Hazardous Materials Management

Compliance With Dot Requirements
Objectives

1. Define the term Hazardous material
2. Navigate through the DOT hazardous material regulation
3. Summarize:
   I. Who must comply with the regulation,
   II. What training is required
   III. Hazard Classification
   IV. Packaging
   V. Marking
   VI. Labeling
   VII. Shipping Papers
   VIII. Placarding
   IX. Emergency and Safety
Hazardous Material

A hazardous material is defined as a substance or material, that transported in commerce, is capable of posing a risk to:

- Health
- Property
- Safety
Code of Federal Regulation

- Regulations of Federal Agencies are communicated through the Code of Federal Regulations
  - Published annually
  - The Agency that wrote the Regulation is identified by the Title
    - DOT 49 CFR
    - EPA 40 CFR
    - OSHA 29 CFR
Hazardous Material Injuries Do Occur

A minor transportation accident can quickly escalate into major catastrophe when hazardous materials are involved.
Department of Transportation

Regulates

- Transportation of Hazardous Material
- Packaging Standards
- Definition Hazmat for Labeling, Marking and Placarding
Federal Hazardous Materials Transportation LAW (49 CFR) apply to:

- Classification
- Packaging
- Hazard Communication
- Emergency response
- Employ Training
- Transportation
- Incident Reporting
- Security
- Responsibilities for offering and accepting shipments
Structure of HMR

- Part 171 Definitions
- Part 172 - Hazard Communication
- Part 172.101 - Hazardous Materials Table
- Part 173 - Classification and Packaging
- Part 178 - Standards for Non-Bulk Packaging
- Part 179 - Standards for Bulk Packaging (tank cars)
General Dot Hazardous Materials Regulatory Requirements

"No person may offer or accept a hazardous material for transportation in commerce unless that person is registered in conformance with subpart G of Part 107 of this chapter, if applicable, and the hazardous material is properly classed, described, packaged, marked, labeled, and in condition for shipment as required or authorized…"(49 CFR 171.2(a))
Hazmat Employee

- Load, unload or handle hazmat
- Prepare hazmat for transport
- Responsible for the safe transport of hazmat
- Operate vehicle used for transport of hazmat
- Supervise hazmat employees
Training Requirements [172.704]

- Train all HAZMAT employees to:
  - Understand the regulations
  - Recognize and identify hazardous materials
  - Know reg. requirements that apply to his/her job
  - Be aware of relevant emergency response info.

- Types of Training:
  - General awareness
  - Function specific
  - Safety
Administrative Requirements

The HAZMAT employer must
- Train & test employees
- Certify & keep records

Training Compliance Dates
- New employee - 90 days
- Job function changed - 90 days
- Update every 3 years
Penalties

- Civil Penalties
  - Maximum fines up to $25,000 per day per violation. Updated for inflation

- Criminal Penalties
  - Fines up to $500,000 per day per violation
  - Up to five years in prison

- Injunctive Action
  - Shipments stopped or seized
Hazard Classes/Divisions

- Class 1 - Explosives (173.50)
- Class 2 - Compressed gasses (173.115)
- Class 3 - Flammable liquids (173.120)
- Class 4 - Flammable solids (173.240)
- Class 5 - Oxidizers and organic peroxides (173.127 & 128)
- Class 6 - Poisonous and infectious materials (173.132 & 134)
- Class 7 - Radioactive (173.403)
- Class 8 - Corrosive materials (173.136)
- Class 9 - Miscellaneous Hazardous Materials (173.140),
- ORM - Other Regulated Material (173.144)
## Hazard Class Definitions Table B

