origin."

8.5 COMPLIANCE ASSURANCE

Part 7, Chapter 4 of the Supplement to the Technical Instructions has information to the States on Compliance Assurance and it states:

> "The competent authority should ensure compliance with the Technical Instructions. Means to discharge this responsibility include the establishment and execution of a programme for monitoring the design, manufacture, testing, inspection and maintenance of packaging, the classification of dangerous goods and the preparation, documentation, handling and stowage of packages by consignors and carriers, to provide evidence that the provisions of the Technical Instructions are being met in practice."

8.6 REPORTING OF THE LITHIUM BATTERY INCIDENT

The reporting of a lithium battery incident was already discussed in Chapter 2, but that mainly focused on the coordination and reporting of the preliminary lithium battery incident with other related States to the transport of the package. Now that the investigation is complete and a root cause or suspected root cause of the incident has been determined, additional reporting is required.

The Supplement to the 2013-2014 ICAO Technical Instructions contains information and guidance primarily of interest to States that generally supplements or explains in greater depth the basic information contained in the Technical Instructions.

Part 7, Chapter 4 of the Supplement to the Technical Instructions has information to the States involving DG Incidents and it substantially states:

> "A report of the incident must be forwarded **to ICAO** and **to the other States concerned** when an investigation shows that the requirements of the Technical Instructions were inadequate or when it is desirable to prevent the recurrence of similar incidents. Reports of dangerous goods incidents…should contain sufficient information so that the reasons for the incident(s) are included and any areas of special interest to other States are identified."

In the interest of notifying the States involved and the Dangerous Goods Section of ICAO, a detailed, final report should be created. This final report should contain detailed information regarding the incident, the entities involved in the shipment, photographs to help explain the incident, cell/battery testing documents, action taken, pending action still to be completed, and an analysis or evaluation of what caused the incident, if known. This report, through ICAO, can now be utilized to inform the many UN States of this serious incident and many will be able to learn from this experience. It also provides an opportunity to look at the requirements in the Technical Instructions to see if modification or amendments can be made to prevent such serious incidents in the future.

APPENDIX 1

DG INCIDENT INVESTIGATION SUPPORT GUIDES

INTERVIEWS AND STATEMENTS

1. Determine the type of interviewee such as:

a) Participants (individuals who were directly involved with the subject shipment)
   1) Air carrier / Handling personnel
   2) First responders
   3) Freight forwarder / Logistics company
   4) Packer
   5) Shipper
   6) Manufacturer
   7) Battery tester
   8) Package tester
   9) Alleged violator (subject of investigation)
   10) Any other entity who can provide relevant or corroborating testimony

b) Eyewitness (individuals who directly observed the subject shipment)

c) Background Witnesses (individuals who can provide explanations or technical expertise)
   1) Air carrier resources
   2) Battery manufacturer technical experts
   3) Packaging manufacturer technical experts
   4) Any other entity who can provide background information

   Note: All individuals should be interviewed separately.

2. Types of questions

There are two basic types of interview questions.

a) Open questions, which include both
   1) Primary questions
   2) Probing questions

b) Closed questions

3. There are two types of questions you should avoid.

a) Leading questions

b) Loaded questions

Refer to the Interview Questions Job Aid in this appendix for more detailed information.

4. A statement is a written record of an interview. Determine the type of statement needed at the conclusion of the interview (listed from weakest to strongest evidence).

a) Investigator Statement

b) Record of Interview

c) Written Statement by the Subject

5. Elements of a Statement

a) Date, time, and place

b) Identification of interviewee
    1) Name/Title
    2) Company
    3) Length of service
    4) Phone numbers
    5) E-mail address
c) Text of statement
    1) A complete account of all pertinent information known to the interviewee
    2) Interview questions form the basis of the text
    3) Must be in a logical order
    4) Written in the first person
    5) Must include – who, what, where, when, why and how

Interview Questions Job Aid

1. Use **primary open questions** designed to secure information directly related to the matters under discussion.

2. Use **open-ended** questions. Examples of open-ended questions include:

    - "What did you see and hear?"
    - "What happened?"
    - "Is there anything else you would like to add?"

3. Follow-up responses with **probing** open questions to get clarification and details.

4. Don't ask too many **closed** questions which provide simple "yes" or "no" type responses.

5. Avoid **vocabulary** the interviewee may not understand. When the interviewee uses slang or regional expressions, obtain clarification. This is especially important for the written statement when all responses must be understood.

6. Avoid **leading** questions. Questions that suggest an answer may cause the interviewee to answer erroneously or fabricate a response by accepting the suggested answer without thinking.

7. Avoid **loaded** questions. These questions introduce the interviewer's bias and do not address any legitimate interview objectives.

DOCUMENT COLLECTION EXAMPLES

If applicable, obtain copies of the following documents:

a) Master air waybill

b) House air waybill

c) Dangerous goods shipping paper

d) Packing list / Invoice

e) Dangerous goods checklist

f) Tracking information

g) Material Safety Data Sheet / Technical sheet

h) State authority and authorizations

i) Section IB alternative written documentation

j) Section IB documentation (additional requirements)

k) Section II documentation (additional requirements)

l) Test report (UN Manual of Tests and Criteria, Part III, Subsection 38.3)

m) Test report for UN specification packaging

n) Contracts between various entities

o) Training records

p) Email communication

q) Bill of lading

PHOTOGRAPH EVIDENCE GUIDE

Take as many photographs of the shipment as possible. You cannot have too many photos.

