Welcome!

Thank you for attending DOT (Department of Transportation) Hazardous Materials and IATA (International Air Transport Association) Dangerous Goods training. You are attending this training because you work in a capacity that directly affects the safe transportation of hazardous materials. U.S. law (49 CFR, subpart H) requires that you are trained appropriately.

Each person who offers hazardous materials for transportation must know how to properly classify, package, mark, label, placard and document a shipment. All persons coming in contact with and directly affecting the safe transportation of the shipment must be trained.

The (IATA) regulations are the most widely used for both international and domestic Dangerous Goods shipments by air. These regulations are applicable to:

- All airlines which are members or associate members of IATA
- All shippers and agents who offer consignments of dangerous goods to these operators

If you have any questions regarding the safe transportation of hazardous materials, please feel free to contact the Department of Risk Management and Safety at 895-4226. We want you to feel comfortable and confident when handling these materials.

Enjoy the training.

Ben Fausett
Safety Training Officer
University of Nevada, Las Vegas

2008
Objectives

Given the appropriate regulations and shipping scenarios, the student should be able to:

- Demonstrate an understanding of the format of the regulations
- Comply with US training requirements
- Define key symbols and abbreviations
- Define industry terms
- Apply the rules of applicability
- Identify and locate the classification criteria for the nine classes of dangerous goods
- Utilize correct UN Specification packaging

IATA

- Demonstrate proper use of the appendices
- Apply limitations found in the Dangerous Goods Regulation (DGR)
- Classify articles or substances with multiple hazards
- Utilize the Alphabetical List and Numerical Code reference for Dangerous Goods (DG)
- Apply special provisions to a given material
- Identify items not listed by name in the Alphabetical List of Dangerous Goods
- Understand how to classify and identify mixtures and solutions with multiple hazards
- Utilize packing instructions
- Locate and apply State and Operator Variations
- Mark and label packages containing Dangerous Goods
- Prepare a Shipper’s Dangerous Goods Declaration and the DG requirements for the Airway Bill
- Properly prepare a Limited Quantity shipment
- Properly prepare an Excepted Quantity shipment
- Assemble overpacks properly
- Mark, label and document consignments containing overpacks
- Apply air carrier operating procedures
- Offer packages containing more than one hazard class

DOT

- Utilize the Hazardous Materials Table
- Apply Special Provisions
- Select the Proper Packing Provisions
- Identify, Mark and Document shipments of Hazardous Materials
- Identify, Mark and Document shipments of Marine Pollutants
- Apply Placarding, Segregation and Overpack Requirements
Classification of Hazardous Materials and Dangerous Goods

The term "hazardous materials" is used when transporting certain materials in the United States. Internationally, this term is called dangerous goods. For the purpose of this course, these terms can be used interchangeably.

In general, hazardous materials and dangerous goods are articles or substances which are capable of posing a risk to health, safety, property or the environment.

Some items we use everyday on the ground may become hazardous when subjected to conditions normal to transport by air, such as paint and batteries.

There are nine different Classes of Dangerous Goods. Some classes are further divided into Divisions based on their different properties (see below).

Some Classes or Divisions also have Packing Groups. A Packing Group identifies the dangerousness of a substance. There are three Packing Groups.

**Packing Group I** – Strongest – High Danger

**Packing Group II** – Stronger – Medium Danger

**Packing Group III** – Strong – Low Danger

These Packing Groups will determine the type of packaging used, markings to be applied, quantity limitations and, in some cases, whether an article can go on a passenger or cargo aircraft.

Not all classes have Packing Groups. These are Radioactive, Gases and Infectious Substances. However, these classes are packed according to the degree of danger each represents and are subject to stringent regulations.

It is the shipper’s responsibility to identify and classify the Dangerous Goods they wish to transport and to assign the Packing Group, if relevant.

This information will be provided for both DOT and IATA.
Class 1
Explosives

Class 1 is divided into 6 divisions:

1.1 Articles and substances having a mass explosion hazard.
   - Black powder, Dry TNT

1.2 Articles and substances having a projection hazard, but not a mass explosion hazard.
   - Hand grenades, Rocket motors

1.3 Articles and substances having fire hazard, a minor blast hazard, and/or a minor projection hazard.
   - Aerial flares

1.4 Articles and substances presenting no significant hazard.
   - Ammunition, Fireworks

1.5 Very insensitive substances having a mass explosion hazard.
   - Explosive, blasting, type B or E

1.6 Extremely insensitive articles that do not have a mass explosion hazard.
   - Articles, explosive, extremely insensitive

The division number of an explosive tells us the type of explosive we are dealing with.
In addition to a division number explosives are assigned a letter code A through L, excluding I and there is an N and an S. These codes are termed compatibility group because they determine if packages of explosives may be loaded, stored or stowed together. These codes also indicate additional information about the explosive.

Explosives moving to, from or within the United States must have prior approval of the Associate Administrator for Hazardous Materials Safety. An EX number will be Assigned to the explosive and must be marked on the package to verify approval or in association with the required basic description of the shipping paper.

**Class 2**  
**Gases**

Class 2 is divided into 3 divisions:

2.1 Flammable gas  
Butane, UN1011

![Flammable Gas](image)

2.2 Non-flammable, non poisonous/toxic gas  
Carbon dioxide, UN1013

![Non-Flammable Gas](image)

2.3 Poisonous/Toxic gas  
Ethylene oxide, UN1040

![Inhalation Hazard](image)

Gases are not assigned Packing Groups as their Division Number and label indicate the degree of risk. All regulations state that gas cylinders are regulated by the country where
they are filled. Therefore, gas cylinders are the only non-bulk specification packaging that is not UN approved packing – they are DOT specification packaging.

Also, in the United States, toxic gases must show the Inhalation Hazard label and are forbidden on passenger aircraft and restricted on cargo aircraft (see 49 CFR, part 175).

**Toxic Gases and Inhalation Hazard Zones**

All toxic gases (Division 2.3) are assigned and **Inhalation Zone A, B, C or D** based on the criteria of the inhalation toxicity table in 49 CFR 173.116.

A **special provision number in column 7** of the Hazardous Materials Table (49 CFR 172.101) will indicate what hazard zone has been assigned to a gas. This will be covered later in this course.

All toxic gases must be labeled with the **Inhalation Hazard Label** shown on the preceding page.

All toxic gases also require the entry: **Toxic Inhalation Hazard Zone A, B, C or D**, as appropriate, on the shipping paper immediately following the required basic description of the material.

Toxic gases of any quantity when loaded onto a vehicle will require placards.
Flammable liquids are assigned packaging groups based on their flash point and initial boiling point.

Class 3 Assignment of Packing Group

<table>
<thead>
<tr>
<th>Packing group</th>
<th>Flash point (closed-cup)</th>
<th>Initial boiling point</th>
</tr>
</thead>
<tbody>
<tr>
<td>I ............</td>
<td>........................................</td>
<td>≤35°C (95°F)</td>
</tr>
<tr>
<td>II ...........</td>
<td>&lt;23°C (73°F) ..................</td>
<td>&gt;35°C (95°F)</td>
</tr>
<tr>
<td>III ..........</td>
<td>≥23°C, ≤60°C (≥73°F, ≤140°F)</td>
<td>&gt;35°C (95°F)</td>
</tr>
</tbody>
</table>

The table shown above is used to determine the Packing Groups for class 3 materials.

A Combustible liquid is one with a flash point above 60.5°C (141°F) and below 93°C (200°F). Other than elevated temperature materials, a flammable liquid offered for transport domestically by highway or rail ONLY, with a flash point at or above 38°C (100°F) may be reclassified as a combustible liquid. Combustible liquids in non-bulk packagings are not regulated as hazardous materials, unless they are being shipped as a waste, hazardous substance, or as a marine pollutant.

HM-2151, effective January 1, 2008, changed the classification criteria for flammable and combustible liquids. The maximum flash point for flammable liquids has been lowered to 140°F (60°C), which aligns it with the international regulations. Consequently, the lower limit for combustible liquids is lowered as well. The new classification criteria may be used beginning January 1, 2007. The current classification criteria (shown above) may continue to be used until January 1, 2012.
Class 4
Flammable Solids

Class 4 is divided into 3 divisions:

4.1 Flammable solid
- Readily combustible which when transported may cause or contribute to fire through friction
- Matches, sulphur

4.2 Spontaneously combustible material
- Substances liable to spontaneous heating under normal conditions to transport, or to heating up in contact with air, and then liable to catch fire
- Phosphorus, yellow, dry

4.3 Dangerous when wet material
- Substances liable to become spontaneously flammable or give off flammable gases in dangerous quantities when interacting with water
- Sodium, Lithium

Packing Groups for Class 4 materials are assigned based on criteria found in subsection 3.4 (or 49 CFR 173.125).

In the United States, vehicles carrying Class or Division 4.3 materials must be placarded on all four sides of the vehicle, regardless of the amount or mode of transport. (See 49 CFR 172.504(e).) The only exception to this rule is if the material is packed in accordance with 49 CFR 173.13 or 173.151.
Class 5
Oxidizers and Organic Peroxides

Class 5 has 2 divisions:

5.1 Oxidizer (agents)
   • Lithium nitrate, UN2722

5.2 Organic peroxide
   • Organic peroxide type b, liquid, UN3101

Note: The new 5.2 label may be used effective January 1, 2007. The all-yellow 5.2 label may continue to be used until January 1, 2011. The all-yellow 5.2 placard may continue to be used for domestic transportation until January 1, 2014.

Oxidizers may yield oxygen that could cause or contribute to the accelerated combustion of other materials.

Organic peroxides are materials which may exhibit one or more of the following properties:
   • Liable to explosive decomposition
   • Burn rapidly
   • Sensitive to impact or friction
   • React dangerously with other substances
   • Cause damage to the eyes
Class 6
Poisonous or Toxic and Infectious Substances

Class 6 has 2 divisions:

6.1 Poisonous/Toxic substance
Arsenic, UN1558

6.2 Infectious Substances

These materials are liable to cause injury or harm to human or animal health if swallowed, inhaled or absorbed through the skin.

The Packing Groups for toxic materials are based on animal experiments that give us toxicity results.

The table below (Table 3.6.A) gives us the data for determining these Packing Groups. Many toxic materials are also assigned inhalation zones (A, B, C, or D), based on inhalation toxicity data.

Class 6 Assignment of Packing Group

<table>
<thead>
<tr>
<th>Packing group</th>
<th>Oral toxicity LD_{50} (mg/kg)</th>
<th>Dermal toxicity LD_{50} (mg/kg)</th>
<th>Inhalation toxicity by dusts and mists LC_{50} (mg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>≤5.0</td>
<td>≤50</td>
<td>≤0.2</td>
</tr>
<tr>
<td>II</td>
<td>&gt;5.0 and ≤50</td>
<td>&gt;50 and ≤200</td>
<td>&gt;0.2 and ≤2.0</td>
</tr>
<tr>
<td>III</td>
<td>&gt;50 and ≤300</td>
<td>&gt;200 and ≤1000</td>
<td>&gt;2.0 and ≤4.0</td>
</tr>
</tbody>
</table>

HM-2151, effective January 8, 2008, changed the classification criteria for Poisonous/Toxic materials to align with the international criteria established in the GHS. As a result, some materials that were not previously regulated under the HMR will be regulated as Division 6.1, PGIII: some materials currently regulated as Division 6.1 PG I and PG II will be assigned different packing groups and some materials that were previously regulated as Division 6.1 will no longer be regulated. This new classification
criteria can be used beginning January 1, 2007. The current classification criteria may continue to be used until January 1, 2012.

Toxic Material with an Inhalation Hazard

A number of toxic materials have been designated as having an inhalation hazard. Those that are assigned Hazard Zone A or B must display the Inhalation Hazard Label on the package (shown above). Those toxic materials that are designated as having an inhalation hazard other than hazard A or B will continue to display the standard toxic label on the package; however, they must be marked: “Inhalation Hazard.

Those toxic materials with a Zone A or B require the entry: Toxic Inhalation Hazard Zone A or B, as appropriate, immediately following the required basic description. Those toxic materials with an inhalation hazard other than Zone A or B must have the wording “Inhalation Hazard.”

6.2 Infectious Substances

These are substances known or reasonably expected to contain pathogens. Pathogens are defined as micro-organisms (including bacteria, viruses, parasites, fungi, etc) which can cause disease in humans or animals. Infectious substances shall be assigned to UN2814, UN2900, UN3291, or UN3373.

Infectious substances are divided into the following categories:

**Category A** – an infectious substance which is transported in a form that, when exposure occurs, is capable of causing permanent disability, life-threatening or fatal disease in otherwise healthy humans or animals.

- Infectious substances meeting the criteria which cause disease in humans or both humans and animals are assigned to UN2814, Infectious Substance, Affecting Humans.
- Infectious substances which cause disease in animals only are assigned to UN2900, Infectious Substance Affecting Animals Only.
- Assignment to UN2814 or UN2900 shall be based upon the known medical history and symptoms of the source human or animal, endemic local conditions or professional judgment concerning individual circumstances of the human or animal source.

The table is not exhaustive. Infectious substances, including new or emerging pathogens, which do not appear in the table, but meet the same criteria shall be
assigned to Category A. In addition, if there is doubt as to whether or not a substance meets the criteria it shall be included in Category A.

Category B – an infectious substance which does not meet the criteria for inclusion in Category A. Infectious substances in Category B shall be assigned to UN3373.

The Proper Shipping Name for UN3373 is Biological Substance, Category B.

Class 7
Radioactive Materials

Radioactive material is any material or substance which spontaneously and continuously emits ionizing radiation that can be harmful to human health. These radiations are undetectable to the human senses. However, they can be accurately detected and measured with special instruments.

The atoms of radioactive materials exist in a number of variants known as isotopes or nuclides. These variants are also called radioisotopes or radionuclides. They may be in the form of liquids, solids or gases.

The transportation regulations attempt to keep radiation exposures ALARA (As Low As Reasonably Achievable) by limiting the activity which may be transported in a given package.

Specific activity or activity concentration is defined as the activity (atomic disintegrations) of the radionuclide per unit mass of that nuclide. The specific activity of a material of which the radionuclide is essentially uniformly distributed is the activity per unit mass of the material.

Radioactive materials have an excellent safety record in transportation, as class 7 is the only hazard class in which some packaging is designed to withstand an accident scenario. The more radiotoxic the material, the better the packaging must be. The regulations for the transport of class 7 materials are written by the Atomic Energy Agency in Vienna, Austria. These regulations are updated every ten years and are reflected in the IMDG Code, the ICAO/IATA Dangerous Goods Regulations and Title 49, Code of Federal Regulations (49 CFR).
For detailed training in shipping radioactive materials, please contact the Department of Risk Management and Safety.

**Class 8**

**Corrosive Materials**

Class 8 materials mean a liquid or a solid that causes full thickness destruction of human skin at the site of contact within a specified period of time.

Corrosive materials are assigned packaging groups based on the following criteria found in Table 3.8.A.

**Class 8- Assignment of Packing Group**

**Packing Group I** – Materials that cause full thickness destruction of intact skin tissue within an observation period of up to 60 minutes starting after an exposure time of three minutes or less.

**Packing Group II** – Materials other than those meeting Packing Group I criteria that cause full thickness destruction of intact skin tissue within an observation period of up to 14 days starting after an exposure time of more than three minutes but not more than 60 minutes.

**Packing Group III** – Materials, other than those meeting Packing Group I or II criteria that:

- Cause full thickness destruction of intact skin tissue within an observation period of up to 14 days starting after the exposure time of more than 60 minutes but not more than 4 hours; or
- Do not cause full thickness destruction of intact skin tissue but exhibit corrosive rate on steel or aluminum surfaces exceeding 6.25 mm (0.25 inch) a year at a test temperature of 55°C (130°F). For the purpose of testing steel P3 (ISO 9328-1) or a similar type, and for testing aluminum, non-clad types 7075-T6 or AZ5GU-T6 should be used. An acceptable test is described in ASTM G 31-722 (Reapproved 1995).
Class 9
Miscellaneous Dangerous Substances or Articles

Miscellaneous dangerous goods are substances or materials which may present a danger during transport, and which are not covered under the other 8 hazard class definitions. They may be a Marine Pollutant, a Hazardous Substance, Hazardous Waste, or Elevated Temperature Material. These substances also include any 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.
Handling Labels
Handling labels are required for some Dangerous Goods. There are five handling labels.

The “Magnetized Material” label must be used on packages and overpacks containing magnetized material.

The “Cargo Aircraft Only” label must be used on packages which are packed according to a Cargo Aircraft Only Packing Instruction number. When the quantity and Packing Instruction are identical for passenger and cargo aircraft, the label should not be used. The label must not be used on a package that is packed for a passenger aircraft, but being transported on a cargo aircraft (See 7.2.4.2).

Note: Some States may require a shipment label “Cargo Aircraft Only” and carried on a Cargo Aircraft even though it is permitted on a passenger aircraft.

Arrows or Package Orientation labels are required on combination packages of liquid Dangerous Goods. The exceptions are:
- Flammable liquids in inner packagings of 120 mL or less.
- Infectious substances in primary receptacles of 50 mL or less.
- Radioactive materials.

The arrows can be red or black on contrasting background. When arrows are required there must be a minimum of two; one on each opposite side of the package (See 7.2.4.4).

The “Cryogenic Liquid” handling label must be used in addition to the Non-flammable gas hazard label on packages and overpacks containing cryogenic liquids (See 7.2.4.3).

The “Keep Away From Heat” label and any other applicable hazard label must be applied to all packages and overpacks containing self-reactive substances of Division 4.1 and 5.2 organic peroxides (See Special Provision A20).
Material Safety Data Sheets

The use of Material Safety Data Sheets (MSDS) is mandated when using Hazardous Materials. Chemical manufacturers MUST develop an MSDS for each hazardous chemical they produce. Employers SHALL have an MSDS for each hazardous material they use.

No specific form is required by federal law. However, certain information is required to be included on each MSDS. This information includes:

- The identity of the material
- Physical and chemical characteristics
- Physical and health hazards
- Primary route(s) of entry
- The OSHA Permissible Exposure Limit (PEL); ACGIH Threshold Limit Value (TLV); and any other exposure limit used or recommended by the manufacturer
- Whether the chemical is listed in the NTP, the IARC, or OSHA
- Precautions of safe handling and use
- Recommended engineering controls
- Emergency and first aid response
- Date of preparation
- Name, address and telephone number of the chemical manufacturer

OSHA also encourages the use of the Globally Harmonized System of Classification and Labeling of Chemicals (GHS) adopted by the United Nations. The GHS includes criteria for the classification of health, physical and environmental hazards, as well as specifying what information should be included on labels of hazardous chemicals as well as safety data sheets. The United States was an active participant in the development of the GHS, and is a member of the UN bodies established to maintain and coordinate implementation of the system.

For any questions regarding chemical or Materials Safety Data Sheets, contact the Department of Risk Management and Safety.
UN Specification Packaging

Packagings that successfully pass all required tests are marked with UN specification marks. The UN codes associated with the specification marks are:

1 means a drum  A means steel (all types)
2 means a wooden barrel  B means aluminum
3 means a jerrican  C means natural wood
4 means a box  D means plywood
5 means a bag  F means reconstituted wood
6 means a composite packaging  G means fiberboard
7 means a pressure receptacle  H means plastic
                             L means textile
                             M means paper, multi-wall
                             N means metal
                             (other than steel or aluminum)
P means glass, porcelain or stoneware

Additional numerals indicating the category of packaging within the kind to which the package belongs may be included. For example,

1A  Means steel drum. However, an additional number (1 or 2) may be included to indicate whether the drum has a removable or non-removable head.

1A1  Steel drum, non-removable head

1A2  Steel drum, removable head
Combination Packaging of Solids

1. The UN symbol
2. A number designating the type of package (i.e. 4 = box)
3. A letter designating the packaging material (i.e. G = fiberboard)
4. A letter designating the Packing Group for which the design type has been tested.
   a. X = Packing Group 1, II, or III
   b. Y = Packing Group II or III
   c. Z = Packing Group III only
5. The maximum gross mass in kilograms for packages intended to contain solids or inner packages. (Gross weight = the weight of the contents and packaging.)
6. For packages intended to contain solids or inner packagings, the letter “S”.
7. The last two digits of the year of manufacture.
8. The state (country) authorizing allocation of the mark. “USA” indicates the packaging is manufactured and marked in the United States.
9. Name and address or symbol of the manufacturer.
Single Packaging Containing Liquids

1A1/Y1.4/150/07/NL/JJ0116

1. The UN symbol
2. A number designating the type of package (i.e. 1 = drum); a letter designating the packaging material (i.e. A = steel); a number indicating the type of head on a drum (i.e. 1 = non-removable)
3. A letter designating the Packing Group for which the design type has been tested.
   a. X = Packing Group 1, II, or III
   b. Y = Packing Group II or III
   c. Z = Packing Group III only
4. A number indicating the specific gravity, rounded down to the first decimal
5. The hydraulic test pressure which the package was shown to withstand, in kPa, rounded down to the nearest 10 kPa.
6. The last two digits of the year of manufacture.
7. The state (country) authorizing allocation of the mark. “USA” indicates the packaging is manufactured and marked in the United States.
8. Name and address or symbol of the manufacturer.
Cylinders

Gas cylinders are regulated by 49 CFR 173.300 and 180.205 through 180.215. The minimum specification markings required are: DOT type of cylinder followed by the service pressure; the serial number of the cylinder; symbol of the manufacturer; inspector’s mark; and month and year of test.

