6.0D CARRIER REQUIREMENTS – WATER
STUDENT WORKBOOK
**Table of Contents**

Table of Contents.......................................................................................................................................... 2
Module 6.0d: Carrier Requirements – Water ............................................................................................... 4
   Introduction .............................................................................................................................................. 4
      Introduction .......................................................................................................................................... 4
      Objectives.............................................................................................................................................. 4
   Use of International Maritime Dangerous Goods Code ........................................................................... 4
   Title 49, CFR Part 176 - Carriage by Vessel ........................................................................................... 4
   Definitions of Terms Used in Part 176 .................................................................................................. 4
   Training and Record Keeping ................................................................................................................ 5
   Preparation of Hazardous Materials ................................................................................................. 5
      General Operating Requirements ................................................................................................. 5
      General Handling and Stowage ........................................................................................................ 7
      Stowage Locations ........................................................................................................................... 7
      Alternate Stowage Locations ........................................................................................................... 8
   Stowage Requirements ....................................................................................................................... 8
   General Segregation Requirements .................................................................................................. 9
      General Segregation Requirements .............................................................................................. 9
      Segregation Table .......................................................................................................................... 10
      Segregation Table Definitions for Breakbulk Cargo ........................................................................ 11
      Segregation Table Definitions ...................................................................................................... 11
      Segregation Tables for Freight Containers and Transport Units .................................................... 12
      Segregation Table for Freight Containers ..................................................................................... 12
      Segregation Table for Trailerships ............................................................................................... 12
   Ferry Vessels and Barges .................................................................................................................... 12
      Special Requirements for Hazardous Materials Transported on Board Ferry Vessels ................... 12
      Special Requirements for Barges .................................................................................................. 12
      Detailed Requirements for Class 1 (Explosives) ............................................................................ 12
      Loading and Unloading Requirements: Class 1 Explosives ........................................................... 13
      Responsible Person for Class 1 (Explosive) Materials ................................................................... 13
General Stowage Conditions for Class 1 (Explosive) Materials ........................................................... 13
Electrical Equipment ........................................................................................................................... 14
General Stowage Conditions for Class 1 (Explosive) Materials ........................................................... 14
Segregation Requirements for Class 1 (Explosive) Materials ............................................................. 15
Transport and Handling Class 1 .............................................................................................................. 16
Stowage Arrangements in Passenger Vessels ..................................................................................... 16
Transport of Class 1 (Explosive) Materials in Vehicle Spaces ............................................................. 16
Transport of Class 1 (Explosive Materials) in Freight Containers ....................................................... 17
Special Handling Requirements for Class 1 (Explosives) While in Port .................................................. 17
Stowage of Class 1 (Explosive) Materials on Magazine Vessels .......................................................... 19
Precautions Loading/Unloading .............................................................................................................. 19
Precautions During Loading and Unloading for Class 1 ...................................................................... 19
Other Special Requirements ................................................................................................................... 20
Detailed Requirements for Class 2 (Compressed Gas) Materials ....................................................... 20
Detailed Requirements for Class 3 (Flammable) and Combustible Liquid Materials ................................ 20
Detailed Requirements for Class 4 (Flammable Solids), Class 5 (Oxidizers and Organic Peroxides), and Division 5.1 Materials ................................................................................................. 21
Permit Requirements for Division 1.5 Materials, Ammonium Nitrate and Ammonium Nitrate Mixtures ................................................................................................................................. 21
Detailed Requirements for Division 2.3 (Poisonous Gas) and Division 6.1 (Poisonous Materials) .... 21
Detailed Requirements for Radioactive Materials .................................................................................. 21
Requirements Relating to Transport Indexes and Segregation Distances .............................................. 22
Leakage or Contamination from Radioactive Material ........................................................................... 22
Requirements for Class 8 (Corrosive) Materials .................................................................................... 22
On-Deck Stowage of Class 8 Materials ................................................................................................... 22
Detailed Requirements for Cotton and Vegetable Fibers, Motor Vehicles, and Asbestos ................... 22
Incident Reporting ................................................................................................................................. 23
Reportable Incidents ............................................................................................................................. 23
Summary ................................................................................................................................................. 24
References .............................................................................................................................................. 24
Module 6.0d: Carrier Requirements – Water

Introduction

This module is based on Part 176 of the Hazardous Materials Regulations (HMR) and covers the requirements for accepting and/or transporting hazardous materials by most commercial vessels, foreign or domestic, when in the navigable waters of the United States. Exceptions are found in Section 176.5(b). Part 176 requirements for vessel transportation are in addition to those contained in Parts 171, 172 and 173 of the HRM.

Objectives

1. Summarize general operating requirements, as well as general handling, stowage, and segregation requirements for transporting hazardous materials by commercial vessels.
2. Define special requirements for transport vehicles and barges.
3. Recognize segregation requirements for specific classes of hazardous materials and highlight any exceptions to those requirements.
4. Compare the uses of the International Maritime Dangerous Goods (IMDG) Code for similarities to and differences from the uses of the HMR.
5. Identify and apply the incident reporting requirements in 49 CFR.

Use of International Maritime Dangerous Goods Code

You may use the International Maritime Dangerous Goods (IMDG) Code when carrying hazardous materials by vessel, as long as you also follow the requirements listed in sections 171.22 and 171.25 of the HMR.

