ALASKA ENERGY AUTHORITY

Rural Bulk Fuel Facilities

Operator Handbook

FIRST EDITION

March 2018

Introduction

This information included in this handbook expands on, and includes material directly from the Aboveground Storage Tank Operator Handbook, Third Edition prepared by the Alaska Department of Environmental Conservation.

The purpose of this handbook is to provide operators of Aboveground Storage Tanks (AST) bulk fuel facilities a guidebook and reference manual that describes basic operation procedures for a typical rural community bulk fuel facility. Throughout the handbook are photographs, easy-to-follow diagrams and definitions for major pieces of equipment found in bulk fuel facilities throughout Alaska. The basic operation of the major equipment is described along with the required routine checks and maintenance for the equipment. Links to online resources in the text can be accessed when viewing this manual electronically. To view links, simply click on the link and you will be directed to the corresponding resources.

This manual is divided into eight sections that provide quick access to information on the following topics:

- Section 1-Basic Overview of Major Components and Equipment
- Section 2-Recommended Operating Procedures
- Section 3-Recommended Periodic Maintenance Procedures
- Section 4-Common Types of Failures and How to Prevent Them
- Section 5-Safety
- Section 6-Spill Response Equipment and Procedures
- Section 7-Spill Response and Reporting Procedures
- Section 8- Summary of Regulatory Requirements and Compliance

Construction of new facilities can cost millions of dollars and available funding for new facilities is limited. Because of this, it is in the best interest of the facility owner and operator to maximize the lifespan of their facility. Proper operation and maintenance of your facility will ensure long life, reliable performance and protect against oil spills.

In addition to following the guidance presented in this manual, operators should receive regular training to develop the skills required to properly operate and maintain their community's bulk fuel facility. Available training resources include:

- AEA Bulk Fuel Operator Training through Alaska Vocational Technical Center (AVTEC):
  This two-week course is offered three times a year and provides students the knowledge and skills necessary to safely operate and maintain a bulk fuel storage facility while complying with state and federal laws.

- AEA Bulk Fuel Facility Itinerant Training :
  Instructors travel to individual communities to ensure bulk fuel operators are adequately operating and maintaining their specific facility. Training activities include initial physical inspections, identification of operation and maintenance needs, hands-on repairs and

replacement of minor maintenance needs and additional on-site training of specific facility concerns and considerations.

For more information regarding these programs visit:

http://www.akenergyauthority.org/Programs/Training

Or contact:

Karin St. Clair, Project Control Specialist with AEA
Email. kstclair@aidea.org
Tel. (907)-771-3081
Fax. (907) 771-3044

TABLE OF CONTENTS

1 Aboveground Storage Tank Farm Facilities Components and Equipment

This section includes picture examples and brief explanations for main components and equipment that can be found at a typical aboveground storage tank farm (AST) facility. In general, an AST facility will include:

A. Aboveground storage tanks with proper appurtenances

B. Secondary containment to capture fuel spills in the event of a facility failure

C. Control panel to operate pumps, valves, and alarm systems within the facility

D. Fuel transfer/dispensing equipment including all pumps and pipes used to move fuel into, within, and out of the facility

E. Security and safety equipment to protect fuel products, personnel, and the general public

F. Cathodic protection systems to help prevent corrosion to ASTs and piping within the facility

A brief video showing an overview of a typical AST facility can be viewed by clicking HERE

Figure 1 illustrates a generic AST facility and labels major components described throughout this section.

