Module 2:

Recognition and Identification
Module 2: Recognition and Identification

Module Description

The module primarily covers the different types of hazardous materials containers. The two primary sections focus on containers used for transport and those used for stationary storage. Offensive tactics such as plugging and patching leaks are described in the text and should be practiced in hands-on activities.

Prerequisites

• Students should have completed a first responder operations level training program.

• Students should have completed Module 1, Regulations.
Objectives

Upon completion of this module, participants will be able to:

<table>
<thead>
<tr>
<th>Objectives</th>
<th>NFPA Standards</th>
<th>OSHA Standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Describe different types of cargo tanks</td>
<td>NFPA 472 4-2.1</td>
<td>29 CFR 1910.120 (q) (6) (iii) (E)</td>
</tr>
<tr>
<td>• Identify typical products carried by different types of cargo tanks</td>
<td>NFPA 472 4-2.1.1</td>
<td>29 CFR 1910.120 (q) (6) (iii) (E)</td>
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<tr>
<td>• Describe hazards associated with non-specification tankers</td>
<td>NFPA 472 4-2.1.1</td>
<td>29 CFR 1910.120 (q) (6) (iii) (E)</td>
</tr>
<tr>
<td>• Distinguish between non-pressure, pressure, cryogenic, and miscellaneous tank cars</td>
<td>NFPA 472 4-2.1.1-4, 4-2.1.1.5</td>
<td>29 CFR 1910.120 (q) (6) (iii) (E)</td>
</tr>
<tr>
<td>• Explain the problems that occur with:</td>
<td>NFPA 472 9-2.1.9</td>
<td>29 CFR 1910.120 (q) (6) (iii) (E)</td>
</tr>
<tr>
<td>• Gauging instruments in tank cars</td>
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<tr>
<td>• Valving</td>
<td></td>
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<td>• Pressures</td>
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<tr>
<td>• Describe hazards of an air transportation incident</td>
<td>NFPA 472 4-2.3.3</td>
<td>29 CFR 1910.120 (q) (6) (iii) (E)</td>
</tr>
<tr>
<td>• Recognize the limitations of your response team during a water transportation emergency</td>
<td>NFPA 472 4-2.1.1</td>
<td>29 CFR 1910.120 (q) (6) (iii) (E)</td>
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<tr>
<td>• Describe the importance of quick response to shutting down a pipeline incident to limit an environmental problem</td>
<td>NFPA 472 4-2.1.1-4, 4-2.1.1.5</td>
<td>29 CFR 1910.120 (q) (6) (iii) (E)</td>
</tr>
<tr>
<td>• Distinguish between different types of non-bulk containers</td>
<td>NFPA 472 4-2.1.1-5</td>
<td>29 CFR 1910.120 (q) (6) (iii) (E)</td>
</tr>
<tr>
<td>• Distinguish between different types of fixed-site storage containers</td>
<td>NFPA 472 4-2.1.1</td>
<td>29 CFR 1910.120 (q) (6) (iii) (E)</td>
</tr>
<tr>
<td>• Recognize the need for a specialist when working with valving on any vessel</td>
<td>NFPA 472 4-2.5.1</td>
<td>29 CFR 1910.120 (q) (6) (iii) (E)</td>
</tr>
</tbody>
</table>

Equipment/Supplies

Materials for Customizing

• Slides of railroad routes, rail yards, or depots in your area
• Waybills
• Train consists/wheel reports
• Slides of tank cars showing various markings
• Slides of the following types of tank cars:
  • Non-pressure tank cars
  • Pressure tank cars
• Cryogenic liquid tank cars
• High pressure tube cars
• Pneumatically unloaded hopper cars
• Multi-unit tank car tanks
• Examples of various types of cargo tank valves (including discharge and emergency valves)
• Examples of various types of cargo tank venting devices
• Examples of tank car fittings
• Skid protection
• Maps of your area showing major transportation routes
• Pre-incident plans for transportation corridors, if available
• Completed shipping papers
• Slides of markings on cargo tanks
• Copies of the *North American Emergency Response Guidebook*
• Slides of various types of cargo tanks
• Overpack drum
• Plugging and patching materials
• Fifty-five gallon metal drum
• Materials for Application Exercise (at end of module before appendices)

**Media and Equipment**

Slide Projector and Slides
VCR and Videotape

• *Training for Hazardous Materials Specialists: Cargo Tanks*
• *Training for Hazardous Materials Specialists: Tank Cars*
• *Indianapolis, IN Thermogas Propane Explosion*

**References**

• International Maritime Dangerous Goods Code - Section 13 pertains to “Portable Tanks and Road Tank Vehicles”
• The American Society of Mechanical Engineers
  Department of Transportation (DOT) 49 CFR178.245 - pressure vessel standards
Instructor Preparation

Plan on giving the Prerequisite Quiz at the beginning of this module. If any students fail to answer at least half the questions correctly, they should be directed to read Unit 3 of *Hazardous Materials Training for First Responders*, available from the IAFF.

Tailor this module to fit the needs of your students. If highway corridors have more hazardous materials incidents, address these containers in greater detail. If the jurisdiction includes rail yards, spend more time on tank cars.

Although this module includes slides and videotapes, the instruction will be much more valuable if you customize the course to the local area. Obtain the items listed on a previous page under Equipment/Supplies to make training more relevant for your students.

To give the students practical experience with cargo tanks, contact a shipper and arrange to have a pressure, non-pressure, or corrosive carrier at the training facility when you cover the information on cargo tanks. Having a cargo tank on hand is extremely helpful for pointing out the locations of specification plates, valves, manways, and other fittings.

Approximate Length

This module requires a minimum of 16 hours to complete; however you may choose to extend training time and include site visits to area rail yards, chemical storage facilities, etc.
Module 2
Prerequisite Quiz

1. How can DOT subsidiary placards be distinguished from primary placards?
   A. Subsidiary placards are smaller
   B. Subsidiary placards are a single solid color
   C. Subsidiary placards do not carry hazard class or UN numbers
   D. Subsidiary placards carry only UN numbers

2. Bulk containers for liquids hold a maximum capacity of more than:
   A. 119 gallons
   B. 500 gallons
   C. 882 pounds
   D. 1001 pounds

3. An “MC 331” is a:
   A. Non-pressure cargo tank
   B. Low pressure cargo tank
   C. Pressure cargo tank
   D. Corrosive liquid cargo tank

4. Non-pressure cargo tanks have:
   A. Elliptical cross-sections and flat heads
   B. Circular cross-sections and flat heads
   C. Elliptical cross-sections and rounded heads
   D. Circular cross-sections and rounded heads

5. Caustic soda is frequently transported in:
   A. Corrosive liquid tank cars
   B. Non-pressure tank cars
   C. Covered hopper cars
   D. Ton containers

6. Non-pressure cargo tanks primarily carry:
   A. Solids
   B. Corrosive materials
   C. Food products
   D. Petroleum products

7. Which of the following is not true regarding shipping papers:
   A. DOT requires all vehicles hauling hazardous materials to carry shipping papers
   B. DOT requires shipping papers to be within reach of a cargo tank operator
   C. DOT requires that MSDSs accompany shipping papers
   D. Dangerous Cargo Manifests are used in waterway transportation
8. Non-pressure tank containers transport liquid and solid materials at pressures up to:
   A. 50 psig
   B. 100 psig
   C. 250 psig
   D. 500 psig

9. Tube trailers carry:
   A. Liquefied gases
   B. Pressurized gases
   C. Non-pressurized gases
   D. Cryogenic molecules

10. Which of the following best describes the most common type of tank container?
    A. Multiple compartments, stainless steel
    B. Single compartment, aluminum tank in wooden frame
    C. Multiple compartment, aluminum tank in metal frame
    D. Single compartment, stainless steel tank in metal frame
Introduction

Questions

1. What type of container is an MC 331?

2. What does “NQT” indicate, as marked on a cargo tank specification?

3. What are carboys?

4. Which type of intermodal container is considered non-pressurized? IM101, IM102, IM105, or IM107?

Identification Confirmation

As a hazardous materials technician, you need to evaluate all clues at the incident scene. Are there visible DOT placards? Are they correct? Did we check more than one document? Does what you see make sense with what you are reading? If a container is stenciled with a name of a product and is placarded, do the two identifiers match? Always check and double check to confirm the product that is being transported.

Different methods of confirmation:

Shipping papers
Placards
Labels
Sampling
NFPA 704
Hazardous Material Identification System
Military Marking System
Stenciled Name
Chemical Sampling
Questions to driver or 911 caller
Container type
North American Emergency Response Guidebook

The North American Emergency Response Guidebook can be an extremely useful resource. Before you can use it, however, you need to obtain information such as shipping papers, ID numbers, and placards. The more information you obtain, the safer your response will be.

Shipping Papers

Shipping papers are critical documents for both First Responders and Technicians. They contain information such as:

- UN identification number
- Reportable quantity when applicable
- Emergency contact
- Phone number
- Shipping name
- Hazard class

Shipping papers can be found in:

- The cab of a motor vehicle
- The possession of a train crew member
- The holder on the bridge of a vessel
- The aircraft pilot’s possession

Placards

Department of Transportation placards are diamond-shaped signs used on transport vehicles. Placards include the cargo’s:

- Name
- ID number
- Hazard class number
**ID number**

The four-digit UN Identification number will be on shipping papers as either an ID or UN number. The 4-digit ID number or name is found on:

- Placards
- Shipping papers
- Packaging

Once you have researched the product, you may still be unsure of the appropriate response. If so, you can consult other resources such as CHEMTREC, CHEMTEL, or the National Response Center. Some information is required before you contact these organizations, such as:

- Information from shipping papers
- Your name, call back number, FAX number
- Location and nature of the problem
- Name and identification of materials
- Shipper/consignee/point of origin
- Container type and size
- Quantity of material transported or released
- Local conditions
- Injuries or exposures
- Local emergency services that have been notified
Non-Bulk Storage Containers

The DOT defines bulk packaging as those containers with no intermediate form of containment and with an internal volume greater than:

- 118.9 gallons (450 liters) for liquid
- 881.8 pounds (400 kilograms) for solids
- 1,000 pounds (453.6 kilograms, water capacity) for gases

In an effort to make the following information more meaningful, however, this text will not necessarily follow the DOT’s strict definition of bulk versus non-bulk packaging.

Trying to determine the contents of non-bulk packaging based on the shape and size of the container is generally impractical. Non-bulk packaging for hazardous (as well as non-hazardous) materials includes drums, cylinders, dewars, carboys, bottles, bags, aerosol cans, fiberboard and wooden boxes, and other containers of similar size. These containers are in wide use for a great variety of products. In addition, any of these containers may be found in and around warehouses, retail outlets, homes, boxcars, cargo vans, and semi-trailers. Often, you cannot determine whether or not the contents of such packaging are hazardous without getting close to the materials. In most cases, you will have to rely on proper markings to determine the contents.

When labels and other markings are missing or not legible on these containers, the following descriptions and guidelines may give you some general information about the possible contents of these containers.
Common Non-Bulk Containers

Drums come in a great variety of sizes, and may be constructed of metal, fiberboard, or plastic. Other than compressed gases and etiologic agents, drums may contain any type of hazardous material including powders, liquids, pastes, and slurries.

There are two types of drums: open head and tight head drums. The open head has a full head or cover that can be removed completely. The tight head drum has two openings, a 2” standard pipe and a 0.75” standard pipe.

Pails are a type of drum. They are made of metal, fiberboard, or plastic and usually hold one to five gallons of material. Pails may be used for flammable or combustible liquids, flammable solids, oxidizers, organic peroxides, or poisons. They are in wide use and may be found at all types of locations.
Plastic bags, multi-layered paper bags, and paper bags lined or layered with plastic may contain dry corrosives, blasting agents, explosives, flammable solids, oxidizers, organic peroxides, poisons, or ORMs. Bags typically hold 100 pounds of product and are often stacked on pallets.

Wooden and fiberboard boxes are usually used as cases for smaller, inner containers. Wooden boxes may be used for every class of hazardous material except compressed gases. Fiberboard boxes may be used for everything except compressed gases and poisons. A box can be the primary container or an outside package for other non-bulk packages.

Multicell packages usually contain polystyrene form fitted to a particular container. DOT limits the capacity to no more than six bottles and a maximum of four liters.
Limited Use Non-Bulk Containers

There are, however, a few containers which are in limited use and/or have specific uses. If you can recognize these containers and their possible contents, you may save valuable time during an emergency.

Carboys are used almost exclusively for hazardous materials. These bottle-type containers are usually made of plastic or glass and encased in specially cushioned boxes made of either wood or cardboard. Carboys are used primarily for corrosive liquids. These containers usually hold 13 gallons, but can carry as much as 20 gallons or more.

Cylinders contain compressed gases, flammable or combustible liquids, poisons, radioactive materials, or corrosives. These containers may have some identifying characteristics beyond their required labels (which can be difficult to identify from a distance). For example, short, broad cylinders are generally used for low pressure materials; tall, thin cylinders are usually used for high pressure materials. Cylinders that have a seam running up the side are not used for high pressure materials.

Most cylinders have a pressure relief device such as a safety relief valve, disc, or fusible plug. Cylinders may be coupled together. A DOT specification marking near the top of the cylinder shows DOT specification, pressure rating, and test date.
Many manufacturers of medical gases voluntarily follow a color-coding system recommended by the Compressed Gas Association. **This system is not required by law so you cannot rely on it as a means of identifying the contents of compressed gas cylinders.**

**Dewars** are designed and used for the storage of cryogenic materials such as liquid nitrogen, oxygen, and helium. These are non-pressurized, heavily insulated containers, usually with a vacuum space between the inner and outer shells (sometimes called a jacketed-vacuum). The heavy insulation is usually obvious in that it gives the container a bulky appearance. Larger dewars often have dispensing tubes.

**Tote tanks** transport solids and liquids. Quantities range from 100 to 500 gallons with smaller containers hauling the heaviest products. Totes are usually four feet by six feet high and made of metal or plastic. Most totes load through the top and unload through the bottom valve. One difference is in the valve on the bottom for unloading. On some tote tanks, **when this valve is in the inline position, the valve is off, and when in the across-the-valve position, the valve is on.** They generally use a quarter turn ball valve. There will be a label of some type on a tote tank that the valve position is different than the normal. A normal quarter turn valve is on when the handle is inline and off when the handle is 90° to the piping.

![Diagram of valve positions](image.png)

**Normally closed**

**Normally open**
Radiological Materials

**Radiological packaging** may be made of any number of materials, depending on the content’s level of radioactivity.

**Type A Packaging**

Type A packaging is for low level radioactive materials. This type of packaging consists of an inner package cushioned and placed within a stronger outer package.

**Type B Packaging**

Type B packaging is for higher level radioactive materials that require more secure packaging. These are often large cylindrical steel containers lined with lead or paraffin. Type B packages may be up to 10 feet in diameter and 50 feet long. In general, radiological materials packaging is distinct because it is usually well-marked and better secured against spills, leaks, and other accidents.

Remember, without DOT labels or other markings, it is often impossible to determine the contents of non-bulk containers because the same size and shape container may be used for a number of different products.
Highway Cargo Tanks

Overview

Cargo tank trucks carry a wide variety of commodities that are designed to safely and efficiently transport materials from the point of manufacture to the distributor or end user. Many times you can use the shape and design of the tank to determine the type of cargo. Occasionally you will find a tank truck that was made for a specific job or product. The tank trucks used for spill and waste recovery, vacuum trucks, carry a multitude of products. They must be placarded if they carry hazardous materials.

Tank shape and design are especially important when placards are missing or not visible. One of the elements of tank construction refers to the tank’s shape as it looks from behind, or its “cross-section.” Cargo tanks will be either circular or elliptical in cross-section, depending on their intended use. (In some cases, insulation is used on tanks; this insulation may change the appearance of the tank shape, making circular tanks appear elliptical.) Tank shape also refers to the tank’s ends, usually called “heads”; the heads will either be rounded or flat. Flat heads sometimes appear slightly rounded, but are considered flat unless they are distinctly rounded.

Cargo Tank Shipping Papers

Shipping papers—called “bills of lading” in highway transportation—provide one of the first available and most accurate sources of information about the materials involved in a highway incident. While placards indicate the presence of hazardous materials and their primary hazards, shipping papers provide more detailed information about the materials. Even when hazardous materials are transported in small quantities, not requiring placards, the shipping papers identify:

- The shipper, who should be able to provide complete information about the contents
• The consignee, who should have information on the product and who may be more accessible than the shipper
• The carrier, who should have complete information about the vehicle
• The name of the hazardous material
• The quantities involved
• Basic hazard and response information
• A phone number for 24-hour access to emergency response information

As with any mode of transportation, shipping papers must accompany each shipment of hazardous materials.

The shipping papers must remain within easy reach of the driver while he or she is fastened in the seat belt. Most drivers keep the shipping papers in a pouch on the driver’s door or in a briefcase on the front seat. However, if involved in an accident, the driver should take the shipping papers with him or her when leaving the vehicle.

Although not required by DOT, the carrier may be able to provide you with Material Safety Data Sheets (MSDSs) for the contents. In fact, it is becoming fairly common for MSDSs to be included with shipping papers. If not available on the scene, you can obtain an MSDS directly from the manufacturer of the material or from the shipper, once you have identified the shipment and its contents. MSDSs are a valuable source of information on product hazards and on recommended emergency response actions for specific materials. Keep in mind, however, that MSDS data can be incorrect or incomplete, so MSDS information should be verified with other sources.

Finally, cargo tanks are required to carry vehicle registration and inspection information on the tank trailer. This paperwork is usually located in an enclosure or closed tube near the cargo tank spec plate; it contains information about the cargo tank truck. Never attempt to obtain this paperwork unless you are sure the situation is stable.

Activity
### Truck Loading Ticket and Bill of Lading

**Unocal Refining & Marketing Division**

<table>
<thead>
<tr>
<th>Carrier Agent Signature</th>
<th>Date</th>
<th>Shipment Received By</th>
<th>Date</th>
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</thead>
</table>

**Loader's Signature**

**Truck Seal Numbers**

**Refer Your Payment To:**

<table>
<thead>
<tr>
<th>DRV</th>
<th>KF</th>
<th>TM</th>
<th>DIST</th>
<th>SUP</th>
<th>FTRX CUST/DEST</th>
<th>PERMIT</th>
<th>SCAC</th>
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<tr>
<th>B/L</th>
<th>DATE</th>
<th>IN TIME OUT</th>
<th>SHIP</th>
<th>SHIPPED FROM</th>
<th>CUST NO.</th>
<th>CODE</th>
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<tr>
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<th>EQAL</th>
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<th>CONTRACT NO.</th>
<th>ITEM NO.</th>
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**Sold To**

**Ship To**

SAME AS "SOLD TO" UNLESS NOTED

**Product Description and Material Label**

<table>
<thead>
<tr>
<th>Gross Gal</th>
<th>API</th>
<th>Temp</th>
<th>Net Gal</th>
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_IN CASE OF TRANSPORTATION EMERGENCY CALL: CHEMTREC (800) 424-9300_
### ALWAYS LIST HAZARDOUS MATERIALS FIRST IN DESCRIPTION OF ARTICLES COLUMN.

