HAZARDOUS MATERIALS TRANSPORTATION

July 26, 1996
Seattle, Washington

Sponsored by the

Northwest Center for Occupational Health and Safety
Department of Environmental Health
School of Public Health and Community Medicine
University of Washington

in cooperation with the
Centers for Education and Training of the NIOSH-funded
New York/New Jersey Educational Resourse Center

HAZARDOUS MATERIALS TRANSPORTATION

University of Washington

ACCREDITATION

This course has been approved for 1.0 CM point by the American Board of Industrial Hygiene.

This course has been approved for 0.60 CEU's to the Washington State Board of Registered Sanitarians.

Credit can be obtained for safety professionals by sending the course brochure and schedule to the Board of Certified Safety Professionals.

50272-101

REPORT DOCUMENTATION PAGE	1. REPORT NO.	2.	PB97-147151

4. Title and Subtitle Hazardous Materials Transportation	5. Report Date 1996/07/00
	6.
7. Author(s) Malool, J. M.	8. Performing Organization Rept. No.
9. Performing Organization Name and Address Northwest Center for Occupational Health and Safety, Department of Environmental Health, School of Public Health and Community Medicine, University of Washington, Seattle, Washington	10. Project/Task/Work Unit No.
	11. Contract (C) or Grant(G) No. (C) (G) T42-CCT-010418
12. Sponsoring Organization Name and Address	13. Type of Report & Period Covered
	14.

15. Supplementary Notes

16. Abstract (Limit: 200 words) This one day course was designed to educate the participants in the field of hazardous materials transportation. The definitions of hazardous materials are reviewed from the point of view of the Environmental Protection Agency, the Department of Transportation, and the Occupational Safety and Health Administration. Proper container determination is considered. Nine hazard classes are noted including explosive materials, gases, flammable liquids, flammable solids, oxidizers, poisonous materials, radioactive materials, corrosive materials and miscellaneous hazardous materials. Labeling and placarding, including the use of the Hazardous Materials Table, identifying placards, and UN numbers, are discussed. Shipping documents including the Bill of Lading and the Hazardous Waste Manifests are reviewed. Choosing a proper shipping description for hazardous material and hazardous wastes is discussed. Detailed information should be known about the shipment including the process which generated the materials or wastes, chemical constituents present, concentration or percent of each chemical present, physical state, specific gravity or density, hazard characteristics, flashpoint, intended use of the material, pH, whether the material is reactive or contains cyanides or sulfides, the concentration of any toxic constituents, shipment method, and amount of material per container. Carrier preparation is reviewed and spill prevention and cleanup discussed. Consideration of transporter responsibilities and liabilities conclude the course work.

17. Document Analysis a. Descriptors

b. Identifiers/Open-Ended Terms NIOSH-Publication, NIOSH-Grant, Grant-Number-T42-CCT-010418, Grant-Number-T42-OH-07125, End-Date-06-30-1997, Training, Regulations, Transportation-industry, Drivers, Hazardous-materials, Transportation-workers, Accident-prevention, Industrial-wastes

c. COSATI Field/Group

18. Availability Statement	19. Security Class (This Report)	21. No. of Pages 25
	22. Security Class (This Page)	22. Price

HAZARDOUS MATERIALS TRANSPORTATION

University of Washington

ADVISORY COMMITTEE

Nir Barnea
Industrial Hygienist
NOAA HAZMAT
Seattle, Washington

Teresa Bess
Program Coordinator
Department of Environmental Health
University of Washington

Jeff Burgess, MD
Acting Assistant Professor
Occupational and Environmental Medicine
Harborview Medical Center
Seattle, Washington

John Butler
Spills Operations Specialist
Department of Ecology
Olympia, Washington

Mary Evans
Operations Research Analyst
NOAA HAZMAT
Seattle, Washington

Chris Field
On-Scene Coordinator
U.S. Environmental Protection Agency, Region X
Seattle, Washington

HAZARDOUS MATERIALS TRANSPORTATION
ADVISORY COMMITTEE *(continued)*

Dean Ikeda, MS, CIH
Area Director
U.S. Department of Labor-OSHA
Bellevue, Washington

Carl Osaki
Chief
Environmental Health Services
Seattle-King County Department of Public Health
Seattle, Washington

Lt. Jim Peschel
Assistant Chief
Marine Safety Office Puget Sound
U.S. Coast Guard
Seattle, Washington

Doug Pierce
Environmental Manager
Operations Division
Department of Transportation
Olympia, Washington

Janine Rees
Industrial Hygienist
Department of Labor and Industries
Seattle, Washington

Jan Schwert, MHSA
Manager, Continuing Education Program
Department of Environmental Health
University of Washington

Karen R. Stout-Abariotes, CIH
Industrial Hygiene Consultant
Division of Industrial Safety and Health
Department of Labor and Industries
Spokane, Washington

HAZARDOUS MATERIALS TRANSPORTATION

University of Washington

FACULTY

John M. Malool, MS, Course Director
Lecturer
Centers for Education and Training
New York/New Jersey NIOSH Educational Resource Center
and
Chief of Operations
Hazmat Unit
Piscataway, New Jersey

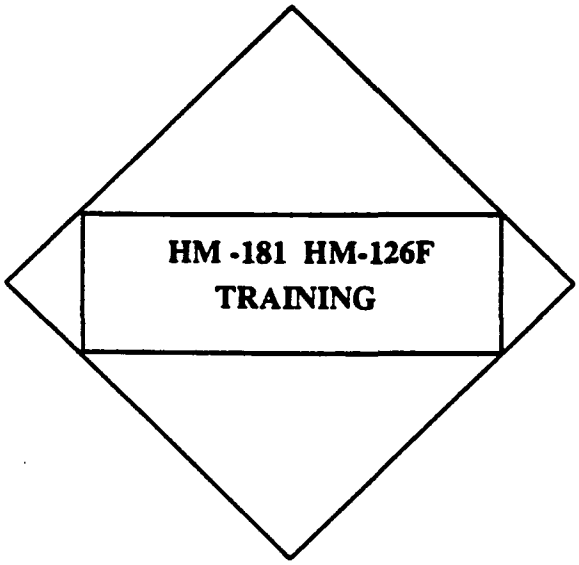
HAZARDOUS MATERIALS TRANSPORTATION

University of Washington

PROGRAM

8:00 am	Registration and Continental Breakfast
8:30	Introduction
9:00	What is a Hazardous Material? • EPA • DOT • OSHA
9:30	Proper Container Determination
10:00	Labeling and Placarding • Use of Hazardous Materials Table • Identifying Placards • UN Numbers
11:00	Shipping Documents • Bill of Lading • Hazardous Waste Manifests
12:00	Lunch (provided)
12:45 pm	Carrier Preparation
1:45	Spill Prevention/Spill Response • Response Plans • Spill Reporting • Additional Training Requirements
2:30	Transporter Responsibilities/Liabilities
3:45	Exam
4:30	Adjourn

HAZARDOUS MATERIALS TRANSPORTATION REGULATIONS



HAZ-MAT TRANSPORTATION REGULATIONS TRAINING COURSE

TABLE OF CONTENTS

INTRODUCTION ..... TAB 1

- DOT Regulation
- Training Requirements

WHAT IS A HAZARDOUS MATERIAL? ..... TAB 2

PROPER CONTAINER DETERMINATION ..... TAB 3

LABELLING AND PLACARDING ..... TAB 4

SHIPPING DOCUMENTS ..... TAB 5

- Bills Of Lading
- Hazardous Waste Manifests

CARRIER PREPARATION ..... TAB 6

- Vehicle Marking
- Loading/Unloading Procedures

SPILL PREVENTION/SPILL RESPONSE ..... TAB 7

- Response Plans
- Spill Reporting
- Additional Training Requirements

TRANSPORTER RESPONSIBILITIES/LIABILITES ..... TAB 8

DEFINITIONS ..... TAB 9

CASE STUDY EXERCISE ..... TAB 10

HAZARDOUS MATERIALS TRANSPORTATION REGULATIONS

- 49 CFR 171-180
  - New regulations published: December 21, 1990
  - Effective date: October 1, 1991

NEW RULING

- Hazardous Materials Uniform Safety Act (HMTUSA)
- Amends the Hazardous Materials Transportation Act of 1974
- Many times referred to by the Docket Number - HM181

PROVISIONS of the REGULATION

- Adopts UN labels, placards and Identification Numbers for hazardous materials
- Provides packing standards based on performance criteria
- Makes US Standards compatible with international standards
- Establishes training requirements for Haz-Mat employees

COMPONENTS of 49 CFR

- Hazardous Materials Regulations are found in 10 Parts, each designated numerically:
  - Part 171 General Info, Regulations and Definitions
  - Part 172 Hazardous Materials Table
  - Part 173 Hazard Class Definitions
  - Part 174 Rail Car Transportation Requirements

COMPONENTS of 49 CFR

- Continued
  - Part 175 Aircraft Transportation Requirements
  - Part 176 Marine Transportation Requirements
  - Part 177 Motor Carrier Transportation Requirements

COMPONENTS of 49 CFR

- Continued
  - Part 178 Container Specifications
  - Part 179 Tank Car Specifications
  - Part 180 Container Maintenance, Testing, Re-Use

REGULATION ENACTMENT

- New Regulation creates tremendous impact on industry
- Regulation creates a phase in period for certain provisions

COMPLIANCE DATES

- October 1, 1991
  - New explosives placards in effect
  - Creation of designation of chemicals that are Poisonous by Inhalation (PIH)
- October 1, 1992
  - Placarding requirements for chemicals that are PIH
- October 1, 1993
  - Compliance with training requirements
  - Implementation of packaging requirements for PIH chemicals

COMPLIANCE DATES, Continued

- January 1, 1994
  - Compliance with new regulations for infectious substances
- October 1, 1994
  - New placarding requirements implemented
  - New package manufacturing and marking requirements in place
- October 1, 1996
  - Additional package requirements in effect
- October 1, 2001
  - All placarding requirements in place
  - All labelling and packaging requirements effective

TRAINING REQUIREMENTS

- Training must include:
  - General Awareness Training
  - Function Specific Training
  - Safety Issues
  - Driver/Operator Training (for those who operate a motor vehicle

HMTUSA TRAINING PROGRAM

- Must contain provisions for:
  - Training
  - Testing
  - Certification
  - Record Retention

TRAINING RECORDS

- Must contain the following information:
  - employee's name
  - completion date of most recent training
  - training materials (copy or location and description)
  - name and address of trainer
  - certification that the employee has been trained and tested

WHAT IS A HAZARDOUS MATERIAL?

- Not an easy question to answer
- Three federal agencies deal with dangerous chemicals
  - Occupational Safety & Health Administration (OSHA)
  - Environmental Protection Agency (EPA)
  - Department of Transportation (DOT)
- Each agency refers to the same material by a different name

OSHA

- refers to these materials as:
  - hazardous chemicals

EPA

- refers to these materials as:
  - hazardous substances (under CERCLA regulations)
  - hazardous wastes (under RCRA regulations)

DOT

- refers to these materials as
  - hazardous materials

IMPORTANT NOTE

- All CERCLA hazardous substances and RCRA hazardous wastes are considered to be hazardous materials under the provisions of HMTUSA

DOT DEFINITIONS

- Three important definitions found in DOT regulations
  - Hazardous Material
  - Hazardous Substance
  - Marine Pollutant

HAZARDOUS MATERIAL

- A substance or material (including hazardous substances, wastes, marine pollutants and elevated temperature materials), which have been determined by the Secretary of Transportation to be capable of posing an unreasonable risk to health, safety and property when transported in commerce.

HAZARDOUS SUBSTANCE

- A material, including its mixtures and solutions that:
  - a. is listed in Appendix A of 49 CFR 172.01
  - b. is in a quantity, in one package, which equals or exceeds the reportable quantity (RQ) listed in Appendix A and
  - c. is in a concentration by weight which equals or exceeds a specified concentration corresponding to the RQ of the material.

MARINE POLLUTANT

- A hazardous material that when in a solution or mixture of more marine pollutants, is packaged in a concentration equal to:
  - ten percent or more by weight of the solution or mixture for materials listed in the Appendix, or
  - one percent or more by weight of the solution or mixture for materials that are identified as severe marine pollutants

HAZARD CLASS

- the category of hazard assigned to a hazardous material
- there are nine hazard classes
- a hazardous material may only have one hazard class designation even if it has more than one hazard
- each hazard class is designated numerically

DIVISIONS

- divisions are subdivisions of a hazard class
- designated by the hazard class number followed by a decimal point and an additional number

THE HAZARDOUS MATERIALS TABLE

- Often referred to as Table 172
  - this is the official listing of those chemicals designated as a hazardous material by the Dept. of Transportation
  - if a substance is not listed in Table 172, it is not a hazardous material and is shipped as a regular commodity

INFORMATION PROVIDED IN TABLE 172

- Identifies the hazard class
- Specifies if the material is "forbidden" in transportation
- Identifies the proper shipping name
- Provides the UN/NA identification number

INFORMATION PROVIDED IN TABLE 172

- Establishes packaging requirements
- Specifies labeling requirements
- Creates quantity limits for aircraft
- Provides stowage requirements aboard vessels

TABLE 172 FORMAT

- Table arranged in a 10 column format
- Each column provides special information

TABLE 172 COLUMNS

- Column 1 - Symbols
  - "+" fixes the proper shipping name, hazard class and packing group for special chemicals
  - "A" restricts the material by aircraft transportation
  - "D" creates the proper shipping name for domestic transportation
  - "I" identifies the proper shipping name for international transportation
  - "W" restricts the material by vessel transportation

TABLE 172 COLUMNS

- Column 2 - Hazardous Materials Description, Proper Shipping Name
- Column 3 - Hazard Class/Division
  - lists the numerical designation
  - identifies forbidden materials

TABLE 172 COLUMNS

- Column 4 - UN/NA Identification Number
- Column 5 - Packing Group
  - specifies packing type based on the hazard class of the material
- Column 6 - Labels
  - identifies primary and subsidiary label requirements

TABLE 172 COLUMNS

- Column 7 - Special Provisions
- Column 8 - Packaging Authorizations
  - spells out requirements for:
    - bulk packaging requirements
    - non-bulk packages
    - packaging exceptions

TABLE 172 COLUMNS

- Column 9 - Quantity Limitations
  - establishes maximum transportation quantities for:
    - passenger aircraft
    - passenger rail cars
    - cargo aircraft
- Column 10 - Vessel Stowage Requirements

REGULATION COMPLIANCE

- Many columns have conditions and exemptions
- It is not easy to state that a material is hazardous or not
- A close examination of Table 172 is necessary to assure total compliance

TABLE 2 - 2

THE NINE HAZARD CLASSES

Class	Division	Characterization
1		**Explosive materials**
	1.1	Explosives having a mass explosion hazard
	1.2	Explosives having a projection hazard, but not a mass explosion hazard
	1.3	Explosives having a fire hazard, and either a minor blast hazard or a minor projection hazard, but not a mass explosion hazard
	1.4	Explosive devices (containing no more than 25 g [9 oz.] of detonating material) presenting a minor explosion hazard
	1.5	Very insensitive explosives
	1.6	Extremely insensitive articles that do not have a mass explosive hazard
2		**Gases**
	2.1	Flammable gases
	2.2	Non-flammable, non-poisonous compressed gases (including compressed gas, liquefied gas, pressurized cryogenic gas and compressed gas in solution)
	2.3	Poisonous gases (by inhalation)
3		**Flammable liquids** (*Combustible* liquids are specially defined. They have a higher flash point temperature than flammable liquids. Although "combustible liquid" is not a numerical division designation within Class 3, it is used to classify materials for some purposes—strictly for domestic shipments—in the HMR.)
4		**Flammable solids**
	4.1	Wetted explosives, self-reactive materials, and readily combustible solids
	4.2	Spontaneously combustible materials
	4.3	Dangerous when wet materials
5		**Oxidizers**
	5.1	Oxidizing materials
	5.2	Organic peroxides
6		**Poisonous materials**
	6.1	Poisonous liquids or solids
	6.2	Infectious substances (etiologic agents)
7		**Radioactive materials**
8		**Corrosive materials**
9		**Miscellaneous hazardous materials** (includes hazardous substances and wastes not otherwise classified)
ORM-D		Materials such as consumer commodities that are subject to the HMR, but present a limited hazard during transportation because of their form, quantity, and packaging. There are specific exemptions for ORM–D materials in the Hazardous Materials Table.

