Shipping Hazardous Materials ... Who? Me?

Overview of transportation of samples and small quantities of hazardous materials by highway and air

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There are over 800,000 hazardous materials shipments each day in the United States. The hazardous materials transportation regulations and dangerous goods regulations exist to protect the:

- Safety and health of transportation workers;
- Safety and health of the general public;
- Property of the shipper, carrier, and public; and
- Environment
Where are the regulations?

49 CFR Parts 100 - 185

ICAO (International Civil Aviation Organization) Technical Instructions for the Safe Transport of Dangerous Goods by Air

IATA (International Air Transport Association) Dangerous Goods Regulations

IMDG (International Maritime Dangerous Goods) Code
Hazardous Material – means a substance or material that the Secretary of Transportation has determined is capable of posing an unreasonable risk to health, safety, and property when transported in commerce, and has designated as hazardous under Section 5103 of Federal hazardous materials transportation law (49 U.S.C. 5103). The term includes hazardous substances, hazardous wastes, marine pollutants, elevated temperature materials, materials designated as hazardous in the Hazardous Materials Table (see CFR 172.101), and materials that meet the defining criteria for hazard classes and divisions in Part 173 of Subchapter C of this chapter.
Hazardous Materials vs. Dangerous Goods

• “Hazardous Materials is a DOT term as previously defined.

• “Dangerous Goods” is an international term used by ICAO and IATA.

IATA defines dangerous goods as articles or substances which are capable of posing a risk to health, safety, property or the environment and which are shown in the list of dangerous goods in these regulations or which are classified according to the Regulations.

For the purposes of this discussion, these terms can be used interchangeably and “hazardous materials” will be used unless referring specifically to an IATA reference for simplicity.
Common “hidden” hazardous materials include:

- Samples
- Biological materials
- Certain battery powered equipment
- Small gas cylinders and aerosols
- Toolbox items (propane torches, touchup paint, adhesives, urethanes, epoxies)
- Equipment containing radioactive sources
- Breathing apparatus & diving equipment
- Dry ice (for air shipments)
- Household goods
- Laboratory/testing equipment
- Refrigeration equipment & mercury switches
- Fire extinguishers
- Magnetized material (by air).
Training

- Periodic training is required for all hazmat employees
- A Hazmat Employee is an individual who “directly” affects hazardous material transportation safety.
Universe of potential hazmat employees

- Individuals who prepare hazmat shipments (including classifying, packaging, marking, labeling, and documenting)
- Individuals arranging hazardous materials shipments that are prepared by contractors
- Medical Personnel
- Radiation Safety Officers
- Material handlers who load and unload hazardous materials
- Truck drivers
- Individual filling containers
- Packers
- Documentation clerks
- Engineers or technicians that use FedEx or other carriers from field locations
- Field engineers
- Administrative assistants assisting with paper work
- Individuals that design, fabricate, recondition, or test certified packaging
Training Elements

• Training Elements
  – General Awareness
  – Function Specific
  – Safety Training
  – Security Training (General Awareness and/or In-Depth depending on the type and quantity of materials shipped)

• When is training required?
  – By DOT regulations, after a change in job function, after a regulation change and every three years.
    (Employees may perform functions for up to 90 days if under direct supervision of a trained employee)
  – By ICAO/IATA requirements, training is required before performing a regulated job function and every two years.
Classification…the first step

• Shipper’s must properly classify and describe all hazardous materials...

• Classification involves determining the following information for the basic shipping description:
  - UN/ID/NA number
  - Proper shipping name
  - Hazard Class/Division
  - Packaging Group
Shipping Description Terminology

• UN/ID/NA Number
  – A code number used to quickly identify different hazardous materials. Generally UN (United Nations) numbers will be used.

• Proper shipping name
  – The most appropriate name designated in the hazardous materials/dangerous goods material list (roman print for 49 CFR, bold print for IATA) from DOT or IATA as applicable.

• Packing Group – Most materials are categorized in a packing group:
  ➢ PG I – Greatest degree of danger
  ➢ PG II – Medium degree of danger
  ➢ PG III – Minor degree of danger
Hazard Classes/Divisions

Class 1 - Explosives: 1.1, 1.2, 1.3, 1.4, 1.5, 1.6
Class 2 - Flammable gas, Non-flammable gas, Poison gas: 2.1, 2.2, 2.3
Class 3 - Flammable and Combustible liquids:
Class 4 - Flammable solids, Spontaneously combustible, Dangerous when wet: 4.1, 4.2, 4.3
Class 5 - Oxidizers, Organic peroxides: 5.1, 5.2
Class 6 - Poisonous materials, Infectious substances: 6.1, 6.2
Class 7 - Radioactive materials: 7
Class 8 - Corrosive materials: 8
Class 9 - Miscellaneous hazardous materials 9 (e.g. Environmentally Hazardous Substances and lithium batteries)
But I only ship samples, aren’t they exempt?

