# HAZ MAT SPECIALIST

# 1F - SPECIAL MITIGATION TECHNIQUES

## PARTICIPANT MANUAL

2022

THE CALIFORNIA GOVERNOR'S
OFFICE OF EMERGENCY SERVICES
CALIFORNIA SPECIALIZED TRAINING INSTITUTE

## Table of Contents

### Module 1F

# Hazardous Materials Specialist 1F
# Plan of Instruction

## Course Title: Hazardous Materials Specialist 1F: Special Mitigation Techniques

A. Course Goal and Objectives

Goal: The goal of Module 1F is to prepare individuals who have completed Hazardous Materials Technician Training to perform advanced Assessment and Mitigation. This course provides information and skills required to complete this week and the second, and last week (G-Week) of the Hazardous Materials Specialist Program.

Course Objectives:

A complete list of the objectives for this course can be found in Title 19 of the California Code of Regulations, Section 2520 (p). In general terms, the objectives of this course are to provide the student with knowledge, skills and experience:

1. Assessing unknown (to the student) solids and liquids using the HazCat or 5 Step system and recognizing those chemicals which can be used as a potential weapon
2. Assessing and mitigating hazardous materials releases from highway, rail and intermodal containers, routine and intentional (Terrorism)

B. Scope of the Course

The Hazardous Materials Specialist Curriculum is a logical continuation of the Hazardous Materials Technician Course and is designed to build upon the knowledge gained from previous classes. At this juncture, students enter the next level of hazard assessment by means of advanced chemical analysis and incident intervention. Accidental and intentional releases involving a wide range of transportation modes are presented. This course, the first of two, provides qualified individuals with a minimally didactic and largely practical experience. Lecture and/or demonstration are used to focus learning, while practical application provides the experiential components. The subject matter centers around two general aspects, identification of unknown materials through chemical analysis and the mitigation of transportation incidents (HazMat).

C. CSTI/CSFM Hazmat Technician/Specialist Training

The California Specialized Training Institute/California State Fire Marshall (CSTI/CSFM) Hazmat Technician/Specialist certification program consists of six 40-hour modules. The first four (1A, 1B, 1C, and 1D) are required for Technician certification. These four courses plus Hazmat 1F and 1G comprise Specialist certification. This course is the 1F portion and is titled Hazardous Materials Technician 1F: “Special Mitigation Techniques.”

D. Levels of Hazardous Materials Response Training

Too many deaths and injuries have occurred due to improper response to hazardous materials incidents. A certification process is essential to prepare responders to safely deal with these situations. This particular CSTI/CSFM program is designed for the Technician/Specialist. However, there are numerous different levels of hazardous materials responders:

1. Hazmat First Responder:

    A. Awareness: Likely to witness or discover a hazardous substance release. No special clothing or equipment is utilized. These personnel initiate the response process.

    B. Operational: Part of initial defensive response to protect persons, the environment, and property. No special clothing or equipment is utilized.

2. Hazmat Technician: Responds for the purpose of stopping the release. Uses specialized clothing, tools, meters, and references to assess hazards and risks. Able to implement employer's emergency response plan and function within the Incident Command System to initiate advanced, offensive control measures and decontamination procedures.

3. Hazmat Specialist: Duties parallel those of the hazmat technician, although the specialist's duties require a more specific knowledge of the hazardous substance. Specialists may also act as a site liaison with federal, state, and local government authorities.

4. Hazmat On-Scene Incident Commander: Assumes control of the incident scene beyond the first responder awareness level.

5. Other Support Personnel. Training levels that are not specified in Section Q of 29 CFR 1910.120.

    A. Skilled Support Personnel: Not necessarily the employer's own employees, but who may be exposed to the hazards at an emergency scene. Not required to meet hazmat responder training requirements, but must be briefed on site regarding:
        1. Personal protective equipment
        2. Anticipated chemical hazards
        3. Duties required

    B. Specialist Employees: Employees who regularly work with and are trained in the hazards of a specific hazardous product. These personnel may provide technical advice or assistance to the Incident Commander.

E. Qualifications

Participant Qualifications:

Participants must have completed the Hazardous Materials Technician Course as notated in Title 8 CCR 5192 (q)(6)(C) -- A through D- Week with C.S.T.I. or through outreach in a C.S.T.I. certified course. The student should take this course within one year of Technician Certification (although not required) for consistency of information. They should be those individuals who will potentially respond, assess and mitigate a hazardous materials release.

Instructor Qualifications:

Instructors shall meet the instructor certification requirements as listed in CCR Title 19, Division 2, Chapter 1, Sub-Chapter 2, Section 2530 and have competence in the subject matter and adult education delivery skills.

F. Evaluation

Participants must pass a CSTI certified Haz Mat Emergency Response Technician 1F course written 40 question exam with a minimum passing score of 70%. Participants shall also meet the minimum attendance of 40 hours, accomplish all objectives and participate in the training exercises to become certified.

G. Course Supplies and Equipment

Instructors are encouraged to acquire and use any props, support materials, videos, etc., they may desire for class activities and exercises. The instructor may also need a white board or chalk board with markers, CSTI or CSFM Roster, applications, safety policies, ICS forms, Haz Mat data worksheets, Haz Mat field identification worksheets, and evaluation forms.

All instructors who are conducting or participating in any State certified hazardous materials course shall adhere to the safety policy as in the California Code of Regulations Title 19, Division 2, Chapter 1, Sub-Chapter 2, Section 2540 (k) Safety Policy.

Special equipment is required for the competencies section of this course. Instructors are encouraged to review the equipment list specified by Title 19, Section 2520 (p) prior to setting up a class to insure that all skill sets can be presented.

H. Inclusion of CBRNE Materials

Chemical, Biological, Radiological, Nuclear and Explosive Weapons are considered super toxic, or super energetic hazardous materials. Instructors must include WMD and CBRNE concepts in their lectures. It is no longer sufficient to discuss the industrial accident or transportation accident. Instructors must also include approaches to mitigation which address issues including additional devices, IEDs, Terrorist Threats and Terrorist Attacks.

Responder safety is paramount and situational awareness must be stressed throughout this course.

# Chapter 1: Welcome and Introduction

**Scope:**
This chapter provides an overview of the course and introduces the Hazardous Materials Technician with an two week Specialist program.

**Time :** 30 minutes

**Instructor/Participant Ratio:** 1-30

**Method of Instruction:** Lecture

## Terminal Learning Objective (TLO)

At the end of instruction for Chapter 1, participants will be able to determine the range of skills necessary to function as a Hazardous Materials Specialist working on a Hazmat Team.

## Enabling Learning Objectives (ELO)

This chapters enabling (performance) objectives are to ensure participants will be able to:

1. Understand who needs to be trained at the Specialist Level
2. Describe some of the risks a Specialist may face.
3. Describe the need for safety for the Hazardous Materials Specialist

## Linkages to Universal Task List

The information, objectives, and activities in this chapter promote the acquisition of knowledge and skills in support of the target capabilities identified in the Universal Task List:

**ResB2b 1** Develop Plans, Policies, Procedures, and systems to support WMD hazardous materials response and decontamination operations

**ResB2b 2** Develop and implement training and exercise programs for WMD hazardous materials response and decontamination

## Materials and Preparation

- Seating and work stations for up to 30 participants
- Instructor Manual and CD with Power Point presentation (1 for instructor)
- participant manual (1 for each participant)

**Supporting Materials:** None

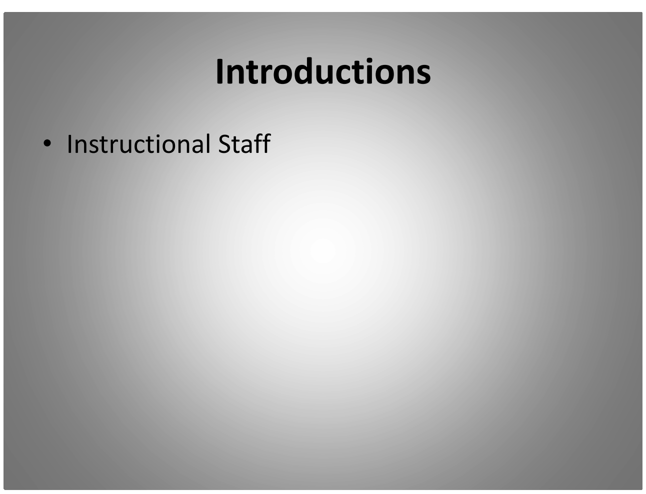
**Activities:** Introductions of instructors and students

**Practical Exercise:** None


**Slide 1**

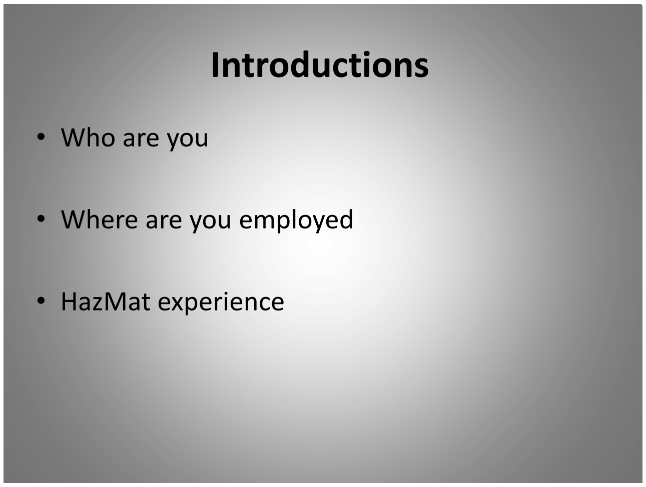
Welcome Class!


**Slide 2**



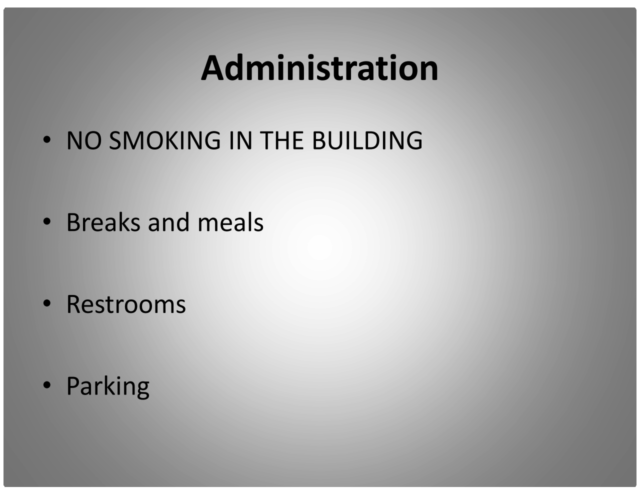

**Slide 3**

Introduce Instructor Team



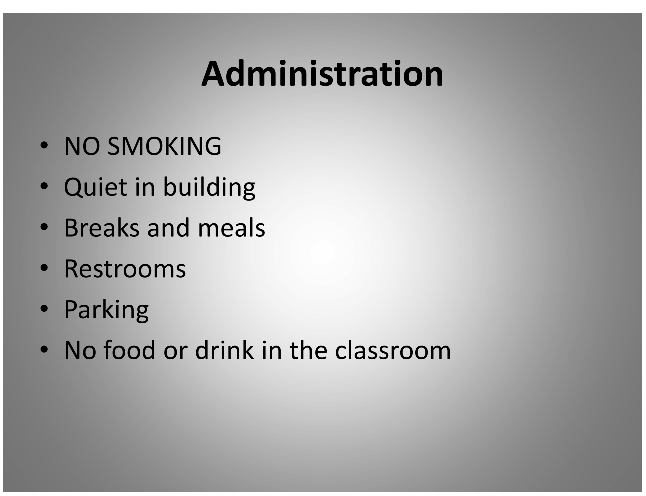

**Slide 4**

Have class introduce themselves.

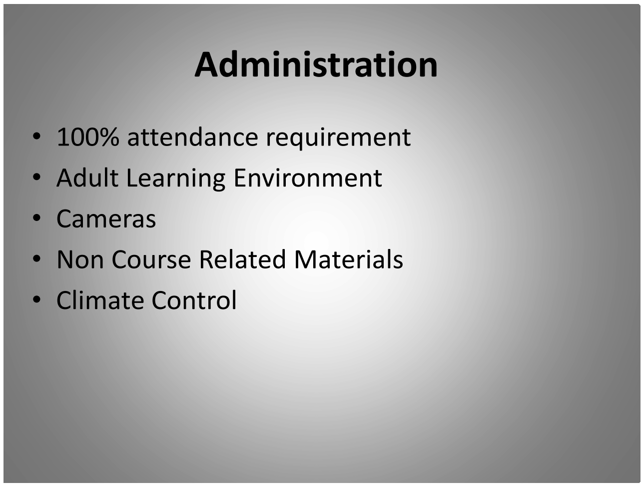



**Slide 5**

Class rules and information

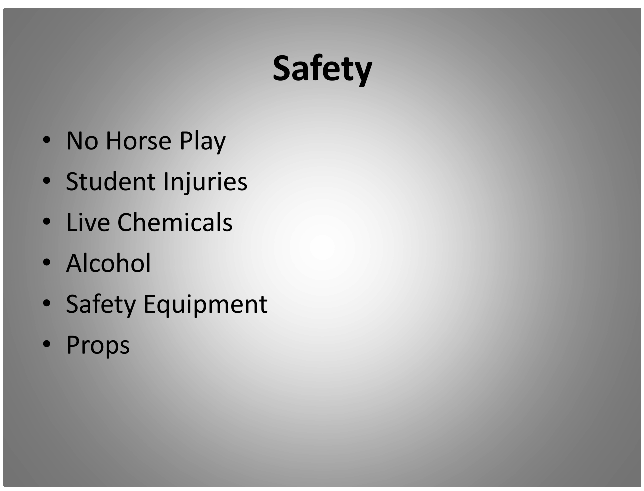



**Slide 6**



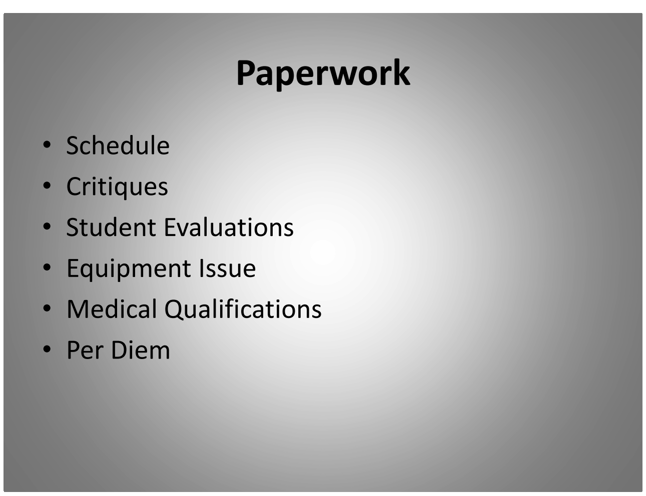

**Slide 7**

Course Requirements



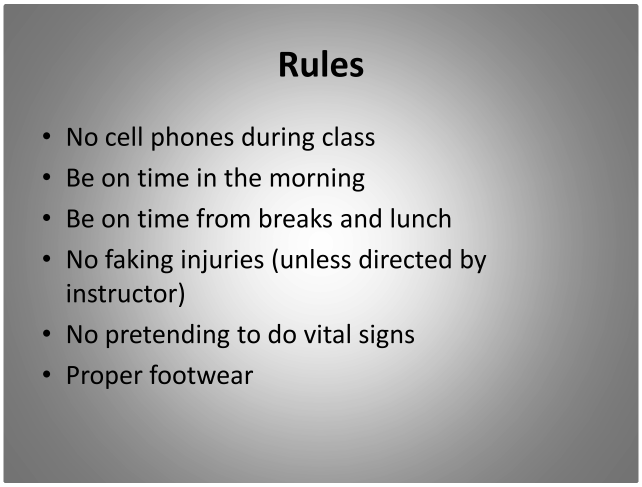

**Slide 8**

Basic safety issues



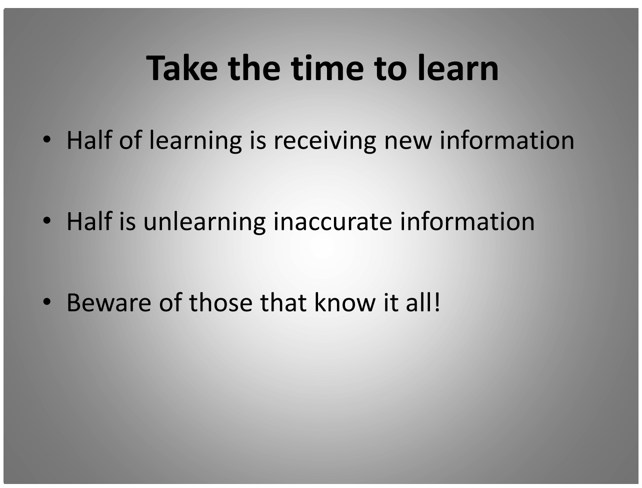

**Slide 9**

Administrative paperwork required for the course




**Slide 10**

Basic class rules continued

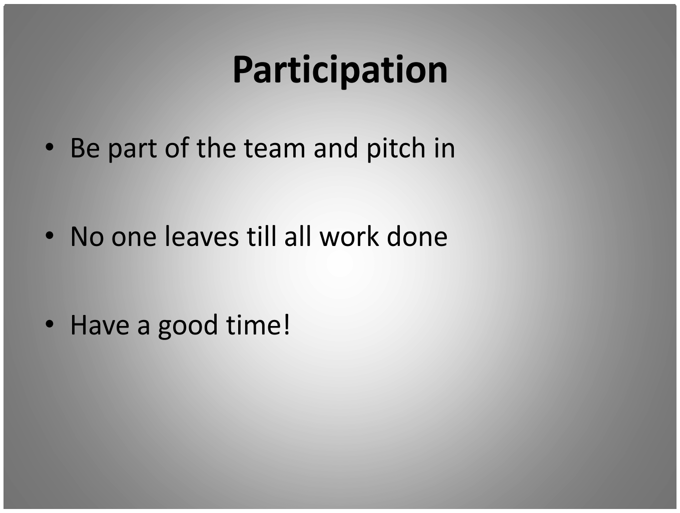



**Slide 11**

Be open to learning new things and unlearning inaccurate things


**Slide 12**

The Instructor will be covering the safety Policy for the class and then get into the HazCat (field analysis) portion of the class.


Participation
• Be part of the team and pitch in
• No one leaves till all work done
• Have a good time!

**Slide 13**

# Chapter 2: Safety and Protection

**Scope:**
This chapter provides an overview of the hazards involved in this training program and procedures to follow to ensure the safety of all students. This includes the handling of live chemicals and full scale exercises.

**Time :** 1 Hour

**Instructor/Participant Ratio:** 1-30

**Method of Instruction**: Lecture

**Terminal Learning Objective (TLO)**
At the end of instruction for Chapter 2, participants will be able to determine the safety hazards inherent in this advanced course and procedures to follow in case of accident or injury.

**Enabling Learning Objectives (ELO)**
This chapter's enabling (performance) objectives are to ensure participants will be able to:

1. Understand the hazards involved in this course
2. Describe the procedures to follow in case of a chemical spill.
3. Describe the need for safety for the Specialist and recognize the wide range of dangers from hazardous materials

**Linkages to Universal Task List**
The information, objectives, and activities in this chapter promote the acquisition of knowledge and skills in support of the target capabilities identified in the Universal Task List:

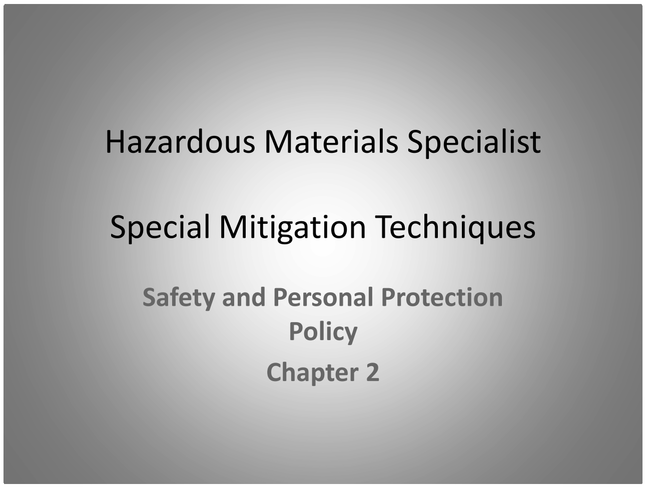
| | |
|---|---|
| **ResA1a 1.1** | Establish procedures for assessing an immediate incident scene |
| **ResB2b 2.1** | Develop and implement hazardous materials training |
| **ResB2b 5.2.1** | Identify hazardous materials and extent/scope of the incident |
| **ResB2b 3.2.5.2** | Develop and implement a site specific safety and health plan that includes worker risk assessment and risk management |

**Materials and Preparation**

- Seating and work stations for up to 30 participants
- Instructor Manual and CD with Power Point presentation (1 for instructor)
- participant manual (1 for each participant)

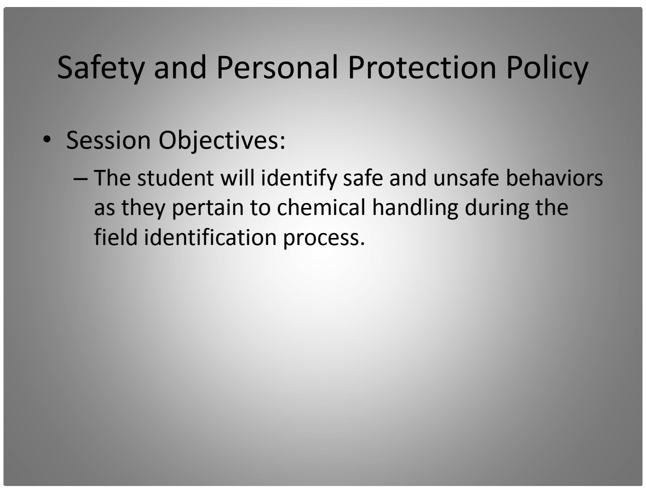
**Supporting Materials**
Activities: Students will review and sign the Safety Policy provided in the participant manual as part of their training records.

**Practical Exercise:** No exercises have been assigned for this chapter.




**Slide 1**

Safety is the first order of business in this class.

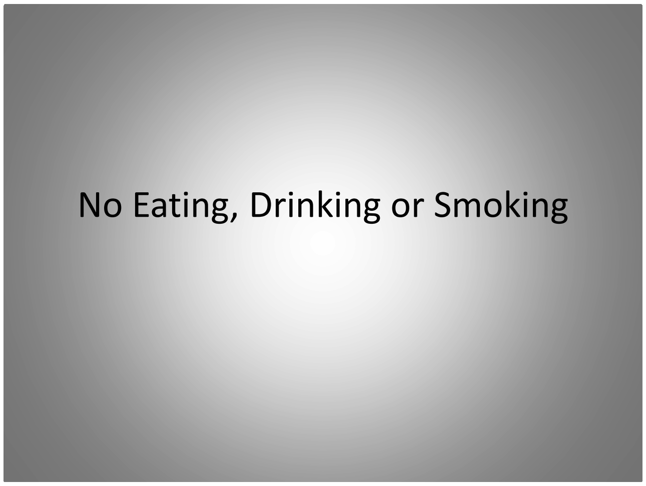



**Slide 2**

Because responders do dangerous operations and handle numerous live chemicals, they need a strong safety policy.

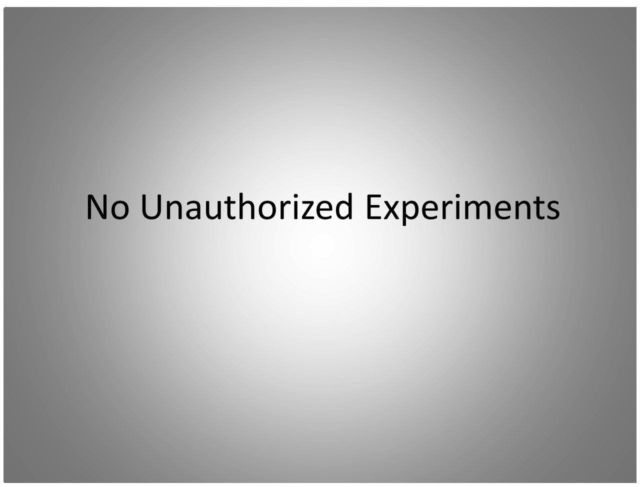

**Slide 3**

Appropriate safety gear will be worn at all times when engaged in class activities.



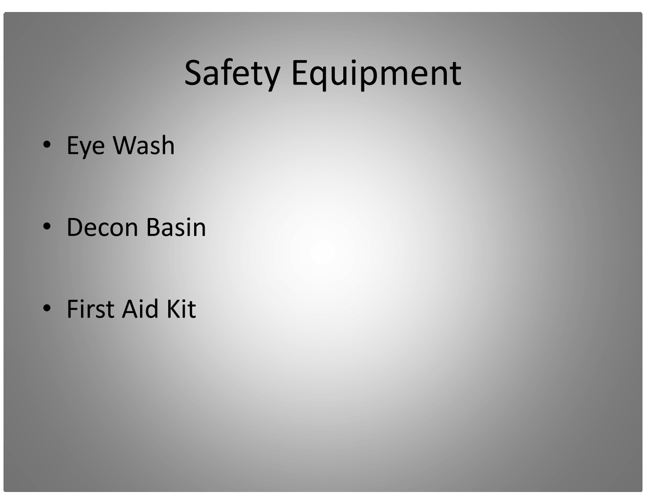

**Slide 4**

No eating, drinking or smoking in the chemical testing areas.



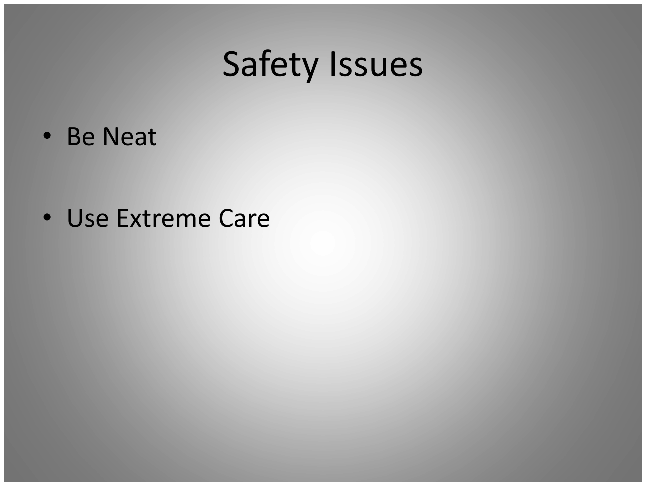

**Slide 5**

No Ad Hoc testing during this class.



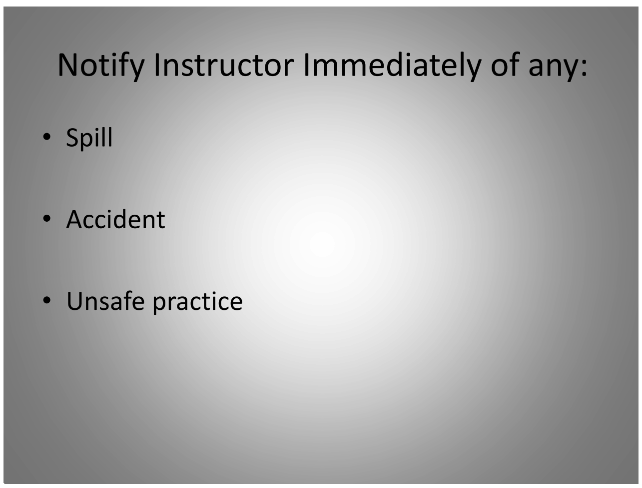

**Slide 6**

In case of spill or splash, Instructors are prepared with eye wash and decontamination stations.



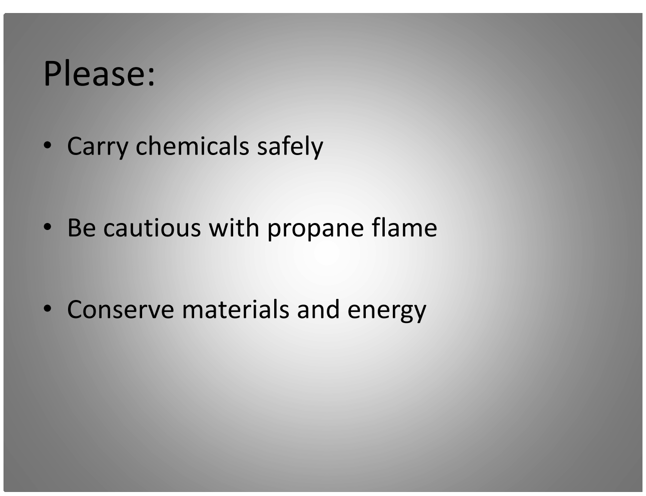

**Slide 7**

Try not to spill or be messy in your work area.



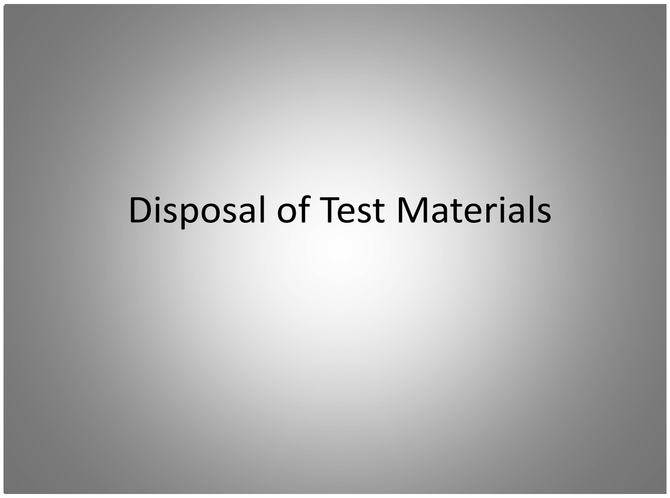

**Slide 8**

Always notify an instructor if you see something unsafe or spill a chemical.



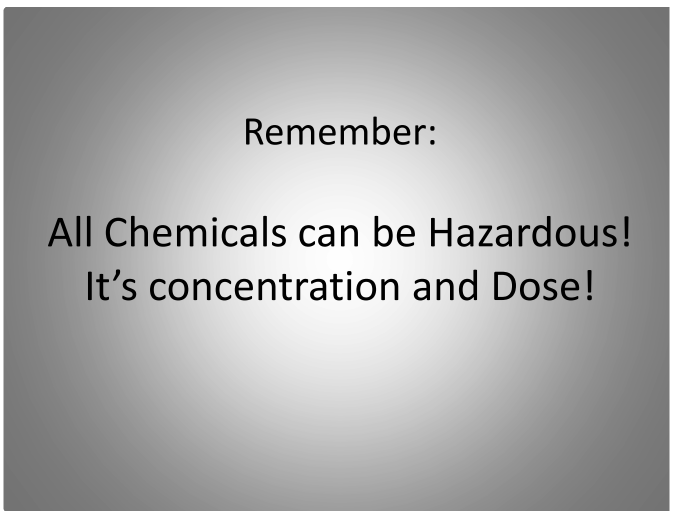

**Slide 9**

Be careful with chemicals and torches.




**Slide 10**

All test materials will be disposed of in the identified containers.




**Slide 11**

All chemicals can be hazardous. Handle with care.

# Chapter 3: Chemical Field Identification

**Scope:**
This chapter provides an overview of the course and introduces the Hazmat Specialist to chemical field identification techniques

| | |
|---|---|
| **Time:** | 16-24 hours |
| **Instructor/Participant Ratio:** | 1-10 |
| **Method of Instruction:** | Lecture and hands on training |

**Terminal Learning Objective (TLO)**
At the end of instruction for Chapter 3 students will be able to initiate and complete the identification of hazardous materials using the HazCat or 5-Step identification system

**Enabling Learning Objectives (ELO)**
This chapters enabling (performance) objectives are to ensure participants will be able to:

1. Understand who needs to be trained to do field identification of chemicals
2. Describe some of the risks in field identification that when you do not follow an approved method (ad Hoc Testing)
3. Describe the field identification system being used. HazCat, 5- Step or other

**Linkages to Universal Task List**
The information, objectives, and activities in this chapter promote the acquisition of knowledge and skills in support of the target capabilities identified in the Universal Task List:

| | |
|---|---|
| **ResB2b 3.3** | Coordinate and direct HazMat detection and assessment activities |
| **ResB2b 3.3.2** | Coordinate, integrate, and manage efforts to detect or identify releases of hazardous substances including those from underground storage tanks |
| **ResB2b 3.4.4** | Coordinate actions to prevent spread of contaminants |

**Materials and Preparation**

- Seating and work stations for up to 30 participants
- Provide system manual for each group of 3 students (Based on system used)
- Provide field identification kit to each group of 3 students

**Supporting Materials:** Tables and chairs for testing. Provide adequate ventilation.

**Activities:** Students will participate in closely monitored identification of a series of unknown chemicals using the system being used in the class.

**Practical Exercise:** Students will be tested during full scale exercises in G week

This chapter deals with field analysis of chemical unknowns. There are a number of accepted methods of doing this evolution. In California we most frequently use HazCat or The Heinz 5 Step Method.

Each of these methods and other acceptable methods take different amounts of time to develop an operational skill level. Each Agency or Jurisdiction should evaluate what system works best for them and teach the appropriate amount of time .

Because we use both systems mentioned above at the California Specialized Training Institute we are incorporating the training manuals for both systems by reference.

Please refer to the appropriate manual for your agency.

# Chapter 4: Rail Car Tank Car Review

**Scope:**
This chapter provides an overview of the Tank Cars used in Rail Transportation and tank car markings and construction

**Time :** 1 hour

**Instructor/Participant Ratio:** 1-30

**Method of Instruction:** Lecture, PowerPoint

**Terminal Learning Objective (TLO)**
At the end of instruction for Chapter 4, participants will be able to identify Rail Tank Cars by construction features and markings

**Enabling Learning Objectives** (ELO)
This chapter's enabling (performance) objectives are to ensure participants will be able to:

1. Be able to understand the marking on tank cars
2. Understand the principles of construction of Rail Tank Cars
3. Be able to recognize the difference between General Service and Pressure Tank Cars

**Linkages to Universal Task List**
The information, objectives, and activities in this chapter promote the acquisition of knowledge and skills in support of the target capabilities identified in the Universal Task List:

**ResB2b 1.1.3** Conduct community hazard assessments to identify hazards, threats, vulnerabilities and risk of facilities involved in the production, storage or distribution of hazardous materials

**ResB2b 2.1** Develop and implement hazardous materials training

**ResB2b 3.2.4** Provide a Hazardous Materials technical expertise team for emergency operations for both industry and public

**Materials and Preparation**

- Seating and work stations for up to 30 participants
- Instructor Manual and CD with Power Point presentation (1 for instructor)
- Participant Guide (1 for each participant)

**Supporting Materials:** None

**Activities:** Students will participate in rail car repair activities

**Practical Exercise** **"G" Week**

Haz Mat Specialist 1F
Special Mitigation Techniques

## Chapter 4
## Railroad Tank Car Review

**Slide 4.1**
**Railroad Tank Car Review**

### *Railroad Safety*

- ***ALWAYS:***
  - ***Set brakes and chock wheels before accessing railcar***
  - ***Notify the railroad via dispatch, phone numbers at crossings or use the"ASKRAIL"App for contact information***
  - ***Be aware of other trains on adjacent tracks***
  - ***Walk at least 1 car length around the end of a car***
  - ***Use the catwalk when crossing between cars if you can't keep a safe distance***
  - ***Wear hard hats– overhead work (OSHA)***
  - ***Chain work area when on top of the car***

**Slide 4.2**
**Railroad Safety**

Safety is paramount when working on the railroad. Responders must always set brakes and chock wheels before accessing any car.
The railroad must be notified when working on an incident involving railcars.
Responders must always wear appropriate safety gear, especially when work is being done overhead.

### *Railroad Safety*

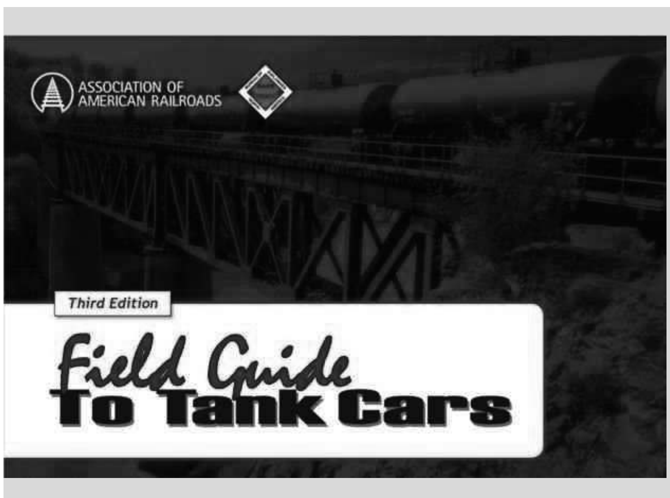
- ***NEVER:***
  - ***Walk between cars (use the catwalk)***
  - ***Step on rails and oily ties (slip hazard)***
  - ***Throw anything up or down from the car (use a drop bag)***

**Slide 4.3**
**Railroad Safety**

Never step on rails and oily ties. Rails are slick, they are an easy place to slip and cause injury.
Never walk between couplers. Railcars move with little noise or warning. People have been crushed between them. It is best to use the catwalk when crossing between cars.
Never throw things up or down from a car. Use a drop bag.

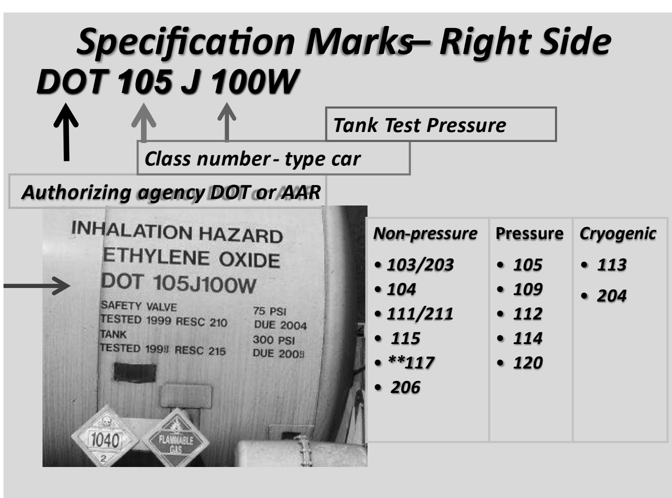

**Slide 4.4**
**Ask Rail**

The train list is now found electronically.
The Ask Rail app is by invitation only and available to emergency responders.
Responders can obtain the train list and valuable information about the car and commodity, as well as contact information for railroad responders.
Those qualified may obtain more information at the BNSF HazMat or Union Pacific web site.
*(AskRail video available on BNSF HAZMAT web site)*



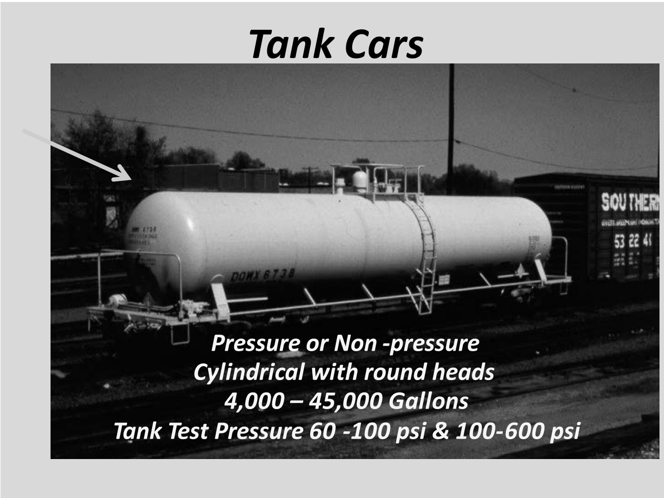

**Slide 4.5**
**Field Guide to Tank Cars**

Responders must be able to identify each type of railcar their construction features and specific hazards when performing a size up or damage assessment. The Field Guide to Tank Cars has the most current information to identify the type of car with illustrations for valves, fittings and repair options.




**Slide 4.6**
**Specification Marks**

Tank car specification marks are located on the right side of the car. Refer to pp7 in the field guide to help you interpret this information. It will direct you to the type of car such as pressure, non-pressure or cryogenic car. It will also give the tank test pressure which is vital to decision making especially when applying a capping kit.

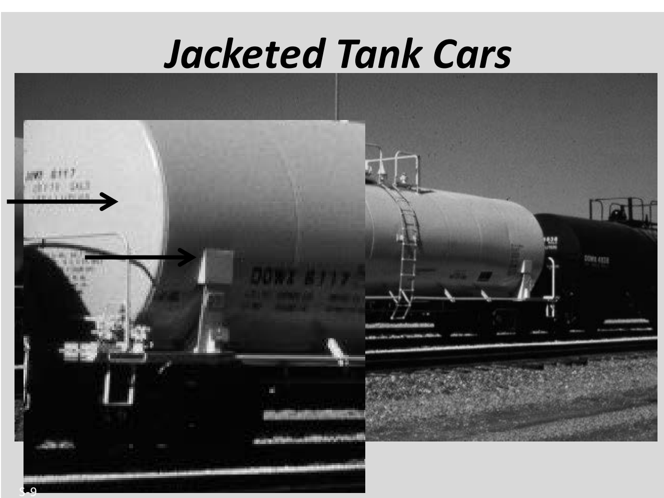



**Slide 4.7**
**Tank Cars**

All tank cars may be pressure, non-pressure (also called general service) and special such as cryogenic.
The tanks themselves are cylindrical with round head and hold from 4,000 to 45,000 liquid gallons. Tank test pressures will be 60-100 psi for non-pressure cars and 100-600 psi for pressure cars.  The car may jacketed or non-jacketed


**Slide 4.8**
**Non-Jacketed Tank Cars**

Non-jacketed cars are distinguished by the distinctly round heads, smooth welds and the body bolster is visibly welded to the tank.

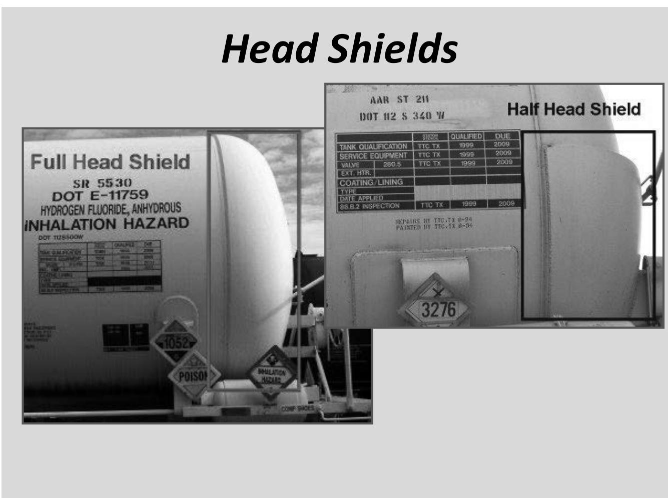



**Slide 4.9**
**Jacketed Tank Cars**

The ends of a jacketed car will be less rounded. You will also notice that the body bolster goes under a shroud that protects rain from getting between the tank and jacket.

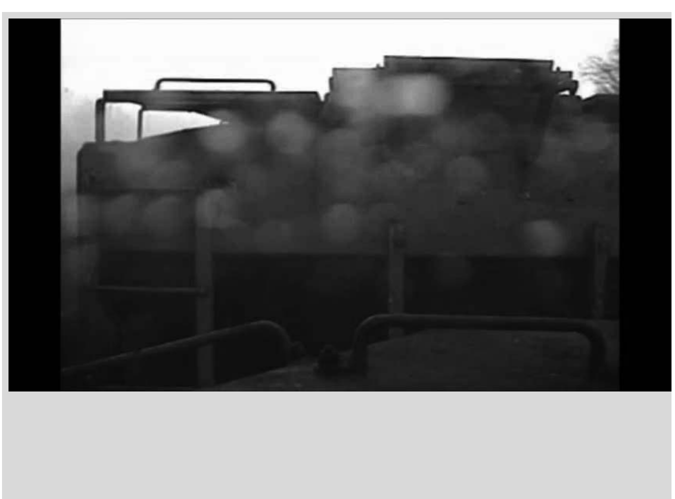

**Slide 4.10**
**Insulation and Jacket**

Insulation is used to protect commodity temperature. Fiberglass or foam insulation are most common. Jackets are in place to protect insulation, thermal protection, exterior heater coils and head shields.
The space between the tank and jacket is usually 4” to 6” thick.




**Slide 4.11**
**Head Shields**

Head shields are in place to prevent couplers from puncturing a tank in the event of a derailment.

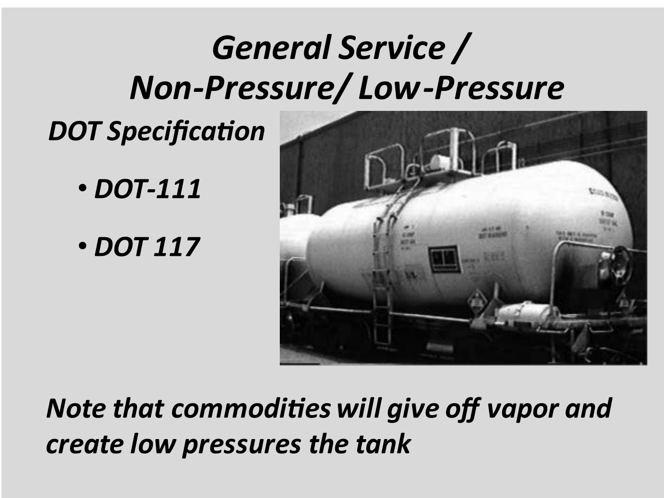


**Slide 4.12**
**Head Shields**

Video clip of an ethylene oxide tank car that crashes into the back of a locomotive. The tank did not fail because of the head shield.

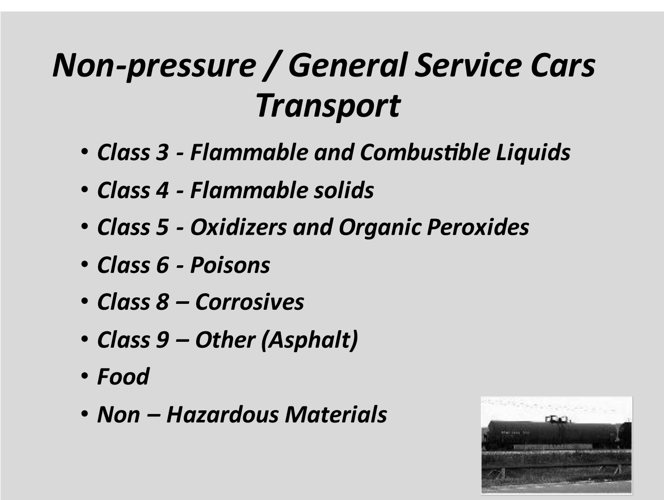

**Slide 4.13**
**Head Shields**

Head of the tank from the previous video. The tank head had relatively minimal damage due to the effectiveness of the head shield.



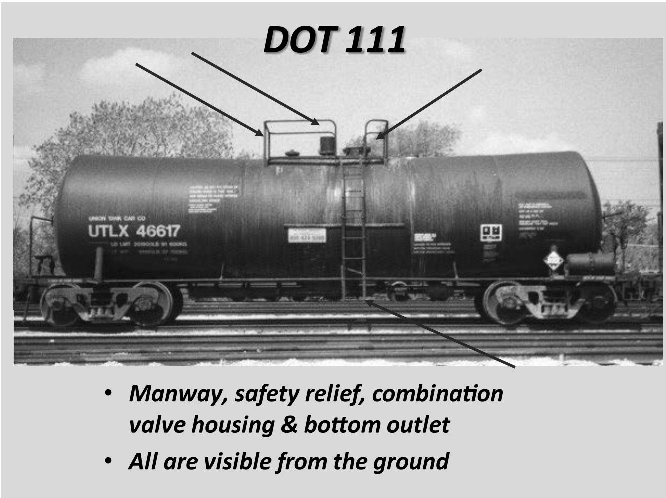

**Slide 4.14**
**General Service / Non-Pressure / Low-Pressure**

General service cars, also called non-pressure or low-pressure tank cars transport hazardous and non-hazardous materials. Capacities from 4,000 – 45,000 liquid gallons. Tank test pressures are between 60-100 psi.
They have at least one manway for access to the interior, liquid and vapor valves for loading and offloading and a safety relief device. They may or may not have a bottom outlet. Some will have special fittings such as a vacuum breaker.




**Slide 4.15**
**Commodities**

Transport a variety of hazardous materials such as: Class 3 (flammable liquid), Class 4 (combustible solids), Class 5 (Oxidizers / organic peroxides), Class 6 (poisons and irritants), Class 8 (corrosives). They also transport non-hazardous commodities such as food.




**Slide 4.16**
**DOT 111**

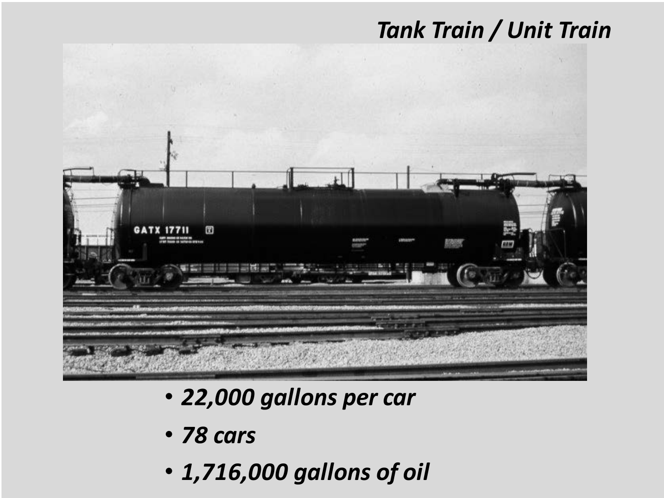
These cars may be jacketed or non-jacketed and with or without insulation, thermal protection, heater coils or head shields. The manway, safety relief device, bottom outlet and combination valve housing are visible from the ground. They will also have double shelf couplers for cars that transport hazardous materials.


**Slide 4.17**
**DOT 117**

These cars were designed to transport crude oil from the Bakken oil fields. It is a sweet crude oil with a lower flash point than traditional crude oil. This required a stronger built container.
The tank wall thickness is greater than the DOT 111. Liquid, vapor, SRV and other valves are under a single stronger protective housing. The silhouette appears to be a pressure car. However, you will notice a manway lid next to the housing. These cars may also have a bottom outlet.

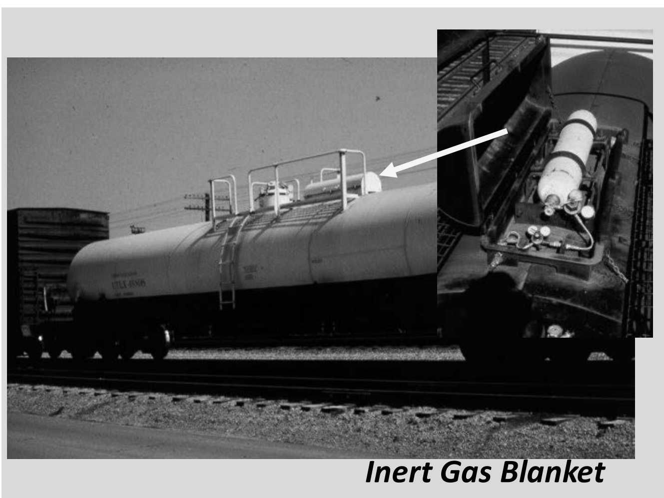

**Slide 4.18**
**Multiple Compartments**

Some cars may have up to 6 compartments. Each with its own distinct tank and individual valves and fittings. The compartments may have different sizes and different but compatible commodities. This car has two compartments as seen by the valve assemblies on top.



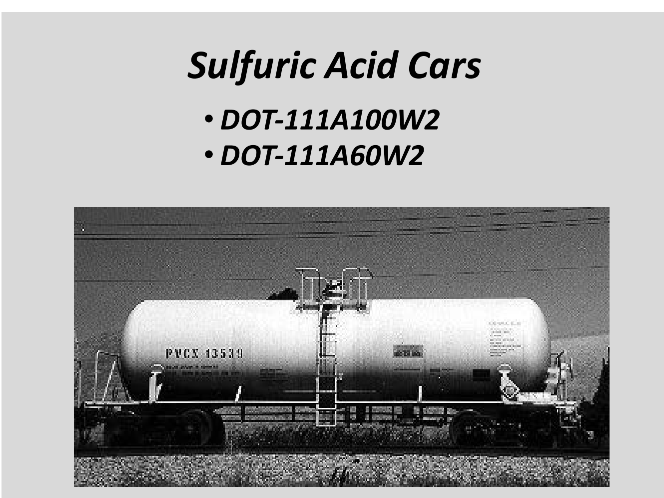

**Slide 4.19**
**Tank Train / Unit Train**

The tank train system is a series of non-pressure tank cars connected with flexible hoses for loading & unloading the cars from one end. A spring-loaded butterfly valve on each car is controlled pneumatically from the loading point. After loading, the hoses are purged of product and valves close automatically, isolating each car.
One train can hold up to 1,716,000 gallons of oil.




**Slide 4.20**
**Inert Gas Blanket**

An inert gas blanket is sometimes used to suppress flammable vapors inside a tank. You can see the box on top of the car. Inside will be a cylinder of, usually nitrogen or dry air.




**Slide 4.21**
**Sulfuric Acid Cars**

Non-pressure / General Service cars have special construction features to transport acids such as Sulfuric Acid.

## Sulfuric Acid Car Features

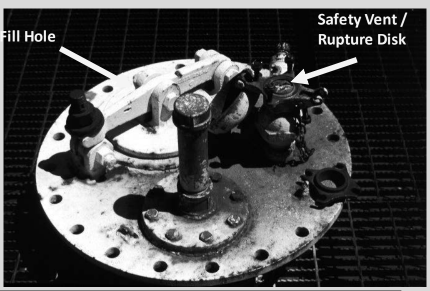

- *Top loading and unloading*
- *Top and bottom shelf couplers required*
- *Bottom outlet prohibited but bottom washout is optional*
- *Non-insulated and insulated tanks*
- **May not be lined**

**Slide 4.22**
**Sulfuric Acid Cars Features**

Top loading & unloading
Top and bottom shelf couplers
Bottom outlets are prohibited but a washout is optional
Tanks may be insulated or non-insulated and with or without jackets
Sulfuric Acid tanks may not have a lining

## Sulfuric Acid Fittings

- *Vulcanized fill hole*
- *2" liquid line*
- *Safety Vent*

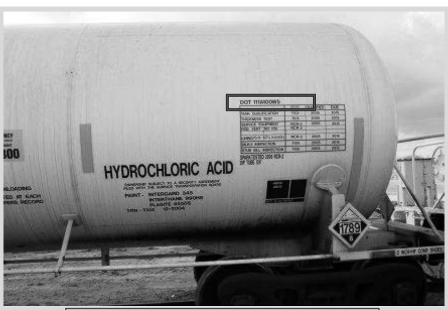



***OFFENSIVE CONTROL OPTION:***

- ✓ *Product should not be under pressure.*
- ✓ *Close all valves, tighten bolts and replace gaskets, caps or plugs*
- ✓ *Gauge the car before replacing rupture disk*

**Slide 4.23**
**Sulfuric Acid Cars Fittings**

A typical sulfuric acid car will have a fill / inspection hole, a 2" liquid line and a safety relief device typically a rupture disk.
Sulfuric acid is not transported under pressure.
If the tank is leaking responders must determine whether the car is over-loaded and leaking through loose valves or fittings or has pressure built up to cause a release.




***HYDROCHLORIC ACID CARS***

- *DOT 111A100W5*
- *Rubber lined*
- *Top loading and unloading*
- *Top and bottom shelf couplers required*
- *Bottom outlet or washout prohibited*
- *Non-insulated and insulated tanks*

**Slide 4.24**
**Hydrochloric Acid Cars**

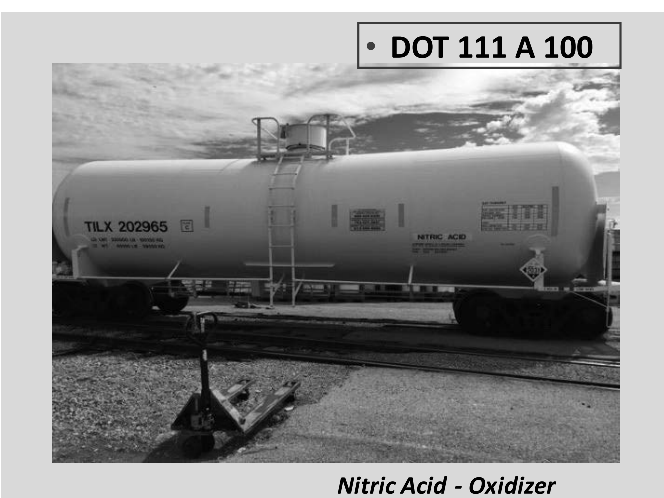
Hydrochloric Acid cars will have lining that is sprayed or painted to the interior of the tank. Rubber is most common, other materials may include lead, nickel, polyurethane and PVC.


**Slide 4.25**
**Hydrochloric Acid Cars Fittings**

A typical hydrochloric acid car will have an inspection hole, a 2" vapor line for vapor recovery when loading, a 3" liquid line for loading product and a safety relief device typically a rupture disk.
Hydrochloric acid is not transported under pressure. If the tank is leaking responders must determine whether the car is over-loaded and leaking through loose valves or fittings or has pressure built up to cause a release.


**Slide 4.26**
**Hydrochloric Acid Cars Protective Housing**

New HCl cars now have all valves and fittings inside a protective housing.
The silhouette may appear to be a pressure car. However, these are DOT 111 specification (non-pressure) cars.




**Slide 4.27**
**Nitric Acid Cars**

Valves are located inside a single protective housing on Nitric Acid cars. The silhouette appears to be a pressure car, but the tank specification marks indicate a DOT 111, non-pressure car.
These cars are top loading & unloading, the interior is lined with a protective coating, insulated or non-insulated and have double shelf couplers.

### Pressurized Rail Cars

- *DOT-105*
- *DOT-112*
- *DOT-114*


**Slide 4.28**
**Pressure Car Classification**

The most common classes of pressure tank cars are the DOT-105, 112, and 114

### Pressurized Rail Cars

DOT 105 J 500

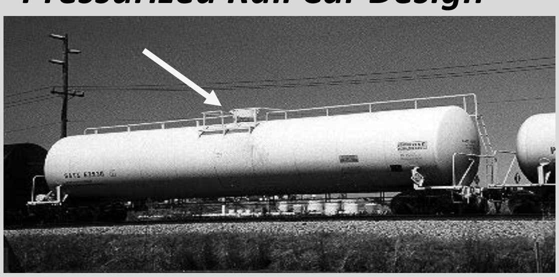
18,080 US Gallons


- *Primarily used for flammable and nonflammable gases including poison "A" materials*
- *Tank test pressure from 100– 600 psig.*
- *Capacity: 4,000 to 38,000 gallons*

**Slide 4.29**
**Pressurized Rail Cars**

Pressure cars transport Class 2 (flammable, non-flammable, and poison gasses). They may also carry flammable liquids.
Tank test pressures are from 100 – 600 psig.
Capacity is from 4,000 to 38,000 liquid gallons

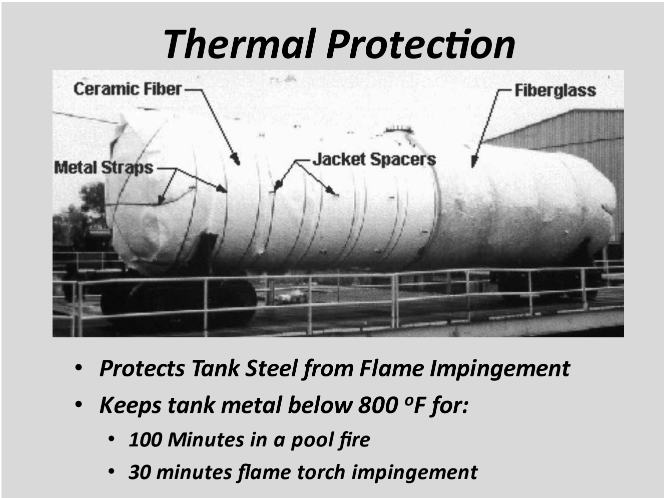
### Pressurized Rail Car Design



- *Single protective housing on top*
- *Jacketed or non-jacketed*
- *With or without insulation*
- *Cars transporting flammable gasses & liquids will have thermal protection sprayed on the tank and under the jacket*

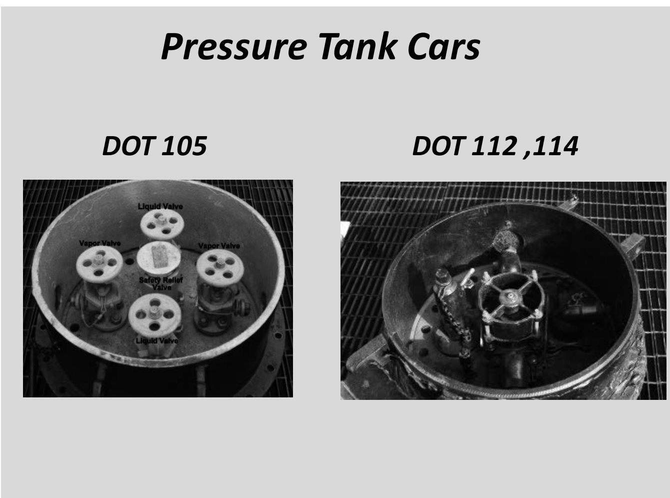
**Slide 4.30**
**Pressurized Rail Car Design**

A cylindrical tank with round heads. May be jacketed or non-jacketed with insulation or thermal protection.
All valves and fittings are under a single protective housing.
Cars transporting flammable gasses will usually have thermal protection sprayed on the tank, under the jacket.
Top and bottom shelf couplers are required.



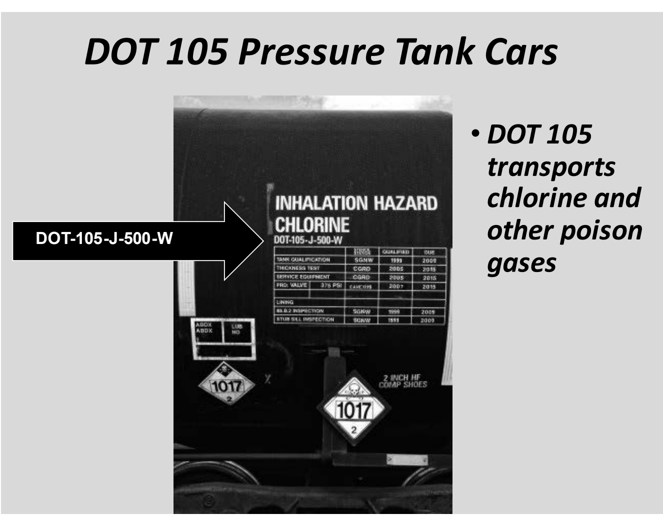

**Slide 4.31**
**Thermal Protection**

Thermal protection protects cars from flame from a pool or torch fire. It keeps tank metal temperatures below 800ºF for 100 minutes from pool fire exposure and 30 minutes from torch fire exposure. It is required for 2.1 and 2.3 flammable and poison gasses.
Materials include mineral wool or ceramic fiber blankets held in place by the jacket. Some thermal protection materials are sprayed on. This material expands when exposed to fire.




**Slide 4.32**
**Pressure Tank Car Housings**

All valves and fittings are located under a single protective housing. Pressure cars do not have bottom outlets.
You can notice that the types of valves and valve configurations are different. This is important when deciding what type of capping kit to use.




**Slide 4.33**
**DOT 105 Pressure Tank Cars**

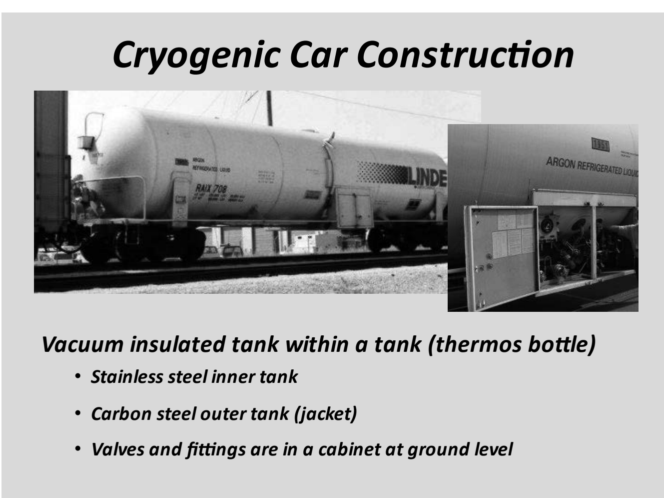
DOT 105 class tank car typically transports poison gasses such as Chlorine, Sulfur Dioxide, and Hydrogen Sulfide.


**Slide 4.34**
**DOT 112 & 114 Pressure Tank Cars**

DOT 112 & 114 class tank car typically transports pressurized gas's such as LPG's, Butadiene, vinyl chloride and Ammonia.

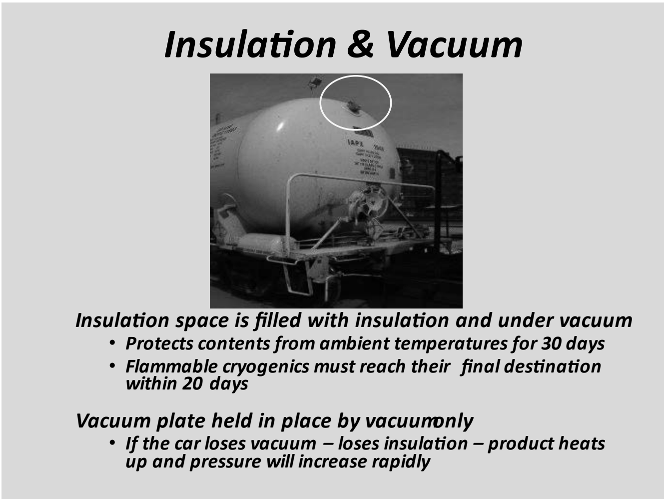

**Slide 4.35**
**DOT-113 & AAR-204Cryogenic Tank Cars**

Cryogenic liquid tank cars are designed to transport refrigerated liquified gasses with a boiling point less than minus $^{-}130^{o}$F. Such as liquid hydrogen, ethylene, oxygen, nitrogen, and argon. Also liquified natural gas (LNG) for new locomotives




**Slide 4.36**
**Cryogenic Car Construction**

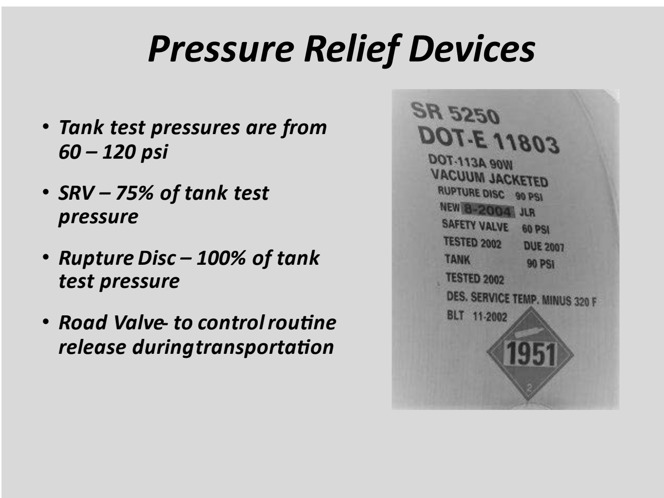
Cryogenic liquid tank cars are vacuum insulated with an inner stainless-steel tank and an outer carbon steel tank. Valves and fittings are in a cabinet at ground level. The space between the inner and outer tank is filled with insulation and is under a vacuum.




**Slide 4.37**
**Insulation & Vacuum**

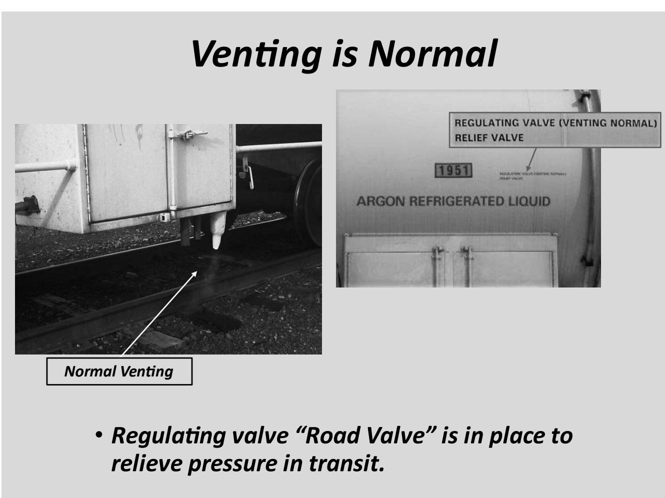
The space between the inner and outer tanks is filled with insulation and under a vacuum. This protects contents from ambient temperatures for 30 days. Note the FRA must be notified any time a flammable cryogenic product does not reach its destination within 20 days.
A vacuum plate is located on the end of a car and is held in place by vacuum only.

- No plate – No vacuum = Increased pressure inside the tank



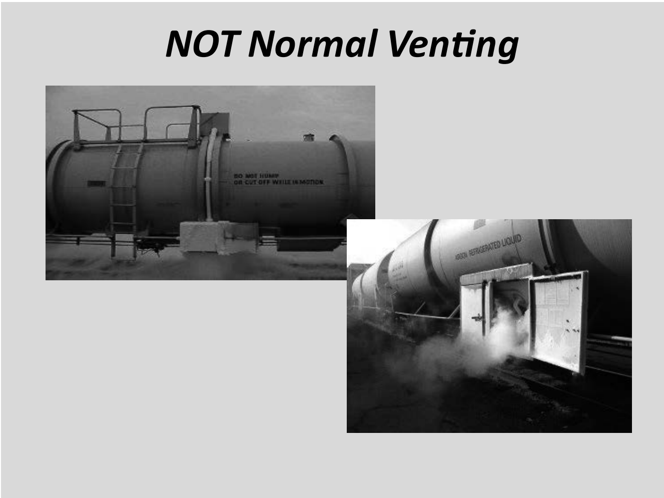

**Slide 4.38**
**Pressure Relief Devices**

All cars are required to have at least one pressure relief valve, typically set at 75% of tank test pressure, and one rupture disk designed to rupture at 100% of the tank test pressure. Cars may also have a pressure control valve "Road Valve" used to control pressure during transportation.



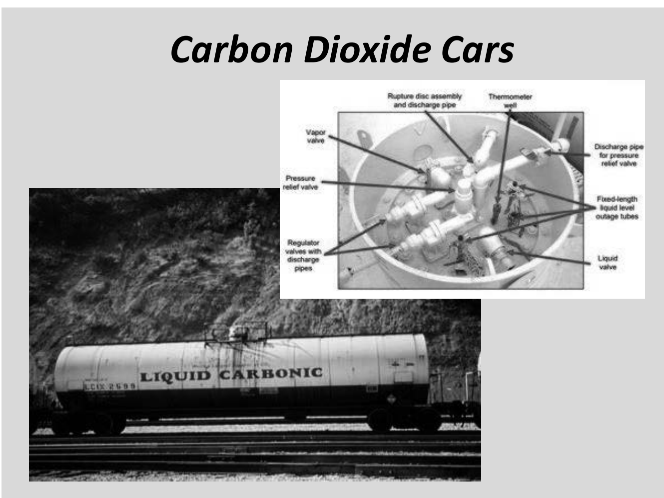

**Slide 4.39**
**Venting is Normal**

A "Road Valve" opens and closes automatically to control pressure in transit. It is normal for relatively small amounts of product to be released through a discharged labeled regulating valve.




**Slide 4.40**
**Not Normal Venting**

It is not normal to have a large volume of vapor or frosting around valve cabinets.
First responders should contact the railroad, the shipper, and the owner of the car before attempting to mitigate and release from cryogenic cars.

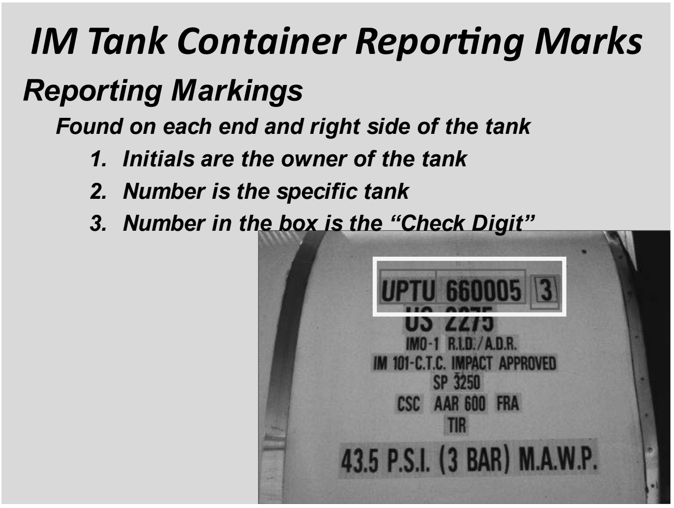



**Slide 4.41**
**DOT 113 Carbon Dioxide Cars**

Carbon dioxide cars will have a valve housing located on top of the car. Valves include vapor and liquid valves, thermometer well, fixed length liquid level outage tubes, a pressure relief valve, a rupture disk, and pressure regulator valve.


**Slide 4.42**
**Intermodal Tank Containers**

Intermodal tank containers are simply a tank inside a frame designed for stacking and lifting. They can be transported by rail, highway, or water. The advantage is that the commodity can be transported from the manufacturer to the customer without having to transfer the product.

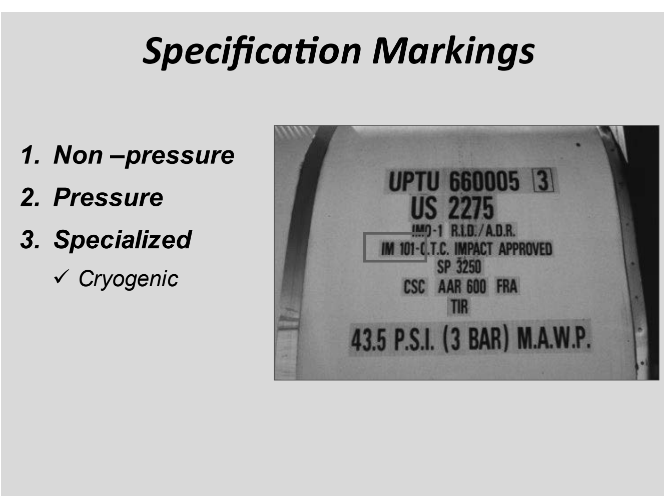



**Slide 4.43**
**IM Tank Container Reporting Marks**

Reporting marks are found on the right side of the tank. The letters indicate the owner of the tank, and the numbers identify that specific tank. The last number in a separate box is a check digit and will not be found on railroad shipping papers.