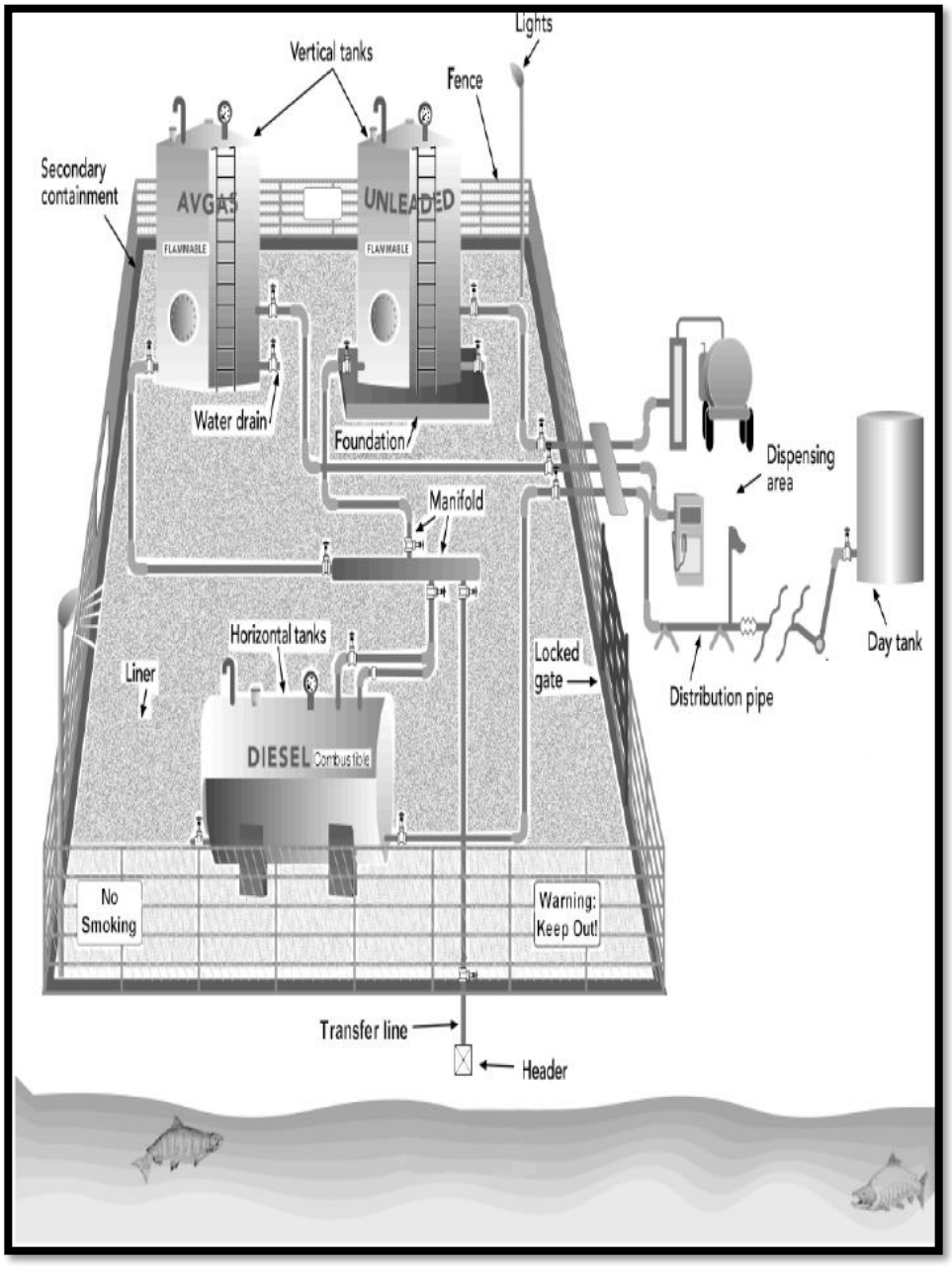


Figure 1: Conceptual AST Facility

A. Aboveground Storage Tanks

Aboveground storage tanks (ASTs) found in typical rural communities can be constructed in different sizes and shapes. The majority of ASTs are steel walled tanks. Steel tanks should be constructed to meet ANSI/UL 142, ANSI/UL 2085, or API 650 standards. Some tank farms include non-standard tanks that have been re-purposed for fuel storage and older tanks that do not meet current standards.

Many facilities will include larger ASTs to store fuel, and smaller ASTs to dispense fuel for retail sales and other transfers out of the facility. If a tank's capacity is greater than 12,000 gallons, it should only be used

as a **storage tank**. If a tank's capacity is less than 12,000 gallons, it can be used as a storage tank and/or a **dispensing tank** for retail sales.

TANK SHAPES

There are three main tank shapes: (1) Horizontal cylindrical, (2) Vertical cylindrical, and (3) Rectangular.

(1) Horizontal Cylindrical

(2) Vertical Cylindrical

(3) Rectangular

TYPES OF TANKS

There are three main types of ASTs: (1) Tanks with built-in secondary containment, (2) Protected tanks, and (3) Single-wall tanks. These tanks can be manufactured using any one of the three tank shapes previously discussed.

(1) Tanks with Secondary Containment

Tanks with built-in secondary containment are capable of containing fuel in the event of an interior tank failure, and do not need to be placed within a constructed secondary containment area. The most common types of tanks manufactured to include secondary containment are double-wall tanks or diked tanks.

Double-wall Tank

Self-diked Tank

- *Double-wall Tanks*

  Double-wall tanks include a primary tank enclosed in a secondary tank. If the primary tank leaks or ruptures, the secondary tank captures and contains all the lost fuel. Most double-wall tanks should have a label showing the tank was manufactured to the requirements of ANSI/UL 142.

- *Self-diked Tanks*

  Diked tanks include a primary tank that is partially enclosed in an exterior shell. If the primary tank leaks or ruptures, the dike captures and contains all the lost fuel. As with double-wall tanks, diked tanks must be constructed to the requirements of UL 142. The dike can be open top or closed top. Open top dikes do not have covers and will collect water that must be removed. The most common diked tank design is a horizontal cylindrical tank placed within a rectangular dike.

(2) Protected Tanks

Depending on the location of the facility in relation to other structures, regulations may require a tank to be "protected". Protected tanks must be constructed following ANSI/UL 2085 standards. These tanks are fabricated with an interior and exterior steel similar to ANSI/UL 142 double-wall tanks but also include a layer of lightweight concrete between the inner and outer tank walls. Protected tanks are able to resist impact and heat far better than standard tanks. Fireguard® tanks are the most common types of tanks installed when regulations require a protected tank.

Fireguard Tank

(3) Single-wall Tanks

Single-wall tanks, as the name implies, are constructed with only a single layer of steel. Single-wall tanks must still be manufactured to the requirements of UL 142. Regulations require that all single-wall tanks, regardless of size, must be placed inside of a secondary containment structure. See Subsection B for secondary containment area discussions.

Single-wall Tank

(4) Compartment Tanks

All tanks previously described can also be manufactured to have multiple compartments to allow for different types of product to be stored in the same tank.

(5) Day Tanks

Day tanks are smaller capacity tanks used for home heating applications or to supply fuel for generators, boilers, and other engine driven or oil fired equipment.

Day Tank

TANK FOUNDATIONS/SUPPORTS/TIE-DOWNS

Fuel tank foundations in rural communities vary based on the age of the tank farm facility and the size and shape of the fuel tanks. Older horizontal fuel tanks may have been placed directly on the ground with wood blocks placed on the side of the tanks to keep the tank from rolling. Some older horizontal and vertical fuel tanks may have been placed on wood cribbing to support the tanks and to keep the tanks from contacting the ground surface.

Newer UL labeled horizontal fuel tanks include steel tank saddle supports and steel skids welded to the bottom of the tanks. The tanks are also supported on a wood timber or concrete foundation. Some newer tank farm facilities include horizontal and vertical fuel tanks supported on steel piling.

To extend the useful life of the fuel tanks and reduce the risks for a fuel spill, fuel tanks should be supported on a stable foundation, the tank should not be in contact with the ground, and the tanks should be tied down to keep the tanks from moving if the area experiences flooding or seismic activity.

