

NOTICE

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

N 8900.344

National Policy

Effective Date:
2/9/16

Cancellation Date:
2/9/17

SUBJ: Transportation of Lithium Ion and Lithium Ion Polymer Batteries as Cargo

1. Purpose of This Notice. This notice provides guidance to principal inspectors (PI) and Hazardous Materials Safety Inspectors (HSI) on surveillance requirements of operational procedures for the carriage of lithium ion and lithium ion polymer batteries as cargo on aircraft.

2. Audience. The primary audience for this notice is Flight Standards District Office (FSDO) and certificate management office (CMO) PIs who are responsible for regulatory oversight of Title 14 of the Code of Federal Regulations (14 CFR) part 121 certificate holders. The secondary audience includes Flight Standards (AFS) branches and divisions in the regions and headquarters (HQ), and Hazardous Materials Safety branches and divisions in the regions and in HQ.

Note: This notice applies to part 121 certificate holders that have a “will carry” authorization in Operations Specification (OpSpec) A055, Carriage of Hazardous Materials. PIs with certificate holders not issued OpSpec A055 should contact their certificate holders to raise awareness of the potential risk of inadvertent transportation of lithium batteries, and then work with their certificate holders to develop procedures that ensure lithium batteries are not inadvertently accepted.

3. Where You Can Find This Notice. You can find this notice on the MyFAA employee Web site at https://employees.faa.gov/tools_resources/orders_notices. Inspectors can access this notice through the Flight Standards Information Management System (FSIMS) at <http://fsims.avs.faa.gov>. Operators can find this notice on the Federal Aviation Administration’s (FAA) Web site at <http://fsims.faa.gov>. This notice is available to the public at http://www.faa.gov/regulations_policies/orders_notices.

4. Background. The carriage of lithium batteries is a safety risk due to fires that may exceed the fire suppression capabilities of aircraft, leading to a potentially catastrophic failure of the airframe.

a. Data Collection. The FAA continues to evaluate the hazards and risks associated with the transportation of lithium batteries on aircraft. In order to obtain more data, the FAA has determined that PIs and HSIs must perform surveillance on their assigned carriers. The information obtained from the surveillance conducted will:

- Support an initial risk assessment associated with the carriage of these batteries, and
- Provide the FAA with a means to determine requirements for future action.

b. Battery Types and Fires. Lithium batteries fall into two broad categories: lithium ion (rechargeable) and lithium metal (nonrechargeable). Recent tests conducted by the FAA Technical Center concluded that these batteries could cause fires that cannot be extinguished using available fire extinguishing systems currently on board aircraft.

c. Thermal Runaway. Lithium batteries experiencing thermal runaway can create conditions including:

- Intense fires,
- Explosive hydrogen and hydrocarbon gases, and
- Quantities of gases sufficient to cause an explosive atmosphere and unsafe condition.

(1) The conditions necessary for a lithium battery to go into thermal runaway are associated with internal defects of the batteries, improper handling of the packaging, and extreme environmental conditions.

(2) The following variables may impact the outcomes, should thermal runaway occur:

- The total number, size/type, and chemistry of lithium batteries on board the aircraft, including state of charge if known;
- The batteries' proximity to one another; and
- The location of the batteries in association with other dangerous cargo.

Note: See Appendix A, Classification of Lithium Batteries, for further information on the classification of lithium batteries.

5. Industry/FAA Recommendations. Industry groups (the International Coordinating Council of Aerospace Industries Associations (ICCAIA)), manufacturers (Boeing and Airbus), the International Civil Aviation Organization (ICAO), and the FAA have worked together to establish recommendations for certificate holders transporting lithium batteries. One critical step listed among the recommendations is the Safety Risk Assessment (SRA). Regardless of the certificate holder's status with Safety Management Systems (SMS), the FAA believes that an SRA could assist certificate holders in determining if the risk of carrying lithium batteries is acceptable.

Note: See Appendix C, Example Safety Risk Assessment (SRA), for an example of an SRA.

