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Billing Code: 4910-60-P

DEPARTMENT OF TRANSPORTATION

Pipeline and Hazardous Materials Safety Administration

49 CFR Parts 172, 173, 175

[Docket No. PHMSA-2009-0095 (HM-224F)]

RIN 2137-AE44

Hazardous Materials: Transportation of Lithium Batteries

AGENCY: Pipeline and Hazardous Materials Safety Administration (PHMSA), DOT.

ACTION: Notice of proposed rulemaking

SUMMARY: PHMSA, in consultation with the Federal Aviation Administration (FAA), is proposing to amend requirements in the Hazardous Materials Regulations (HMR) on the transportation of lithium cells and batteries, including lithium cells and batteries packed with or contained in equipment. The proposed changes are intended to enhance safety by ensuring that all lithium batteries are designed to withstand normal transportation conditions. This would include provisions to ensure all lithium batteries are packaged to reduce the possibility of damage that could lead to a catastrophic incident, and minimize the consequences of an incident. In addition, lithium batteries would be accompanied by hazard communication that ensures appropriate and careful handling by air carrier personnel, including the flight crew, and informs both transport workers and emergency response personnel of actions to be taken in an emergency. These proposals are largely consistent with changes made to the United Nations

Recommendations on the Transport of Dangerous Goods (UN Recommendations) and the International Civil Aviation Organization Technical Instructions on the Safe Transport of Dangerous Goods by Air (ICAO Technical Instructions) and respond to recommendations issued by the National Transportation Safety Board (NTSB).

DATES: Comments must be received by [INSERT DATE 60 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER].

We are proposing a mandatory compliance date of 75 days after the date of publication of a final rule in the Federal Register. In this NPRM, we solicit comments from interested persons regarding the feasibility of the proposed compliance date.

ADDRESSES: You may submit comments by any of the following methods:

- Federal Rulemaking Portal: http://www.regulations.gov. Follow the on-line instructions for submitting comments.
- Fax: 1-202-493-2251.
- Mail: Docket Management System; U.S. Department of Transportation, Dockets Operations, M-30, Ground Floor, Room W12-140, 1200 New Jersey Avenue, S.E., Washington, DC 20590-0001.
- Hand Delivery: To U.S. Department of Transportation, Dockets Operations, M-30, Ground Floor, Room W12-140, 1200 New Jersey Avenue, S.E., Washington, DC 20590-0001 between 9 a.m. and 5 p.m. Monday through Friday, except Federal holidays.

Instructions: Include the agency name and docket number PHMSA-2009-0095 (HM-224F) or RIN 2137-AE44 for this rulemaking at the beginning of your comment. Note that all comments received will be posted without change to http://www.regulations.gov including any personal information provided. If sent by mail, comments must be submitted in duplicate. Persons wishing to receive confirmation of receipt of their comments must include a self-addressed stamped postcard.

Privacy Act: Anyone is able to search the electronic form of any written communications and comments received into any of our dockets by the name of the individual submitting the document (or signing the document, if submitted on behalf of an association, business, labor union, etc.). You may review DOT's complete Privacy Act Statement in the Federal Register published on April 11, 2000 (65 FR 19477), or you may visit http://www.regulations.gov.

Docket: You may view the public docket through the Internet at http://www.regulations.gov or in person at the Docket Operations office at the above address (See ADDRESSES).

FOR FURTHER INFORMATION CONTACT: Charles E. Betts or Kevin A. Leary Office of Hazardous Materials Standards, Pipeline and Hazardous Materials Safety Administration, telephone (202) 366-8553, or Janet McLaughlin, International & Outreach Division, Federal Aviation Administration, telephone 202-385-4897.

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I. Background

A. The Safety Problem

Lithium batteries are hazardous in transportation because they present both chemical (e.g., flammable electrolytes) and electrical hazards. If not safely packaged and handled, lithium batteries can present a significant risk in transportation. Batteries which are misused, mishandled, improperly packaged, improperly stored, overcharged, or defective can overheat and ignite and, once ignited, fires can be especially difficult to extinguish. Overheating has the potential to create a thermal runaway, a chain reaction leading to self-heating and release of the battery's stored energy. In general, the risks posed by all batteries are a function of battery size and chemistry. The high energy density (i.e. high energy to weight ratio) of lithium batteries increases the consequences of a short circuit or fire posing a greater risk in transportation.

Lithium batteries fall into one of two basic categories, lithium metal, including lithium alloy (also known as primary lithium batteries), and lithium ion, including lithium ion polymer (also known as secondary lithium batteries). As the name indicates, lithium metal batteries contain a small amount of metallic lithium or a lithium alloy. Batteries of this type are mostly non-rechargeable and these cells and batteries are often used in medical devices, computer memory and as replaceable batteries (AA and AAA size) suitable for electronic devices. The lithium content in these cells and batteries ranges from a fraction of a gram to a few grams and typical geometries include coin cells,

cylindrical, and rectangular. Conversely, lithium ion cells and batteries contain a lithium compound (e.g., lithium cobalt dioxide, lithium iron phosphate) and they are generally rechargeable. Lithium ion batteries are mostly found in portable computers, mobile phones and power tools. Common configurations are cylindrical and rectangular. The size of a lithium ion battery is currently measured by equivalent lithium content. Equivalent lithium content is described in greater detail in Part II, Section C "Watt Hours versus Equivalent Lithium Content."

Once used primarily in industrial and military applications, lithium batteries have become commonplace in consumer electronic devices because they have a much higher energy density compared to their predecessors (e.g. alkaline, nickel cadmium, and nickel metal hydride batteries). They are now found in a variety of popular consumer items, including cameras, notebook computers, and mobile telephones. The numbers, types, and sizes of lithium batteries moving in transportation have grown steadily in recent years with the increasing popularity of these and other portable devices and a corresponding proliferation of battery designs, manufacturers, and applications. An estimated 3.3 billion lithium cells and batteries were transported worldwide in 2008 by all modes of transportation. On aircraft, lithium batteries are transported in shipments of batteries by themselves and they are also packed with or contained in battery powered equipment. Lithium batteries are also carried on board aircraft by passengers in portable electronic equipment and as spares; however these are not addressed in this rulemaking.

As the demand for lithium batteries increases, so do the risks associated with their transportation, especially on board aircraft. The risk of transporting lithium batteries on-board aircraft increases with the increase in the number of batteries

transported by air, given the assumption that the proportion of the number of correctly packaged shipments to the total number of shipments remains constant. In other words, an increase in the number of shipments will result in an increase in the number of incidents even if the incident rate remains the same since the number of incidents is a product of the incident rate and the total number of batteries transported. Moreover, increasing the proportion of flights that transport only one lithium battery shipment introduces a risk where previously there was none. The risk of multiple shipments on one aircraft increases the probability of an event within individual shipments, and also introduces the possibility of one defective shipment influencing other, properly packaged shipments on the same aircraft.

The increasing manifestation of these risks, inside and outside of transportation, drives the need for stricter safety standards. Since 1991, PHMSA and the FAA have identified over 40 air transport-related incidents and numerous additional non-transport incidents involving lithium batteries and devices powered by lithium batteries. These incidents occurred, variously, aboard passenger aircraft and cargo aircraft, prior to loading batteries aboard an aircraft, and after batteries were transported by air. Twenty-one of these 44 incidents involved a passenger aircraft. These incidents occurred in the cabin of the airplane, in a passenger's checked baggage, in the cargo area of the airplane or in the airport prior to boarding an aircraft. The incident data suggest overheating or damage to the device occurred immediately prior to the first indications of an incident. The remaining incidents involved lithium batteries transported aboard cargo aircraft. Many of these incidents were attributed to external short circuiting and several packages involved in the incidents were not subject to regulatory requirements for display of

hazard communication markings or labels. It is important to note that while each single incident may appear relatively benign and while the overall incident numbers may appear small when compared to the total number of lithium batteries transported by aircraft each year, the incidents illustrate the short circuit and fire risks posed by lithium batteries and the potential for a serious incident that could result if the risks as not addressed through transportation safety controls. The following table shows a breakdown of these incidents:

	Passenger Aircraft		Cargo on Passenger Aircraft	Cargo Aircraft	Grand Total
	Carry-on	Checked Baggage			
Lithium Batteries	16	1	4	23	44

A list of aviation incidents involving batteries reported to the FAA since 1991 is available through the following URL:

http://www.faa.gov/about/office_org/headquarters_offices/ash/ash_programs/hazmat/aircarrier_info/

Besides these incidents involving air transportation of lithium batteries, there have been several recalls of lithium batteries used in notebook computers and other consumer commodities. The Consumer Product Safety Commission (CPSC) found that these batteries could spontaneously overheat and cause a fire, because of a manufacturing defect or when the battery is struck forcefully on the corner (e.g., a direct fall to the ground).

In addition to incidents definitely attributed to lithium batteries, the NTSB investigated a February 7, 2006 incident at the Philadelphia International Airport in which a fire – suspected to have been caused by lithium batteries – destroyed a United

Parcel Service cargo aircraft and most of its cargo. While the captain, first officer, and a flight engineer evacuated the airplane after landing, sustaining only minor injuries, the NTSB concluded that flight crews on cargo-only aircraft remain at risk from in-flight fires involving both primary (non-rechargeable) and secondary (rechargeable) lithium batteries. Following the incident investigation, NTSB issued the following recommendations to PHMSA:

> **Safety Recommendation A-07-104:** Require aircraft operators to implement measures to reduce the risk of primary lithium batteries becoming involved in fires on cargo-only aircraft, such as transporting such batteries in fire resistant containers and/or in restricted quantities at any single location on the aircraft.
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> **Safety Recommendation A-07-105:** Until fire suppression systems are required on cargo-only aircraft, as asked for in Safety Recommendation A-07-99, require that cargo shipments of secondary lithium batteries, including those contained in or packed with equipment, be transported in crew-accessible locations where portable fire suppression systems can be used.
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> **Safety Recommendation A-07-106:** Require aircraft operators that transport hazardous materials to immediately provide consolidated and specific information about hazardous materials on board an aircraft, including proper shipping name, hazard class, quantity, number of packages, and location, to on-scene emergency responders upon notification of an accident or incident.
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> **Safety Recommendation A-07-107:** Require commercial cargo and passenger operators to report to the Pipeline and Hazardous Materials Safety Administration all incidents involving primary and secondary lithium batteries, including those contained in or packed with equipment, that occur either on board or during loading or unloading operations and retain the failed items for evaluation purposes.
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> **Safety Recommendation A-07-108:** Analyze the causes of all thermal failures and fires involving secondary and primary lithium batteries and, based on this analysis, take appropriate action to mitigate any risks determined to be posed by transporting secondary and primary lithium batteries, including those contained in or packed with equipment, on board cargo and passenger aircraft as cargo; checked baggage; or carry-on items.
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> **Safety Recommendation A-07-109:** Eliminate regulatory exemptions for the packaging, marking, and labeling of cargo shipments of small secondary lithium batteries (no more than 8 grams equivalent lithium content) until the analysis of

the failures and the implementation of risk-based requirements asked for in Safety Recommendation A-07-108 are completed.

Safety Recommendation A-08-01: In collaboration with air carriers, manufacturers of lithium batteries and electronic devices, air travel associations, and other appropriate government and private organizations, establish a process to ensure wider, highly visible, and continuous dissemination of guidance and information to the air-traveling public, including flight crews, about the safe carriage of secondary (rechargeable) lithium batteries or electronic devices containing these batteries on board passenger aircraft.

Safety Recommendation A-08-02: In collaboration with air carriers, manufacturers of lithium batteries and electronic devices, air travel associations, and other appropriate government and private organizations, establish a process to periodically measure the effectiveness of your efforts to educate the air-traveling public, including flight crews, about the safe carriage of secondary (rechargeable) lithium batteries or electronic devices containing these batteries on board passenger aircraft.

Most of the recent lithium battery incidents have been determined to originate from packages in non-compliant shipments of lithium batteries. As a result, many feel that additional regulations will not help lower the number of incidents. PHMSA and FAA believe non-compliance most often arises from confusion concerning the regulatory requirements. This confusion typically results from a lack of proper training. Currently, shippers of small-size lithium batteries are excepted from the training requirements in Subpart H of Part 172 of the HMR. The proposals in this NPRM would require these shippers to train employees who prepare lithium battery shipments for transportation to ensure the employees are knowledgeable about all the applicable regulatory requirements and that shipments conform to those requirements. The training requirements would also apply to air carrier employees; thus, training in the requirements applicable to the transportation of small lithium batteries would be included in the currently required air carrier training for acceptance, handling, and loading and unloading lithium battery packages.

The proposals in this NPRM would also subject packages of small-size lithium batteries to well-recognized hazardous materials marking and labeling requirements. These hazard communication provisions will ensure that packages of lithium batteries are placed into a well-established and high-functioning cargo transportation system that provides for more careful handling, more precise record keeping, and more detailed tracking and reporting than is typically provided for non-hazardous cargo.

In addition to markings and labels, the proposals in this NPRM would also require transport documentation to accompany a shipment of small-size lithium batteries. This includes notation of the presence and location of lithium batteries aboard the aircraft on the notice to the pilot in command (NOPIC). This will allow pilots and crew to make appropriate decisions in the event of an emergency. For example, if the flight crew identifies fire or smoke in a location where a lithium battery shipment is stowed, the crew can make an informed decision about the possible severity of the fire, whether the presence of lithium batteries could worsen the fire, and the time available to land the aircraft or take other emergency actions. The NOPIC also allows ground crew, firefighters and first responders to know how they should respond in case of an emergency because they will know not only that there are packages of lithium batteries aboard the aircraft, but also where on the aircraft these packages are located.