<table>
<thead>
<tr>
<th>CUSTOMER P.O. NO.</th>
<th>ROUTE</th>
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<table>
<thead>
<tr>
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<thead>
<tr>
<th>(DESTINATION) CITY, STATE, ZIP</th>
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<thead>
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<th>IS CUSTOMER'S CHECK ACCEPTABLE FOR COD?</th>
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<table>
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<tr>
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| KIND OF PACKAGING, DESCRIPTION OF ARTICLES, SPECIAL MARKS AND EXCEPTIONS |
| (LIST HAZARDOUS MATERIALS FIRST) |
|                                 |

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<tr>
<th>WEIGHT LBS. (INKJERT IN CORRECTION)</th>
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<tr>
<th>NOTE: DRIVER AFFIX PRO NUMBER LABEL HERE</th>
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**STRAIGHT BILL OF LADING - SHORT FORM - Original-Not Negotiable**

RECEIVED, subject to the classifications and tariffs in effect on the date of the issue of this Original Bill of Lading, the property described above in apparent good order, except as noted (packaging, marked, and labeled, and are in proper condition for transportation according to the applicable regulations of the Department of Transportation.)

SHIPLER: YELLOW FREIGHT SYSTEM, INC.

PER: DRIVER TRAILER

MARK "X" IN "HM" COLUMN FOR HAZARDOUS MATERIALS

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**RETURN TO TOP**
SAMPLE HAZARDOUS WASTE LABEL

HAZARDOUS WASTE
STATE AND FEDERAL LAW PROHIBITS IMPROPER DISPOSAL

IF FOUND CONTACT THE NEAREST POLICE OR PUBLIC SAFETY AUTHORITY OR THE U.S. ENVIRONMENTAL PROTECTION AGENCY.

ACCUMULATION START DATE_______________ EPA WASTE NO._______ CA WASTE NO._______

D.O.T. PROPER SHIPPING NAME:__________________________________________________________

AND

U.N. OR N.A. NO. ______________________________________________________________________

GENERATOR NAME:_____________________________________________________________________

ADDRESS:____________________________________________________________________________

CITY:___________________________ STATE:___________________________ ZIP:____________

EPA ID NO._________________________ MANIFEST DOCUMENT NO.________________________

CONTENTS COMPOSITION:________________________________________________________________

<table>
<thead>
<tr>
<th>PHYSICAL STATE</th>
<th>HAZARDOUS PROPERTIES</th>
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<tbody>
<tr>
<td>SOLID</td>
<td>FLAMMABLE</td>
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<td>TOXIC</td>
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<td>CORROSIVE</td>
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<td></td>
<td>REACTIVE</td>
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<td>OTHER</td>
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HAZARDOUS WASTE HANDLE WITH CARE
HAZARD WARNING

MOTOR GASOLINE UN 1203

DANGER! EXTREMELY FLAMMABLE • VAPORS MAY EXPLODE • HARMFUL OR FATAL IF SWALLOWED • VAPOR HARMFUL • POSSIBLE CANCER HAZARD BASED ON TESTS WITH LABORATORY ANIMALS.

- NO SMOKING, KEEP AWAY FROM HEAT, SPARKS OR FLAME, INCLUDING PILOT LIGHTS, ELECTRIC MOTORS, AND OTHER SOURCES OF IGNITION.
- VAPORS MAY BE IGNITED BY SPARKS OR FLAME SOURCES MANY FEET AWAY.
- DO NOT OVERFILL TANK.
- USE ONLY WITH ADEQUATE VENTILATION AND AVOID PROLONGED BREATHING OF VAPOR.
- KEEP FACE AWAY FROM NOZZLE AND CONTAINER OPENING.
- KEEP AWAY FROM EYES, SKIN, AND CLOTHING. WASH THOROUGHLY IF EYE OR SKIN CONTACT OCCURS.
- NEVER SIPHON BY MOUTH.
- FOR USE AS MOTOR FUEL ONLY. DO NOT USE FOR ANY OTHER PURPOSE.
- MAY CONTAIN LEAD ANTIKNOCK COMPOUND.
- DO NOT CUT, PUNCTURE, OR WELD ON OR NEAR THIS CONTAINER AFTER CONTAINER HAS BEEN EMPTIED. IT WILL CONTAIN EXPLOSIVE VAPORS.
- KEEP OUT OF REACH OF CHILDREN.

FAILURE TO USE CAUTION MAY CAUSE SERIOUS INJURY OR ILLNESS.
FIRST AID: IF SWALLOWED DO NOT INDUCE VOMITING. CALL PHYSICIAN IMMEDIATELY.
FOR HEALTH EMERGENCIES: CONTACT LOS ANGELES POISON INFORMATION CENTER — (213) 664-2121.

FOR ADDITIONAL INFORMATION SEE MATERIAL SAFETY DATA SHEET.

MID-DISTILLATES NA 1993, UN 1863, UN 1223

DANGER! HARMFUL OR FATAL IF SWALLOWED • COMBUSTIBLE • CAUSES IRRITATION • POSSIBLE SKIN CANCER HAZARD BASED ON TESTS WITH LABORATORY ANIMALS.

- KEEP AWAY FROM HEAT AND FLAME.
- DO NOT GET IN EYES, ON SKIN, OR ON CLOTHING. WASH THOROUGHLY AFTER HANDLING.
- DO NOT BREATHE MIST OR VAPOR.
- KEEP CONTAINER CLOSED. USE ONLY WITH ADEQUATE VENTILATION.
- DO NOT CUT, PUNCTURE, OR WELD ON CONTAINER.

FIRST AID: IF SWALLOWED DO NOT INDUCE VOMITING. CALL PHYSICIAN IMMEDIATELY.
FOR HEALTH EMERGENCIES: CONTACT LOS ANGELES POISON INFORMATION CENTER — (213) 664-2121.

FOR ADDITIONAL INFORMATION SEE MATERIAL SAFETY DATA SHEET.
When documentation such as shipping papers and MSDSs are not accessible, you must look for other methods to identify the materials involved. In many cases, the trucking company dispatcher can provide some information, particularly if you can provide him or her with the tractor or trailer number.

**Cargo Tank Markings**

Cargo tanks may display a number of markings that can be used to gain valuable information about the tank itself and about its contents. Knowledge of a cargo tank that is involved in an emergency situation—its construction, fittings, capacity, etc.—will help you identify potential problems and possible solutions. Knowledge of the tank’s contents will help you make educated decisions about rescue, evacuation, and control. And markings can be used to confirm information from the shipping papers. Keep in mind, however, that these markings are difficult to read from a distance and you will probably not be able to safely approach involved equipment until you know something about the cargo tank and its contents. In some cases, aided vision will allow you to read cargo tank markings from a safe distance.

All compressed gases—flammable and non-flammable—and all cryogenic liquids are required to have their proper shipping names or common technical names (e.g., Liquefied Petroleum Gas=proper shipping name; LPG=technical name) marked on both sides and both ends of the cargo tank. Hydrogen peroxide is the only liquid (non-cryogenic) that must also be transported in a cargo tank marked with its name. In addition, cargo tanks are frequently marked with a brand name or the name of a shipper or product manufacturer. Keep in mind, however, that these markings do not necessarily provide complete or accurate information since many manufacturers produce a variety of products.

Other cargo tank markings may also provide information that can be valuable during emergency response operations.
**Specification Plates**

All specification cargo tanks are required to carry a DOT specification/certification plate. This plate must be permanently attached in a location that is readily accessible for inspection, such as on the landing gear frame or on the left side of the cargo tank near the front. (On tanks constructed prior to July 1, 1985, this plate is mounted on the right side near the front.) Insulated cargo tanks, such as cryogenic liquid cargo tanks and some corrosive liquid cargo tanks, have two specification plates. One plate is located on the left side near the front, but because it is welded to the tank under the jacket and insulation, it is hidden from sight (unless the jacket and insulation have been torn away). The second plate is located either on the outside of the jacket, near the front left side, or inside the cabinet at the operator’s station (on cryogenic liquid cargo tanks).

In addition, cargo tanks that fulfill all of the requirements of the American Society of Mechanical Engineers (ASME) Code for pressure carriers (e.g., corrosive liquid cargo tanks, pressure cargo tanks, and cryogenic liquid cargo tanks) must carry a plate that contains required ASME information, as shown in Figure 1. This plate may be located anywhere on the tank, or the information may be included on the specification plate—making it a combination ASME/DOT specification plate. ASME plates are easily identified by an embossed “U” in the upper left corner of the plate. Any repair work to a cargo tank that carries the ASME plate must be performed by an ASME-certified or National Board of Pressure Vessels-certified repair shop. Work performed by non-certified shops violates the code and is likely to be inadequate.

| Mfg. Serial No. | ________________________________ |
| Mt’l No. | ________________________________ |
| Certification: Yes | No | ____ |
| Water Gal. | ________________________________ |
| Year Built | ________________________________ |

*Figure 1: ASME-Required Information*
Specification plates for tanks being constructed under current regulations are required to contain the following information:

- Cargo tank motor vehicle manufacturer
- Cargo tank motor vehicle certification date (if different from the cargo tank certification date)
- Cargo tank manufacturer
- Cargo tank date of manufacture (month and year)
- Maximum weight of lading (in pounds)
- Maximum loading rate in gallons per minute, at maximum loading pressure in psig
- Maximum unloading rate in gallons per minute, at maximum unloading pressure in psig
- Lining material (if applicable)
- Heating system design pressure (if applicable)
- Heating system design temperature (if applicable)

On cargo tanks that are older, but still in service, the specification plates may contain slightly different information. For example, the chart below illustrates a typical specification plate for many non-pressure, low pressure, and corrosive liquid cargo tanks still in service. (The last two entries, loading and unloading limits, apply only to tanks that are bottom loaded with the dome covers closed.)

<table>
<thead>
<tr>
<th>Manufactured by</th>
<th>Mfg. Company</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mfg. Serial</td>
<td>Mfg. Date</td>
</tr>
<tr>
<td>DOT Spec.</td>
<td></td>
</tr>
<tr>
<td>Original Test Date</td>
<td>Certification Date</td>
</tr>
<tr>
<td>Design</td>
<td>PSIG</td>
</tr>
<tr>
<td>Test Pressure</td>
<td>PSIG</td>
</tr>
<tr>
<td>Head Material</td>
<td>Shell Material</td>
</tr>
<tr>
<td>Weld Material</td>
<td>Lining Material</td>
</tr>
<tr>
<td>Nominal Compartment Capacity (Front to Rear)</td>
<td>U.S. gallons</td>
</tr>
<tr>
<td>Maximum Product Load</td>
<td>Lbs.</td>
</tr>
<tr>
<td>Maximum Temperature</td>
<td>°F</td>
</tr>
<tr>
<td>Loading Limits</td>
<td></td>
</tr>
<tr>
<td>Unloading Limits</td>
<td></td>
</tr>
</tbody>
</table>

Figure 2: Specification Plate for Non-Pressure, Low Pressure, and Corrosive Liquid Cargo Tanks
The DOT spec, listed near the top of the plate shown in the specification plate, identifies the specs to which the tank was built. For example, MC 306 would indicate that the tank is a non-pressure cargo tank. Specification designations represent the following:

<table>
<thead>
<tr>
<th>Specification Designation</th>
<th>Tank Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>DOT 406</td>
<td>Non-Pressure Cargo Tank 3 to 4 psig</td>
</tr>
<tr>
<td>MC 300</td>
<td></td>
</tr>
<tr>
<td>MC 301</td>
<td></td>
</tr>
<tr>
<td>MC 302</td>
<td></td>
</tr>
<tr>
<td>MC 303</td>
<td></td>
</tr>
<tr>
<td>MC 305</td>
<td></td>
</tr>
<tr>
<td>MC 306</td>
<td></td>
</tr>
<tr>
<td>DOT 407</td>
<td>Low Pressure Cargo Tank 25 to 35 psig</td>
</tr>
<tr>
<td>MC 304</td>
<td></td>
</tr>
<tr>
<td>MC 307</td>
<td></td>
</tr>
<tr>
<td>DOT 412</td>
<td>Corrosive Liquid Cargo Tank</td>
</tr>
<tr>
<td>MC 310</td>
<td></td>
</tr>
<tr>
<td>MC 311</td>
<td></td>
</tr>
<tr>
<td>MC 312</td>
<td></td>
</tr>
<tr>
<td>MC 330 MC 331</td>
<td>Pressure Cargo Tank 100-500 psig (most are 250 to 265 psig)</td>
</tr>
<tr>
<td>MC 338</td>
<td>Cryogenic Liquid Cargo Tank</td>
</tr>
</tbody>
</table>

The letters immediately following the DOT specification indicate the type of material used to build the tank. For example, MC 306 AL would indicate that the tank is an MC 306 (non-pressure cargo tank) constructed of aluminum. Material abbreviations represent the following:

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL</td>
<td>Aluminum</td>
</tr>
<tr>
<td>CS</td>
<td>Carbon Steel</td>
</tr>
<tr>
<td>SS</td>
<td>Stainless Steel</td>
</tr>
<tr>
<td>MS</td>
<td>Mild Steel</td>
</tr>
</tbody>
</table>

The material of construction may be particularly relevant in emergency response situations because it indicates relative tank strength and how the tank is likely to react under
certain conditions. For example, aluminum is softer and bends and tears more easily than the other metals, while stainless steel is harder and less likely to be punctured than aluminum. Keep in mind, however, that all metals lose their tensile strength (resistance to rupture under tension) at temperatures above 1200°F. While the destructive temperature varies with different alloys, the alloys used most in cargo tanks sustain irreparable damage at 1300°F to 1500°F. This does not necessarily mean that a tank will fail at this temperature. You should become concerned when a tank is likely to be subjected to these temperatures for more than 30 minutes.

The following definitions will help you interpret spec plate information.

**Design Pressure:** indicates the working or maximum allowable pressure for the particular tank (not the pressure above which the tank is likely to fail).

**Head, Shell, and Weld Material:** indicates the thickness or strength of the materials used.

**Lining Material:** indicates the type of material, if any, that the cargo tank is lined with; if blank, the tank is not lined.

**Nominal Compartment Capacity:** indicates the maximum capacity—in gallons—that each compartment will hold (in consecutive order, from front to rear); if the tank is not compartmented, the total number of gallons that the tank will hold may appear here.

**Maximum Product Load:** indicates—in pounds—the maximum product load and, on corrosive carriers, the maximum weight per gallon that the tank will hold; this generally appears as follows:

Max. Product Load—56,250 lbs. @ 7.5 lbs. per gal.

**Maximum Temperature:** indicates the maximum temperature at which the tank will safely carry the material without a failure; though not always required, this is usually provided, even on non-insulated cargo tanks.
Specification plates for pressure and cryogenic cargo tanks contain very little information, as shown in Figure 3. Note that the tank capacity is indicated in pounds of water. Once again, however, the important item is the specification marking to which the tank was built.

| Manufactured by __________________________ Mfg. Co. |
| Mfg. Serial No. ____________________________ |
| DOT Spec. ________________________________ |
| Vessel Material Spec. ______________________ |
| Water Cap. Lbs. ____________________________ |
| Original Test Date __________________________ |

Figure 3: Specification Plate for Pressure and Cryogenic Liquid Cargo Tanks

While the information contained on spec plates can be very useful, being close enough to a cargo tank to read its spec plate may jeopardize your safety. Until you can be sure that the situation is stable, you must not approach an involved cargo tank.

Additional Markings

Test date markings, which appear on the front head or on the side (near the metal specification plate) of each cargo tank, indicate the month and year and the type of inspection/test last performed. Numerical figures—representing month and year—are followed by a letter that indicates the type of inspection/test (e.g., 12/91 V). These letters indicate the following:

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Test Inspection Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>V</td>
<td>External Visual Inspection</td>
</tr>
<tr>
<td>I</td>
<td>Internal Visual Inspection</td>
</tr>
<tr>
<td>K</td>
<td>Leakage Test</td>
</tr>
<tr>
<td>L</td>
<td>Lining Inspection</td>
</tr>
<tr>
<td>P</td>
<td>Pressure Test</td>
</tr>
<tr>
<td>T</td>
<td>Thickness Test (corrosive tanks only)</td>
</tr>
</tbody>
</table>
In addition, pressure cargo tanks are stenciled with the letters “QT” or “NQT,” in letters at least two inches high, near the metal specification plate on the side of the tank. QT, an abbreviation for quench tempered, means that the tank was heated and then rapidly cooled when it was being constructed. NQT is an abbreviation for non-quench tempered, indicating that the tank did not undergo the quenching and tempering process.

Most newer pressure cargo tanks are constructed of quench tempered steel because it provides greater tensile strength than non-quench tempered steel. Because the steel is stronger, QT tanks can be built lighter (less steel is required) and can, therefore, carry more product without exceeding weight limits. While quenching and tempering makes the tank metal extremely hard, it also makes it slightly more brittle when exposed to high temperatures, as in incidents involving fire. Quench tempered tanks are a little more likely to crack, split, or break open when impinged by flame than are non-quench tempered tanks. Quench tempered tanks are also more susceptible to corrosion caused by materials such as anhydrous ammonia, liquefied petroleum gas, and those with high sulfur content.

**While QT tanks will fail slightly faster than NQT tanks when exposed to high temperatures, NQT tanks will, in all probability, also fail under the same conditions; the difference in speed of failure is generally negligible. All metal loses tensile strength and softens when exposed to high temperatures.**

**Tractor Hazards**

Diesel leaks from tank car tractors are often overlooked. There is always a potential for a diesel leak from a tractor, even if it is not attached to a tanker. This type of incident can create major problems that require a significant number of resources. When an over-the-road truck is involved in an incident and leaks diesel fuel onto the exhaust manifold, onto the ground, and into a storm sewer, you will need virtually all your equipment for containment and control. In an incident at a turnpike toll booth in Ohio, a cargo tank driver was burned to death when diesel fuel ignited. The runoff entered a storm sewer and became an environmental problem for the EPA when it reached an open field.
Overview of Cargo Tank Design

Specification Cargo Tanks

Cargo tank trucks carry a wide variety of commodities and are designed to safely and efficiently transport the material from the point of manufacture to the distributor or end user. Many times, the shape and design of the tank can be used to determine the type of materials that may be contained within. Occasionally you will find a tank truck that was made for a specific job or product.