<table>
<thead>
<tr>
<th>Class</th>
<th>Class Name</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Explosives</td>
<td>Ammunition, Dynamite, Fireworks</td>
</tr>
<tr>
<td>2</td>
<td>Gases</td>
<td>Propane, Oxygen, Helium</td>
</tr>
<tr>
<td>3</td>
<td>Flammable</td>
<td>Gasoline Fuel, Acetone</td>
</tr>
<tr>
<td>4</td>
<td>Flammable Solids</td>
<td>Matches, Fuses</td>
</tr>
<tr>
<td>5</td>
<td>Oxidizers</td>
<td>Ammonium Nitrate, Hydrogen Peroxide</td>
</tr>
<tr>
<td>6</td>
<td>Poisons</td>
<td>Pesticides, Arsenic</td>
</tr>
<tr>
<td>7</td>
<td>Radioactive</td>
<td>Uranium, Plutonium</td>
</tr>
<tr>
<td>8</td>
<td>Corrosives</td>
<td>Hydrochloric Acid, Battery Acid</td>
</tr>
<tr>
<td>9</td>
<td>Miscellaneous Hazardous Materials</td>
<td>Formaldehyde, Asbestos</td>
</tr>
<tr>
<td>None</td>
<td>ORM-D(Other Regulated Domestic)</td>
<td>Hair Spray or Charcoal</td>
</tr>
<tr>
<td>None</td>
<td>Combustible Liquids</td>
<td>Fuel Oils, Lighter Fluid</td>
</tr>
</tbody>
</table>
CLASS 1 EXPLOSIVES

- DIVISION 1.1 MASS EXPLOSIVE HAZARD, black powder, nitroglycerine (desensitized)
- DIVISION 1.2 PROJECTION HAZARD, certain types of fireworks, types of detonating fuses
- DIVISION 1.3 MASS FIRE HAZARD sodium picramate, some liquid and solid propellants
- DIVISION 1.4 MINOR EXPLOSION HAZARD common fireworks, toy caps, empty grenades
- DIVISION 1.5 VERY INSENSITIVE EXPLOSIVES type E blasting agents, some type B blasting agents,
- DIVISION 1.6 EXTREMELY INSENSITIVE EXPLOSIVES

Explosives were formerly classified as Class A, B, C or Blasting Agent.
Class 2 Gases

- DIVISION 2.1 FLAMMABLE GASES, A material that is a gas at 68° F (20° C) or less and 14.7 psi (101.3 kPa) of pressure.
- DIVISION 2.2 NON-FLAMMABLE, NON TOXIC GASES
- DIVISION 2.3 POISONOUS OR TOXIC GASES

This class includes materials that are Compressed, Dissolved under Pressure, or Pressurized Cryogenic Liquids, and Liquefied Gases
Class 3 Flammable and Combustible Liquid

- **Flammable Liquid** means a liquid that has a flashpoint of not more than 141°F (60.5°C), or any material in a liquid phase that has a flashpoint at or above 100°F (38°C). Acetone, Methanol

- **Combustible Liquid** means any liquid that does not meet the definition of any other hazard class and has a flashpoint above 141°F (60.5°C) and below 200°F (93°C).

**PG I-III based on the Flash Point and Boiling point**
Class 4 Flammable Solids

**Division 4.1**, Flammable Solids- can be ignited readily.
- PGI if it burns under 45 seconds
- PG II IF it burns under 5 minutes

**Division 4.2**, Spontaneously Combustible. A liquid or solid pyrophoric material that even in small amounts and without an external ignition source can ignite within 5 minutes after coming in contact with air
- Pyrophoric liquids and solids of 4.1 are PG I
- A self heating material of 4.2 is PGII or III

**Division 4.3**, Dangerous When Wet. A material that, by contact with water, is likely to become spontaneously flammable or to give off flammable or toxic gas
- PGI if it reacts violently with water at ambient temperature and ignites spontaneously
- PG II if it reacts readily but not as reactive as PG I
- PG III if it reacts slowly
Class 5 Oxidizing Substances; Organic Peroxides

Division 5.1, Oxidizing Substances. A material that may, generally by yielding oxygen, cause or enhance the combustion of other materials
- PG I if it reacts spontaneously with cellulose when mixed 1:1
- PG II and III for lesser severe situations.