1. **Camera Settings**
   a) Use the largest photo size (in megapixels).
   b) Adjust the flash setting (for lighting).
   c) Use the macro focus (for close-ups).
   d) Ensure the date and time is set prior to departure.
2. **Location of Photographs**
   a) Take initial photographs of the package(s) as first observed, including distance and close-up photos for perspective.
   b) After initial photographs, move package(s) if necessary. Choose a location with sufficient light, space, and minimal traffic.
   c) Take photographs of the location where the incident occurred or was discovered.
   d) Take photographs of any damage to other packages, equipment, vehicles, persons, etc.
3. **Content of Photographs**
   a) Use rulers and tape measures as much as possible for perspective.
   b) Use labels, sticky notes, tags, and cards for the identification of the subject shipment in photographs.
   c) Take photographs of the outer packaging (prior to opening packages) including:
      1) 6 sides (top, side 1, side 2, side 3, side 4, and bottom, if safe)
      2) Close-up of markings, labels, and documentation affixed to the package
      3) Close-up of damage to the integrity of the package
   d) Take photographs of the inner packaging. Photograph each phase of unpacking including:
      1) Empty package
      2) Close-up of damage to the integrity of the package
   e) Take photographs of the inner contents of the packaging including:
      1) Close-up of lithium batteries (damaged and undamaged for comparison)
      2) Close-up of damage to lithium batteries
      3) Close-up of battery terminals
      4) Close-up of the battery label for manufacturer information such as:
         i) Manufacturer name, location, website, etc.
         ii) Brand name, model, and serial numbers
         iii) Electrical information (i.e. volts, watts, watt-hours)
         iv) If any residue covers the battery label, photograph the original condition of the battery before the residue is removed.
   f) Use pre-printed labels to identify the subject of each photograph (i.e. top, side 1, side 2, side 3, side 4, bottom, box 1, box 2, etc.). Be careful not to obscure any relevant aspect of the subject item.

SUGGESTIONS FOR A DANGEROUS GOODS INCIDENT KIT

The following is a list of suggested items for a Dangerous Goods Incident Response Kit.

a) Camera (with media storage devices, batteries, charger, tripod, and USB cable)
b) Identification / Credentials
c) Pad / Notebook
d) Pens, pencils, markers, and highlighters
e) Stapler, staples, staple remover, and paperclips
f) Sticky notes (in several sizes and colors)
g) Tape measure (for measuring packages and perspective in photos)
h) Ruler (for measuring batteries and perspective in photos)
i) Knife / Utility tool
j) Moist wipes (to clean sooty surfaces and hands)
k) Hand sanitizer
l) Rubber gloves
m) Work gloves
n) Flashlight (with extra batteries and/or charger)
o) Mobile phone charger
p) GPS and charger
q) Laptop or tablet device and charger (to view and store photos on site)
r) Food and drink
s) Packing tape
t) Plastic Ziploc bags
u) Business cards
v) Regulations / Job aids
w) Binder with pre-printed labels (i.e. top, side 1, side 2, side 3, side 4, bottom, box 1, box 2, etc.)
x) Bag or backpack (for storage of all supplies)

APPENDIX 2

THE SUPPLEMENT TO THE TECHNICAL INSTRUCTIONS
DG AUDIT FORM – SHIPPER
(PART S-5)

ATTACHMENT I TO CHAPTER 1

DANGEROUS GOODS AUDIT FORM — SHIPPER

PRE-INSPECTION RESEARCH

Shipper Name:
Inspection initiation date:
Office preparation: Prior to inspecting the shipper research the following:

State database: Review previous inspections associated with this shipper and record previous violation information below:

State safety risk management (SRM) database: Run "company search" or "incident summaries" on the shipper. Note any information from inspections on the same shipper from other locations besides the one you plan to inspect. Print out the report and attach it to this job aid for your files. Record any notable information below:

State SRM database: Review the following additional information:

Is the shipper a holder of any exemption?

No: ☐
Yes: ☐

If yes, record the exemption(s) and obtain copies to review and take to the inspection:

Is the shipper a holder of any approval?

No: ☐
Yes: ☐

If yes, record the approval(s) and obtain copies to review and take to the inspection:

Other public information: Note any information from other sources on the shipper that may be helpful in conducting the inspection:

CONDUCT OF THE INSPECTION

Once at the shipper's location, record the following information:

General company information:

Shipper:
Address:
Phone number:
Email:
Fax number:
Company point-of-contact (name/title):

General company information: Business organization:

Individual: ☐
Partnership: ☐
Corporation: ☐

If corporation, is this a branch or division?

No: ☐
Yes: ☐

Is it a wholly-owned subsidiary?

No: ☐
Yes: ☐

If the corporation is a branch or division, then record the parent corporation's information here:

Corporation headquarters:

Address:
Phone number:
Email:
Fax number:
Corporate point-of-contact (name/title):

Shipper profile information:

Days/hours of operation:

Operators that are offered dangerous goods for air transportation from the shipper:

List hazard class or divisions of dangerous goods offered by the shipper:

Exemptions utilized by this shipper:

Approvals utilized by this shipper:

Determine if the shipper is required to have a security plan (Technical Instructions, Part 1;5):

No: ☐
Yes: ☐

If yes, what dangerous goods require the shipper to have a security plan?

Shipping area/package production area:

Observation/interview/verification:

Inspect completed dangerous goods packages awaiting pick-up for air transport by an operator for:

Transport documents
Marking
Labelling
Packaging (authorized for air transport)
Classification

Does the shipper use a checklist to ensure shipments are offered in compliance with the Technical Instructions?

No: ☐
Yes: ☐

Notes:

If packages are being prepared, then review if workers are properly closing UN specification packaging as per the package manufacturer's closing instructions. Also, verify if single packagings and the inner packagings of combination packages are permitted by the Technical Instructions for the substances being shipped (Technical Instructions, Parts 4 and 5).

Notes:

Record names of all workers who you observe performing dangerous goods functions to verify training records:

Notes:

Warehouse:

Observation/interview/document review/verification:

Perform a complete physical walk-through of the shipper's warehouse/storage area during the inspection. Look for, and question the company on, any products that are marked or labelled as dangerous goods.