Vacuum trucks are used for spill and waste recovery, so they can contain a variety of products. These trucks must be placarded if the cargo is hazardous.

Tank shape and design are especially important when placards are missing or not visible. One element of tank construction refers to the tank’s shape as it looks from behind, or its “cross-section. Cargo tanks will be either circular or elliptical in cross-section, depending on their intended use. (In some cases, insulation is used on tanks; this insulation may change the appearance of the tank shape, making circular tanks appear elliptical.)

Tank shape also refers to the tank’s ends, usually called “heads”; the heads will either be rounded or flat.

Although they appear to be one continuous container, many cargo tanks are compartmentalized within. Sometimes the compartment capacities are marked on the outside of the tank. Whether they are marked or not, each compartment
will have its own manhole for loading and unloading. In addition, cargo tanks have a series of valves and safety devices, and various types of rollover protection. However, since cargo tank trucks are designed with different tank shapes, it is usually more expeditious for emergency response personnel to learn to recognize tank shapes rather than tank assemblies. (Tank assemblies become extremely important in identifying cargo tank cars.)

Most cargo tanks in service today were built to “MC” (motor carrier) specifications, and they are often identified by the specifications to which they were built, such as MC 306, MC 307, etc. These numbers refer to the pressures and types of cargo the tank is designed to carry. Older MC specifications, such as MC 302, MC 303, and MC 305, can no longer be used to build cargo tanks, but tanks built to these specifications are still in service. In addition, recent regulatory changes have added new cargo tank specifications—DOT 406, DOT 407, and DOT 412. These tank specs will replace their forerunners, the MC 306, MC 307, and MC 312, respectively.

There is actually little difference between DOT and MC descriptions. The changes relate primarily to pressure ratings and relief devices, as noted below:

- New cargo tank specifications as of September 1, 1996
  - MC-306 becomes DOT 406
  - MC-307 becomes DOT 407
  - MC-312 becomes DOT 412
- Must be manufactured in accordance with ASME code
- Thicker shells, heavier tanks, less product
- Requires more emergency venting
Frangible and fusible vents are no longer permitted, all vents must reseat.
Vents must not leak over one gallon of product.
Internal valve shear section must break at no more than 70% of failure load.
Internal valves must be designed to self-close in 30 seconds of actuation.
Requires nameplate and specification plate to carry 25 items.

Until September 1, 1993, cargo tanks could be built to either MC specs—MC 306, MC 307, MC 312,—or new DOT specifications—DOT 406, DOT 407, DOT 412. While cargo tanks could not be built to MC 306, MC 307, or MC 312 specs after August 31, 1993, many of these (and older spec) cargo tanks will remain in service for several years.

Specifications for pressure and cryogenic liquid cargo tanks are not changing at this time. On the new DOT 406, DOT 407, and DOT 412 cargo tanks, each compartment with a capacity in excess of 400 gallons must have its own manhole.

Non-Pressure Cargo Tanks
(MC 306/DOT406)

Non-pressure cargo tanks are designed primarily to carry petroleum products such as gasoline and fuel oil, however they may also be used to transport alcohol. These cargo tanks, which haul from 1,500-12,000 gallons of product, class B poisons, and liquid food products, make up 57% of the total fleet of tankers on the road.

MC 306 cargo tanks are elliptical in cross-section, and have flat heads. They are usually made of .25 inch aluminum, but some may be carbon steel. In addition, these tanks are usually compartmentalized. Each compartment has its own manhole assembly or dome cover. Manholes and dome covers are the most common areas for leaks. Large compartments may have more than one manhole; the number of discharge valves (beneath the tank) will indicate the number of compartments. Vapor recovery lines (which are smaller than product lines) should not be used to judge
the number of compartments. There may be more vapor recovery lines than product compartments. These tanks also have rollover protection running the length of the tank. In many cases, non-pressure tank carriers are permanently marked with the owners name and/or the type of material being transported.

![Non-Pressure Cargo Tank](image)

This tank is designed for head pressures not to exceed the static head pressure on its contents, usually a minimum and maximum of 3 psig. Emergency shut-offs are usually manual and a second shut-off may be present. Pressure-activated vents limit the vacuum to 1 psig and pressure to 3 psig. A fusible element that melts at 250 degrees must be installed if the vent will not vent 6,000 cubic feet at 5 psig.

DOT 406 cargo tanks have a thicker shell than MC 306s. The internal pressures must be a minimum of 2.65 psig and a maximum of 4 psig. The manways must withstand without leakage 36 psig. These tanks are top loaded and unloaded through the bottom.

**Low Pressure Cargo Tanks**  
*(MC 307/DOT407)*

Low pressure cargo tanks have circular cross-sections and flat heads, though from behind, some of these tanks may appear to have a horse-shoe shaped cross-section. This tank makes up approximately 20% of the total cargo tank fleet on the road. The tanks are made of aluminum, mild steel, or stainless steel. The diameter of the tank may appear to taper down from the front to the back, helping to distinguish this tank from others. In addition, these tanks will have rollover protection around the area of the manhole assembly. Some low pressure cargo tanks have rollover protection extending from the front of the tank to the back of the tank; this is sometimes called a “catwalk.”
This rollover protection must carry twice the weight of the loaded tank.

![Diagram of a Low Pressure Cargo Tank (MC 307 and DOT 407)]

Low Pressure Cargo Tank (MC 307 and DOT 407)

This type of rollover protection usually indicates that the tank is compartmentalized and has more than one manhole assembly or dome cover, at least 15’ or larger. This type of tanker can carry from 5,000 to 8,000 gallons. (Each compartment of a compartmentalized tank is considered a separate tank. Tanks with capacities equal to or greater than 2,500 gallons are fitted with manhole assemblies; dome covers are smaller than manhole assemblies and are used in their place when the corresponding tank’s capacity is less than 2,500 gallons.) Compartmentalized tanks can carry more than one Class of product at a time. One and two compartment tanks are common but many have up to four compartments. A fusible cap which will melt at 250 degrees and a frangible disc at 130%-150% of design pressure are required on flammable loads. Unloading and loading is done through bottom internal valves or through the manway. Low pressure cargo tanks have working pressures of 25-35 psig.

DOT 407 cargo tanks have a thicker shell and head material, which allows them to haul up to 9,500 gallons. Some DOT 407s are designed for vacuum service but must meet a standard for vacuum.

These tanks are used to transport flammable and combustible liquids, mild corrosives, poisons, and almost all other liquid chemicals.

**Corrosive Liquid Cargo Tanks**
While corrosive liquid cargo tanks have the same basic configuration as low pressure cargo tanks (circular cross-sections with flat heads) they are very different. These tanks usually have a single compartment, a working pressure of 15-50 psig (normally 35 psig) and a capacity of 3,000-7,000 gallons. This tanker makes up 12% of the total fleet on the road. Tanks are not compartmentalized.

Because most corrosives are heavier than other liquids, corrosive liquid cargo tanks are often smaller in diameter than other cargo tanks. This limits the amount of product that can be loaded, thereby keeping the weight of the shipment down. They also have visible stiffening rings running vertically around the tank for added strength. These tanks can be insulated and covered by a jacket that may hide the stiffening rings, but the tank will still appear smaller in diameter. These tanks generally have a liner bonded to the tank. If the product leaks through the lining there is a chance the tank structure will fail. These tanks have rollover protection around the manhole and fittings and may be equipped with splash protection around the manhole assembly. Because they carry corrosives, they are often discolored around the loading/unloading area, or this area may be painted with a corrosive-resistant paint.

Corrosive liquid cargo tanks are loaded and unloaded from either the top by air pressure or the bottom by gravity. If unloaded from the top, the shut-off valve is installed at the top as close to the tank as possible. If unloaded from the bottom, the valve is installed at the bottom outlet, and an emergency valve is located no more than 10 feet from the tank. Safety venting devices must function at 150% of design pressure. When using air to off-load, a relief valve must be installed to limit tank pressure to 130% of inlet valve pressure.
Obviously, corrosive liquid cargo tanks are used to transport corrosives, such as sodium hydroxide, hydrochloric acid, and sulfuric acid. They may also be used to transport other high density liquids. Also, some vacuum trucks are built to MC 312/DOT 412 specifications. In addition, some vacuum trucks are built to DOT 412 specifications.

DOT 412s may be round in shape. The minimum internal vacuum pressure is 25 psig. If design pressure exceeds 15 psig, the the tank must be circular in design.

**Pressure Cargo Tanks (MC 331)**

Pressure cargo tanks transport gases that have been liquefied through compression; the contents must remain under pressure to maintain a liquid state. These tanks make up 10% of the total fleet of tankers on the road. The working pressure of an MC 331 is 100 - 500 psig, with a capacity of 8,000 - 11,500 gallons with no manways. To withstand this internal pressure, pressure cargo tanks are “rounded.” The tank cross-section is circular with a rounded head, and is easily distinguished from other tanks. In addition, the upper two-thirds or the entire tank will be painted white or a highly reflective color.

All valves on MC 331s have to be labeled as to liquid or vapor. All MC 331s with a water capacity under 3,500 gallons must have at least one emergency discharge control valve on the emergency internal valves. All tanks over 3,500 gallons must have emergency discharge control valves (mechanical and thermal) at each end of the tank. Excess flow valves must close automatically. Safety valves will be set to 110% of the tanks design pressure. Usually MC 331 tanks are loaded and off-loaded through compart-
ments containing the valving. Some have outside valving. In most cases, this is a single compartment tank carrying a dedicated product.

Pressure Cargo Tank (MC 331)

Pressure cargo tanks carry commodities such as propane, butane, anhydrous ammonia, nitrous oxide, carbon monoxide, and chlorine. Sometimes they have permanent markings such as “Flammable Gas”, “Compressed Gas” or the manufacturer’s name. Tanks marked with “NQT are authorized to carry anhydrous ammonia, and liquefied petroleum gas.

Tank trucks hauling over 125 gallons of a flammable cryogenic require written instructions on handling a release.

The instructions must include:
• General precautions (usually copies from the North American Emergency Response Guidebook)
• Manual venting procedures
• Emergency procedures
• Names and phone numbers of contacts in an emergency

Cryogenic Cargo Tanks (MC 338)

These specialized tanks are designed to carry gases that have been liquefied through temperature reduction. The carrier must keep the contents extremely cold (below minus 130°). Cryogenic cargo tanks make up a very small percentage of the total fleet of tanks on the road. Because they carry cryogenics, you will be able to do very little in the way of plugging and patching. Most cryogenic manufacturers have their own response teams.

These tanks have a capacity of 8,000-10,000 gallons. They are highly insulated, giving them a bulky appearance.
Cross sections are circular and heads are flat. The container is comprised of a welded inner tank holding the cryogenic product surrounded by a vacuum space containing insulation. The outer final shell is often made of steel.

Discharge and fill piping, valves, and a pump are usually located within a cabinet or station at the front or rear of the tank. The cabinet protects the piping, valves, and pumps should the carrier overturn in an accident.

Cryogenic materials are stored and transported in well-insulated containers. Due to the fact that they have a very low boiling point, they are constantly “boiling off” while being transported. This boiling causes pressure build-up that escapes through a relief valve. It is not uncommon to see an occasional vapor relief from these vehicles.

Cryogenic cargo tank pressures are between 25.3 psig and 500 psig. Each tank must have a pressure gauge visible to the driver from the cab. MC 338s carrying flammable liquids or oxygen must be set to discharge at 110% of the tanks design pressure. A thermal closure must activate at 250°F.

Loading and off-loading is done through a rear or side compartment where valves are secured and protected. Liquid oxygen (LOX), liquid nitrogen, liquid hydrogen, liquid helium, and liquid carbon dioxide are commonly transported in cryogenic cargo tanks.

Activity
Other Types of Carriers

There are five other highway carriers that can usually be distinguished from most others. Knowing their general body shapes and designs will help you identify the cargo.

Tube Trailers

DOT does not class tube trailers as cargo tanks. These carriers are modified semi-trailers made up of from 2 to 20 long, thin cylinders, or tubes, cascaded together and permanently mounted on a semi-trailer. The cylinders range from 9 to 48 inches in diameter with working pressures up to 5,000 psig. This tank makes up a very small percentage of the total fleet. DOT specification cylinders 3AX, 3AAX, or 3T carry non-liquefied gases; a 3T can not carry hydrogen.

Cylinder markings include:
- DOT specifications
- Service pressure
- Manufacturers registration number
- Inspectors number
- Tire weight in pounds
- Test date

These carriers are designed to carry gases under pressure; they do not carry liquefied gases. Tube trailers usually carry atmospheric gases, such as argon, carbon dioxide, helium, hydrogen, nitrogen, and oxygen, and refrigerant gases. Their distinct design makes tube trailers easily distinguishable from other cargo carriers.
Non-Specification Cargo Tanks

Non-specification cargo tanks are not regulated and do not conform to DOT specifications. However, hazardous materials are often carried in these types of cargo tanks, even in bulk quantities. For example, fuel oil can be carried in bulk quantities in non-specification cargo tanks. Other materials can be carried in non-specification tanks if their quantities or pressures do not exceed certain limits. Cryogenic materials, LPG, anhydrous ammonia, fertilizers and pesticides are examples.

Dry Bulk Commodity Carriers

The most distinguishing characteristics of this vehicle are its large, heavy, sloping V-shaped unloading compartments located at the bottom of the trailer and its rear-mounted air compressor. These tanks are pneumatically off-loaded hoppers that carry dry materials, such as fertilizers, oxidizers, and plastics. They can also carry non-hazardous and hazardous materials. When carrying hazardous materials, they should be appropriately placarded. Some of the materials carried by this type of tanker may be very water reactive.

Molten Material Carriers
Unless otherwise regulated due to the material’s chemical properties, molten materials are not technically considered hazardous and, therefore, are not required to be placarded. However, the high temperatures associated with molten materials can cause them to be extremely dangerous.

Usually the tank will be stenciled with the name of the product, such as “Molten Sulfur”. Molten material carriers can be easily recognized by the large, heavily insulated, metal “pots” on flat trailers. These trailers are small in quantity (3,300 - 3,400 gallons) because molten material is usually very heavy. For example, sulfur weighs 17 pounds per gallon.

**Tar and Asphalt Carrier**

This type of carrier is commonly used to carry hot asphalt and solvent mixtures for asphalt products. This is a non-pressure tank made of mild steel with an outer jacket. Tank temperature is usually 400-500°F. This type of tank may have propane burners and attached propane tanks.

**Special Product Carrier**

Special product carriers are made of fiberglass and covered with a stainless steel jacket with reinforcement rings and a cork insulation. The insulation keeps the product at 325°F. These tanks are designed to carry dimethyl terephthalate and phthalic anhydride. The working pressure is 30 psig with a capacity of 5,800 gallons. This tank is similar to an MC 307.

Food grade tankers are another example of a special product carrier. Although cargo is not hazardous, products are sometimes shipped at 250°F with a working pressure of 30 psig (if pressurized). This tank is similar to an MC 307.
**Multipurpose Tanks**

Multipurpose tanks must meet the specifications of two or more tank classifications. They must be color-coded as follows:

- MC 306—Red
- MC 307—Green
- MC 312—Yellow
- Non-specification—Blue

In addition, several other highway carriers are used to transport hazardous and non-hazardous materials. Unfortunately, when hazardous materials are transported in cargo vans, semi-trailers, and straight truck vans, the shape of the vehicle will not provide clues about the contents of the vehicle. Emergency response personnel will have to rely on the driver, the shipping papers, and/or placards for information.

**Activity**

**Cargo Tank Fittings**

**Valves**

Valves consist of seven basic types. Contact a manufacturer for a diagram, or work with a specialist to learn how each type operates. Do not work on valves unless you have had hands-on experience!

The following are typical valves used in highway cargo tanks.

**“Y” adapter valves** are commonly used on MC 306 and 407 cargo tanks to bottom load and off-load.

**Hydrolet valves** are bottom loading and unloading valves. They are used on the MC 307, MC 407, and MC 312 cargo tanks. These valves are usually made of stainless steel with a Teflon seat and are quickly removed for cleaning.
**Ball valves** rotate 90 degrees to allow quick on and off. They are commonly used on MC 331 and MC 312 cargo tanks.

**Butterfly valves** are used to save space on pneumatic tankers. Turning a butterfly valve 90 degrees will open it fully.

**Flush valves** provide full flow for complete drainage.

**Gate valves** are positive closure valves used at the terminal valves on product lines.

**Globe valves** are used as flow control valves.
Emergency Valves

Bottom loading tanks have internal valves or emergency valves that are designed to remain closed if an accident occurs. Because the valves are internal (seated within the tank, flange, or sump) they remain intact and prevent product from being released if the piping is torn away. In addition, these product discharge valves have automatic, heat-activated closures that melt and close the valves under fire conditions.

The emergency valve system usually includes a secondary means of closure that is remote from filling and discharge openings. Remote emergency closures are usually located on the left front corner of the tank, although you may also find them on the right corner.

All bottom loading/offloading piping is protected by a shear section that is designed to break away if struck. The shear section will break under the strain of impact and leave the emergency valve head, seat, and its attachment to the tank intact and capable of retaining the product. Remember, however, that piping on non-pressure cargo tanks sometimes contains 30 to 40 gallons of product that will be released if the piping is sheared off.

An emergency valve must be opened manually by mechanical, hydraulic, or pneumatic means. Many times, the lines that lead to the pneumatically and hydraulically operated vents have fusible plugs. If melted, these plugs close the vent.
Venting and Safety Relief Devices

With the exception of tanks carrying poisonous materials, most cargo tanks are built with fittings that allow venting under normal conditions as well as venting, or pressure/vacuum relief, when the tank is under stress. These fittings include:

- Breather vents
- Loading/offloading vents
- Safety relief devices

Vents

Breather vents allow normal venting of vapors. They are designed to open at predetermined settings to relieve pressure or a vacuum. Breather vents re-close when internal tank pressure has been restored below the predetermined setting.

Loading/offloading vents, also called vapor recovery vents, are high-capacity vents that allow tanks to be vented while being bottom loaded or offloaded with the dome covers closed. These vents are installed in the dome cover or on top of the tank itself.

Safety Relief Devices

Safety relief devices include both safety vents and safety relief valves. They are designed to relieve tank pressure or vacuum at predetermined limits. Tank size and number of compartments, in addition to prescribed cargo tank specifications, dictate how many safety relief devices a tank must have—generally, one per compartment.