- No, if a material that is considered to be a hazardous waste or a sample but an accurate shipping description cannot be determined without shipping the material to a lab for analysis, the material must be assigned a tentative proper shipping name, hazard class, identification number and packing group, if applicable.

- The tentative shipping description is made with consideration to:
  - The definitions and criteria of the hazard classes and packing groups;
  - The hazard precedence table for multiple hazards; and
  - The shipper's knowledge of the material.
Additional DOT Requirements for Samples

- Except when the word “Sample” already appears in the proper shipping name, the word “Sample” must appear as part of the proper shipping name or in association with the basic description on the shipping paper.

- A sample must be transported in a combination packaging that conforms to the requirements of this subchapter that are applicable to the tentative packing group assigned, and may not exceed a net mass of 2.5 kg (5.5 pounds) per package.

- Certain materials may not be shipped using a tentative shipping description. There are additional requirements for the transportation of samples of self-reactive materials, organic peroxides, explosives or lighters.

- If the proper shipping name is assigned by a “G” in Column 1 of the Hazardous Materials Table (HMT) and the primary constituent(s) for which the tentative classification is based are not known, the technical name for the constituents is not required.
Additional IATA Requirements for Samples

- The most severe packing group possible for the proper shipping name chosen must be used.
- A tentative shipping name cannot be used for explosives, infectious substances, or radioactive materials.
- Additional restrictions for self-reactive materials and organic peroxides.
- The sample cannot be packed together with other goods.
Exceptions that may simplify your life

• Material of Trade Exception (Highway)
  – Provides a private carrier less restrictive regulation to carry small quantities of certain hazardous materials used for their own business.

• Limited Quantities (Highway, Rail, Air*, and Vessel*)
  – Provides a means to ship small quantities of hazardous materials using a for-hire carrier with less stringent requirements than that of a “fully regulated” hazardous materials shipment.

• Consumer Commodities (ORM-D)
  – Provides a means to reclassify certain hazardous materials with less stringent requirements if they are packaged and distributed in a form intended or suitable for sale through retail sales.

• Small Quantities (Highway or Rail)
  – Provides a means to ship very small quantities of certain hazardous materials with even less stringent requirements than a “fully regulated” or “limited quantity” shipment.
Exceptions (Cont’d.)

• Excerpted Quantities (Highway, Rail, Air*, and Vessel*)
  - Provides a means to ship very small quantities of certain hazardous materials by any mode under less regulation that a “fully regulated” or “limited quantity” shipment.

• De Minimus Exception (Highway, Rail, Air*, and Vessel*)
  - Provides a means to reclassify very small quantities of certain PG II and III so that they do not meet the definition of a hazardous material.
Material of Trade Exception

• Allows certain hazardous materials transported in small quantities by a private motor carrier to be subject to less stringent regulation because of the limited hazard they pose.

• The material being transported must be:
  
  - To protect the health and safety of the vehicle operator or passengers (e.g. fire extinguishers, flares, insect repellant);
  
  - To support the operation or maintenance of the vehicle (e.g. fuel additives, spare battery, gasoline); or
  
  - To support the principal business of a private motor carrier (e.g. landscapers, painters, or other businesses carrying supplies).

• All MOTs shipments must comply with the hazard class and quantity limitations specified by DOT.
Allowable hazard classes include:

- Flammable Liquid (Class 3)
- Corrosive Materials (Class 8)
- Miscellaneous Hazardous Materials (Class 9)
- Flammable (Division 2.1) and Non-Flammable Gases (Division 2.2)
- Toxic (Poison) (Division 6.1)
- Oxidizers (Division 5.1)
Materials of Trade (Cont’d.)