Title 49, CFR Part 176 - Carriage by Vessel

Part 176 is divided into Subparts A through O:

- Subparts A through D provide general information and operating requirements, as well as general handling, stowage, and segregation requirements.
- Subparts E and F provide special requirements for transport vehicles and barges loaded with hazardous materials.
- Subparts G through O provide detailed requirements for specific classes of hazardous materials.

Definitions of Terms Used in Part 176

Definitions for the terms used in Part 176 are given in section 176.2. Familiarity with these terms is important in properly applying the regulations in this part. Spend some time looking at these definitions in section 176.2.
Training and Record Keeping

Under section 176.13, each carrier must ensure that its employees involved in the transportation of hazardous materials are trained in accordance with the HMR, Part 172, Subpart H. The record of training required by section 172.704(d) must be kept on board the vessel while the crew member is in service on board the vessel.

Preparation of Hazardous Materials

Under section 176.3, all hazardous materials must be prepared for transportation in accordance with Parts 172 and 173 of the HMR before they can be transported by vessel. Explosives forbidden under section 173.54 may not be transported by vessel.

General Operating Requirements

You may not transport hazardous materials by vessel unless they are properly described and certified on the shipping paper as set forth in Part 172. General operating requirements also align with Part 176, Subpart B.

Container Packing Certificate

At the time a freight container or transport vehicle containing hazardous materials is offered for transportation by vessel, the person responsible for packing or loading it must give the vessel operator a signed container packing certificate stating:

- The container or transport unit is serviceable for the material loaded therein
- It contains no incompatible goods
- That it is properly marked, labeled, and placarded as applicable
- The packages contained within the container have been properly inspected, marked, labeled or placarded, and secured, and are not damaged

The signed certification may be on the shipping paper or on a separate document stating that the packing of the container has been carried out in accordance with the provisions of the 49 CFR and the IMDG Code. (Sample wording can be found in section 176.27(c)(2). The container packing certification statement is in addition to the shipper’s certification in section 172.204.)

Stowage and Segregation

The term “stowage” as used in this lesson refers to where a cargo may be located on the vessel and how it is secured. The term “segregation” refers to a separation of hazardous cargo from other hazardous cargoes by distance or barriers.

Stowage and segregation are critical on a vessel because of the forces and stresses that affect it while it is underway. Rotational and linear forces can cause shifts of cargo that can result in significant damage.
Dangerous Cargo Manifest, List, or Stowage Plan
The carrier must prepare a dangerous cargo manifest, list, or stowage plan for materials subject to the requirements of 49 CFR or the IMDG Code. The carrier must prepare a dangerous cargo manifest, list, or stowage plan for materials subject to the requirements of 49 CFR or the IMDG Code. A list of the information required is:

- Name of the vessel and official number
- Nationality of vessel
- Shipping name and identification number of each hazardous material on board
- The number and description of each type of package
- Classification of the hazardous material in accordance with either the HMR or IMDG
- Any additional description required by section 172.203
- Stowage location of hazardous material
- Additional information in the case of a vessel used for the storage of explosives or other hazardous materials

You must keep this document in a designated holder on or near the vessel's bridge. Each carrier must retain a copy of the dangerous cargo manifest for at least one year.

Inspections
After stowage is complete, the carrier must inspect each hold or compartment containing hazardous materials, to ensure that stowage has been accomplished properly and that there are no visible signs of damage.

The carrier must inspect again after periods of heavy weather, and, unless the vessel is equipped with smoke- or fire-detecting systems with automatic monitoring capability, every 24 hours.

Accidents
If an accident occurs on board a vessel damaging hazardous materials packages, then damaged or unauthorized packagings may be used on an emergency basis only, but may not be offered to any forwarding carrier for transportation.

The master of the vessel must request instructions for disposition of the packages from the nearest United States Coast Guard Captain of the Port (COTP).

The master of the vessel may decide to jettison hazardous materials only to prevent or substantially reduce a hazard to human life or reduce a substantial risk to property.

Damaged Packages
A carrier may not transport by vessel any damaged package containing hazardous materials that appears to have leaked or may leak. Packages may be repaired or restored to the satisfaction of the master of the vessel. A package containing radioactive materials (other than low-specific activity), may not be repaired or restored.
Misrepresentation
A carrier may not knowingly transport by vessel any hazardous material offered under a deceptive name, marking, invoice, or shipping paper. If a shipment is found to be in violation while in transit, the master of the vessel must take whatever measures are necessary to ensure the safety of the vessel, its passengers, and its crew.

If the vessel is in port, the carrier may not deliver the shipment to any party, and the master must immediately request instructions for disposal of the material from the nearest COTP.

Repairs
The carrier must not repair a vessel containing hazardous materials using welding, burning, or power-actuated tools and appliances that may produce intense heat, unless the emergency repairs are necessary for safety reasons, or the work has previously been approved by the COTP.

General Handling and Stowage
You may handle or stow hazardous materials on board a vessel only under the direction and observation of a responsible person who has been assigned this duty.

On domestic vessels, this person must be a licensed officer assigned to the vessel, except it may also be an employee of the carrier when the vessel is engaged in a coastwise voyage or on rivers, bays, sounds, or lakes. On a foreign vessel, the responsible person must be an officer of the vessel.

These requirements also align with Part 176, Subpart C.

Before you may stow hazardous materials on board a vessel, each hold or compartment must be free of debris. This requires examination of the bilges to ensure that residue from previous cargo has been removed.