Safety vents are typically used on non-pressure, low pressure, and corrosive liquid cargo tanks; they are not used on pressure or cryogenic liquid cargo tanks. When present, they are sometimes mounted on the manhole cover plate or are part of a fusible cap. There are two common types:

- Fusible plugs
- Frangible disks
Fusible plugs melt at predetermined temperatures, whereas frangible disks burst at predetermined pressures. Neither of these devices re-close, even when normal temperatures and pressures have been restored. Regulations now prohibit the installation of non-reclosing pressure relief devices on newer cargo tanks (built after August 31, 1990) used to transport hazardous materials. Frangible disks, however, may still be used in conjunction with one or more re-closing safety relief devices.

Since they do not re-close, melted and ruptured safety vents are common causes of leaks from cargo tanks. Once they have melted or ruptured, safety vents must be replaced. If you have the proper training, you may be able to replace a melted or ruptured safety vent, if an appropriate replacement is available.

**Safety relief valves** are used on pressure and cryogenic liquid cargo tanks as well as on non-pressure, low pressure, and corrosive liquid cargo tanks. They allow for emergency venting, often referred to as PAV—pressure actuated venting. These devices are spring loaded and are designed to open when pressure inside the tank reaches a predetermined limit. Safety relief valves reseat themselves when normal pressure has been restored.

The DOT requires that venting and safety relief devices not leak, regardless of the position of the vehicle (e.g., after a rollover). Breather vents often leak, however, when a tank overturns. Screw-on fusible caps sometimes blow out when pressure surges as a tank rolls over, and frangible disks may burst when tank contents surge during normal transit. And, as mentioned earlier, fusible and frangible disks will continue to vent, and may leak, even after normal pressure and temperature have been restored.

In addition, liquid or vapor leaking from a safety relief valve could indicate that the relief valve spring is defective. However, leaks caused by defective valves on low pressure cargo tanks, pressure cargo tanks, and non-pressure cargo tanks should be handled only by industry specialists.
Miscellaneous Fittings

Cargo tanks may have various other fittings and devices to allow for the safe transit, loading, and offloading. Most pressure and low pressure cargo tanks are equipped with thermometers that indicate product temperature and pressure gauges that indicate internal tank pressure. Pressure cargo tanks are usually also equipped with gauging devices used to determine the volume of product in the tank; low pressure cargo tanks rarely have gauging devices.

Manholes

Manholes are large openings on the tops of cargo tanks, or on the back head on most pressure cargo tanks. Manholes allow access to the interior of the tank for inspection, cleaning, and repairs. There are numerous styles of manhole covers, but all must:

- Provide a secure closure to prevent product loss
- Withstand specified internal pressures
- Have safety devices that prevent covers from opening due to internal pressure
- Have gaskets that can withstand the effects of the product (on corrosive liquid cargo tanks)

For non-pressure, low pressure, and corrosive liquid cargo tanks, manholes are required on every compartment with a capacity in excess of 2,500 gallons. On pressure cargo tanks, only those compartments holding over 3,500 gallons are required to have manholes. Some cargo tanks have more than one manhole per compartment.

Typical Manhole Assembly for Low Pressure Cargo Tanks
Often, other fittings are located in the area of the manhole or are mounted on the manhole cover. Some cargo tanks have fill holes for loading and offloading on the manhole cover. Manholes and surrounding fittings are protected by overturn protection devices. These devices either run the length of the cargo tank or surround just the manhole.

Manhole Assembly with Fill Hole, Typical for Low Pressure Cargo Tanks
Railroad Tank Cars

Overview

Tank cars are the bulk containers used to carry both hazardous and non-hazardous materials by rail. A variety of cargo can be transported by rail, including compressed and non-compressed gases, liquids, and solids. However, the specific type of material that can be carried in a tank car depends on the construction of the car itself, as well as its size, fittings, linings, and other fittings.

Tank Car Shipping Papers

Whenever you respond to an emergency situation involving rail or other transportation equipment, it is essential that you obtain shipping papers if at all possible. Placards provide useful information, but shipping papers provide more detailed information. Furthermore, some products that may be legally transported without placards are very hazardous even in small quantities or if allowed to mix with other materials, as in the case of a derailment.

Two pieces of documentation are carried on trains; only one of these, the waybill, is required.

- The waybill contains information specific to a particular rail car; there is one waybill for each car in the train.

- The consist/wheel report lists all of the cars and their location in the train and identifies any cars that are carrying hazardous materials.

Waybills

Waybills must be carried by a member of the train crew, usually the conductor. The conductor generally rides with the rest of the crew in the locomotive at the head of the train. On trains where a caboose is still used, the conductor often rides in the caboose at the rear of the train.
Each waybill must contain the following information:

- Proper shipping name(s) of the car’s contents
- UN/NA identification number(s)
- Standard Transportation Commodity Code(s)
- Additional identification information for generic descriptions and not otherwise specified (N.O.S.) commodities
- Amount of commodity(ies) in shipment/shipping weight
- Number of containers
- Primary hazard class(es) of the load
- Placard requirements
- Car initial and number
- Railroad carrier
- Emergency telephone numbers
- Shipper’s full name and address
- Consignee’s full name and address

Waybills provide information that is critical to sizing up a situation and making informed decisions about tactics. Whenever possible, obtain these documents immediately on arriving at the scene of a rail emergency.

**Consists/Wheel Reports**

The consist, also called the wheel report, lists each car in succession, beginning at the front of the train with the locomotives and working back to the end of the train. This information can be used to identify cars loaded with hazardous materials, particularly when placards and other markings are missing or illegible. However, the consist may not reflect changes in the order of the cars if switching operations occurred between rail terminals.

Like the waybill, the consist contains information critical to sizing up a rail incident:

- Bold type face for contents of cars containing hazardous materials followed by additional special consideration information
- Special handling instructions
- Additional information regarding fire fighting procedures
Consist information is often abbreviated. In the example in Figure 1, “ORR” means originated and “RFP” means Richmond, Fredericksburg, and Potomac Railroad—indicating that the train originated on the Richmond, Fredericksburg, and Potomac Railroad. The train reporting number is listed as R40921. With this number, the railroad can quickly obtain accurate information about the contents of the train. The time and date the train was ordered—left the yard—are also included in this area of the consist. Again, the cars are listed in succession, beginning with the locomotives.

Figure 1

<table>
<thead>
<tr>
<th>NEF</th>
<th>NUMBER</th>
<th>KD</th>
<th>GTN</th>
<th>NTN</th>
<th>CTENTS</th>
<th>DEST CITY ST CONSIGNEE INTERCHNG</th>
<th>INRR</th>
<th>OT</th>
<th>BLK</th>
</tr>
</thead>
<tbody>
<tr>
<td>FF</td>
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<td>EL</td>
<td>000</td>
<td>000</td>
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<td>0000</td>
<td></td>
<td></td>
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<tr>
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<td>EL</td>
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<td>000</td>
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<tr>
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<td>158393</td>
<td>CP</td>
<td>047</td>
<td>013</td>
<td>MTYTRL</td>
<td>ROCMOUNT NC RAMP 0933 1021 RFP 18</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>BDZ</td>
<td>232032</td>
<td>EZ</td>
<td>000</td>
<td>000</td>
<td>PNS</td>
<td>ROCMOUNT NC RAMP 2045 1020 RFP 18</td>
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<tr>
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<td>013</td>
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<tr>
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<td>EZ</td>
<td>000</td>
<td>000</td>
<td>PNS</td>
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<tr>
<td>USX</td>
<td>009435</td>
<td>EC</td>
<td>035</td>
<td>000</td>
<td>SUGAR</td>
<td>CLEWISTON FL EVESUGREF 1947 1020 BO 30</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GATX</td>
<td>042901</td>
<td>ET</td>
<td>031</td>
<td>000</td>
<td>CORMT</td>
<td>EASTAMPA FL GARDINIR2 1947 1020 BO 30</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LCX</td>
<td>224598</td>
<td>ET</td>
<td>037</td>
<td>000</td>
<td>PLASTI</td>
<td>JACKSONV FL ALLSIGNA1 1947 1020 BO 30</td>
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<td></td>
</tr>
<tr>
<td>ATX</td>
<td>030480</td>
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<td>031</td>
<td>000</td>
<td>NORDCO</td>
<td>GA NORKAOLIN 0148 1020 BO 31</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>SX</td>
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<td>CL</td>
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<td>032 LOADS 058 MTYS 090 TOTAL CARS 126 TOT INCL TRL 03964 GTONS 00974 NTONS</td>
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<td></td>
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</tbody>
</table>
Note that the GATX tank car (shown in italics) contains a corrosive material that is acidic and poisonous. The abbreviation, SPEC INSTR, indicates special instructions, provided in a supplemental section, for emergency response.

The end of the consist report provides vital information about the train—the number of loaded and empty cars, along with the total gross tons for the completed train. This train has a total of 126 cars with a gross weight of 3,964 tons.

The supplemental section to the consist, illustrated in Figure 2, provides further information about cars containing hazardous materials. Each car is listed separately with its reporting letters and numbers. This section also indicates whether the car is loaded, empty, or contains a residual amount of product. In the column marked “L/E,” “L” indicates that the car is loaded, “E” indicates that the car is empty, and “R” indicates that the car contains a residual amount of the product. The primary hazard class and the appropriate UN/NA identification number is included. Finally, the position of the car (from the front of the train) is indicated in the column marked “POS.” The information in each column will vary depending on the railroad. Contact the rail yards in your area to obtain examples of their consists and an explanation of their codes.
### SUPPLEMENTAL INFORMATION

**FORM 823 NOTICE OF PLACARDED CARS CONTAINING HAZ MATS**

<table>
<thead>
<tr>
<th>POTOMAC YARD, VA</th>
<th>10/21/88</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>13:01</td>
</tr>
</tbody>
</table>

**TO – TRAIN CREW**

**OUT RR – RFP**

**TRAIN SYMBOL – R40921**

**LEAD ENGINE – 000125**

<table>
<thead>
<tr>
<th>INIT</th>
<th>NUMBER</th>
<th>L/E</th>
<th>PLACARDED</th>
<th>UN NUMB</th>
<th>POS</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>GATX</td>
<td>042901</td>
<td>L</td>
<td>CORROSIVE</td>
<td>NA1778</td>
</tr>
<tr>
<td>02</td>
<td>GATX</td>
<td>011220</td>
<td>E</td>
<td>CORROSIVE</td>
<td>NA1778</td>
</tr>
<tr>
<td>03</td>
<td>UTLX</td>
<td>011220</td>
<td>E</td>
<td>CORROSIVE</td>
<td>NA1778</td>
</tr>
</tbody>
</table>

HYDROSILICOFLUORIC ACID IS A COLORLESS FUMING LIQUID WITH A PENETRATING PUNGENT ODOR. IT IS USED IN WATER FLUORIDATION, IN HARDENING CEMENT AND CERAMICS, AS A WOOD PRESERVATIVE, AND FOR MANY OTHER USES. IT IS SOLUBLE IN WATER WITH RELEASE OF HEAT. IT IS CORROSIVE TO METALS AND TISSUE; THE FUMES AND VERY SHORT CONTACT WITH SMALL QUANTITIES OF THE LIQUID CAN CAUSE SEVERE PAINFUL BURNS.

IF MATERIAL INVOLVED IN FIRE:
EXTINGUISH FIRE USING AGENT SUITABLE FOR TYPE OF SURROUNDING FIRE. (MATERIAL ITSELF DOES NOT BURN OR BURNS WITH DIFFICULTY.) USE WATER IN FLOODING QUANTITIES AS FOG. COOL ALL AFFECTED CONTAINERS WITH FLOODING QUANTITIES OF WATER. APPLY WATER FROM AS FAR A DISTANCE AS POSSIBLE.

IF MATERIAL NOT INVOLVED IN FIRE:
KEEP MATERIAL OUT OF WATER SOURCES AND SEWERS. BUILD DIKES TO CONTAIN FLOW AS NECESSARY. USE WATER SPRAY TO KNOCK-DOWN VAPORS. NEUTRALIZE SPILLED MATERIAL WITH CRUSHED LIMESTONE, SODA ASH, OR LIME.

PERSONNEL PROTECTION:
AVOID BREATHING VAPORS. KEEP UPWIND. WEAR POSITIVE PRESSURE SELF-CONTAINED BREATHING APPARATUS. AVOID BODILY CONTACT WITH THE MATERIAL. WEAR APPROPRIATE CHEMICAL PROTECTIVE GLOVES, BOOTS, AND GOGGLES. DO NOT HANDLE BROKEN PACKAGES UNLESS WEARING APPROPRIATE PERSONAL PROTECTIVE EQUIPMENT. WASH AWAY ANY MATERIAL WHICH MAY HAVE CONTACTED THE BODY WITH COPIOUS AMOUNTS OF WATER OR SOAP AND WATER. IF CONTACT WITH THE MATERIAL ANTICIPATED, WEAR APPROPRIATE CHEMICAL PROTECTIVE CLOTHING.

FIRST AID RESPONSES:
MOVE VICTIM TO FRESH AIR, CALL EMERGENCY MEDICAL CARE. REMOVE AND ISOLATE CONTAMINATED CLOTHING AND SHOES AT THE SITE. IN CASE OF CONTACT WITH MATERIAL, IMMEDIATELY FLUSH SKIN OR EYES WITH RUNNING WATER FOR AT LEAST 15 MINUTES. KEEP VICTIM QUIET AND MAINTAIN NORMAL BODY TEMPERATURE.
Emergency Response Information

Emergency response information is also included on shipping papers. In addition to an emergency telephone number for the shipper or shipper’s representative, this information typically includes the following details about each hazardous material:

- Classification of material
- STCC Number (Standard Transportation Commodity Code)
- Proper shipping name, Hazard Class, UN/NA identification number
- Brief product description
- Emergency actions involving fire
- Emergency actions involving release only
- Personnel protective measures
- Environmental considerations—land, water, air—as appropriate
- First aid actions
- Compatible protective equipment construction materials, when available

Before actions are taken, shipping paper information should be cross-referenced to the train consist/wheel report or track list by the sequence of the car in the train and by the car’s initials (reporting marks) and number.

Shipping paper information is available either directly from the shipping papers on the scene or from the railroad’s dispatch center. The process for obtaining shipping paper information differs slightly with each railroad; therefore, as part of your pre-emergency planning efforts, you must contact the railroads operating in your response area and determine how to obtain the necessary shipping paper information in an emergency.


Tank Car Markings

Stenciled Commodity Names

When certain commodities are shipped by rail, the name of the commodity must be stenciled on the side of the tank. Tank cars that carry these materials are sometimes known as “dedicated” tank cars because they carry only the material for which they have been stenciled. When the commodity is changed, the stencil is also changed. Commodities that must be carried in stenciled tank cars include:

- Acrolein
- Anhydrous Ammonia
- Bromine
- Butadiene
- Chlorine
- Chloroprene (stenciling required for some tank cars)
- Difluoroethane
- Difluoromonochloromethane*
- Dimethylamine, Anhydrous
- Dimethyl Ether
- Ethylene Imine
- Ethylene Oxide
- Formic Acid
- Fused Potassium Nitrate and Sodium Nitrate
- Hydrocyanic Acid
- Hydrofluoric Acid
- Hydrogen
- Hydrogen Chloride
- Hydrogen Fluoride
- Hydrogen Peroxide
- Hydrogen Sulfide
- Liquefied Hydrogen
- Liquefied Hydrocarbon Gas (may also be stenciled Propane, Butane, Propylene, or Ethylene)
- Liquefied Petroleum Gas (may also be stenciled Propane, Butane, Propylene, or Ethylene)
- Methyl Acetylene Propadiene Stabilized
- Methyl Chloride
- Methyl Mercaptan
- Methyl Chloride - Methylene Chloride Mixture
- Monomethylamine, Anhydrous
Motor Fuel Anti-Knock Compound or Anti-Knock Compound
Nitric Acid
Nitrogen Tetroxide
Nitrogen Tetroxide - Nitric Oxide Mixture
Phosphorus
Sulfur Trioxide
Trifluorochloroethylene*
Trimethylamine, Anhydrous
Vinyl Chloride
Vinyl Fluoride Inhibited
Vinyl Methyl Ether Inhibited

*May be stenciled “Dispersant Gas” or “Refrigerant Gas” in lieu of name.

When commodity names are not stenciled on railroad tank cars, other means of identification must be used.

**Reporting Marks (Initials) and Car Number**

Tank cars can be identified by their reporting marks, sometimes called “initials”, and a specific sequence of numbers. The reporting marks and numbers are stenciled on the left side of the car and on both ends. The reporting marks, consisting of up to four letters, indicate ownership of the car. The car number may contain up to six digits. Using the car’s initials and number, responders (as well as shippers and carriers) can determine a tank car’s contents from shipping papers or the railroad’s computer database.

**Specification Markings**

Specification markings are stenciled on the right sides of tank cars, opposite the reporting marks, and stamped on the ends (called “heads”) of the tank. On ton containers (described later in the text), the specification markings are stamped on each tank or onto a metal plate affixed to each tank. These markings represent the Department of Transportation (DOT) or Association of American Railroads (AAR) standards to which the car was built. In addition, specification information can be obtained from the railroad’s computer system using the car’s initials and number. While specification markings indicate how the tank car was constructed, they rarely identify its cargo.
Use the following as a quick guide for markings on tank cars:

Car reporting marks and number

Example of tank car specification marking
There are many markings on a cargo tank. You will need most of them to help you determine your response.

<table>
<thead>
<tr>
<th>Tank Car Classes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Non-pressure tank cars (0-100 psig)</strong></td>
</tr>
<tr>
<td>DOT-103</td>
</tr>
<tr>
<td>DOT-104</td>
</tr>
<tr>
<td>DOT-111A</td>
</tr>
<tr>
<td>DOT-115</td>
</tr>
<tr>
<td><strong>Pressure tank cars (100-600 psig)</strong></td>
</tr>
<tr>
<td>DOT-105</td>
</tr>
<tr>
<td>DOT-109</td>
</tr>
<tr>
<td>DOT-112</td>
</tr>
<tr>
<td><strong>Cryogenic liquid tank car</strong></td>
</tr>
<tr>
<td>DOT-113</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Miscellaneous</strong></td>
</tr>
<tr>
<td>DOT-106A/DOT-110A (both multi-unit tank car tank—ton containers)</td>
</tr>
<tr>
<td>DOT-107A</td>
</tr>
<tr>
<td>AAR-207</td>
</tr>
<tr>
<td>AAR-208</td>
</tr>
</tbody>
</table>
Overview of General Tank Car Design

Unfortunately, there will be occasions when tank car markings (and placards) are obstructed from view even with the aid of binoculars. In these cases, response personnel will have to rely on basic tank car design characteristics to identify the nature of the tank’s contents. Each car must be identified in the initial stages of the incident to determine proper response and proper PPE.