Division 5.2, Organic Peroxides. Any organic compound that contains oxygen in the bivalent structure and that may be considered a derivative of hydrogen peroxide, where one or more of the hydrogen atoms have been replaced by organic radicals.
Class 6 Poisonous (Toxic) And Infectious Substances

Division 6.1: toxic substances, poisons, and irritating material.
  – Examples: bromobenzyl cyanide, methyl bromide, motor fuel anti-knock mixtures, and tear gas.

Division 6.2: infectious substances.
  – Examples: infectious substances, biological products, regulated medical waste, sharps medical waste, used health care products.

PG I, II, III depends on toxicity.
CLASS 7: RADIOACTIVE MATERIAL

CLASS 8: CORROSIVES - visible destruction or irreversible alteration in human skin tissue at the site of contact, or a liquid that has a severe corrosion rate on steel

- Examples: Nitric Acid, Sulfuric Acids, Mercury,
  - PG I causes full thickness skin destruction within 60 minutes
  - PG II within 14 days
  - PG III destruction in 14 days after 60 minutes exposure

CLASS 9: MISCELLANEOUS DANGEROUS GOODS presents a hazard during transportation but does not meet the definition of any other hazard class-

- lithium batteries, magnetized materials, life–saving appliances (i.e., automobile air–bags), and asbestos.
How to Remember Class

1. Every Explosives
2. Good Gases
3. Lieutenants Liquids(Flammables)
4. Standard Solids(Flammables)
5. Operating Oxidizers
6. Procedure Poison
7. Requires Radioactive
8. Corrective Corrosives
9. Management Miscellaneous
Multiple Hazards

Some materials may have more than one hazard

- The first one is called the *primary hazard*
- Other hazards are called *subsidiary risks*

- How do you determine primary hazard?
  - Precedence of Hazard Table (173.2a(b))
  - HM Table
## Hazardous Precedence List

<table>
<thead>
<tr>
<th>Order</th>
<th>Hazard Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Class 7 (radioactive material)</td>
</tr>
<tr>
<td>2</td>
<td>Division 2.3 (Poisonous gas)</td>
</tr>
<tr>
<td>3</td>
<td>Division 2.1 (Flammable Gas)</td>
</tr>
<tr>
<td>4</td>
<td>Division 2.2 (Nonflammable Gas)</td>
</tr>
<tr>
<td>5</td>
<td>Division 6.1 (Poisonous gas), PG I, Poisonous by inhalation only</td>
</tr>
<tr>
<td>6</td>
<td>Division 4.2 (Pyrophoric material)</td>
</tr>
<tr>
<td>7</td>
<td>Division 4.1 (Self Reactive)</td>
</tr>
<tr>
<td>8</td>
<td>If the material meets one or more of the hazard class, it must be classified by the Precedence Table</td>
</tr>
<tr>
<td></td>
<td>Class 3 (Flammable Liquids)</td>
</tr>
<tr>
<td></td>
<td>Class 8 (Corrosive Material)</td>
</tr>
<tr>
<td></td>
<td>Division 4.1 (Flammable Liquids)</td>
</tr>
<tr>
<td></td>
<td>Division 4.2 (Spontaneously Combustible)</td>
</tr>
<tr>
<td></td>
<td>Division 4.3 (Dangerous when wet)</td>
</tr>
<tr>
<td></td>
<td>Division 5.1 (oxidizers)</td>
</tr>
<tr>
<td></td>
<td>Division (Poisonous liquids or solids other than PG I)</td>
</tr>
<tr>
<td>9</td>
<td>Combustible Liquids</td>
</tr>
<tr>
<td>10</td>
<td>Class 9 (Miscellaneous)</td>
</tr>
</tbody>
</table>
Examples

POISON-INHALATION HAZARD

Inhalation Hazard
Primary Hazard
Subsidiary Hazard

Inhalation Hazard

ADDITIONAL LABELING

Primary Hazard Class Label With Hazard Class Number
Subsidiary Hazard Class Label Without Hazard Class Number
## Hazardous Materials Table