Container Selection and Management

Only containers which meet DOT standards may be used for the transportation of hazardous materials or hazardous waste. In order to avoid repackaging hazardous waste prior to shipment and to avoid compatibility problems between the waste and the container, it is wise to use DOT-specification containers for hazardous waste accumulation as well. DOT has recognized that not all materials are compatible with every type of container. Acids will destroy metal drums and some organic solvents will dissolve the materials in certain plastic containers. In addition, containers must be designed and constructed to hold hazardous materials and wastes during the stresses and rigors that occur during container handling and transportation. No one container has been designed which is appropriate for the transportation of all hazardous materials. Consequently, DOT has specified which containers are best suited for particular materials and wastes.

US DOT hazardous material regulations were amended on December 21, 1990 to align the regulations with United Nations recommendations and International Civil Aviation Organization Technical Instructions in the areas of classification, packaging, and hazard communication during the transport of hazardous materials. International performance-oriented packaging standards will replace the current DOT-specification system used for container selection and must be used for non-bulk, domestic shipments by October 1, 1996. New packaging requirements for materials that are poisonous by inhalation become mandatory on October 1, 1993. Under the new system, packaging requirements for a hazardous material are based on the material's packing group and vapor pressure, and the chemical compatibility between the packaging and the hazardous material.

The new regulations change the requirements on the selection, use, and reuse of plastic and metal drums as well as other containers. Use of the new hazardous materials table and associated classification, labeling, marking, and packaging requirements is mandatory on October 1, 1991 for explosives and most infectious substances. By October 1, 1992, hazard communication requirements are effective for all materials which are poisonous by inhalation. January 1, 1994 is the date after which most other provisions of this final rule become effective (certain performance-oriented packaging requirements become effective in 1994 and 1996 as noted above).

4.1 Container Selection

To select the proper container for transportation off-site, you must use the DOT Hazardous Materials Table found in 49 CFR 172.101. There are two versions of the table, either of which may be used depending on date of the shipment and the type of containers used. The newer (HM-181) DOT Hazardous Materials Table is reprinted in Appendix A of this handbook. These tables identify the regulatory requirements for hazardous material containers. A hazardous material is defined by DOT as a substance or material in a quantity and form which may pose an unreasonable risk to

ealth, safety and property when transported in commerce. All hazardous wastes are DOT hazardous materials when transported in commerce.

The following procedure may be used to select the proper container for waste accumulation.

1. Select a proper shipping name for the hazardous material. For example, if you are shipping acetone, look up the word "Acetone" in column 2. If the hazardous material is a mixture containing more than one chemical compound or element, use the most descriptive proper shipping name (A procedure for determining the proper shipping names for mixtures is presented in Chapter 6).

2a. If using the HM-181 table, determine the packing group associated with the proper shipping name. The packing group is listed in column 5 of the HM-181 hazardous materials table. The more hazardous the material being shipped, the more stringent the packing requirements. There are three packing groups (PG): PG I = great danger; PG II = medium danger; PG III = minor danger.

2. In column 5 of the pre-HM-181 table, find the packaging specifications corresponding to the proper shipping name you have selected. Column 5(a) refers to packaging specifications for very small or limited quantities of hazardous materials. Column 5(b) is used to determine which regulations specify the proper non-bulk containers, such as drums, that can be used for transportation of hazardous materials. Or, in column 8 of the HM-181 table, find the packaging standards for the proper shipping name you selected. Column 8A contains specifications for exceptions, similar to column 5(a) of the pre-HM-181 table. Column 8B is used to determine which regulations specify the proper non-bulk containers that can be used for transportation of hazardous materials. Column 8C is used to determine the requirements for bulk packages.

3. Identify the specific packaging requirements and packaging codes for the material in the referenced section of 49 CFR 173.

4. Obtain containers that are marked with one of the specification codes identified in the referenced section of 49 CFR.

If a container is a DOT specification package, somewhere on the container (e.g., top or bottom) will be a mark with the DOT specification. This mark indicates the container manufacturer has followed DOT requirements when manufacturing and testing the container. An example mark and a complete explanation of the container manufacturer's marking system is presented in Chapter 5.

4.1.1 Assignment of Packing Groups under HM-181

When more than one packing group is identified on the hazardous materials table, the shipper must determine the appropriate packing group based on the physical and health hazards of the material being shipped. The following scussion explains how to determine the packing group for all hazard classes cept for Class 1 explosives and Class 7 radioactive materials, for which the reader is referred to the DOT regulations in 49 CFR 173.

Class 2 Gases

In Class 2, only Division 2.3 gases have multiple packing groups. The packing group is based on the inhalation toxicity of the gas, which is separated into three hazard zones. The hazard zone and packing group may be determined using the table below:

Hazard zone	Inhalation toxicity*
A.....	$LC_{50} \leq 200$ ppm
B.....	200 ppm $< LC_{50} \leq 1000$ ppm
C.....	1000 ppm $< LC_{50} \leq 3000$ ppm
D.....	3000 ppm $< LC_{50} \leq 5000$ ppm

*LC_{50} is lethal concentration-50. This is the concentration that will cause death to 50 percent of a sample population of experimental animals under specified conditions (see definitions for poisonous substances in Chapter III).

Class 3 Flammable Liquids

For Class 3, packing group is determined by the criteria on the following table:

Packing Group	Flash Point (closed cup)	Initial Boiling Point
I	.....	≤ 35 °C (95 °F)
II	< 23 °C (73 °F)	> 35 °C (95 °F)
III	≥ 23 °C, ≤ 60.5 °C (141 °F)	> 35 °C (95 °F)

Class 4 Flammable Solids

Packing groups are determined as follows when the hazardous materials table assigns more than one packing group:

Division 4.1

- For materials other than metal powders, PG II if the burning rate (when tested in accordance with Appendix E of 49 CFR 173) is greater than 2.2 mm/s and flame passes the wetted zone. PG III if the burning rate is greater than 2.2 mm/s and the wetted zone stops the flame.
- For metal powders, PG II if the zone of reaction spreads over the whole length of the sample in ≤ 5 minutes; PG III if the zone of reaction spreads over the whole length of the sample in more than 5 but less than 10 minutes.

Division 4.2

- Self heating materials are assigned to PG II if the material gives a positive test result when tested with a 2.5 cm cube size sample; PG III if the material gives a positive test result when tested with a 10 cm cube size sample but a negative test result with a 2.5 cm cube size sample.

Division 4.3

- PG I is assigned if spontaneous ignition occurs, or material demonstrates a tendency of spontaneous ignition, or the rate of evolution of flammable gases is ≥ 10 l/kg of material over any one minute.

PG II is assigned the if rate of evolution of flammable gases is ≥ 20 l/kg of material per hour.

- PG III is assigned if the rate of evolution of flammable gases is greater than 1 l/kg of material per hour.

Class 6 Poisonous Materials

Packing groups for Division 6.1 materials that are toxic in any way **except** by inhalation of vapors are determined by using the following table when the hazardous materials table assigns more than one packing group:

Packing Group	Oral LD_{50} mg/kg	Dermal LD_{50} mg/kg	Inhalation LD_{50} mg/kg (dusts and mists)
I	≤5	≤40	≤0.5
II	>5, ≤ 50	>40, ≤200	>0.5, ≤2
III	solids: >50, ≤200 liquids: >50, ≤500	>200, ≤1000	>2, ≤10

The packing group and hazard zone assignments for liquids based on inhalation of vapors are based on the criteria listed in the following table and in Fig. 4.1. These overlap with the Division 2.3 gases hazard zones as shown by the extensions at the right side of the graph (see also 49 CFR 173.133(2)(ii)).

Packing Group	Vapor concentration* and toxicity
Hazard Zone A)	$V \geq 500 \times LC_{50}$ and $LC_{50} \leq 200$ ml/m^3
I (Hazard Zone B)	$V \geq 10 \times LC_{50}$; $LC_{50} \leq 1000$ ml/m^3; and the criteria for PG I, HZ A are not met.
II	$V \geq LC_{50}$; $LC_{50} \leq 3000$ ml/m^3; and the criteria for PG I are not met.
III	$V \geq .2 \times LC_{50}$; $LC_{50} \leq 5000$ ml/m^3; and the criteria for PG I and II are not met.

*V is the saturated vapor concentration in air of the material in ml/m3 at 20°C and standard atmospheric pressure

Class 8

Packing groups for Class 8 are determined as using the following criteria when the hazardous materials table assigns more than one packing group:

- PG I for substances that cause visible destruction or irreversible alterations of the skin at the site of contact when tested on the intact skin of an animal for a period of not more than 3 minutes.
- PG II for substances, other than PG I, that cause visible destruction or irreversible alterations of the skin at the site of contact when tested on the intact skin of an animal for a period of not more than 60 minutes.
- PG III for substances other than PG I or II that cause visible destruction or irreversible alterations of the skin at the site of contact when tested on the intact skin of an animal for a period of not more than 4 hours or which have a corrosion rate on steel or aluminum exceeding 6.25 mm (0.246") a year at a temperature of 55°C.

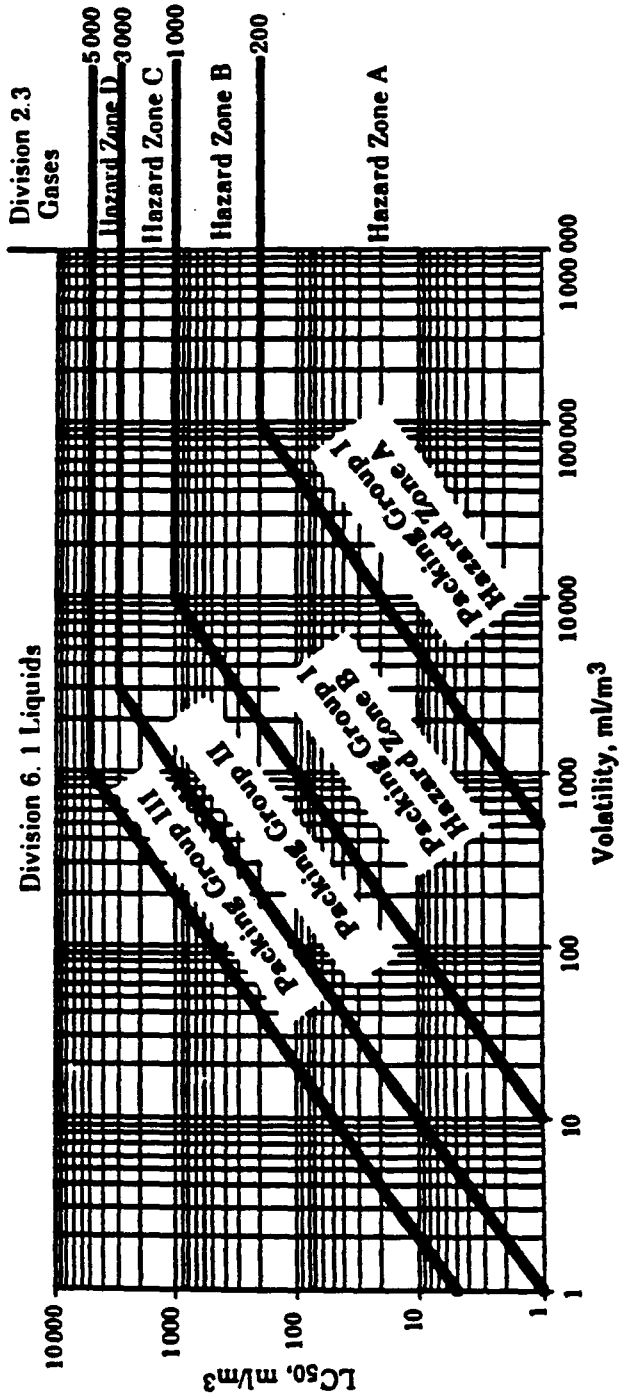


Fig. 4.1 Inhalation Toxicity: Packing Group and Hazard Zone Borderlines

.1.1 Container Reuse

Under the pre-HM-181 system, a container may be marked "NRC" meaning non-reusable container or "STC" meaning single trip container. The implications are the same for containers marked with either acronym. These containers may be reused for the shipment of hazardous materials only if the following conditions are met: 1) the material must be packaged and offered for transportation in accordance with DOT regulations, 2) transportation is by highway only, 3) the container may not be offered for transportation less than 24 hours after it is finally closed for transportation, 4) the container must be inspected for leakage immediately before being offered for transportation, 5) each container must be loaded by the shipper and unloaded by the consignee, unless the motor carrier is a private or contract carrier, and 6) unless the container has been reconditioned or altered and retested according to prescribed methods, the container may be reused only once for the transportation of hazardous waste.

Under the HM-181 40 CFR 173.28 requirements, non-bulk packages (except those made of paper, plastic film or textile) may be re-used provided:

- There is no evidence of a reduction in container integrity (unless the container is then reconditioned)
- Packages subject to the leakproofness test are retested in accordance with 49 CFR 178.604 and marked with the letter "L"
- Metal and plastic containers may be reused only when marked with a minimum thickness for reuse and the containers meet this minimum thickness
- Plastic inner receptacles of composite packages must have a minimum thickness of 1 mm
- Used non-bulk containers may be reused for hazardous waste provided:
  - the container meets the packaging requirements for the waste shipped
  - transportation is by highway only
  - the container is not offered for transportation less than 24 hours after it is finally closed for transportation and it is inspected and found to be free from leaks immediately prior to being offered for shipment
  - the container is loaded by the shipper and unloaded by the consignee, unless the motor carrier is a private or contract carrier
  - The container may be reused only once under this exception unless it meets the 49 CFR 173.28 requirements described above.

4.1.2 Container Condition Requirements

Both EPA and DOT regulate the condition of containers used to accumulate and ship hazardous waste. During waste accumulation, 40 CFR 265.171 requires that hazardous waste in containers at both accumulation points and at satellite accumulation points must be in good condition. Good condition means that drums should have no severe rusting, no sharp-edged creases or dents, no bulging heads caused by overpressuring a container, and no severe structural defects. If a container is not in good condition or begins to leak, e hazardous waste must be immediately transferred to another container or must be overpacked in a salvage drum. Containers with pools of hazardous

Container Labeling and Marking

It is the shipper's responsibility to determine what container labels and marks are required before offering the container for transportation. DOT requirements for container labeling and marking, including changes coming under HM-181 are discussed below.

5.1 Container Labeling

Any person or employee who offers a package for transportation that contains a hazardous material or hazardous waste must affix the appropriate DOT warning label (the diamond-shaped color-coded label). The following steps should be followed to determine the proper DOT label(s) for hazardous material and hazardous waste shipments.

1. Locate the proper shipping name in column 2 of the Hazardous Materials Table in 49 CFR 172.101.

2. Locate the hazard class (or classes) in column 3 of the Table.

3. Locate the hazard label required for the material in column 4 of the pre-HM-181 Table (or column 6 of the HM-181 Table.

Hazard warning labels must be placed next to the proper shipping name marked on the container.

Some hazardous material descriptions have more than one hazard class listed in the Hazardous Materials Table. If the container being shipped meets more than one hazard class, multiple labels are required. Multiple labels should be located next to one another (do not place labels over any other information).

