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

Hazardous Material- Part of everyday life




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






Billions of Tons of Cargo Transported Across the Nation Each Year

Hazardous Material Injury 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

Classification

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		
Class	**Class Name**	**Example**
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 Material- 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

Packing Group	Flash Point	Initial Boiling Point
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)

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

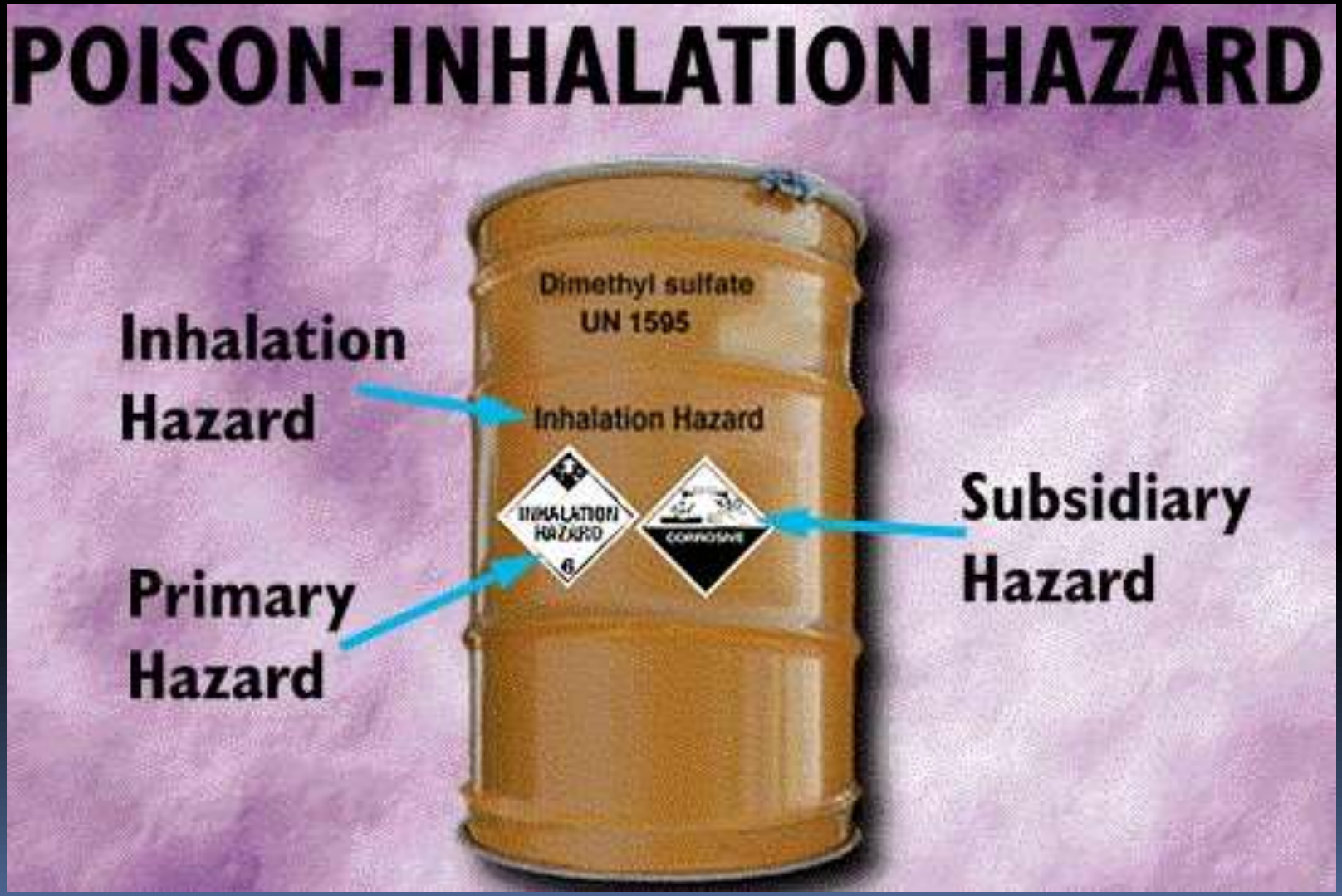
- The first one is called the primary hazard
- Other hazards are called subsidiary risks

- 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	If the material meets one or more of the hazard class, it must be classified by the Precedence Table Class 3(Flammable Liquids) Class 8 (Corrosive Material) Division 4.1 (Flammable Liquids) Division 4.2 (Spontaneously Combustible) Division 4.3 (Dangerous when wet) Division 5.1 (oxidizers) Division (Poisonous liquids or solids other than PG I)
9	Combustible Liquids
10	Class 9 (Miscellaneous)

