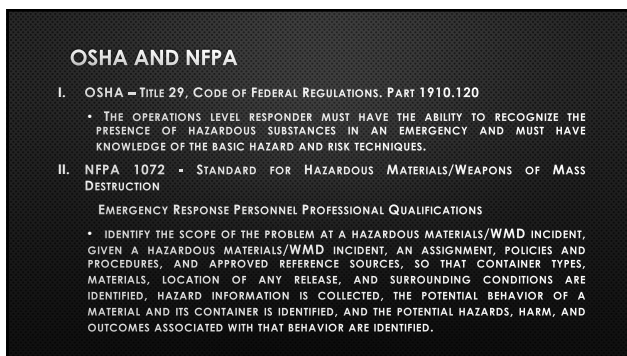
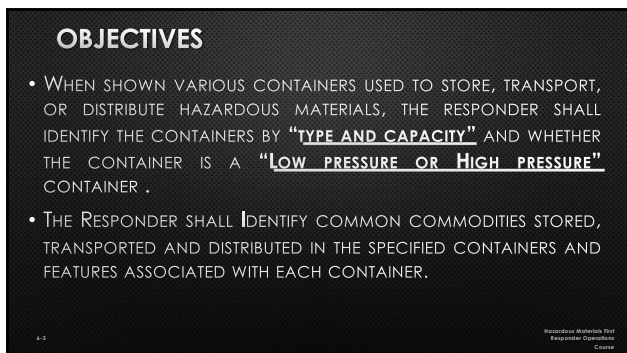


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3

INTRODUCTION

- IDENTIFYING AND UNDERSTANDING VARIOUS CONTAINERS WILL HELP THE RESPONDER TO RECOGNIZE A CONTAINER QUICKLY AND BY UNDERSTANDING ITS FEATURES PREDICT HOW THE CONTAINER MAY REACT WHEN STRESSED.



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CONTAINER OVERVIEW

- CONTAINERS CAN BE GROUPED INTO TWO MAJOR CATEGORIES:
 - NON-BULK
 - BULK



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CONTAINER OVERVIEW

- CONTAINERS CAN ALSO BE CLASSIFIED BY THE PRESSURE EXERTED ON THE CONTAINER BY ITS CONTENTS:
 - LOW-PRESSURIZED
 - HIGH-PRESSURE

4-4

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CONTAINER OVERVIEW

Capacity	Pressure
NON-BULK – A package or container which has: <ul style="list-style-type: none">• Liquid – A maximum capacity of 119 gallons (450L) or less• Solid – A maximum capacity of 882 LBS (454 kg) or less• Gas – A water capacity of 1000 (454kg) pounds or less	LOW Pressure – Containers with working pressure less than 100 psig. This includes tanks that are considered "atmospheric" pressure tanks.
BULK – A package or container which has: <ul style="list-style-type: none">• Liquid – A maximum capacity greater than 119 gallons (450L).• Solid – A maximum capacity greater than 882 pounds (454kg)• Gas – A water capacity greater than 1000 pounds (454kg)	HIGH Pressure – Containers with working pressure greater than 100 psig. These containers, often called vessels, can have pressures up to approximately 6000 psig

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NON-BULK CONTAINERS



8

NON-BULK CONTAINERS

- NON-BULK CONTAINERS HOLD RELATIVELY SMALL AMOUNTS OF MATERIAL.
- NON-BULK CONTAINER VOLUMES
 - LIQUIDS – 119 GALLONS (450 LITERS) OR LESS
 - SOLIDS – 882 POUNDS (400 KILOGRAMS) OR LESS
 - COMPRESSED GASES – 1,001 POUNDS (454 KILOGRAMS) OR LESS.