The hazardous materials regulatory system has for decades proven its effectiveness in mitigating hazardous materials transportation risk. Shippers and operators understand this system and have included steps in their processes to ensure compliance. However, lithium batteries have largely operated outside of this structure through the use of exceptions. This current exception-based system has created a set of

regulations that is not easily understood or enforced. This, coupled with the lack of required training, adds to the difficulty of ensuring compliance. PHMSA and FAA believe the system created specifically for the transportation of hazardous materials is sound and can be used to effectively mitigate the risk posed by lithium batteries in air transportation.

B. Overview of Current Regulations

Currently, the HMR address lithium battery transportation safety through design type testing, short circuit protection, limits on battery size, and limits on net and gross weight. The HMR provide exceptions for small cells and batteries often found in consumer electronic devices.

Lithium batteries are regulated as a Class 9 material. Class 9 materials present a hazard during transportation but do not meet the definition of any other hazard class. The HMR prohibit the transport of primary lithium batteries as cargo on passenger aircraft unless packed with or contained in equipment. Packaging and design type testing requirements and exceptions for lithium batteries are found in § 173.185. For transportation by all modes, lithium batteries of all types and sizes must pass applicable tests in the UN Manual of Tests and Criteria. These tests are designed to ensure that the battery can withstand conditions normally encountered in transportation. In addition, the battery must be designed in a manner that precludes a violent rupture and must be equipped with an effective means of preventing external short circuits and a means to prevent reverse current flow if it contains cells that are connected in parallel.

Batteries transported as a Class 9 material must be packaged in combination packagings that conform to the performance standards specified in Part 178 of the HMR

at the Packing Group II performance level. In addition, the batteries must be packaged so as to prevent short circuits, including movement that could lead to short circuits. A package containing lithium batteries must be labeled with a Class 9 label and must be accompanied by a shipping paper that describes the lithium batteries being transported and emergency response information. The location and quantity of shipments must also be provided to the pilot in command.

The HMR provide exceptions for lithium batteries based on the battery size and packing method. Generally, shipments of small lithium batteries are excepted from the specification packaging and hazard communication requirements outlined above provided each package containing more than 24 lithium cells or 12 lithium batteries is: (1) marked to indicate that it contains lithium batteries and that special procedures must be followed if the package is known to be damaged; (2) accompanied by a document indicating that the package contains lithium batteries and that special procedures must be followed if the package is known to be damaged; (3) no more than 30 kilograms gross weight; and (4) capable of withstanding a 1.2 meter drop test in any orientation without shifting of the contents that would allow short-circuiting and without release of package contents. Further, each such package that contains a primary lithium battery or cell forbidden for transport aboard passenger carrying aircraft must be marked ‘‘PRIMARY LITHIUM BATTERIES—FORBIDDEN FOR TRANSPORT ABOARD PASSENGER AIRCRAFT’’ or “LITHIUM METAL BATTERIES—FORBIDDEN FOR TRANSPORT ABOARD PASSENGER AIRCRAFT.” The marking, documentation and 1.2 meter drop test requirements described above do not apply when these small cells or batteries are contained in a piece of equipment.

For medium-size lithium batteries and cells transported by motor carrier or rail, the HMR provide exceptions similar to those for small lithium batteries. Under these exceptions, a package containing medium size lithium batteries and cells of all types must: (1) be marked to indicate it contains lithium batteries and special procedures must be followed if the package is known to be damaged; (2) be accompanied by a document indicating the package contains lithium batteries and special procedures must be followed if the package is known to be damaged; (3) weigh no more than 30 kilograms; and (4) be capable of withstanding a 1.2 meter drop test. For those packages that are not prepared for air shipment, (i.e., not offered and transported as a Class 9 material) the HMR require the package to be marked to indicate that they may not be transported by aircraft or vessel. The marking, documentation and 1.2 meter drop test requirements described above do not apply when these medium cells or batteries are contained in a piece of equipment.

The exceptions for small and medium size lithium batteries described above are found in § 172.102 Special Provisions 188 and 189 respectively. Additional exceptions for special cases such as small production runs of batteries and specific aircraft quantity limitations are found in § 172.102, Special Provisions 29, A54, A55, A100, A101, A103, and A104.

The current requirements in the HMR pertaining to the transport of lithium batteries reflect a number of actions taken by PHMSA and FAA in response to the past incidents and NTSB recommendations, aimed at reducing the risks posed by batteries and battery powered devices in transportation. These include—

- Safety advisories issued by PHMSA to the public (64 FR 36743 [July 7, 1999]; 72

FR 14167 [Mar. 26, 2007]) and by the FAA to the airline industry on July 2, 1999, May 23, 2002 and August 3, 2007 to remind persons that batteries and electrical devices that contain batteries are prohibited for transport unless properly packaged to prevent the likelihood of creating sparks or generating dangerous heat.

- Changes to UN Recommendations in 2000 and the 2003-04 ICAO Technical Instructions based on proposals by the United States which (1) revised battery testing requirements and required testing of small lithium batteries, (2) adopted hazard communication and packaging requirements for small batteries, (3) eliminated an exception for medium-sized batteries, and (4) adopted limited exceptions for passengers and crew to carry lithium batteries and battery-powered equipment aboard an aircraft.
- A series of tests performed by FAA in 2004 concluded that the presence of a shipment of primary lithium batteries can significantly increase the severity of an in-flight cargo compartment fire and the fire suppression systems currently in use aboard passenger aircraft are ineffective.
- PHMSA's December 15, 2004 interim final rule (69 FR 75208, correction, 71 FR 56894 [Sept. 28, 2006]), based on the results of the FAA tests, adopted a limited prohibition on the transportation on passenger-carrying aircraft of primary lithium batteries.
- Further testing by FAA in 2006 concluded that flames produced by secondary lithium batteries and cells are hot enough to cause adjacent cells to vent and ignite, but currently approved fire suppression systems are effective on the

electrolyte fire and prevent any additional fire from subsequent cell venting.

- PHMSA's August 9, 2007 final rule (72 FR 44930) finalized the December 15, 2004 interim final rule and (1) adopted design type testing of all lithium batteries in accordance with international standards, and (2) revised the exception for consumer electronic devices and spare lithium batteries carried by passengers and crew. The preamble to this final rule also discussed in more detail some of the prior incidents during transportation of lithium batteries, the FAA testing programs, the recalls of notebook computer batteries, and the rulemaking changes up to that time.
- PHMSA's January 14, 2009 final rule (74 FR 2199) addressed NTSB safety recommendations A-07-106 and A-07-107 by requiring an air carrier, in the event of a serious incident, to make immediately available to an authorized official of a federal, state, or local government agency (including an emergency responder), the shipping papers and notice to pilot in command or the information contained in those documents. This requirement represents a proactive approach to information dissemination similar to that in the ICAO Technical Instructions. This final rule also added a requirement to report all incidents that result in a fire, violent rupture, explosion or dangerous evolution of heat (*i.e.* an amount of heat sufficient to be dangerous to packaging or personal safety to include charring of packaging, melting of packaging, scorching of packaging, or other evidence) that occurs as a direct result of a battery or battery-powered device. Additionally, the final rule amended regulatory requirements to clarify acceptable methods for packaging batteries to protect against short circuits and overheating and required

the reporting of certain incidents involving batteries or battery powered devices. PHMSA set forth examples of methods to prevent short circuit and damage (such as individually packaging each battery, securely covering terminals with non-conductive caps or tape, or designing batteries with terminals that are recessed or otherwise protected) appropriate for all batteries.

- PHMSA and FAA have also conducted a campaign to educate the public about ways to reduce lithium battery transportation risks. On February 22, 2007; April 26, 2007; May 24-25 2007; and April 11, 2008, PHMSA hosted meetings with public and private sector stakeholders who share our concern for the safe transportation of batteries and battery powered devices. The meetings provided an opportunity for representatives of the NTSB, CPSC, manufacturers of batteries and battery powered devices, airlines, airline employee organizations (e.g. pilots and flight attendants), testing laboratories, and the emergency response and law enforcement communities to share and disseminate information concerning battery related risks and developments.

The amendments to the HMR adopted since 2004 have produced positive results, but they addressed only very specific issues and specific transport contexts. The proposals outlined in this NPRM are intended to comprehensively address the hazards posed by lithium batteries in all modes of transportation and further reduce the likelihood and the consequences of a battery related fire in transportation. In this NPRM, PHMSA plans to address safety recommendations A-07-104, A-07-105, A-07-108 and A-07-109.

In addition to the safety measures identified in this NPRM, PHMSA and FAA are considering additional safety standards. Many of these additional measures affect

multiple transport modes, including aviation. As we develop these concepts we will continue to work with the appropriate international transportation standards-setting bodies, such as the United Nations Subcommittee of Experts on the Transport of Dangerous Goods (UNSCOE TDG) and the International Civil Aviation Organization (ICAO) Dangerous Goods Panel, to encourage their world-wide acceptance. These additional measures may include:

- Establishing a new system for the classification of articles, such as lithium batteries that have the potential to produce heat and fire.
- Determining the feasibility of developing performance standards for fire resistant containers that can be used for the transport of lithium cells and batteries of all types and all other flammable materials on board aircraft.
- Examining the role of packaging in preventing damage and short circuits to lithium cells and batteries.

C. Ongoing Efforts to Evaluate Lithium Battery Risk

As previously mentioned, PHMSA and FAA have identified 44 air transport related incidents and numerous additional non-transport incidents involving lithium batteries and lithium battery powered devices. The January 14, 2009 final rule required air carriers to report all incidents that result in a fire, violent rupture, explosion or dangerous evolution of heat that occur as a result of a battery or a battery powered device. In addition to requiring an incident report NTSB, A-07-107 recommends PHMSA require air carriers retain the failed items for evaluation purposes. We have concerns with requiring a person involved in an incident reported under §§ 171.15 or 171.16 to maintain in a secure manner items or packages especially if the item is an

airline passenger's property. Such a requirement would impose additional responsibility on the air carrier to maintain possession of the item or package in a secure manner. Currently, when an incident occurs, DOT works with the person in physical possession of the item such as a battery or device to ensure the incident is thoroughly documented and when the air carrier has accepted the property (68 FR 9735) it is maintained and in some instances transported for evaluation. Depending on the nature and severity of the incident we work with carriers on a case-by-case basis to collect and analyze evidence as appropriate and we continue to seek ways to improve the quality and consistency of data we receive. As part of this NPRM, PHMSA seeks comments on how this data collection could be improved.

The proposals in this NPRM are intended to address the root causes of lithium battery incidents. The available incident data suggest the most likely causes of lithium battery incidents are:

1. External short circuiting ─ occurs when an exposed battery terminal contacts a metal object. When this happens, the battery can heat up and may cause ignition of the battery and/or the surrounding combustible materials.

2. In-use situation ─ generally relating to improper "charging" and/or "discharging" conditions associated with the use of equipment (e.g., computer or cell phone). This also includes inadvertent activation and subsequent overheating (such was the case when a power drill activated and burned in a passenger's checked baggage).

3. Non-compliance ─ includes faulty design of the battery (cells or battery packs), false certification of compliance with regulatory testing/classification requirements, and improper packing and handling including some counterfeit batteries.

4. Internal short circuit ─ can be caused by foreign matter introduced into a cell or battery during the manufacturing process. An internal short circuit can also occur when a battery is physically damaged (e.g. dropped or punctured).

As noted in the previous section, FAA's Technical Center initiated a series of tests to evaluate the risk posed by lithium batteries involved in an unrelated fire. FAA completed a study in 2004 to assess the flammability characteristics of bulk packed primary lithium batteries and a second study in 2006 examining the flammability characteristics of bulk packed secondary lithium batteries. In both studies the tests were designed to simulate the behavior of the batteries in an environment that is similar to actual conditions possible in an aircraft cargo compartment fire. Both the 2004 and 2006 test reports are available at the following url: http://www.fire.tc.faa.gov/reports/reports.asp.

In the case of primary lithium batteries, the FAA tests showed that the packaging materials delayed the ignition of the batteries, but eventually added to the fire and contributed to battery ignition, even after the original (alcohol) fire had been exhausted. In addition, the packaging material held the batteries together, allowing the plastic outer coating to fuse the batteries together. This enhanced the probability of a burning battery igniting adjacent batteries, increasing the propagation rate. The technical report concluded that the presence of a shipment of primary lithium batteries can significantly increase the severity of an in-flight cargo compartment fire. In addition, the report concluded that primary lithium batteries pose a unique threat in the cargo compartment of an aircraft because primary lithium battery fires cannot be suppressed by means of Halon, the only FAA-certified fire suppression system permitted for use in cargo compartments of a passenger-carrying aircraft operating in the United States.

The second study completed in 2006 used a similar methodology to determine the flammability of secondary lithium batteries and cells. The testing demonstrated that

flames produced by the batteries are hot enough to cause adjacent cells to vent and ignite. The testing also demonstrated that Halon is effective in suppressing the electrolyte fire and preventing any additional fire from subsequent cell venting. The lithium ion cells will continue to vent due to high temperatures but will not ignite in the presence of Halon.

