Shipping Hazardous Materials By Air

College and University Hazardous Materials Outreach

By: Federal Aviation Administration – Joint Office of Security & Hazardous Materials Safety, Central

Date: November 30, 2016
FEDERAL AVIATION ADMINISTRATION
Office of Security and Hazardous Materials Safety (ASH)

Our Mission
Provide quality services to ensure and promote aviation safety in support of national security and the national aerospace system.

Our Objective
Prevent fatalities resulting from improper shipments of hazardous materials in U.S. air commerce.
HAZARDOUS MATERIALS SAFETY PROGRAM

Chicago Hazardous Materials Safety Division

- 2 Security Field Offices
- 5 Posts of Duty
- 15 Hazmat Specialists
Title 49, United States Code § 40113

“The Secretary of Transportation may take action the Secretary, Under Secretary, or Administrator, as appropriate, considers necessary to carry out this part, including conducting investigations, prescribing regulations, standards, and procedures, and issuing orders.
SCOPE OF AUTHORITY

• Aircraft Operators
• Air Passengers
• Aviation Repair Stations
• Freight Forwarders
• Shippers
HAZARDOUS MATERIALS REGULATIONS

Definition of a Hazardous Material –

“A substance or material, which has been determined by the Secretary of Transportation to be capable of posing an unreasonable risk to health, safety, and property when transported in commerce, and which has been so designated.”

-- 49 CFR 171.8

*Note - In the aviation industry the term Dangerous Goods is used synonymously with the term Hazardous Material.
Hazardous Materials must be Classified for Transportation

To aid in determining when something is a hazardous material for transportation, the DOT classifies material into nine different hazard classes.

- Each of these hazard classes has its own technical and scientific criteria.
Classes of Hazardous Materials

Class 1 Explosives
• Fireworks, Bullets, Charges, Squibs

Class 2 Flammable, Non-Flammable or Toxic Gases
• Lighters, Propane, Butane, Oxygen, Nitrogen

Class 3 Flammable Liquids
• Paint, Lighter Fluid, Fuels

Class 4 Flammable or Combustible Solids
• Matches, Sterno heaters

Class 5 Oxidizers or Organic Peroxides
• Hydrogen peroxides, 8% or higher
Classes of Hazardous Materials

Class 6  Toxic or Infectious Substances
• Pesticides, Biological substances

Class 7  Radioactive Materials

Class 8  Corrosives
• Acids (sulfuric, hydrochloric), some batteries

Class 9  Miscellaneous
• Can include lithium batteries, dry ice, auto parts (i.e. air bag inflators), dangerous goods in machinery or apparatus (i.e. a chainsaw with fuel), Consumer Commodities
Classes of Hazardous Materials

Class 1  Explosives (173.50)
Class 2  Flammable & Non-Flammable Gases (173.115)
Class 3  Flammable Liquids (173.120)
Class 4  Flammable Solids (173.124)
Class 5  Oxidizers & Organic Peroxide (173.128)
Class 6  Toxic or Infectious Substances (173.132)
Class 7  Radioactive Materials (173.403)
Class 8  Corrosive Materials (173.136)
Class 9  Miscellaneous (173.140)
Why it Matters...
ValuJet Flight 592

May 11, 1996

- Aircraft type McDonnell-Douglas DC 9
- 110 passengers & crew – no survivors
- Hit Florida Everglades at 440 knots (in excess of 506 MPH)
- Cause of crash: Improperly packaged, marked & labeled Chemical Oxygen Generators
VALUJET FLIGHT 592

May 11, 1996

110 Passengers & Crewmembers Killed

An oxygen canister

144 undeclared, improperly packaged oxygen generators
Impacted Florida Everglades at 440 knots
110 Passengers & Crewmembers Killed
2006 Philadelphia International Airport Suspected Hazmat Incident
A fire in the cargo bay led the crew to deploy oxygen and conduct an emergency landing. Although the cause is unknown, it is believed that several lithium ion batteries for laptop computers either caused or contributed to the fire.
INCIDENT

Fire in the cargo hold. Flight forced into an emergency decent from 33,000 feet, flight conducted a successful emergency landing. Emergency personnel were delayed in their response due to unavailability of information as to the type of hazardous materials, locations and quantity.

The fire aboard the aircraft was not extinguished for 4 hours and destroyed the aircraft.