The allowable quantity limitations under the MOTs exemption are generally:

- 1 lb or 1 pint for Packing Group I materials
- 66 pounds or 8 gal. of Packing Group II materials
- 220 pounds gross weight per gas cylinder
- 440 pounds aggregate gross weight of all MOTs on a motor vehicle
- For tanks of Class 9 liquids with < 2% concentration, 400 gal.
## Materials of Trade - DOT

<table>
<thead>
<tr>
<th>Mode of Transport</th>
<th>Highway</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permissible materials</td>
<td>Flammable gases, Non-flammable gases, Flammable liquids and solids, Dangerous when wet, Oxidizers, Organic peroxides, Toxic substances, Certain Infectious Substances, Corrosive, Miscellaneous hazardous materials, Consumer Commodities (ORM-D)</td>
</tr>
<tr>
<td>Maximum Inner Container Quantity</td>
<td>Generally depends on the hazard class/division. Cylinders may not exceed 100 kg (220 pounds) each. Mixtures of Class 9 liquid of &lt; 2% concentration may be up to 1500 L (400 gal).</td>
</tr>
<tr>
<td>Maximum Shipment Quantity</td>
<td>Aggregate weight 200 kg (440 pounds) except a mixture of Class 9 liquid of &lt; 2% concentration may be up to 1500 L (400 gal.)</td>
</tr>
<tr>
<td>Packaging Requirements</td>
<td>Generally must be the manufacturer’s original packaging or a package of equal strength and integrity. Must be leak tight for liquids and gases, silt proof for solids. Packages must be securely closed, secured against movement, and protected from damage. Outer packagings are not required for receptacles that are properly secured against movement. Gasoline must be transported in a metal or plastic container meeting certain DOT or OSHA requirements. Cylinders must meet the HMR except outer packagings are not required.</td>
</tr>
<tr>
<td>Package Testing Requirements</td>
<td>None, except cylinders which must meet the HMR.</td>
</tr>
<tr>
<td>Marking/Labeling Requirements</td>
<td>Must be marked with a proper shipping name or a common name such as “spray paint” or “Refrigerant 134a.” A tank with a mixture of Class 9 liquid &lt;2% concentration must be marked on two opposing sides with the ID number. If a package contains a reportable quantity of a hazardous substance, it must be marked “RQ.”</td>
</tr>
<tr>
<td>Materials not permitted</td>
<td>Explosives, Certain Infectious substances, radioactive material.</td>
</tr>
<tr>
<td>Documentation Requirements</td>
<td>None</td>
</tr>
<tr>
<td>Training Requirements</td>
<td>Must have knowledge of the Materials of Trade Exception requirements.</td>
</tr>
<tr>
<td>Comments</td>
<td></td>
</tr>
</tbody>
</table>
Limited Quantities (Highway)

- Limited quantities are items that are shipped in commerce by for-hire carriers but are excepted from certain requirements (e.g. labeling, limited marking requirements, shipping papers, emergency response information). Note that significant changes in these requirements became mandatory effective 1/1/12.

- The permissible quantity is typically located by reviewing the reference in Column 8a (Packaging Exceptions) of the Hazardous Materials Table (172.101).

- As an example, for PG II flammables or corrosives, not over 1L (0.3 gallons) per inner container with a maximum package weight of 66 pounds per package may be shipped as a limited quantity.
Limited Quantities (Ground) Cont’d.

• Limited Quantity shipments are not required to be in specification packaging, however the general requirements for packaging must be met. These general requirements include:
  - Packaged must be designed constructed, filled, and closed to prevent releases of hazardous materials under normal transport conditions.
  - Hazardous materials must be compatible with their packagings.
  - Mixing hazardous and non-hazardous material in one outer packaging is allowed only if they do not react dangerously together.
  - Inner packagings must be secured and cushioned to prevent breakage and leakage.
  - Packagings for liquids must have sufficient outage (ullage).

• Individuals preparing limited quantity shipments must have appropriate DOT hazardous materials training.
Limited Quantities (Air)

- Limited Quantities by air are similar but with additional restrictions:
  - A Shipper’s Declaration of Dangerous Goods (shipping paper) is required.
  - Permissible quantities are specified in Column H of the IATA 4.2 “List of Dangerous Goods.”
  - Packaging is as specified in the “Y” package instruction specified in Column G of the IATA 4.2 “List of Dangerous Goods.”
  - General packaging requirements include being capable of withstanding certain temperature, pressure, and vibration specifications, stack, and pressure testing. Inner container closures must be closed by a secondary means (tape, closure rings, etc.)
  - Full marking and labeling is required including the “Air Limited Quantity” mark.
Limited Quantity (Air) Cont’d.
Consumer Commodities

- A consumer commodity is a material that is packaged and distributed in a form intended or suitable for sale through retail sales agencies by individuals for the purposes of personal care or household use. This term also includes drugs and medicines.