We are aware of additional testing conducted in 2004 and 2005 independent of the FAA or PHMSA to assess the effect of a battery's state of charge on its overall risk. The 2004 preliminary report titled "Effect of Cell State of Charge on Outcome of Internal Cell Faults" concluded the severity of the result of an internal short circuit is strongly affected by the state of charge. The Draft 2005 report titled "US FAA Style Flammability Assessment of Lithium Ion Cells and Battery Packs in Aircraft Cargo Holds" concluded: (1) direct flame impingement on small unpackaged quantities of lithium ion cells and battery packs can lead to thermal runaway; (2) Halon 1301 is effective at controlling burning lithium ion cells; (3) the fires had a minimal effect on bulk packaged lithium ion cells with less than 50% state of charge; and (4) the aircraft liner typically used on commercial aircraft is capable of withstanding burning gases discharged from venting lithium ion cells and batteries. A copy of this analysis is available for review in the docket of this rulemaking.

The FAA results with lithium ion batteries at 100 % state of charge exposed to a fire showed similar, but more forceful results (i.e. more sparks, and more forceful cell venting). FAA and other test data on lithium ion cells and batteries suggest that state of charge affects their behavior under abuse conditions. PHMSA recognizes this fact and commonly requires transport at a reduced state of charge as a condition of competent

authority approvals issued for the transport of extremely large lithium ion batteries found in vehicles and military and aerospace equipment. To date, we are not aware of any data that can be used to suggest a reduced state of charge affects the behavior of primary lithium batteries under abuse conditions.

The United Kingdom Civil Aviation Authority completed a report in 2003 titled: "Dealing with In-Flight Lithium Battery Fires in Portable Electronic Devices." The test results verified the effectiveness of existing fire extinguishing agents in responding to an in-flight fire involving a lithium battery powered portable electronic device. The report also concluded that the safety systems inherent to lithium batteries and battery powered devices decrease the likelihood of a fire, but since there is a potential for a fire, these devices must be considered a potential risk in flight and during ground based operations. If a fire does occur in the aircraft cabin, the force of the explosion is not sufficient to cause structural damage to the aircraft, but there is a risk the fire could spread to adjacent flammable material such as clothing and seats and flames and fumes from burning batteries pose a hazard to passengers in the immediate vicinity.

The UK CAA testing, combined with additional research from the FAA has formed the basis for improved response procedures and cabin crew fire fighting training. Since 2007, the International Federation of Airline Pilots Associations has issued several safety bulletins with updated recommendations for flight crew actions. In March of 2009, the FAA released a training video recreating in-flight scenarios which includes actual lithium battery fires and appropriate response measures. All of these test reports are available for review in the public docket for this rulemaking.

II. Discussion of Proposed Regulatory Changes

A. Summary of Proposals in this NPRM

In this NPRM, we propose a number of provisions to enhance the safe transportation of lithium batteries. The proposals are intended to reform the current regulatory framework specific to lithium batteries and strengthen the regulations by eliminating certain exceptions. These revisions will enhance safety by ensuring that all lithium batteries are designed to withstand normal transportation conditions, packaged to reduce the possibility of damage that could lead to an incident, and accompanied by hazard communication information that ensures appropriate and careful handling by air carrier personnel and informs transport workers and emergency response personnel of actions to be taken in an emergency. The additional hazard communication information will also provide the pilot in command with additional information about the location and quantity of lithium batteries should an unrelated fire require emergency measures. Several of the proposals are based on recommendations issued by the NTSB. Specifically, in this NPRM, we propose to:

- Revise current shipping descriptions for lithium batteries (UN3090), lithium batteries packed with equipment (UN3091), and lithium batteries contained in equipment (UN3091) to specify lithium metal batteries *including lithium alloy batteries* as appropriate.[a]
- Adopt shipping descriptions for lithium ion batteries *including lithium ion polymer batteries* (UN3480), lithium ion batteries packed with equipment

[a] In 2006, separate shipping descriptions for lithium metal batteries and lithium ion batteries were adopted into the UN Recommendations. The International Civil Aviation Organization and the International Maritime Organization subsequently adopted these shipping descriptions. All references to primary or secondary lithium batteries in international regulations were revised to reflect this change.

including lithium ion polymer batteries (UN3481), lithium ion batteries contained in equipment *including lithium ion polymer batteries* (UN3481). [a]

- Adopt watt-hours in place of equivalent lithium content to measure the relative hazard of lithium ion cells and batteries.
- Incorporate by reference the latest revisions to the United Nations Manual of Tests and Criteria applicable to the design type testing of lithium cells and batteries.
- Adopt and revise various definitions including “Aggregate lithium content” “Lithium content”, “Lithium ion cell or battery”, “Lithium metal cell or battery”, “Short circuit”, and “Watt-hour” based on definitions found in the UN Manual of Tests and Criteria.
- Require manufacturers to retain results of satisfactory completion of UN design type tests for each lithium cell and battery type and place a mark on the battery and/or cell to indicate testing has been completed successfully. PHMSA and the FAA will coordinate with the appropriate international organizations to ensure consistency.
- For air transportation, eliminate regulatory exceptions for lithium cells and batteries, other than certain exceptions for extremely small lithium cells and batteries that are shipped in very limited quantities such as button cells and other small batteries that are packed with or contained in equipment and those required for operational use in accordance with applicable airworthiness requirements and operating regulations.

- For all transport modes, require lithium cells and batteries to be packed to protect the cell or battery from short circuits.
- Unless transported in a container approved by the FAA Administrator, when transported aboard aircraft, limit stowage of lithium cells and batteries to crew accessible cargo locations or locations equipped with an FAA approved fire suppression system.
- Consolidate and simplify current and revised lithium battery requirements into one section of the HMR.
- Apply appropriate safety measures for the transport of lithium cells or batteries identified as being defective for safety reasons, or those that have been damaged or are otherwise being returned to the manufacturer.

To expedite compliance with the amendments in this notice, we are proposing a mandatory compliance date of 75 days after the date of publication of the final.

The following sections discuss these changes in detail.

B. Evidence Preservation

In this NPRM, in § 171.21, we propose to require a shipper, carrier, package owner or person reporting an incident under the provisions of §§ 171.15 or 171.16 to provide upon request, by an authorized representative of the Federal, State or local government agency reasonable assistance in investigating the damaged package or article, if available.

C. New Shipping Names

Currently, under the HMR, lithium metal batteries and lithium ion batteries share the same UN number. However, differences in chemistry, functionality, and behavior

when exposed to a fire are well documented. Based in part on the previously mentioned FAA fire tests, PHMSA imposed additional requirements on lithium metal (primary) batteries including prohibiting them from transportation aboard passenger aircraft, unless packed with or contained in equipment. The fact that both lithium metal and lithium ion batteries share the same UN number yet are regulated differently has the potential to cause problems in acceptance procedures for carriers and may unnecessarily hinder or delay the transportation of these products.

In 2006, the UN Recommendations adopted separate shipping names and ID numbers for lithium metal and lithium ion batteries. The ICAO and the International Maritime Organization subsequently adopted these entries into their respective dangerous goods lists effective January 1, 2009. While the HMR permit the use of the ICAO Technical Instructions and the International Maritime Dangerous Goods (IMDG) Code for international and for domestic transportation when a portion of the transportation is by aircraft or vessel, subsequent domestic reshipping of packages containing lithium batteries remains difficult.

In this NPRM, PHMSA proposes to provide two separate entries in the hazardous materials table for primary lithium batteries, now referred to as “lithium metal batteries” and secondary lithium batteries, now referred to as “lithium ion batteries”. Separate entries for lithium metal and lithium ion batteries will facilitate the transportation of these materials through various modes, both domestically and internationally, and enable the application of different emergency response actions. We will replace all references to “primary lithium batteries” with “lithium metal batteries” and all references to “secondary lithium batteries” with “lithium ion batteries”.

D. Watt Hours versus Equivalent Lithium Content

When requirements for lithium ion batteries were first adopted into the HMR, it was necessary to provide an indication of the lithium content in each cell and battery. Since lithium ion batteries do not contain metallic lithium, an expression of lithium content analogous to lithium metal batteries was devised. This term became known as equivalent lithium content (ELC), also known as lithium equivalent content. The ELC of a lithium ion cell measured in grams is calculated to be 0.3 times the rated capacity in ampere hours. The ELC of a lithium ion battery equals the sum of the grams of ELC contained in the component cells of the battery. Although the term equivalent lithium content is used in the HMR, this term is not widely used or understood and can lead to confusion when calculating the ELC of a battery. For example, the aggregate ELC for a lithium ion battery consisting of multiple cells within a battery can be difficult to calculate based solely on the ampere-hour capacity of the battery. Information on the ampere-hour capacity of the component cells within a battery is not normally provided and the ampere-hour capacity of a battery can change depending on the configuration of component cells within a battery.

PHMSA proposes to adopt a methodology for determining the relative strengths of lithium ion batteries using measurements of watt-hours rather than ELC. The term watt-hour, expressed as (Wh) is commonly used in electrical applications. The watt-hour value of a lithium ion cell or battery is determined by multiplying a cell or battery's rated capacity in ampere-hours, by its nominal voltage. Therefore, watt-hour (Wh) = ampere-hour (Ah) x Volts (V). This product is easy to calculate for both cells and batteries and

the watt-hour measurement is independent of how the component cells within a lithium ion battery are connected.

PHMSA further proposes to replace the term equivalent lithium content, or lithium equivalent content and aggregate equivalent content each place it appears with watt-hour and replace the equivalent lithium content values with their equivalent watt-hour values. These proposals are consistent with proposals already adopted in the UN Recommendations, ICAO Technical Instructions, and IMDG Code.

E. Design Type Testing

Each lithium cell or battery is required to be of a type proven to meet the requirements of each test in the UN Manual of Tests and Criteria.[b] These tests are designed to ensure that the cells and batteries will withstand exposure to severe environmental conditions encountered during transport without resulting in a short circuit or a rupture. A comparison of the battery appearance before and after these tests is intended to detect battery damage such as leakage or abnormal venting, disintegration, cracking, swelling or distortion of the battery pack, or any other observation that could indicate the occurrence of an internal short circuit or constitute a transportation safety hazard. Certain tests, including altitude simulation, thermal, vibration and shock tests are designed to simulate extremes that may be encountered during transport. External short circuit, impact, overcharge and forced discharge tests are included, as these conditions contribute to short circuits and other potentially hazardous conditions.

[b] As previously discussed, shipments of small lithium cells and batteries have been prohibited on passenger-carrying aircraft since December 15, 2004, but, before October 1, 2009, small lithium cells and batteries that met certain limited packaging and hazard communication conditions could be shipped by surface transportation (and small secondary lithium cells and batteries could be shipped on cargo-only aircraft), without being subject to the testing requirements in the UN Manual of Tests and Criteria. Small lithium cells and batteries were defined as follows: Cells with up to 1 g lithium (primary) or 1.5 equivalent lithium content (ELC) (secondary); batteries with up to 2 g lithium (primary) or 8 g ELC.

An informal lithium battery working group of the United Nations Subcommittee of Experts on the Transport of Dangerous Goods (UNSCOE TDG) met in November 2008 and again in April 2009 to discuss the test methods relevant to lithium cells and batteries as contained in the UN Manual of Tests and Criteria. The group concluded that while the design type tests outlined in the UN Manual of Tests and Criteria adequately address safety concerns involving lithium cells and batteries, they can be improved based on an evolving understanding and use of lithium battery technology.

Recently, interest in adding an internal short circuit test into the UN Manual of Tests and Criteria has grown. Several different tests have been developed; however, each method has strengths and weaknesses including repeatability and the ability to control the mechanism of the internal short circuit. While no consensus has been reached on this subject, research and discussion continues. Once a reliable internal short circuit test method is developed and incorporated into the UN Manual of Tests and Criteria, we will consider adopting this additional test into the HMR. We invite commenters to address issues related to the development of an internal short circuit test, including recommendations on an appropriate and effective test methodology, real-world experience in applying such a test, and the costs that would be associated with an additional test requirement.

In December 2008, the UN Committee of Experts adopted several amendments to section 38.3 of the UN Manual of Tests and Criteria (fourth revised edition), which we propose to incorporate by reference in § 171.7. These changes include:

- Modifications to the terms “module” and “battery assembly”, new definitions for the terms “large battery” and “small battery” and modifications to the testing protocol for large batteries and battery assemblies.
- Revised criteria for a different design type by adding additional criteria for rechargeable lithium cells and batteries that would trigger a new round of design-type testing.

Currently, the UN Manual of Tests and Criteria specifies that a change from a tested design type of 0.1 grams or 20% by mass to the anode, the cathode, or electrolyte material constitutes a change in the design of the battery requiring design-type testing. A change that would materially affect the test results is also considered a new design type requiring retesting. While we continue to believe in the importance of harmonization with international standards, we believe a change of 20% by mass to the anode, cathode, or electrolyte material by mass is too high. Additionally, the language referencing a “change that would materially affect the test results” remains too broad and leaves a great deal to interpretation from the individual cell or battery manufacturer or assembler. In this NPRM we propose to require a change of 0.1 grams or 5% by mass to the anode cathode or electrolyte material from a tested design type to constitute a new design and require retesting. Depending on the lithium content, such a change would affect the test results. In addition, we propose to include the examples of changes that could materially affect the test results developed by the informal UN working group. These examples include:

- a change in the material of the anode, the cathode, the separator, or the electrolyte;

- a change of protective devices, including hardware and software;
- a change of safety design in cells or batteries, such as a venting valve;
- a change in the number of component cells;
- a change in connecting mode of component cells.