5.1.1 Multiple Labeling Requirements (Pre-HM-181)

The following DOT rules apply for containers bearing more than one hazard class or for those bearing special hazards:

- When compatible hazardous materials of different hazard classes are in the same package, overpack, or container, the label for each class must be shown on the container.
- A material classed as an explosive A, poison A, or radioactive material that also meets the definition of another hazard class, must be labeled for each class.
- A poison B material that also meets the definition of a flammable liquid, flammable solid, corrosive material, or oxidizing material must be labeled "POISON" in addition to the appropriate label for the other class.
- A flammable solid that also meets the definition of a water reactive material must be labeled "FLAMMABLE SOLID" and "DANGEROUS WHEN WET."

- A flammable solid that also meets the definition of a corrosive material must be labeled "FLAMMABLE SOLID" and "CORROSIVE."

- An oxidizer that meets the definition of a corrosive material must be labeled "OXIDIZER" and "CORROSIVE."

- A flammable liquid that also meets the definition of a corrosive must be labeled "FLAMMABLE LIQUID" and "CORROSIVE."

5.1.2 Additional Labeling Requirements (Pre-HM-181)

In addition to the hazard labels specified by the DOT Hazardous Material Table, other labels are required under the circumstances described below:

- Empty radioactive materials packagings which have been emptied as far as practical must have previously applied labels removed and the "Empty" label applied.

- Wastes and materials which are poison inhalation hazards as described in the marking section of this chapter, must be labeled "POISON" in addition to any other labels which are required.

- "Cargo Aircraft Only" labels must be applied when shipping hazardous waste via air in quantities not permitted on a passenger carrying aircraft.

- A bung label must be applied to metal barrel or drums containing a flammable liquid having a vapor pressure between 16 and 40 pounds psia at 100°F. The following warning is required on a bung label:

> CAUTION: Unscrew This Bung SLOWLY. Do not unscrew entirely until all interior pressure has escaped through the loosened threads. REMOVE BUNG IN OPEN AIR. Keep all open flame lights and fires away. Enclosed Electric Lights are safe.

5.1.3 Multiple Labeling Requirements (HM-181)

In addition to the label specified in Column 6 of the Hazardous Materials Table, each package of Class 1 material that also meets the definition for Division 6.1 packing groups I or II shall be labeled POISON. Class 7 radioactive materials also have additional labeling requirements (see 49 CFR 173.403).

When column 6 of the hazardous materials table indicates that a subsidiary label is required, this label must be affixed to the container next to the primary hazard label. The subsidiary label may not display the hazard class number or division number. If a hazardous material does not have a subsidiary labeling requirement designated in column 6 of the hazardous material and it is not a Class 1 or Class 2 material, it must be labeled with a subsidiary label in accordance with the following table:

Subsidiary hazard level (packing group)	Subsidiary Hazard (Class or Division)						
	3	4.1	4.2	4.3	5.1	6.1	8
I	X	***	***	X	X	X	X
II	X	X	X	X	X	X	X
III	*	N	X	X	N	N	**

X Required for all modes
* Required for transport by vessel only
** Required for transport by aircraft and vessel only
*** Impossible as subsidiary hazard
N None required

5.1.4 Exceptions from Labeling Requirements (Pre-HM-181)

Labels are not always needed on every package containing a hazardous waste or hazardous material. For example a freight container having a volume of 640 cubic feet or more should not be labeled, but should be placarded. The same is true for portable tanks that are properly placarded. Combustible liquids in packages do not require labels. Other Regulated Materials or ORMs are not labeled if they do not contain any other hazardous material. These materials are identified by the ORM mark.

5.1.5 Exceptions from Labeling Requirements (HM-181)

Labels are not required for the following:

- Cylinders containing Division 2.1 or Division 2.2 gas that is not poisonous, carried by a private or contract motor carrier, not overpacked, and durably and legibly marked in accordance with Compressed Gas Association Pamphlet C-7, Appendix A.
- Military explosives, ammunition and certain other materials shipped by or on behalf of the DOD (see 49 CFR 172.400a for details)
- An overpack or unit load device in or on which labels representative of each hazardous material in the overpack or unit load device is visible.
- A package of low specific activity radioactivity when transported in accordance with the packaging requirements in 49 CFR 173.425(b).
- Small or limited quantities with listed exemptions in 49 CFR 173.

5.1.6 Changes under HM-181

Effective **1 October 1993**, a number of significant DOT labeling changes go into effect:

1. The new Hazardous Materials Table must be used to determine which labels are required on a container. You will note that the labeling requirements are in column 6 of the new table.

2. The new DOT labels must be used. A number of significant changes have been made to the labels, such as:
   - the addition of the numerical hazard class number in the lower corner of the square-on-point labels
   - there are revisions to, removals and additions of some labels:
     - Explosive A, Explosive B, Blasting Agent, and Irritant labels are removed
     - Explosive 1.1, 1.2, 1.3, 1.4, 1.5, 1.6 labels, Explosive subsidiary risk label,
       KEEP AWAY FROM FOOD and INFECTIOUS SUBSTANCE labels, and the CLASS 9 labels are added
     - the ETIOLOGIC AGENT label is removed

5.2 Container Marking by Hazardous Material Shippers

DOT marking requirements are concerned with the obligation to mark the exterior of a package or container with specific information. For shipments in **non-bulk packages** only, the following information must be marked by the shipper on each container:

- *Proper Shipping Name*—as it appears on the Hazardous Materials Table (49 CFR 172.101). The pre-HM-181table may be used until **1 October 1993**, after which the new HM-181 DOT table must be used.
- *Technical Name*—This must be marked on the container whenever the material is described with an "n.o.s." (not otherwise specified) entry.
- *Identification Number (UN or NA)*—this is to immediately follow the proper shipping name.
- *Names and Addresses of Consignee* or *Consignor*
- *ORM*—the Other Regulated Material designation is required on packages containing materials classed as Other Regulated Materials on the Hazardous Materials Table (such as ORM-D, indicating a consumer commodity).
- *This End Up / This Side Up*—required for packages containing inside packaging of liquid hazardous materials. These packages must be packed with the closures upward and marked with the words "This End Up" or "This Side Up." Arrows may be used in addition to indicate the proper orientation of the package, but this does not eliminate the requirement for marking the package with the words "This End Up" or "This Side Up."
- *Inhalation Hazard*—Materials that pose a health hazard through inhalation must be marked with the words "Inhalation Hazard." This is an HM-181 requirement that is in effect today.
- *Reportable Quantity*—if the material being shipped is a Hazardous Substance (listed in Appendix A to 49 CFR 172.101) with a reportable quantity in the individual package, the letters "RQ" must be marked in association with the proper shipping name (including the technical name or waste code, as applicable).
- *EPA Hazardous Waste Code*—If the material being shipped is a hazardous waste, the EPA hazardous waste code must be marked on the container.

For example, a container of ignitable hazardous waste (used paint thinner) must be marked "D001."

- *Radioactive materials*—Gross weight, Type A or Type B packaging, and USA (if package is destined for export shipment).

5.2.1 Changes under HM-181

In addition to the package marking requirements specified above, the following requirements go into effect **1 October 1993**:

1. *Exemption Numbers*—packagings authorized under an exemption must be plainly marked "DOT-E" followed by the exemption number.
2. All ORM marks are eliminated, with the exception of ORM-D (consumer commodities). Each package containing an ORM-D material must be marked on at least one side or end with the ORM-D designation immediately following or below the proper shipping name.
3. Combination packages that have inner packages containing liquid hazardous materials which must be packed with the closure upward must be marked on two opposite sides with arrows pointing in the correct upward direction.
4. The word POISON must be marked on each non-bulk outer package used as a single or composite package for Division 6.1 materials.
5. Class 1 explosives must be marked with the exception number for each substance, article, or device in the package.

5.2.2 Marine Pollutant Markings

For **vessel transportation** of each **non-bulk packaging** that contains a listed marine pollutant, the following requirements go into effect on **1 January 1993**:

- If the **proper shipping name** for a material that is a marine pollutant does not identify by name the component that makes the material a marine pollutant, the name of that component must be marked on the package **in parentheses** in association with the marked proper shipping name. Where two or more components that make a material a marine pollutant are present, the names of **at least two** of the components most predominantly contributing to the marine pollutant designation must appear in parentheses in association with the marked proper shipping name.
- The **MARINE POLLUTANT mark** must be placed in association with the hazard warning labels required, or, in the absence of any labels, in association with the marked proper shipping name. There are exceptions for certain **combination packagings**:
  - A combination packaging containing a **severe** marine pollutant in inner packagings each of which contains—
    - 0.5 liters (17 ounces) or less net capacity for liquids
    - 500 grams (17.6 ounces) or less net capacity for solids

- A combination packaging containing a marine pollutant, other than a severe marine pollutant, in inner packagings each of which contains—
  - 5 liters (1 gallon) or less net capacity for liquids
  - 5 kilograms (11 pounds) or less net capacity for solids

5.2.3 Bulk Packages

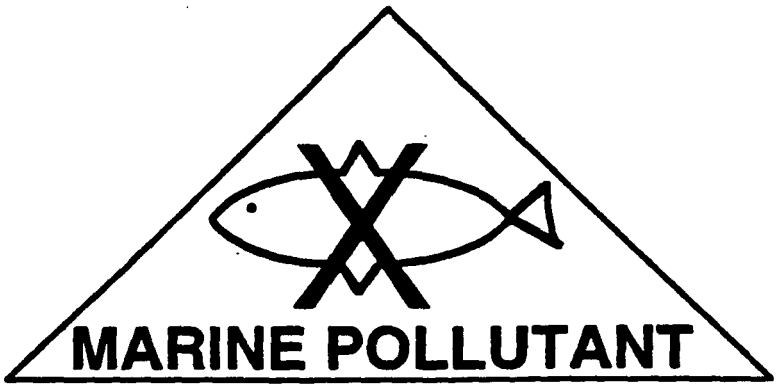
The following are required to be displayed when transporting hazardous materials in portable tanks, cargo tanks, and tank cars with a capacity greater than or equal to 450 liters or 400 kilograms:

1. **Hazardous material identification numbers**, displayed in one of several ways:
   - on an orange panel measuring 160 mm by 400 mm (6.3" x 15.7")
   - across the center of the primary hazard placard
   - for hazard classes for which placards are not required, the identification number must be displayed either on an orange panel or on a plain white square-on-point panel with the same outside dimensions as a placard.

   Identification numbers must be placed on each side of a package that has a capacity of < 3,785 liters (1,000 gal); and on each side and each end of a package that has a capacity of ≥ 3,785 liters, and any tube trailer motor vehicle.
2. **Portable tanks** with a capacity ≥ 450 liters or 400 kilograms must also (in addition to item 1) be marked with the proper shipping name on two opposite sides, and the owner or lessee's name.
3. **Cargo tanks** with a capacity ≥ 450 liters or 400 kilograms transporting Class 2 materials must also (in addition to item 1) be marked on each side with the proper shipping name and an appropriate common name.
4. **Tank cars and multi-unit tank cars** with a capacity ≥ 450 liters or 400 kilograms must also (in addition to item 1) be marked on each side with the proper shipping name and an appropriate common name.
5. **MARINE POLLUTANT mark** must be placed on each end and each side of a bulk packaging (capacity ≥ 450 liters or 400 kilograms) that contains a marine pollutant, and be visible from the direction the packaging faces. This mark may be displayed in black lettering on a white square-on-point configuration having the same outside dimensions as a placard (see following page). Except for transportation by vessel, a bulk packaging or freight container that bears a specified **label** or **placard** does not require a MARINE POLLUTANT mark.

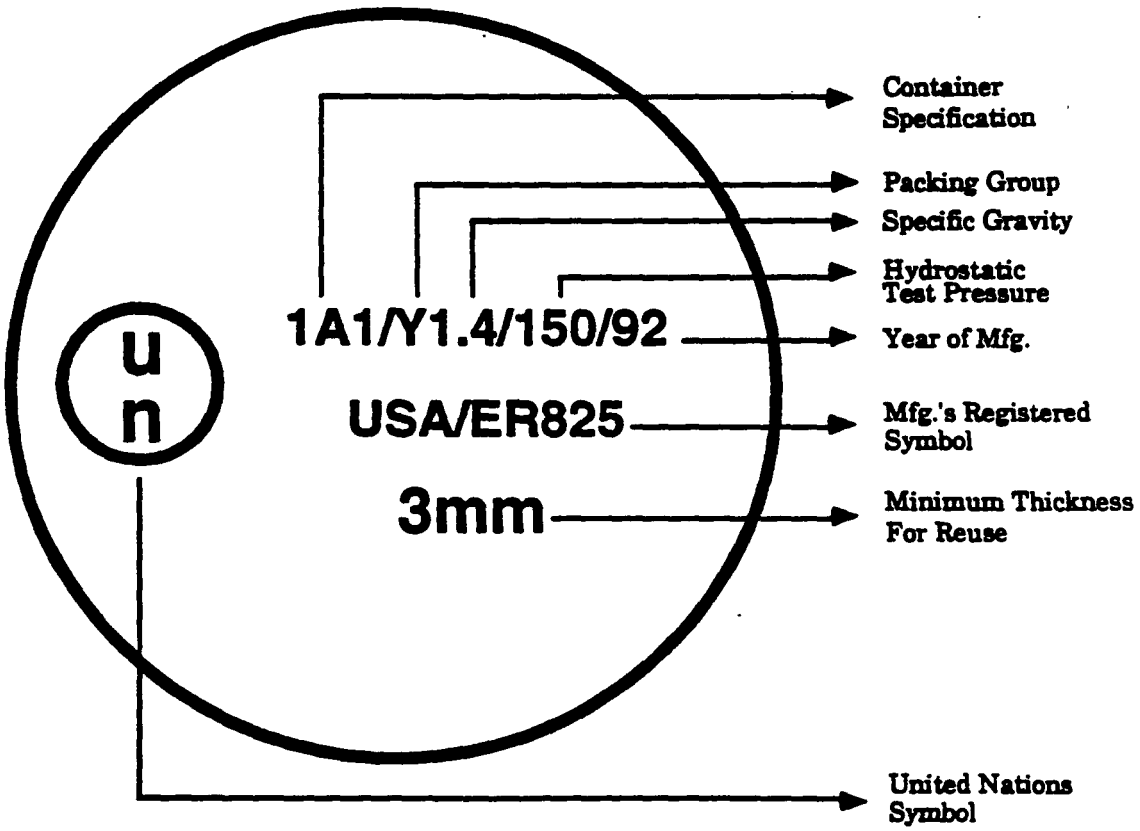
The symbol, letters and border must be black and the background white, or the symbol, letters, border and background must be of contrasting color to the surface to which the mark is being affixed. For **non-bulk** packagings of marine pollutants, each side of the mark must be at least 100 mm (3.9"), except in the case of packagings which, because of their size, can only bear smaller marks. For **bulk** packagings, each side of the mark must be at least 250 mm (9.8").

MARINE POLLUTANT Mark:



5.3 Manufacturer's Mark

Containers that are manufactured to meet the HM-181 performance oriented packaging requirements must be marked with the following information, as shown on the diagram below.



Container manufacturer's marks include the following information:

- The United Nations symbol
- The container specification code, such as **1A1**, where the first digit designates the type of container, the second item is a letter that identifies the materials of construction, and for drums, the third designates closed (1) or removable (2) head drum. Number designations for non-bulk containers are shown on the table below:

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

The second item designates the materials of construction, as shown below. Composite containers will be marked with two codes, with the first code identifying the material of construction of the inner layer and the second identifying the material of construction for the outer layer. For example, a non-composite, closed head steel drum may have the specification 1A1, and an open head steel drum with a plastic liner would have the code 1HA2.