**Slide 4.44**
**AAR 600 Approval/Registration Markings**

The railroad requires all tanks used for interchange to meet the AAR 600 standard "Specifications for Tank Cars."




**Slide 4.45**
**Specification Markings**

Specification markings are located just below the reporting marks. This indicates the standards to which the tank was built. In the United States the DOT standards are IM 101 and 102 tanks for non-pressure and IM 51 for pressure tanks. International standards are IMO 1 & 2 for non-pressure, IMO 5 for pressure, and IMO 7 for cryogenic tanks.

## Non – Pressure IM Tanks

**IM-101 (IMO-1)Tanks**

- 25.4-100 (MAWP)
  - Poisons
  - Corrosives
  - Flammable/Combustible

**IM -102 (IMO -2)Tanks**

- 14.5 – 25.4 (MAWP)

| | |
|---|---|
| Alcohol | Resins |
| Food | Solvents |
| Corrosives | Flammables |
| Pesticides | Whiskey |

**Slide 4.46**
**Non-Pressure IM Tanks**

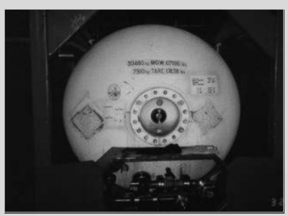
IM-101 (IMO-1) tanks are built to withstand maximum allowable working pressure (MAWP) of 25.4 – 100 psig. They transport poisons, corrosives, flammable, and combustible liquids.
IM-102 (IMO-2) tanks are built to withstand MAWP of 14.5 – 25.4 psig. They transport food, alcohol, corrosives, pesticides, flammables. Both tanks are tested at 1.5 times the MAWP.

## Pressure IM Tanks

**DOT Spec 51 (IMO-5) tanks**

100 – 500 (MAWP)

- Liquefied petroleum gases
- Other compressed liquefied gases- Ammonia
- May transport liquids
- Up to 5,000 gallons

**Slide 4.47**
**Pressure IM Tanks**

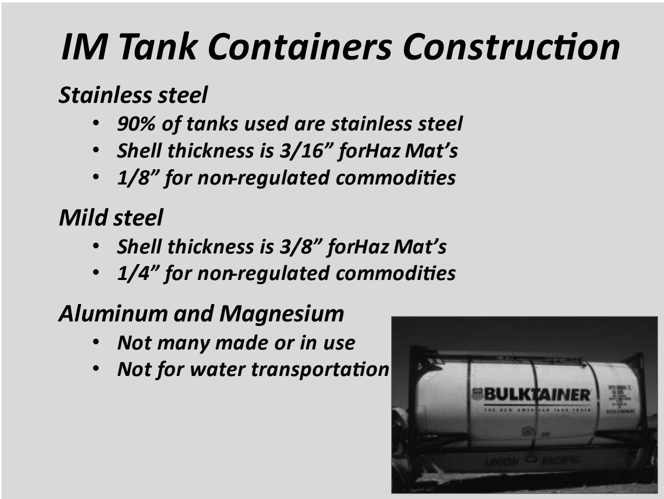
IM-51 (IMO-5) tanks are built to withstand maximum allowable working pressure (MAWP) of 100-500 psig. They transport LPG's, Ammonia and other compressed liquified gasses.

## Cryogenic Tank Containers


- DOT Spec 51L (IMO -7)
- Stainless steel tank inside a carbon steel tank
- Insulation under vacuum between tanks
  - Refrigerated liquid gases
  - Argon, oxygen, hydrogen

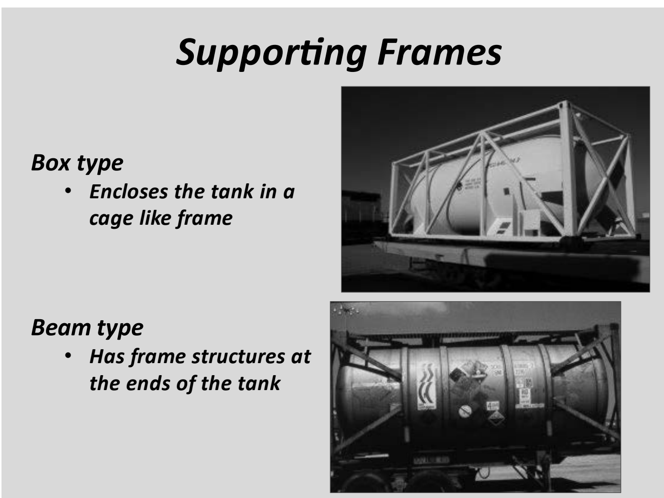
**Slide 4.48**
**Cryogenic IM Tanks**

IM-51L (IMO-7) tank containers have a stainless-steel inner tank with a carbon steel outer tank. They are thermally insulated under vacuum and designed to keep contents in a liquid state. They transport products such as argon, oxygen, helium, and nitrogen in a refrigerated state.



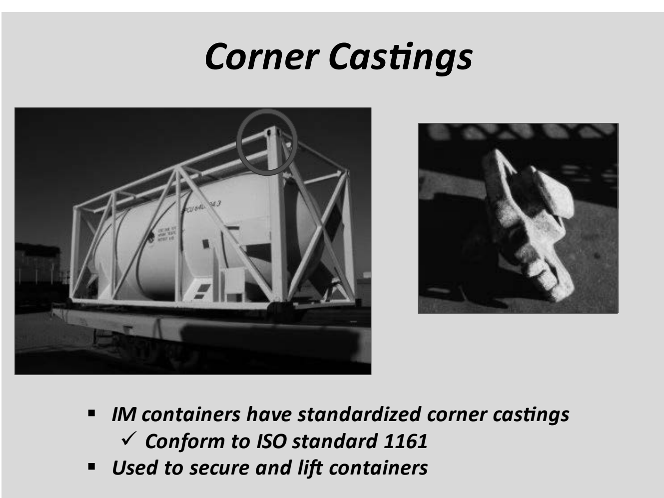

**Slide 4.49**
**IM Tank Containers Construction**

Tanks are built according to the pressure vessel standards of the American Society of Mechanical Engineers (ASME)
90% of tanks are made of stainless steel. The shell is 3/16″ for hazardous materials and 1/8″ for non-regulated materials.
Steel tanks are ¼″ for regulated material and 3/8″ for non-regulated material.
Cryogenic tanks are 0.110″ for the inner tank and 0.024″ for the outer tank




**Slide 4.50**
**Supporting Frames**

The supporting frame protects the tank, provides for stacking, lifting, and securing the container, and supports walkways and ladders. Most of them are 20′ long, 8′ wide and 8.5′ tall. There are two basic types of supporting frames. The box type that encloses the tank in a cage-like framework. The beam type uses frame structures only at the ends of the tank.

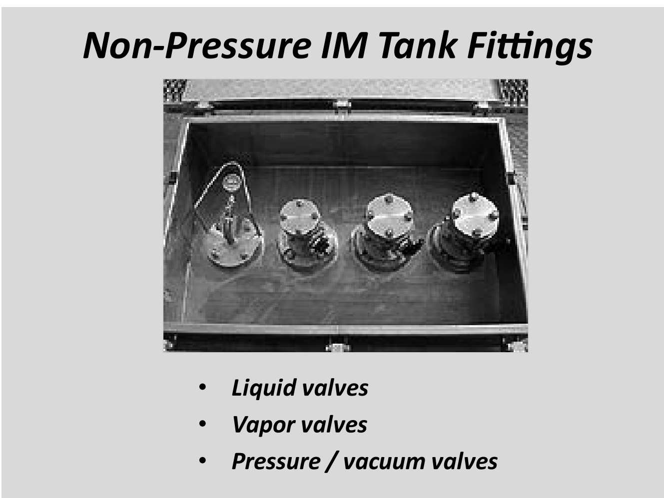



**Slide 4.51**
**Corner Castings**

Supporting frames for all intermodal containers are built with standard corner castings. They are used to secure the tank and lift it with standard container handling equipment. The container must **only** be lifted using the corner castings. Consult the tank owner or manufacturer for lifting instructions before moving the container.

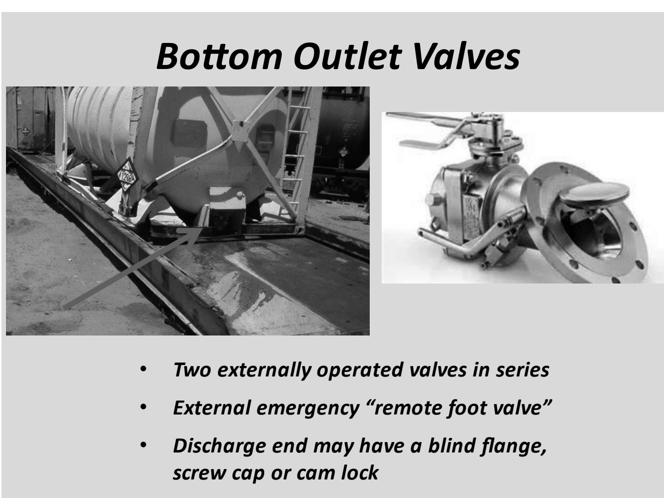

**Slide 4.52**
**IM Tank Features**

Linings protect the tank from contents. They can be rubber, glass or other material depending on the commodity. Refrigeration units maintain commodity temperature. They require an external power supply, usually an external generator. Heater coils are used to warm contents for loading and offloading. Insulation is usually 3" – 4" thick and covered by a jacket.




**Slide 4.53**
**Non-Pressure IM Tank Fittings**

Top loading valves will be in a spill box to protect the side of the tank from spillage. Liquid valves will be in line with the tank with an eduction pipe extending to the bottom. A vapor line may or may not be in line with the tank. Valves may require a blind flange in place for transportation. Non-pressure tanks may have a combination pressure / vacuum valve that operates at 0.75 negative pressure.




**Slide 4.54**
**Bottom Outlet Valves**

Containers that transport hazardous materials must have two externally operated bottom-outlet valves. The valves are connected in series with a replaceable gasket between them and are located at the discharge end of the tank. A liquid-tight closure is also required, usually a blind flange. In an emergency, the internal valve (foot valve) can be shut off from a remote location. The emergency foot valve is a cable located on the right side when facing the discharge.

# Chapter 5: Assessing and Repairing Damaged Fittings

**Scope:**
This chapter provides information on the assessment of damage to rail cars involved in accidents and how to repair damaged fittings in accordance with the Specialist training and equipment

| | |
|---|---|
| **Time :** | 1 hour |
| **Instructor/Participant Ratio:** | 1-30 |
| **Method of Instruction:** | Lecture, PowerPoint |

**Terminal Learning Objective (TLO)**
At the end of instruction for Chapter 5, participants will be able identify damage to tank cars that may result in tank car failure and understand how to repair damaged or malfunctioning fittings.

**Enabling Learning Objectives (ELO)**
This chapters enabling (performance) objectives are to ensure participants will be able to:

1. Understand in-depth hazard and risk assessment techniques in rail car transportation of hazardous materials
2. Be able to identify damaged fittings on Rail Tank Cars
3. Recognize the wide range of dangers from hazardous materials transportation in rail

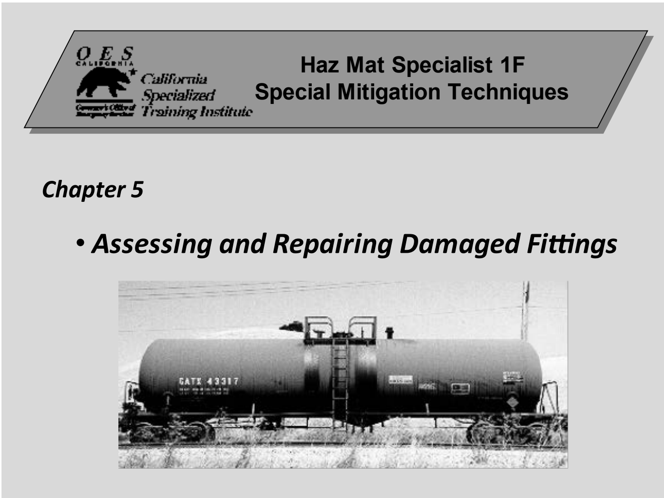
**Linkages to Universal Task List**
The information, objectives, and activities in this chapter promote the acquisition of knowledge and skills in support of the target capabilities identified in the Universal Task List:

| | |
|---|---|
| **ResB2b 3.2.5.1** | Assess hazardous material situation and assist the incident command (IC) and planning section in developing an incident action plan (IAP) |
| **ResB2b 3.2.6** | Coordinate with safety officer to ensure the safety of on-scene WMD/HazMat responders |
| **ResB2b 3.2.6.1** | Observe the scene and review/evaluate hazard and response information as it pertains to the safety of all persons on the scene and responding |

**Materials and Preparation**

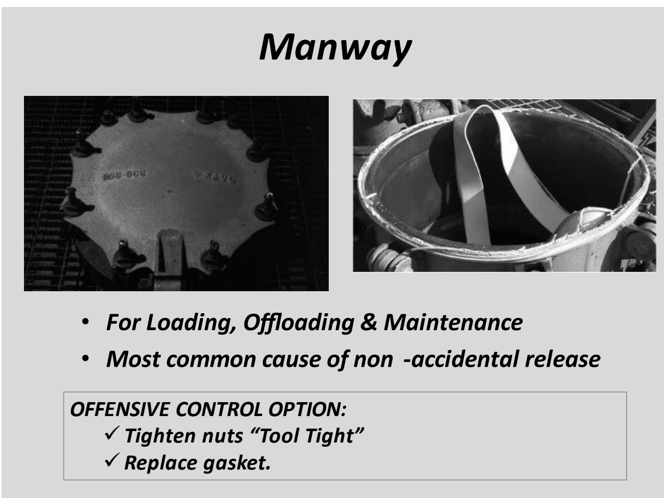
- Seating and work stations for up to 30 participants
- Instructor Manual and CD with Power Point presentation (1 for instructor)
- Participant Guide (1 for each participant)

| | |
|---|---|
| **Supporting Materials** | **Valves and fittings for demonstration** |
| **Activities** | **None** |
| **Practical Exercise:** | Students will spend 5 hours in field working on rail car valves and fittings |



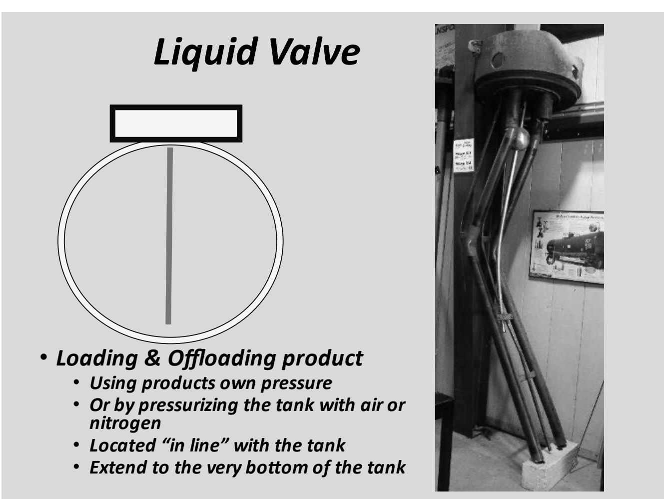

**Slide 5.1**
**Assessing and Repairing Damaged Fittings**

This chapter discusses tank car fittings for pressure and non-pressure tank cars. Fittings represent those that are commonly used today; the list is not all-inclusive.



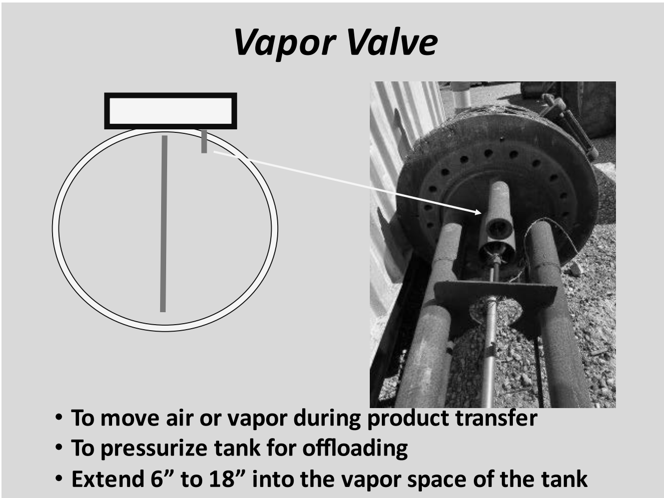

**Slide 5.2**
**Manway**

Manway is an opening on top of the car to allow access to the interior of a tank for cleaning, inspection, repairs and sometimes for "splash" loading.
Common cause of leaking is that the car is overloaded, nuts are not tight, or the gasket is bad.
The lid is bolted "tool tight."



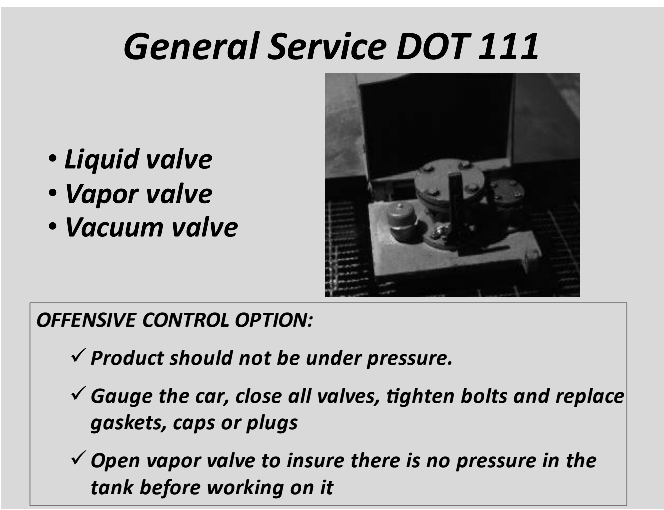

**Slide 5.3**
**Liquid Valves**

Liquid valves are used for loading and off-loading product.
They are located in-line with the center of the tank. Pick up tubes extend to the deepest part of the tank to capture the most product.




**Slide 5.4**
**Vapor Valves**

Vapor valves are used to recover vapor during loading or pressurize the car for off-loading. They extend 6" to 18" into the vapor space of the tank.




**Slide 5.5**
**General Service DOT 111 Valve Housing**

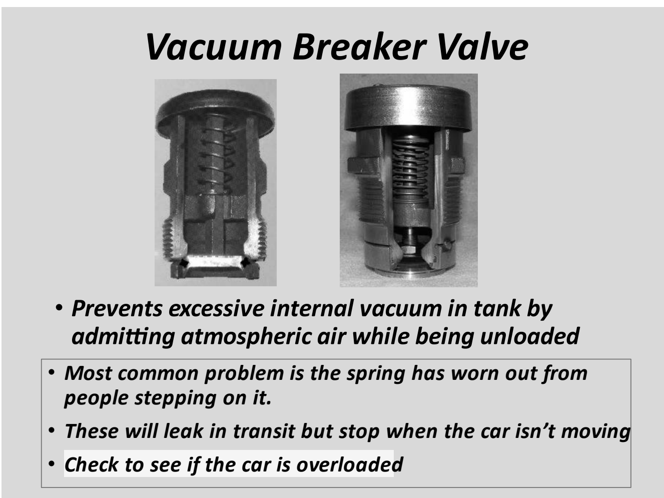
DOT 111 cars will have a "Combination Housing" with at least one liquid valve and one vapor valve. They may also have vacuum breakers and sample lines.
Product should not be under pressure.
Common causes of leaks include loose valves or packing glands. If the car is not under pressure, the control option is to close the valve, tighten all bolts & replace plugs or caps


**Slide 5.6**
**General Service DOT 117 Valve Housing**

DOT 117 cars will have a "Heavy Duty" housing similar an LPG pressure car. It will still have at least one liquid valve and one vapor valve and a vacuum breaker.
NOTE: The safety relief valve is also inside the housing.
Causes for a release are loose valves and fittings.

**Slide 5.7**
**Video**

Tank car under vacuum video

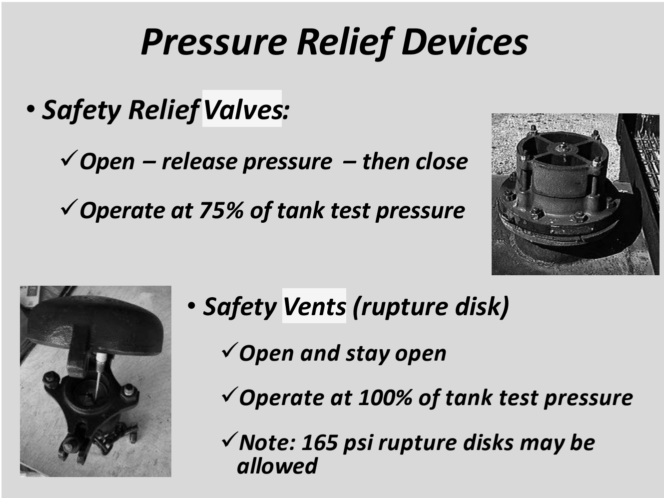



**Slide 5.8**
**Vacuum Breaker Valve**

Spring loaded valve designed to open and allow air into the tank if excessive vacuum is formed.
One cause for accidental spill/release is the spring wears out and the valve remains in the open position while the car is moving. Product splashes out of the valve.
Never step on the valve as it wears out the spring


**Slide 5.9**
**Pressure Relief Device**

A fitting that opens at a pre-determined setting to relieve excess pressure. Pressure relief devices may be reclosing using a spring, non-reclosing using a frangible/rupture disk or a combination of the two where the rupture disk is in place to protect the spring closing device from corrosive products.




**Slide 5.10**
**Pressure Relief Devices**

Pressure relief valves open and close with a spring set at a pre-determined pressure. Usually, 75% of the tank test pressure.
Pressure relief vents open with a frangible disk that does not re-close. The vent remains open util the disk can be replaced.
Disks usually activate at 100% of the tank test pressure. However, some may open at 165 psi


**Slide 5.11**
**Next Generation DOT 117 Pressure Relief Devices**

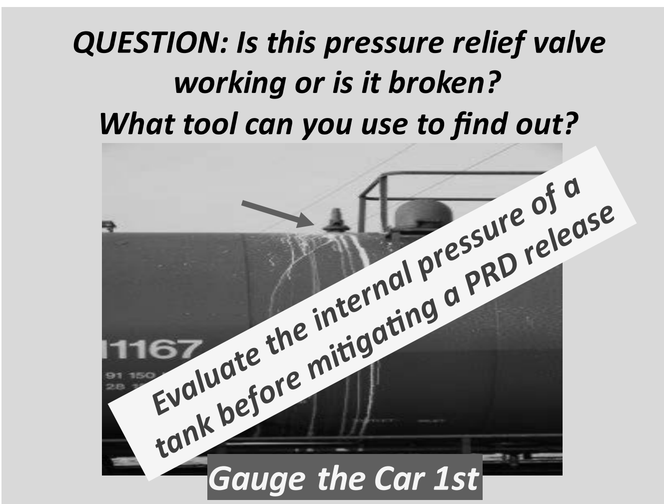
The "Kelso" brand PRD is designed for the DOT 117 general service tank cars. It is an external valve with four separate springs surrounding a valve stem in the middle.
The valve cover as a unique mushroom like design.


**Slide 5.12**
**Pressure Relief Vents**

Pressure relief vents operate with a frangible / burst disk. These disks are designed to "burst" open at a pre-set pressure. If the car reaches that pressure the disk will burst and relieve the pressure inside the tank.
Disks are usually at 100% of the tank test pressure (60-100 psi). However, some cars may have an exemption for a 165 psi. disk.

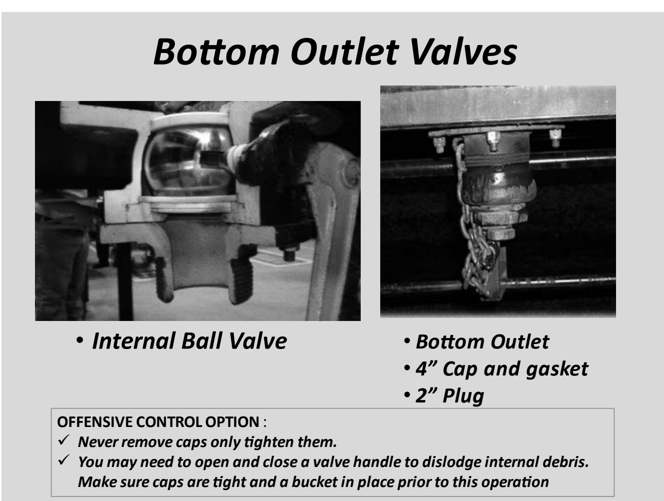

**Slide 5.13**
**SRV / PRD Problems**

Pressure relief devices may release product for two possible options. The device is either **working** properly and relieving pressure or it is **broken**. Responders MUST check the tank pressure to evaluate the condition of the device before attempting to mitigate a release from a SRV / PRD




**Slide 5.14**
**SRV / PRD Problems**

Is this valve working (relieving pressure) or is something in the valve broken?
Procedure: Find the tank test pressure on the right side of the car. Determine the pressure that the PRD opens. Apply a pressure gauge to check the tank internal pressure. If it is above the valve working pressure then it is doing its job. If it is below the activation pressure, then the valve is broken, and the release must be managed

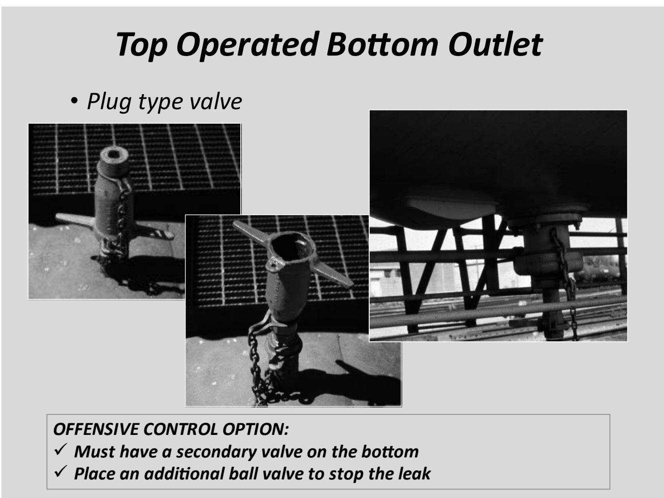



**Slide 5.15**
**Bottom Outlet Valves**

Bottom outlet valves are typically used for offloading. They will be either ball valve or butterfly valve type. Debris can become lodged in the valve preventing a complete closure or cause for the valve to open accidentally. Responders should tighten caps, never remove them.

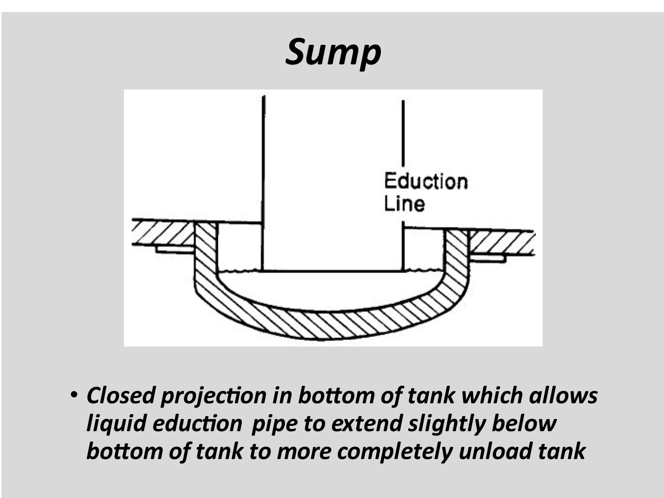

**Slide 5.16**
**Skid Protection**

A protective assembly to protect valves, washouts, and sumps from damage in the event of a derailment.
Notice the handle that attaches to the valve inside the protection.
Discharges will also have a “Shear Section” to prevent damage to a valve.



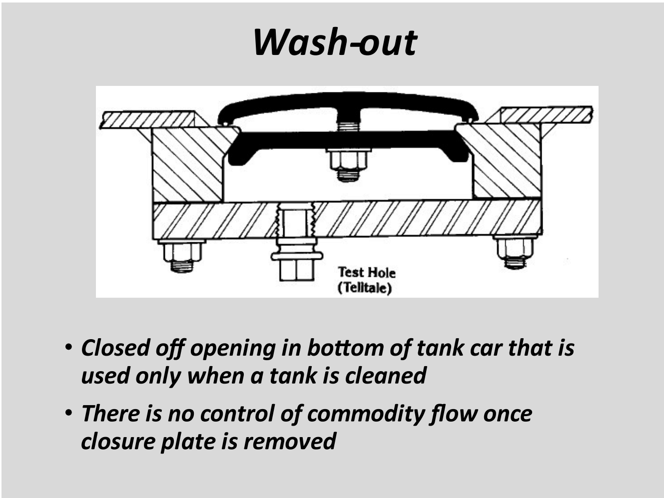

**Slide 5.17**
**Top Operated Bottom Outlet**

The valve handle is on top of the car. It opens a plug type valve that is at the bottom of the tank.
Occasionally debris will become lodged between the valve seat that creates a leak.
A secondary ball valve is attached to the bottom of the discharge line.



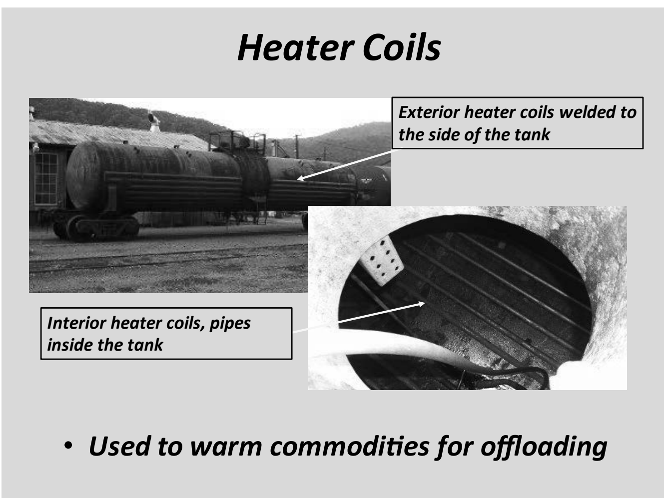

**Slide 5.18**
**Sump**

A depression in the center of the tank where the bottom of the liquid eduction line ends. This allows the maximum amount of product to be recovered.



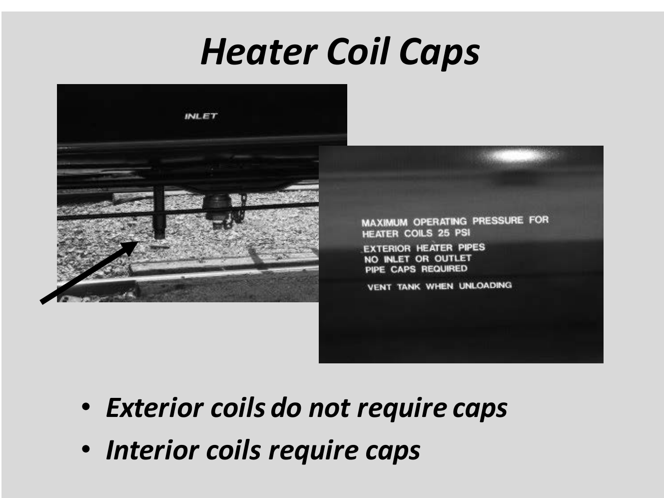

**Slide 5.19**
**Wash-out**

A closed opening in the bottom of a tank car used to completely drain a tank during and after cleaning only.




**Slide 5.20**
**Heater Coils**

Heater coils are used to warm product to facilitate loading and off-loading. Steam, hot water, or other medium is pumped through the coils to warm product and allow it to flow easier.
Exterior coils are welded to the outside of the tank.
Interior heater coils are installed inside the tank located in the product




**Slide 5.21**
**Heater Coil Caps**

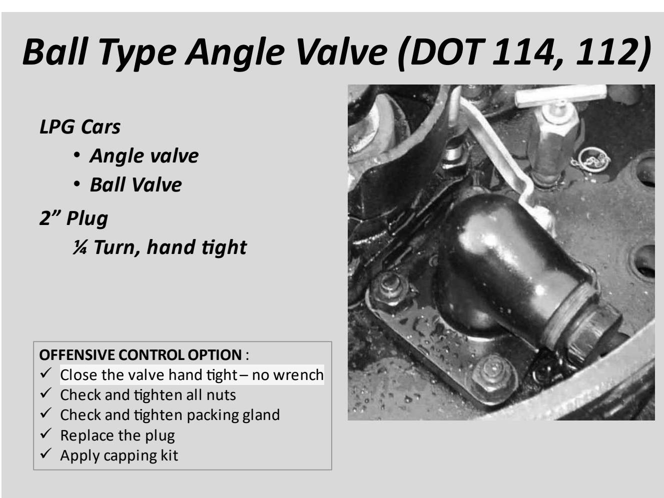
The inlet and outlet for **exterior** heater coils do not require caps as the coils don't come in contact with the product.
**Interior** inlet and outlet piping require caps to prevent product release if the interior pipe fails.


**Slide 5.22**
**DOT 112, 114 Pressure Car Valves**

In this next section we will discuss valves used on the DOT 112 & 114 pressure cars.
These cars have a protective housing bolted on top of the manway. All valves and fittings are mounted inside this housing.

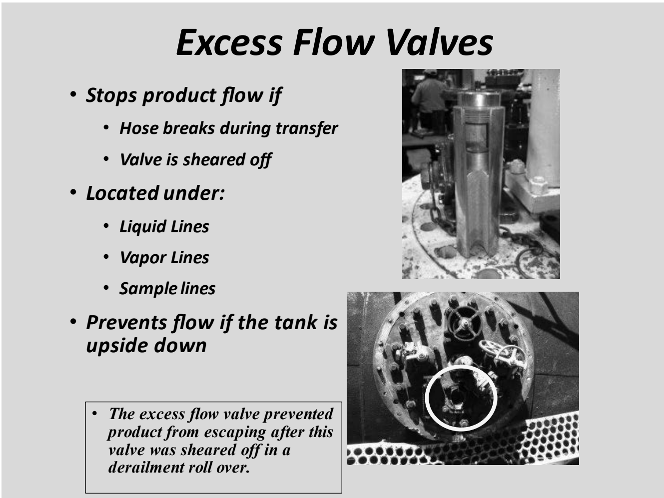

**Slide 5.23**
**Liquid and Vapor Valves**

These valves are called angle valves because the access port is at a 90$^{o}$ angle to the car. Valves will have a plug seat or ball valve configuration. The 112 & 114 cars will have a 2" national pipe thread.
The most common cause of release is the valve will vibrate open or a loose packing gland. Control options are to close the valve, tighten all bolts, replace the plug and the Midland capping kit as a last resort.



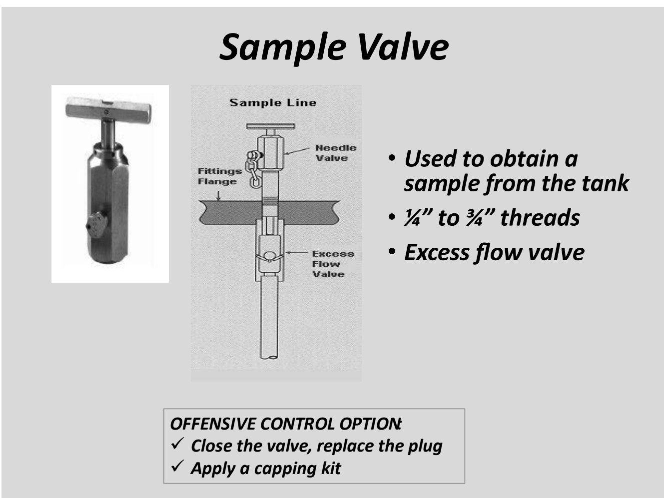

**Slide 5.24**
**Liquid and Vapor Valves**

This is a ball type angle valve. It has a ¼ turn shut off.
Causes for release is the valve will vibrate open or a loose packing gland
Control option is to close the valve, tighten bolts and replace the plug. Apply the Midland capping kit as a last resort.



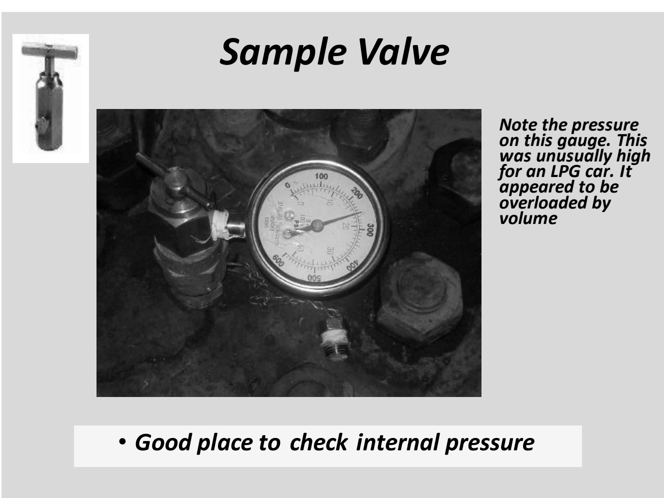

**Slide 5.25**
**Excess Flow Valves**

A device installed underneath a liquid, vapor or sample line designed to stop the flow of product if the valve is damaged or sheared off or if a hose breaks during product transfer.
It also prevents flow if the tank is upside down which makes offloading difficult.
The top picture is an excess flow valve from the vapor side of a DOT 112 Specification car. The bottom picture is from a valve that was sheared off in a derailment




**Slide 5.26**
**Sample Valve**

Typically, a ¼" valve that extends into the tank to obtain a sample of the product.
Common cause of release is the valve vibrates open.
Control options are to close the valve and replace the plug.
Capping kit as a last resort.

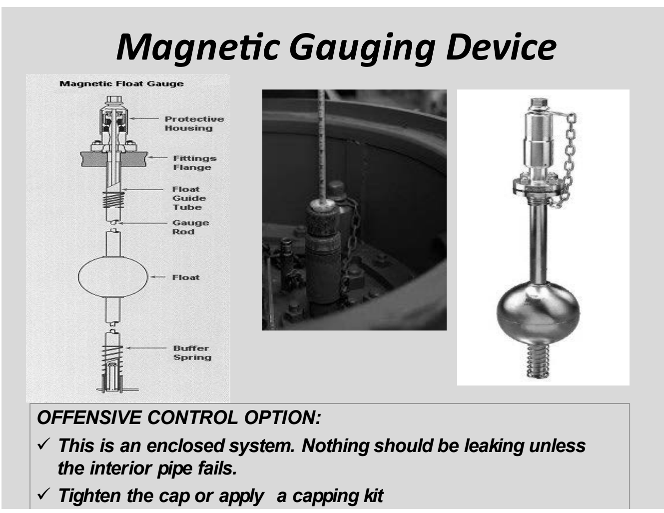



**Slide 5.27**
**Sample Valve**

The most important vital sign of any closed container is the pressure. Responders must ensure that the commodity pressure is within normal limits before applying a capping kit. The sample line is the preferred location to apply a pressure gauge on the DOT 112 & 114 tank cars.

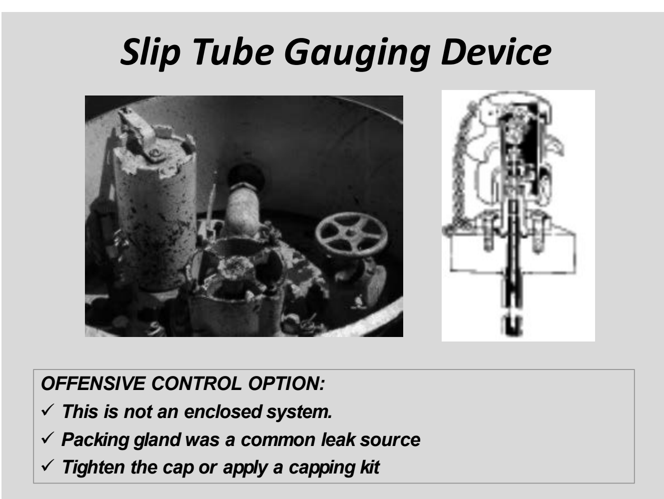

**Slide 5.28**
**Thermometer Well**

This is a ¾” closed end pipe filled with antifreeze that extends into the tank. It is used to evaluate the commodity temperature. The cap does not contain pressure under normal circumstances.
Causes for release are a corroded internal pipe or damaged threads at the pressure plate.
A” telltale” hole will release product if the interior pipe is damaged. If so, tighten the cap and apply the capping kit if necessary.



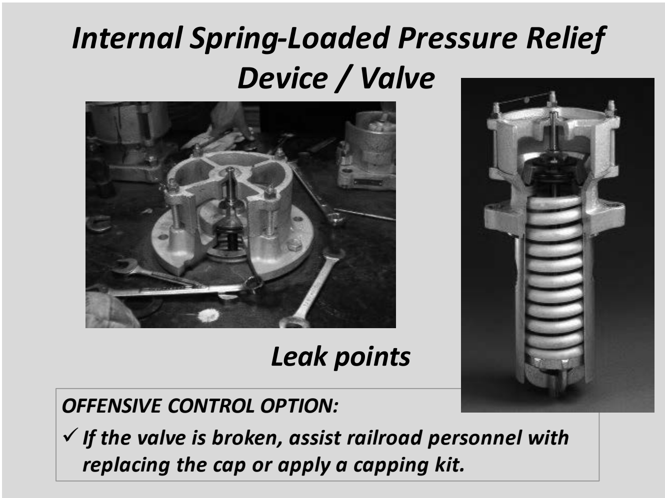

**Slide 5.29**
**Magnetic Gauging Device**

Used to measure the level of liquid or vapor space in a tank car. It incorporates a magnetic ball that floats on the liquid. A magnet on a gauging rod aligns with the magnetic ball. The rod indicates the outage.
This is a closed system and should not have product release. The cap has “telltale” holes to indicate compromise to the system.
If there is a release. Tighten the cap and apply the caping kit if necessary.



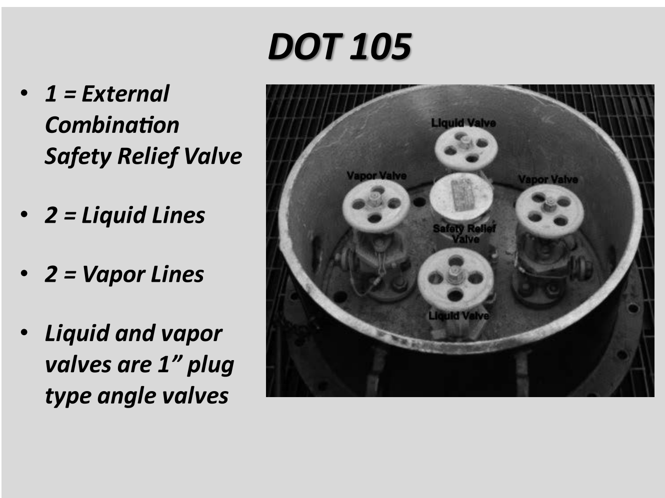

**Slide 5.30**
**Slip Tube Gauging Device**

This is a restricted gauging device that extends into the product. A small amount of product is released through an open valve as the gauging rod is raised into the vapor space of the tank. Danger, the gauging rod is always under pressure. Do not have any part of your body over the top of the rod during operation.



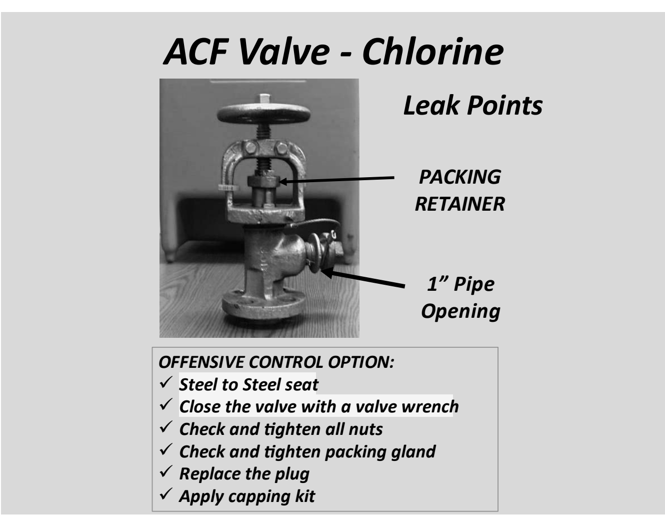

**Slide 5.31**
**Internal Spring-Loaded Pressure Relief Device / Valve**

PRD's will operate due to excess pressure, overfilling or chemical reactions. They will also leak from failed "O" rings, broken springs or adjusted incorrectly. Responders must evaluate tank pressure before deciding a control option. Control options include adjusting the valve seat with a mallet, replace "O" ring / cap or apply a capping kit



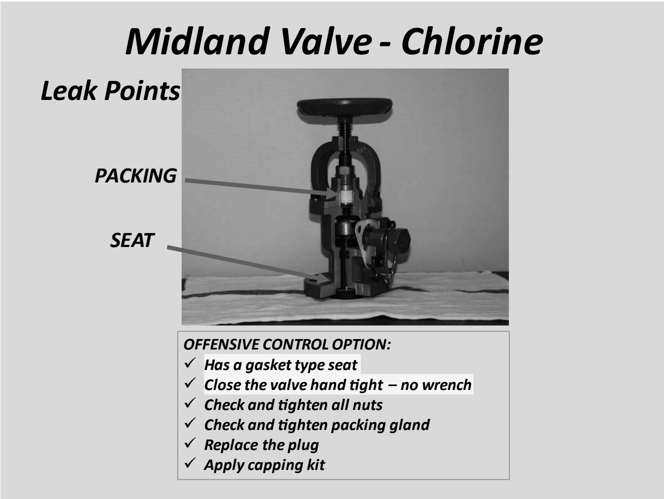

**Slide 5.32**
**DOT 105 Tank Car**

These cars typically transport poison gasses such as Chlorine, Sulfur Dioxide and Ethylene Oxide.
They have two liquid and two vapor plug type angle valves. Discharge ports are 1" NPT.
They have a combination external pressure relief device located in the center of the housing.




**Slide 5.33**
**ACF Valve**

American Cast and Foundry valve. 1" NPT plug type angle valve with a steel to steel valve seat. A valve wrench is used to secure the valve completely.
Problems include valve wheel that vibrates open and a loose packing gland.
Mitigation is to close the valve, tighten the packing gland and apply the C-Kit as a last resort.

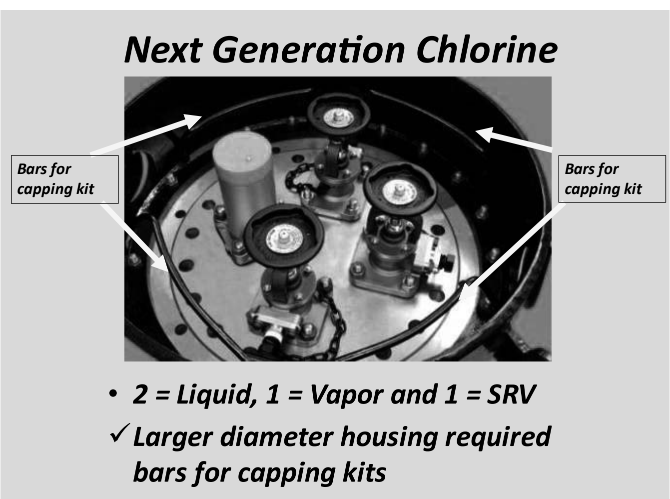



**Slide 5.34**
**Midland Valve**

Midland brand valve. 1” NPT plug type angle valve with a neoprene valve seat. These valves are closed hand tight. Using a wrench can damage the valve seat.
Problems include valve wheel that vibrates open and a loose packing gland.
Mitigation is to close the valve, tighten the packing gland and apply the C-Kit as a last resort.

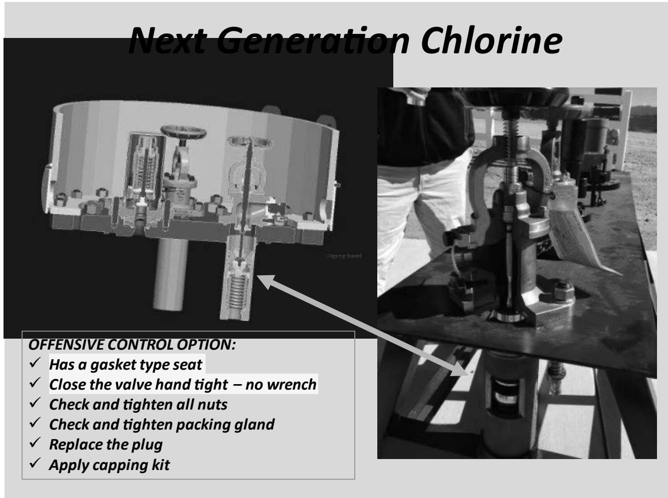

**Slide 5.35**
**Excess Flow Valve Chlorine**

This is the excess flow valve located only under the liquid lines of a chlorine car. (DOT 105 Specification) It uses a ball bearing configuration to stop the flow of product if the valve is damaged or sheared off.



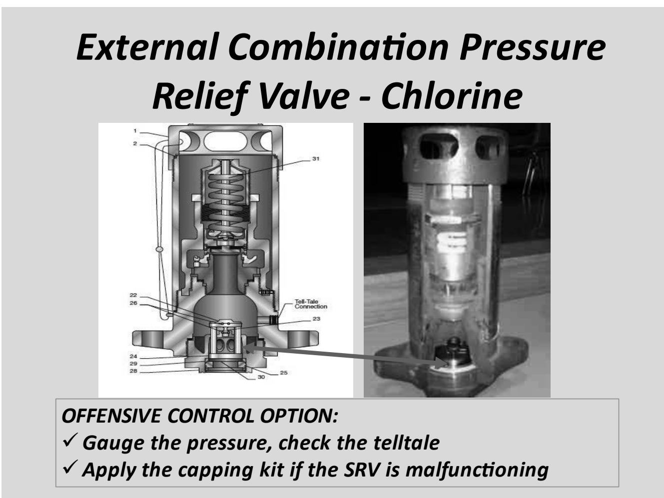

**Slide 5.36**
**DOT 105 Tank Car – Next Generation Chlorine Cars**

These cars have two liquid valves and one vapor valve with an external combination pressure relief device located opposite the vapor valve. Liquid and vapor valves are 1” NPT plug type angle valves.




**Slide 5.37**
**Next Generation Chlorine Valve**

A 1" NPT plug type angle valve with a Viton or Teflon seat. It opens and closes like a regular valve, but the valve seat is underneath the pressure plate. An internal spring is used to ensure that the valve stays closed if it becomes damaged or removed in an accident.
Cause for release: Valve vibrates open or loose packing gland.
Solution: Close the valve tighten nuts & apply the capping kit if necessary




**Slide 5.38**
**External Combination Pressure Relief Valve**

These valves are typically found with Chlorine, Ethylene Oxide, Co2. They incorporate a frangible disk between the product and valve spring to protect the spring from corrosion. Both disk and spring are typically set at 75% of the tank test pressure.


**Slide 5.39**
**Capping Kit Safety**

Never apply a capping kit on a pressure relief device that is relieving excess pressure. Use a pressure gauge to evaluate the status of the tank before applying a capping kit.
Remember: SRV's typically operate at 75% of the tank test pressure. Safety vents typically open at 100% of the tank test pressure.
Check the right side of the car "Haz Mat Corner" for accurate PRD setting.


**Slide 5.40**
**C-Kit / Capping Kit**

The “C-Kit” is made by the Indian Springs Company. It is specifically designed for the DOT 105 Chlorine car.
Note that the newer chlorine cars have a wider housing. Bars are installed inside the housing to facilitate the arms of the bridge assembly.

*NOTE: Capping kits are used after all other options for stopping a release have failed. (Close all valves, tighten bolts and replace caps & plugs first.)*


**Slide 5.41**
**Midland Kit – Universal Capping Kit**

The Midland brand capping kit is made by the most common railroad valve manufacturer. The kit has tools and equipment necessary for capping valves and fittings on all pressure cars. The kit also has tools for immediate mitigation for non-pressure cars.

*NOTE: Capping kits are used after all other options for stopping a release have failed. (Close all valves, tighten bolts and replace caps & plugs first.)*


**Slide 5.42**
**Indian Springs ERK – Universal Capping Kit**

Indian Springs in conjunction with the chlorine institute has developed their universal capping kit. This kit also has tools and equipment necessary for capping valves and fittings on all types of pressure cars as well as extra tools for non-pressure cars.

*NOTE: Capping kits are used after all other options for stopping a release have failed. (Close all valves, tighten bolts and replace caps & plugs first.)*

# Chapter 6: Railroad Tank Car Assessment

**Scope:**
This chapter provides information and tools to assess damage to tank cars involved in accidents

**Time :** 1 hour
**Instructor/Participant Ratio:** 1-30
**Method of Instruction:** Lecture and PowerPoint

**Terminal Learning Objective (TLO)**
At the end of instruction for Chapter 6, participants will be able to determine the magnitude of damage to rail tank cars involved in derailments and rail accidents

**Enabling Learning Objectives (ELO)**
This chapter's enabling (performance) objectives are to ensure participants will be able to:
1. Understand the forces that can damage a rail tank car
2. Assess damage to rail tank cars involved in accidents
3. Provide damage assessment to the incident commander and Safety Officer for protective actions

**Linkages to Universal Task List**
The information, objectives, and activities in this chapter promote the acquisition of knowledge and skills in support of the target capabilities identified in the Universal Task List:

**ResB2b 3.2.6.2** Provide required Personal Protection Equipment to WMD/HazMat responders in coordination with safety officer
**ResB2b 3.2.6.3** Coordinate with safety officer to brief hazardous materials branch/group personnel on site-specific occupational safety and health issues involving hazardous materials/WMD releases

**ResB2b 3.3.3** Coordinate, integrate, and manage efforts to prevent, or mitigate, or minimize threat of potential releases

**Materials and Preparation**
- Seating and work stations for up to 30 participants
- Instructor Manual and CD with Power Point presentation (1 for instructor)
- Participant Guide (1 for each participant)

**Supporting Materials:** Rail Tank cars with: General Service Fittings, Pressure Fittings, and Chlorine fittings

**Activities**: Students will work in the field on each of these rail car domes.

**Practical Exercise:** "G" Week Field Scenarios

Haz Mat Specialist 1F
Special Mitigation Techniques

**Chapter 6**
**Railroad Tank Car Assessment**

**Slide 6.1**
**Chapter 6**

Railroad Tank Car Assessment must be performed by qualified personnel. Hazardous Materials Specialists must be able to analyze the situation, establish objectives and tactical priorities to ensure a favorable outcome while protecting life, the environment and property at a hazardous materials incident. First responders must consult with railroad specialists and tank manufacturers before off-loading product or moving containers.

## *Typical Release from Tank Cars*

1. ***Non-pressure cars***
   - ✓ ***Corrosive or flammable liquid***
2. ***Not involved in an accident***
   - ✓ ***Valves are easily accessible***
3. ***Release of a small amount of product***
   - ✓ ***Generally less than 100 gallons***

**Slide 6.2**
**Typical Release from Tank Cars**

- The typical railroad hazardous materials release involves non-pressure cars that transport flammable or corrosive liquids.
- The typical cause is from loose valves or fittings.
- And involves less than 100 gallons of product.

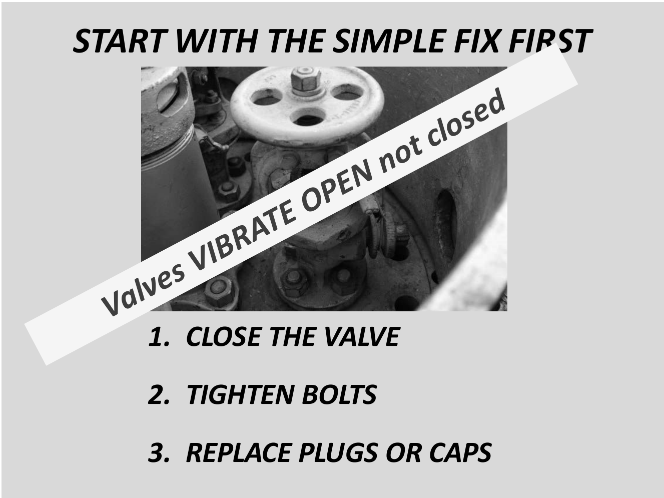
## *Tank Car Problems*

1. ***Leaking fittings***
   - ✓ ***Not secure***
   - ✓ ***Worn***
   - ✓ ***Damaged***

2. ***Overloaded / over pressurized tank***
   - ❖ ***Always check the pressure in the tank first***
   - ❖ ***Never apply a Capping Kit before checking the pressure***
3. ***Tank / Car damage***

**Slide 6.3**
**Tank Car Problems**

The most common cause of a release is from valves or fittings that are not secure, worn out, damaged or vibrate loose.
The second common cause is that cars are overloaded or over pressurized. The most important vital sign of any closed container is pressure. Always check tank pressure before applying a capping kit.
The least common cause of release in a is tank damage from an accident or derailment.

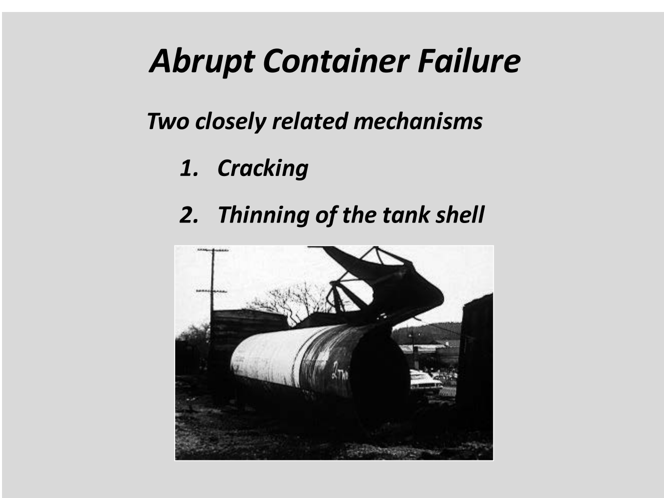



**Slide 6.4**
**Start with the simple fix first**

Many non-accidental releases can be resolved by simply closing a valve, ensuring that packing gland and pressure plate bolts are tight and replacing plugs or caps.

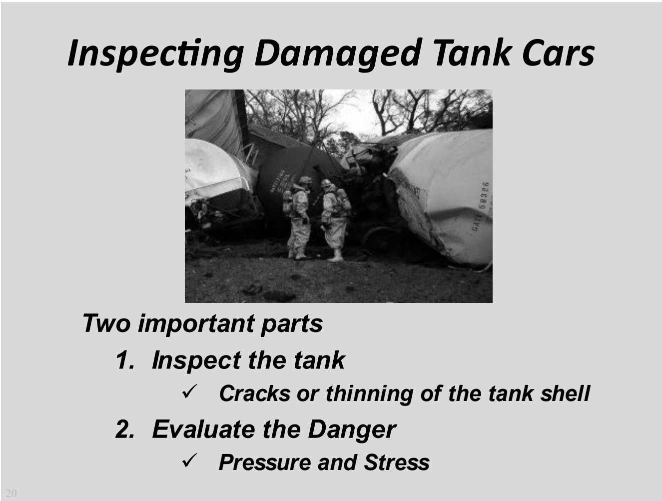

**Slide 6.5**
**Assessing Tank Damage**

Major releases in train accidents typically occur immediately. Damaged valves and fittings will leak, or the tank will fail at the time of the accident. However, tank cars may also sustain extensive damage without immediate release. The potential for delayed failure is greater for pressure cars. They are stronger and built to withstand more pressure but will fail rapidly with little or no warning.




**Slide 6.6**
**Conditions that Trigger Abrupt Failure**

Two closely related mechanisms that trigger a violent rupture in rail cars are cracks in the tank and thinning of tank head or shell.




**Slide 6.7**
**Inspecting Damaged Tank Cars**

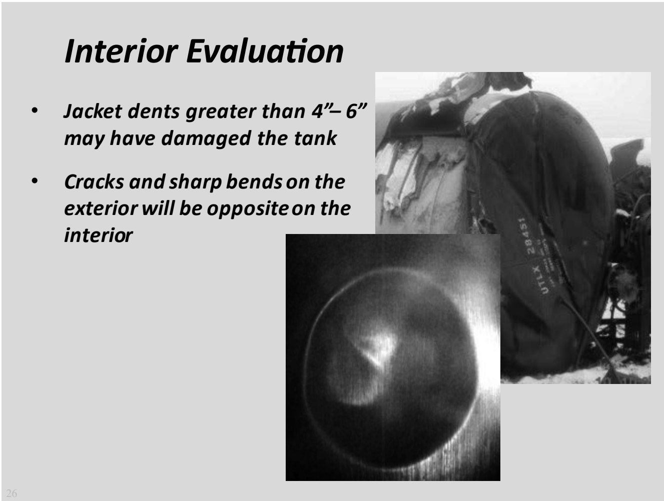
Two important parts of tank inspection are to inspect the tank for cracks, dents and thinning of the tank shell. And evaluate stress on the tank. Inspect all accessible surfaces of the tank for type, location, direction, and extent of damage. Since it is not possible to see the entire surface of a damaged tank, reinspection is necessary when adjacent cars or surrounding materials are being moved or when the car is being lifted.


**Slide 6.8**
**Steps for Inspecting Damaged Tank Cars**

The first step is to check the tank pressure and temperature if possible. First responders should contact the shipper to determine a normal pressure for their commodity.
Second step is to determine how much product is in the car. You may be able to use the gauging device on the car. A thermal imaging camera may also be used for non-jacketed cars.
The third step is to examine all surfaces for cracks, dents, scores, gouges, wheel, and rail burns.

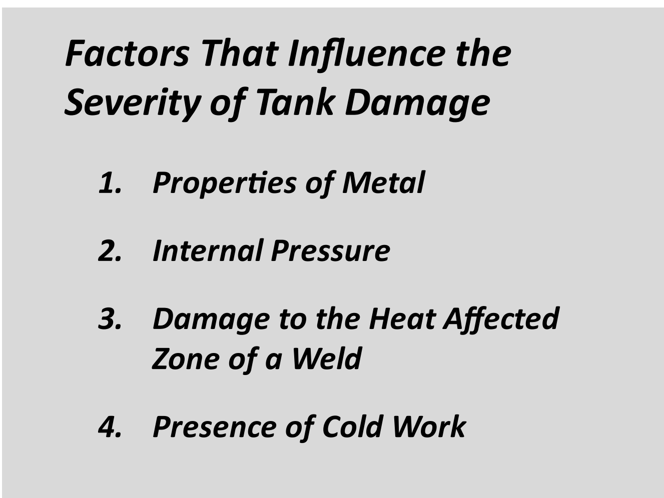

**Slide 6.9**
**Jacketed vs. Non-jacketed Tank Cars**

Jacketed tank cars are difficult to inspect without removing the jackets. Lack of damage to the jacket usually indicates that the tank is undamaged. However, when the jacket is torn or dented for several inches or more, it may be cause for concern. Jacket material may have to be cut away by mechanical means to determine the extent of damage.



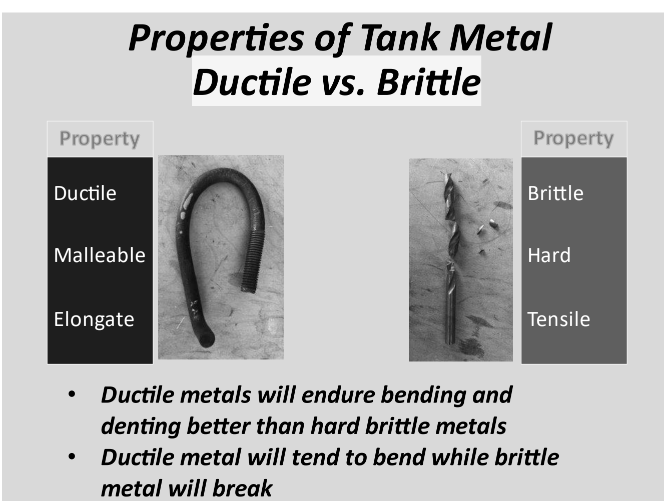

**Slide 6.10**
**Jacketed vs. Non-jacketed Tank Cars**

Always suspect tank damage when the dent in the car jacket is deeper than the insulation space (usually 4" – 6").
Sharp bends that lead to tension or compression on the outside will be opposite on the inside of the tank.




**Slide 6.11**
**Factors That Influence the Severity of Tank Damage**

1. Properties of metal
2. Internal pressure
3. Damage to the heat affected zone of a weld
4. Presence of cold work

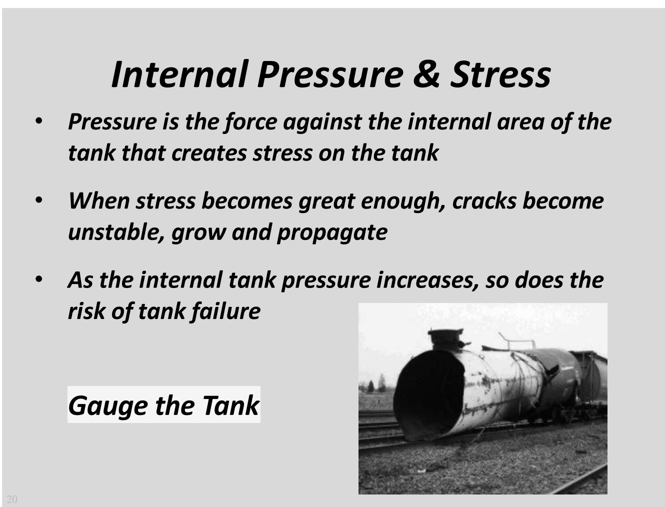



**Slide 6.12**
**Properties of Tank Metal**

Transition temperature is the point which properties of steel change from ductile to brittle. Ductile metal tends to bend, rather than break It will endure elongation, bulging, stretching, and thinning better than brittle metal. Brittle metals resist deformation and require a greater amount of energy for tank failure. Cracks grow more unstable under brittle conditions. They are more stable under ductile conditions.

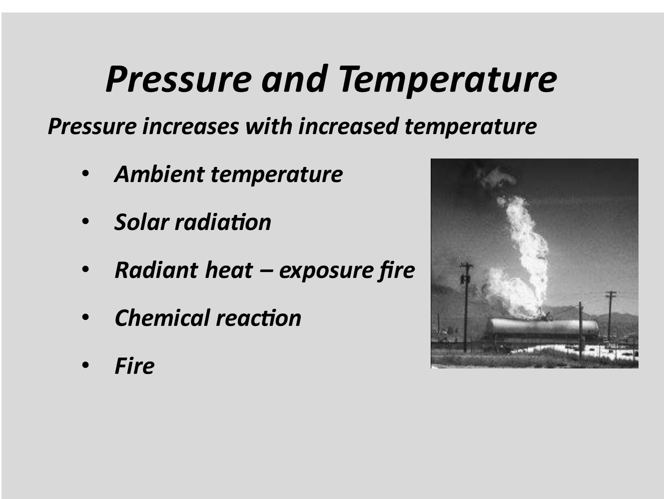

**Slide 6.13**
**Desired Properties for Steel Tank Cars**

Before 1967 most pressure tank cars were made of steels that had unpredictable transition temperature and tended to be more brittle. A fine grain high tensile steel with better ductility was used between 1967 – 1988. Fine grain "normalized" steel has been used since 1989 to make a tank with improved ductility and toughness, retention of ductility and toughness in cold temperatures, and high ultimate strength



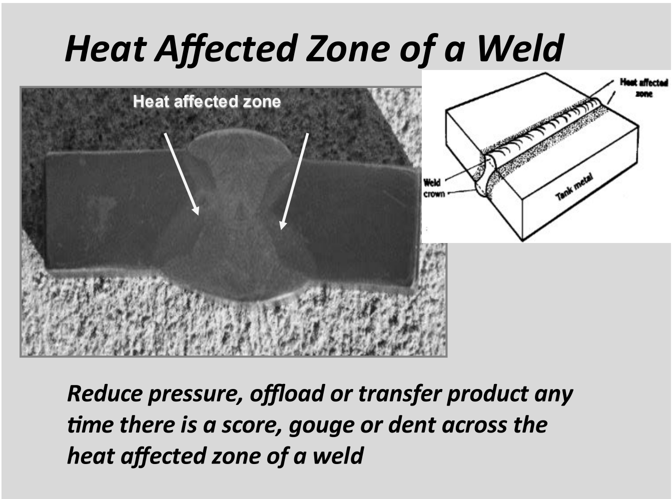

**Slide 6.14**
**Internal Pressure and Stress**

Internal pressure is the force against the internal area of the tank car that creates stress on the tank. When stress becomes great enough, cracks become unstable, begin to grow, and propagate. As internal pressure increases so does the risk of tank failure. Pressure is the most important vital sign of any closed container. Always use a pressure gauge to check the tank pressure before deciding a control option.



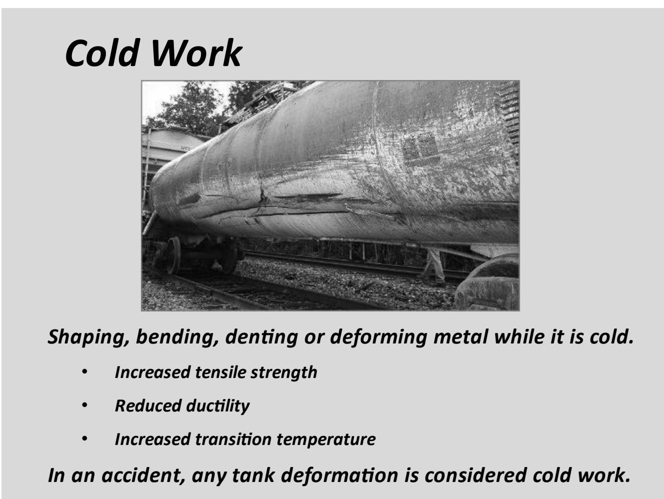

**Slide 6.15**
**Pressure and Temperature**

Pressure varies with the temperature of the contents according to the individual vapor pressure/temperature relationship of the contents. Pressure increases come from ambient temperature, solar radiation, radiant heat, chemical reactions, and flame impingement.




**Slide 6.16**
**Heat Affected Zone of a Weld**

The heat affected zone of the weld is the undisturbed tank metal on both sides of the actual weld material. (As much as 1" on either side) The tank metal in this area has been heated and cooled which changes metal composition. This reduces ductility of the steel, making the heat affected zone a likely origin of cracks. Off load product before moving, any time there is a score, gouge, dent, or cold work across a weld.




**Slide 6.17**
**Cold Work**

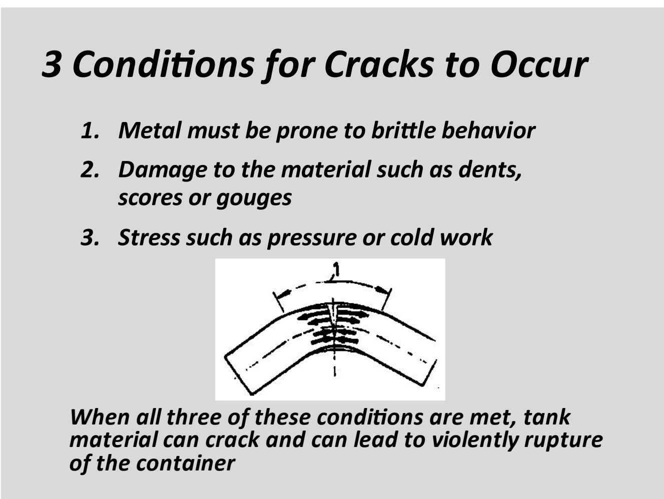
Cold work is shaping, bending, stretching, or deforming metal without the benefit of heat. This action mechanically forces the crystalline structure of the metal to change. Cold work tends to increase transition temperature. All of this makes steel more susceptible to cracking. In an accident, any tank deformation is considered cold work.


**Slide 6.18**
**Potential for Delayed Tank Failure**

Most tank cars can receive different forms of damage such as cracks, dents, scores, gouges, and cold work without releasing product. Damage combined with external forces such as pressure, bending, twisting, or lifting operations to move cars can cause container failure. Personnel must evaluate damage and stressors that could lead to a violent rupture.


**Slide 6.19**
**Cracks**

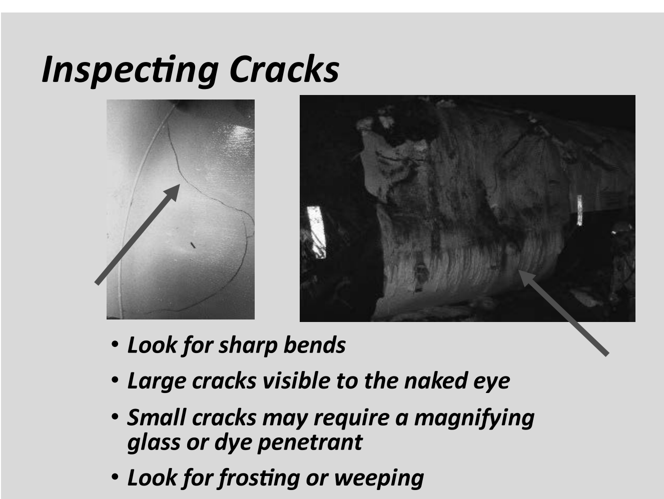
A crack is a narrow split or break in the tank metal which may or may not penetrate through the tank metal.
Cracks typically occur in tension areas and cause failure because they grow under stress and close to the speed of sound.
Cracks grow rapidly in brittle steel and relatively slow in ductile steel.




**Slide 6.20**
**3 Conditions for Cracks to Occur**

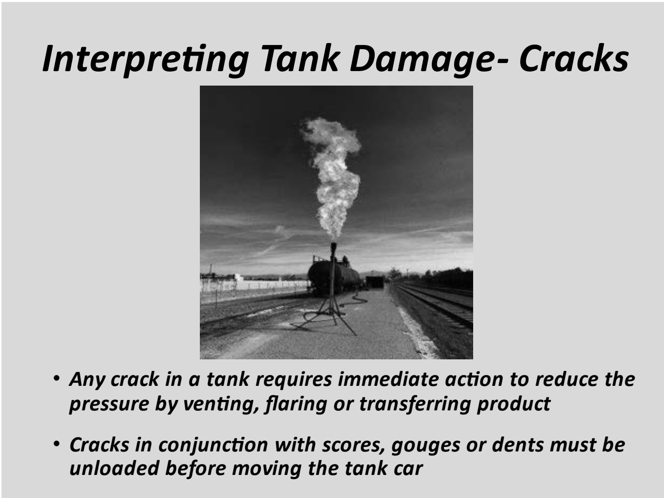
Creation of a crack requires the simultaneous occurrence of three conditions.

- Material must be prone to brittle behavior
- A discontinuity in the surface of the material or changes in crystalline structure such as dents, scores, gouges, or flaws
- Higher than normal stress to tank material such as pressure and cold work.