Stowage Locations
Column 10 of the Hazardous Materials Table, (HMT) in section 172.101 contains specific information relating to authorized vessel stowage locations. Column 10A, Vessel stowage, Location, specifies the authorized stowage locations on board cargo and passenger vessels. They are defined in section 172.101(k).

- “On Deck” means located on the weather deck
- “Under the deck” means located in a hold or compartment below the weather deck
- “Under deck away from heat” means located under deck and have built-in means of ventilation

Column 10B, Vessel stowage, Other, specifies codes for vessel stowage requirements for specific hazardous materials. The meaning of each code found in Column 10B is defined in section 176.84.

Column 7 of the HMT specifies codes for special provisions applicable to hazardous materials. The “W” codes, in particular, only apply to transportation by water. The meaning and requirements of each special provision are found in section 172.102.
**Limited Quantities**
Hazardous materials offered for transport as limited quantities are allocated stowage category A and are not subject to any of the specific stowage requirements indicated in column 10B in section 172.01 of this subchapter for the material being transported.

**Alternate Stowage Locations**
If the prescribed stowage location is shown to be impractical for a vessel, the COTP may authorize in writing an alternative stowage location or method of segregation as long as it will afford the same level of safety.

**Stowage Requirements**
Hazardous materials must be stowed in a manner that will facilitate inspection during the voyage, removal from a potentially dangerous situation, and removal in case of fire.

If a package contains liquid hazardous materials, it must have orientation markings on it and bestowed with the markings pointing up. The carrier must secure packages of hazardous materials to prevent shifting in any direction and brace them so that they are not likely to be pierced or crushed by a superimposed load.

**Marine Pollutants**
You must properly stow and secure marine pollutants to minimize the hazards to the marine environment without impairing the safety of the ship and the people on board.

**Break-Bulk Hazardous Materials**
You may not use a metal bale hook to handle any packages of hazardous materials.

You may not use equipment designed to lift or move cargo by means of pressure exerted on the package, if the package was not designed to be moved in that manner, or if it could cause damage to the package.

Other equipment used must supply adequate support to the packages to prevent them from falling during loading.

**On Deck Stowage of Break-Bulk**
Under section 176.74 the following guidelines pertain to the stowage of hazardous materials on decks of vessels:

- Packages must be secured in boxes, cribs, or cradles and lashed with wire rope, strapping or by other means
- Packaging susceptible to weather or water damage must be protected
- No more than 50 percent of the open deck area should be used for stowage of hazardous materials except Class 9 material
- Hazardous materials may not be stowed in crew and passenger spaces or areas set aside for the crew’s use
• Stowed hazardous materials must permit access to the crew’s quarters and to all parts of the deck required for navigating and working the vessel
• No lifesaving and firefighting devices or passageways may be blocked by the stowage of hazardous materials
• Hazardous materials may not be stowed within 25 feet of an operating or embarkation point of a lifeboat
• Runways for use of the crew, built over stowed hazardous materials must contain rails and lifelines for the crew’s protection

Transport Vehicles, Freight Containers, and Portable Tanks
When carrying transport vehicles, freight containers, and portable tanks containing hazardous materials by vessel, additional conditions under section 176.76, including the following, must be met:

• The hazardous materials must be in proper condition for transportation
• All packages in the vehicles or containers must be secured to prevent shifting in any direction
• Each package with orientation markings must be stowed with the orientation arrows pointing up
• Any slack space between packages must be filled with dunnage
• The weight in the container must be evenly distributed and the maximum permissible weight must not be exceeded
• Bulkheads made of dunnage must be provided if the packages are not stowed flush with the sides or ends
• Each level of bagged and baled cargo must be stored in alternate directions so that each tier will bind to the one below
• All hazardous materials must be contained entirely within the freight container with the exception of oversized vehicles with batteries attached
• Additional requirements for transporting freight containers and vehicles containing Class 1 (explosive) materials are found in sections 176.168 through 176.172
• Special requirements for transporting cryogenic liquids are found in sections 176.76(g) and for fumigated transport units in 176.76(h)

Use of Power-Operated Industrial Trucks
Power-operated trucks or cargo handling vehicles, like forklifts, must conform to the requirements of section 176.78 before they may be used onboard a vessel in a space containing hazardous materials.

Truck ratings and special operating conditions are designated in section 176.78, with minimum safety features identified in section 176.78(f).

General Segregation Requirements

General Segregation Requirements
General requirements for segregation are found in Part 176, Subpart D. When you stow hazardous materials together, you must segregate them according to the General Segregation Table found in section 176.83(b).

Additional requirements for segregation are found in Column 10B of the Hazardous Materials Table in section 172.101.
Section 176.84(b) applies to a broad range of materials and additional notes for Class 1 (explosive) materials can be found in section 176.84(c)(2). If the requirements differ, you must use the most restrictive segregation requirements.

**Segregation Table**

To use the General Segregation Table, section 176.83(b), by finding one class of material in the vertical column, and then finding another class in the horizontal row. The intersection of the vertical column and the horizontal row contains a number or symbol that represents the method of segregation that you must use between the two classes.

**Note:** The terms associated with these numbers and symbols are listed at the bottom of the table.

![Segregation Table Image](image-url)
**Segregation Table Definitions for Breakbulk Cargo**

"Away From"

"Away From" means that incompatible hazardous materials may be carried in the same compartment, hold, or deck provided they are horizontally separated by 3 meters (10 feet).