In general, most tank cars look very similar. Although there are exceptions, most carry only a single commodity. They have circular cross sections and rounded/ellipsoidal heads.

Shelf Couplers

Effective November 15, 1990, all tank cars used for the transportation of materials subject to the hazardous materials regulations must be equipped with shelf couplers. Shelf couplers prevent the cars from becoming unhooked and the tanks from colliding during a derailment.
Head Shields

Many retrofit programs have been developed to protect the cars from damage during a derailment. **Head shields** are protective covers that are either built into the head of a car or “half head” or “trapezoidal-shaped” plates mounted on each end of the tank car.

![Head Shield](image)

Lifting Lugs and Skid Protection

Lifting lugs have been added to many tank cars for lifting the car when it derails or is involved in an accident. Bottom discontinuity or skid protection is a safety device placed on the bottom of tank cars to prevent the valving from being torn off during a derailment.

![Skid Protection](image)
Insulation

Commodities that must maintain a certain temperature during transportation will be carried in insulated tank cars. Fiberglass or polyurethane foam is most often used as the insulating material. However, cork may be used as an insulator on cars carrying certain materials, such as hydrocyanic acid. Perlite is commonly used to insulate cars carrying refrigerated liquefied gases. The insulation is held in place by a metal jacket which gives the tank car the appearance of flat or nearly flat heads. Insulated tank cars may also be recognized by the presence of flashing over the tank bands, and flat sections on the sides of the jackets. Insulation masks the location of a leak, making it difficult to plug or patch. The best option is to off-load the tank car. Do not damage insulation while searching for a leak.

Thermal Protection

In addition, tank cars may have thermal protection. This is not the same as insulation. Rather than safeguarding the contents of the tank car from outside temperatures (as insulation does), thermal protection shields the tank car from the effects of fire. Such protection prevents tank temperatures from exceeding 800°F during exposure to flames.

When fire fighting around an insulated tank car, you should know the temperature at which the product should be maintained. For example, if a product must be kept at 40°F and you apply 60°F water, you will raise the product temperature and possibly cause it to vaporize, creating a very dangerous situation.

There are two types of thermal protection:

**Jacketed thermal protection** utilizes a thin steel outer covering, or jacket, to hold thermal protection, such as mineral wool or ceramic fiber blankets, in place.

**Sprayed-on thermal protection** incorporates a rough textured, heat-resistant coating applied to the outside of the tank or tank jacket. The coating protects the car by expanding when exposed to fire.
Types of Tank Cars

Locomotive

The locomotive is an often overlooked rail car. It has a large electrical source as well as large amounts of diesel fuel. Even though they are not placarded, diesel fuel, acid from batteries, the potential for fire, and electrical shock from locomotives can be extremely hazardous. Shutting down a locomotive is not easy. If the locomotive is on fire, it must be isolated and shut down before attempting to put out the fire. The main battery switch located on the engine control panel must be pulled. You consult the rail service in your area for instruction on proper shut-down and to become familiar with the different pieces of equipment. There are generally a number of controls involved with shutdown.

Tank cars are the bulk containers used to carry both hazardous and non-hazardous materials by rail. A variety of cargo can be transported by rail, including compressed and non-compressed gases, liquids, and solids. However, the specific type of material that can be carried in a tank car depends on the construction of the car itself, as well as its size, fittings, linings, and other fittings.

Tank cars can be divided into seven categories, each with its own distinct characteristics.
Non-Pressure Tank Cars

Sometimes called low-pressure tank cars, these tank cars carry liquids and molten solids at low vapor pressures (below 25 psig/40 psig at 105°F to 115°F). Non-pressure tank cars are generally used to transport flammable and combustible liquids, flammable solids, oxidizers and organic peroxides, liquid poisons, and corrosive materials. However, certain non-pressure tank cars may carry flammable or non-flammable gases. In addition, non-pressure tank cars carry many non-hazardous materials. The only ways to predict the nature of the contents of non-pressure tank cars are to obtain the shipping papers or to identify the placards or other markings.

Like pressure tank cars, non-pressure tank cars are cylindrical in shape with convex heads, with capacities ranging from 4,000 to 45,000 gallons. However, tank test pressures range from 35 psig to 100 psig. In addition, non-pressure tank cars may be divided into separate compartments; each compartment may have a different capacity and each may be carrying a different product. Each compartment is considered a separate tank and will have its own fittings, including its own manway or expansion dome.

Non-pressure tank cars may or may not be insulated. Along with the necessary safety devices, they have external fittings to allow loading and unloading. They also have at least one manway or expansion dome. The expansion dome may, at first, resemble the enclosed manway of a pressurized tank car. However, fittings on non-pressurized tank cars are visible either around the manway or on top of
the expansion dome. Unfortunately, there are a few exceptions; for example, non-pressure tank cars carrying nitric acid are equipped with a protective housing approximately twice as tall as a normal pressure housing.

Expansion Dome

Generally, when fittings are visible on a tank car, the car is a non-pressure tank car.

Corrosive liquids are transported in non-pressurized liquid tank cars. They resemble most other non-pressure tanks cars in their basic shape and design and are usually difficult to differentiate from other non-pressure tank cars. However, they may occasionally be distinguished from other non-pressure tank cars by characteristic staining or corrosion of paint around the manway area. Some corrosive tank cars may also be painted with a wide band of corrosion-resistant paint running vertically around the tank car at the manway.
Pressure Tank Cars

Pressure tank cars usually carry flammable and non-flammable compressed gases or poisonous compressed gases. However, they are sometimes used to carry other hazardous products, such as:

- Acrolein, Inhibited
- Anhydrous Hydrogen Fluoride
- Bromine
- Ethylene Oxide
- Motor Fuel Anti-Knock Compound
- Pyrophoric Liquids
- Sodium Metal
- Chlorine
- LPG

Pressure tank cars are top loading with pressures ranging from 100 psig to 600 psig. They are capable of carrying between 4,000 and 45,000 gallons of product at a time. Generally all valves, gauging devices, thermometer wells, and other fittings are located within a covered protective housing, sometimes called an enclosed manway. The protective housing attaches to the manway to protect the fittings in the event of a derailment. Protective housings are approximately 18-24 inches high and 30-36 inches in diameter, allowing most pressure tank cars to be easily distinguished.

There are exceptions, however. In some cases pressure tank cars will have safety valves outside the protective housing, some may have an auxiliary pressure manway, and some will have other distinct characteristics. For example, the pressure tank cars used to transport hydrocyanic acid, according to voluntary industry agreement, may be painted white with three red stripes (one stripe running horizontally...
around the tank, and two stripes running vertically around the tank). These are considered “candy stripers” and are very toxic.

Some pressure tank cars may be equipped with insulation or jacketed thermal protection. Pressure cars that do not have insulation or thermal protection will have at least the top two-thirds of the tank painted white.

Other pressure tank cars have shields covering the lower portions of both heads to protect the tank from punctures. Tanks carrying flammable gases and anhydrous ammonia, for example, may be built or retrofitted with these shields.

Cryogenic Liquid Tank Cars

These cars carry very cold, liquefied refrigerated gases (those with boiling points below -155°F) under a low pressure, usually 25 psig or lower. The products carried in cryogenic liquid tank cars occur naturally as gases; they are liquefied through refrigeration rather than through pressurization. Liquefied gases such as argon, hydrogen, ethylene, nitrogen, and oxygen are often transported in cryogenic liquid tank cars.

Cryogenic liquid tank cars are actually made up of two tanks. The product resides in an inner tank made of steel alloy (stainless or nickel). This inner tank is supported within an outer tank. The space between the two tanks is placed under a vacuum and filled with an insulating material to protect the contents of the inner tank. Cryogenic liquid tank cars are designed to maintain refrigerated gases in their liquid state for up to 30 days.
Safety devices include safety relief valves and safety vents. Loading/unloading fittings and inner tank safety devices are located in enclosures at either end or at diagonal corners of the car. Cryogenic tank cars may be recognized by the distinct absence of both exposed fittings and an enclosed manway dome on top of the tank.

It is important for responders to know that there are a few cryogenic liquid tank cars in the United States that are permanently secured in box cars; these are called “XT boxed tanks”. The XT boxed tanks look like ordinary box cars, but they contain cryogenic tank cars. All valves and fittings are located inside the box car doors.

**Other Rail Cars**

**Box Cars and Gondola Cars**

There are a number of non-tank rail cars in use today, many which transport hazardous materials. These rail cars include boxcars, gondola cars, hopper cars, and flatcars (including containers on flatcars and trailers on flatcars). These rail cars usually transport bulk quantities of dry materials. Boxcars may carry hazardous materials in drums, wooden crates, bags, fiber drums, cartons or cases.

Because these rail cars do not possess any specific features to handle hazardous materials, they all look very similar. Placards may be the only way to determine the nature of their contents. Luckily, there are a few rail cars with distinct features. Calcium carbide, for example, is transported by rail in a flat car with vertical bins with conical tops.
Tank Type Covered Hoppers

These tank cars are simply covered hopper cars that are unloaded pneumatically; that is, the product is forced out of the tank as air is forced in. Though they are non-pressure cars, they are designed to withstand pressures ranging from 20 psig - 80 psig. It is not unusual for the car to carry 100 tons of product.

Some of the hazardous materials carried in dry bulk are caustic soda, calcium carbide, and other Table I hazardous materials products. If water is applied to calcium carbide, acetylene gas is generated which poses significant concerns for fire fighters.

Refrigerator cars

The three basic types of refrigerator cars are the standard ice car (RS), insulated bunkerless car (RB), and mechanical refrigerated car (RP). The insulated bunkerless car has limited hazards. Sometimes heaters are placed in the top of doorways, which can cause fire in the event of an accident. The third type, mechanical refrigerated car, has a compressor supplied by a 220 volts diesel generator. This is only a limited hazard in the event of an accident, but the fuel system for this generator will contain 500-550 gallons. Mechanical refrigerated cars also contain freon or other refrigerant gases.
High Pressure Tube Cars

![High Pressure Tube Car Image]

Rail high pressure tube cars are similar to highway tube trailers. These cars carry oxygen, hydrogen, or (most often) helium. Tank test pressures range up to 5,000 psig. High pressure tube cars, 40 feet long, carry permanently-attached seamless steel cylinders arranged horizontally within an open frame. Each end of the steel cylinders is covered by a steel casing. High pressure tube cars are not insulated. Each cylinder, however, is equipped with a safety relief valve or safety vent. High pressure tube cars that transport flammable gases must also be equipped with an ignition device to burn any venting gas. Other fittings are enclosed at one end of the car.

Ton Containers

![Ton Container Image]

Ton containers, sometimes called multi-unit tank car tanks, are cylindrical with either concave or convex heads. They can carry from 180 to 320 gallons of liquid product, at pressures up to 1,000 psig. All fittings are in the head of each container. When present, a fusible plug safety relief device is also located in the head.

Ton containers are carried in box cars or gondola cars, or they are secured on specially designed flat cars. They are
used to transport gases such as chlorine, anhydrous ammonia, sulfur dioxide, and phosgene.

When hazardous materials incidents involving railroad cars occur, the best source of information will probably be the railroad. They are the experts on rail car design and use, and want to provide emergency response personnel with the most accurate information available. Becoming familiar with the railroad company(s) in your community before an incident occurs will provide emergency response personnel with an invaluable source of information.

**Tank Car Fittings**

Tank cars are built with a variety of fittings which allow commodities to be loaded and unloaded and safely transported. In order to effectively communicate with railroad officials and experts during an incident, it is important that you be able to recognize different fittings and understand how they operate and function. Not all tank cars will be equipped with the following fittings.

**Manways**

*Manways* are one of the most obvious fittings found on tank cars. They allow access to the interior of the tank car so that it can be cleaned, inspected, and repaired. Manways are relatively large openings on top of the car that have either permanently-affixed cover plates with attached fittings, or hinged covers that can be opened. Manways play an important part in tank car identification.
Valves and Venting Devices

Valves are the fittings that allow commodities to pass into and out of the tank. Liquid valves are used to load and unload liquid commodities. An eduction pipe connects the valve to the bottom of the tank. Sumps are low spots in the bottom of the tank that extend the eduction pipes beneath the flat bottom of the tank; this allows for complete removal of the commodity. Vapor valves are used to release vapor from the tank or to pressurize the tank. These valves are called vapor valves on pressure cars, but are referred to as air inlets or air valves on non-pressure cars.

Angle-Type Liquid and Vapor Valves

When a tank car is derailed and turns upside down, valving becomes an important issue. Product lines become vapor lines. Generally, vapor valves are smaller than product valves on non-pressure tanks. The valves on pressure tanks are usually the same size.

Safety Relief Devices

Safety relief devices allow some of a tank’s internal pressure to escape when over-pressurization occurs, such as when the contents are exposed to excessive heat.

Safety relief valves are spring-operated and will open and re-close at predetermined pressures. Safety vents, on the other hand, are designed with frangible disks that are
normally closed but rupture when the tank’s internal pressure exceeds a predetermined limit. A disk will not close again once it has opened. Fusible plugs melt to allow venting when the temperature reaches a predetermined point; these devices do not re-close. Combination devices incorporate a rupture disk or breaking pin with a spring-operated safety relief valve. These devices will open and re-close even after the disk is ruptured.

Vacuum relief valves prevent internal vacuums from forming in non-pressure tanks when the contents are unloaded. These valves work by admitting outside air into the tank, and will re-close when there is no longer a vacuum forming. This valve prevents the internal vacuum pressure from exceeding 0.75 psig. Vacuum valves need to be functional during off-loading. If you are transferring a product with a damaged valve and do not gauge the tank, the tank may collapse.

Other Fittings

Sample lines allow a sample of the commodity to be taken without unloading the car.

Thermometer wells allow the temperature of the tank’s contents to be checked. The wells are closed tubes extending into the tank into which a thermometer can be inserted. Temperature gauges are filled with an antifreeze solution that will give you an accurate temperature of the product. If a tank car overturns, you will not have an accurate way to measure the temperature. In addition, an antifreeze leak from the thermometer may well be mistaken for a product release. You will need to assess the damage to make sure product is not leaking from the thermometer well.

Gauging devices are used to measure the amount of product in a tank. They are used to determine either the contents remaining in the tank (“innage”) or, more often, the vapor space in the tank (“outage”). There are two types of gauging devices, open type and closed type.

The open type has a fixed or adjustable tube that will eject liquid when the level reaches the opening. Use care when working with this type of gauging device; the tube can eject violently. The closed type is usually magnetic. A float
coupled with a magnet, measuring rod, or dial indicator indicates the level of the commodity.

**Bottom outlet valves** are fittings at the bottom of tanks used for unloading or cleaning. For example, bottom outlets provide controlled-flow unloading from the bottom of the tank; washouts are used only during cleaning and provide no flow control once the washout is opened.

Before entering the Hot Zone to perform offensive tactics, review a diagram of the particular car you are going to work on. This will show exact fittings that will be on the tank car.
Rail Incident Scene Management

The safety of all personnel on the incident scene should be the number one concern of the incident commander and staff. In order to insure fire fighters are protected from other train movements while on the derailment scene, rapid telephone contact with the appropriate rail dispatcher is vital.

All rail traffic should be stopped at least one and a half miles from the incident scene in both directions. In the early stages of an incident, response personnel should be sent with red flares and portable radios to physically provide security for the incident scene. The flares, when ignited, should be placed in the center of the track structure on a tie.

Once the incident scene has been protected from additional train movement, the incident commander will need to become thoroughly familiar with the status of the scene. Should it become necessary to reduce the volume of hazardous materials at the site, emergency response personnel may have to uncouple and move rail cars. A brief overview of the rail air brake system will help you move rail cars safely.

Activity
Intermodal Containers

Intermodal containers were introduced in Europe in the mid-sixties and are now worldwide. Intermodals are basically a tank or cylinder within a frame. They may have single or multiple containers. They are unique in that they can be transferred from water to rail to highway. Because they are handled frequently, there is a greater risk of release. This section covers intermodals that transport hazardous materials. These tanks can only be lifted, secured, or mounted by the corner castings.

Intermodal tanks are generally 20 feet in length and 8 feet wide. Height varies from 8 to 9.5 feet. Tanks used in the US are not longer than 20 feet. In Europe large containers (up to 40 feet) can be used. Sea-land containers are 35 feet long.

Containers use two types of frame construction, box type and beam type. The box type encloses the tank with framework. The beam type has frame structure only at the ends. Refrigerated units can clip on to the nose or front end of the container. Tanks may be lined, electric or steam heated, and insulated.

Containers may be identified with a number of different markings because they travel worldwide. Containers usually carry country, size, specification, DOT exemption, AAR600, and type of container markings. Most tanks are built according to the pressure vessel standards of the American Society of Mechanical Engineers.

There are three basic types of intermodals: non-pressure, pressure, and specialized.

Non-pressurized Tank Containers

Non-pressurized tank containers are marked as IM101/IMO Type 1 Tank Containers or IM102/IMO Type 2 Tank Containers. These containers have top loading valves and bottom off-loading valves. They are equipped with emergency remote shut-off devices, fusible links and nuts, and pressure/vacuum relief devices depending on the product.
being transported. Data plates are attached to the frame rail. Non-pressurized tank containers can carry liquids or solids.

- **IM101/IMO Type 1 Tank Container:**
  This is the most common intermodal container for hazardous materials. It has a working pressure of 25.4 psig to 100 psig, with a capacity of 5,000 to 6,300 gallons. Type I containers carry hazardous or non-hazardous materials.

- **IM102/IMO Type 2 Tank Container:**
  This type of container has a working pressure of 14.5 psig to 24.4 psig, with a capacity of 5,000 to 6,300 gallons. It carries materials like whiskey, pesticides, insecticides, resins, and flammable solvents.

### Pressurized Tank Containers

Pressurized tank containers are marked DOT Spec. 51/IMO Type 5 Tank Containers. This type of container has an internal pressure of 100 psig to 500 psig with a 1,000 gallon capacity. The tank itself may be as large as 6 feet in diameter and 20 feet long. Data plates are attached to the frame rail. Fittings are on the top, end, or the bottom. Gauging devices are rotary, open, or closed devices. Pressurized tank containers have safety relief valves, excess flow valves, emergency remote shut-off devices, and fusible links and nuts. Cargo includes products such as LP gas or anhydrous ammonia.

### Specialized Tank Containers

- **IMO Type 7 Tank Container (Cryogenic):**
  IMO Type 7 containers carry refrigerated liquid gases such as argon, oxygen, helium, and nitrogen. They are thermally insulated.