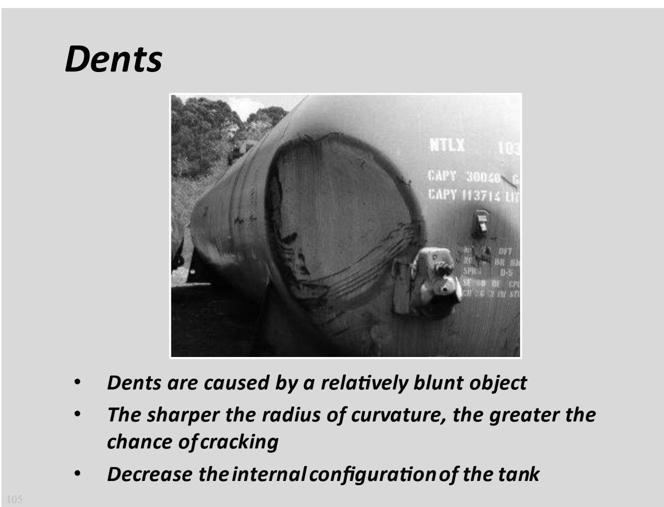

**Slide 6.21**
**Inspecting Cracks**

Pay particular attention if cracks are in areas where longitudinal damage is present. Inspect areas with sharp bends. Look for large cracks that are visible to the naked eye. Use dye penetrant for smaller cracks. Look for signs of frosting or clear liquid on the tank surface, since material weeps through small cracks.



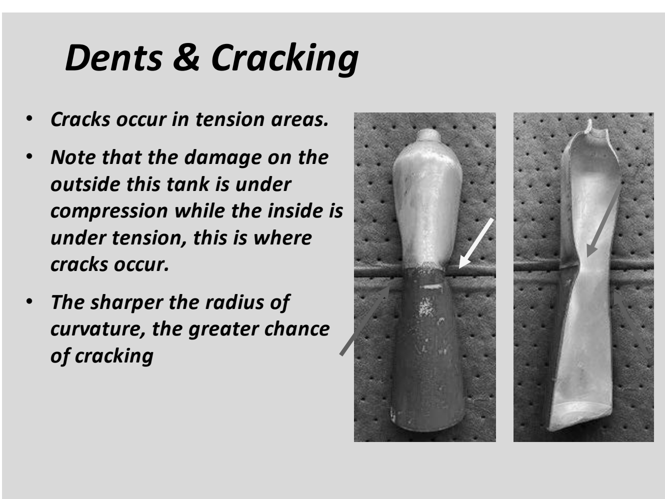

**Slide 6.22**
**Interpreting actions with presence of a crack**

Any crack in a tank, no matter how small, demands immediate action to relieve the stress by venting, flaring, or transferring tank contents. Cracks in conjunction with dents, scores or gouges should be unloaded as soon as possible before moving.
Consider the pressure of the commodity and evaluate the potential for pressure rise.




**Slide 6.23**
**Dents**

Dents are a deformation in the tank shell or head caused by a relatively blunt object. The most common dent is a head dent. The sharper of the curvature of the dent will increase the chance of cracking. Long dents with scores and gouges are called rail burns. A significant dent will decrease the internal capacity of the tank and increase the internal pressure if unvented.




**Slide 6.24**
**Dents and Cracking**

Radius of curvature describes the sharpness of a curve at a dent. A small radius of curvature indicates a small circle and a sharp bend. A larger radius of curvature indicates a large circle and more gentle bend. A gentle radius causes little trouble unless it exists with other damage. Sharp dents in the shell of a tank are most serious as they can reduce the strength of the tank significantly. Sharp bends will have a higher probability of cracking.

## *Inspecting Dents*

- *Measure the radius of the dent with a dent gauge*
- *Identify dents associated withscores, gouges and welds*
- *Evaluate sharp bends for cracks*

**Slide 6.25**
**Inspecting Dents & Rail Burns**

Measure the radius of curvature for each dent using a dent gauge. Identify dents that have scores, or gouges associated with them. Dents in combination with scores or gouges that cross welds are most dangerous. Examine each point of minimum curvature on a dent or rail burn for cracks. A magnifying glass may be required. Measure the length of a dent or rail burn. Rail burns 7 feet long or greater are most dangerous.

## *Massive Tank Dents*

- *Reduced internal capacity*
- *Hydrostatic failure could occur if the product volume exceeds the tank capacity*

**Slide 6.26**
**Massive Denting**

Massive denting could reduce tank shell capacity by as much as 5%. If massive denting causes the volume of the tank to equal the volume of tank lading, the tank may undergo hydrostatic failure.

## *Interpreting Tank Damage- Dents*

***Unload tank cars without moving if the following conditions exist:***

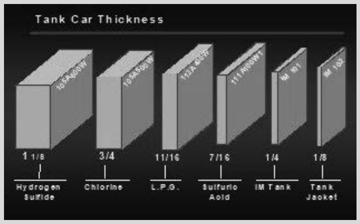
- *A dent with a 4” radius in cars built before 1967*
- *A dent with a 2” radius in cars bult after 1967*
- *AND one or more of the following*
    - *Presence of a crack anywhere*
    - *Dent crossing a weld*
    - *Presence of a score or gouge*
    - *Evidence of cold work*

**Slide 6.27**
**Interpreting Tank Damage - Dents**

Cars should be unloaded before moving with presence of a 4” dent in cars built before 1967 and 2” dent in tank cars built after 1967 and with the presence of one or more of the following: presence of a crack, dent crossing a weld, presence of a score or gouge or evidence of cold work.

## Thinning of Tank Metal

1. Gouges
2. Scores
3. Wheel Burns
4. Rail Burns
5. Flame impingement

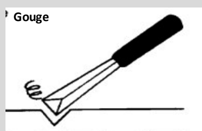



**Slide 6.28**
**Thinning Tank Metal**

Thinning of tank metal associated with scores, gouges, wheel burns, and flame impingement acts similar to a crack. The abrupt change in thickness increases stress to tank metal. This can cause the tank to violently rupture when additional stress is placed on a tank. Flame impingement causes more gradual thinning of tank metal. Depending on the ductility of the steel, the tank can tolerate some localized thin spots without presenting a dangerous situation.

## Gouges

*Reduces tank wall thickness by removing metal*



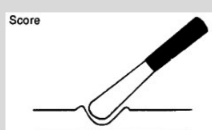

*Caused by contact with other metal*

**Slide 6.29**
**Gouges**

Gouges cause thinning of the tank by removing material usually by a sharp metal object. These are grooves in the tank metal which result from impact with a sharp, chisel-like object. Gouges cause cutting and complete removal of the tank or weld metal along the path of contact.

## Scores

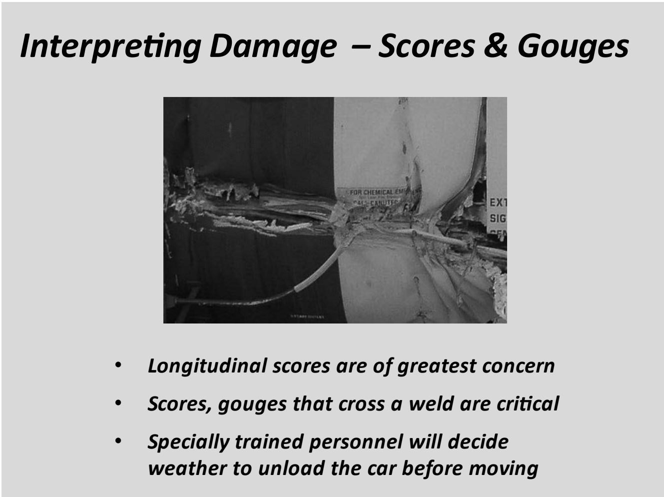
*Reduce tank wall thickness by relocating metal along the path of contact*




*Associated with wheel and rail burns*

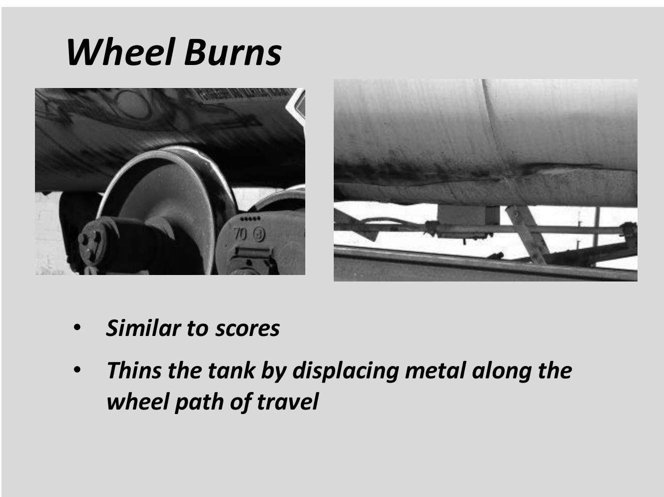
**Slide 6.30**
**Scores**

Scores reduce tank wall thickness by relocating metal along the path of contact. They are grooves in the tank metal which occur when a relatively blunt object comes in contact with the tank. Scores cause the relocation of the tank or weld metal so that the metal is pushed aside along the path of contact with the blunt object.



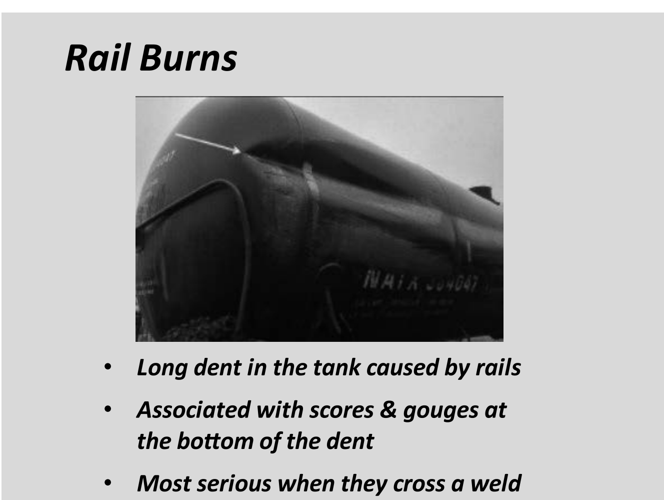

**Slide 6.31**
**Interpreting Tank Damage – Scores & Gouges**

Longitudinal scores are of greatest concern however, you must also evaluate circumferential scores. Scores or gouges that cross a weld and damage to the heat affected zone are potentially critical. Experienced personnel will evaluate the depth of the score or gouge in conjunction with the tank pressure to decide whether the car must be unloaded in place or if it can be moved to another location for product transfer.




**Slide 6.32**
**Wheel Burns**

Wheel burns are similar to scores, in that prolonged contact of the wheel with the tank reduces thickness of the tank, pushing metal aside at the point of contact.
Tank cars with wheel burns deeper than 1/8″ must be unloaded before moving. Cars with wheel burns less than 1/8″ deep can be moved to the closest unloading facility. Consult the tank manufacturer before deciding a final option.




**Slide 6.33**
**Rail Burns**

Rail burns are long dents in the shell of a tank, with cold work, (scores & gouges) at the bottom of the dent. Longitudinal rail burns are the most serious when they cross a weld.
Measure the length of a dent or rail burn. Dents 7 feet or longer that run longitudinally and cross a circumferential weld are the most dangerous. All cars with rail burns require contents to be offloaded before moving.


THE END

# Chapter 7: Emergency Procedures Involving MC306/DOT 406 Cargo Tanks

**Scope:**
This chapter provides information on the off loading of hydrocarbons from an MC 306/DOT 406 aluminum tank truck that is not upright.

| | |
|---|---|
| **Time :** | 4 hours |
| **Instructor/Participant Ratio:** | 1-30 |
| **Method of Instruction:** | Lecture, Powerpoint, field exercise |

**Terminal Learning Objective (TLO)**
At the end of instruction for Chapter 7, participants will be able to determine features of MC 306/DOT 406 cargo tanks, materials transported and methods of proper removal.

**Enabling Learning Objectives (ELO)**

1. Recognize and identify specialty vehicles and their unique hazards
2. Identify the valves, attachments, appurtenances and control features of MC 306/DOT 406 cargo tanks
3. Identify Plug and Patch materials and techniques for mitigating leaks
4. Identify the elements of a hazard assessment for MC 306/DOT 406 cargo tanks and state the mitigation technique.
5. Describe the process for Stinger Operations

**Linkages to Universal Task List**
The information, objectives, and activities in this chapter promote the acquisition of knowledge and skills in support of the target capabilities identified in the Universal Task List:

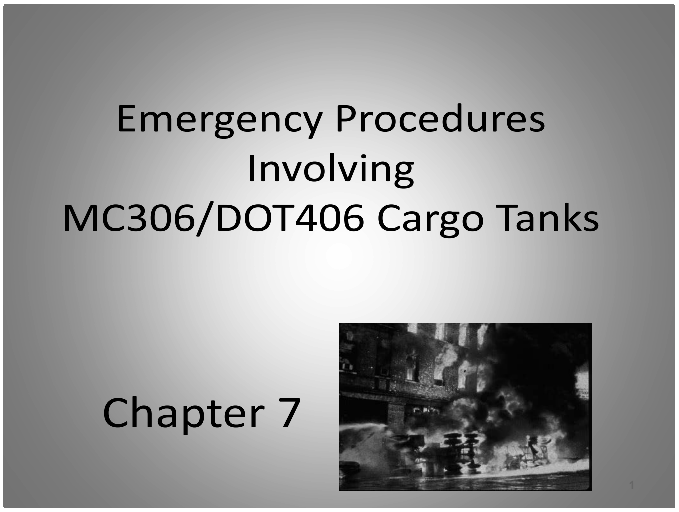
| | |
|---|---|
| **ResB2b 3.4.4** | Coordinate actions to prevent spread of contaminants |
| **ResB2b 3.2.8** | Coordinate resource management of hazardous materials equipment, supplies and personnel |
| **ResB2b 3.2.4** | Provide a Hazardous Materials technical expertise team for emergency operations for both industry and public |

**Materials and Preparation**

- Seating and work stations for up to 30 participants
- Instructor Manual and CD with Power Point presentation (1 for instructor)
- participant manual (1 for each participant)

**Supporting Materials:** Cargo Tank Props

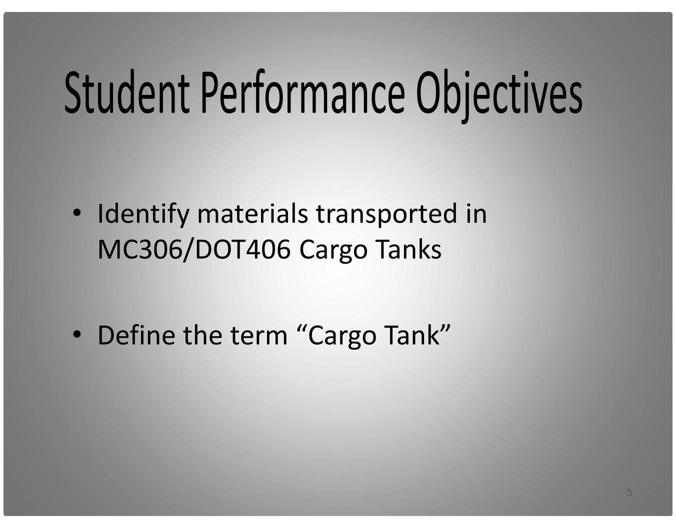
**Activities:** Students will perform a stinger operation on an MC306/DOT 406 or a prop that is constructed of identical material.




**Slide 1**

Chapter 7 Emergency Procedures Involving MC 306/ DOT 406 Cargo Tanks

**Slide 2**

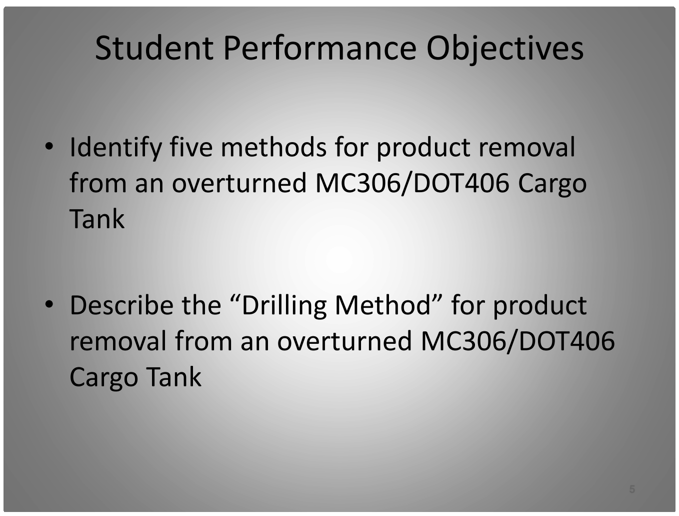



**Slide 3**

Outline objectives of Block to students.  At the end of this Block the student will be able to describe a, "Cargo Tank", and identify materials transported in MC 306/DOT 406 Cargo Tanks.

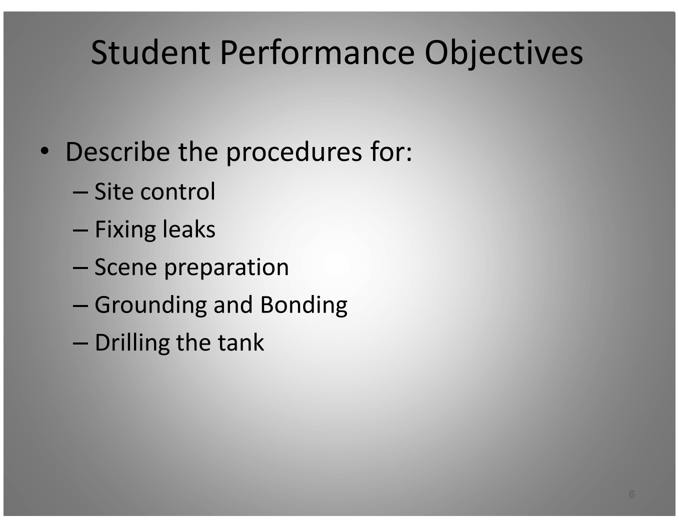

**Slide 4**

At the end of this Block the student should be able to describe how MC 306/DOT 406 Cargo Tanks are constructed, maintained, inspected, tested and repaired.



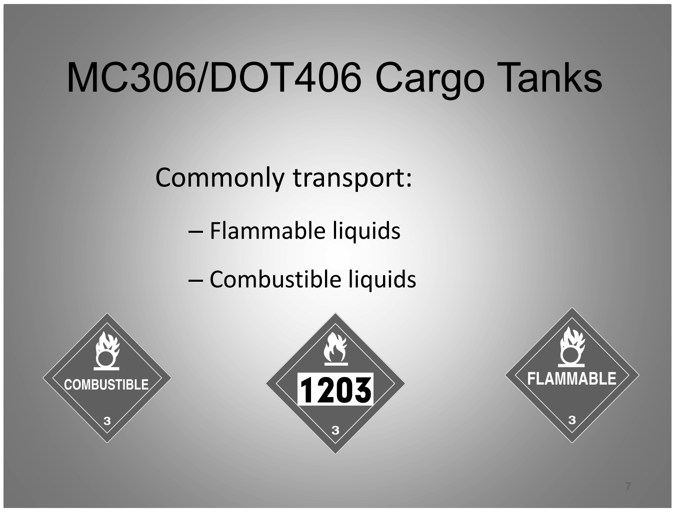

**Slide 5**

At the end of this block the student should be able to describe the five methods for product removal and describe the “Drilling Method” for product removal from a overturned MC 306/DOT 406 Cargo Tank .



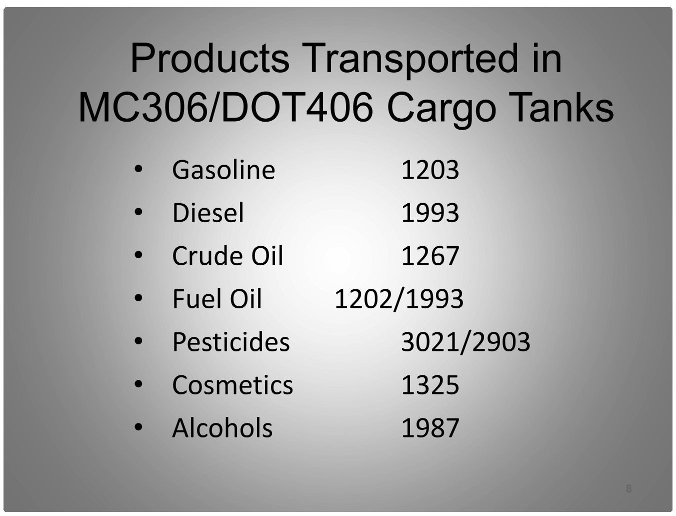

**Slide 6**

Objectives continued



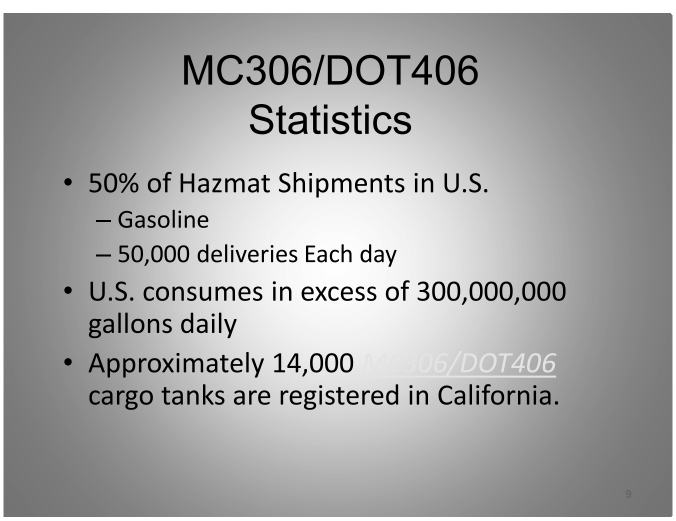

**Slide 7**

MC 306/DOT 406 Cargo tanks commonly transport flammable and combustible liquids.



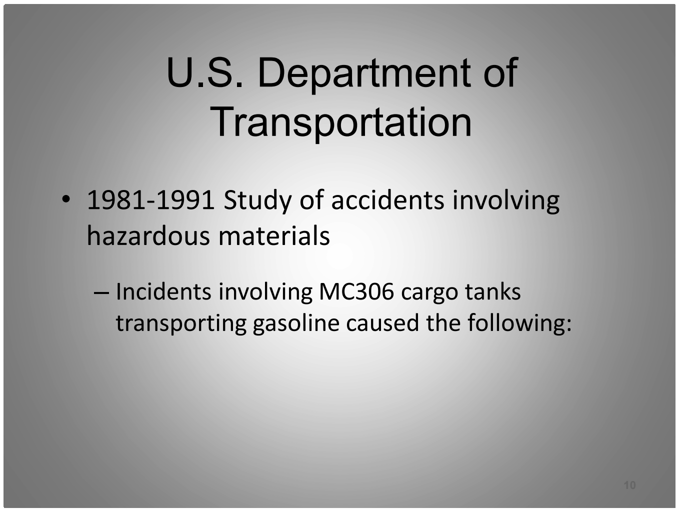

**Slide 8**

The slide describes some products along with respective Emergency Response Guidebook (ERG) ID numbers transported in MC 306/DOT 406 Cargo Tanks.



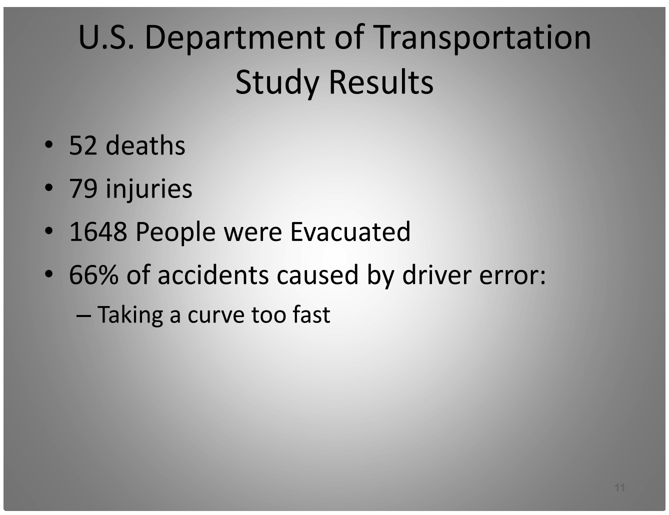

**Slide 9**

Statistically 50% of all hazardous materials shipments in the United States are gasoline. There are approximately 14,000 MC 306/DOT 406 Cargo Tanks registered in California.



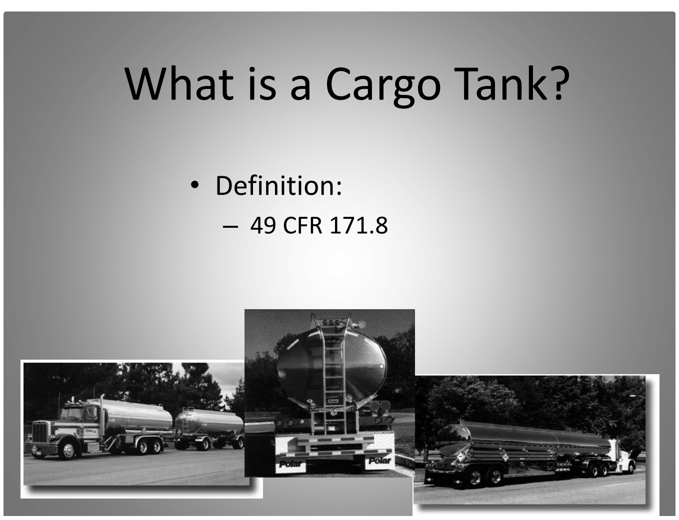

**Slide 10**

United States Department of Transportation study between 1981-1991, of accidents involving MC 306 Cargo Tanks transporting gasoline.



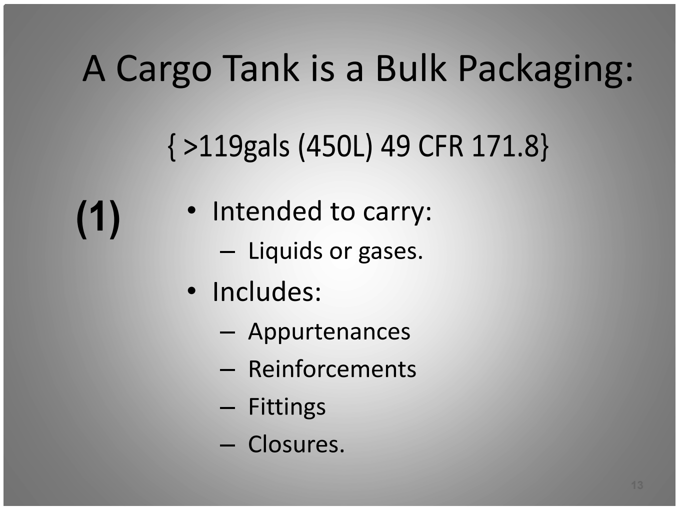

**Slide 11**

United States Department of Transportation study revealed the statistics outlined in the slide.



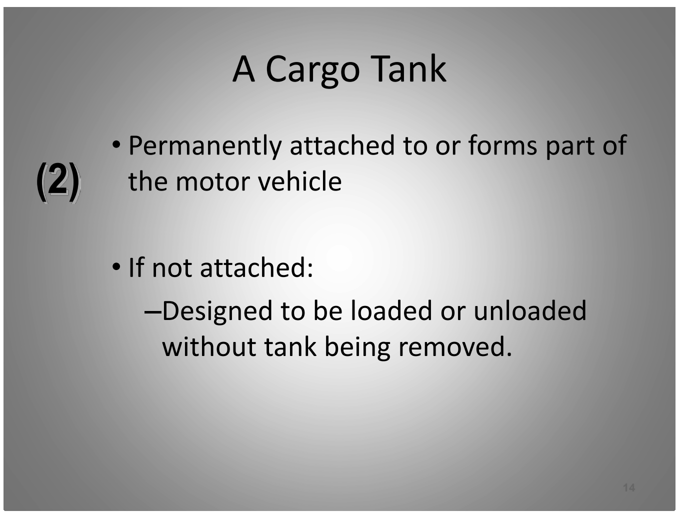

**Slide 12**

Introduction into Cargo Tank definition per 49 CFR 171.8



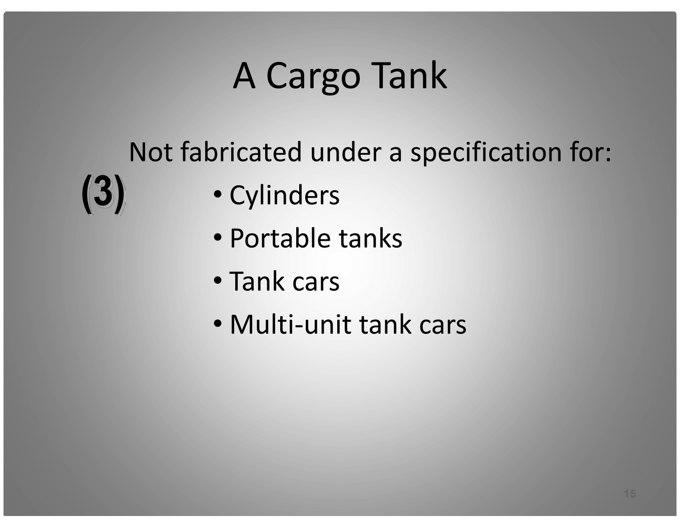

**Slide 13**

A Cargo Tank is bulk packaging >119gals (450L) as defined in 49 CFR 171.8. They are intended to carry liquids or gases and includes appurtenances, reinforcements, fittings and closures.



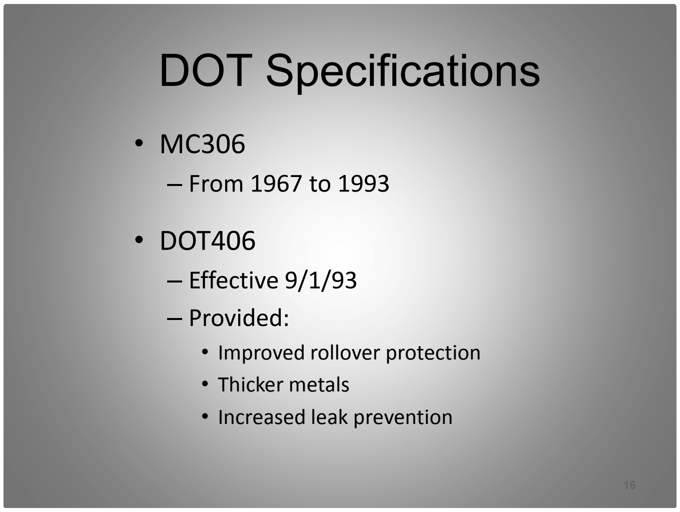

**Slide 14**

A Cargo Tank is permanently attached to or forms a part of a motor vehicle. If not attached it is designed to be loaded or unloaded without the tank being removed.




**Slide 15**

A Cargo tank is not fabricated under a specification for cylinders, portable tanks, tank cars or multi-unit tank cars.




**Slide 16**

DOT specifications for MC 306 were built from 1967 to prior to 9/1/1993. DOT 406 specifications were effective 9/1/1993 and were constructed to provide increased safety, which included improved rollover protection, thicker metals and increased leak prevention


**Slide 17**

The California Highway Patrol participated in a study of accidents in California involving MC 306 Cargo Tanks. The study revealed the following information 43% turned-over, 50% experienced a leak and 23% caught fire.


**Slide 18**

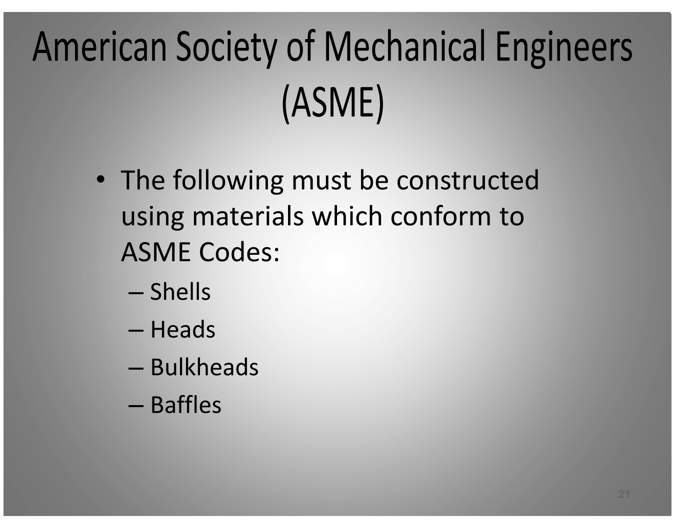
Department of Transportation requirements, 49 CFR Part 178.345 & 346, Specifications for Cargo Tanks include construction, maintenance, inspection, testing and repair.


**Slide 19**

Introduction into Cargo Tank Construction

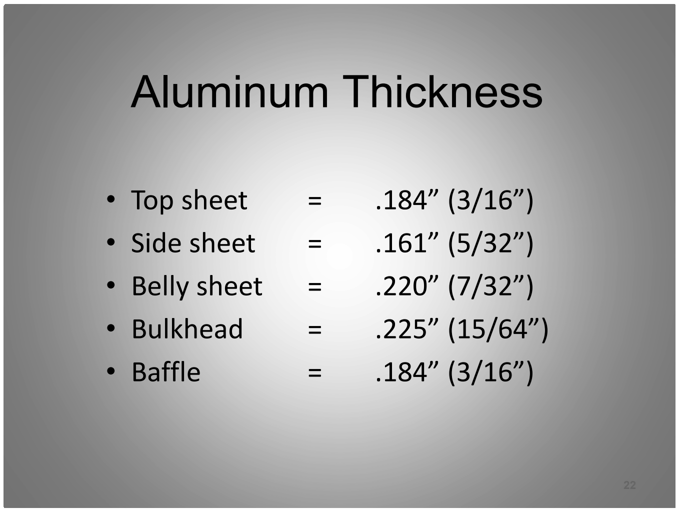

**Slide 20**

MC 306 and DOT 406 Cargo Tank construction materials include mild steel, stainless steel and aluminum. Aluminum is the most common construction material due to the following advantages. Aluminum is a lighter material and Cargo Tanks are limited by weight requirements, it is non-sparking and has a melting point of approximately 1200°F which reduces the potential for BLEVE.



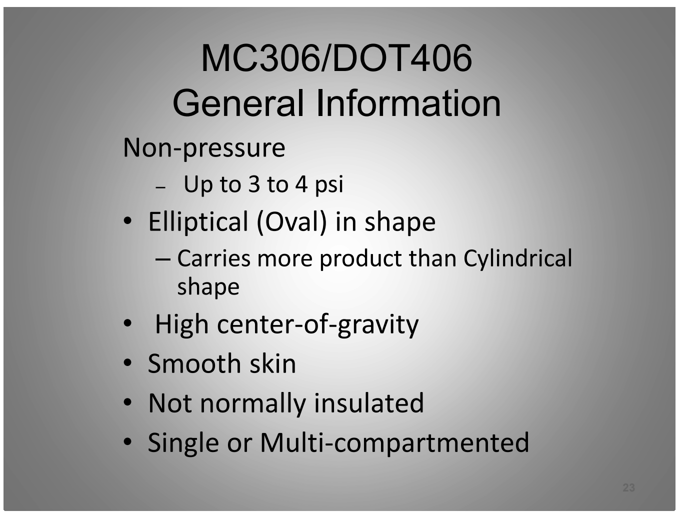

**Slide 21**

The following must be constructed using materials which conform to ASME Codes, shells, heads, bulkheads and baffles.



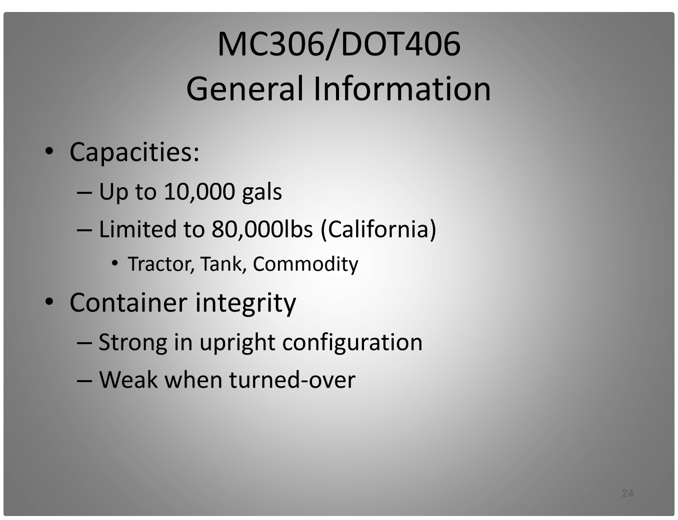

**Slide 22**

Aluminum thickness on top, sides, belly, bulkhead and baffle. When a MC 306/DOT 406 cargo tank is overturned or on its side it is resting on the thinnest part of the tank.



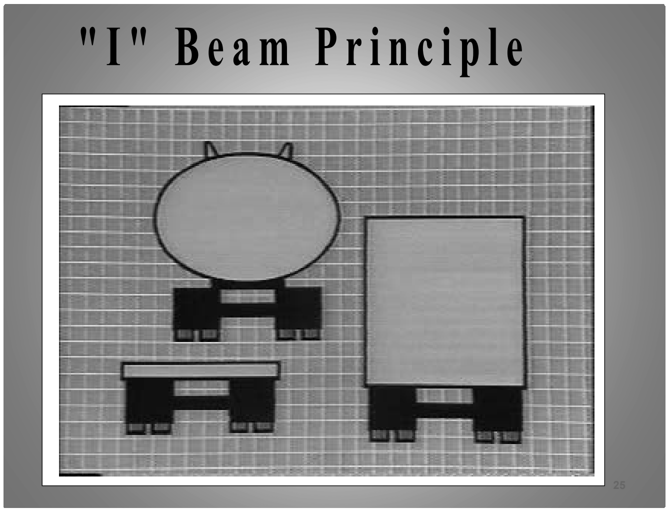

**Slide 23**

MC 306/DOT 406 Cargo tank specifications include the following features, non pressure up to 3-4 psi, elliptical (oval) shape which allows for more product to be carried than a cylindrical shape, A high center of gravity, smooth skin, single or multi-compartmented and not normally insulated .




**Slide 24**

MC 306/DOT 406 Cargo Tank specifications also include, capacities of up to 10,000 gallons with a weight limitation of 80,000 lbs in California including the tractor, tank and commodity. These Cargo Tank types are strong while in the upright position however weak when turned over.

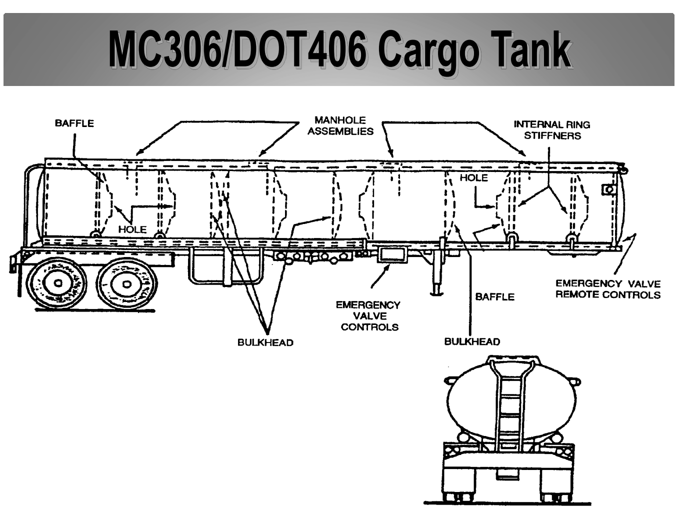



**Slide 25**

The I-Beam Principle

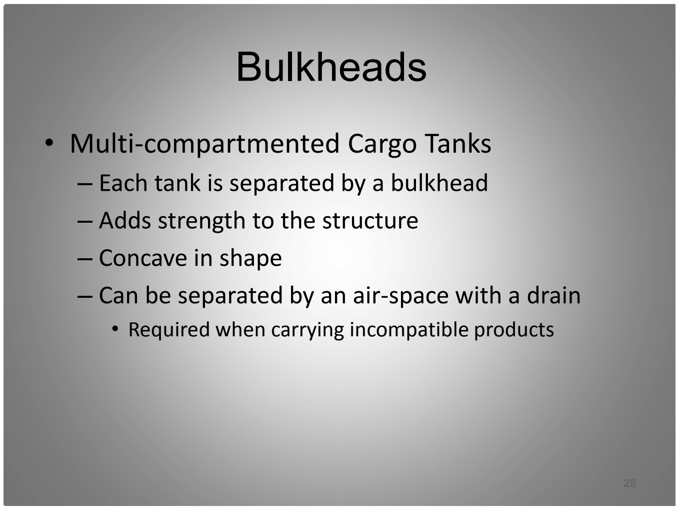

**Slide 26**

Cargo Tank construction features include bulkheads, baffles, valves, dome covers, piping, overturn protection and vapor recovery.



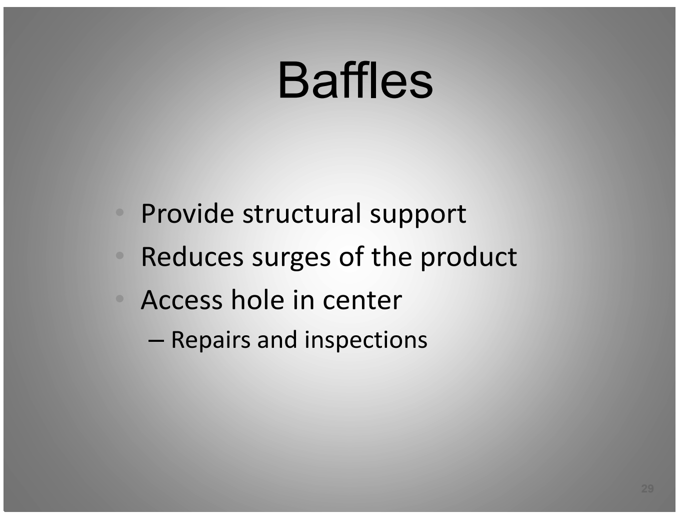

**Slide 27**

The graphic in the slide illustrates the names and locations of many of the features found in a MC 306/ DOT 406 Cargo Tank.



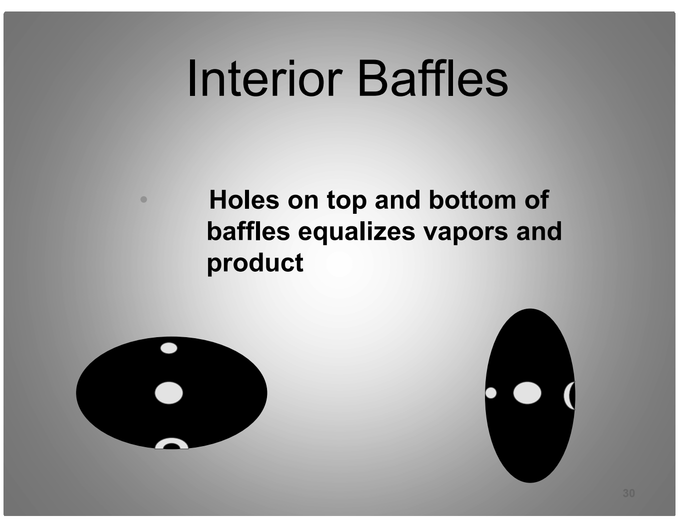

**Slide 28**

Bulkheads are found in multi-compartmented Cargo Tanks. Each of the tanks in a multi-compartment cargo tank are separated by a bulkhead. Bulkheads are concave in shape and add strength to the Cargo Tank. Bulkheads can be separated by an air space with a drain to allow moisture to be removed from the void space. These are required when multi-compartment Cargo Tanks are carrying incompatible materials.



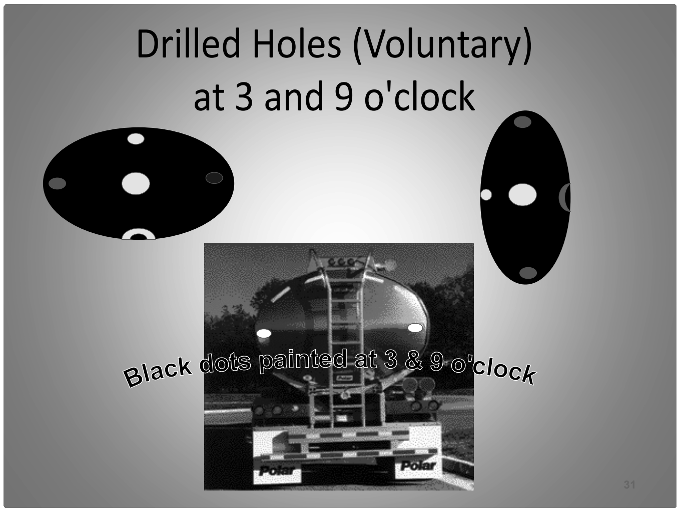

**Slide 29**

Baffles are designed to reduce surges of the product within the tank. They are configured with smaller holes on the top and bottom and a larger hole in the center which allows for product flow, inspections and repairs. Much like bulkheads, baffles provide structural support to the tank.



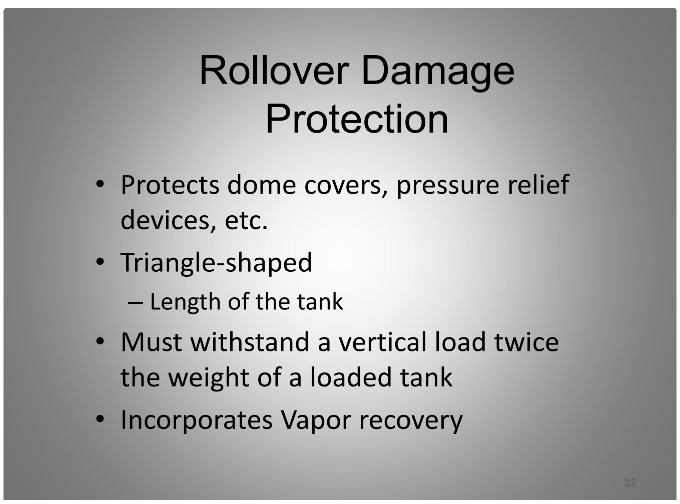

**Slide 30**

Interior baffles are configured with holes on the top, bottom and center as pictured in the slide. They allow for equalizing the product and vapors and reducing surge while the vehicle is in motion.




**Slide 31**

Some Cargo Tanks have two additional holes in the baffles which are located at 3 and 9 o'clock. Often, when these additional holes are present, they are identified by two black dots painted at 3 and 9 o'clock at the rear of the cargo tank. These additional holes are advantageous in the event that the Cargo Tank is on its side and they allow the product to pass through the baffle below the center hole. When these additional holes are present, and off loading the product utilizing the drilling method, only one hole is needed on either side of the baffles. This allows the product to drain both sides of the tank between the baffles. In the illustration above if these optional holes were not present you can see that the product will not flow below the bottom of the baffles and two holes would be necessary to drain the product one on either side of the baffles.




**Slide 32**

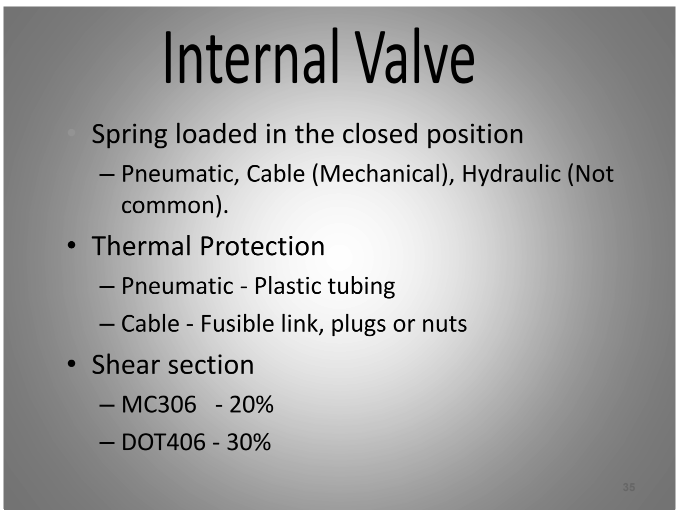
Rollover damage protection provides protection to dome covers and relief devices. The rollover protection is triangle shaped and runs the length of the tank and incorporates the vapor recovery. It is designed to withstand a vertical load of twice the weight of a loaded tank.


**Slide 33**

The picture in the slide illustrates the rollover protection, which protects the exposed devices on the top of the Cargo Tank in a rollover accident. In the photo we can see the spill box, dome covers and vapor recovery hose.

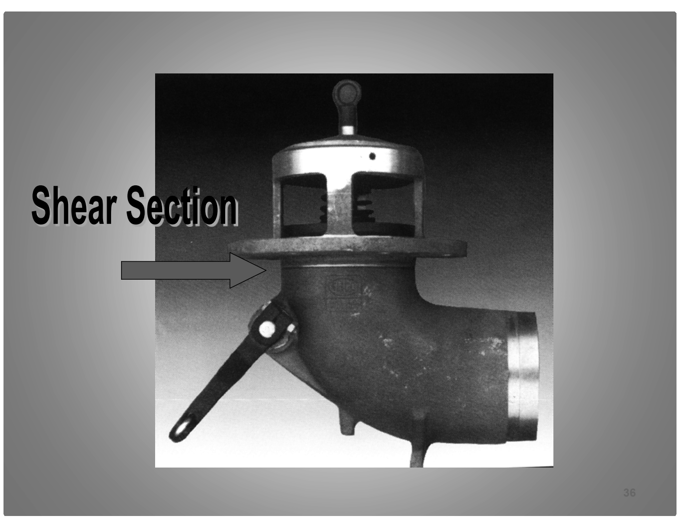

**Slide 34**

Each compartment will have its own dome cover. For example, a 2 compartment tank would have 2 dome covers. These dome covers are spring loaded and are not used for loading and unloading. They may have pressure relief and vacuum relief valves along with vapor recovery built into them.



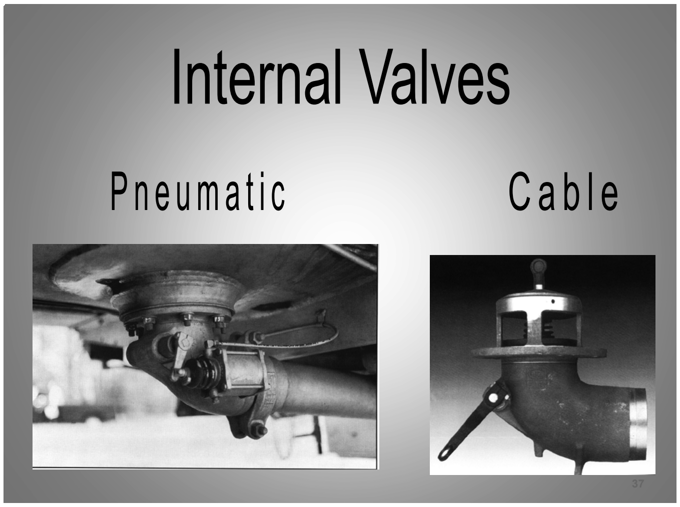

**Slide 35**

The internal valve is spring loaded in the closed position and must be forced into the open position by either pneumatic, cable or hydraulic means. Each of these designs have safety mechanisms built into them. The pneumatic system utilizes plastic tubing which allows the spring in the internal valve to close in the event of a loss of air. The hydraulic system utilizes fusible plugs which allows the spring in the internal valve to close in the event of a loss of fluid. The cable system utilizes a fusible link, which allows the spring in the internal valve to close in the event of a loss of tension. The MC 306 internal valve has a shear section of 20% thickness reduction and the DOT 406 has a shear section of 30% thickness reduction which was one of many safety design improvements.



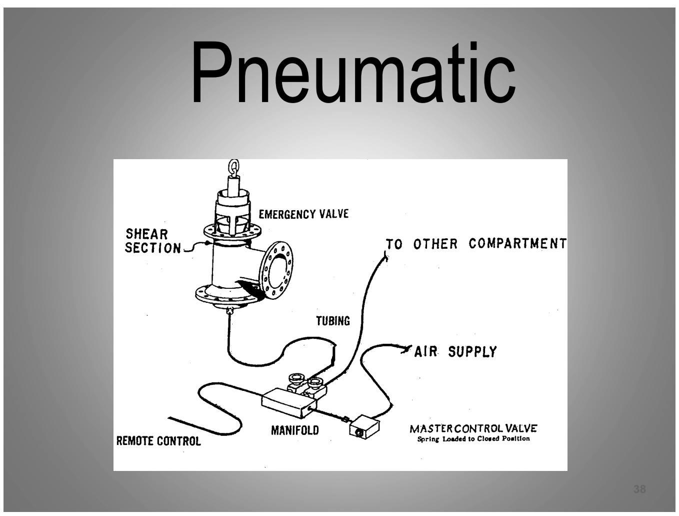

**Slide 36**

In the photograph above the arrow points to the shear section which is a score cut on the valve. The shear section is designed to allow for the piping to break off at the score in the event of an accident to prevent the valve from tearing the belly of the tank. The internal valve is spring loaded in the closed position and in the event that the piping is sheared off the only product released would be the amount in the pipe which is approximately 10 gallons.



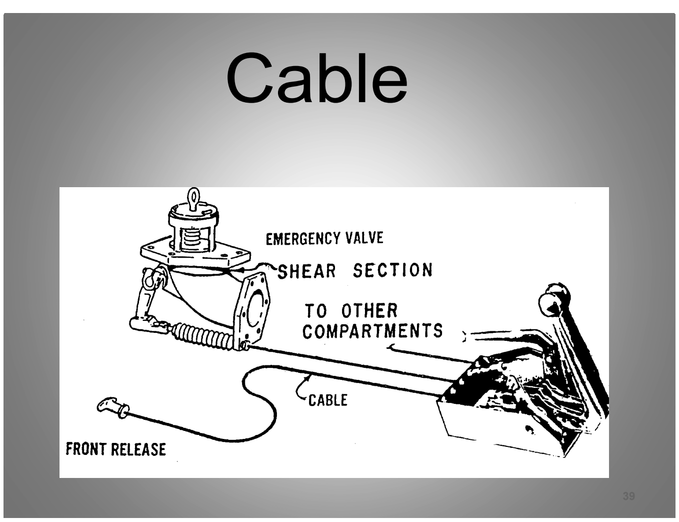

**Slide 37**

Internal vales are spring loaded in the closed position and must be forced open either by pneumatic (air), hydraulic (fluid), or mechanical (cable) means. The above photos illustrate the pneumatic and mechanical internal valve examples.



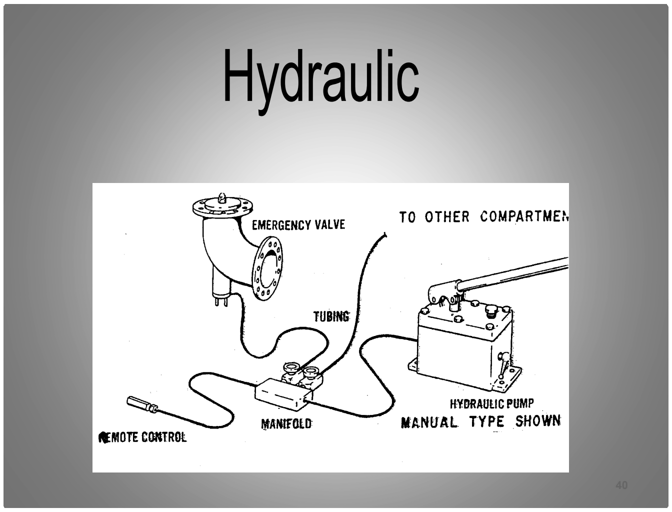

**Slide 38**

The pneumatic internal valve example in the slide illustrates an air supply which passes through plastic tubing to a master control valve and manifold. The air is directed to the internal valve from the manifold which places enough pressure to the valve to overcome the spring and force the valve open. If the plastic hose loses air pressure from either breaking or melting from a fire, the spring will close the valve.



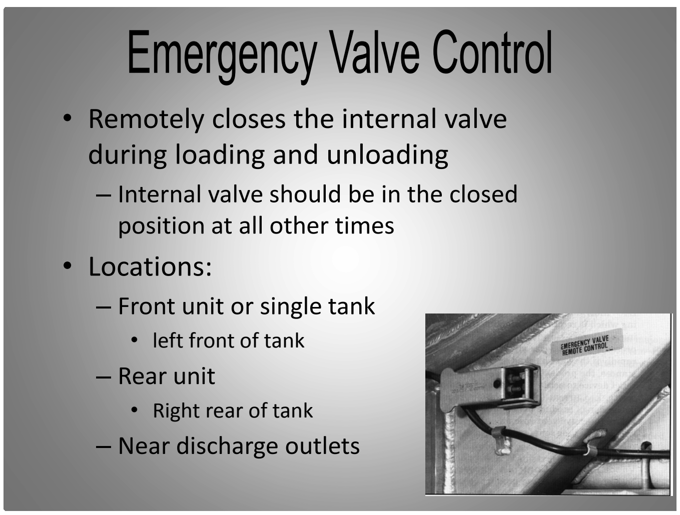

**Slide 39**

The mechanical (cable) operated internal valve example in the slide illustrates a cable which is attached to a handle. When the handle is operated, the cable pulls an arm on the internal valve and forces the valve open. The mechanical system has a fusible link attached to the cable, which is designed to melt and cause the cable to release in the event of fire, allowing the spring on the internal valve to return to the closed position.



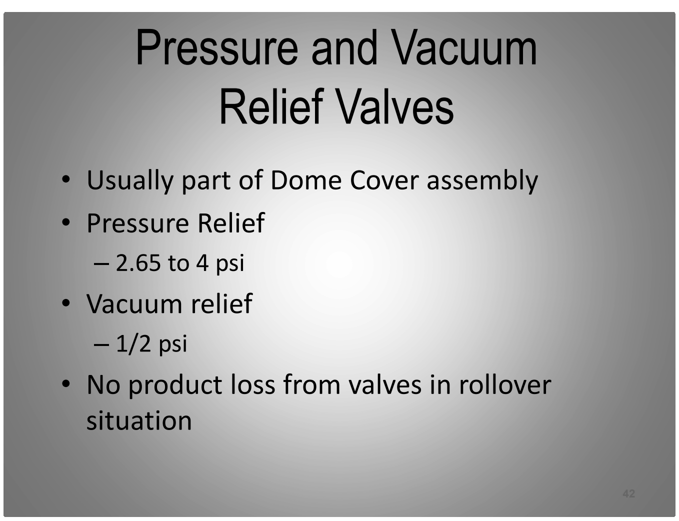

**Slide 40**

Some internal valves are hydraulic and are operated through the use of hydraulic fluid forcing the internal valve open for loading and unloading operations. The remote safety control has a shear section and when broken off releases the hydraulic fluid and allows the valve to close in an emergency.




**Slide 41**

Emergency valve controls remotely close the internal valve during loading and unloading. The internal valve is normally in the closed position and must be activated to open. The location of the emergency control valve is at the left front of the tank on a front unit (or single tank) and at the right rear of the tank on the rear unit, and near the discharge outlets.

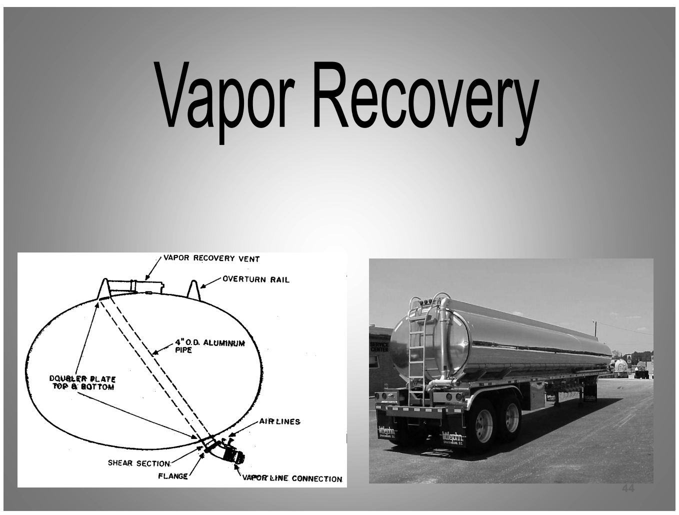



**Slide 42**

Safety devices are normally integrated into the dome cover and include both pressure and vacuum relief valves. Pressure relief valves are normally set at 2.65-4 psi and vacuum relief at 0.5 psi.


**Slide 43**

Vapor recovery systems serve several functions - they contain flammable vapors, protect the environment and recover fuel during transfer operations.

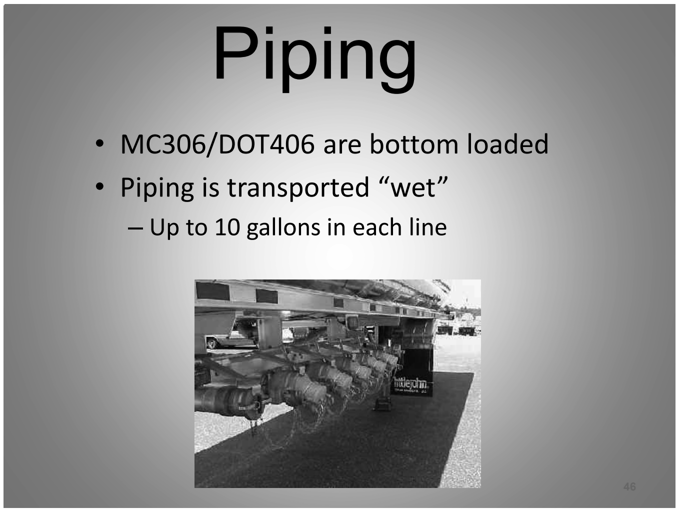



**Slide 44**

The figure shows the plumbing of the vapor recovery system in an MC 306/DOT 406 Cargo Tank. During transfer operations, vapors are recovered and returned back into the Cargo Tank.

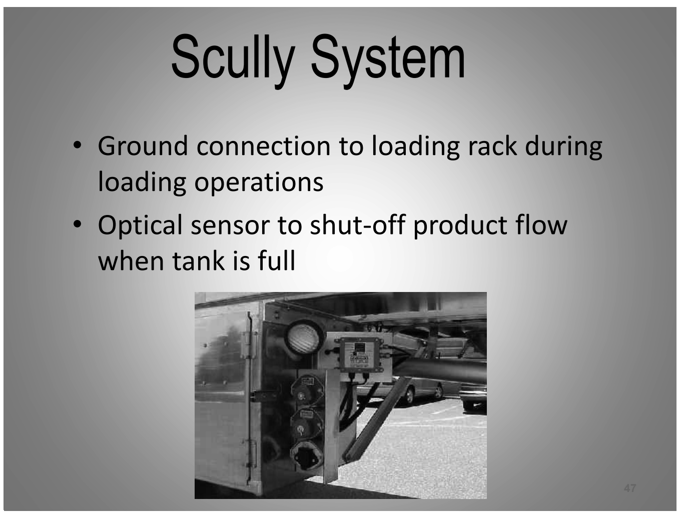

**Slide 45**

The vapor recovery valve is a return line which returns vapors back into the tank during transfer




**Slide 46**

MC 306 and DOT 406 Cargo Tanks are bottom loaded. The piping is transported wet and will normally have up to 10 gallons in each line.




**Slide 47**

Scully systems shown in the figure are built - in safety systems which shut off product flow when the tank is full.

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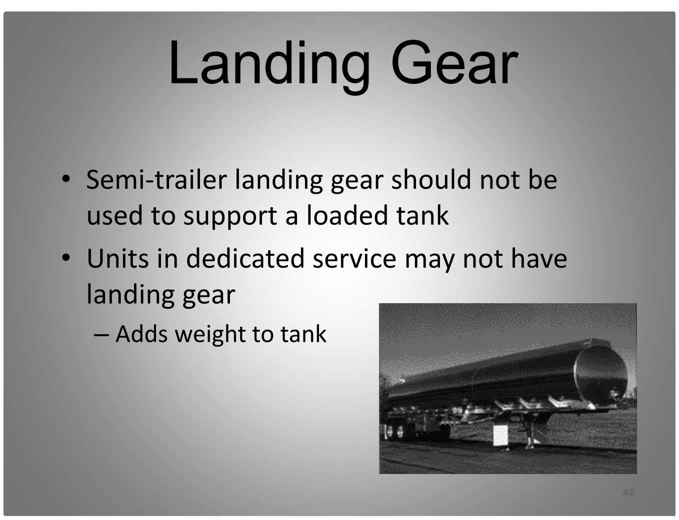
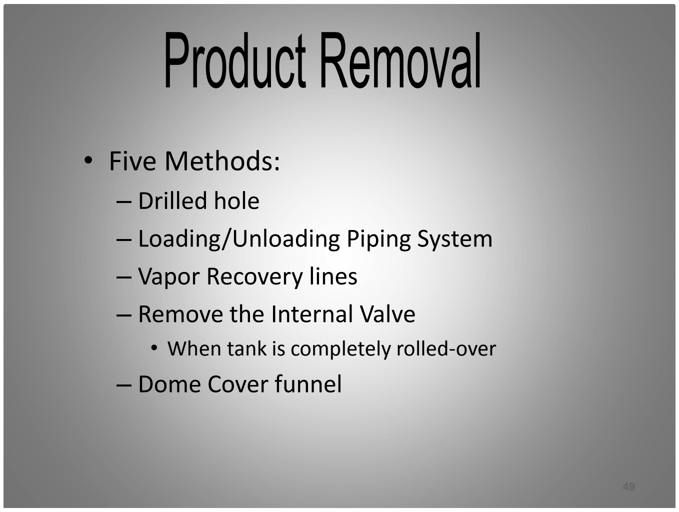


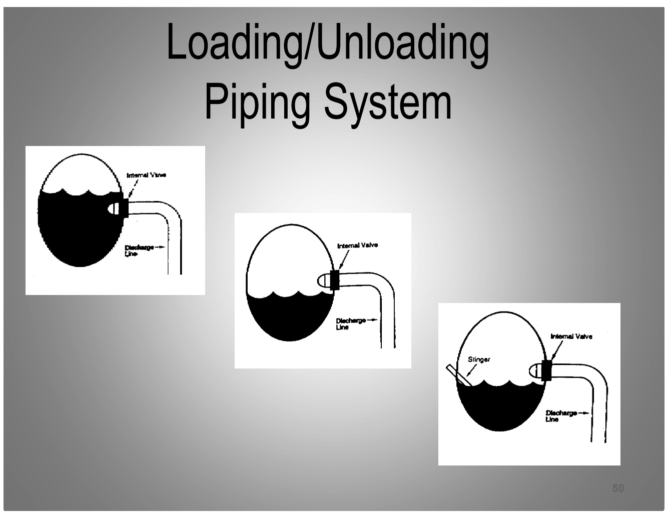

**Slide 48**

Semi-trailer landing gear should not be used to support a loaded tank due to the potential for failure. Many dedicated Cargo Tanks do not have landing gear due to the added weight to the Cargo Tank.



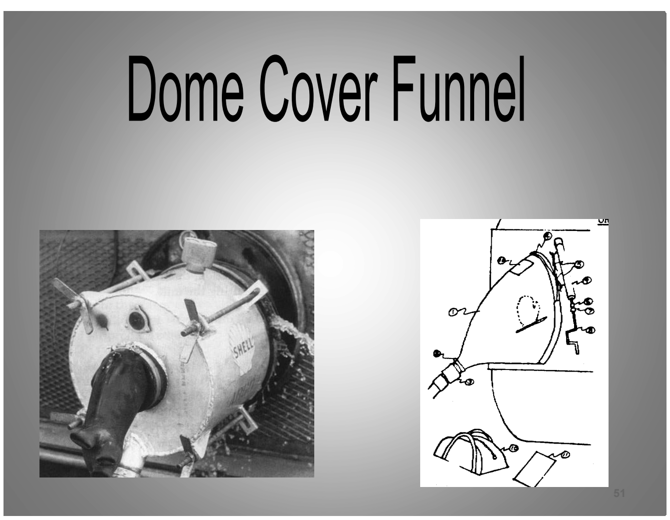

**Slide 49**

There are generally five recognized methods for product removal. They include drilling a hole(s), utilizing the piping system, utilizing the vapor recovery lines, removal of the internal valve or the dome cover funnel.




**Slide 50**

This figure depicts the combinations use of utilizing the internal valve in conjunction with a stinger. Once the product level falls below the internal valve a hole is drilled to off load the remainder of the product. The product is removed through the drilled hole with a pipe that is inserted and connected to a vacuum truck. This pipe is referred to as a stinger due to the angle on the end of the pipe resembling a bee stinger.

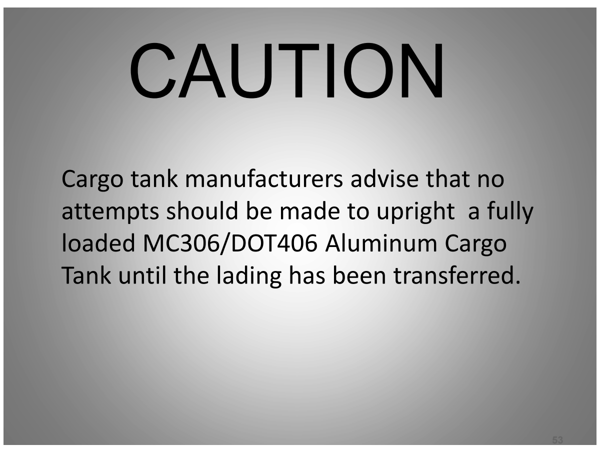



**Slide 51**

A dome cover funnel is one alternative for off-loading. This figure shows an example of a dome cover funnel.

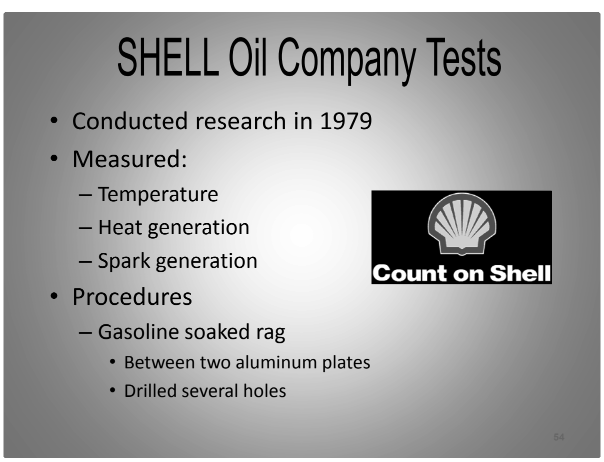

**Slide 52**

Off-loading an MC 306 or DOT 406 Cargo Tank using the drilling method.



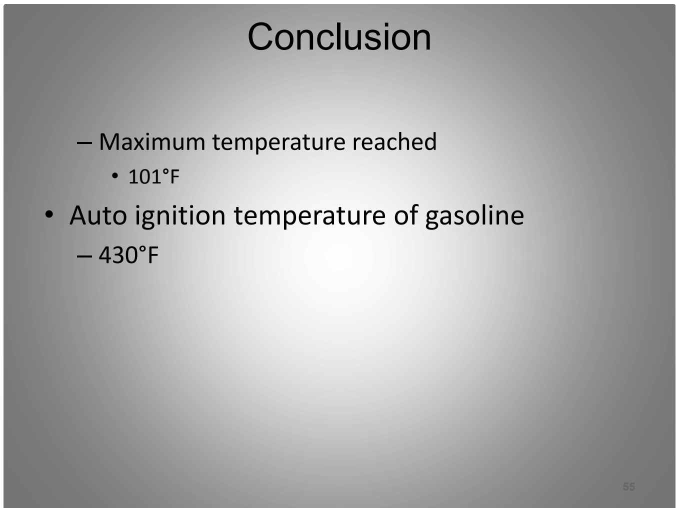

**Slide 53**

Emphasize to the students the caution issued by Cargo Tank manufacturers. They advise that no attempt should be made to upright a fully loaded MC 306 or DOT 406 Aluminum Cargo Tank until the lading has been transferred. Aluminum cargo tanks are at risk of tearing open and spilling the lading if attempts are made to upright it while it is full.




**Slide 54**

In 1979 Shell Oil Company conducted research to determine the hazards associated with drilling into aluminum Cargo Tanks. They measured temperature, heat, and spark generation. They simulated the conditions utilizing a gasoline soaked rag between two aluminum plates and drilled several holes.

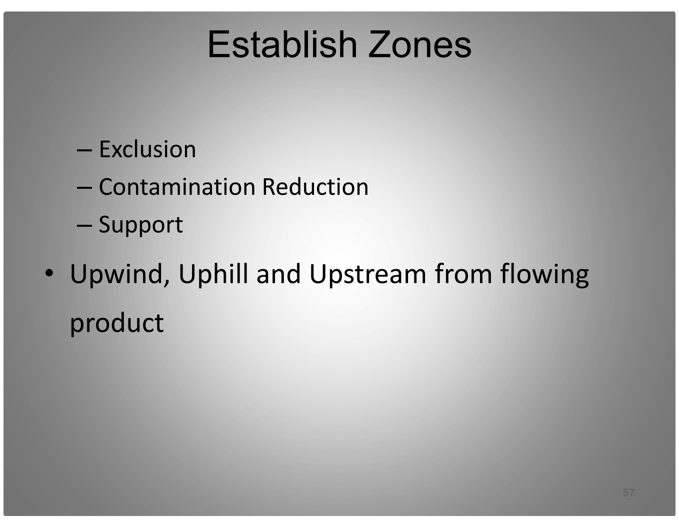



**Slide 55**

Conclusions from the test revealed that the maximum temperature reached was 101 degrees, Fahrenheit. Auto ignition temperature for gasoline is 430 degrees, Fahrenheit.

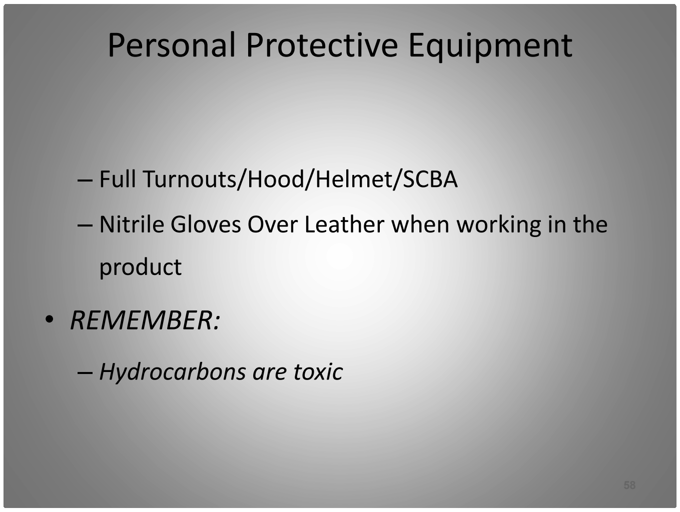

**Slide 56**

Point out to the students that a checklist for, "Site Control" can be found in the participant manual.