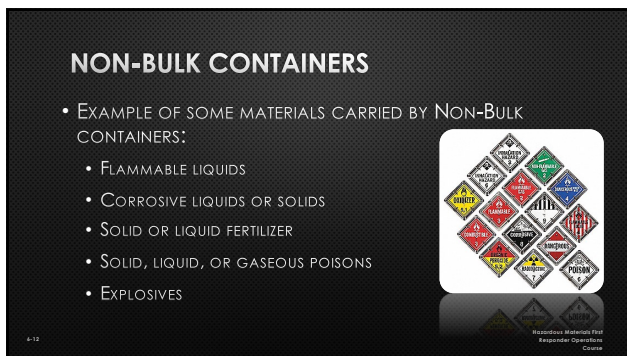
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11



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NON-BULK CONTAINER MARKINGS

- US DOT LABELS
- PRODUCT OR MANUFACTURER'S LABELS
- HMIS OR HAZCOM LABELS
- "IN-HOUSE" MARKINGS
- PESTICIDE LABELS



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BULK CONTAINERS



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BULK CONTAINERS

- BULK CONTAINERS HOLD LARGE VOLUMES OF MATERIAL.
- BULK CONTAINER VOLUMES
 - LIQUIDS – MORE THAN 119 GALLONS (450 LITERS)
 - SOLIDS – MORE THAN 882 POUNDS (400 KILOGRAMS)
 - COMPRESSED GASES – MORE THAN 1,001 POUNDS (454 KILOGRAMS)



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BULK CONTAINERS

BULK CONTAINERS COME IN MANY DIFFERENT TYPES DUE TO THE PHYSICAL AND CHEMICAL PROPERTIES OF THE MATERIALS THAT THEY MAY CARRY.



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Responsible Operations
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INTERMEDIATE BULK CONTAINERS ARE SUB CLASS OF BULK CONTAINERS



hazardousmaterials.com

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INTERMEDIATE BULK CONTAINERS

- IBCs ARE CLASSIFIED AS BULK CONTAINERS BUT DO NOT HOLD AS MUCH MATERIAL AS THE LARGER CONTAINERS WITHIN THIS GROUP.
- IBCs ARE USUALLY FOUND IN INDUSTRIAL OR COMMERCIAL APPLICATIONS THAT REQUIRE MORE MATERIAL THAN NON-BULK CONTAINERS BUT NOT AS MUCH AS CARGO TANKS.
- USUALLY PLACED ON OR IN A TRANSPORT VEHICLE.
- CAPACITIES OF THESE CONTAINERS RANGE FROM 119 TO 793 GALLONS.



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IBC EXAMPLES

- PLASTIC OR METAL TANKS (TOTES)
- WOOD OR FIBERBOARD BOXES
- CYLINDERS




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Hazardous Materials Post
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IBC MARKINGS

- DOT LABELS
- PRODUCT OR MANUFACTURER'S LABELS
- HMIS OR HAZCOM LABELS
- "IN-HOUSE" MARKINGS




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Hazardous Materials Post
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BULK CONTAINERS

1. BULK CONTAINERS CAN BE FOUND IN DIFFERENT MODES OF TRANSPORTATION:
 - HIGHWAY
 - RAIL
 - MARINE
2. BULK CONTAINERS CAN ALSO BE FOUND IN FIXED FACILITY USE.



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Hazardous Materials Post
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HIGHWAY TRANSPORT VEHICLES INCLUDE

TYPE	DISCRIPTION
MC 306/DOT 406	LOW PRESSURE FLAMMABLE LIQUID TANK TRUCK
MC 307/DOT 407	LOW PRESSURE CHEMICAL TANK TRUCK
MC 312/DOT 412	CORROSIVE LIQUID TANK TRUCK
MC-331	HIGH PRESSURE TANK TRUCK
MC-338	CRYOGENIC LIQUID TANK TRUCK
DRY BULK CARGO TRAILER	*****
HIGH PRESSURE TUBE TRAILER	*****
BOX TRAILER	*****

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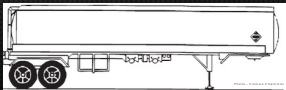
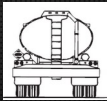
MC-306 / DOT-406 LOW PRESSURIZED
HIGHWAY CARGO TANK



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MC-306 / DOT-406 LOW PRESSURE HIGHWAY
CARGO TANK

1. DESIGNED TO WORK AT ATMOSPHERIC PRESSURES.
2. TYPICAL MAXIMUM CAPACITIES IS 9,000 GALLONS.
3. TANK DESIGN FEATURES:
 - OVAL CROSS-SECTION WITH BLUNT ENDS
 - MAY HAVE SINGLE OR MULTIPLE COMPARTMENTS
 - SINGLE-WALL STEEL OR ALUMINUM CONSTRUCTION
 - MAWP UP TO 4 PSIG



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MC-306 / DOT-406 LOW PRESSURE HIGHWAY CARGO TANK