"Separated from"

The definition "Separated from" found in section 176.83(b)(2)(iii) means packages must be carried in different compartments or holds if “under deck,” and separated horizontally by 6 meters (20 feet) if “on deck.”

"Separated by a complete compartment or hold form"

The definition "Separated by a complete compartment or hold from" found in section 176.83(b)(2)(iv) means packages may be separated between decks as long as one of the decks is resistant to fire and liquid or, if “on deck,” horizontally separated by 12 meters (39 feet).

"Separated longitudinally by an intervening complete compartment or hold from"

The definition "Separated longitudinally by an intervening complete compartment or hold from" found in section 176.83(b)(2)(v) means for packages separated between “under deck” and “on deck,” a complete compartment must separate them, as well as a longitudinal distance of 24 meters (79 feet).

For “on deck” stowage, a separation of at least 24 meters (79 feet) longitudinally must be maintained.

**Segregation Table Definitions**

X - The segregation, if any, as shown in the §172.101 table

Where the code in Column (10B) of Table 172.101 specifies that "Segregation as for" applies, the segregation requirements applicable to that class in the §176.83(b) General Segregation Table must be applied. Section 176.83(d) states that two hazardous materials for which any segregation is required may not be stowed in the same cargo transport unit.

<table>
<thead>
<tr>
<th>Label Code</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 Location</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>(6)</td>
<td>(7)</td>
<td>(8A)</td>
<td>(8B)</td>
<td>(BC)</td>
<td>(9A)</td>
</tr>
<tr>
<td>3</td>
<td>3 A3, B18, T11, TP2, TP7 1B8, 1P3, 1P7, 1T1, 1TP33 B1, B83, T4, TP1</td>
<td>150 None 156 150 154</td>
<td>202 204 202</td>
<td>242 243 242 243</td>
<td>5 L 30 L 200 kg 60 L</td>
</tr>
</tbody>
</table>

* - See 176.144 of this part for segregation within Class 1

Except as provided in §176.145 of this subpart, Class 1 (explosive) materials may be stowed within the same compartment, magazine, portable magazine, or transport unit as indicated in Table 176.144(a).
Segregation Tables for Freight Containers and Transport Units
Separate segregation tables govern freight containers on board container vessels and transport units carried on board trailerships and trainships.

Segregation Table for Freight Containers
Table 176.83(f) sets forth the general requirements for segregation between freight containers on board container vessels.

Segregation Table for Trailerships
Table 176.83(g) sets general requirements for segregation between transport units on board trailerships and trainships.

Additionally, section 176.83(h) sets requirements for segregation on board barge-carrying vessels; section 176.83(i) segregation in shipborne barges; section 176.83(j) segregation between shipborne barges on barge-carrying vessels; section 176.83(k) segregation for ferry vessels; and section 176.83(l) segregation of containers on board hatchless (open-top) container ships.

Ferry Vessels and Barges

Special Requirements for Hazardous Materials Transported on Board Ferry Vessels
The person in charge of a transport vehicle containing hazardous materials must provide to the vessel’s representative a copy of the shipping papers required by section 176.24 and certification stating that the hazardous materials were prepared in accordance with the HMR as required by section 176.27.

A transport vehicle, a private automobile, or a motorboat containing hazardous materials may be transported on board ferry vessels subject to the conditions found in Part 176, Subpart E.

Special Requirements for Barges

You may transport packaged hazardous materials on a barge, provided the barge is constructed of steel, and is not a dump scow. You may need a permit from the Captain of the Port (COTP) to carry certain hazardous materials. Refer to section 176.99 for a list of these materials.

A barge loaded with these materials, while being placed on, removed from, or handled on board a barge-carrying vessel, is not subject to these permits. Barges carried on board barge-carrying vessels must be stowed in accordance with the requirements in section 176.77.

Detailed Requirements for Class 1 (Explosives)
Before Divisions 1.1 and 1.2 may be discharged from or loaded on board a vessel in the United States, the carrier must obtain a permit from the Captain of the Port (COTP). The COTP may assign a US Coast Guard supervisory detail to any vessel during loading, handling, or unloading Class 1 (explosive) materials.
**Loading and Unloading Requirements: Class 1 Explosives**

Section 176.104 lists specific points concerning the loading and unloading of Class 1 (explosive) materials.

- You may not throw, drop, roll, drag or slide packages of Class 1 (explosive) materials over each other or over a deck.
- When Class 1 (explosive) materials are stowed in a hold below one in which any cargo is being handled, all covers of the hatch must remain securely in place.
- You may not raise, lower, or suddenly stop drafts of Class 1 (explosive) materials.
- You may not release a draft by tripping or freeing one side of the cargo-handling equipment, tumbling the Class 1 materials off.
- You must manually free all drafts, beams, shackles, briddles, slings, and hooks before the winch takes control.
- Slings may not be dragged from under a draft by winching, except the topmost layer in the hold when the cargo cannot be toppled, and when power removal is the only practical method.
- You may not use handles or brackets on packages in a draft for slinging purposes.
- You may not use a combination of woven rope and wire sling, or a sling formed by an open hook.
- You may only use safety hooks or hooks that have been closed by wire.
- Wire rope or assemblies must remain unpainted and kept bare to permit inspection of their safe working conditions.
- You must load and unload unpalletized packages of Division 1.1 and 1.2 materials using a chute, a conveyor, or mechanical hoist, and a pallet, skipboard, tray, or pie plate fitted with a cargo net or sideboards.
- You must mechanically hoist unpackaged explosive devices on a pallet, or load them using a chute or conveyor. Do not handle them by their lifting lugs.
- You may not load or unload packages through a hatch at the same time that other cargo is being handled in a hold or service hatch.
- You may not lift packages over any other hazardous materials.