2nd Container Code	Materials of Construction
A	Steel
B	Aluminum
C	Natural Wood
D	Plywood
F	Reconstituted Wood
G	Fiberboard
H	Plastic
L	Textile
M	Multi-Wall Paper
N	Metal (not steel or aluminum)
P	Porcelain, Glass, or Stoneware

A third code may be a numeral indicating the category of packaging within the type to which the packaging belongs. For example, for steel drums ("1A"), the codes are as shown below (note that this varies from container type to type; many have no third code):

3rd Container Code	Drum Head Configuration
1	Closed head drum, non-removable head
2	Open head drum

The container specification code may be followed by a letter designating the Packing Group performance standard, designated by the letters X, Y, or Z, as shown on the table below:

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

For containers intended to hold liquids, the Packing Group performance standard is followed by a designation of the maximum rated specific gravity. The specific gravity may be omitted if it is less than 1.2. For containers intended to hold solids (or inner packages), the performance standard is followed by the maximum gross mass (in kg).

For packages intended to hold liquids, the specific gravity is followed by the hydrostatic test pressure, to the nearest 10 kPa. For packages intended to hold solids, the maximum gross mass is followed by the letter "S."

The last two digits of the year of manufacture are marked on all drums, except 1H (plastic drums) and 3H (jerricans) which must also be marked with the month of manufacture. This is followed by the abbreviation of the country where the container was manufactured and for which standards it meets, such as "USA," followed by the symbol of the container manufacturer (or the manufacturer's name and address).

Combination packages that are tested in accordance with a selective test procedure are marked with the letters "SP" to indicate that the container qualifies for this test exemption. The container is also marked with the minimum thickness (in millimeters) for reuse.

Reconditioned containers should be marked with additional markings near those described above, including the country (or abbreviation) where the container was reused, the reconditioner's symbol (or name and address), the month and last two digits of the year the container was reconditions, the letter "R," and the letter "L" if the container successfully passed a leakproofness test.

DOT Shipping Papers

6.1 Introduction to Shipping Papers

It is the shipper's responsibility to properly complete the appropriate shipping documents (even though the transporter may do this for you, you are still responsible if the papers are not filled out properly). Shipping papers are completed for all shipments of hazardous materials. When they are hazardous wastes, the shipping paper is the Uniform Hazardous Waste Manifest. It is your responsibility to verify that the information on the shipping paper accurately and properly describes the materials being shipped, in accordance with DOT and EPA regulations.

6.1.1 Content of Hazardous Materials Shipping Papers

Typically, the hazardous material shipping paper is a bill of lading—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. Keep in mind, however, that shipping papers must be prepared for all shipments of hazardous materials over public highways, by air, rail, or water. If a commercial bill of lading is not required—for example, for shipments on a company's own truck from one facility to another within the same company—there must still be some type of shipping paper to describe the shipment. The paper may be a company memorandum or internal form, as long as it contains the information required by the HMR, and is carried on the vehicle (or other mode of transport) transporting the hazardous materials shipment.

At a minimum, the shipping papers must include the following information:

- *Name and address of the consignor and consignee*
- *Proper shipping name of the hazardous material.* If the material is a hazardous substance and the name of the hazardous substance is not identified in the proper shipping name, the constituents making it a hazardous substance must be entered in parentheses after the proper shipping name
- *Hazard Class* (if the proper shipping name includes the hazard class, it doesn't need to be repeated)
- *UN/NA identification number*
- *Total quantity of the shipment by weight or volume*
- *Emergency response telephone number.* If your organization has registered with CHEMTREC (Chemical Transportation Emergency Center), it is authorized to use CHEMTREC's 24-hour Emergency Notification Number - (800) 424-9300

  DOT regulations also require emergency response information to be included on or attached to the shipping papers. Photocopies of the appropriate guide from the DOT Emergency Response Guidebook or Material Safety Data Sheets may be attached to the shipping papers to

satisfy this requirement, or write the DOT Guide number on the papers and **always** keep a DOT Guidebook readily accessible in the cab of the vehicle. If the DOT Guidebook is used, the driver must verify that the corresponding page of the Guidebook is clearly referenced on the shipping papers for each hazardous material.

- *Shipper's certification.* This is certification that the shipment is prepared in accordance with the applicable hazardous materials regulations. The specific wording required is "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." This shipper's certification statement is not required when the hazardous material is offered for highway transport if it is in a cargo tank supplied by the carrier, or when the material is transported by the shipper operating as a private carrier, unless the material will be transferred from one carrier to another or reshipped.

NOTE: When a material that is not subject to these requirements (i.e. not a hazardous material) is described on the same shipping paper as a hazardous material, the hazardous material description must be:

- entered first, or
- entered in a color which clearly contrasts from the description of non-hazardous materials; or
- must be identified by an "X" placed before the proper shipping name in a column titled "HM."

Figure 6.1, at the end of this chapter, gives an example of a multi-purpose shipping paper that might be used by a company making frequent shipments of the same types of hazardous materials, plus other items that may or may not be hazardous. Note that this format **cannot** be used in place of a hazardous waste manifest.

6.1.2 Changes to Shipping Documents under HM-181

Effective **1 October 1993**, the first major change that affects shipping documents (e.g., the hazardous material bill of lading) is that the appropriate Packing Group must be described on the shipping document. Under HM-181, there have been significant changes to the manufacturing specifications for DOT packages. DOT is moving to performance-oriented packaging (POP) standards, and under this new system, packaging requirements for a material are based on:

- Packing Group—
  - Packing Group I—great danger
  - Packing Group II—medium danger
  - Packing Group III—minor danger
- its vapor pressure
- chemical compatibility between the packaging and the hazardous material.

In short, after 1 October 1993, all hazardous material shipping documents must indicate the Packing Group. The packing group is indicated in column 5 of the new DOT Hazardous Materials Table in 49 CFR 172.101.

Under HM–181 requirements, the proper shipping name, hazard class, identification number, packing group, and total quantity of material being shipped must also be in a prescribed sequence. The first entry must be the **proper shipping name**. The second entry is the **hazard class**, followed by the **identification number**, followed by the **Packing Group**, followed by the **total quantity** (this may also be placed before the proper shipping name).

6.2 Choosing a Proper Shipping Description for Hazardous Materials and Hazardous Wastes

The key to properly completing DOT shipping papers is to determine the best and most descriptive DOT proper shipping **description**, which will lead you to the entries in the Hazardous Materials Table that set out the regulatory requirements for your shipment. The proper shipping description consists of the proper **shipping name**, **hazard class** or **division** (as a number), DOT **identification number**, and **packing group** (I–III), in that order. For example:

Acetone, 3, UN 1090, PG II.

[Compare with the pre-HM–181: Acetone, Flammable liquid, UN 1090.]

Except for empty packagings, cylinders of compressed gases, and bulk packagings, you must also indicate the total quantity, including the unit of measurement. For example:

55 gal. *or* 208 L

Depending on the format of the shipping papers, the quantity may be placed before or after the description.

In order to determine the best shipping description, you must be familiar with the DOT Hazardous Materials Table and the appendices (Hazardous Substances and Marine Pollutants) to the Hazardous Materials Table in 49 CFR 172.101. (The HM–181 version of the Hazardous Materials Table is provided in Appendix A of this handbook.) The process will generally be more complex for hazardous wastes, which often consist of mixtures of varying composition. You should also know detailed information about your hazardous materials or wastes including:

- Process which generated the materials or wastes
- Chemical constituents present
- Concentration or percent of each chemical constituent present
- Physical state (e.g., solid, liquid, gas)
- Specific gravity or density
- Hazard characteristics (e.g., oxidizer, flammable solid, flammable gas, etc.)
- Flashpoint
- Intended use of the material
- pH

- Whether material is reactive or contains cyanides or sulfides
- If a waste, concentration of any Toxicity Characteristic constituents which are present
- Shipment method (e.g., bulk or container)
- Amount of material per container

You may obtain this information by reviewing the process generating the material to determine the actual or likely chemical constituents, by reviewing MSDSs and documents which provide chemical hazard information, and, for wastes, by analyzing them for hazard characteristics and chemical constituents. Once you have obtained this information, you can use the following key to determine the best US DOT description for your hazardous materials and wastes.

Key To Determining the US DOT Description for Mixtures

1. Does the material contain more than one chemical compound or element?

   Yes: Go to question 2.

   No: The material is not a mixture. Use table 172.101 to find the proper shipping name which most accurately describes the material. Go to question 13.

2. Is there a name on the Hazardous Materials Table that describes the mixture? See, for example, chlorate and magnesium chloride mixture, carbon dioxide-oxygen mixture, boron trifluoride-acetic acid complex, arsenical mixture, etc.

   Yes: Use the proper shipping name listed in table 172.101, column 2. Add the word "Waste" before the US DOT hazardous material description if the material is a hazardous waste. Go to question 9.

   No: Go to question 3.

3. Is there a name listed in the table that defines the material by a former use? See, for example, compounds, cleaning, liquid; coating solution; paint related material; etc.

   Yes: Use the proper shipping name listed in table 172.101, column 2. Add the word "Waste" before the US DOT hazardous material description if the material is a hazardous waste. Go to question 9.

   No: Go to question 4.

4. Is the material a mixture of one material listed in table 172.101, column 2 and one or more other materials which <u>are not</u> listed in 172.101, column 2 and are not DOT hazardous materials?

   Yes: Go to question 8.

   No: Go to question 5.

5. Is the material a mixture of at least two materials which <u>are</u> listed by name or hazard class in 172.101?

   Yes: Go to question 6.

   No: Go to question 7.

6. Does the material meet the description and the definition of more than one hazard class? For example, is the mixture both a Flammable Liquid (Class 3) and a Corrosive Material (Class 8)?

   Yes: Select a proper shipping name from Table 6.3 that includes both hazard classes in the proper priority as established by referring to the precedence tables (Tables 6.1 and 6.2). If both hazard classes are not represented by one shipping name, use the hazard precedence list in Table 6.2 to select a hazard class for the material. Precede this proper shipping name by the word "Waste" if the material is a waste. Add the highest priority hazard class/division number to the shipping name you selected. Check the 172.101 table for proper wording and punctuation. Go to question 10.

   No: Use the hazard class for the mixture as the proper shipping name (preceded by the word "Waste" if it is a waste) and followed by the letters "n.o.s." Check the Hazardous Materials Table for proper wording of the shipping name. Go to question 10.

   Note: If there is a plus (+) in column 1 of the hazardous materials table for one or more of the components of the material, then the hazard class and proper shipping name of this material cannot be modified.

7. Is the material a mixture of materials which <u>are not</u> listed by name or hazard class in 172.101, column 2 of the hazardous materials table?

   Yes: Use your knowledge of the material's characteristics to determine an appropriate hazard class. (DOT hazard classes are defined in Chapter III). Use the hazard class you select as the proper shipping name (preceded by the word "Waste" if it is a waste) and followed by the letters "n.o.s." Check the Hazardous Material Table for proper wording and punctuation. Go to question 10.

   If the hazardous material or waste does not meet the definition of any other hazard class other than Class 9 (Miscellaneous hazardous materials) use only one of the following shipping descriptions and go to Question 10:

For RCRA Hazardous Waste:	• Hazardous waste, liquid, n.o.s., 9, NA 3082, PG III • Hazardous waste, solid, n.o.s., 9, NA 3077, PG III
	or
For Other Hazardous Materials:	• Environmentally hazardous substances, liquid, n.o.s., 9, UN 3082, PG III • Environmentally hazardous substances, solid, n.o.s., 9, UN 3077, PG III

   No: Error, return to question 1.

8. Is the mixture a homogeneous liquid consisting of two or more chemical compounds or elements that will not undergo any segregation under conditions normal to transportation?

   Yes: The material is a solution, according to DOT definitions. Refer to the Hazardous Materials Table and select the name listed for the hazardous component of the mixture. If the mixture is a waste, add the word "Waste" prior to the shipping name. Add the qualifying word

"solution" after the name (for example, Waste Acetone Solution). Go to question 9.

No: The material is a mixture, according to DOT definitions. The qualifying word "mixture" should be inserted after any shipping name you select (for example, Waste Sodium Hydroxide Mixture). Go to question 9.

9. Does the material have just one hazard class and meet the definition of the hazard class associated with the proper shipping name you selected? (DOT hazard classes are defined in Chapter III).

   Yes: Use the shipping name you selected followed by the hazard class listed next to that shipping name in column 3 of table 172.101. Add the DOT identification number and Packing Group designation after the hazard class. Go to question 10.

   No: Discard the shipping name you previously selected. If the material has more than one hazard class, select a proper shipping name from Table 6.3 which includes both hazard classes (in precedence order), preceded by the word "Waste" if it is a waste. Add the hazard class from table 172.101 to the shipping name you selected. If both hazard classes are not represented by one shipping name, use the hazard precedence list in Tables 6.1 and 6.2 to select a hazard class for the material. Use the hazard class determined from the precedence list for the mixture as the proper shipping name (preceded by the word "Waste" if it is a waste) and followed by the letters "n.o.s." Check the Hazardous Material Table for proper wording and punctuation. Go to question 10.

   Note: If there is a plus (+) in column 1 of the hazardous materials table for one or more of the components of the material, then the hazard class of this material cannot be modified. For example, if column 3 of the hazardous materials table calls the material a Class 8 material, you may not change the hazard class to 3, or any other hazard class even though a different hazard class may more adequately describe the waste mixture.

10. Are the constituents of the material and their respective concentrations (percentages) known?

    Yes: Go to question 12.

    No: Is the material a waste?

    Yes: Go to question 11.

    No: Go to question 12.

11. Is the material a waste with a D, F, or K hazardous waste code?

    Yes: Look up the waste stream listing and RQ in Appendix A to 172.101. Go to question 13.

    No: Go to question 15.

12. Is any component of the mixture in Appendix A to 172.101?

    Yes: Go to question 13.

    No: Go to question 11.

13. Is the material a hazardous substance (refer to the definition of hazardous substance on page 65)?

Yes: Add the letters "RQ" either before or after the proper shipping description. Use the Hazardous Materials Table and, after the hazard class, add the DOT ID Number and packing group that corresponds to the proper shipping name unless it was entered previously.
After the US DOT description, add in parentheses the name or, for a waste with unknown constituents, the EPA hazardous waste number of the constituent(s) that caused the material to be a hazardous substance. Go to question 15.

No: Go to question 14.

14. Have you selected a proper shipping name listed in Table 6.3?

Yes: After the US DOT description, add in parentheses "contains _____ [the technical name of the hazardous material most predominantly contributing to the hazard]." If the material is a mixture of two or more hazardous materials, the technical names of at least two components most predominantly contributing to the hazards of the mixture or solution must be entered. Add the Hazard Class and DOT ID Number that correspond to the proper shipping name unless they were entered previously. Determine from the table, or from the criteria in 49 CFR Part 173, Subpart D, what packing group the material is in and enter the packing group number. For example, "Flammable liquid, corrosive, n.o.s., 3, UN 2924, PG II (contains Methanol, Potassium hydroxide)." Go to question 15.

No: Go to question 15.

15. Is the material a Marine Pollutant (refer to the definition on page 65)?

Yes: Add the words "Marine Pollutant" to the shipping description. If there are two or more listed marine pollutants, add the technical names of at least the two listed constituents that most predominantly contribute to the designation of marine pollutant. Go to question 16.

No: Go to question 16.

16. Does your material fall in any of the following categories?

- Class 7 Radioactive Material—Add the words "RADIOACTIVE MATERIAL" unless it is already in the shipping description. Add the physical and chemical form of the material. Enter the name of the radionuclide. Add the activity of each package. Enter the words "HIGHWAY ROUTE CONTROLLED QUANTITY" if applicable. Enter the category of label required (category I and II only). Enter the Transport Index if applicable.
- Division 4.3 Dangerous when wet materials—Add the words "DANGEROUS WHEN WET" to the shipping description.
- Division 6.1 Poisonous materials (primary or subsidiary hazard, Packing Groups I and II)—Add the word "POISON" to the shipping

- Inhalation Hazards (division 6.1 PG I or division 2.3)—Add the words "POISON—INHALATION HAZARD" and the appropriate hazard zone (ZONE A, B, C, or D) immediately following the shipping description.
- Elevated Temperature materials—Enter the word "HOT" immediately before the proper shipping name
- Empty Packagings—Containers with residue in them must have the words "RESIDUE: Last contained _____." and RQ entered in the description when appropriate.