Notes:

Administrative office:

Interview:

Have a knowledgeable company official describe how the shipper retains dangerous goods shipping documentation (Technical Instructions, Part 5):

- ☐ Separate dangerous goods transport document file (folder)
- ☐ Record of rejected consignments
- ☐ Electronic records (separate file or by order)
- ☐ Transport document filed with purchase/invoice order
- ☐ Transport document filed with customer file
- ☐ Transport document filed with other shipping documentation
- ☐ Test reports and instructions for packaging
- ☐ Other

Describe method utilized and note if the shipper maintains other transport documents in different locations.

Notes:

Administrative office:

Document review/verification:

Review dangerous goods transport documents on file.

Any transport documents that are in violation of the dangerous goods regulations?

No: ☐
Yes: ☐

If yes, document for possible further investigation.

List all names of individuals who certified shipments according to the transport documents for verification of training (Technical Instructions, Part 1):

Review all transport documents that indicate that a State exemption was used by the shipper. Verify that the shipper complied with the exemptions utilized (Technical Instructions, Part 1).

List exemptions utilized:

Review all transport documents that indicate a State approval was used by the shipper. Verify that the shipper complied with the approval (Technical Instructions, Part 1).

List approvals utilized:

Review all transport documents that indicate a security plan would be required. Verify that the shipper complied with all security plan requirements (Technical Instructions, Part 1).

Classification of dangerous goods:

Notes:

Review all dangerous goods classifications listed on transport documents against supporting documentation that the shipper utilized to classify the material.

What is the primary method utilized by the shipper to classify their dangerous goods shipments?

- ☐ Material safety data sheet
- ☐ Product information (manufacturer)
- ☐ Lab analysis
- ☐ State approval
- ☐ Other

List:

Obtain a roster of all employees, agents, and contractors who perform a dangerous goods function and/or transport function for the shipper (Technical Instructions, Parts 1 and 5).

Notes:

Obtain training records that the shipper has on file (Technical Instructions, Parts 1 and 5):

Record the following training programme information:

Name of training programme:

Description of training programme:

Location of training material(s):

Name and address of person providing training:

Name:
Address:

Notes:

Review, verify, and compare worker rosters against training records provided by the shipper.

Compare names of workers you observed performing dangerous goods functions against shipper's training records.

Notes:

Outreach

Provide State dangerous goods information for the safe transport of dangerous goods by air.

APPENDIX 3

UN MANUAL OF TESTS AND CRITERIA, PART III, SUBSECTION 38.3 (FIFTH REVISED EDITION, AMENDMENT 2)

Recommendations on the

TRANSPORT OF DANGEROUS GOODS

Manual of Tests and Criteria

Fifth revised edition

Amendment 1 - With Amendment 2 Revisions

UNITED NATIONS

SECTION 38

38.3 Amend to read as follows:

"38.3 Lithium metal and lithium ion batteries

38.3.1 ***Purpose***

This section presents the procedures to be followed for the classification of lithium metal and lithium ion cells and batteries (see UN Nos. 3090, 3091, 3480 and 3481, and the applicable special provisions of Chapter 3.3 of the Model Regulations).

38.3.2 ***Scope***

38.3.2.1 All cell types shall be subjected to tests T.1 to T.6 and T.8. All non-rechargeable battery types, including those composed of previously tested cells, shall be subjected to tests T.1 to T.5. All rechargeable battery types, including those composed of previously tested cells, shall be subjected to tests T.1 to T.5 and T.7. In addition, rechargeable single cell batteries with overcharge protection shall be subjected to test T.7. A component cell that is not transported separately from the battery it is part of needs only to be tested according to tests T.6 and T.8. A component cell that is transported separately from the battery shall be tested as a cell.

38.3.2.2 Lithium metal and lithium ion cells and batteries shall be subjected to the tests, as required by special provisions 188 and 230 of Chapter 3.3 of the Model Regulations prior to the transport of a particular cell or battery type. Cells or batteries which differ from a tested type by:

(a) For primary cells and batteries, a change of more than 0.1 g or 20% by mass, whichever is greater, to the cathode, to the anode, or to the electrolyte;

(b) For rechargeable cells and batteries, a change in nominal energy in Watt-hours of more than 20% or an increase in nominal voltage of more than 20%; or

(c) A change that would lead to failure of any of the tests,

shall be considered a new type and shall be subjected to the required tests.

NOTE: *The type of change that might be considered to differ from a tested type, such that it might lead to failure of any of the test results, may include, but is not limited to:*

(a) A change in the material of the anode, the cathode, the separator or the electrolyte;

(b) A change of protective devices, including hardware and software;

(c) A change of safety design in cells or batteries, such as a venting valve;

(d) A change in the number of component cells; and

(e) A change in connecting mode of component cells.

In the event that a cell or battery type does not meet one or more of the test requirements, steps shall be taken to correct the deficiency or deficiencies that caused the failure before such cell or battery type is retested.

38.3.2.3 For the purposes of classification, the following definitions apply:

Aggregate lithium content means the sum of the grams of lithium content contained by the cells comprising a battery.

Battery means two or more cells which are electrically connected together and fitted with devices necessary for use, for example, case, terminals, marking and protective devices. A single cell battery is considered a "cell" and shall be tested according to the testing requirements for "cells" for the purposes of the Model Regulations and this Manual (see also the definition for "cell").

NOTE: *Units that are commonly referred to as "battery packs", "modules" or "battery assemblies" having the primary function of providing a source of power to another piece of equipment are for the purposes of the Model Regulations and this Manual treated as batteries.*

Button cell or battery means a round small cell or battery when the overall height is less than the diameter.

Cell means a single encased electrochemical unit (one positive and one negative electrode) which exhibits a voltage differential across its two terminals. Under the Model Regulations and this Manual, to the extent the encased electrochemical unit meets the definition of "cell" herein, it is a "cell", not a "battery", regardless of whether the unit is termed a "battery" or a "single cell battery" outside of the Model Regulations and this Manual.

Component cell means a cell contained in a battery.

Cycle means one sequence of fully charging and fully discharging a rechargeable cell or battery.