- If permitted by the packaging exceptions section indicated in Column 8a of the Hazardous Materials Table (172.101), certain consumer commodities can be renamed “Consumer commodity” and reclassified as ORM-D or ORM-D-AIR.
ORM-D Consumer Commodities

• The ORM-D designation for consumer commodities can be used until December 31, 2013.

• The ORM-D AIR* designation for consumer commodities can be used until December 31, 2012.

• Using these designations shipping papers are not required unless shipping by air.

• Packaging and quantity limitations are found in the designated section indicated in Column 8a (Exceptions) and/or 8b (Non-bulk packagings) of the Hazardous Materials Table (172.101) and 173.27 for air shipments or IATA Packing Instruction Y963.

*For air shipments, consumer commodities will typically ship as ID 8000, Consumer commodity. Special provision A112 lists items that can use this shipping name.
## Small Quantities - DOT

<table>
<thead>
<tr>
<th>Mode of Transport</th>
<th>Highway or Rail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Inner Container Quantity</td>
<td>30 mL (1 oz) /30g (1 oz) for non-radioactive. For radioactive, must meet excepted package criteria.</td>
</tr>
<tr>
<td>Maximum Package Quantity</td>
<td>29 kg (64 lb.)</td>
</tr>
<tr>
<td>Packaging Requirements</td>
<td>Minimum thickness requirements for inner receptacle and not liquid full at 131 F, inner secured with wire, tape, or other means, unless certain criteria are met an intermediate packaging must be used, and sufficient absorbent to absorb entire contents of package, appropriate outer packaging.</td>
</tr>
<tr>
<td>Package Testing Requirements</td>
<td>Prototype must pass a drop test and compressive load test. Self-testing permitted.</td>
</tr>
<tr>
<td>Marking/Labeling Requirements</td>
<td>Must be marked “This package conforms to 49 CFR 173.4 for domestic highway or rail transport only.”</td>
</tr>
<tr>
<td>Materials not permitted</td>
<td>Explosives, Aerosols, Flammable Gases, Infectious substances Lithium batteries</td>
</tr>
<tr>
<td>Documentation Requirements</td>
<td>None</td>
</tr>
<tr>
<td>Training Requirements</td>
<td>Subject to DOT training requirements.</td>
</tr>
<tr>
<td>Comments</td>
<td>The package may not be opened or otherwise altered until it is no longer in commerce.</td>
</tr>
</tbody>
</table>

*See 173.4 for additional restrictions*
## Excepted Quantities - DOT/IATA

<table>
<thead>
<tr>
<th>Mode of Transport</th>
<th>Air or Vessel, can also be highway/rail</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Maximum Inner Container Quantity</strong></td>
<td>1 mL (0.03 oz)/1 g (0.04 ounce) - 30 mL (1 oz) /30g (1 ounce) for non-radioactive. See 173.4a for details. See Column F in IATA 4.2 Dangerous Goods List for air shipments. For radioactive, must meet excepted package criteria.</td>
</tr>
<tr>
<td><strong>Maximum Package Quantity</strong></td>
<td>300 mL(0.08 gallons)/300 g(0.66 ounce)/– 1 L (0.2 gal)/1 kg (2.2 pounds)</td>
</tr>
<tr>
<td><strong>Packaging Requirements</strong></td>
<td>Minimum thickness requirements for inner receptacle, inner secured with wire, tape, or other means, intermediate packaging that would contain contents regardless of orientation, absorbent sufficient to absorb entire contents of package, outer packaging.</td>
</tr>
<tr>
<td><strong>Package Testing Requirements</strong></td>
<td>Prototype must pass a drop test and compressive load test. Self-testing permitted. Also, must be capable of meeting specified pressure testing.</td>
</tr>
<tr>
<td><strong>Marking/Labeling Requirements</strong></td>
<td>Must use the IATA Excepted Quantity Package Mark, including the hazard class/ division number and the name of the shipper or consignee.</td>
</tr>
<tr>
<td><strong>Materials not permitted</strong></td>
<td>Explosives, Aerosols, Flammable Gases, Infectious substances Lithium batteries, mercury, dry ice.</td>
</tr>
<tr>
<td><strong>Documentation Requirements</strong></td>
<td>No shipping paper required for highway or rail. Minimal documentation requirements for air or vessel.</td>
</tr>
<tr>
<td><strong>Training Requirements</strong></td>
<td>Yes, under IATA. Must be aware of requirements under DOT.</td>
</tr>
<tr>
<td><strong>Comments</strong></td>
<td>The package may not be opened or otherwise altered until it is no longer in commerce. Items cannot go in baggage or carry-on bags.</td>
</tr>
</tbody>
</table>