6. Discussion. The carriage of lithium batteries is a recognized risk based on significant laboratory testing and the number of catastrophic accidents/incidents that have occurred in aviation during the past 10 years. The FAA needs accurate information on certificate holder operations to support an initial risk assessment associated with the carriage of these batteries.

a. Certificate Holders' Responsibility. The FAA and others continue to research the best possible ways to transport these batteries and provide new risk mitigation strategies. Until these new strategies are developed, certificate holders must develop processes and procedures to prevent unintended outcomes.

b. FAA Inspectors' Role. FAA inspectors play a critical role in confirming that certificate holders are appropriately evaluating the risks associated with transporting lithium batteries and making clear decisions to reduce risk to an acceptable level. The purpose of data collection required by this notice is to provide notice to certificate holders of the risk of transporting lithium batteries and confirm that each certificate holder uses appropriate risk mitigation procedures.

7. Action. PIs and HSIs should review the documents listed in paragraph 9 to familiarize themselves with current information on risk associated with the carriage of lithium batteries and also accomplish the following:

a. Areas of Evaluation. PIs and HSIs will verify that procedures in approved or accepted manuals address the risks and mitigations associated with the transportation of lithium batteries. PIs utilizing the Safety Assurance System (SAS) will use the National Custom Data Collection Tool (C DCT) template labeled "Lithium Battery" for verification. HSIs using the Air Transportation Oversight System (ATOS) will continue to document their findings in ATOS using an Other Dynamic Observation Report (DOR). Regardless of the automation used, PIs and HSIs should evaluate the following areas in the certificate holder's procedures:

(1) How the operator determines battery shipments are in compliance with appropriate packaging and shipping requirements.

(2) What risk mitigation is applied when carrying high-density (overpacks) packages and cells.

(3) What training is included in the operator's procedures for all personnel who handle lithium batteries.

(4) How an operator conducts a review of the shipper's history of compliance and training with dangerous goods regulations.

(5) Proper means of loading batteries in the cargo compartment:

- Avoidance of container damage when loading,
- Proper cargo restraint of bulk shipment not secured on a unit load device (ULD), and
- Proper ULD loading if used.

(6) The load plan used for location of the batteries in the cargo compartment:

- Proximity to other batteries, and
- Proximity to other dangerous goods.

(7) Training programs should include:

- Information on the dangers of lithium batteries,
- Proper labeling, loading, and rejection criteria for damaged goods, and
- Emergency response in the event of a thermal runaway.

(8) Conditionally excepted items do not require declaration; therefore, certificate holders should have procedures addressing the following:

- Ensure operators recognize the hazard of accepting conditionally excepted items as cargo,
- Verify that cargo and ramp personnel receive training on conditionally excepted items, and
- If the certificate holder policy requires rejection of conditionally excepted items, determine the procedures used for identification and rejection.

(9) Adequate notification procedures for the flight crew, to include:

- Location of the batteries in the cargo area, and
- Quantity of items shipped.

b. Review of Associated Information. PIs and HSIs will provide a copy of Safety Alerts for Operators (SAFO) 16001, Risks of Fire or Explosion when Transporting Lithium Ion or Lithium Metal Batteries as Cargo on Passenger and Cargo Aircraft, to their operators.

c. Confirmation of Risk Assessment. PIs and HSIs should confirm that operators have assessed the risks and considered mitigation strategies for cargo shipment of lithium batteries. Operators that have implemented a formal SMS should accomplish an SRA, in accordance with the Safety Risk Management process in its SMS.

Note: See Appendix C for suggested items to consider when conducting an SRA.

8. SAS and ATOS Reporting. PIs in SAS will use the National C DCT template labeled “Lithium Battery” to record their surveillance and will place “lithium,” without quotes, in the Local/Regional/National Use field. HSIs using ATOS will create an Other DOR. PIs will evaluate the items listed in subparagraphs 7a(1)–(9), and place “lithium,” without quotes, in the Local/Regional/National Use field.

a. Needed Data. Record all answers, to show whether the certificate holder has or has not mitigated the risk to an acceptable level. Responses must contain an explanation of how the certificate holder has/has not met the requirements within this notice. Recording only a “Yes” or “No” response does not provide sufficient information for data analysis.