NOTE: IATA/ICAO and the IMDG have introduced provisions applicable to the design, construction, testing, inspection and marking of UN certified gas cylinders. These regulations also accept cylinders approved by competent authority. Therefore, our DOT cylinders are still authorized internationally. The United States will harmonize 49 CFR with the international standards in the future.
Exercise 1

1. Match the hazard class or division number on the left with the description of that class shown on the right.

________ Class 4.2  A. Exposure/observation times used to determine packing group.
________ Class 6.1  B. Substances liable to spontaneously combust.
________ Class 8  C. LC_{50} used to determine packing group.
________ Class 6.2  D. A substance known or reasonably believed to cause disease in humans and animals.
________ Class 5.1  E. May yield oxygen.
________ Class 3  F. Flashpoint/Boiling point used to determine packing group.

2. What do the following marks represent on the package below?

4D X25 S 07 USA JP0221

a. 4D__________________________________________________________
b. X______________________________________________________________
c. 25______________________________________________________________
d. S______________________________________________________________
e. 07______________________________________________________________
f. JP0221__________________________________________________________
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Format of Dangerous Goods Regulations

The key to using the IATA Dangerous Goods Regulation (DGR) is knowing how to find the information.

The IATA manual is divided into 10 sections and 8 appendices (A through H). Each section is further divided into subsections, paragraphs, sub-paragraphs and sub-sub-paragraphs.

<table>
<thead>
<tr>
<th>Section</th>
<th>Subsection</th>
<th>Paragraph</th>
<th>Sub-paragraph</th>
<th>Sub-sub-paragraph</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>5.</td>
<td>2.</td>
<td>2</td>
<td>(a)</td>
</tr>
</tbody>
</table>

Shipper's Responsibilities

In Section 1.3.1.1 it reads, "A shipper must comply fully with these Regulations when offering a consignment of Dangerous Goods to an IATA Member, Associate Member Airlines and to airlines participating in IATA interline agreements for cargo. In addition, shippers must comply with any applicable regulations set forth by States of origin, transit and destination."

The terms “shall” and “must” indicate mandatory requirements.

The terms “should” and “may” are preferred but not binding.

The shipper must keep at least one copy of documentation relevant to the transportation of Dangerous Goods for at least three (3) months. However, the United States requires documentation to be kept no less than two (2) years after the initial operator has accepted the shipment (effective January 2006).
Use of the Appendices

The Appendices contain valuable information and references when using the Regulations.

Appendix A – Glossary
This section contains definitions and terms which will be referenced throughout the IATA manual. When we begin using the Alphabetical list of Dangerous Goods (blue pages), you may come across the † symbol. At that point you will turn to Appendix A and simply look up the term in alphabetical order. Sometimes you shipment will be affected, but in most cases it will give you an explanation regarding your shipment.

Appendix B – Nomenclature
All measurements must be in the metric system, referred to here as S.I. units (International System of Units). Appendix B offers tables for converting different measurements to and from the metric system. All of the authorized abbreviations and reference marks are also listed in Appendix B.

Appendix C – Currently Assigned Substances
C1) Self-Reactive Substances of Division 4.1
C2) Organic peroxides, Division 5.2

Appendix D – List of IATA members, Associate Members and other Airlines

Appendix E – Competent Authorities
E1) Non-Radioactive
E2) Radioactive

Appendix F – Packaging Testing Facilities, Manufacturers and Suppliers
F1) UN Specification Packaging Suppliers
F2) Packaging Testing Facilities
F3) UN Specification Packagings

Appendix G – Related services
List additional services
List IATA endorsed training schools based on states (countries)

Appendix H – IATA Safety Standards Programs
Section 2 - Limitations

This section explains different methods of transport for Dangerous Goods. Some items are not allowed to be transported in an aircraft, in which cases an alternative method of transport must be found. There are some Dangerous Goods, depending on the quantity to be shipped, that may be transported as “Excepted Quantities of Limited Quantities” and are exempt from some of the IATA requirements.

2.1.1 Dangerous Goods Forbidden in Aircraft under any circumstances
Any material that under normal transport conditions gives off toxic, corrosive or flammable gases that may explode, dangerously react or give off heat or flame may not be carried on an aircraft at any time.

In the List of Dangerous Goods materials that are listed as “forbidden” in Column I or J may not be carried aboard a passenger aircraft. If the word “forbidden” is listed in Columns K or L, the material may not be carried aboard an aircraft without governmental permits.

2.1.2 Dangerous Goods Forbidden Unless Exempted
Dangerous Goods that may not be carried on an aircraft unless exempted by the States involved (see 2.6.1) include:

- Some radioactive materials
- Materials listed as forbidden in the 4.2 table
- Infected live animals
- Liquids toxic by vapor inhalation that require PGI packaging
- Liquids offered for transport at temperatures that equal or exceed 100°C (212°F)
- Solids offered for transport at temperatures that meet or exceed 240°C (464°F)
- Any other materials specified by the national authority

2.2 Hidden Dangerous Goods
This section provides a trigger list of the training of operator’s cargo and passenger acceptance personnel. If in doubt that an item can be carried aboard an aircraft, the acceptance personnel must confirm with the shipper or the passenger the content of those items.

2.3 Dangerous Goods Carried by Passenger or Crew
Dangerous goods must not be carried by passengers or crew, on their person or in checked or carry-on baggage. Some exceptions are listed in this section.

2.4 Dangerous Goods in Airmail
Dangerous goods must not be transported in airmail except infectious materials, carbon dioxide, solid dry ice, and radioactive materials under certain conditions.

2.5 Dangerous Goods in Operator’s Property
The following items are exempt from the regulations when carried by an operator:
- Aircraft equipment that is necessary for the airworthiness of the aircraft
- Consumer goods carried for use or sale during the flight
- Dry ice for use in food and beverage service

2.6 Dangerous Goods Permitted as Air Cargo
This section permits operators to accept dangerous goods as cargo under the conditions of these regulations or under State approval.

2.7 Dangerous Goods in Excepted Quantities
This section outlines the shipment of very small amounts of dangerous goods in non-specification packaging with certain requirements.

2.8 Dangerous Goods in Limited Quantities
This section outlines the rules for an alternate method of shipping dangerous goods using non-specification packaging.

2.9 State and Operator Variations
States (countries) and Operators (air carriers) may file additional restrictions to Dangerous Good shipments being transported on their aircraft or through their territories. These additional restrictions are called Variations.
Using the Alphabetical List of Dangerous Goods

Steps 1 and 2

Most Dangerous Goods shipments follow the same sequence:

1. **Select a Proper Shipping Name** from sub-section 4.2 (List of Dangerous Goods).
2. **Check for any Special Provisions** (list of Dangerous Goods).
3. **Select a Packing Instruction** based on the quantity, packing group, type of packaging and if it is allowed on a passenger or cargo aircraft.
4. **Check the State and Operator Variations** listed under the Packing Instruction number.
5. Using the Packing Instruction, **ensure the packaging selection is authorized**.
6. **Package your Dangerous Goods** following the General Packing Requirements.
7. **Mark and label** the package.
8. **Complete the Shipper’s Declaration for Dangerous Goods and the Air Waybill**.

**Case Study**
**Substance:** Sodium nitrite
**Quantity:** 8 kg
**Packaging:** 4 IP1 glass inner packagings each containing 2 kg
1 4G fiberboard box
Step 1
Select a Proper Shipping Name

Turn to sub-section 4.2 in Section 4 and look up “Sodium nitrite” in the Alphabetical List of Dangerous Goods. Proper Shipping Names are listed in bold print. “Sodium nitrite” is in bold print; therefore it is a Proper Shipping Name.

Column B
Proper Shipping Name Description (4.1.6.2)

<table>
<thead>
<tr>
<th>UN/ID No.</th>
<th>Proper Shipping Name/Description</th>
<th>Class or Div.</th>
<th>Sump Risk</th>
<th>Hazard Label(s)</th>
<th>PG</th>
<th>Pkg Inst</th>
<th>Max Net Qty/Pkg</th>
<th>Limited Qty</th>
<th>Cargo Aircraft Only</th>
<th>S.P. see 4.4</th>
<th>ERG Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Sodium nitrite</td>
<td>5.1</td>
<td>6.1</td>
<td>Oxidizer &amp; Toxic</td>
<td>III</td>
<td>Y516</td>
<td>10 kg</td>
<td>516</td>
<td>100 kg</td>
<td>5P</td>
<td></td>
</tr>
</tbody>
</table>

Names listed in fine print are not Proper Shipping Names but will usually refer you to the correct Proper Shipping Name. Text in fine print MAY also be for descriptive purposes.

When looking up a Proper Shipping Name that has a prefix (such as alpha or numeric), ignore the prefix and look up the prominent name.

The proper shipping name 2-Amino-4-chlorophenel is listed under “A” in the Alphabetical List of Dangerous Goods, due to the fact that the prominent chemical begins with the word Amino.1

Some symbols and abbreviations which may be found in Column B are:

† look up the Proper Shipping Name in Appendix A for additional information
n.o.s. Not Otherwise Specified
★ The technical name of the article(s) or substance(s) is/are required.

---

1 The following components of names should be ignored when selecting a proper shipping name:
- numerals;
- the single letters a-, b-, D-, L, m-, N-, n-, O-, α-, and p-;
- the prefixes alpha, beta, meta, omega, sec, and tert;
- the term “n.o.s.”.
### Column A
**UN/ID Number (4.1.6.1)**

Column A reflects the 4-digit UN or ID Number assigned under the United Nations classification system. All proper shipping names must have a UN or ID Number associated with it. The UN number for “Sodium nitrite” is UN 1500.

The UN Number is a permanent number assigned to the article or substance. UN numbers are 7999 and below. The ID Numbers are temporary identification numbers which will always be 8000 or above. The number will remain in this category until the substance has been assigned a permanent UN number.

### Column C
**Class or Division Number (4.1.6.3)**

Column C tells us the primary Class or Division our substance is in. “Sodium nitrite” is in division 5.1, an oxidizer.

---

<table>
<thead>
<tr>
<th>UN/ID No.</th>
<th>Proper Shipping Name/Description</th>
<th>Class or Div.</th>
<th>Suitability Risk</th>
<th>Hazard Label(s)</th>
<th>PG</th>
<th>Ltd Qty</th>
<th>Pkg Inst</th>
<th>Max Net Qty/Pkg</th>
<th>Pkg Inst</th>
<th>Max Net Qty/Pkg</th>
<th>Pkg Inst</th>
<th>Max Net Qty/Pkg</th>
<th>S.P. Code</th>
<th>ERG Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1500</td>
<td>Sodium nitrite</td>
<td>5.1</td>
<td>6.1</td>
<td>Oxidizer &amp; Toxic</td>
<td>III</td>
<td>Y516</td>
<td>10 kg</td>
<td>516</td>
<td>25 kg</td>
<td>518</td>
<td>100 kg</td>
<td>5P</td>
<td>4.4</td>
<td></td>
</tr>
</tbody>
</table>

**Sodium nitrite** is an oxidizer and belongs to division 5.1 as per the UN/ID Number table.
Column D
Subsidiary Risk (4.1.6.4)

When an item has more than one hazard associated with it, the secondary or subsidiary hazard will be identified in Column D. “Sodium nitrite” has a sub-risk of 6.1 (toxic).

Column E
Hazard Labels (4.1.6.5)

All hazard labels required on a package of Dangerous Goods are identified in Column E. Primary hazard labels will be listed first, followed by any subrisk labels, if applicable. “Sodium nitrite” requires both an oxidizer and toxic label.
## Column F
### Packing Groups (4.1.6.6)

Column F tells us which Packing Group our substance is in, if applicable. In our example, “Sodium nitrite” is in Packing Group III, which presents low danger.

<table>
<thead>
<tr>
<th>Packing Group I</th>
<th>Packing Group II</th>
<th>Packing Group III</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Danger</td>
<td>Medium Danger</td>
<td>Low Danger</td>
</tr>
</tbody>
</table>

### Columns G through J
#### Passenger and Cargo Aircraft (4.1.6.7 – 4.1.6.10)

The next four columns are broken down into two separate sets of requirements for items allowed on passenger and cargo aircraft.

### Columns G and H (4.1.6.7 – 4.1.6.8)

Columns G and H are for Limited Quantity (LTD QTY) shipments. These types of shipments do not require the shipper to use UN Specification Packages, but rather, good strong, sturdy packages. The LTD QTY packing instructions will always begin with the letter “Y” in Column G. Column H is the maximum allowable quantity in each package.

Sodium nitrite offered for transport as a “Limited Quantity” has a packing instruction of Y516 and a maximum allowable quantity per package of 10 kg.

### Columns I and J (4.1.6.9 – 4.1.6.10)

Column I lists the Packing Instruction for passenger or cargo aircraft. Sodium nitrite offered for transport on either type of aircraft, would utilize packing instruction 516 when determining authorized packaging.

Column J allows up to twenty five kg (25 kg) per package. If either of these columns I or J contain the word “forbidden” the material is not allowed on passenger aircraft.
Column K
Cargo Aircraft Only (4.1.6.11)

Column K is for cargo aircraft only shipments, which are not allowed to be transported on a passenger aircraft. If you decide to use an all cargo carrier, it does not mean you must use a Cargo Aircraft Only packing instruction. It may depend on the substance, quantity and packaging you have available. Sodium nitrite would utilize packing instruction 518 for cargo aircraft only shipments.

Column L
Cargo Aircraft Only Maximum Net Quantity per Package (4.1.6.12)

Column L tells us the amount that is allowed in one package on a cargo aircraft. In this case we could ship up to 100 kg net quantity of “Sodium nitrite” in one package. In most cases these packages must be labeled with the “Cargo Aircraft Only” label. If either column K or L contains the word “forbidden” the material can not be transported aboard an aircraft, without special governmental permits.
Step 2
Check for Any Special Provisions

Column M
Special Provisions (4.1.6.13)

Column M refers to subsection 4.4. This is a reference that must always be checked if a special provision code is found in this column. An “A” number in column M applies to all packing groups of the material. Special Provisions may have an effect on the packaging or the way the shipment must be transported. In our example, Sodium nitrite has no special provisions.

Column N
ERG Code (4.1.6.14)

Column N references the Emergency Response Drill Code as listed in the International Civil Aviation Organization (ICAO) document “The Emergency Response Guidance for Aircraft Incidents Involving Dangerous Goods” (ICAO Document 9481). The codes consist of a combination of letters and numbers which represent responses to incidents involving specific dangerous goods, and to which a drill code has been assigned. Sodium nitrite has an ERG Code of 5P.
All Proper Shipping Names may also be found in subsection 4.3, “The Numerical Cross Reference List of Dangerous Goods.” They are listed here by UN or ID number and the page number in subsection 4.2 where they may be found.

<table>
<thead>
<tr>
<th>UN Number</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1481</td>
<td>Perchlorates, inorganic, n.o.s. (PG II: 5L; PG III: 5L)</td>
<td>234</td>
</tr>
<tr>
<td>1482</td>
<td>Permanganates, inorganic, n.o.s. (PG II: 5L; PG III: 5L)</td>
<td>234</td>
</tr>
<tr>
<td>1483</td>
<td>Peroxides, inorganic, n.o.s. (PG II: 5L; PG III: 5L)</td>
<td>235</td>
</tr>
<tr>
<td>1484</td>
<td>Potassium bromate (5L)</td>
<td>240</td>
</tr>
<tr>
<td>1485</td>
<td>Potassium chlorate (5L)</td>
<td>240</td>
</tr>
<tr>
<td>1486</td>
<td>Potassium nitrate (5L)</td>
<td>241</td>
</tr>
<tr>
<td>1487</td>
<td>Potassium nitrate and sodium nitrite mixture (5L)</td>
<td>241</td>
</tr>
<tr>
<td>1488</td>
<td>Potassium nitrite (5L)</td>
<td>241</td>
</tr>
<tr>
<td>1489</td>
<td>Potassium perchlorate (5L)</td>
<td>241</td>
</tr>
<tr>
<td>1490</td>
<td>Potassium permanganate (5L)</td>
<td>241</td>
</tr>
<tr>
<td>1491</td>
<td>Potassium peroxide (5L)</td>
<td>241</td>
</tr>
<tr>
<td>1492</td>
<td>Potassium persulphate (5L)</td>
<td>241</td>
</tr>
<tr>
<td>1493</td>
<td>Silver nitrate (5L)</td>
<td>252</td>
</tr>
<tr>
<td>1494</td>
<td>Sodium bromate (5L)</td>
<td>253</td>
</tr>
<tr>
<td>1495</td>
<td>Sodium chlorate (5L)</td>
<td>254</td>
</tr>
<tr>
<td>1496</td>
<td>Sodium chlorite (5L)</td>
<td>254</td>
</tr>
<tr>
<td>1498</td>
<td>Sodium nitrate (5L)</td>
<td>255</td>
</tr>
<tr>
<td>1499</td>
<td>Sodium nitrate and potassium nitrate mixture (5L)</td>
<td>255</td>
</tr>
<tr>
<td>1500</td>
<td>Sodium nitrite (5L)</td>
<td>255</td>
</tr>
<tr>
<td>1502</td>
<td>Sodium perchlorate (5L)</td>
<td>255</td>
</tr>
</tbody>
</table>
Exercise 2

1. What is the Proper Shipping Name for each of the following?
   Motorcycle________________________________________________________
   Magnesium in pellets_______________________________________________

2. Answer the following questions regarding a shipment of:
   Paint UN1263;
   Packing Group II;
   Quantity 2L; and packed in a fiberboard box.

   What is the Proper Shipping Name?_______________________________
   How much is allowed per package in a passenger aircraft?____________
   Are there any sub-risks for this material?__________________________
   Are there any special provisions?_______________________________
This page left intentionally blank.
Packing Instructions

Step 3
Select a Packing Instruction

We have 8 kg of “Sodium Nitrite” to ship. 25 kg’s may be shipped on a passenger aircraft under Packing Instruction 516 using UN packaging, which is what we have available. Turn to Packing Instruction 516.

The first items you must check under the Packing Instructions are the State and Operator Variations. USG-04 and USG-13 are listed which may affect the packagings of this shipment. Turn to subsection 2.9.
Step 4
Check the State and Operator Variations (2.9.2 and 2.9.3)

State Variations (2.9.2)

States (countries) may submit variations to the IATA regulations. These variations are found in Subsection 2.9.2. The variations may affect your shipment, so always check the variations first.

State variations should not be less restrictive than the regulations. If they are less restrictive, they will be listed for information purposes only and may be applied only within the territory by operators whom the territory is the State of the Operator (2.9.1.3).

Packing Instruction 516

State Variations: USG-04/13
Operator Variations: AA-01, AS-02, BW-01, CI-01, CM-03, CO-05, CS-05, FX-02, HA-01, IR-05, LY-04, ME-07, MX-05, TU-08, UA-01/10, UX-04

This instruction applies to solids of Division 5.1 in Packing Group III on passenger and cargo aircraft.
The General Packing Requirements of 5.0.2 must be met.
Packagings must meet Packing Group II performance standards.
Single packagings are not permitted.

State variations apply to the transport of Dangerous Goods moving to, from or through all territory subject to the sovereignty of the state by all air carriers (2.9.1.2).

“How do I know when a variation must be referenced?”

Variations are listed under the Packing Instruction Number in Section 5; or the section heading they pertain to;

5.0.2 General Packing Requirements
⚠️ STATE VARIATION: JRG-24
OPERATOR VARIATION: FX-02

Some countries have variations which apply to all shipments. These will not be listed in the above examples. We recommend you check all the variations listed for the countries you are shipping from, to or transiting through.
Operator Variations (2.9.3)

Operators (air carriers) may impose additional restrictions to Dangerous Goods shipments being transported on their aircraft. These variations should not be less restrictive than the Regulations (See 2.9.3.1)

If you know the air carrier which will be transporting your freight, look up their variations in subsection 2.9.4. Some of the variations may definitely impact your shipment. Do not forget that any special handling or processing requirements may not be in the IATA Regulations, but may appear in the individual carrier’s operators manual (See 2.9.3.2).

“How do I know when to check the Operator Variations?”

Like State Variations, Operator Variations are often found in the Packing Instructions in Section 5 or the section heading they pertain to.

---

Packing Instruction 516

State Variations: USG-04/13
Operator Variations: AA-01, AS-02, BW-01, CI-01, CM-03, CO-05, CS-05, FX-02, HA-01, IR-05, LY-04, ME-07, MX-05, TU-08, UA-01/10, UX-04

This instruction applies to solids of Division 5.1 in Packing Group III on passenger and cargo aircraft.
The General Packing Requirements of 5.0.2 must be met.
Packagings must meet Packing Group II performance standards.
Single packagings are not permitted.

Combination Packagings

<table>
<thead>
<tr>
<th>Desc.</th>
<th>Glass, Earthenware</th>
<th>Plastic</th>
<th>Metal (not aluminium)</th>
<th>Aluminium</th>
<th>Paper bag</th>
<th>Plastic bag</th>
<th>Fibre can or box</th>
<th>Glass ampoule</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spec.</td>
<td>IP1</td>
<td>IP2</td>
<td>IP3</td>
<td>IP3A</td>
<td>IP4</td>
<td>IP5</td>
<td>IP6</td>
<td>IP8</td>
</tr>
<tr>
<td>Unit</td>
<td>kg</td>
<td>kg</td>
<td>kg</td>
<td>kg</td>
<td>kg</td>
<td>kg</td>
<td>kg</td>
<td>kg</td>
</tr>
<tr>
<td>Max. Qty</td>
<td>2.5</td>
<td>2.5</td>
<td>2.5</td>
<td>2.5</td>
<td>2.5</td>
<td>2.5</td>
<td>2.5</td>
<td>0.5</td>
</tr>
</tbody>
</table>

Outer Packagings

Type | Drums | Jerrycans | Boxes |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Desc.</td>
<td>Steel</td>
<td>Aluminium</td>
<td>Plywood</td>
</tr>
<tr>
<td>Spec.</td>
<td>1A2</td>
<td>1B2</td>
<td>1D</td>
</tr>
</tbody>
</table>

5.0.1.6 Salvage Packaging

△ Operator Variations: AA-04, EI-03, EY-08, KJ-02, KZ-08, ME-05, MH-03, MP-02, NH-08, RG-07, SV-06, UA-07, UX-09
Step 5  
**Ensure the packaging selection is authorized**

We now must ensure our packaging is listed under Packing Instruction 516.