*See 173.4a and DGR 4.2 table for additional restrictions*
# De Minimis Exception- DOT

<table>
<thead>
<tr>
<th>Mode of Transport</th>
<th>Highway or Rail. Also air and vessel under DOT requirements.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permissible materials</td>
<td>Packing Group II and III materials in the following classes: Flammable liquids and solids, Spontaneously combustible, Dangerous when wet, Oxidizers, Toxic substances, Corrosive, Non-infectious specimens (details on next slide), and Certain miscellaneous hazardous materials.</td>
</tr>
<tr>
<td>Maximum Inner Container Quantity</td>
<td>1 mL (0.03 ounce) / 1 g (0.04 ounce) for non-radioactive.</td>
</tr>
<tr>
<td>Maximum Package Quantity</td>
<td>Aggregate hazardous material 100 mL (3.38 ounces) / 100 g (0.22 pounds). Gross mass of completed package 29 kg (64 pounds).</td>
</tr>
<tr>
<td>Packaging Requirements</td>
<td>Inner receptacle secured with wire, tape, or other means, unless certain criteria are met an intermediate packaging must be used, and sufficient absorbent to absorb entire contents of package, appropriate outer packaging.</td>
</tr>
<tr>
<td>Package Testing Requirements</td>
<td>The completed package must be capable of passing a drop test and compressive load test. Self-testing permitted.</td>
</tr>
<tr>
<td>Marking/Labeling Requirements</td>
<td>None, except for non-infectious specimens.</td>
</tr>
<tr>
<td>Materials not permitted</td>
<td>Explosives, Aerosols, Flammable Gases, Infectious substances, Lithium batteries</td>
</tr>
<tr>
<td>Documentation Requirements</td>
<td>None</td>
</tr>
<tr>
<td>Training Requirements</td>
<td>Persons offering shipments under this exception must know about the requirements.</td>
</tr>
<tr>
<td>Comments</td>
<td>The package may not be opened or otherwise altered until it is no longer in commerce. By air, must be authorized to be carried on a passenger aircraft and cannot be in checked or carry-on baggage. Materials shipped under this exception do not meet the definition of a hazardous material when packaged in accordance with this section.</td>
</tr>
</tbody>
</table>
De Minimis Exception For Non-Infectious Specimens

- Non-infectious specimens, such as specimens of mammals, birds, amphibians, reptiles, fish, insects, and other invertebrates containing small quantities of Ethanol, Formaldehyde solution, or Alcohols are not subject to the hazardous materials requirements provided they the following provisions are met:
  - Specimens are wrapped in paper towels or cheese cloth in placed in a plastic bag with a maximum of 30 mL free liquid or placed in rigid containers with no more than 30 mL of alcohol solution and placed in a heat-sealed bag.
  - The bagged specimens are placed in another plastic bag with sufficient absorbent material to absorb the entire liquid contents and the outer bag is heat-sealed.
  - The completed bag is placed in a strong outer packaging with sufficient cushioning material.
  - The aggregate flammable liquid in one outer packaging cannot exceed 1 L.
  - The outer package must be legibly marked “Scientific research specimens, 49 CFR 173.4 applies.”
De Minimis Exception – DOT for Non-Infectious Specimens (Cont’d.)

• Documentation
  – By highway or rail, no shipping paper is required.
  – By air, a shipping paper is not required, except if a document such as an air waybill is used, it must include the statement “Scientific research specimens, 49 CFR 173.4b applies” and the number of packages indicated.
  – By vessel, a shipping paper is not required, however, the Dangerous Cargo Manifest must include the statement “Scientific research specimens, 49 CFR 173.4b applies” and the number of packages indicated.

• Each person offering Excepted quantities of hazardous materials must know the relevant requirements.

• For air, items may not be carried in checked or carry-on baggage.


What are Materials of Trade, and What Regulations Apply? – DOT PHMSA

https://hazmatonline.phmsa.dot.gov/services/publication_documents/MOTS05.pdf
Questions???

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