Disassembly means a vent or rupture where solid matter from any part of a cell or battery penetrates a wire mesh screen (annealed aluminium wire with a diameter of 0.25 mm and grid density of 6 to 7 wires per cm) placed 25 cm away from the cell or battery.

Effluent means a liquid or gas released when a cell or battery vents or leaks.

Fire means that flames are emitted from the test cell or battery.

First cycle means the initial cycle following completion of all manufacturing processes.

Fully charged means a rechargeable cell or battery which has been electrically charged to its design rated capacity.

Fully discharged means either:

a primary cell or battery which has been electrically discharged to remove 100% of its rated capacity; or

a rechargeable cell or battery which has been electrically discharged to its endpoint voltage as specified by the manufacturer.

Large battery means a lithium metal battery or lithium ion battery with a gross mass of more than 12 kg.

Large cell means a cell with a gross mass of more than 500 g.

Leakage means the visible escape of electrolyte or other material from a cell or battery or the loss of material (except battery casing, handling devices or labels) from a cell or battery such that the loss of mass exceeds the values in Table 38.3.1.

Lithium content is applied to lithium metal and lithium alloy cells and batteries, and for a cell means the mass of lithium in the anode of a lithium metal or lithium alloy cell, which for a primary cell is measured when the cell is in an undischarged state and for a rechargeable cell is measured when the cell is fully charged. The lithium content of a battery equals the sum of the grams of lithium content contained in the component cells of the battery.

Lithium ion cell or battery means a rechargeable electrochemical cell or battery in which the positive and negative electrodes are both intercalation compounds (intercalated lithium exists in an ionic or quasi-atomic form with the lattice of the electrode material) constructed with no metallic lithium in either electrode. A lithium polymer cell or battery that uses lithium ion chemistries, as described herein, is regulated as a lithium ion cell or battery.

Mass loss means a loss of mass that exceeds the values in Table 38.3.1 below.

Table 38.3.1: Mass loss limit

Mass *M* of cell or battery	Mass loss limit
M < 1 g	0.5%
1 g ≤ M ≤ 75 g	0.2%
M > 75 g	0.1%

NOTE: *In order to quantify the mass loss, the following procedure is provided:*

$$\text{Mass loss (\%)} = \frac{(M_1 - M_2)}{M_1} \times 100$$

where M_1 is the mass before the test and M_2 is the mass after the test. When mass loss does not exceed the values in Table 38.3.1, it shall be considered as "no mass loss".

Nominal energy or Watt-hour rating, expressed in watt-hours, means the energy value of a cell or battery determined under specified conditions and declared by the manufacturer. The nominal energy is calculated by multiplying nominal voltage by rated capacity expressed in ampere-hours.

Nominal voltage means the approximate value of the voltage used to designate or identify a cell or battery.

Open circuit voltage means the voltage across the terminals of a cell or battery when no external current is flowing.

Primary cell or battery means a cell or battery which is not designed to be electrically charged or recharged.

Prismatic cell or battery means a cell or battery whose ends are similar, equal and parallel rectilinear figures, and whose sides are parallelograms.

Protective devices means devices such as fuses, diodes and current limiters which interrupt the current flow, block the current flow in one direction or limit the current flow in an electrical circuit.

Rated capacity means the capacity, in ampere-hours or milliampere-hours, of a cell or battery as measured by subjecting it to a load, temperature and voltage cut-off point specified by the manufacturer.

NOTE*: The following IEC standards provide guidance and methodology for determining the rated capacity:*

(1) IEC 61960 (First Edition 2003-12) : Secondary cells and batteries containing alkaline or other non-acid electrolytes – Secondary lithium cells and batteries for portable applications;

(2) IEC 62133 (First Edition 2002-10): Secondary cells and batteries containing alkaline or other non-acid electrolytes – Safety requirements for portable sealed secondary cells, and for batteries made from them, for use in portable applications;

(3) IEC 62660-1 (First Edition 2011-01): Secondary lithium-ion cells for the propulsion of electric road vehicles – Part 1: Performance testing.

Rechargeable cell or battery means a cell or battery which is designed to be electrically recharged.

Rupture means the mechanical failure of a cell container or battery case induced by an internal or external cause, resulting in exposure or spillage but not ejection of solid materials.

Short circuit means a direct connection between positive and negative terminals of a cell or battery that provides a virtual zero resistance path for current flow.

Single cell battery means a single electrochemical unit fitted with devices necessary for use, for example, case, terminals, marking and protective devices.

Small battery means a lithium metal battery or lithium ion battery with a gross mass of not more than 12 kg.

Small cell means a cell with a gross mass of not more than 500 g.

Type means a particular electrochemical system and physical design of cells or batteries.

Undischarged means a primary cell or battery that has not been wholly or partly discharged.

Venting means the release of excessive internal pressure from a cell or battery in a manner intended by design to preclude rupture or disassembly.

Watt-hour rating, see *Nominal energy*.

38.3.3 When a cell or battery type is to be tested under this sub-section, the number and condition of cells and batteries of each type to be tested are as follows:

(a) When testing primary cells and batteries under tests T.1 to T.5 the following shall be tested in the quantity indicated:

(i) ten cells in undischarged states;

(ii) ten cells in fully discharged states;

(iii) four small batteries in undischarged states;

(iv) four small batteries in fully discharged states;

(v) four large batteries in undischarged states; and

(vi) four large batteries in fully discharged states.

(b) When testing rechargeable cells and batteries under tests T.1 to T.5 the following shall be tested in the quantity indicated:

(i) ten cells at first cycle, in fully charged states;

(ii) four small batteries at first cycle, in fully charged states;

(iii) four small batteries after 50 cycles ending in fully charged states;

(iv) two large batteries at first cycle, in fully charged states; and

(v) two large batteries after 25 cycles ending in fully charged states.