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MC-307 / DOT-407 LOW PRESSURE HIGHWAY CARGO TANK



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MC-307 / DOT-407 LOW-PRESSURE HIGHWAY CARGO TANK

1. DESIGNED TO WORK AT ATMOSPHERIC PRESSURES.
2. CAPACITIES RANGE FROM 5000 TO 7000 GALLONS
3. TANK DESIGN FEATURES:
 - CIRCULAR CROSS-SECTION
 - TANK STIFFENING RINGS
 - 1 OR 2 COMPARTMENTS
 - CAN BE INSULATED ON NON-INSULATED
 - MADE FROM HIGH-STRENGTH STEEL OR STAINLESS STEEL.
 - MAY BE INSULATED OR NON-INSULATED
 - MAWP UP TO 40 PSIG



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MC-312 / DOT-412 CORROSIVE LIQUID HIGHWAY CARGO TANK

1. DESIGNED TO WORK AT LOW PRESSURES.
2. CAPACITIES : UP TO 7000 GALLONS.
3. TANK DESIGN FEATURES:
 - CIRCULAR CROSS-SECTION (SMALLER THAN 307)
 - UP 10 EXTERNAL STIFFENING RINGS
 - SINGLE COMPARTMENT WITH A MAWP UP TO 50 PSIG
 - SINGLE OR DOUBLE WALL STEEL OR STAINLESS STEEL CONSTRUCTION.

30

MC-312 / DOT-412 CORROSIVE LIQUID HIGHWAY CARGO TANK



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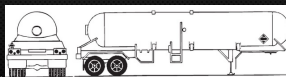
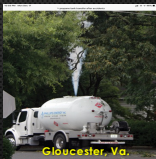
MC-331 HIGH PRESSURE HIGHWAY CARGO TANK



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MC-331 PRESSURE HIGHWAY CARGO TANK

1. DESIGNED TO WORK AT PRESSURES UP TO 500 PSI.
2. OVERALL CAPACITY 11,500 GALLONS.
3. TANK DESIGN FEATURES:
 - CIRCULAR CROSS-SECTION / ROUNDED ENDS
 - SINGLE COMPARTMENT
 - SINGLE-WALL STEEL CONSTRUCTION
 - PAINTED A REFLECTIVE COLOR
 - BOBTAILS USED FOR HOME DELIVERY (3500 GAL)



33

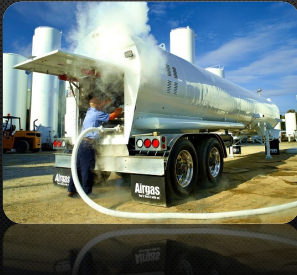
MC-331 HIGH PRESSURE HIGHWAY CARGO TANK



Photo: YOUNG BENT

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MC-338 CRYOGENIC HIGHWAY CARGO TANK



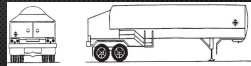
4-35

Responsible Material Test
Responder Operations
Center

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MC-338 CRYOGENIC HIGHWAY CARGO TANK

1. DESIGNED TO WORK AT PRESSURES UP TO **500 PSIG.**
2. OVERALL CAPACITY: 14,000 GALLONS
3. TANK DESIGN FEATURES:
 - INNER TANK AND OUTER SHELL
 - PRODUCT -150 PSIG OR BELOW
 - SINGLE COMPARTMENT
 - PAINTED A REFLECTIVE COLOR



4-34

Chesapeake, Va. 2017

Chesapeake MC-338 off unit
Photo: Brian Hynes

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DRY BULK CARGO TANK OR PNEUMATICALLY OFF-LOADED HOPPER TRAILER



Source: www.p-power.com

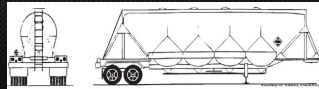
4-37

Intermediate Mechanical Plant
Responder Operations
Course

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DRY BULK CARGO TANK OR PNEUMATICALLY OFF-LOADED HOPPER TRAILER

- USES PRESSURE TO OFF-LOAD PRODUCT.
- CAPACITIES RANGE UP TO 2,800 CUBIC FEET.
- TANK DESIGN FEATURES:
 - OVAL SHAPE
 - SINGLE COMPARTMENT
 - SINGLE-WALL STEEL CONSTRUCTION
 - MULTIPLE SUMPS AND BOTTOM OPENINGS
 - CARRIES DRY BULK (SAND, NITRATES, CALCIUM CARBIDE, FLOUR, ETC....)