<table>
<thead>
<tr>
<th>Symbols</th>
<th>Hazardous materials descriptions and proper shipping names</th>
<th>Hazard class or division</th>
<th>Identification Numbers</th>
<th>PG</th>
<th>Label Codes</th>
<th>Special provisions (§172.102)</th>
<th>(8) Packaging (§173.***</th>
<th>(9) Quantity limitations</th>
<th>(10) Vessel stowage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acetaldehyde</td>
<td></td>
<td>3</td>
<td>UN1089</td>
<td></td>
<td>3</td>
<td>A3, B16, T11, TP2, TP7</td>
<td>None</td>
<td>Forbidden</td>
<td>30 L E</td>
</tr>
<tr>
<td>Acetaldehyde</td>
<td></td>
<td>9</td>
<td>UN1641</td>
<td>III</td>
<td>9</td>
<td>IP8, IP6</td>
<td>155...</td>
<td>204...</td>
<td>200 kg A</td>
</tr>
<tr>
<td>Acetaldehyde oxime</td>
<td></td>
<td>3</td>
<td>UN2332</td>
<td>III</td>
<td>3</td>
<td>B1, I83, T4, TP1</td>
<td>150...</td>
<td>203...</td>
<td>60 L 220 L A</td>
</tr>
</tbody>
</table>
Packing group

Packing Group Based on the Relative degree of danger

- PG 1 - Great Danger
- PG 11 - Medium Danger
- PG111 - Minor Danger

<table>
<thead>
<tr>
<th>Packing Group</th>
<th>Flash Point</th>
<th>Initial Boiling</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>≤95°F (35°C)</td>
<td>≤95°F (35°C)</td>
</tr>
<tr>
<td>II</td>
<td>&lt; 73°F (23°C)</td>
<td>&gt;95°F (35°C)</td>
</tr>
<tr>
<td>III</td>
<td>≥ 73°F (23°C), ≤140°F (60°C)</td>
<td>&gt;95°F (35°C)</td>
</tr>
</tbody>
</table>
## Non-Bulk package codes

<table>
<thead>
<tr>
<th>First Container code</th>
<th>Type of container</th>
<th>Second Container code</th>
<th>Materials of Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Drum</td>
<td>A</td>
<td>Steel</td>
</tr>
<tr>
<td>2</td>
<td>Wooden Barrel</td>
<td>B</td>
<td>Aluminum</td>
</tr>
<tr>
<td>3</td>
<td>Jerrican</td>
<td>C</td>
<td>Natural Wood</td>
</tr>
<tr>
<td>4</td>
<td>Box</td>
<td>D</td>
<td>Plywood</td>
</tr>
<tr>
<td>5</td>
<td>Bag</td>
<td>F</td>
<td>Reconstituted Wood</td>
</tr>
<tr>
<td>6</td>
<td>Composite Packaging</td>
<td>G</td>
<td>Fiber Board</td>
</tr>
<tr>
<td>7</td>
<td>Pressure Receptacle</td>
<td>H</td>
<td>Plastic</td>
</tr>
</tbody>
</table>

Non-bulk Package codes: First code

Non-Bulk Package codes: Second code
Non-Bulk packages – code cont....

<table>
<thead>
<tr>
<th>Third Container Code</th>
<th>Drum Head Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Non-Removable head Drum</td>
</tr>
<tr>
<td>2</td>
<td>Removable Head Drum</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Performance Standard</th>
<th>Packages Meeting Packing Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>I, II and III</td>
</tr>
<tr>
<td>Y</td>
<td>II and III</td>
</tr>
<tr>
<td>Z</td>
<td>III</td>
</tr>
</tbody>
</table>
1A1
Steel Drum, Non-removable head, used as single packaging

1A2
Steel Drum, Removable Head, Used as combination packaging

1H2
Plastic Drum, Removable Head
1A1 Steel Drum, Non-removable head, used as single packaging

1A2 Steel Drum, Removable Head, Used as combination packaging

1H2 Plastic Drum, Removable Head
Marking requirements for non-bulk packaging

If a package is separated from its documentation, then marking must be adequate to help in emergency situations.