**Inner Packagings:**  IP1 - glass inners  
**Outer Packagings:**  4G - fiberboard box

- IP1 glass, earthenware is listed under **Inner Packagings** and allows our 2 kg in each.  
- 4G fiberboard box is listed under **Outer Packagings**.

The shipper may use any combination of the packagings listed below, as long as the requirements of Section 5 and 6 are complied with.

**Special Note:**

Be very careful to read all of the Packing Instructions. Sodium nitrite is a PG III material, but the Packing Instruction states that our packaging must be “upgraded” to PG II packaging performance standards.

---

**PACKING INSTRUCTION 516**

**STATE VARIATIONS: USG-04/13**

**OPERATOR VARIATIONS: AA-01, AS-02, BW-01, CI-01, CM-03, CO-05, CS-05, FX-02, HA-01, IR-05, LY-04, ME-07, MX-05, TU-08, UA-01/10, UX-04**

This instruction applies to solids of Division 5.1 in Packing Group III on passenger and cargo aircraft.  
The General Packing Requirements of 5.0.2 must be met.  
Packagings must meet Packing Group II performance standards.  
*Single packagings are not permitted.*

### COMBINATION PACKAGINGS

<table>
<thead>
<tr>
<th>Desc.</th>
<th>Glass, Earthenware</th>
<th>Plastic</th>
<th>Metal (not aluminium)</th>
<th>Aluminium</th>
<th>Paper bag</th>
<th>Plastic bag</th>
<th>Fibre can or box</th>
<th>Glass ampoule</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spec.</td>
<td>IP1</td>
<td>IP2</td>
<td>IP3</td>
<td>IP3A</td>
<td>IP4</td>
<td>IP5</td>
<td>IP6</td>
<td>IP6</td>
</tr>
<tr>
<td>Unit</td>
<td>kg</td>
<td>kg</td>
<td>kg</td>
<td>kg</td>
<td>kg</td>
<td>kg</td>
<td>kg</td>
<td></td>
</tr>
<tr>
<td>Max. Qty</td>
<td>2.5</td>
<td>2.5</td>
<td>2.5</td>
<td>2.5</td>
<td>2.5</td>
<td>2.5</td>
<td>2.5</td>
<td>0.5</td>
</tr>
</tbody>
</table>

### OUTER PACKAGINGS

<table>
<thead>
<tr>
<th>Type</th>
<th>Drums</th>
<th>Jerricans</th>
<th>Boxes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Desc.</td>
<td>Steel</td>
<td>Aluminiun</td>
<td>Plywood</td>
</tr>
<tr>
<td>Spec.</td>
<td>1A2</td>
<td>1B2</td>
<td>1D</td>
</tr>
</tbody>
</table>
Not all Packing Instructions look the same. For example, consider the following situation.

**Substance:** Acetyl chloride  
**Quantity:** 1 Liter  
**Packaging:** 1 IP1 glass inner packagings each containing 1 Liter  
1 4G fiberboard box

1. Select a Proper Shipping Name  
2. Check for any Special Provisions  
3. Select a Packing Instruction

Once you turn to Packing Instruction 306, the instructions are UN number specific. Browse the list until you find UN1717.
The Packing Instruction allows 1 Liter per IP1, but this material has in the PPR column the number 2, 5 and 13. This column refers to the Particular Packing Requirements (PPR) at the end of the Packing Instructions. PPRs are special handling requirements based on the substance and what packaging is used.

Since our IP1 is glass, we must follow the requirements is PPR 13.

PPRs may also be based on Single Packaging or Outer Packaging of combination packages.

**Step 6**

**Package your Dangerous Goods**

We decided to use Packing Instruction 516 for our shipment of “Sodium nitrite.” Under the Variations, it states, “The General Packing Requirements of Subsection 5.0.2 must also be met.”

Assemble the package according to the General Packing Requirements in 5.0.2.
Step 7
Mark and Label the Package
Section 7 covers all the marking and labeling requirements. Our shipment of sodium nitrite is now ready for this next step.

General Marking Requirements:
- All marking must be in English
- Must be visible and legible
- Able to withstand open weather conditions
- Must provide adequate permanency

The four marks required on most packages of Dangerous Goods are:
  - Proper Shipping Name (with technical name, if applicable).
  - UN or ID Number
  - Full name and address of the shipper (From).
  - Full name and address of the consignee (To).

It is recommended that package and overpack use markings should be at least 12 mm high, except that packages of 30 L or 30 kg capacity or less should be a minimum of 6 mm in height. (See 7.1.5.5)

Note:
The UN number may be placed above, below or along side of the Proper Shipping Name as long as it is clearly and easily understood.
All package markings are the sole responsibility of the shipper (See 7.0.1).
### Additional Marking Requirements

**Explosives**

The net quantity of the explosives and the gross weight of the package.

**Infectious Substances**

The name and telephone number of a responsible person.

**Refrigerated Liquefied Gases**

The wording “Keep Upright” at 120° intervals around the package or on each side. The package must be clearly marked, “Do Not Drop – Handle With Care.”

**Dry Ice**

The net weight of the Dry Ice (Carbon Dioxide, solid) in the package.

**UN3373**

These packages must state, “Biological Substance, ‘Category B.”

**Net or Gross markings**

Classes 2 through 6, 8, and UN 1845 (carbon dioxide, solid) must be marked on the outside with the net or gross weight (when the maximum amount allowed is a gross weight) of the dangerous goods contained in the package. The quantity should be marked adjacent to the UN Number and Proper Shipping Name.

Except for carbon dioxide, solid. This requirement is only applicable when the consignment contains more than one package.

**Note:**

a. When the weight on the Shipper’s Declaration is a gross weight and you use “G” then the markings for the packages should be a gross weight and use the “G.”

b. Class 9 materials may have the net or gross marked on the outside of the package.

**Empty Packages**

Must be marked as required by this section unless steps have been taken to nullify the hazard (i.e. purging, cleaning of substances, etc.).

Empty packages that have contained infectious substances must be disinfected or sterilized and all markings must be removed. (7.1.5.6.2)
Labeling Requirements

There are two types of labels: Hazard labels and handling labels.

Hazard Labels

The hazard labels that must be used on packages are found in Column E of the Alphabetical List of Dangerous Goods. A primary hazard label is listed for each article and in some cases a secondary label for those Dangerous Goods which have a subsidiary risk (See 7.2.3.1).

Primary and subsidiary risk labels must show the class or division number in the bottom corner of the label.

Unless the package dimensions are inadequate, hazard labels must be affixed at an angle of 45° (diamond shaped).
The Completed Package

To:  
From:  
Sodium nitrite  
UN1500  

OXIDIZER  
5.1  

TOXIC  
6  

4G/Y40/S/07  
USA/JJ0116
Exercise 3
Marking and Labeling

1. Utilizing the following information, please mark and label the outside of the package. You may use “To” and “From” as your full name and address of shipper and consignee. You may presume that all general packaging requirements have been met, and the appropriate packing instruction has been followed.

Package A

Material: UN1090
Quantity: 5L
Inner Packagings: Five IP1’s containing 1 L each
Outer Package: One 4G fiberboard box
This page left intentionally blank.
Step 8  
**Complete the Documentation**

The last step for our shipment of Sodium nitrite is to complete the documentation.

Some important points found in Section 8 for completing the Shipper’s Declaration:

- The shipper is responsible for the completion of the Shippers Declaration. (See 8.0.2)
- Left and right margins must have red hatchings. (See 8.1.1.2)
- The wording must be in the English language. (See 8.1.2.1)
- Two copies of the Declaration form must be tendered to the Operator. (See 8.1.2.3)
- No abbreviations are allowed except those permitted in Appendix B.
- Alterations are not allowed unless signed in accordance with the signature requirements of 8.1.2.6.
- The Declaration form must be signed and dated by the Shipper. (See 8.1.4.1)
- Persons, organizations (consolidators, freight forwarders, and IATA cargo agents) employed by the shipper may undertake the preparation and signing of the Shipper’s Declaration only if they are trained according to 1.5.

Special Note: Anyone preparing or signing the Shipper’s Declaration on the behalf of the shipper must understand they are now part of the shipper and could be subject to all fines and legal penalties.

- The Shipper’s Declaration must be completed in strict accordance with the Detailed Instructions of 8.1.6. (There may be other entries required by the appropriate national authority (8.1.2.2).)
- The entries in the boxes for Air Way bill number, Airport of Departure and Airport of Destination may be inserted or amended by the shipper, forwarder or accepting carrier. (See 8.1.5.1)
- All other information must be completed by the Shipper. (See 8.1.5.1)
Completion of the Shipper's Declaration (8.1.6)

Enter the full name and address of the Shipper and Consignee. States may be abbreviated to their two-letter code. Include zip codes, if applicable.

Enter the Air Waybill number (may be completed or amended by the shipper, forwarder or accepting carrier).

Enter the page of pages (i.e., Page 1 of 1 pages).

Transport Details. Delete “Passenger and Cargo Aircraft” or “Cargo Aircraft Only” according to your Packing Instruction.

Enter the full name of the airport of city of departure and destination. No abbreviations are allowed. May be completed or amended by the shipper, forwarder or carrier.

Shipment Type. Delete “Radioactive” or “No-Radioactive” depending on the type of shipment. Radioactive Material may not be on the same Declaration form as Non-Radioactive Material, except in the case of Dry Ice or Carbon Dioxide, Solid.

<table>
<thead>
<tr>
<th>Shipper</th>
<th>Air Waybill No.</th>
<th>Page 1 of 1 Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNLV</td>
<td>1234567890</td>
<td></td>
</tr>
<tr>
<td>4505 Maryland Parkway</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Las Vegas, NV 89154</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Consignee</th>
<th>Shipper's Reference Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>LLNL</td>
<td></td>
</tr>
<tr>
<td>7000 East Avenue</td>
<td></td>
</tr>
<tr>
<td>Livermore, CA 94550</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Transport Details</th>
<th>WARNING</th>
</tr>
</thead>
<tbody>
<tr>
<td>This shipment is within the limitations prescribed for: (delete non-applicable)</td>
<td>Failure to comply in all respects with the applicable Dangerous Goods Regulations may be in breach of the applicable law, subject to legal penalties.</td>
</tr>
<tr>
<td>PASSENGER AND CARGO AIRCRAFT</td>
<td></td>
</tr>
<tr>
<td>Airport of Departure: LAS</td>
<td></td>
</tr>
<tr>
<td>Airport of Destination: OAK</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Shipment type:</th>
<th>NON-RADIOACTIVE</th>
</tr>
</thead>
</table>

FedEx Express

Two completed and signed copies of this Declaration must be handed to the operator.
First Sequence

UN or ID number (with the UN/ID prefix)
The Proper Shipping Name, supplemented by the technical name, if appropriate.
Class or Division number and the Subsidiary risk in () if applicable
Packing Group, if applicable

<table>
<thead>
<tr>
<th>UN or ID No.</th>
<th>Proper Shipping Name</th>
<th>Class or Division (Subsidiary Risk)</th>
<th>Packing Group</th>
<th>Quantity and type of packaging</th>
<th>Packing Inst.</th>
<th>Authorization</th>
</tr>
</thead>
<tbody>
<tr>
<td>UN 1500</td>
<td>Sodium nitrite</td>
<td>5.1(0.1)</td>
<td>III</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Additional Handling Information

Emergency Telephone Number

I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labelled/placarded, and are in all respects in proper condition for transport according to applicable International and National Governmental Regulations. I declare that all of the applicable air transport requirements have been met.

Name/Title of Signatory
Place and Date
Signature

Some items have additional requirements for this sequence. (See 8.1.6.9.1, First Sequence)
Second Sequence

The number of packages, the type of package and the net weight for solids or the net liquid content of the Dangerous Goods in each package. Do not list the inner packagings.

Under subsection 4.2 where the maximum quantity per package is shown as “No Limit” or has a Packing Instruction reference in columns H, J or L, the net quantity of the hazard contained or the gross weight of the article or substance per package must be shown. It is recommended that when the weight shown on the Shipper’s Declaration is a gross weight that the “G” be added following the unit of measure.

Example: UN3268 Airbag modules 9 III//one fiberboard box x 25 kg.G.

Note – The type of packaging must now show the description, not just the code.
Example: Fiberboard box (4G) not just 4G. (see 8.1.6.9.2)

Third Sequence

Enter the number of the Packing Instruction used.

Fourth Sequence

If “Special Provision” A1, A2, A51, A81 or A109 is applicable to the shipment, place the number in this box.

If the shipment is being transported under any government authorizations, list them in the “Authorization” column and ensure a copy of the authorization is attached.

Some items have additional requirements for this sequence. (See 8.1.6.9.2, Second Sequence; 8.1.6.9.3, Third Sequence; 8.1.6.9.4, Fourth Sequence)
### Additional Handling Information

Any special handling information may be placed in this box. For some classes, such as self-reactive substances of Division 4.1 and organic peroxides of Division 5.2, the shipper must indicate that these packages must be shaded from direct sunlight, stored away from all sources of heat in a well ventilated area and not stowed with other cargo. (See 8.1.6.11.1)

For most shipments to, from, within or through the United States emergency response information is required. There are two essential parts to the Emergency Response Information. The first is a 24-hour emergency response telephone number (including area codes and for telephone numbers outside the U.S., the international access code, country code and city code needed to complete the call from within the U.S.) for use in the event of an incident involving the dangerous goods (USG-12). The second is the Emergency Response Information that must be in written form away from the package. For more detailed information see USG-12 or 49 CFR 172.602.

Also, under 49 CFR 171.11 (d)(4)(ii), the Shipper’s Declaration may include an identification that the shipment is being made under 49 CFR or ICAO.

---

<table>
<thead>
<tr>
<th>Additional Handling Information</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Emergency Telephone Number</strong></td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Name/Title of Signatory</th>
<th>Benjamin Fausett, Safety Training Officer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Place and Date</td>
<td>Las Vegas/20 Feb 2008</td>
</tr>
<tr>
<td>Signature</td>
<td>(see warning above)</td>
</tr>
</tbody>
</table>

Name/Title of Signatory: Enter the full name and title of the person signing the Declaration

Place and Date: Enter the place (city) and date where the Declaration was signed.

Signature: Signature of Shipper or his agent (See 8.1.2.3 and 8.1.4.1)
# Completed Shipper's Dangerous Goods Declaration

**SHIPPER'S DECLARATION FOR DANGEROUS GOODS**

| Shipper | UNLV  
| 4505 Maryland Parkway  
| Las Vegas, NV 89154 |
|---|---|
| Air Waybill No. | 1234567890 |
| Page | 1 |
| Shipper's Reference Number | |

**Consignee**

| LLNL  
| 7000 East Avenue  
| Livermore, CA 94550 |

Two completed and signed copies of this Declaration must be handed to the operator

**FedEx Express**

**WARNING**

Failure to comply in all respects with the applicable Dangerous Goods Regulations may be in breach of the applicable law, subject to legal penalties.

**TRANSPORT DETAILS**

This shipment is within the limitations prescribed for: (delete non-applicable)

- Passenger and Cargo Aircraft

**Airport of Departure**

LAS

**Airport of Destination**

OAK

**Shipment type** (delete non-applicable)

- Non-Radioactive

**NATURE AND QUANTITY OF DANGEROUS GOODS**

<table>
<thead>
<tr>
<th>UN or ID No.</th>
<th>Proper Shipping Name</th>
<th>Class or Division (Subsidary Risk)</th>
<th>Packing Group</th>
<th>Quantity and type of packaging</th>
<th>Packing Inst.</th>
<th>Authorization</th>
</tr>
</thead>
</table>
| UN 1500 | Sodium nitrite | 5.1(6.1) | III | One fiberboard box x 8 kg  
or  
One fiberboard box (4U) x 8 kg  
or  
1 box, fiberboard x 8 kg | 516 | A1  
and/or  
US DOT  
CA1257  
ATTACHED  
and/or  
LTD QTY |

<table>
<thead>
<tr>
<th>Additional Handling Information</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Emergency Telephone Number</th>
<th>702-895-4226</th>
</tr>
</thead>
</table>

I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labelled/placarded, and are in all respects in proper condition for transport according to applicable International and National Governmental Regulations. I declare that all of the applicable air transport requirements have been met.

**Name/Title of Signatory**

Benjamin Faussett, Safety Training Officer

**Place and Date**

Las Vegas/20 Feb 2008

**Signature**

FOR RADIOACTIVE MATERIAL SHipment ACCEPTABLE FOR PASSENGER AIRCRAFT, THE SHIEMENT CONTAINS RADIOACTIVE MATERIAL INTENDED FOR USE IN OR INCIDENT TO RESEARCH, MEDICAL DIAGNOSIS, OR TREATMENT.
Completion of the Air Waybill

The Air Waybill is a document used by the freight forwarder and operator which lists weights, charges and other information regarding all air shipments. In Section 6 of the Air Waybill, mark “Yes” or “No” to indicate your shipment contains Dangerous Goods. If “Yes, as per attached Shipper’s Declaration,” include three copies of a Shipper’s Declaration for Dangerous Goods.

International shipments require a slightly different air waybill. If you need to ship internationally, please contact the Department of Risk Management and Safety for assistance.

Some Dangerous Goods, such as Dry Ice, do not require a Shipper’s Declaration. Only an Air Waybill is required with the appropriate sections marked.

This is required for all Dangerous Goods when it is stated in the Packing Instructions that a Shipper's Declaration is not required. (See 8.2.3)

- When dry ice is being used to refrigerate other dangerous goods that do require a Shipper’s Declaration, the information regarding the dry ice must appear on the Shipper’s Declaration. (See 8.2.4)
Exercise 4  
Dangerous Goods Declarations and Air Waybills

1. On the following pages, please complete the Shipper's Declaration for Dangerous Goods and the Air Waybill. Then mark and label the package. Use the information listed below:

**Substance:** White spirit (flashpoint is 40°C, boiling point 150°C) PG III  
**Quantity:** 20 L  
**Packaging:** 10 IP2’s, containing 2 L each, with plastic inner liner and cushioning material, all packed in one UN approved plywood box.  

**Shipment Date:** Today

All State and Operator Variations have been complied with and all general packaging requirements have been met. The names and addresses of the shipper and consignee have been supplied for you, as have the airports of departure and destination. Please complete all required information and/or fill in missing information. You are employed by the shipper, so please use your name and title.
### SHIPPER'S DECLARATION FOR DANGEROUS GOODS

**(Provide at least three copies to the airline.)**

**Shipper**

UNLV  
4505 Maryland Parkway  
Las Vegas, NV  89154

**C**onsignee

LLNL  
7000 East Avenue  
Livermore, CA  94550

**Air Waybill No.**

**Page of**  Pages  
**Shipper's Reference Number**

---

**WARNING**

Failure to comply in all respects with the applicable Dangerous Goods Regulations may be in breach of the applicable law, subject to legal penalties.

**Shipment type:** (delete non-applicable)  
NON-RADIOACTIVE  RADIOACTIVE

---

### TRANSPORT DETAILS

<table>
<thead>
<tr>
<th>This shipment is within the limitations prescribed for: (delete non-applicable)</th>
<th>Airport of Departure</th>
</tr>
</thead>
<tbody>
<tr>
<td>CARGO AIRCRAFT ONLY</td>
<td>LAS</td>
</tr>
</tbody>
</table>

| Airport of Destination: | OAK |

---

### NATURE AND QUANTITY OF DANGEROUS GOODS

**Dangerous Goods Identification**

<table>
<thead>
<tr>
<th>UN or ID No.</th>
<th>Proper Shipping Name</th>
<th>Class or Division (Subsidiary Risk)</th>
<th>Packing Group</th>
<th>Quantity and type of packaging</th>
<th>Packing Inst.</th>
<th>Authorization</th>
</tr>
</thead>
</table>

**Additional Handling Information**

**Emergency Telephone Number**

---

I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labelled/placarded, and are in all respects in proper condition for transport according to applicable International and National Governmental Regulations. I declare that all of the applicable air transport requirements have been met.

Name/Title of Signatory

Place and Date

Signature  
*(see warning above)*

---

*FOR RADIOACTIVE MATERIAL SHIPMENT ACCEPTABLE FOR PASSENGER AIRCRAFT, THE SHIPMENT CONTAINS RADIOACTIVE MATERIAL INTENDED FOR USE IN OR INCIDENT TO RESEARCH, MEDICAL DIAGNOSIS, OR TREATMENT.*
2. Mark and label the UN specification plywood box. 
Chose the correct UN specifications for the package. 
This package was manufactured in the U.S. 
You may use “To” and “From” for the Shipper and Consignee.
Dangerous Goods in Limited Quantities

When preparing some Dangerous Goods shipments, there may be an alternate choice to using UN specification packaging. The requirements for this alternate method of transporting dangerous goods are found in the provisions for “Dangerous Goods in Limited Quantities.” (See 2.8)

Definition: The provisions for limited quantities allow for the continued use of strong, sturdy packaging which meets the construction requirements of subsections 6.1 and 6.2. These packages need not be marked and tested according to subsections 6.0.4 and 6.3. However, all other requirements of the regulations must be met unless indicated. (See 2.8.0.1)

| Substance: | Sodium Nitrite |
| Quantity: | 5 kg |
| Packaging: | 5 IP2 plastic inner packagings |
| | Cushioning and absorbent material |
| | 1 Fiberboard box (non-UN specification) |

Step 1

Most of the General Packing Requirements must be followed as well as the provisions for Limited Quantities in subsection 2.8.