Examples

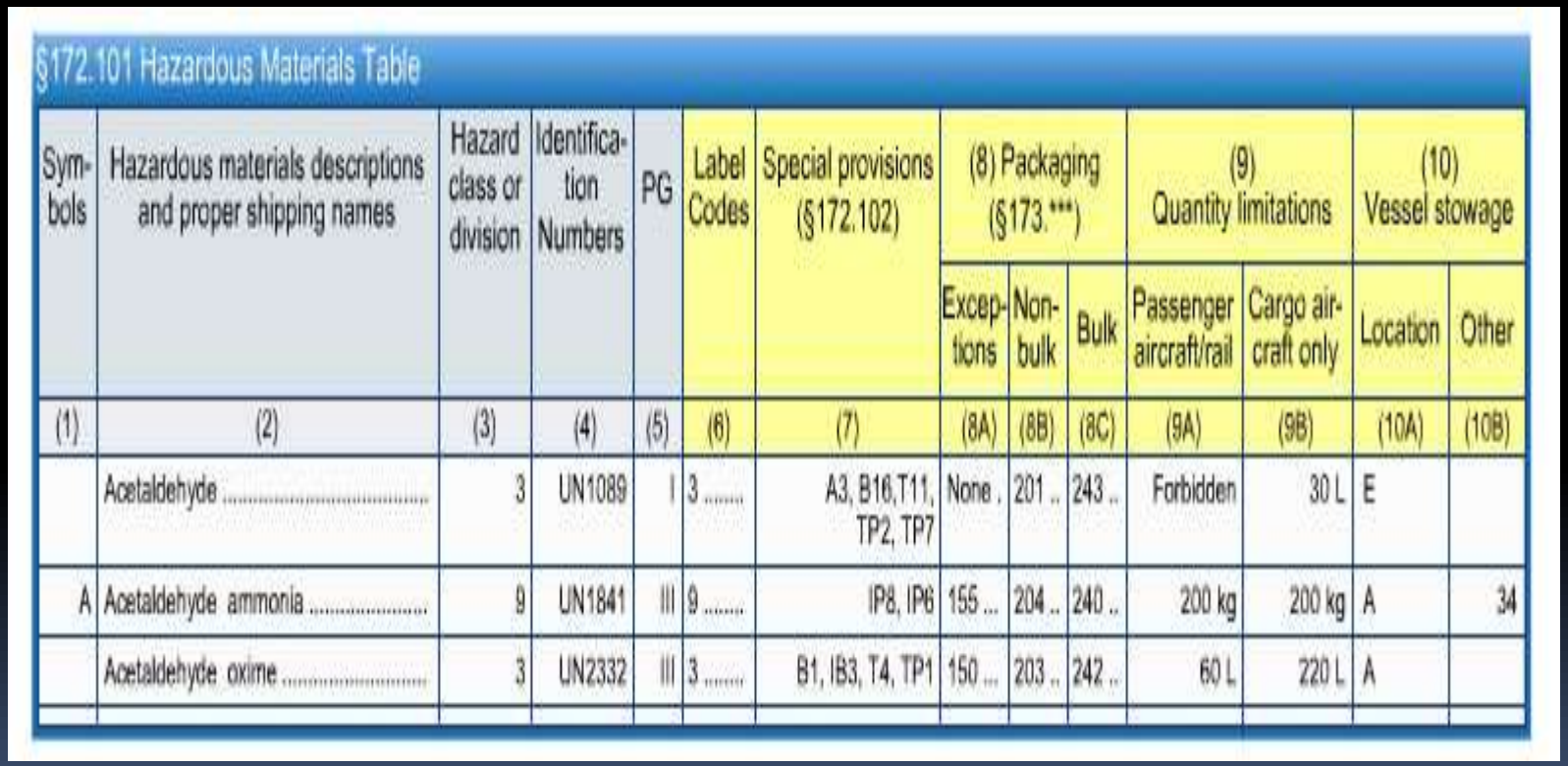

POISON-INHALATION HAZARD
Inhalation Hazard
Primary Hazard
Subsidiary Hazard
Dimethyl sulfate
UN 1595
Inhalation Hazard
INHALATION HAZARD
6
CORROSIVE

Examples


ADDITIONAL LABELING
DECABORANE
UN1868
FLAMMABLE
SOLID
4
POISON
Primary Hazard Class
Label With Hazard
Class Number
Subsidiary Hazard Class
Label Without Hazard
Class Number

Packaging

Hazardous Materials Table



§172.101 Hazardous Materials Table

Sym-bols	Hazardous materials descriptions and proper shipping names	Hazard class or division	Identification 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 Point
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