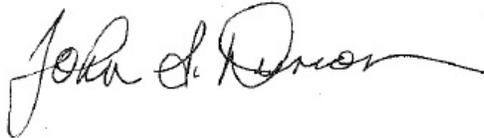
b. Completion Date. Complete the data collection by March 31, 2016.

9. References (current editions).

- SAFO 10017, Risks in Transporting Lithium Batteries in Cargo by Aircraft, dated 10/8/2010.
- Information found in the FAA Technical Center's fire safety site (<http://www.fire.tc.faa.gov/systems/Lithium-Batteries>).
- IATA lithium batteries risk mitigation guidance for operators (<http://www.iata.org/whatwedo/cargo/dgr/Pages/lithium-batteries.aspx>).
- ICCAIA guidance (<http://www.iccaia.org/Pages/Transport-of-Lithium-Batteries-on-Passenger-and-Cargo-Aircraft.aspx>).
- European Aviation Safety Agency (EASA) Safety Information Bulletin (SIB) No.: 2015-19, Transport of Lithium Batteries as Cargo by Air (http://ad.easa.europa.eu/blob/EASA_SIB_2015_19.pdf/SIB_2015-19_1).
- SAFO 16001, Risks of Fire or Explosion when Transporting Lithium Ion or Lithium Metal Batteries as Cargo on Passenger and Cargo Aircraft.

Note: Boeing operators can reference Boeing Multi Operator Message, MOM-MOM-15-0469-01B, dated July 17, 2015. Airbus operators can reference Airbus In-Service Information publication, ISI 00.00.00182, dated July 24, 2015.

10. Disposition. We will incorporate the information in this notice into FAA Order 8900.1 before this notice expires. Direct questions concerning this notice to the Flight Standards National Field Office, AFS-900, at (703) 661-0500.



John S. Duncan
Director, Flight Standards Service

Appendix A. Classification of Lithium Batteries

Note: Regulation of these items is at the package level. Not addressed are the consequences of multiple packages on overall risk. In some cases, shipment consists of thousands of cells as a collection of small individual packages combined into overpacks (multiple individual packages bundled together for shipment). Overpack consolidation into even larger shipments also occurs.

Lithium batteries are currently classified as Class 9 materials under the Hazardous Materials Regulations (HMR) (Title 49 of the Code of Federal Regulations (49 CFR) parts 171–180).

The United Nations (UN) identification number for lithium *ion* batteries, which include lithium ion polymer batteries, is UN 3480. The UN identification number for lithium ion batteries installed in equipment or packed with equipment is UN 3481.

The UN identification number for lithium *metal* batteries is UN 3090. The UN identification number for batteries installed in equipment or packed with equipment is UN 3091.

Previously, most lithium batteries and devices were classified as excepted from the Class 9 provisions of the HMR. Recent testing resulted in new requirements for how to accept, package, and provide notification related to UN 3480 and UN 3481 classifications.

Note: Only cargo aircraft may carry lithium metal batteries. Passenger aircraft may not transport lithium metal batteries not contained in or packed with equipment.

Appendix B. Image of Outcome of Thermal Runaway of Lithium Batteries



This item had undeclared lithium batteries installed as a power source in equipment. This is an example of a thermal runaway of lithium batteries.

Appendix C. Example Safety Risk Assessment (SRA)

1. SRAs. Boeing, Airbus, the International Air Transport Association (IATA), and the International Civil Aviation Organization (ICAO) also recommend that operators choosing to accept lithium ion batteries for shipment conduct an SRA prior to accepting them. Unless operators have access to the information necessary to support their SRAs, they cannot determine if they can mitigate the risks associated with carriage of lithium batteries to an acceptable level of safety. The Federal Aviation Administration (FAA) is working with ICAO and aircraft manufacturers to support this vital safety risk assessment activity.