Wood Cribbing

Skid Mounted Tank on a Concrete Foundation

Steel Piling

TANK APPURTENANCES

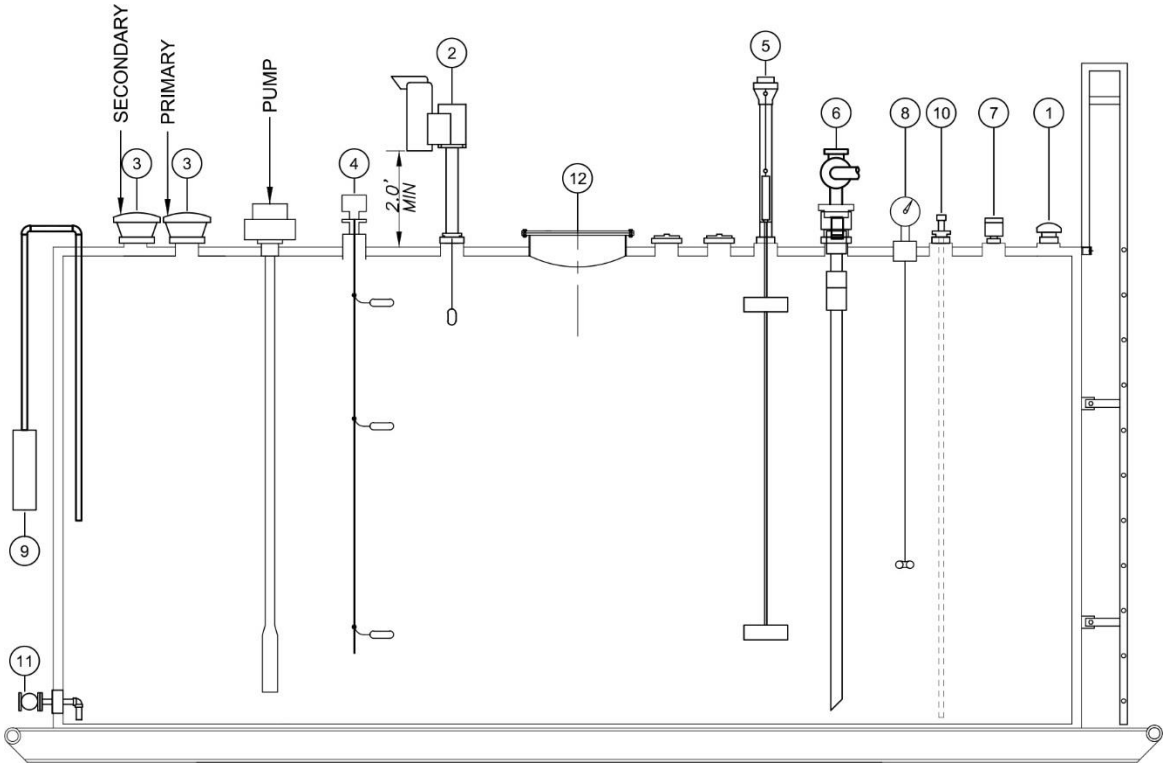


Figure 2: AST Tank Appurtenances

Aboveground storage tanks must have vent openings, fittings to accommodate filling, inventory control, and product withdrawal. The figure above labels different appurtenances that can be installed on an AST.

(1) Normal Vents

As fuel sits in a tank, it will release gas vapors. As fuel levels and temperatures change, vapors within the tank will grow in volume (expand) or shrink in volume (contract) to fill the empty space in the tank. If the tank is sealed the expansion of vapors within a tank can create enough pressure to split open the tank walls. If the tank is sealed the contraction of vapors within a tank can create enough pressure to suck the tank walls in and cause the tank to collapse in on itself.

Normal vents or "breather vents" are required to maintain steady pressures inside the tank. Normal vents bring outside air into the tanks to prevent tanks from collapsing and let built-up vapors out of the tank to prevent tanks from splitting. Vents are required to maintain tanks at atmospheric pressure. Tank vents should be located at least 12 feet above the ground to let the released vapors mix with the surrounding air and reduce the flammable limit of the air around the tank.

(2) Pressure-Vacuum Vents

Pressure-vacuum vents are often installed on tanks in place of the normally open vent. Pressure-vacuum vents are normally closed and open when the pressure inside of the tank increases or decreases beyond a set point. Pressure-vacuum vents reduce the amount of fuel vapors that escape the fuel tank during normal operation. These vents are typically equipped with an alarm whistle feature that changes tone as fuel is added to the tank, and will whistle when fuel reaches a set level within the tank.

Pressure-Vacuum/Whistle Vent

Double-wall tanks are typically configured with a pressure-vacuum vent for the inner tank, and a normal vent for the outer tank. Tanks with multiple compartments are required to have vents for each compartment.

(3) Emergency Vents

Emergency vents are pressure relief devices designed to help prevent tanks from rupturing under extreme pressure build-ups. Emergency vents are typically designed as a weighted lid that will only open when vapors expand rapidly to create extreme tank pressures.

Double-wall tanks are required to have two emergency vents, one for the inner tank and one for the outer tank. Tanks with multiple compartments are required to have emergency vents for each compartment.

(4) Float Switch

Float switches are used to detect and tell the control system when fuels reach certain levels within the tank. Float switches are installed in a hanging position at a fixed level within the tank. Float switches are typically installed to alert the control system when fuel reaches low, high, and critical levels. The switch activates when fuel levels move the float from a hanging to a floating position. Once the float switch is activated, depending on your facility, the control system can turn pumps on and off, or trigger level alarms.

(5) Liquid Level Sensors

Liquid level sensors use hydrostatic pressure transmitters, magnetic sensors, float cables or other devices used to monitor a broad range of liquid levels in the tank. Readings from the liquid level sensor can be displayed at the control panel or on the sensor's console. Liquid level sensors can also be programmed to alert the control system when fuels reach certain levels within a tank.

(6) Fill Limiter Valve

Fill limiter valves are used when tanks are filled from the top and are installed at the fill connection. The fill limiter valve includes a float that rises with the liquid levels in the tank and once the float reaches a preset level, it will stop the fuel flow into the tank.

(7) Gauge Hatch

A gauge hatch is installed at the top of the fuel tank and provides access for gauging or collecting product samples. The gauge hatch typically includes a locking lid for tank security.

(8) Clock Gauge

A clock gauge is installed at the top of the tank and displays fuel levels in the tank. Like a clock, the gauge has a small hand and a large hand. You read the gauge like a clock where the hour hand (small hand) shows feet and the minute hand (large hand) shows inches.

Clock Gauge

(9) Site Gauge

Site gauges display the level of product in the tank. A site gauge assembly includes a float that moves with the fuel levels within the tank. The float is connected to a measuring tape through a pulley system. As the float moves up and down with fuel levels, the measuring tape moves up and down through a gauge reading site mounted at eye level on the outside of the tank. The value on the tape at the gauge reading indicates the location of the float and the fuel level inside the tank.

(10) Water Draw Connections

Water draw connections are used to remove water from the interior of a tank. Since water is heavier than diesel/gasoline, any water in the tank will be at the bottom.