Following information must be marked on non-bulk containers:

- Proper shipping names
- Identification numbers
- Technical names
- Names and address of the consignees
- Special marking requirements
Non-Bulk container Packaging

United Nations Symbol

Packaging identification Code

Specific Gravity

Hydrostatic Test Pressure

Year of manufacture

Manufacturer’s Registered Symbol

Country of Origin

Performance Standard

1A1/Y1.4/150/12
USA/M1234
Flammable Liquid, Toxic, N.O.S., 3, 6.1, UN1992, III (Contains Acetone, Methyl Chloride)
Hazardous Materials Warning Placards
Actual placard size: at least 250 mm (9.84 inches) on all sides

**CLASS 1 Explosives**
- IVEs
- **
- * *
- * *
- * *

CLASS 2 Gases
- Oxygen
- 2
- Inhalation Hazard
- 2

CLASS 3 Flammable Liquid and Combustible Liquid
- Gasoline
- Fuel Oil
- Combustible
- 3

CLASS 4 Flammable Solid, Spontaneously Combustible, and Dangerous When Wet
- Flammable Solid
- Spontaneously Combustible
- Dangerous When Wet

CLASS 5 Oxidizer & Organic Peroxide
- Organic Peroxide
- Oxidizer

CLASS 6 Poison (Toxic) and Poison Inhalation Hazard
- Poison
- Inhalation Hazard

CLASS 7 Radioactive
- Radioactive

CLASS 8 Corrosive
- Corrosive

CLASS 9 Miscellaneous
- Dangerous

Safety begins with communication!
DOT Labeling System

- Diamond shaped labels, 4 inches on each side, required to be affixed on two sides of non-bulk containers.
- Subsidiary labels indicate additional hazards.
Labeling

- May have more than one warning label,
- Affix them on the same side of the surface
- Must be clearly visible
- Marked 6 inches apart
DOT Labeling System

HAZARDOUS MATERIALS

FedEx GROUND SHIPPER NUMBER
1 2 3 4 5 6

EMERGENCY CONTACT NUMBER
412-123-4567

Number and Type of Packaging/DOT Shipping Name of Material (Additional Entries If Applicable)

1 fiberboard box; compounds, cleaning
liquid (contains ethyl alcohol)

Hazard Class or Division Number
3

Identification Number
NA1993

Packing Group
I

Weight
5 lb.

Type DOT Label(s). Ltd. Qty., Special Permit or Required Information
Flammable liquid

SHIPPER: Use ball point pen and press firmly when preparing this form.
Mixed and consolidated packages

- Two or more compatible hazardous materials with different packing classes within the same box or within the same outside container or over pack are mixed package.

- Labels for each package must be displayed on the package, outside container or over pack.
Labels

Class 1    Explosives
Class 2    Gases
Class 3    Flammable & Combustible Liquids
Class 4    Flammable Solids, Dangerous When Wet, Combustible
Class 5    Oxidizer
Class 6    Hazard
Class 7    Radioactive
Class 8    Corrosive
Class 9    Miscellaneous
Shipping Paper

- A document issued by the shipper to a carrier that describes the hazardous material to be shipped, acknowledges its receipt, and states the terms of the contract for its carriage.
- EPA Uniform Hazardous Waste Manifest form which is issued by the generator to track the waste to its ultimate disposal.
- Must be accurate with the DOT and EPA Regulation.
- Contains:
  - Basic description
  - Total quantity
  - Certification Statement
  - Shipper’s signature
  - Emergency information
Hazardous and Non-Hazardous Materials
You can list hazardous and non-hazardous materials on the same shipping paper.