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Responder Operations
Course

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THIS TRUCK WAS HAULING AMMONIUM NITRATE WHEN IT CAUGHT FIRE IN ARKANSAS - THE TRUCK EXPLODED CREATING A LARGE CRATER



39

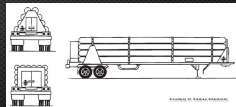
HIGH PRESSURE /COMPRESSED GAS TRAILER (TUBE TRAILER)



40

HIGH PRESSURE/COMPRESSED GAS TRAILER (TUBE TRAILER)

1. TYPICALLY CARRIES PRESSURIZED GASES (SUCH AS AIR, HELIUM, AND OXYGEN, HYDROGEN) IN PRESSURIZED TUBES.
2. PRESSURE MAY BE UP TO 5,000 PSI
3. TANK DESIGN FEATURES:
 - STEEL TANKS MOUNTED TO A TRAILER
 - CONTROL BOX IN THE REAR OF THE TRAILER
 - TANKS ARE MANIFOLDED TOGETHER



4-41

Responsible Materials First
Responsible Operations
Careers

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BOX TRAILER

1. TYPICALLY CARRIES PALLETIZED GOOD, DRUMS, IBC CONTAINERS, ROLLS OF PAPER OR STEEL...
2. MAY BE INSULATED WITH REFRIGERATION UNIT
3. LENGTHS CAN BE UP TO 53' FEET



4-42

Responsible Materials First
Responsible Operations
Careers

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BOX TRAILER



4-43, Burnsville County, Virginia
Photo: Virginia State Police

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DOT-103 / DOT-111 LOW PRESSURIZED CARGO TANK RAILCAR



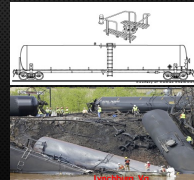
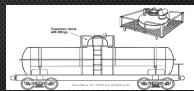
4-44

Responsible Materials Unit
Responder Operations
Center

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DOT-103 / DOT-111 LOW PRESSURIZED CARGO TANK RAILCAR

1. DESIGNED TO WORK AT ATMOSPHERIC PRESSURES BELOW 100 PSI.
2. CAPACITIES UP TO 30,000 GALLONS
3. TANK DESIGN FEATURES:
 - EXAMPLES DOT-111, DOT 103 (WITH EXPANSION DOME)
 - CIRCULAR CROSS-SECTION / FLAT ENDS
 - COMMONLY SINGLE COMPARTMENT
 - VALVES AND FITTING ARE LOCATED ON TOP OF THE CAR.
 - AN EXPANSION DOME MAY BE PRESENT.
 - TYPICALLY CARRIES CHEMICALS SUCH AS COMBUSTIBLE, FLAMMABLE LIQUIDS (E.G., GASOLINE OR FUEL OIL), CORROSIVES, OXIDIZERS, ORGANIC PEROXIDES, SLURRIES, POISONS, OR FOOD LIQUIDS



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LYNCHBURG VIRGINIA DERAILMENT



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DOT-105 / DOT-112 PRESSURIZED CARGO TANK RAILCAR



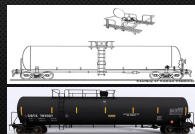
L-47

 Hazardous Materials First
 Responders Operations
 Course

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DOT-105 / DOT-112 HIGH PRESSURE CARGO TANK RAILCAR

1. DESIGNED TO WORK AT PRESSURES OF UP TO 600 PSI.
2. CAPACITIES CAN BE UP TO 45,000 GALLONS
3. TANK DESIGN FEATURES:
 - CIRCULAR CROSS-SECTION / ROUNDED ENDS
 - SINGLE COMPARTMENT
 - VALVES AND FITTINGS ARE LOCATED IN A PROTECTIVE HOUSING ON TOP OF THE TANK.
 - INCLUDES CAR CLASSES, DOT109,, DOT114, AND DOT120



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KINGMAN ARIZONA BLEVE 1973

On July 5, 1973 a propane tank caught fire in Kingman, AZ. A railroad worker and 11 FF's were killed after a leak caught fire and the tank subsequently exploded. It created a fireball 1,000' high and a shockwave felt 5 miles away. The train car landed 1/4 mile away.