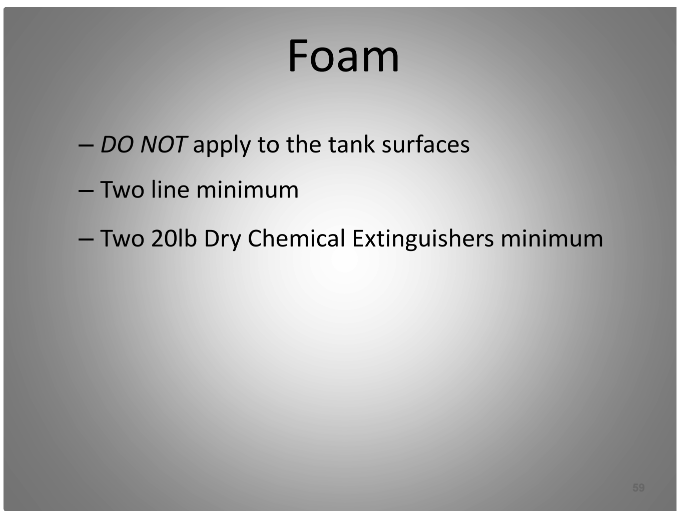

**Slide 57**

Remind the students of the first consideration at a hazardous materials incident is, Safety, Isolation and Notifications (SIN). Ensure that you are upwind, uphill and upstream and relay this information to responding units. Establish appropriate zones and clearly identify them for others operating at the scene.



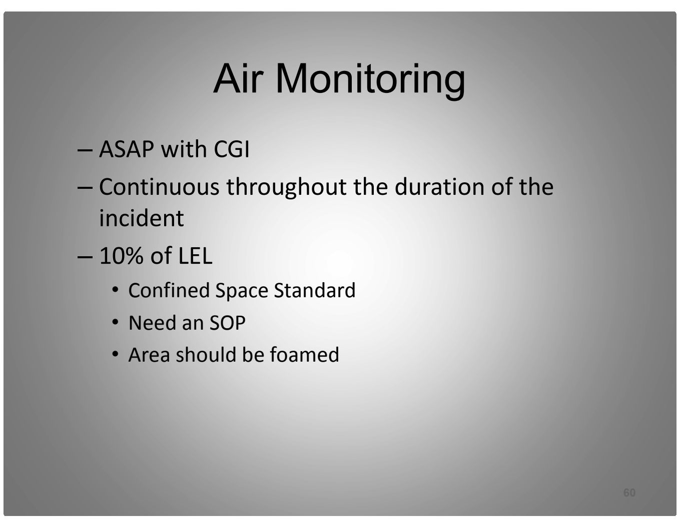

**Slide 58**

Although Flammable and combustible liquids have secondary hazards, the primary hazard normally is fire. PPE for these types of incidents normally call for the use of fire fighting turnouts and SCBA. Hydrocarbons are toxic and PPE can be augmented with nitrile gloves, which are large enough to go over leather fire fighting gloves, to prevent absorption through contact with the hands.



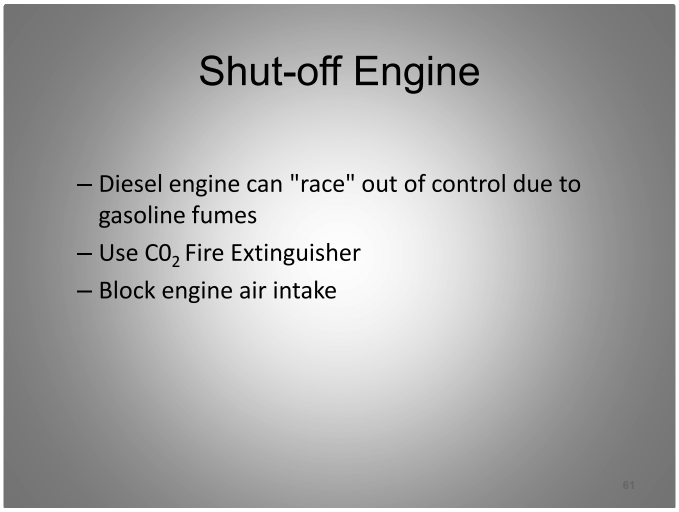

**Slide 59**

Safety considerations include the application of foam to reduce and/or eliminate flammable vapors. Foam should not be applied to the cargo tank surface directly, it should be directed onto product on the ground. Additionally, consideration should be given to deploying two fire fighting lines with sufficient hose to apply protection to any part of the tank. These hose lines should be loaded and have dedicated firefighters in appropriate PPE to place them into immediate operation, if needed. Also, consideration for two 20 lb. dry chemical extinguishers should be placed with dedicated firefighters in appropriate PPE to place them into immediate operation if needed.



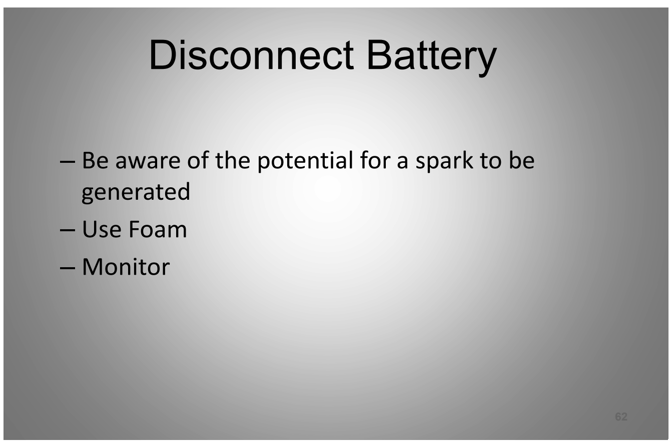

**Slide 60**

Air monitoring should be established as early as practical. One of the most dangerous situations can be the presence of flammable vapors, and readings should be in accordance with the agency's standard operating guidelines. The 10% LEL confined space standard may be adopted for confined spaces and 20% LEL standard may be adopted for incidents occurring outdoors. In either instance, these conditions may be improved by deploying a foam blanket to reduce or eliminate flammable vapors.



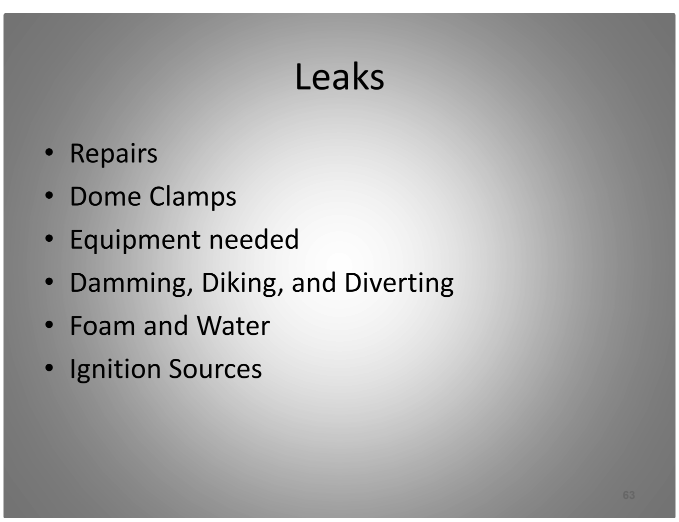

**Slide 61**

Attempts should be made to shut off the tractor engine if it is running, (attempts to access the cab to use the engine shut off should be considered when practical). Other methods, including the use of a C02 extinguisher or blocking the air intake, may also be effective .



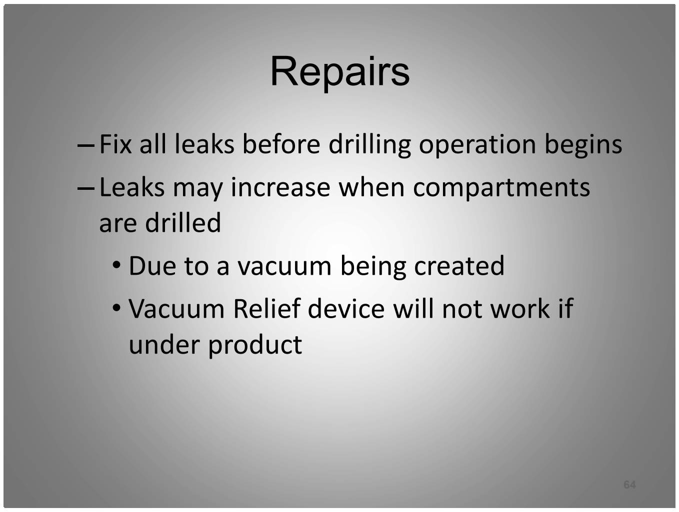

**Slide 62**

Remind students that the battery is a potential source of ignition. Whenever practical attempt to locate and speak to the driver who may be able to assist in locating the main battery shutoff. Additionally, the driver may be a valuable resource in identifying unique features to the cargo tank.



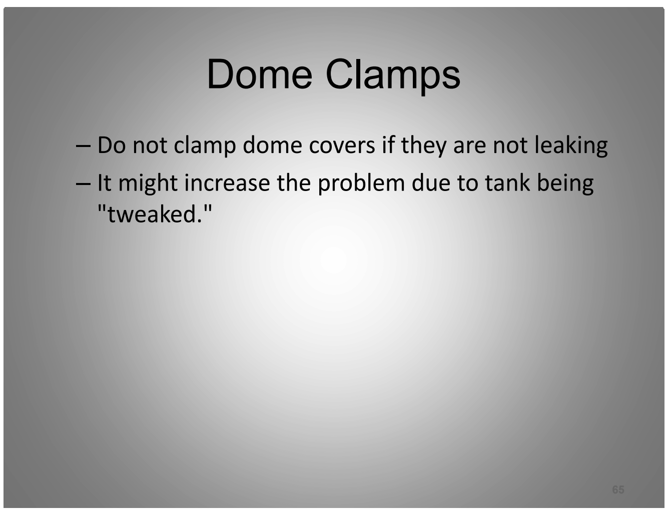

**Slide 61**

Attempts should be made to shut off the tractor engine if it is running, (attempts to access the cab to use the engine shut off should be considered when practical). Other methods, including the use of a C02 extinguisher or blocking the air intake, may also be effective .



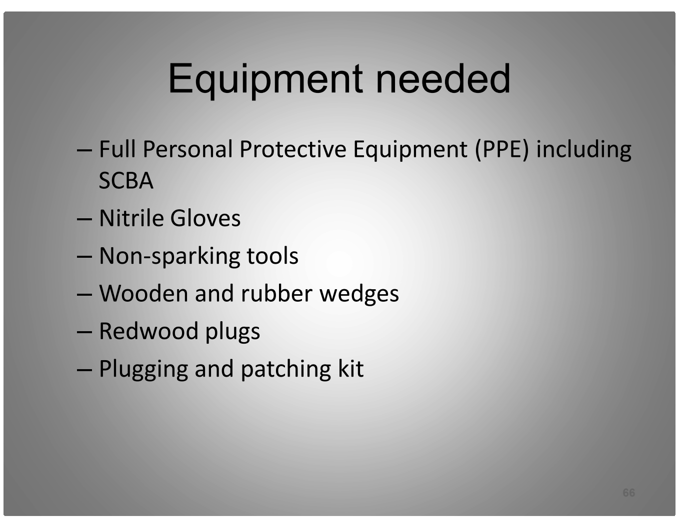

**Slide 64**

Overturned cargo tanks should be carefully surveyed and any leaks should be mitigated whenever practical. A small leak can become a significant leak once a hole is drilled and the vacuum in the tank is broken. Remember, a vacuum relief device cannot function properly when it is under the product, which could easily occur if the overturned cargo tanker is on its side or upside down. The vacuum breaker is designed to function in the vapor space.




**Slide 65**

Dome clamps can be very effective in stopping and/or slowing product leaking from dome covers. When dome covers are not leaking, dome clamps may be staged nearby or placed on the cover. However they should not be tightened which could cause the cover to begin leaking. Remember, these covers may be under substantial stress while the cargo tank is on its side or upside down in an unnatural position. The act of placing and tightening a clamp over a cover that is not leaking may be enough to cause it to leak.

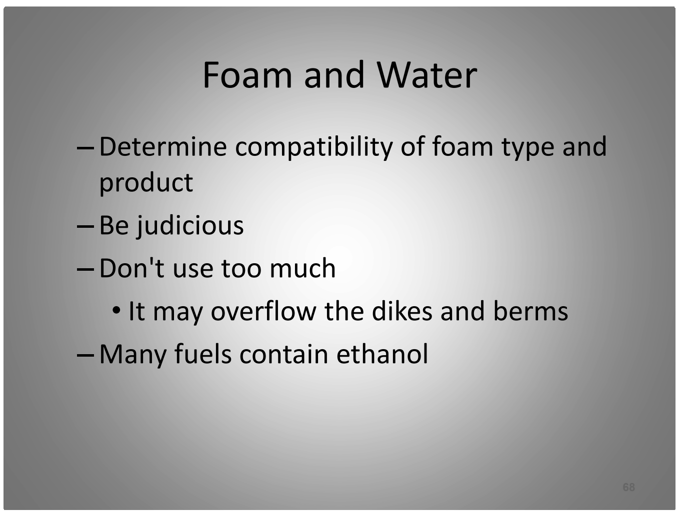



**Slide 66**

Equipment considerations should begin with personal protective equipment (PPE). Although flammable and combustible liquids have secondary hazards the primary hazard normally is fire. PPE for these types of incidents normally call for the use of fire fighting turnouts and SCBA. This can be augmented with nitrile gloves, which are large enough to go over leather fire fighting gloves, to prevent absorption through contact with the hands. Other considerations for equipment include non-sparking tools, wooden and rubber wedges, redwood plugs and equipment for plugging and patching.

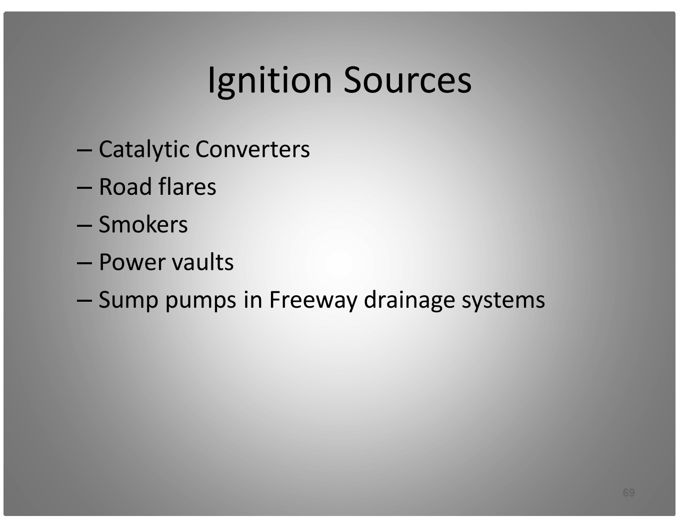

**Slide 67**

When attempting to dam, dike and divert the product ensure that areas such as storm drains and sewer covers are protected. Also direct the flow away from the overturned cargo tank and attempt to stop the flow of the product.



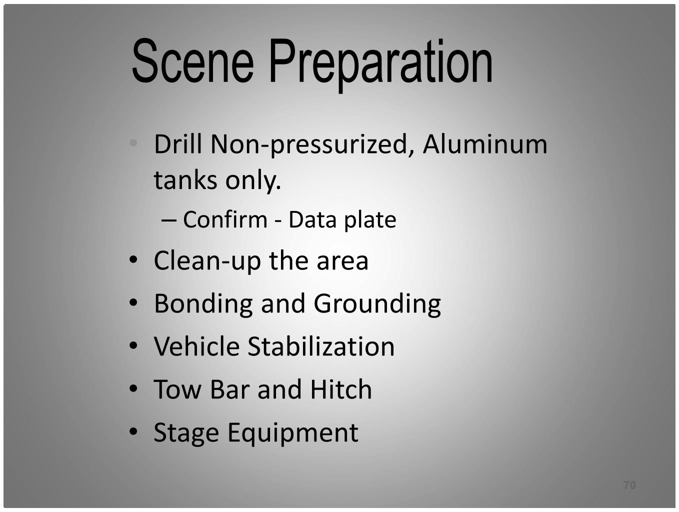

**Slide 68**

Ensure that if foam is utilized, that it is compatible with the product. Many fuels contain ethanol, which is miscible in water. Once a foam blanket is established, ensure that it is monitored for breakdown. When utilizing foam and water, use caution with regard to overflowing dikes that have been established to contain the product. Be sure not to direct foam onto the tank, which will likely create a dangerous situation with regard to slips and falls.



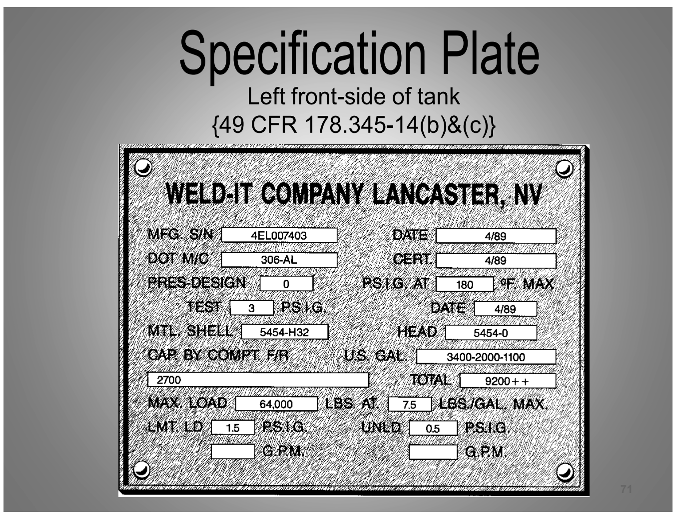

**Slide 69**

Emphasize the dangers ignition sources pose with regard to incidents involving flammable and combustible liquids. This slide shows some examples of ignition sources.



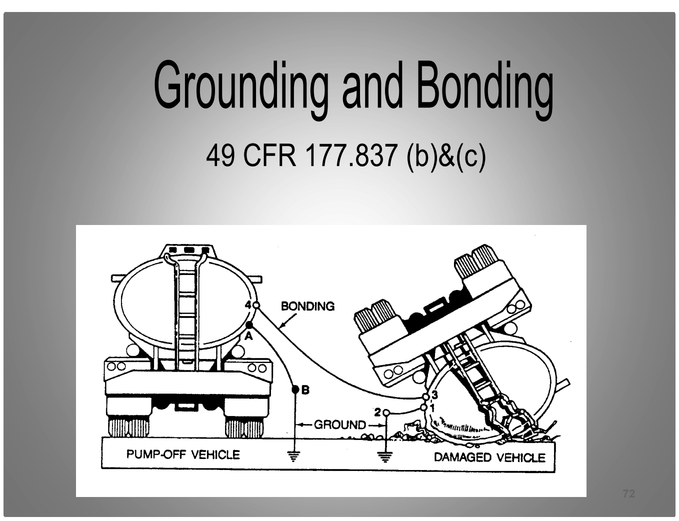

**Slide 70**

Point out to the students that there is a "Scene Preparation" example in the participant manual. This includes the caution to drill non-pressurized aluminum tanks only. Additionally, it includes checklist, grounding and bonding, vehicle stabilization tow bar and hitch danger area and equipment staging examples.



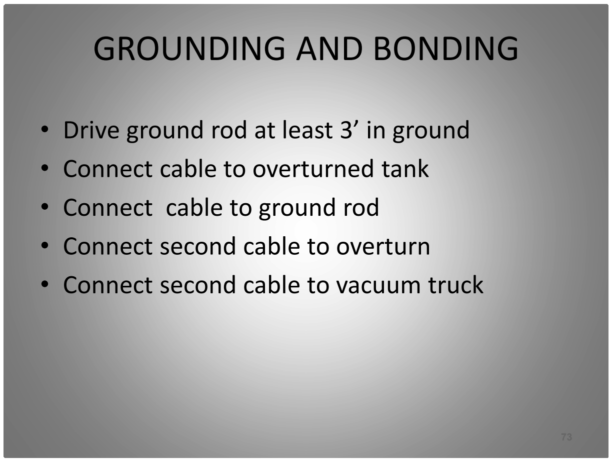

**Slide 71**

The figure in the slide shows a specification plate which illustrates the information found on the plate. The plate is located on the front left side of the Cargo Tank. In some instances where the Cargo Tank is overturned, this plate will not be accessible. Note that the DOT M/C field in this illustration indicates an aluminum MC 306.



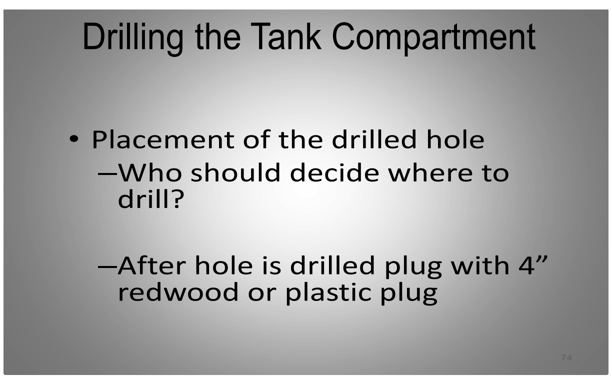

**Slide 72**

Advise the students that there is a "Grounding and Bonding" sequence example in the participant manual.




**Slide 73**

The first step of the procedure for grounding and bonding should begin with identification of a location for the ground rod, which should be upwind, uphill and upstream whenever this can be achieved. Once a location for the ground rod has been identified, the rod should be driven into the ground at least 3 feet. A post-driving tool can make this much easier than other methods such as a sledge hammer. Once the rod has been set, the ground should be measured and validated. This can be accomplished by utilizing an earth resistance instrument and readings should be in accordance with the agency standard operating guidelines. The vacuum truck should be grounded by establishing a second ground rod, as described previously, or sharing the original ground rod which was placed in step one. Once a ground has been established, the order of connecting the cables is as follows. Connections should be made by utilizing the clamp at the end of the cable. The first connection is made by selecting one end of a ground cable and connecting it to the overturned Cargo Tanker, preferably at a ground connection point. The second connection is to the ground rod. Once both the overturned Cargo Tanker and vacuum truck have been grounded the second step is the bonding process. This begins with connecting one end of the cable to the overturned Cargo Tanker and the other end of the cable is attached to the vacuum truck, bonding the two together. At the end of this sequence, both the overturned Cargo Tanker and vacuum truck are grounded and bonded.

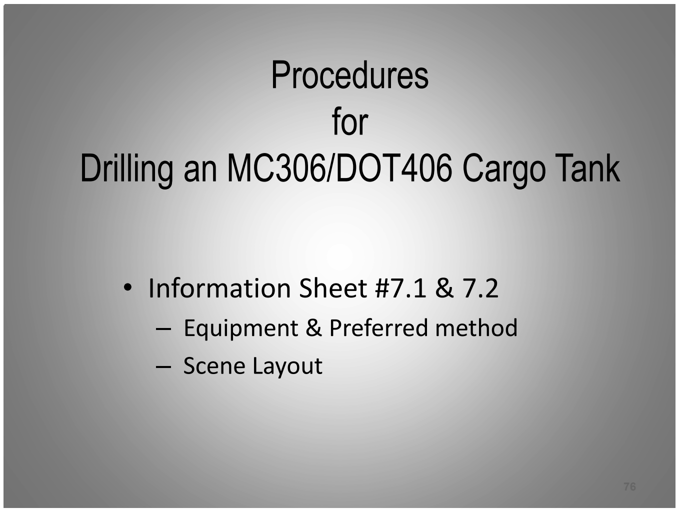



**Slide 74**

Members of the drilling team and the team leader should carefully examine the cargo tank to determine where holes will be placed prior to climbing onto the overturned Cargo Tanker. These hole locations can be identified by utilizing a grease pencil, chalk or marking pen. Once the holes are drilled the holes should be plugged with a plastic plug to keep vapors contained within the cargo tank.

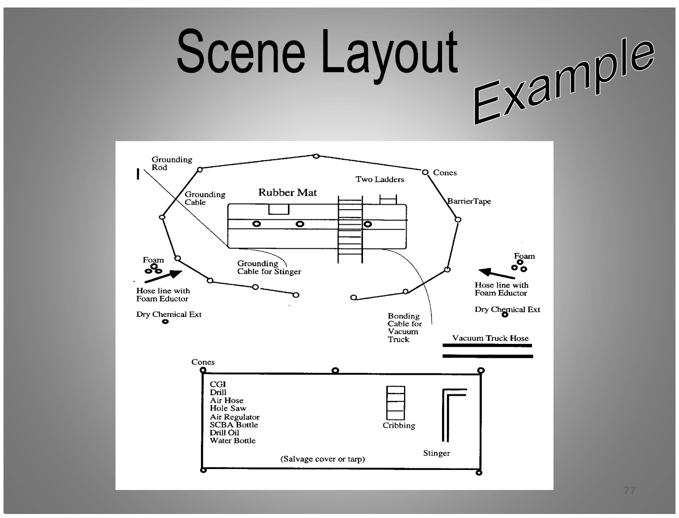

**Slide 75**

Describe to the students methods of surveying an MC306/DOT406 Cargo Tanker for areas to place drill holes. Preferred areas are in line with the dome cover or internal valve, since these areas normally do not present any obstacles. Areas to avoid can be identified by seams (when closely examining the side of the Cargo Tank) and include bulkhead and baffle seams, and double thickness areas such as pads and bolsters.



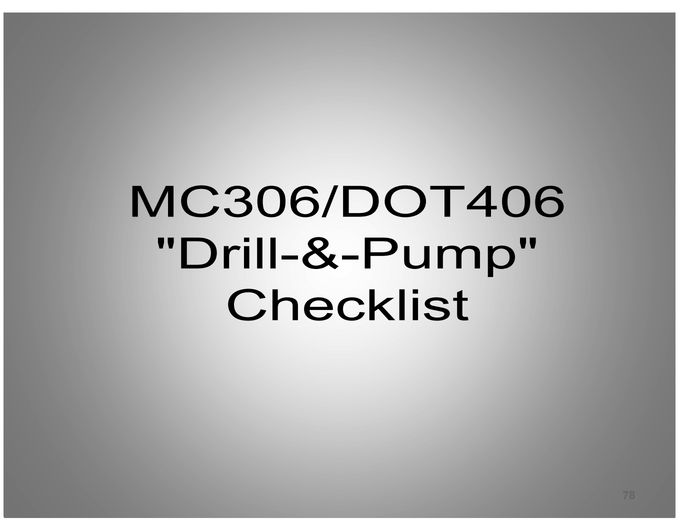

**Slide 76**

Point out to the students that there are examples in the participant manual which they can utilize for equipment checklists for drilling an MC 306/DOT 406 Cargo Tank.




**Slide 77**

Point out to the students that there is a "Scene Layout" example located in the participant manual.




**Slide 78**

Point out to the students that there is a "Drill and Pump" checklist located in the participant manual.


**Slide 79**

Ask the students if there are any questions about any of the information that has been presented in this block. Answer any questions that need clarification and/or additional explanation.

# Emergency Procedures Involving MC306/DOT406 Cargo Tanks

**Highway Transportation**

A rising number of highway incidents involve hazardous materials. According to the Department of Transportation, 90% of the hazardous materials incidents involving motor vehicles occurred in the trucking industry. The causes of trucking incidents can be attributed to human error in driving the vehicle or product handling operations, mechanical breakdown, equipment failure, or to accidents involving other vehicles.

This chapter will provide you with a basic understanding of the MC306/DOT406 cargo tanks that are most commonly used to transport flammable and combustible liquids. Design features, planning considerations and suggested operational procedures for you to consider at an emergency will be discussed.

**Department of Transportation Requirements**

The Department of Transportation (DOT) defines highway cargo tanks as "any tank(s) attached to or forming a part of any motor vehicle or any bulk liquid or compressed gas packaging not permanently attached to any motor vehicle, which by reason of its size, construction, or attachment to a motor vehicle, is loaded or unloaded without being removed from the motor vehicle."

Cargo Tanks are constructed in accordance with the specifications of the American Society of Mechanical Engineers (ASME). The Department of Transportation has published specifications for Cargo Tanks in DOT 49 Code of Federal Regulations, (49 CFR). These Federal Regulations are enforced by Federal and State agencies for both interstate and intrastate transport. Specific requirements for the manufacture, maintenance, inspection, testing and repair of Cargo Tanks are listed in 49 CFR 178.

Effective September 1, 1993, DOT released a new set of regulations that replaces the MC (Motor Carrier) 300 series specifications. After August 31, 1993, manufacturers can no longer build to MC 300 specifications but instead must meet the DOT 400 series specification. The DOT 400 series specifications require a lower center of gravity, improved rollover protection, stronger metals, improved bulkhead designs, and are somewhat larger in design to transport more product. The MC 300 series can still be used as long as they meet the new DOT 400 series specifications. To the emergency responder, this means that a wide variety of vehicles will be in service.

**Design Requirements of MC306/DOT406**

Each Cargo Tank will be equipped with a manway or dome lids or covers for each compartment. These manways are not used for loading, and are securely closed. They have rollover protection and safety devices that prevent the cover release. Cargo Tanks in California are loaded through valves in the bottom. MC306/DOT406 in California must have a vapor recovery system.

**Construction Materials**

The construction materials of the MC306/DOT406 Cargo Tanker are primarily aluminum (AL) however they can be constructed of mild steel (MS) or stainless steel (SS). The MC306/DOT406 AL is the most common transporter of flammable and combustible liquids on the highway due, in part, to its light weight. There are over 14,000 of these vehicles registered in California. Most of these are dedicated to carrying motor fuels and can switch load (diesel to gasoline, or gasoline to diesel) because of the bottom loading features. The tank skin on a MC306/DOT406 tanker is smooth, though some may have ribbing similar in appearance to that on a corrosive-carrying truck (MC 312). The ribbing is part of the container's vapor recovery system and is not designed to provide structural integrity.

Each compartment of an MC306/DOT406 Cargo Tank is required to be separated by bulk heads. These bulk heads add to the strength of the structure, are disk shaped, opposing each other, to allow transport of different products. The disk shaped bulkheads are provided with an air space and a drain at the bottom and vent at the top in the air space to help identify leaks.

The baffles in an MC306/DOT406 cargo tank are dish shaped as well, and are designed to give structural support and limit product movement. Access holes are designed into the center of the baffle for repairs and inspections. There are also holes in the upper portion of baffles to equalize vapors. Voluntary holes approximately 3" in diameter are drilled at 3 and 9 o'clock. These holes equalize liquid in the compartment if the vehicle is rolled over. Some manufacturers paint 3" dots on heads to identify baffles.

**Safety Features**

Aluminum is the transport tank of choice due to its light weight. In an accident involving a rollover, the aluminum tank will not spark when dragged on the pavement. In a fire the aluminum will melt at 1,200˚F, and usually to the liquid level when fuel is also involved. Because of its relatively low melting point in a fire, there should be little concern for BLEVE. The aluminum tank is easy to drill for emergency off-loading and is the only MC306/DOT406 a Haz Mat Technician/Specialist can drill. This is not hot tapping.

**Valves**

Each compartment of an MC306/DOT406 tanker is equipped with an internal safety valve that is "Shear Cut" by design, meaning that the body of the valve thickness is reduced at least 20%. This internal safety valve is spring loaded in the closed position. The valves may operate open by either hydraulic, pneumatic or mechanical means.

These valves are required to be equipped with a heat actuated device (250˚F), usually a fusible nut or link and cable, to allow the internal safety valve top to close when melted. Some are equipped with an air-actuated emergency system that relies on plastic air lines that will melt and close the valve. The manual controls for these emergency shut off valves are found on the left front of the tank, and a switch will be located at the right rear of the trailer or near discharge outlets.

Vacuum or relief valves are usually installed in the dome cover. These valves are designed to provide normal and emergency pressure relief. Vacuum relief valves must limit tank vacuum to 1 psi. Pressure relief systems must not be less than 125% of the maximum allowable working pressure (MAWP) or 3.3 psi, whichever is greater, and not more than 138% of the MAWP. Both are designed to prevent loss of product in a rollover. Prior to 1995 designs allowed up to one gallon release of liquid. After 1995, no releases were permitted.

**Rollover Protection**

Rollover protection, designed to withstand a vertical load twice the weight, are required on the top of tanks to protect fill openings, manholes, domes, inspection devices, and valves. Some manufacturers utilize the rollover protection as piping to link vapor recovery systems for the various compartments.

**Loading and Unloading Operations**

In California, the MC306/DOT406 cargo tanks are required to be loaded and unloaded from bottom valves to comply with emissions standards. There are safety features built into most of these operations to comply with state and federal standards.

The discharge piping from the bottom of the tank used for loading and unloading operations may be protected by guard rails or break away piping from emergency valves. Emergency responders should be aware that the discharge piping can contain as much as ten gallons of product in each line.

There are many safety devices incorporated into loading racks that increase safety. These include, but may not be limited to electrical sensors on the trucks, deadman switches, and computerized presets.

Off-loading operations are conducted via gravity. The piping is equipped with a vapor recovery system that can collect as much as eight gallons of liquid for a 9,200 gallon tank.

# Emergency Off-Loading of Hydrocarbon Products from an Aluminum MC306/DOT406 Cargo Tanker

## Rationale: The Shell Oil Company Test

The Shell Oil Company conducted research on drilling operations on aluminum cargo tanks as a means of off-loading product. They measured the temperature, heat generation and spark generation when drilling a 3" or 3 1/2" hole in a vapor rich tank filled with gasoline.

## Test Procedures

Using gasoline soaked rags clamped between two plates of aluminum, they drilled several times with a sharp hole saw under cooling water. The results indicated that the temperature reached only 50˚F. The same results were recorded when using a worn drill and cooling water. Overall, the thermocouple in the gasoline soaked rags did not exceed 101˚F.

## Conclusion

Gasoline has an auto ignition temperature of 430˚Fahrenheit. However, test drilling did not exceed 101˚F. The manufacturers recommend off-loading of hydrocarbons prior to lifting or righting the tank. Additional damage can occur when trying to move a loaded aluminum cargo tank (i.e. splitting the tank and creating environmental problems as a result of contents spilling).

## Sample Procedures

Off-loading gasoline or other hydrocarbons from an MC306/DOT406 can be a dangerous operation. The following procedures are presented as guidelines from the Los Angeles County Fire Department for safe and effective off-loading operations. Consider all options, discuss the factors contributing to your decision to off-load, and proceed with safety as your number one priority during all evolutions of this operation.

### Size-Up

Upon arrival at the scene of a tank truck rollover incident, you should size up the incident as it pertains to Haz Mat. On scene fire department companies may have already handled some of your problems, but you need to assess the following factors to make sure:

1. Do you have a fire?

2. Do you have a spill?

    a) Where is it going?
    b) Can it be controlled?

3. Do you have a leak?

    a) How large is it?
    b) How many gallons are involved?

4. Is there a rescue problem?

    a) Driver
    b) Other motorists
    c) Others

5. Are you upwind and uphill?

6. Can you confirm the identification of the product?

    a) Obtain shipping papers
    b) Check placards
    c) Talk with the driver

7. Can you control all sources of ignition in the immediate area?

8. Is the traffic controlled in the hazardous area?

## Resources

Consider requesting additional resources through the Incident Commander:

1. Fire Department Resources:

   a) Task forces
   b) Rescue crews
   c) Foam carriers
   d) Additional battalion chiefs
   e) Helicopters
   f) Emergency air SCBA's
   g) Skip loader

2. Police Agencies:

   a) Local police
   b) Highway patrol

3. Materials:

   a) Sand for diking
   b) Crushed asphalt

4. Additional Agencies to assist the IC:

   a) Department of Transportation
   b) County Health
   c) EPA
   d) Flood Control
   e) Coast Guard
   f) Caltrans Haz Mat Team
   g) Fish and Wildlife
   h) Air Quality Management District

5. If drilling is indicated:

At least two vacuum trucks and two large tow trucks will be needed. These will normally be ordered by the owner of the overturned tanker, Caltrans or CHP.

Use of immediate resources available at the scene:

1. Traffic Control using apparatus

2. Dirt for diking

3. Plastic for blocking storm drains

4. The driver can provide important information:

    a) Product identification
    b) Amounts
    c) Name(s) of owner(s)
    d) Phone numbers
    e) Special hazards
    f) Possible contracted clean up companies

Contacting the owner or responsible persons should be done early on. This action will facilitate the timely contact of a disposal company. The IC should keep in mind that the owner will probably need to order two clean vacuum trucks; one for the contents left in the trailer and one for any product on the ground (including foam and water). The owner will also be responsible for ordering two large tow trucks to upright the empty tank.

If the owner is not capable of paying, County Health, EPA or Caltrans (if the incident is on the freeway) may be able to secure "super funds" to pay for abatement of the hazard.

**Site Control**

Site control and product identification is very important at this point. You are in charge of the Haz Mat part of the incident, so take command as soon as possible. Act, don't react. Make sure you are up hill/wind. Identify the Exclusion Zone with haz mat barrier tape. Have your personnel in full turnouts, with SCBA if they are in the Exclusion Zone or areas where vapors are present. Do not allow more people into the Exclusion Zone than are required to perform the necessary jobs. Keep everyone else away from the tanker.

Personnel who are not members of the Entry Team, but who are manning protective hose lines should be placed around the tank outside the barrier tape. They should be in full turnouts. They should also be wearing SCBAs or respirators as required, based on environmental monitoring. Remember, hydrocarbons are toxic.

If the first-in companies have not laid down foam on the spill, do so prior to entering or performing any work in or around the spill. Do not apply the foam to the tanker. This causes the work area to become slippery and serves no useful purpose. To protect personnel, place an 1 1/2" hose line and several dry chemical extinguishers in position before attempting containment, diking, patching or plugging operations, or disconnecting batteries. Always be aware of vapor concentrations.

Air sampling shall be conducted as soon as possible by response personnel with combustible gas detectors. Air sampling shall continue throughout the entire incident; as long as members are in the danger area or until the product on the ground and/or in the tank is removed. This will ensure a safe working atmosphere for all members. If vapors are detected at an unsafe LEL, all personnel shall be removed until the area is re-foamed and the vapor concentration is brought back to a safe level.

Make sure that the diesel engine on the tank truck is shut off. If it is not, the diesel engine may be fed by the rich vapors of the gasoline/product and will continue to increase its RPM's until the engine blows up. If this occurs, you will not be able to shut off the engine from inside the cab or via the emergency shut off. You must cover the air intake or use a CO2 extinguisher in the air intake of the diesel engine to stop it.

Check to see if the batteries have external disconnects. If they do, disconnect them. If they don't you must open the battery box(es) to disconnect the batteries. Use non sparking tools when disconnecting the batteries to decrease the chance of ignition. Ensure that an explosive atmosphere does not exist before disconnecting the batteries.

**Leaks**

Stopping the leak(s) may be difficult, depending on where they occur. Plugging and patching materials may be used when it is safe to do so and the hole is not too large. The leak may be slowed down by using wood or rubber wedges before using the patching materials. Remember this is only a temporary patch and will not hold for long periods of time. Use aluminum tape with epoxy glue over it for extra holding capability. Remember the leak will increase when the compartment is breached.

Check dome covers to see if they are leaking because they are not designed to hold back pressure. If they do leak, consider using the dome cover clamps. You may have to place wooden wedges behind the clamps and between the pressure relief valves which are incorporated in the dome covers. If they are not leaking, do not touch them. You may cause them to start leaking.

The following is a list of equipment which may be needed to stop a leak:

- All safety equipment and SCBAs
- Non-sparking tools
- Nitrile gloves over your fire fighting gloves
- Wood/rubber wedges
- Redwood plugs
- Plugging and patching materials
- Epoxy
- Duct or aluminum tape
- Series “A” Patch Kit

Try to protect the environment by attempting to contain the product and prevent it from spreading. This can be accomplished by using dirt, sand, absorbent or other materials which are readily available. Plastic works well on curb and street drains that have metal grates. Use several layers of plastic by overlapping it. Lay the plastic the way it comes on the roll; it’s thicker that way. Place your dirt or sand on top of the plastic. For drains or areas with large openings where support is needed, you can use metal street signs, wood, or canvas floor runners. Then lay plastic down and cover with dirt/sand. You can also divert the flow away from the drain openings. Try not to contain the product under or near the overturned tanker. Channeling the liquid away from the tanker provides a safer work area for firefighters and will limit flame impingement on the tanker in the event of a fire.

Try not to flow any more foam/water than you need to. Doing so may cause you to over flow the barrier/dikes and spread the product.

Check for ignition sources such as street/freeway drains which may have automatic sump pumps, power vaults, catalytic converters, flares, smokers, structures and fire apparatus. Remember, when you contain the product you limit your ignition sources.

## Off-Loading Using The Drilling Method

The drilling method is for non-pressurized aluminum tanks only. Under no circumstances should you drill a steel or pressurized vessel. Special considerations must be employed if you have a stainless steel tank. Aluminum and stainless steel tanks can both be highly polished. However, aluminum is soft and will scratch easily. Stainless steel tanks are normally used to carry dairy products or products that are corrosive. They are not normally used to transport hydrocarbons.

Steel tanks are much more dense and heavier. The tanks are usually dark in color (anti-rust coating) and are not shiny like stainless or aluminum tanks. You can look for rust on the tank or use a magnet for a more positive identification.

Once the vacuum trucks are on scene, and you have confirmed through monitoring that the area around the tanker is safe, it is time to prepare the tanker for off-loading. If there is product on the ground around the tank, have the vacuum truck pick it up first. Move the second vacuum truck into place when it is safe.

All tankers and vacuum trucks carrying flammable liquids are required to ground their vehicles whenever they are flowing any liquid. When transferring or vacuuming any flammable product, every vessel must be bonded together and grounded to a suitable ground. This will prevent a spark from a static electric charge created by product flowing through hoses.

The grounding/bonding process should always begin by grounding the truck/trailer to a verified ground. Once this has been accomplished, the stinger and vacuum truck are then bonded to the truck/trailer using a separate cable.

One way of obtaining a verified ground is to use a 4’ copper grounding rod. When using this rod, it is best to dig a hole 4 to 6 inches deep and then pound the rod into the ground at least 3 feet. Add water to make the ground more conductive. You now need to verify that the ground is good. One method is to extend the electrical cord from the generator to the rod and use a continuity tester to verify the ground.

Stabilize the tank by cribbing. The tank may shift due to the weight change as it is being off-loaded. The cribbing may need to be adjusted after each compartment is emptied to ensure that the tank remains stable.

If the truck and trailer are still attached by the tow bar and hitch, it may be difficult to separate them. They may be under tension. A chain should be placed around the hitch and frame so if it does disconnect it won’t cause additional damage or injury. Leaving them hooked together will help to stabilize the tank.

Place all equipment on a salvage cover outside the exclusion zone. This will identify the equipment area. Equipment should include:

- Drilling tool box kit
- Pump off tube
- Grounding rod with cable reel
- Rubber mat
- Two 12’ ext. ladders w/o pike poles
- Dry chemical extinguisher
- Foam nozzle/foam
- One 1” hose line w/decon wand or small spray bottle for cooling the drill
- 30/60 minute air bottles
- Air regulator

## Drilling the Tank Compartment

The actual drilling of the tank shell consumes approximately one minute. You will be able to drill one hole with a 30 minute bottle and 2 holes with a 60 minute bottle.

If the tank is leaking, or the potential for a leak exists, drilling a hole into the compartment/tank will vent the tank interior to the atmosphere thereby increasing the quantity of the leak. Therefore, it is important not to drill the tank until all other concerns such as grounding, bonding, cribbing, protective lines, and extinguishers are in place, and the vacuum truck is in position.

The placement of the hole to be drilled in the tank should be discussed amongst the drilling team. Care should be taken to avoid areas on the tank that have double thickness such as piping supports. Do not drill the hole over a baffle or bulkhead seam. Try to drill the hole at the upper most part of the tank compartment to ensure drilling into a vapor space. Note: a loaded tank should have approximately 3% to 10% outage, or vapor space, depending on the compartment size. The smaller compartments have the least outage.

NOTE: The probability of causing an ignition while drilling into the vapor space of the tank/compartment is very low. However, the operation should be carried out in a careful manner with a sharp saw blade and using water to cool the saw cutting area.

A captain or safety officer who is familiar with the drilling procedures will enter with a team/monitor and mark the tank where the hole will be drilled. A good guideline is that if the tanker is on its side, you should place the hole in line with the dome/hatch cover located on the top. This will alleviate the chance of drilling into a baffle or bulkhead. If the tanker is on its top, you will not be able to use the dome covers as a guide. Place the mark two feet from the internal valves towards the center of the compartment. Use the tank seams as a guide.

## The Procedures

Manned foam hose lines and dry chemical extinguishers should be positioned on both sides of the tank first.

Two 12’ extension ladders should be placed against the tank for access and egress, one on each side.

The driller goes in first, bringing a rubber mat with him because the top of the tank becomes very slippery.

After placing the mat on the tank, the driller straddles the tank and gets ready to drill on the predetermined marked area.

A helper brings in the water/wand for cooling the tank and takes a position where he can easily reach the hole that is going to be drilled. He should be standing on the ground.

All personnel and equipment should be removed before the tank is uprighted. The only members in the area should be the ones manning the protective lines and the Safety Officer. Usually two tow trucks are needed to upright the tanker. Response personnel may have to supervise their operation. It may also be necessary to provide some sort of safety clothing in case of a flash.

The CHP and the tow truck driver will check to see if the truck is operable. If it is not, and it has to be towed, that tank will also have to be off-loaded.

The truck and trailer tanks may now be towed away.

**Summary**

Often the most effective way to handle an overturned aluminum MC306/DOT406 cargo tanker is to drill the tank and off-load the product. The procedure is fairly simple. However, there are inherent risks involved. Response personnel must carefully assess the situation to evaluate the options. If the tank is to be drilled and off-loaded, several safety precautions must be in place and proper procedures must be followed to ensure the safety of personnel and the environment. The procedure should be practiced, in full protective clothing, until response personnel are comfortable and confident.

Review Questions

1. What are the major causes of trucking incidents?

2. What are some of the operational requirements for safety valves on the MC306/DOT406 cargo tanks?

3. What are the factors which must be assessed at the scene of a tank truck rollover?

4. Where should foam be applied in a spill situation?

5. What are some options for handling leaks?

6. What are some ways to protect the environment in a spill situation?

7. What kind of tanks can/cannot be drilled?

8. What safety precautions must be implemented before drilling or off-loading cargo tanks?

**Information Sheet # 7.1**

Emergency Procedures For Off-Loading Hydrocarbons
From A Rolled-Over MC306/DOT406 AL Cargo Tank

A Procedures Checklist

Vehicle either on its side or top.

1. Life hazard
    a. Driver
    b. Other vehicles involved
        (1) Rescue
            (a) PPE - full turn-outs, with hood and SCBA
            (b) Visible leak - uphill and upwind
            (c) Use foam to make entry, back up with dry powder extinguisher
            (d) Use either two 1 3/4” or 1 1/2” lines for entry
            (e) Remove driver
            (f) Turn engine off, disconnect battery if safe to do so

2. Leak - no fire
    a. Use foam
        (1) ID product - UN placards, driver’s shipping papers, talk to driver
        (2) Foam only around the tank, not on the top
        (3) Proper foam type
            (a) Regular AFFF
            (b) Polar/alcohol type
    b. Monitor area
        (1) Use combustible gas indicator
        (2) To be done continuously 360 degrees
        (3) Add more foam if needed
    c. Ignition sources
        (1) Vehicle catalytic converters
        (2) Flares
        (3) Smokers
        (4) Structures
        (5) Fire equipment
    d. Static electricity
        (1) Grounding
            (a) Drive a metal grounding rod into ground
            (b) Length/depth at least 3 feet into ground
            (c) Cables at least 25’ in length
            (d) Attach to tank first, then to ground rod. Very important.
        (2) Bonding
            (a) Cable from tank attached to truck
            (b) Cable from grounded tank to pump-off truck
            (c) Continuity
            (d) Remember - static electricity is a source of ignition we can’t eliminate but we can redirect

e. Containment
  (1) Protect environment, keep out of drains
    (a) Dirt
    (b) Plastic sheeting
    (c) Plastic bags
f. Plug and Patch
  (1) Plug N' Dike
  (2) Wood plugs, redwood
  (3) Wood and rubber wedges
g. Dome leak
  (1) Dome clamp
  (2) Wood wedge
  (3) "Lid-Loc"
  (4) Bucket with bonding cable
h. Bracing or cribbing
  (1) Stabilize tank/vehicle
    (a) Wood
    (b) Dirt
    (c) Chalk blocks
    (d) Air bags
    (e) Place lower stabilizing material at bulkheads and baffles

**Information Sheet # 7.2**

Drilling an MC306/DOT406 Cargo Tank

I. Equipment for Drilling
   A. Air drill, high torque, low rpm.
      1. Recommended rpm for 4" hole saw drilling, .177" - .250" Aluminum is 135 rpm.
      2. Acceptable air drill is anything from 350 rpm to 500.
      3. Air pressure at the hose connection at the handle while drill is free-wheeling should be a minimum of 90 psi.
      4. Half hour 4,500 psi bottle with regulator and 15' to 25' 3/8" hose.
      5. Half hour bottle has air for one hole.
      6. One hour bottle, 2 holes.
      7. Drill consumes 20 to 22 cubic feet per minute.
   B. Two choices of hole saw, 3" or 4".
      1. Plastic 4" plugs are available.
      2. Stinger, OD is 2 7/3", 4" hole allows for better angle.
      3. Hole saw pilot drill and mandrel assembly will not fit in 1/4" chuck.
   C. Stinger - 8 1/2' with 90 degree elbow and 3" cam-lock coupler.
      1. Bonding tab at elbow.
      2. Two or three "V" type cuts or serration at the bottom end.
   D. Sight glass. Optional.
      1. 3" female by 3" male cam-locks with clear plastic "donut" in the middle.
      2. Allows pump-off operator to actually see if product is following.
      3. Fits either between sections of pump-off hose on the ground or attached to the stinger.
   E. Water supply for cooling the hole saw teeth.
      1. Quart-size squeeze bottle works fine.
   F. Plugs (redwood or plastic).
      1. Place in hole when finished.
      2. Keeps vapors in.
      3. No need to de-gas or inert tank when finished.
   G. Rubber type mat (3' x 5').
      1. Used on top of tank to keep from sliding off.
   H. Ladder
      1. Used by the driller to position him/herself on top side of the tank.
      2. 8' - 12' one on each side (if possible).
      3. Driller and helper will escape using this route if emergency arises. Do not place a rope on these people.
   I. Vacuum truck or pump-off truck.
      1. Vacuum truck, might need two, capacity not as much as MC306/DOT406.
         a. Need one if spillage occurs or cleanup of foam and water.
      2. Vacuum trucks capacity rated in barrels.
         a. 100 BBL'S = 4,200 gallons
         b. Trailer (pull type) holds about 4,800.
      3. Pump-off or transfer truck is nothing more than an MC306/DOT406.
         a. Exception - has a chassis-mounted positive displacement pump.
         b. Mostly rotary gear.
         c. Very cost-effective, 100% salvage.
         d. Vacuum trucks are usually dirty.

4. Hose
    a. Need extra hose for this operation.
    b. 100’ is a good distance to keep between trucks. Use monitoring equipment.
    c. Both types of transfer vehicles will need vapor exhaust hose to direct vapor away from ignition source. Minimum 25’.
    d. 1 1/2” hose line with 30 degree fog pattern placed in same direction as the vapor flow will lean out the vapor.

II. Drilling Holes “The Preferred Method”
  A. HazMat Group and Safety Officer
    1. Make plans.
    2. Pick spot to drill.
  B. HazMat Group checks on:
    1. Monitoring.
    2. Foam on ground.
    3. 2 - 1 1/2” or 1 3/4” foam lines in place.
    4. Two dry powder-type extinguisher.
    5. PPE, includes SCBA.
    6. Bonding and grounding.
    7. Bracing.
    8. Exhaust hose location.
  C. Driller and helper
    1. Transports ladder, mat, air bottle with drill, hose and regulator.
    2. Second helper brings in a ladder.
    3. Driller and helper bring in water bottle, stinger and bonding cable.
    4. Driller climbs ladder and places mat on tank.
    5. Helper hands driller the drill, stands on the ladder with cooling water bottle. Option: Have bottle on necklace-type arrangement with breakaway link.
    6. Driller checks drill speed, starts drilling. Helper dribbles cooling water on teeth of drill.
    7. After hole is drilled, drill is taken to the ground by helper, helper hands up the stinger.
    8. Driller puts stinger into the hole, attaches bond wire to it and the tank.
    9. Helper brings in sight glass and 4” plug.
    10. Driller attaches sight glass to stinger.
    11. Both helpers bring in suction hose and assist in connecting hose to the stinger.
    12. All entry team members back out.
    13. Vacuum truck is grounded, using 4’ rod.
    14. Vacuum truck bonding cable is attached to the original ground.
    15. Transfer truck uses same procedure. Needs to be grounded and bonded.
    16. Product exhaust vapors from either type of truck shall be broken up by placing a fog nozzle at the discharge of the hose. Monitor the area.
    17. Start off-loading, product can be observed via sight glass.
    18. When empty, check with the truck drivers to see if the quantities match.
    19. If quantity not in the ballpark, remove equipment, put 4” plug in hole.
    20. Move to other side of baffle and repeat drilling operation.
    21. Note: Drilling on the other side of the baffle won’t have to be done if the holes have been drilled at 3 and 9 o’clock.
    22. Repeat for each compartment, seal all holes with plastic plugs, not redwood.
    23. Stand by for lifting and setting it back either on its wheels or a flat bed. Foam lines and extinguisher manned.

# Information Sheet #7.3

## Glossary of Terms

| Term | Definition |
|---|---|
| Baffle | A transverse partition in a cargo tank which is not liquid tight. Main purpose is for tank strength. |
| Capacity | The maximum volume of any tank in United States gallons or pounds. |
| Cargo Tank | Any atmospheric tank, low pressure tank, pressure vessel or special vessel designed or used for the transportation of liquid or gaseous hazardous materials. |
| Compartment | A separate product carrying space of a tank motor vehicle. One tank may have one or more such spaces. |
| Crossover Line | A line installed in the tank piping system to allow unloading from either side of the tank. |
| Gladhands | Fittings for connection of air brake lines between vehicles/trailers. |
| Head and Bulkhead | A liquid-tight transferase closure at the end of a cargo tank or between compartments of a cargo tank. |
| Internal Valve | A valve designed and installed in such a manner as to remain in an operable condition when the exterior parts are damaged or sheared off. It will prevent the unintentional es- |
| Low Pressure Tank | Any tank designed to operate at pressures above 0.5 psig, but not more than 15 psig. |
| Manifest Box | A moisture proof container used for storage of important papers or records relating to the cargo being carried. This box is carried in the cab area of the truck. |
| Manifold | Used to join a number of pipelines to a common inlet or outlet. |
| MC 306 | The code of Federal Regulations for Motor Carrier of flammable and combustible liquids for low pressure tanks. |
| Tank Trailer | (*"full trailer"* as called in industry) Any vehicle without motive power, equipped with a tank mounted thereon and constructed so that it can be drawn by a motor vehicle. No part of its own weight rests upon or is carried by the towing motor vehicle. |
| Tank Truck | Any motor vehicle equipped with a cargo tank mounted thereon. |
| Truck Tractor | A powered motor vehicle designed primarily for drawing semi-trailers and so constructed as to carry part of the trailer weight and load. |
| Semi-Trailer | A vehicle with no motive power, equipped with a tank mounted thereon. It is constructed so that part of its weight is carried by the truck tractor. |
| Shear Section | A machined groove which reduces the wall thickness of an outlet valve or adjacent piping by at least 20 percent so that strain on piping will not affect the product retention capability of the outlet valve. |
| Vacuum Truck | A truck with the ability to vacuum up chemical spills or remove hazardous materials/waste by using a pump on the truck. |
| Vapor Recovery Line | A line which connects the vapor recovery hood to a convenient location for attachment to a vapor recovery hose |
| Vents | Devices which control or limit tank pressure, including: Pressure Relief Vents, Vacuum Relief Vents, Fusible Vents, and Frangible Vents |
| Void | An enclosed space inside a tank or vessel between the individual compartments. |

# MC306/DOT406 “Drill & Pump” Checklist

| Tank Information | | |
|---|---|---|
| Tank Specification | [ ] MC306 | [ ] DOT406 |
| Type | [ ] Single Unit | [ ] Tandem Unit |

| Compartment (Size and Product) | | | | |
|---|---|---|---|---|
| | Unit #1 | | Unit #2 | |
| Compartment # | Gallons | Product | Gallons | Product |
| 1 | | | | |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |
| 5 | | | | |
| 6 | | | | |

| Product Identified By: | |
|---|---|
| [ ] Driver: | [ ] Terminal/Facility: |
| [ ] Bill of Lading: | [ ] Consignee: |
| [ ] Placards: | [ ] Other: |

| Tank Condition | |
|---|---|
| Has the tank been breached? | [ ] Yes [ ] No |
| If yes, describe the breach: | |
| | |
| | |
| | |
| Have any tank appurtenances been damaged? | [ ] Yes [ ] No |
| (dome cover, piping, shear section, valves, safety relief vents, vapor recovery system) | |
| If yes, describe the damage: | |
| | |
| | |
| | |

| Personal Protective Clothing | |
|---|---|
| Full firefighter's PPE with hood, helmet and SCBA | [ ] Yes [ ] No |
| Nitrile gloves as over gloves for driller and helpers | [ ] Yes [ ] No |
| Other: | [ ] Yes [ ] No |

| Tactical Considerations | | |
|---|---|---|
| Are all ignition sources controlled? | | [ ] Yes [ ] No |
| Ignition Source | Location | Controlled |
| Vehicles (park apparatus min. 100 feet and facing away) | | [ ] Yes [ ] No |
| Flares | | [ ] Yes [ ] No |
| Smokers | | [ ] Yes [ ] No |
| Structures | | [ ] Yes [ ] No |
| | | [ ] Yes [ ] No |
| | | [ ] Yes [ ] No |
| | | [ ] Yes [ ] No |
| Have control zones been established? | | [ ] Yes [ ] No |

| Zone | Location | Distances |
|---|---|---|
| Exclusion | | |
| Contamination Reduction | | |
| Support | | |

**Keep all unnecessary personnel out of the controlled zones!**

| | |
|---|---|
| Is spill area being monitored with a CGI to confirm effectiveness of foam blanket? | [ ] Yes [ ] No |
| Results of air monitoring: | |
| | |
| | |
| | |

**Caution: Readings higher than 10% LEL indicate an immediate hazard!**

| Rescue | | | |
|---|---|---|---|
| Is there a rescue? | | | [ ] Yes [ ] No |
| Vehicle / Location | Identity | Rescue Needed | Quantity |
| Cargo Tank | Driver | [ ] Yes [ ] No | |
| Cargo Tank | Passenger(s) | [ ] Yes [ ] No | |
| | | [ ] Yes [ ] No | |
| | | [ ] Yes [ ] No | |
| | | [ ] Yes [ ] No | |
| | | [ ] Yes [ ] No | |

| Protection Lines | |
|---|---|
| At least two 1-1/2 inch foam lines | [ ] Yes [ ] No |
| At least two dry chemical fire extinguishers | [ ] Yes [ ] No |

| Foam | | |
|---|---|---|
| Is foam being used? | | [ ] Yes [ ] No |
| Foam Available | Compatible with Product | Percent Required |
| AFFF | [ ] Yes [ ] No | |
| ATC | [ ] Yes [ ] No | |
| | [ ] Yes [ ] No | |
| | [ ] Yes [ ] No | |
| Is there enough foam available for the duration of the incident? | | [ ] Yes [ ] No |

Use the following calculations:

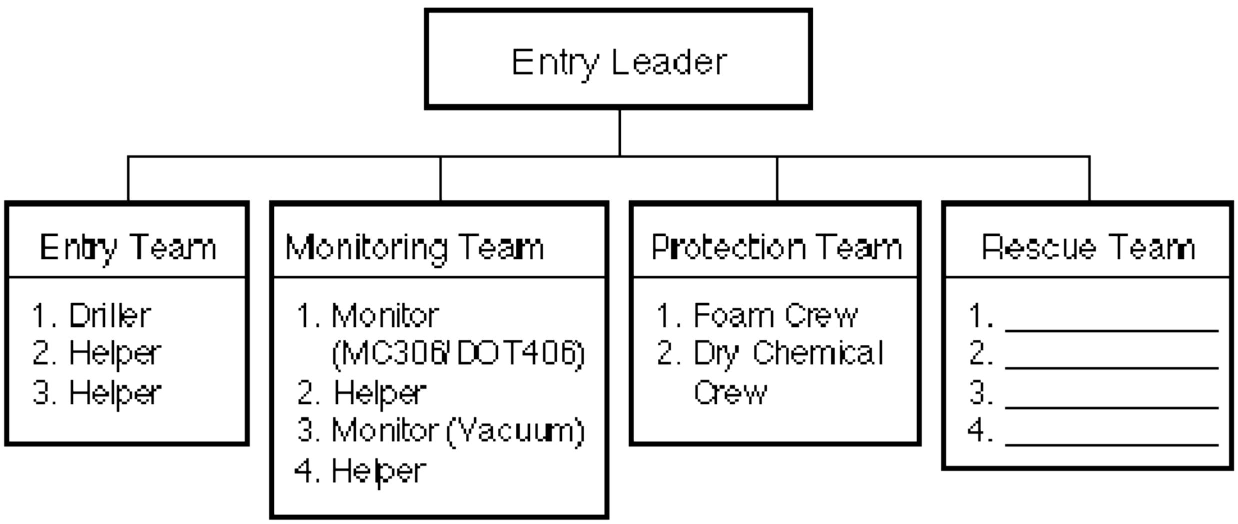
| Factor | Calculation | Example |
|---|---|---|
| Recommended Application Density | Polar Solvent = 0.16 gpm/sq.ft.<br>Non-Polar Solvent = 0.10 gpm/sq. ft. | |
| Application Rate | Surface Area to Cover (Sq. Ft.) X Recommended Density (gpm) = Application Rate of Foam Solution | 1000 sq. ft. X .10 gpm = 100 gpm of foam solution |
| Total Foam Solution | Application Rate (gpm) X Application Time (Minutes) = Total Foam Solution (gallons) | 100 gpm X 10 minutes = 1000 gallons |
| Total Concentrate Needed | Total Foam Solution X Foam Concentrate Type (%) = Gallons of Concentrate Needed | 1000 gallons X 6% = 60 gallons |

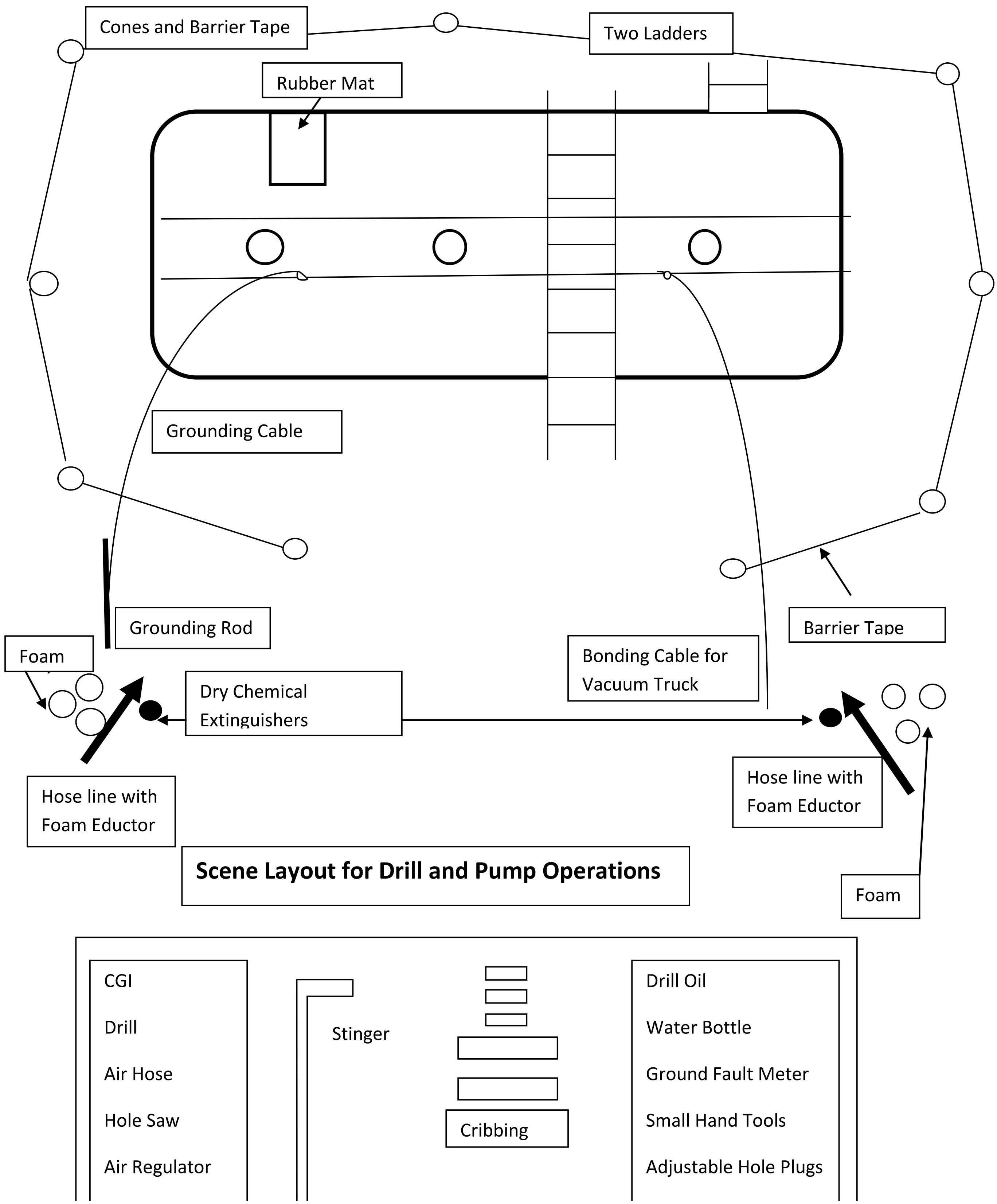
| Concentrate Type | Amount of Concentrate | Amount of Water | Total Foam Solution |
|---|---|---|---|
| 1% Foam | 1 gallon | 99 gallons | 100 gallons |
| 3% Foam | 3 gallons | 99 gallons | 100 gallons |
| 6% Foam | 6 gallons | 94 gallons | 100 gallons |
| 10% Foam | 10 gallons | 90 gallons | 100 gallons |

**Foam Spill Area Only - Do Not Foam Tank!**

| Containment of Leaks | |
|---|---|
| Do you have a leak? | [ ] Yes [ ] No |
| Size of leak: | |
| Rate of leak: | |
| Where is it going?: | |
| Can it be controlled?: | |
| Leaking dome covers have been secured with dome clamps | [ ] Yes [ ] No |
| All leaks have been plugged and patched prior to commencement of drilling operation | [ ] Yes [ ] No |
| Dikes have been erected to contain pooled or flowing liquid | [ ] Yes [ ] No |

| Protective Actions | |
|---|---|
| Upwind, uphill, upstream (vapors are heavier than air) | [ ] Yes [ ] No |
| Evacuation | [ ] Yes [ ] No |
| In-Place Protection | [ ] Yes [ ] No |
| Grounding and Bonding | [ ] Yes [ ] No |
| Stabilize cargo tank (cribbing, air bags) | [ ] Yes [ ] No |
| Vacuum trucks (100 barrel truck = 4,200 gallons) | [ ] Yes [ ] No |


Entry Leader
Entry Team
1. Driller
2. Helper
3. Helper
Monitoring Team
1. Monitor (MC306/DOT406)
2. Helper
3. Monitor (Vacuum)
4. Helper
Protection Team
1. Foam Crew
2. Dry Chemical Crew
Rescue Team
1. ___________
2. ___________
3. ___________
4. ___________


Cones and Barrier Tape
Two Ladders
Rubber Mat
Grounding Cable
Grounding Rod
Barrier Tape
Foam
Bonding Cable for Vacuum Truck
Dry Chemical Extinguishers
Hose line with Foam Eductor
Hose line with Foam Eductor
Scene Layout for Drill and Pump Operations
Foam
CGI
Drill
Air Hose
Hole Saw
Air Regulator
Stinger
Cribbing
Drill Oil
Water Bottle
Ground Fault Meter
Small Hand Tools
Adjustable Hole Plugs

# FIELD SCENARIOS
# MODULE 1G
## Participant Manual
# ADVANCED FIELD OPERATIONS

2022
California Governor's Office of Emergency Services
California Specialized Training Institute

# Hazardous Materials G Week
# Table of Contents

# CSTI/CSFM
# Hazardous Materials Specialist 1G

Course Title

Hazardous Materials Specialist 1G:  Advanced Field Operations

Course Objectives

The course objectives are to provide the student with an opportunity to:

1. Practice operational guidelines at simulated hazardous materials incidents.
2. Utilize chemical protective clothing and perform simulated hazardous materials mitigation skills.
3. Utilize methods and procedures to mitigate leaking containers.
4. Utilize methods and procedures to transfer hazardous materials between containers.
5. Classify known and unknown chemicals.
6. Utilize methods and procedures to participate as a member of a Haz Mat Team in simulated hazardous materials incidents.
7. Practice safe methods and procedures while operating at hazardous materials incidents.
8. Participate in at least two exercises with CBRNE WMD related events.
9. Other suitable scenarios may be substituted for those in this book based on team or agency needs.

| | |
|---|---|
| Course Content: | 40 Hours |
| Orientation and Administration | :30 |
| Field Scenarios | 36:00 |
| Equipment Check-Out, Clean Up, Check-In | 2:30 |
| Graduation and Closing Remarks | 1:00 |

| | |
|---|---|
| TOPIC: | Orientation and Administration |
| LEVEL: | I |
| TIME: | 30 Minutes |
| BEHAVIORAL OBJECTIVE: | Students will apply knowledge and skills gained during the previous 5 weeks of Technician & Specialist training. |
| REFERENCES: | CSFM/CSTI Tech/Spec 1G Instructor Guide, Chapter 1<br>CSFM/CSTI Tech/Spec 1G participant manual, Chapter 1<br>NFPA 470 and CCR 8, 5192 (q) (6) (D) |
| MATERIALS NEEDED: | White board or chalk board with markers<br>1G Instructor Guide and Participant Guide<br>*Audio/visual (slide/overhead projectors)<br>*Overhead transparencies<br>*VCR and monitor<br>*These materials are optional |
| PREPARATION: | Throughout the previous five courses students received in-depth training in hazardous materials incidents. In this course students will apply that knowledge in a series of exercises designed to reinforce the information and to provide an opportunity to work as part of a Hazardous Materials Team. |

## Orientation and Administration

I. Administration and Registration
  A. Course Goals
    1. To provide students with an opportunity to:
      a) Practice operational guidelines at simulated hazardous materials incidents.
      b) Utilize chemical protective clothing and perform simulated hazardous materials mitigation skills.
      c) Utilize methods and procedures to mitigate leaking containers.
      d) Utilize methods and procedures to transfer hazardous materials between containers.
      e) Classify known and unknown chemicals.
      f) Utilize methods and procedures to participate as a member of a Haz Mat Team in simulated hazardous materials incidents.
      g) Practice safe methods and procedures while operating at hazardous materials incidents.
  B. Administrative
    1. 40 hours (100% attendance required)
    2. Start time and End Time daily
    3. Evaluation Exercises
  C. Registration
    1. CSTI Roster
    2. CSFM Roster
    3. College Applications (optional)
    4. Other Rosters (optional)
  D. Fee Schedule
    1. Registration Fee
    2. Certification Fee

II. Other Announcements
  A. Parking
  B. Breaks
    1. Off limit areas
    2. Restrooms
    3. Refreshments
    4. Eating /drinking/smoking policies
    5. Public Phone Location
    6. Emergency Message Phone Number
  C. Dress Code
    1. No open Shoes
  D. Importance of Sleep
  E. Class Critique Form

III. Equipment Sign-Out and Maintenance Procedures
   A. Hard hat
   B. Work gloves
   C. Chemical resistant gloves
   D. Splash suit
   E. Disposable chemical suit (Tyvek)
   F. Goggles or protective glasses
   G. Ear Protection
   H. Rubber Boots (steel toe and shank)
   I. Clipboard
IV. Introductions
   A. Students
   B. Instructor(s)
   C. Instructor Phone Number (optional)
V. At the End of Each Day
   A. Clean up
   B. Review
   C. Question and answer

SUMMARY:

Students will be given a wide variety of Hazardous Materials challenges over a 40-hour course.

EVALUATION:

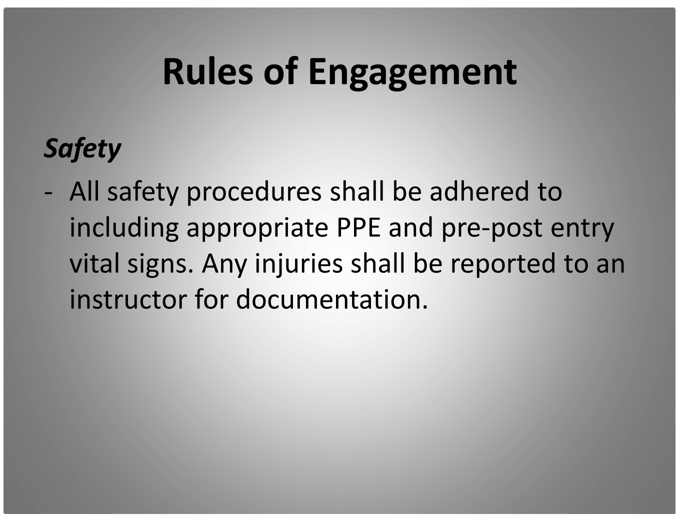
See evaluation guidelines in back of book.

ASSIGNMENT:

Students will rotate into various Hazmat group positions during the week.

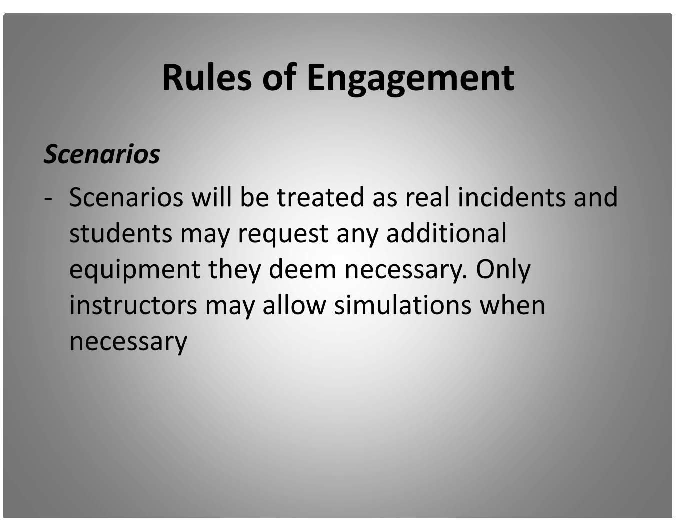

**Slide 1**

Instructor will cover basic rules and guidelines for this week.



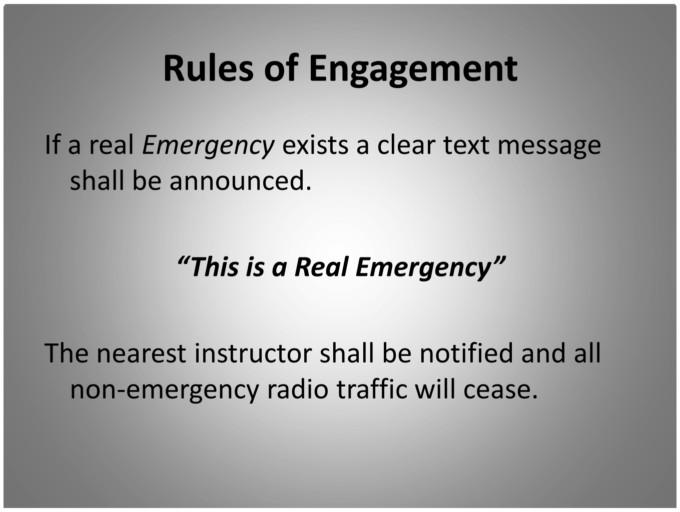

**Slide 2**

Student safety is goal one.