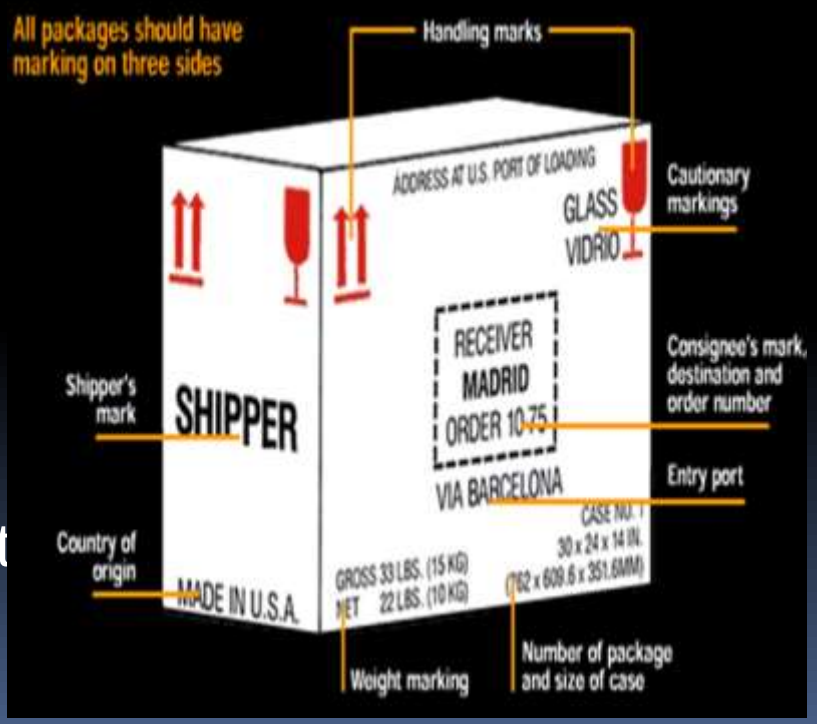
1H2
Plastic Drum,
Removable Head

Marking requirements for non-bulk packaging

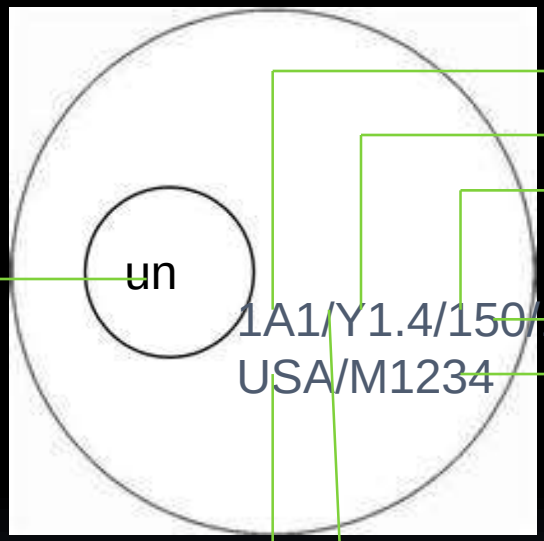
If a package is separated from its documentation, then marking must be adequate to help in emergency situations.

Following information must be marked on non-bulk containers

- Proper shipping names
- Identification numbers
- Technical names
- Names and address of the consignees
- Special marking requirement