Water draw connections are located at the top of the tank and typically include a drop pipe that extends to a few inches from the tank bottom. A hand pump can be mounted to the water draw connection for water removal. If a drop pipe is not installed as part of the water draw connection, the pump must have a drop tube that is long enough to reach the bottom of the tank.

(11) Water Drain

Water drains are used to remove water from inside a tank. A water drain is located a few inches from the bottom of the tank and includes an interior pipe leading to an exterior valve. When the valve is opened, water at the bottom of the tank will flow out. Since water is heavier than diesel/gasoline, fuel will sit on top of the water and will only drain out of the tank after the water is removed. Water drain valves should normally be locked in the closed position when not in use.

(12) Tank Manhole

Manholes are used to access the inside of a tank for cleaning and inspection. Since a tank is considered a confined space, only certified personnel with the proper safety equipment should access the manhole.

B. Secondary Containment

The purpose of secondary containment is to prevent petroleum products from flowing onto the lands or into waters in the event of a spill. Secondary containment is required for all tanks and areas of fuel transfers including truck fill stations and header connections.

Secondary containment areas must be sized to capture the entire contents of the largest tank within the area. If the secondary containment is open to rainfall or snowfall, it must be designed to also hold volumes from a 25-year, 24-hour storm event. (IFC 2015, 5004.2.2.4). The containment area must also include a way to drain snowmelt and rain water out of the containment area.

Secondary containment can be provided within the tank itself (double-wall tanks and self-diked tanks) or tanks can be placed inside a constructed secondary containment area. The entire constructed secondary containment area is lined with a material that will not allow petroleum products to seep into the ground. The liner is typically covered with a layer of sand and gravel and the area is contained with vertical or sloped walls. Depending on space availability, walls can be constructed vertically using concrete or wood, or sloped earthen berms.

Single-wall tanks must be placed within a secondary containment berm. Some facilities also place double-wall or diked tanks within a secondary containment berm for extra protection.

Earth Sloped Dike

Vertical Wall Dike

Portable Spill Containment Liner

Tank Farm Liner Installation

C. Control Panel

The control panel is the electrical control system that governs the operation of the equipment within the facility. Tank farm control panels typically include some type of pump operation, fuel level monitoring, alarm functions, and emergency shut-off functions.

The control panel is programmed based on a specific equipment and set points and will be unique to every facility. The tank farm operator should refer to their facility **Operation Manual** for the proper operation of their tank farm control panel.

Control Panel

Emergency Shut-off Switch

D. Fuel Transfer/Dispensing Equipment

Fuel transfer and dispensing equipment allows the operator to accept fuel deliveries, fill bulk storage tanks, transfer from bulk storage tanks to dispensing tanks, and dispense fuel out of the facility.

FUEL HEADER

The fuel header is the connection used by the barge, truck, or air tanker for fuel deliveries to the tank farm. Delivery vessels typically attach flexible fuel rated rubber hosing to the header using cam-lock fitting connections. The header should have labels and/or be color coded to identify fuel types. There should also be a drip pan or spill box at the header connection to collect any fuel spills.

Fuel Header

MANIFOLD

Manifold piping includes all piping and valves used to connect tanks to other tanks and pumps and allows for control of where/how fuel is moved through the facility. The operator must understand the functions of all the valves and pipes within the manifold piping and know which valves are normally left open and closed. Pipes and valves can be color-coded and have labels to indicate types of fuel and normal valve positions. The pipe is typically installed above ground on evenly spaced pipe supports to keep the pipe from moving and sagging.

JOINT CONNECTIONS

Pipes and fittings can be joined together in a variety of ways. The most common methods of creating pipe joints are as follows:

(1) Welded

Skill is required to join welded steel pipe. Specially licensed workers, whose skills are re-tested periodically, are required to properly join welded steel pipe. Properly welded joints are considered reliable and durable. For critical fuel tank farm applications, every joint is tested with nondestructive methods. Only welded pipe connections or welded/flanged connections are recommended for tank farm pipe connections.

(2) Threaded

Threaded joints include an end with threads that screw into an end with grooves. When ends are screwed together there are small gaps between the threads and grooves. To make joints leak free, the threaded end should be wrapped in a pipe seal tape, or a sealant compound should be applied.

Threaded joints and fittings are mainly used with smaller pipes with diameters 2-inches or less. Many older tank farm facilities were constructed with threaded pipe connections. Threaded pipe connections typically are not as strong or as reliable as welded pipe joints. Over time, threaded pipe joints may develop leaks and require maintenance.

(3) Flanged

A flanged connection is a method of connecting pipes, valves, pumps and other equipment within the piping system. Flanged connections provide easy access for cleaning, inspection or modification, and part replacements. Flanges are plates with bolt holes that are welded to pipe ends. Flanged joints are made by bolting together two flanges with a gasket between them to provide a seal.

(4) Flexible Connectors

Flexible connectors are installed in the pipe manifold system to allow for small pipe movements caused by thermal expansion, pump vibration, and uneven pipes.

(5) Flange Gaskets

Flange gaskets create a seal between the faces of the mated flanges of the flange connection. Gaskets are manufactured in many materials. Gaskets installed in the fuel pipe system must be rated for the type of fuel products in the pipe system. Typically, spiral wound metallic gaskets are used in rural tank farm facility piping systems, but there are some flange connections that may require fuel rated non-metallic gaskets. When replacing flange gaskets, refer to the facility **Operation Manual** for the proper type of gaskets to use.

(1) (3) Welded and Flanged Joint Connections

(2) Threaded Joint Connections

(4) Flexible Connectors

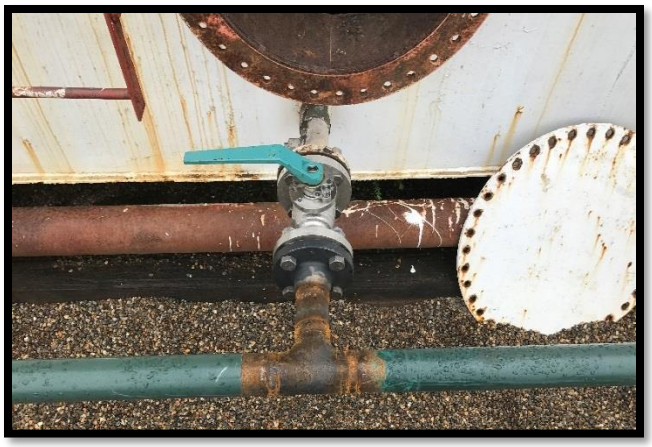
VALVES

Valves allow the operator to control flows during fuel deliveries, during fuel transfers between tanks, and during dispensing operations. There are multiple types of valves that can be used to control fuel flows. The most common types of valves found at a bulk fuel storage facility are further described below.