Fire caused by undeclared flammable liquids (acetonitrile and tetrahydrofuran)
Other Examples of Hazmat Incidents Aboard Aircraft

Chemical reaction between sodium hydroxide and hydrogen peroxide solution

Safety Matches Burst Into Flames During Loading
Other Examples of Hazmat Incidents Aboard Aircraft

Sulfuric Acid Carried Onboard By A Passenger

A Can Of Gasoline + A 12 Volt Battery In An Overhead Bin
Incidents…

April 2004 – Midway Airport, Chicago, IL.
Suspected Battery Fire

- Fifty bags burned
- This occurred 5 minutes prior to loading
- Being loaded onto a passenger aircraft
News crew audio/video equipment causes fire in cabin and emergency landing

• A passenger aircraft made an emergency landing shortly after takeoff from NYC

• Batteries in a bag of audio-video equipment caused a fire in an overhead compartment.

• A 9-volt lithium battery is the most likely source.
Passenger baggage

FORBIDDEN ITEM

49 CFR 171.15(b)(6) / 173.21(c)

Dangerous evolution of heat
Offered for transportation in air commerce by a University Employee

Discovered in checked baggage

UNDECLARED ITEM

1 Liter
UN1230, Methanol
Class 3 (6.1), PG II
Summary of Findings

UNIVERSITY RESEARCH SCIENTIST

Observations
- Checked Baggage
- Discovered during Security Screening

Factors
- Traveling on behalf of University
- Obtained from University Lab Storage

NOTE
Vicarious Liability: Employer is responsible for employees who offer undeclared hazmat in checked or carry-on baggage if used for business purposes
FLAMMABLE GAS TORCHES

Threat

Torches and lighters are equipped with a source of ignition and fuel contained within the same device. Inadvertent activation could lead to a fire or explosion.

Micro Torch
Lighter
Utility Lighter
Large Torches
DRY ICE

3 lbs. of dry ice inside a plastic container rather than placing it between the inner and outer packaging. Dry ice could not vent its gases and exploded.

Shipment of improperly vented Class 6.2 materials that exploded during the sort process. 5 hour evacuation and response by local police and hazmat teams.

**CAUSES**

Failure to properly package hazardous materials and train hazmat employees.
HAZARDOUS MATERIAL REGULATIONS

• 49 Code of Federal Regulations, Parts 100-181
  www.gpoaccess.gov/ecfr/

• International Civil Aviation Organization (ICAO)
  Technical Instructions
  www.icao.int/
What to expect from the FAA on an inspection of your facility…..

- **AT A MINIMUM, A REVIEW OF:**

  - Hazardous Materials Shipping papers (Two Year File).

  - Training records for your personnel, both general awareness and function specific.


  - Your packaging and handling procedures.

Most commonly found areas of non-compliances during investigations & inspections

- Classification
- Shipping papers
- Packaging
- Training
Classification

• SAFETY DATA SHEETS
  – Proper Shipping Name
  – Hazard Class
  – Packing Group
  – UN or ID number
Shipping Papers

- UN, PSN and PG
- Emergency Response Number
- Record Retention

49 CFR 172.200
Packaging

• **Quantity Limit Violations**
  – Including Inner Packaging

• **Closure Instructions**
  – Solids or Liquids

• **Package Variations**
  – 4G vs 4GV
# TRAINING

## What Must Training Include?

1. General Awareness  
   - [172.704(a)(1)]
2. Function-Specific  
   - [172.704(a)(2)]
3. Safety  
   - [172.704(a)(3)] *
4. Security Awareness  
   - [172.704(a)(4)] *
5. In-Depth Security  
   - [172.704(a)(5)] **

* Per 172.704(b), training provided to comply with the hazard communication programs required by OSHA and EPA, or training provided to comply with security training programs of other federal or international agencies, may be used to comply with the requirements of (3) and (4).

** In-depth security training is only required when a DOT Security Plan is required per 172.800(b).
TRAINING

Who needs to be trained?