(c) When testing primary and rechargeable cells under test T.6, the following shall be tested in the quantity indicated:

(i) for primary cells, five cells in undischarged states and five cells in fully discharged states;

(ii) for component cells of primary batteries, five cells in undischarged states and five cells in fully discharged states;

(iii) for rechargeable cells, five cells at first cycle at 50% of the design rated capacity; and

(iv) for component cells of rechargeable batteries, five cells at first cycle at 50% of the design rated capacity.

(d) When testing rechargeable batteries or rechargeable single cell batteries under test T.7, the following shall be tested in the quantity indicated:

(i) four small batteries at first cycle, in fully charged states;

(ii) four small batteries after 50 cycles ending in fully charged states;

(iii) two large batteries at first cycle, in fully charged states; and

(iv) two large batteries after 25 cycles ending in fully charged states.

Batteries not equipped with overcharge protection that are designed for use only in a battery assembly, which affords such protection, are not subject to the requirements of this test.

(e) When testing primary and rechargeable cells and component cells under test T.8, the following shall be tested in the quantity indicated:

(i) ten primary cells in fully discharged states;

(ii) ten primary component cells in fully discharged states;

(iii) ten rechargeable cells, at first cycle in fully discharged states;

(iv) ten rechargeable component cells, at first cycle in fully discharged states;

(v) ten rechargeable cells after 50 cycles ending in fully discharged states; and

(vi) ten rechargeable component cells after 50 cycles ending in fully discharged states.

(f) When testing a battery assembly in which the aggregate lithium content of all anodes, when fully charged, is not more than 500 g, or in the case of a lithium ion battery, with a Watt-hour rating of not more than 6 200 Watt-hours, that is assembled from batteries that have passed all applicable tests, one battery assembly in a fully charged state shall be tested under tests T.3, T.4 and T.5, and, in addition, test T.7 in the case of a rechargeable battery assembly. For a rechargeable battery assembly, the assembly shall have been cycled at least 25 cycles.

When batteries that have passed all applicable tests are electrically connected to form a battery assembly in which the aggregate lithium content of all anodes, when fully charged, is more than 500 g, or in the case of a lithium ion battery, with a Watt-hour rating of more than 6 200 Watt-hours, that battery assembly does not need to be tested if it is equipped with a system capable of monitoring the battery assembly and preventing short circuits, or over discharge between the batteries in the assembly and any overheat or overcharge of the battery assembly.

38.3.4 ***Procedure***

Tests T.1 to T.5 shall be conducted in sequence on the same cell or battery. Tests T.6 and T.8 shall be conducted using not otherwise tested cells or batteries. Test T.7 may be conducted using undamaged batteries previously used in tests T.1 to T.5 for purposes of testing on cycled batteries.

38.3.4.1 *Test T.1: Altitude simulation*

38.3.4.1.1 Purpose

This test simulates air transport under low-pressure conditions.

38.3.4.1.2 Test procedure

Test cells and batteries shall be stored at a pressure of 11.6 kPa or less for at least six hours at ambient temperature (20 ± 5 °C).

38.3.4.1.3 Requirement

Cells and batteries meet this requirement if there is no leakage, no venting, no disassembly, no rupture and no fire and if the open circuit voltage of each test cell or battery after testing is not less than 90% of its voltage immediately prior to this procedure. The requirement relating to voltage is not applicable to test cells and batteries at fully discharged states.

38.3.4.2 *Test T.2: Thermal test*

38.3.4.2.1 Purpose

This test assesses cell and battery seal integrity and internal electrical connections. The test is conducted using rapid and extreme temperature changes.

38.3.4.2.2 Test procedure

Test cells and batteries are to be stored for at least six hours at a test temperature equal to72 ± 2 °C, followed by storage for at least six hours at a test temperature equal to - 40 ± 2 °C. The maximum time interval between test temperature extremes is 30 minutes. This procedure is to be repeated until 10 total cycles are complete, after which all test cells and batteries are to be stored for 24 hours at ambient temperature (20 ± 5 °C). For large cells and batteries the duration of exposure to the test temperature extremes should be at least 12 hours.

38.3.4.2.3 Requirement

Cells and batteries meet this requirement if there is no leakage, no venting, no disassembly, no rupture and no fire and if the open circuit voltage of each test cell or battery after testing is not less than 90% of its voltage immediately prior to this procedure. The requirement relating to voltage is not applicable to test cells and batteries at fully discharged states.

38.3.4.3 *Test T.3: Vibration*

38.3.4.3.1 Purpose

This test simulates vibration during transport.

38.3.4.3.2 Test procedure

Cells and batteries are firmly secured to the platform of the vibration machine without distorting the cells in such a manner as to faithfully transmit the vibration. The vibration shall be a sinusoidal waveform with a logarithmic sweep between 7 Hz and 200 Hz and back to 7 Hz traversed in 15 minutes. This cycle shall be repeated 12 times for a total of 3 hours for each of three mutually perpendicular mounting positions of the cell. One of the directions of vibration must be perpendicular to the terminal face.

The logarithmic frequency sweep shall differ for cells and batteries with a gross mass of not more than 12 kg (cells and small batteries), and for batteries with a gross mass of more than 12 kg (large batteries).

For cells and small batteries: from 7 Hz a peak acceleration of 1 g_n is maintained until 18 Hz is reached. The amplitude is then maintained at 0.8 mm (1 6 mm total excursion) and the frequency increased until a peak acceleration of 8 g_n occurs (approximately 50 Hz). A peak acceleration of 8 g_n is then maintained until the frequency is increased to 200 Hz.

For large batteries: from 7 Hz to a peak accele ration of 1 g_n is maintained until 18 Hz is reach ed. The amplitude is then maintained at 0.8 mm (1.6 mm total excursion) and the frequency increased until a peak acceleration of 2 g_n occurs (approximately 25 Hz). A peak acceleration of 2 g_n is then maintained until the frequency is increased to 200 Hz.

38.3.4.3.3 Requirement

Cells and batteries meet this requirement if there is no leakage, no venting, no disassembly, no rupture and no fire during the test and after the test and if the open circuit voltage of each test cell or battery directly after testing in its third perpendicular mounting position is not less than 90% of its voltage immediately prior to this procedure. The requirement relating to voltage is not applicable to test cells and batteries at fully discharged states.