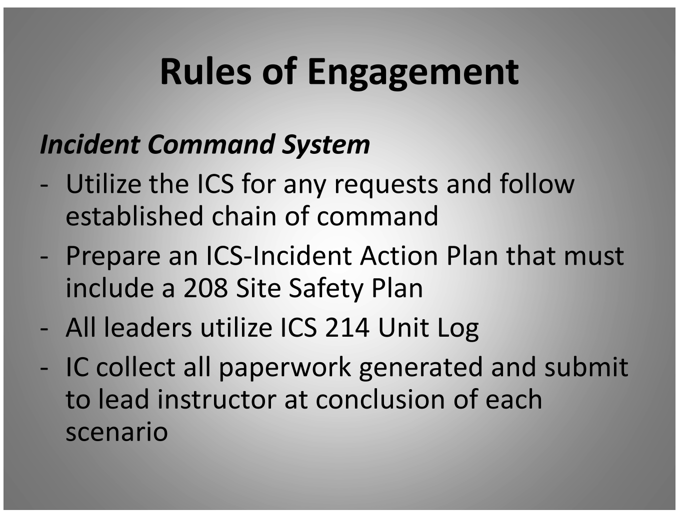

**Slide 3**

This course will consist of a number of HazMat scenarios.



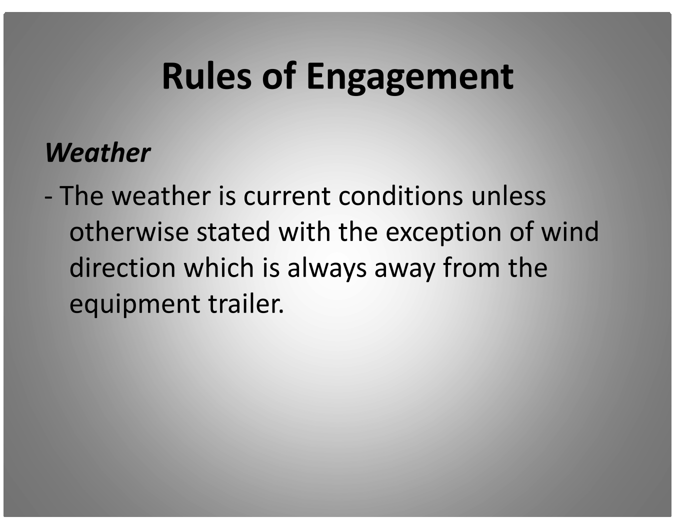

**Slide 4**

Stress the rules if an actual injury or accident occured.



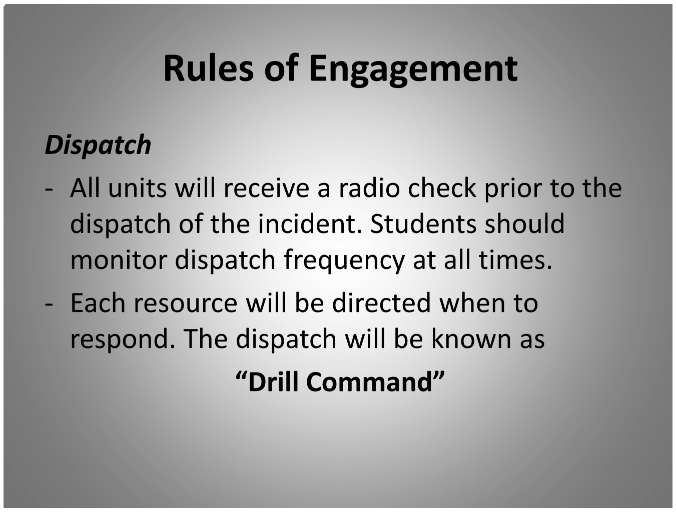

**Slide 5**

Stress the use of the Incident Command System at all times.



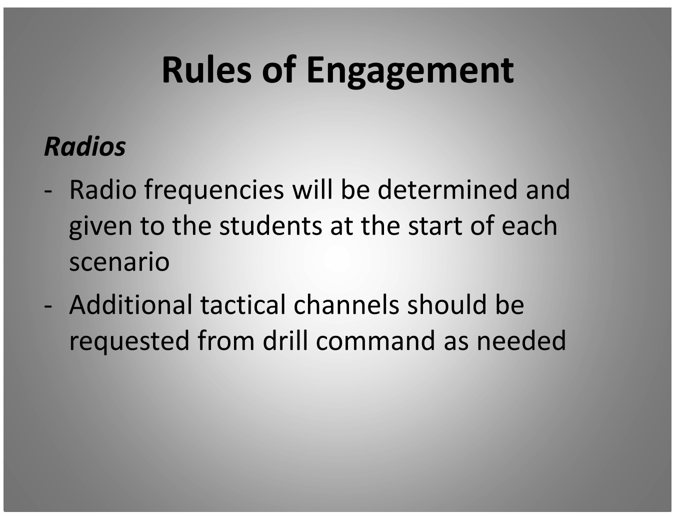

**Slide 6**

Instructors should use current weather where possible. Some simulations may occur like wind direction, based on the training site.



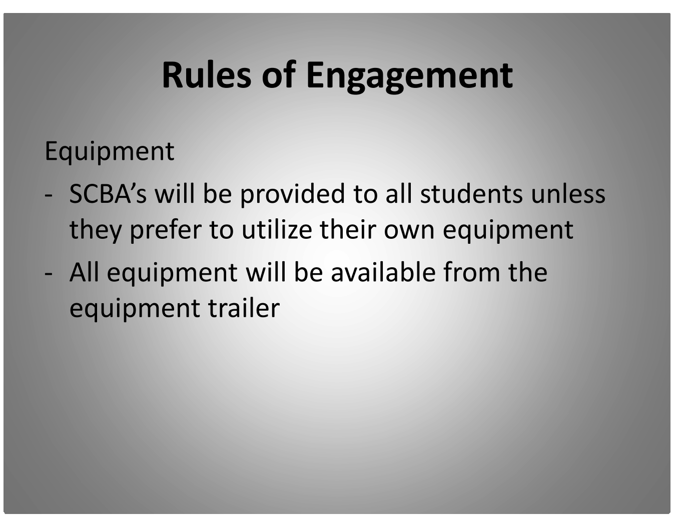

**Slide 7**

A member of the instructor team will function as "Drill Command" during each exercise.



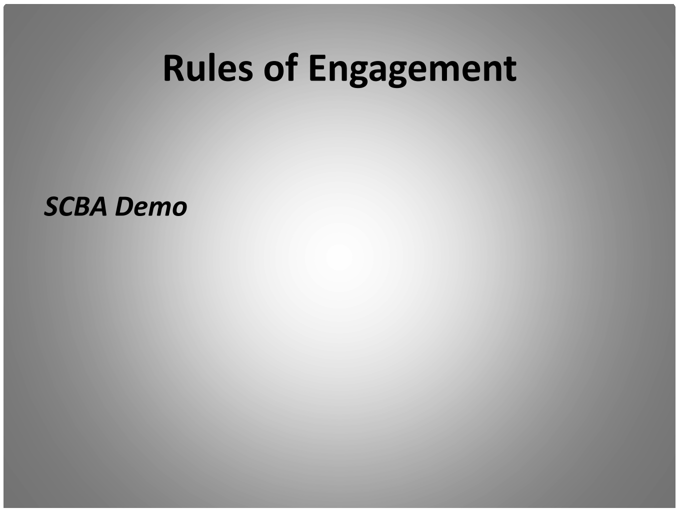

**Slide 8**

Instructors will assign all radio channels.



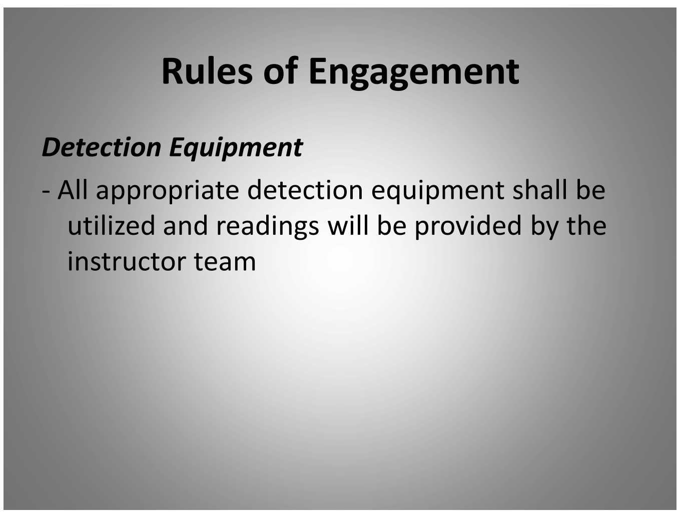

**Slide 9**

High pressure SCBAs will be available if students do not provide their own.



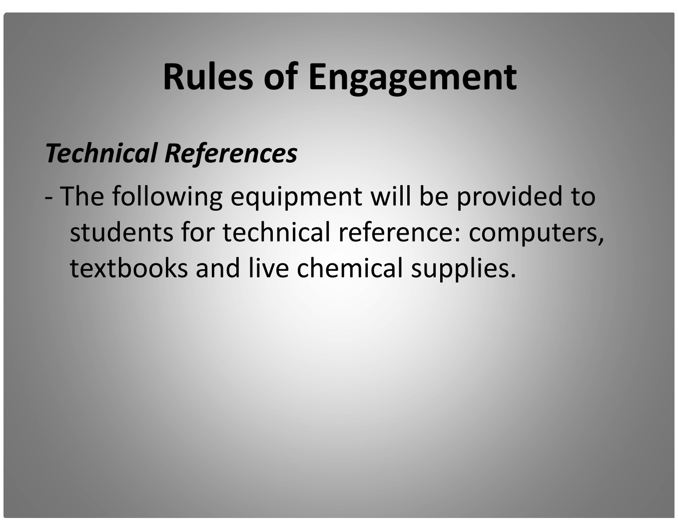

**Slide 10**

Instructors will demonstrate the use of the SCBA being provided.



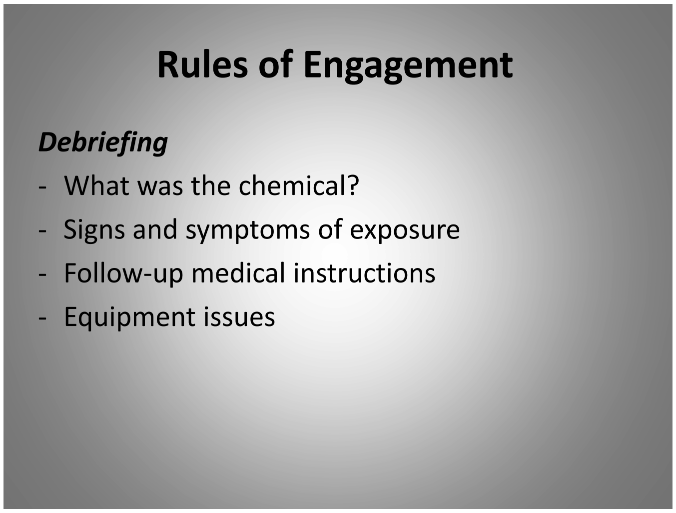

**Slide 11**

During scenario instructions will provide simulated reading based on the incident.



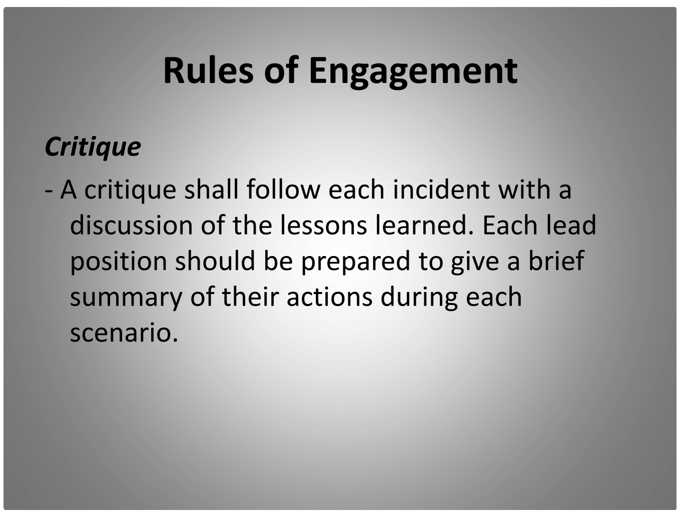

**Slide 12**

A full complement of Technical Reference material and equipment will be available.




**Slide 13**

At the conclusion of each scenario, the HazMat group will conduct a quick debriefing.




**Slide 14**

After equipment cleanup, an instructor will conduct a critique to determine what went well and areas for improvement.


**Slide 15**

Have fun but be safe!

TOPIC: Field (Evaluation) Scenarios

LEVEL: III

TIME: 4 hours

BEHAVIORAL OBJECTIVES:

Condition: Field scenarios

Behavior: The student will:

1. Analyze the simulated hazardous materials incident to determine the problem and predict the outcome
2. Identify and perform the appropriate ICS positions required to manage the simulated incident
3. Utilize appropriate technical references to determine product identification and hazards, chemical protective clothing required, and appropriate tactical operations and decon procedures
4. Select and use proper chemical protective clothing and equipment
5. Develop and utilize a Site Safety Plan
6. Develop and utilize an Incident Action Plan
7. Identify and perform appropriate decontamination procedures
8. Identify and use the appropriate tools and equipment necessary to mitigate the simulated problem
9. Identify and use the selected method for field identification of the released hazardous material
10. Identify and use accepted Standard Operating Procedures for hazardous materials incidents
11. Participate in an Incident Debriefing and a Post Incident Analysis

Standard: According to the information provided in the CSFM/CSTI Tech/Spec Student Manuals

REFERENCES: CSFM/CSTI Tech/Spec 1G participant manual
CSFM/CSTI Tech/Spec 1G Instructor Guide
NFPA 470 and CCR 8, 5192 (q) (6) (D)

MATERIALS NEEDED: A CSTI/CSFM Approved Field Training Facility

Certified curriculum for the Hazardous Materials Specialist (1G) Advanced Field Operations course shall include participation in a minimum of seven of the following training exercises/scenarios, with a at least one exercise/scenario conducted in reduced lighting:

1. Release of a Class B Poison from a railroad tankcar
2. Release of a Class A Poison from a railroad tankcar
3. Accidental release of unknown powdered material from a truck accident
4. Abandoned leaking drums with multiple hazards
5. Pressurized gas leak from a 1-ton or smaller container which contains an IED
6. Transportation incident release in an open area
7. Pressurized pipeline emergency
8. Fixed bulk storage tank release
9. Radioactive materials exposure, "dirty bomb"
10. Corrosive hazardous materials release from a railroad tank car
11. Release of a mixed cargo in a confined area
12. Collection of evidence and cleanup of an illegal drug lab
13. Release of a combustible or flammable liquid from a railroad tank car
14. Cryogenic tanker accident
15. Release of a combustible or flammable liquid from an MC 306/DOT 406 cargo tank
16. Stinger operation of an overturned MC 306/DOT 406 cargo tank carrying combustible or flammable liquids
17. Release of a liquefied gas from a railroad tankcar

CBRNE Component: Items 5 and 9 are designated WMD/CBRNE exercises. Other exercises may be modified to include this component.

SCENARIO PREPARATION:

1. Select or develop a scenario
    a) Select the site for the simulated incident
    b) Assemble the required equipment
    c) Divide the class into groups by assigned roles
2. Brief students as to their roles and responsibilities
3. Conduct the scenario
4. Clean up site and equipment
5. Conduct the Post Incident Analysis

Field Scenarios

I. Introduction
   A. The goal of this exercise is to give the student an opportunity to become familiar with the process necessary to mitigate a hazardous materials incident
   B. The student will be given a simulated hazardous materials release
   C. The student will perform the following:
      1. Analyze the simulated hazardous materials incident to determine the problem and predict the outcome
      2. Identify and perform the appropriate ICS positions required to manage the simulated incident
      3. Utilize appropriate technical references to determine product identification and hazards, CPC required, and appropriate tactical operations and decon procedures
      4. Select and use proper CPC and equipment
      5. Develop and utilize a site safety plan
      6. Develop and utilize an Incident Action Plan
      7. Identify and perform appropriate decon procedures
      8. Identify and use the appropriate tools and equipment necessary to mitigate the simulated problem
      9. Identify and use the selected method for field identification of the released hazardous material
      10. Identify and use accepted Standard Operating Procedures for hazardous materials incidents
      11. Participate in an Incident Debriefing and a Post Incident Analysis
      12. Differentiate a terrorist incident from an industrial accident when provided specific scenarios.
      13. Participate in the development and implementation of a site safety and incident action plan consistent with a CBRNE terrorist incident.

APPLICATION:

Students are to participate in each scenario.

EVALUATION:

A performance evaluation.

ASSIGNMENT:

To be determined by the instructor(s).

# Evaluation Record

The following pages contain Evaluation Record forms which you may use to evaluate student performance during the scenarios.

# California Specialized Training Institute
# Hazardous Materials Specialist
## Evaluation Record

Position

I.C.Staff
- Incident Commander
- Aide
- Site Safety Officer
- Information Officer
- Liaison Officer
- Plans Chief
- Operations Chief

Haz Mat Group
- Haz Mat Group Supervisor
- Assistant Safety
- Entry Leader
- Decon Leader
- Haz Mat Tech/Ref Leader
- Site Access Control Leader
- Medical Unit Leader

Entry Team
- Entry team member

Decon Team
- Decon Team Member

Haz Mat Tech/Ref Team
- Tech/Ref Team Member

Scenario #

| PERFORMANCE |
|---|
| 3 = OUTSTANDING |
| 2 = ABOVE AVERAGE |
| 1 = AVERAGE |
| 0 = FAILURE |

____/____/____
Date

________________
Class #

Comments Section

Scenario # _____ Date__________ Proctor__________

Scenario # _____ Date__________ Proctor__________

Scenario # _____ Date__________ Proctor__________

Scenario # _____ Date__________ Proctor__________

Scenario # _____ Date__________ Proctor__________

Scenario # _____ Date__________ Proctor__________

Scenario # _____ Date__________ Proctor__________

Scenario # _____ Date__________ Proctor__________

Scenario # _____ Date__________ Proctor__________

Scenario # _____ Date__________ Proctor__________

| Final Score | Instructor |
|---|---|

Description of Evaluation Goals

Note to Evaluator: A student must perform at least once within each of the 5 boxed functional areas by the end of week 1-G. Student will have at least 7 exercises to accomplish this requirement. You are about to proctor this student during a single exercise. Be sure you mark the appropriate boxes to indicate students participation.

I.C. Staff: Student to demonstrate ability to function as Incident Commander; or as a member of Incident Commander staff (I.C. Aide, Site Safety Officer, Information Officer., Liaison Officer); or function in one of the most often used I.C. operational staff positions (Operations Chief, Planning Chief). Whatever position is assumed, student to function within the guidelines of Firescope ICS HM-120. Demonstrate ability to communicate well, to organize a smooth functioning "staff." Demonstrate ability to provide leadership, guidance, and a sense of command to the system. To provide ability to maintain control throughout incident.

Positions that do not count toward completion of this evaluation are: law enforcement; health; O.E.S.; or any other position representing an agency that is a "support agency" only and not part of the function and application of the incident command structure.

Haz-Mat Group Supervisor: Demonstrate ability to function as the Haz-Mat Group Supervisor, or a member of his staff, such as Assistant Safety Officer Haz-Mat. Be responsible for the implementation of the site safety plan, and enforce it. Be responsible for assignment of duties. Be responsible for acquisition of resources. Conduct incident briefings with team leaders and conduct safety meetings. Demonstrate ability to function smoothly and professionally within this portion of the I. C. system.

Entry Team Leader: Demonstrate ability to manage, plan, and direct the overall entry operations of a scenario. This includes re-con entry, and any and all additional entries into the "hot zone." Demonstrate ability to manage personnel. Demonstrate ability to be efficient and successful in managing time and personnel. Demonstrate ability to coordinate functions of Entry Team with other "happenings" going on at the same time. Communicate clearly all commands to team members. Conduct review and rehearsal of various tasks when necessary. Demonstrate ability to manage all entry operations in concert with functions of other tasks when necessary. Demonstrate ability to manage all entry operations in concert with functions of other teams, such as decon and site access control. If student is a member of a team, demonstrate ability to listen clearly and follow directions explicitly. Demonstrate ability to perform necessary functions correctly and within accepted guidelines.

Decon Team Leader: Demonstrate ability to function correctly within the description of the decontamination team. Be responsible for the entire decon operation. Make assignments, determine level of chemical protective clothing required for each position. Organize the corridor to function smoothly for the duration of the incident. Demonstrate ability to identify when to rotate crews. Identify contaminated people, equipment. Coordinate involvement of people through the decon corridor and transfer of people requiring medical attention to the "medical group." If student is member of Decon Team, demonstrate ability to communicate with others and follow orders. Demonstrate ability to properly set up a full decon corridor.

Haz-Mat Tech/Ref: Demonstrate ability to function as the individual or group which must research and provide technical information support and assistance to the Incident Commander and to the Haz-Mat Group Supervisor. Demonstrate proficiency in use of references, and demonstrate exceptional skill in conveying important information to other individuals or teams who need specific details. Demonstrate accuracy. Demonstrate ability to interpret data. Determine and suggest appropriate C.P.C. to be used for each phase of the incident. Provide analysis of samples.

Site Access Control Leader: Demonstrate ability to function in capacity as leader of a team for the purpose of controlling and monitoring the movement of "personnel" into, out of, and through various "zones." Be responsible for zone identification and establishment. Be responsible to assign duties and communicate clearly directives to members of team. Demonstrate ability to manage the scene smoothly. Determine access and egress points. Communicate with other team leaders and declare location of decon corridor. If student is member of site access control team, demonstrate ability to follow orders and carry them out correctly. Demonstrate ability to apply those functions appropriate to site access control. Maintain good records.

Entry Team Member: Demonstrate the ability to perform entry operations of a scenario. This includes re-con entry, and any and all additional entries into the "exclusion zone." Demonstrate the ability to properly don and doff chemical protective clothing. Demonstrate the ability to select and apply the proper mitigation tools for your assigned task in the scenario. Demonstrate the ability to select, operate and interpret the readings from atmospheric and doff chemical monitoring equipment. Demonstrate ability to work within the buddy system. Demonstrate the ability to work with the decon team to insure proper decon. If student is a member of a team, demonstrate ability to listen clearly and follow directions explicitly. Demonstrate ability to perform necessary functions correctly and within accepted guidelines.

Decontamination Team Member: Demonstrate the ability to perform Decon operations of a scenario. This includes Emergency, Primary and Patient Decon Demonstrate the ability to properly don and doff chemical protective clothing. Demonstrate the ability to select and apply the proper tools for your assigned task in the decon evolution. Demonstrate ability to work within the buddy system. Demonstrate the ability to work with the decon team to insure proper decon. If student is a member of a team, demonstrate ability to listen clearly and follow directions explicitly. Demonstrate ability to perform necessary functions correctly and within accepted guidelines.

Technical Reference Team Member: Demonstrate the ability to perform Tech/Ref operations of a scenario. Using printed reference materials, Computer data bases and contact with outside subject matter experts demonstrate the ability to determine the following; Establish the correct isolation distances, Determine the correct Chemical protective clothing to be worn by the Entry and Decon Teams, Determine the Signs and Symptoms of Exposure to the target chemical, Determine the appropriate decontamination method to be used by the decon team, Determine the compatibility of repair and mitigation tools with the target chemicals, demonstrate the ability to select and interpret the readings from atmospheric monitoring equipment. Using a chemical Field ID kit Demonstrate ability analyze and unknown sample to determine its hazards. If student is a member of a team, demonstrate ability to listen clearly and follow directions explicitly. Demonstrate ability to perform necessary functions correctly and within accepted guidelines

# Hazardous Materials Regulations

(p) Hazardous Materials Emergency Response - Specialist (1F): Specialized Mitigation Techniques.

(1) Certified curriculum for Haz Mat Emergency Response Specialist (1F) Specialized Mitigation Techniques shall include all of the following course objectives:

(A) The student shall define the term "matter", list the three states of matter, describe physical and chemical change, giving examples of each, read and interpret information from the periodic table, describe atomic structure and list the four families: alkali metals, alkaline earths, halogens and noble gases.

(B) The student shall list six salts, provide the chemical formula and list the hazards of each. The student shall identify and name non-salts, list the hydrocarbon radicals and derivatives, draw their structural formulas and list the hazards associated with each.

(C) Given at least five unknown substances, two of which are solid, and three are liquids, the student shall identify or classify by hazard each of the unknown substances.

(D) The student shall identify safe and unsafe behaviors as they pertain to chemical handling.

(E) The student shall identify the principles and tests used in field identification kits to determine the hazards or identity of unknown chemicals.

(F) The student shall describe the process of looking for contaminants in air, list the major components of a normal atmosphere, and list the types of contaminants which make an atmosphere hazardous. The student shall list the OSHA requirements for entry into a confined space, describe the process of finding unknown gases based on vapor density and interpreting results. Also, the student shall list the four uses of monitoring and the types of instruments available, including the capabilities of each. The student shall utilize a monitoring strategy to analyze unknown atmospheres including an analysis of site specific conditions.

(G) The student shall define what Radiation Detection Monitors are designed to detect, describe how they operate, demonstrate how to prepare the Radiation Monitors for use and how to monitor an unknown atmosphere, describe how to interpret the results, and list some of the limitations associated with Radiation Monitors.

(H) The student shall describe the development of an incident action plan for a Radioactive Materials Emergency Incident.

(I) The student shall define what Combustible Gas Indicators (CGI's) are designed to detect, describe how they operate, demonstrate how to prepare the CGI for use and how to monitor an unknown atmosphere, describe how to interpret the results, and list some of the limitations associated with CGI's.

(J) The student shall define what Photoionization Detectors (PID's) are designed to detect, describe how they operate, demonstrate how to prepare the PID for use and how to monitor an unknown atmosphere, describe how to interpret the results, and list some of the limitations associated with PID's.

(K) The student shall identify what colorimetric tubes, electrochemical sensors, flame ionization detectors and infrared spectroscopy are designed to detect; describe how these various devices work; and identify some of the use considerations and limitations associated with these devices.

(L) The student shall recognize explosives by their chemical formula, structure or characteristics; list initiators of explosives. The student shall also list the four categories of explosives, and give examples of common improvised and conventional explosives.

(M) Student shall identify the mechanisms by which heat builds up in workers operating in chemical protective clothing, and the appropriate measures to take for someone experiencing a heat related illness.

(N) Student shall identify procedures by which hazardous materials response personnel shall be medically evaluated at incidents.

(O) The student shall don Level "A" chemical protective clothing and perform simulated hazardous materials mitigation skills. The student shall complete the course or proceed through the course within the limits of one full SCBA tank.

(P) The student shall demonstrate the use of grounding and bonding equipment for product transfer.

(Q) The student shall demonstrate the use of plugging and patching equipment for drums.

(R) The student shall demonstrate the use of transfer pumps for product transfer between drums.

(S) The student shall demonstrate the safe use of a drum hand truck.

(T) The student shall demonstrate the safe use of a drum upender.

(U) The student shall demonstrate overpacking of a 55 gallon drum by the "V- Roll" and "End Over" Techniques.

(V) The student shall demonstrate the use of plugging and patching equipment for repairing leaks on piping systems.

(W) The student shall demonstrate the use of plugging and patching equipment for horizontal and vertical storage tanks.

(X) The student shall demonstrate the safe application of a "Chlorine Institute A Kit".

(Y) The student shall demonstrate the safe application of a "Chlorine Institute B Kit".

(Z) The student shall identify the features of a general service railroad tank car.

(AA) The student shall close a bottom-operated outlet valve to stop a simulated leak on a general service railroad tank car.

(BB) The student shall tighten the cap/plug on a bottom outlet valve using a pipe wrench on a general service railroad tank car.

(CC) The student shall close a top-operated bottom outlet valve on a general service railroad tank car.

(DD) The student shall tighten the stuffing box packing for a top-operating bottom outlet valve using a pipe wrench on a general service railroad tank car.

(EE) The student shall stop a simulated leak on a general service manway using a wrench on a general service railroad tank car.

(FF) The student shall explain the purpose of a vacuum breaker valve and demonstrate the proper method for depressurizing a general service rail car.

(GG) The student shall repair a simulated leak on a liquid line valve on a general service railroad tank car.

(HH) The student shall stop a simulated leak in the vapor line on a general service railroad tank car.

(II) The student shall stop a simulated leak from a safety relief valve on a general service railroad tank car.

(JJ) The student shall identify the features of a pressurized rail car.

(KK) The student shall stop a simulated leak in an angle ball/gate valve on a pressurized rail car.

(LL) The student shall stop a simulated leak in the sample line on a pressurized rail car.

(MM) The student shall stop a simulated leak in the thermometer well of a pressurized rail car.

(NN) The student shall stop a simulated leak in the slip tube gauging device on a pressurized rail car.

(OO) The student shall stop a simulated leak in the safety relief valve on a pressurized rail car.

(PP) The student shall identify the dome features of a pressurized chlorine rail car.

(QQ) The student shall stop a simulated leak on the angle gate valve on a pressurized chlorine rail car.

(RR) The student shall stop a simulated leak on the safety relief valve of a pressurized chlorine rail car.

(SS) The student shall identify advantages of recycling, general conditions and restrictions that apply to recycling, and some of the materials that can and cannot be recycled.

(TT) The student shall identify some of the agencies that might have responsibility for site mitigation management; important considerations regarding funding, transporting waste, utilizing temporary storage facilities, and dealing with citizen concerns. The student shall identify some of the regulations that must be complied with during site mitigation, as well as four legal methods of hazardous waste disposal.

(UU) The student shall identify the three tactical priorities at a haz mat incident, and essential command and control functions. The student shall also be able to describe the levels that a haz mat incident may be divided into, and list criteria for determining those levels.

(VV) The student shall demonstrate the ability to perform one of the following functions at a simulated hazardous materials incident:

(i) Analyze the simulated hazardous materials incident to determine the problem and predict the outcome.

(ii) Identify and perform the appropriate ICS positions required to manage the simulated incident.

(iii) Utilize appropriate technical references to determine product identification and hazards, chemical protective clothing required, and appropriate tactical operations and decon procedures.

(iv) Select and use proper chemical protective clothing and equipment.

(v) Develop and utilize a site safety plan.

(vi) Develop and utilize an Incident Action Plan.

(vii) Identify and perform appropriate decontamination procedures.

(viii) Identify and use the appropriate tools and equipment necessary to mitigate the simulated problem.

(ix) Identify and use the selected method for field identification of the released hazardous material.

(x) Identify and use accepted Standard Operating Procedures for hazardous materials incidents.

(WW) The student shall participate in an Incident Debriefing and a Post Incident Analysis.

(2) Certified curriculum for Hazardous Materials Emergency Response Specialist (1F) Specialized Mitigation Techniques shall include all of the current course material listed in Section 2540(t).

(3) Certified curriculum for the Hazardous Materials Emergency Response Specialist (1F) Specialized Mitigation Techniques Course shall be 40 hours in length.

(4) Certified curriculum for the Hazardous Materials Emergency Response Specialist (1F) Specialized Mitigation Techniques Course shall include all of the following training exercises:

(A) Participation in a Level “A” Chemical Protective Clothing Manipulative Obstacle Course including successful completion of all of the following objectives while donned in Level “A” CPC:

(i) Student shall be able to walk on uneven terrain.

(ii) Student shall be able to climb a fire service ladder to the working platform on a railroad tankcar.

(iii) Student shall be able to cross underneath a cargo tank or rail car without touching knees to the ground.

(iv) Student shall be able to open and/or close a gate valve.

(v) Student shall be able to right an overturned 55-gallon drum.

(vi) Student shall be able to select the proper tools and unbolt or reconnect a simulated pipe mount.

(vii) Student shall be able to remove and replace a drum bung.

(viii) Student shall be able to remove and replace a threaded pipe cap.

(ix) Using a drum hand truck, student shall be able to move a full 55-gallon drum 50 feet.

(x) Student shall be able to shovel 4 shovels full of dirt.

(xi) Student shall be able to insert a redwood plug in a hole in a tank.

(xii) Using a hand transfer pump, student shall be able to transfer 2 gallons of water from a 55-gallon drum into a bucket, then pour the bucket into another 55-gallon drum.

(B) Participation in a Chlorine "B" Kit Exercise, including successful completion of all of the following objectives:

(i) Student shall be able to select and apply the proper components to mitigate a given leak.

(ii) Student shall be able to roll a 1-ton container to change a liquid leak into a vapor leak.

(C) Participation in an Elevated Storage Tank Exercise, including successful completion of all of the following objectives:

(i) Student shall be able to mitigate leaks using mechanical plugging and patching equipment.

(ii) Student shall be able to mitigate leaks using pneumatic plugging and patching equipment.

(iii) Student shall be able to mitigate leaks using granular plugging and patching materials.

(D) Participation in a Piping Simulator Exercise, including successful completion of all of the following objectives:

(i) Student shall be able to mitigate leaks using mechanical plugging and patching equipment.

(ii) Student shall be able to mitigate leaks using pneumatic plugging and patching equipment.

(E) Participation in a Drum Handling Exercise, including successful completion of all of the following objectives:

(i) Student shall be able to mitigate leaks using mechanical plugging and patching equipment.

(ii) Student shall be able to apply chemical patching materials.

(iii) Student shall be able to demonstrate product transfer operations.

(iv) Student shall be able to demonstrate over-packing a drum.

(v) Student shall be able to demonstrate moving a loaded drum.

(F) Participation in a Level "A" Exercise/Scenario, including successful completion of all of the following objectives:

The student, acting within a team, shall:

(i) Apply hazard and risk assessment.

(ii) Employ entry team operations.

(iii) Utilize sampling and monitoring techniques.

(iv) Establish control zones.

(v) Utilize product control methods.

(vi) Establish decontamination operations.

(vii) Develop site-safety plans and incident-action plan.

(viii) Employ rescue/decontamination of the injured.

(ix) Employ medical surveillance.

(x) Select appropriate protective clothing, reservice and clean.

(xi) Employ Incident Command System.

(xii) Perform field identification of chemical unknowns.

(xiii) Prepare a press release.

(xiv) Utilizing the proper current ICS forms, document all incident operations using the following forms:

(1) ICS Form 201 - Incident Briefing;

(2) ICS Form 202 - Incident Objectives;

(3) ICS Form 206 - Medical Plan

(4) ICS Form 214 - Unit Log;

(5) ICS Form 208 - Site Safety Plan

(5) Certified curriculum for the Hazardous Materials Emergency Response Specialist (1F) Specialized Mitigation Techniques Course shall include the following evaluation methods:

(A) Completion of a Level "A" manipulative obstacle course with a minimum passing score of 100%; and,

(B) Completion of the CSTI certified Hazardous Mat Specialist (1F) Specialized Mitigation Techniques Course Final Exam with a minimum passing score of 70% correct.

(6) The following materials/training aids/equipment are required for teaching the Hazardous Materials Emergency Response Specialist (1F) Specialized Mitigation Techniques Course:

(A) A State Certified Hazardous Materials Field Training Facility (FTF) containing all of the training aids, equipment, reference materials, protective clothing, forms and safety items as designated in Section 2560(a).

(7) Certification for participants in the Hazardous Materials Emergency Response Specialist (1F) Specialized Mitigation Techniques Course shall include successful completion of the certified course as referenced in 2520(p), delivered by a CSTI certified instructor as referenced in 2530. Student shall attend 40 hours of training as defined by Title 19 s 2540(j)(4), accomplish all objectives, participate in the training exercise and complete the evaluation method at the 70% standard as referenced in section 2520(p).

(q) Hazardous Materials Emergency Response - Specialist (1G): Tactical Field Operations.

(1) Certified curriculum for Hazardous Materials Emergency Response Specialist (1G) Tactical Field Operations Course shall include all of the following course objectives:

(A) Student shall function as a Hazardous Materials Team member under the Incident Command System at a simulated hazardous materials incident.

(B) Student shall demonstrate the ability to perform the duties of a member of the Command Staff within the Incident Command System at a simulated hazardous materials incident.

(C) Student shall demonstrate the ability to perform the duties of a member of the Hazardous Materials Group within the Incident Command System at a simulated hazardous materials incident.

(D) Student shall demonstrate the ability to perform the duties of a member of the Entry Team within the Incident Command System at the simulated hazardous materials incident.

(E) Student shall demonstrate the ability to perform the duties of a member of the Decontamination Team within the Incident Command System at a simulated hazardous materials incident.

(F) Student shall demonstrate the ability to perform the duties of a member of the Technical Specialist Haz Mat Reference Team within the Incident Command System at a simulated hazardous materials incident.

(G) Student shall demonstrate the ability to perform the duties of a member of the Site Access Control Team within the Incident Command System at a simulated hazardous materials incident.

(H) Student shall demonstrate the ability to don and doff chemical protective clothing at a simulated hazardous materials incident.

(I) Student shall demonstrate the ability to collect and handle chemical samples at a simulated hazardous materials incident.

(J) Student shall demonstrate the ability to select, operate and interpret readings from atmospheric monitoring instruments at a simulated hazardous materials incident.

(K) Student shall demonstrate the ability to perform field identification of chemical unknowns at a simulated hazardous materials incident.

(L) Student shall demonstrate the ability to perform medical monitoring of personnel donned in chemical protective clothing and make recommendations based on the results at a simulated hazardous materials incident.

(M) Student shall demonstrate the ability to select and use proper hand tools to mitigate or control a chemical release at a simulated hazardous materials incident.

(N) Student shall demonstrate the ability to implement proper mitigation techniques at a simulated hazardous materials incident.

(O) Student shall demonstrate the ability to participate in the incident termination phase at a simulated hazardous materials incident.

(2) Certified curriculum for the Hazardous Materials Emergency Response Specialist (1G) Tactical Field Operations Course shall be 40 hours in length.

(3) Certified curriculum for the Hazardous Materials Emergency Response Specialist (1G) Tactical Field Operations Course shall include a minimum of seven of the following training exercises/scenarios, with a minimum of one exercise/scenario conducted in reduced lighting (after sunset):

(A) Participation in a Release of a simulated DOT Hazard Class 6.1 Poison from a Railroad Tankcar Exercise/Scenario.

(B) Participation in a Release of a simulated DOT Hazard Class 2.3 Poison from a Railroad Tankcar Exercise/Scenario.

(C) Participation in a simulated Accidental Release of Unknown Powered Material from a Truck Accident Exercise/Scenario.

(D) Participation in an Abandoned Leaking Drums-Multiple Hazard Exercise/Scenario.

(E) Participation in a Pressurized Gas Leak from a 1-Ton or Smaller Container Exercise/Scenario.

(F) Participation in a Transportation Incident Release of Product in an Open Area Exercise/Scenario.

(G) Participation in a Pressurized Pipeline Emergency Exercise/Scenario.

(H) Participation in a Fixed Bulk Storage Tank Exercise/Scenario.

(I) Participation in a simulated Radioactive Materials Exposure Exercise/Scenario.

(J) Participation in a simulated Corrosive Hazardous Materials Release From Railroad Tankcar Exercise/Scenario.

(K) Participation in a Release of simulated Mixed Hazardous Cargo in a Confined Area Exercise/Scenario.

(L) Participation in a Collection of Evidence and Cleanup of a simulated Illegal Drug Lab Exercise/Scenario.

(M) Participation in a Release of a simulated Combustible or Flammable Liquid from a Railroad Tankcar Exercise/Scenario.

(N) Participation in a simulated Cryogenic Tanker Accident Exercise/Scenario.

(O) Participation in a simulated Release of a Combustible or Flammable Liquid from MC 306/406 Cargo Tank Exercise/Scenario.

(P) Participation in a Stinger Operation on an Overturned MC 306/406 Cargo Tank Carrying simulated Combustible or Flammable Liquids Exercise/Scenario.

(Q) Participation in a Release of a simulated Liquefied Gas from a Railroad Tankcar Exercise/Scenario.

(4) Certified curriculum for the Hazardous Materials Emergency Response Specialist (1G) Tactical Field

Operations Course shall include the following evaluation methods:

(A) Completion of the CSTI Hazardous Materials Emergency Response Specialist (1G) Tactical Field Operations Course Student Participation Record with a minimum passing score of 70% correct in all of the following manipulative skills:

(i) Donning, doffing and working in level "A" or "B" chemical protective clothing.

(ii) Application of atmospheric monitoring equipment including, combustible gas indicator, oxygen sensors, photoionization detector and radiation detection.

(iii) Collection and handling of samples.

(iv) Field identification of chemical unknowns.

(v) Selection and application of leak mitigation equipment.

(vi) Application of appropriate personnel and equipment decontamination.

(vii) Interpretation of printed and computer based reference sources.

(viii) Application of site access control zones.

(ix) Function as a member of the Hazardous Materials Response Team under the Incident Command System.

(x) Function as a member of the Entry Team.

(xi) Function as a member of the Decontamination Team.

(xii) Function as a member of the Technical Reference Team.

(5) The following materials/training aids/equipment are required for teaching the Hazardous Materials Emergency Response Specialist (1g) Tactical Field Operations Course:

(A) A State Certified Hazardous Materials Field Training Facility (FTF) containing all of the training aids, equipment, reference materials, protective clothing, forms, and safety items as designated in Section 2560(a).

(6) Certification for participants in the Hazardous Materials Emergency Response Specialist (1G) Tactical

Field Operations Course shall include successful completion of the certified course as referenced in section 2520(q), delivered by a CSTI certified instructor as referenced in section 2530. Student shall attend 40 hours of training as defined by Title 19 s 2540(j)(4), accomplish all objectives, participate in all training exercises and complete the evaluation methods at the 70% standard as referenced in section 2520(q).

# Table of Contents - Forms Section

This section contains copies of all the forms which you may use in field or classroom exercises. You can make as many copies as your need. The headers and footers have been removed from each page to eliminate confusion. However, the pages have been numbered so that you may find them easily within your manual.

# Hazardous Materials Data Sheet

## Product Information

| | | | |
|---|---|---|---|
| Product Name: | | Chemical Name: | |
| UN #: | DOT Hazard Class: | DOT Guide #: | CAS #: |
| STCC #: | NFPA 704: Health [ ] Flammability [ ] Reactivity [ ] Other [ ] | | |
| Container Type: | | Amount: | Reportable Quantity: [ ] Yes [ } No |
| Reference Sources (3 minimum): | | | |

## Properties

| | | | |
|---|---|---|---|
| Physical Description: [ ] Solid [ ] Liquid [ ] Gas | | Corrosive: [ ] Yes [ ] No pH: _________ | |
| Boiling Point: | Melting Point: | Specific Gravity: | Water Soluble: [ ] Yes [ ] No |
| Flash Point: | Ignition Temp: | Flammable Limits %: LEL ___________ UEL ___________ | |
| Vapor Density: | Explosive: [ ] Yes [ ] No | Emits Radiation: [ ] Gamma [ ] Beta [ ] Alpha | |
| Reactive or Incompatible with: | | | |

## Toxicology and Health

| | | | |
|---|---|---|---|
| TLV-TWA: | TLV-C: | TLV-STEL: | IDLH: |
| PEL: | LD or LC ( ): | Carcinogen: [ ] Yes [ ] Suspected | |
| Route(s) of Exposure: [ ] Inhalation [ ] Absorption [ ] Ingestion [ ] Other: | | | |
| Additional Information: | | | |
| Secondary Contamination Potential: | | | |
| Signs / Symptoms of Exposure: | | | |
| First Aid Treatment for an Exposure: | | | |

## Evacuation Distances and Control Zones

| | | | |
|---|---|---|---|
| Shelter-in-Place: [ ] Yes [ ] No | | Evacuate: [ ] Yes [ ] No | |
| **Evacuation Distances** | | **Control Zones** | |
| Initial Evacuation: | ________ Feet in All Directions | Exclusion Zone: | ________ Feet |
| Follow-Up Evacuation: | ________ Feet / Mile(s) Wide | Contamination Reduction Zone: | ________ Feet |
| | ________ Feet / Mile(s) Downwind | Support Zone: | ________ Feet |

## Personal Protective Equipment

| PPE | Entry | Decon |
|---|---|---|
| Suit (Level and Type) | | |
| Gloves | | |
| Boots, Boot Covers | | |
| Respiratory Protection: | [ ] SCBA [ ] APR Type: | [ ] SCBA [ ] APR Type: |
| Monitoring Instruments: | | |
| Additional Recommendations: | | |

## Decontamination

| | | | |
|---|---|---|---|
| Decon Solution: | [ ] Water | [ ] 5% Trisodium Phosphate (TSP) | [ ] 5% Sodium Bicarbonate and 5% TSP |
| | [ ] Soap and Water | [ ] 10% Calcium Hypocholorite | [ ] Other: |

## Control Measures

| | |
|---|---|
| Cover Storm and Sewer Openings: [ ] Yes [ ] No | Absorbent Type: |
| Additional Recommendations: | |
| Extinguishing Agent: [ ] Water [ ] AFFF [ ] AFFF / ATC [ ] Dry Chemical [ ] Dry Powder [ ] Halon | |

**Attach Copy to Site Safety Plan**

# Hazardous Materials Data Sheet Instructions

## Purpose

To record pertinent information for site hazard and risk assessment.

To be utilized as Hazard Communication document for site workers.

## General Instructions

1. Complete one page for each Hazardous Material.
2. Fill in all applicable data. Place a check in the box [ ] provided when applicable. Indicate "N/A" if the listed item is not applicable to the material.
3. Cite at least 3 reference sources and appropriate page numbers for each.
4. Attach copies of Material Safety Data Sheets (MSDS) or CAMEO RIDS if utilized as reference sources.
5. Utilize the reverse side of the form for additional recommendations.
6. Attach the completed Hazardous Materials Data Sheet to the incident Site Safety Plan.

## Section Instructions

The Hazardous Materials Data Sheet should be self-explanatory. The following instructions are provided for further clarification.

| Section | Instructions |
|---|---|
| Product Information | List the material by product name, chemical name and identification numbers as appropriate. Identify container type and approximate amount of product involved. Identify at least three reference sources used to complete the remainder of the data sheet. |
| Properties | Place a check mark in the boxes [ ] as appropriate. Indicate Fahrenheit or Celsius for temperatures. |
| Toxicology and Health | List all values in the spaces provided. |
| Evacuation Distances and Control Zones | Complete the section with appropriate data. |
| Personal Protective Equipment | Indicate appropriate personal protective equipment for both entry/backup and decon teams. Identify appropriate monitoring instruments to be utilized. |
| Decontamination | Identify the appropriate decon solution to be utilized. Indicate if equipment is to be decontaminated with an alternate solution. |
| Control Measures | Complete the section with appropriate data. |

# Hazardous Materials Data Worksheet

| | |
|---|---|
| Name: | Date: |
| Chemical Name: | UN # |
| Common Name (s): | CAS # |
| Synonyms: | |

| | | |
|---|---|---|
| Molecular Formula: | Weight: | Structure: |

**Physical, Chemical and Toxicological Properties (Based on STP)**

| | Source #1 | Source #2 | Source #3 |
|---|---|---|---|
| Reference Source | | | |
| Page # | | | |
| **Physical Properties** | | | |
| State/form: | | | |
| Flammable Limits | LEL UEL | LEL UEL | LEL UEL |
| Ignition Temp | | | |
| Flash Point | | | |
| Boiling Point | | | |
| Melting Point | | | |
| Vapor Density | | | |
| Specific Gravity | | | |
| Solubilities | | | |
| Vapor Pressure | | | |
| **Chemical Properties** | | | |
| Reactivities/ Incompatibles | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| Corrosivity (pH) | | | |
| Other | | | |
| **Toxicological Properties** | | | |
| TLV-TWA, -C, -STEL | | | |
| PEL or REL | | | |
| IDLH | | | |
| Routes of Entry | | | |
| | | | |
| Carc./Mut./Tera. | | | |
| Target Organs | | | |
| $LD_{lo}$, $LD_{50}$ | | | |
| $LC_{lo}$, $LC_{50}$ | | | |
| Radioactivity | | | |
| Toxic Products of Combustion | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Use the back side of this form to summarize the data.

| Summary of Data | |
|---|---|
| Reference & Page | |
| Primary Hazard | |
| | |
| | |
| Secondary Hazard | |
| | |
| | |
| Other Hazard | |
| | |
| | |
| Recommended CPC Materials | |
| | |
| | |
| Decon Solution | |
| | |
| Reference & Page | |
| Primary Hazard | |
| | |
| | |
| Secondary Hazard | |
| | |
| | |
| Other Hazard | |
| | |
| | |
| Recommended CPC Materials | |
| | |
| | |
| Decon Solution | |
| | |
| Reference & Page | |
| Primary Hazard | |
| | |
| | |
| Secondary Hazard | |
| | |
| | |
| Other Hazard | |
| | |
| | |
| Recommended CPC Materials | |
| | |
| | |
| Decon Solution | |
| | |

## Sample Protective Action Option Message

**This is** ______________________________ ________________________________
*Rank/Title* *Name*

**From the** ______________________________________________________________
*Agency/Department*

**A** __________________________________ ________________________________
*Size/Intensity* *Incident*

_________________________ _______ ________________________________
*Has occurred/Is Occurring* *in/at* *Location*

**Because of the potential danger to life and health** __________________________
*The authority*

___________ ________________ **everyone within** _______ ________________
*Has/have* *ordered/recommended* *#* *blocks/miles/feet*

**of that area to** _____________________________ ___________________________
*evacuate/shelter-in-place* *immediately/as soon as possible*

**This message will be repeated. Specific instructions and locations will be given.**

**If you are in the following areas, you** ____________ ______________________
*Must/should* *leave the area/ get inside a building*

_____________________________**. The areas involved are as follows:**
*Immediately/ as soon as possible*

_________________________ **of** ____________________________________________
*North/South/East/West* *location/street/highway or another significant geographical point*

_________________________ **of** ____________________________________________
*North/South/East/West* *location/street/highway or another significant geographical point*

_________________________ **of** ____________________________________________
*North/South/East/West* *location/street/highway or another significant geographical point*

_________________________ **of** ____________________________________________
*North/South/East/West* *location/street/highway or another significant geographical point*

***Use this template in conjunction with appropriate portions of the Evacuation instructions or the Shelter-in-place instructions on the following pages.***

# Evacuation Instructions

1. Stay calm.

2. Gather your family, take a neighbor or someone who needs help.

3. If evacuation is mandatory: Take critical items (medicine, purse, wallet, keys) only if they are immediately available. Do not take pets.

   If evacuation is precautionary: Take essential items (diapers, baby food, clothes, money). Leave a message on the door.

4. Turn off all appliances (stove, lights, heaters).

5. Lock your house.

6. Do not use more cars than you have to.

7. Keep windows and vents in the car closed.

8. Go immediately to the home of a friend or relative outside the evacuation area, or to a shelter or staging area located at: ________________________________________________ .

9. Officers will be stationed at intersections along the way to direct you.

10. If you need transportation, call: ________________________ or ________________________ .

11. Children attending the following schools will be evacuated to:

| School | Evacuation Location |
|---|---|
| | |
| | |
| | |
| | |
| | |

12. Do not drive to your child's school. Pick your child up from the authorities at the shelter.

13. The hazardous material is toxic. The signs and symptoms of overexposure are as follows:

14. If you have any of these signs or symptoms, seek medical help outside the evacuation area or at the medic station located at: ________________________________________________ .

15. Do not use telephones unless you need emergency service.

16. Other:

# Shelter-in-Place Instructions

1. Get inside your home or other building as quickly as possible.

2. Close all doors, windows, fireplaces, vents or other openings. Use duct tape, foil or plastic wrap to seal leaks.

3. Turn off all heating, ventilation and air conditioning systems. Close vents.

4. Close drapes, curtains and shades. Stay away from external windows.

5. Use stairwells whenever possible. Limit the use of elevators.

6. Use telephones only if you need immediate emergency service.

7. Turn on the radio or television for information. Tune into the Emergency Broadcast System.

8. Stay inside until the authorities announce that it is safe to come out.

# Protective Actions Worksheet

**To be used in conjunction with the Hazardous Materials Data Sheet.**

## Threat Information

| **Threat Type** | **Details** |
|---|---|
| Fire | |
| Natural Disaster | |
| Hazardous Materials | |
| Civil Disturbance | |
| **Impact** | **Details** |
| Life Safety | |
| Environmental | |
| Other | |
| Comments | |
| | |

## Population / Location

| | | | |
|---|---|---|---|
| Population Size - Numbers of: | Persons: | | Animals: |
| Density | [ ] High | [ ] Medium | [ ] Low |
| Type | [ ] Residential | [ ] Commercial | [ ] Industrial |

**Special Considerations**

| Type | Yes | No | Type | Yes | No |
|---|---|---|---|---|---|
| Jails | | | Transportation Available | | |
| Schools | | | Different Languages Spoken | | |
| Hospitals | | | Hearing / Sight / Mobility Impaired | | |
| Population Indoors | | | Transients | | |
| Shelters Available | | | Familiar with the area | | |

**Location / Distance (Plot on Map)**

| | | |
|---|---|---|
| Distance from incident to population: | [ ] feet: | [ ] miles: |
| Direction threat is moving: | [ ] North [ ] South [ ] East [ ] West | |
| The terrain is: | [ ] Flat [ ] Slightly Steep [ ] Steep [ ] Very Steep | |
| Available Evacuation Routes: | | |
| | | |
| Comments: | | |
| | | |

## Haz Mat Conditions (Haz Mat Incident Only)

| | | | | |
|---|---|---|---|---|
| Condition: | [ ] Contained | [ ] Not Contained | [ ] Controlled | [ ] Uncontrolled |
| | [ ] Continuous | [ ] Not Continuous | [ ] Stable | [ ] Unstable |
| Description: | [ ] Puff | [ ] Pool | [ ] Plume | [ ] Other: |
| Location: | [ ] Ground Level | [ ] Elevated | [ ] Accessible | [ ] Inaccessible |
| Temperature: | Ambient Temp: | On Fire: | Heated: | Cooled: |

Refer to the Hazardous Materials Data Sheet for more information.

## Time

| | | | |
|---|---|---|---|
| When Threat is Likely to Occur: | Time: | | Date: |
| Time Threat Will Last: | Hours: | Days: | Weeks: |

### Rate

| | | | | | |
|---|---|---|---|---|---|
| Rate of Threat / Release | [ ] Rapid | [ ] Moderate | [ ] Slow | [ ] Stopped | [ ] Unknown |
| Rate of Threat Movement | [ ] Rapid | [ ] Moderate | [ ] Slow | [ ] Stopped | [ ] Unknown |

| | | | |
|---|---|---|---|
| Will Contact Population In: | Minutes: | Hours: | Days: |
| Greatest Threat Will Occur In: | Minutes: | Hours: | Days: |

### Time Needed for Implementing Protective Actions

| Action | Minutes | Hours |
|---|---|---|
| Deploy Response Personnel | | |
| Develop Message | | |
| Give Public Warning and Instructions | | |
| Public Mobilization and Travel Time | | |
| Special Needs Mobilization and Travel Time | | |
| Environmental Monitoring | | |
| Comments: | | |
| | | |

## Communications

| Communicate with Public | Yes | No | Communicate with Responders | Yes | No |
|---|---|---|---|---|---|
| Able to warn public? | | | Able to communicate with all agencies? | | |
| Able to warn institutions? | | | Able to communicate with media? | | |
| Able to warn transients? | | | Able to communicate with EBS/EAS? | | |
| Able to warn hearing impaired? | | | Able to use phone system? | | |
| Able to instruct and update? | | | Able to use sirens? | | |
| Comments | | | | | |
| | | | | | |

## Resources and Responder Capabilities

| Mobilize Needed Specialized Resources | Yes | No | Control the Threat | Yes | No |
|---|---|---|---|---|---|
| Able to mobilize existing resources? | | | Able to stop the threat? | | |
| Able to mobilize additional resources? | | | Able to direct / control threat? | | |
| Able to obtain specialized resources? | | | Able to neutralize the threat? | | |
| | | | Able to identify the material? | | |
| Comments | | | | | |
| | | | | | |

# Protective Actions Worksheet Instructions

## General Instructions

1. Use this form in conjunction with the Hazardous Materials Data Sheet.

2. Complete all sections of the worksheet, entering information on the lines provided. Place a check in the box [ ] provided when applicable.

3. Review the contents of the Hazardous Materials Data Sheet and the Protective Actions worksheet at the Safety Briefing.

## Section Instructions

The following instructions are provided for further clarification:

| Section | Instructions |
|---|---|
| Threat Information | Identify the threat type(s) and the potential impact(s). Provide details as appropriate. |
| Population / Location | Identify the population threatened. Identify any special considerations that will impact your protective actions planning. |
| Haz Mat Conditions | If this is a Haz Mat incident, provide additional details about the condition of the release/spill. This information should be used in conjunction with the Hazardous Materials Data Sheet. |
| Time | Indicate time frames regarding the threat and time needed to implement protective actions. |
| Communications | Assess communications capabilities. |
| Resources and Responder Capabilities | Assess the capabilities of mobilizing resources and controlling the threat. |

# INCIDENT BRIEFING (ICS 201)

| 1. Incident Name: | 2. Incident Number: | 3. Date/Time Initiated:<br>Date: Date Time: HHMM |
|---|---|---|

**4. Map/Sketch** (include sketch, showing the total area of operations, the incident site/area, impacted and threatened areas, overflight results, trajectories, impacted shorelines, or other graphics depicting situational status and resource assignment)**:**

**5. Situation Summary and Health and Safety Briefing** (for briefings or transfer of command)**:** Recognize potential incident Health and Safety Hazards and develop necessary measures (remove hazard, provide personal protective equipment, warn people of the hazard) to protect responders from those hazards.

**6. Prepared by:** Name: Position/Title: Signature: ___________________

 Date/Time: Date

# INCIDENT BRIEFING (ICS 201)

| 1. Incident Name: | 2. Incident Number: | 3. Date/Time Initiated: Date: Date Time: HHMM |
|---|---|---|

**7. Current and Planned Objectives:**

**8. Current and Planned Actions, Strategies, and Tactics:**

| Time: | Actions: |
|---|---|
| HHMM | |
| HHMM | |
| HHMM | |
| HHMM | |
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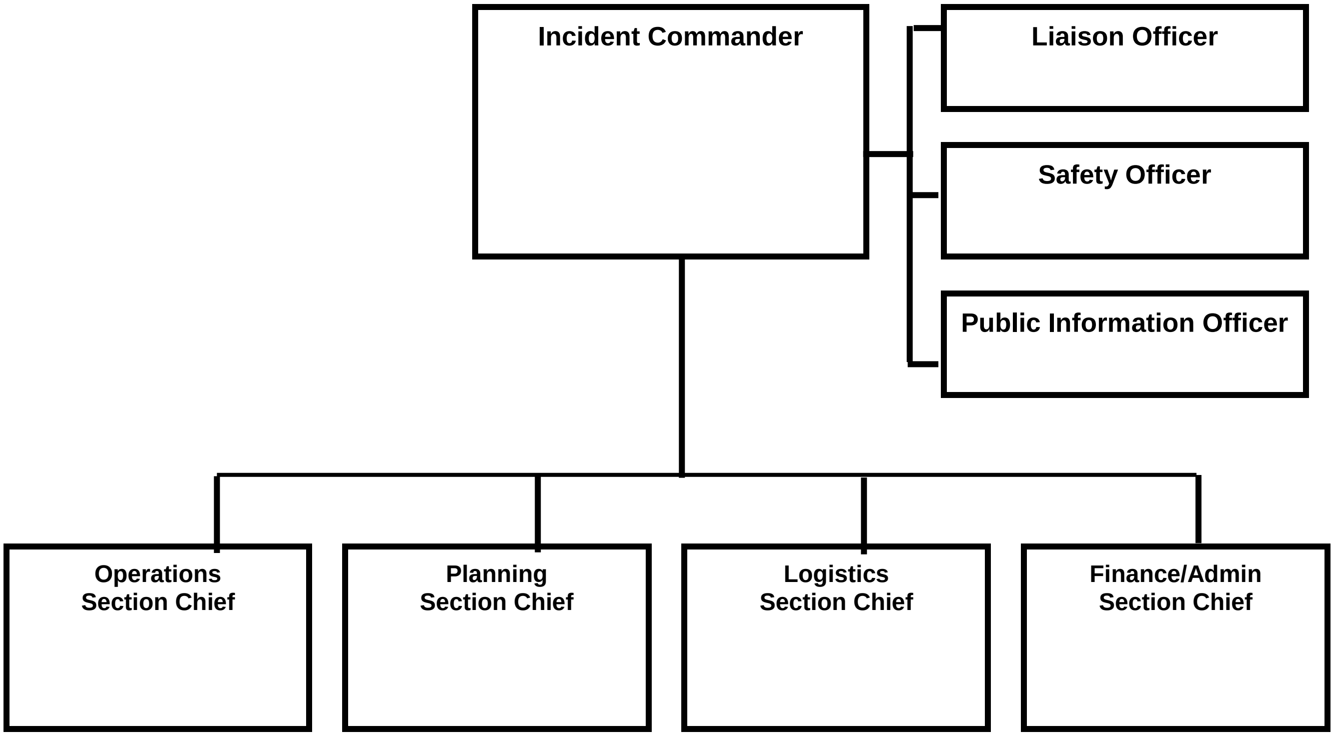
**6. Prepared by:** Name: Position/Title: Signature: ___________________

 Date/Time: Date

# INCIDENT BRIEFING (ICS 201)

| 1. Incident Name: | 2. Incident Number: | 3. Date/Time Initiated: Date: Date Time: HHMM |
|---|---|---|

**9. Current Organization** (fill in additional organization as appropriate)**:**




| | | |
|---|---|---|
| **6. Prepared by:** Name: | Position/Title: | Signature: ____________________ |
| **ICS 201, Page 3** | Date/Time: Date | |

# INCIDENT BRIEFING (ICS 201)

| 1. Incident Name: | 2. Incident Number: | 3. Date/Time Initiated: Date: Date Time: HHMM |
|---|---|---|

**10. Resource Summary:**

| Resource | Resource Identifier | Date/Time Ordered | ETA | Arrived | Notes (location/assignment/status) |
|---|---|---|---|---|---|
| | | | | ☐ | |
| | | | | ☐ | |
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| | | | | ☐ | |

**6. Prepared by:** Name: Position/Title: Signature: ________________

**ICS 201, Page 4** Date/Time: Date

# INCIDENT OBJECTIVES (ICS 202)

| | | | |
|---|---|---|---|
| **1. Incident Name:** | **2. Operational Period:** | Date From: Date<br>Time From: HHMM | Date To: Date<br>Time To: HHMM |

**3. Objective(s):**

**4. Operational Period Command Emphasis:**

General Situational Awareness

**5. Site Safety Plan Required?** Yes ☐ No ☐

**Approved Site Safety Plan(s) Located at:** ____________________

**6. Incident Action Plan** (the items checked below are included in this Incident Action Plan)**:**

| | | |
|---|---|---|
| ☐ ICS 203 | ☐ ICS 207 | Other Attachments: |
| ☐ ICS 204 | ☐ ICS 208 | ☐ ____________ |
| ☐ ICS 205 | ☐ Map/Chart | ☐ ____________ |
| ☐ ICS 205A | ☐ Weather Forecast/Tides/Currents | ☐ ____________ |
| ☐ ICS 206 | | ☐ ____________ |

**7. Prepared by:** Name: Position/Title: Signature: ____________

**8. Approved by Incident Commander:** Name: Signature: ____________

| | | |
|---|---|---|
| **ICS 202** | **IAP Page** | Date/Time: Date |

# ORGANIZATION ASSIGNMENT LIST (ICS 203)

| **1. Incident Name:** | **2. Operational Period:** | Date From: Date | Date To: Date |
|---|---|---|---|
| | | Time From: HHMM | Time To: HHMM |

**3. Incident Commander(s) and Command Staff:**

| | |
|---|---|
| IC/UCs | |
| | |
| | |
| Deputy | |
| Safety Officer | |
| Public Info. Officer | |
| Liaison Officer | |

**4. Agency/Organization Representatives:**

| Agency/Organization | Name |
|---|---|
| | |
| | |
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**5. Planning Section:**

| | |
|---|---|
| Chief | |
| Deputy | |
| Resources Unit | |
| Situation Unit | |
| Documentation Unit | |
| Demobilization Unit | |
| Technical Specialists | |
| | |
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**6. Logistics Section:**

| | |
|---|---|
| Chief | |
| Deputy | |
| **Support Branch** | |
| Director | |
| Supply Unit | |
| Facilities Unit | |
| Ground Support Unit | |
| **Service Branch** | |
| Director | |
| Communications Unit | |
| Medical Unit | |
| Food Unit | |

**7. Operations Section:**

| | | |
|---|---|---|
| Chief | | |
| Deputy | | |
| | | |
| Staging Area | | |
| **Branch** | | |
| Branch Director | | |
| Deputy | | |
| Division/Group | | |
| Division/Group | | |
| Division/Group | | |
| Division/Group | | |
| Division/Group | | |
| **Branch** | | |
| Branch Director | | |
| Deputy | | |
| Division/Group | | |
| Division/Group | | |
| Division/Group | | |
| Division/Group | | |
| Division/Group | | |
| **Branch** | | |
| Branch Director | | |
| Deputy | | |
| Division/Group | | |
| Division/Group | | |
| Division/Group | | |
| Division/Group | | |
| Division/Group | | |
| **Air Operations Branch** | | |
| Air Ops Branch Dir. | | |
| | | |
| | | |

**8. Finance/Administration Section:**

| | |
|---|---|
| Chief | |
| Deputy | |
| Time Unit | |
| Procurement Unit | |
| Comp/Claims Unit | |
| Cost Unit | |

| **9. Prepared by:** Name: | Position/Title: | Signature: ________________ |
|---|---|---|
| **ICS 203** | **IAP Page** | Date/Time: Date |

# ASSIGNMENT LIST (ICS 204)

| **1. Incident Name:** | **2. Operational Period:**<br>Date From: Date Date To: Date<br>Time From: HHMM Time To: HHMM | **3.**<br>Branch:<br>Division:<br>Group:<br>Staging Area: |
|---|---|---|

**4. Operations Personnel:**

| | Name | Contact Number(s) |
|---|---|---|
| Operations Section Chief: | | XXX-XXX-XXXX |
| Branch Director: | | XXX-XXX-XXXX |
| Division/Group Supervisor: | | XXX-XXX-XXXX |

**5. Resources Assigned:**

| Resource Identifier | Leader | # of Persons | Contact (e.g., phone, pager, radio frequency, etc.) | Reporting Location, Special Equipment and Supplies, Remarks, Notes, Information |
|---|---|---|---|---|
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**6. Work Assignments:**

**7. Special Instructions:**

**8. Communications** (radio and/or phone contact numbers needed for this assignment)**:**

| Name | /Function | Primary Contact: indicate cell, pager, or radio (frequency/system/channel) |
|---|---|---|
| | / | |
| | / | |
| | / | |
| | / | |

**9. Prepared by:** Name: Position/Title: Signature: ______________

| **ICS 204** | **IAP Page** | Date/Time: Date |
|---|---|---|

# INCIDENT RADIO COMMUNICATIONS PLAN (ICS 205)

| **1. Incident Name:** | **2. Date/Time Prepared:**<br>Date: Date<br>Time: HHMM | **3. Operational Period:**<br>Date From: Date Date To: Date<br>Time From: HHMM Time To: HHMM |
|---|---|---|

**4. Basic Radio Channel Use:**

| Zone Grp. | Ch # | Function | Channel Name/Trunked Radio System Talkgroup | Assignment | RX Freq N or W | RX Tone/NAC | TX Freq N or W | TX Tone/NAC | Mode (A, D, or M) | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|
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**5. Special Instructions:**

**6. Prepared by** (Communications Unit Leader)**:** Name: Signature: ____________

**ICS 205** | **IAP Page** | Date/Time: Date

| 1. Incident Name | 2. Operational Period (Date/Time)<br>From: To: | **UNIT LOG**<br>**ICS 214-CG** |
|---|---|---|

| 3. Unit Name/Designators | 4. Unit Leader (Name and ICS Position) |
|---|---|

**5. Personnel Assigned**

| NAME | ICS POSITION | HOME BASE |
|---|---|---|
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**6. Activity Log (Continue on Reverse)**

| TIME | MAJOR EVENTS |
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**7. Prepared by:** **Date/Time**

| 1. Incident Name | 2. Operational Period (Date/Time)<br>From: To: | UNIT LOG (CONT.)<br>ICS 214-CG |
| --- | --- | --- |

**6. Activity Log (Continue on Reverse)**

| TIME | MAJOR EVENTS |
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**7. Prepared by:** **Date/Time:**

| 1. Incident Name | 2. Operational Period (Date/Time)<br>From: To: | UNIT LOG<br>ICS 214-CG |
|---|---|---|

| 3. Unit Name/Designators | 4. Unit Leader (Name and ICS Position) |
|---|---|

**5. Personnel Assigned**

| NAME | ICS POSITION | HOME BASE |
|---|---|---|
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**6. Activity Log (Continue on Reverse)**

| TIME | MAJOR EVENTS |
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**7. Prepared by:** **Date/Time**

| 1. Incident Name | 2. Operational Period (Date/Time)<br>From: To: | UNIT LOG (CONT.)<br>ICS 214-CG |
|---|---|---|

**6. Activity Log (Continue on Reverse)**

| TIME | MAJOR EVENTS |
|---|---|
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**7. Prepared by:** **Date/Time:**

**UNIT LOG (ICS FORM 214-CG)**

**Purpose**. The Unit Log records details of unit activity, including strike team activity or individual activity. These logs provide the basic reference from which to extract information for inclusion in any after-action report.

**Preparation**. A Unit Log is initiated and maintained by Command Staff members, Division/Group Supervisors, Air Operations Groups, Strike Team/Task Force Leaders, and Unit Leaders. Completed logs are submitted to supervisors who forward them to the Documentation Unit.

**Distribution**. The Documentation Unit maintains a file of all Unit Logs. All completed original forms MUST be given to the Documentation Unit.

| Item # | Item Title | Instructions |
|---|---|---|
| 1. | Incident Name | Enter the name assigned to the incident. |
| 2. | Check-In Location | Enter the time interval for which the form applies. Record the start and end date and time. |
| 3. | Unit Name/Designators | Enter the title of the organizational unit or resource designator (e.g., Facilities Unit, Safety Officer, Strike Team). |
| 4. | Unit Leader | Enter the name and ICS Position of the individual in charge of the Unit. |
| 5. | Personnel Assigned | List the name, position, and home base of each member assigned to the unit during the operational period. |
| 6. | Activity Log | Enter the time and briefly describe each significant occurrence or event (e.g., task assignments, task completions, injuries, difficulties encountered, etc.) |
| 7. | Prepared By | Enter name and title of the person completing the log. Provide log to immediate supervisor, at the end of each operational period. |
| | Date/Time | Enter date (month, day, year) and time prepared (24-hour clock). |

| SITE SAFETY AND CONTROL PLAN<br>ICS 208-HM page 1 | | 2. DATE PREPARED: | 3: OPERATIONAL PERIOD<br>TIME: |
|---|---|---|---|

**SECTION I: SITE INFORMATION**

4. INCIDENT LOCATION:

**SECTION II: ORGANIZATION**

| | | |
|---|---|---|
| 5. INCIDENT COMMANDER: | 6. HM GROUP SUPERVISOR: | 7. TECH. SPECIALIST – HM REFERENCE: |
| 8. SAFETY OFFICER: | 9. ENTRY LEADER: | 10. SITE ACCESS CONTROL LEADER: |
| 11. ASSISTANT SAFETY OFFICER – HM: | 12. DECONTAMINATION LEADER: | 13. SAFE REFUGE AREA MANAGER: |
| 14. ENVIRONMENTAL HEALTH: | | |

| 15. ENTRY TEAM (BUDDY SYSTEM) | | 16. DECONTAMINATION ELEMENT | |
|---|---|---|---|
| NAME | LEVEL | NAME | LEVEL |
| ENTRY 1: | | DECON 1: | |
| ENTRY 2: | | DECON 2: | |
| ENTRY 3: | | DECON 3: | |
| ENTRY 4: | | DECON 4: | |

**SECTION III: HAZARD / RISK ANALYSIS**

| 17. MATERIAL | CONTAINER TYPE | QTY. | PHYS. STATE | pH | IDLH | F.P. | I.T. | V.P. | V.D. | S.G. | LEL | UEL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | |
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COMMENT:

**SECTION IV: HAZARD MONITORING**

| | |
|---|---|
| 18. LEL INSTRUMENT(S): | 19. $O_2$ INSTRUMENT(S): |
| 20. TOXICITY / PPM INSTRUMENT(S): | 21. RADIOLOGICAL INSTRUMENT(S): |

COMMENT:

**SECTION V: DECONTAMINATION PROCEDURES**

22. STANDARD DECONTAMINATION PROCEDURES: YES: NO: COMMENT:

**SECTION VI: SITE COMMUNICATIONS**

| | | |
|---|---|---|
| 23. COMMAND FREQUENCY: | 24. TACTICAL FREQUENCY: | 25. ENTRY FREQUENCY: |

**SECTION VII: MEDICAL ASSISTANCE**

| | | | | | |
|---|---|---|---|---|---|
| 26. MEDICAL MONITORING | YES: | NO: | 27. MEDICAL TREATMENT AND TRANSPORT IN-PLACE | YES: | NO: |

COMMENT:

SECTION VIII. SITE MAP

28. SITE MAP:

N

- WEATHER ☐
- COMMAND POST ☐
- ZONES ☐
- ASSEMBLY AREAS ☐
- ESCAPE ROUTES ☐
- OTHER ☐

SECTION IX: ENTRY OBJECTIVES

29. ENTRY OBJECTIVES:

SECTION X: SOP'S AND SAFE WORK PRACTICES

| | | | |
|---|---|---|---|
| 30. MODIFICATIONS TO DOCUMENTED SOP'S AND WORK PRACTICES | YES: | NO: | |

COMMENT:

SECTION XI: EMERGENCY PROCEDURES

31. EMERGENCY PROCEDURES:

SECTION XII. SAFETY BRIEFING

| | |
|---|---|
| 32. ASSISTANT SAFETY OFFICER HM SIGNATURE: | SAFETY BRIEFING COMPLETED (TIME): |
| 33. HM GROUP SUPERVISOR SIGNATURE: | 34. INCIDENT COMMANDER SIGNATURE: |

# Sample Site Safety Plan Instructions

## General Instructions

1. Complete all sections of the plan, entering information on the lines provided. Place a check in the box [ ] provided when applicable.

2. Key safety points are indicated with the following symbol: +

3. Items requiring additional documentation are indicated with the following symbol: -

   Additional documentation required includes a Hazardous Materials Data Sheet, a site map (ICS Form 201), a Medical Monitoring Form, and a Site Safety Plan Amendment (as needed).

