



THE UNIVERSITY OF  
ALABAMA IN HUNTSVILLE

# 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

# Hazardous material standards

- 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

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

# 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

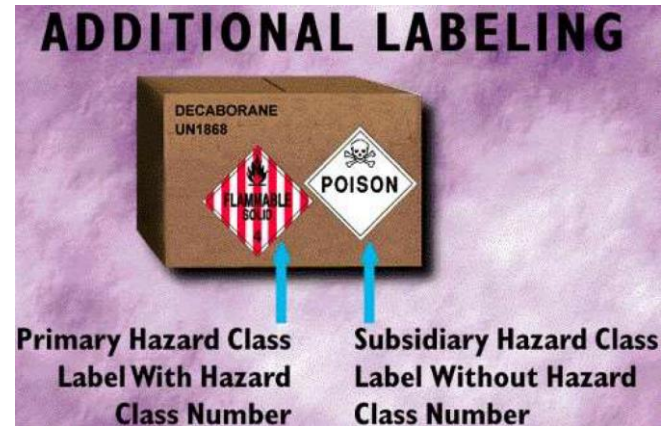
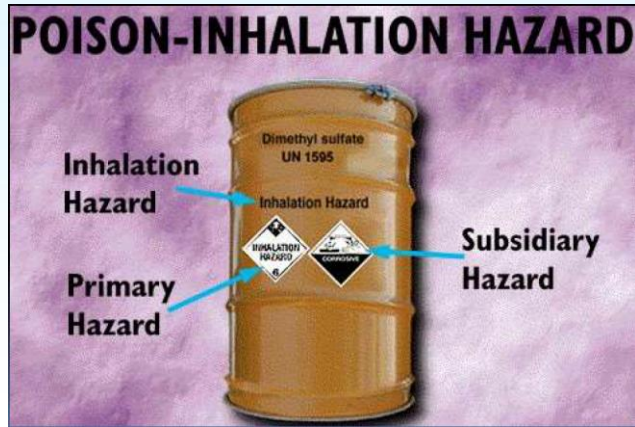
- The first one is called the *primary hazard*
- Other hazards are called *subsidiary risks*
- How do you determine primary hazard?
  - Precedence of Hazard Table (173.2a(b))
  - HM Table



# Hazardous Precedence List

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

# Examples



# Hazardous Materials Table

§172.101 Hazardous Materials Table													
Sym-bols	Hazardous materials descriptions and proper shipping names	Hazard class or division	Identifica-tion Numbers	PG	Label Codes	Special provisions (§172.102)	(8) Packaging (§173.***)			(9) Quantity limitations		(10) Vessel stowage	
							Excep-tions	Non-bulk	Bulk	Passenger aircraft/rail	Cargo air-craft only	Location	Other
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8A)	(8B)	(8C)	(9A)	(9B)	(10A)	(10B)
	Acetaldehyde .....	3	UN1089	I	3 .....	A3, B16, T11, TP2, TP7	None	201 ..	243 ..	Forbidden	30 L	E	
A	Acetaldehyde ammonia .....	9	UN1841	III	9 .....	IP8, IP6	155 ...	204 ..	240 ..	200 kg	200 kg	A	34
	Acetaldehyde oxime .....	3	UN2332	III	3 .....	B1, IB3, T4, TP1	150 ...	203 ..	242 ..	60 L	220 L	A	

# Packing group

Packing Group Based on the Relative degree of danger

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

Packing Group	Flash Point	Initial Boiling
I		≤95°F (35°C)
II	< 73°F (23°C)	>95°F (35°C)
III	≥ 73°F (23°C), ≤140°F (60°C)	>95°F (35°C)

# Non-Bulk package codes

First Container code	Type of container
1	Drum
2	Wooden Barrel
3	Jerrican
4	Box
5	Bag
6	Composite Packaging
7	Pressure Receptacle