(1) Automated Valve

(2) Check Valve

(3) Gate Valve



(4) Ball Valve

(5) Anti-Siphon Valve

(6) Pressure Relief Valve

(1) Automated Ball Valves

Automated valves in fuel tank farms typically include a quarter-turn ball valve and a motorized valve actuator. Automated valves allow certain sections of the fuel piping system to be opened or closed remotely by the tank farm's control panel. They are often installed with pumps to isolate the fuel piping systems before or after the pump when the pump is not in operation.

(2) Check Valves

Check valves have a one-way flapper that only allows flow in one direction. They are often installed at the fuel header connection, at inlet connections for the top of fuel tanks, and in sections of the piping system where flow is only allowed in one direction.

(3) Gate Valves

Gate valves have a disk that when fully drawn up allows flow, and when fully closed stops flow. Gate valves are used to start or stop flow and are generally either fully open or fully closed. Threaded gate valves were often installed in older tank farm facilities as shutoff valves to the tank bottom connections and as isolation valves in the pipe manifold system.

(4) Ball Valves

Ball valves have a hollow ball in the center of the valve. The valve is open when the ball's hole is in line with the flow and closed when it is turned 90-degrees (one-quarter turn) by the valve handle. When the handle is perpendicular to the pipe it is closed and when it is parallel to the pipe it is open. Some ball valves can be manually locked in the open or closed position. They are

often installed as shutoff valves to the tank bottom connections and as isolation valves in the pipe manifold system.

(5) Anti-Siphon Valves

Anti-siphon valves are installed at the connections on the top of fuel tanks and are used to prevent accidental siphoning of fuel tanks should a leak or break occur in the fuel supply line. Anti-siphon valves are normally closed and will only open if fuel is being pumped out of the tank and if the suction side of the pump overcomes the anti-siphon valve spring.

(6) Pressure Relief Valves

Pressure relief valves are a type of safety valve used to limit the pressure within the fuel piping system when fuels expand due to temperature changes. They are typically installed at each isolation valve in the fuel piping system. If an isolation valve closes part of the fuel piping system, a pressure relief valve connected to the closed pipe section will allow excess pressure in the closed pipe to bypass the isolation valve.

PUMPS

Pumps are used to raise and move fuel through and out of the facility. The most common types of pumps found at a bulk fuel storage facility are further described below:

(1) Transfer Pump

(2) Submersible Pump

(3) Fuel Transfer Pump with Meter

(4) Hand Pump

(5) Sump Pump

(1) Transfer Pumps

Transfer pumps create pressure to transfer product from bulk storage tanks to smaller dispensing tanks within in the tank farm.

(2) Submersible Pumps

Submersible pumps are installed inside of the tank farm dispensing tanks and are used to transfer fuel to dispensers outside the secondary containment area. A submersible pump assembly includes a long cylindrical pump and motor that is completely submerged in the fuel inside the tank. When the pump is turned on, it pumps fuel up through one of the connections at the top of the tank.

(3) Fuel Transfer Pumps with Meters

Smaller facilities may use a fuel transfer pump that is manufactured with a meter to quantify how much fuel is dispensed per use.

(4) Hand Pumps

Hand pumps are typically used to remove water from the bottoms of tanks. They are manually operated by lifting up and pushing down a lever to create suction.

(5) Sump Pump

Sump pumps are used to remove storm water from secondary containment dikes.

FUEL FILTERS AND STRAINERS

Fuel filters and strainers help preserve fuel quality by preventing water and/or sediment from entering transfer lines, pumps and valves. Filters and strainers should be maintained and replaced regularly.

Fuel Filters

Y Strainer and Ball Valve

(1) Fuel Filters

Fuel filters prevent water and/or sediment from entering transfer pipelines. They can be installed single or in series. They are typically installed in the piping system after the submersible pump from the dispensing tank and before the dispensing station.

(2) Fuel Strainers

Fuel strainers remove particles and debris from fuel as it flows through pipes. Strainers are placed before pumps. The most common type of strainer is a Y strainer.

FUEL DISPENSERS

Fuel dispensers are used for retail fuel sales or to transfer fuel into larger transfer tanks outside the facility. Fuel dispensers are connected to the submersible pumps in the dispensing tanks and typically are used to meter fuel products for sale. Some retail dispensers are configured to automatically activate the submersible pump when the dispenser is activated. Some mechanical **fuel custody meters** require the submersible pump to be activated by a separate fuel control panel.

Retail Pump Station

Custody Meter

E. Security and Safety Equipment

FENCING AND LIGHTING

AST facilities and filling stations should have security fencing and lighting to prevent damage, vandalism, and theft. The facility should also have signs posted around the facility. All tanks within the facility should also be labeled to identify contents to ensure correct fuel is delivered to the appropriate tank.

FACILITY SIGNS

Signs should be posted around the facility so they can be seen from every side of the tank farm. In general, caution signs such as “NO SMOKING” and “NO OPEN FLAMES” should have red text. Instructional signs such as “AUTHORIZED PERSONNEL ONLY” should have black text.

All tanks within the facility should also be labeled to identify contents to ensure correct fuel is delivered to the appropriate tank. A warning sign stating “DANGER-FLAMMABLE LIQUIDS” should also be posted on the tank shell.

GROUNDING

Tanks, fences, dispensing equipment and other large metal objects within the AST should be grounded. In general, grounding removes electric charge from objects by transferring the charge to the ground. The most common grounding technique is to attach a conductive wire to a rod that is buried in the ground.

Grounding ASTs prevents sparks from igniting built-up vapors. Some tanks come manufactured with a specific location for attaching grounding wire.

Additionally, any electrical connections within the AST facility are required to be constructed with explosion-proof conduit connections.