4. Review contents of the Plan at the Safety Briefing.

5. Submit copies of the completed Plan to the Command Post for dissemination to responding resources.

## Section Instructions

The Site Safety Plan should be self-explanatory. The following instructions are provided for further clarification.

| Section | Instructions |
|---|---|
| Site Information | Provide information about the site and prevailing weather conditions. Indicate how Control Zones are identified (e.g. barrier tape, traffic cones, chain link fence surrounding property). Attach a copy of the ICS Form 201 with a site map. |
| Organization | Enter the names of personnel assigned to each position. |
| Hazard Evaluation | Complete and attach a Hazardous Materials Data Sheet. (This is required for risk assessment and Hazard Communication to the workers.) Enter the information from the Hazardous Materials Data Sheet in this section. |
| Mitigation Actions | Enter the actions taken to mitigate the existing hazards. (Incident Objectives are identified on ICS Form 202.) |
| Safety | Identify general hazards and the appropriate safety precautions. |
| Monitoring | Identify the specific instruments to be used. Identify the monitoring frequency if monitoring will not be continuous. |
| Protective Clothing | Enter the level of suit, the suit type and the glove type recommended from the Hazardous Materials Data Sheet. |

| | |
|---|---|
| Decontamination | Enter the information from the Site Map and the Hazardous Materials Data Sheet. Indicate whether standard decontamination layout is used, or identify the alternate decon setup and procedure. |
| Communications | Indicate the radio frequencies assigned. |
| Health | Pre-Entry and Post-Entry Vitals shall be taken on all Entry and Decon Personnel by a qualified individual. This information is to be entered on a Medical Monitoring Form which shall be attached to the Site Safety Plan. Health Hazards and appropriate treatment information shall be entered on the attached Hazardous Materials Data Sheet. |
| Emergency Procedures | Complete the remaining portions of the Emergency Procedures section. |
| Training | Deviation from the training requirements should be documented on the ICS Form 214 by the Unit Leader in charge and the Assistant Safety Officer / Hazmat. The Entry Team shall be briefed on facility specific information by a facility representative.<br><br>Place a check in the box [ ] to indicate that the personnel on site have the appropriate training. Use the line provided for special requirements or modifications if necessary. |
| Plan Review | All Entry, Backup and Decon personnel must briefed on the plan prior to entry. The plan shall be available for review by all personnel. The Assistant Safety Officer shall review and approve the plan. |
| **Site Safety Plan Amendment** | |
| Check Amended Sections | Indicate which sections have been amended. |
| Items | Provide details on amendments made to the original plan. |
| Plan Review | The Assistant Safety Officer shall prepare the plan. The Haz Mat Group Supervisor shall review the plan. The Incident Commander shall approve the plan. The plan shall be available for review by all personnel. |

# Haz Mat ICS Position Description Checklist

**ICS Position Title:** Incident Commander

**Major Responsibility:** Overall “Macro” management of all operational and support activities of the incident, including the development and implementation of strategic decisions and the ultimate approval of ordering and releasing resources.

**Duty Checklist:**

_____ 1. Assume formal, verbal, visual and firm command, and get briefing.

_____ 2. Assess current problems, resources, actions and organization.

_____ 3. Assign needed ICS command and general staff positions.

____ a. Knowledgeable Safety Officer required for haz mat incident.

_____ 4. Hold planning meetings as needed.

_____ 5. Develop and communicate strategic control objectives.

____ a. For haz mat objectives use.

_____ 6. Approve Incident Action Plan and Site Safety Plan.

_____ 7. Ensure briefing and safety meetings are given to assigned resources before beginning haz mat actions/operations.

_____ 8. Manage and monitor overall incident per CCR 5192 requirements.

____ a. Assess all hazards.
____ b. Take appropriate operations in line with proper safety equipment.
____ c. If inhalation hazard, ensure use of SCBAs.
____ d. Limit number of personnel within exclusion zone, but ensure buddy system.
____ e. Ensure backups and standby EMS unit.
____ f. Designate a knowledgeable safety official that can stop unsafe acts.
____ g. Implement appropriate decon procedures.

_____ 9. Make decisions and adjustments throughout incident as needed.

_____ 10. Aggressively approve news releases to media through PIO.

_____ 11. Ultimately approve all ordering and releasing of resources.

_____ 12. Approve plan for demobilization and transition to cleanup phase.

# Haz Mat ICS Position Description Checklist

**ICS Position Title:** Information Officer

**Major Responsibility:** The Information Officer, a member of the Command Staff, is responsible for the formulation and release of information about the incident to the news media and other appropriate agencies and organizations.

**Duty Checklist:**

_____ 1. Obtain briefing from Incident Commander.

_____ 2. Contact the jurisdictional agency to coordinate public information activities.

_____ 3. Establish single incident information center whenever possible.

_____ 4. Arrange for necessary work space, materials, telephones, and staffing.

_____ 5. Obtain copies of current ICS-209s.

_____ 6. Prepare initial information summary as soon as possible after arrival.

_____ 7. Observe constraints on the release of information imposed by Incident Commander.

_____ 8. Obtain approval for release from Incident Commander.

_____ 9. Release news to news media and post information in Command Post and other appropriate locations.

_____ 10. Attend meetings to update information releases.

_____ 11. Arrange for meetings between media and incident personnel.

_____ 12. Provide escort service to the media and VIPs.

_____ 13. Provide fire retardant clothing for media and VIPs.

_____ 14. Respond to special requests for information.

_____ 15. Maintain Unit Log (ICS Form 214)

## Haz Mat ICS Position Description Checklist

**ICS Position Title:** Safety Officer

**Major Responsibility:** The Safety Officer, a member of the Command Staff, is responsible for monitoring and assessing hazardous and unsafe situations and developing measures for assuring personnel safety. The Safety Officer will correct unsafe acts or conditions through the regular line of authority, although the Officer may exercise emergency authority, to stop or prevent unsafe acts when immediate action is required. The Safety Officer maintains awareness of active and developing situations, approves the Medical Plan (ICS Form 206), and includes safety messages in each Incident Action Plan.

**Duty Checklist:**

_____ 1. Obtain briefing from Incident Commander.

_____ 2. Identify hazardous situations associated with the incident.

_____ 3. Participate in planning meetings.

_____ 4. Review Incident Action Plans.

_____ 5. Identify potentially unsafe situations.

_____ 6. Exercise emergency authority to stop and prevent unsafe acts.

_____ 7. Investigate accidents that have occurred within incident areas.

_____ 8. Review and approve Medical Plan (ICS Form 206).

_____ 9. Maintain Unit Log (ICS Form 214).

# Haz Mat ICS Position Description Checklist

**ICS Position Title:** Liaison Officer

**Major Responsibility:** The Liaison Officer is a member of the Command Staff, and is the point of contact for the assisting and cooperating Agency Representatives. This includes Agency Representatives from other fire agencies, Red Cross, law enforcement, public works and engineering organizations, etc. The Liaison Officer will be from the jurisdictional agency.

**Duty Checklist:**

_____ 1. Obtain briefing from Incident Commander.

_____ 2. Provide a point of contact for assisting/cooperating Agency Representatives.

_____ 3. Identify Agency Representatives from each agency, including communications link and location.

_____ 4. Respond to requests from incident personnel for inter-organizational contacts.

_____ 5. Monitor incident operations to identify current or potential inter-organizational problems.

_____ 6. Maintain Unit Log (ICS Form 214)

## Haz Mat ICS Position Description Checklist
## Operations Section

**ICS Position Title:** Operations Section Chief

**Major Responsibility:** The Operations Section Chief, a member of the General Staff, is responsible for the management of all operations directly applicable to the primary mission. The Operations Chief activates and supervises organization elements in accordance with the Incident Action Plan and directs its execution. The Operations Chief also directs the preparation of unit operational plans, requests or releases resources, makes expedient changes to the Incident Action Plan as necessary; and reports such to the Incident Commander.

**Duty Checklist:**

_____ 1. Obtain briefing from Incident Commander.

_____ 2. Develop operations portion of Incident Action Plan.

_____ 3. Brief and assign operations personnel in accordance with Incident Action Plan.

_____ 4. Supervise operations.

_____ 5. Determine need and request additional resources.

_____ 6. Review suggested list of resources to be released and initiate recommendation for release of resources.

_____ 7. Assemble and disassemble strike teams assigned to Operations Section.

_____ 8. Report information about special activities, events, and occurrences to Incident Commander.

# Haz Mat ICS Position Description Checklist
# Operations Section

**ICS Position Title:** Branch Director

**Major Responsibility:** The Branch Directors, when activated, are under the direction of the Operations Section Chief, and are responsible for the implementation of the portion of the Incident Action Plan appropriate to the Branches.

**Duty Checklist:**

_____ 1. Obtain briefing from Operations Chief.

_____ 2. Develop with subordinates alternatives for Branch control operations.

_____ 3. Attend planning meetings at the request of the Operations Chief.

_____ 4. Review Division/Group Assignment Lists (ICS Form 204) for Divisions/Groups within Branch. Modify lists based on effectiveness of current operations.

_____ 5. Assign specific work tasks to Division/Group Supervisors.

_____ 6. Resolve logistic problems reported by subordinates.

_____ 7. Report to Operations Chief when: Incident Action Plan is to be modified; additional resources are needed; surplus resources are available; hazardous situations or significant events occur.

_____ 8. Approve accident and medical reports (home agency forms) originating within the Branch.

_____ 9. Maintain Unit Log (ICS Form 214).

## Haz Mat ICS Position Description Checklist
## Operations Section

**ICS Position Title:** Staging Area Manager

**Major Responsibility:** The Staging Area Manager is responsible for managing all activities within a Staging Area.

**Duty Checklist:**

_____ 1. Obtain briefing from the Operations Section Chief.

_____ 2. Proceed to Staging Area.

_____ 3. Establish Staging Area layout.

_____ 4. Determine any support needs for equipment, feeding, sanitation, and security.

_____ 5. Establish check-in function as appropriate.

_____ 6. Post areas for identification and traffic control.

_____ 7. Request maintenance service for equipment at Staging Area as appropriate.

_____ 8. Respond to request for resource assignments. (Note: This may be direct from Operations or via the Incident Communications Center).

_____ 9. Obtain and issue receipts for radio equipment and other supplies distributed and received at Staging Area.

_____ 10. Report resource status changes as required.

_____ 11. Maintain Staging Area in orderly condition.

_____ 12. Demobilize Staging Area in accordance with Incident Demobilization Plan.

_____ 13. Maintain Unit Log (ICS Form 214)

# Haz Mat ICS Position Description Checklist
## Planning Section

**ICS Position Title:** Planning Section Chief

**Major Responsibility:** The Planning Section Chief, a member of the Incident Commander's General Staff, is responsible for the collection, evaluation, dissemination and use of information about the development of the incident and status of resources. Information is needed to 1) understand the current situation, 2) predict probable course of incident events, and 3) prepare alternative strategies and control operations for the incident.

**Duty Checklist:**

_____ 1. Obtain briefing from the Incident Commander.

_____ 2. Activate Planning Section units.

_____ 3. Reassign initial attack personnel to incident positions as appropriate.

_____ 4. Establish information requirements and reporting schedules for all ICS organizational elements for use in preparing the Incident Action Plan.

_____ 5. Notify Resources Unit of Planning Section units activated, including names and locations of assigned personnel.

_____ 6. Establish a weather data collection system when necessary.

_____ 7. Supervise preparation of Incident Action Plan (see Planning Process checklist).

_____ 8. Assemble information on alternative strategies.

_____ 9. Assemble and disassemble strike teams not assigned to operations.

_____ 10. Identify need for use of specialized resource(s).

_____ 11. Perform operational planning for Planning Section.

_____ 12. Provide periodic predictions on incident potential.

_____ 13. Compile and display incident status summary information.

_____ 14. Advise General Staff of any significant changes in incident status.

_____ 15. Provide incident traffic plan.

_____ 16. Supervise Planning Section units

_____ 17. Prepare and distribute Incident Commander's orders.

_____ 18. Instruct Planning Section units in distribution of incident information.

_____ 19. Ensure that normal agency information collection and reporting requirements are being met.

_____ 20. Prepare recommendations for release of resources (to be submitted to the Incident Commander).

## Haz Mat ICS Position Description Checklist
## Planning Section

**ICS Position Title:** Field Observer

**Major Responsibility:** The Field Observer is responsible to collect situation information from personal observations at the incident, and provide this information to the Situation Unit Leader.

**Duty Checklist:**

_____ 1. Obtain briefing from Situation Unit Leader.

_____ 2. Determine:

- ____ Location of assignment.
- ____ Type of information required.
- ____ Priorities.
- ____ Time limits for completion.
- ____ Method of communication.
- ____ Method of transportation.

_____ 3. Obtain copy of Incident Action Plan for the Operational Period.

_____ 4. Obtain necessary equipment and supplies.

_____ 5. Perform field observer responsibilities to include but not limited to the following:

- ____ Perimeters of incident.
- ____ Locations of hot spots.
- ____ Unburned islands.
- ____ Rates of spread.
- ____ Weather conditions
- ____ Hazards including escape routes and safe areas.
- ____ Progress of Operations resources.

_____ 6. Be prepared to identify all facility locations (e.g. helispots, Division and Branch boundaries).

_____ 7. Report information to Situation Unit Leader by established procedure.

_____ 8. Report immediately any condition observed which may cause danger and safety hazard to personnel.

_____ 9. Gather intelligence that will lead to accurate predictions.

## Haz Mat ICS Position Description Checklist
## Planning Section

**ICS Position Title:** Documentation Unit Leader

**Major Responsibility:** The Documentation Unit Leader, a member of the Planning Section, is responsible for: 1) maintaining accurate and complete incident files; 2) providing duplication services to incident personnel; and 3) pack and store incident files for legal, analytical and historical purposes.

**Duty Checklist:**

_____ 1. Obtain briefing from the Planning Section Chief.

_____ 2. Establish work area.

_____ 3. Establish and organize incident files.

_____ 4. Establish duplication service and respond to requests.

_____ 5. Retain and file duplicate copies of official forms and reports.

_____ 6. Accept and file reports and forms submitted to unit by incident organizations.

_____ 7. Check on accuracy and completeness of records submitted for files.

_____ 8. Correct errors or omissions by contacting appropriate ICS Units.

_____ 9. Provide duplicates of forms and reports to authorized requesters.

_____ 10. Prepare incident documentation for Planning Section Chief when requested.

_____ 11. Maintain, retain and store incident files for after-incident use

_____ 12. Maintain Unit Log (ICS Form 214)

# Haz Mat ICS Position Description Checklist
# Logistics Section

**ICS Position Title:** Logistics Section Chief

**Major Responsibility:** The Logistics Section Chief, a member of the General Staff, is responsible for providing facilities, services, and material in support of the incident. The Section Chief participates in development and implementation of the Incident Action Plan and activates and supervises the Branches and Units within the Logistics Section.

**Duty Checklist:**

_____ 1. Obtain briefing from the Incident Commander.

_____ 2. Plan organization of Logistics Section.

_____ 3. Assign work locations and preliminary work tasks to Section personnel.

_____ 4. Notify Resources Unit of Logistics Section units activated including names and locations of assigned personnel.

_____ 5. Assemble and brief Branch Directors and Unit Leaders.

_____ 6. Participate in preparation of Incident Action Plan.

_____ 7. Identify service and support requirements for planned and expected operations.

_____ 8. Provide input to and review Communications Plan, Medical Plan and Traffic Plan.

_____ 9. Coordinate and process requests for additional resources.

_____ 10. Review Incident Action Plan and estimate Section needs for next operational period.

_____ 11. Ensure Incident Communications Plan is prepared.

_____ 12. Advise on current service and support capabilities.

_____ 13. Prepare service and support elements of the Incident Action Plan.

_____ 14. Estimate future service and support requirements.

_____ 15. Receive Demobilization Plan from Planning Section.

_____ 16. Recommend release of unit resources in conformity with Demobilization Plan.

_____ 17. Ensure general welfare and safety of Logistics Section personnel.

## Haz Mat ICS Position Description Checklist
## Logistics Section

**ICS Position Title:** Medical Unit Leader

**Major Responsibility:** The Medical Unit Leader, under the direction of the Service Branch Director or Logistics Section Chief, is primarily responsible for the development of the Medical Emergency Plan, obtaining medical aid and transportation for injured and ill incident personnel, and preparation of reports and records. The Medical Unit may also assist Operations in supplying medical care and assistance to civilian casualties at the incident.

**Duty Checklist:**

_____ 1. Obtain briefing from the Service Branch Director or Logistics Section Chief.

_____ 2. Participate in Logistics Section/Service Branch planning activities.

_____ 3. Determine level of emergency medical activities performed prior to of Medical Unit.

_____ 4. Activate Medical Unit.

_____ 5. Prepare the Medical Emergency Plan (ICS Form 206).

_____ 6. Prepare procedures for major medical emergency.

_____ 7. Declare major medical emergency as appropriate.

_____ 8. Respond to requests for medical aid.

_____ 9. Respond to requests for medical transportation.

_____ 10. Respond to requests for medical supplies.

_____ 11. Prepare medical reports.

_____ 12. Submit reports as directed.

_____ 13. Maintain Unit Log (ICS Form 214).

## Haz Mat ICS Position Description Checklist
## Finance Section

**ICS Position Title:** Finance Section Chief

**Major Responsibility:** The Finance Section Chief is responsible for all financial and cost analysis aspects of the incident and for supervising members of the Finance Section.

**Duty Checklist:**

_____ 1. Obtain briefing from the Incident Commander.

_____ 2. Attend briefing with responsible agency to gather information.

_____ 3. Attend planning meeting to gather information on overall strategy.

_____ 4. Identify and order supply and support needs for Finance Section.

_____ 5. Develop an operating plan for Finance function on incident.

_____ 6. Prepare work objectives for subordinates, brief staff, make assignments and evaluate performance.

_____ 7. Determine need for commissary operation.

_____ 8. Inform Incident Commander and General Staff when Section is fully operational.

_____ 9. Meet with Assisting and Cooperating Agency Representatives as required.

_____ 10. Provide input in all planning sessions on financial and cost analysis matters.

_____ 11. Maintain daily contact with agency(s) administrative headquarters on Finance matters.

_____ 12. Ensure that all personnel time records are transmitted to home agencies according to policy.

_____ 13. Participate in all demobilization planning.

_____ 14. Ensure that all obligation documents initiated at the incident are properly prepared and completed.

_____ 15. Brief agency administration personnel on all incident-related business issues needing attention and follow-up prior to leaving incident.

# Hazardous Materials Positions
# Descriptions and Functions

**Hazardous Materials Group Supervisor** - The Hazardous Materials Group Supervisor reports to the Operations Section Chief. The Hazardous Materials Group Supervisor is responsible for the implementation of the phases of the Incident Action Plan dealing with the Hazardous Materials Group operations. The Hazardous Materials Group Supervisor is responsible for the assignment of resources within the Hazardous Materials Group, reporting on the progress of control operations and the status of resources within the Group. The Hazardous Materials Group Supervisor directs the overall operations of the Hazardous Materials Group.

A. Check-in and obtain briefing from the Operations Section Chief or Hazardous Materials Branch Director (if activated).

B. Ensure the development of Control Zones and Access Control Points and the placement of appropriate control lines.

C. Evaluate and recommend public protection action options to the Operations Chief or Branch Director (if activated).

D. Ensure that current weather data and future weather predictions are obtained.

E. Establish environmental monitoring of the hazard site for contaminants.

F. Ensure that a Site Safety Plan is developed and implemented.

G. Conduct safety meetings with the Hazardous Materials Group.

H. Participate, when requested, in the development of the Incident Action Plan.

I. Ensure that recommended safe operational procedures are followed.

J. Ensure that the proper Personal Protective Equipment is selected and used.

K. Ensure that the appropriate agencies are notified through the Incident Commander.

L. Maintain Unit Log (ICS Form 214).

# Hazardous Materials Position Descriptions and Functions

**Entry Leader** - Reports to the Hazardous Materials Group Supervisor. The Entry Leader is responsible for the overall entry operations of assigned personnel within the Exclusion Zone.

A. Check-in and obtain briefing from the Hazardous Materials Group Supervisor.

B. Supervise entry operations.

C. Recommend actions to mitigate the situation within the Exclusion Zone.

D. Carry out actions, as directed by the Hazardous Materials Group Supervisor, to mitigate the hazardous materials release or threatened release.

E. Maintain communications and coordinate operations with the Decontamination Leader.

F. Maintain communications and coordinate operations with the Site Access Control Leader and the Safe Refuge Area Manager (if activated).

G. Maintain communications and coordinate operations with Technical Specialist-Hazardous Materials Reference.

H. Maintain control of the movement of people and equipment within the Exclusion Zone, including contaminated victims.

I. Direct rescue operations, as needed, in the Exclusion Zone.

J. Maintain Unit Log (ICS Form 214).

## Hazardous Materials Position
## Descriptions and Functions

**Decontamination Leader** - Reports to the Hazardous Materials Group Supervisor. The Decontamination Leader is responsible for the operations of the decontamination element, providing decontamination as required by the Incident Action Plan.

A. Check-in and obtain briefing from the Hazardous Materials Group Supervisor.

B. Establish the Contamination Reduction Corridor(s).

C. Identify contaminated people and equipment.

D. Supervise the operations of the decontamination element in the process of decontaminating people and equipment.

E. Maintain control of movement of people and equipment within the Contamination Reduction Zone.

F. Maintain communications and coordinate operations with the Entry Leader.

G. Maintain communications and coordinate operations with the Site Access Control Leader and the Safe Refuge Area Manager (if activated).

H. Coordinate the transfer of contaminated patients requiring medical attention (after decontamination) to the Medical Group.

I. Coordinate handling, storage, and transfer of contaminants within the Contamination Reduction Zone.

J. Maintain Unit Log (ICS Form 214).

## Hazardous Materials Position Descriptions and Functions

**Site Access Control Leader** - Reports to the Hazardous Materials Group Supervisor. The Site Access Control Leader is responsible for the control of the movement of all people and equipment through appropriate access routes at the hazard site and ensures that contaminants are controlled and records are maintained.

A. Check-in and obtain briefing from the Hazardous Materials Group Supervisor.

B. Organize and supervise assigned personnel to control access to the hazard site.

C. Oversee the placement of the Exclusion Control Line and the Contamination Control Line.

D. Ensure that appropriate action is taken to prevent the spread of contamination.

E. Establish the Safe Refuge Area within the Contamination Reduction Zone. Appoint a Safe Refuge Area Manager (as needed).

F. Ensure that injured or exposed individuals are decontaminated prior to departure from the hazard site.

G. Track the movement of persons passing through the Contamination Control Line to ensure that long term observations are provided.

H. Coordinate with the Medical Group for proper separation and tracking of potentially contaminated individuals needing medical attention.

I. Maintain observations of any changes in climatic conditions or other circumstances external to the hazard site.

J. Maintain communications and coordinate operations with the Entry Leader.

K. Maintain communications and coordinate operations with the Decontamination Leader.

L. Maintain Unit Log (ICS Form 214).

# Hazardous Materials Position Descriptions and Functions

**Assistant Safety Officer (Hazardous Materials)** - Reports to the incident Safety Officer as an Assistant Safety Officer and coordinates with the Hazardous Materials Group Supervisor (or Hazardous Materials Branch Director if activated). The Assistant Safety Officer-Hazardous Materials coordinates safety related activities directly relating to the Hazardous Materials Group operations as mandated by 29 CFR part 1910.120 and applicable State and local laws. This position advises the Hazardous Materials Group Supervisor (or Hazardous Materials Branch Director) on all aspects of health and safety and has the authority to stop or prevent unsafe acts. It is mandatory that a Assistant Safety Officer-Hazardous Materials be appointed at all hazardous materials incidents. In a multi-activity incident the Assistant Safety Officer-Hazardous Materials does not act as the Safety Officer for the overall incident.

A. Check-in and obtain briefing from the Incident Safety Officer.

B. Obtain briefing from the Hazardous Materials Group Supervisor.

C. Participate in the preparation of, and implement the Site Safety Plan.

D. Advise the Hazardous Materials Group Supervisor (or Hazardous Materials Branch Director) of deviations from the Site Safety Plan or any dangerous situations.

E. Has authority to alter, suspend, or terminate any activity that may be judged to be unsafe.

F. Ensure the protection of the Hazardous Materials Group personnel from physical, environmental, and chemical hazards/exposures.

G. Ensure the provision of required emergency medical services for assigned personnel and coordinate with the Medical Unit Leader.

H. Ensure that medical related records for the Hazardous Materials Group personnel are maintained.

I. Maintain Unit Log (ICS Form 214).

## Hazardous Materials Position Descriptions and Functions

**Technical Specialist (Hazardous Materials Reference)** - Reports to the Hazardous Materials Group Supervisor (or Hazardous Materials Branch Director if activated). This position provides technical information and assistance to the Hazardous Materials Group using various reference sources such as computer data bases, technical journals, CHEMTREC, and phone contact with facility representatives. The Technical Specialist-Hazardous Materials Reference may provide product identification using hazardous categorization tests and/or any other means of identifying unknown materials.

A. Check-in and obtain briefing from the Hazardous Materials Group Supervisor.

B. Obtain briefing from the Planning Section Chief.

C. Provide technical support to the Hazardous Materials Group Supervisor.

D. Maintain communications and coordinate operations with the Entry Leader.

E. Provide and interpret environmental monitoring information.

F. Provide analysis of hazardous material sample.

G. Determine personal protective equipment compatibility to hazardous material.

H. Provide technical information of the incident for documentation.

I. Provide technical information management with public and private agencies i.e.: Poison Control Center, Tox Center, CHEMTREC, State Department of Food and Agriculture, National Response Team.

J. Assist Planning Section with projecting the potential environmental effects of the release.

K. Maintain Unit Log (ICS Form 214).

# Hazardous Materials Position
# Descriptions and Functions

**Safe Refuge Area Manager** - The Safe Refuge Area Manager reports to the Site Access Control Leader and coordinates with the Decontamination Leader and the Entry Leader. The Safe Refuge Area Manager is responsible for evaluating and prioritizing victims for treatment, collecting information from the victims, and preventing the spread of contamination by these victims. If there is a need for the Safe Refuge Area Manager to enter the Contamination Reduction Zone in order to fulfill assigned responsibilities then the appropriate Personal Protective Equipment shall be worn.

A. Check-in and obtain briefing from the Site Access Control Leader.

B. Establish the Safe Refuge Area within the Contamination Reduction Zone adjacent to the Contamination Reduction Corridor and the Exclusion Control Line.

C. Monitor the hazardous materials release to ensure that the Safe Refuge Area is not subject to exposure.

D. Assist the Site Access Control Leader by ensuring the victims are evaluated for contamination.

E. Manage the Safe Refuge Area for the holding and evaluation of victims who may have information about the incident, or if suspected of having contamination.

F. Maintain communications with the Entry Leader to coordinate the movement of victims from the Refuge Area(s) in the Exclusion Zone to the Safe Refuge Area.

G. Maintain communications with the Decontamination Leader to coordinate the movement of victims from the Safe Refuge Area into the Contamination Reduction Corridor, if needed.

H. Maintain Unit Log (ICS Form 214).

## Assisting Agencies in Hazardous Materials Incident

**Law Enforcement** - The local law enforcement agency will respond to most Hazardous Materials incidents. Depending on incident factors, law enforcement may be a partner in Unified Command or may participate as an assisting agency. Some functional responsibilities that may be handled by law enforcement are:

A. Isolate the incident area.

B. Manage crowd control.

C. Manage traffic control.

D. Manage public protective action.

E. Provide scene management for on-highway incidents.

F. Manage criminal investigations.

## Assisting Agencies
## in Hazardous Materials Incident

**Environmental Health Agencies** - In most cases the local or State environmental health agency will be at the scene as a partner in Unified Command. Some functional responsibilities that may be handled by environmental health agencies are:

A. Determine the identity and nature of the Hazardous Materials.

B. Establish the criteria for clean-up and disposal of the Hazardous Materials.

C. Declare the site safe for re-entry by the public.

D. Provide the medical history of exposed individuals.

E. Monitor the environment.

F. Supervise the clean-up of the site.

G. Enforce various laws and acts.

H. Determine legal responsibility.

I. Provide technical advice.

J. Approve funding for the clean-up.

# Work Mission Duration
# Form Instructions

Each part of the Work Mission Duration Form which needs to be completed is explained below:

1. **Air Supply:** Across the top of the form are standard air supplies (30/45/60 minute air bottles and umbilical air). When completing the form, enter information into the column that corresponds to the air supply being used by the Haz Mat Team.

2. **Safety Factor:** A standard rule of thumb is that personnel should be able to perform the task, exit the zone, complete decontamination, and begin doffing before the low-air alarm bell sounds. On most SCBAs the bell will alarm with approximately a 5 minute reserve. Therefore, 5 minutes is an acceptable standard entry in this portion of the form.

3. **Travel Time:** This should be a close estimation of the travel time to and from the site.

4. **Environmental Conditions:** Environmental conditions impact emergency response personnel before they don PPE, while they are working, and after they doff the garments. Temperature and humidity are the primary factors to be concerned about. The recommended entries are as follows:

| Entry | Environmental Condition |
|---|---|
| 0 | Cool and Dry |
| 5 | Warm and Moist |
| 10 | Hot and Wet |

5. **Work Load:** The type of work is another measurable factor. The greater the work load, the greater the impact. The recommended entries are as follows:

| Entry | Work Load |
|---|---|
| 0 | Light |
| 5 | Moderate |
| 10 | Heavy |

6. **Decontamination:** Decon takes time to accomplish. The more people who need decontamination, the more time will be required. The number entered into this row should account for the time that it takes to decontaminate *all* team members.

7. **Other:** This row provides a place to account for other factors which impact air supply such as age, obesity or personal habits.

8. **Operating Work Time:** The estimated operating work time is entered at the bottom of the form. To determine the operating work time, add the entries from all the previous rows, then subtract that number from the total air supply available.

# Medical Monitoring Worksheet

| Name | Age | Pre-Entry | | | | | Post-Entry | | | | | | Critical Values * | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Pulse | Temp | Wgt | BP | Resp | Pulse | Temp | Wgt | BP | Resp | Pulse 3 Min | MHR | 85% MHR | 60% MHR | 3% Wgt | 5% Wgt |
| | | | | | | | | | | | | | | | | | |
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Prepared by: Name: Position: Agency:

**Key:** BP = Blood Pressure Wgt = Weight MHR = Maximum Heart Rate (220 - Age)

* See chart on back for these values.

# Critical Values for the Medical Monitoring Worksheet

| Weight | 3% Loss | 5% Loss |
|---|---|---|
| 130 | 126 | 124 |
| 135 | 131 | 128 |
| 140 | 136 | 133 |
| 145 | 141 | 138 |
| 150 | 146 | 143 |
| 155 | 150 | 147 |
| 160 | 155 | 152 |
| 165 | 160 | 157 |
| 170 | 165 | 162 |
| 175 | 170 | 166 |
| 180 | 175 | 171 |
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| 250 | 243 | 238 |
| 255 | 247 | 242 |
| 260 | 252 | 247 |
| 265 | 257 | 252 |
| 270 | 262 | 257 |
| 275 | 267 | 261 |
| 280 | 272 | 266 |
| 285 | 276 | 271 |
| 290 | 281 | 276 |
| 295 | 286 | 280 |
| 300 | 291 | 285 |

| Age | MHR | 85% MHR | 60% MHR |
|---|---|---|---|
| 20 | 200 | 170 | 120 |
| 21 | 199 | 169 | 119 |
| 22 | 198 | 168 | 119 |
| 23 | 197 | 167 | 118 |
| 24 | 196 | 167 | 118 |
| 25 | 195 | 166 | 117 |
| 26 | 194 | 165 | 116 |
| 27 | 193 | 164 | 116 |
| 28 | 192 | 163 | 115 |
| 29 | 191 | 162 | 115 |
| 30 | 190 | 162 | 114 |
| 31 | 189 | 161 | 113 |
| 32 | 188 | 160 | 113 |
| 33 | 187 | 159 | 112 |
| 34 | 186 | 158 | 112 |
| 35 | 185 | 157 | 111 |
| 36 | 184 | 156 | 110 |
| 37 | 183 | 156 | 110 |
| 38 | 182 | 155 | 109 |
| 39 | 181 | 154 | 109 |
| 40 | 180 | 153 | 108 |
| 41 | 179 | 152 | 107 |
| 42 | 178 | 151 | 107 |
| 43 | 177 | 150 | 106 |
| 44 | 176 | 150 | 106 |
| 45 | 175 | 149 | 105 |
| 46 | 174 | 148 | 104 |
| 47 | 173 | 147 | 104 |
| 48 | 172 | 146 | 103 |
| 49 | 171 | 145 | 103 |
| 50 | 170 | 145 | 102 |
| 51 | 169 | 144 | 101 |
| 52 | 168 | 143 | 101 |
| 53 | 167 | 142 | 100 |
| 54 | 166 | 141 | 100 |

| Vital Sign | Point at Which Responders Should Be Removed from Work |
|---|---|
| Body Temperature | > 38˚C (100.4˚F) - This is an OSHA requirement |
| Pulse | > 85% of the maximum heart rate (Maximum 220-age) |
| | > 110 beats per minute while the individual is at rest |
| Heart rate recovery | < 10 beats per minute * |
| Body weight loss | > 3% |
| Other | Other signs/symptoms of heat related illness (e.g. skin temperature and cardiac rhythms) |

# Decision Matrix

| Incident | Chemical(s) involved | Direct Life Hazard | Extended Life Hazard | Exposure Hazard | Resources Required | Mitigation Time | Action |
|---|---|---|---|---|---|---|---|
| | | | | | | | FRO HM Team SM |
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# Hazardous Incident Response
# Level "A" Protective Clothing Checklist

Incident Name: ___________________ Incident #: ____________ Date: ___________

| Task Assigned | Team Member Number & Name | | | |
|---|---|---|---|---|
| | # 1 | # 2 | # 3 | # 4 |
| Personal Items Off, Greens On | | | | |
| Nomex Jumpsuit (Optional) | | | | |
| Saranex Inner Chemical Suit | | | | |
| SCBA & Radio (Don & Check) | | | | |
| Record Pressure on Suit Time Log | | | | |
| Inner Gloves | | | | |
| Legs in Suit | | | | |
| Outer Boots & Boot Covers | | | | |
| Color Code & Log on Suit Time Log | | | | |
| (PVC) Suit Gloves & Cuffs in Arms | | | | |
| Arms in Suit | | | | |
| (CPE & TREL) Suit Gloves & Rings | | | | |
| Work Gloves | | | | |
| Glove Covers | | | | |
| Final Briefing, Equipment Ready | | | | |
| | | | | |
| SCBA Air Tube Hookup & Check | | | | |
| Log Time On Air on Suit Time Log | | | | |
| Complete Suiting, Zip & Seal | | | | |

Entry Team Leader/Decon Team Leader Signature: ____________________________

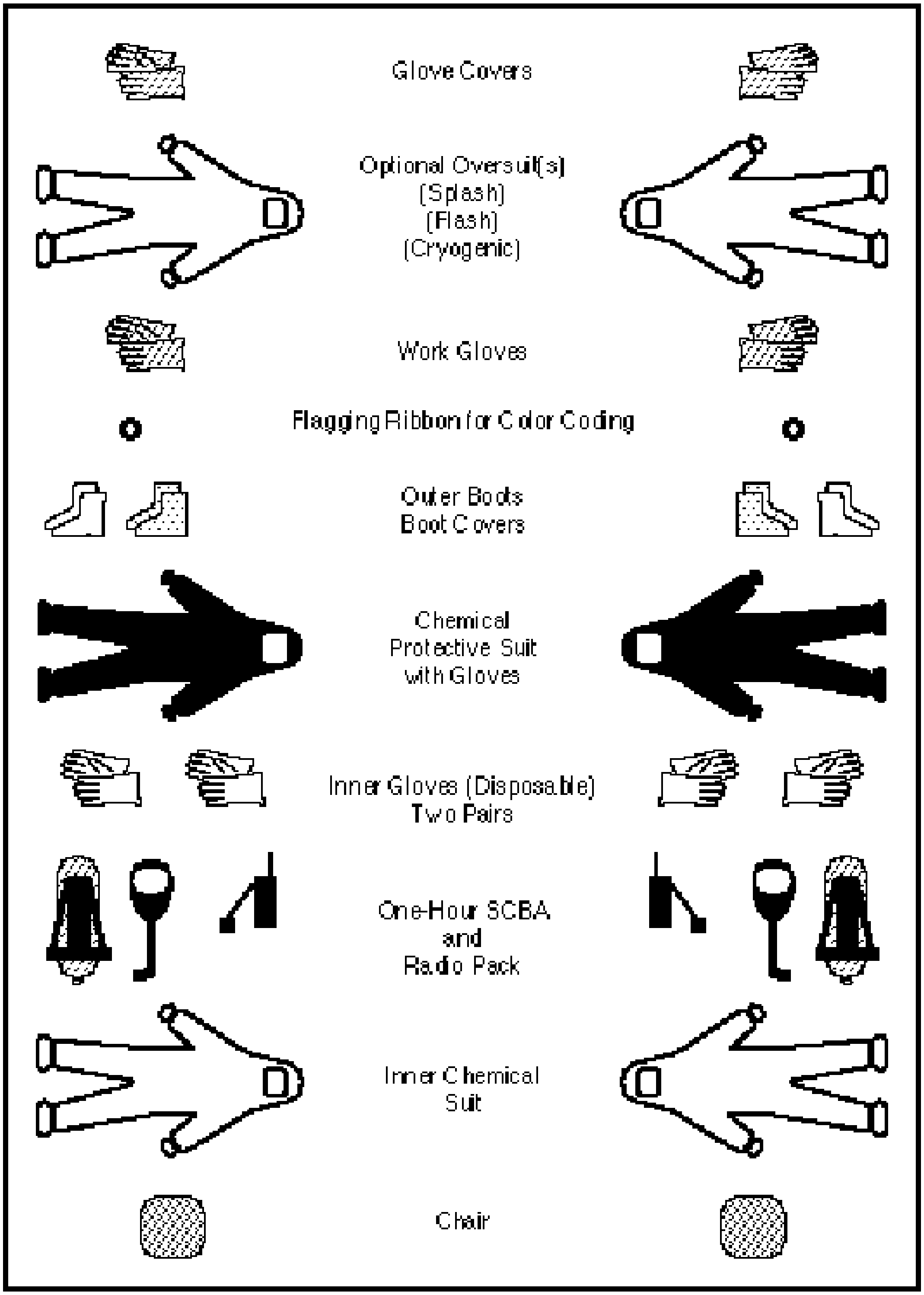
**Hazardous Incident Response**
**Level "B" Protective Clothing Checklist**

Incident Name: ___________________ Incident #: ___________ Date: ___________

| Task Assigned | Team Member Number & Name | | | |
|---|---|---|---|---|
| | # 1 | # 2 | # 3 | # 4 |
| Personal Items Off, Greens On | | | | |
| Nomex Jumpsuit (Optional) | | | | |
| Saranex Inner Chemical Suit | | | | |
| Record Pressure on Suit Time Log | | | | |
| Inner Gloves | | | | |
| Legs in Suit | | | | |
| Outer Boots & Boot Covers | | | | |
| Color Code & Log on Suit Time Log | | | | |
| Arms in Suit | | | | |
| Suit Gloves | | | | |
| Work Gloves | | | | |
| Glove Covers | | | | |
| Final Briefing, Equipment Ready | | | | |
| | | | | |
| SCBA Air Tube Hookup & Check | | | | |
| Log Time on Suit Time Log | | | | |
| Complete Suiting, Zip & Seal | | | | |
| Hard Hat (Optional) | | | | |

Entry Team Leader/Decon Team Leader Signature: ___________________________

## Chemical Protective Clothing Layout



# Field Identification
## Analysis Form

**Unknown Number:**________________________________ **Date:**_____________

Prefix a solid by "S" and a liquid by an "L." (Example: L-15)

**Team Members:** _______________________ _________________________

(First and last name) _______________________ _________________________

**Analysis/Steps Taken:** **(write in additional steps and observations in the blanks)**

1.

2.

3.

4.

5.

6.

7.

8.

9.

10.

**Summary of Hazards/Recommendations:**

1. Chemical and Physical Hazards-
2. Monitoring/Detection Available-
3. Chemical Protective Clothing Recommendation-
4. Containment/Control Options-
5. Other-

# MC306/DOT406 “Drill & Pump” Checklist

## Caution

Cargo tank manufacturers advise that no attempts should be made to upright an MC306/DOT406 while it is loaded!

Only use the drill and pump technique on an aluminum MC306/DOT406.

| Tank Information | | | | |
|---|---|---|---|---|
| Tank Specification | [ ] MC306 | | [ ] DOT406 | |
| Type | [ ] Single Unit | | [ ] Tandem Unit | |
| **Compartment (Size and Product)** | | | | |
| | Unit #1 | | Unit #2 | |
| Compartment # | Gallons | Product | Gallons | Product |
| 1 | | | | |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |
| 5 | | | | |
| 6 | | | | |

| Product Identified By: | |
|---|---|
| [ ] Driver: | [ ] Terminal/Facility: |
| [ ] Bill of Lading: | [ ] Consignee: |
| [ ] Placards: | [ ] Other: |

| Tank Condition | |
|---|---|
| Has the tank been breached? | [ ] Yes [ ] No |
| If yes, describe the breach: | |
| | |
| | |
| | |
| Have any tank appurtenances been damaged?<br>(dome cover, piping, shear section, valves, safety relief vents, vapor recovery system) | [ ] Yes [ ] No |
| If yes, describe the damage: | |
| | |
| | |
| | |

| Personal Protective Clothing | | | |
|---|---|---|---|
| Full firefighter's PPE with hood, helmet and SCBA | | | [ ] Yes [ ] No |
| Nitrile gloves as over gloves for driller and helpers | | | [ ] Yes [ ] No |
| Other: | | | [ ] Yes [ ] No |

| Tactical Considerations | | |
|---|---|---|
| Are all ignition sources controlled? | | [ ] Yes [ ] No |
| Ignition Source | Location | Controlled |
| Vehicles (park apparatus min. 100 feet and facing away) | | [ ] Yes [ ] No |
| Flares | | [ ] Yes [ ] No |
| Smokers | | [ ] Yes [ ] No |
| Structures | | [ ] Yes [ ] No |
| | | [ ] Yes [ ] No |
| | | [ ] Yes [ ] No |
| | | [ ] Yes [ ] No |
| Have control zones been established? | | [ ] Yes [ ] No |

| Zone | Location | Distances |
|---|---|---|
| Exclusion | | |
| Contamination Reduction | | |
| Support | | |

**Keep all unnecessary personnel out of the controlled zones!**

| | |
|---|---|
| Is spill area being monitored with a CGI to confirm effectiveness of foam blanket? | [ ] Yes [ ] No |
| Results of air monitoring: | |
| | |
| | |
| | |

**Caution: Readings higher than 10% LEL indicate an immediate hazard!**

| Rescue | | | |
|---|---|---|---|
| Is there a rescue? | | | [ ] Yes [ ] No |
| Vehicle / Location | Identity | Rescue Needed | Quantity |
| Cargo Tank | Driver | [ ] Yes [ ] No | |
| Cargo Tank | Passenger(s) | [ ] Yes [ ] No | |
| | | [ ] Yes [ ] No | |
| | | [ ] Yes [ ] No | |
| | | [ ] Yes [ ] No | |
| | | [ ] Yes [ ] No | |

| Protection Lines | |
|---|---|
| At least two 1-1/2 inch foam lines | [ ] Yes [ ] No |
| At least two dry chemical fire extinguishers | [ ] Yes [ ] No |

| Foam | | |
|---|---|---|
| Is foam being used? | | [ ] Yes [ ] No |
| Foam Available | Compatible with Product | Percent Required |
| AFFF | [ ] Yes [ ] No | |
| ATC | [ ] Yes [ ] No | |
| | [ ] Yes [ ] No | |
| | [ ] Yes [ ] No | |
| Is there enough foam available for the duration of the incident? | | [ ] Yes [ ] No |

| Use the following calculations: | | |
|---|---|---|
| Factor | Calculation | Example |
| Recommended Application Density | Polar Solvent = 0.16 gpm/sq.ft.<br>Non-Polar Solvent = 0.10 gpm/sq. ft. | |
| Application Rate | Surface Area to Cover (Sq. Ft.) X Recommended Density (gpm) = Application Rate of Foam Solution | 1000 sq. ft. X .10 gpm = 100 gpm of foam solution |
| Total Foam Solution | Application Rate (gpm) X Application Time (Minutes) = Total Foam Solution (gallons) | 100 gpm X 10 minutes = 1000 gallons |
| Total Concentrate Needed | Total Foam Solution X Foam Concentrate Type (%) = Gallons of Concentrate Needed | 1000 gallons X 6% = 60 gallons |

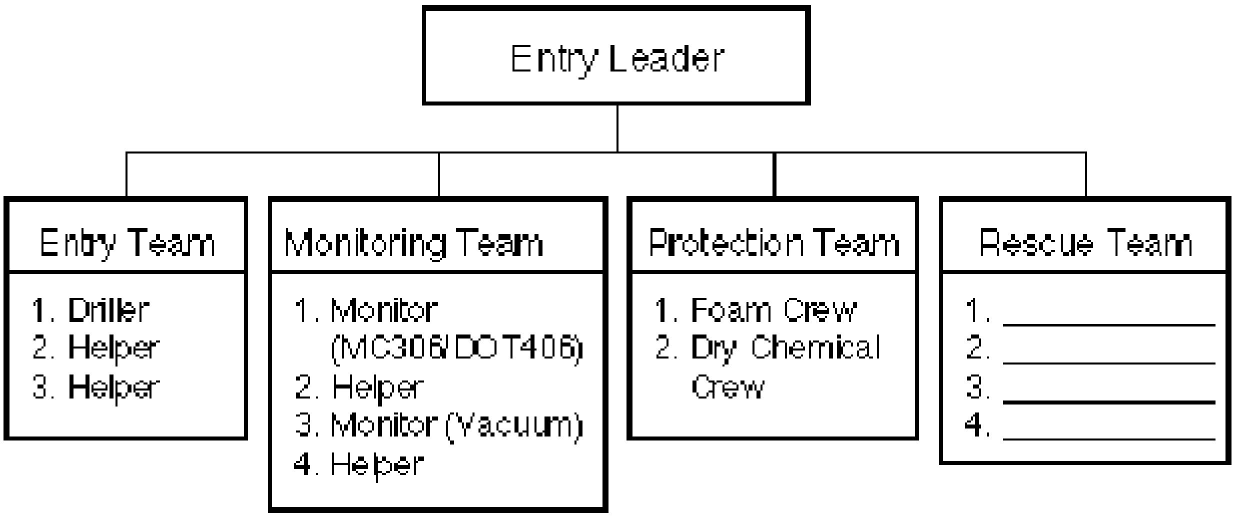
| Concentrate Type | Amount of Concentrate | Amount of Water | Total Foam Solution |
|---|---|---|---|
| 1% Foam | 1 gallon | 99 gallons | 100 gallons |
| 3% Foam | 3 gallons | 99 gallons | 100 gallons |
| 6% Foam | 6 gallons | 94 gallons | 100 gallons |
| 10% Foam | 10 gallons | 90 gallons | 100 gallons |

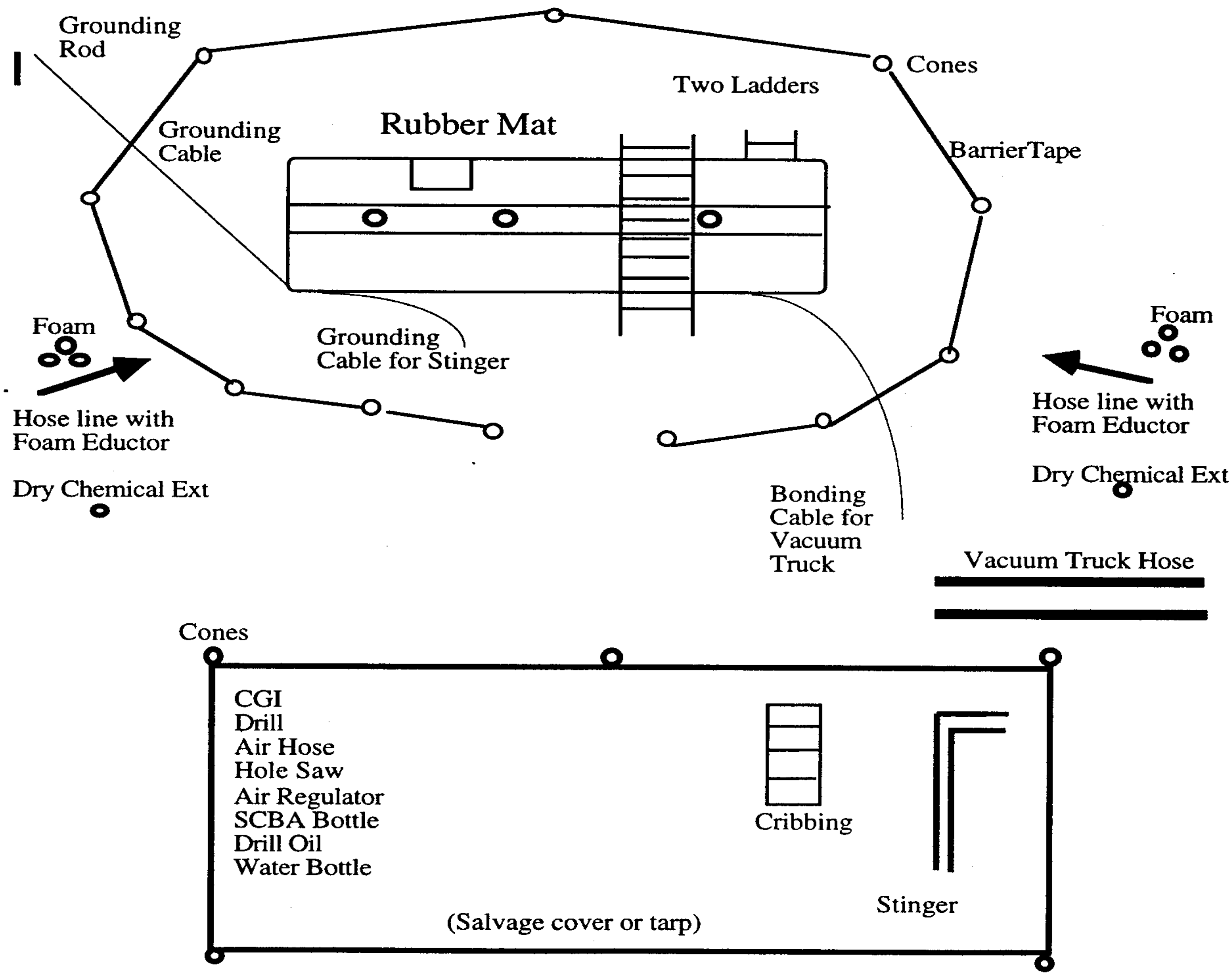
**Foam Spill Area Only - Do Not Foam Tank!**

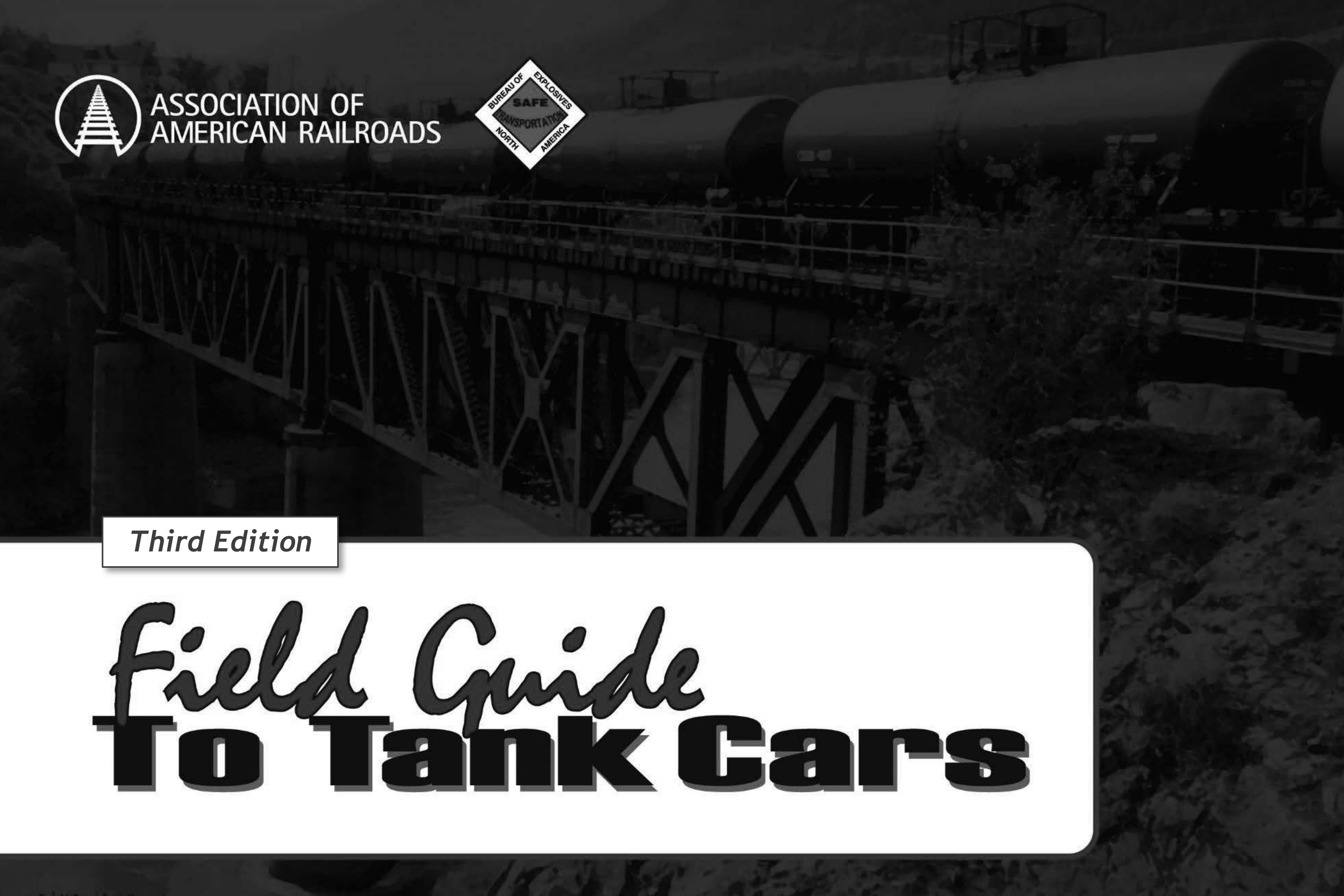
| Containment of Leaks | |
|---|---|
| Do you have a leak? | [ ] Yes [ ] No |
| Size of leak: | |
| Rate of leak: | |
| Where is it going?: | |
| Can it be controlled?: | |
| Leaking dome covers have been secured with dome clamps | [ ] Yes [ ] No |
| All leaks have been plugged and patched prior to commencement of drilling operation | [ ] Yes [ ] No |
| Dikes have been erected to contain pooled or flowing liquid | [ ] Yes [ ] No |

| Protective Actions | |
|---|---|
| Upwind, uphill, upstream (vapors are heavier than air) | [ ] Yes [ ] No |
| Evacuation | [ ] Yes [ ] No |
| In-Place Protection | [ ] Yes [ ] No |
| Grounding and Bonding | [ ] Yes [ ] No |
| Stabilize cargo tank (cribbing, air bags) | [ ] Yes [ ] No |
| Vacuum trucks (100 barrel truck = 4,200 gallons) | [ ] Yes [ ] No |

Organization




Grounding Rod
Grounding Cable
Rubber Mat
Two Ladders
Cones
BarrierTape
Foam
Hose line with Foam Eductor
Dry Chemical Ext
Grounding Cable for Stinger
Foam
Hose line with Foam Eductor
Dry Chemical Ext
Bonding Cable for Vacuum Truck
Vacuum Truck Hose
Cones
CGI
Drill
Air Hose
Hole Saw
Air Regulator
SCBA Bottle
Drill Oil
Water Bottle
Cribbing
Stinger
(Salvage cover or tarp)



ASSOCIATION OF AMERICAN RAILROADS

BUREAU OF EXPLOSIVES — SAFE TRANSPORTATION — NORTH AMERICA

*Third Edition*

# Field Guide To Tank Cars

INSIDE COVER

# FIELD GUIDE TO TANK CARS

**Compiled by Allen D. Maty (Ret.), Chief Inspector, Bureau of Explosives**

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# Dedication

*Field Guide to Tank Cars* is dedicated to the memory of:

Mr. Roy J. Holden
(1921–1989)
Engineer, Technical Services
Bureau of Explosives
Association of American Railroads

"Uncle Roy" was a pioneer in the development of tank car damage assessment techniques. His wit, wisdom, experience and dedication to tank car safety are sorely missed.

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# Table of Contents

# List of Illustrations and Photographs

# INTRODUCTION

*Field Guide to Tank Cars* is intended to be used by emergency responders and others involved with railroad tank cars. It provides information on the types, safety systems, stenciling, and markings of tank cars utilized to transport regulated (hazardous materials/dangerous goods) and nonregulated commodities.

Given the varying characteristics of the different commodities being transported and the shipper's differing needs and uses, it is impossible to cover all the various types of tank cars and fittings used. The illustrations contained in this guide are intended to provide a general overview of tank car types and typical fittings. They show the most common types of single-unit tank cars (a tank car tank mounted on, or forming part of, a railcar structure) currently used to transport both regulated (hazardous materials/dangerous goods) and nonregulated commodities.

All railroad tank cars are built to specifications, standards, and requirements established, implemented, and published by the U.S. Department of Transportation (DOT), Transport Canada (TC), and/or Association of American Railroads (AAR). These specifications, standards, and requirements address tank car design, type, and thickness of material required to be used in construction, types of fittings, welding procedures, inspection, maintenance, repair, and quality assurance system requirements.

**Note:** Regulatory and railroad industry specifications, standards, and requirements are contained in: U.S. DOT Title 49 Code of Federal Regulations, Parts 173 (Subpart B), 174, 179, and 180 (Subpart F); Transport Canada Transportation of Dangerous Goods Regulations (Transport Canada TDG Regulations) and Containers for the Transport of Dangerous Goods by Rail (Standard TP 14877E); and Association of American Railroads Manual of Standards and Recommended Practices (MSRP) Section C-III, Specifications for Tank Cars, Specification M-1002.

Although there are many different single-unit tank cars, they can generally be divided into three separate categories:

1. **Nonpressure tank cars** (called “general service” or “low-pressure” tank cars in the *2016 Emergency Response Guidebook*) typically transport a wide variety of liquid and solid regulated (hazardous materials/dangerous goods) as well as nonregulated commodities.

   **Note:** The DOT and TC regulations use the term “nonpressure” for tank cars that transport liquids and solids; however, this does not necessarily mean that nonpressure tank cars are absent of internal tank pressure. Rather, nonpressure tank cars equipped with pressure relief devices having a discharge pressure from 75 to 165 psig may have a build-up of internal tank pressure. Therefore, caution should still be given when handling these tank cars.

2. **Pressure tank cars** are built with thicker tanks to withstand higher internal pressures, making them stronger than a nonpressure tank car. They typically transport liquefied compressed gases, poison/toxic inhalation hazard (PIH/TIH) materials, reactive materials, and/or some corrosive materials.

3. **Cryogenic liquid tank cars** are vacuum-insulated with an inner container (tank) and carbon steel outer shell (tank, not jacket). They transport refrigerated (extremely cold) liquefied gases having a boiling point colder than minus 130°F at atmospheric pressure, such as liquid hydrogen, ethylene, oxygen, nitrogen, and argon.

The *Field Guide to Tank Cars* is divided into eight sections and an annex:

### Section 1: Tank Car Classification and Specifications

Explains the various DOT, TC, and AAR tank car classes and specifications.

### Section 2: Tank Car Safety Systems

Describes the various pressure relief devices (PRDs) and other safety systems applied to protect the tank.

### Section 3: Tank Car Stenciling and Markings

Provides information on various stenciling/markings required on tank cars by DOT, TC, and AAR.

### Section 4: Nonpressure Tank Cars

Describes the most common tank cars currently used to transport both liquid and solid regulated (hazardous materials/dangerous goods) and nonregulated commodities. This section also describes typical types of top and bottom valve and fittings arrangements with which these cars may be equipped.

### Section 5: Pressure Tank Cars

Describes the tank cars currently used to transport liquefied compressed gases under pressure, as well as some low-pressure, high-hazard materials, such as PIH/TIH materials, that may require the additional protection of a stronger tank car.

### Section 6: Cryogenic Liquid Tank Cars

Describes the tank cars currently used to transport cryogenic liquids, such as argon.

### Section 7: Guidelines for Initial Emergency Response

Provides general guidance when approaching an incident involving tank cars in transportation. It also provides information on assessing damage to tank cars. This damage assessment information is presented to familiarize emergency responders with techniques used by trained and experienced professionals in analyzing and handling tank problems. It is not intended to replace on-scene judgment.

### Section 8: Glossary of Railroad and Tank Car Terms

Provides emergency responders and others involved with tank cars with some of the terminology associated with tank cars.

### Annex A: AAR, U.S. DOT, and Transport Canada Safety Enhancements for Nonpressure Tank Cars

Provides a detailed explanation of recent changes for nonpressure tank cars.

# SECTION 1: TANK CAR CLASSIFICATION AND SPECIFICATIONS

DOT, TC, and the AAR have established specifications for the design, construction, testing/qualification, repair, and maintenance of tank cars. The tank car's specification is required to be stenciled on both sides of the car. The following information defines the lettering. A sample specification appears on the next page.

**Note:** Transport Canada tank car specifications coincide with those of the Department of Transportation; therefore, "TC" may be substituted for "DOT" as the authorizing agency.

Current tank car specifications consist of the following information in order of presentation:

1. Authorizing agency
2. Class designation
3. Delimiter letter
4. Tank test pressure in pounds per square inch gauge (psig)
5. Material of construction when that material is other than carbon steel
6. In this position, "W" denotes fusion welding or "I" indicates use for designated PIH/TIH material
7. Fittings, linings, materials

Further explanation of this information is found on the following pages.

## Specification: DOT-111A100ALW1

| (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---|---|---|---|---|---|---|
| **DOT** | **111** | **A** | **100** | **AL** | **W** | **1** |

(7) Fittings, Linings, Materials

(6) W — Fusion Welding or I — for certain PIH/TIH materials (See “Note”, page 10)

(5) Material of Construction (other than steel)

(4) Tank Test Pressure (psig)

(3) Delimiter Letter – no significance unless J, P, R, S, or T or Class 113 A, C, or D

(2) Class Number

(1) Authorizing Agency

## Components of the Specification Marking

1. **Authorizing Agency:**

   AAR – Association of American Railroads

   DOT – U.S. Department of Transportation

   TC – Transport Canada (replaced Canadian Transport Commission (CTC))

2. **Class number:** The term "class" is a three-digit number used to identify general groupings of tank cars. A "class designation" usually includes several specifications and is made up of the authorizing agency followed by the three-digit class number, such as Class DOT-111, Class TC-111, or Class AAR-211.

**Note:** In this document, the letters "TC" may be substituted for "DOT" when referring to a tank car's class or specification; and, in some cases, the authorizing agency may not be shown preceding the class number (e.g., "Class DOT-111", "Class TC-111" or "Class-111").

- **Nonpressure Tank Car Classes:**

DOT-111: insulated or uninsulated, without an expansion dome.

DOT-115: insulated with a carbon or alloy (stainless) steel or aluminum inner container (tank) and a carbon steel outer shell (tank, not jacket). Also referred to as a tank-within-a-tank.

DOT-117: insulated or uninsulated carbon steel tank with jacketed thermal protection, full height head shields, and top fittings protection; a bottom outlet is optional. Additional information regarding Class-117 tank cars is contained in Section 4: Nonpressure Tank Cars.

AAR-206: insulated with an inner container (tank) and carbon steel outer shell (tank, not jacket), similar to Class-115 tank cars. Also referred to as a tank-within-a-tank.

AAR-211: insulated or uninsulated, without an expansion dome, similar to Class-111 tank cars.

- **Pressure Tank Car Classes:**

DOT-105: insulated carbon or alloy (stainless) steel.

DOT-109: insulated or uninsulated, carbon steel or aluminum.

DOT-112: insulated or uninsulated, carbon or alloy steel.

DOT-114: insulated or uninsulated, carbon or alloy steel.

DOT-120: insulated carbon steel or aluminum.

- **Cryogenic Liquid* Car Classes:**

DOT-113: vacuum insulated with an alloy (stainless) steel or nickel alloy inner container (tank) and carbon steel outer shell (tank, not jacket).

AAR-204: vacuum insulated with an inner alloy (stainless) steel container (tank) and carbon steel outer shell (tank, not jacket). These tank cars are similar in concept to Class-113 tank cars.

---

*Cryogenic liquid is defined by U.S. 49CFR as: “A refrigerated liquefied gas having a boiling point colder than -130°F (-90°C) at atmospheric pressure”. Transport Canada TP 14877E defines it as: “A refrigerated liquefied gas that is handled or transported at a temperature equal to or less than -100°C (-148°F)”.

3. **Delimiter Letter:** On pressure and nonpressure tank cars, the letter A separates the class from the tank test pressure and has no meaning. However, on pressure and some nonpressure tank cars, the delimiter letter is an indicator of tank head puncture resistance and/or thermal protection systems. On cryogenic liquid tank cars, the delimiter letter indicates the authorized lading loading temperature. On Class-117 tank cars, the delimiter letter corresponds to the tank car's as constructed (J), performance (P), or retrofitted (R) status.

- **Nonpressure or Pressure Tank Cars:**

  A – no significance.

  J – equipped with a thermal protection system that is covered by a jacket and tank head puncture-resistance system.

  S – equipped with tank head puncture-resistance system.

  T – equipped with a thermal protection system that is not covered by a jacket (the thermal protection material is sprayed directly onto the tank's surface) and tank head puncture-resistance system.

- **Cryogenic Liquid Tank Cars:**

  A – authorized for minus 423°F loading.

  C – authorized for minus 260°F loading.

  D – authorized for minus 155°F loading.

- **Class-117 Tank Cars:**

  J – constructed to Class-117A specification.

  P – existing nonpressure tank car that meets performance standards for a Class-117A.

  R – existing nonpressure tank car that has been retrofitted to conform to the prescribed retrofit or Class-117A performance standards.

4. **Tank Test Pressure:** The next set of digits is the tank test pressure in psig; typically, 20 to 40 percent of the tank's burst pressure.

   For nonpressure tank cars, test pressures are specified as 60 or 100 psig; however, some manufacturers test 100-pound tanks to 165 psig, because they are equipped with 165 psig pressure relief devices (PRD), which equates to 33 percent of the tank's 500 psig burst pressure.

   For pressure tank cars, test pressures range from 100 psig to 600 psig.

   For cryogenic liquid tank cars, tank test pressures range from 60 psig to 120 psig.

5. **Material of Construction (other than steel):** The letters AL appearing after the tank test pressure indicate that the tank was constructed of aluminum. For other materials of construction, no letters or numerals are shown.

6. **Fusion Welding:** The letter W following the tank test pressure or the letters AL indicates that the tank was constructed using fusion welding. All tank cars are currently constructed using fusion welding. See "Note" below for PIH/TIH materials.

> **Note:** Tank cars built after, March 16, 2009, used for the transportation of PIH/TIH materials may have the letter "I" stenciled in place of the letter W; e.g., Specification DOT-105J500I, Specification DOT-112J500I, or Specification DOT-105J600I. The letter I may be said to indicate interim design standards for a PIH/TIH tank car. More information on these requirements is found in Section 5, Pressure Tank Cars.

7. **Fittings, Linings, and Materials:** For nonpressure tank cars, the numeral following the W will indicate the tank's material of construction, requirements for insulation or interior lining, and options for a bottom outlet or bottom washout. For tank cars constructed of aluminum, the W will be prefaced by the letters AL. Class-117 tank cars do not have a numeral following the W.

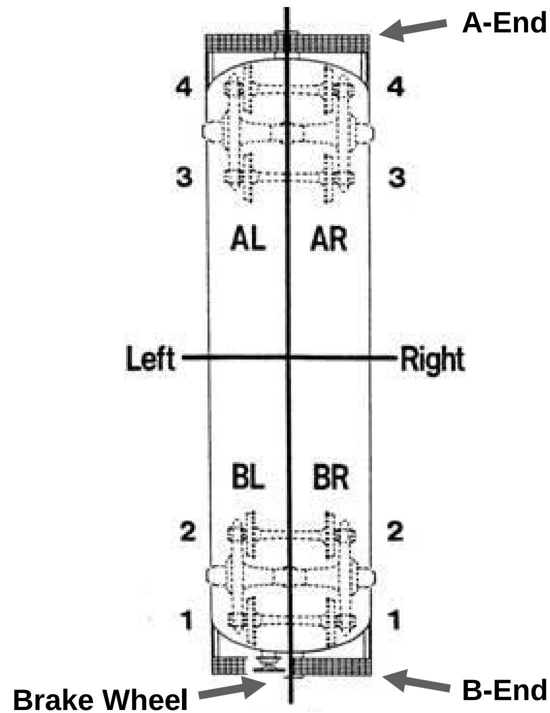
**Nonpressure Tank Car Designator Table**

| Designator | Tank Material | Bottom Outlet | Bottom Washout |
|---|---|---|---|
| ALW1 | Aluminum | Optional | Optional |
| ALW2 | Aluminum | No | Optional |
| W1 | Carbon Steel | Optional | Optional |
| W2 | Carbon Steel | No | Optional |
| W3 | Carbon Steel (Insulated) | Optional | Optional |
| W4 | Carbon Steel (Insulated) | No | No |
| W5 | Carbon Steel (Elastomer Lined) | No | No |
| W6 | Alloy (Stainless) Steel | Optional | Optional |
| W7 | Alloy (Stainless) Steel | No | No |

**Age/Life Limits –** There is no life limit on a tank car tank if it conforms to both the federal regulations and the AAR requirements. An underframe built prior to July 1, 1974, has an AAR life limit of 40 years, unless it has received extended service status. Underframes since July 1, 1974, have an AAR life limit of 50 years.

**Note:** Underframes may be "continuous" or "stub sill"; refer to "Center Sill" and "Stub Sill Tank Car" in Section 8 for additional information.

## Rail Car Orientation Diagram



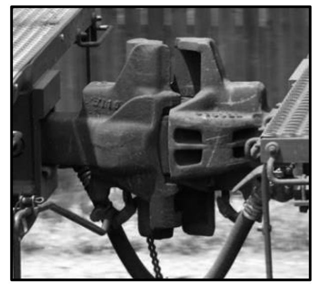
# SECTION 2: TANK CAR SAFETY SYSTEMS

Tank cars are equipped with various devices and safety systems to protect the tank and fittings from damage during an accident or severe impact. These devices and safety systems, discussed below, include pressure relief devices (PRD), coupler vertical restraint systems (double-shelf couplers), tank head puncture-resistance systems (head shields), thermal (fire) protection systems, service equipment (filling, discharge, venting, safety, heating, and measuring devices), and protection systems.

**Pressure Relief Devices** — Per DOT regulation, single-unit tank cars transporting Division 6.1, Packing Group (PG) I and II (poisonous/toxic) materials, Class 2 (compressed gas), Class 3 (flammable liquid), and Class 4 (flammable solid, spontaneously combustible, or dangerous when wet) materials must have reclosing PRDs. However, tank cars built before January 1, 1991, and equipped with a nonreclosing PRD may be used to transport Division 6.1, PG I or II materials or Class 4 liquids, provided the materials are not poisonous (toxic) by inhalation. Refer to subsection titled "Pressure Relief Devices", page 15, for more information on PRDs.

**Coupler Vertical Restraint Systems** — Tank cars are equipped with double-shelf couplers. The function of the top and bottom shelves is to prevent couplers from separating in a derailment or over-speed impact, thus reducing the probability of adjacent tank car head punctures.

**Double-Shelf Couplers**



**Tank Head Puncture-Resistance Systems —** Tank cars transporting Class 2 (compressed gas) materials and those constructed of aluminum or nickel plate used to transport hazardous materials/dangerous goods and Class-117 tank cars must have a system capable of sustaining, without the loss of lading, coupler-to-head impacts of 18 mph. This is usually accomplished by the installation of separate head shields or full-head tank jackets made of 1/2-inch-thick steel on each end of the tank car. On some insulated tank cars (typically Class-105 pressure tank cars), head protection is accomplished by a combination of the thickness of the tank heads and the insulation system, the gauge (thickness) of the head jacket, and the stand-off distance between the jacket and the tank head, which must be proved by testing.

**Thermal Protection Systems** — Single-unit tank cars (except Class-113 cryogenic liquid tank cars) transporting Class 2 (compressed gas) materials and Class-117 tank cars must be equipped with a thermal protection or insulation system that provides sufficient thermal resistance so that there will be no release of any lading, except through the PRD, when subjected to a pool fire for 100 minutes or a torch fire for 30 minutes.

**Bottom Discontinuity Protection Systems** — Depending upon the commodity being transported and the projection distance from the shell, tank cars equipped with bottom fittings, sometimes called bottom discontinuities (including bottom outlets, bottom washouts, sumps, and blind flanges) must have these fittings protected from being sheared off or otherwise damaged in the event of a derailment or by other impact that could result in the loss of lading. Bottom fittings protection may be accomplished by mounting the valve operating mechanism inside the tank and/or protective skids applied to the bottom of the tank. Continuation of the valve assembly below the tank shell or skid must be designed so that it will fail without damaging the valve, causing a release of product. This is accomplished by incorporating a shear groove in the valve body or sizing the bolts attaching the valve extension to have low-shear strength.

**Top Fittings Protection –** Pressure tank cars are required to have a protective housing bolted to the pressure plate. Top fittings on Class-117 tank cars and nonpressure tank cars in sulfuric acid service must also be protected. Depending upon the date when ordered for construction, nonpressure tank cars transporting a Packing Group I or II material must have top fittings protection. (See Section 4: Nonpressure Tank Cars for additional information.)

## Pressure Relief Devices

PRDs are fittings designed to relieve the internal pressure within a tank car above a specified value that may result from abnormal conditions or from normal pressure increases during transportation (pressure relief device is synonymous with safety relief device). Conditions that may cause a PRD to function include the exposure of the tank car to fire, hydrostatic pressure created within a tank overloaded by volume, chemical (exothermic) reaction of the lading in the tank that builds up pressure (such as polymerization), and/or an over-speed impact that results in a pressure spike due to the surge action of the liquid.

A type of a PRD (a regulating valve) may be used on certain tank cars, such as those transporting carbon dioxide and cryogenic liquids, to intentionally vent vapor during transportation. Such venting is normal in transportation.

In addition to devices that relieve internal pressure, nonpressure tank cars may be equipped with a device to prevent a vacuum from forming within the tank.

In general, there are two categories of PRDs: (1) reclosing devices, such as pressure relief valves (PRVs), and (2) nonreclosing devices (rupture disc devices) commonly called safety vents. **Note:** When used in the Field Guide, the term "safety vent" is interchangeable with “rupture disc device” or “nonreclosing pressure relief device”.