**Responsible Person for Class 1 (Explosive) Materials**

A responsible person who is aware of the hazards involved in handling Class 1 (explosive) materials and the steps to be taken in an emergency must be in constant attendance during loading, unloading and stowage of Class 1 (explosive) materials, including the preparation of the holds.

**General Stowage Conditions for Class 1 (Explosive) Materials**

Section 176.116 sets forth general stowage conditions for Class 1 (explosive) materials. They include keeping this material away from heat sources, dry, secured and fully braced.

- You must stow Class 1 (explosive) materials in a cool part of the ship away from all sources of heat including steam pipes, heating coils, sparks, and flame.
- Stowage spaces must be dry.
- All compartments, magazines, and transport units must remain locked or secured to prevent unauthorized access.
• You must securely stow all Class 1 (explosive) materials to prevent load shifting.
• You must stow Class 1 (explosive) materials as far away as practical from any accommodation or machinery space. For more separation from accommodation and machinery spaces, see section 176.116(e).
• Except for Division 1.4 materials, Class 1 may not be positioned closer to the ship’s side than a distance equal to one-eighth of the beam or 2.4 meters, whichever is less.

**Electrical Equipment**

Electrical equipment and cables in compartments where Class 1 (explosive) materials are stowed must be disconnected from the power source or, if energized, must meet minimum requirements for grounding and safety defined in 49 CFR, Subchapter J, Chapter I.

**General Stowage Conditions for Class 1 (Explosive) Materials**

**Portable Magazines**

Each portable magazine used for the stowage of Class 1 (explosive) materials on board vessels must meet the requirements summarized below and explained in detail in section 176.137.

• Must be weather-tight, constructed of wood or metal lined with wood at least 2 cm (0.787 inches) thick, and have a capacity of no more than 3.1 cubic meters (110 cubic feet). Portable magazines exceeding this capacity may be used only under conditions approved by the COTP.
• All inner surfaces must be smooth and free from any protruding nails, screws, or other projections.
• When constructed of wood, they must be framed of nominal 5 cm X 10 cm (2 X 4 inch) lumber and sheathed with thick boards or plywood.
• When constructed of metal, the metal must not be less than 3.2 mm (0.126 inch) thick.
• Runners, bearers, or skids must be provided to elevate the magazine at least 10 cm (3.9 inches) from the floor, and suitable means must be provided for securing.
• If it has a door or hinged cover, the door or cover must have a strong hasp and padlock or an equally effective means of securing.
• Must be marked on the top and four sides in letters at least 8 cm (3 inches) high as follows: EXPLOSIVES - HANDLE CAREFULLY - KEEP LIGHTS AND FIRE AWAY.

**Deck Stowage**

Class 1 (explosives) may not be stowed within a horizontal distance of 6 m (20 feet) from any source of heat and any possible sources of ignition. With the exception of Division 1.4 (explosive) materials, Class 1 (explosives) materials may not be stowed within a horizontal distance of 12 m (39 feet) from the bridge, accommodation areas, and lifesaving appliances.
Segregation Requirements for Class 1 (Explosive) Materials

In general, you must segregate Class 1 (explosive) materials from other packaged hazardous materials in accordance with section 176.83.

Section 176.144 contains a table showing authorized mixed stowage for explosives within the same compartment, magazine, portable magazine, or transport unit. Segregation requirements in single hold vessels are found in section 176.145.

- When you stow Class 1 (explosive) materials of different compatibility groups together, the stowage arrangement must conform to the most stringent requirements for the entire load.
- When you stow a mixed load of Class 1 (explosive) materials of different hazard divisions and/or stowage arrangements in the same compartment, the entire load must be treated as belonging to the hazard division having the greatest hazard.
- If you stow a Class 1 (explosive) requiring ordinary stowage with a Class 1 (explosive) material requiring magazine stowage, there must be no exposed parts of any ferrous metal or aluminum alloy parts, unless separated by a partition.

### Table 176.144(c)—Authorized Mixed Stowage for Explosives

[An “X” indicates that explosives in the two different compatibility groups reflected by the location of the “X” may not be stowed in the same compartment, magazine, or cargo transport unit.]

<table>
<thead>
<tr>
<th>Compatibility groups</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></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td></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></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td>6</td>
<td>6</td>
<td>X</td>
<td>1</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td>6</td>
<td>6</td>
<td>X</td>
<td>1</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>E</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td>6</td>
<td>6</td>
<td>X</td>
<td>1</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>F</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td>6</td>
<td>6</td>
<td>X</td>
<td>1</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>G</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>6</td>
<td>1</td>
<td>1</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>H</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>J</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>K</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td>2</td>
<td>X</td>
</tr>
<tr>
<td>L</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>N</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>3</td>
</tr>
<tr>
<td>S</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**
1. Explosive articles in compatibility group G, other than fireworks, may be stowed with articles of compatibility groups C, D, and E, provided no explosive substances are carried in the same compartment, magazine or cargo transport unit.