Yes: Enter the appropriate wording described above. Check notes below.
No: Check notes below.

Notes: If the name of a compound that causes a mixture to meet the DOT definition of "poison" is not included in the proper shipping name for the mixture, the technical name of the compound must be incorporated into the description of the material. In addition, if a liquid or solid material meets the definition of a poison and the fact that it is a poison is not disclosed in the shipping name or hazard class entry, the word "Poison" must be entered in association with the shipping description.

The words "Poison Inhalation Hazard" or "Inhalation Hazard" and the appropriate hazard zone must be added to the basic shipping description for materials which are poisonous by inhalation. "Poison inhalation hazard" is defined below, and Table 6.3 contains a list of proper shipping names from HM-181 for materials designated as poison inhalation hazards. Hazard zones are defined in Chapter 4.

On completing the preceding key questions and notes, your shipping description should be complete.

Definitions

Elevated Temperature Material	A material which, when offered for transportation or transported in a bulk packaging: (1) Is in a liquid phase and at a temperature at or above 100 °C (212 °F); (2) Is in a liquid phase with a flash point at or above 37.8 °C (100 °F) that is intentionally heated and offered for transportation or transported at or above its flash point; **or** (3) Is in a solid phase and at a temperature at or above 240 °C (464 °F).
Hazardous Material	A material that is listed on the DOT Hazardous Materials Table, the appendices to the table, or a material which meets any of the hazard classifications identified in 49 CFR 173.

Hazardous Substance

A material, including its mixtures and solutions that meets all of the following three criteria:

1) It (or any of its ingredients) is listed in the DOT reportable quantities table (Appendix A to 172.101),
2) It is in a quantity, in one package, which equals or exceeds the reportable quantity (RQ) listed in the table, **and**
3) When in a mixture or solution, is in a concentration by weight which equals or exceeds the concentration corresponding to the RQ of the material, as shown by the following table:

RQ (lbs)	per cent	ppm
5,000	10	100,000
1,000	2	20,000
100	0.2	2,000
10	0.02	200
1	0.002	20

Marine Pollutant

A hazardous material that when in a solution or mixture of one or more marine pollutants, is packaged in a concentration equal to or exceeding one of the following:

(1) 10% by weight of the solution or mixture

(2) 1% by weight of the solution or mixture for materials that are identified as severe marine pollutants

Mixture

A material composed of more than one chemical compound or element.

Solution

Any homogenous liquid mixture of two or more chemical compounds or elements that will not undergo any segregation under conditions normal to transportation.

Technical Names

A recognized chemical name currently used in scientific and technical handbooks, journals, and texts. Generic descriptions are authorized for use as technical names provided they readily identify the general chemical group. Examples of acceptable generic descriptions are organic phosphate compound, petroleum aliphatic hydrocarbons, and tertiary amines. Except for names which appear in Subchapter B of Part 172, trade names may not be used as technical names.

PRECEDENCE OF HAZARD TABLE
(Hazard Class & Packing Group)

	4.2	4.3	5.1 I[1]	5.1 II[1]	5.1 III[1]	6.1, I oral	6.1, I dermal	6.1 II	6.1 III	8, I liquid	8, I solid	8, II liquid	8, II solid	8, III liquid	8, III solid
3 I						3	3	3	3	3	(3)	3	(3)	3	(3)
3 II						3	3	3	3	8	(3)	3	(3)	3	(3)
3 III						6.1	6.1	6.1	3[4]	8	(3)	8	(3)	3	(3)
4.1 I[2]	4.2	4.3	5.1	4.1	4.1	6.1	6.1	4.1	4.1	(3)	8	(3)	4.1	(3)	4.1
4.1 II[2]	4.2	4.3	5.1	4.1	4.1	6.1	6.1	6.1	4.1	(3)	8	(3)	8	(3)	4.1
4.2 II		4.3	5.1	4.2	4.2	6.1	6.1	4.2	4.2	(3)	8	(3)	4.2	(3)	4.2
4.2 III		4.3	5.1	5.1	4.2	6.1	6.1	6.1	4.2	(3)	8	(3)	8	(3)	4.2
4.3 I			5.1	4.3	4.3	4.3	6.1	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3
4.3 II			5.1	4.3	4.3	4.3	6.1	4.3	4.3	8	8	8	4.3	4.3	4.3
4.3 III			5.1	5.1	4.3	6.1	6.1	6.1	4.3	8	8	8	8	4.3	4.3
5.1 I[1]						5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1
5.1 II[1]						5.1	6.1	5.1	5.1	8	8	8	5.1	5.1	5.1
5.1 III[1]						6.1	6.1	6.1	5.1	8	8	8	8	5.1	5.1
6.1 I, Dermal										8	6.1	6.1	6.1	6.1	6.1
6.1 I, Oral										8	6.1	6.1	6.1	6.1	6.1
6.1 II, Inhalation										8	6.1	6.1	6.1	6.1	6.1
6.1 II, Dermal										8	6.1	8	6.1	6.1	6.1
6.1 II, Oral										8	8	8	6.1	6.1	6.1
6.1 III										8	8	8	8	8	8

[1] There are at present no established criteria for determining Packing Groups for liquids in Division 6.1. For the time being, the degree of hazard is to be assessed by analogy with listed substances, allocating the substances to Packing Group I, great; II, medium; or III, minor danger.

[2] Substances of Division 4.1 other than self-reactive substances.

[3] Denotes an impossible combination.

[4] For pesticides only, where a material has the hazards of Class 3, Packing Group III, and Division 6.1, Packing Group III, the primary hazard is Division 6.1, Packing Group III.

Table 6.2 HM-181 Precedence of Hazard Table for Classes 3 and 8, and for Divisions 4.1, 4.2, 4.3, 5.1, and 6.1 (49 CFR 173.2a)

The Precedence of Hazard Table in 49 CFR 173.2a (our Table 6.2) is rather complicated. The key to understanding it is to recognize that it applies only when you must decide what hazard class to assign to a material that is a mixture of materials listed as number 8 in priority order in the Hazard Precedence List from § 173.2 (our Table 6.1). These are Classes 3 and 8, and Divisions 4.1, 4.2, 4.3, 5.1, and 6.1.

The row and column names along the left side and top of the table refer to up to three of the following characteristics of the materials: their **hazard class** or **division**, **packing group**, **route of administration** (the path through which the material presents a hazard to health: *dermal*, *oral*, or *inhalation*), and/or physical **state** (*solid* or *liquid*). At the intersection of a row for one class, packing group, route, and/or state with another, you will find the hazard class that you must assign to their mixture. The blank cells are either impossible combinations or the intersection of two identical material classifications. Where impossible combinations occur in cells surrounded by valid classifications, DOT has used a footnote (3) to avoid confusion.

To use the table, find the hazard class (and division, if applicable), plus other characteristics, of one of the components of your mixture in the row or column headings (note that the headings have been set up to duplicate each other as little as possible—for most materials you will find the classification along the top or left side only). Next, find the classification of the other component in the column or row headings. The cell where the chosen row and column intersect contains the class or division number that you should assign to the mixture. Be sure to take into account any footnotes before automatically applying the table categories (e.g., footnote 4 completely turns around the classification of a Class 3, PG III/Div. 6.1, PG III mixture if it is a pesticide).

Alcohols, toxic, n.o.s.
Articles, explosive, n.o.s.
Caustic alkali liquids, n.o.s.
Combustible liquid, n.o.s.
Compounds, cleaning liquid, *corrosive*
Compounds, cleaning liquid, *flammable*
Compounds, tree *or* weed killing, liquid, *corrosive*
Compounds, tree *or* weed killing, liquid, *flammable*
Compounds, tree *or* weed killing, liquid, *poisonous*
Components, explosive train, n.o.s.
Compressed *or* Liquefied gases, n.o.s.
Compressed *or* Liquefied gases, flammable, n.o.s.
Compressed *or* Liquefied gases, flammable, toxic, n.o.s.
Compressed *or* Liquefied gases, toxic, n.o.s.
Contrivances, water-activated
Corrosive liquids, flammable, n.o.s.
Corrosive liquids, n.o.s.
Corrosive liquids, oxidizing, n.o.s.
Corrosive liquids, poisonous, n.o.s.
Corrosive liquids, which in contact with water emit flammable gases, n.o.s.
Corrosive solids, flammable, n.o.s.
Corrosive solids, n.o.s.
Corrosive solids, oxidizing, n.o.s.
Corrosive solids, poisonous, n.o.s.
Corrosive solids, self heating, n.o.s.
Corrosive solids, which in contact with water emit flammable gases, n.o.s.
Disinfectants, corrosive, liquid, n.o.s.
Disinfectants, liquid, n.o.s.
Disinfectants, solids, n.o.s.
Dispersant gas, n.o.s.
Dyes, liquid, *or* Dye intermediates, liquid, n.o.s.
Dyes, solid, *or* Dye intermediates, solid, n.o.s.
Environmentally hazardous substances, liquid, n.o.s.
Environmentally hazardous substances, solid, n.o.s.
Flammable liquids, corrosive, n.o.s.
Flammable liquids, n.o.s.
Flammable liquids, poisonous, n.o.s.
Flammable solids, corrosive, n.o.s.
Flammable solids, n.o.s.
Flammable solids, poisonous, n.o.s.
Halogenated irritating liquids, n.o.s.
Hazardous waste, liquid, n.o.s.
Hazardous waste, solid, n.o.s.
Infectious substances, affecting animals
Infectious substances, affecting humans

Table 6.3 Proper Shipping Names Requiring Technical Names as Part of the Shipping Description

Insecticide gases, *flammable*, n.o.s.
Insecticide gases, n.o.s.
Insecticide gases, toxic, n.o.s.
Medicines, n.o.s.
Metal powders, flammable, n.o.s.
Organic peroxide type B, liquid
Organic peroxide type B, liquid, temperature controlled
Organic peroxide type B, solid
Organic peroxide type B, solid, temperature controlled
Organic peroxide type C, liquid
Organic peroxide type C, liquid, temperature controlled
Organic peroxide type C, solid
Organic peroxide type C, solid, temperature controlled
Organic peroxide type D, liquid
Organic peroxide type D, liquid, temperature controlled
Organic peroxide type D, solid
Organic peroxide type D, solid, temperature controlled
Organic peroxide type E, liquid
Organic peroxide type E, liquid, temp. controlled
Organic peroxide type E, solid
Organic peroxide type E, solid, temperature controlled
Organic peroxide type F, liquid
Organic peroxide type F, liquid, temperature controlled
Organic peroxide type F, solid
Organic peroxide type F, solid, temperature controlled
Other regulated substances, liquid, n.o.s.
Other regulated substances, solid, n.o.s.
Oxidizing substances, liquid, corrosive, n.o.s.
Oxidizing substances, liquid, n.o.s.
Oxidizing substances, liquid, poisonous, n.o.s.
Oxidizing substances, solid, corrosive, n.o.s.
Oxidizing substances, solid, n.o.s.
Oxidizing substances, solid, poisonous, n.o.s.
Pesticides, liquid, flammable, toxic, n.o.s.
Pesticides, liquid, toxic, flammable, n.o.s.
Pesticides, liquid, toxic, n.o.s.
Pesticides, solid, toxic, n.o.s.
Poisonous liquids, corrosive, n.o.s.
Poisonous liquids, flammable, n.o.s.
Poisonous liquids, n.o.s.
Poisonous liquids, oxidizing, n.o.s.
Poisonous liquids, which in contact with water emit flammable gases, n.o.s.
Poisonous solids, corrosive, n.o.s.
Poisonous solids, flammable, n.o.s.
Poisonous solids, n.o.s.

Table 6.3 Proper Shipping Names Requiring Technical Names as Part of the Shipping Description (Continued)

Poisonous solids, oxidizing, n.o.s.
Poisonous solids, self-heating, n.o.s.
Poisonous solids, which in contact with water emit flammable gases, n.o.s.
Pyrophoric liquids, n.o.s.
Pyrophoric solids, n.o.s.
Pyrophoric metals, n.o.s. *or* Pyrophoric alloys, n.o.s.
Refrigerant gas, n.o.s.
Refrigerant gases, n.o.s.
Rodenticides, n.o.s.
Samples, explosive (*other than initiating explosives*)
Self-heating substances, solid, corrosive, n.o.s.
Self-heating substances, solid, n.o.s.
Self-heating substances, solid, poisonous, n.o.s.
Self-reactive substances, Sample, n.o.s.
Self-reactive substances,
Trial quantities, n.o.s.
Substances , explosive, n.o.s.
Substances , explosive, very insensitive (substances, EVI) n.o.s.
Substances , which in contact with water emit flammable gases, liquid, corrosive, n.o.s.
Substances , which in contact with water emit flammable gases, liquid, n.o.s.
Substances, which in contact with water emit flammable gases, liquid, poisonous, n.o.s.
Substances, which in contact with water emit flammable gases, solid, corrosive, n.o.s.
Substances, which in contact with water emit flammable gases, solid, n.o.s.
Substances, which in contact with water emit flammable gases, solid, oxidizing, n.o.s.
Substances, which in contact with water emit flammable gases, solid, poisonous, n.o.s.
Substances, which in contact with water emit flammable gases, solid, self-heating, n.o.s.
Substances, which in contact with water emit flammable gases, solid, flammable n.o.s.
Tear gas substances, n.o.s. liquid *or* solid

Table 6.3 Proper Shipping Names Requiring Technical Names as Part of the Shipping Description (Continued)

Acetone cyanohydrin, stabilized
Acrolein, inhibited
Aerosols, poison, n.o.s.
Allyl alcohol
Allylamine
Allychloroformate
Allyl isothiocyanate, stabilized
Ammonia, anhydrous, liquified
Arsenic trichloride
Arsine
Boron tribromide
Boron trichloride
Boron trifluoride
Bromide chloride
Bromine
Bromine pentafluoride
Bromine solutions
Bromine trifluoride
Bromoacetone
n-Butylchloroformate
sec-Butylchloroformate
n-Butylisocyanate
tert-Butylisocyanate
Carbon dioxide and ethylene oxide mixtures
Carbon monoxide
Carbonyl fluoride
Carbonyl sulfide
Chlorine
Chlorine pentafluoride
Chlorine trifluoride
Chloroacetaldehyde
Chloroacetone, stabilized
Chloroacetonitrile
Chloroactyl chloride
Chloroformates, n.o.s.
Chloropicrin
Chloropicrin and methyl bromide mixtures
Chloropicrin and methyl chloride mixtures
Chloropicrin mixture, n.o.s.
Chloroplvailoyl chloride
Chlorosulfonic acid
Coal gas
Compressed gases, flammable, toxic, n.o.s.
Compressed gases, toxic, n.o.s.
Crotonaldehyde, stabilized
Cyanogen bromide

Table 6.4 HM-181 Proper Shipping Names for Materials which are Poison Inhalation Hazards