Employees who…

- Determine the hazard class of a material
- Select hazardous materials packaging
- Fill a hazardous materials packaging *
- Secure a closure on a hazardous materials packaging *
- Mark/Label a package
- Prepare a shipping paper
- Provide/Maintain emergency response information
- Review/Certify shipping papers
- Load/Block/Brace hazardous materials in a container or vehicle
- Select/Provide/Affix placards

* Note – to include an inner packaging
A hazmat employer must create and retain a record of training, inclusive of the previous 3 years, which includes:

1) Employee name
2) Date of most recent training
3) Description, copy, or location of training materials
4) Name and address of the person who provided training
5) Certification that employee has been trained & tested
By providing a certification, the hazmat employer is confirming that the hazmat employee “has a familiarity with the HMR, is able to recognize and identify hazardous materials, has a knowledge of specific requirements of the HMR applicable to the functions performed, and has a knowledge of emergency response information, self protection measures, and accident prevention methods and procedures.” {49 CFR 172.700(b)}
Challenges for Universities

• **Hazmat Employees**
  – Identify *who* may perform “pre-transportation functions”
    • Administrative Staff, Scientist, R&D, Students, Custodial and Maintenance Staff, Engineering, Security, Shipping and Receiving
  – Identify *who* has access to
    • Shipping accounts, documents and packaging

• **Many Locations and Many Shippers**
  – Identify *where & when* hazmat may be offered
    • Shipping, Receiving, Labs, Test Facilities
    • Shipping for Field Tests, Conferences and Trade Shows
    • Sports Teams, Robotic Teams, Clubs
Challenges for Universities

• **Identify Hazardous Materials**
  – Identify *what* products are subject to the HMR
    • Lab chemicals, Biological products, Cleaning Supplies, Paints, etc.

• **Offering Electronics and Batteries**
  – Mistakenly offered as non-hazardous
  – Equipment with compressed air chambers or pistons
  – Lithium Ion (rechargeable)
  – Lithium Metal (primary) in laptops, etc.
  – Instruments with compressed gas cartridges / canisters / cylinders
  – Traditionally offered by employees not traditionally thought of as “hazmat employees”
Violation Enforcement

- Counseling
- Warning Notice
- Civil Penalty
- Criminal Action
Civil Penalty Amount$

49 CFR §107.329  Maximum penalties.

(a) A person who knowingly violates a requirement of the Federal hazardous material transportation law, an order issued thereunder, this subchapter, subchapter C of the chapter, or a special permit or approval issued under this subchapter applicable to the transportation of hazardous materials or the causing of them to be transported or shipped is liable for a civil penalty of not more than $75,000 for each violation, except the maximum civil penalty is $175,000 if the violation results in death, serious illness or severe injury to any person or substantial destruction of property. There is no minimum civil penalty, except for a minimum civil penalty of $450 for violations relating to training. When the violation is a continuing one, each day of the violation constitutes a separate offense.
DRY ICE

- Dry ice is only regulated for transportation by vessel and air.
- Up to 2.5 kilograms (5.5 pounds) of dry ice may be in carry-on baggage. Package **must** allow the release of carbon dioxide gas (no airtight containers).
- There are additional requirements for dry ice offered as cargo.
- FAA Advisory Circular, No. 91-76, issued to identify potential hazards associated with dry ice shipments. Document is available at:

  http://www.faa.gov/regulations_policies/
Class 6.2
Infectious Substances
Infectious Substance Categories

Infectious substances are divided into two categories:

- **Category A** – Fully regulated infectious substances
  UN 2814 or UN 2900

- **Category B** – Regulated infectious substances with exceptions
  UN 3373
Infectious Substance Definition

“(1) Division 6.2 (Infectious substance) means a material known or reasonably expected to contain a pathogen. A pathogen is a microorganism (including bacteria, viruses, rickettsiae, parasites, fungi) or other agent, such as a proteinaceous infectious particle (prion), that can cause disease in humans or animals.”

49 CFR 173.134(a)(1)
Category A Classification

Category A: An infectious substance in a form capable of causing permanent disability or life-threatening or fatal disease in otherwise healthy humans or animals when exposure to it occurs.…

49 CFR 173.134(a)(1)(i)
Category B Classification

Category B: An infectious substance that is **not in a form generally capable of causing permanent disability or life-threatening or fatal disease in otherwise healthy humans or animals when exposure to it occurs**....