In recent years, lithium battery technology has been developed for use in electric vehicles, hybrid electric vehicles and plug-in hybrid electric vehicles. The batteries now being utilized in hybrid electric vehicles are assemblies that include systems of electronic controllers, sensors, air flow ducts, cabling, cell mounting fixtures, cells, trays, covers, and attachment brackets and are much larger than lithium batteries found in consumer electronic devices (vehicle battery sizes generally have a gross mass between 14 kg and 80 kg). While the current UN Test standards and the HMR are broad enough in scope to accommodate extremely large batteries and assemblies, some believe the forces required by some of the UN tests are excessive and certain HMR requirements hamper the commercial development of this technology. Because these new lithium battery applications may require modifications to the UN Manual of Tests and Criteria and revisions to the HMR, we issue competent authority approvals on a case-by-case basis and continue to actively participate in the advancement of modified testing schemes and practical methods that support the development of this technology without compromising safety. Based on transportation experience gained through competent authority approvals, we may consider revising the HMR to more adequately address these scenarios, provided we can do so without creating adverse safety consequences.

The cell and battery design type tests outlined in the UN Manual of Tests and Criteria are generally completed prior to the initial shipment of a battery from the

manufacturer. While we believe most cell and battery manufacturers ensure the appropriate tests are conducted and the batteries and devices are safe for use, we remain uncertain that all manufacturers or battery assemblers take such steps or are even aware of the need to test each battery design type. We also remind battery manufacturers and assemblers that each lithium battery design-type is subject to the tests in the UN Manual of Tests and Criteria, even if the cells that make up the battery have been tested.

In this NPRM, we propose to require cell and battery manufacturers to retain evidence of satisfactory completion of each of the lithium cell and battery design type tests outlined in the UN Manual of Tests and Criteria. This evidence must be maintained in a readily accessible location at the principal place of business for as long as the lithium batteries are offered for transportation in commerce and for one year thereafter. Each person required to maintain this evidence must make this information available for inspection by a representative of a federal, state or local government agency. Since cell and battery design type tests already must be completed prior to transport we do not believe this should be a particularly burdensome requirement.

Additionally, we are considering a requirement for a visible quality mark to appear on the outside case of each cell or battery. This mark would signify successful completion of the required lithium battery design type tests in a readily recognizable manner. Visible quality marks on electronic devices are very common. Familiar examples include the UL symbol meaning a particular product has been evaluated and representative samples have been tested by Underwriters Laboratories and those products meet particular requirements for safety and quality. The CE marking certifies compliance with certain European Union Directives. For the purposes of lithium design

type testing, we are considering requiring a UN symbol, identical to the symbol currently required on UN packagings and UN cylinders to appear on all cells and batteries that have met each of the design type tests prescribed in the UN Manual of Tests and Criteria. Below is an example of the mark we are considering:

This mark is readily recognized throughout the world and is generally associated with hazardous materials transportation. The intended effect of these new provisions is to promote knowledge of the UN Tests throughout the world and enhance compliance with these important safety standards. We intend to develop proposals for a quality mark and associated documentation for inclusion in the UN Model Regulations and the UN Manual of Tests and Criteria. We invite commenters to address these concepts. Based on comments from the public in response to this notice and discussion with the UN SCOE TDG, we may adopt the UN Marking or a similar mark in the final rule.

F. Elimination of Exceptions for Small Lithium Batteries

As noted above, since October 1, 2009, the HMR except small lithium cells and batteries from most HMR requirements provided the cells or batteries meet the test requirements in the UN Manual of Tests and Criteria and the shipment conforms to minimal packaging and hazard communication requirements (see Special Provision 188 in § 172.102(c)). Consistent with NTSB Safety Recommendation A-07-109, in this NPRM we propose to eliminate the regulatory exceptions for lithium cells and batteries when transported aboard aircraft. Thus, small lithium batteries and cells would be

required to be offered for transportation as Class 9 materials and would be subject to the requirements for lithium cells and batteries in § 173.185, including the packaging requirements discussed in the next section and the hazard communication requirements (shipping papers, package marking and labeling) that apply to shipments of Class 9 materials.

In cargo transportation, generally packages are treated as either regulated hazardous materials or non-regulated general cargo. Packages that display a hazardous materials label are typically handled in a separate cargo stream to ensure more direct oversight than non-regulated cargo. Those materials that are regulated as hazardous materials are recognized by handlers, who ensure that proper precautions are taken and the package is handled in accordance with all applicable regulatory requirements,

The proposals outlined in this NPRM have the net effect of moving a discrete number of shipments of lithium cells and batteries that are currently handled as general cargo into the hazardous material transport system. When lithium batteries are offered for transportation as a Class 9 material, the package itself provides a clear indication of the presence of hazardous material that is readily recognized by transport workers and ensures these packages are handled in a manner appropriate to their hazard. This also ensures that individuals responsible for ensuring the safety of these packages are appropriately trained in accordance with the HMR. We believe most air carriers who accept lithium batteries for transportation also accept other hazardous materials for transportation and already have the necessary personnel and procedures in place to handle these packages safely. Thus, the requirement to identify and package lithium batteries as

Class 9 materials provides significant safety benefits without imposing large additional costs on air carriers.

Air carriers are required during the certification process to declare in their Operating Specifications if a business decision has been made to "carry hazardous materials" or a business decision has been made "to prohibit the carriage of hazardous material". Each air carrier who elects to carry hazardous material must include handling procedures, incident reporting procedures, and other information in its operations manual for the appropriate personnel to follow, as well as a hazardous material training program that is approved by FAA and provided every 24 months to all appropriate persons. This training would include recognition of all hazard communication information that would be associated with lithium battery shipments as they are trained to recognize all hazard class labels, marking and documentation.

Under the HMR, materials that pose a specific and serious air transportation risk are regulated more stringently than materials that pose less of a risk when transported by air. Lithium batteries are a current exception to this standard. The need to fully regulate these items and to aggressively enforce all applicable regulatory requirements is critical to air safety. Once lithium batteries are fully regulated, enforcement agencies will be able to take appropriate action against non-compliant shipments, reducing the number of non-compliant packages and therefore, reducing the number of lithium battery incidents.

We note the ICAO Technical Instructions include provisions for certain lithium cells and batteries, provided outer packages are marked with a lithium battery handling label. This handling label shown below notes the presence of lithium batteries and communicates a fire hazard if damaged. While this handling label is not specifically

authorized by the HMR, we believe that it complements the basic intent of identifying the materials adequately for emergency response and we would permit packages containing lithium batteries to display the lithium battery handling label in addition to the markings and labels required by the HMR. The ICAO lithium battery handling label is displayed below:

The Class 9 label would alert transport workers to the presence of a hazardous material and should result in more careful handling and stowage. Shipping papers would provide written notice to the pilot in command of the presence of lithium batteries and the type, location and number of packages of lithium batteries on board the aircraft. The NOPIC serves as a valuable tool to relay information about the hazardous materials on board an aircraft to first response personnel and provide critical safety information when making decisions in emergency situations. The additional information will also assist carriers in the acceptance and handling of shipments. The hazardous material regulatory system has been effective in mitigating risk for decades. Shippers and carriers understand this system and have included steps in their processes to ensure compliance and safety. Operating outside of the regulatory structure has created a safety environment

that is haphazard, at best, and a set of requirements that is not easily understood. The lack of required training only adds to the difficulty. PHMSA and FAA believe the current system for the transportation of hazardous materials is sound and can be used to effectively mitigate the risk posed by the batteries in air transportation.

A requirement for small lithium batteries and cells to be transported as Class 9 materials will have significant safety benefits that will more than offset any additional transportation costs that may result. PHMSA invites comments on the impacts associated with elimination of existing regulatory exceptions and the risk reduction benefits associated with eliminating the exceptions.

To reduce compliance costs and facilitate multimodal transportation without sacrificing safety, in § 173.185(d) we propose to specify provisions for the transportation of lithium cells and batteries by highway, rail and vessel consistent with the IMDG Code. In addition, we propose specific requirements for extremely small batteries with very low energy (e.g., less than 0.3 grams or 3.7 Wh) when packed with or contained in equipment. When contained in equipment, these types of batteries are often embedded into circuit boards and are well protected from damage and pose a negligible risk. We are seeking comments on whether certain exceptions are appropriate from a risk and cost perspective. Such exceptions would include lithium ion batteries shipped at a reduced state of charge (e.g. less than 50% state of charge) or “very low energy” batteries (3.7Wh) packed or contained in equipment.

On December 15, 2008, we received a petition (P-1533) from the Air Transport Association of America and the Regional Airline Association requesting we amend the

HMR to permit airlines to carry a limited number of small lithium batteries in the aircraft cabin in a constant state of readiness with adequate backup power for the duration of the flight. The petition states such necessary equipment includes electronic flight bags, onboard medical monitoring devices, portable oxygen concentrators, personal entertainment devices and credit card readers. We agree a need exists for airlines to use and maintain certain types of equipment that are increasingly powered by lithium batteries. Under Federal Aviation Regulations, these devices must be approved by the FAA to ensure they will not cause interference with the navigation or communication system of the aircraft on which it is to be used and crew members can safely handle these devices and batteries. In this NPRM we propose to modify § 175.8 to allow other items approved by the FAA Administrator to be used on board an aircraft. FAA will provide additional information published in an upcoming INFO to supplement this requirement.

G. Packaging and Stowage

The risks associated with the transport of lithium cells and batteries are largely a function of the amount of stored energy in a single cell or battery and the number of batteries in a shipment or a package. In addition, factors such as battery chemistry, state of charge, transport mode, type and method of packaging, quality of manufacturing, age, and handling all contribute varying amounts to the overall risks in transportation. Understanding and addressing these risks pose unique challenges to U.S. and international regulatory bodies.

The available incident data suggest external short circuiting is a leading cause of lithium battery incidents. Effective insulation of exposed terminals, designing batteries with recessed terminals and other such measures would help to prevent incidents

resulting from external short circuits. To reduce the potential of short-circuiting, in this NPRM we are proposing to require lithium cells and batteries to be transported in inner packagings of combination packagings that completely enclose the cell or battery. The intent of the requirement for inner packaging is to ensure that the conductive terminals of batteries remain isolated from each other. This can be achieved in many ways including individually packing each cell or battery or packing batteries in blister packs commonly found in retail outlets where the batteries would be contained between paperboard card and transparent clear plastic. We continue to stress the intent of the packaging is to protect the batteries from short circuits and damage. The above examples are provided only to enhance understanding of the packaging requirement and not to limit the acceptable packaging methods used for compliance.

For air transportation, the HMR impose per-package weight limitations for lithium cells and batteries. However, there are no limits on the number of packages that may be transported in an overpack, unit load device, or cargo compartment. PHMSA and FAA are concerned about the aggregate risks inherent in transportation situations in which a large number of packages each containing small-sized batteries, are transported in close proximity to one another. Indeed, the risks inherent in the transportation of multiple packages of small-sized batteries may be more serious than the risks associated with a small number of packages containing large-sized batteries. Currently, packages containing up to 24 cells or 12 batteries may be transported without marks or labels indicating of the presence of lithium batteries. Further, a single battery shipment may consist of many packages, each of which is excepted from the packaging and hazard communication requirements. An individual battery will pose a fire risk that can be

exacerbated by poor packaging and careless handling and, the number of batteries in a shipment can substantially affect the severity of an incident. For example, several thousand small lithium batteries consolidated together may present more significant potential risks than a shipment of a single large lithium battery, because one burning lithium battery can produce enough heat and energy to propagate to other lithium batteries in the same overpack, freight container, or cargo hold.

PHMSA and FAA are aware of one incident that involved a shipment of 120,000 lithium metal batteries contained in small packages, each excepted from the HMR. The pallets containing the packages were mishandled by ground crew personnel, which led to their eventual ignition. Initial attempts to extinguish the fire with water and chemical fire extinguishers were ineffective. More recently, PHMSA and FAA observed an incident involving lithium metal batteries contained in personal disposable vaporizers. The shipment consisted of 40 cartons with each package containing 50 devices. Upon landing at their destination, the flight crew was alerted to a fire in the forward compartment. Fire department personnel successfully extinguished the fire with no injury or damage to the aircraft. These two examples illustrate the potential for a serious incident that could result if the risks are not addressed through transportation safety controls. Both the 2004 and 2006 FAA technical reports show that an increase in the number of batteries involved increases the duration of a fire. Currently, fire suppression systems are not required in all cargo compartments of cargo only aircraft. Therefore, even though Halon fire suppression systems are effective at suppressing a fire involving lithium ion batteries, flight crews on cargo only aircraft remain at risk. In this NPRM we are proposing several actions intended to mitigate this risk. Specifically we propose to prohibit the stowage of

lithium batteries in an inaccessible manner unless the inaccessible cargo compartment or freight container is equipped with an FAA approved fire suppression system or the lithium batteries are packaged in an FAA approved fire resistant container. We believe the enhanced packaging and hazard communication combined with loading and stowage limitations will reduce the likelihood of a fire and will mitigate the consequences of such a fire should one occur. We are also considering whether imposing a limit on the number of lithium battery packages transported in a single aircraft, single compartment, unit load device, pallet, or similar overpack would further enhance safety. We invite commenters to address such a limitation, including potential safety benefits, possible cost impacts and operational implications or alternative suggestions for reducing risk. We invite commenters to address methods available to quantify lithium battery risks, and potential risk mitigation techniques and alternatives – either in lieu of, or in addition to, the provisions proposed in this NPRM. Based on the merits of these comments we may consider adoption of additional stowage requirements in the final rule.