Non-Bulk container Packaging



United Nations Symbol

Packaging identification code

Specific gravity

Hydrostatic test pressure

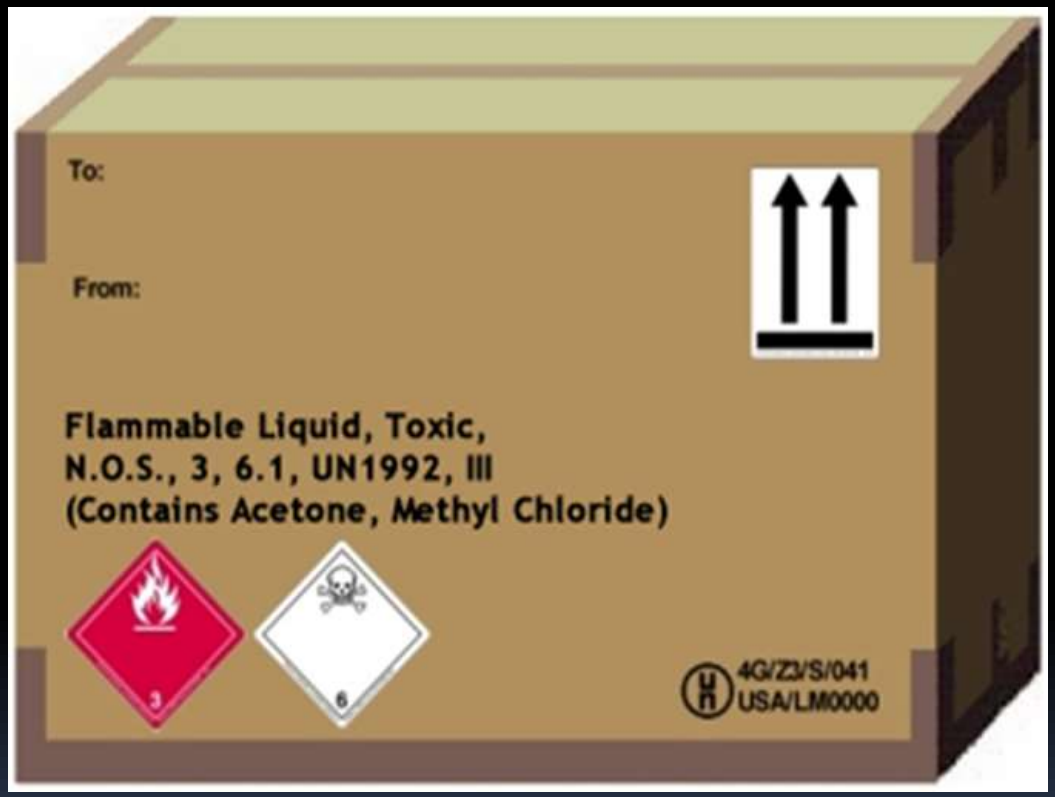
Year of manufacture

Manufacturer's registered symbol

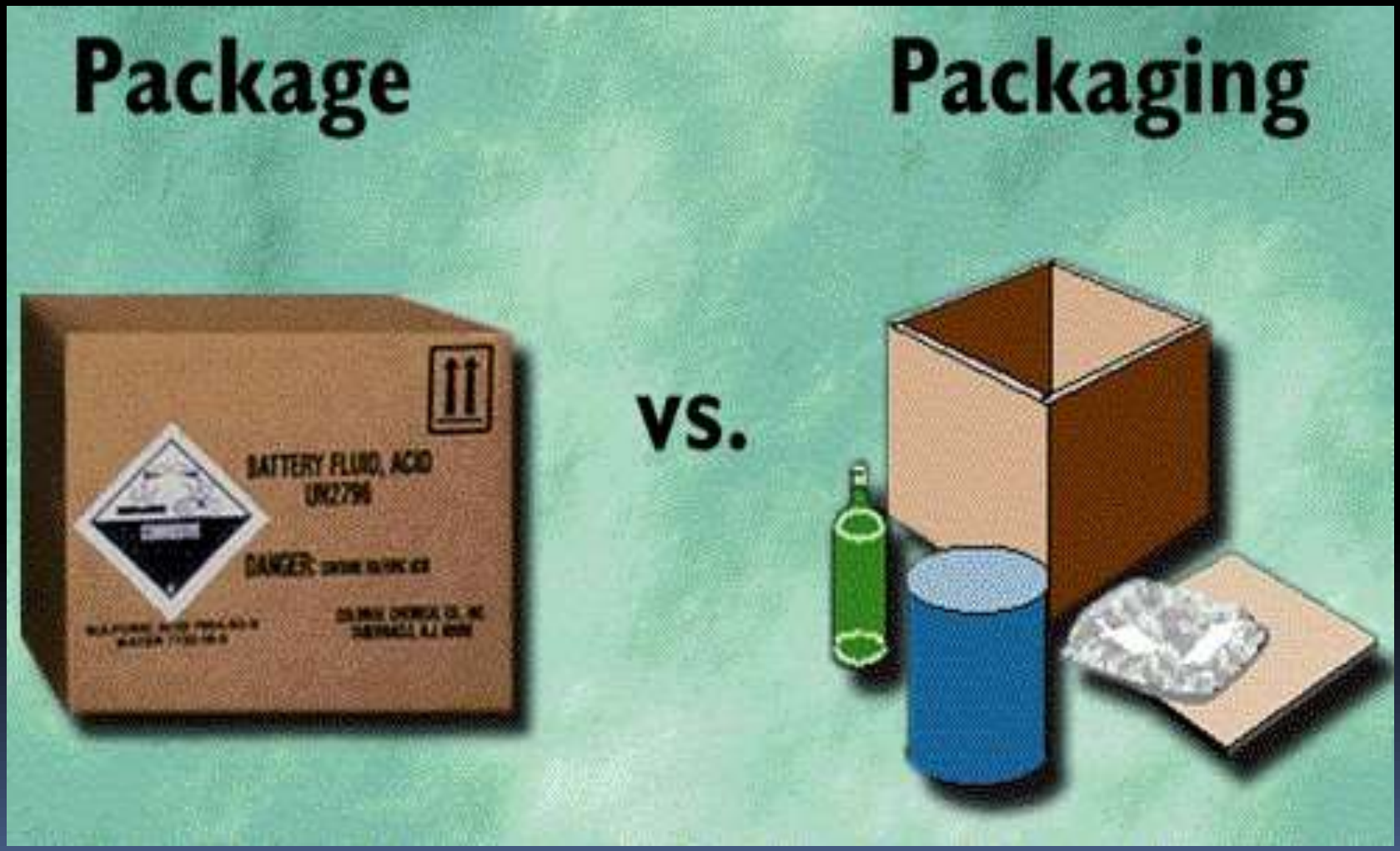
Country of origin

Performance standard

Label Sample



Package vs. Packaging



Labeling

Hazardous Materials Warning Labels

Actual label size: at least 100 mm (3.9 inches) on all sides

CLASS 1 Explosives: Divisions 1.1, 1.2, 1.3, 1.4, 1.5, 1.6

§172.411

* Include compatibility group letter

** Include division number and compatibility group letter

CLASS 2 Gases: Divisions 2.1, 2.2, 2.3

§172.405(h), §172.415, §172.416, §172.417

CLASS 3 Flammable Liquid

§172.419

CLASS 4 Flammable Solid, Spontaneously Combustible, and Dangerous When Wet: Divisions 4.1, 4.2, 4.3

§172.420, §172.422, §172.423

CLASS 5 Oxidizer, Organic Peroxide: Divisions 5.1 and 5.2

Organic Peroxide, Transition-2011

§172.426, §172.427

CLASS 6 Poison (Toxic), Poison Inhalation Hazard, Infectious Substance: Divisions 6.1 and 6.2

For Regulated Medical Waste (RMW), an Infectious Substance label is not required on an outer packaging if the OSHA Biohazard marking is used as prescribed in 29 CFR 1910.1030(g). CDC Etiologic Agent label must be used as prescribed in 42 CFR 72.3 and 72.6. A bulk package of RMW must display a BIOHAZARD marking.

§172.323, §172.405(c), §172.429, §172.430, §172.432

CLASS 7 Radioactive

§172.436, §172.438, §172.440, §172.441

CLASS 8 Corrosive

§172.442

CLASS 9 Miscellaneous Hazardous Material

§172.446

Subsidiary Risk Label

§172.411

Cargo Aircraft Only

§172.448

Empty Label

§172.450

HAZARDOUS MATERIALS MARKINGS

Package Orientation (Red or Black)

§172.312(a)

§172.317

§173.25(a)(4)

§172.325

§172.332(a)

Fumigant Marking (Red or Black)

§172.302(g) and §173.9

Biological Substances, Category B

§173.199(b)(5)

§172.322

§172.315(a)

§172.316(a)

Keep a copy of the Emergency Response Guidebook handy!