Segregation of Non-Hazardous Materials

With the exception of mail, baggage, personal and household effects, you need not segregate Class 1 (Explosive) materials from non-dangerous cargo. Explosives with a secondary hazard of POISON or CORROSIVE must be “separated from” all food stuffs.

Precautionary Measures

You must take specific precautionary measures involving artificial lighting, radio and radar use, fueling, security, fire precautions and firefighting during the loading and unloading of Class 1 (explosive) materials.
**Transport and Handling Class 1**

**Stowage Arrangements in Passenger Vessels**
The transport of Class 1 (explosive) materials is restricted on passenger vessels as described in section 176.166. Class 1 (explosive) materials that may be carried on passenger vessels are identified in Column 10 of the HMT. Authorized materials must be stowed in accordance with Table 176.166(b) shown here.

**Transport of Class 1 (Explosive) Materials in Vehicle Spaces**
Transport vehicles carrying Class 1 (explosive) materials must be properly secured and meet the structural serviceability requirements in section 176.172. You must stow Class 1 (explosive) materials of different compatibility groups, except as allowed under section 176.144, and vehicles must be separated from each other as provided in section 176.144.

<table>
<thead>
<tr>
<th>Class/Division</th>
<th>Samples, explosive</th>
<th>Goods, N.O.S. Class 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>d</td>
<td>d</td>
</tr>
<tr>
<td>1.2</td>
<td>d</td>
<td>d</td>
</tr>
<tr>
<td>1.3</td>
<td>d</td>
<td>d</td>
</tr>
<tr>
<td>1.4</td>
<td>d</td>
<td>d</td>
</tr>
<tr>
<td>1.5</td>
<td>d</td>
<td>d</td>
</tr>
<tr>
<td>1.6</td>
<td>d</td>
<td>d</td>
</tr>
</tbody>
</table>

**Goods shipped under a specific proper shipping name**

<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—As for cargo ships, on deck or under deck.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b—As for cargo ships, on deck or under deck, in portable magazines only.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c—Prohibited.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d—As specified by the Associate Administrator, or the competent authority of the country in which the Class 1 (explosive) materials are loaded on the vessel.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e—In containers or the like, on deck only.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Activity: Think It Through**

For each scenario below, identify if the stowage arrangements below are in accordance with Table 176.66(b) on the previous page. Mark the appropriate column to indicate your answer: yes or no.

<table>
<thead>
<tr>
<th>Stowage Arrangement Scenario</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Division 1.1, Class 1 explosive material stored in containers on deck with other like materials of compatibility group B commodities</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Division 1.4, Class 1 explosive material stored in a portable magazine with compatibility group A commodities</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Answers:** 1. yes, 2. no

**Transport of Class 1 (Explosive Materials) in Freight Containers**

Freight containers carrying Class 1 (explosive) materials may be transported on vessels only under the conditions listed here:

- A freight container may be regarded as a magazine but not as a separate compartment.
- Freight containers carrying different Class 1 (explosive) materials may not be stowed within the same compartment except as allowed in section 176.144.
- When stowage Type A is required, the container must have floors of wood or equivalent non-metallic and a non-metallic lining.
- On vessels, other than container ships, freight containers containing Class 1 (explosive) materials must be stowed on the lowest tier.
- A freight container must be structurally serviceable. This means that it cannot have major defects in its structural components. It must have a current International Convention for Safe Containers (CSC) approval plate, be verified by a detailed visual examination, and be accompanied by a certification statement.

**Special Handling Requirements for Class 1 (Explosives) While in Port**

Special handling is required for Class 1 (explosive) materials while in port. Some of these special requirements involve the use of signals, mooring lines, and watch keeping.

**Signals**

When loading, handling, or unloading Class 1 (explosive) materials in port, the vessel must exhibit a flag "B" (Bravo) of the International Code of Signals by day, and an all-round fixed red light by night.
Mooring Lines
Mooring lines must be of sufficient strength, type, and number for the size of the vessel and conditions. The mooring arrangements must be such that the vessel can be released quickly in case of emergency. While in port, towing wires of adequate size and length must be properly secured at the bow and stern, ready for use.

Watchkeeping
When in port, a vessel carrying Class 1 (explosive) materials must have sufficient crew on board to maintain a proper watch and to operate the propulsion and firefighting equipment in case of an emergency.

Handling on Board Ship
Class 1 (explosive) materials must not be handled on board vessels during electrical storms or weather conditions that may increase the hazards of the Class 1 (explosive) materials. Also, Class 1 (explosive) materials must not be handled during hours of darkness unless prior content has been obtained from the COTP, without sufficient lighting to safely perform the handling operation, without appropriate protective equipment, or by a person impaired by the influence of alcohol or drugs.

In addition, smoking is prohibited on the vessel while Class 1 (explosive) materials are being handled or stowed, except in places designated by the master of the vessel, and “No Smoking” signs must be posted and clearly visible at all locations where Class 1 (explosive) materials are handled or stored.

Compatibility Group L
Class 1 (explosive) materials in Compatibility Group L may not be handled in any port area without special permission from, and subject to, any special precautions required by the COTP.