Cyanogen chloride, inhibited
Cyanogen, liquified
Cyclohexyl isocyanate
Diborane
Diborane mixtures
Dichlorodifluoromethane and ethylene oxide mixture
Dichlorosilane
3,5-Dichloro-2,4,6trifluoropyridine
Diketene, inhibited
Dimethyl hydrazine, symmetrical
Dimethyl hydrazine, unsymmetrical
Dimethyl sulfate
Dimethyl thiophospharyl chloride
Dinitrogen tetroxide, liquified (Nitrogen dioxide)
Ethylchloroformate
Ethyl chlorothioformate
Ethyl dichloroarsine
Ethylene chlorohydrin
Ethylene dibromide
Ethyleneimine, inhibited
Ethylene oxide
Ethyl isocyanate
Ethyl phosphonothioic dichloride, anhydrous
Ethyl phosponous dichloride, anhydrous
Ethyl phosphorodichloridate
Fluorine, compressed
Gas identification set
Germane
Hexachlorocyclopentadiene
Hexaethyl tetraphosphate and compressed gas mixtures
Hexafluoroacetone
Hydrocyanic acid, aqueous solutions
Hydrogen bromide, anhydrous
Hydrogen chloride, anhydrous
Hydrogen chloride, refrigerated liquid
Hydrogen cyanide, anhydrous, stabilized
Hydrogen selenide, anhydrous
Hydrogen sulfide, liquified
Insecticide gases, toxic, n.o.s.
Iron pentacarbonyl
Isobutyl chloroformate
Isobutyl isocyanate
Isocyanates, n.o.s.
Isophoronediisocyanate
Isopropyl chloroformate
Isopropyl isocyanate

Table 6.4 HM-181 Proper Shipping Names for Materials which are Poison Inhalation Hazards (Continued)

Methoxymethyl isocyanate
Mesitylene*
Methylamine, anhydrous
Methyl bromide
Methyl bromide and ethylene dibromide mixtures
Methyl chloroformate
Methylchloromethyl ether
Methylchlorosilane
Methyldichloroarsine
Methylhydrazine
Methyl iodide
Methyl isocyanate
Methyl isothiocyanate
Methyl mercaptan
Methyl orthosilicate
Methyl phosphonic dichloride
Monochloroacetic acid, liquid*
Nickel carbonyl
Nitric acid, red fuming
Nitric oxide
Nitric oxide and nitrogen dioxide mixtures
Nitrogen dioxide, liquified
Nitrogen trifluoride
Nitrogen trioxide
Organic phosphate compound; mixed with compressed gas
Oxygen difluoride
Parathion and compressed gas mixture
Pentaborane
Perchloromethylmercaptan
Perchloryl fluoride
Phenylcarbylamine chloride
Phenyl isocyanate
Phenyl mercaptan
Phosgene
Phosphine
Phosphorus oxychloride
Phosphorous pentafluoride
Phosphorus trichloride
Poisonous liquids, corrosive, n.o.s. *inhalation hazard*
Poisonous liquids, flammable, n.o.s. *inhalation hazard*
Poisonous liquids, n.o.s. *inhalation hazard*
Poisonous liquids, oxidizing, n.o.s. *inhalation hazard*
n-Propyl chloroformate
n-Propyl isocyanate
Selenium hexafluoride

Table 6.4 HM-181 Proper Shipping Names for Materials which are Poison Inhalation Hazards (Continued)

Silicon tetrafluoride
Stibene
Sulfur chlorides
Sulfur dioxide, liquified
Sulfuric acid, fuming
Sulfur tetrafluoride
Sulfur trioxide, inhibited
Sulfur trioxide, uninhibited
Sulfuryl fluoride
Tellurium hexafluoride
Tetraethyl dithiopyrophosphate and gases in solution (and gas mixtures)
Tetraethyl pyrophosphate and compressed gas mixtures
Tetramethoxysilane*
Tetranitromethane
Thio-4-pentanal
Thionyl chloride
Thiophosgene
Titanium tetrachloride
Trichloroacetyl chloride
Trimethoxysilane
Trimethylacetyl chloride
Tungsten hexafluoride

Table 6.4 HM-181 Proper Shipping Names for Materials which are Poison Inhalation Hazards (Continued)

* Denotes chemicals which are not listed in the DOT Hazardous Materials Table.

PAGE ___ OF ___

STRAIGHT BILL OF LADING

ORIGINAL—NOT NEGOTIABLE

Shipper's No. _____

Carrier's No. _____

OUR TRUCK ☐
THEIR TRUCK ☐
COMMON CARRIER ☐

CARRIER: SCAC DATE

Route: Vehicle Number

TO: Consignee
Street
Destination ZIP

FROM: STUPENDOUS INDUSTRIES, INC.
666 INDUSTRIAL PARKWAY
COMPLEX, NC 27999

NUMBER OF PACKAGES	PACKAGE TYPE (Line out those not applicable)	HM (Enter X if the material is a Hazardous Material)	Description of Articles IF HAZARDOUS MATERIALS—PROPER SHIPPING NAME	Hazard Class or Division	Identification Number (UN or NA)	Packing Group	Total Quantity	Unit (WT/Vol)	Shipping weight (subject to correction)
	DRUM PAIL BOX TT _____	X	Paint	3	UN1263	II			
	DRUM PAIL BOX TT _____	X	Paint related material	3	UN1263	III			
	DRUM PAIL BOX TT _____	X	Nitrocellulose with alcohol, ___% alcohol by mass and ___% nitrogen by dry mass	4.1	UN2556	II			
	DRUM PAIL BOX TT _____		Aqueous Paint Freezable Liquid						
	DRUM PAIL BOX TT _____		Aqueous Filler Freezable Liquid						
	DRUM PAIL BOX TT _____								

Remit C.O.D. to:
Address:
City: State ZIP:

C.O.D. Amt.: $

C.O.D. Fee: ☐ Prepaid ☐ Collect $

FREIGHT CHARGES ☐ Prepaid ☐ Collect

NOTE—Where the rate is dependent on value, shippers are required to state specifically in writing the agreed or declared value of the property. The agreed or declared value of the property is hereby specifically stated by the shipper to be not exceeding $ _____ Per _____.

Subject to Section 7 of Conditions of applicable bill of lading, if this shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement:
The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges.
(Signature of Consignor) _____

RECEIVED, subject to the classifications and lawfully filed tariffs in effect on the date of issue of this Bill of Lading, the property described above in apparent good order, except as noted (contents and conditions of contents of packages unknown), marked, consigned, and destined as indicated above, which said carrier (the word carrier being understood throughout this contract as meaning any person or corporation in possession of the property under the contract) agrees to carry to its usual place of delivery at said destination, if on its route, otherwise to deliver to another carrier on the route to said destination. It is mutually agreed as to each carrier of all or any of, said property over all or any portion of said route to destination and as to each party at any time interested in all or any said property, that every service to be performed hereunder shall be subject to all the bill of lading terms and conditions in the governing classification on the date of shipment.
Shipper hereby certifies that he is familiar with all the bill of lading terms and conditions in the governing classification and the said terms and conditions are hereby agreed to by the shipper and accepted for himself and his assigns.

Where the applicable tariff provisions specify a limitation of the carrier's liability (NMFC Item 172), if there is no release of value declaration by the shipper, and the shipper does not declare a value or release the carrier's liability, that liability shall be limited to the extent provided by NMFC Item 172. California intrastate shipments must comply with NMFC Item 173.

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.

SIGNED: _____

PLACARDS REQUIRED: (Line out those not applicable)
FLAMMABLE LIQUID
FLAMMABLE SOLID

PLACARDS SUPPLIED
☐ YES
☐ NO—FURNISHED BY CARRIER

DRIVER'S SIGNATURE: _____

SHIPPER: _____
PER: _____
DATE: _____

CARRIER: _____
PER: _____
DATE: _____

EMERGENCY CONTACT: FOR CHEMICAL EMERGENCY SPILL, LEAK, FIRE, EXPLOSION, OR ACCIDENT, CALL—
TELEPHONE NUMBER: (___) ___-_____

Monitored at all times the Hazardous Material is in transportation including storage incidental to transportation (49 CFR 172.604).

IRONMENTAL RESOURCE CENTER SBL-HM (4/93)

Example of a Customized Bill of Lading/Shipping Paper Form

Vehicle Loading, Unloading, and Placarding

7.1 General Loading Requirements

The following are required for all shipments of hazardous materials:

- If tanks, barrels, drums, cylinders, or other packagings are not permanently attached to a motor vehicle, and they contain any flammable liquids (Class 3), compressed gases (Class 2), corrosive materials (Class 8), poisonous materials (Division 6.1), or radioactive materials (Class 7), they must be secured against movement within the vehicle during transportation. Brace these containers by using load bars or other devices that will prevent movement. Be careful to avoid damaging valves and fitting on containers during loading and stowage.
- Never load hazardous wastes or hazardous materials into pole trailers.
- Never smoke while loading explosive, flammable and oxidizing materials. Post signs or take other precaution to keep fire away and prevent anyone in the vicinity from smoking.
- Make sure the hand brake of the vehicle is set before loading or unloading all hazardous wastes and materials. The engine must be stopped whenever explosive or flammable materials are loaded unless the engine is needed to operate a pump on a cargo tank.
- Use tools designed for the containers that are loaded into the vehicle. Never use tools or equipment that could damage the containers or the closures on the containers. For example, a fork lift used to lift and move an open-head 55-gallon by the ring on the drum could damage the ring and result in a spill of hazardous waste during transportation.
- Cargo heaters are always prohibited in vehicles hauling explosives. Cargo heaters used in hauling flammable liquids must be catalytic and must meet the design and operational requirements specified in 49 CFR 177.
- Cargo tanks must be attended by a qualified person at all times during loading. "Attended" means throughout the process the person is awake, has an unobstructed view of the tank, and is within 25 feet of the tank or the delivery hose to the tank. A person is "qualified" if he is aware of the nature of the hazardous waste that is loaded, has been instructed on the procedures to follow in an emergency, and is authorized to move the tank and is able to do so.
- Follow bonding and grounding procedures when loading flammable liquids into cargo tanks through open filling holes. Bonding and grounding is not required by DOT when a cargo tank is loaded through a vapor tight top or bottom connection so that there is no release of vapor at a point where a spark could occur.
- The load on any motor vehicle transporting flammable solids (Class 4) or oxidizing materials (Class 5) must be contained entirely within the body of the motor vehicle and covered by the body, by tarpaulins, or other suitable means; and if the motor vehicle has a tailboard or tailgate, it must be closed and secured in place during transportation of the Class 4 or 5

materials. However, these precautions do not need to be applied to "pick-up and delivery" motor vehicles when they are used in no other transportation than in and around cities, towns, or villages. Shipments in water-tight bulk containers do not need to be covered by a tarpaulin or other means.

- Never load poisons into a motor vehicle that also contains foodstuffs, feed or any edible material meant for human or animal consumption. Hazardous waste should never be shipped with food and animal feed or in tank trucks used for shipping food stuffs. Hazardous waste should not be transported in the cab of the vehicle.

7.2 Stowing of Incompatible Materials

DOT prohibits the loading of certain combinations of hazardous materials on the same motor vehicle in order to prevent fires, explosions and spills caused by incompatible chemical reactions. When shipping hazardous materials by highway, the material segregation requirements in the following table must be followed:

To read the chart you must know the hazard class for the material being shipped. If you are shipping a hazardous material with a hazard class that is listed, follow the row on the chart associated with that hazard class and specific material. The symbols in the table have the following meanings:

- An "X" in the row indicates that materials may not be loaded, transported, or stored together.

  An "O" indicates that the materials may not be transported together unless separated by a distance of 1.2 meters (4 ft) in all directions, and packages maintained at a minimum height of 10 cm (4 in) off the floor of the vehicle, or separated in such a way that, in the event of leakage from packages under normal transportation conditions, the hazardous materials could not commingle.

- A "*" indicates the segregation of Class 1 materials is governed by the Compatibility Table for Class 1 materials in 49 CFR 177.848.

- The note "A" in the second column of the Table means that, notwithstanding the requirements of the letter "X", ammonium nitrate fertilizer may be loaded or stored with Division 1.1 (Class A explosive) materials.

In addition to the requirements shown on the Segregation Table for Hazardous Materials:

- Cyanides or cyanide mixtures must not be loaded or stored with acids or acidic materials. The reaction of cyanides with acids releases deadly hydrogen cyanide gas.

- Regardless of the methods of separation employed, Class 8 (corrosive) liquid materials may not be loaded above Class 4 (flammable solid) materials or Class 5 (oxidizing) materials.

  When the §172.101 Table or 49 CFR 172.402 requires a package to bear a subsidiary hazard label, segregation appropriate to the subsidiary hazard must be applied when that segregation is more restrictive than that

required by the primary hazard. However, hazardous materials of the same class may be stowed together without regard to segregation required for any secondary hazard if the materials are not capable of reacting dangerously with each other and causing combustion or dangerous evolution of heat, evolution of flammable, poisonous, or asphyxiant gases, or formation of corrosive or unstable materials.

SEGREGATION TABLE FOR HAZARDOUS MATERIALS

Class or Division	Notes	1.1, 1.2	1.3	1.4	1.5	1.6	2.1	2.2	2.3 gas Zone A	2.3 gas other than Zone A	3	4.1	4.2	4.3	5.1	5.2	6.1 liquids PG I Zone A	7	8 liquids only
Explosives 1.1 and 1.2	A	•	•	•	•	•	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	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	O
Non-toxic, nonflammable gases 2.2		X			X														
Poisonous gas Zone A 2.3		X	X	O	X		X				X	X	X	X	X	X			X
Poisonous gas other than Zone A 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 materials 4.2		X	X	O	X				X	O							X		X
Dangerous when wet materials 4.3		X	X		X				X	O							X		O
Oxidizers 5.1	A	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									X	
Corrosive liquids 8		X	X	O	X				X	O		O	X	O	O	O	X		

Class 1 (explosive) materials are broken down into **compatibility groups** for transport. These groups are indicated by letters A–H and J–L, plus N and S. The **classification code** for an explosive consists of the **division number** followed by the compatibility group letter. Compatibility group letters are used to specify the controls for the transportation and transportation related storage of explosives and to prevent an increase in hazard that might result if certain types of explosives were stored or transported together.

Compatibility groups and classification codes for the various types of explosives are set forth in the tables in §173.52. The Classification Code Table sets forth compatibility groups and classification codes for substances and articles described in the first column. Altogether, there are 35 possible classification codes for explosives, because the possible combinations of hazard divisions and compatibility groups are limited.

CLASS 1 (EXPLOSIVES) CLASSIFICATION CODES TABLE

Description of substances or article to be classified	Compatibility group	Classification code
Primary explosive substance	A	1.1A
Article containing a primary explosive substance and not containing two or more effective protective features	B	1.1B 1.2B 1.4B
Propellant explosive substance or other deflagrating explosive substance or article containing such explosive substance	C	1.1C 1.2C 1.3C 1.4C
Secondary detonating explosive substance or black powder or article containing a secondary detonating explosive substance, in each case without means of initiation and without a propelling charge, or article containing a primary explosive substance and containing two or more effective protective features	D	1.1D 1.2D 1.4D 1.5D
Article containing a secondary detonating explosive substance, without means of initiation, with a propelling charge (other than one containing flammable liquid or hypergolic liquid).	E	1.1E 1.2E 1.4E
Article containing a secondary detonating explosive substance with its means of initiation, with a propelling charge (other than one containing flammable liquid or hypergolic liquid) or without a propelling charge	F	1.1F 1.2F 1.3F 1.4F
Pyrotechnic substance or article containing a pyrotechnic substance, or article containing both an explosive substance and an illuminating, incendiary, tear-producing or smoke-producing substance (other than a water-activated article or one containing white phosphorus, phosphide or flammable liquid or gel or hypergolic liquid)	G	1.1G 1.2G 1.3G 1.4G
Article containing both an explosive substance and white phosphorus	H	1.2H 1.3H
Article containing both an explosive substance and flammable liquid or gel	J	1.1J 1.2J 1.3J

CLASS 1 (EXPLOSIVES) CLASSIFICATION CODES TABLE

Description of substances or article to be classified	Compatibility Group	Classification Code
Article containing both an explosive substance and a toxic chemical agent	K	1.2K 1.3K
Explosive substance or article containing an explosive substance and presenting a special risk (e.g., due to water-activation or presence of hypergolic liquids, phosphides or pyrophoric substances) needing isolation of each type	L	1.1L 1.2L 1.3L
Articles containing only extremely insensitive detonating substances	N	1.6N
Substance or article so packed or designed that any hazardous effects arising from accidental functioning are limited to the extent that they do not significantly hinder or prohibit fire fighting or other emergency response efforts in the immediate vicinity of the package	S	1.4S

Class 1 materials may not be loaded, transported, or stored together, except as allowed in the regulations, and in accordance with the following table:

COMPATIBILITY TABLE FOR CLASS 1 (EXPLOSIVE) MATERIALS

Compatibility group	A	B	C	D	E	F	G	H	J	K	L	N	S
A		X	X	X	X	X	X	X	X	X	X	X	X
B	X		X	X	X	X	X	X	X	X	X	X	
C	X	X		2	2	X	X	X	X	X	X	3	
D	X	X	2		2	X	X	X	X	X	X	3	
E	X	X	2	2		X	X	X	X	X	X	3	
F	X	X	X	X	X		X	X	X	X	X	X	
G	X	X	X	X	X	X		X	X	X	X	X	
H	X	X	X	X	X	X	X		X	X	X	X	
J	X	X	X	X	X	X	X	X		X	X	X	
K	X	X	X	X	X	X	X	X	X		X	X	
L	X	X	X	X	X	X	X	X	X	X	1	X	X
N	X	X	3	3	3	X	X	X	X	X	X		
S	X	4/5	4/5	4/5	4/5	4/5	4/5	4/5	4/5	4/5	X	4/5	

Instructions for using the compatibility table for Class 1 materials:

- A **blank** space in the Table indicates that no restrictions apply.
- The letter **"X"** in the Table indicates that explosives of different compatibility groups may not be carried on the same transport vehicle.
- The numbers in the Table mean the following:
  - **"1"** means an explosive from compatibility group L may only be carried on the same vehicle with an identical explosive.
  - **"2"** means any combination of explosives from compatibility groups C, D, or E is assigned to compatibility group E.