- If you do one of the following:
  - Enter all hazardous materials first
  - Highlight hazardous materials
  - Mark an “X” or RQ in column headed “Hazardous Materials” or “HM”
Emergency Response Information

- Shippers use SDS, ERG.
- Information must include:
  - Basic Description of the hazardous material
  - Immediate hazards to health
  - Risks of fire or explosion
  - Immediate precautions in case of an accident
  - Procedures in case of fire
  - Methods for handling spills and leaks
  - Preliminary first aid
  - 24-hour telephone number (on shipping papers)
Sample Shipping Paper

**Figure 9-4. Example of Shipping Paper**

<table>
<thead>
<tr>
<th>To:</th>
<th>Wafers R Us</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>88 Valley Street</td>
</tr>
<tr>
<td></td>
<td>Silicon Junction, CA</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>From:</th>
<th>Essex Corporation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5775 Dawson Avenue</td>
</tr>
<tr>
<td></td>
<td>Goleta, CA 93117</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Qty</th>
<th>HM</th>
<th>Description</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 cyl</td>
<td>RQ</td>
<td>Phosgene, 2,3, UN1076, Poison Inhalation</td>
<td>25 lbs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hazard, Zone A</td>
<td></td>
</tr>
</tbody>
</table>

This is to certify that the above named materials are properly classified, described, packaged, marked, and labeled, and are in proper condition for transportation according to the applicable regulations of the Department of Transportation.

Shipper: Essex Corp  
Carrier: Knuckle Bros.
Per: Shultz  
Date: 6/27/94

SPECIAL INSTRUCTIONS: 24 Hr. Emergency Contact, Ed Shultz, 1-800-555-5555
Loading and Unloading

- All packages must be secured against movement within the vehicle
- Never smoke while handling explosive, flammable or oxidizing chemicals
- Post sign to keep fire away from loading unloading areas
- Set the handbrake of the vehicle
- Use the right size wrenches
- Hazardous material must be attended at all times while loading and unloading
- Take precautions to prevent undue rise in temperature of the containers
- Remove the contents from the containers only after unloading from the vehicle
- Stop the engine while unloading flammables and other hazardous materials
DOT Placarding System

- Shipper is responsible for providing the placards
- Each placard must be of at least 10.75 inches in size on each side
- Must appear on all four sides of the vehicle
Mixed Placards

- Dangerous Placard
- Two or more categories that require different placards may be replaced by one dangerous placard
Storage and Transport

- Hazmat may not be stored, loaded or transported together except in accordance with the DOT segregation table for Hazmat
- Acid cannot be stored or transported together with cyanides
Loading and Unloading

Many incidents involving hazardous materials occur during the loading or unloading phases of transportation.

- Check safety guide before loading or unloading begins.
- Remove ignition keys prior to loading/unloading to avoid "pull-away" incidents.
- No smoking
- Keep packages dry
- Be careful not to overfill or overload.
- Be careful when handling cylinders and packages of hazardous materials.
Security and Emergency response

In the event of an emergency situation, it is critical that the primary hazards associated with a shipment be communicated to emergency response personnel and to other people in the immediate area.

- Know what to do with the hazardous materials cargo in case of an emergency situation.
- Become familiar with the properties of your hazardous materials cargo
- Do not rely on package labels in emergency situations, but rather refer to shipping papers and safety literature
Security and Emergency Response cont.

- 1.2 million hazmat shipments daily in the US mainly by truck
- Vulnerable to sabotage and misuse- significant threat to national security
  - Dumped into water supplies
  - Ignited in tunnels
  - Poisonous gas released to public places
Hazmat Security

- Secure your hazmat with locked or supervised doors, restricted doors or sign out sheets
- Watch for strangers or disgruntled personnel trying to get access to the hazmat
- Promptly report concerns to the supervisor

or

UAH Police
- Emergency:
  - 6911 from Campus phones
  - 256.824.6911 from any phone
- Non-Emergency: 256.824.6596
References

Hazardous material management, Compliance with DOT requirements Environmental Resource Center hand out
Acknowledge Training

Click here to acknowledge receipt of training

If you have any questions contact:
Office of Environmental Health and Safety
Physical Plant Building
301 Sparkman Drive
Huntsville, AL 35899
oehs@uah.edu
256-824-6053