<table>
<thead>
<tr>
<th>Hazard division</th>
<th>Compatibility group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
</tr>
<tr>
<td>1.1</td>
<td>1.1A</td>
</tr>
<tr>
<td>1.2</td>
<td>1.2A</td>
</tr>
<tr>
<td>1.3</td>
<td></td>
</tr>
<tr>
<td>1.4</td>
<td></td>
</tr>
<tr>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td>1.6</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>1</td>
</tr>
</tbody>
</table>

In section 175.52, Table 1 – Classification Codes describes Compatibility Group L as “Explosive substance or article containing an explosive substance and presenting a special risk (e.g., due to water-activation or presence of hygroglic liquids, phosphides, or pyrophoric substances) needing isolation of each type.”
Cargo Handling Equipment
Except in an emergency, only equipment specifically designed for the handling of freight containers may be used for loading, handling and uploading containers containing Division 1.1 or 1.2 (explosive) materials. The gross weight of the freight container containing Class 1 (explosive) materials may not exceed the safe working load for the handling gear.

Stowage of Class 1 (Explosive) Materials on Magazine Vessels
Section 176.194 describes the special requirements for the stowage of Class 1 (Explosive) materials on a magazine vessel. Review section 176.194 for additional specifics.

Precautions Loading/Unloading

Precautions During Loading and Unloading for Class 1
You must take specific precautionary measures involving artificial lighting, radio and radar use, fueling, security, fire precautions and firefighting during the loading and unloading of Class 1 (explosive) materials.

Artificial Lighting
Electric lights, except arc lights, are the only form of artificial lighting permitted.

Radio and Radar
You must de-energize sources of electromagnetic radiation, such as radio and radar transmitters, or remove them to the distances specified in section 176.150.

Fueling
Vessels may not be fueled (bunkered) during loading or unloading, and fueling (bunkering) may not take place with the hatches open unless authorized by COTP.

Defective Packages
You may not accept defective packages containing Class 1 (explosive) materials for shipment. You must set aside any defective package for examination and repair, or legal disposal, as directed by the shipper. You may not repair these packages on board a vessel.

In case of spillage, the appropriate emergency response must be taken as required under section 172.602 and reported to the COTP as soon as possible.

Protection Against Weather
The carrier must take adequate measures to prevent packages from becoming wet due to weather.

Security
A responsible person must be present at times when the hatches of spaces containing Class 1 (explosive) materials are open, and no authorized entry may be permitted.
Fire Precautions and Firefighting
Sources of fire are prohibited on or near any vessel during loading or unloading. No repair work involving fire, flame, spark, or arc-producing equipment may be conducted on board except in an emergency and, if in a port, when authorized by COTP.

A fire hose long enough to reach every part of the loading area must be laid and connected to the water main, ready for immediate use. Each compartment containing Class 1 (explosive) materials must have a fixed fire extinguishing system. Adjacent compartments must have the same type system to be accessible for firefighting operations.

Other Special Requirements

Detailed Requirements for Class 2 (Compressed Gas) Materials
You must stow Cylinders of Class 2 (compressed gas) materials in such a way that the cylinders do not make direct contact with the vessel’s deck, side, or bulwark.

When you stow cylinders of Class 2 (compressed gas) materials horizontally, you must stow each tier in the cantlines of the tier below it, and the valves on the cylinders must be at alternate ends of the stow.

If you stow them vertically, stow them upright in a box or crib and brace them to prevent any movement. The carrier must keep them as cool as practical and stow them away from all sources of heat and ignition.

On-Deck Stowage
Cylinders of Class 2 (compressed gas) may not be stowed “on-deck” over a hold or compartment containing coal, and must be protected from radiant heat, including the direct rays of the sun.

No smoking or open flame may be used in any hold or compartment containing Division 2.1 (flammable gas), and warning signs must be posted at each approach.

Under-Deck Stowage
Cylinders of Class 2 (compressed gas) when stowed “under deck” must be mechanically ventilated with no source of artificial heat and clear of living quarters. No smoking or open flame may be used in any hold compartment containing Division 2.1 (flammable gas), and warning signs must be posted at each approach.

Detailed Requirements for Class 3 (Flammable) and Combustible Liquid Materials
The carrier must keep Class 3 (flammable) and combustible liquids as cool as reasonably possible, and stow them away from all sources of heat and ignition. You must stow them “on deck” if they are equipped with vents or safety relief devices.
Fire Protection
You must keep a dry chemical, foam fire extinguisher, or a fire hose fitted with an approved portable mechanical foam nozzle accessible to the tank it is intended to cover.

Hand Flashlights, Smoking, and Open Flame
Only flashlights suitable for use in locations where fire or explosion hazards are possible may be used. Smoking, or the use of an open flame, is prohibited in any hold or compartment containing Class 3 (flammable) and combustible liquids and warning signs must be posted.

Detailed Requirements for Class 4 (Flammable Solids), Class 5 (Oxidizers and Organic Peroxides), and Division 5.1 Materials
Class 4 (flammable solids) and Division 5.2 (organic peroxide) materials must also be kept cool and be stowed away from all sources of heat and ignition. You must stow Division 5.2 materials away from living quarters or prevent access to them. You may not stow Division 1.5 or Class 5 (oxidizers and organic peroxides) in the same hold or compartment as any readily combustible material, or in or near a hold containing sulfur in bulk.

Permit Requirements for Division 1.5 Materials, Ammonium Nitrate and Ammonium Nitrate Mixtures
You must follow special provisions and procedures when transporting Division 1.5 materials, ammonium nitrate, and ammonium nitrate mixtures. Under certain circumstances, written permission from the nearest COTP is necessary before Division 1.5, ammonium nitrates, and certain ammonium nitrate fertilizers may be loaded on or unloaded from a vessel at any waterfront facility (section 176.415 details these requirements).