38.3.4.4 *Test T.4: Shock*

38.3.4.4.1 Purpose

This test simulates possible impacts during transport.

38.3.4.4.2 Test procedure

Test cells and batteries shall be secured to the testing machine by means of a rigid mount which will support all mounting surfaces of each test battery. Each cell or battery shall be subjected to a half-sine shock of peak acceleration of 150 g_n and pulse duration of 6 milliseconds. Each cell or battery shall be subjected to three shocks in the positive direction followed by three shocks in the negative direction of three mutually perpendicular mounting positions of the cell or battery for a total of 18 shocks.

However, large cells and large batteries shall be subjected to a half-sine shock of peak acceleration of 50 g_n and pulse duration of 11 milliseconds. Each cell or battery is sub jected to three shocks in the po sitive direction followed by three shocks in th e negative direction of each of three mutually perpendicular mounting positions of the cell for a total of 18 shocks.

38.3.4.4.3 Requirement

Cells and batteries meet this requirement if there is no leakage, no venting, no disassembly, no rupture and no fire and if the open circuit voltage of each test cell or battery after testing is not less than 90% of its voltage immediately prior to this procedure. The requirement relating to voltage is not applicable to test cells and batteries at fully discharged states.

38.3.4.5 *Test T.5: External short circuit*

38.3.4.5.1 Purpose

This test simulates an external short circuit.

38.3.4.5.2 Test procedure

The cell or battery to be tested shall be temperature stabilized so that its external case temperature reaches 55 ± 2 °C and then the cell or battery shall be subjected to a short circuit condition with a total external resistance of less than 0.1 ohm at 55 ± 2 °C. This short circuit condition is continued for at least one hour after the cell or battery external case temperature has returned to 55 ± 2 °C.

38.3.4.5.3 Requirement

Cells and batteries meet this requirement if their external temperature does not exceed 170 °C and there is no disassembly, no rupture and no fire during the test and within six hours after the test.

38.3.4.6 *Test T.6: Impact / Crush*

38.3.4.6.1 Purpose

These tests simulate mechanical abuse from an impact or crush that may result in an internal short circuit.

38.3.4.6.2 Test procedure – Impact (applicable to cylindrical cells not less than 18.0 mm in diameter)

The sample cell or component cell is to be placed on a flat smooth surface. A 15.8 mm ± 0.1mm diameter, at least 6 cm long, or the longest dimension of the cell, whichever is greater, Type 316 stainless steel bar is to be placed across the centre of the sample. A 9.1 kg ± 0.1 kg mass is to be dropped from a height of 61 ± 2.5 cm at the intersection of the bar and sample in a controlled manner using a near frictionless, vertical sliding track or channel with minimal drag on the falling mass. The vertical track or channel used to guide the falling mass shall be oriented 90 degrees from the horizontal supporting surface.

The test sample is to be impacted with its longitudinal axis parallel to the flat surface and perpendicular to the longitudinal axis of the 15.8 mm ± 0.1mm diameter curved surface lying across the centre of the test sample. Each sample is to be subjected to only a single impact.

38.3.4.6.3 Test Procedure – Crush (applicable to prismatic, pouch, coin/button cells and cylindrical cells less than 18.0 mm in diameter)

NOTE: Diameter here refers to the design parameter (for example the diameter of 18650 cells is 18.0 mm).

A cell or component cell is to be crushed between two flat surfaces. The crushing is to be gradual with a speed of approximately 1.5 cm/s at the first point of contact. The crushing is to be continued until the first of the three options below is reached.

(a) The applied force reaches 13 kN ± 0.78 kN;

Example: The force shall be applied by a hydraulic ram with a 32 mm diameter piston until a pressure of 17 MPa is reached on the hydraulic ram.

(b) The voltage of the cell drops by at least 100 mV; or

(c) The cell is deformed by 50% or more of its original thickness.

Once the maximum pressure has been obtained, the voltage drops by 100 mV or more, or the cell is deformed by at least 50% of its original thickness, the pressure shall be released.

A prismatic or pouch cell shall be crushed by applying the force to the widest side. A button/coin cell shall be crushed by applying the force on its flat surfaces. For cylindrical cells, the crush force shall be applied perpendicular to the longitudinal axis.

Each test cell or component cell is to be subjected to one crush only. The test sample shall be observed for a further 6 h. The test shall be conducted using test cells or component cells that have not previously been subjected to other tests.

38.3.4 6.4 Requirement

Cells and component cells meet this requirement if their external temperature does not exceed 170 °C and there is no disassembly and no fire during the test and within six hours after this test.

38.3.4.7 *Test T.7: Overcharge*

38.3.4.7.1 Purpose

This test evaluates the ability of a rechargeable battery to withstand an overcharge condition.

38.3.4.7.2 Test procedure

The charge current shall be twice the manufacturer's recommended maximum continuous charge current. The minimum voltage of the test shall be as follows:

(a) when the manufacturer's recommended charge voltage is not more than 18 V, the minimum voltage of the test shall be the lesser of two times the maximum charge voltage of the battery or 22V.

(b) when the manufacturer's recommended charge voltage is more than 18V, the minimum voltage of the test shall be 1.2 times the maximum charge voltage.

Tests are to be conducted at ambient temperature. The duration of the test shall be 24 hours.

38.3.4.7.3 Requirement

Rechargeable batteries meet this requirement if there is no disassembly and no fire during the test and within seven days after the test.

38.3.4.8 *Test T.8: Forced discharge*

38.3.4.8.1 Purpose

This test evaluates the ability of a primary or a rechargeable cell to withstand a forced discharge condition.

38.3.4.8.2 Test procedure

Each cell shall be forced discharged at ambient temperature by connecting it in series with a 12V D.C. power supply at an initial current equal to the maximum discharge current specified by the manufacturer.