DOT Labeling System

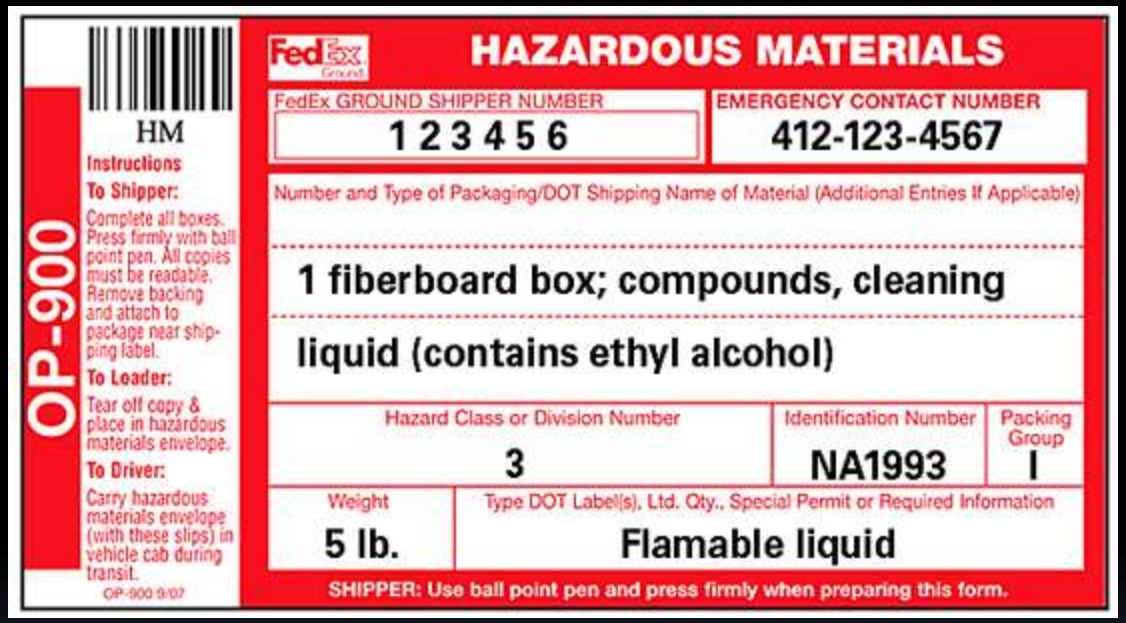
- Diamond shaped labels, 4 inches on each side, required to be affixed on two sides of non-bulk containers
- Subsidiary labels indicate additional hazards

Labeling

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

ID Number

DOT Labeling System



OP-900

HM

Instructions

To Shipper:
Complete all boxes. Press firmly with ball point pen. All copies must be readable. Remove backing and attach to package near shipping label.

To Loader:
Tear off copy & place in hazardous materials envelope.

To Driver:
Carry hazardous materials envelope (with these slips) in vehicle cab during transit.

OP-900 9/07

FedEx Ground

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	Identification Number	Packing Group
3	NA1993	I

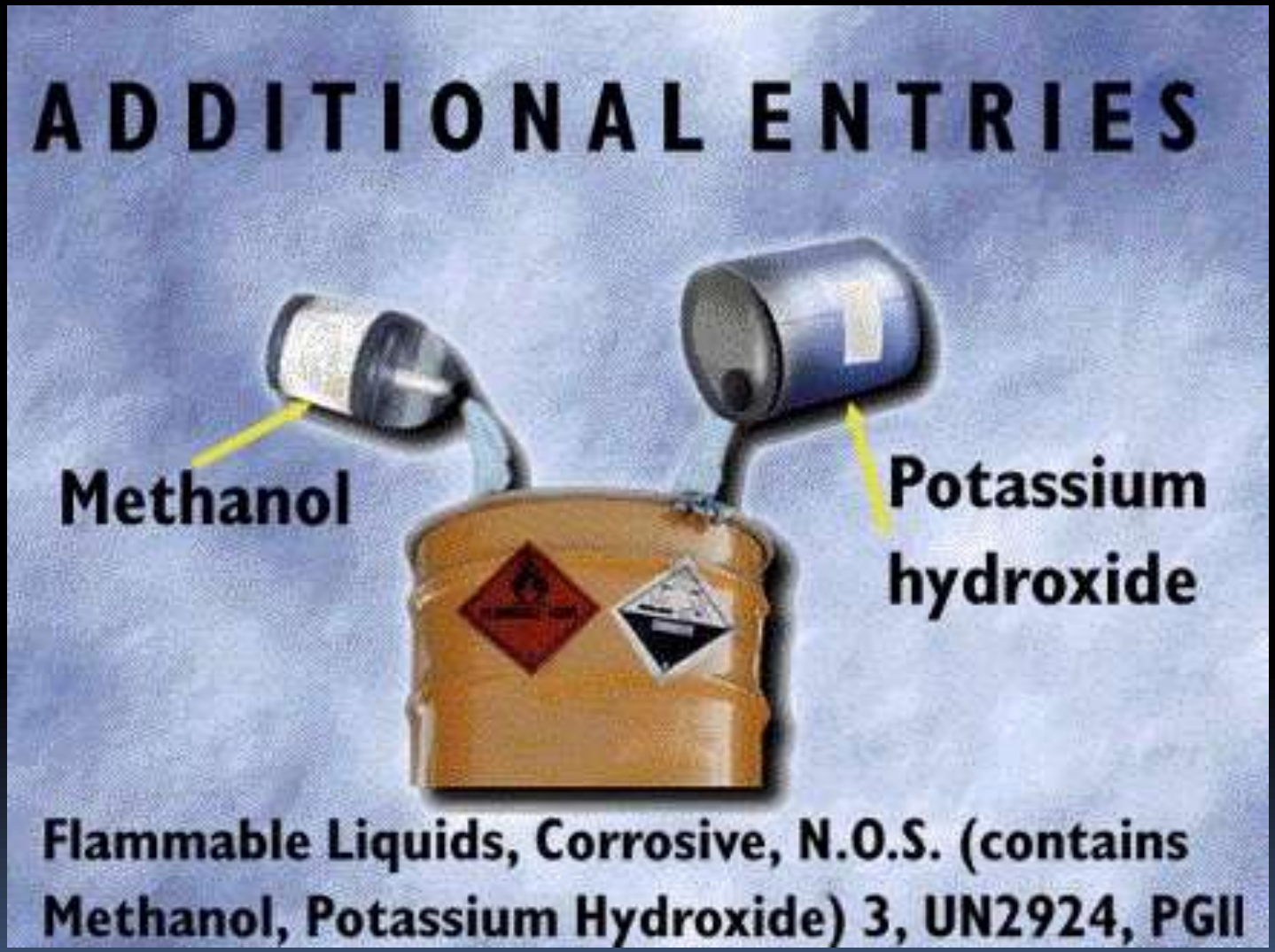
Weight	Type DOT Label(s), Ltd. Qty., Special Permit or Required Information
5 lb.	Flamable liquid