On nonpressure and pressure tank cars, the PRDs are located on the top of the tank; on cryogenic liquid tank cars, the PRDs are located in closed compartments or cabinets containing the loading and unloading equipment, typically mounted on the sides or on one end of the car.

**Pressure relief valves (PRVs)** are spring-loaded, reclosing PRDs designed to open at a set pressure to relieve excessive pressure within the tank. They then automatically reclose after normal conditions are restored. A tank car may be equipped with multiple PRVs to provide the necessary flow capacity for the commodity.

**Safety vents** are nonreclosing pressure relief devices equipped with a rupture disc designed to burst at a certain pressure to relieve pressure. If the disc bursts, the device remains open until the disc is replaced.

Rupture discs are made from plastic/composite materials or a metal body (usually stainless steel) incorporating an elastomeric-type membrane. Rupture disc devices, instead of PRVs, are typically used on tank cars transporting corrosive materials (such as sulfuric acid) and other materials that may have properties that would be detrimental to the components of a PRV.

Safety vents are also used on tank cars transporting nonregulated commodities, such as corn syrup and clay slurry, and in combination with other PRDs on tank cars transporting cryogenic liquids, such as ethylene, argon and oxygen.

Nonpressure tank cars in regulated commodity service that are equipped with a rupture disc device must have a surge pressure reduction device that, by design, reduces the internal surge pressures at the pressure relief device interface. Such devices are not required for molten sulfur, acrylamide and elevated temperature materials.

Combination PRDs incorporate a nonreclosing device, such as a breaking pin or rupture disc, in series with a spring-loaded reclosing pressure relief valve. The PRV must be outboard of the nonreclosing device (breaking pin or rupture disc). The breaking pin or rupture disc must be designed to fail at a pressure higher than that of the spring-loaded portion of the device. Thus, if internal pressure causes the pin or disc to fail, the spring-loaded portion will open.

Combination PRDs are typically used on high-hazard PIH/TIH materials, such as chlorine. Combination PRDs utilizing a rupture disc are required to be equipped with a device to detect any accumulation of pressure between the disc and the spring-loaded valve. The device must be a needle valve, try cock, or telltale indicator, which must remain closed during transportation.

**Regulating (regulator) valves** (called a pressure control device for cryogenic liquid tank cars) are required on pressure tank cars transporting carbon dioxide and nitrous oxide, and cryogenic liquid tank cars transporting liquefied argon, nitrogen, or oxygen. These spring-loaded PRDs, with start-to-discharge pressures lower than the other PRDs (a pressure relief valve and a safety vent), are intended to vent vapor during transportation to maintain internal pressure (through auto-refrigeration) below that of other PRDs.

Tank cars equipped with these devices must be stenciled "REGULATING VALVE(S) VENTING NORMAL" on both sides.

**Vacuum-relief valves** (also called vacuum breakers) are applied to some nonpressure tank cars to admit air into the tank to prevent excessive internal vacuum that may result in a collapse (implosion) of the tank. This danger exists during closed-system unloading operations using pumps, where the tank is not vented to allow air to enter or, in extreme cases, where an empty tank is subjected to wide temperature variations (hot to cold); e.g., steaming or steam-cleaning a tank car.

Vacuum-relief valves are typically set at negative 0.75 psig or lower. A vacuum-relief valve should not be depressed to determine if there is pressure in the tank, because doing so may dislodge the O-ring seal causing the device to leak.

**Breather vents** (also called continuous vents) are devices equipped with a permeable disc, such as pumice stone or a plastic-type membrane. Breather vents are typically applied to nonpressure tank cars transporting hydrogen peroxide solutions to prevent pressure buildup within the tank by allowing the venting of oxygen, which is generated as the material naturally decomposes.

**Totally contained commodities** are commodities like corn syrup that have been authorized by the AAR Tank Car Committee to be shipped in tank cars not equipped with PRDs. Such tank cars must be stenciled with an AAR specification (a DOT Special Permit is required for DOT specification tank cars.)

Further, tank cars must be marked with the name of the commodity it is carrying in minimum 4-inch high lettering and the words "NO PRESSURE RELIEF DEVICE" in minimum 2-inch high lettering beneath the name of the commodity.

## Pressure Relief Device Settings

For nonpressure and pressure tank cars, governmental regulations prescribe that the start-to-discharge (STD) pressure of a reclosing PRD may not be lower than 75 psig or exceed 33 percent of the tank's minimum burst pressure. For example, a tank car with a 300 psig tank test pressure (750 psig minimum burst pressure), must have the pressure relief valve's STD set between a minimum of 75 psig and a maximum of 247.5 psig (33% of 750 psig).

A reclosing valve must have a vapor-tight pressure (VTP) of at least 80 percent of the STD pressure. For example, the minimum VTP for a 75 psig valve would be 60 psig, and the minimum VTP for a 247.5 psig valve would be 198 psig.

Tanks built prior to October 1, 1997, having a minimum burst pressure of 500 psig or less may be equipped with reclosing valve(s) having an STD pressure of no less than 14.5 percent of the minimum burst pressure, but no more than 33 percent of the minimum burst pressure. For example, on a tank with a 60 psig tank test pressure (240 psig) minimum burst pressure, the pressure relief valve must be set between 38.8 (35) and 79.2 (80) psig.

For a nonreclosing safety vent, the rupture disc must be designed to burst at a pressure equal to the greater of either 100 percent of the tank's test pressure or 33 percent of the tank's burst pressure. For example, on a tank car with a 100 psig tank test pressure (500 psig minimum burst pressure), the disc must burst at the greater of 100 psig or 165 psig (33% of 500 psig); therefore, the disc must be designed to burst at 165 psig.

For a combination PRD, the breaking pin must be designed to fail or the rupture disc burst at the pressure prescribed for a reclosing PRD/PRV. Further, the reclosing PRV must be set to discharge at a pressure not greater than 95 percent of the STD pressure. For example, on a tank car with a 500 psig tank test pressure (1250 psig minimum burst pressure), the breaking pin must fail or the rupture disc must burst between 75 and 412.5 psig, and, depending upon the pin or disc's fail point, the reclosing valve must be set to discharge between 71.25 and 391.9 psig.

The type of PRD and the start-to-discharge (STD) pressure of a reclosing pressure relief device or the burst pressure of a rupture disc or breaking pin (in psi) must be applied to the tank's qualification stencil (see page 25). When a rupture disc or breaking pin is used in a combination PRD, the pressure shown is that of the rupture disc or breaking pin.

Tank cars transporting carbon dioxide and nitrous oxide are equipped with three types of PRDs: (1) a reclosing PRV having a STD pressure not exceeding 75 percent of the tank test pressure, (2) a nonreclosing safety vent designed to burst at a pressure less than the tank test pressure, and (3) two regulating valves set to open at a pressure not to exceed 350 psig on a 500 psig test pressure tank or 400 psig on a 600 psig test pressure tank. In addition, the final discharge of each PRD must be piped outside of the protective housing. **Under no circumstances should these discharge pipes be plugged or otherwise blocked.**

**Note:** Carbon dioxide tank cars are loaded between 200 and 215 psi pressure, with commodity temperature of minus 16 to minus 20 degrees F. These tank cars have 5 inches of urethane foam insulation, which provides approximately 8 to 10 days' transport time before the commodity warms up. If pressure builds in a 500 psig test pressure tank, the first regulator valve vents at 340 psi. The second regulating valve will vent at 350 psi. If pressure continues to increase, the safety relief valve will open at 375 psi. If the commodity temperature continues to increase, the rupture disk will open at 486 psi. If a rupture disc fails, the liquid will start turning to dry ice when the pressure falls below about 60 psig. Regulating valves create a light hissing sound typically noticeable within one to two car lengths. A venting PRV will be noticeable approximately 5 to 10 car lengths. An open vent can be heard from greater distances.

Cryogenic liquid tank cars transporting atmospheric gases are equipped with one or more pressure relief valves, safety vents/rupture disc device, and regulating valves. The regulating valve is normally set to limit internal pressure to no more than 25.3 psig under ambient temperature conditions. Some tank cars may have a second safety vent/rupture disc device in series with the first. They are connected to the tank by means of a crossover valve so that only one safety vent/rupture disc device is on line at a time.

# SECTION 3: TANK CAR STENCILING AND MARKINGS

There is a considerable amount of information required by DOT, TC, and/or AAR to be stenciled or marked on the exterior of a tank car. There are standards as to the location and size of the required stenciling.

The information most useful is the tank car's reporting mark (also called initials) and the car number. The reporting mark, usually three to four letters, identifies the car's owner (marks ending with an X denote that the car is not owned by a railroad) and is followed by up to six digits; e.g., AARX 122016. The reporting mark and number are the tank car's unique identifier and are required to be marked on each side of the car to the far left of center and in the center of each end.

Many tank cars are also marked with the reporting mark and number on the top of the car and/or diagonally positioned on the ends.

In an emergency, you may identify the contents of a car, from a safe distance, by looking up its reporting mark and number on the train consist/train list/wheel report or other shipping document.

Stenciled below the reporting mark and number will be the tank car's load limit (LD LMT) and light weight (LT WT). The load limit is the maximum weight of lading that may be loaded into the tank car. The light weight is the weight of the tank car when empty. The tank's volumetric capacity, in gallons and liters, is stenciled centered on each end. (The capacity may also be shown in imperial gallons.)

The tank car's specification is required to be marked on both sides to the far right of center. The following information can be used to identify the type and characteristics of the tank car.

**DOT and TC Tank Car Classes:**

- Nonpressure Tank Cars: 111, 115, and 117
- Pressure Tank Cars: 105, 109, 112, 114, and 120
- Cryogenic Liquid Tanks Cars: 113

**AAR Tank Car Classes:**

- Nonpressure Tank Cars: 206 and 211
- Cryogenic Liquid Tank Cars: 204

Nonpressure and pressure tank cars manufactured prior to July 25, 2012, were required to have the specification; material; cladding material (if any); tank builder's initials; date of original test; and car assembler (if other than the tank builder) permanently stamped into the metal near the center of both outside heads.

Currently, Class-113 cryogenic liquid tank cars are required to have similar information, including additional information, such as, design service temperature, water capacity, in pounds, and tank shell and head thickness stamped into, or displayed on a metal plate applied to, the B-end (the end of the tank car with the hand brake) outer jacket/shell.

Tank cars manufactured after July 25, 2012, are required to display two identical permanent identification (ID) plates made of corrosion-resistant metal mounted diagonally on the inboard surfaces of the right side (AR) and left side (BL) body bolster webs. The following information is required to be shown on the ID plates: the car builder's name and serial number; the AAR Certificate of Construction (CofC) number; tank shell/head material; insulation/thermal protection materials and thickness; underframe/stub-sill type; and, date built. For examples of ID plate formatting, see page 23.

### Identification Plate

| | |
|---|---|
| **Car builder's name:** | **Allied Tank Car Co** |
| **Builder's serial number:** | **2016 – 01110** |
| **Certificate of construction/exemption:** | **AO10209-1234** |
| **Tank specification:** | **DOT-117A100W** |
| **Tank shell material/head material:** | **TC128 GR B NORM** |
| **Insulation materials:** | **Ceramic Fiber/Fiberglass** |
| **Insulation thickness:** | **0.5 inch/3.0 inch** |
| **Underframe/Stub sill type:** | **RPM-101** |
| **Date built:** | **Dec 2016** |

**Note**: Tank cars built before July 25, 2012 may have the identification plates instead of, or in addition to, the head stamping.

When a modification (e.g., retrofitting a Class-111 tank car to a Class-117) changes any of the information on the ID plate, an additional variable ID plate must be installed that includes the "AAR Number" (AAR CERT NO) assigned to the modification, items that were modified, and the month and year of the modification.

### Variable ID Plate

| | |
|---|---|
| **AAR Cert No:** | **AO11222-2345** |
| **Insulation Material:** | **1/2 inch Ceramic Fiber** |
| **Date of Mfg:** | **10/2016** |

Other information is required to be stenciled on both sides of the tank car near the specification marking on a "qualification stencil"; e.g., required periodic inspections and testing of the tank, PRDs, interior heater system, and interior lining/coating. The stencil will also include the due dates for next inspections and tests.

At the time of construction, tank car tanks are subject to an initial hydrostatic pressure test corresponding to its specification; e.g., the tank test pressure for a specification DOT-111A100W2 tank car is 100 psig. (Some tank car builders test nonpressure cars to 33 percent of the minimum burst pressure; i.e., 165 psig for a tank with a 500 psig minimum burst pressure.)

Prior to 1998, governmental regulations prescribed periodic internal visual inspections, hydrostatic testing of the tank and internal heater coils (if so equipped), and testing of the PRV. Beginning in 1998 (for tank cars without metal jackets) and 2000 (for tank cars with a metal jacket or thermal protection system), all single-unit tank cars (other than Class-113 cryogenic liquid tank cars) used to transport hazardous materials/dangerous goods became subject to periodic "continuing qualification" inspection and testing requirements in lieu of periodic hydrostatic retesting.

The frequency of continuing qualification inspections is based on whether or not the tank car transports commodities that are corrosive to the tank, and whether or not the tank has an interior lining or coating. By regulation, qualification intervals for the tank may not exceed 10 years; for the service equipment, qualification intervals are 5 or 10 years, unless a greater period is approved by the Federal Railroad Administration.

The current periodic qualification inspections include the following:

- Internal and external visual examinations of the tank
- Structural integrity inspections of various tank welds
- Tank thickness tests
- Safety system inspections, including thermal, head and skid protection, reclosing PRD, and service equipment (valves and fittings)
- Marking inspections
- Lining and coating inspections
- Leakage pressure tests

In addition, the AAR requires periodic inspections of the tank car's trucks and coupler/draft gear components (88.B.2 Inspection) and stub sills (Stub Sill Inspection).

The qualification/test dates and the due date for the next inspections (year only, in four digits) are recorded on a standardized qualification stencil (measuring 44 11/16 inches by 18 3/4 inches) applied to both sides of the tank.

### Tank Car Qualification Stencil


**Note:** The following is an explanation of some of the information found in the qualification stencil.

**Station stencil:** an alpha code assigned by the AAR to the tank car facility performing the inspection.

**Service equipment:** filling/discharge, venting, safety (other than pressure relief devices), heating, and measuring devices.

**PRD**: indicates the type of pressure relief device applied and its start-to-discharge (STD) or burst pressure.

- **VALVE:** reclosing pressure relief valve.
- **DISC or VENT:** nonreclosing rupture disc device.
- **COMB**: combination pressure relief device (reclosing valve with a rupture disc or breaking pin).
- **NONE:** no pressure relief device (total containment).

**INT HTRS:** interior heater system. Exterior heater systems do not require requalification.

**Lining PP:** indicates the lining is applied to maintain product purity, not to protect the tank from the corrosive effects of the lading. PP linings do not require requalification.

The date the tank car was built (BLT) and type of air brake valves are shown on a consolidated stencil applied to each side of the tank.

In addition to placards and identification number markings, governmental regulations require that the proper shipping name or authorized common name of certain hazardous materials/dangerous goods must be marked on each side of the tank car in letters at least 3.9 inches high. For shipments originating in the United States, these commodities are listed in §§172.325(b) and

172.330(a)(1)(ii) of Title 49, Code of Federal Regulations (CFR).

Other markings that may be required on tank cars include:

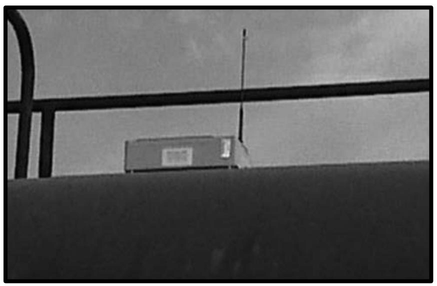
- Marine Pollutant mark for Marine Pollutants.
- HOT for Elevated Temperature Materials.
- INHALATION HAZARD for commodities that are poisonous/toxic by inhalation.
- NON-ODORIZED or NOT ODORIZED for shipments of unodorized Liquefied Petroleum Gases (LPGs). These markings may appear on a tank car used for both unodorized and odorized LPG.
- REGULATING VALVE(S) VENTING NORMAL, REGULATING VALVE(S), RELIEF VALVE, or RUPTURE DISC, as appropriate, over/under the discharge pipe for tank cars in argon, oxygen, carbon dioxide, and nitrous oxide.
- DOT-SP***** for a tank car operating under the provisions of a DOT Special Permit.
- SR-**** for a tank car that is operating under the provisions of a Canadian Safety Permit-Rail.
- AAR ST-*** for a tank car that is operating under an AAR Service Trial.
- EXS after the reporting mark and number for a tank car authorized for extended service status. Example: BOEX 2016 EXS
- FRA AIP near the qualification stencil indicates that a Federal Railroad Administration (FRA) approved alternative inspection program authorizes an extended qualification interval.
- Tank cars equipped with bolted and hinged manway covers must be marked with a manway style decal or stencil near the manway. The letters and numerals must be at least 1/4-inch high. Manway style charts are found in Appendix D of the AAR Specifications for Tank

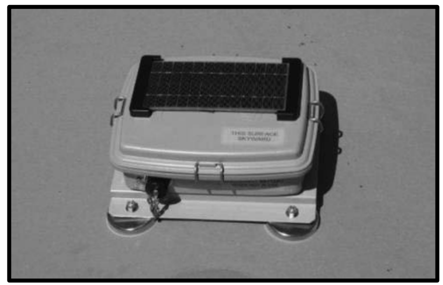
Cars and AAR Pamphlet 34 and identify manway styles, manway nominal diameter, number of bolts, and gasket dimensions.

Some tank cars are equipped with remote monitoring equipment (RME) to monitor and record or transmit certain data regarding a shipment, such as location (via GPS), lading temperature and/or pressure, leak detection, impact detection, indication of tampering with or opening the protective housing, and loaded or empty status.

The AAR has established standards regarding the placement of such devices and wiring. Tank cars equipped with RME must display labels or stencils within 12 inches of the sensor, be bright yellow or orange with black lettering, and be at least 2 x 3 inches. The marking must describe the device and provide a telephone number to call for information on the device.

**Typical Remote Monitoring Devices**





# Location of Key Stenciling


**Right Side:**
- DOT SP / SR / AAR ST
- COMMODITY NAME
- DOT / TC / AAR SPECIFICATION
- QUALIFICATION PANEL

**Left Side:**
- REPORTING MARK / NUMBER
- LD LMT (LB / KG)
- LT WT (LB / KG)

**Heads:**
- REPORTING MARK / NUMBER
- CAPY (GAL)
- CAPY (L)


## Consolidated Stencil

Type of air brake valves → DB – 10 DB – 20

Car built date → BLT 10-16

Photos courtesy of Norfolk Southern Railway Company.

# SECTION 4: NONPRESSURE TANK CARS

Nonpressure tank cars (also called "general service" or "low-pressure" tank cars in the *2016 Emergency Response Guidebook*), Classes DOT/TC-111, 115 and 117 and AAR-206 and 211, are used to transport a wide variety of liquid and solid regulated (hazardous materials/dangerous goods) as well as nonregulated commodities. The most common nonpressure tank cars in use today are Class-111 and Class AAR-211.

Class-111 tank cars made of carbon or alloy (stainless) steel are required to have a minimum shell thickness of 7/16 inch, and those made of aluminum are required to have a minimum shell thickness of 1/2 inch (60 psig tank test pressure) or 5/8 inch (100 psig tank test pressure). Regardless of the material of construction, Class-111 tank car tanks with a 60 psig tank test pressure are required to have a minimum burst pressure of 240 psig, and those with a 100 psig tank test pressure are required to have minimum burst pressure of 500 psig.

Class-117 tank cars are designed primarily for the transportation of Class 3 (flammable liquid) materials. Specification DOT/TC-117A100W tanks are required to be constructed of AAR TC-128 Grade B, normalized carbon steel, with a minimum thickness of 9/16 inch. The tank test pressure is 100 psig, with a bursting pressure of 500 psig. Class-117 tank cars must have a tank head puncture resistance system consisting of full-height head shields at least 1/2-inch thick and a thermal protection system covered by a metal jacket of not less than 11 gauge (approximately 1/8 inch) thick (tank insulation is optional). A reclosing pressure relief device and top fittings must be protected. If equipped with a bottom outlet, the operating handle must be removed before movement, or the valve must be designed with a protection safety system to prevent unintended actuation during train accident scenarios.

**Note:** Additional information regarding Class-117 tank cars may be found in the Annex.

Class-211 tank cars are similar to Class-111 tank cars, and, with certain exceptions, must be built in accordance with the applicable DOT/TC specification; e.g., a specification AAR-211A100W1 tank car must be built to the requirements for a specification DOT-111A100W1 tank car. The main differences between an AAR tank car and its DOT/TC specification counterparts are:

- Class-211 tank car tanks require only partial post-weld heat treatment at the time of construction. Class-111 carbon and alloy (stainless) steel tanks and welded attachments must be post-weld heat treated as a unit. Tank car tanks made of aluminum are not allowed to be post-weld heat treated.
- Class-211 tank car tanks constructed of carbon and alloy (stainless) steel do not require radioscopic examination of welded joints; however, welded joints of aluminum tanks must be examined.
- Additional/special fittings on AAR cars to meet user needs.

Most nonpressure cars have a low-profile manway nozzle on top of the tank, equipped with a gasketed hinged and bolted manway cover. The cover is opened for loading/unloading or for access into the tank for maintenance. Other styles of manway covers (such as those on sulfuric or hydrochloric acid tank cars) are semi-permanently attached to the manway nozzle and are equipped with a small gasketed hinged and bolted fill hole with a cover that is opened for loading or unloading.

Loading and unloading fittings are typically located in the general area of the manway and are often enclosed within a hinged combination housing called a protective housing by DOT regulations, but commonly called a breadbox or mailbox. Some nonpressure tank cars may be equipped with a protective housing similar to those used on pressure tank cars to provide additional protection for the valves and fittings.

All Class-117 tank cars, and some other nonpressure tank cars, are equipped with a protective housing similar to those used on pressure tank cars to provide additional protection for the valves and fittings.

On nonpressure tank cars, the top-mounted loading/unloading equipment will usually include a 2- or 3-inch liquid eduction line (located along the centerline of the tank). The liquid eduction line consists of a liquid valve (or other closure) and eduction (or siphon) pipe that extends to the bottom of the tank. The eduction pipe may extend into a sump.

A sump is a formed depression (or bowl) in the bottom of the tank where the lading will drain, allowing more complete emptying of the tank.

There may also be a smaller eduction line (typically 1 inch), called an air line, air inlet or vapor valve, used to introduce a compressed gas (e.g., air and nitrogen) to pressurize the tank for unloading through the liquid eduction line. This device may also be used to vent the tank during loading or unloading.

Other fittings may include a vacuum-relief valve, a 1/4-inch sample line, and/or a gauging device (either a magnetic ball style or a fixed-length telltale pipe with a control [needle] valve). The interior of the tank may be equipped with an outage gauge (at the manway nozzle) indicating vacant or vapor space in the tank, usually graduated in inches of outage.

On nonpressure tank cars in some services (e.g., sulfuric acid), the liquid eduction line and air line fittings may not have control valves because they are closed with pipe caps, plugs, or blind flanges.

PRDs (reclosing pressure relief valves or nonreclosing rupture disc devices/safety vents) may be attached to the top of the tank on separate nozzles or attached to the manway cover.

Nonpressure tank cars in some corrosive services will often have the manway plate face and fittings flange faces rubber lined. However, due to advances in coating and lining materials, some nonpressure tank cars in corrosive service may have metal-based, hard coated, or hard polymer-lined manway plate or fittings flange faces and components of material suitable for the service.

In addition to insulation, some nonpressure tank cars in flammable liquid service have been equipped with thermal protection and Class-117 tank cars are required to have a jacketed thermal protection system (insulation is optional).

Except for certain specifications, nonpressure tank cars may be equipped with bottom outlet valves for loading or unloading. These valves may be ball, wafer-sphere, or butterfly style valves that are operated from beneath the car. They may also be plug or clapper style valves that are operated from the top of the tank.

The top-operated bottom outlet valve is an internal plug valve that is mounted on the bottom of the tank. The valve is attached to a rod that passes up through the tank and through a stuffing box body on top of the tank. The stuffing box body is equipped with a combination cover and wrench (T-wrench or cone) used to open and close the valve.

Certain specification nonpressure tank cars may be equipped with a bottom washout that can be removed to facilitate cleaning of the tank's interior. It is not used in loading/unloading operations.

Depending upon their projection from the bottom of the tank shell, bottom outlet, blind flanges, washouts, and sumps (referred to as bottom discontinuities) applied to stub sill tank cars may be required to have bottom fittings protection.

Typically, this protection is provided by attaching skids to the bottom of the tank to protect the fittings in the event of a derailment. Some nonpressure tank cars are also equipped with skids to protect their top fittings.

Nonpressure tank cars may have insulation (typically fiberglass, mineral wool blankets, or foam) applied over the tank and enclosed within a metal jacket. For Classes 115 and 206, the insulation is applied between the inner and outer tanks. Per regulation, the jacket must be not less than 11 gauge (approximately 1/8 inch) thick. Insulation is used to moderate the temperature of the lading during transportation; e.g., to keep the lading cool or warm, depending upon its characteristics and the season of the year or as an aid in heating the product for unloading.

Nonpressure tank cars may also be equipped with interior or exterior heater coils. Prior to unloading, steam, hot water, or hot oil lines are attached to the coil inlets and outlets. As the heating medium circulates through the coils, it heats the liquid or melts solidified ladings, such as phosphorus, sulfur, wax, and asphalts, to facilitate unloading. Interior heater coil inlet and outlet pipes are required to have caps or plugs applied during transportation. Exterior heater coils do not require caps, and the car must be stenciled "EXTERIOR HEATER PIPES – NO INLET OR OUTLET PIPE CAPS REQUIRED". Some nonpressure tank cars are equipped with electric-resistance heater systems in place of heater coils.

Nonpressure single-unit tank cars may be divided into compartments by inserting ellipsoidal heads into the tank shell (heads must be concave to the lading of each compartment) or by joining separately constructed tanks to make a single car structure. Each compartment will have its own loading/unloading fittings and PRD.

Compartments must be identified numerically, beginning with the B-end (the end of the car with the hand brake wheel) compartment as number 1 and numbered consecutively toward the A-end (the end without the brake wheel).

**Note:** Unlike highway cargo tanks, tank car compartments are not constructed by applying interior walls within a single tank. Further, unlike some cargo tanks, tank cars do not have interior baffles to control lading surges.

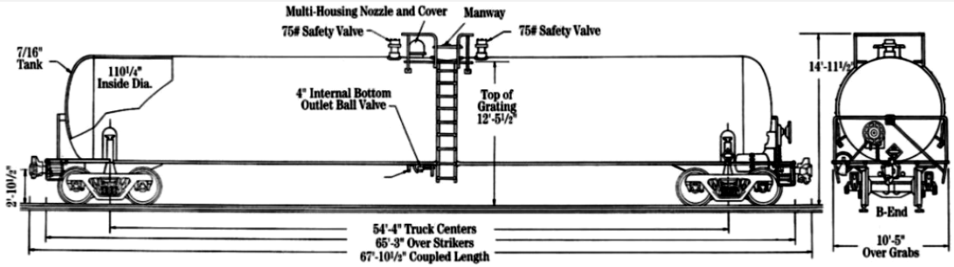
Class-115 and Class-206 nonpressure tank cars have an inner container (tank) constructed of carbon steel, alloy (stainless) steel, manganese molybdenum steel, or aluminum. The inner tank is supported within an outer shell (tank, not jacket).

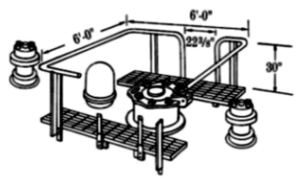
The annular space between the inner tank and outer tank contains insulation. These cars are commonly referred to as tanks-within-a-tank as the outer shell (tank) is constructed in the same manner as a tank car tank; it is not merely a metal jacket covering an insulated tank.

For Class-115 tank cars, the outer tank may be fabricated of the same materials authorized for inner tanks and must be at least 7/16-inch thick. For Class-206 tank cars, the outer tank must be fabricated from carbon steel. They may be divided into compartments, have a 60-psig tank test pressure, and, in addition to loading/unloading and pressure relief devices, they may be equipped with a bottom outlet and/or bottom washout. These tank cars are normally used to transport temperature-sensitive commodities that require a highly efficient insulation system.

**Note:** The following illustrations (pages 35-68) show typical valve and fittings arrangements for nonpressure tank cars. Individual tank car arrangements may vary based upon product service and/or the equipment manufacturer. Nomenclature used in the illustrations may not always be consistent with that used in the text of the Field Guide.

# DOT/TC-111A100W1 Tank Car for Alcohol and Methanol Service




**CAPACITY & WEIGHTS**

Net Capacity @ 2% Outage – 29,348 gals.

Estimated Light Weight – 67,000 lbs.

Rail Load Limit (100 Ton Trucks) – 263,000 lbs.

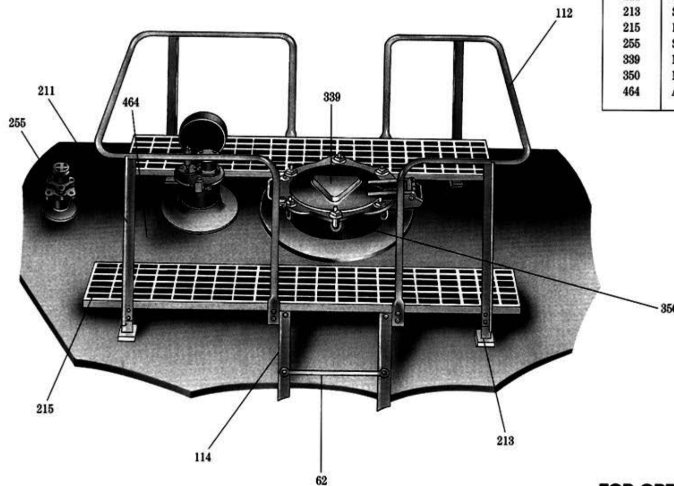
**COMMODITY MAXIMUM DENSITY**

| Truck Cpty. | Wheel Base | Non-Coiled Comm. wt./gal. |
|---|---|---|
| 100 Ton | 5'-10" | 6.68# |

DOT-111A100W1
For Alcohol & Methanol Service
**29,947 GALLON CAPACITY – NON-INSULATED (v. 1)**

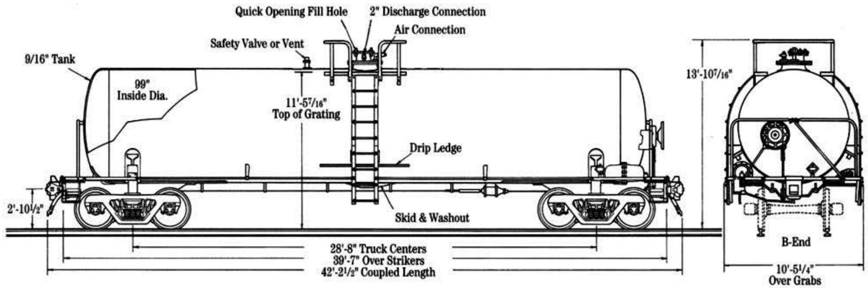
# Top Operating Platform for Nonpressure Tank Cars (Post 1982)

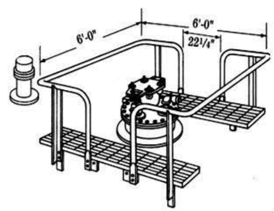
| Part No. | Description |
|---|---|
| 62 | Step Tread |
| 112 | Handrail |
| 114 | Ladder Stile |
| 211 | Corner Post |
| 213 | Support Bracket |
| 215 | Platform Grating |
| 255 | Safety Valve Assembly |
| 339 | Manway Cover |
| 350 | Manway Ring |
| 464 | Anti-Skid Coating |




**TOP OPERATING PLATFORM FOR GENERAL SERVICE CARS (POST 1982)**
(6' x 6' Shown – Other Lengths/Widths Available)

# DOT/TC-111A100W2 Tank Car for Sulfuric Acid Service




**CAPACITY & WEIGHTS**

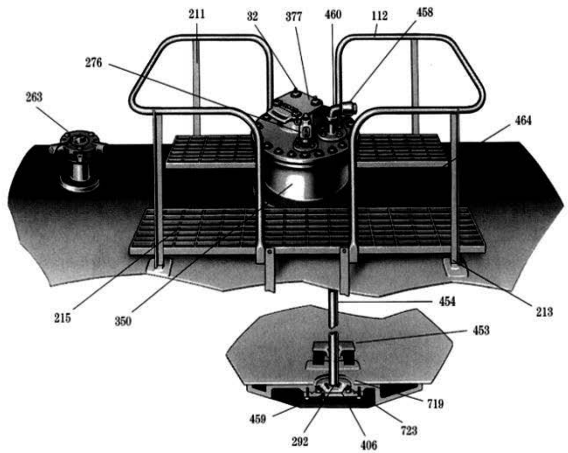
Nominal Capacity @ 2% Outage – 13,600 gals.
Estimated Light weight (Non-Coiled) – 55,200 lbs.
Rail Load Limit (100 Ton Trucks) – 263,000 lbs.

**COMMODITY MAXIMUM DENSITY**

| Truck Cpty. | Wheel Base | Non-Coiled Comm. wt./gal. |
|---|---|---|
| 100 Ton | 5'-10" | 15.2# |

DOT-111A100W2
For Sulfuric Acid Service
**13,946 GALLON CAPACITY – NON-INSULATED (v. 2)**

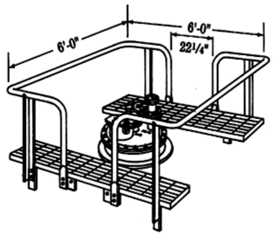
# Loading and Unloading Arrangement and Top Operating Platform for Sulfuric Acid Cars




| Part No. | Description |
|---|---|
| 32 | Eye Bolt |
| 112 | Hand Rail |
| 211 | Corner Post |
| 213 | Support Bracket |
| 215 | Platform Grating |
| 263 | Safety Vent Assembly |
| 276 | 1" Air Connection Valve |
| 292 | Washout Plug |
| 350 | Flued Manway Nozzle |
| 377 | 8" Fill Hole Cover |
| 406 | Washout Nozzle Flg. |
| 453 | Pipe Guide |
| 454 | Eduction Pipe |
| 458 | Pipe Cap |
| 459 | Tell-Tale Plug & Chain |
| 460 | Street Elbow |
| 464 | Anti-Skid Coating |
| 719 | "O" Ring |
| 723 | Gasket |

**LOADING AND UNLOADING ARRANGEMENT AND TOP OPERATING PLATFORM FOR SULFURIC ACID CARS**

# DOT/TC-111A100W5 (Rubber Lined) Tank Car for Hydrochloric Acid Service



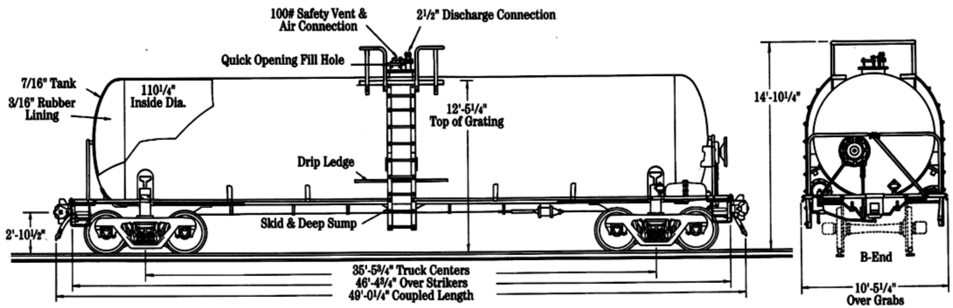

**20,429 GALLON CAPACITY - NON-INSULATED (v. 2)**
DOT-111A100W5 (Rubber Lined)
For Hydrochloric Acid Service

**CAPACITY & WEIGHTS**

Nominal Capacity @ 2% Outage – 20,000 gals.
Estimated Light Weight – 58,600 lbs.
Rail Load Limit (100 Ton Trucks) – 263,000 lbs.

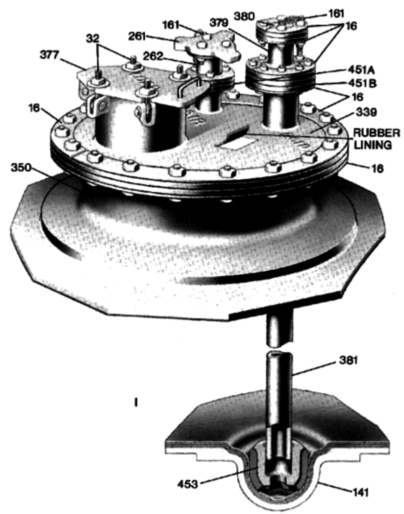
**COMMODITY MAXIMUM DENSITY**

| Truck Cpty. | Wheel Base | Non-Coiled Comm. wt./gal. |
|---|---|---|
| 100 Ton | 5'-10" | 10.20# |



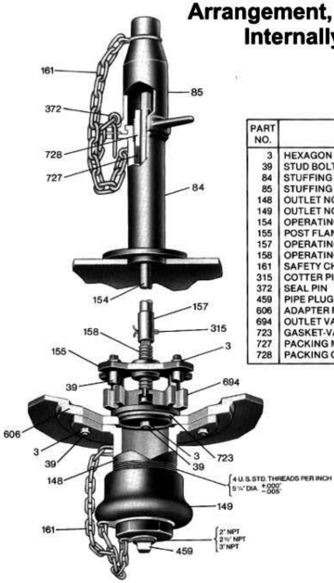
# Loading and Unloading Arrangement for DOT/TC-111A100W5 (Rubber Lined) Tank Cars

| PART NO. | DESCRIPTION |
|---|---|
| 16 | SEGMENTAL WASHERS |
| 32 | EYE BOLT ASSEMBLY |
| 141 | SUMP |
| 161 | SAFETY CHAIN |
| 261 | SAFETY VENT HOUSING |
| 262 | SAFETY VENT NOZZLE |
| 339 | MANWAY COVER PLATE |
| 350 | FLUED MANWAY NOZZLE |
| 377 | FILL HOLE COVER |
| 379 | UNLOADING PIPE ADAPTER |
| 380 | UNLOADING CONNECTION BLIND FLANGE |
| 381 | DISCHARGE PIPE |
| 451A | AIR CONNECTION FLANGE |
| 451B | DISCHARGE PIPE FLANGE |
| 453 | DISCHARGE PIPE GUIDE |



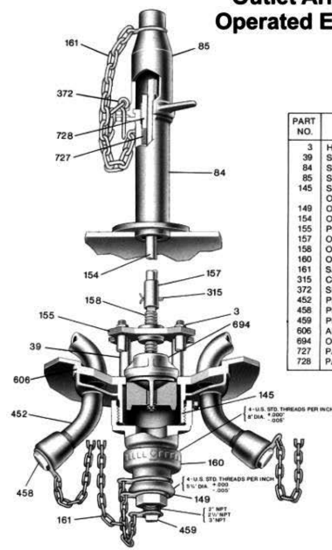
# Top Operated, Bottom Unloading Valves

## 6-Inch Positive Internal Type Bottom Outlet Arrangement, Top Operated Internally Guided



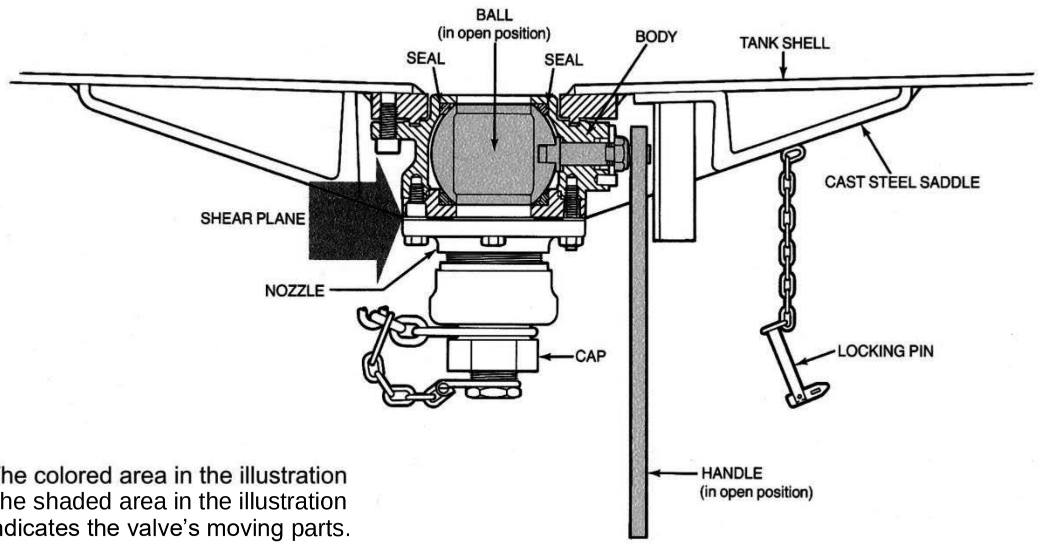

| PART NO. | DESCRIPTION |
|---|---|
| 3 | HEXAGON NUT |
| 39 | STUD BOLT |
| 84 | STUFFING BOX BODY |
| 85 | STUFFING BOX COVER |
| 148 | OUTLET NOZZLE EXTENSION |
| 149 | OUTLET NOZZLE CAP |
| 154 | OPERATING ROD (POLISHED) |
| 155 | POST FLANGE |
| 157 | OPERATING ROD SOCKET |
| 158 | OPERATING SCREW |
| 161 | SAFETY CHAIN |
| 315 | COTTER PIN |
| 372 | SEAL PIN |
| 459 | PIPE PLUG |
| 606 | ADAPTER FLANGE |
| 694 | OUTLET VALVE (TOP GUIDED) |
| 723 | GASKET-VALVE SEAT (TEFLON) |
| 727 | PACKING MATERIAL (TEFLON CHEVRON) |
| 728 | PACKING GLAND (STAINLESS STEEL) |

## 6-Inch Positive Internal Type, Jacketed, Bottom Outlet Arrangement, Top Operated Externally Guided



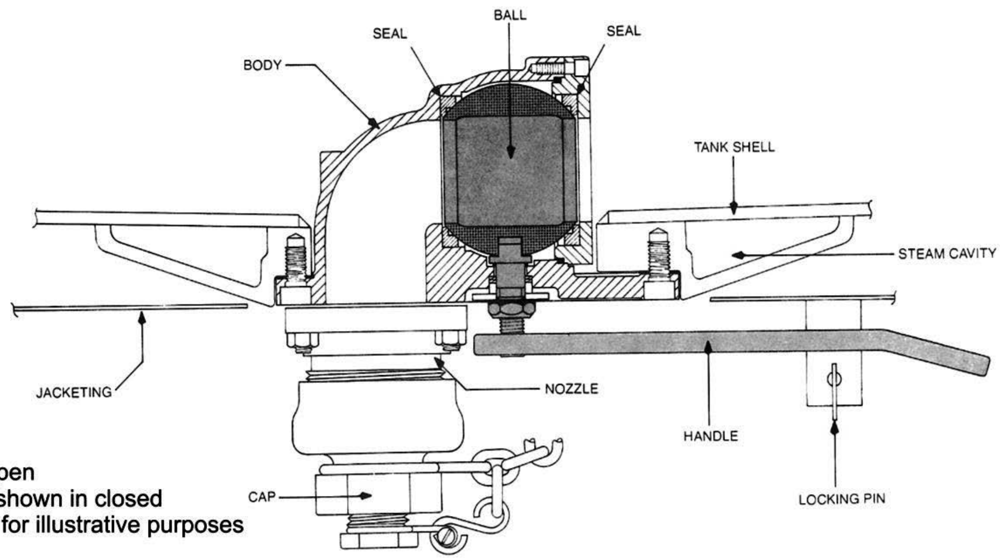

| PART NO. | DESCRIPTION |
|---|---|
| 3 | HEXAGON NUT |
| 39 | STUD BOLT |
| 84 | STUFFING BOX BODY |
| 85 | STUFFING BOX COVER |
| 145 | STEAM JACKETED OUTLET NOZZLE |
| 149 | OUTLET NOZZLE CAP |
| 154 | OPERATING ROD |
| 155 | POST FLANGE |
| 157 | OPERATING ROD SOCKET |
| 158 | OPERATING SCREW |
| 160 | OUTLET NOZZLE REDUCER |
| 161 | SAFETY CHAIN |
| 315 | COTTER PIN |
| 372 | SEAL PIN |
| 452 | PIPE NIPPLE |
| 458 | PIPE CAP |
| 459 | PIPE PLUG |
| 606 | ADAPTER FLANGE |
| 694 | OUTLET VALVE |
| 727 | PACKING MATERIAL |
| 728 | PACKING GLAND |

## Bottom Outlet with Skid Protection



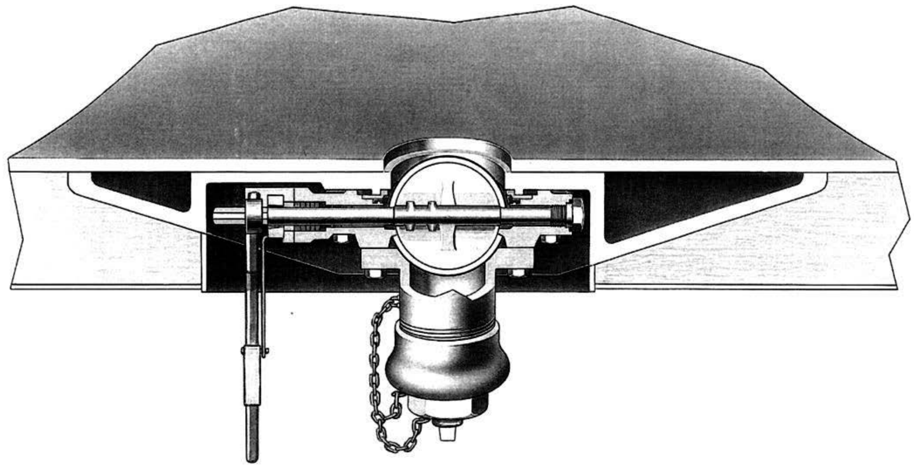

The colored area in the illustration
The shaded area in the illustration
indicates the valve’s moving parts.

# Internal Ball Valve

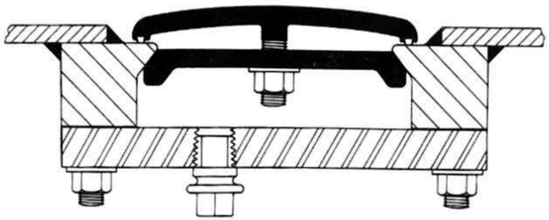



Valve Open
Handle shown in closed
position for illustrative purposes

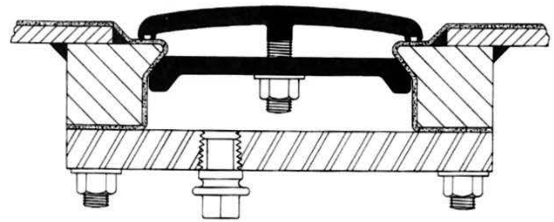
# Jamesbury and Posi-Seal Bottom External Butterfly-Type Valve



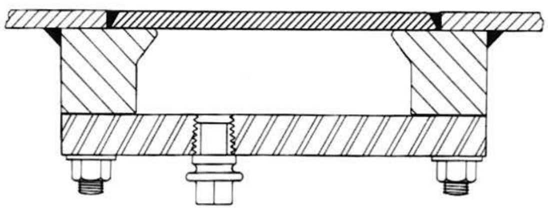
# Typical Bottom Washout Arrangements



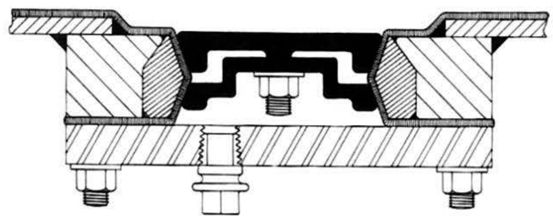
WASHOUT PLUG FOR UNCOATED, UNLINED CAR



WASHOUT PLUG FOR CHEMICALLY COATED CAR

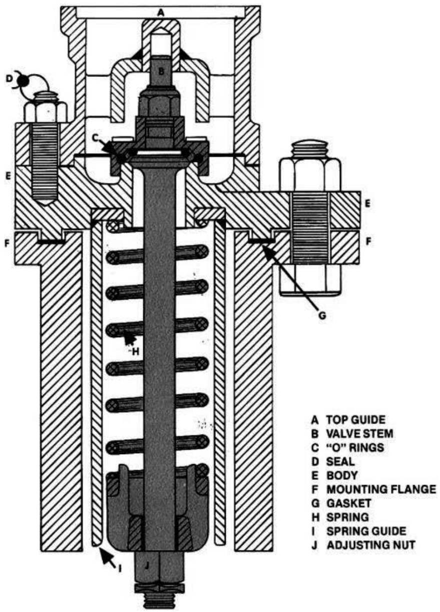


WELDED IN CLOSURE PLATE

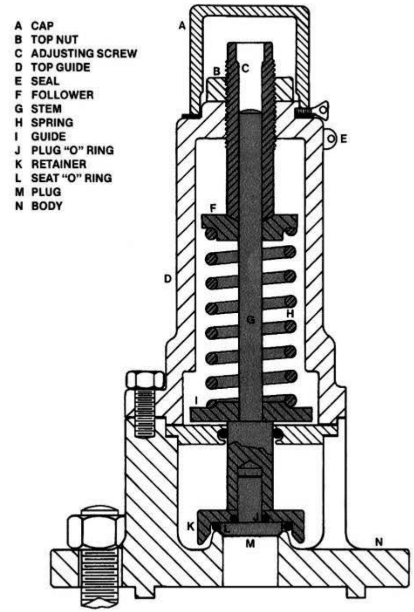


WASHOUT PLUG FOR RUBBER LINED CAR

# Pressure Relief Valve



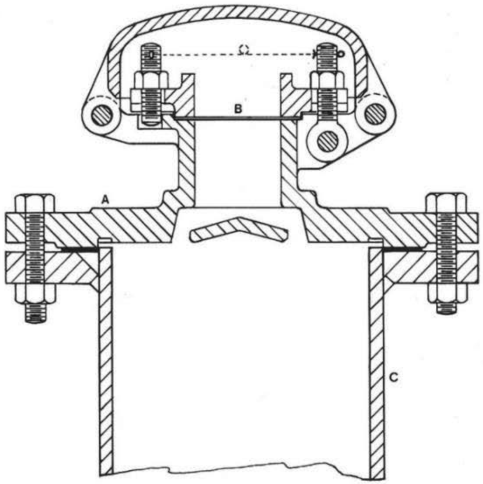

Internal Valve



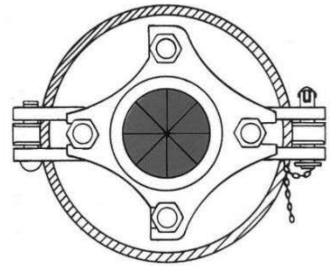

External Valve

## Safety Vent

**Note:** Safety vents are also called a “rupture disc devices” and “nonreclosing pressure relief devices”.




Detail of Side View

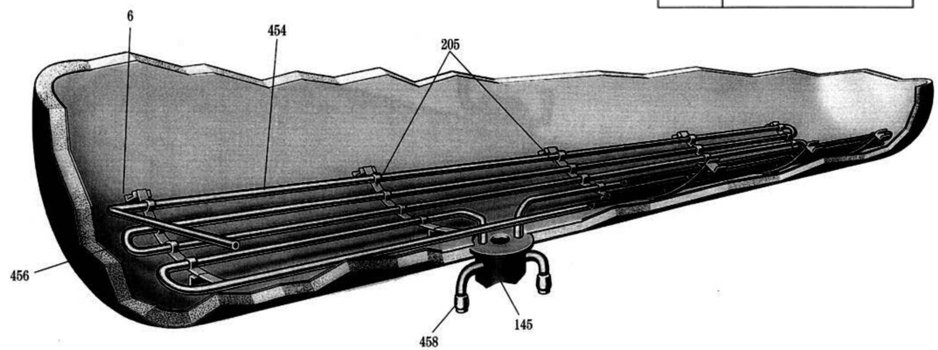


Cross Section
Showing Frangible Disc

A Safety Vent Housing
B Frangible Disc
C Nozzle

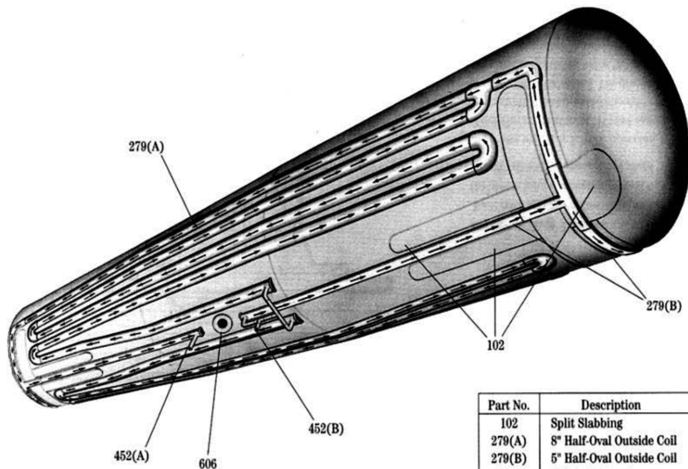
# 8 Line Interior Heater Coil, Simplex System, Connections at Bottom Outlet

| Part No. | Description |
|---|---|
| 6 | Bar Support |
| 145 | Steam Jacketed Outlet Nozzle |
| 205 | Cradle Bar |
| 454 | Coil Pipe |
| 456 | Coil Return Bend |
| 458 | Pipe Cap |




**8 LINE INTERIOR HEATER COIL, SIMPLEX SYSTEM, CONNECTIONS AT BOTTOM OUTLET**

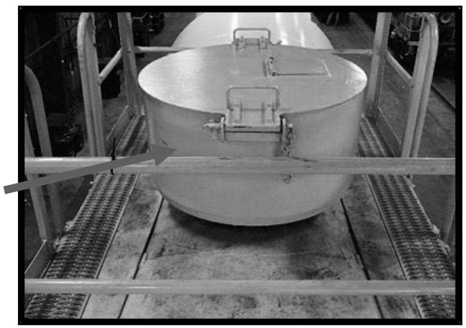
# 10L 2T Serpentine Manifolded Half-Oval Outside Coil (Post 1974)

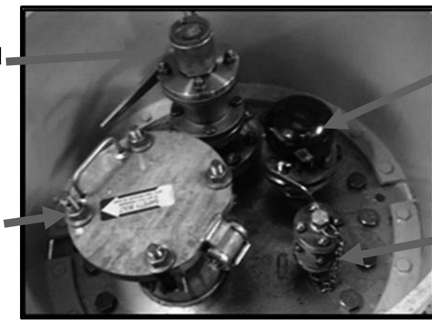



| Part No. | Description |
|---|---|
| 102 | Split Slabbing |
| 279(A) | 8" Half-Oval Outside Coil |
| 279(B) | 5" Half-Oval Outside Coil |
| 452(A) | Coil Inlet Nozzle |
| 452(B) | Coil Outlet Nozzle |
| 606 | Outlet Flange Adaptor |

**10L 2T SERPENTINE MANIFOLDED HALF-OVAL OUTSIDE COIL (POST 1974)**

## Sulfuric Acid Tank Car with Top Fittings Protection


Courtesy of Veolia North America.

## Sodium Hydroxide Tank Car with Top Fittings Protection

## Bottom Outlet Valve with Operating Instructions


Courtesy of Norfolk Southern Railway Company.

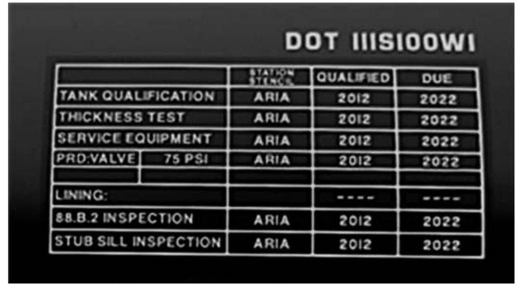
## Class DOT/TC-111A "CPC 1232" Tank Car for Flammable Liquid Service

(Equipped with Top Fittings Protection and Headshields)


Courtesy of Railway Association of Canada.

## Headshield Detail

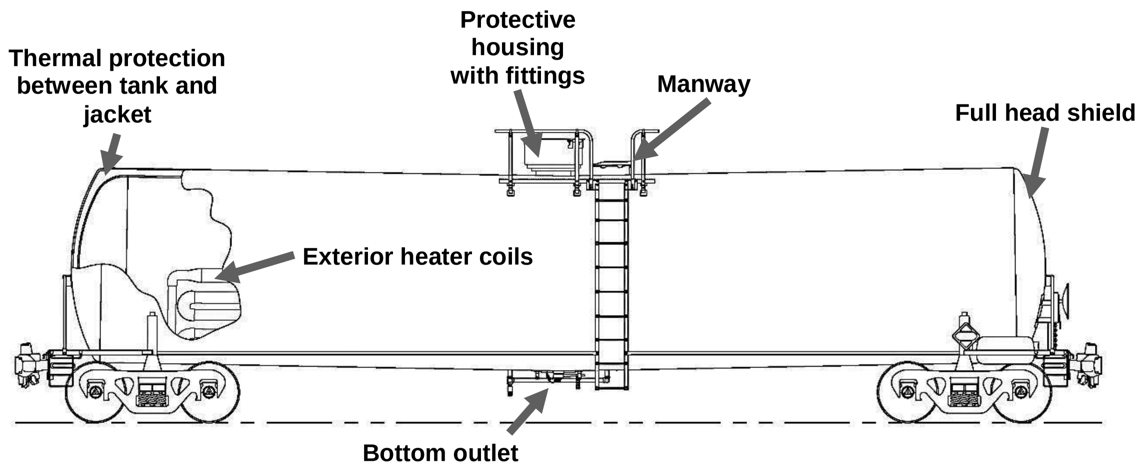

## DOT Specification and Qualification Stencil




Courtesy of Canadian National Railway.

The letter “S” in the specification indicates the tank car is equipped with headshields.

## Class DOT/TC-117 Tank Car Features

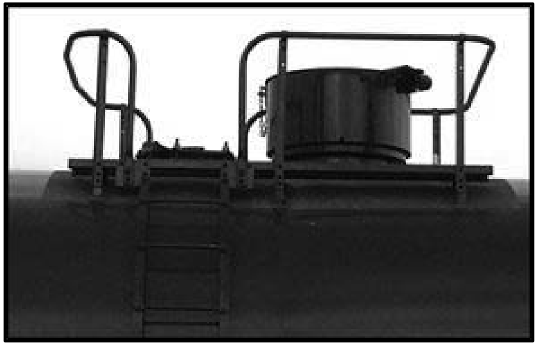



Courtesy of Trinity Industries, Inc.

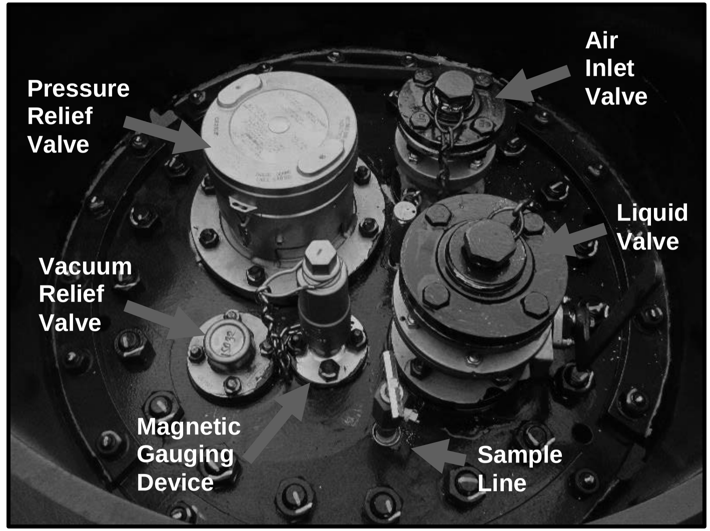
# DOT/TC-117J100W Tank Car for Flammable Liquid Service


Courtesy of Railway Association of Canada.

## Class DOT/TC-117 Manway and Top Fittings Protective Housing



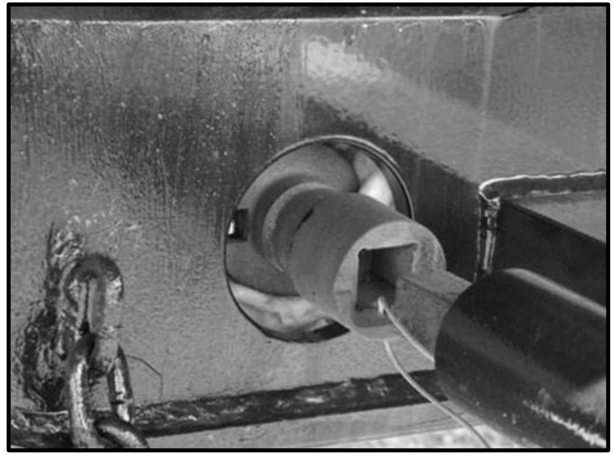
## Class DOT/TC-117 Fittings Arrangement Inside Protective Housing




Courtesy of Railway Association of Canada.

## Class DOT/TC-117 Bottom Outlet Operating Mechanism

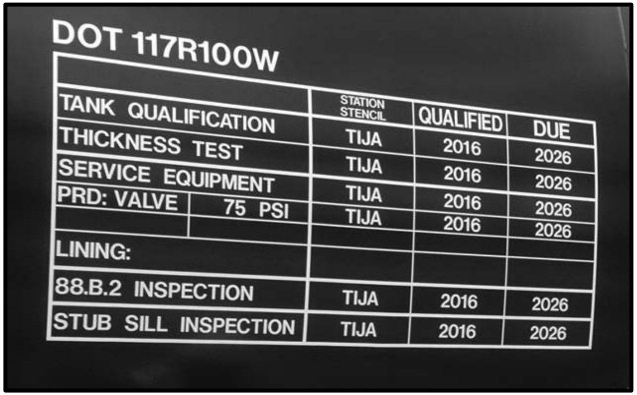
(Operating Handle Disengaged During Transportation)



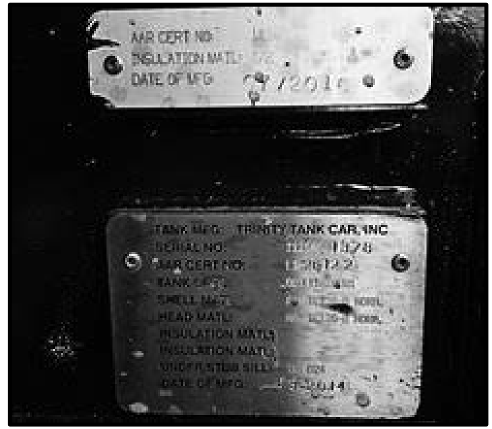
Courtesy of Railway Association of Canada.

# DOT/TC-117R100W Tank Car for Flammable Liquid Service

**DOT-117R100W Specification and Qualification Stencil**




**DOT-117R100W Retrofit and Original ID Plates**



## Examples of Nonpressure Tank Car Service Equipment

### Single Bolt Manway Covers

**"One-Bolt Manway System"**
Courtesy of Kelso Technologies, Inc.

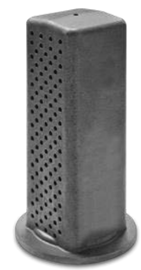
**"The Duke" Manway**
Courtesy of Transquip USA.

## Flexible Liquid Eduction Tubes

Courtesy of Kelso Technologies, Inc.

Courtesy of Salco Products, Inc.

## Safety Vents (Rupture Disc Devices) and Surge Suppressors



Courtesy of Salco Products, Inc.

# Vacuum Relief Valves

Courtesy of Midland
Manufacturing Co.


Courtesy of
Salco Products, Inc.


Courtesy of
Kelso Technologies, Inc.

## Reclosing Pressure Relief Valves

(Similar appearing valves may be found on pressure tank cars.)

Courtesy of Midland Manufacturing Co.

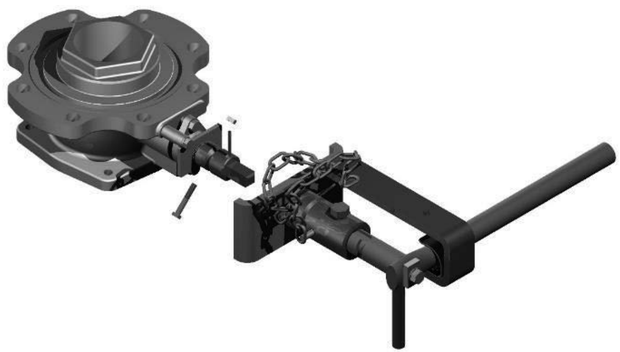
# “Constant Force Spring” Pressure Relief Valves

Valve with debris/
bee screen

Teflon© coated for
corrosive service

Courtesy of Kelso Technologies, Inc.

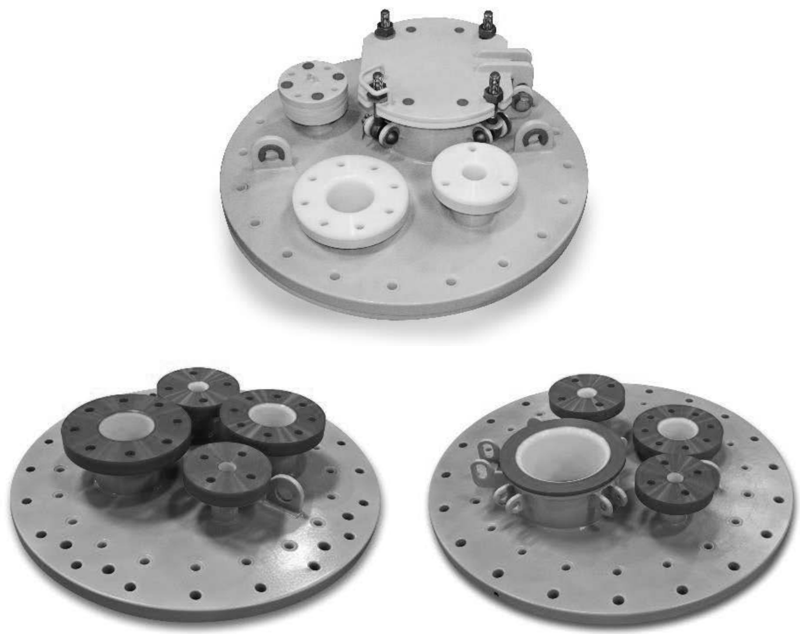
# New-Style Bottom Outlet Valves and Operating Handles



Courtesy of Salco Products, Inc.

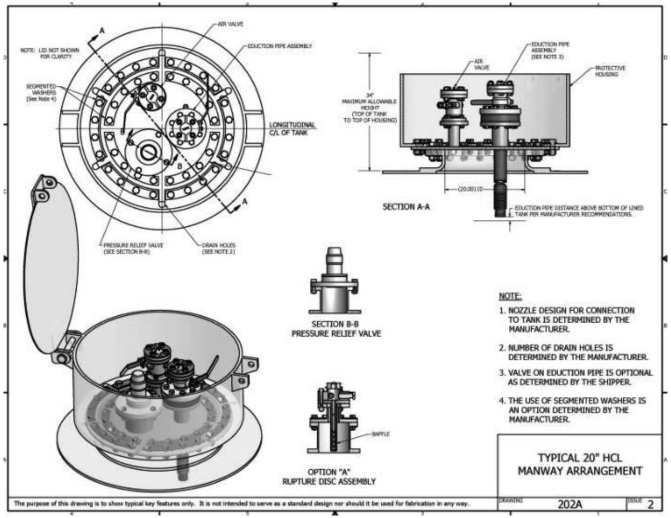

Courtesy of Midland Manufacturing Co.

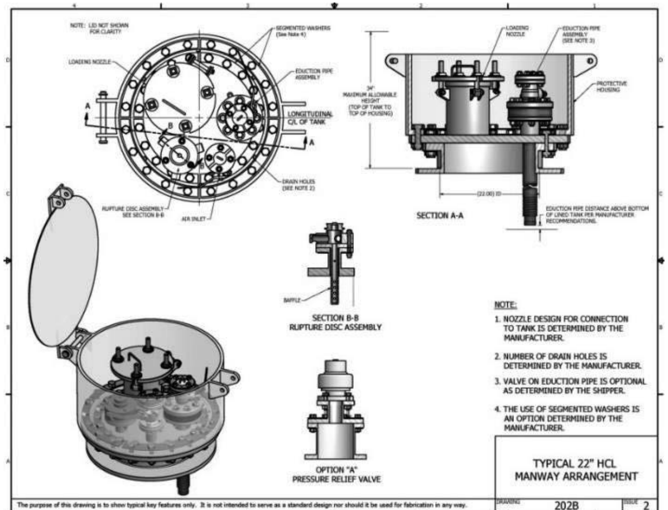
## Lined Fittings Manway Plates for Hydrochloric Acid Tank Cars



Courtesy of Salco Products, Inc. Institute

# Typical 20- and 22-inch Hydrochloric Acid Manway Fittings Arrangements




Courtesy of The Chlorine Institute

# SECTION 5: PRESSURE TANK CARS

Pressure tank cars, Classes DOT/TC-105, 109, 112, 114, and 120, are used to transport liquefied compressed gases, poison/toxic inhalation hazard (PIH/TIH) materials, reactive materials, and/or corrosive materials requiring the additional protection. There are no equivalent AAR-type pressure tank car specifications.

Minimum tank plate thickness ranges from 1/2 inch to 11/16 inch for steel tanks (depending on tank diameter and tensile strength of the plate used) and 5/8 inch for aluminum. Depending upon the specification, pressue tank cars have burst strengths from 500 psig to 1500 psig.

Class-105 insulated carbon or alloy (stainless) steel or aluminum pressure tank cars are designed for top loading and unloading. Bottom outlets and washouts are prohibited. Tank test pressures range from 100 psig to 600 psig. These cars may be equipped with tank head puncture resistance and thermal protection systems.

Class-109 insulated carbon steel or aluminum pressure tank cars are designed for top loading and unloading. Bottom washouts are authorized; however, bottom outlets are prohibited. Tank test pressures range from 100 psig to 300 psig. There are very few Class -109 tank cars in service.

Class-112 insulated or uninsulated carbon or alloy (stainless) steel pressure tank cars are designed for top loading. Bottom outlets and washouts are prohibited. These cars may be equipped with tank head puncture resistance and wrapped with thermal protection systems. Tank test pressures range from 200 psig to 500 psig.

Class-114 are insulated or uninsulated carbon or alloy (stainless) steel pressure tank cars with tank test pressures of 340 or 400 psig. These cars may be constructed of noncircular cross section, and, except for the PRD, the valves and fittings may be located somewhere other than the top of the tank.

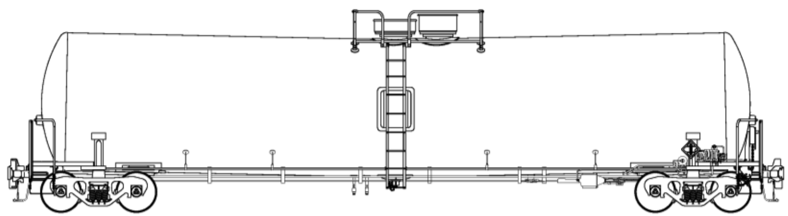
Class-114 cars may be equipped with bottom outlets and washouts, and tank head puncture resistance and thermal protection systems. Currently, those in service are similar in appearance to Class-112 tank cars. No noncircular cross section tank cars are in service.

Class-120 tank cars are insulated steel or aluminum pressure tank cars with tank test pressures of 100 to 500 psig. Like Class-114 tank cars, they may have valves and fittings located somewhere other than the top of the tank and may be equipped with bottom outlets and washouts and tank head puncture resistance and thermal protective systems.

One tank car manufacturer has built a number of specification DOT-120J200W tank cars for the transportation of flammable liquids. These tank cars are similar in appearance to Class-117 tank cars, except the hinged and bolted manway cover is contained within a protective housing. These tank cars operate under a DOT Special Permit and Canadian Safety Permit-Rail. (see page 80).

Pressure tank cars are most readily identifiable by the presence of a protective housing on top of the tank (not to be confused with an expansion dome applied to obsolete nonpressure tank cars).

**DOT/TC-120J200W for Flammable Liquid Service**



The loading/unloading fittings and the PRD (PRV or combination PRD) will be mounted on a manway cover or pressure plate and enclosed within the protective housing. Some tank cars in refrigerant gas or certain corrosive service may have a bottom outlet, bottom washout, and a hinged and bolted manway cover enclosed within a dome-shaped housing.

Unlike nonpressure tank cars, which may be loaded or unloaded using an open system, pressure tank cars are loaded and unloaded using a closed system; i.e., the tank is not opened to the atmosphere during the process. The manway cover or pressure plate is removed only for maintenance purposes at a tank car repair facility.

Although rare, pressure tank cars may be equipped with heater coil systems.

Typically, in addition to the PRDs, a pressure tank car will have two liquid eduction lines running along the tank's longitudinal centerline with the valves facing the ends with eduction pipes reaching to the bottom of the tank and at least one vapor eduction line with the valve facing the side of the tank car with an eduction pipe extending only into the top of the tank.

The valves for liquid and vapor eduction lines are commonly called angle valves (so called because product flow through the valve is at a right angle to the flow through the eduction line).

The angle valves may be either plug or quarter-turn ball style valves. Instead of angle valves, some pressure tank cars are equipped with ball valves designed for vertical flow of the product.

Depending upon the tank car's service, the following additional fittings may be found mounted on the pressure plate:

- **Sample Line:** may be used to obtain a sample of the tank's lading for laboratory analysis. The device consists of an open pipe extending into the tank that may or may not go to the bottom and is closed with a control (needle) valve on the outside. To obtain a sample, a hose is connected to the control valve's port, with the other end attached to a container for the sample (usually a small compressed gas cylinder). When the control valve is opened, lading will flow into the container.

  The sample line valve may also be used to attach a pressure gauge to determine the pressure within the tank. Because the sample line's pipe may not extend completely to the bottom of the tank, it cannot be relied upon to determine if there is any liquid remaining in an empty tank.

- **Gauging Device:** typically, a magnetic-ball device consisting of a hollow metallic pipe, capped at the end inside the tank. A metallic ball or float equipped with ring magnets is placed around the rod. The inside of the pipe is equipped with a composite-material gauging rod, with a magnet on the lower end. As the tank is filled, the ball floats on the liquid and the magnetic force between the ball and the rod causes the rod to follow the ball, rising with the liquid level. The gauging rod is typically graduated in one-quarter inch increments, and the liquid-level measurement can be converted to gallons of outage (vacant or vapor space in the tank) using outage tables supplied by the tank car's builder. Subtracting the outage from the tank's volumetric capacity will give the "innage" or number of gallons of product inside the tank.

In lieu of a magnetic gauging device, pressure tank cars may be equipped with electronic or "telltale" (also called "dip tube') gauging devices. Telltale gauges consist of a fixed open tube that extends into the tank (but not to the bottom) with an outside control (needle) valve, similar in appearance to the control (needle) valve on a sample line. The length of the tube(s) has been predetermined to typically correspond to 1 percent and/or 2 percent, or up to 5 percent outage by volume. During loading, the control valve(s) are open, and when liquid is emitted, the designated outage has been reached.