Detailed Requirements for Division 2.3 (Poisonous Gas) and Division 6.1 (Poisonous Materials)
You must stow each package required to have a “POISON GAS,” “POISON INHALATION HAZARD,” or “POISON” label clear of living quarters and any ventilation ducts serving living quarters according to the requirements in the HMT in section 172.101 Columns 10A and 10B, and section 176.600.

You must also separate such packages from foodstuffs, except when the hazardous materials and the foodstuffs are in different closed transport units.

A hold or compartment containing a package of Division 2.3 (poisonous gas) or Division 6.1 (poisonous materials) that has leaked or sifted must be thoroughly cleaned and decontaminated before any other cargo may be stowed there.

Detailed Requirements for Radioactive Materials
No person may remain unnecessarily in a hold or compartment, or in the immediate vicinity of any package on deck containing radioactive materials. A package of radioactive materials with a surface temperature of more than 5°C (9°F) above the ambient air may not be overstowed with any other cargo. If the package is stowed under deck, the hold or compartment must be ventilated.
Requirements Relating to Transport Indexes and Segregation Distances

Certain packages of Class 7 (radioactive) materials should be marked with transport indexes. The sum of these indexes may not exceed the limits specified. Requirements relating to transport indexes can be found in sections 176.704 and 176.708.

Leakage or Contamination from Radioactive Material

If an accident occurs involving Class 7 (radioactive) materials, you must segregate the materials from unnecessary contact with personnel. If the package has leaked, you must isolate the hold or compartment containing the cargo. Do not use the hold or compartment for any other cargo until it has been decontaminated in accordance with section 176.715.

Requirements for Class 8 (Corrosive) Materials

General stowage requirements for Class 8 (corrosive) materials are found in section 176.800 and include prohibitions against stowing these materials near living quarters, foodstuffs, combustible materials, or cotton.

- They must be stowed clear of living quarters and away from foodstuffs and cargo of an organic nature.
- They may not be stowed over any readily combustible materials.
- They may not be stowed over a hold or compartment containing cotton unless the deck is of steel and the hatch is fitted with a tight coaming.

On-Deck Stowage of Class 8 Materials

When you stow break bulk Class 8 materials on deck, you must make provisions in case of leakage to drain away from other cargo and into an overboard scupper or freeing port.

Leakage may not enter an enclosed drainage system other than a direct overboard scupper. If proper drainage is not practical, you must place enough clean dry sand under and around the lower tier of packages to absorb any leakage.

Damage must be provided on the deck and arranged so that any leakage will be apparent. You must wash down any leakage using liberal quantities of water.

Detailed Requirements for Cotton and Vegetable Fibers, Motor Vehicles, and Asbestos

Cotton and vegetable fibers that are transported on a vessel must be securely baled and bound. Each bale must be covered with bagging on at least three-fourths of its surface. You must stow each bale of wet cotton separately from dry bales of cotton or vegetable fiber.
Incident Reporting

Reportable Incidents
Despite all safety efforts, incidents do occur. When hazardous materials are involved in a transportation incident, a report may be required.

For certain incidents, you must notify either the National Response Center (NRC) or, for infectious substances, the Centers for Disease Control (CDC), as soon as practical, but not later than 12 hours after the incident occurs. For any such incident, you must also follow up with a written Hazardous Materials Incident Report.

You must file a written Hazardous Materials Incident Report within 30 days of discovering any unintentional release of hazardous materials or unintentional discharge of hazardous waste, as well as under certain other conditions. (See the guidelines in section 171.16). However, unless a requirement listed in section 171.15 applies, you do not need to notify the NRC or CDC by phone.

Radioactives and Infectious Substances
You must notify the NRC as soon as practical, and not later than 12 hours after the discovery of the event, in the event of fire, breakage, spillage, or suspected radioactive contamination from a radioactive material.

You must notify the CDC as soon as practical, and not later than 12 hours after the discovery of the event, in the event of fire, breakage, spillage, or suspected contamination involving an infectious substance other than a diagnostic specimen or regulated medical waste.

Marine Pollutants
You must report a large release of a marine pollutant, by phone, as soon as possible, and not later than 12 hours after the discovery of an event, to the NRC. This requirement applies to the release of 400 kilograms (882 pounds) of a solid and to the release of over 450 liters (119 gallons) of a liquid.

Other Incidents
Hazmat incidents that result in any of the following require notification as soon as possible, and not later than 12 hours after discovery of the event, to the NRC or the CDC, if applicable when due to the hazardous materials:

- Death or injury requiring hospitalization
- Change in the operational flight pattern or routine of an aircraft
- Shutdown of a major facility or transportation artery for more than one hour
- An evacuation of the general public that lasts more than one hour
- A situation that, in your judgment, requires notification, even if none of the above conditions are met—for example, a continuing danger to life, although no death has yet occurred
Summary

You have completed all the material for Module 6d. You should be able to:

- Summarize general operating requirements, as well as general handling, stowage, and segregation requirements for transporting hazardous materials by commercial vessels.
- Define special requirements for transport vehicles and barges.
- Recognize segregation requirements for specific classes of hazardous materials and highlight any exceptions to those requirements.
- Compare the uses of the International Maritime Dangerous Goods Code for similarities to and differences from the uses of the hazardous materials regulations.
- Identify and apply incident reporting requirements in 49 CFR.

References