- **ISO (Tube Modules):**
  The ISO frame is 8 feet by 8 feet carrying cylinders 12 to 48 inches in diameter, with pressures up to 5,000 psig. One end encloses the valves.
Air Transportation

During aircraft incidents, there is almost always the possibility that hazardous materials will be involved. While hazardous materials shipments on aircraft are closely regulated and limited, emergency response personnel must be prepared to deal with the possibility of large amounts of aircraft fuel (gasoline, kerosene, or a blend of gasoline and kerosene), the stored oxygen system, and the materials that make up the body of the aircraft, such as titanium (a flammable metal).

The DOT restricts or prohibits the shipment of many hazardous materials aboard aircraft for a number of reasons. In some cases, these restrictions apply only to passenger aircraft. In other cases the restrictions apply to both passenger aircraft and cargo-only aircraft. Therefore, the likelihood of hazardous materials involvement in an aircraft incident is much greater when the aircraft carries only cargo.

If hazardous materials are permitted to be shipped aboard aircraft it is usually because the hazard is somewhat limited due to the nature of the chemical, the limited quantity allowed on board, or because the usefulness greatly diminishes with time. This is particularly true in the case of many radioactive isotopes used in medicine.

Examples of materials that are prohibited on passenger aircraft but permitted with certain restrictions on cargo craft are:

- Gasoline
- Aerosols containing flammable liquids
- Corrosives
- Infectious substances
- Fireworks
- Petroleum oil
- Other flammable liquids such as methyl alcohol or toluene

Aircraft do not display outer markings or placards indicating the type of cargo they may be carrying, so there is little opportunity for emergency response personnel to identify the aircraft’s contents from a safe distance.

The DOT requires that shipping papers be carried by aircraft containing any hazardous materials shipments. These
papers are kept in the cockpit. Therefore, shipping papers are only available if response personnel enter the aircraft or the captain (or another crew member) is able to bring the shipping papers with him/her when departing the aircraft.

Generally, the same DOT labeling requirements that apply to containers in other modes of transportation also apply to containers shipped by air. However, as with labeling in other shipments, labels may be ambiguous, incorrect or absent. In addition, labels may indicate only the material’s “most dangerous” characteristic(s).

Fuel, oxygen, and the components of the aircraft body usually create a much greater threat during aircraft incidents than the limited quantities of hazardous materials allowed on board for shipment.

**Estimating Fuel Volume**

If the aircraft is not on fire or carrying known hazardous cargo, your primary concern is the fuel remaining on board. The following checklist will assist you in estimating the remaining fuel:

1. Collect information.
   - Obtain rail identification numbers and company name
   - Obtain cargo shipping papers from the cockpit
   - Review records indicating when tank was last filled or when fuel was last transferred
   - Interview pilot or groundcrew who last fueled aircraft
   - Take photos of scene

2. Determine the volume of fuel in the aircraft prior to spill, then subtract any fuel used or discharged since the aircraft was last filled.

3. Determine the post-spill volume in the aircraft.
   - Off-load the fuel into a stable container of known volume, then gauge the volume
   - Contact the National Transportation Safety Board for commercial aircraft; they have access to detailed records
   - Estimate remaining fuel in the tank using onboard gauging equipment
4. Calculate the spill volume by subtracting post-spill volume from pre-spill volume.

The following range of fuel capacities can be used to estimate total fuel on board. However, after-market and add-on fuel tanks may be present, adding to the volume carried. In cases where fuel capacity is typically measured in pounds, capacities are listed as such with gallons in parentheses (Jet-A fuel is typically calculated by the aviation industry @ 6.7 pounds/gallon).

General Aviation Aircraft:
- Piston power 30-180 gallons of gasoline
- Turboprop 300-700 gallons of Jet-A
- Jet 800-5,800 gallons of Jet-A

Commercial Aircraft:
- Commercial 3,000-12,500 lbs. (448-1,900 gallons) of Jet-A
- Commercial Jet 22,500-360,000 lbs. (3,400-54,000 gallons) of Jet-A

Commercial airlines can calculate how much fuel is onboard their aircraft at any given time. Fuel status is critical and carefully monitored throughout the fueling process and in flight. Also, the Federal Aviation Administration (FAA) will have access to detailed information on fuel aboard a particular flight.

Military:
- Tactical 7,000-26,500 lbs. (1,000-4,000 gallons) of Jet-A
- Military 63,000-340,000 lbs. (9,400-51,000 gallons) of Jet-A

Most military aircraft have inflight refueling capability so even after hours of flight they may be at or near capacity.

Helicopters:
- Sport to commercial passenger 15-500 gallons
- Huey 530-2,000 gallons
Waterway Transportation

As with aircraft, it is often difficult to determine the types of cargo aboard ships and barges from a safe distance because they are not marked with placards or other identifying signs. Unlike aircraft, however, hazardous materials are common on ships and barges and often carried in very large quantities.

The surest way to determine the contents of the cargo is to obtain the bill of lading (kept in the shipping office of the carrier), the cargo manifest cards (kept on the bridge or in the pilot house of the tugboat), or the dangerous cargo manifest (also kept on the bridge or in the pilot house of the tugboat). One example is shown on the following pages. Containers within the holds of the ship will be placarded (if placarding would normally be required); however, the placards are not generally useful in emergency situations since they cannot be seen except by persons in the hold.

It is useful to be able to recognize some basic ship and barge designs since this may be the only way to determine the type of materials on board.
Tank barges, which transport bulk quantities of liquid petroleum products and all types of liquid chemicals, store their cargo in large tanks on the deck. The tanks are equipped with piping, venting, and access hatches. Tankers, which are also designed to carry many types of liquid petroleum products and chemicals, store their cargo in tanks built into the ship. The tanks are equipped with pipes, vents, manifolds, and catwalks. One very distinctive type of tanker is designed to carry liquefied natural gas; it is easily recognized by its large spherical or (sometimes) prismatic tanks.

Dry bulk products are usually shipped in closed-hopper barges. These barges may have mechanical gear and rigging to load and off-load the cargo.

Activity
## Module 2: Recognition and Identification

### 2-89

<table>
<thead>
<tr>
<th>UNIFORM HAZARDOUS WASTE MANIFEST</th>
<th>Generator's US EPA ID No.</th>
<th>Manifest No.</th>
<th>Page 1 of 2</th>
<th>Information in the shaded area is not required by Federal law</th>
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<td>1. Generator's US EPA ID No.</td>
<td>TXR0000000893278744</td>
<td>A. State Manifest Document Number</td>
<td>NO 00427877</td>
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<td>2. Page 1 of 2</td>
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<td>C. State Transporter's ID 2765</td>
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<td>D. Transporter's Phone 713 529 6806</td>
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<td>3. Generator's Name and Mailing Address</td>
<td>BENJAMIN AZTRONITE, INC. 1581 JOINT-CROSS HOUSTON, TX 77504</td>
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<td>F. Transporter's Phone</td>
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<td>4. Generator's Phone</td>
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<td>H. Facility's Phone 713 671-5400</td>
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<td>10. US EPA ID Number</td>
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<td>IIA. Additional Descriptions for Materials Listed Above</td>
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<td>J. Total Quantity</td>
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<td>K. Handling Codes for Wastes Listed Above</td>
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<td>11. Description (including Proper Shipping Name, Hazard Class, and ID Number)</td>
<td>A. Waste Flammable Liquid, N.O.S. (Methylen Chloride, Chloroform) 3, UN 1993, III</td>
<td>0010 F000300 P</td>
<td>DO01 DO18</td>
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<td>14. Unit Weight</td>
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<td>15. Special Handling Instructions and Additional Information</td>
<td>UNIVERSITY ANNEX, BENJAMIN AZTRONITE CONTRACTOR - C. LE BLANC 201-781-1724, FAX 201-781-1742</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>16. Generator's Certification</td>
<td>I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations, including applicable state regulations.</td>
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<td>20. Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19</td>
<td>Printed/Typed Name:</td>
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<td>Month Day Year:</td>
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**Printed/Typed Name**

**Signature**

**Month Day Year**

**White - original**

**Pink** - TSD Facility

**Yellow** - Transporter

**Green** - Generator's first copy
Pipeline Transportation

Pipelines primarily carry liquid petroleum products and natural and manufactured gases. Since they are buried some 30 to 36 inches underground, they are not easy to locate. However, pipeline markers are placed over buried pipelines at railroad crossings, most public road crossings (though this is not possible in urban settings), and along the course of the pipeline.

Markings for petroleum pipelines are usually placed on poles extending up from the ground. They usually include the word “Warning” and contain information on the type of product carried through the pipeline and the name and telephone number of the carrier. Markings for gas pipelines, on the other hand, are not standardized and may be located on poles or placed flat on the ground. The type of information provided on these markings varies greatly.

The environmental impact in a pipeline incident is high. Thousands of gallons of product can flow from a pipeline before it is noticed and shut down. Pre-planning and an overall knowledge of your jurisdiction will help you become familiar with the location of pipelines running through your community. Pipeline companies will distribute maps of their pipelines and will respond to a leak. You will need to keep a resource book with emergency phone numbers for your department and dispatch.
Fixed Site Facilities

The Occupational Safety and Health Administration requires that hazardous chemicals in containers in a workplace be identified and appropriate hazard warnings be given. This information may be in the form of labels, tags, signs, placards, process sheets, batch tickets, operating procedures, or other such written materials. This data will be helpful to you in case of an emergency. In addition, existing but up-to-date pre-incident plans will provide detailed information about the contents and exact location of fixed-site storage containers. However, there may be occasions when written identification information and pre-incident plans are not available during an emergency, and you will be forced to rely on other information about the site. Initially, the mere presence of large storage tanks at fixed sites should indicate that hazardous materials are present. Remote shutoff switches, warning signs, dikes, and on-site emergency equipment all point to the likelihood that hazardous materials are present.

Types of Fixed Site Containers

Identifying the type of hazardous materials at a fixed site can be much more difficult than simply recognizing the presence of hazardous materials. As a hazardous materials Technician, you must look for clues which will provide missing information.

Remember that most storage tanks are designed to meet the specific needs of certain commodities. Tank size, shape, and design do not occur by chance; tanks are built to meet the needs of their intended contents. For example, as with other forms of storage and transportation containers, tanks with rounded ends and pressure relief valves are designed to withstand internal pressure, indicating the contents are likely to be under pressure.

The following tank descriptions provide general information about some basic tank designs.
Vertical Flat-Roof Tank

Circular in shape with a flat roof and wider than they are tall, these tanks are often found grouped together in diked areas. A manway may be noticeable on the top of the flat roof.

These tanks usually contain large quantities of flammable or combustible liquids, although they may also contain corrosives or non-hazardous materials. Tanks that store non-hazardous materials are less likely to require diking.

Vertical Cone-Roof Tanks

Except for their slightly pointed, cone-shaped roofs, these tanks resemble vertical flat-roof tanks in shape and size. In some cases, the roofs have been designed to break apart should internal pressure become too high.

These tanks are used primarily for storing of flammable, combustible, and corrosive liquids.

Open Floating-Roof Tanks

Designed to hold very large quantities of material, these tanks may resemble vertical flat-roof tanks except that their roofs actually float on top of the material contained within. Therefore, the roof moves up and down with the level of
the tank’s contents. There may be a ladder up the side of
the tank and to the top of the roof.

Open floating-roof tanks were designed to store flammable
and combustible liquids, such as gasoline. The floating
roof design eliminates a space between the surface of the
material and the roof, thereby reducing the possibility of
vapor build-up.

**Covered Floating-Roof Tanks**

These vertical tanks incorporate a fixed cone-shaped roof
with an inner floating roof. They can be differentiated from
vertical cone-roof tanks by the large vents running horizon-
tally around the top of the tank. This design allows vapor
to be released.

Covered floating-roof tanks are usually used to store flam-
mable and combustible liquids, such as crude oil.

**Dome-Roof Tanks**

These vertical storage tanks are very distinct from other
vertical tanks because they are generally taller than they are
wide and their roofs are an obvious dome shape. (The
dome design accommodates changes in vapor pressure.)

Dome-roof tanks are generally used to store flammable and
combustible liquids, although they may be used to store
non-hazardous materials as well.
One-Ton Cylinders

As discussed earlier, one ton cylinders are used for transportation as well as storage, these tanks are small (about three feet high, and five to six feet long) compared to most other bulk storage tanks. They lie horizontally rather than upright, and their ends are concave rather than flat or rounded.

One-ton cylinders are commonly used for liquefied gases such as chlorine, anhydrous ammonia, and sulfur dioxide.

Horizontal Tanks

Horizontal tanks differ from one-ton cylinders in that, although they lie horizontally, they are usually much larger than one-ton cylinders, their ends are not concave, and they are not used for transportation. They are usually set on legs or blocks.

Pressurized horizontal tanks are easy to identify because of their typical rounded ends. Butane, propane, anhydrous ammonia, chlorine, sulfur dioxide, and hydrogen chloride may be stored in pressurized horizontal tanks.

Non-pressurized horizontal tanks are easy to distinguish from pressurized horizontal tanks in that their ends are flat rather than rounded. These tanks are used to store flammable and combustible liquids, corrosives, and poisons, and solvents. Examples include fuel oil, diesel fuel, processing chemicals, and octane boosters.

Non-pressurized horizontal tanks set on legs or blocks are particularly vulnerable to tank failure during a fire; the legs or blocks often burn or give way and/or the tanks themselves may fail under high temperatures. For this reason, the use of non-pressurized horizontal tanks has been restricted or banned in many jurisdictions.
Spherical Tanks

Easily recognized by their ball-like shape, these tanks are usually painted white or another highly reflective color. When pressure relief devices are present at the top of the tanks, they are probably being used to store pressurized commodities such as methane, propane, LPG, or other gases.

When pressure relief devices are not present and the tank appears to be heavily insulated, it is probably being used to store cryogenic liquids, such as hydrogen, nitrogen, or oxygen.

Covered Spherical Tanks

From the outside, these tanks resemble vertical tanks with rounded roofs, not unlike many water towers. However, these are actually sphere tanks with sheet-metal built around the sphere. Large pressure relief valves can be seen on top of the tank.

These tanks are often used to store LPG or other liquefied gases.
Cryogenic Liquid Tanks

These tanks may resemble dome-roof tanks because they are taller than they are wide and their roofs are rounded. However, cryogenic liquid tanks are heavily insulated and rest on legs rather than directly on the ground.

These tanks are used primarily to store liquefied oxygen, liquefied nitrogen, and liquefied carbon dioxide.

Underground Storage Tanks

Underground storage tanks are used to store both liquids and gases. Obviously, it is impossible to see the tank’s characteristics, but gauges, controls, and vents are visible above ground.

Liquefied petroleum gas, gasoline, and fuel oil are three of the most commonly stored commodities in this type of tank.
Control Techniques

Decision-Making and Mitigation

Whether you are responding to a transportation or a fixed site incident, you will be better able to identify the materials involved and make informed decisions about your response if you can recognize basic vehicle and container designs. Remember, however, that recognition and identification clues enable you to make educated guesses. Even when information appears to be concrete it must be viewed with caution. Always use clues in conjunction with reference materials, shipping or facility documents, and reported information before taking action.

All of the recognition and identification techniques presented in this module can be reinforced with reliable information if you conduct and prepare an in-depth pre-plan. Pre-planning takes much of the guesswork out of recognition and identification.

Offensive Operations Decision-Making

You will need to decide whether you have the training and resources necessary to undertake offensive operations. Answering the following questions will help you make these critical decisions.

• What stresses caused the breach? (e.g., chemical, mechanical or thermal); are these stresses likely to continue?
• What is the identity of the product? Based on its chemical and physical properties, do you have the resources (e.g. overpack drums, foam, non-sparking tools, neutralizing chemicals) to mitigate the situation?
• Assess the defensive actions you have already taken. Are these operations sufficient to ensure the safety of the public, or is an offensive approach necessary?
• If offensive actions are necessary, what is the risk versus the benefit to the entry team? Other responders? The public? The environment?
• What are the hazards if offensive actions are not taken? For example, is there likely to be a pressure release, or a reaction between incompatible chemicals?
• Can these hazards be controlled through offensive tactics?
• Can offensive control be done safely? Is the material stable, and can it be continuously monitored?
• Are you reasonably certain that your offensive actions will have a positive outcome? For example, will you be able to patch a hole before the material leaks completely?

**Mitigation**

If you decide that:
• The situation warrants offensive tactics, and
• Your team has the necessary training and resources, and
• All operations can be carried out safely, then

Proceed with the offensive containment tactics. Such actions may include:
• Uprighting leaking containers
• Closing and tightening caps and lids
• Repositioning a container so the level of the hazardous material is below the breach
• Decreasing container pressure by closing/opening a valve, or shutting down a pumping system
• Blanketing with vapor suppression agents, such as foam
• Neutralizing a chemical by applying another chemical
• Disposing of the hazardous material in place
• Using clamps or pneumatic plugs to stop dome cover leaks
• Plugging or patching small holes
• Applying inflatable bandages, straps, absorbents, and/or wedges to larger leaks such as gouges and splits
Safety

While you are in the process of mitigating an incident, whether it is through defensive or offensive actions, keep the following points in mind:

• Larger containers may require climbing, so make sure you have sufficient harnesses/ladders/high angle equipment to do this safely.
• Be aware of slip and fall hazards, particularly if large amounts of material have spilled.
• Make sure the container is stabilized before you attempt to control a leak; changing container orientation is usually not an option with larger containers.
• Be aware of routine hazards, such as traffic.
• Do not attempt to move stressed containers, especially if they are heavily loaded.

Remember the order of priority:

• Safety of the responder
• Safety of the public
• Preservation of the environment
• Prevention of property loss

Basic Control Techniques for Cargo Tanks and Tank Cars

Assessing Damage

Use the following checklist as a guide for assessing damage, whether a release is from a cargo tank or a tank car:

Cracks
• Narrow split or break in material caused by fatigue or impact
• May lead to catastrophic failure in pressurized containers

Scores
• Reduction in thickness by indentation

Gouges
• Reduction in thickness by removal or container material
Dents
- Deformation in tank caused by blunt object
- Sharp radius dents may result in cracking

Burns
- Wheel—constant contact with turning wheel reduces thickness of tank car
- Rail—moving tank passes over stationary object
- Street—deformation in tank shell caused by sliding on pavement

To assess dents, examine each point of minimum curvature for cracks, and use a dent gauge to measure the curvature. Record all dents, no matter how small.

Rail car damage gauges can be used to assess how dangerous the dent is in a tank. If the dent is sharper than the gauge, the tank will have to be offloaded before it is moved. In general, dents that run the length of the vessel are the most dangerous and reduce tank integrity. Gentle bends without other damage offer little risk. The smaller and deeper the bend, the more dangerous the situation.