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

Mixed and consolidated packages

- Two ore more compatible hazardous materials with different packing classes within the same box or within the same outside container or overpack are mixed package.
- Labels for each package must be displayed on the package, outside container or overpack

Examples


ADDITIONAL ENTRIES
Methanol
Potassium hydroxide
Flammable Liquids, Corrosive, N.O.S. (contains Methanol, Potassium Hydroxide) 3, UN2924, PGII

DOT Segregation Standards for combination packaging

DOT Segregation Table for Hazardous Materials

Class or Division		1.1 & 1.2	1.3	1.4	1.5	1.6	2.1	2.2	2.3 gas zone A	2.3 gas zone B	3	4.1	4.2	4.3	5.1	5.2	6.1 PG I zone A	7	8 liquid only
Explosives	1.1 & 1.2	*	*	*	*	*	X	X	X	X	X	X	X	X	X	X	X	X	X
Explosives	1.3	*	*	*	*	*	X		X	X	X		X	X	X	X	X		X
Explosives	1.4	*	*	*	*	*	O		O	O	O		O				O		O
Very insensitive explosives	1.5	*	*	*	*	*	X	X	X	X	X	X	X	X	X	X	X	X	X
Extremely insensitive explosives	1.6	*	*	*	*	*													
Flammable gases	2.1	X	X	O	X				X	O							O	O	
Non-toxic, non-flammable gases	2.2	X			X														
Poisonous gases	Zone A 2.3	X	X	O	X		X				X	X	X		X			X	
Poisonous gases	Zone B 2.3	X	X	O	X		O				O	O	O	O	O	O			O
Flammable liquids	3	X	X	O	X				X	O					O		X		
Flammable solids	4.1	X			X				X	O							X		O
Spontaneously combustible	4.2	X	X	O	X				X	O							X		X
Dangerous when wet	4.3	X	X		X				X	O							X		O
Oxidizers	5.1	X	X		X				X	O	O						X		O
Organic peroxides	5.2	X	X		X				X	O							X		O
Poisonous liquids PG I, Zone A	6.1	X	X	O	X		O				X	X	X	X	X	X			X
Radioactive materials	7	X			X		O												
Corrosive liquids	8	X	X	O	X				X	O		O	X	O	O	O	X		