"3" means any combination of explosives from compatibility groups C, D, or E with those in compatibility group N is assigned to compatibility group D.

"4" means §177.835(g) applies when transporting detonators.

"5" means Division 1.4S fireworks may not be loaded on the same vehicle with Division 1.1 or 1.2 (Class A explosive) materials.

- Except as excluded below, explosives of the same compatibility group but of different divisions may be transported together provided that the whole shipment is transported as though its entire contents were of the lower numerical division (i.e., Division 1.1 being lower than Division 1.2). For example, a mixed shipment of Division 1.2 (Class A explosive) materials and Division 1.4 (Class C explosive) materials, both of compatibility group D, must be transported as Division 1.2 (Class A explosive) materials.
- When Division 1.5 (blasting agent) materials, compatibility group D, are transported in the same freight container as Division 1.2 (Class A explosive) materials, compatibility group D, the shipment must be transported as Division 1.1 (Class A explosive) materials, compatibility group D.

7.3 Vehicle Inspections

Shipments of hazardous materials and hazardous waste should both be thoroughly checked and inspected immediately before leaving the facility for treatment, storage or disposal to confirm compliance with the regulations. The Hazardous Materials Pre-transportation Checklist and the Hazardous Waste Pre-transportation Checklist presented in Figures 7.1 and 7.2 may be used to facilitate these inspections.

Name of Inspector: _____ Date: _____

Item	Conditions Reviewed	Status	
		Complete	Incomplete
Container Marking	Container Contents (Proper Shipping Name)		
	DOT ID Number		
	Organization Name and Address		
	Emergency Response Information & 24-hour Telephone Number		
Container Label	Appropriate DOT Label(s) on Each Container		
Placard	Appropriate DOT Placard(s) on Truck		
Bill of Lading			
Condition of Containers: ❑ Good ❑ Poor ❑ Leaking Date Shipment Left Facility: Comments:			

Figure 7.1 Hazardous Material Pre-transportation Checklist

Name of Inspector: _____ Date: _____

Item	Conditions Reviewed	Status	
		Complete	Incomplete
Container Marking	Container Contents (Proper Shipping Name)		
	DOT ID Number		
	Begin Accumulation Date		
	U.S. EPA ID Number		
	Warning Mark: "Hazardous Waste—Federal Law Prohibits Improper Disposal. If found, contact nearest police or public safety authority or the U.S. Environmental Protection Agency."		
	Organization Name and Address		
	Manifest Document Number		
Container Label	Appropriate DOT Label(s) on Each Container		
Manifest	Current Manifest (expires 30 September 1994)		
Placard	Appropriate DOT Placard(s) on Each Vehicle		
Condition of Containers: ❑ Good ❑ Poor ❑ Leaking Date Shipment Left Facility: Comments:			

Figure 7.2 Hazardous Waste Pre-transportation Checklist

The following questions should also be answered before the hazardous waste shipment leaves the facility:

Does emergency response information accompany the shipment? ____ Yes ____ No

Have special marks been applied to appropriate containers (RQ, Bung Label, ORM designation, Poison-Inhalation designation, Poison-Inhalation Hazard)? ____ Yes ____ No

Is the waste restricted from land disposal? ____ Yes ____ No

If "Yes" above, has the Appropriate Land Disposal Notice or Certification been attached to the manifest? ____ Yes ____ No

7.4 Placarding

Placards alert persons to the potential dangers associated with hazardous materials contained within motor vehicles, rail cars, freight containers, cargo tanks and portable tanks. Placards also guide emergency personnel who respond to incidents involving hazardous materials.

Except under very limited circumstances, each highway transport vehicle containing hazardous materials or hazardous waste must be placarded on

each end and on each side with the placards specified by the DOT. It is the shipper's responsibility to offer appropriate placard(s) to the transporter. Each shipper must have a supply of appropriate placards which can be offered to transporters hauling hazardous materials and hazardous waste. It is the transporter's responsibility to replace any placards which become dislodged from the vehicle during transportation.

The color, size and design of placards are specified by DOT in 49 CFR 172 Subpart F. The hazard class division number as prescribed by the United Nations may be printed in the lower corner of the placard. All placards must be durable and able to withstand exposure to weather.

7.4.1 Placement of Placards

Placards must be visible from the directions in which they face. Placards must be placed on each side and each end of the motor vehicle. They may be placed on the front of the tractor of a tractor-trailer instead of placarding the front of the trailer, or may be placed on both units. Place each placard at least 3" away from any ladders, pipes or other appurtenances which might reduce the effectiveness of the placard. Place placards so dirt or water from vehicle wheels will not be sprayed on the placard. Securely fix each placard on the sides and ends of the vehicle or use a placard holder.

7.4.2 Selecting the Proper Placard (Pre-HM-181)

It is the shipper's responsibility to offer the correct placard(s) to the transporter. To determine which placards are required, you must use DOT's placarding rules and tables summarized below.

There are two tables that you must refer to when selecting the proper placards. Table 1 lists those materials, **regardless of the quantity shipped**, which must be placarded as noted.

Department of Transportation
Placard Table 1

If The Hazard Class Is	Offer This Placard
Class A explosives	EXPLOSIVES A[1]
Class B explosives	EXPLOSIVES B[2]
Poison A	POISON GAS[1]
Flammable solid (DANGEROUS WHEN WET label only)	FLAMMABLE SOLID W[3]
Radioactive material	RADIOACTIVE[4,5]
Radioactive material (UF_6, fissile)†	RADIOACTIVE[4] and CORROSIVE[6]
Radioactive material (UF_6, low specific activity)‡	RADIOACTIVE[4,5] and CORROSIVE[6]

Notes to Placard Table 1

1 See 49 CFR 172.510(a)
2 EXPLOSIVES B placard is not required if the transport vehicle contains class A explosives and is placarded EXPLOSIVES A as required.
3 FLAMMABLE SOLID "W" placard is required only when the DANGEROUS WHEN WET label is specified in the Hazardous Materials Table for a material classed as a Flammable solid.
4 Applies only to any quantity of packages bearing the RADIOACTIVE Yellow-III label (refer to 49 CFR 172.403).
5 For exclusive use shipments (as defined in 49 CFR 173.403) of low specific activity radioactive materials transported in accordance with 49 CFR 173.425(b) or (c).
6 CORROSIVE placard is not required to be displayed on transport vehicles for shipments of less than 1,000 pounds gross weight.
† Uranium hexafluoride, fissile (with > 0.1% U^{235})
‡ Uranium hexafluoride, low specific activity (with ≤ 0.1% U^{235})

Department of Transportation
Placard Table 2

If The Hazard Class Is	Offer This Placard
Class C explosives	DANGEROUS[1]
Blasting Agents	BLASTING AGENTS[9,10]
Nonflammable gas	NONFLAMMABLE GAS[8]
Nonflammable gas (Chlorine)	CHLORINE[7]
Nonflammable gas (Fluorine)	POISON
Nonflammable gas (Oxygen, cryogenic liquid)	OXYGEN
Flammable gas	FLAMMABLE GAS[8]
Combustible liquid	COMBUSTIBLE[3,4]
Flammable liquid	FLAMMABLE
Flammable solid	FLAMMABLE SOLID[5]
Oxidizer	OXIDIZER[9,10]
Organic Peroxide	ORGANIC PEROXIDE
Poison B	POISON
Corrosive material	CORROSIVE[6]
Irritating material	DANGEROUS

Notes to Placard Table 2

1 Applies only to a Class C explosive required to be labeled with an EXPLOSIVE C label.
2 [RESERVED]
3 A COMBUSTIBLE placard is required only when a material classed as combustible liquid is transported in a package having a rated capacity of more than 110 gallons, a cargo tank, or a tank car.
4 A FLAMMABLE placard may be used on a cargo tank or portable tank during transportation by highway, rail or water, and on a compartmented tank car containing materials classed as flammable liquid and combustible liquid.
5 Except when offered for transportation by water, a FLAMMABLE placard may be displayed in place of a FLAMMABLE SOLID placard except when a DANGEROUS WHEN WET label is specified for the material on the Hazardous Materials Table.
6 Refer to 49 CFR 173.245(b) for authorized exceptions.
7 A CHLORINE placard is required only for a packages having a rated capacity of more than 110 gallons; a NONFLAMMABLE GAS placard is to be displayed for packages having a rated capacity of 110 gallons or less.
8 A NONFLAMMABLE GAS placard is not required on a motor vehicle displaying a FLAMMABLE GAS placard or an OXYGEN placard.
9 BLASTING AGENTS, OXIDIZER and DANGEROUS placards need not be displayed if a transport vehicle or freight container also contains Class A or Class B explosives and is placarded EXPLOSIVES A or EXPLOSIVES B as required.
10 Except for shipments by water, OXIDIZER placards need not be displayed if a freight container, motor vehicle, or rail car also contains blasting agents and is placarded BLASTING AGENT as required.

For Placard Table 2, the following guidelines apply:

1. **1,000 pounds** or more of materials classified in Table 2 must be placarded as specified in the table.
2. If two or more Table 2 materials are being transported, the DANGEROUS placard may be displayed instead of separate placards specified in the table. However, when **5,000 pounds** or more of one hazard category is loaded at one facility, the placard specified in the table must be displayed.

7.4.3 Selecting the Proper Placard (HM-181)

For most hazardous materials, as of 1 October 1994, new placards and placarding tables must be used (see section 7.4.4 for exceptions). The new placards are intended to align with international shipping standards. Each bulk packaging, freight container, unit load device, transport vehicle or rail car containing hazardous material must be placarded on each side and each end with the placards specified in Tables 1 and 2 below and in accordance with any hazard class specific placarding requirements, including the

specifications for the placards named in the tables and described in detail in §§172.519 through 172.558.

DANGEROUS placard. A freight container, unit load device, transport vehicle or rail car which contains non-bulk packagings with two or more categories of hazardous materials that require different placards specified in Table 2 may be placarded with DANGEROUS placards instead of the separate placarding specified for each of the materials in Table 2. However, when 2,268 kg (**5,000 pounds**) or more of one category of material is loaded therein at one loading facility, the placard specified in Table 2 of paragraph for that category must be applied.

Exception for less than 454 kg (1,001 pounds). Except for transport vehicles and freight containers subject to §172.505, bulk packagings, or transportation by aircraft or vessel, placards for hazardous materials covered by Table 2 are not required on:

- A transport vehicle or freight container which contains less than 454 kg (1,001 pounds) aggregate gross weight of hazardous materials covered by Table 2 of paragraph (e) of this section;
- A rail car loaded with transport vehicles or freight containers, none of which is required to be placarded.

The above exceptions provided do not prohibit the display of placards in the manner prescribed, if not otherwise prohibited (see §172.502), on transport vehicles or freight containers which are not required to be placarded.

Exception for empty non-bulk packages. A non-bulk packaging that contains only the residue of a hazardous material covered by Table 2 need not be included in determining placarding requirements.

Placards are specified for hazardous materials in accordance with the following tables:

Department of Transportation
HM-181 Placard Table 1

Category of material (Hazard class or division number and additional description, as appropriate)	Placard name	Placard design section reference (§)
1.1	EXPLOSIVES 1.1	§177.522
1.2	EXPLOSIVES 1.2	§172.522
1.3	EXPLOSIVES 1.3	§172.522
2.3	POISON GAS	§172.540
4.3	DANGEROUS WHEN WET	§172.548
6.1 (PG I, inhalation hazard only)	POISON	§172.554
7 (Radioactive Yellow III label only)	RADIOACTIVE[1]	§172.556

[1]RADIOACTIVE placard also required for exclusive use shipments of low specific activity material in accordance with §173.425(b) or (c).

Any quantity of material falling within the hazard classes and divisions listed in Table 1 must be placarded.

Department of Transportation
HM-181 Placard Table 2

Category of material (Hazard class or division number and additional description, as appropriate)	Placard name	Placard design section reference (§)
1.4	EXPLOSIVES 1.4	§172.523
1.5	EXPLOSIVES 1.5	§172.524
1.6	EXPLOSIVES 1.6	§172.525
2.1	FLAMMABLE GAS	§172.532
2.2	NON-FLAMMABLE GAS	§172.528
3	FLAMMABLE	§172.542
Combustible liquid	COMBUSTIBLE	§172.544
4.1	FLAMMABLE SOLID	§172.546
4.2	SPONTANEOUSLY COMBUSTIBLE	§172.547
5.1	OXIDIZER	§172.550
5.2	ORGANIC PEROXIDE	§172.552
6.1 (PG I or II, other than PG I inhalation hazard)	POISON	§172.554
6.1 (PG III)	KEEP AWAY FROM FOOD	§172.553
6.2	(None)	
8	CORROSIVE	§172.558
9	CLASS 9	§172.560
ORM-D	(None)	

For Table 2, the following guidelines apply:

1. **1,000 pounds** or more of materials classified in Table 2 must be placarded as specified in the table.
2. If two or more Table 2 materials are being transported, the DANGEROUS placard may be displayed instead of separate placards specified in the table. However, when **5,000 pounds** or more of one hazard category is loaded at one facility, the placard specified in the table must be displayed.

Under HM-181, placards are not required for the following:

- Infectious substances;
- Hazardous materials classed as ORM-D;
- Hazardous materials authorized by this subchapter to be offered for transportation as Limited Quantities when identified as such on shipping papers in accordance with 49 CFR 172.203(b);
- Hazardous materials which are packaged as small quantities under the provisions of §173.4 of this subchapter; and
- Combustible liquids in non-bulk packagings.