Some Highlights for Limited Quantities

- The limitations and provisions are identical for passenger or cargo aircraft. (See 2.8.0.2)
- Single packages and composite packagings are not allowed. (See 2.8.3.3)
- Limited Quantity Packing Instructions are prefixed with the letter “Y.” (See 2.8.3.4)
- The inner packagings must meet the requirements of subsection 6.1. Outer packagings must be so designed that they are constructed according to the requirements of subsection 6.2. (See 2.8.3.5)
- The gross weight of the completed package must not exceed 30 kg (66lbs). (See 2.8.4.2)
- Completed packages must be capable of passing a 1.2m (4 foot) drop test and a 3 meter stacking test. (See 2.8.5)
- The following airlines will not accept Dangerous Goods in Limited Quantities:
  - Air Austral (UU-08)
  - Air Europe (UX-02)
  - Air Namibia (SW-02)
  - Air Tahiti Nui (TN-04)
  - Garuda Indonesia (GA-03)
  - Gulf Air (GF-04)
  - Lufthansa (LH-01)
  - Malaysia Airlines (MH-14)
  - Saudia (SV-02)
  - Swiss International (LX-02)
### Step 2

Ensure that “sodium nitrite” is a listed Dangerous Good. Since this material is listed in bold print, it is a Proper Shipping Name.

### Step 3

Determine which Packing Instruction to use. Column G, under Passenger Aircraft, LTD Qty, lists Packing Instruction Y516. Packing Instruction 516 is for UN packaging only. As we have non-specification packaging available, we have to use the “Y” Packing Instruction for the “Limited Quantity Provisions.” In this case, Y516, which allows 10 kg per package.

Don’t forget to check column M for any Special Provisions. Sodium nitrite does not have any special provisions.
Step 4

Packing Instruction Y516 allows the use of plastic inner packagings (IP2’s) with 1 kg in each and non-spec fiberboard boxes for the outer packaging.

Note that 2.8.3.5 of IATA states that the inner packagings meet the requirements of subsection 6.1.

Step 5

Check State and operator Variations. Some of the General Packaging requirements of 5.0.2 must be met along with requirements from section 2.8. The shipper must ensure that all applicable requirements given in the packing instruction have been complied with. The shipper must make sure that the package is airworthy.

---

**Packing Instruction Y516**

**STATE VARIATIONS: USG-04**

**OPERATOR VARIATIONS:** AA-01, AS-02, BW-01, CI-01, CM-03, CO-05, CS-05, FX-02, GA-03, GF-04, HA-01, IR-05, LH-01, LX-02, LY-04, ME-07, MH-14, MX-05, SV-02, SW-02, TN-04, TU-08, UA-01/10, UU-08, UX-02

The General Packing Requirements of Subsection 5.0.2 (with the exception of 5.0.2.3, 5.0.2.5, 5.0.2.11(f), 5.0.2.11(g) and 5.0.2.14) must be met except that the packagings do not have to meet the marking and testing requirements of 6.0.4 and Subsection 6.3. Packagings must meet the construction criteria specified in Subsections 6.1 and 6.2 and the test criteria specified in Subsection 6.7.

The requirements of Subsection 2.8 must be met. *Single packagings are not permitted.*

Limited quantities of solids of Division 5.1 assigned to this packing instruction must be packed in one of the following inner packagings.

The inner packagings must be packed in one of the following sturdy outer packagings with sufficient cushioning material so as to prevent movement.

The maximum quantity in each outer package must not exceed the quantity shown in Column H of the List of Dangerous Goods.

The gross weight of the completed package must not exceed 30 kg (66 lb).

### COMBINATION PACKAGINGS

<table>
<thead>
<tr>
<th>Desc.</th>
<th>Glass, Earthenware</th>
<th>Plastic</th>
<th>Metal (not aluminium)</th>
<th>Aluminium</th>
<th>Paper bag</th>
<th>Plastic bag</th>
<th>Fibre can or box</th>
<th>Glass ampoule</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit</td>
<td>kg</td>
<td>kg</td>
<td>kg</td>
<td>kg</td>
<td>kg</td>
<td>kg</td>
<td>kg</td>
<td>kg</td>
</tr>
<tr>
<td>Max. Qty</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>0.5</td>
</tr>
</tbody>
</table>

### OUTER PACKAGINGS

<table>
<thead>
<tr>
<th>Type</th>
<th>Drums</th>
<th>Jerricans</th>
<th>Boxes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Desc.</td>
<td>Steel</td>
<td>Aluminium</td>
<td>Plywood</td>
</tr>
</tbody>
</table>

---
Step 6

Assemble the package then mark and label.

- Limited Quantity shipments must be marked “Limited Quantity” or “LTD QTY” on the outside of the package. (See 7.1.5.3)

- The gross weight of the completed package must not exceed 30 kg (66 lbs). (See 2.8.4.2)

Note: The UN number may be placed within a diamond shape. The line that forms the diamond must be at least 2mm thick and the letters and numbers must be at least 6mm high. It is anticipated that beginning January 1, 2009, this diamond marking will be required for limited quantities of dangerous goods.
**Step 7**

Complete the Shipper’s Declaration. Ensure you list a “Y” packing instruction number and the Authorization column states “Limited Quantity” or “LTD QTY.”

---

**Transport Details**

Airport of Departure: LAS  
Airport of Destination: OAK

**Nature and Quantity of Dangerous Goods**

<table>
<thead>
<tr>
<th>UN or ID No.</th>
<th>Proper Shipping Name</th>
<th>Class or Division (Subsidiary Risk)</th>
<th>Packing Group</th>
<th>Quantity and type of packaging</th>
<th>Packing Inst.</th>
<th>Authorization</th>
</tr>
</thead>
<tbody>
<tr>
<td>UN 1500</td>
<td>Sodium nitrite</td>
<td>5.1(6.1)</td>
<td>III</td>
<td>One fiberboard box x 5 kg</td>
<td>Y516</td>
<td>LTD QTY</td>
</tr>
</tbody>
</table>

---

**Additional Handling Information**

Emergency Telephone Number: 702-895-4226

---

I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labelled/placarded, and are in all respects in proper condition for transport according to applicable International and National Governmental Regulations. I declare that all of the applicable air transport requirements have been met.

Name/Title of Signatory: Benjamin Fausett, Safety Training Officer  
Place and Date: Las Vegas/20 Feb 2008  
Signature: [Signature] (see warning above)
UN Packaging vs. Limited Quantities

Differences

- Must have specification mark.
- Combination or single packages.
- Accepted by most countries and carriers.
- Cargo Aircraft Only shipments allowed.
- Maximum gross weight according to the package and the “blue pages.”
- No specification mark; must state “Limited Quantity” or “LTD QTY.”
- No single packages allowed.
- Must use a “Y” Packaging Instruction number.
- No Cargo Aircraft Only shipments.
- Maximum gross weight is 30 kg.
- 24-hour Emergency Number not required (USG-12).

Similarities

All required marks and labels applied
Shipper’s Declaration and Air Waybills completed
Follow the General Packing Requirements (with some exceptions for Limited Quantities).
Exercise 5
Dangerous Goods in Limited Quantities

1. Which USG states that it is not necessary for limited quantity shipments to display a 24-hour emergency contact number on the documentation?
   a. 15
   b. 7
   c. 12
   d. None of them, Limited Quantities must have a 24-hour contact number.

2. You wish to ship the following as a Limited Quantity: All general packaging requirements have been met and all State and Operator variations have been complied with.

   **Consignment Details:** Two packages

   **Substance:** UN1444 UN2659

   **Quantity:** 2 kg (each)

   **Packaging:** Each package contains 4 IP1s containing .5 kg each, packed inside one non-UN specification fiberboard box.

   **Shipment Date:** Today

Mark and label the outside of the packages and complete the portion of the Shipper’s Declaration shown on the next page.
**SHIPPER'S DECLARATION FOR DANGEROUS GOODS**

(Provide at least three copies to the airline.)

**Shipper**

UNLV  
4505 Maryland Parkway  
Las Vegas, NV  89154

**Air Waybill No.**

Page of  Pages

Shipper's Reference Number

**Consignee**

LLNL  
7000 East Avenue  
Livermore, CA  94550

**WARNING**

Failure to comply in all respects with the applicable Dangerous Goods Regulations may be in breach of the applicable law, subject to legal penalties.

**Airport of Departure**

LAS

**Airport of Destination:**

OAK

**TRANSPORT DETAILS**

This shipment is within the limitations prescribed for:  
(except non-applicable)

<table>
<thead>
<tr>
<th>PASSENGER AND CARGO AIRCRAFT</th>
<th>CARGO AIRCRAFT ONLY</th>
</tr>
</thead>
</table>

**Shipment type:**  
(except non-applicable)

<table>
<thead>
<tr>
<th>NON-HAZARDOUS</th>
<th>RADIOACTIVE</th>
</tr>
</thead>
</table>

**NATURE AND QUANTITY OF DANGEROUS GOODS**

**Dangerous Goods Identification**

<table>
<thead>
<tr>
<th>UN or ID No.</th>
<th>Proper Shipping Name</th>
<th>Class or Division (Subclass or Risk)</th>
<th>Packing Group</th>
<th>Quantity and type of packaging</th>
<th>Packing Inst.</th>
<th>Authorization</th>
</tr>
</thead>
</table>

**Additional Handling Information**

Emergency Telephone Number

I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labelled/packaged, and are in all respects in proper condition for transport according to applicable International and National Governmental Regulations. I declare that all of the applicable air transport requirements have been met.

**Name/Title of Signatory**

**Place and Date**

**Signature**

(see warning above)

**FOR RADIOACTIVE MATERIAL SHIPMENT ACCEPTABLE FOR PASSENGER AIRCRAFT, THE SHIPMENT CONTAINS RADIOACTIVE MATERIAL INTENDED FOR USE IN OR INCIDENT TO RESEARCH, MEDICAL DIAGNOSIS, OR TREATMENT.**
Dangerous Goods in Excepted Quantities

Excepted Quantities of Dangerous Goods are shipments which are so limited in quantity that they are exempt from many of the requirements. (See 2.7)

Not all classes/Divisions are allowed to be shipped under the Excepted Quantity provisions. Subsection 2.7.1 lists those permitted and 2.7.2 lists those not permitted.

Only dangerous goods which are permitted on passenger aircraft and meet all the criteria of 2.7.1 may be carried under the provisions for dangerous goods in Excepted Quantities.

For those classes that are allowed to be shipped as an Excepted Quantity, the following provisions must be complied with:

- the training requirements of 1.5
- the definitions of Appendix A
- the classification provisions in Section 3
- the loading restrictions in 9.3.1
- the reporting of Dangerous Goods accidents and incidents in 9.6.1

Example:

Substance: Sodium nitrite, UN1500, P.G. III
Quantity: 3 plastic inner packagings that contain 1g each, further placed in to sealed plastic bags with cushioning and absorbent material
Packaging: One fiberboard box

Step 1

Determine if sodium nitrite is a Dangerous Good. Verify that it is permitted on a passenger aircraft.

Table 4.2 shows that sodium nitrite is an oxidizer, toxic packing group III. Note: Toxicity LD50 information comes from oral testing
Step 2

Turn to Table 2.7.A to determine if our quantity exceeds the quantity limitations for inner and outer packagings. Be sure to look in the column for Packing Group III material.

Table 2.7.A allows 30 g in each inner packaging and 1 kg of the entire package for oxidizers. We must also check the 6.1 sub-risk. Whichever limits are the most restrictive, than these are the limits you must use for you package. The 6.1 (oral) PGIII sub-risk limits are the same as the 5.1 primary, therefore; we may offer this substance as an Excepted quantity shipment.

<table>
<thead>
<tr>
<th>CLASS or DIVISION of PRIMARY or SUBSIDIARY RISK</th>
<th>PACKING GROUP I</th>
<th>PACKING GROUP II</th>
<th>PACKING GROUP III</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: Explosives</td>
<td>Forbidden</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.1: Flammable gas</td>
<td>Forbidden</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.2: Non-Flammable, non-toxic gas</td>
<td>See Note⁶</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.3: Toxic gas</td>
<td>Forbidden</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3: Flammable liquid</td>
<td>30 mL 300 mL</td>
<td>30 mL 500 mL</td>
<td>30 mL 1 L</td>
</tr>
<tr>
<td>4.1: Self reactive substances</td>
<td>Forbidden</td>
<td>Forbidden</td>
<td>Forbidden</td>
</tr>
<tr>
<td>4.1: Other flammable solids</td>
<td>30 g 500 g 30 g</td>
<td>500 g 30 g 1 kg</td>
<td></td>
</tr>
<tr>
<td>4.2: Pyrophoric substances</td>
<td>Forbidden</td>
<td>Not Applicable</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>4.2: Spontaneously combustible substances</td>
<td>Not Applicable</td>
<td>30 g 500 g 30 g</td>
<td>1 kg</td>
</tr>
<tr>
<td>4.3: Water reactive substances</td>
<td>Forbidden</td>
<td>30 g 500 g 30 g</td>
<td>1 kg or 1 L</td>
</tr>
<tr>
<td>5.1: Oxidisers</td>
<td>30 g 500 g 30 g</td>
<td>500 g 30 g 1 kg</td>
<td>1 L</td>
</tr>
<tr>
<td>5.2: Organic peroxides</td>
<td>Not Applicable</td>
<td>30 g 250 g 30 g</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>5.1: Toxic substances — inhalation</td>
<td>Forbidden</td>
<td>1 g 1 mL 1 g</td>
<td>1 mL 1 L</td>
</tr>
<tr>
<td>6.1: Toxic substances — oral</td>
<td>1 g 1 mL 300 g</td>
<td>1 g 1 mL 300 g</td>
<td>1 g 1 mL 300 g</td>
</tr>
<tr>
<td>6.1: Toxic substances — dermal</td>
<td>1 g 1 mL 300 g</td>
<td>1 g 1 mL 300 g</td>
<td>1 g 1 mL 300 g</td>
</tr>
<tr>
<td>6.2: Infectious substances</td>
<td>Forbidden</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7: Radioactive material</td>
<td>Forbidden</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8: Corrosive materials</td>
<td>30 g 500 g 30 g</td>
<td>500 g 30 g 1 kg</td>
<td></td>
</tr>
<tr>
<td>9: Other miscellaneous materials</td>
<td>Not Applicable</td>
<td>30 g 500 g 30 g</td>
<td>1 kg</td>
</tr>
</tbody>
</table>

---

⁶ UN 1040 Ethylene oxide is permitted in Excepted Quantities when prepared in accordance with the provisions of Special Provision A131.

⁷ Applies only to Organic Peroxides when contained in a chemical kit or a first aid kit.

⁸ See 10.5.9 radioactive material in excepted packages.

⁹ UN 2933 and UN 2809 are not permitted in Excepted Quantities.

Notes:
1. Authorized materials only, see 2.7.2 for excluded materials.
2. The above limits only apply to substances that are permitted on passenger aircraft.
Step 3

Packing requirements can be found under 2.7.8. The inner and outer packagings need not be specification packagings, but they must pass the package tests of 2.7.9.

The inner packagings must be placed in an intermediate packaging with cushioning and absorbent material (See 2.7.8.3).
Step 4
Labeling requirements (See 2.7.6)

- The ID Number may be substituted for the UN Number
- The boxes for both primary hazard and the sub-risk must be checked
- The shipper must enter the required information and sign it as indicated in 2.7.6.2.
Step 5

Complete the documentation.

A Shipper’s Declaration for Dangerous Goods is **NOT** required. (See 2.7.7.1)

The “Nature and Quantity of Goods” box of the Air Waybill must be completed with the words “Dangerous Goods in Excepted Quantities.” (See 2.7.7.2 and 8.2.5)

---

**Additional Highlights**

- Different Excepted Quantities contained in one outer package. (2.7.8.7)
- Overpacks containing Excepted Quantities. (2.7.8.10)
- Excepted Quantities may only be packed with other materials that do not require a shipper’s declaration. (2.7.8.11)

**Many carriers have placed restrictions on these types of shipments. Make sure you check the Operator Variations in 2.9.3.**

Should the amount needed to be transported exceed Table 2.7.A, then the shipment must be transported following all the requirements for packaging, marking, labeling and documentation.
Exercise 6
Dangerous Goods in Excepted Quantities

1. You wish to ship the following as an Excepted Quantity:

   Substance:  UN2803
   Quantity:  20 inner plastic bottles containing 1g each

   What is the maximum quantity allowed in each inner packaging?
   
   What is the total net quantity allowed per package?
   
   Complete the label (choose your own shipper).

DANGEROUS GOODS IN EXCEPTED QUANTITIES

This package contains dangerous goods in excepted small quantities and is in all respects in compliance with the applicable international and national government regulations and the IATA Dangerous Goods Regulations.

Signature of Shipper

Title Date

Name and Address of Shipper

This package contains substance(s) in Class(es) (check applicable box(es))
Class: 2 3 4 5 6 8 9

and the applicable UN Numbers are
**Overpacks**

If the shipper has one or more completed packages that need to be transported to the same final destination, it may be possible to ship them as one unit for convenience of handling and stowage.

Definition of Overpack: “An enclosure used by a single shipper to contain one or more packages and to form one handling unit for convenience of handling and stowage. Dangerous Goods packages contained in the overpack must be properly packed, marked, labeled and in proper condition as required by these Regulations.” (Appendix A)

**Example**

You wish to transport the following completed packages in one overpack:

- **Acrylamide, solid**
  - UN2074
  - 5 kg
  - Quantity = 5 kg
  - Packing Group II

- **Benzene**
  - UN1114
  - 2 L
  - Packing Group II
  - Quantity = 2 L
**Step 1**

Ensure the Dangerous Goods do not require separation according to 9.3.A.

An “X” at the intersection of a line and column indicates the Classes/Divisions must be separated.

An “-” indicates no separation is required.

The primary and subrisk hazard must be considered.

The following Class/Divisions do not need to be separated from any other Dangerous Goods: 4.1, 6, 7 and 9.

For those items which need to be separated, there is no actual distance. Separation is based on the shippers discretion.

*(graphic 11-3)*

In our example, we wish to overpack a Class 6 and a Class 3. No separation is required.

Table 9.3.A contains general guidelines. Further separation may be required based on knowledge and experience.

**Step 2**

Each package within the overpack must be properly packed, marked, labeled and in all respects be properly prepared for transport. Packages must be free of any indication of damage or leakage (see 5.0.1.5.2).

The intended function of each package must not be impaired by the overpack (5.0.1.5.4).

**Step 3**

All marks and labels representative of all the dangerous goods contained within the overpack must be clearly visible or reproduced on the outside of the overpack (7.1.4.1). Single packages of liquids do not require arrows except when the packages are overpacked, in which case arrow would be required on two opposite sides of the overpack (see 7.2.4.4).

Labels need not be applied for a subrisk if the hazard is already represented by a primary label (7.2.3.13).
When marks or labels are not visible, the statement “Overpack” must be on the outside of the overpack. Overpacks containing Limited Quantities must additionally state “Limited Quantity” or LTD QTY ” marked on the outside of the overpack.

When a consignment consists of multiple overpacks, an identification mark and the total quantity as declared on the Shipper’s Declaration must be indicated on each overpack to facilitate identification, loading and notification.

In our example, we have only one overpack, the identification mark is not required.

Shrinkwrap and banding may be considered overpacks.

**Step 4**

An overpack must not contain packages bearing the “Cargo Aircraft Only” label except when:
- There is only one package in the overpack
- Two or more packages are in the overpack and they are assembled in such a way that clear visibility and easy access is possible (i.e. shrink wrap or banding)
- They are of the following Class/Divisions:
  - Class 3, Packing Group III, no subrisk
  - Class 6
  - Class 7
  - Class 9
Step 5

Complete the Shipper's Declaration

<table>
<thead>
<tr>
<th>UN or ID No.</th>
<th>Proper Shipping Name</th>
<th>Class or Division (Subsidiary Risk)</th>
<th>Packing Group</th>
<th>Quantity and type of packaging</th>
<th>Packing Inst.</th>
<th>Authorization</th>
</tr>
</thead>
<tbody>
<tr>
<td>UN 1114</td>
<td>Benzene</td>
<td>3</td>
<td>II</td>
<td>One fiberboard box x 2L</td>
<td>305</td>
<td></td>
</tr>
<tr>
<td>UN 2074</td>
<td>Acrylamide, solid</td>
<td>6.1</td>
<td>III</td>
<td>One fiberboard box x 5 kg</td>
<td>619</td>
<td></td>
</tr>
</tbody>
</table>

Overpack Used
Example of Multiple Overpacks

Overpack 1 - 1 box of Resin solution, PG II, 5 L
  1 box UN1133, PG III, 2 L

Overpack 2 - 1 box UN1654, 5L
  1 box UN2335, 1L
<table>
<thead>
<tr>
<th>UN or ID No.</th>
<th>Proper Shipping Name</th>
<th>Class or Division (Primary Risk)</th>
<th>Packing Group</th>
<th>Quantity and type of packaging</th>
<th>Packing Inst.</th>
<th>Authorization</th>
</tr>
</thead>
<tbody>
<tr>
<td>UN 1114</td>
<td>Resin Solution</td>
<td>3</td>
<td>II</td>
<td>One fiberboard box x 5 L</td>
<td>305</td>
<td></td>
</tr>
<tr>
<td>UN 1133</td>
<td>Adhesives</td>
<td>3</td>
<td>III</td>
<td>One fiberboard box x 2 L Overpack Used Box 1 Total Quantity 7 L</td>
<td>309</td>
<td></td>
</tr>
<tr>
<td>UN 2335</td>
<td>Allyl ethyl ether (6.1)</td>
<td>3</td>
<td>II</td>
<td>One fiberboard box x 1 L</td>
<td>305</td>
<td></td>
</tr>
<tr>
<td>UN 1654</td>
<td>Nicotine</td>
<td>6.1</td>
<td>II</td>
<td>One fiberboard box x 5 L Overpack Used Box 2 Total Quantity 6 L</td>
<td>609</td>
<td></td>
</tr>
</tbody>
</table>
Exercise 7
Overpacks

You wish to overpack two packages of Dangerous Goods. All are in completed UN fibreboard boxes and are correctly marked and labeled. Complete the marking and labeling requirements for each overpack.