Non-bulk Package codes: First code

Second Container code	Materials of Construction
A	Steel
B	Aluminum
C	Natural Wood
D	Plywood
F	Reconstituted Wood
G	Fiber Board
H	Plastic

Non-Bulk Package codes: Second code

# Non-Bulk packages – code cont....

Third Container Code	Drum Head Configuration
1	Non-Removable head Drum
2	Removable Head Drum

Performance Standard	Packages Meeting Packing Groups
X	I, II and III
Y	II and III
Z	III

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

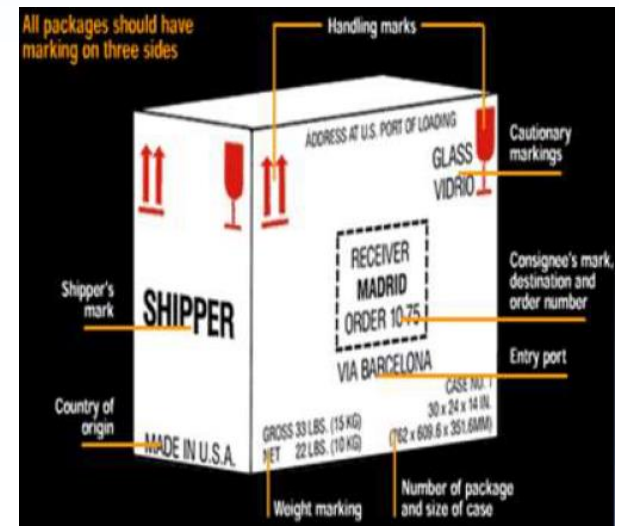


# Marking requirements for non-bulk packaging

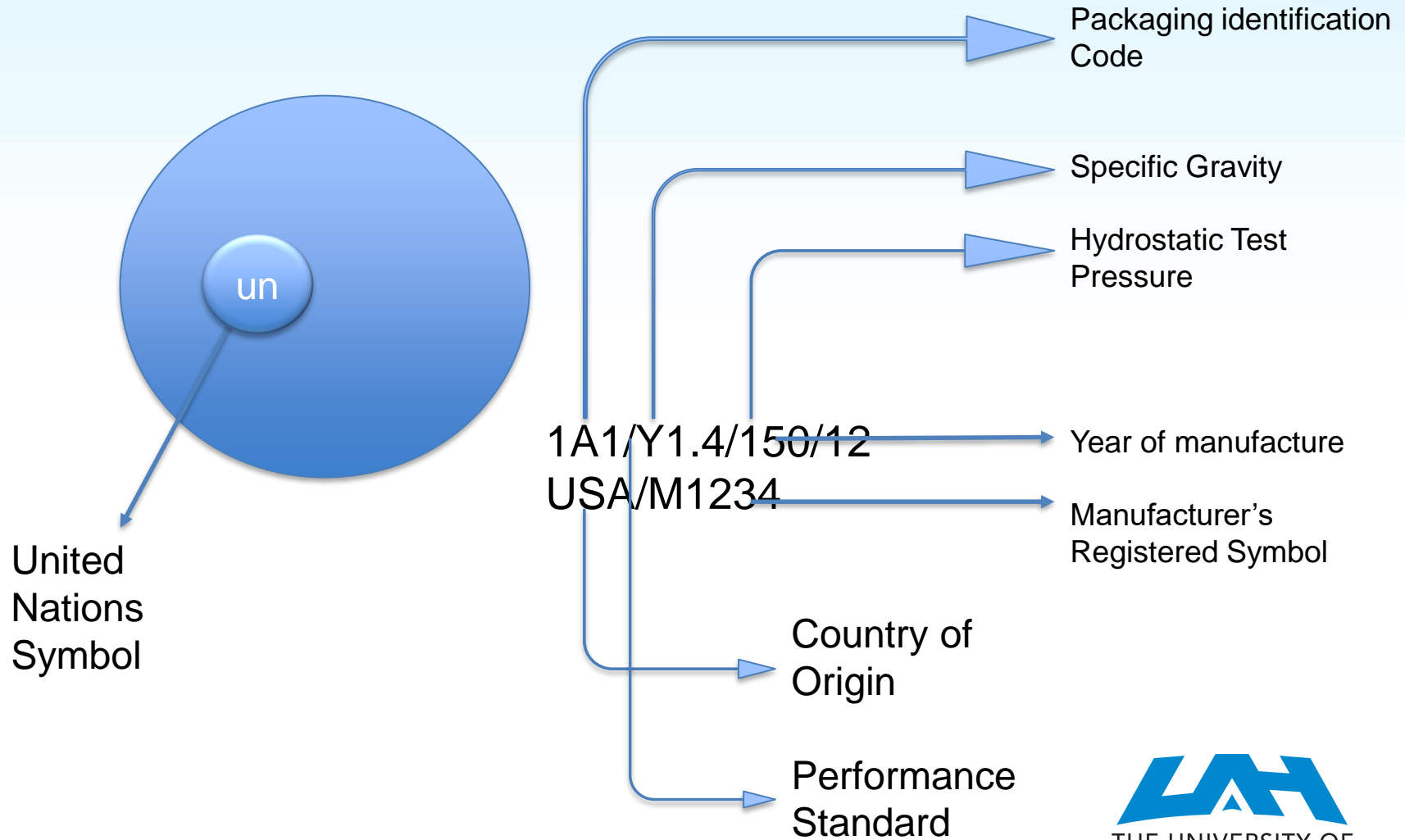
If a package is separated from its documentation, then marking must be adequate to help in emergency situations.