Placarding for Subsidiary Hazards

- Each transport vehicle, portable tank, freight container or unit load device that contains a poisonous material subject to the "Poison—Inhalation Hazard" shipping description of 49 CFR 172.203(m)(3) shall be placarded with POISON or POISON GAS placards, as appropriate, on each side and each end, if not so placarded under 49 CFR 172.504.
- In addition to the RADIOACTIVE placard which may be required by 49 CFR 172.504(e), each transport vehicle, portable tank or freight container that contains 454 kg (**1,001 pounds**) or more gross weight of fissile or low specific activity uranium hexafluoride shall be placarded with a CORROSIVE placard on each side and each end.
- Each transport vehicle, portable tank, freight container or unit load device that contains a material which has a subsidiary hazard of being dangerous when wet, as defined in 49 CFR 173.124 of this subchapter, shall be placarded with DANGEROUS WHEN WET placards, on each side and each end, in addition to the placards required by 49 CFR 172.504.
- Hazardous materials that possess secondary hazards may exhibit subsidiary placards that correspond to the primary placards, even when not required by (see also 49 CFR 172.519(b)(4)).

MARINE POLLUTANT Mark on Vehicles

A **transport vehicle** or **freight container** that contains either a non-bulk or bulk package subject to the marine pollutant marking requirements of §172.322(a) or (b) must be marked with the MARINE POLLUTANT mark. The mark must appear on each side and each end of the transport vehicle or freight container, and must be visible from the direction it faces. This requirement may be met by the marking displayed on a freight container or portable tank loaded on a motor vehicle or rail car. This mark may be displayed in black lettering on a white square-on-point configuration having the same outside dimensions as a placard. The mark is not required, however, except for transportation by vessel, on a transport vehicle or freight container that bears a specified **label** or **placard**.

7.4.4 Selecting Proper Placards (Transitional Provisions)

As noted under compliance deadlines (Chapter I, sect. 1.5), Until **1 October 2001**, placards that conform to specifications for placards in effect on 30 September 1991, or placards specified in the 21 December 1990 final rule may be used, for highway transportation only, in place of the placards specified in subpart F of 49 CFR 172. Because hazard classes are changed, during the transition period, §171.14(c)(2) provides the following table for selecting placards:

PLACARD SUBSTITUTION TABLE

Hazard class or division No.	Current placard name	Old (30 Sept. 1991) placard name
Division 1.1	Explosives 1.1	Explosives A.
Division 1.2	Explosives 1.2	Explosives A.
Division 1.3	Explosives 1.3	Explosives B.
Division 1.4	Explosives 1.4	Dangerous.
Division 1.5	Explosives 1.5	Blasting agents.
Division 1.6	Explosives 1.6	Dangerous.
Division 2.1	Flammable gas	Flammable gas.
Division 2.2	Nonflammable gas	Nonflammable gas.
Division 2.3	Poison gas	Poison gas.
Class 3	Flammable	Flammable.
Combustible liquid	Combustible	Combustible.
Division 4.1	Flammable solid	Flammable solid.
Division 4.2	Spontaneously combustible	Flammable solid.
Division 4.3	Dangerous when wet	Flammable solid W.
Division 5.1	Oxidizer	Oxidizer.
Division 5.2	Organic peroxide	Organic peroxide.
Division 6.1, PG I and II	Poison	Poison.
Division 6.1, PG III	Keep away from food	(none required).
Class 7	Radioactive	Radioactive.
Class 8	Corrosive	Corrosive.
Class 9	Class 9	(none required.)

HAZARDOUS MATERIALS SPILLS

- "Human error is the most probable cause of most transportation incidents and associated consequences involving the release of hazardous materials".
  - US DOT

PROVIDING THE BEST INFORMATION

- HMTUSA requires specific emergency response information to be available
- This info is intended to be used away from the compromised container
- Information must be in plain English

MINIMUM INFORMATION REQUIRED

- Basic description and technical name of material transported
- Immediate precautions to be taken in the event of a spill/release
- Fire/explosion hazards

MINIMUM INFORMATION REQUIRED - continued

- Health hazards
- Means of fire extinguishment
- Spill confinement procedures
- First aid procedures

PROVIDING THE INFORMATION

- Material Safety Data Sheets (MSDS)
- Emergency Response Guidebook

THE EMERGENCY RESPONSE GUIDEBOOK

- Published every 3 years by DOT
- Intended for use by emergency responders
- Provides unique emergency response information

HANDLING TRANSPORTATION RELEASES

- In the event of a spill/release motor carrier drivers are required to take the following actions:
  - Prevent fire from occurring
  - Limit the spread of spilled material
  - Make repairs to damaged containers
  - Transport materials in a suitable container
    - i.e.: overpack drums

OSHA COMPLIANCE

- These actions are considered to be either "defensive" or "offensive"
- Requires additional training per 29 CFR 1910.120
- The only action a driver might be able to do is call for help

REPORTING HAZARDOUS MATERIALS SPILLS

- State regulations
- National Response Center

THE NATIONAL RESPONSE CENTER

- Transportation related spills must be reported whenever:
  - A fatality occurs
  - An injury requiring hospitalization occurs
  - Property damage exceeds $50,000
  - Evacuations lasting more than 1 hour occur

THE NATIONAL RESPONSE CENTER

- Transportation related spills must be reported whenever:
  - A fatality occurs
  - An injury requiring hospitalization occurs
  - Property damage exceeds $50,000
  - Evacuations lasting more than 1 hour occur

REQUIRED INFORMATION

- The following information must be provided to the National Response Center
  - Name and location of person making notification
  - Name and address of the carrier
  - Contact person and phone number
  - Extent of injuries

REQUIRED INFORMATION

- Information, continued
  - Classification, proper shipping name and quantity of the material involved
  - Type of incident and nature of the material involved
  - Whether a danger to life continues

WRITTEN REPORTS

- A written follow-up report must be filed with DOT
  - Within 30 days of reporting to National Response Center
  - Hazardous waste manifest (copy) must be attached
  - Retained for 2 year minimum

RESPONSIBILITIES OF TRANSPORTERS

- No person may accept for transportation or transport any shipment of hazardous materials that is not in compliance with the regulations
- Requirements apply to hazardous materials before, during, and after the shipment has occurred

PRIOR TO SHIPMENT

- Before transport, the carrier must assure:
  - all training requirements have been complied with
  - cargo is accompanied by proper shipping documents
  - proper labels have been affixed to the shipment

PRIOR TO SHIPMENT

- Carrier must assure:
  - conduct pre-transportation safety inspection of vehicle
  - cargo has been loaded, secured and segregated
  - not accept "forbidden" materials
  - be aware of specific transportation routes

DURING SHIPMENT

- During the shipment of hazardous materials the carrier must:
  - ensure shipping papers are readily available by:
    - distinguishing them from all other documents
    - store them in a pouch on the driver's door
    - keep them on the front seat of the vehicle

DURING SHIPMENT

- Carrier must:
  - not move the vehicle if the placards or labels are lost or damaged
    - non-placarded vehicles can be moved if:
      - vehicle is escorted by State or local officials
      - has received special permission from DOT
      - movement is necessary to protect life or property

DURING SHIPMENT

- Carrier must:
  - follow designated shipping routes
  - follow requirements for stopping and parking vehicle
  - follow established procedures in the event of an emergency

FOLLOWING SHIPMENT

- Carriers must assure that all paperwork is completed including:
  - vehicle registration requirements
  - waste manifest requirements
  - vehicle/tank testing and inspection documents

GLOSSARY OF TERMS

Approved: approval issued or recognized by the Department of Transportation unless otherwise specifically indicated in the DOT regulations for shippers, transporters and manufacturers.

Bag: a flexible packaging made of paper, plastic film, textiles, woven or other similar materials.

Barge: a non-self propelled vessel.

Bottle: an inner packaging having a neck or relatively smaller cross section than the body and an opening capable of holding a closure for retention of the contents.

Box: a packaging with complete rectangular or polygonal faces, made of metal, wood, plywood, reconstituted wood, fiberboard, plastic or other suitable material.

Bulk packaging: a packaging, other than a vessel or a barge, including a transport vehicle or freight container, in which hazardous materials are loaded with no intermediate form of containment and which has:
a) a maximum capacity of 119 gallons as a recepticle for a liquid;
b) a maximum net mass greater than 882 pounds and a maximum capacity greater than 119 gallons as a recepticle for a solid;
c) a water capacity greater than 1,000 pounds as a recepticle for a gas

Cargo tank: a bulk packaging which:
a) is a tank intended primarily for the carriage of liquids or gases and includes appurtenances, reinforcements, fittings and closures;
b) is permanently attached to or forms a part of a motor vehicle, or is not permanently attached to a motor vehicle but which, by reason of its size, construction or attachment to a motor vehicle is loaded or un-loaded without being removed from the motor vehicle; and
c) is not fabricated under a specification for cylinders, portable tanks, tank cars or multi-unit tank car tanks.

Cargo tank motor vehicle: a motor vehicle with one or more cargo tanks permanently attached to or forming an integral part of the motor vehicle.

Carrier: a person engaged in the transportation of property by:
a) land or water, as a common, contract or private carrier, or;
b) civil aircraft

Class: the catagory of hazard assigned to a hazardous material. See also **Hazard class** for complete Department of Transportation definition.

Class 1 (explosive) any substance or article, including a device which is designed to function by explosion (an extremely rapid release of gas and heat) or which by chemical reaction within itself, is able to function in a similar manner even if not designed to function by

explosion, unless the substance or article is otherwise classed under provisions by the DOT.

Class 2 :	**Division**	**2.1**	Flammable gas
	Division	**2.2**	Non-flammable, non-poisonous compressed gas including compressed gas, liquified gas, pressuruzed cryogenic gas and compressed gas in solution.
	Division	**2.3**	Gas poisonous by inhalation
Class 3	(flammable liquid) a liquid having a flash point of not more than 141°F, or any material in a liquid phase with a flash point at or above 100 °F that is intentionally heated and offered for transportation, or transported at or above its flash point in a bulk package.		
Class 4	**Division**	**4.1**	Flammable solid
	Division	**4.2**	Spontaneously combustible material
	Division	**4.3**	Dangerous when wet material
Class 5	**Division**	**5.1**	Oxidizing material
	Division	**5.2**	Organic peroxide
Class 6	**Division**	**6.1**	Poisonous material
	Division	**6.2**	Infectious substance
Class 7	(radioactive material) any material having a specific activity greater than 0.002 microcuries per gram.		
Class 8	(corrosive material) a liquid or solid that causes visible destruction or irreversible alterations in human skin tissue at the site of contact, or a liquid that has a severe corrosion rate on steel or aluminum.		
Class 9	(miscellaneous hazardous material) a material which has an anesthetic, noxious or other similar property which could cause extreme annoyance or discomfort to a flight crew member so as to prevent the correct performance of assigned duties and meets the definition in 49 CFR 171.8 for a hazardous substance or haardous waste.		

Cylinder: a pressure vessel designed for pressures higher than 40 psia and having a circular cross section. It does not include portable tanks, tank cars or cargo tanks.

Domestic transportation: transportation between places within the United States other than through a foreign country.

Division: a subdivision of a hazard class

Drum: a flat ended or convex-ended cylindrical packaging made of metal, fiberboard plastic, plywood or other suitable materials. This defintion also includes packages of other shapes made of metal or plastic (ie: pail shaped packagings) but does not include cylinders, jerricans or wooden barrels.

Elevated temperature material: a material which when offered for transportation or transported in bulk packaging is:

a) in a liquid phase at a temperature at or above 212°F;
b) in a liquid phase with a flash point at or above 100°F and is intentionally heated and offered for transporation or transported at or above its flash point;
c) in a solid phase and at a temperature at or above 464°F

Flash point: the minimum temperature at which a substance gives of flammable vapors which, in contact with sparks or flame, will ignite.

Freight container: a reusable container having a volume of 64 cubic feet or more, designed and constructed to permit being lifted with its contents intact and intended primarily for containment of packages during transportation.

Hazard class: the catagory of hazard assigned to a hazardous material under the definitional criteria of 49 CFR Part 173 and the provisions of 49 CFR 172.101 Table. A material may meet the defintion for more than one hazard class, but may be assigned to only one hazard class.

Hazard zone: one of four levels of hazard assigned to gases (Zones A - D), or one of two levels of hazards assigned to liquids that are poison by inhalation. A hazard zone is based on the LC50 value for acute inhalation toxicity of gases and vapors.

Hazardous material: a substance or material, which has been determined by the Secretary of Transportation to be capable of posing an unreasonable risk to health, safety and property when transported in commerce and which has been so designated. This term includes hazardous substances, hazardous wastes, marine pollutants, and elevated temperature materials.

Hazardous waste: for the purposes of complying with the HMTUSA any material that is subject to the Hazardous Waste Manifest requirements of the US Environemntal Prtection Agency.

Hazmat employee: a person who is employed by a hazmay employer and who in the course of employment directly affects hazardous materials transportation safety. This term includes a self employed individual who during the course of employment:

a) loads, unloads or handles hazardous materials;
b) tests, reconditions, repairs, modifies, marks or otherwise represents containers, drums, or packagings as qualified for use in the transportation of hazardous materials;
c) prepares hazardous materials for transportation
d) is responsible for safety of transporting hazardous materials
e) operates a vehicle used to transport hazardous materials

Hazmat employer: a person who uses one or more of its employees in connection with: transporting hazardous materials, causing hazardous materials to be transported or shipped, marks, certifies, sells, reconditions, tests, repairs or modifies containers for use in the transportation of hazardous materials. This term includes any department or

agency of the United States, a State, political sub-division of a State, or an Indian Nation.

Inner Packaging: a packaging for which an outer packaging is required for transport. It does not include the inner recepticle of a composite package.

Intermodal container: a freight container designed and constructed to permit it to be used interchangeably in two or more modes of transport.

International transportation: transportation which occurs:
a) between any place in the US and any place in a foreign country;
b) between places in the United States through a foreign country;
c) between places in one or more foreign countries through the US

Marine pollutant: a hazardous material that is listed in Appendix B of the transportation regulations and when in a solution or mixture of one or more marine pollutants, is packaged in a concentration equal to or exceeding one of the following:
a) ten percent by weight of the solution or mixture for materials listed in Appendix B
b) one percent by weight of the solution or mixture for materials that are severe marine pollutants designated by "PP" in Appendix B

Marking: the descriptive name, identification number, instructions, cautions, weight, specification, UN marks, or combinations thereof, required by the DOT regulations for shippers, transporters, and manufacturers on outer packagings of hazardous materials.

Mode: any of the following transportation methods: rail, highway air or water.

Name of contents: the proper shipping name as specified in 49 CFR 172.101.

Outer packaging: the outermost enclosure of a composite or combination packaging together with any absorbent materials, cushioning and any other components necessary to contain and protect inner recepticles or inner packagings.

Overpack: an enclosure that is used by a single consignor to provide protection or convenience in handling of a package or to consolidate two or more packages.

Packing group: a grouping according to the degree of danger presented by the hazardous material. Packing group I indicates great danger, Packing Group II medium danger and Packing Group III minor danger.

Primary hazard: the hazard class of amaterial as assigned by the 49 CFR 172.101 Table.

Proper shipping name: the name of the hazardous material found in 49 CFR 172.101, and not printed in italics.

Reportable Quantity (RQ): for the purposes of DOT regulations the quantity specified in column 3 of the Appendix to 49 CFR 172.101

Residue: the hazardous materials remaining in a package, including a tank car, after its contents have been unloaded to the maximum extent practicable and before the packaging is either refilled or cleaned of hazardous material and purged to remove any hazardous vapors.

Shipping paper: a shipping order, bill of lading, manifest or other shipping document serving a similar purpose and containing information required by the Hazardous Materials Transportation Regulations.

Subsidiary hazard: a hazard of material other than its primary hazard.

Tank: a container consisting of a shell and heads, that forms a pressure tight vessel having openings designed to accept pressure tight fittings or closures, but excluding any appurtenances, reinforcements, fittings, or closures. For tank specificatioon purposes, "tank" means inner vessel and "jacket" means either the outer shell or insulation cover.

Technical name: a recognized chemical name or microbiological name currently used in scientific and technical handbooks, journals, and texts. Generic names are authorized for use as technical names provided they readily identify the general chemical group or micrbiological group. Trade names can not be used as technical names.