H. Consolidation of Lithium Battery Regulations

At present, requirements on transporting lithium cells and batteries are located in several different special provisions in § 172.102 and in § 173.185. We believe that consolidating in a single section the requirements that apply to these articles, in a manner similar to most other hazardous materials, will promote greater understanding and compliance with the regulations and reduce the potential for undeclared or frustrated shipments.

In this NPRM, PHMSA proposes to consolidate the regulations pertaining to the packaging of lithium batteries primarily by relocating relevant provisions currently

contained in special provisions to § 173.185. Additionally, aircraft quantity limitations currently located in § 172.102, Special provisions A100, A101 and A103 will be incorporated into the § 172.101 hazardous materials table (HMT). Consequently, Column 9A of the HMT (passenger aircraft/passenger rail quantity limits) for the entry "Lithium metal batteries, UN3090" will be revised to read "Forbidden" and packages containing lithium metal batteries would be required to display the cargo aircraft only label. We would remove the current requirement found in Special provision 188 to mark packages as forbidden aboard passenger aircraft. However, general requirements applicable to all hazardous materials, such as hazard communication, training, and emergency response information would not be repeated in § 173.185 (except to the extent that any exceptions from these requirements apply).

The United Parcel Service (UPS) filed a petition for rulemaking on May 11, 2009 (P-1541), requesting an amendment to the HMR specific to the marking of packages containing lithium batteries shipped under the exceptions found in § 172.102(c) Special Provision 189. In its petition, UPS states the markings required by Special provisions 188 and 189 are too similar and can be easily confused. The UPS petition asked PHMSA to develop a pictorial marking that would unambiguously communicate the prohibition of loading packages meeting the exceptions of Special provision 189 aboard aircraft and vessel.

We agree the markings required by Special provisions 188 and 189 are similar and can be confused. As previously described, all packages of small lithium metal batteries (UN3090) would be required to display a Class 9 label and the cargo aircraft only label. We believe the addition of the new proper shipping names specific to lithium

ion cells and batteries and the elimination of the exception currently found in § 172.102(c), Special provision 188 effectively eliminates the confusion expressed by the petitioner.

We are aware of situations in which damaged or recalled batteries are required to be returned to the manufacturer. Product recalls or returns may occur for a variety of reasons including a consumer product recall in cooperation with the CPSC, a defective product that failed during field tests or a battery or device involved in an incident. In this NPRM we are proposing requirements for transporting such articles based on requirements developed for competent authority approvals and previously developed guidance. We propose to limit transport of damaged or defective batteries to highway and rail transport only. Where rail or highway transport is impracticable, we will work with FAA to develop air shipping protocols under Competent Authority Approvals on a case-by-case basis.

I. Ongoing Safety Initiatives

This NPRM represents another step in our continuing efforts to increase the safety controls applicable to the transportation of lithium batteries. This NPRM is part of a larger effort to comprehensively address the risks posed by the transportation of lithium batteries primarily those lithium batteries shipped as cargo. This NPRM does not impact lithium batteries carried by a passenger or crewmember in checked or carry-on baggage. PHMSA has taken steps to address this safety issue through several initiatives, including a battery safety public awareness campaign targeting airline passengers and infrequent battery shippers, focused enforcement with the goal of maximum compliance, and research into appropriate fire detection and suppression and containment methods.

Since 2007, PHMSA has been working with air carriers, battery manufacturers, air travel associations, airline pilot and flight crew associations and other government agencies, including the Transportation Security Administration, to educate the public about potential safety problems and measures that will reduce or eliminate those problems. PHMSA agrees that these efforts must be highly visible and continuous to be effective. One of the most visible programs to promote battery safety is the SafeTravel Web site, which includes guidance and information on how to travel safely with batteries and battery-powered devices. We have also been working with the major airlines, travel and battery industries to provide SafeTravel information for ticketed passengers and frequent flyers, and place printed battery safety materials in seat pockets on passenger planes. We have recorded several million hits on our SafeTravel Web site. PHMSA continues to maintain and update the SafeTravel website as new information becomes available and is currently in the process of a major revision to the site. TSA includes SafeTravel information and links on its popular public website and FAA has issued Travel Tips and FAQs on Batteries Carried by Airline Passengers with a link to the SafeTravel website. This material illustrates appropriate means for airline passengers to safely handle and protect their portable electronic devices and spare batteries. The goal is to educate the flying public to play a part in ensuring air transportation safety. Application of the measures set forth in this guidance would likely have prevented at least some of the incidents involving lithium batteries in a passenger's checked or carry-on baggage.

PHMSA continues to pursue other initiatives targeting infrequent shippers of lithium batteries. In March, 2009, PHMSA published a guidance booklet called

"Shipping Batteries by Air: What You Need to Know." This booklet describes the requirements applicable to the air shipment of all battery types including lithium batteries in easy to understand terms and is intended to assist infrequent shippers. PHMSA and FAA continue to collect battery incident data to enhance our understanding of the causes of lithium battery failures and have conducted several effective investigations of battery shippers. PHMSA seeks comments on the impact of the proposals in this NPRM on infrequent shippers, and seeks data on the number of shipments, types of shipments, costs incurred by these shippers. PHMSA also seeks comments on how communication of the requirements for travelers and infrequent shippers could be improved.

J. Compliance Date

PHMSA and FAA believe that, if adopted, the provisions of this NPRM will significantly enhance the safe transportation of lithium batteries by aircraft. Therefore, we are considering requiring compliance with the provisions of the final rule no later than 75 days after its publication in the Federal Register. We are seeking comments as to the feasibility and practicability of such a compliance schedule. We invite commenters to provide data and information concerning the additional costs that would result from such a compliance schedule, practical difficulties associated with quickly coming into compliance with the provisions of a final rule, and any other issues that we should consider in making a decision on the compliance schedule. We also invite commenters to address the feasibility and practicability of a phased compliance schedule under which certain provisions of the final rule would become effective on a faster schedule than other provisions for which immediate compliance would be more difficult.

III. Regulatory Analyses and Notices

A. Statutory/Legal Authority for this Rulemaking

This proposed rule is published under the following statutory authorities:

1. 49 U.S.C. 5103(b) authorizes the Secretary of Transportation to prescribe regulations for the safe transportation, including security, of hazardous material in intrastate, interstate, and foreign commerce.

2. 49 U.S.C. 44701 authorizes the Administrator of the Federal Aviation Administration to promote safe flight of civil aircraft in air commerce by prescribing regulations and minimum standards for practices, methods, and procedures the Administrator finds necessary for safety in air commerce and national security. Under 49 U.S.C. 40113, the Secretary of Transportation has the same authority to regulate the transportation of hazardous materials by air, in carrying out § 44701, that he has under 49 U.S.C. 5103.

B. Executive Order 12866 and DOT Regulatory Policies and Procedures

This proposed rule is a significant regulatory action under section 3(f) of Executive Order 12866 and, therefore, was formally reviewed by the Office of Management and Budget. This proposed rule also is a significant rule under the Regulatory Policies and Procedures of the Department of Transportation (44 FR 11034). The following sections address the costs and benefits of the measures adopted in this proposed rule.

In developing this NPRM, PHMSA considered several regulatory alternatives including (1) a do nothing approach, (2) imposing Class 9 requirements on all lithium battery shipments, (3) adopting the latest requirements of the ICAO Technical Instructions for all lithium battery shipments and (4) adopting certain provisions of

options (2) and (3). In this NPRM we adopted alternative (4). This alternative combines many of the safety elements described in Alternative 2 while harmonizing with international regulatory standards to create a more complete regulatory solution. Under the proposed regulations, we will minimize the regulatory exceptions for lithium batteries transported by aircraft. Specifically, certain extremely small lithium batteries packed with or contained in equipment that do not pose an unreasonable risk in transport would not be subject to the HMR, and we would maintain an exception for specifically packaged lithium batteries transported by highway and rail only. All other lithium cells and batteries must be transported as fully regulated Class 9 material, and will be required to be packaged in combination packages. Each inner packaging must be packed into an outer package meeting the Packing Group II performance standard. This is expected to result in new costs associated with packaging, hazard communication, cargo stowage and training requirements. We expect two primary industry groups will be most directly affected by the proposals in this NPRM: (1) manufacturers and distributors of all types of lithium batteries (including electronic device manufacturers); and (2) passenger and cargo air carriers. The costs of implementing the new rules come to approximately $9.3 million for the first year; using a constant 7% discount, the 10-year projected costs for the proposed rule come to $70.2 million. PHMSA invites commenters to address the assumptions in the regulatory evaluation, and to provide supporting data related to battery shipments which would be covered by this proposal. Specifically, data on the size distribution, value distribution, end usage, and number of batteries by type of shipment and mode of transportation - as well as any other data that would assist in validating impact estimates for this proposal, including quantification of costs and how these costs

would be distributed across the lithium battery supply chain. PHMSA also invites comments on the diversion of shipments from air to other modes of transportation (due to the proposed elimination of regulatory exceptions), including the impacts this diversion will have on cost and length of shipments, and the nature of these shipments that would be impacted. In addition to data related to quantification of costs, PHMSA invites comments and data related to the quantification of risk, and risk- reduction benefits.

The regulatory evaluation does not include costs associated with handling charges that are sometimes imposed by air carriers on hazardous materials shipments. PHMSA believes the net cost of the handling fee is zero; cash is transferred from one affected industry group—shippers—to another industry group—carriers. The shipper incurs the surcharge to compensate the carrier for the enhanced service involved with transporting a hazardous materials package. Moreover, the dynamics of this market make it difficult to conclude that shipping costs will rise, fall, or remain relatively steady. Some high volume shippers may negotiate a reduced surcharge with air carriers. Some shippers may decide to switch to another mode. Rail and highway transport is less expensive than air transport, although both require more time in transit. If a shipper chose a different transport mode, the net effect would be that the shipper or consignee would be required to maintain an increase in inventory (and related costs) to replace the product in transit, offsetting to some extent the savings realized by using the less expensive mode. In this NPRM PHMSA specifically invites commenters to address the economic impact of surcharges and other fees associated with the handling of hazardous materials including how the fees are determined.

The principal anticipated benefits associated with this proposed rule are a reduction in the risk of an aircraft cargo compartment fire that involves lithium batteries becoming a catastrophic fire that can threaten the entire aircraft. While the risk of this type of incident is small, PHMSA has determined that, if adopted, the proposals in this NRPM will generate benefits for system users by reducing that risk. Our data shows an average of about three lithium battery incidents aboard aircraft per year. The total costs of an incident can vary greatly, from under $500 for a minor incident to hundreds of millions of dollars should an incident result in the loss of an aircraft and cargo. To calculate benefits we assumed that under the current regulations and battery-market growth trends, we will observe approximately three incidents per year and assume the average loss of $4.4 million per incident. We anticipate benefits to be approximately $13.2 million per year. Starting with 2008, the annual cost of $9.3 million and benefit of $13.2 million have been discounted at a 7% annual rate to project a total cost of $70.2 million and total benefit of $99.2 million, for an overall benefit-cost ratio of 1.41, clearly demonstrating the utility of the proposed regulation. A regulatory evaluation is available for review in the public docket for this rulemaking.

C. Executive Order 13132

This proposed rule has been analyzed in accordance with the principles and criteria contained in Executive Order 13132 (“Federalism”). This proposed rule preempts State, local and Indian tribe requirements but does not impose any regulation that has substantial direct effects on the States, the relationship between the national government and the States, or the distribution of power and responsibilities among the various levels of government. Therefore, the consultation and funding requirements of Executive Order

13132 do not apply.

The Federal hazardous material transportation law, 49 U.S.C. 5101-5128, contains an express preemption provision (49 U.S.C. 5125(b)) that preempts State, local and Indian tribe requirements on the following subjects:

(1) The designation, description, and classification of hazardous material;

(2) The packing, repacking, handling, labeling, marking, and placarding of hazardous material;

(3) The preparation, execution, and use of shipping documents related to hazardous material and requirements related to the number, contents, and placement of those documents;

(4) The written notification, recording, and reporting of the unintentional release in transportation of hazardous material; and

(5) The design, manufacture, fabrication, inspection, marking, maintenance, recondition, repair, or testing of a packaging or container represented, marked, certified, or sold as qualified for use in transporting hazardous material in commerce.

This proposed rule addresses subject items (1), (2), (3), and (5) above and preempts State, local, and Indian tribe requirements not meeting the "substantively the same" standard.

D. Executive Order 13175

This proposed rule was analyzed in accordance with the principles and criteria contained in Executive Order 13175 ("Consultation and Coordination with Indian Tribal Governments"). Because this proposed rule does not have tribal implications and does not impose substantial direct compliance costs, the funding and consultation requirements

of Executive Order 13175 do not apply.