Points to Remember
- Damage may be to outer shell only
  - Difficult to assess
- Pressure containers may fail catastrophically
- Valves may not operate properly when in a different orientation (sideways, upside down)
  - May be cause of leak
- If unsure of container status
  - Get expert help
  - Ensure all defensive measures taken
Inspecting Damaged Cargo Tanks

Damaged cargo tanks must be thoroughly inspected to determine the type and extent of damage sustained. These inspections can be performed by Technicians who have the background training in this area. Personal protective equipment must be worn during the inspection.

Examine all accessible surfaces for the type, location, direction, and extent of damage. If you cannot see the entire surface of the damaged cargo tank, reinspect it during and after surrounding materials have been removed, or when the tank is lifted or uprighted. You must be experienced enough to determine the possible damage to the tank based on its position (i.e., on soft ground or hard/sharp surfaces).

Jacketed cargo tanks are difficult to inspect without removing the jackets. Lack of damage to the jacket usually indicates that the tank has not been damaged.

Inspecting and Repairing Damaged Cargo Tank Fittings

Many of the problems associated with cargo tank leaks involve valves and fittings. Once you identify the product involved, the source of the release, and the personal protective equipment needed, you can begin considering control measures. Often, releases associated with fittings can be stopped by tightening a fitting or re-closing a valve or cover. However, because the majority of cargo tanks are equipped with internal valves for product discharge, very little, if any, field repair can be performed. Firefighters do not repair or replace fittings unless specifically trained. Railroad specialists are responsible for this type of work.

The tables on the following pages describe, in some detail, the likely locations of leaks, probable causes for these leaks, and basic control or repair methods.
## Corrective Actions for Cargo Tank Fittings

<table>
<thead>
<tr>
<th>Location of Leak</th>
<th>Probable Cause</th>
<th>Basic Repair Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Manhole Cover</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liquid or vapor leak around manhole cover</td>
<td>Loose clamp ring</td>
<td>Tighten bolt</td>
</tr>
<tr>
<td></td>
<td>Defective gasket</td>
<td>To be handled by a cargo tank specialist</td>
</tr>
<tr>
<td><strong>Fill Hole Cover</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liquid or vapor leak around fill hole cover</td>
<td>Not securely closed</td>
<td>Check for zero pressure, then open and re-close (do not if the tank is on its side); or</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tighten wing nuts or apply cover clamp</td>
</tr>
<tr>
<td></td>
<td>Defective gasket</td>
<td>To be handled by cargo tank specialist</td>
</tr>
<tr>
<td><strong>Top Mounted Shutoff Valve</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liquid or vapor valve leaking</td>
<td>Valve not completely closed</td>
<td>Close valve</td>
</tr>
<tr>
<td>Liquid or vapor valve leaking at tank outlet</td>
<td>Valve not seated</td>
<td>Tighten valve</td>
</tr>
<tr>
<td></td>
<td>Defective seat or threads on valve</td>
<td>To be handled by cargo tank specialist</td>
</tr>
<tr>
<td><strong>Bottom Outlet Valves</strong> (internal or external)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liquid leak at flange between tank and valve</td>
<td>Loose flange bolts/nuts</td>
<td>Tighten valve bolts/nuts</td>
</tr>
<tr>
<td></td>
<td>Defective gasket</td>
<td>To be handled by cargo tank specialist</td>
</tr>
<tr>
<td>Liquid leak at end of off-loading pipe (s)</td>
<td>Internal valve not properly seated</td>
<td>Open and re-close valve</td>
</tr>
<tr>
<td></td>
<td>Broken internal valve</td>
<td>To be handled by cargo tank specialist</td>
</tr>
</tbody>
</table>
## Corrective Actions for Cargo Tank Fittings

<table>
<thead>
<tr>
<th>Location of Leak</th>
<th>Probable Cause</th>
<th>Basic Repair Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Vapor Recovery Vents</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liquid leak from vapor recover line</td>
<td>Top vent not closed</td>
<td>Open and re-close top vent</td>
</tr>
<tr>
<td></td>
<td>Tank overloaded</td>
<td>Off-load product*</td>
</tr>
<tr>
<td><strong>Safety Relief Devices</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liquid or vapor leak from safety vent</td>
<td>Ruptured frangible disk (liquid indicated possible overload)</td>
<td>Replace frangible disk; off-load product if necessary*</td>
</tr>
<tr>
<td></td>
<td>Melted fusible plug (liquid indicates possible overload)</td>
<td>Replace fusible plug; off-load product if necessary*</td>
</tr>
<tr>
<td>Liquid or vapor leak from safety relief valve -- non-pressure tanks</td>
<td>Defective valve</td>
<td>Replace valve</td>
</tr>
<tr>
<td></td>
<td>Tank overloaded</td>
<td>Off-load product*</td>
</tr>
<tr>
<td>Liquid or vapor leak from safety relief valve -- low and high pressure tanks</td>
<td>Defective valve</td>
<td>To be handled by industry specialist</td>
</tr>
<tr>
<td></td>
<td>Tank overloaded</td>
<td>To be handled by industry specialist</td>
</tr>
</tbody>
</table>

*Many leaks can be repaired on loaded, but not overloaded tanks. Off-loading (or transferring) some or all of the product should be performed when the situation dictates.*
Handling Damaged Cargo Tanks

Mitigation Methods

The following methods for handling damaged cargo tanks are prioritized from least to greatest risk.

1. Make any necessary repairs and allow the vehicle to proceed to its destination for product removal. Repairs you might be able to perform include replacing bolts, gaskets, or caps. You should not attempt repairs using plugs or patches that could be dislodged.

2. Move the cargo tank a short distance to an offloading facility or other safe area for offloading (only if the tank is not leaking). The hazardous materials team should follow the tanker to that location in case of a second spill.

3. Offload the materials from the damaged cargo tank to another cargo tank. This method should be performed by cargo tank specialists only.

4. Drill the cargo tank for product removal (non-pressure aluminum cargo tanks only). This method should be performed by cargo tank specialists only.

5. On-site disposal by flaring (compressed gases in pressure cargo tanks). This method should be performed by cargo tank specialists only.

Activity

Field Product Removal Methods

Field product removal methods are those techniques used to remove the contents from a damaged or overloaded cargo tank. All of these product removal methods are considered outside the legitimate responsibility of the fire department.
However, overseeing the planning and implementation of these methods is within the realm of fire department responsibilities.

These methods are discussed in this section to provide you with enough information to oversee these processes and recognize when inappropriate actions are taking place. Remember, protecting yourself and the community are your primary responsibilities.

Field product removal methods include:
- Transferring
- Venting
- Flaring
- Venting/burning

A transfer involves moving the contents of a damaged or overloaded cargo tank into a receiving tank (e.g., another cargo tank, intermodal tank, or portable tank).

Often, cargo tanks involved in a rollover or other serious accident cannot withstand being uprighted if the tank is full—this is particularly true of aluminum non-pressure cargo tanks. The product must be transferred prior to uprighting and transporting the cargo tank if:

- The cargo tank has been damaged to the extent that it cannot be safely uprighted or moved to an appropriate offloading facility.
- The tank itself is sound but, due to frame or understructure damage or other mechanical damage, it cannot be safely moved, or the damage to piping, valves, or fittings is such that it cannot be repaired.
- Site conditions prevent uprighting the tank (e.g., terrain does not permit the use of air bags, cranes, or other equipment).

**Safety Precautions When Transferring**

The following safety precautions must be taken when performing a transfer:
- Limit site access to required personnel only
- Allow only qualified and experienced personnel to perform the work
- Use appropriate personal protective equipment
Monitor site with appropriate vapor monitoring devices

Have foam, dry chemical extinguisher, and other suitable systems ready in the event of accidental release or sudden flare-up

If transferring flammable or combustible liquids (or finely divided solids) using an open system:
- Ground and bond the tank
- Eliminate all ignition sources and prohibit smoking in the vicinity
- Eliminate or shut down electrical equipment that is not intrinsically safe
- Shut off internal combustion engines
- Use an emergency shutoff system to either automatically or manually shut down the operation in the event of an unintentional release (caused by a hose failure or other malfunction)

Venting, Flaring, and Venting/Burning

For highway transportation, these procedures are rarely used and are generally limited to pressure cargo tanks, such as those transporting liquefied petroleum gas and other flammable products. Flaring, venting, and venting/burning are always last resort options and should only be performed by highly trained and experienced personnel, and only after all other options have been examined and ruled out. Accordingly, this discussion of flaring and venting and burning is limited.

Venting

Venting is the process of releasing flammable and non-flammable liquefied compressed gas vapors into the atmosphere to reduce internal tank pressure. This release can be direct or (in the case of toxic products) indirect through an appropriate treatment (scrubber) or vapor recovery system. Typically, venting is used for non-flammable gases.

Flaring

Flaring is the controlled release and disposal of flammable materials by burning from the outlet of a flare pipe. It is used to reduce pressure, dispose of the residual vapors in a
damaged or overloaded tank, or burn off liquid when transferring the liquid is impractical.

Venting/Burning

Venting/burning is a method of removing liquefied flammable compressed gases or flammable liquids from a tank by creating openings through the controlled use of explosives. Explosive charges are strategically placed on the tank—one at the highest point on the tank for venting vapor and the second at the lowest point on the tank for releasing liquid. The released contents are allowed to flow into a pit for evaporation or burn-off.

Venting/burning is the last resort and is to be performed only by experienced personnel.

Inspecting Damaged Tank Cars

Most unintentional releases of hazardous materials occur in non-accident situations as a result of improperly secured valves, bad gaskets, overfilled cars, other unsecured fittings, and venting from safety relief devices. Whenever a release occurs, you must work with the railroad to determine the material involved, the origin and cause of the release, and any potential problems. In addition, control activities should never be taken without proper training and appropriate personal protective equipment.

Inspecting and Repairing Damaged Tank Car Fittings

Once you identify the product involved, the source of the release, and the personal protective equipment needed, you can begin considering control measures. Many releases associated with fittings can be stopped simply by tightening a valve or fitting using hand tools that are readily available. The most basic control measures for stopping releases from fittings include:

- If open, close it (clockwise to close)
- If loose, tighten it (clockwise to tighten)
- If missing (but available), replace it
The following tables describe, in more detail, the likely locations of leaks, probable causes for these leaks, and basic repair methods.
## Corrective Actions for Tank Car Fittings
### Loading and Unloading Fittings

<table>
<thead>
<tr>
<th>Location of Leak</th>
<th>Probable Cause</th>
<th>Basic Repair Method</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Liquid or Vapor Valve - Ball - or Plug Type</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liquid or vapor leak from threaded orifice in valve</td>
<td>Valve not completely closed</td>
<td>Close valve</td>
</tr>
<tr>
<td></td>
<td>Plug loose or missing</td>
<td>Tighten or replace plug</td>
</tr>
<tr>
<td></td>
<td>Plug or seat worn</td>
<td>To be handled by a tank car specialist</td>
</tr>
<tr>
<td>Liquid or vapor leak from seat between valve and the manway cover plate</td>
<td>Loose flange nuts</td>
<td>Tighten flange nuts</td>
</tr>
<tr>
<td></td>
<td>Bad gasket</td>
<td>To be handled by a tank car specialist</td>
</tr>
<tr>
<td>Liquid or vapor leak around valve stem</td>
<td>Packing retainer loose</td>
<td>Tighten packing retainer</td>
</tr>
<tr>
<td></td>
<td>Missing split ring packing</td>
<td>To be handled by a tank car specialist</td>
</tr>
<tr>
<td><strong>Fill Hole Cover</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liquid or vapor leak around hole cover</td>
<td>Loose cover nuts</td>
<td>Tighten loose cover nuts fill</td>
</tr>
<tr>
<td></td>
<td>Fill hole gasket damaged or missing</td>
<td>To be handled by a tank car specialist</td>
</tr>
<tr>
<td><strong>Manway Cover</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liquid or vapor leak between manway nozzle and manway cover</td>
<td>Loose cover nuts</td>
<td>Tighten loose cover nuts</td>
</tr>
<tr>
<td></td>
<td>Manway gasket damaged or missing</td>
<td>To be handled by a tank car specialist</td>
</tr>
<tr>
<td><strong>Top-Operating Mechanism (Stuffing Box) for Bottom Outlet Valve</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liquid or vapor leak from cover of valve</td>
<td>Loose packing gland nut</td>
<td>Tighten packing gland nut</td>
</tr>
<tr>
<td></td>
<td>Defective packing material</td>
<td>To be handled by a tank car specialist</td>
</tr>
</tbody>
</table>
Corrective Actions for Tank Car Fittings (continued)

## Loading and Unloading Fittings

<table>
<thead>
<tr>
<th>Location of Leak</th>
<th>Probable Cause</th>
<th>Basic Repair Method</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bottom Outlet</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liquid leak from bottom outlet cap</td>
<td>Bottom outlet valve open</td>
<td>Close bottom outlet valve</td>
</tr>
<tr>
<td></td>
<td>Bottom outlet cap/plug loose</td>
<td>Tighten bottom outlet</td>
</tr>
<tr>
<td></td>
<td>Bottom outlet cap gasket missing or defective</td>
<td>To be handled by a tank car specialist</td>
</tr>
<tr>
<td><strong>Liquid Line Flange</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liquid leak from flange</td>
<td>Loose flange nuts</td>
<td>Tighten flange nuts</td>
</tr>
<tr>
<td></td>
<td>Missing or defective gasket</td>
<td>To be handled by a tank car specialist</td>
</tr>
</tbody>
</table>
# Corrective Actions for Tank Car Fittings

## Pressure/Vacuum Fittings

<table>
<thead>
<tr>
<th>Location of Leak</th>
<th>Probable Cause</th>
<th>Basic Repair Method</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Safety Relief Valve-External, Internal, or Combination</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liquid or vapor leak from joint between base of valve and manway cover</td>
<td>Loose flange nuts</td>
<td>Tighten flange nuts</td>
</tr>
<tr>
<td>Liquid or vapor leak from valve seat</td>
<td>“O” ring or washer installed incorrectly or damaged from normal wear. <strong>Caution</strong>: Spring may be broken and is not repairable in the field.</td>
<td>To be handled by a tank car specialist; do not remove the safety relief valve</td>
</tr>
<tr>
<td>Liquid or vapor leak from valve seat</td>
<td>Valve stem bent or broken</td>
<td>To be handled by a tank car specialist</td>
</tr>
<tr>
<td></td>
<td>Overloaded tank</td>
<td>Unload; to be handled by a tank car specialist</td>
</tr>
<tr>
<td><strong>Safety Vent</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liquid or vapor leak from opening in center of safety vent</td>
<td>Ruptured frangible (rupture disk). Liquid indicates overload or splash without overload</td>
<td>Replace frangible disk with new disk identical to the ruptured disk</td>
</tr>
<tr>
<td><strong>Vacuum Relief Valve</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liquid or vapor leak from under deflector cap</td>
<td>“O” ring off seat or valve stem bent</td>
<td>To be handled by a tank car specialist</td>
</tr>
<tr>
<td></td>
<td>Solidified product</td>
<td>To be handled by a tank car specialist</td>
</tr>
</tbody>
</table>
## Corrective Actions for Tank Car Fittings
### Fittings for Gauging

<table>
<thead>
<tr>
<th>Location of Leak</th>
<th>Probable Cause</th>
<th>Basic Repair Method</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Open-Type Gauging Device, Slip Tube With Quick Release or Screw Cover</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liquid or vapor leak from gauging device control valve orifice plug</td>
<td>Gauging device control valve not closed; valve plug is loose or missing</td>
<td>Close gauging device control valve</td>
</tr>
<tr>
<td>Liquid or vapor leak from joint between gauging device and manway cover plate</td>
<td>Loose flange nuts</td>
<td>Tighten flange nut</td>
</tr>
<tr>
<td>Liquid or vapor leak from around cover at base of fitting</td>
<td>Loose flange nuts</td>
<td>Tighten flange nut</td>
</tr>
<tr>
<td>Liquid or vapor leak around gauge rod packing gland or missing</td>
<td>Packing gland nut loose</td>
<td>Tighten packing gland retainer</td>
</tr>
<tr>
<td></td>
<td>Packing materials defective</td>
<td>To be handled by a tank car specialist</td>
</tr>
<tr>
<td><strong>Closed-Type Gauging Device, Magnetic</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liquid or vapor leak from base of gauging</td>
<td>Broken pipe</td>
<td>Tighten gauging device cover</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Do not remove cover</strong></td>
</tr>
<tr>
<td>Liquid or vapor leak from seal between gauging device and manway cover plate</td>
<td>Loose flange nuts</td>
<td>Tighten flange nuts</td>
</tr>
<tr>
<td><strong>Closed-Typed Gauging Device, Tape-Type</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liquid or vapor leak from seal between gauging device and manway cover plate</td>
<td>Loose flange nuts</td>
<td>Tighten flange nuts</td>
</tr>
</tbody>
</table>
### Corrective Actions for Tank Car Fittings
#### Miscellaneous Fittings

<table>
<thead>
<tr>
<th>Location of Leak</th>
<th>Probable Cause</th>
<th>Basic Repair Method</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sample Line</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liquid or vapor leak from sample line orifice or from around plug</td>
<td>Sample line valve not closed</td>
<td>Close sample line valve</td>
</tr>
<tr>
<td></td>
<td>Plug missing or loose</td>
<td>Replace and/or tighten plug</td>
</tr>
<tr>
<td></td>
<td>Damaged sample line plug</td>
<td>To be handled by a tank car specialist</td>
</tr>
<tr>
<td><strong>Thermometer Well</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liquid or vapor leak from thermometer well cap</td>
<td>Loose cap with damaged thermometer well pipe</td>
<td>Tighten cap; do not remove cap</td>
</tr>
<tr>
<td></td>
<td>Missing or defective “O” ring in cap or on nipple with damaged thermometer well pipe</td>
<td></td>
</tr>
<tr>
<td>Liquid leaking from between thermometer well nipple and manway cover</td>
<td>Damaged thermometer well pipe</td>
<td>To be handled by a tank car specialist; <strong>do not tighten thermometer well nipple</strong></td>
</tr>
<tr>
<td>Thermometer well nipple broken off with no leak</td>
<td>Mechanical damage to thermometer well nipple</td>
<td>To be handled by a tank car specialist</td>
</tr>
<tr>
<td><strong>Heater Coil-Internal</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liquid leak from inlet or outlet pipes at bottom of tank</td>
<td>Condensation from material used for heating contents</td>
<td>Tighten caps</td>
</tr>
<tr>
<td><strong>Washout</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liquid leaking from around seal between tank and washout plate</td>
<td>Flange nuts loose</td>
<td>Tighten flange nuts</td>
</tr>
<tr>
<td></td>
<td>Defective gasket</td>
<td>To be handled by a tank car specialist</td>
</tr>
</tbody>
</table>
Handling Damaged Tank Cars

Mitigation Methods

Damaged tank cars should be handled as simply and safely as circumstances allow. The following list prioritizes control methods from least to greatest risk. All of the following shall be done by or with a tank car specialist!