Overpack contains:
1 box Gasoline, PG II, 3L
1 box UN3426, 3L
This page left intentionally blank.
When we have a listed Dangerous Good, in most cases, it is a step-by-step process to complete the packing requirements and move the shipment.

With the thousands of chemicals in existence today, many names will not be found in sub-section 4.2. These items must be assigned Proper Shipping Names based on their properties and the hazard involved.

**Technical Name:** Dichloromethylene  
**Properties:** Organic solid with an Oral LD50 = 15 mg/kg  
**Quantity:** 5 kg

### Step 1

Look up “Dichloromethylene” in sub-section 4.2.

### Step 2

Since the material is not listed in the Alphabetical List of Dangerous Goods, turn to Section 2.1, **Forbidden Dangerous Goods**. Check its properties against the properties listed in 2.1. Dichloromethylene does not have these properties; therefore, it is not forbidden for air transport.

### Step 3

The material in question is not forbidden, so turn to **Section 3, Classification** and compare its properties with the criteria for the nine hazard classes.

We have been told that Dichloromethylene has the following properties: Organic solid with an Oral LD50 = 15 mg/kg.

Table 3.6.A determines if items may be considered toxic based on the criteria above.

<table>
<thead>
<tr>
<th>Packing Group</th>
<th>Oral Toxicity LD₅₀ (mg/kg)</th>
<th>Dermal Toxicity LD₅₀ (mg/kg)</th>
<th>Inhalation Toxicity by Dusts and Mists LC₁₀₀ (mg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>≤ 6.0</td>
<td>≤ 60</td>
<td>≥ 0.2</td>
</tr>
<tr>
<td>II</td>
<td>&gt; 5.0 but ≤ 50</td>
<td>&gt; 50 but ≤ 200</td>
<td>&gt; 0.2 but ≤ 2</td>
</tr>
<tr>
<td>III*</td>
<td>≥ 50 but ≤ 300</td>
<td>&gt; 200 but ≤ 1,000</td>
<td>&gt; 2 but ≤ 10</td>
</tr>
</tbody>
</table>

* Tear gas substances must be included in Packing Group II even if their toxicity data correspond to Packing Group III values.

**Notes:**
1. See 3.6.1.5 for explanation of LD₅₀ and LC₁₀₀.
2. Substances meeting the criteria of Class 8 and with an inhalation toxicity of dusts and mists (LC₁₀₀) leading to Packing Group I are only accepted for an allocation to Division 6.1 if the toxicity through oral ingestion or dermal contact is at least in the range of Packing Group I or II. Otherwise an allocation to Class 8 is made when appropriate (see 3.8.2.2).

Dichloromethylene may be considered a toxic material based on the criteria given and in Packing Group II according to Table 3.6.A.
Step 4

Select the most appropriate n.o.s. Proper Shipping Name (See 4.1.2.1(c)).

There are four choices in order of preference:

1. Single entries for well-defined substances or articles.
   Example: kerosene.
2. General entries for well-defined groups.
   Example: Paint related material
3. Specific n.o.s. entries of chemical or technical groups.
   Example: Alcohols, n.o.s. ★
4. General n.o.s. entries meeting the criteria of one or more classes or divisions.
   Example: Flammable liquid, toxic, n.o.s. ★

Table 4.1.A lists all of the n.o.s. Proper Shipping Names. Many generic and n.o.s.
Proper Shipping Names also require the technical name in parenthesis following the
Proper Shipping Name. These are identified by the “(star)” symbol.

The “★” and the “†” are not part of the Proper Shipping Name.

We have determined the Dichloromethylene is an organic toxic material in Packing
Group II. The substance is in solid form. We have 5 kg to transport.

Table 4.1.A is in order according to Class/Division number. Turn to the Class 6.1 hazard
entries.

<table>
<thead>
<tr>
<th>Class or Division</th>
<th>Subsidiary Risk</th>
<th>UN or ID No.</th>
<th>Proper Shipping Names</th>
</tr>
</thead>
<tbody>
<tr>
<td>General entries</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.1</td>
<td></td>
<td>2810</td>
<td>Toxic liquid, organic, n.o.s.★</td>
</tr>
<tr>
<td>6.1</td>
<td></td>
<td>2811</td>
<td>Toxic solid, organic, n.o.s.★</td>
</tr>
<tr>
<td>6.1</td>
<td></td>
<td>3172</td>
<td>Toxins, extracted from living sources, liquid, n.o.s.★</td>
</tr>
<tr>
<td>6.1</td>
<td></td>
<td>3243</td>
<td>Solids containing toxic liquid, n.o.s.★</td>
</tr>
<tr>
<td>6.1</td>
<td></td>
<td>3297</td>
<td>Toxic liquid, inorganic, n.o.s.★</td>
</tr>
<tr>
<td>6.1</td>
<td></td>
<td>3298</td>
<td>Toxic solid, inorganic, n.o.s.★</td>
</tr>
<tr>
<td>6.1</td>
<td></td>
<td>3315</td>
<td>Chemical sample, toxic</td>
</tr>
<tr>
<td>6.1</td>
<td></td>
<td>3381</td>
<td>Toxic by inhalation, liquid, n.o.s.★ with an inhalation toxicity ≤ 1000 mL/m³ and a saturated vapour concentraion ≥ 600 L/m³</td>
</tr>
<tr>
<td>6.1</td>
<td></td>
<td>3382</td>
<td>Toxic by inhalation, liquid, n.o.s.★ with an inhalation toxicity ≤ 1000 mL/m³ and a saturated vapour concentraion ≥ 10 L/m³</td>
</tr>
<tr>
<td>6.1</td>
<td></td>
<td>3462</td>
<td>Toxins, extracted from living sources, solid, n.o.s.★</td>
</tr>
</tbody>
</table>

We must consider three key word components: “Toxic,” “Solid” and “Organic” as they
will become part of our Proper Shipping Name.

Our Proper Shipping Name is:
**Toxic solid, organic, n.o.s. (Dichloromethylene) UN2811**

Note: Self-reactive substances Class 4.1 must use Appendix C.1 to assign the Proper
Generic Shipping name (4.1.0.3). Organic peroxides Class 5.2 must use Appendix C.2
to assign the Proper Generic Shipping name.
Where there is any doubt as to whether a non-listed article or substance is permitted for transport by air, or under what conditions, the shipper and/or operator must consult the appropriate national authority.

**Step 5**

Now that we have a listed Proper Shipping Name, we can continue preparing the shipment for transport. Remember to check the Special Provisions in Column M.

All three Packing Groups are listed. Our substance is in Packing Group II.

<table>
<thead>
<tr>
<th>UN/ID No.</th>
<th>Proper Shipping Name/Description</th>
<th>Class or Div.</th>
<th>Sub Risk</th>
<th>Hazard Label(s)</th>
<th>PG</th>
<th>S.P. see 4.4</th>
<th>ERG Code N</th>
</tr>
</thead>
<tbody>
<tr>
<td>A 2811</td>
<td>Toxic sulfide, urgent, n.o.s.</td>
<td>6.1</td>
<td>Tuxu</td>
<td>—</td>
<td>I</td>
<td>—</td>
<td>6L</td>
</tr>
<tr>
<td>II Y813</td>
<td>1 kg</td>
<td>813</td>
<td>25 kg</td>
<td>815</td>
<td>100 kg</td>
<td>A5</td>
<td>6L</td>
</tr>
<tr>
<td>III Y819</td>
<td>10 kg</td>
<td>819</td>
<td>100 kg</td>
<td>819</td>
<td>200 kg</td>
<td>6L</td>
<td></td>
</tr>
</tbody>
</table>
Classification of Articles/Substances with Multiple Hazards

When classifying an article or substance that is not identified in the list of dangerous goods and which meet the criteria of more than one hazard class, Table 3.10.A must be used to establish the primary hazard, subrisk and packing group of that material.

Example
You have chemical X which after laboratory testing demonstrates the following properties:
Flashpoint: 18°C
Boiling point: 37°C
LD₅₀: 5 mg/kg oral (rat)

Considering all of the properties, we discover that this material fits the classification criteria of two hazards classes: Class 3, Packing Group II and Class 6.1, Packing Group I.

Since our material has two hazard classes, we must use Table 3.10.A to determine the primary and subsidiary class for chemical X.
Find Class 3, PG II vertically and Division 6.1, PG I(o) horizontally. The intersection shows Class 3 is the primary hazard in Packing Group I. Class 6.1 is the subsidiary hazard.

Note: The Packing Group will always be the most stringent of the different hazard classes.

Subsection 3.10.2 lists the hazards that will always take precedence, regardless of what other hazards are present.
Mixtures and Solutions

There are instances when one Dangerous Good is mixed with non-dangerous goods. The resulting substance is termed “mixture” or “solution.”

Example

**Substance:** Acetone mixed with a non-dangerous liquid  
**Properties:** Flashpoint is 8°C, Boiling point is 78°C

**Step 1**

Determine if Acetone mixed with a non-dangerous liquid is a listed Dangerous Good. We do this by referencing Subsection 4.2, The Alphabetical List of Dangerous Goods.

Only **pure** Acetone in Packing Group II is listed.

Now that the Acetone has been **mixed** with a non-dangerous liquid, we need to determine if it is still in the same Packing Group or if its properties have changed.

**Step 2**

Compare the new test results with Table 3.3.A.

From this Table we see that this solution/mixture has remained in Packing Group II.
Remember: If no change occurs to:

Packing Group
Form (i.e. solid, liquid, gas)
Emergency Response Information

Then the Proper Shipping Name remains the same.

**Step 3**
Therefore our Proper Shipping Name stays “Acetone.” The qualifying word “mixture” or “solution” must be added to further qualify the substance as not technically pure.

In addition, the concentration of the mixture of solution may also be added.

Example: Acetone 75% solution
Example
Substance: Acetone mixed with a non-dangerous liquid
Properties: Flashpoint is 25°C, Boiling point is 80°C

<table>
<thead>
<tr>
<th>Packing Group</th>
<th>Flash Point (closed-cup)</th>
<th>Initial Boiling Point</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>—</td>
<td>≤ 35°C</td>
</tr>
<tr>
<td>II</td>
<td>&lt; 23°C</td>
<td>&gt; 35°C</td>
</tr>
<tr>
<td>III</td>
<td>≥ 23°C but ≤ 60°C</td>
<td></td>
</tr>
</tbody>
</table>

**Step 1**

Again, compare the new criteria with Table 3.3.A. This solution has changed from Packing Group II to Packing Group III.

**Remember:** When the Packing Group changes, the Proper Shipping Name must also change and it becomes the most appropriate generic or n.o.s. Proper Shipping Name. The Proper Shipping Name will also change if the hazard class, physical state or emergency response differs from the listed substance.

**Step 2**

Turn to Table 4.1.A to select the Proper Shipping Name. Our solution is now simply a flammable liquid which contains acetone.

<table>
<thead>
<tr>
<th>Class or Division</th>
<th>Subsidiary Risk</th>
<th>UN or ID No.</th>
<th>Proper Shipping Names (Note: The * is not part of the proper shipping name.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>8</td>
<td>2985</td>
<td>Chlorosilanes, flammable, corrosive, n.o.s.</td>
</tr>
<tr>
<td>Hazard entries</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>1993</td>
<td>Flammable liquid, n.o.s.*</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>3256</td>
<td>Elevated temperature liquid, flammable, n.o.s.* with flash point above 60.5°C (141°F), at or above its flash point</td>
</tr>
<tr>
<td>3</td>
<td>6.1</td>
<td>1992</td>
<td>Flammable liquid, toxic, n.o.s.*</td>
</tr>
<tr>
<td>3</td>
<td>6.1 and 8</td>
<td>3286</td>
<td>Flammable liquid, toxic, corrosive, n.o.s.*</td>
</tr>
</tbody>
</table>

Our new shipping name becomes:

**Flammable Liquid, n.o.s. (containing acetone), UN1993**

In parenthesis is MAY say “containing” or “mixture” or “solution” or just the name of the substance.
## Step 3

Package according to the Packing Instructions for "Flammable liquid, n.o.s.," Packing Group III.

<table>
<thead>
<tr>
<th>UN/ID No.</th>
<th>Proper Shipping Name/Description</th>
<th>Class or Div.</th>
<th>Sub Div.</th>
<th>Hazard Label(s)</th>
<th>PC</th>
<th>Passenger and Cargo Aircraft</th>
<th>Cargo Aircraft Only</th>
<th>S.P. Code</th>
<th>ERG Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1993</td>
<td>Flammable liquid, n.o.s.</td>
<td>3</td>
<td>Flamm. liquid</td>
<td>I</td>
<td>302</td>
<td>1 L</td>
<td>303</td>
<td>30 L</td>
<td>A3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>II</td>
<td>305</td>
<td>5 L</td>
<td>307</td>
<td>60 L</td>
<td>JH</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>III</td>
<td>309</td>
<td>60 L</td>
<td>310</td>
<td>220 L</td>
<td>JH</td>
</tr>
</tbody>
</table>

University of Nevada, Las Vegas
Exercise 8
Mixtures and Solutions

1. Determine the Proper Shipping Name and Packing Group for the following substance:
   Substance: Sodium azide mixed with a non-dangerous liquid
   Form: Inorganic liquid
   Properties: Oral LD50 = 15 mg/kg

2. Using Table 3.10.A, list the fill in the missing information below (if applicable):

<table>
<thead>
<tr>
<th>Class/Division</th>
<th>Packing Group</th>
<th>Class/Division</th>
<th>Packing Group</th>
<th>Primary Hazard</th>
<th>Subsidiary Risk</th>
<th>Packing Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.1</td>
<td>III</td>
<td>3</td>
<td>II</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.3</td>
<td>III</td>
<td>5.1</td>
<td>III</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.2</td>
<td></td>
<td>8</td>
<td>II</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>II</td>
<td>5.1</td>
<td>I</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Different Dangerous Goods Packed in One Outer Package**

There are times you may have inner packagings of different Dangerous goods that need to be shipped to one location. Under certain circumstances, the shipper may put different substances packaged in separate inner packagings contained in one combination package (see 5.0.2.11).

You wish to offer the following materials in one outer, combination package:

<table>
<thead>
<tr>
<th>Substance</th>
<th>Inner Packaging</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acrylamide, solid</td>
<td>2 IP2 @ 1 kg each</td>
</tr>
<tr>
<td>Fluoroboric acid</td>
<td>2 IP2 @ .1 L each</td>
</tr>
<tr>
<td></td>
<td>Intermediate packaging – two metal cans</td>
</tr>
<tr>
<td>Ammonium persulphate</td>
<td>2 IP1 @ 1 kg each</td>
</tr>
</tbody>
</table>

**Outer Packaging:** One UN approved fiberboard box – 4G.
Step 1 - The shipper must ensure that different Dangerous Goods packed together will not react with each other (see 5.0.2.11(a)).

Step 2 - The Dangerous Goods must not require segregation according to Table 9.3.A. Our three materials (Division 6.1, Class 8, Division 5.1) do not require segregation from one another.

Step 3 - Infectious Substances (Division 6.2) must not be transported in the same outer package with other dangerous goods, except as permitted by Packing Instruction 602 (see 5.0.2.11(c)).

Step 4 - Each item must comply with its individual Packing Instruction for inner packagings. IP1 and IP2 inner packagings are allowed respectively for the individual Packing Instructions for each material (see 5.0.2.11(d)).

Step 5 - The outer packaging used must be allowed for each item. Our 4G is allowed for each material according to the individual Packing Instructions (see 5.0.2.11(e)).

Step 6 - Check the items for the most restrictive Packing Group. One of the materials is in Packing Group II and the others are in Packing Group III. Our 4G must meet Packing Group II performance standards (see 5.0.2.11(f)).

Step 7 - Compute the “Q” (Quantity) value. Simply, this total is meant to ensure we do not exceed the value of 1 (one) in the package (see 5.0.2.11(g)).

The “Q” value is determined using the formula below. As long as “Q” does not exceed 1 (one), the items may be transported together.

\[ Q = \frac{n_1}{M_1} + \frac{n_2}{M_2} + \frac{n_3}{M_3} \]

The top figure represents the net quantity of the items to be shipped. The lower figure represents the amount allowed per package on a passenger aircraft according to 4.2 List of Dangerous Goods. This figure can be for passenger or cargo aircraft, but all must be consistent. Our example would look like:

\[ Q = \frac{2}{100} + \frac{.2}{1} + \frac{2}{25} \]

So,

\[ Q = .02 + .20 + .08 = .3 \]
**Remember:** As long as “Q” does not exceed 1 (one), the times may be transported in one outer package. You may mix liters and kilograms to compute the “Q” value.

The following items do not need to be taken into account when calculation the “Q” value (see 5.0.2.11(h)):

Dry Ice

Any item in 4.2 List of Dangerous Goods where the quantity shows “No Limit”

Any items with the same UN number, Packing Group and same physical state provided they are the only Dangerous Goods in the package and the total net weight does not exceed the maximum net quantity allowed per package in the List of Dangerous Goods.

**Step 8** - Mark and label the package.

Labels need not be applied for a sub-risk if the hazard is already represented by a primary risk label (see 7.2.3.13).

![Image of a labeled package]

**Note:** One package in the shipment makes the net quantity mark optional.
# Step 9 - Complete the Shipper's Declaration

## NATURE AND QUANTITY OF DANGEROUS GOODS

<table>
<thead>
<tr>
<th>UN or ID No.</th>
<th>Proper Shipping Name</th>
<th>Class or Division (Subsidiary Risk)</th>
<th>Packing Group</th>
<th>Quantity and type of packaging</th>
<th>Packing Inst.</th>
<th>Authorization</th>
</tr>
</thead>
<tbody>
<tr>
<td>UN 2074</td>
<td>Acrylamide, solid</td>
<td>6.1</td>
<td>III</td>
<td>2 kg</td>
<td>619</td>
<td></td>
</tr>
<tr>
<td>UN 1775</td>
<td>Fluoroboric acid</td>
<td>8</td>
<td>II</td>
<td>2 L</td>
<td>809</td>
<td></td>
</tr>
</tbody>
</table>
| UN 1444      | Ammonium persulphate   | 5.1                                 | III           | 2 kg

*All packed in one fiberboard box*

\[ Q = 0.3 \]
Dangerous Goods in Limited Quantities Packed in One Outer Package

For Dangerous Goods in Limited Quantities packed together in one outer package, the "Q" value must be calculated.

For Class 2 and Class 9 only, when packed together without dangerous goods in other classes, the total gross weight must not exceed 30 kg (66 lbs) and the "Q" value is not required.

Or, when Class 2 and Class 9 are packed with goods in other classes, the gross weight must not exceed 30 kg (66 lbs) and the "Q" value must be calculated for the other classes.

Do not forget to calculate the “Q” value for Limited Quantities using the “Y” Packing Instruction number (see 5.0.3.2 through 5.0.3.4).

Example:
Your wish to ship:

- UN1090 – Acetone 0.2 L
- UN2839 – Aldol 0.2 L
- UN1950 – Aerosols, non-flammable 10 kg Gross (each not exceeding 1 L)

Compute the “Q” value:

\[
\begin{align*}
\text{UN1090} & \quad 0.2 \text{ L} / 1 \text{ L} (Y305) = 0.2 \\
\text{UN2839} & \quad 0.2 \text{ L} / 1 \text{ L} (Y609) = 0.2 \\
\end{align*}
\]

\[Q = 0.4\]

Do not include UN1950 in the “Q” value calculation.

This package must not exceed 30 kg gross.
Remember!

Do NOT confuse **Different Dangerous Goods Packed Together** shipment with **Overpack** Shipments!

Different Dangerous Goods packed together contain **inner packagings** of different items. An overpack contains **completed packages** of different items.
Exercise 9
Different Dangerous Goods Packed in One Outer Package

1. You are offering the following different materials all packed in one outer package. Calculate the "Q" value. Assume the inner packagings are appropriate and all PPRs have been complied with.

Mark and label the package for the shipment.

<table>
<thead>
<tr>
<th>UN or ID No.</th>
<th>Proper Shipping Name</th>
<th>Class or Division (Subsidiary Risk)</th>
<th>Packing Group</th>
<th>Quantity and type of packaging</th>
<th>Packing Inst.</th>
<th>Authorization</th>
</tr>
</thead>
<tbody>
<tr>
<td>UN 2430</td>
<td>Alkylphenols, solid, n.o.s.</td>
<td>8</td>
<td>II</td>
<td>4 kg</td>
<td></td>
<td>814</td>
</tr>
<tr>
<td>UN 1638</td>
<td>Mercury iodide, solid</td>
<td>6.1</td>
<td>II</td>
<td>5 kg</td>
<td></td>
<td>613</td>
</tr>
<tr>
<td>UN 1090</td>
<td>Acetone</td>
<td>3</td>
<td>II</td>
<td>2 L</td>
<td></td>
<td>305</td>
</tr>
</tbody>
</table>

All packed in one fiberboard box

Q =
This page left intentionally blank.
Using the Hazardous Materials Table (HMT) (172.101)

The Hazardous Materials Table 9172.1010 is the “starting Point” when shipping hazardous materials domestically in the United States. The HMT is used to determine hazard classes, shipping paper entries, packaging authorizations (packing instructions), markings, labels, quantity limitations on aircraft, stowage requirements aboard vessels and determining if any exceptions may be allowed for a material.