E. Regulatory Flexibility Act, Executive Order 13272, and DOT Procedures and Policies

The Regulatory Flexibility Act (5 U.S.C. 601 et seq.) requires an agency to review regulations to assess their impact on small entities, unless the agency determines that a rule is not expected to have a significant impact on a substantial number of small entities. This NPRM proposes measures to enhance the safety in transportation of lithium batteries by ensuring that all lithium batteries are designed to withstand normal transportation conditions, packaged to reduce the possibility of damage that could lead to an incident, minimize the consequences of an incident and ensure packages of lithium batteries are accompanied by hazard information that ensures appropriate and careful handling by air carrier personnel and informs transport workers and emergency response personnel of actions to be taken in the event of an emergency.

Two types of businesses are likely to incur costs associated with compliance with the provisions of this NPRM – manufacturers and distributors of lithium batteries and manufacturers of equipment using lithium batteries. Unless alternative definitions have been established by the agency in consultation with the Small Business Administration (SBA), the definition of "small business" has the same meaning as under the Small Business Act. Since no such special definition has been established, we employ the thresholds published by SBA for industries subject to the HMR. For this analysis, we identified 60 small businesses that manufacture and/or distribute lithium metal or lithium-ion batteries or cells and are potentially affected by the NPRM. Additionally, we

identified 2,179 businesses that manufacture or distribute electronics shipped with lithium metal or lithium-ion batteries.

The compliance costs to small businesses subject to the provisions in the NPRM are costs primarily related to packaging for lithium battery shipments. As detailed in the regulatory evaluation, incremental costs are expected to range from $0.02 to $0.09 per cell for those shipments that are currently excepted from specification packaging requirements. We estimate that small businesses will make 69,876 shipments per year for which more robust packaging will be required; each shipment will average about 200 cells. Using the mid-range incremental packaging cost estimate of $0.04 per cell, a small business will incur an incremental cost of about $8 per shipment. The total incremental packaging cost is $559,008 per year or about $250 per small entity per year.

Small entities will also incur increased costs related to training. These costs are estimated to total $98 per small entity per year.

We have prepared and placed in the docket a regulatory impact analysis (RIA) addressing the economic impact of this rule. The RIA includes qualitative discussions and quantitative measurements of costs related to implementation of this rule.

Based on this analysis, I certify that the provisions of this NPRM, if adopted, would not have a significant impact on a substantial number of small entities.

F. Paperwork Reduction Act

PHMSA currently has an approved information collection under Office of Management and Budget (OMB) Control Number 2137-0034, “Hazardous Materials Shipping Papers and Emergency Response Information” with an expiration date of May 31, 2011. PHMSA believes this proposed rule will result in an increase in the annual

burden of this information collection.

Under the Paperwork Reduction Act of 1995, no person is required to respond to a collection of information unless it is approved by OMB and displays a valid OMB control number. Section 1320.8(d), Title 5, Code of Federal Regulations requires that PHMSA provide interested members of the public and affected agencies an opportunity to comment on information collection and recordkeeping requests.

This notice identifies a revised information collection request that PHMSA will submit to OMB for approval based on the requirements in this proposed rule. PHMSA has developed burden estimates to reflect changes in this proposed rule, and estimates the additional information collection and recordkeeping burden as proposed in this rule to be as follows:

OMB Control No. 2137-0034.

Additional Annual Number of Respondents:	5,131.
Additional Annual Number of Responses:	167,800.
Additional Annual Burden Hours:	1,939.
Additional Annual Burden Costs:	$48,480.

PHMSA specifically requests comments on the information collection and recordkeeping burdens associated with developing, implementing, and maintaining these requirements for approval under this proposed rule.

Requests for a copy of this information collection should be directed to: Deborah Boothe or T. Glenn Foster, Office of Hazardous Materials Standards (PHH-10), Pipeline and Hazardous Materials Safety Administration, Room E24-426, 1200 New Jersey Ave, SE, Washington, DC 20590-0001, telephone (202) 366-8553.

G. Regulation Identifier Number (RIN)

A regulation identifier number (RIN) is assigned to each regulatory action listed in the Unified Agenda of Federal Regulations. The Regulatory Information Service Center publishes the Unified Agenda in April and October of each year. The RIN contained in the heading of this document can be used to cross-reference this action with the Unified Agenda.

H. Unfunded Mandates Reform Act

This proposed rule does not impose unfunded mandates under the Unfunded Mandates Reform Act of 1995. It does not result in costs of $141,300,000 or more, adjusted for inflation, to either State, local or tribal governments, in the aggregate, or to the private sector in any one year, and is the least burdensome alternative that achieves the objective of the rule.

I. Environmental Assessment

The National Environmental Policy Act (NEPA), §§ 4321-4375, requires Federal agencies to analyze proposed actions to determine whether the action will have a significant impact on the human environment. The Council on Environmental Quality (CEQ) regulations order Federal agencies to conduct an environmental review considering (1) the need for the proposed action, (2) alternatives to the proposed action, (3) probable environmental impacts of the proposed action and alternatives, and (4) the agencies and persons consulted during the consideration process. 40 CFR § 1508.9(b).

Purpose and Need. As discussed elsewhere in this preamble, lithium batteries are potentially hazardous in transportation because they present both chemical (e.g., flammable electrolytes) and electrical hazards. If not safely packaged and handled when

transported, lithium batteries can become dangerous. Defective batteries or batteries which are misused, mishandled, or improperly packaged, improperly stored, or overcharged can overheat and ignite and, once ignited, fires can be especially difficult to extinguish. This NPRM proposes measures to enhance the safety in transportation of lithium batteries by ensuring that all lithium batteries are designed to withstand normal transportation conditions, packaged to reduce the possibility of damage that could lead to an incident, minimize the consequences of an incident and ensure packages of lithium batteries are accompanied by hazard information that ensures appropriate and careful handling by air carrier personnel and informs transport workers and emergency response personnel of actions to be taken in an emergency.

Alternatives. PHMSA considered the following alternatives:

Alternative 1: Do Nothing

Under this alternative, the current regulatory scheme applicable to lithium batteries would continue in place. We rejected this alternative because newly identified safety risks would not be addressed.

Alternative 2: Impose Class 9 requirements on all lithium battery shipments

Under this alternative, we would eliminate the current regulatory exceptions for small lithium batteries and require their shipment as fully regulated Class 9 materials. The current packaging requirement for these excepted batteries (a package meeting the general packaging requirements of Subpart B of Part 173 and capable of withstanding 1.2 meter drop test in any orientation) would be replaced by a requirement to package the batteries in UN specification packaging conforming to the Packing Group II performance level. The current marking applicable to packages containing these excepted batteries

would be replaced with a CLASS 9 label and proper shipping name, UN ID number mark, and the CARGO AIRCRAFT ONLY label, as appropriate.

In addition, each shipment would be accompanied by shipping papers and emergency response information, documentation that is currently not required for excepted battery shipments. In addition, eliminating the regulatory exceptions would require notification to the pilot in command of the presence of lithium batteries, the number of packages, and their stowage location. Under this alternative, the ban on the transport of lithium metal batteries aboard passenger aircraft would continue. The maximum quantities that may be offered for transportation in one package aboard passenger and cargo only aircraft would remain unchanged at 5 kg and 35 kg respectively.

We rejected Alternative 2. While it would address many of the safety issues associated with the transportation of lithium batteries, Alternative 2 does not represent a comprehensive regulatory solution. Moreover, Alternative 2 does not address critical international harmonization issues.

Alternative 3: Impose ICAO requirements on all lithium battery shipments

Under this alternative, PHMSA would amend the HMR to harmonize transportation requirements for lithium batteries with requirements in the ICAO Technical Instructions, as follows: (1) the current exception for small lithium batteries would be retained; (2) for excepted shipments, the watt-hour rating for the batteries would be marked on the outside case and the package would be required to have a new lithium battery handling label in place of the current mark; (3) package weight limitations applicable to different lithium battery types would be revised; and (4) for lithium metal

batteries, each package would be allowed to contain up to 2.5 kg of net lithium content per package when surrounded by cushioning material and packaged in rigid metal outer packaging.

We rejected Alternative 3. Although it harmonizes the HMR with international requirements applicable to lithium batteries, it does not address safety issues associated with small batteries nor does it limit the weight of batteries that may be carried in inaccessible compartments on cargo aircraft. Our data and research suggest that the severity of a fire involving lithium batteries is proportional to the numbers of batteries involved in the fire.

Alternative 4: Adopt the provisions in both Alternatives 2 and 3.

Under this alternative, PHMSA would adopt the new and revised regulatory provisions summarized in the discussion of Alternatives 2 and 3 above. In addition, we would adopt requirements for the transport of recalled or defective batteries.

Alternative 4 is the selected alternative. This alternative combines many of the safety elements described in Alternative 2 while harmonizing with international regulatory standards to create a more complete regulatory solution. This alternative will minimize the regulatory exceptions for lithium batteries transported by aircraft. Specifically, with the exception of incident reporting requirements, certain extremely small lithium batteries packed with or contained in equipment that do not pose an unreasonable risk in transport would not be subject to the HMR, and we would maintain an exception for specifically packaged lithium batteries transported by highway and rail only. All other lithium batteries would be fully regulated Class 9 materials. These lithium batteries would be packed in UN specification packaging conforming to the

Packing Group II performance level and appropriately marked and labeled consistent with Part 172. Each shipment of lithium batteries would be accompanied by shipping papers, emergency response information, and a notice to the pilot in command. Further, we would limit the manner in which lithium batteries may be stowed on cargo aircraft. Finally, under this alternative, the requirements applicable to lithium batteries would be harmonized with international standards to the extent possible consistent with our overall safety goals, thereby enhancing safety and facilitating transportation of these critical energy devices.

Analysis of Environmental Impacts. Hazardous materials are substances that may pose a threat to public safety or the environment during transportation because of their physical, chemical, or nuclear properties. The hazardous material regulatory system is a risk management system that is prevention-oriented and focused on identifying a safety hazard and reducing the probability and quantity of a hazardous material release. Hazardous materials are categorized by hazard analysis and experience into hazard classes and packing groups. The regulations require each shipper to classify a material in accordance with these hazard classes and packing groups; the process of classifying a hazardous material is itself a form of hazard analysis. Further, the regulations require the shipper to communicate the material's hazards through use of the hazard class, packing group, and proper shipping name on the shipping paper and the use of labels on packages and placards on transport vehicles. Thus the shipping paper, labels, and placards communicate the most significant findings of the shipper's hazard analysis. A hazardous material is assigned to one of three packing groups based upon its degree of hazard - from a high hazard Packing Group I to a low hazard Packing Group III material. The quality,

damage resistance, and performance standards of the packaging in each packing group are appropriate for the hazards of the material transported.

Releases of hazardous materials, whether caused by accident or deliberate sabotage, can result in explosions or fires. Radioactive, toxic, infectious, or corrosive hazardous materials can have short- or long-term exposure effects on humans or the environment. Generally, however, the hazard class definitions are focused on the potential safety hazards associated with a given material or type of material rather than the environmental hazards of such materials.

Lithium is the lightest solid metal. It can be absorbed into the body by inhalation of its aerosol and by ingestion and is corrosive to the eyes, the skin and the respiratory tract. Lithium reacts violently with strong oxidants, acids and many compounds (hydrocarbons, halogens, halons, concrete, sand and asbestos) causing fire and explosion hazard. In addition, it reacts with water, forming highly flammable hydrogen gas and corrosive fumes of lithium hydroxide. Lithium hydroxide represents a potentially significant environmental hazard, particularly to water organisms. Lithium metal batteries contain no toxic metals.

Lithium ion batteries contain an ionic form of lithium but no lithium metal. Lithium ion batteries do not pose an environmental hazard and are safe for disposal in the normal municipal waste stream. While other types of batteries include toxic metals such as cadmium, the metals in lithium ion batteries - cobalt, copper, nickel and iron - are considered safe for landfills or incinerators.

The measures proposed in this NPRM will reduce the risks to people and the environment posed during transportation of lithium metal and lithium ion batteries by

ensuring that the batteries will withstand conditions normally encountered in transportation; packaged to reduce the possibility of damage that could lead to an incident and minimize the consequences of an incident; and ensure packages of lithium batteries are accompanied by hazard information that ensures appropriate and careful handling by air carrier personnel and informs transport workers and emergency response personnel of actions to be taken in an emergency.

Lithium batteries are a key part of strategies to develop greener technologies to power many different applications from automobiles to cell phones and computers. The measures proposed in this NPRM will facilitate the safe transportation of lithium metal and lithium ion batteries across national boundaries, thereby supporting more widespread use of these batteries as alternatives to other types of energy sources that have adverse environmental impacts. We have preliminarily concluded that there are no significant environmental impacts associated with proposed amendments in this final rule.

Consultation and Public Comment. We invite commenters to address the potential environmental impacts of the proposals in this NRPM.