Tank Grounding Connection

Fence Grounding Connection

F. Cathodic Protection

The most common type of corrosion on tanks and piping is rust. Cathodic protection systems are installed to reduce or eliminate corrosion on metal tanks and piping. There are two main modes of providing cathodic protection: galvanic systems (sacrificial metal) which can include replaceable metal pieces or metal coatings, and impressed current systems. Each system has its benefits and drawbacks, and both are sometimes used in conjunction with each other. Each system works by utilizing electrical charges to slow down or eliminate corrosion.

GALVANIC SYSTEMS

Cathodic protection provided by sacrificial metals can also be referred to as galvanic systems. In this application, the sacrificial metal, or anode, is chosen because it will corrode more readily than the metal that it is meant to protect. In order to work properly, the anode must be connected to the tank or pipe it is protecting.

(1) Zinc Coatings (Galvanizing/Zinc Primers)

One common way of providing corrosion protection is through the use of a zinc rich primer, which is installed prior to final painting. Zinc rich primers are most commonly used on larger items such as ASTs and buried pipes.

One other common form of providing a zinc coating is galvanization. The galvanization process deposits a thin layer of zinc onto the surface of a metal, which protects it from further corrosion. Galvanization is typically used on items such as nails, bolts, hand rails, etc. Galvanized metals are easy to spot because when new they will have a shiny gray color; weathered galvanization will often have white splotches or a chalk-like coating.

(2) Sacrificial Metal Anodes

Many ASTs and pipes employ a form of galvanic corrosion protection, which use sacrificial metal anodes. Anodes achieve corrosion protection the same way as coatings, however, these systems use large pieces of metal, which are directly attached to the item that it is meant to protect. Common ways of attaching sacrificial metal anodes for tanks are to bolt the anode directly to the inside tank wall. For buried steel tanks and piping and for above ground steel tanks, anodes are connected to steel to be protected via a cable and placed in the ground next to the pipe or tank.

IMPRESSED CURRENT SYSTEMS

On newer, large structures which require cathodic protection, impressed current systems are sometimes used. These systems work by running a weak electrical charge through the structure which is then transferred through the soil to a network of anodes buried around the structure. The electrical charge is induced from a device called a rectifier, which is specially tuned to the protected structure and the overall site conditions. One of the primary benefits of impressed current systems is their low maintenance requirements after installation.

2 Facility Operation

This section discusses basic operational practices for a bulk fuel facility. Major topics include:

- General Operating Procedures - includes step by step procedures for day to day activities and fuel transfers.
- Inventory Control - includes step by step procedures for calculating and monitoring fuel volumes.
- Best practices for preserving fuel quality.

2.1 Operating Procedures

The facility operator is typically responsible for (A) Daily System Startup/Shutdown; (B) Filling of Dispensing Tanks; (C) Dispensing Procedures; and (D) Receiving Fuel Deliveries. The following sections provide general step-by-step guidelines for each of these responsibilities, as well as troubleshooting techniques to use if the system is not working properly. Appendix B includes checklists for each of these general procedures. Note that depending on the size and function of your facility, some of the steps may not apply.

For all procedures, tank isolation through proper valve control is extremely important.

A. Daily System Startup/Shutdown

Daily system startup and shutdown procedures can vary greatly depending on your facility's layout and control system.

FACILITY STARTUP

- ✓ Visually inspect dispensing area, dispensing tanks, and storage tanks for any evidence of spills leaks or damage.
- ✓ Verify proper valves are closed and locked.
- ✓ Turn on appropriate control panels.
- ✓ Observe stormwater level within secondary containment and remove as required (see Section 3 for procedure).
- ✓ Check fuel level in dispensing tanks. Follow Procedure C if dispensing tank(s) need to be filled.

FACILITY SHUTDOWN

- ✓ Turn appropriate control panels off.
- ✓ Verify all valves and switches are closed and locked.
- ✓ Close and lock security gates.

B. Dispensing Procedures

Facilities may include dispensing equipment for smaller retail sales and large transfers into fuel trucks.

GENERAL PROCEDURE

- ✓ Unlock security gate.
- ✓ Open appropriate fuel dispenser valve.
- ✓ Turn on dispenser pump.
- ✓ If required, set fuel meter to record amount of fuel to be dispensed.
- ✓ Ensure meter is working.
- ✓ Dispense desired quantity of fuel.
- ✓ Turn off dispenser pump.
- ✓ Close fuel dispenser valve.
- ✓ Lock security gate.

TROUBLESHOOTING

If fuel does not flow out of the nozzle at the dispenser:

- ✓ Check to ensure the appropriate control panels are on.
- ✓ Check to see if any emergency pump shutoff switches have been tripped.
    - If emergency pump shutoff switches have been tripped **DO NOT** simply reset or deactivate them, diagnose the cause of the shutoff and make appropriate repairs.
- ✓ Verify fuel level in the dispensing tank.
- ✓ Verify proper valves are open.

If fuel is flowing slow:

- ✓ Replace filter element inside the dispenser.
- ✓ Check nozzle for frost. If nozzle is frozen, close valves to the dispenser. Remove nozzle, being careful to catch all drips, and then place nozzle in a warm space to thaw and dry thoroughly. Reinstall the nozzle and open the valves to the dispenser.

C. Dispensing Tank Filling Procedures

If your facility has storage tanks greater than 12,000 gallons, fuel must be transferred to a dispensing tank before it can be distributed outside of the facility. Your facility should have a pre-determined “low level” for the dispensing tank that lets you know when you should fill the tank.

GENERAL PROCEDURE

- ✓ Check fuel level in the dispensing tank.
- ✓ Select the bulk tank from which you will be transferring from and verify fuel level.
- ✓ Unlock and open valves between the selected bulk tank and dispensing tank. Make sure all other bulk tank valves and manifold valves are CLOSED AND LOCKED.

- ✓ Discontinue all vehicle-dispensing operations while transferring fuel to the dispensing tank.
- ✓ Use the control panel to start fuel transfer. If you do not have a control panel with this function, manually start the transfer pump.
- ✓ Continuously monitor storage tank and dispensing tank fuel levels during transfer.
- ✓ When the dispensing tank reaches 90% full, stop fuel transfer.
- ✓ Once fuel transfer operations are complete, turn and lock valves in the closed position, and ensure transfer pump switch is in the off position.

TROUBLESHOOTING

If pump is not turning on:

- ✓ Check the control panel and verify pump switch is on and pump "ON" light is illuminated. If pump switch is on and light is not illuminated, check the pump circuit breaker.
- ✓ Check to see if emergency pump shutoffs have been activated.
- ✓ Ensure dispensing tank is not in use. Many facilities have lockout features that prevent filling the dispensing tank if dispensing operations are occurring.