49 CFR 173.134(a)(ii)
Medical Waste

Regulated Medical Waste, UN3291
When containing Category B Substances

When containing Category A substances, the waste must use a Category A PSN and UN# (UN 2814 or UN 2900)

Medical waste are not regulated by the 49 CFR when not containing infectious substances or other hazmat
Class 9: Miscellaneous Hazardous Materials
Lithium Batteries – Class 9
Updated February 06, 2015
80 FR 1075 - FR

- Six Proper Shipping Names changed
- New UN numbers
- Updated Special Provisions
- Lithium metal batteries now forbidden on passenger flights
- Must be properly marked for cargo flight
- Check the FR for background details.

ICAO has adopted similar restriction
(49 CFR)Lithium Batteries – Class 9

HMT Listings:

- Lithium metal batteries - UN3090
- Lithium metal batteries, contained in equipment – UN3091
- Lithium metal batteries, packed with equipment – UN3091
- Lithium ion batteries - UN3480
- Lithium ion batteries, contained in equipment – UN3481
- Lithium ion batteries, packed with equipment – UN3091

Exceptions and requirements located in Part 173.185 and the Special Provisions referenced for each Proper Shipping Name (PSN) referenced in the Hazardous Materials Table (HMT).
(ICAO) Lithium Batteries – Class 9

ICAO Listings (as of 2009):

- Lithium metal batteries - UN3090
- Lithium metal batteries contained in equipment – UN3091
- Lithium metal batteries packed with equipment – UN3091
- Lithium ion batteries – UN3480
- Lithium ion batteries contained in equipment – UN3481
- Lithium ion batteries packed with equipment – UN3481

Each listing has its own Packing Instruction (965 – 970) describing the applicable requirements for fully regulated shipments in Section I and the conditions of exceptions in Section IB and Section II.
Dry Ice - Class 9

Dry Ice is a regulated hazardous material when transported by air or water. It is not regulated for surface transportation which may lead to the offer of undeclared shipments of Dry Ice if you are unfamiliar with the requirements.

49 CFR Part 173.217 covers the requirements and exceptions for dry ice.
Dry Ice - Class 9

49 CFR Part 173.217

**Air Applicable Regulations**

173.217(a) – Must be packaged in a vented package.
173.217(c) – For air transport:
1. Must mark the quantity on the package
2. Must make arrangements with the carrier
3. Requirements for Unit Load Devices
4. Alternate documentation exception
5. Exception for quantities not exceeding 2.5 kg (5.5 lb)
   - must comply with 173.217(a)
   - must be marked with PSN and quantity (or an indication < 2.5 kg)
   - IS excepted from all other requirement of the HMR (including training)

173.217(d) – Exception for diagnostic or treatment materials.
   - excepted from shipping paper & certification – **NOT** labeling, marking or training
   - must comply with 173.217(a) & (c)(2)
   - must meet additional marking requirements
Other Materials Common to Universities

• Formaldehyde & Alcohol solutions:
  – depending on concentration they might not fit the criteria for hazardous materials set forth in the regulations
  – depending on the quantity and/or type of packaging, you may qualify for exceptions
  – if the material that is being preserved qualifies as a hazardous material, it must be properly classified and prepared

– Compressed gases (Class 2)–
  – Flammable (2.1)
  – Non-flammable (2.2)
  – Toxic (2.3)
CONTACT INFORMATION

FAA Great Lakes, Regional Operations Center (ROC):
1-800-ROC-1457

FAA Chicago Hazardous Materials Division:
1-847-294-7414

PHMSA Hazardous Materials Information Center (HMIC):
1-800-HMR-4922

National Response Center (NRC)
1-800-424-8802

The HMIC is open for direct calls from 9:00 am to 5:00 pm EST, however you may leave a message at any time, or you may email questions to infocntr@dot.gov (please include your telephone number in your email). You may also write to:

Director, Office of Hazardous Materials Standards
U.S. DOT/PHMSA (PHH-10)
1200 New Jersey Ave., SE East Building, 2nd Floor
Washington, D.C. 20590-0001
USEFUL WEBSITES

PHMSA HAZMAT Safety Homepage: http://phmsa.dot.gov/hazmat


OTHER MODAL ADMINISTRATIONS


United States Coast Guard: http://www.uscg.mil/USCG.shtm
QUESTIONS

Disclaimer: The content of this presentation does not satisfy the DOT hazardous materials training requirements in 49 CFR, Subpart H.