J. Privacy Act

Anyone is able to search the electronic form of any written communications and comments received into any of our dockets by the name of the individual submitting the document (or signing the document, if submitted on behalf of an association, business, labor union, etc.). You may review DOT's complete Privacy Act Statement in the Federal Register published on April 11, 2000 (Volume 65, Number 70; Pages 19477-78) or you may visit http://www.regulations.gov/search/footer/privacyanduse.jsp

K. International Trade Analysis

The Trade Agreements Act of 1979 (Public Law 96-39), as amended by the Uruguay Round Agreements Act (Public Law 103-465), prohibits Federal agencies from establishing any standards or engaging in related activities that create unnecessary obstacles to the foreign commerce of the United States. For purposes of these requirements, Federal agencies may participate in the establishment of international standards, so long as the standards have a legitimate domestic objective, such as providing for safety, and do not operate to exclude imports that meet this objective. The statute also requires consideration of international standards and, where appropriate, that they be the basis for U.S. standards. PHMSA participates in the establishment of international standards to protect the safety of the American public, and we have assessed the effects of the proposed rule to ensure that it does not exclude imports that meet this objective. Accordingly, this rulemaking is consistent with PHMSA's obligations under the Trade Agreement Act, as amended.

List of Subjects

49 CFR Part 171

Exports, Hazardous materials transportation, Hazardous waste, Imports, Incorporation by reference, Reporting and recordkeeping requirements.

49 CFR Part 172

Education, Hazardous materials transportation, Hazardous waste, Incorporation by reference, Labeling,

Markings, Packaging and containers, Reporting and recordkeeping requirements.

49 CFR Part 173

Hazardous materials transportation, Packaging and containers, Radioactive materials, Reporting and recordkeeping requirements, Uranium.

49 CFR Part 175

Air carriers, Hazardous materials transportation, Radioactive materials, Reporting and recordkeeping requirements.

In consideration of the foregoing, we propose to amend 49 CFR Chapter I as follows:

PART 171--GENERAL INFORMATION, REGULATIONS, AND DEFINITIONS

1. The authority citation for part 171 continues to read as follows:

   Authority: 49 U.S.C. 5101-5128, 44701; 49 CFR 1.45 and 1.53; Pub. L. 101-410 section 4 (28 U.S.C. 2641 note); Pub. L. 104-134, section 31001.

2. In § 171.7, in the paragraph (a)(3) table, the entry "UN Recommendations on the Transport of Dangerous Goods, Manual of Tests and Criteria, Fourth revised edition, (2003), and Addendum 2, (2004)" is revised to read as follows:

§ 171.7 Reference material.

(a) * * *

(3) Table of material incorporated by reference. * * *

Source and name of material	49 CFR reference
* * * * * * *	
UN Recommendations on the Transport of Dangerous Goods Manual of Tests and Criteria, Fifth revised edition (2009)	172.102; 173.21; 173.56; 173.57;

173.58; 173.115;
173.124; 173.125;
173.127; 173.128;
173.137; 173.185;
Part 173, appendix H;
178.274.

* * * * * * *

3. In § 171.8:

    1. The definition for “Equivalent lithium content” is removed.
    2. The definitions for “Lithium cell or battery”, “Lithium ion cell or battery” “Lithium metal cell or battery”, “Short circuit” and “Watt-hour” are added in appropriate alphabetical order.
    3. The definitions for “Aggregate lithium content” and “Lithium content” are revised.

The additions and revisions, in appropriate alphabetic order, read as follows:

§ 171.8 Definitions and abbreviations.

* * * * *

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

* * * * *

Lithium cell or battery refers to a family of cells and batteries with different chemistries comprising many types of cathodes and electrolytes. A lithium cell is a single encased exhibits a voltage differential across its two terminals. A lithium battery consists of

multiple lithium cells electrically connected together fitted with devices necessary for use, for example, case, terminals, markings and protective devices. For the purposes of this subchapter, units that are commonly referred to as "battery packs" or “battery modules” or “battery assemblies” having the primary function of providing a source of power to another piece of equipment are treated as batteries.

Lithium content means

(1) For a lithium metal or lithium alloy cell the mass in grams of lithium or lithium alloy in the anode, and

(2) For a lithium metal or lithium alloy battery, the sum of the grams of lithium content contained in the component cells of the battery.

(3) For a lithium ion cell or battery, see the definition for “Watt-hour”.

Lithium-ion cell or battery means a rechargeable electrochemical cell or battery in which the positive and negative electrodes are both lithium compounds constructed with no metallic lithium in either electrode. A lithium ion polymer cell or battery that uses lithium-ion chemistries, as described herein, is regulated as a lithium-ion cell or battery.

Lithium metal cell or battery means an electrochemical cell or battery utilizing lithium metal or lithium alloys as the anode.

* * * * *

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.

* * * * *

Watt-hour means a unit of energy equivalent to one watt (1 W) of work acting for one hour (1 h) of time and is expressed as (Wh). The Watt-hour rating of a lithium ion cell or battery is determined by multiplying a cell or battery's rated capacity in ampere-hours, by its nominal voltage. Therefore, Watt-hour (Wh) = ampere-hour (Ah) × volts (V).

* * * * *

4. In § 171.12, paragraphs (a)(6) is revised to read as follows:

§ 171.12 North American Shipments.

(a) * * *

(6) Lithium cells and batteries. Lithium cells and batteries must be offered for transport and transported in accordance with the provisions of this subchapter. Lithium metal cells and batteries (UN3090) are forbidden for transport aboard passenger-carrying aircraft.

(i) The provisions of this paragraph (a)(6) do not apply to packages that contain 5 kg (11 pounds) net weight or less lithium metal cells or batteries that are contained in or packed with equipment (UN3091).

(ii) Lithium cells and batteries with a lithium content of not more than 0.3 grams or a watt-hour rating of not more than 3.7 Wh packed with or contained in equipment are not subject to any other requirements of this subchapter except for the requirements in §§ 171.15 and 171.16 applicable to the reporting of incidents.

* * * * *

5. Section 171.21(a) is revised to read as follows:

§ 171.21 Assistance in investigations and special studies.

(a) A person reporting an incident under the provisions of § 171.15 or § 171.16 must:

(1) Give an authorized representative of the Federal, State or local government agency reasonable assistance in the investigation of the incident; (i.e. making all records and information pertaining to the incident available or assisting in the transportation of the evidence upon request).

(2) Give an authorized representative or special agent of the Department of Transportation reasonable assistance in the investigation of the incident; and

(3) Upon request, provide an authorized representative or special agent of the Department of Transportation reasonable access to the damaged package or article, if available.

* * * * *

6. In § 171.24, paragraphs (d)(1)(ii) and (d)(1)(iii) are revised to read as follows:

§ 171.24 Additional requirements for the use of the ICAO Technical Instructions.

* * * * *

(d) * * *

(1) * * *

(ii) Lithium cells and batteries. The following conditions and limitations apply to lithium batteries and cells:

(A) Lithium cells and batteries meeting the provisions found in Section II of Packing Instructions 965 through 970 must be offered for transportation and transported in accordance with the provisions of this subchapter;

(B) Lithium metal cells and batteries (UN3090) are forbidden for transport aboard passenger-carrying aircraft.

(*1*) The provisions of this paragraph do not apply to packages that contain 5 kg (11 pounds) net weight or less lithium metal cells or batteries that are contained in or packed with equipment (UN3091); and

(*2*) Lithium cells and batteries of a design type proven to meet the criteria of Class 9 in Sub-section 38.3 of the UN Manual of Tests and Criteria with a lithium content of not more than 0.3 grams or a watt-hour rating of not more than 3.7 Wh packed with or contained in equipment are not subject to any other requirements of this subchapter except for the requirements in §§ 171.15 and 171.16 applicable to the reporting of incidents.

(iii) Pre-production prototype lithium cells and batteries. Pre-production cells and batteries must be approved by the Associate Administrator prior to transportation aboard cargo aircraft.

* * * * *

7. In § 171.25, paragraph (b)(3) is revised to read as follows:

§ 171.25 Additional requirements for the use of the IMDG Code.

* * * * *

(b) * * *

(3) Lithium cells and batteries—

(i) Transported in accordance with Special Provision 188 of the IMDG Code may be offered for transportation and transported by highway, rail or vessel only. Additionally, each package must be marked "LITHIUM BATTERIES—FORBIDDEN FOR TRANSPORT ABOARD AIRCRAFT" on a background of contrasting color. The marking must be durable, legible and of such a size relative to the package as to be readily visible.

(ii) Lithium cells and batteries of a design type proven to meet the criteria of Class 9 in Sub-section 38.3 of the UN Manual of Tests and Criteria with a lithium content of not more than 0.3 grams or a watt-hour rating of not more than 3.7 Wh packed with or contained in equipment are not subject to any other requirements of the subchapter except for the requirements in §§ 171.15 and 171.16 applicable to the reporting of incidents.

* * * * *

PART 172--HAZARDOUS MATERIALS TABLE, SPECIAL PROVISIONS,

HAZARDOUS MATERIALS COMMUNICATIONS, EMERGENCY RESPONSE INFORMATION, AND TRAINING REQUIREMENTS

8. The authority citation for part 172 continues to read as follows:

Authority: 49 U.S.C. 5101-5128, 44701; 49 CFR 1.45 and 1.53.

9. In § 172.101, the Hazardous Materials Table is amended by removing and adding entries in the appropriate alphabetical sequence, to read as follows:

Symbols (1)	Hazardous materials descriptions and proper shipping names (2)	Hazard class or division (3)	Identification numbers (4)	PG (5)	Label codes (6)	Special provisions (7)	(8) Packaging (§ 173.***) Exceptions (8A)	Non-bulk (8B)	Bulk (8C)	(9) Quantity limitations (see §§ 173.27 and 175.75) Passenger aircraft/rail (9A)	Cargo aircraft only (9B)	(10) Vessel stowage Location (10A)	Other (10B)
	[**REMOVE**] *		*		*		*		*		*		*
	Lithium batteries, contained in equipment	9	UN3091	II	9	29, 188, 189, 190, A54, A55, A101, A104	185	185	None	See A101, A104	35 kg	A	
	Lithium batteries packed with equipment	9	UN3091	II	9	29, 188, 189, 190, A54, A55, A101, A103	185	185	None	See A101, A103	35 kg gross	A	
	Lithium battery	9	UN3090	II	9	29, 188, 189,190, A54, A55, A100	185	185	None	See A100	35 kg gross	A	
	*		*		*		*		*		*		*
	[**ADD**] *		*		*		*		*		*		*
	Lithium ion batteries contained in equipment <u>including lithium ion polymer batteries</u>	9	UN3481	II	9		185	185	None	5 kg	35 kg	A	
	Lithium ion batteries <u>including lithium ion polymer batteries</u>	9	UN3480	II	9		185	185	None	5 kg gross	35 kg gross	A	

	Lithium ion batteries packed with equipment including lithium ion polymer batteries	9	UN3481	II	9		185	185	None	5 kg	35 kg	A	
	Lithium metal batteries contained in equipment including lithium alloy batteries	9	UN3091	II	9		185	185	None	5 kg	35 kg	A	
	Lithium metal batteries including lithium alloy batteries	9	UN3090	II	9		185	185	None	Forbidden	35 kg gross	A	
	Lithium metal batteries packed with equipment including lithium alloy batteries	9	UN3091	II	9		185	185	None	5 kg	35 kg	A	
	*		*		*		*		*		*		*

§ 172.102 Special Provisions

10. In § 172.102, in paragraph (c)(1), Special Provisions 134 and 157 are revised; Special Provisions 29, 188, 189, and 190 are removed; and in paragraph (c)(2), Special Provisions A54, A55, A100, A101, A103, and A104 are removed.

The revisions read as follows:

§ 172.102 Special provisions.

* * * * *

(c) * * *

(1) * * *

Code/Special Provisions

* * * * *

134 This entry only applies to vehicles, machinery and equipment powered by wet batteries, sodium batteries, or lithium batteries that are transported with these batteries installed. Examples of such items are electrically-powered cars, lawn mowers, wheelchairs, and other mobility aids. Self-propelled vehicles that also contain an internal combustion engine must be consigned under the entry “Vehicle, flammable gas powered” or “Vehicle, flammable liquid powered”, as appropriate.

*** * * * ***

157 This entry includes hybrid electric vehicles powered by both an internal combustion engine and wet, sodium or lithium batteries installed. Vehicles containing an internal

combustion engine must be consigned under the entry “Vehicle, flammable gas powered” or “Vehicle, flammable liquid powered”, as appropriate.

* * * * *

PART 173--SHIPPERS--GENERAL REQUIREMENTS FOR SHIPMENTS AND PACKAGINGS

11. The authority citation for part 173 continues to read as follows:

Authority: 49 U.S.C. 5101-5128, 44701; 49 CFR 1.45 and 1.53.

12. Section 173.185 is revised to read as follows:

§ 173.185 Lithium cells and batteries.

Lithium cell and battery. A lithium cell or battery must be transported only under the following conditions:

(a) General Requirements. (1) Each lithium cell or battery must:

(i) Be of a design type proven to meet the criteria of Class 9 in Sub-section 38.3 of the UN Manual of Tests and Criteria (IBR; see §171.7 of this subchapter).

(A) A lithium cell or battery that differs from a tested design type would be considered a new design type and would be required to be retested:

(*1*) A change of 0.1 grams or 5% by mass to the cathode, to the anode, or to the electrolyte; or for rechargeable batteries a change in the nominal energy in watt-hours or an increase in the nominal voltage of more than 5%; or

(2) A change that would materially affect the test results would be considered a new design type;

Note to paragraph (a)(1)(i)(A): 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 tests, may include but is not limited to:

- A change in the material of the anode, the cathode, the separator, or the electrolyte;
- A change of protective devices, including hardware and software;
- A change of safety design in cells or batteries, such as a venting valve;
- A change in the number of component cells;
- A change in connecting mode of component cells.