There are ten columns to the HMT. Some columns are further divided into sub-columns such as column 8 (8a, 8b AND 8c).

§172.101 Hazardous Materials Table

<table>
<thead>
<tr>
<th>Symbols</th>
<th>Hazardous materials descriptions and proper shipping names</th>
<th>Hazard class or division</th>
<th>Identification Numbers</th>
<th>PG</th>
<th>Label Codes</th>
<th>Special provisions (§ 172.102)</th>
<th>(8) Packaging (§173-***)</th>
<th>(9) Quantity limitations (see §§173.27 and 175.75)</th>
<th>(10) Vessel stowage</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(8)</td>
<td>(9)</td>
<td>(10)</td>
</tr>
<tr>
<td>(2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(8)</td>
<td>(9)</td>
<td>(10)</td>
</tr>
<tr>
<td>(3)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(8)</td>
<td>(9)</td>
<td>(10)</td>
</tr>
<tr>
<td>(4)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(8)</td>
<td>(9)</td>
<td>(10)</td>
</tr>
<tr>
<td>(5)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(8)</td>
<td>(9)</td>
<td>(10)</td>
</tr>
<tr>
<td>(6)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(8)</td>
<td>(9)</td>
<td>(10)</td>
</tr>
<tr>
<td>(7)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(8)</td>
<td>(9)</td>
<td>(10)</td>
</tr>
</tbody>
</table>

The HMT is an alphabetical list of the hazardous materials most often shipped in the United States. It would be impossible to list every hazardous material known in one volume; therefore, there is a number of generic “n.o.s.” Proper Shipping Names that cover materials not listed.

When using the HMT it is advisable to use a straight edge you are on the correct horizontal line.
### Column 1

#### Symbols

Column 1 may have one of six symbols: "\+", "A", "D", "G", "I" or "W". The absence of the letters A or W means the material is regulated by all modes of transportation.

- **\+** Fixes the proper shipping name, hazard class, and packing group for the material. **We must use the information shown in Columns 2, 3, and 5 for the material.** No changes are permitted.

- **A** The material is regulated only if being transported by air. (not applicable if the material in question is a hazardous substance or hazardous waste)

- **D** Identifies the proper shipping name(s) for domestic transportation, and may be unacceptable for international transportation.

- **G** This letter identifies proper shipping names for which one or more technical names of the hazardous material must be entered in parentheses

- **W** The material is regulated only if being transported by vessel. (not applicable if the material in question is a hazardous substance or hazardous waste)

- **I** Identifies acceptable proper shipping names for international transportation and indicates there may be an alternative domestic proper shipping name.

---

<table>
<thead>
<tr>
<th>Symbols</th>
<th>Hazard materials descriptions and proper shipping names</th>
<th>Hazard class or Division</th>
<th>Identification Numbers</th>
<th>PG</th>
<th>Label Codes</th>
<th>Special provisions (§ 172.102)</th>
<th>(8) Packaging</th>
<th>(9) Quantity limitations (see §§ 173.27 and 173.75)</th>
<th>Vessel stowage</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>Ferrous chloride, solution</td>
<td>8</td>
<td>NA1709</td>
<td>II</td>
<td>B3, IIB, T11, TP2, TP27</td>
<td>154</td>
<td>262</td>
<td>242</td>
<td>1 L</td>
</tr>
<tr>
<td>D</td>
<td>Ferrous metal shavings or Ferrous metal cuttings in a form liable to self-ignition</td>
<td>4.2</td>
<td>UN2973</td>
<td>II</td>
<td>A1, A18, IB8, IF3, IF7</td>
<td>None</td>
<td>213</td>
<td>241</td>
<td>25 kg</td>
</tr>
<tr>
<td>D</td>
<td>Fertilizer ammoniating solution with two ammonias</td>
<td>2.2</td>
<td>UN1043</td>
<td>II</td>
<td>N87</td>
<td>300</td>
<td>364</td>
<td>314</td>
<td>315</td>
</tr>
<tr>
<td>IV</td>
<td>Fibers, animal or Fibers, vegetable, wet or damp</td>
<td>4.2</td>
<td>UN1372</td>
<td>II</td>
<td>A1</td>
<td>151</td>
<td>213</td>
<td>240</td>
<td>Forbidden</td>
</tr>
<tr>
<td>IV</td>
<td>Fibers, vegetable, dry</td>
<td>4.1</td>
<td>UN3359</td>
<td>II</td>
<td>137</td>
<td>151</td>
<td>213</td>
<td>240</td>
<td>No Limit</td>
</tr>
<tr>
<td>IV</td>
<td>Fibers or Fabrics, animal or vegetable or Synthetic, n.o.s. with animal or vegetable oil</td>
<td>4.2</td>
<td>UN1373</td>
<td>II</td>
<td>137, IB8, IF3, IF3</td>
<td>None</td>
<td>213</td>
<td>241</td>
<td>Forbidden</td>
</tr>
<tr>
<td>IV</td>
<td>Fibers or Fabrics impregnated with weakly nitrocellulose, n.o.s.</td>
<td>4.1</td>
<td>UN1353</td>
<td>II</td>
<td>A1, IB8, IF3</td>
<td>None</td>
<td>213</td>
<td>240</td>
<td>25 kg</td>
</tr>
</tbody>
</table>

---

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Column 2
Proper Shipping Name

Column 2 lists the acceptable proper shipping names for hazardous materials. Proper Shipping Names are shown in Roman type, NOT - ITALICS.

When an entry that is italicized refers to another entry in Roman type with the word "see" the name in Roman type must be used. (See Steel swarf above.) When an entry in Roman type refers to another entry in Roman type with the word "see" or "or" either name may be used. (See Strychnine and Strychnine salts above.)

Proper shipping names may be used in the singular or plural and in either capital or lower case letters.

The word "poison" may be used interchangeably with the word "toxic" for domestic shipments.
### Column 3
#### Hazard Class or Division

Column 3 reflects the hazard class and division number (if applicable) for the proper shipping name in column 2 (see “Chlorates, inorganic, n.o.s.” above). If the material is forbidden for transport, Column 3 will show the word “Forbidden” (see “Chlorine azide” above).

### Column 4
#### Identification Number

Column 4 reflects a UN or NA number that has been assigned to the proper shipping name. If it is an UN number it is acceptable for domestic or international transportation. If the number is an NA number this entry is only acceptable for transportation domestically within the United States and into Canada (see “Chlorine dioxide, hydrate, frozen” above).

### Column 5
#### Packing Group

Column 5 reflects the packing group(s) (if applicable) assigned to the proper shipping name (see “Chlorine” above – it does not have a packing group as it is a Class 2).

### Column 6
#### Label Codes

Column 6 specifies what hazard label(s) required for each package. If more than one hazard class number is in Column 6, the first hazard class number represents the Primary Hazard Label required, and any additional number(s) in Column 6 are the required Subsidiary Hazard Label(s).

**Important:** Column 6 is the only place that indicates if there is a subsidiary risk to a hazardous material. This is important to know because some subsidiary risk to a require placarding of vehicles and might affect segregation of two or more materials in a

---

### Table: Hazardous Materials Table

<table>
<thead>
<tr>
<th>Column</th>
<th>Hazardous materials descriptions and proper shipping names</th>
<th>Hazard class or Division</th>
<th>Identification Numbers</th>
<th>PG</th>
<th>Label Codes</th>
<th>Special provisions (§172.102)</th>
<th>Packaging (§173.400)</th>
<th>Quantity Limitations (see §172.200)</th>
<th>Vessel stowage (see §172.217)</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>Blue and clear liquid........................................</td>
<td>2, 3</td>
<td>UN1017</td>
<td>2, 3, 8</td>
<td>2, 89, 814, N86, N50, N190</td>
<td>None</td>
<td>Forbidden</td>
<td>304</td>
<td>314</td>
<td>315</td>
</tr>
<tr>
<td>(2)</td>
<td>Chlorine azide................................................</td>
<td>5.1</td>
<td>NA9101</td>
<td>6.1, 6.1</td>
<td>None</td>
<td>226</td>
<td>None</td>
<td>Forbidden</td>
<td>49, 51, 55, 62, 68, 89, 90</td>
<td>(10B)</td>
</tr>
<tr>
<td>(3)</td>
<td>Chlorine dioxide, hydrate, frozen.........................</td>
<td>Forbiden</td>
<td>N91251</td>
<td>2, 3, 8</td>
<td>1, 87, 89, B14, B110</td>
<td>None</td>
<td>Forbidden</td>
<td>304</td>
<td>314</td>
<td>315</td>
</tr>
<tr>
<td>(4)</td>
<td>Chlorine nitrate..............................................</td>
<td>2.3</td>
<td>UN1749</td>
<td>2, 3, 8</td>
<td>2, 89, 814, N86</td>
<td>None</td>
<td>Forbidden</td>
<td>304</td>
<td>314</td>
<td>315</td>
</tr>
</tbody>
</table>

---

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package, overpack, unit load device or cargo transport unit. The subrisk is also required to be placed on the Bill of Lading after the hazard class in parentheses 172.202(a)(2).

<table>
<thead>
<tr>
<th>Column 7 Special Provisions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Column 7</strong> reflects special provision codes and numbers which MUST be checked in 172.102. The codes have the “final-say” – they take precedence.</td>
</tr>
</tbody>
</table>

**Numbers**
- Apply to all modes of transportation and any type of packaging (bulk or non-bulk).
  - **“A”**
    - “A” numbers apply to air shipments only.
  - **“B”**
    - “B” numbers apply to bulk packaging (IBC and portable tank shippers must also check “IB” and “IP” numbers for IBC’s and “T” and “TP” numbers for tanks).
  - **“IB”/“IP”**
    - “IB” and “IP” numbers apply to Intermediate Bulk Containers.
  - **“N”**
    - “N” numbers apply to any non-bulk shipments.
  - **“R”**
    - “R” numbers apply to rail shipments only.
  - **“T”/“TP”**
    - “T” and “TP” numbers apply to portable tank shipments.
  - **“W”**
    - “W” numbers apply to water shipments only.

**Important**: Column 7 will indicate if the material has an inhalation hazard and what Zone has been assigned. This will require additional shipping paper entries and markings on the package. (See next page for more details.)
The user of 49 CFR is advised to pay attention to these special provisions. These codes are in addition to any other information regarding the material. Special provisions of particular importance in relation to inhalation hazard information are the numbers 1, 2, 3, 4, 5, 6, and 13. They may be found in § 172.102.

1. This material is poisonous by inhalation in Hazard Zone A, and must be described as an inhalation hazard under the provisions of this subchapter. (Class 2.3 Zone A and Class 6.1 Zone A)

2. This material is poisonous by inhalation in Hazard Zone B, and must be described as an inhalation hazard under the provisions of this subchapter. (Class 2.3 Zone B and Class 6.1 Zone B)

3. This material is poisonous by inhalation in Hazard Zone C, and must be described as an inhalation hazard under the provisions of this subchapter. (Class 2.3 Zone C)

4. This material is poisonous by inhalation in Hazard Zone D, and must be described as an inhalation hazard under the provisions of this subchapter. (Class 2.3 Zone D)

5. If this material meets the definition for material poisonous by inhalation, a shipping name must be selected which identifies the inhalation hazard in Division 2.3 or Division 6.1 as appropriate. (Potential PIH/TIH material. Analysis required)

6. This material is poisonous by inhalation and must be described as an inhalation hazard under the provisions of this subchapter. (PIH/TIH material other than #1 – 5)

13. The words “Inhalation Hazard” shall be entered on each shipping paper in association with the shipping description, shall be marked on each on-bulk package in association with the proper shipping name and identification number, and shall be marked on two opposing sides of each bulk package. Size of marking on bulk package must conform to 172.302(b) of this subchapter. The requirements of 172.203(m) and 172.505 of this subchapter do not apply. (Communications required only – marking, labeling and shipping papers)
§ 172.101 HAZARDOUS MATERIALS TABLE

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Hazardous materials description and proper shipping name</th>
<th>Hazard class or Division</th>
<th>Identification Numbers</th>
<th>PG</th>
<th>Special provisions (§172.102)</th>
<th>Packaging (§172.103)</th>
<th>Quantity limitations (see §§173.27 and 173.75)</th>
<th>Location (10A)</th>
<th>Other (10B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluoric acid, neat hydrofluoric acid, etc</td>
<td>2.3</td>
<td>UN1045</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fluorine, compressed</td>
<td>6.1</td>
<td>UN2841</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fluoroacetic acid</td>
<td>6.1</td>
<td>UN2842</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fluorochloromethane</td>
<td>3</td>
<td>UN1755</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Column 8**

**Packaging**

**Column 8A** - This column reflects a section to turn to in Part 173 that might give some relief to the regulations. This is where a shipper can determine if a Limited Quantity shipment or a Consumer Commodity shipment is allowed (see fluorobenzene above – the shipper may turn to 173.150 to see what exceptions are allowed). The shipper must use columns 8B to 8C if any one of the three following conditions occur:

1. The word “None” appears in Column 8A which means there are no exceptions available.
2. The shipper cannot meet the conditions of the exception.
3. The shipper elects not to sue the exception.

**Column 8B** - This column lists packaging authorizations (packaging instructions) for materials transported in non-bulk packaging (Fluorobenzene would go to 173.202).

**Column 8C** - This column lists packaging authorizations for materials transported in bulk packaging (Fluorobenzene would go to 173.242).

**Important:** The special provision numbers in Column 7 that refer us to 172.102 are in addition to the packaging authorizations. The special provisions might override the packaging authorizations.
### Column 9
**Quantity Limitations**

Column 9 consists of two columns. Normally a domestic shipment of hazardous materials is limited per package for whatever quantity or weight the package has been rated for by the manufacturer. (Usually found on the specification marking.) (See 173.26.) However, when using passenger aircraft, passenger railcar or cargo aircraft, Columns 9A and 9B reflect quantity limits **net quantity per completed package** (unless the word “gross” follows the quantity).

**Column 9A** – Reflects quantity limitations for passenger aircraft or passenger railcar.

**Column 9B** – Reflects quantity limitations for cargo aircraft (freighters).

If the word “Forbidden” appears in any column, it means the material may not be offered for transportation in the applicable mode (see methyl iodide above).

If we wished to ship Methyl isobutyl ketone (see above) on a passenger aircraft or passenger railcar, our net quantity allowed in each package would be 5L. If our package quantity exceeds this amount we must transport the material on a Cargo Aircraft Only (CAO) and our new limitation would be 60L per package. We would be required to apply the Cargo Aircraft Only label on our package next to the hazard label(s). We would also be required to enter “Cargo Aircraft Only” on the shipping paper following the required basic description.

---

#### Table: § 172.101 Hazardous Materials Table

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Hazard Materials Description and Proper Shipping Name</th>
<th>Hazard Class or Division</th>
<th>Identification Number</th>
<th>PG</th>
<th>Label Codes</th>
<th>Special Provisions (§172.102)</th>
<th>Packaging (§172.300)</th>
<th>Quantity Limitations (see §§173.27 and 175.75)</th>
<th>Vessel Stowage</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
<td>(5)</td>
<td>(6)</td>
<td>(7)</td>
<td>(8A)</td>
<td>(8B)</td>
<td>(9A)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Exceedings</td>
<td>Non-bulk</td>
<td>Bulk</td>
<td>Passenger Aircraft Only</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>T11, T12, T13, T14, T15, T16</td>
<td>201</td>
<td>243</td>
<td>Forbidden</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>381, 382, 383, 384, 385, 386</td>
<td>227</td>
<td>244</td>
<td>Forbidden</td>
</tr>
<tr>
<td></td>
<td>Methyl isobutyl carbinitol</td>
<td>3.1</td>
<td>3.1</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>150</td>
<td>203</td>
<td>60 L</td>
</tr>
<tr>
<td></td>
<td>Methyl isobutyl ketone</td>
<td>3.1</td>
<td>3.1</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>150</td>
<td>202</td>
<td>5 L</td>
</tr>
</tbody>
</table>
Column 10

Vessel Storage

Column 10 also consists of two columns. This columns show vessel stowage requirement codes.

Column 10A – Specifies the authorized stowage location on board vessels (ships). These codes consist of letters A through E and numerical codes 1 through 15. The codes are interpreted in 172.101(k). Our second material above, “urea nitrate, wetted with not less than 20 percent water, by mass” has a stowage category A. When we turn to 172.101(k), we find stowage category A allows that material to be stowed “on deck” or “under deck” on a cargo vessel and on a passenger vessel.

Column 10B – This column reflects very specific stowage codes for certain hazardous materials. These codes are interpreted in 176.84(b). Our same material above has a code 28 in Column 10B. When we turn to 176.84(b), we find code 28 tells us to stow our material “away from” flammable liquids.
Exercise 10

1. "None" in Column 8A mean that I may ship my material as a limited quantity?
   a. True
   b. False
   
   Explain your answer________________________________________________

2. May a shipper in Austin, TX ship a denatured alcohol, 3, NA1987 to Japan via Japan Airlines?
   a. Yes
   b. No
   
   Reference________________________________________________________

3. What is the proper shipping name for each of the following?
   a. Zinc fluorosilicate_____________________________________________
   b. Gas sample, non-pressurized, toxic, n.o.s., not refrigerated liquid________
   c. Hazardous substances, liquid, n.o.s._______________________________

4. Is a 50 lb. shipment of Calcium oxide shipped via ground by Yellow freight a hazardous material?
   ________________________________________________________________
Hazardous Substances and Reportable Quantities

There are a number of materials when shipped in certain quantities can be an endangerment to the environment if a spill or leak occurs. These materials are identified by the EPA as hazardous substances in their Title 40 CFR.

Appendix A to 172.101 of 49CFR reflects the list of possible hazardous substances (see excerpt below).

### Table 1 to Appendix A – Hazardous Substances other than Radionuclides

<table>
<thead>
<tr>
<th>Hazardous substance</th>
<th>Reportable quantity (RQ)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>pounds (kilograms)</td>
</tr>
<tr>
<td>Aconaphthene</td>
<td>100 (45.4)</td>
</tr>
<tr>
<td>Aconaphylene</td>
<td>5000 (2270)</td>
</tr>
<tr>
<td>Acetaldehyde</td>
<td>1000 (454)</td>
</tr>
<tr>
<td>Acetaldehyde, chloro-</td>
<td>1000 (454)</td>
</tr>
<tr>
<td>Acetaldehyde, trichloro-</td>
<td>5000 (2270)</td>
</tr>
</tbody>
</table>

A material becomes a hazardous substance if **two conditions** are met:

1. Is the material listed in Appendix A?
2. Are you shipping in **one package** an amount that **meets or exceeds** the amount shown in the Reportable Quantity Column of Appendix A?

You must answer **YES** to both questions for the shipment to become a hazardous substance.

If a shipment becomes a hazardous substance the letters **RQ** must be entered on the shipping paper either preceding or following the required basic description of the material. The letters **RQ** must also be marked on the package in association with the proper shipping name.

When a material is not a hazardous substance to begin with, but is found to be a hazardous substance, it becomes a hazardous material. When we look up hazardous substance in 172.101, we find “hazardous substance” in italics telling us to see “Environmentally hazardous substance, etc.”

When we turn to “Environmentally hazardous substance,” we find two possible names:

- “Environmentally hazardous substance solid, n.o.s.”
- “Environmentally hazardous substance liquid, n.o.s.”

There is a “G” in column 1 which requires the actual chemical or technical name of what we are shipping to be added to our new proper shipping name in parenthesis.
Example
We want to ship 100 pounds of Saccharin in one package. It is not listed as a hazardous material; however, since we are shipping an amount that meets the amount in Appendix A, we have a hazardous substance. Our Saccharin becomes Class 9 hazardous material and our shipping paper entry would be:

RQ Environmentally hazardous substance, solid, n.o.s. (Saccharin), 9, UN3077, III

Or, we may enter the RQ following the packing group III. RQ would also be marked on the package in association with our new proper shipping name.

Marine Pollutants

Any material listed in Appendix B of 172.101 shipped by vessel (by water) or in bulk packagings is regulated as a marine pollutant. This will require the words “Marine Pollutant” on the shipping paper clearly associated with the basic description (172.203).

When going by vessel non-bulk and bulk packaging must be marked. When going by vessel, bulk packaging must be marked on each end and each side. Non-bulk packages must be marked only once. When going by surface, bulk packages also must be so marked unless there is already a hazard placard on the package; then no marine pollutant mark is required. If the bulk packaging has a capacity of less then 3,785 L (1,000 gal) or is an IBC, the marine pollutant mark is only required to be on two opposing sides (172.322).

For some materials listed on Appendix B there is a PP in column 1. This indicates the material is a severe marine pollutant. Those materials without a PP in column 1 are considered “regular” marine pollutants. Both are treated equally when shipped in pure form.