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



# Label Sample

To:

From:

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

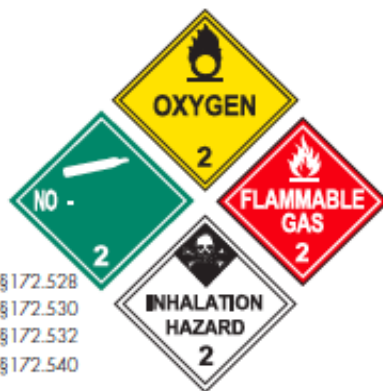
## CLASS 1 Explosives



§172.522  
§172.523  
§172.524  
§172.525

\* For Divisions 1.1, 1.2, or 1.3, enter division number and compatibility group letter, when required; placard any quantity. For Divisions 1.4, 1.5, and 1.6, enter compatibility group letter, when required; placard 454 kg (1,001 lbs.) or more.

## CLASS 2 Gases



§172.528  
§172.530  
§172.532  
§172.540

For NON-FLAMMABLE GAS, OXYGEN (compressed gas or refrigerated liquid), and FLAMMABLE GAS, placard 454 kg (1,001 lbs.) or more gross weight. For POISON GAS (Division 2.3), placard any quantity.

## CLASS 3 Flammable Liquid and Combustible Liquid



§172.542  
§172.544

For FLAMMABLE placard 454 kg (1,001 lbs.) or more. GASOLINE may be used in place of FLAMMABLE placard displayed on a cargo tank or portable tank transporting gasoline by highway. Placard combustible liquid transported in bulk. See §172.504(f)(2) for use of FLAMMABLE placard in place of COMBUSTIBLE. FUEL OIL may be used in place of COMBUSTIBLE on a cargo or portable tank transporting fuel oil not classed as a flammable liquid by highway.

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



§172.546, §172.547, §172.548

For FLAMMABLE SOLID and SPONTANEOUSLY COMBUSTIBLE, placard 454 kg (1,001 lbs.) or more. For DANGEROUS WHEN WET (Division 4.3), placard any quantity.

## CLASS 5 Oxidizer & Organic Peroxide



§172.550, §172.552

For OXIDIZER and ORGANIC PEROXIDE (other than TYPE B, temperature controlled), placard 454 kg (1,001 lbs.) or more. For ORGANIC PEROXIDE (Division 5.2), Type B, temperature controlled, placard any quantity.