The specified discharge current is to be obtained by connecting a resistive load of the appropriate size and rating in series with the test cell. Each cell shall be forced discharged for a time interval (in hours) equal to its rated capacity divided by the initial test current (in ampere).

38.3.4.8.3 Requirement

Primary or rechargeable cells meet this requirement if there is no disassembly and no fire during the test and within seven days after the test. ".

APPENDIX 4

THE SUPPLEMENT TO THE TECHNICAL INSTRUCTIONS
DG AUDIT FORM – OPERATOR
(PART S-7)

ATTACHMENT I TO CHAPTER 5

DANGEROUS GOODS AUDIT FORM

Name of Operator: _____

Inspector: _____

Date(s) of Inspection: _____

Location: _____

Principle Operator/Handling Agent Personnel involved: _____

The objective of an audit is to demonstrate that operators have procedures in place, either on their own account and/or through their handling agent(s), to ensure the correct processing and handling of dangerous goods.

During the audit, if non-conformities are identified, they shall be entered against the applicable requirement in the "Non-conformities" section. Where there is a non-conformity for a requirement that is not shown, it shall be added in the space provided. Observations that are not non-conformities against a requirement or a procedure shall be entered in the "Observations" section.

At the end of the audit, the non-conformities and observations shall be discussed with the operator to ensure that they are understood, together with the necessary action to be taken within the applicable timescales. The inspector and a responsible person of the operator should then sign the form in the spaces provided. The original shall be left with the responsible person, with a copy retained by the inspector.

Level 1: Any non-compliance with the Technical Instructions, which would lower the standard and probably place the aircraft or personnel in a hazardous situation. Depending on the extent of the Level 1 finding, consideration should be given to prohibiting the operator from carrying dangerous goods until corrective action has been taken.

Level 2: Any non-compliance with the Technical Instructions, which could lower the standard and possibly place the aircraft or personnel in a hazardous situation. The corrective action period granted by the National Aviation Authority should be appropriate to the nature of the finding, but initially not more than three months.

Level 3: An observation intended to give background information. Level 3 must not include information suggesting non-compliance with the requirements of the Technical Instructions. No regulatory action is required to be taken in the case of Level 3.

CAA Reference	*Summary of requirement*	*Technical Instructions reference*	*Audited*	*Non-conformity*	*Level*	*Details of non-conformity (continued below, where necessary)*
1	Dangerous goods permissions, approvals or exemptions (held and correct)	N/A	☐	☐		Verify approval held if appropriate to State
2	Provision of information to handling agents	7;4.2	☐	☐		Verify manuals, staff instructions, etc. are provided
3	Information about dangerous goods contained in the Operations Manual and/or other manuals	7;4.2	☐	☐		Verify information is present, correct and current
4	Provision of relevant manuals and instructions to cargo and operations staff	7;4.2	☐	☐		Verify manuals, staff instructions, etc. are provided
5	Up-to-date copies of dangerous goods reference publications (e.g. ICAO/IATA)	1;1.2	☐	☐		Verify copy held and which edition
6	Procedures for loading and stowing medical aid for a patient, and provision of information to handling agents	1;1.1.5.1 a), 1;1.1.5.2-1.1.5.4 7;4.2	☐	☐		Verify procedure available

CAA Reference	*Summary of requirement*	*Technical Instructions reference*	*Audited*	*Non-conformity*	*Level*	*Details of non-conformity (continued below, where necessary)*
7	Compliance with requirements for "combi" aircraft where main deck hold is not at least Class B (exemption/approval or prohibition) and provision of information to handling agents	7;2.1	☐	☐		Verify compliance, if applicable
8	Procedures for notification by pilot-in-command to air traffic services in the event of an in-flight emergency	7;4.3	☐	☐		Verify availability
9	Emergency response guidance information on board aircraft	7;4.9	☐	☐		Verify availability
10	Procedures for reporting of dangerous goods accidents, incidents, undeclared/misdeclared dangerous goods, dangerous goods occurrences, and liaison between handling agent/operator	7;4.4, 7;4.5 and 7;4.6	☐	☐		Verify arrangement between operator and handling agent established to ensure reporting to appropriate authorities
11	Procedures for immediate notification to the competent authority of dangerous goods on board an aircraft in the event of an aircraft accident or incident	7;4.7	☐	☐		Verify arrangement between operator and handling agent established to ensure reporting to the State in which the accident occurred
12	Adequacy and standard of flight crew training	1;4.1.2	☐	☐		To be verified
13	Adequacy and standard of cabin crew training (including emergency response training)	1;4.1.2	☐	☐		To be verified
14	Adequacy and standard of ground staff training (including emergency response training)	1;4.1.2	☐	☐		To be verified
15	Dangerous goods training records maintained	1;4.2.5	☐	☐		To be verified
16	Currency of ground staff training	1;4.2.3	☐	☐		To be verified
17	Currency of flight/cabin crew training	1;4.2.3	☐	☐		To be verified
18	Training of security staff employed by the operator (for both cargo and passengers)	1;4.1.1 g)	☐	☐		To be verified, if applicable
19	Awareness of requirements by maintenance staff in respect of replacements or unserviceable items	1;2.2.2, 1.2.2.3 and 1.2.2.4	☐	☐		To be verified
20	Provision of information/instructions on dangerous goods and passengers to passenger handling staff	7;4.2 and 7;6.1	☐	☐		Verify appropriate manuals, information, etc. available to passenger handling staff
21	Measures to ensure dangerous goods information is provided with/in passenger tickets	7;5.1	☐	☐		Confirm information provided, e.g. at ticket sales point at airport
22	Procedures for dealing with and the reporting of passengers with dangerous goods that are not permitted (including liaison with security staff)	7;4.5	☐	☐		Verify arrangement between operator and handling agent established to ensure reporting to the State in which the dangerous goods were discovered
23	Dangerous goods notices at the cargo acceptance point	7;4.8	☐	☐		Check notice(s) in place
24	Dangerous goods notices at ticket sales desks, check-in desks and boarding areas (including measures to ensure they are displayed by handling agents)	7;5.1	☐	☐		Check notice(s) in place