Appendix A to HMT – List of Marine Pollutants

<table>
<thead>
<tr>
<th>Marine pollutant</th>
<th>Marine pollutant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohol C-6 – C-17 (secondary)poly(3-6) ethoxylate</td>
<td>Chlorodinitrobenzenes, liquid or solid</td>
</tr>
<tr>
<td>Aldicarb</td>
<td>1-Chloroheptane</td>
</tr>
<tr>
<td>Aldrin</td>
<td>1-Chlorohexane</td>
</tr>
<tr>
<td>Akyl (c12-c14) dimethylamine</td>
<td>Chloronitroanilines</td>
</tr>
<tr>
<td>Akyl (c7-c9) nitrates</td>
<td>Chloronitrotoluenes, liquid</td>
</tr>
<tr>
<td>Akylbenzenesulphonates, branched and straight chain (excluding C11–C13 straight chain or branched chain homologues)</td>
<td>Chloronitrotoluenes, solid</td>
</tr>
<tr>
<td>Alkyl bromide</td>
<td>1-Chloroocantane</td>
</tr>
<tr>
<td>ortho-Aminoanisole</td>
<td>Chlorophenolates, liquid</td>
</tr>
<tr>
<td>Aminocarb</td>
<td>Chlorophenolates, solid</td>
</tr>
<tr>
<td>Ammonium dimethyl-o-cresolate</td>
<td>Chlorophenyltrichloroethane</td>
</tr>
<tr>
<td>n-Amylbenzene</td>
<td>Chloropicrin</td>
</tr>
<tr>
<td>Azinphos-ethyl</td>
<td>alpha-Chloropropylene</td>
</tr>
<tr>
<td>Chlorotoluene (meta-para-)</td>
<td>Chlorpyrifos</td>
</tr>
</tbody>
</table>
When offering mixtures, solutions, n.o.s. shipments or very generic type shipments such as flammable liquid, n.o.s. or paints, the shipper must evaluate the percentage of the ingredients of the material. If the material contains 1% of a “severe” marine pollutant the material becomes a marine pollutant. If the material contains 10% of a “regular” marine pollutant it becomes a marine pollutant (171.8).

When a mixture or solution is not a hazardous material but because of the percentage of its ingredients makes it a marine pollutant, it becomes a hazardous material. When we look up marine pollutant in the HMT 172.101 we are instructed to use the name “Environmentally hazardous substance, liquid or solid, n.o.s.” There is a “G” in Column 1; therefore, the technical name making the mixture or solution a marine pollutant must be entered in parenthesis with the new proper shipping name.

Example:
A solution contains 2% Lindane and 98% water. Because of the dilution, the solution is no longer a hazardous material. However, because it meets or exceeds 1% of a severe marine pollutant, it becomes a hazardous material as well as a marine pollutant. Our basic description for our shipping paper would be:

Environmentally hazardous substance, liquid, n.o.s. (contains Lindane 2%), 9, UN3082, III

The words “Marine Pollutant” would also be entered on the shipping paper clearly associated with the basic description above. The package would display both a Class 9 label and the marine pollutant mark in addition to any other marking and labeling that is required.

The marine pollutant mark is not required on combination packaging when the inner packaging for a “severe” marine pollutant contains .5L (17 oz) or less for fluids and 500g (17.6oz) or less for solids; and for “regular” marine pollutants when the inner packagings contain 5L (1.3 gal) or less for liquids and 5 kg (11 lbs) or less for solids.
General Packaging Provisions

Subpart 173.24 and 173.24a pertain to general packing standards that must be met for every shipment of dangerous goods. Highlights from 173:

a. Effectiveness of package must not be substantially reduced.

b. No mixture of gases that could cause a spontaneous increase in heat or pressure that reduces the quality of the packaging.

c. Hazardous material must be checked for compatibility with their packaging.

d. Extra care must be taken with plastic packaging to avoid such things as softening and embrittlement.

e. Packing different dangerous goods and non-dangerous goods together in one outer packaging is allowed if they do not react dangerously together.

f. Packaging for solid materials that may become liquid in transportation must be capable of containing the materials in that liquid state.

g. Securing and cushioning inner packaging must be maintained as to prevent breakage and leakage. The function of the cushioning material must not be weakened, even in the event of leakage.

h. A closure use don specification packaging must conform to all applicable requirements of the specification and must be closed in accordance with information, as applicable, provided by the manufacturer’s notification.

Remember, it is the shipper's responsibility to make sure that all the packagings are allowed and are chemically resistant and compatible with the dangerous goods.
Case Study

In almost all cases, the identification of hazardous materials follows the same sequence:

Select a Proper Shipping Name from the Hazardous Materials Table. Determine if the material is a Hazardous Substance and/or Marine Pollutant. Identify and apply any Special Provisions for the material. Identify if any Exceptions to packaging may be applied and select the Authorized Packaging. Mark and Label the package. Complete the shipping papers.

We will be shipping a Limited Quantity of Acetone and will complete Steps 1 through 4.

**Substance:** Acetone

**Quantity:** 15 L

**Packaging Available:** 15 plastic inner packagings, 1 L each
Non-specific Fiberboard box

**Step 1** - Turn to the Hazardous Materials Table (172.101) and locate “Acetone.” Since Acetone is listed in Roman font, this is the Proper Shipping Name.

**Step 2** - Check 172.101 Appendix A to determine if the material is listed. If the material is listed does the amount per package meet or exceed the amount shown in the Reportable Quantity Column. Acetone is listed and we are below the RQ amount listed on the table (5000 lb) per package. Therefore, our shipment does not qualify as a Hazardous Substance shipment.
Step 3 - Read Column 7 to determine if there are any special provisions for our material. IB2, T4, and TP1 are listed for IBCs and tanks. We are shipping a non-bulk shipment on the ground, so none of these special provisions apply to our shipment.

Step 4 - Check Column 8A to determine if there are exceptions which may be applied. Since the number 150 is listed, we check 173.150. This section offers provisions for us to ship our material as a Limited Quantity. Shipping as a Limited Quantity offers us relief from labeling (unless transported by air), specification packaging, and placarding requirements. It also states that we may not exceed 30 kg (66 lb) gross weight for the package and our inner receptacles do not exceed 1 L each. We may ship our shipment as a Limited Quantity shipment.

Our shipping paper entry and package appear below.

<table>
<thead>
<tr>
<th>No. Shipping Units</th>
<th>Kind of Packaging, Description of Articles, Special Marks and Exceptions</th>
<th>Weight (KGS) to Collect or Charge</th>
<th>RATE</th>
<th>CHARGES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 box X</td>
<td>Acetone, 3, UN1000, II LTD QTY</td>
<td>25 kg</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

To:  
From:  
Acetone
Small Quantity Exceptions (173.4)

Small quantities of Class 3, 4.1, 4.2 (PG II and III), 4.3 (PG II and III), 5.1, 5.2, 6.1, 7, 8, and Class 9 materials that also meet the definition of one or more of these hazard classes are not subject to any other requirements of this subchapter when:

- The maximum quantity of material per inner receptacle is limited to:
  1. 30 ml (1 ounce) for authorized liquids, other than Division 6.1, PG I;
  2. 30 g (1 ounce) for authorized solids, other than Division 6.1, PG I;
  3. 1 g (0.04 ounce) for authorized materials classes as Division 6.1, PG I; and
  4. An activity level not exceeding that specified in 173.421, 173.424, 173.425 or 173.426, as appropriate, for a package containing a Class 7 (radioactive) material.

With the exception of temperature sensing devices, each inner receptacle:
- Is not liquid full at 55°C (131°F), and
- Is constructed of plastic having a minimum thickness of no less than 0.2 mm (0.008 inch), or earthenware, glass, or metal.

Combination packaging must be used and quantity limitations of this particular section must be met. In addition, certain packaging requirements are mandated and packages **MUST** be capable of passing the drop tests and stacking tests of 173.4(a)(6).

The gross weight of the competed package may not exceed 29 kg (64 lb).

The package must be marked by the shipper with the statement, "**This package conforms to 49 CFR 173.4.**"

Packages containing a Class 7 (Radioactive) material must also conform to the requirements of 173.421(a)(1) through (a)(5) or 173.424(a) through (g), as appropriate.

Excepted quantity shipments that meet the conditions of 173.4 are not subject to any other requirements of Subchapter C (Hazardous Materials Regulations).

Materials of Trade (173.6)

"Materials of Trade" means a hazardous material, other than hazardous waste, that is carried on a motor vehicle:

1. For the purpose of protecting the health and safety of the operator or passengers;
2. For the purpose of supporting the operation or maintenance of a motor vehicle (including its auxiliary equipment); or
3. By a private motor carrier (including vehicles operated by rail carrier) in direct support of a principal business that is other than transportation by a motor vehicle.

When transported by motor vehicle and in compliance with 173.6, a material of trade is not subject to any other requirements of this subchapter besides those set forth or referenced in this section.
There are additional requirements for materials and amounts, packaging, hazard communication, and aggregate gross weights.

Case Study 2
Non-bulk Packaging

Substance: Sodium nitrite, PG III
Quantity: 30 kg
Packaging Available: 5 plastic receptacles, 6 kg each
Fiberboard box (4G)

Following our 4 basic steps:

Step 1 - Turn to the Hazardous Materials Table (172.101) and locate “Sodium nitrite.”

Step 2 - Check 172.101 Appendix A to determine if the material is listed. If the material is listed, does the amount per package meet or exceed the amount shown in the Reportable Quantity column? Sodium nitrite is listed and our package is below the amount listed on the table (100 lb).

Step 3 - Read Column 7 to determine if there are any special provisions for our material. A1 and A29 are listed for air shipments. IB8, IP3, T1 and TP33 are listed for IBCs and tanks. We are shipping a non-bulk package so none of the special provisions applies to this shipment.

Step 4 - Check Column 8A for any exceptions. We must check 173.152. This exception has a 5kg limitation on PG III material. Since each of our inner receptacles exceeds 5kg, we may not use this exception. We must offer the material as a non-bulk shipment.

173.213 states that each packaging must:
   Be a non-bulk package that is listed.
   Conform to the general packaging requirement.
   Use UN specification packaging at performance level I, II, or III.

The plastic inner receptacles and the 4G fiberboard box are both listed.

We are now ready for Step 5 and 6.
General Packing Requirements

Types of Packaging

Packagings are of two types:

- Those manufactured to specifications mandated by the regulation (i.e. cylinders, portable tanks, etc.); and
- Those based on their performance as determined by testing (i.e. performance-oriented packaging)

Manufacturers must mark all authorized packaging (specification or performance-oriented) as required by Parts 178 and 179. This marking is the manufacturer’s certification that the packaging has been manufactured and tested properly.

Basic Guidelines

1. Hazardous materials can only be transported in packagings that are authorized by the regulations. The packaging authorized in Part 173 can only be used for a hazardous material if the section in Part 173 is referenced in Column 8 of the Hazardous Material Table for the Proper Shipping Name chosen for the material. Part 173 provides detailed packaging rules for each class of hazardous materials. The packaging requirement set forth for a specific hazardous materials are the same for all modes of transport unless otherwise stated or exceptions are authorized.

2. The more hazardous the material, the more restrictive the packaging requirements will be. This is not just determined by the hazard class, but also by the degree of hazard (i.e. the packing group).

Example:
Not all flammable liquids present the same degree of danger and the packaging requirement will reflect this.

3. Performance-oriented packaging test requirements are more or less restrictive depending on the Packing Group of the material for which the package is to be used.

4. All packages or packaging (bulk and non-bulk) must comply with the “General requirements of packaging and packages” (173.24).
Marking (172.300)

There are three marks required for non-bulk hazardous materials with few exceptions.

1. Proper Shipping Name (with technical name, if applicable)
2. UN or NA number with the appropriate prefix
3. Full name and address of the Shipper or Consignee (both are recommended). This is not required if the shipment is by highway only and will not be transferred from one motor carrier to another nor if the shipment is a carload lot, truckload lot or freight container load; and the entire contents of the rail car, truck or freight container are shipped from one consignor to one consignee.
Limited Quantity Markings

Packages containing Limited Quantities will have the following options of marking the packages:

1. Mark only the proper shipping name (172.301(a)(1))
Additional Required Non-bulk Markings (172.315)

1. **DOT-SP** (followed by the special permit number) if the shipment is authorized under a special permit.

   DOT-E exemptions issued prior to October 1, 2007 may still be used instead of a DOT-SP until (1) it has passed its expiration date, (2) terminated by the Associate Administrator, or (3) is issued as a Special Permit.

2. **Orientation arrows** must be marked on two opposite sides of combination packaging having inner packagings containing liquid hazardous materials – except as provided in 172.312(c).

3. **Inhalation hazard** shall be marked on packages containing materials that are poisonous by inhalation. This is not required if the package displays the inhalation hazard label.

4. **Poison** shall be durably marked on non-bulk plastic outer packaging used as a single or composite packaging for Toxic materials (172.313(b)).

5. UN number must be marked on vehicles or freight containers loaded at one facility that contain 1,000 kg (2,205 lb) of more of non-bulk packages that contain Poison Inhalation Hazard Zone A or Zone B materials having the same proper shipping name and identification number. (For different materials of the same hazard zone, use the identification number of the material having the greatest aggregate gross weight. For different materials in both Hazard Zone A or Zone B, use the identification number for the Hazard Zone A material.)

6. **EX-number** for Class 1 (explosives) materials – except as provided in 172.320.

7. **RQ** must be marked in association with the proper shipping name on packages that contain a reportable quantity of a hazardous substance (172.324(b)).

8. **Marine pollutant** mark is required for packages going by vessel if they contain a marine pollutant – except as provided by 172.322(d).

9. **UN or NA number** must be marked on vehicles or freight containers that contain a full load of non-bulk packages of hazardous materials loaded at one facility and the aggregate gross weight is 4,000 kg (8,820 lb) or more. This does not apply to Class 1, Class 7 or Limited Quantities.

   The UN or NA numbers in items 8 and 9 above must be displayed on the hazard placards or on orange panels next to the hazard placards.
Labeling (172.400)

The shipper is responsible for selecting and affixing the correct labels shown in Column 6 for the hazardous material being shipped.

The Shipper must:

1. Remove or obliterate any irrelevant labels already on the package.
2. Use only labels of durable quality and correct specifications reflected in 172.407.
3. Use English to inscribe on each label, in a durable manner, any required additional information (such as radioactive labels).
4. Affix the labels on the same surface of the package and near the Proper Shipping Name marking, if the package dimensions are adequate.
5. The following materials are excepted from labeling: small quantities and permitted Limited Quantities from Section 173.
Multiple Labeling Requirements

1. When Column 6 reflects more than one hazard class, the package must be labeled for each hazard. The first hazard indicates the primary hazard label; any other labels are subsidiary hazards.

2. When a hazardous material has a subsidiary hazard, but this hazard is not listed in Column 6 of the HMT, the package must be labeled with a sub-risk label according to 172.402(a)(2).

3. When different hazard classes are packed within the same combination packaging, the outside packaging must be labeled as required for each hazard class.

4. When two or more packages containing compatible hazardous materials are place in the same outside container or overpack, the outside container or overpack must be labeled for each hazard class.

Subsidiary Hazard Labels – 172.402(a)(2)

<table>
<thead>
<tr>
<th>Subsidiary hazard level (packing group)</th>
<th>Subsidiary Hazard (Class or Division)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3</td>
</tr>
<tr>
<td>I</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>X</td>
</tr>
<tr>
<td>III</td>
<td></td>
</tr>
</tbody>
</table>

X—Required for all modes.
**—Reserved
***—Impossible as subsidiary hazard.

Note: As of October 1, 2005, all labels – primary and subsidiary – must now display the hazard class number in the lower corner.

When multiple labels are applied they must be within six inches of each other (172.406(c)).
Case Study

Substance: Lead nitrate
Quantity: 20 kg
Packaging: 2 glass inner packagings containing 10 kg each, inside one 4G

<table>
<thead>
<tr>
<th>Symb</th>
<th>Hazardous materials descriptions and proper shipping names</th>
<th>Hazard class or Division</th>
<th>Identification Numbers</th>
<th>PG</th>
<th>Label Codes</th>
<th>Special provisions (§172.107)</th>
<th>(8)</th>
<th>(9)</th>
<th>(10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.1</td>
<td>Lead nitrate</td>
<td>II</td>
<td>5.1, 6.1</td>
<td>IB8, IP2, IP4, T3, TP33</td>
<td>152</td>
<td>212</td>
<td>242</td>
<td>5 kg</td>
<td>25 kg</td>
</tr>
</tbody>
</table>

Step 1
Refer to 172.101 (Hazardous Materials Table). Lead nitrate is in Roman print; therefore, it is an acceptable Proper Shipping Name. Column 1 is blank – it is regulated by all modes.

Step 2
Determine if we have a Reportable Quantity (RQ) by referring to Appendix A. Our material is listed, but it is above the amount listed per package. Therefore, the shipment is a hazardous substance and “RQ” must now be added to the package and paperwork.

If we were shipping a bulk shipment or shipping by water, we would be required to consult Appendix B to see if we have a marine pollutant. Our material is listed in Appendix B. Since our material is a marine pollutant, we would be required to put the marine pollutant mark on the package next to the labels. We would also be required to put the words “Marine Pollutant” on the shipping paper in association with the basic description.

Step 3
Check Column 7 for any special provisions that might apply to our shipment. IB8, IP2, IP4, T3 and TP33 are listed and these pertain to IBC and Portable Tank shipments. Therefore, there are no special provisions that affect our shipment.

Step 4
Check Column 8A to see if we have any exceptions available for our material. “152” appears; therefore, we can check 173.152 to see if any exceptions can be used for this shipment.

Our material is a Packing Group II. Limited Quantities of PGII that have a subsidiary risk of 6.1 may not exceed .500 kg per inner packaging. Our shipment exceeds that amount, so it may not be packaged as a Consumer Commodity. The shipment has no exception that we may use. We must go back to Column 8B. 173.212 allows glass inners and fiberboard box (4G) as outer packaging.

Step 5
Check Column 6 for the required hazard label(s). We find our material requires a primary hazard label 5.1 (oxidizer) and a subsidiary hazard label 6.1 (toxic).
Mark and label the package. Our inner package contains a solid; therefore, arrows are not necessary.

RQ, Lead nitrate
UN1469

To:
From:
Exercise 11

Complete all required markings – including the UN specification markings – and labeling for the following shipment. The shipment is by surface.

Contents: Paint UN1263 (PGII)
Inner Packaging: 5 steel inner packagings @ 1 gallon (3.78 L) each
Outer Packaging: 1 UN fiberboard box tested for a gross weight of 30 kg –
Manufactured in the United States in the year 2007 by JJPJ0793.
It is suitable for the Packing Group you are shipping.
This page left intentionally blank.
Shipping Papers

49 CFR does not require a specific form for hazardous material shipping papers. It can be a straight bill of lading, cargo manifest, waybill, or any other document used to transport freight. Whatever form is used must contain all the requirements of 172.200 through 172.204.

172.201(e) requires each person who provides the shipping paper to retain a copy for two (2) years after the material is accepted by the initial carrier. (Hazardous waste shipping papers must be retained for three (3) years.)

Consumer Commodity (ORM-D) shipments are exempt from the shipping paper requirements unless being shipped by air.

A shipping paper may combine hazardous and non-hazardous materials provided:

1. Hazardous materials are entered first and clearly separated from the non-hazardous
2. Hazardous materials are printed in a color that clearly contrasts with the non-hazardous
3. The shipping paper has a column with the heading “HM” in which the shipper can enter an “X” to indicate that whatever is to the right of the “X” is a hazardous material. (“RQ” may be entered here for hazardous substances instead of the “X.”)
Basic Description Requirements (172.201 and 172.202)

The information obtained in Columns 2, 3, 4, and 5 of the HMT gives us the required basic description of the hazardous material we intend to ship. The Proper Shipping Name, hazard class, identification number and Packing Group (if applicable) are shown in these columns. A new mandatory element to the basic description is the sub-risk. The sub-risk class or division must be entered in parenthesis immediately following the hazard class or division.

- **Butyryl chloride, 3, (8), UN2353, II**

There are a few exceptions:

1. The Packing Group may be preceded by the letters “PG.”
   - **Butyryl chloride, 3, (8), UN2353, PG II**

2. When technical or chemical names are required in parenthesis, they shall be entered following the Proper Shipping Name or the basic description
   - **Flammable liquids, n.o.s. (contains Acetone), 3, UN1993, III**
   - Or
   - **Flammable liquids, n.o.s., 3, UN1993, III (contains Acetone)**

3. The total quantity (by net or gross weight), capacity or as otherwise appropriate, including the unit of measurement of the hazardous material, must be shown before or after the required basic description.

4. The number and type of packages must be indicated before or after the basic description.
   - **12 4G boxes, 12 fiberboard boxes, 12 boxes**

5. The alternate basic description is Identification Number, Proper Shipping Name, Hazard Class, Sub-risk (if applicable) and Packing Group (if applicable).
   - **UN2353, Butyryl chloride, 3, (8), PG II**

**NOTE:** Effective January 1, 2013, the alternate basic description will be the only order authorized. International shipments currently require this method.

### Example of Basic Descriptions

<table>
<thead>
<tr>
<th>No. Shipping Units</th>
<th><em>H</em></th>
<th>Kind of Packaging, Description of Articles, Special Marks and Exceptions</th>
<th>Weight (if applicable)</th>
<th>RATE</th>
<th>COMFORMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 box</td>
<td>X</td>
<td>Paint, 3, UN1263, II</td>
<td>10 lbs</td>
<td></td>
<td></td>
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<tr>
<td>2 boxes</td>
<td>X</td>
<td>Flammable liquids, n.o.s. (contains acetone), 3, UN1993, III</td>
<td>5 lbs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 box</td>
<td>X</td>
<td>Ethylene dichloride, 3, (G.1), UN1184, PG II</td>
<td>15 lbs</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Additional Description Requirements (172.203)

In addition to the required basic descriptions previously mentioned, there are additional description requirements. Some of these are:

1. Hazardous substances required the letters “RQ” either before or after the required basic description of the material.

2. Limited quantity materials require the words “Limited Quantity” or “LTD QTY” following the basic required description.