Labels, Class 1 Explosives

Class 2 Gases

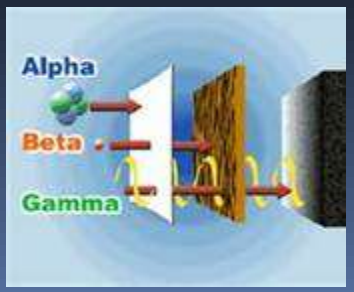
Class 3 Flammable & Combustible Liquids

Class 4 Flammable Solids, Dangerous When Wet, Combustible

Hazard Class5, Oxidizer

Hazard Class 6

Class 7, Radioactive

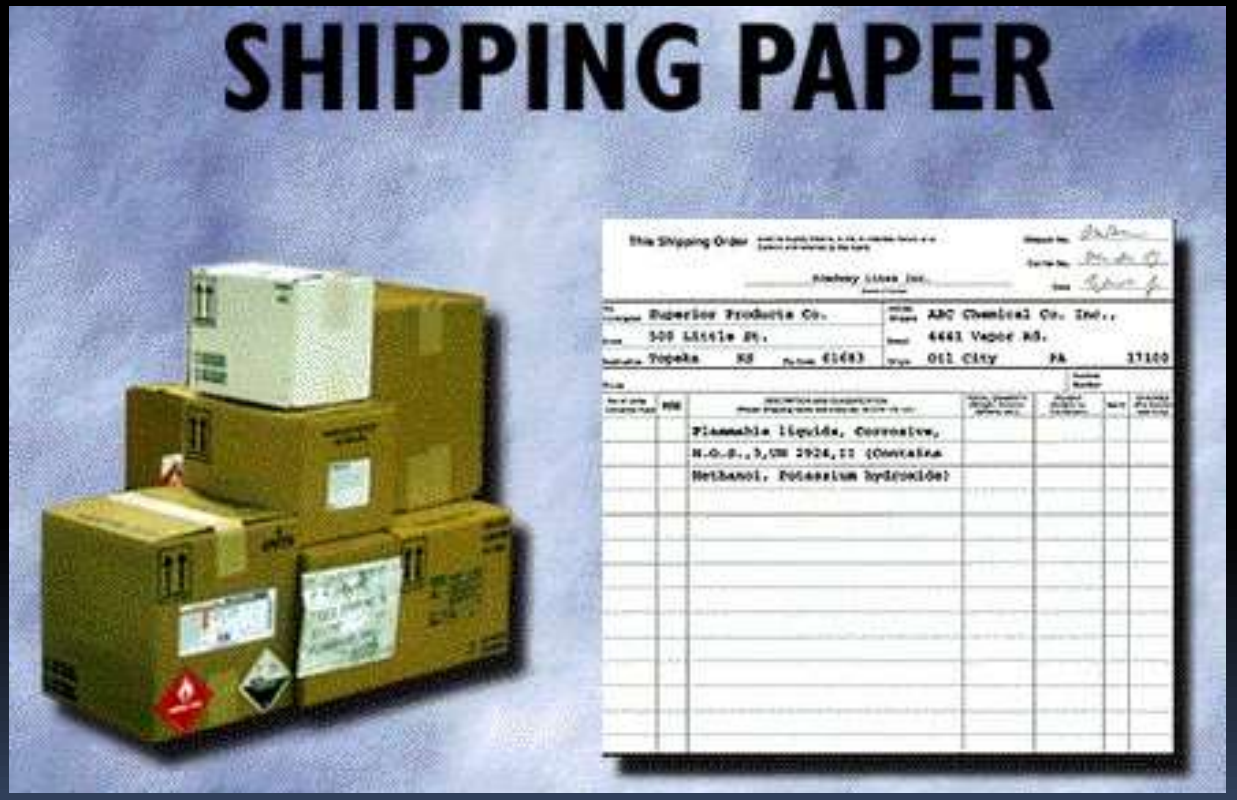


Class 8, Corrosive

Class 9, Miscellaneous

Shipping papers

Completing the Shipping Paper



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

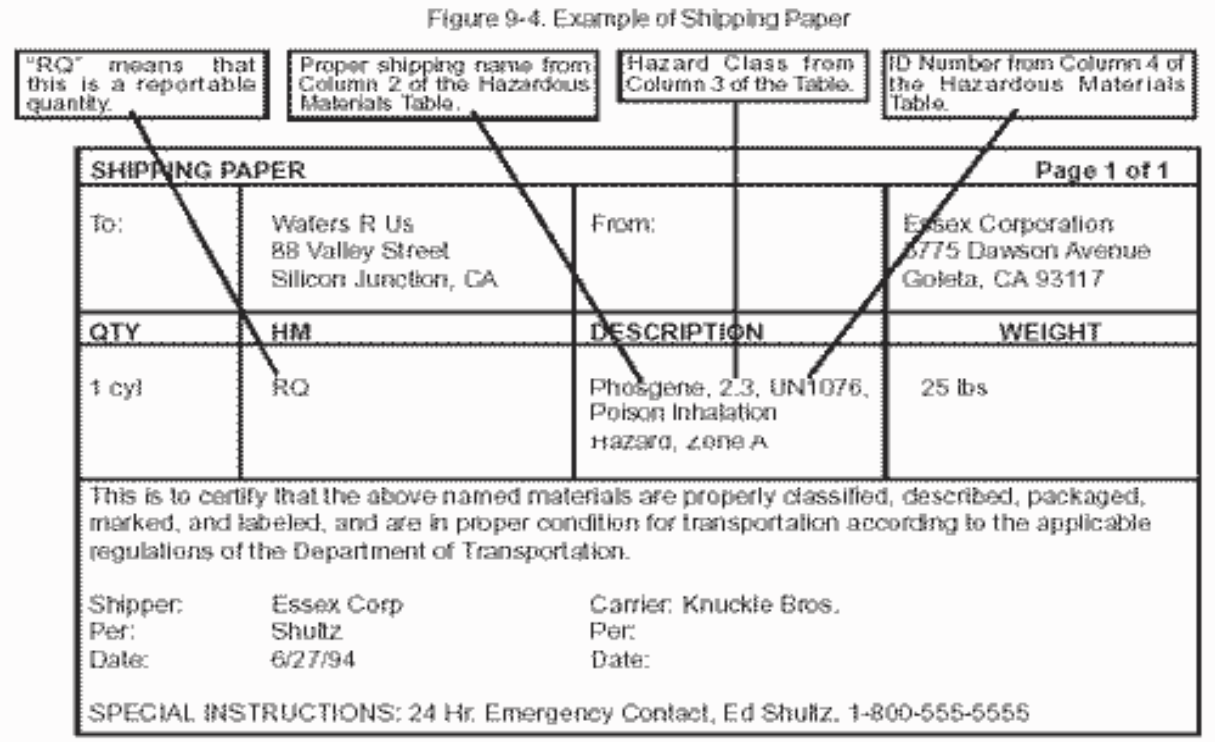


Figure 9-4. Example of Shipping Paper

"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.