CAA Reference	*Summary of requirement*	*Technical Instructions reference*	*Audited*	*Non-conformity*	*Level*	*Details of non-conformity (continued below, where necessary)*
25	Adequacy and use of acceptance checklists	7;1.3	☐	☐		Verify use and adequacy of checklist
26	Retention of acceptance check forms, dangerous goods transport documents (shipper's declarations) and NOTOCs	7;4.11	☐	☐		Verify documents are retained for at least 3 months
27	Handling of dangerous goods packages (including Divisions 4.1 and 5.2) in the warehouse	7;2.3, 7;2.14 and 7;2.15	☐	☐		Verify packages are handled correctly
28	Preparation and building of pallets and ULDs with regard to segregation and separation of dangerous goods	7;2.2, 7;2.8, 7;2.9 and 7;2.11	☐	☐		Verify dangerous goods segregated in accordance with Technical Instructions
29	ULD marking and labelling	7;2.8	☐	☐		Verify ULD tags marked correctly (e.g. with class/division)
30	Inspections for damage or leakage immediately prior to loading and immediately after unloading	7;3.1	☐	☐		Verify inspections carried out
31	Procedures for removal of damaged or leaking packages from aircraft, inspection of aircraft for contamination; and decontamination	7;3.1 and 7;3.2	☐	☐		Verify staff awareness of applicable procedures
32	Procedures for loading and stowing a wheelchair for a passenger (including notification to the commander)	Table 8-1, 5), 6) and 7)	☐	☐		Verify procedure (check-in staff)
33	Correct loading of dangerous goods (including segregation, securing and accessibility)	7;2	☐	☐		Verify (by observation if possible) correct loading of dangerous goods
34	Completion of NOTOCs and provision to flight crew (including signing of form)	7;4.1	☐	☐		Verify correct completion (including signature/some other indication)
35	Accessibility of NOTOCs (or information on it) on ground at points of departure and scheduled arrival for duration of flight	7;4.1.8	☐	☐		Verify accessibility
36	Accessibility of dangerous goods transport document/shipper's declarations during journey	7;1.2.2 and 7;1.2.3	☐	☐		Verify accessibility

CAA reference	***Details of non-conformity (continued from above table)***

Additional Observations

	Description
1	
2	
3	
4	
5	

Signature of Inspector _____ Date _____

Signature of Responsible Person* _____ Date _____

* Signature by the Responsible Person indicates that the non-conformities have been explained, but not necessarily agreed upon by the Responsible Person or the Operator concerned.

APPENDIX 5

HOW TO CALCULATE LITHIUM BATTERY WATT-HOURS & ESTIMATED LITHIUM METAL CONTENT

HOW TO CALCULATE WATT-HOURS

Volts (V) x ampere hour (Ah) = Watt-hours (Wh)

- This calculation is mainly used for **Lithium Ion Cells and Batteries**.
- If the battery you wish to ship is rated at 14.8 volts and 3,200 mAh:
- 3,200 mAh is 3,200 milliamp hours. Since most batteries have a low ampere hour rating, they are rated in milliamp hours (mAh).
- Since a milliamp hour is one thousandth of an ampere hour, then:divide
    - 3,200 mAh divided by 1000 to get ampere hours (Ah).
    - 3,200 mAh ÷ 1000 = 3.2 Ampere hours
- To determine the watt hours in this battery, multiply 11.1 volts by 4.4 ampere hours:

14.8 V x 3.2 Ah = 47.36 Wh

Note – Contact manufacturer if battery or cell is not marked.

HOW TO CALCULATE THE ESTIMATED LITHIUM METAL CONTENT

Ah per cell x 0.3gm x number of cells

- This calculation to estimate the lithium metal content is used by **Lithium Metal Cells and Batteries**.
- Many batteries are not rated in Ampere hours (Ah), they are rated in milliamp hours (mAh). Milliamp hours are one thousandth of an ampere hour. To determine the Ah, divide the mAh by 1,000.
- It requires about 0.3 grams (g) of lithium metal to produce 1 Ampere hour of power. Example, if the battery you wish to ship is rated at 2,500 mAh per cell and contains 6 cells:
    - Divide 2,500 mAh by 1,000 to get the rating in Ampere hours: 2,500 mAh ÷ 1,000 = 2.5 Ah
    - Multiply the Ah by 0.3 g to determine the estimated amount of lithium metal in each cell: 2.5 Ah x 0.3 g/Ah = 0.75 grams of lithium in each cell
- Multiply the amount of lithium in each cell by the number of cells in each battery:

0.75 grams per cell x 6 cells = 4.5 grams of lithium in the battery

Note – Contact manufacturer if battery or cell is not marked.

APPENDIX 6

LITHIUM CELL OR BATTERY:
UN MANUAL OF TESTS & CRITERIA INSPECTION TOOL

UN MANUAL OF TESTS & CRITERIA

CELL OR BATTERY TEST INSPECTION TOOL

Step 1:

Determine test required based on battery or cell types manufactured.

Tests required per cell or battery type (see table below):

Primary (metal)		**Rechargeable (ion)**			
Cell	Battery	Cell	Battery	Single cell with overcharge protection	Component cell not transported separately from battery it is part of
T1	T1	T1	T1	T1	
T2	T2	T2	T2	T2	
T3	T3	T3	T3	T3	
T4	T4	T4	T4	T4	
T5	T5	T5	T5	T5	
T6		T6		T6	T6
			T7	T7	
T8		T8		T8	T8
					Note- if component cell is transported separately treat as single cell

Step 2:

For each test (T1 – T8) required above, ask the following questions and record results.

1) When was the test performed?
2) Who performed the test?
3) Where was the test performed?
4) Was the test performed as required?
5) How was the test documented?
    a. Was it video recorded?
    b. Paper documentation only?