(B) Each person who manufactures lithium cells or batteries must maintain a record of satisfactory completion of these tests prior to offering the cell or battery for transport and must make this record available, upon request, to an authorized official of a Federal, State, or local government agency at reasonable times and locations. Each person who manufactures lithium cells or batteries must retain this record for as long as that lithium battery design type is offered for transportation and for one year thereafter.

(ii) Incorporate a safety venting device or otherwise be designed in a manner that will preclude a violent rupture under conditions normally incident to transportation.

(iii) Be equipped with an effective means to prevent dangerous reverse current flow (e.g., diodes, fuses, etc.) if a battery contains cells or a series of cells that are connected in parallel; and

(iv) Be equipped with an effective means of preventing external short circuits and the evolution of a dangerous amount of heat (i.e. an amount of heat sufficient to be dangerous to packaging or personal safety to include charring, melting or scorching of packaging, or other evidence).

(2) Packaging. Lithium cells and batteries must be packaged as follows:

(i) Lithium cells or batteries, including lithium cells or batteries packed with or contained in equipment, must be packaged in a manner to prevent short-circuiting, generation of sparks, or a dangerous quantity of heat. Examples of acceptable packaging methods include but are not limited to the following: packaging each battery or each battery powered device in fully enclosed inner packagings made of non-conductive material; separating batteries and battery powered devices in a manner to prevent contact with other batteries, devices, or conductive materials (e.g., metal) in the packagings; ensuring exposed terminals are protected with non-conductive caps, non-conductive tape; or other appropriate means; and

(ii) Lithium cells or batteries must be packaged in combination packagings conforming to the requirements of part 178, subparts L and M, of this subchapter at the Packing Group II performance level. The lithium cell or battery must be packed in inner packagings that completely enclose the cell or battery. The inner packagings must be

packed within one of the following outer packagings: metal boxes (4A or 4B); wooden boxes (4C1, 4C2, 4D, or 4F); fiberboard boxes (4G); solid plastic boxes (4H2); fiber drums (1G); metal drums (1A2 or 1B2); plywood drums (1D); plastic jerricans (3H2); or metal jerricans (3A2 or 3B2).

(3) Except as provided in paragraph (e) of this section, cells and batteries with a liquid cathode containing sulfur dioxide, sulfuryl chloride or thionyl chloride may not be offered for transportation or transported if any cell has been discharged to the extent that the open circuit voltage is less than two volts or is less than 2/3 of the voltage of the fully charged cell, whichever is less.

(4) Cells and batteries with lithium content of not more than 0.3 grams or a watt-hour rating of not more than 3.7 Wh that meet the requirements of paragraph (a) that are packed with or contained in equipment in accordance with paragraphs (b) or (c) of this section are not subject to any other requirements of the subchapter except for the incident reporting requirements in §§ 171.15 and 171.16.

(b) Lithium cells or batteries packed with equipment. Lithium cells or batteries packed with equipment must meet all the requirements of paragraph (a) of this section except the specification packaging requirements of paragraph (a)(2)(ii).

(1) The cells or batteries must be packed to prevent short circuits, including shifting that could lead to short circuits. The equipment and the packages of cells or batteries must be further packed in a strong outer packaging.

(2) The package may contain no more than the number of lithium cells or batteries necessary to power the piece of equipment plus two spare cells or batteries.

(c) Lithium cells or batteries contained in equipment. Lithium cells or batteries contained in equipment must meet all the requirements of paragraph (a) of this section, except the specification packaging requirements of paragraph (a)(2)(ii).

(1) The equipment must be packed in a strong outer packaging that is waterproof or is made waterproof through the use of an inner packaging or a liner unless the equipment is made waterproof by nature of its construction.

(2) The package may contain no more than the number of lithium cells or batteries necessary to power the piece of equipment plus two spare cells or batteries. The additional cells or batteries must be packaged in accordance with paragraph (b) of this section.

(3) If package contains cells or batteries in equipment and other cells or batteries packed with equipment, the package must be marked with the proper shipping name "Lithium metal batteries packed with equipment" or "Lithium ion batteries packed with equipment" as appropriate.

(d) Exceptions for surface transport. When transported by motor vehicle, rail car, or vessel, lithium cells or batteries, including lithium cells or batteries packed with or contained in equipment, are excepted from the subparts C, D and E of part 172 of this subchapter and the specification packaging requirements of paragraph (a)(2)(ii) of this section provided they conform to all of the following conditions:

(1) For a lithium metal cell, the lithium content is not more than 1 g per cell and the aggregate lithium content is not more than 2 g per battery and, for a lithium ion cell or battery, the watt-hour rating is not more than 20 Wh per cell and not more than 100 Wh per battery. These limits may be increased to 5 g per lithium metal cell or 25 grams per lithium metal battery and 60 Wh per lithium ion cell and 300 Wh per battery when transported by highway or rail only;

(2) Cells or batteries are separated or packaged in a manner to prevent short circuits and are packed in a strong outer packaging or are contained in equipment;

(3) Except when contained in equipment, each package containing more than 4 lithium cells or 2 lithium batteries must be capable of withstanding a 1.2 meter drop test in any orientation without damage to cells or batteries contained in the package, without shifting of the contents that would allow short circuiting and without release of package contents;

(4) Each package must be marked "LITHIUM BATTERIES—FORBIDDEN FOR TRANSPORT ABOARD AIRCRAFT" on a background of contrasting color. The marking must be durable, legible and of such a size relative to the package as to be readily visible and include any special procedures that should be followed if the package is damaged;

(5) Each shipment consisting of one or more packages must be accompanied by a document indicating that the package contains lithium batteries and any special procedures that should be followed if the package is damaged; and

(6) The net weight of lithium batteries or cells in the package may not exceed 30 kg (66 pounds).

(e) Lithium cells and batteries, for disposal or recycling. A lithium cell or battery offered for transportation or transported by motor vehicle to a permitted storage facility or disposal site or for purposes of recycling is excepted from the specification packaging requirements of paragraph (a)(2)(ii) of this section and the requirements of paragraphs (a)(1)(i) and (a)(3) of this section when protected against short circuits and packed in a strong outer packaging conforming to the requirements of §§ 173.24 and 173.24a.

(f) Small production runs and pre-production prototypes. When transported by motor vehicle or rail car, production runs of not more than 100 lithium cells or batteries per year or pre-production prototype lithium cells or batteries transported for purposes of testing are excepted from the testing requirements of paragraph (a)(1)(i) of this section provided:

(1) The cells or batteries are individually packed in an inner packaging, surrounded by cushioning material that is non-combustible and non-conductive; and

(2) The cells or batteries are packed in an outer packaging that is a metal, plastic or plywood drum (1A2, 1H2, 1D) or a metal, plastic or wooden box (4A, 4B, 4H1, 4H2, 4C1 or 4C2) that meets the criteria for Packing Group I packagings

(g) Damaged, defective, or recalled batteries. Lithium cells or batteries that have been damaged, identified as defective, or are otherwise being returned to the manufacturer for safety reasons must be packaged in accordance with paragraph (a)(2) of

this section. Inner packagings must be surrounded by cushioning material that is non-combustible, and non-conductive. Damaged, defective, or recalled batteries packaged in this manner must be transported by highway or rail only.

(h) Batteries exceeding 12 kg. Batteries employing a strong, impact-resistant outer casing and exceeding a gross weight of 12 kg (26.5 lbs.), and assemblies of such batteries, may be packed in strong outer packagings, in protective enclosures (for example, in fully enclosed wooden slatted crates) or on pallets. Batteries must be secured to prevent inadvertent movement, and the terminals may not support the weight of other superimposed elements. Batteries packaged in this manner are not permitted for transportation by passenger aircraft, and may be transported by cargo aircraft only if approved by the Associate Administrator prior to transportation.

(i) Approval. A lithium cell or battery that does not conform to the provisions of this subchapter may be transported only under conditions approved by the Associate Administrator.

13. In § 173.219, paragraph (b)(3) is revised as follows:

§ 173.219 Life-saving appliances.

* * * * *

(b) * * *

(3) Electric storage batteries or lithium batteries. Life saving appliances containing lithium batteries must be transported in accordance with §173.185.

* * * * *

14. In § 173.220, paragraphs (d) and (e) are revised as follows:

§ 173.220 Internal combustion engines, self-propelled vehicles, mechanical equipment containing internal combustion engines, and battery powered vehicles or equipment.

* * * * *

(d) Lithium batteries. (1) A vehicle, engine, or machinery powered by lithium metal batteries that is transported with these batteries installed may be transported on board passenger-carrying aircraft provided the lithium content of each cell, when fully charged, is not more than 5 grams, the aggregate lithium content of the anode of each battery, when fully charged, is not more than 25 grams and the net weight of lithium batteries does not exceed 5 kg (11 pounds). Lithium batteries contained in vehicles, engines, or mechanical equipment must be securely fastened in the battery holder of the vehicle, engine, or mechanical equipment and must be protected in such a manner as to prevent damage and short circuits (e.g., by the use of non-conductive caps that cover the terminals entirely). Except for vehicles transported by highway for product testing with prototype lithium batteries securely installed, each lithium battery must be of a type that has successfully passed each test in the UN Manual of Tests and Criteria as specified in § 173.185, unless approved by the Associate Administrator.

(2) Equipment (other than vehicles, engines or mechanical equipment) containing lithium batteries, must be described as “Lithium metal batteries contained in equipment” or “Lithium ion batteries contained in equipment”, as appropriate, and transported in accordance with §173.185.

(e) Other hazardous materials. (1) Items containing hazardous materials, such as fire extinguishers, compressed gas accumulators, safety devices, and other hazardous materials, that are integral components of the motor vehicle, engine, or mechanical equipment and are necessary for the operation of the vehicle, engine, or mechanical equipment, or for the safety of its operator or passengers must be securely installed in the motor vehicle, engine, or mechanical equipment. Such items are not otherwise subject to the requirements of this subchapter.

(2) Equipment (other than vehicles, engines or mechanical equipment) containing lithium batteries must be described as "Lithium metal batteries contained in equipment" or "Lithium ion batteries contained in equipment", as appropriate, and transported in accordance with §173.185.

* * * * *

PART 175--CARRIAGE BY AIRCRAFT

15. The authority citation for part 175 continues to read as follows:

Authority: 49 U.S.C. 5101-5128, 44701; 49 CFR 1.45 and 1.53.

16. In § 175.8, add a new paragraph (a)(4) to read as follows:

§ 175.8 Exceptions for operator equipment and items of replacement.

(a) * * *

(4) Items containing hazardous materials used by the operator aboard the aircraft when approved by the Administrator of the Federal Aviation Administration.

* * * * *

17. In § 175.10, paragraph (a)(17) is revised to read as follows:

§ 175.10 Exceptions for passengers, crewmembers, and air operators.

(a) * * *

(17) Except as provided in § 173.21 of this subchapter, portable electronic devices (for example, watches, calculating machines, cameras, cellular phones, laptop and notebook computers, camcorders, etc.) containing dry cells or dry batteries (including lithium cells or batteries) and spare dry cells and batteries for these devices, when carried by passengers or crew members for personal use. Each installed or spare lithium battery must be of a type proven to meet the requirements of each test in the UN Manual of Tests and Criteria, and each spare battery must be individually protected so as to prevent short circuits (by placement in original retail packaging or by otherwise insulating terminals, e.g , by taping over exposed terminals or placing each battery in a separate plastic bag or protective pouch) and carried in carry-on baggage only. In addition, each installed or spare battery must not exceed the following:

(i) For a lithium metal battery, a lithium content of not more than 2 grams per battery; or

(ii) For a lithium-ion battery, a rating of not more than 100 Wh, except that up to two batteries with a watt hour rating of more than 100 Wh but not more than 300 Wh may be carried.

* * * * *

18. In § 175.75, the last sentence of paragraph (c) and paragraph (e)(1) are revised to read as follows:

§ 175.75 Quantity limitations and cargo location.

*** * * * ***

(c) * * * The requirements of this paragraph do not apply to ORM-D materials or Class 9 materials, except that lithium batteries, including lithium batteries packed with or contained in equipment may be loaded in an inaccessible manner only if they are packaged in an container approved by the FAA Administrator for such use or carried in a Class C cargo compartment.

* * * * *

(e) * * *

(1) Class 3, Packing Group III, materials that do not meet the definition of another hazard class, Division 6.1 materials except those also labeled FLAMMABLE, Division 6.2, Class 7, or ORM–D materials; Class 9 materials, except that lithium batteries, including lithium batteries packed with or contained in equipment may be loaded in an inaccessible manner only if they are packaged in a container approved by the FAA Administrator for such use or carried in a Class C cargo compartment.

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Issued in Washington, DC on January 6, 2010, under authority delegated in 49 CFR part 1.

Magdy El-Sibaie,
Acting Associate Administrator for Hazardous Materials Safety

<FRDOC> [FR Doc. 2010–281 Filed 1–8–10; 8:45 am]
<BILCOD>BILLING CODE 4910–60–P

[FR Doc. 2010-281 Filed 01/08/2010 at 8:45 am; Publication Date: 01/11/2010]