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DOT-113 CRYOGENIC LIQUID TANK RAILCAR



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DOT-113 CRYOGENIC CARGO TANK RAILCAR

1. TANK IS GENERALLY DOUBLE WALLED AND INSULATED. TEST PRESSURES FROM **60-175 PSI**.
2. CAPACITIES UP TO 20,000 GALLONS.
3. TANK DESIGN FEATURES:
 - CIRCULAR CROSS-SECTION / ROUNDED ENDS
 - SINGLE COMPARTMENT
 - TEMPERATURE AT -130°F OR LESS.
 - COMMODITIES: NITROGEN, ARGON, CO2 ...
 - INCLUDES CLASSES AAR204W, AND AAR204XT



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INTERMODAL CARGO TANKS

- CAN BE PRESSURIZED OR NON-PRESSURIZED.
- CAPACITIES RANGE UP TO 6,300 GALLONS.
- TANK DESIGN FEATURES:
 - TANK MOUNTED INSIDE A METAL SUPPORT STRUCTURE.
 - TANKS CAN BE OVAL, RECTANGULAR, OR CIRCULAR IN CROSS-SECTION

Intermediate Bulk Container
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INTERMODAL CARGO TANKS

1. CAN BE TRANSPORTED IN ALL MODES OF TRANSPORTATION:

- RAILROAD
- HIGHWAY
- MARINE
- AIR

Intermediate Bulk Container
Responsible Operations
Course

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INTERMODAL CARGO TANKS CONSIDERATIONS

- **IMO-TYPE 1 / IMO TYPE 2** NON-PRESSURIZED CARGO TANKS HAVE A WORKING PRESSURE OF UP TO 100 PSIG AND CARRY VARIOUS LIQUIDS
- **IMO TYPE 5** PRESSURIZED CARGO TANKS HAVE WORKING PRESSURES FROM 100 TO 500 PSIG AND CARRY LPG, AMMONIA, ETC....
- **IMO TYPE 7** CRYOGENIC CARGO TANKS HAVE THE "TANK-WITHIN-A-TANK" DESIGN FOR VERY COLD MATERIALS SUCH AS NITROGEN, HELIUM, CO₂, O₂, ETC...



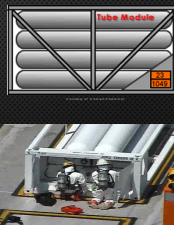
4-55

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INTERMODAL CARGO TANKS CONSIDERATIONS

- **HIGH PRESSURE TUBE MODULE** TRANSPORTS GASES IN HIGH-PRESSURE CYLINDERS TESTED TO 6000 PSIG
- COMMODITIES CARRIED OXYGEN, NITROGEN, HELIUM, HYDROGEN, AND RADIOLOGICAL
- CAPACITY IS UP TO 80,000 CUBIC FEET



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NON/LOW PRESSURE FIXED FACILITY BULK STORAGE TANKS

- COME IN A VARIETY OF DESIGNS & SIZES.
- GENERALLY CONSTRUCTED FROM STEEL.
- TANKS ARE OFTEN LOADED AND UNLOADED FROM BOTTOM OF TANK.
- THESE TANKS CAN STORE MANY DIFFERENT TYPES OF LIQUIDS.



Plains America-Yorktown, Va

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NON/LOW PRESSURE FIXED FACILITY BULK STORAGE TANKS


CONE ROOF TANK

- TANK WITH VERTICAL CYLINDRICAL WALLS SUPPORTING A FIXED INVERTED CONE ROOF.
- OPERATES AT ATMOSPHERIC PRESSURE. MAY HAVE INSULATION, PARTICULARLY FOR HEAVY FUEL OIL AND ASPHALT SERVICE



COVERED TOP FLOATING ROOF TANK

- ALSO REFERRED TO AS AN INTERNAL FLOATING ROOF.
- CONE ROOF TANK WITH AN INTERNAL FLOATING ROOF. LARGE VENTS FOUND AT THE TOP OF THE TANK SHELL.
- TANK STORES FLAMMABLE AND COMBUSTIBLE



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NON/LOW PRESSURE FIXED FACILITY BULK STORAGE TANKS

COVERED FLOATING ROOF TANK (GEODESIC DOME)




- OPEN FLOATING ROOF WITH LIGHTWEIGHT ALUMINUM GEODESIC DOME. TANK STORES FLAMMABLE LIQUIDS

OPEN TOP FLOATING ROOF TANK

- WIND GIRDER AROUND TOP OF TANK SHELL, LADDER ON ROOF, AND ROOF ACTUALLY FLOATS ON LIQUID SURFACE.
- TANK STORES FLAMMABLE AND COMBUSTIBLE LIQUIDS.