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



§172.504(f)(10), §172.554, §172.555

For POISON (PGI or PGII, other than inhalation hazard) and POISON (PGIII), placard 454 kg (1,001 lbs.) or more. For POISON-INHALATION HAZARD (Division 6.1), inhalation hazard only, placard any quantity.

## CLASS 7 Radioactive



§172.556

Placard any quantity - packages bearing RADIOACTIVE YELLOW-III labels only. Certain low-specific-activity radioactive materials in "exclusive use" will not bear the label, but the radioactive placard is required for exclusive-use shipments of low-specific-activity material and surface-contaminated objects transported in accordance with §172.504(a) Table 1 and §173.427(a)(6).

## CLASS 8 Corrosive



§172.558

For CORROSIVE, placard 454 kg (1,001 lbs.) or more.

## CLASS 9 Miscellaneous



§172.560

Not required for domestic transportation. A bulk packaging containing a Class 9 material must be marked with the appropriate ID number displayed on a Class 9 placard, an orange panel, or a white square-on-point display.

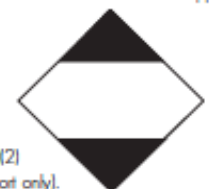
## Dangerous



§172.521

A freight container, unit-load device, transport vehicle, or rail car that contains non-bulk packages with two or more categories of hazardous materials that require different placards specified in Table 2 §172.504(a) may be placarded with DANGEROUS placards instead of the specific placards required for each of the materials in Table 2. However, when 1,000 kg (2,205 lbs.) or more of one category of material is loaded at one loading facility, the placard specified in Table 2 must be applied.

Limited Quantity Marking



§172.315(a)(2)  
(Vessel transport only).

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

 <b>HM</b> <b>Instructions</b> <b>To Shipper:</b> Complete all boxes. Press firmly with ball point pen. All copies must be readable. Remove backing and attach to package near shipping label. <b>To Loader:</b> Tear off copy & place in hazardous materials envelope. <b>To Driver:</b> Carry hazardous materials envelope (with these slips) in vehicle cab during transit. <small>OP-900 9/07</small>	<b>FedEx</b> <small>Ground</small>			<b>HAZARDOUS MATERIALS</b>		
	FedEx GROUND SHIPPER NUMBER			EMERGENCY CONTACT NUMBER		
	<b>1 2 3 4 5 6</b>			<b>412-123-4567</b>		
	Number and Type of Packaging/DOT Shipping Name of Material (Additional Entries If Applicable)					
	<b>1 fiberboard box; compounds, cleaning liquid (contains ethyl alcohol)</b>					
Hazard Class or Division Number			Identification Number		Packing Group	
<b>3</b>			<b>NA1993</b>		<b>I</b>	
Weight	Type DOT Label(s), Ltd. Qty., Special Permit or Required Information					
<b>5 lb.</b>	<b>Flamable liquid</b>					
<b>SHIPPER: Use ball point pen and press firmly when preparing this form.</b>						

# 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 the 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 MSDS, 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

SHIPPING PAPER		Page 1 of 1	
To:	Wafers R Us 88 Valley Street Silicon Junction, CA	From:	Essex Corporation 6775 Dawson Avenue Goleta, CA 93117
QTY	HM	DESCRIPTION	WEIGHT
1 cyl	RQ	Phosgene, 2.3, UN1076, Poison Inhalation Hazard, Zone A	25 lbs
<p>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.</p> <p>Shipper: Essex Corp                      Carrier: Knuckle Bros.            Per: Shultz                                Per:            Date: 6/27/94                              Date:</p> <p>SPECIAL INSTRUCTIONS: 24 Hr. Emergency Contact, Ed Shultz. 1-800-555-5555</p>			

"RQ" means that this is a reportable quantity.

Proper shipping name from Column 2 of the Hazardous Materials Table.

Hazard Class from Column 3 of the Table.

ID Number from Column 4 of the Hazardous Materials Table.

# 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](mailto:oehs@uah.edu)

256-824-6053