If transfer pump is running but no fuel is flowing:

- ✓ Verify proper valves are open.
- ✓ If your system includes actuating (motorized) valves, check to see if they are turning open. If the motorized valve is stuck, it can be manually opened and closed in an emergency situation using a wrench. If the motorized valve is not working properly it should be serviced by a qualified technician or replaced.
- ✓ Verify the fuel level in the storage tank.

D. Offloading Procedures

Offloading procedures can vary depending on how fuel is delivered to your facility. Barge deliveries must comply with United States Coast Guard (USCG) regulations, which require that inspections be performed prior to delivery with backup documentation showing:

- Declaration of Inspection (DOI);
- Pre-transfer meeting with barge personnel;
- Results from hydrostatic pressure test completed before the first delivery of the season.

The following procedure summarizes the USCG regulations for barge deliveries. The tank farm operator must understand and follow the requirements in their tank farm's USCG Operations Manual, Prevention Control and Countermeasure Plan (SPCC), as required by the EPA and the Facility Response Plan (FRP) as required by the Coast Guard and EPA, during each fuel transfer operation.

If your facility receives fuel from a cargo plane, or truck, the same procedure can be followed as a general best practice.

BEFORE BEGINNING A TRANSFER

- ✓ Check the fuel level of the receiving tank to determine how much product it can take. It is important to determine a Safe Gauge Height (SGH), that is, how much fuel the tank can safely hold allowing for expansion due to temperature variations. A rule of thumb is the SGH should not be over 90% in the summer and not over 95% in the winter. In order to determine the SGH one must know the tank's storage capacity and how to properly gauge the tank. These topics are discussed in the inventory control section.
- ✓ Develop a product receiving plan for each tank that lists the volume to be delivered to each tank in sequential order.
- ✓ Walk the pipeline or hose to check for visible leaks, cracks, or damage to the pipe or hose. Put drip pans under hose connections and confirm all drain plugs are in place.
- ✓ Confirm fire extinguishers are in place.
- ✓ Ensure all stormwater is removed from the containment dike and from the spill box at the header connection.
- ✓ Verify all valves along the pipeline between the tanks and header are CLOSED.
- ✓ Have a pre-transfer meeting with the barge operators and facility operators. The USCG requires this meeting and for the parties to go over and sign a Declaration of Inspection (DOI). Procedures that will be used during the transfer are included in the DOI. A sample DOI form is included in Appendix B.
- ✓ Determine how much fuel is above the receiving pipe inside the tank. If there is less than a foot of fuel above the receiving pipe, transfer fuel at a reduced rate until at least one foot of fuel is covering the pipe. This will reduce the potential for explosions caused by static electricity that may be generated when fuel is pumped into the tank at a high rate.
- ✓ Ensure all required personnel are available and prepared.

DURING THE TRANSFER

- ✓ Remove cap at the header and allow fuel barge personnel to connect their fuel transfer hose. Open the valve at the marine header.
- ✓ Upon command from fuel barge personnel, open valves between the marine header and the first storage tank designated to be filled in the receiving plan.
- ✓ Begin the transfer at a reduced rate until you are sure the product is going into the correct tank and that there are no major problems or leaks.
- ✓ DO NOT WALK AWAY DURING A TRANSFER. Make sure an operator is at the site during the entire transfer. Several spills have occurred at AST facilities because the operator did not follow this rule. Since transfers occur at various rates depending on equipment, operators must be patient.
- ✓ Maintain communication between the barge operators and the facility operators at all times. Use intrinsically safe hand-held radios for communications.

- ✓ Check tank level at regular intervals. As the tank fills, frequency of checks on the tank level should be increased to avoid overfilling the tank.
- ✓ Reduce the transfer rates when nearing the SGH to avoid overfilling the tank. **Note**: if the whistle vent begins to alarm while filling a tank, check the tank level immediately and be prepared to slow down or stop pumping as required.
- ✓ Notify the fuel barge personnel when the transfer procedure is almost complete. This will ensure that fuel barge pumps can be shut down before valves within the AST facility are closed. If tank valves are closed first, high pressure in the lines may cause a "hydraulic hammer" to occur which can cause fuel spillage or significant damage to valves and/or piping.
- ✓ Close and lock tank valves.
- ✓ Repeat for each tank in the order specified in the receiving plan.

WHEN THE TRANSFER IS COMPLETE

- ✓ Close all valves between the marine header and manifold.
- ✓ After fuel barge personnel remove hoses, replace cap over marine header and lock.
- ✓ Conduct a post-transfer meeting between the fuel barge personnel and the facility operators. Ensure that all required personnel sign-off on the DOI.
- ✓ Allow a minimum of a 30-minute relaxation period for static electricity to dissipate before gauging tanks or beginning transfer operations.
- ✓ Allow product to settle for a minimum of two days prior to dipping with water cut paste (refer to Inventory control for tank dipping procedures). Waiting to dip the tanks will allow water to settle to the bottom of the tank, making readings more accurate.

2.2 Inventory Control

Operators should monitor and record their product inventory on a regular basis. Product inventory should include fuel level readings for each of the tanks in the facility, volume of fuel that has been dispensed from the facility, and volume of fuel that has been delivered to the facility. These values should be monitored and recorded on a regular basis, and the recorded data should be reconciled to make sure the facility is not losing fuel. For large facilities, inventory data is recorded daily and reconciled monthly. In smaller facilities, daily monitoring is not always practical, but inventory data should be recorded on a weekly or monthly basis and reconciled on a regular basis.