3. Shipments under a Special Permit must bear the notation “DOT-SP” followed by the assigned exemption number. This must be clearly associated with the basic required description of the material to which the exemption applies.

4. Materials that are identified as “Poison – Inhalation Hazard” materials must have the words “Poison – Inhalation Hazard” followed by the appropriate Zone (i.e. Zone A, Zone B, etc.). These words must be shown immediately following the required basic description for the material.

Examples of Additional Descriptions

<table>
<thead>
<tr>
<th>No. Shipping Code</th>
<th>IM</th>
<th>Kind of Packaging, Description of Article, &quot;Special Marks and Exceptions&quot;</th>
<th>Weight (to Be Carried)</th>
<th>RATE</th>
<th>CHARGES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 drum</td>
<td>RQ</td>
<td>Benzene, 3, UN1114, II</td>
<td>230 lbs</td>
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<td></td>
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<tr>
<td>1 box</td>
<td>X</td>
<td>Acetone, 3, UN1090, II</td>
<td>15 lbs</td>
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<td></td>
</tr>
<tr>
<td>1 box</td>
<td>X</td>
<td>Propionitrile, 3, (6 1), UN2494, II</td>
<td>8 lbs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 box</td>
<td>X</td>
<td>Nitric acid, 5, UN251, II</td>
<td>DOT- E3630</td>
<td>5 lbs</td>
<td></td>
</tr>
<tr>
<td>1 box</td>
<td>X</td>
<td>Methylisothiocyanate, 6, (3), UN2417, I</td>
<td>Poison – Inhalation Hazard, Hazard Zone B</td>
<td>15 lbs</td>
<td></td>
</tr>
</tbody>
</table>

Emergency Response Information

There are two essential parts to emergency response information.

Emergency Response Information
Emergency Response Telephone Number

Emergency Response Information (172.602(a))

This subsection requires:

- Proper basic required description of the hazardous material(s)
- Immediate hazards to health
- Risks of fire or explosion
- Immediate precautions to be taken in the event of an accident or incident
- Immediate methods for handling fires
- Initial methods for handling spills or leaks in the absence of fire
- Preliminary first aid measures
The items listed above are the minimum requirements for information. This information is usually provided on the shipping paper with a Material Safety Data Sheet (MSDS) attached. Or a copy of the appropriate guide page from the North American Emergency Response Guidebook (NAERG) may be substituted.

However the information is given, it is required to provide the minimum details listed above. **This is the shipper’s responsibility.**

This information must be in English and available for use away from the package containing the hazardous material.

**The North American Emergency Response Guidebook**

Although the emergency response information may be furnished in any manner, the easiest method would be to enter the web and go to [http://hazmat.dot.gov/pubs/erg/gydebook.htm](http://hazmat.dot.gov/pubs/erg/gydebook.htm).

The Emergency Response Guidebook online allows the user to view or print Guide pages corresponding to the material being shipped. This can be done by clicking on a search by name or by identification number.

The response will be two pages that provide initial responders with information pertaining to “potential hazards” and “emergency response.” (All seven items required by 172.602(a) are included.)

If a shipper of hazardous materials printed out these two pages and attached them to the hazardous materials shipping paper, they would be in compliance.
POTENTIAL HAZARDS

HEALTH
- TOXIC; may be fatal if inhaled, ingested or absorbed through skin.
- Inhalation or contact with some of these materials will irritate or burn skin and eyes.
- Fire will produce irritating, corrosive and/or toxic gases.
- Vapors may cause dizziness or suffocation.
- Runoff from fire control or dilution water may cause pollution.

FIRE OR EXPLOSION
- HIGHLY FLAMMABLE: Will be easily ignited by heat, sparks or flames.
- Vapors may form explosive mixtures with air.
- Vapors may travel to source of ignition and flash back.
- Most vapors are heavier than air. They will spread along ground and collect in low or confined areas (sewers, basements, tanks).
- Vapor explosion and poison hazard indoors, outdoors or in sewers.
- Those substances designated with a "P" may polymerize explosively when heated or involved in a fire.
- Runoff to sewer may create fire or explosion hazard.
- Containers may explode when heated.
- Many liquids are lighter than water.

PUBLIC SAFETY
- CALL Emergency Response Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, refer to appropriate telephone number listed on the inside back cover.
- As an immediate precautionary measure, isolate spill or leak area for at least 50 meters (150 feet) in all directions.
- Keep unauthorized personnel away.
- Stay upwind. Keep out of low areas.
- Ventilate closed spaces before entering.

PROTECTIVE CLOTHING
- Wear positive pressure self-contained breathing apparatus (SCBA).
- Wear chemical protective clothing that is specifically recommended by the manufacturer. It may provide little or no thermal protection.
- Structural firefighters' protective clothing provides limited protection in fire situations ONLY; it is not effective in spill situations where direct contact with the substance is possible.

EVACUATION

Spill
- See the Table of Initial Isolation and Protective Action Distances for highlighted substances. For non-highlighted substances, increase, in the downwind direction, as necessary, the isolation distance shown under "PUBLIC SAFETY".

Fire
- If tank, rail car or tank truck is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions.
EMERGENCY RESPONSE

FIRE
CAUTION: All these products have a very low flash point: Use of water spray when fighting fire may be inefficient.
Small Fires • Dry chemical, CO₂, water spray or alcohol-resistant foam.
Large Fires
• Water spray, fog or alcohol-resistant foam.
• Move containers from fire area if you can do it without risk.
• Dike fire control water for later disposal; do not scatter the material.
• Use water spray or fog; do not use straight streams.

Fire involving Tanks or Car/Trailer Loads
• Fight fire from maximum distance or use unmanned hose holders or monitor nozzles.
• Cool containers with flooding quantities of water until well after fire is out.
• Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.
• ALWAYS stay away from tanks engulfed in fire.
• For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from area and let fire burn.

SPILL OR LEAK
• Fully encapsulating, vapor protective clothing should be worn for spills and leaks with no fire.
• ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area).
• All equipment used when handling the product must be grounded.
• Do not touch or walk through spilled material. • Stop leak if you can do it without risk.
• Prevent entry into waterways, sewers, basements or confined areas.
• A vapor suppressing foam may be used to reduce vapors.
Small Spills • Absorb with earth, sand or other non-combustible material and transfer to containers for later disposal.
• Use clean non-sparking tools to collect absorbed material.
Large Spills • Dike far ahead of liquid spill for later disposal.
• Water spray may reduce vapor; but may not prevent ignition in closed spaces.

FIRST AID
• Move victim to fresh air. • Call 911 or emergency medical service.
• Give artificial respiration if victim is not breathing.
• Do not use mouth-to-mouth method if victim ingested or inhaled the substance: give artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device.
• Administer oxygen if breathing is difficult.
• Remove and isolate contaminated clothing and shoes.
• In case of contact with substance, immediately flush skin or eyes with running water for at least 20 minutes.
• Wash skin with soap and water. • Keep victim warm and quiet.
• In case of burns, immediately cool affected skin for as long as possible with cold water. Do not remove clothing if adhering to skin.
• Effects of exposure (inhalation, ingestion or skin contact) to substance may be delayed.
• Ensure that medical personnel are aware of the material(s) involved and take precautions to protect themselves.
Emergency Response Telephone Number (172.604)

This subsection states:

- That an emergency response telephone number is required to be provided by anyone who offers a hazardous material for transportation. This number must include the area code or international access code for use.

- The number must be entered once on the shipping paper in a clearly visible location. The number must indicate that it is for emergencies only.

- The telephone number must be answered 24 hours-a-day and monitored at all time the hazardous material is in transportation, including storage incidental to transportation.

- The number must be answered by a person who is knowledgeable of the hazardous material being shipped and has comprehensive emergency response and incident mitigation information for the material or has immediate access to someone who does.

- The telephone number must be the number of the person offering the hazardous material for transportation or the number of an agency or organization capable of, and accepting responsibility for, providing the detailed information concerning the hazardous material.

- If an agency or organization is used, the person offering the material in transportation shall ensure that the agency or organization has receive current information on the material before it is offered for transportation.

Emergency response telephone numbers are not required for those materials which do not require shipping papers. The requirements of this section DO NOT apply to:

- Hazardous materials that are offered in Limited Quantities;

- Hazardous materials described under the Proper Shipping Names of:
  - Battery powered equipment
  - Battery powered vehicle
  - Carbon dioxide, solid
  - Castor bean
  - Castor flake
  - Castor meal
  - Castor pomace
  - Consumer Commodity
  - Dry ice
  - Engines, internal combustion
  - Fish meal, stabilized
  - Fish scrap, stabilized
  - Refrigerating machine
  - Vehicle, flammable gas powered
  - Vehicle, flammable liquid powered
  - Wheelchair, electric
**Exercise 12**

Please complete the Bill of Lading and mark and label the package. Use the information below:

- **Substance:** Formalin (with 30 percent Formaldehyde)
- **Quantity:** 20 L
- **Total Gross Weight:** 40 kg
- **Packaging:** 2 glass inner packagings containing 10 L each
- **Outer packaging:** 1 fiberboard box

<table>
<thead>
<tr>
<th>No. Shipping Units</th>
<th>HM</th>
<th>Kind of Packaging, Description of Articles, Special Marks and Exceptions</th>
<th>Weight (Subject to Correction)</th>
<th>RATE</th>
<th>CHARGES</th>
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</thead>
<tbody>
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</table>

![Image of a cube with dimensions]
Segregation

Segregation and Separation by Highway (177.848)

Specific requirements govern the segregation and separation of hazardous materials. For highway transportation of hazardous materials, the segregation requirements apply to materials that are in:

- Packages that must be labeled under Part 172;
- A compartment of a multi-compartmented cargo tank subject to 173.33; or
- Portable tanks loaded in a transport vehicle or freight container.

The following segregation table specifies the restrictions on loading, transporting and storing hazardous materials when offered for or transported by highway.

**Note:** Cyanides and cyanide mixtures may not be loaded or stored with acids.

**How to Use the Table 177.848(e)**

1. Locate the hazard classes or divisions of the material in question – one is in the vertical column, the other is in the horizontal row.
2. Follow each to the location where they intersect.
3. The codes at the intersection are defined as follows:
   - **"Blank"** means there are no restrictions.
   - **"X"** means the material may not be loaded, transported or stored together.
   - **"O"** means the material may not be loaded, transported or stored unless separated in a manner that, in the event of leakage, there would be no co-mingling of the materials under circumstances normal to transportation.
   - **"*"** means that segregation of different Class 1 materials is governed by the compatibility table in 177.848(f).
   - **"A"** means ammonium nitrate fertilizer may be loaded or stored with Division 1.1 or Division 1.5 materials, regardless of the "X."

The absence of any hazard class or division in the table indicates that no restrictions apply.
### Segregation Table for Hazardous Materials

<table>
<thead>
<tr>
<th>Class or Division</th>
<th>Notes</th>
<th>1 1 1 2</th>
<th>1 3 1.4</th>
<th>1.5 1.6</th>
<th>2.1 2.2</th>
<th>2.3 Gaseous Zone A</th>
<th>2.3 Gaseous Zone B</th>
<th>3 3.1 3.2</th>
<th>3.3 3.4</th>
<th>3.5 3.6</th>
<th>4.1 4.2</th>
<th>4.3 4.4</th>
<th>5.1 5.2</th>
<th>5.3 5.4</th>
<th>5.5 5.6</th>
<th>6.1 Liquids PG Zone A</th>
<th>7 8 Liquids Only</th>
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<tbody>
<tr>
<td>Explosives</td>
<td>1.1 and</td>
<td>A</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
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<td>Flammable solids</td>
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<td>Non-flammable</td>
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<td>Poisonous gases</td>
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<td>Flammable solids</td>
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<td>Spontaneously com-</td>
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</tbody>
</table>

(e) Instructions for using the segregation table for hazardous materials are as follows:

(1) The absence of any hazard class or division or a blank space in the table indicates that no restrictions apply.

(2) The letter "X" in the table indicates that these materials may not be loaded, transported, or stored together in the same transport vehicle or storage facility during the course of transportation.

(3) The letter "O" in the table indicates that these materials may not be loaded, transported, or stored together in the same transport vehicle or storage facility unless separated in a manner that, in the event of leakage from packages under conditions normally incident to transportation, the mixing or storage of hazardous materials would not occur. Notwithstanding the methods of separation employed, Class 8 corrosive liquids may not be loaded above or adjacent to Class 4 flammable or Class 5 oxidizing materials; except that shippers may load truckload shipments of such materials together when it is known that the mixture of contents would not cause a fire or a dangerous building of heat or gas.

(4) The "*" in the table indicates that segregation among different Classes (explosive) materials is governed by the compatibility table in paragraph (f) of this section.

(5) The note "A" in the second column of the table means that, notwithstanding the requirements of the letter "X", ammonium nitrate (UN 1942) and ammonium nitrate fertilizer may be loaded or stored with Division 1.1 (explosive) or Division 1.5 materials.

(f) When the §172.101 table or §172.402 of this subchapter 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 asphyxiating gases, or formation of corrosive or unstable materials.

(f) Class 1 (explosive) materials shall not be loaded, transported, or stored together, except as provided in this section, and in accordance with the following table:

### Compatibility Table for Class 1 (Explosive) Materials

<table>
<thead>
<tr>
<th>Compatibility Group</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>J</th>
<th>K</th>
<th>L</th>
<th>N</th>
<th>S</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<tr>
<td>B</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<td>X</td>
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<tr>
<td>C</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<tr>
<td>D</td>
<td>X</td>
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<td>G</td>
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<td>K</td>
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<tr>
<td>N</td>
<td>X</td>
<td>X</td>
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<td>S</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<td>X</td>
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<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>
Exercise 13

1. May the following be loaded next to each other on the same vehicle?
   a. Class 3 and Class 8 (liquid) Yes No
   b. Division 2.3, Zone A and Division 2.2 Yes No
   c. Division 5.1 and Class 3 Yes No
   d. Division 4.3 and Division 4.2 Yes No

2. May you stack a package containing 1 Liter of 1-Pentol on top of a package containing 25 kg of Sodium nitrate? Please explain your answer.

_________________________________________________________________________________

_________________________________________________________________________________

_________________________________________________________________________________
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Overpacks (173.25)

If a shipper has one or more completed packages that need to be transported to the same final destination, it may be possible to ship them as one unit for convenience of handling and stowage.

An overpack is an enclosure that is used by a single shipper to provide protection or convenience in handling of a package or to consolidate two or more packages. Overpack does not include a transport vehicle, freight container, or aircraft unit load devise.

Examples of overpacks are one or more packages:

1. Placed or stacked onto a load board (such as a pallet or skid) and secured by strapping, shrink wrapping, stretch wrapping, or other suitable means; or
2. Placed in a protective outer packaging, such as a box or crate.

Packages within an overpack must meet the general packing requirements of 173.24 and must be marked and labeled according to the regulations.

If a representation of all marks and labels on the packages within the overpack are not visible then all marks and labels must be reproduced to the outer overpack. In other words, whatever hazardous information is covered up by an overpack must be duplicated on the outside.

Class 8 materials and Division 5.1 materials in PG I may NOT be overpacked with any other materials.

Important: Before overpacking packages, the shipper must ensure that each package has fully complied with the regulations. Each package must be complete as though it were being shipped by itself. Also the shipper must ensure that the packages are compatible.
Examples of an Overpack Shipment

The shipper is shipping 2 L of Thioglycol and 5 L of Ethyl formate. The shipper must complete all the required steps for each material that we have covered. Each package must be complete. The shipper must ensure the materials are compatible.

After the packages are overpacked, the overpack must be marked and labeled for each hazardous material inside. There were two UN 4G packages placed inside the overpack; therefore, the statement “Overpack” must be marked on the overpack.

When entering hazardous materials on a shipping paper for packages that have been overpacked, the entries are the same. Each package is entered as though it is going by itself in the usual manner. After the last package in the overpack is entered, a statement should follow to indicate the packages listed above are in an overpack. (This is why overpacked shipments should be listed first on a shipping paper. Other packages in a shipment can follow this statement.)

<table>
<thead>
<tr>
<th>No. Shipping Units</th>
<th>X</th>
<th>Kind of Packaging, Description of Articles, Special Marks and Cautions</th>
<th>Weight (Subject to Dimensions)</th>
<th>RATE</th>
<th>CHARGES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 box X</td>
<td></td>
<td>Thioglycol, 5.1, UN2966, II</td>
<td>8 lbs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 box X</td>
<td></td>
<td>Ethyl formate, 3, UN1190, II</td>
<td>13 lbs</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>“OVERPACK used for the above”</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Exercise 14

You have packed the following materials into UN 4G boxes and wish to overpack them. Mark and label the overpack below for the packages that you put inside. Complete the shipping paper as well.

5 L  Acrylamide solution, gross weight 15 lbs
5 L  Picolines, gross weight 15 lbs

<table>
<thead>
<tr>
<th>No. Shipping units</th>
<th>5</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kind of Packaging, Description of Articles, Special Marks and Exceptions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight (Subject to Correction)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RATE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHARGES</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
This page left intentionally blank.
Materials Not Listed in the Hazardous Materials Table

When we are offering for transport a hazardous material which is listed in the Hazardous Materials Table, it is a step-by-step process to complete the packing and documentation requirements.

However, with thousands of chemicals in existence today, many names will not be found in the HMT. These items must be assigned a Proper Shipping Name based on their properties and the hazards involved.

In most cases, these names will be assigned a Proper Shipping Name ending in “n.o.s.”

Example

Substance: Trichloromethylene

Properties: Organic liquid with an Oral LD50 = 50 mg/kg

Quantity: 1 L (plastic receptacle) in a 4G

Step 1

Look of Trichloromethylene in the HMT.

Since the material is not listed, we must assign a Proper Shipping Name based on the properties and the hazards exhibited. We should try to determine the Proper Shipping Name in accordance with the chemical family name (e.g. alcohols, etc.) if the family name exists in the HMT.

Since the chemical family name is not shown, we will make a determination of the Proper Shipping Name by the end-use of the product or the hazard class(es) the material exhibits. We do not know what the product is used for, but we do know the hazard class, as the material exhibits oral toxicity.

Step 2

Determine the Primary Hazard and the Packing Group.

Our fictitious MSDS told us this material had an Oral LD50 of 50 mg/kg. There were no other hazards represented by the MSDS, so our material is toxic.

To determine the packing group of the material, we must consult the table in 173.133(a)(1).

<table>
<thead>
<tr>
<th>Packing group</th>
<th>Oral toxicity LD50 (mg/kg)</th>
<th>Dermal toxicity LD50 (mg/kg)</th>
<th>Inhalation toxicity by dusts and mists LC50 (mg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>≤5.0</td>
<td>≤50</td>
<td>≤0.2</td>
</tr>
<tr>
<td>II</td>
<td>&gt;5.0 and ≤50</td>
<td>&gt;50 and ≤200</td>
<td>&gt;0.2 and ≤2.0</td>
</tr>
<tr>
<td>III</td>
<td>&gt;50 and ≤300</td>
<td>&gt;200 and ≤1000</td>
<td>&gt;2.0 and ≤4.0</td>
</tr>
</tbody>
</table>

Utilizing this table, we find our material falls under Packing Group II.
Step 3
Determine the Proper Shipping Name and the UN Number.

Column 1 of the HMT contains the letter “G” for those Proper Shipping Names requiring the addition of a chemical or technical name to be shown in parentheses. Since our material is a “toxic organic liquid” we will refer to the HMT and locate entries beginning with the word “toxic.” We will also be looking for the words “liquid” or “organic.”

Our Proper Shipping Name becomes:

**Toxic, liquids, organic, n.o.s. (Trichloromethylene)**

The UN Number becomes **UN2810**.

We are now able to obtain all necessary information for packaging, marking, labeling and documentation requirements for this material.

Step 4
Package the material in accordance with the HMT.

In referencing the HMT, we note Column 8B states that we should look in 173.202 for the non-bulk packaging authorizations.

**Caution!!** There are three Packing Groups listed for the Proper Shipping Name we have selected. The shipper must determine the Packing Group prior to selection of the Proper Shipping Name or the wrong information may be used.

We wish to ship this material in a UN fiberboard box.

When referencing 173.202, we note that for combination packagings (inner and outer packagings together), a 4G outer and plastic inner receptacles are authorized for this material.

We would also check Column 7 to ensure that no special provisions apply to our material. The only special provisions listed are those for Bulk or IM Portable Tanks. These special provisions do not apply to our shipment.

We also check to determine if our material is a Hazardous Substance. Since the material is not listed in Appendix A to 172.101, we do not meet the definition of a Hazardous Substance.
Step 5
Mark and label the package for transport.

Assure the correct package specification markings have been applied by the packaging manufacturer.

Mark the Proper Shipping Name with the technical name and the UN Number.

Affix the “Toxic” label.

Mark with orientation arrow on two opposing sides.

Step 6
Document the shipment.
Exercise 15
Materials Not Listed By Name

1. An organic liquid not listed in the Hazardous Materials Table has an Oral LD50 of 10 mg/kg and a dermal LD50 of 55 mg/kg with no other hazards present. Its technical name is Trimethylene.

   a. What is the hazard class?

   b. What is its Packing Group?

   c. What is the Proper Shipping Name?

   _____________________________________________________________

   _____________________________________________________________

   _____________________________________________________________