HORIZONTAL CYLINDRICAL TANK

- HORIZONTAL CYLINDRICAL TANK SITTING ON LEGS, BLOCKS, ETC...
- STRUCTURAL INTEGRITY OF THE SUPPORTS IS CRITICAL. OLDER TANKS HAVE BOLTED CONSTRUCTION, TANKS SINCE 1950 ARE GENERALLY WELDED. TANK
- TANKS CAN STORES FLAMMABLE AND COMBUSTIBLE LIQUIDS, CORROSIVES, POISONS, ETC...

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NON/LOW PRESSURE FIXED FACILITY BULK STORAGE TANKS

HEMISPHERICAL TANK

- TYPICALLY STORE VOLATILE LIQUIDS SUCH AS GASOLINE.
- CONTENTS STORED AT LOW PRESSURE (0.5 – 15 PSIG)

DOME ROOF TANK

- TYPICALLY STORES FLAMMABLE OR COMBUSTIBLE, VOLATILE LIQUIDS (SUCH AS GASOLINE, LIQUID FERTILIZERS, AND SOLVENTS).
- CONTENTS STORED AT LOW PRESSURE (0.5–15 PSIG)

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PRESSURE FIXED FACILITY BULK STORAGE TANKS

- SINGLE SHELL, NON-INSULATED TANK, ROUNDED ENDS INDICATE HIGH PRESSURE. PAINTED WHITE OR HIGHLY REFLECTIVE COLOR.
- SIZE VARIES WITH OCCUPANCY - 1,000 TO 3,000+ GALLONS.
- TANK CONTAINS LP GASES, ANHYDROUS AMMONIA, HIGH VAPOR PRESSURE FLAMMABLE LIQUIDS.



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PRESSURE FIXED FACILITY BULK STORAGE TANKS



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FIXED FACILITY BULK STORAGE TANKS

THESE BULK STORAGE TANKS OFTEN HAVE "IN-HOUSE" MARKINGS USED FOR PRODUCT IDENTIFICATION.



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PIPELINES

- THESE SUPPLY LINES ARE OFTEN FOUND UNDERGROUND.
- MARKING FOR PIPELINES MAY BE FOUND ON POSTS THAT ARE LOCATED ABOVE THE PIPELINE.
- "IN-HOUSE" MARKINGS ARE SOMETIMES FOUND ON ABOVEGROUND OR OVERHEAD TRANSFER PIPING.

Diagram illustrating Pipeline Markers, Aerial Markers, and Casing Head Markers. Below the diagram is a photo of a hazardous materials site with yellow and black markings on overhead transfer piping, including the text 'HAZARDOUS MATERIALS' and 'NITRIC ACID'.

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CONCLUSION

- PACKAGES AND CONTAINERS ARE USED TO STORE AND TRANSPORT HAZARDOUS MATERIALS.
- THE TYPE OF PACKAGING USED CAN GIVE THE EMERGENCY RESPONDER CRITICAL INFORMATION AS TO THE PACKAGE'S CONTENTS.

Photo of three large, cylindrical, blue hazardous materials containers (drums) stacked on a concrete surface.

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CONCLUSION

THE EMERGENCY RESPONDER, DURING THEIR SIZE-UP OF THE INCIDENT, SHOULD BE ABLE TO ANSWER THE FOLLOWING QUESTIONS:

1. WHAT PHYSICAL STATE OF PRODUCT IS TYPICALLY CARRIED IN THE INVOLVED CONTAINER?
2. WHAT IS THE RELATIVE CAPACITY OF THE CONTAINER?
3. IS THE CONTAINER A LOW-PRESSURE CONTAINER OR IS IT HIGH-PRESSURE?
4. IS THE PACKAGE A SINGLE CONTAINER OR ARE MULTIPLE CONTAINERS INVOLVED?
5. ARE THERE MARKINGS ON THE CONTAINER? IF SO, WHAT ARE THEY?

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