1. Make any necessary repairs and forward to destination.

2. Move the car a short distance to a fixed loading/unloading facility for unloading (only if the tank is not leaking).

3. Conduct a field transfer—tank car to tank car.

4. Conduct a field transfer—tank car to cargo tank or intermodal tank container.

5. On-site treatment by flaring, neutralization, or other method.

6. Hot tap the tank car to facilitate transfer, flare, or otherwise unload the car.

7. Vent and burn the contents on-site.

Activity
Application Exercise
Application Exercise

The following are suggestions for activities that will help students apply their new technology and skills in the field.

Preparation

1) Contact a facility that builds and/or repairs tanks (highway cargo tanks, rail tank cars, or bulk storage tanks) and arrange a visit. The facility will be able to demonstrate the valves, fittings, and construction of tanks and containers. This will allow students to become familiar with containers used in their area.

2) Contact a site where there are containers (highway cargo tanks, rail tank cars, or bulk storage tanks) and arrange a visit and discuss each type of tank or container, what it may hold, possible hazards, and possible pressures in the container. Also, if you visit a location where containers are stored, use one of the containers that is placarded and look for typical problems that may exist during a spill, such as chemical flow into storm sewers or rivers. Compare notes taken by the groups.

3) Take slides of containers in the local jurisdiction. Show the slides and discuss the type of tank or container, what it may hold, possible hazards, and possible pressures in the container. Also, discuss how you would assess damage to those containers and/or repair different leaks. Using maps from the area, discuss how a material leaking from those containers would disperse and how you would contain it.
Action Statement
Action Statement

You have just completed Module 2 of the Hazardous Materials Training course. The topics included:

- The design of non-bulk storage containers and the materials they may carry
- The format and information included on shipping papers
- The design and construction of highway cargo tanks and the materials they often carry
- The design of rail tank cars and the materials they often carry
- Types of intermodal containers
- The transportation of hazardous materials by air
- The transportation of hazardous materials by water
- The transportation of hazardous materials by pipeline
- Fixed site facilities and the design of bulk containers
- Basic control techniques for cargo tanks and tank cars

Knowing how you respond to emergencies in your first due areas, would you change your actions or habits based on the information covered in this module? Listed below are some suggested actions. Some you may already do, and others may not fit into your work environment. If these are actions you have not done in the past, do you think you will begin doing them as a result of this training?

As a result of this training, I will:

1) Visit shippers and rail yards in my area to become more familiar with cargo tanks and tank cars

2) Identify cargo tanks I see on roads and highways

3) Visit facilities in my first due area to become more familiar with their bulk and non-bulk storage containers

4) Closely inspect cargo tank damage the next time I respond to an incident involving these vehicles

5) Practice control techniques for mitigating leaks from cargo tanks

6) (Create my own action statement) ____________________________________________________________
   _______________________________________________________________________________________
   _______________________________________________________________________________________
Appendix A

Activities
Shipping Papers Activity 1

Use the Straight Bill of Lading on the back of this page and the North American Emergency Response Guidebook and your own department’s SOPs to answer the following questions.

1. What are the four most important items on this Bill of Lading?

2. List at least one hazard posed by the cargo.

3. Assuming first responders have secured the scene, what are five initial actions your hazardous materials team might take?
Cryogenic Case Study Activity 2

The Akron, Ohio Fire Department responded to a report of a leaking liquid oxygen tanker. The truck was moved during unloading, breaking the discharge lines. When fire fighters arrived, the bottom of the tanker was covered with frozen product. Liquid oxygen was leaking into the building where the tanker was unloading.

Questions

1. What are the hazards of LOX?

2. How would your hazardous materials team have handled this incident?
Cargo Tank Activity 3

Four of the five basic types of specification cargo tanks are pictured below. Identify each, then match the following list of products to the tank in which it is most likely to be carried.

A

B

C

D

Products:
- Liquid oxygen
- Sulfuric acid
- Diazinon
- Chlorine
- Propane
- Liquid hydrogen
- Fruit juice
- Sodium hydroxide
- LPG
Scenario Activity 4

Scenario A

You respond to a call reporting that a cargo tank, parked at a truck stop, is leaking an unknown chemical. When you arrive you notice that the truck is placarded 1203; from that information and other markings it is obvious the truck is carrying gasoline. The truck driver cannot be located, and it is reported that he has left the premises. You do not have access to the shipping papers, and you do not know how much gasoline remains in the tank. The truck is parked among several other cargo tanks, some also carrying flammable materials. The leak appears to be coming from the end of a pipe beneath the truck. How would you initially assess this situation? What actions should you take?

Scenario B

A truck driver calls the fire department from a rest stop. He reports that a motorist on the highway gestured for him to pull over. When he did, he discovered that a relief valve on the tank was discharging vapor. When you arrive, the driver tells you that he had just made a pickup, during which the tank had been filled with anhydrous ammonia. How would you initially assess this situation? What actions should you take?
Scenario C

A serious traffic accident on a busy interstate has resulted in a multiple-vehicle pileup. Two separate fires have ignited as a result of gasoline spills. Four cars are involved, as well as a cargo tank carrying liquid nitrogen. The tank is discharging vapor from the relief valve, but otherwise appears to be intact. The driver reports that the tank began to vent several minutes after the accident occurred. How would you initially assess this situation? What actions should you take?

Scenario D

You respond to a traffic accident in which a non-pressure cargo tank placarded 1993 has run off the road. The driver is in the truck cab, unconscious. The shipping papers are also in the truck cab. The bottom of the tank is damaged, and bottom piping appears to be sheared off and leaking an unknown liquid. How would you initially assess this situation? What actions should you take?
Scene Management Activity 5

February, 1996

A train derailment resulted in two fatalities and a toxic material spill that occurred near Leadville, Colorado. Both of the dead are believed to be Southern Pacific Railroad employees who were aboard the train at the time of the derailment. The accident occurred at approximately 6:00 a.m. near U.S. Highway 24, between Leadville and Minturn, Colorado.

Twenty-five cars of the mixed load freight train left the track and several cars overturned. Two of those cars leaked sulfuric acid onto nearby Highway 24. A toxic gas cloud was reportedly formed as the spilled sulfuric acid mixed with snow and began to react. At least one person was admitted to the nearby Vail Valley Medical Center with respiratory difficulties, and several others were treated for eye and breathing irritation.

Several nearby homes and businesses were evacuated as a special hazardous materials spill team attempted to control the spill and limit the spread of the gas cloud. Highway 24 was reportedly contaminated and closed by State Patrol officers as the fire fighters worked to mitigate the emergency. Traffic congestion was also reported, as Interstate Highway 70 was previously closed by a snowslide and Highway 24 was being used as an alternative route.

The Avalanche Information Center of Colorado speculated that the crash was caused by 16 inches of new snow and a snowslide that may have covered the tracks. A State Patrol spokesperson said that “all theories” regarding the calamity would be given consideration, but that it was too early in the investigation to reach any conclusions.

Questions

1. What happens when sulfuric acid mixes with water?

2. This derailment affected rail as well as highway traffic. How would your hazardous materials team have handled the scene?
A freight forwarder’s recent attempt to ship 22 suitcases stuffed with pesticide as belly cargo points to the need for more training and tougher enforcement of existing laws governing the shipment of hazardous materials, industry sources said. It also revealed a potentially serious loophole in air cargo security.

The incident occurred October 1 at Miami International Airport when a courier appeared at the passenger counter and tried to ship the hazardous material as additional luggage aboard an American Airlines (AMR) Boeing 757 flight to Ecuador. The hazardous material was discovered when one of the suitcases slipped from a conveyor belt, broke open, and emitted noxious fumes, according to a spokesperson for the Miami office of the Federal Bureau of Investigation. Investigators said the shipper wrapped the packages in thick black plastic, which covered the pesticide labels, and hired a courier to transport them to Ecuador as passenger luggage.

The shipper was charged with one count of transporting Dowcide (sodium o-phenylphenate tetrahyde and sodium hydroxide) and faces up to five years for the violation. The pesticide can cause burning of the lungs and eye damage when released into the air. Five passengers on the plane were taken to the hospital following the incident.

Questions

1. Discuss other types of products that cannot be shipped via air.

2. How would your hazardous materials team have handled this incident?
Waterway Activity 7

December, 1997

A chemical spill from a grounded barge on the swollen Mississippi River put Baton Rouge, Louisiana on alert and forced the evacuation of hundreds of people on both sides of the river.

The stranded barge was one of a string of 25 that struck the U.S. 190 over the Mississippi and broke free. It was carrying 400,000 gallons of the chemicals toluene and benzene, both flammable and toxic.

The barge overturned near the west bank and began leaking below the water line. More than a dozen families were evacuated in Port Allen, and on the east side in Baton Rouge, Southern University was evacuated as well.

The state police spokesperson said instruments showed benzene in the air. “You can clearly smell the chemical,” he said. The concentration of fumes was in the safe range although shifting winds made the measurements difficult.

Southern University, about two miles away, closed down as a precaution. Half of the 2,600 students went across town to spend the night at Louisiana State University’s cavernous fieldhouse. Most of the others moved in with off-campus friends, local students, and their families.

Many students were annoyed that the school waited hours to announce the evacuation, especially since spring break was to begin soon. Baton Rouge’s business section, including the Capitol, was under alert. The gambling boat, Casino Rouge, shut down voluntarily at dusk and The Advocate newspaper pushed up its deadline in case the evacuation zone was expanded.

The Mississippi River was swollen with floodwaters from the Ohio River and the U.S. Army Corps of Engineers began diverting some of the water.

A two and one-half mile stretch of the river was closed and a swift current played havoc with barges on the river.

As teams worked on the leaking barge, another batch of twelve broke free about six miles downstream, but they were quickly brought under control.

Divers went into the fast-moving river during the night in an attempt to stabilize the barge and a crane was being shipped from New Orleans to lift the barge from the river and remove its toxic cargo, Jones said.

Source: Associated Press
Questions

1. What are the flash points of toluene and benzene?

2. What toxic effects result from exposure to these chemicals?

3. How would your hazardous materials team have handled this incident?
Common Carrier Activity 8

Scenario

The time is 0158 hours, weather is clear and 72°F and the wind is calm. Your unit has been called to the scene of a Gator Freightways double freight van accident. EMS has just left the scene with a 52 year old male truck driver who has suffered an apparent heart attack. The truck left a freeway feeder road and came to rest against a tree in a wooded area near a 24-hour Whataburger restaurant. On arrival a police officer meets you with a Corrosive placard from the front trailer and a Bill of Lading. He has no other information.

During your initial recon of the site, you notice a small leak coming through the floor at the front of the trailer dripping on a tire.

1. Based on the above information and attached shipping documents, describe your initial actions.

2. Describe your actions to bring the incident to a conclusion based on your resources and standard operating procedures.
Tank Car Activity 9

RECOGNITION EXERCISE
PRESSURE TANK CAR FEATURES

Place the letter from the diagram below in front of its correct description.

___ Capacity in gallons/liters           ___ Proper shipping name
___ DOT Placard                         ___ Reporting marks, car number
___ DOT tank car classification         ___ Safety relief valve
___ Empty wt. in pounds/kilograms       ___ Safety valve, tank test info.
___ Gauging device                      ___ Sampling line
___ Liquid valve (two)                   ___ Thermometer well
___ Load limit in pounds/kilograms      ___ Vapor valve
Answer Key in Instructor Guide
RECOGNITION EXERCISE
GENERAL PURPOSE (NON-PRESSURE) TANK CAR FEATURES

Place the letter from the diagram below in front of its correct description.

- Capacity in gallons/liters
- DOT placard
- DOT tank car classification
- Empty wt. in pounds/kilograms
- Air valve (optional)
- Bottom outlet valve
- Load limit in pounds/kilograms
- Proper shipping name
- Reporting marks, car number
- Safety valve
- Safety valve, tank test info.
- Manway
- Manway cover/vacuum relief valve
- Unloading line, 3" ball valve (optional)
Answer Key in Instructor Guide
Appendix B

Additional Rail Car Information
The General Motors Model GP38 locomotive, illustrated in Fig. 1-1, is equipped with a Model 645E diesel engine that delivers 2,000 horsepower to the main generator for tractive purposes. This power is then distribute to four traction motors, each of which is directly geared to a pair of driving wheels.

The basic locomotive is arranged and equipped so that the short hood or cab end is considered the front or forward part of the unit. However, the locomotive operates equally well in either direction, and on special order controls may be arranged so that the long hood end is forward, or dual controls may be provided.
The locomotive may consist of one or more individual units, each of which is a completely functional power plant. When coupled together for multiple unit operation, all can be simultaneously controlled from a single set of controls located in the cab of the lead unit. This is accomplished through jumper cables connected between the units.

The general arrangement of equipment used on the SD38 locomotive is shown in Fig. 1-1. Each of the more important equipment components is numbered and identified in this illustration.

**How the Locomotive Operates**

1. The fuel pump is driven by an electric motor which, for fuel priming, uses current from the storage battery. Once the engine is started and running, the fuel pump motor uses current directly from the auxiliary generator. The fuel pump transfers fuel from the fuel tank under the locomotive to the engine injectors.

2. The diesel engine is started by means of the direct coupled main generator which is temporarily used as a starting motor. A storage battery supplies the electric current to rotate the generator and start the engine.

3. When the engine is running, it supplies mechanical power through shafts and couplings to directly drive three electrical generators, the air compressor, motor and generator blowers, and engine mounted lube oil and cooling water pumps.

4. The auxiliary generator charges the storage battery and supplies low voltage direct current for the control, lighting, and main generator excitation circuits. The alternating current generator furnishes power to the radiator cooling fans and to the inertial separator blower motor. The main generator supplies high voltage direct current to the traction motors for locomotive pulling power.

5. By means of the cab controls, low voltage circuits are established to actuate the engine governor and the switchgear in the electrical cabinet. This switchgear controls generator excitation and distribution of power.

6. Four traction motors are located under the locomotive. Each traction motor is directly geared to an axle and pair of driving wheels. These motors are located in two trucks which support the locomotive weight and distribute it to the driving wheels.

7. The throttle electrically controls speed and power by actuating a governor mounted on the engine, and by tying the response of the locomotive power control system to throttle position. The main generator converts the engine’s mechanical power to electrical power, which is then distributed to the traction motors through circuits established by the various switchgear components in the electrical cabinet.

8. At locomotive start the throttle controls electrical devices that provide rapid power response at a level consistent with smoothly controlled starting.
9. After the locomotive is moving, a load regulator prevents the engine from being over or underloaded by regulating the electrical load on the engine in all throttle positions.

10. The air compressor supplies, to the reservoirs, air under pressure used primarily for the air brakes. The air brakes are controlled by the operator through suitable equipment in the cab.

11. Except for manual operation of the cab controls, the locomotive operation is completely automatic. Various alarms and safety devices will alert the operator should any operating difficulties occur.

**In Case of Fire**

A locomotive must be isolated and shut down before attempting to extinguish a fire in the high voltage cabinet. After the locomotive is isolated and shut down, the main battery switch, located on the engine control panel, should be pulled.

**Fire Extinguishers**

Each locomotive is equipped with CO-2 and dry chemical fire extinguishers. On most locomotives, one extinguisher is located in the short hood end compartment, accessible through door in engine cab, and two are located behind stencilled doors along the side of the long hood end.

**Ways to Stop a Locomotive Engine**

1. **Use Throttle Handle.** Move handle to the IDLE position, pull the handle out and away from the control stand beyond IDLE to the STOP position.

2. **Press Stop Button on Engine Control Panel.** Place isolation switch in STOP position, then press STOP button.

3. **Press Emergency Fuel Shut-off Button.** Press one of three emergency fuel shut-off buttons. One of the emergency shut-off buttons is located on each side of the locomotive, near the fuel filler cap, and a third button is located on the engine control panel in the engine cab.

4. **Use Layshaft Lever.** Pull the layshaft lever, located inside the engine compartment near the engine governor.

5. **Use Low Oil Shut-down Switch.** Pull the low oil shut-down switch, located on the governor unit inside of the engine compartment.
### Tank Car Damage Assessment

#### Tank Car Characteristics/Features

<table>
<thead>
<tr>
<th>Type of Car:</th>
<th>Non-pressure</th>
<th>Pressure</th>
<th>Cryogenic</th>
<th>Other</th>
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<table>
<thead>
<tr>
<th>Specification No:</th>
<th>Tank Test Pressure</th>
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<th>Build Date:</th>
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<table>
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<th>Construction Material:</th>
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<table>
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<tr>
<th>Stress:</th>
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<th>C</th>
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#### Fittings Damage

<table>
<thead>
<tr>
<th>Type fitting</th>
<th>Damaged?</th>
<th>Description Damage/Leak</th>
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<tbody>
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<td>Liquid Valve</td>
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<td>Bottom Outlet Type:</td>
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<td>Pressure Relief Device Type:</td>
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<td>Vacuum Relief Valve</td>
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<td>Gauging Device Type:</td>
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<td>Fill Hole</td>
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<tr>
<td>Other Type:</td>
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</tbody>
</table>

Indicate location and severity of damage (punctures, cracks, scores, gouges, wheel burns, dents, rail burns, underframe, and leaks) on the appropriate diagram(s).
Appendix C

Consist
## Consist—Transportation

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<thead>
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<th>Key:</th>
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<tr>
<td>(1) Engines</td>
</tr>
<tr>
<td>(2) ID—Letter and number</td>
</tr>
<tr>
<td>(3) Type of car</td>
</tr>
<tr>
<td>(4) Overall dimensions for builder</td>
</tr>
<tr>
<td>(5) Length in feet (estimated)</td>
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HTL- *A1  RKA0000001RKA
3 M61502 XXB000  XXB175  10030610  10030600  M200410

**TONNAGE GRAPH** * =4 TONS  **H=HAZARD  STCC C=CONTAMINATED**  **E=PLATE C/F**

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**TRN-------CAR--------  L  CAR -----------------TONS     -------------140&      SPL  EST TR**

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**Key:**

(1) Engines
(2) ID—Letter and number
(3) Type of car
(4) Overall dimensions for builder
(5) Length in feet (estimated)
Appendix D

Slide Script

(Instructor Guide only)