2. Content of the SRA. SRAs consist of a set of processes that involve analysis of systems and their operational environments, identification of hazards in those systems and environments, analysis of the associated risk, and decisions about risk acceptability. The following information should be considered in conducting SRAs and decisions regarding acceptability of the risk.¹

a. System and Operational Analysis (Operations and Environment): What Are We Doing?

- (1) Type of operation:
 - (a) Passenger or all-cargo.
 - (b) Domestic or international.
- (2) Type of carriage (e.g., bulk or incidental).
- (3) Method of receipt:
 - (a) Direct from shipper.
 - (b) Through a freight forwarder.
 - (c) Interline transfer from another carrier.
- (4) Documentation available on shipments.
- (5) Conditions of carriage:
 - (a) The types and quantities of lithium batteries carried.
 - (b) The fire protection features of each model aircraft in their fleet.
 - (c) The expected flight profile (flight duration, extended operations (ETOPS), etc.).

¹ See also the current edition of FAA Order 8040.4, *Safety Risk Management Policy*, for additional information on the safety risk management process.

(d) History of battery shippers' compliance with dangerous goods transport regulations.

(e) Quantity of batteries per flight.

(f) Location of batteries within the cargo compartment.

(g) Proximity to other dangerous goods.

(h) Potential ignition sources in the compartment.

(i) Other relevant aspects of the operator's cargo carriage experience.

b. Hazard Identification: What Could Go Wrong? Assessments should evaluate the conditions of operation and environment potentially leading to events and consequences to identify hazards. The following are characteristic of lithium battery events:

(1) Potential events.²

(2) The FAA Technical Center has identified several key characteristics of lithium battery fires that differentiate them from general aircraft fires:

(a) Thermal runaway leads to extremely high temperatures and electrolyte gases.

(b) Highly explosive atmosphere due to gas composition within the cargo hold.

(c) Aircraft fire suppression and other control mechanisms capabilities are not adequate.

(3) Possible ultimate outcomes (consequences):

(a) Aircraft damage and emergency landing.

(b) Loss of aircraft and passengers and/or crew.

c. Risk Analysis and Assessment (Decision): How Likely Are These Events to Occur?

(1) Assessments should evaluate the following under the conditions of operations contemplated by the operator:

(a) Likelihood of thermal runaway of batteries in shipment (including ability to identify and suppress thermal runaway should it start).

(b) Likelihood of fire if thermal runaway occurs.

² FAA Order 8040.4 and Title 14 of the Code of Federal Regulations (14 CFR) part 5 define hazards as "condition[s] that could foreseeably cause or contribute to an aircraft accident as defined in 49 CFR 830.2." Defining the types of accident outcomes that could occur will assist in identifying which elements of operational systems and environments could be considered hazardous. Defining these events will also assist in evaluating risk severity.

(c) Likelihood of accident if fire occurs.

(2) Based on this analysis, operators should make a decision whether or not to carry lithium batteries and, if so, under what conditions.

d. Risk Controls: What Can We Do About It?

(1) Operators should evaluate existing and potential additional controls and potential effectiveness and determine the actions needed to control risks to a level that they find acceptable.

(2) Proactive: preventive of immediate events (thermal runaway, fire):

(a) All batteries must comply with appropriate packaging and shipping requirements for dangerous goods. The regulations are a minimum standard. Should the operator require additional information to make informed decisions, that should be done through additional operator processes and procedures.

(b) Do not carry damaged packages of batteries. Do not carry packages of high-density batteries and cells unless aircraft systems have been determined to provide adequate mitigation.

(c) Training of personnel who handle the batteries must include the risks posed by lithium batteries and information on the dangers of lithium batteries, proper labeling, proper loading, and rejection criteria for damaged items.

(3) Reactive (response to thermal runaway/fire sequence):

(a) Effective emergency response in the event of a thermal runaway.

(b) Effective fire suppression.

3. References (current editions).

- FAA Order 8040.4, Safety Risk Management Policy.
- Advisory Circular (AC) 120-92, Safety Management Systems for Aviation Service Providers.