SHIPPING PAPER Page 1 of 1

To:	Wafers R Us 88 Valley Street Silicon Junction, CA	From:	Essex Corporation 5775 Dawson Avenue Goleta, CA 93117

QTY	HM	DESCRIPTION	WEIGHT
1 cyl	RQ	Phosgene, 2.3, UN1076, Poison Inhalation Hazard, Zone A	25 lbs

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
Per: Shultz
Date: 6/27/94

Carrier: Knuckle Bros.
Per:
Date:

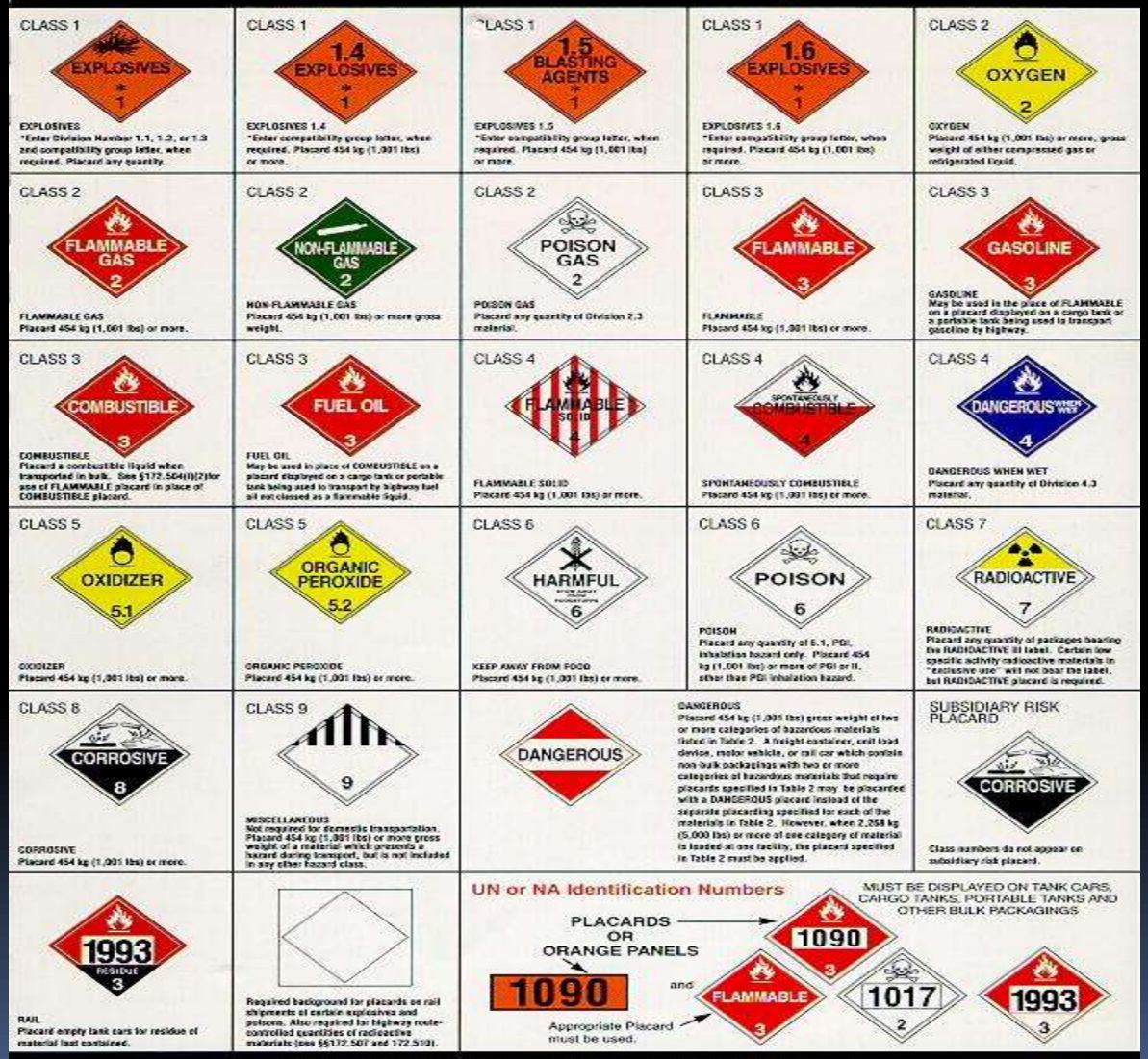
SPECIAL INSTRUCTIONS: 24 Hr. Emergency Contact, Ed Shultz, 1-800-555-5555

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
- Haz 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 flammable s and other haz materials

Placarding

Hazardous Materials Warning Placards



Response begins with identification!

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

Examples

OPPOSITE SIDES

or

Label Two Sides
172.406(e)(4)

Portable Tank

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 UAHuntsville police

Incident Reporting


Questions?
5.2

References

1. Hazardous material management, Compliance with DOT requirements Environmental Resource Center hand out