- **Thermometer Well:** used to take the temperature of the lading. The device consists of a pipe (sealed at the bottom) filled with an antifreeze solution or oil that extends into the tank and is closed with a cap (not with a valve) on the outside. With the cap removed, a thermometer, which does not travel with the car, is lowered into the tube. The temperature of the liquid in the tube will correspond to the temperature of the lading, which is transferred to the thermometer. The external pipe and/or the thermometer well cap are equipped with telltale holes that are intended to provide a warning should there be a failure of the internal pipe. Some pressure tank cars are equipped with electronic temperature sensing devices.

- **Excess Flow Valves:** required by governmental regulations for certain commodities. An excess flow valve (not to be confused with a check valve that only allows flow in one direction) is a device that closes automatically against the outward flow of the contents of a tank in case the external closure valve is broken off or removed during transit.

Excess flow valves may be equipped with a bypass feature that allows for pressure equalization. Excess flow valves are neither designed nor intended to stop the flow of a tank car's contents in the event of a failure of a loading/unloading system's piping or hoses.

For commodities that have a primary or subsidiary hazard of Division 2.1 (flammable gas) material hazard, the interior (eduction) pipes for the loading and unloading valves and sample devices must be equipped with excess flow valves. Tanks transporting chlorine must have excess flow valves or spring-loaded check valves only on the interior (eduction) pipes for the liquid discharge valves. **Note:** See "Enhanced Fittings Package for PIH/TIH Tank Cars" for exceptions.

Although not required by regulation, pressure tank cars transporting other commodities may be equipped with excess flow valves; e.g., a tank car may be in dual service, wherein it transports LPG (Division 2.1) requiring excess flow valves during part of the year and anhydrous ammonia (Division 2.2), which does not require excess flow valves, during other times of the year.

## Fittings for the Most Common Commodities Shipped in Pressure Tank Cars

**Liquefied Petroleum Gases** (e.g., propane, butane, and propylene), vinyl chloride, butadiene, and anhydrous ammonia:

- Two liquid eduction lines along the centerline of the tank with the eduction valves pointing towards the ends of the car.
- One vapor eduction line with the eduction valves pointing to the side of the car.
- Pressure relief valve.
- Thermometer well.
- Sample line.
- Magnetic gauging device.

**Chlorine and Sulfur Dioxide:**

- Two liquid eduction lines along the centerline of the tank with the eduction valves pointing towards the ends of the car.
- Two vapor eduction lines with the eduction valves pointing to the sides of the car. Tank cars equipped with the enhanced fitting package (see page. 87) may be equipped with one instead of two vapor eduction lines.
- Combination PRD (breaking pin or rupture disc beneath a pressure relief valve).
- No gauging device, sample line, or thermometer well.

**Carbon Dioxide and Nitrous Oxide:**

- One liquid eduction line with an eduction valve and one vapor eduction line with an eduction valve along the centerline of the tank with the valves pointing towards opposite ends of the car. Typically, these eduction valves will be identified on a plate inside the protective housing or by the letters L (for liquid) and V (for vapor) applied to the interior wall of the protective housing.
- Two pressure regulating valves.
- Pressure relief valve.
- Safety vent/rupture disc device.
- Two or more fixed-length, telltale outage gauges.
- Thermometer well.

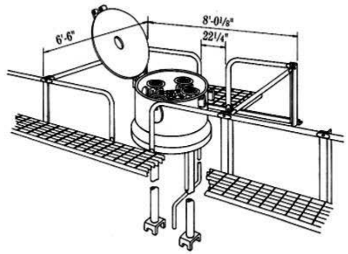
**Note:** Regulations require that the final discharge of the regulating valves, PRV, and rupture disc must be piped to the outside of the protective housing and identified by stenciling "REGULATING VALVES VENTING NORMAL", "RELIEF VALVE", "REGULATING VALVES", and/or "RUPTURE DISC", as appropriate, over or under the discharge pipes from the respective devices. Under no circumstances should these discharge pipes be plugged or otherwise blocked.

# DOT/TC-112J340W Tank Car for Liquefied Petroleum Gas and Anhydrous Ammonia Service

**33,500 GALLON CAPACITY - NON-INSULATED - THERMAL PROTECTED**

DOT-112J340W

For Liquefied Petroleum Gas & Anhydrous Ammonia Service




**CAPACITY & WEIGHTS**

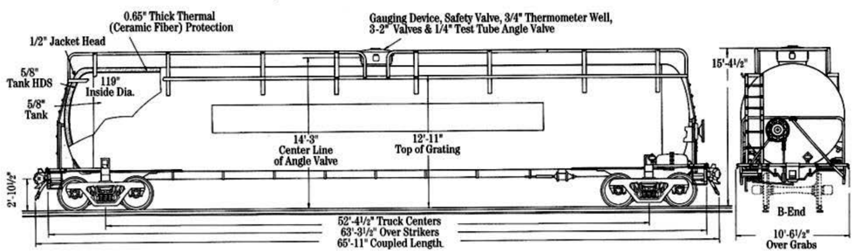
Nominal Capacity @ 58.28% Filling Density – 33,500 gals.

Estimated Light Weight – 99,500 lbs.

Rail Load Limit (100 Ton Trucks) (5'-10" Wheel Base) – 263,000 lbs.

**COMMODITY MAXIMUM DENSITY**

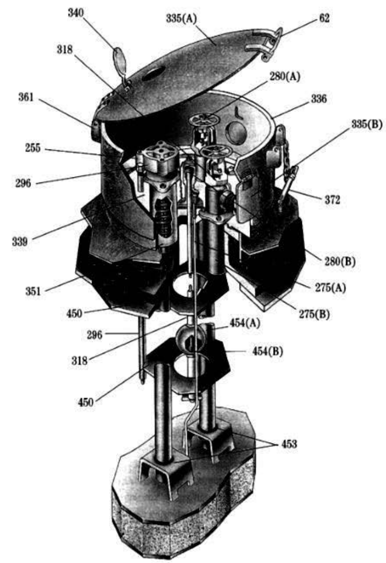
| Truck Cpty. | Wheel Base | Commodity Density |
|---|---|---|
| 100 Ton | 5'-10" | 58.28% Max Fill Density |






Note: Nomenclature used in the illustrations may not always be consistent with that used in the text of the field guide.

# Loading and Unloading Arrangement for Liquefied Petroleum Gas and Anhydrous Ammonia Service




| Part No. | Description |
|---|---|
| 62 | Bonnet Cover Handle |
| 255 | Safety Valve Assembly |
| 275(A) | 1/4" Check Valve |
| 275(B) | 3" Check Valve |
| 280(A) | 2" Angle Valve |
| 280(B) | 1/4" Angle Valve |
| 296 | Thermometer Well |
| 318 | Gauging Device Assembly |
| 335(A) | Manway Bonnet Cover |
| 335(B) | Manway Bonnet Side Cover |
| 336 | Manway Bonnet |
| 339 | Manway Cover Plate |
| 340 | Vent Cover |
| 351 | Manway Nozzle |
| 361 | Hinge |
| 372 | Seal Pin |
| 450 | Pipe Bracket |
| 453 | Pipe Guide |
| 454(A) | Discharge Pipe |
| 454(B) | Test/Sample Pipe |

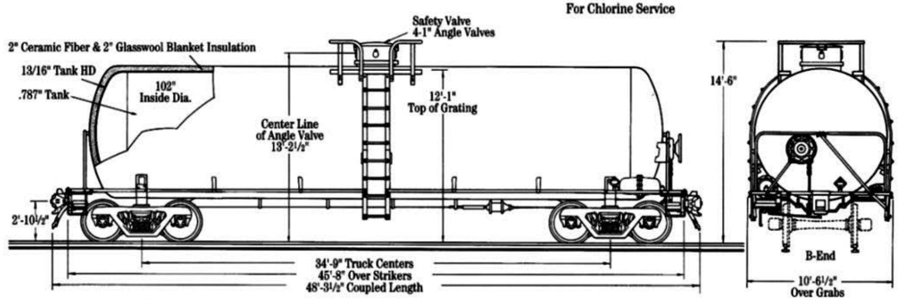
**LOADING AND UNLOADING ARRANGEMENT FOR LIQUEFIED PETROLEUM GASES AND ANHYDROUS AMMONIA CARS WITH THERMAL INSULATION AND MAGNETIC FLOAT TYPE GAUGE DEVICE (POST 1979)**

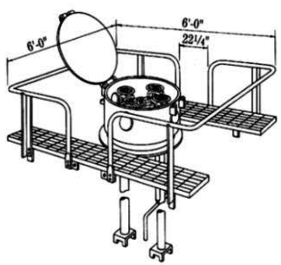
# DOT/TC-105J500W Tank Car for Chlorine Service

**90 TON CAPACITY – INSULATED – THERMAL PROTECTED**

DOT-105S500W

For Chlorine Service




**CAPACITY & WEIGHTS**

Nominal Capacity @ 125% Filling Density – 90 tons

Estimated Light Weight – 79,700 lbs.

Rail Load Limit (100 Ton Trucks) –

(5'-10" Wheel Base) – 263,000 lbs.

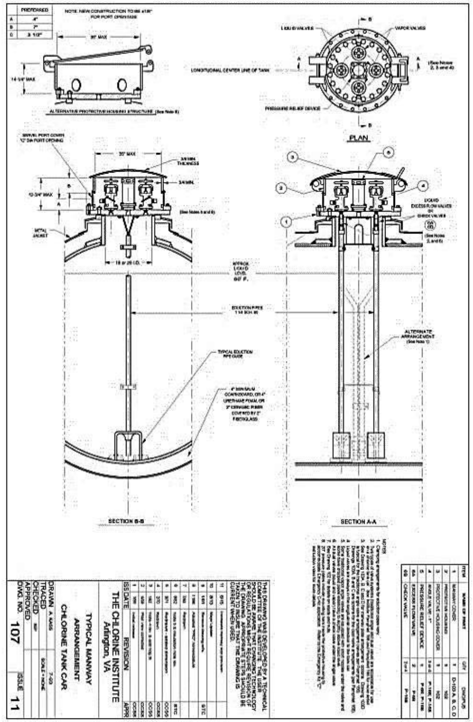
**COMMODITY MAXIMUM DENSITY**

| Truck Cpty. | Wheel Base | Non-Coiled Comm. wt./gal. |
|---|---|---|
| 100 Ton | 5'-10" | 17,290 gal. max. |



**Note:** As the tank car is equipped with 2” ceramic fiber, the specification is actually “DOT-105J500W”.

# Typical Chlorine Tank Car Fittings Arrangement




Courtesy of The
Chlorine Institute.

## DOT/TC-120J200W for Flammable Liquid Service


Photographs courtesy of UTLX Manufacturing.

## Magnetic Ball Gauging Device

(May also be found on some nonpressure tank cars.)

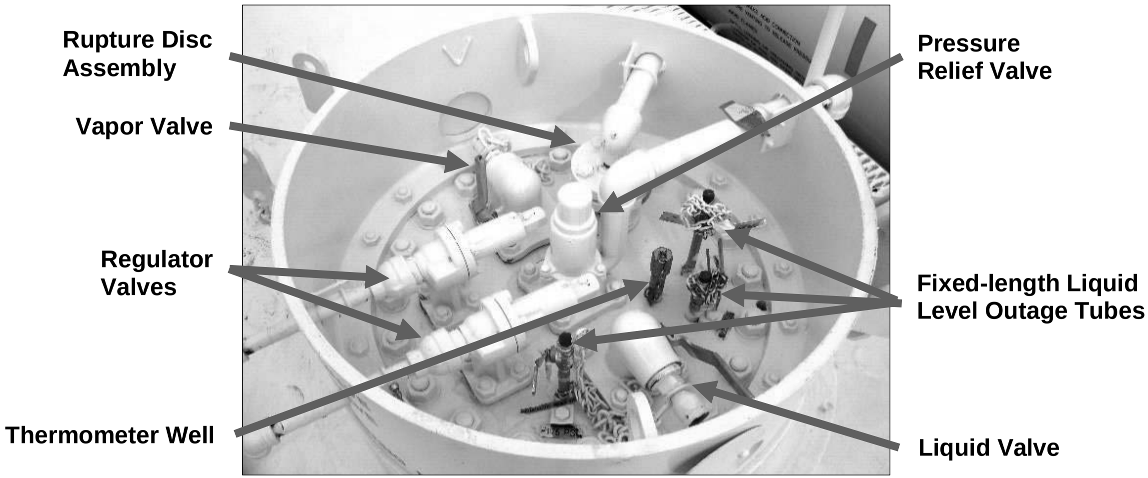
Courtesy of Salco Products, Inc.

## Pressure Relief Valves That May Be Found on Pressure Tank Cars

**"REGO 8890-SERIES"**
Courtesy of Transquip USA.

**"CROSBY JQ" CHLORINE COMBINATION PRV**
**Courtesy of Salco Marketing, LLC.**

# Fittings Arrangement for Carbon Dioxide and Nitrous Oxide Tank Cars




Tank cars transporting Carbon Dioxide and Nitrous Oxide will be stenciled “REGULATING VALVES VENTING NORMAL” on each side of the car.

The venting of vapor from the regulator valves is a normal function to reduce internal pressure through auto-refrigeration.  DO NOT attempt to plug the discharge pipes of the pressure relief devices.

## Top Fittings Protection Requirements for Tank Cars Transporting Materials Poisonous (Toxic) by Inhalation (PIH/TIH Materials)

As mentioned in Section 1: Tank Car Classification and Specifications, the U. S. DOT issued new rules in January 2009 requiring enhanced safety measures for tank cars transporting PIH/TIH materials.

A tank car built after March 16, 2009, for the transportation of a PIH/TIH material, must have the service equipment enclosed within a protective housing and cover.

In addition, it must be equipped with a top fittings protection system and nozzle capable of sustaining, without failure, a rollover accident at a speed of 9 miles per hour, in which the rolling protective housing strikes a stationary surface assumed to be flat, level, and rigid.

Failure is deemed to occur when the deformed protective housing contacts any of the service equipment, or when the tank retention capability is compromised.

As an alternative to the above top fittings protection, the tank may be equipped with a system that prevents the release of the product from any top fitting in the case of an accident where any fitting would be sheared off (i.e., "Enhanced Fittings Package for PIH/TIH Tank Cars). See the illustrations on pages 87-89 for examples of these devices.

## Enhanced Fittings Package for PIH/TIH Tank Cars

A coalition of tank car and valve manufacturers, chemical producers, and railroads researched tank car design criteria to improve transportation safety of PIH/TIH materials, primarily chlorine. This research project was referred to as the "Next Generation Rail Tank Car ("NGRTC" or "Next-Gen") Project".

In addition to added safety features to the tank car structure itself, an enhanced fittings package has been developed that is designed to prevent the loss of product should any top fittings be damaged or sheared off in an accident. Tank car housings may have some form of marking or labeling indicating that an enhanced fittings package is installed on the car.

The enhanced fittings package differs from traditional chlorine fittings arrangements by:

- Equipping the car with one instead of two vapor lines, in which case the pressure relief valve is relocated from the center of the pressure plate to the side where the second vapor line would have been located.
- Replacing product flow-activated excess flow valves with spring-loaded check valves that are closed when the eduction (angle) valves are closed. When the valve is opened, the valve stem depresses the check valve, allowing liquid or vapor to flow through the eduction pipes; therefore, if an eduction valve is sheared off, the check valve remains closed, preventing the loss of product.
- Replacing the combination PRD (rupture disc/breaking pin assembly below a pressure relief valve contained in one assembly) with a spring-loaded pressure relief valve mounted above a rupture disc assembly that is embedded in the pressure plate. Should the PRD be sheared off, the rupture disc device, being the primary seal, will retain the product.

## Enhanced Design for PIH/TIH Tank Cars

Although the NextGen Project came to completion and the enhanced fittings package has been implemented, research continues to enhance PIH/TIH tank car design. Currently, a new chlorine tank car design is operating under a DOT SP-15036 and TC SR-10521.

This design involves a "tank-within-a-tank" concept (referred to as a "sandwich car design") wherein the "outer tank" is only anchored to the "inner" commodity tank at the nozzle, and the bottom of the commodity tank rests on cradles within the outer tank.

The commodity tank has a lower test pressure (300 psig) than a typical chlorine tank car. This tank car design operates with the enhanced fittings package described above.


Courtesy of UTLX Manufacturing.

## Enhanced Fittings Arrangement for Chlorine Tank Cars with One Vapor Line


Illustration courtesy of Midland Manufacturing Company.

# Cutaway View of Enhanced Fittings Arrangement for Chlorine Tank Cars

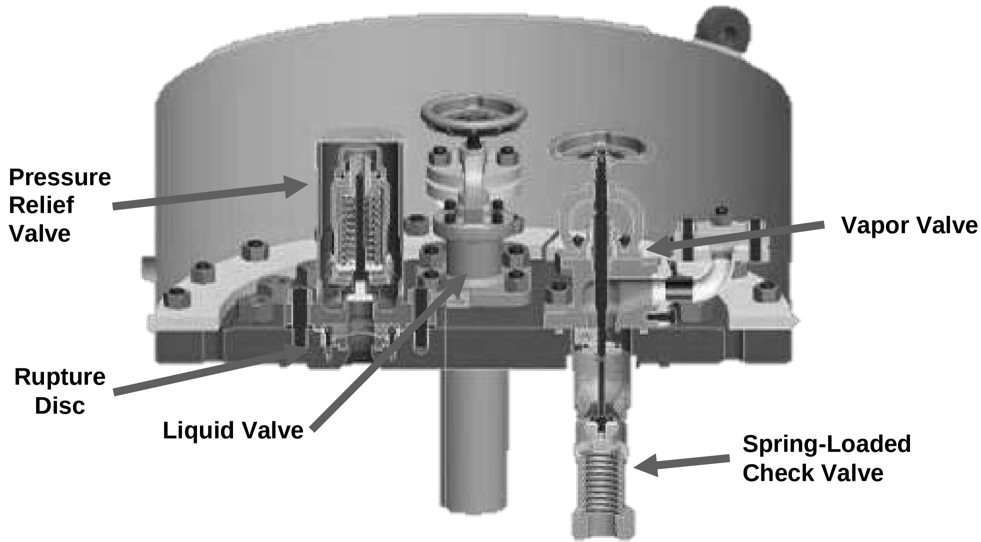
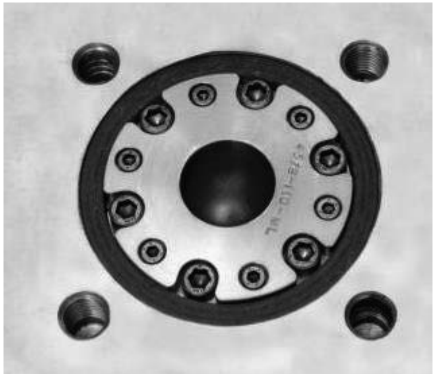


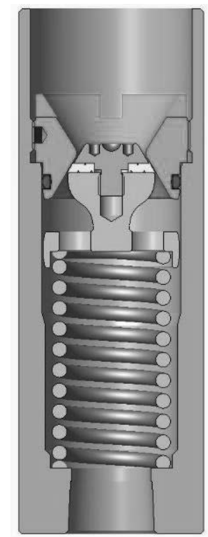

Illustration courtesy of Midland Manufacturing Company.

# Enhanced Chlorine Fittings



Rupture Disc Assembly Embedded in the Pressure Plate

Angle Valve with Stem to Open the Check Valve



Spring-loaded Check Valve

Illustrations courtesy of Midland Manufacturing Company.

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# SECTION 6: CRYOGENIC LIQUID TANK CARS

Cryogenic liquid tank cars, Class DOT/TC-113 and Class AAR-204, are vacuum-insulated cars having an inner container (tank) and outer shell (tank, not a jacket (although referred to as an "outer jacket" in 49CFR)). The inner tank is constructed of alloy (stainless) steel and the outer shell is constructed of carbon steel. Cryogenic tank cars are designed to transport refrigerated liquefied gases having a boiling point colder than minus 130°F at atmospheric pressure; e.g., liquid hydrogen, ethylene, oxygen, nitrogen, and argon.

The annular space between the inner and outer tanks has a vacuum drawn and is equipped with an insulation system using granular perlite or an alternating wrap of multiple layers of aluminum foil and paper. These tank cars are frequently referred to as Thermos® bottle tank cars.

The insulation system (designed for the commodity being transported and meeting specified performance standards) and vacuum controls the rate of heat input for normal transportation time periods.

**Note:** DOT regulations require the shipper to notify the Federal Railroad Administration whenever a tank car containing any flammable cryogenic liquid is not received by the consignee within 20 days from date of shipment. Typically, the insulation system will keep the commodity pressure from activating the PRDs for at least double this 20-day period.

Specification DOT/TC-113A60W tank cars have a design service temperature of minus 423°F, a minimum burst pressure of 240 psig, and a tank test pressure of 60 psig.

Specification DOT/TC-113C120W tank cars have a design service temperature of minus 260°F, a minimum burst pressure of 300 psig, and a tank test pressure of 120 psig.

Specification AAR-204W tank cars must meet the specification requirements for Class-113 tank cars, with some exceptions. The minimum required burst strength is 240 psig, with a 60 psig tank test pressure. Specification AAR-204W tank cars are not authorized for Division 2.1 (flammable gas) materials.

Cryogenic liquid tank cars are required to have two liquid-level gauges. One gauge measures the liquid level in the inner tank (this gauge may be a portable gauge that does not move with the car) and the other gauge, a fixed-length dip tube set, indicates the maximum allowable liquid level for the allowable filling density. In addition, the car must be equipped with a vapor-phase pressure gauge to indicate the pressure within the inner tank.

The cars must be equipped with various PRDs for the protection of the tank assembly and piping system. The discharge of the PRD must be directed away from operating personnel, the car structure, trucks, and safety appliances; e.g., steps, handholds/grab irons, and handrails.

The inner tank must be equipped with at least one PRV and at least one safety vent (rupture disc device), which may be replaced by an alternate PRV. The car may also be equipped with a pressure control device (regulator valve) and mixing device to control the routine release of vaporized lading during transportation. Tank cars in liquid hydrogen service must be equipped with a device that will instantly ignite any hydrogen that is discharged through the PRDs. The outer jacket/tank must be equipped with a system to prevent buildup of pressure within the annular space.

The loading/unloading valves and other fittings are required to be enclosed within a protective housing (not to be confused with protective housings on pressure tank cars), which appears to be a box or cabinet. The protective housing(s) is located on both sides, at one end or, in rare cases, on the top of the car. The housing(s) must be adequate to protect the fittings from direct solar radiation, mud, sand, adverse environmental exposure, and mechanical damage incident to normal operation.

The protective housings for the fittings must be equipped with precautionary instructions for the safe operation of the equipment during storage and transfer operations, and must include a diagram of the tank and piping system with the various gauges, control valves, and PRDs clearly identified, and their location indicated. In addition, all valves and gauges must be clearly identified with corrosion-resistant nameplates.

In addition to other stenciling, cryogenic liquid tank cars must be stenciled "DO NOT HUMP OR CUT OFF WHILE IN MOTION" and "VACUUM JACKETED" on both sides in lettering at least 1 1/2 inches high.

## Typical Cryogenic Liquid Tank Car (Class DOT/TC-113)


Photo courtesy of Chart Industries.

## Typical Cryogenic Liquid Tank Car Fittings Compartment

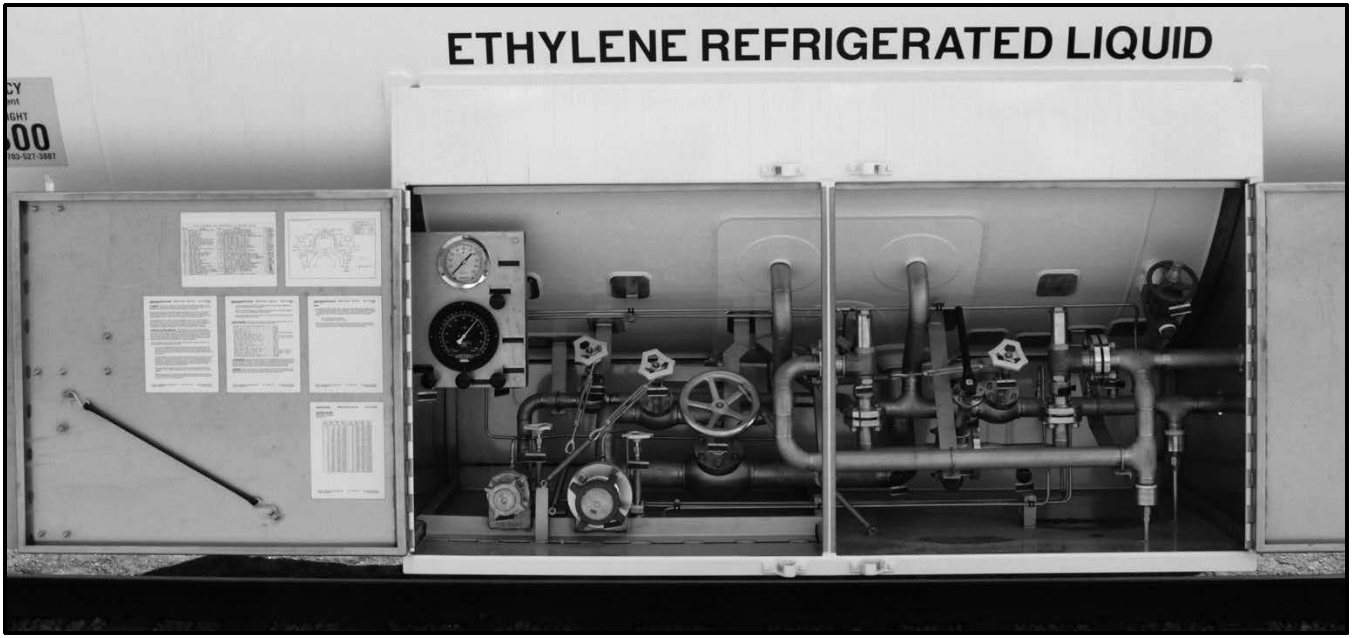


Photo courtesy of Chart Industries.

# Cryogenic Liquid Tank Car Fittings Diagram

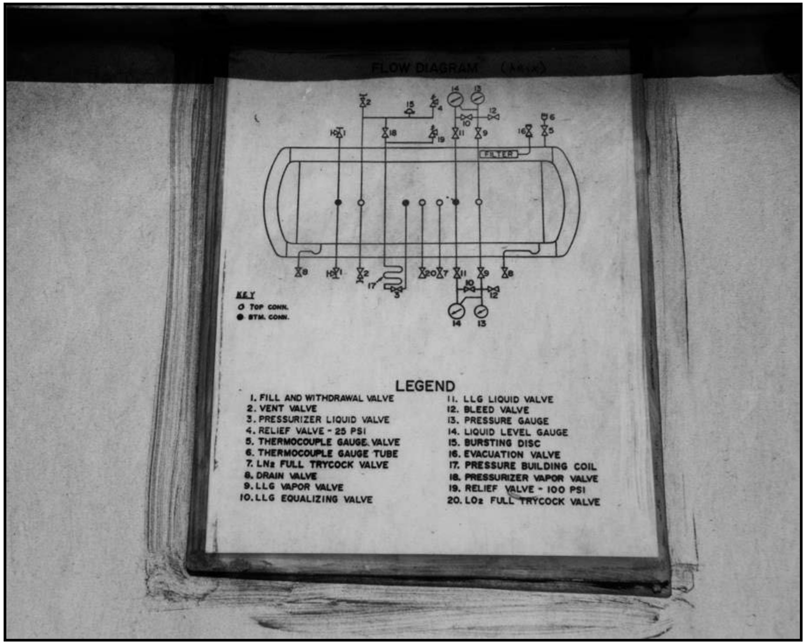


Photo courtesy of Tony Bacino.

# SECTION 7: GUIDELINES FOR INITIAL EMERGENCY RESPONSE

Accidents involving tank cars must be evaluated and approached with great care due to the possible presence of hazardous materials/dangerous goods. Absence of visible hazard warning labels, markings, or placards is not a guarantee that commodities involved are harmless. Careful, thorough evaluation, assessment, and initial response are critical to any emergency involving tank cars.

It is possible that an accident involving hazardous materials/dangerous goods will present such a high degree of hazard that the only safe course is to evacuate ALL personnel from the area and allow the incident to run its own course without intervention.

## Initial Notification

If you are the first on scene of a transportation accident, your first step is to avoid endangering yourself and call for help. Immediately notify local emergency response personnel and the transportation carrier. After notifying the local emergency response agency, attempt to obtain the shipping papers and call the Emergency Response telephone number shown thereon. You should also contact the railroad directly via its Emergency Telephone Number for emergency response and technical assistance. Numbers for the major carriers are:

- BNSF Railway: 800-832-5452
- Canadian National Railway 800-465-9239
- Canadian Pacific Railway 800-716-9132
- Conrail 856-231-6400
- CSX Transportation 800-232-0144
- Kansas City Southern Railway 877-527-9464
- Norfolk Southern Railway 800-453-2530
- Union Pacific Railroad 888-877-7267

- Railway Association of Canada (RAC): 1-647-206-2896. RAC personnel are available for emergency response and technical assistance at railroad incidents involving dangerous goods in Canada.

### AskRail® app

The AskRail® app is a collaborative effort among all North American Class I railroads, the Association of American Railroads, and Railinc Corp. The app is a safety tool that provides first responders immediate access to accurate, timely data about the commodity a railcar is carrying. AskRail® is a backup resource if information from a train crew or train consist is not available. For security reasons, only qualified emergency responders can download and use the restricted features in the AskRail® app. In addition, railroads can offer the app to known emergency responders along their routes. Additional information may be found at: https://askrail.us.

Binoculars are recommended to assist responders in assessing the accident from a safe distance. Provide as much of the following information as you can when calling for assistance.

- Your name, location, and telephone number.
- Location of incident.
- Type vehicle or container involved.
- Wind direction and approximate speed.
- Presence of injured people.
- Presence of smoke, fire, or fumes.
- Presence of markings, labels, or placards on containers or vehicle.
- Carrier name.
- Other pertinent information.

After the initial notification is made, isolate the scene by ensuring all unnecessary personnel are clear of the site. Make sure your vehicle is far enough away that the hot exhaust system does not provide a possible ignition source. Turn off the vehicle's ignition. Do not smoke or use flares, fusees, or open flames near the scene.

Resist the urge to rush into an accident site and rescue injured personnel until after the commodities are identified and the nature and severity of the hazard is assessed.

## Initial Assessment

Remain a safe distance upwind from the site. Use binoculars to survey the site and surrounding area. Make notes and sketches, as necessary. Pay particular attention to:

- Location of injured personnel and their proximity to surrounding hazards.
- Location of potentially threatened personnel.
- Markings, labels, or placards on containers or vehicles that may aid in identifying commodities present.
- Number and types of containers or vehicles involved.
- Visible damage to and/or leakage from containers or vehicles (gas, vapor, liquid, or solid).
- Vehicle or container reporting marks (letters) and number.
- Accessibility to site and possible escape routes.
- Weather conditions.
- Topographical features of the site and surrounding areas, especially bodies of water.

Report the above information directly to other response organizations as soon as possible. When identifying chemical commodities, copy names and other information precisely. Even minor spelling errors can have serious consequences in determining the properties of materials involved.

## Identifying Materials

Before entering the incident site, identification of the commodities and containers or vehicles involved is essential. The shipping paper is the best source for this information. For rail carriers, this information is typically contained in a document called a train consist, train list, or wheel report, which is in the possession of a member of the train crew. This information may also be available by contacting the railroad by phone.

The train consist, train list, or wheel report will identify whether the commodity is hazardous and where the car is located in the train. In a rail yard, shipping paper information is available at the yard office.

In the absence of shipping papers, using binoculars from a safe distance upwind, try to locate any 4-digit identification numbers on the placards (or orange panels) applied to the containers or vehicles and/or labels on packages. This may help determine the presence of hazardous materials/dangerous goods.

If shipping papers, placards, markings, or labels are destroyed, the reporting marks and number on the railcar or intermodal container can often be used to help identify the commodities present. Railcar reporting marks are a series of letters (those ending with an X are privately owned; i.e., not owned by a railroad) followed by a series of numbers; e.g., BOEX 123456. Intermodal containers use a similar numbering pattern. Trailers have numbers, but may not have reporting marks. With this information, the carrier will be able to determine the vehicle's contents.

Attempting to retrieve shipping papers or obtain the commodity name from the containers should only be tried if it can be done without undue risk to personnel. Unidentified spilled commodities should be approached with caution. Use the maximum level of personal protective equipment necessary.

## Tank Car Damage Assessment

Tank car damage assessment guidelines presented are intended only to allow those first on the scene to make an initial appraisal of railroad tank car tank damage for purposes of determining what actions should be taken until expert appraisal assistance is available.

These guidelines may not be appropriate for assessment of damage to other types of transportation and storage tanks, such as tank trucks, tank trailers, portable tanks, and stationary tanks.

Tank cars and other bulk containers involved in accidents may suffer severe damage without loss of lading. This damage may look impressive, even awesome, yet the car or container may still have sufficient strength to permit it to be carefully removed from the accident site for later transfer or unloading of its contents.

The most serious damage that can occur to tanks and other containers transporting compressed gases is caused by bending, denting, scoring, or gouging without resultant leaks. Time, pressure, and handling can result in delayed rupture.

Virtually all liquefied gases are shipped in tank cars with jackets. Tank damage refers to damage to the tank itself, not to the surrounding jacket. The presence of a jacket may be determined by looking to see if ripped or torn metal reveals insulating materials. The jacket may also be noted by the flashing over the body bolster, flat spots on the sides or ends of tanks, and lap welds. The tank is found beneath the jacket. Removing a jacket to access the tank for damage assessment should only be done under the supervision of railroad personnel.

Assessment of the tank damage is not a casual matter and requires the presence of trained specialists. Each visible dent, score, or gouge must be examined. As adjacent cars or surrounding materials are removed or as the tank car itself is moved, newly exposed surfaces must be examined as well. Dents in combination with scores, gouges, or cracks and dents which cross a weld seam, are the most dangerous and the tighter or smaller the radius or curve of the dent, the more dangerous it is.

Dents that run lengthwise on the cylindrical section of the tank are usually considered to be more dangerous than large dents in the head. But even large head dents are dangerous, if they appear in conjunction with a gouge, score, or crack. Small head dents not exceeding 12 inches in diameter, especially in tightly bent edges, should be considered marginal and may justify unloading in place, usually by transferring material to another tank car or other container on site rather than attempting to move or rerail it.

Any crack in the base metal of a tank, especially if in combination with a dent or gouge, justifies unloading the tank before it is moved, except as may be necessary to get the valves upright or accessible. Scores or gouges are especially dangerous if they run lengthwise over a distance of 7 feet, cross a weld on the tank, and are greater than 1/16 inch in depth.

To repeat, assessment of tank damage is a skill that requires training and experience. Factors include evaluation of damage to the tank itself, outside air temperature, material in the tank and its vapor pressure, and the internal pressure. In the event of a spill and/or fire, refer to the EVACUATION section of the applicable Guide(s) (orange page) contained in the *Emergency Response Guidebook*.

When fire, especially a torch-like flame, impinges on a tank, a high-volume hose stream directed at the point of flame contact may prevent a dangerous heat and pressure buildup in the tank. Torch fires occur when a tank has been punctured or the pressure relief valve functions as well as other sources where flammable gas is burning out of the opening in a strongly projecting flame. With this kind of fire, a large standoff distance is required, and unmanned monitor nozzles provide greater protection for responders than hand lines.

Situations where flooding with water may be inappropriate occur when the water temperature is higher than the temperature of the material in the tank. This is often the case during winter months. Additional factors to consider before attempting to cool a tank with water include the tank's construction (may be insulated and covered with a jacket), the supply of water, possible environmental damage from contaminated runoff, and ground saturation, which may prevent heavy equipment from entering the site to perform wreck clearing operations.

A water attack is almost never the first thing that emergency responders should attempt. The guidelines in this section, especially those relating to the initial notification, making an initial survey, collecting and interpreting hazard and response information, and reviewing the tank damage noted, should be followed prior to laying, charging, and using hose lines.

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# SECTION 8: GLOSSARY OF RAILROAD AND TANK CAR TERMS

**AAR** — the Association of American Railroads, a trade association comprised of North American railroads. The AAR, among other activities, issues specifications and rules regarding the interchange of railcars between the various railroads. The AAR's requirements for tank cars are contained in the AAR *Manual of Standards and Recommended Practices* (MSRP) C-III, Specification M-1002.

**AAR Specification Tank Car** — a tank car built, altered, or converted in accordance with the tank car specifications of the Association of American Railroads.

**A-end** — the end of a railcar, opposite the end equipped with the hand brake (see B-end.)

**Ambient** — the temperature and barometric pressure of the local environment.

**B-end** — the end of a railcar on which the hand brake is attached. If both ends of the railcar have a hand brake, the car will be stenciled "A-END" and "B-END". When facing the B-end, the sides of the railcar are identified as the Right Side and Left Side, respectively.

**Body Bolster** — the structural members at each end of a car body that support the car on its truck assemblies.

**Bottom Outlet Valve** — a valve located in the bottom of the tank for loading or unloading.

**Bottom Washout** — a plugged and flanged opening in the bottom of a tank to facilitate cleaning of a tank car that does not have a bottom outlet.

**Brake Rigging** — the assembly of cylinders, levers, and/or rods under a railcar that provides and transmits braking action to the wheels.

**Breather Vent** — a device having an operating part that is a permeable disc or a disc having a breather hole or slit. Breather vents are typically applied to tank cars transporting hydrogen peroxide to allow vapors created by the decomposition of the commodity to be vented from the tank.

**Burst Pressure** — the value of the inlet static pressure at which a rupture disc device or breaking-pin device functions.

**Burst Pressure (Tank)** — the internal pressure at which a tank will theoretically burst. For a tank car tank, the minimum burst pressure is based on the tank's inside diameter, welding joint efficiency, minimum tensile strength of the plate material, and the minimum thickness of the plate after forming.

**CANUTEC** — acronym for the Canadian Transport Emergency Centre. CANUTEC is operated by the Transport of Dangerous Goods Directorate of Transport Canada and provides a national bilingual (English and French) advisory service, including emergency response advice for incidents involving dangerous goods. Call collect at 613-996-6666 (24 hours) or *666 cellular (Canada only). Call 613-992-4624 (24 hours) for nonemergency inquiries.

**Capacity/CAPY** — the volumetric capacity (stenciled in gallons and liters) of a tank car's tank. The capacity may also be shown in imperial gallons.

**Center Sill** — the center longitudinal structural member of a car underframe that forms the backbone of the underframe and transmits most of the buffering shocks from one end of the car to the other (also see Stub Sill Tank Car).

**Check Valve** — a valve that automatically closes to stop the flow of liquid or vapor in one direction. A spring-loaded check valve has its valve maintained in the closed position by a spring and is opened by the valve above it.

**CHEMTREC®** — acronym for the Chemical Transportation Emergency Center, a 24-hour emergency response service that provides assistance in the handling of incidents involving hazardous materials/dangerous goods. Call toll free at 800-424-9300 in the U.S. and Canada (outside calls: collect at 703-527-3887).

**C-Kit/Capping Kit** — a set of components used to cap (cover) and contain leakage from a fitting on a tank car. C-Kits are specifically designed for use on chlorine and sulfur dioxide tank cars. Tank cars built or altered after December 1, 2003, and used for the transportation of Class 2 (gases) or Poison-Inhalation Hazard/Toxic Inhalation Hazard materials must have a manway cover (or pressure plate) designed to accommodate capping kits. This requirement does not apply to tanks cars transporting carbon dioxide or Class DOT/TC-113 and Specification AAR-204W cryogenic liquid tank cars.

**Clad/Cladding** — the bonding of dissimilar metal sheets to form a composite material. The more corrosion-resistant metal acts as an interior protective coating after a tank car tank is fabricated.

**Class (Tank Car)** — a general designation of tank cars, usually including several specifications; e.g., Class DOT/TC-117 or Class AAR-204. The word "Class" is used if the designation embraces several specifications.

**Closure** — a device that closes an opening into a tank, valve or fitting. Examples: pipe plugs, quick-disconnect caps, blind flanges, manway covers, outlet caps, eduction pipe caps and fill hole covers.

**Combination Pressure Relief Device** — a PRD that incorporates a nonreclosing device (breaking pin or rupture disc assembly) in conjunction with an outboard reclosing pressure relief valve.

**Commodity/Lading** — the product inside a tank car.

**Coupler Vertical Restraint System** — see "Double-Shelf Coupler" definition.

**Cryogenic Liquid Tank Car** — a vacuum-insulated tank car, consisting of an inner alloy (stainless) steel container (tank) enclosed within an outer carbon shell (tank, not jacket), designed for the transportation of refrigerated liquefied gases such as liquid hydrogen, oxygen, ethylene, nitrogen, and argon. These cars are built to the specifications contained in Subpart F, Part 179, 49CFR, for Class DOT-113 tank cars; Section 8.6 of TC14877E for Class TC-113 tank cars; and Chapter 3 of the AAR Specifications for Tank Cars for Class AAR-204 tank cars. Cryogenic liquids are defined by:

- U. S.: 49CFR: "A refrigerated liquefied gas having a boiling point colder than -130°F (-90°C) at atmospheric pressure"; and
- Canada: TC TP 14877E: "A refrigerated liquefied gas that is handled or transported at a temperature equal to or less than -100°C (-148°F)".

**DOT** — acronym for the Department of Transportation, which is the governmental department that regulates the transportation of hazardous materials within the United States.

**DOT/TC Specification Tank Car** — the U. S. Department of Transportation or Transport Canada specification to which a tank car was built, altered, or converted.

**Double-Shelf Coupler/Coupler Vertical Restraint System** — a railcar coupler having top and bottom shelves designed to prevent vertical disengagement of mating couplers in the event of an excessive speed end-to-end impact or derailment. Double-shelf couplers are fully compatible with all other railcar couplers and required by DOT regulation on all DOT specification tank cars and any tank car transporting hazardous materials/dangerous goods.

**Eduction Line** — the combination of the eduction valve and eduction pipe.

**Eduction Pipe** — the pipe that runs from the eduction valve into the tank.

**Eduction Valve** — a valve used to load or unload liquid product or to introduce or remove vapor from a tank car tank.

**Excess Flow Valve** — a device installed in a liquid, vapor, or sample line, or a gauging device rod designed to stop the outward flow of product in the event the fitting is removed during transportation, such as the device being sheared off during an accident. When not in operation, the device allows the flow of liquid or vapor in two directions. Do not confuse this valve with a check valve, which is a device that allows the flow of liquid or vapor in only one direction.

**Expansion Dome (Dome)** — a cylindrical metal enclosure located on top of an obsolete nonpressure tank car tank intended to function as the expansion area for the lading during transportation. Do not confuse an expansion dome with protective housing, which is found on pressure tank cars and some nonpressure tank cars.

**Fill Hole** — an opening in the manway cover, closed with a fill-hole cover, through which product may be loaded or unloaded. Typically found on tank cars in sulfuric or hydrochloric acid service.

**Fitting** — a pressure retaining part that is in contact with the lading and has no operating components, made of one or more pieces, that joins service equipment to the tank car tank or joins two pieces of service equipment.

**Flange** — a disc-shaped device that is part of a nozzle or fitting (valve, PRD), used to create a bolted attachment to the tank car. Also, it may be a solid disc (blind flange) or have a threaded hole for a plug or secondary valve bolted to the eduction valve to provide closure.

**Gasket** — material inserted in the joint between two mating surfaces to prevent leakage through the joint.

**Gauging Device —** a piece of equipment or a device used to measure the level of liquid or vapor space in a tank car tank, which may be a fixed gauge bar/outage scale or T-bar attached to the top of the tank below the manway nozzle (in nonpressure tank cars), or a magnetic-ball, fixed-length (telltale) tube, or an electronic device.

**Hand Brake** — A device mounted on railcars and locomotives to provide a means for applying brakes manually without air pressure. Common types include vertical wheel, horizontal wheel, and lever type, so-named because of the configuration or orientation of their operating handles.

**Head** — one of the ellipsoidal ends of a tank car tank.

**Head Shield** — A method of providing tank head puncture-resistance by mounting a metal shield on the end of a tank car to protect against punctures from the coupler of another railcar. Head shields may be separate attachments or may be incorporated into a tank's jacket.

**Heel** — common term used for the product or residue remaining in a tank car tank after it has been unloaded.

**Insulation** — a material, typically fiberglass or foam, enclosed within a metal jacket, used to maintain or moderate the temperature of the lading during transportation. For cryogenic liquid tank cars, in addition to a vacuum and insulation system, either perlite or an alternating wrap of multiple layers of aluminum foil and paper is used. Not all tank cars are insulated. Do not confuse insulation with thermal protection.

**Internal Valve** — a type of bottom outlet valve located inside a tank car tank to prevent damage in the event of an accident.

**Jacket** — a metal covering (minimal thickness of 11 gauge) surrounding a tank car tank designed to protect and secure the insulation and/or thermal protection systems on a tank car. A jacket is not an outer tank.

**Lading** — the commodity being transported.

**Light Weight/LT WT** — empty weight or tare weight of a rail car. The light weight is stenciled in pounds and kilograms on every rail freight car and is abbreviated LT WT.

**Liquid Eduction Line** — a pipe, equipped with a valve, cap, or blind flange closure that extends to the bottom of a tank car tank for the loading and unloading of the lading.

**Load Limit/LD LMT** — the maximum weight of lading that can be loaded in a railcar. Load limit is stenciled in pounds and kilograms on every rail freight car and is abbreviated LD LMT.

**Manway** — a general term designating the circular-shaped opening located at the top of a tank car tank to allow access into the tank's interior for maintenance, inspection, and loading or unloading. Depending upon a tank car's class or product service, the manway will be closed with either a hinged and bolted manway cover (typical for nonpressure tank cars) or a semi-permanently bolted manway cover or pressure plate, typical for pressure and cryogenic liquid tank cars.

**Nitrogen Blanket/Nitrogen Pad** — nitrogen gas inserted into a tank car tank to provide an inert atmosphere for a lading that may react with air in order to protect the lading's purity or to prevent the entry of moisture.

**Nonpressure Tank Car** — a tank car with a tank test pressure of 60 or 100 psig, built to the specifications contained in Subpart D, Part 179, Title 49CFR or Chapter 3, AAR *Manual of Standards and Recommended Practices*, Section C-III, Specification M-1002. Nonpressure tank cars are also referred to as "general service" or "low-pressure" tank cars in the *2016 Emergency Response Guidebook*.

**Normalized Steel** — steel plate that has been heated and held at elevated temperatures (usually 1600 to 1700°F) followed by still-air or forced-air cooling. Normalization is a kind of heat treatment that relieves stress on steel and improves ductility and toughness.

**Nozzle** — a circular or oval-shaped attachment applied to openings in a tank for the application of a manway cover (or pressure plate), valves, pressure relief devices, and other fittings.

**Outage** — the vacant space left in a tank car tank after filling to allow for product expansion during transportation so it will not reach shell-full capacity (maximum volume of a tank). Governmental regulations prescribe minimum outages for hazardous materials/dangerous goods at specified reference temperatures. In addition to minimum outage by volume, tank cars may not be loaded by weight in excess of their gross weight on rail limit as determined by their truck capacity. Another term for outage is ullage.

**Packing** — a general term denoting the various substances and devices used to prevent leakage of fluids or gases through openings (valve body and valve stem) that cannot be closed by ordinary contact of the parts concerned.

**Packing Gland** — the portion(s) of a device used to contain packing on a valve body or other fitting to prevent leakage.

**PIH/TIH** (Poison/Toxic Inhalation Hazard) — a gas or liquid that meets the definition of a "material poisonous by inhalation" as defined in §171.8, Title 49 CFR (see TIH).

**Pressure Plate** — on a pressure tank car, the circular-shaped steel plate closing the manway nozzle to which the valves, pressure relief device(s), and other fittings are mounted. Some nonpressure tank cars may be equipped with a pressure plate assembly in lieu of a hinged and bolted manway cover.

**Pressure Relief Device (PRD)** — a fitting that opens at a predetermined setting to reduce the pressure within a tank car tank resulting from exposure to abnormal conditions. PRDs may be reclosing (spring-loaded) pressure relief valves, regulating valves, nonreclosing rupture disc devices/safety vents, or a combination device (incorporating both a rupture disc/breaking pin and a reclosing pressure relief valve).

**Pressure Relief Valve (PRV)** — a reclosing spring-loaded device, actuated by inlet static pressure, that relieves excess pressure and recloses after normal conditions are restored. "Pressure relief valve" has replaced the term "safety relief valve".

**Pressure Tank Car** — a tank car with a tank test pressure of 100 to 500 psig built to the specifications contained in Subpart C, Part 179, Title 49CFR.

**Protective Housing** — on pressure and some nonpressure tank cars, a heavy, circular steel housing that surrounds the fittings to protect them in the event of an accident and from unauthorized access. Nonpressure tank cars may be equipped with light-gauge steel protective housings (referred to as combination housings, breadboxes, or mailboxes) that provide weather and tamper protection. Do not confuse with an expansion dome as found on some (obsolete) nonpressure tank cars. The protective housings for cryogenic liquid tank cars are boxes or cabinets on the sides or end of the tank car.

**Regulating (Regulator) Valve** — a reclosing (spring-loaded) pressure relief device applied to tank cars transporting certain refrigerated liquids (e.g., carbon dioxide and argon) to maintain internal pressure below a certain point. If the pressure exceeds a specific point, the valve will open, releasing vapor, which results in auto-refrigeration, lowering the product's temperature and pressure.

**Reporting Mark and Number** — the alphabetic initial stenciled (typically 3 or 4 letters ending with an X for nonrailroad owned cars, followed by 1 to 6 numerals; e.g., BOEX 2017) on the sides and ends of every freight car to identify the railroad or private car line that owns the car. Reporting marks are assigned by the Association of American Railroads.

**Residue** — the amount of commodity remaining in a tank car after it has been unloaded to the maximum extent practicable. Also referred to as "the heel".

**Rupture Disc** — the operating part of a rupture disc device/safety vent. When used in combination with a spring-loaded reclosing pressure relief valve, the device is called a combination pressure relief device. (Replaces the term "frangible disc".

**Rupture Disc Device** — a nonreclosing pressure relief device actuated by inlet static pressure and designed to function by the bursting of a rupture disc. These devices are also referred to as "safety vents" by DOT and TC. (see Safety Vent.)

**Safety Relief Valve** — See Pressure Relief Valve. Pressure relief valve has replaced the term safety relief valve.

**Safety Systems** — thermal protection, insulation, tank head puncture-resistance, coupler vertical-restraint and systems used to protect discontinuities and service equipment; e.g., skid protection and protective housings.

**Safety Vent** — a nonreclosing pressure relief device utilizing a rupture disc. The term is synonymous with "rupture disc device" (AAR) and is a term used by DOT and TC. (See Rupture Disc Device.)

**Sample Line** — a pipe (typically 1/4 inch in diameter), equipped with a control valve that extends to near the bottom of a tank car tank for drawing a sample of the lading.

**Shell** — the cylindrical section of a tank car tank, without heads. Do not confuse with jacket. (See Tank Car and Head.)

**Service Equipment** — equipment used for filling, sampling, emptying, venting, vacuum relief, pressure relief, heating (if internal to the tank), lading temperature measurement, or measuring the amount of lading within the tank. Commonly referred to as valves and fittings.

**SETIQ** — acronym for the Mexican Emergency Transportation System for the Chemical Industry, a service of the National Association of Chemical Industries (ANIQ). Responders in the Mexican Republic can call SETIQ (24 hours) 01-800-00-214-00. In Mexico City and the metropolitan area, call 5559-1588. Elsewhere call, call +52-55-5559-1588.

**Shipping Paper (Hazardous Materials/Dangerous Goods)** — a shipping order, bill of lading, manifest, waybill, or other shipping document serving a similar purpose and containing the information required by governmental regulations.

**Skid Protection** — a device attached to the bottom of a tank car to protect the bottom outlet, washout and/or sump (referred to as bottom discontinuities) from damage in the event of a derailment.

**Specification** — the specific designation within a tank car class; e.g., DOT-111A100W2.

**STC Code or STCC** — abbreviation for Standard Transportation Commodity Code, which is a 7-digit freight description coding system used by the North American railroad industry. For hazardous materials/dangerous goods, the STCC is referred to as the Hazmat Code, and begins with 49 or 48 for hazardous wastes. The Hazmat Code may be found on shipping papers and may be used to access computer-based emergency response information.

**Stenciling** — a term used to describe all forms of lettering on cars regardless of the actual method of application. Specific information that is required to be marked on the exterior surface of a tank car.

**Stub Sill Tank Car** — a tank car design with draft sills at each end of the tank instead of a continuous center sill that utilizes the tank as part of the car structure. (Also see Center Sill.)

**Stuffing Box** — the portion of a top-operated bottom outlet valve assembly through which the valve operating rod passes to the exterior of the tank. The stuffing box contains packing that, when compressed by the packing gland nut, forms a seal around the rod to prevent leakage and keeps the rod from vibrating. The stuffing box cover, when removed and inverted, is used as a wrench to open and close the internal valve.

**Sump or Siphon Bowl** — a small depression located near the longitudinal center of a tank bottom where the liquid eduction line extends, thereby allowing the maximum amount of product to be removed from the tank.

**Surge Pressure Reduction Device** — a device designed to reduce the internal surge pressures of the pressure relief devices. These devices are primarily used on tank cars equipped with nonreclosing pressure relief devices (safety vents) and are intended to reduce pressure surges that can cause the rupture disc to fail.

**Tank Car/Tank Car Tank** — a railcar that has a tank for its body for transporting liquids, solids, and liquefied gases, consisting of a shell and heads together with connections welded directly to it. In accordance with AAR specifications, "tank" means "tank car tank". The head of a tank is one of the end closures. Tank cars may be pressure or nonpressure and are often equipped with special equipment to enhance their usefulness for handling specific commodities. For pressure class tank cars, the tank includes the manway nozzle as well. Note: Tanker or tanker car are inappropriate terms to describe a tank car.

**Tank Test Pressure** — the pressure (psig) at which a tank car tank is to be hydrostatically tested at the time of construction. Depending upon the specification, the tank test pressure varies from 20 percent to 40 percent of the minimum burst pressure. Tank test pressure is also known as service pressure.

**TC or Transport Canada** — the governmental agency that regulates the transportation of dangerous goods in Canada.

**Thermal Protection** — a material or system applied to tank car tanks to limit the transfer of heat to the tank in the event of exposure to pool or torch fires. It is intended to reduce the likelihood of tank failure under such conditions. Thermal protection is not the same as insulation, which is intended to maintain or moderate lading temperature under ambient conditions. Per 49CFR, a thermal protection system must have sufficient thermal resistance so there will be no release of any lading within a tank car, except through the pressure relief device, when subjected to:

- A pool fire for 100 minutes; and/or,
- A torch fire for 30 minutes.

**Thermometer Well** — a small diameter pipe, usually 3/4 inch, filled with an antifreeze solution or oil that extends into the tank and is closed at the top with a removable cap. The temperature of the lading transfers to the liquid in the pipe. A thermometer or probe is lowered into the pipe to obtain the lading's temperature.

**TIH/PIH** (Toxic/Poison Inhalation Hazard) — a gas or liquid that meets the definition of a "material poisonous by inhalation" as defined in §171.8, Title 49 CFR (see PIH).

**Train Consist** — for purposes here, a document (also referred to as a Train List or Wheel Report) that sequentially lists the location of each railcar in a train. A consist may also serve as the shipping paper for a railcar containing hazardous materials/dangerous goods, provided it contains all of the information required by governmental regulations.

**Truck —** the assembly of wheels, axles, roller bearings, springs, side bearings, side frames, and bolster that supports each end of a railcar and enables it to move on the rails.

**Type (Tank Car)** — for tank cars, designates the approving authority (DOT, TC, or AAR). Preferred usage is, for example, "DOT tank cars".

**Vacuum Relief Valve** — a spring-loaded valve mounted at the top of some nonpressure tank cars, designed to open and allow air into the tank if an excessive vacuum is formed that may cause the tank to collapse. A vacuum relief valve should not be depressed to determine if there is pressure in the tank. Doing so may dislodge the sealing component causing the device to leak vapor or liquid.

**Valves** — A device attached to a tank car tank designed to control the flow of lading into and out of the tank. Purposes include, but are not limited to: measure fluid pressure and temperature, sample fluids in the tank, detect or determine liquid levels, or relieve overpressures for the purposes of emergency relief or temperature control.

**Vapor Line** — a pipe equipped with a valve, cap, or blind flange closure that extends to the top of the tank through which vapor is introduced or removed during loading or unloading. On a nonpressure tank car, this device is usually called an air line and is used to introduce compressed air or vapor, or an inert gas to unload the car.

**Vapor Space** — the space in a tank above the liquid; may also be referred to as outage.

# ANNEX A: AAR, U.S. DOT, AND TRANSPORT CANADA SAFETY ENHANCEMENTS FOR NONPRESSURE TANK CARS

**Note:** The intent of this Annex is to provide a historical time line of the various rule changes regarding the transportation of ethanol and crude oil by tank car.

## AAR-INITIATED SAFETY ENHANCEMENTS FOR NONPRESSURE TANK CARS

**Top Fittings Protection for Tank Cars in Sulfuric Acid Service.**

With certain exceptions, nonpressure tank cars ordered new after June 10, 2010, are required to have top-fitted service equipment protection. Top fittings protection is typically met by the installation of a protective device or structure.

**Top Fittings Protection for Tank Cars Used to Transport Packing Group I and II Materials.**

For protection of top fittings against rollovers and accidental horizontal loads, all new nonpressure Class DOT/TC tank cars ordered after July 1, 2010, used to transport all Packing Group I and II materials, are required to have top fitting protection. Currently, there are no requirements to retrofit existing tank cars (refer to the following "DOT Regulations for Tank Cars in High-Hazard Flammable Train Service" regarding tank cars transporting Class 3 (flammable liquids).

**Tank Cars Built for the Transportation of Class 3 (Flammable Liquids).**

In September 2011, the AAR published, via Casualty Prevention Circular (CPC) 1232, new requirements in Chapter 2 of the AAR Specifications for Tank Cars for tank cars built for the transportation of Class 3 (flammable liquids) Packing Group I and II, with the proper shipping names of "Petroleum Crude Oil", "Alcohols, n.o.s.", and "Ethanol and Gasoline Mixture".

Class-111 tank cars ordered after October 1, 2011, are required to comply with the following requirements:

1) Top Fittings Protection: Must have top fittings protection per Appendix E; typically met by enclosing the fittings within a protective housing.
2) Pressure Relief Devices (PRDs): Must be equipped with reclosing pressure relief devices. Upon approval by DOT's Pipeline and Hazardous Materials Administration (PHMSA), a non-reclosing device can be used where the applicant demonstrates that a non-reclosing device is required and affords an equivalent level of safety.
3) Tank Material: Heads and shells must be constructed of normalized TC128 Grade B steel or normalized ASTM A516-70 steel. Tank heads must be normalized after forming. The AAR Executive Director of Tank Car Safety may approve non-normalization after forming if a facility has demonstrated that its equipment and controls provide an equivalent level of safety.
4) Tank Thickness:
    - Tanks constructed of normalized TC128 Grade B steel:
        - Non-jacketed tanks must be at least 1/2-inch thick; and
        - Jacketed tanks must be at least 7/16-inch thick.

- Tanks constructed of normalized ASTM A516-70 steel:
  - Non-jacketed tanks must be at least 5/8-inch thick; and
  - Jacketed tanks must be at least 1/2-inch thick.

  In all cases, the cars must be equipped with at least 1/2-inch-thick half-head shields.

- Tanks constructed of alloy (stainless) steel (DOT-111****W6 and DOT 111****W7):
  - Non-jacketed tanks must have heads and shells at least 1/2-inch thick and be equipped with 1/2-inch-thick half-head shields, and
  - Jacketed tanks must be at least 7/16-inch thick and equipped with, at a minimum, 1/2-inch- thick jacket heads.

Tank cars built to meet the above requirements are referred to as "CPC-1232 tank cars". Tank cars built prior to the CPC-1232 standards being used to transport the above commodities are commonly referred to as "legacy tank cars".

## U.S. DOT REGULATIONS FOR TANK CARS IN CLASS 3 (FLAMMABLE LIQUID) SERVICE

### Tank Cars in "High-Hazard Flammable Train Service"

On May 8, 2015, the Department of Transportation established a new tank car specification, "DOT 117A100W" to be utilized for the transportation of all Class 3 (flammable liquids) (not just Crude Oil and certain Alcohols (Ethanol), as covered by AAR's CPC-1232). The rule also published a phase-out schedule for the use of existing Class DOT-111 (a/k/a "legacy tank cars") and those CPC-1232 tank cars.

Excerpted from Title 49CFR:

**§171.8:** High-hazard flammable train (HHFT): a single train transporting:

- 20 or more loaded tank cars of Class 3 (flammable liquids) in a continuous block, or;
- 35 or more loaded tank cars of a Class 3 (flammable liquids) throughout the train consist.

High-hazard flammable unit train (HHFUT): a single train transporting 70 or more loaded tank cars containing Class 3 (flammable liquids).

**§§173.241(a), 173.242(a), and 173.243(a):** Bulk packaging requirements. DOT-111 tank cars and DOT-111 tank cars built to the AAR's CPC-1232 industry standard are no longer authorized to transport Class 3 (flammable liquids) in high-hazard flammable train service, unless retrofitted to DOT-117R retrofit standards, or meet the DOT-117P performance standards prescribed by §179.202-12.

DOT-111 tank cars and DOT-111 CPC-1232 tank cars are no longer authorized for use in high-hazard flammable train service unless retrofitted prior to the dates shown in the following table:

**DOT Phase-Out Dates for DOT-111 and DOT-111 CP-1232 Tank Cars in High-Hazard Flammable Train Service** *(May 8, 2015; superseded by FAST Act on August 15, 2016 – see page 128)*

| PACKING GROUP | DOT 111 NOT AUTHORIZED ON OR AFTER: | DOT 111 CPC-1232 NOT AUTHORIZED ON OR AFTER: |
|---|---|---|
| I | January 1, 2018 – Non-jacketed | April 1, 10/1/2022 – Non-jacketed |
| | March 1, 2018 - Jacketed | May 1, 2025 - Jacketed |
| II | May 1, 2023 – Jacketed and Non-jacketed | July 1, 2023 – Non-jacketed |
| | | May 1, 2025 - Jacketed |
| III | May 1, 2025 | May 1, 2025 |

**§179.202:** Specification requirements for DOT-117 tank car tanks:

- Plate thickness: Minimum 9/16 inch, AAR TC-128, Grade B normalized steel.

- Tank head puncture resistance: Full-height head shields at least 1/2-inch thick.
- Thermal protection system: Conforming to §179.18, and include a reclosing pressure relief device.
- Jacket: Minimum 11 gauge of A1011 steel, or equivalent. Insulation is optional.
- Bottom outlet: If equipped, the handle must be removed prior to train movement, or be designed with protection safety system(s) to prevent unintended actuation during accident scenarios.
- Top fittings protection: Top fittings protection conforming to Appendix E of the AAR Specifications for Tank Cars.
- ECP (Electronically Controlled Pneumatic) brakes: By January 1, 2021, a high-hazard flammable unit train having at least one PG I Class 3 material, and operating in excess of 30 mph, must be equipped with ECP brakes. By May 1, 2023, other high-hazard flammable unit trains operating in excess of 30 mph must be equipped with ECP brakes. Alternative brake systems may be submitted to the DOT for approval.

**Note:** The U. S. Government Accountability Office (GAO) is facilitating a study to determine the viability of ECP brakes.

**§179.202-13:** Retrofit standard requirements for DOT-117R. Existing DOT-111, including CPC-1232, tanks may be retrofitted to DOT-117 requirements provided:

- Plate thickness: The wall thickness after forming of the tank shell and heads must be, at a minimum, 7/16 inch and constructed with steel authorized by the DOT regulations at the time of construction (differs from DOT-117A specification).
- Tank head puncture resistance: Full-height head shields at least 1/2-inch thick (same as DOT-117A).
- Thermal protection system: Conforming to §179.18 and include a reclosing pressure relief device (same as DOT-117A).

- Jacket: Minimum 11 gauge of A1011 steel, or equivalent (same as DOT-117A). Insulation is optional. (same as DOT-117A).
- Bottom outlet: If equipped, the handle must be removed prior to train movement, or be designed with protection safety system(s) to prevent unintended actuation during accident scenarios (same as DOT-117A).
- Top fittings protection: Existing tank car tanks may continue to rely on the equipment installed at the time of manufacture (same as DOT-117A).
- ECP (Electronically Controlled Pneumatic) brakes: By January 1, 2021, a high-hazard flammable unit train having at least one PG I Class 3 material, and operating in excess of 30 mph, must be equipped with ECP brakes. By May 1, 2023, other high-hazard flammable unit trains operating in excess of 30 mph. must be equipped with ECP brakes. Alternative brake systems may be submitted to the DOT for approval (same as DOT-117A).

Tank car specification markings:

- DOT-117 tank cars are built to the specification "DOT-117A100W"; however, as jacketed thermal protection is required, they will be stenciled "DOT-117J100W".
- Existing Class-111 and CPC-1232 tank cars that are retrofitted will be stenciled "DOT-117R100W".
- Existing Class-111 and CPC-1232 tank cars that meet the performance standards specified in §179.202-12 will be stenciled "DOT-117P100W".

**Note:** The DOT-117A100W specification does not include a numeral following the letter "W" as prescribed for other Class DOT-111A nonpressure tank cars (i.e., "1" – "7").

**Transportation of Flammable Liquids by Rail (excerpted from "Fixing America's Surface Transportation Act")** (a/k/a "FAST Act" – October 1, 2015 – signed into law on December 4, 2015)

The "FAST Act" revised the May 8, 2015, DOT rulemaking for Tank Cars in High-Hazard Flammable Train Service to include all Class 3 (flammable liquids) materials transported by rail (not just those transported in a high-hazard flammable train (HHFT) or a high-hazard flammable unit train (HHFUT)).

**§7304:** Phase-out of all Tank Cars Used to Transport Class 3 (Flammable Liquids)

- Except as provided in subsection (b), beginning on 10/1/2015, all DOT-111 specification railroad tank cars used to transport Class 3 (flammable liquids) shall meet the DOT-117, DOT-117P, or DOT-117R specifications in Part 179 of Title 49, CFR, regardless of train composition.
- Phase-out schedule: As of 10/1/2015, certain tank cars not meeting DOT-117, DOT-117P, or DOT-117R specifications may be used regardless of train composition, until the end-dates shown in the table to the right: (Superseded by FAST Act August 15, 2016.)

**DOT Phase-Out Dates for Non-DOT-117 Tank Cars in Class 3 (Flammable Liquids) Service** *(10/1/2015)*

| COMMODITY | TANK CAR | END-DATE |
|---|---|---|
| Class 3 Unrefined Petroleum Products, including Crude Oil | Non-jacketed DOT-111 | January 1, 2018 |
| | Jacketed DOT-111 | March 1, 2018 |
| | Non-jacketed CPC-1232 | April 1, 2020 |
| | Jacketed CPC-1232 | May 1, 2025 |
| Ethanol | Non-jacketed and jacketed DOT-111 | May 1, 2023 |
| | Non-jacketed CPC-1232 | July 1, 2023 |
| | Jacketed CPC-1232 | May 1, 2025 |
| Other Class 3 (Flammable Liquids) – Packing Group I | DOT-111 and CPC-1232 | May 1, 2025 |
| Other Class 3 (Flammable Liquids) – Packing Groups II and III | DOT-111 and CPC-1232 | May 1, 2029 |

**§7305** Thermal Blankets: DOT-117 and non-jacketed tank cars modified to meet the DOT-117R specification must be equipped with an insulating thermal blanket at least 1/2 inch thick.

**§7306:** Minimum Requirements for Top Fittings Protection for DOT-117 Tank Cars:

(a) Protective Housing - Except as provided in (b) and (c), top fittings on DOT-117R tank cars shall be located inside a protective housing not less than 1/2-inch thick; and

(1) Shall be as tall as the tallest valve or fitting involved and the height of a valve or fitting within the protective housing must be kept to the minimum compatible with their operation.

(2) The protective housing or cover may not reduce the flow capacity of the pressure relief device below the minimum required.

(3) The protective housing shall provide a means of drainage with a minimum flow area equivalent to 6-inch diameter holes.

(4) When connected to the nozzle or fittings cover plate, and subject to a horizontal force applied perpendicular to, and uniformly over, the projected plane of the housing, the tensile connection strength of the housing shall be designed to be:

(A) no greater than 70% of the nozzle to tank tensile connection strength;

(B) no greater than 70% of the cover plate to nozzle connection strength; and

(C) no less than either 40% of the nozzle to tank connection strength or the shear strength of twenty 1/2-inch bolts.

(b) Pressure Relief Devices (PRD):

(1) The PRD shall be located inside the protective housing, unless space does not permit. If multiple PRDs are utilized, no more than one may be located outside of the housing.

(2) The highest point of any PRD located outside of the housing may not be more than 12 inches above the tank jacket.

(3) The highest point on the closure of any unused PRD nozzle may not be more than 6 inches above the tank jacket.

(c) Alternative Protection: As an alternative to the protective housing requirements, a tank car may be equipped with a system that prevents the release of product from any top fitting in the case of an incident where the top fitting would be sheared off.

**"Fast Act" Requirements for Flammable Liquids and Rail Tank Cars**

On August 10, 2016, the Department of Transportation issued Final Rule HM-251C to codify certain mandates and minimum requirements of the "FAST Act" into Title 49CFR. The table on the following page summarizes the DOT phase-out of non-DOT 117 tank cars in Class 3 (flammable liquids) service:

In addition, 49CFR, Part 179, Specifications for Tank Cars, was revised to include the "FAST Act" requirements applicable to DOT Specification 117A, 117P and 117R tank cars.

## DOT Phase-Out Dates for Non-DOT-117 Tank Cars in Class 3 (Flammable Liquids) *(as of 08/15/2016)*

| Material | Jacketed or Non-jacketed Tank Cars | DOT-111 not authorized on or after: | DOT-111 CPC-1232 not authorized on or after: |
|---|---|---|---|
| Unrefined petroleum products – Class 3, PG I (e.g., Crude Oil) | Non-jacketed | January 1, 2018 | April 1, 2020 |
| | Jacketed | March 1, 2018 | May 1, 2025 |
| Class 3, PG I (flammable liquid), other than unrefined petroleum products | Non-jacketed | May 1, 2025 | May 1, 2025 |
| | Jacketed | May 1, 2025 | May 1, 2025 |
| Unrefined petroleum product – Class 3, PG II or PG III (flammable liquid) | Non-jacketed | January 1, 2018 | April 1, 2020 |
| | Jacketed | March 1, 2018 | May 1, 2025 |
| Ethanol | Non-jacketed | May 1, 2023 | July 1, 2023 |
| | Jacketed | May 1, 2023 | May 1, 2025 |
| Class 3, PG II or PG III (flammable liquid) other than unrefined petroleum products or ethanol (see above) | Non-jacketed | May 1, 2029 | May 1, 2029 |
| | Jacketed | May 1, 2029 | May 1, 2029 |

## TRANSPORT CANADA REGULATIONS FOR TANK CARS

### Transport Canada Protective Direction No. 34

Issued April 23, 2014, Protective Direction (PD) No. 34 required owners to identify and report to Transport Canada each CTC (Canadian Transport Commission) 111, DOT 111 and AAR 211 stub sill tank cars with certain construction characteristics (non-normalized ASTM A515 Grade 70 steel shell material; not having exterior heater coils; and, not having bottom-shell continuous reinforcement).

Subject tank cars cannot be offered for transport or transported in Canada. In addition, these tank cars are required to be marked "Do not load with dangerous goods in Canada/Ne pas charger de merchandises dangereuses au Canada", or similar words to that effect. On May 2, 2014, AAR issued CPC-1281 requiring such marking to be placed on both sides of the tank car adjacent to the car number on a stencil or decal measuring approximately 10 1/2 by 20 1/2 inches (see sample to the lower left).

**DO NOT LOAD WITH DANGEROUS GOODS IN CANADA**

**NE PAS CHARGER DE MERCHANDISES DANGEREUSES AU CANADA**

### TC-117 Tank Cars for Flammable Liquids

On May 1, 2015, the Transportation of Dangerous Goods (TDG) Regulations were amended to incorporate a TC-117 tank car specification for the transport of flammable liquids. The TC-117 specification, including TC-117P and TC-117R, is equivalent to DOT-117, DOT-117P, and DOT-117R tank cars; however, all TC-117 tank cars are not required to be equipped with ECP (Electronically Controlled Pneumatic) brakes.

As of October 1, 2015, TC-117 tank cars are the only nonpressure tank cars permitted to be built for flammable liquid service. TC/DOT-111 tank cars manufactured before October 1, 2015, (including CPC-1232 tank cars) may be retrofitted for continued use for the transport of flammable liquids. Such tank cars will be designated as TC-117R. Per Transport Canada Protective Order 37, issued June 6, 2016, the retrofit requirements, including application of a protective housing around the service equipment mounted on the manway cover plate, are the same as the retrofit requirements for DOT-117R tank cars under the United States' "FAST Act".

Transport Canada has published a phase-out schedule for tank cars transporting flammable liquids:

### Transport Canada Protective Direction No. 38

On July 13, 2016, Protective Direction 38 was issued to accelerate the phase-out of jacketed and non-jacketed "legacy" (non-CPC-1232) DOT-111 tank cars from being used to transport Crude Oil in Canada as of November 1, 2016. Prior to PD 38, the cut-off dates for Crude Oil were May 1, 2017, for DOT-111 non-jacketed tank cars and March 1, 2018 for jacketed tank cars.

### Transport Canada Phase-Out Schedule for Tank Cars Transporting Class 3 (Flammable Liquids)

| Cut-off Date | Flammable Liquid/Packing Group | TC/DOT-111 removed from service |
|---|---|---|
| November 1, 2016 | Crude Oil, PG I, II, and III | Non-CPC-1232, non-jacketed "Legacy tank cars" |
| November 1, 2016 | Crude Oil, PG I, II, and III | Non-CPC-1232, jacketed "Legacy tank cars" |
| April 1, 2020 | Crude Oil, PG I, II, and III | CPC-1232, non-jacketed |
| May 1, 2023 | Ethanol, PG II | Non-CPC-1232, non-jacketed; non-CPC-1232, jacketed |
| July 1, 2023 | Ethanol, PG II | CPC-1232, non-jacketed |
| May 1, 2025 | Crude Oil and Ethanol, PG I, II, and III | CPC-1232, jacketed* |
| May 1, 2025 | All other flammable Liquids, PG I, II and III | Non-CPC, non-jacketed; non-CPC, jacketed; CPC-1232, non-jacketed; CPC-1232, jacketed* |

*Most jacketed CPC-1232 tank cars will meet the requirements of TC-117R, with minor changes, if any.

BACK COVER (INSIDE)


Field Guide
To Tank Cars