The following discussions explain:

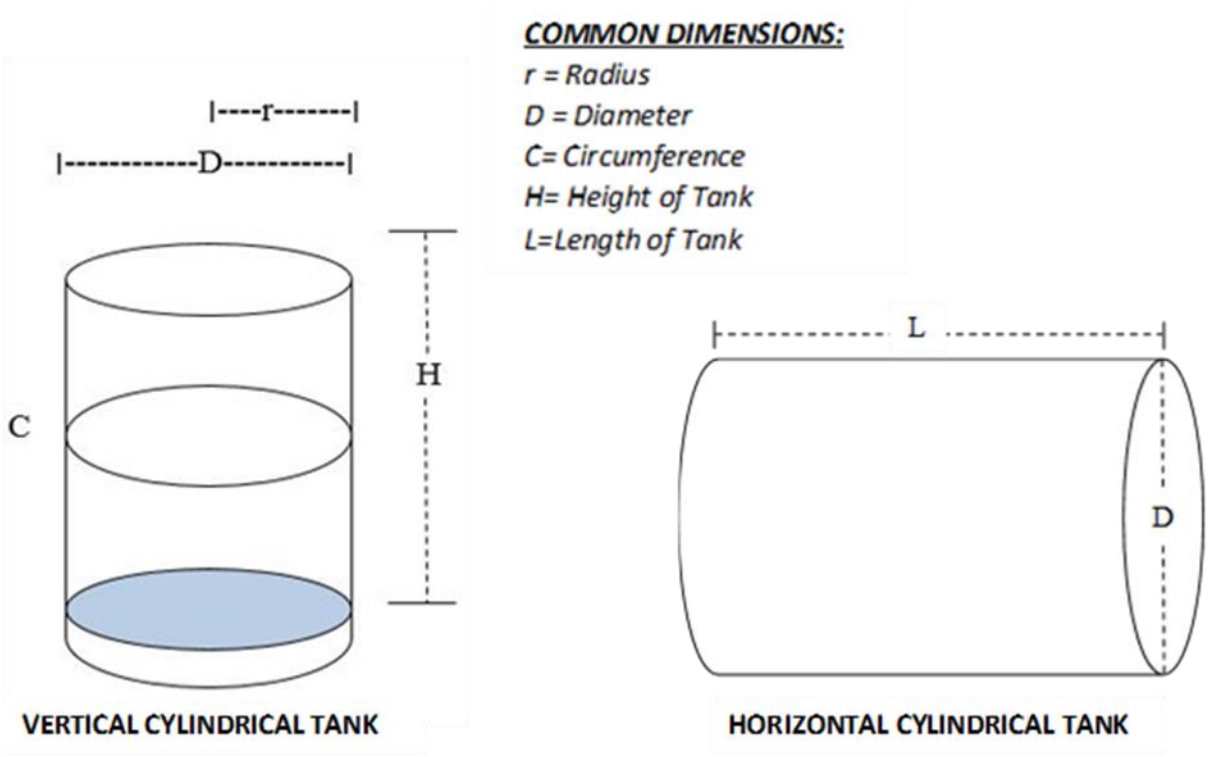
- How to calculate total storage capacity, and safe gauge height (SGH);
- Procedure on how to properly gauge product levels and make temperature adjustments.

A. Total Storage Capacity

Storage capacity is the total volume of fuel a tank can hold. In order to monitor product inventory, you must know the storage capacity for every tank in your facility. When a tank is purchased from a

manufacturer you will be told the storage capacity. However, the storage capacity of older tanks is often not known and must be calculated.

Storage capacities can be calculated using online calculators or manual hand calculations. For either of these methods you must know what shape of tank you have and measure the appropriate dimensions. The following figure defines dimensions you will need for horizontal and vertical cylindrical tanks.



ONLINE CALCULATORS

Online calculators use tank shapes and dimensions to calculate volumes. Note that these online calculators give **estimated values** and will not be as accurate as information provided by tank manufacturers.

The following online calculator can be used to determine overall tank capacity:

https://www.calculatorsoup.com/calculators/construction/tank.php

To use this online tool:

- ✓ Select the correct type of tank.
- ✓ Type in measured tank dimensions. The required dimensions will depend on what shape of tank you have.
- ✓ Leave the filled depth blank.
- ✓ Click the “Calculate” button.
- ✓ The answer box will give you your **total volume**, which is the total tank capacity.

MANUAL HAND CALCULATIONS

If you do not have internet access, you can manually calculate tank capacities. Horizontal and Vertical tank capacities are calculated differently. Useful equations and step by step calculations are provided as follows:

USEFUL EQUATIONS:

$A = \frac{\pi}{4} D^2$

$A = \pi r^2$

r = D/2

r = C/2π

V=HA

DEFINITIONS:

r = Radius
D = Diameter
C= Circumference
H= Height of Tank
A= Area
V=Volume
ft = feet (measurement of length)
ft^2 = square feet (measurement of area)
ft^3 = cubic feet (measurement of volume)
π = 3.14

USEFUL CONVERSIONS:

1 gallon = 7.48 ft^3
1 feet = 12 inches

(1) CALCULATING TOTAL CAPACITY OF HORIZONTAL CYLINDRICAL TANK

- ✓ To calculate the volume of a **horizontal cylindrical** storage tank first measure the **diameter**, and **length** of the tank. You can record your measurements here (make sure you measure using feet):

  Diameter (D) = _____ ft

  Length (L) = _____ft

- ✓ Calculate the end area of the tank.

  Area = 0.785 x Diameter x Diameter

  Area = 0.785 x_____ft *x* _____ft = _____ ft^2

- ✓ Calculate total volume by multiplying the end area by the length of the tank.

  Total Volume = Area x Length

  Total Volume = _____ ft^2 x _____ft = _____ft^3

- ✓ Convert cubic feet to gallons by multiplying the total volume by 7.48 gal/ft^3**:**

  Total Volume in Gallons = Total Volume in cubic feet x 7.48

  _____ft^3 *x* 7.48 = _____ gallons ← **Total Capacity**

(2) CALCULATING TOTAL CAPACITY OF VERTICAL CYLINDRICAL TANK

- ✓ To calculate the volume of a vertical cylindrical storage tank first measure the **circumference**, and **height** of the tank. You can record your measurements here (make sure you measure using feet):

  Circumference (C) = _____ ft
  Height (H)= _____ft

- ✓ Calculate radius using circumference and height measurements:

  Radius = Circumference/6.28

  Radius = _____ft / 6.28 = _____ft

- ✓ Calculate surface area of the top of the tank:

  Area = 3.14 x Radius x Radius

  Area = 3.14 x _____ft *x* _____ft = _____ ft^2

- ✓ Calculate total volume:

  Total Volume = Area x Height

  Total Volume = _____ ft^2 x _____ft = _____ft^3

- ✓ Convert cubic feet to gallons by multiplying the total volume by 7.48 gal/ft^3**:**

  Total Volume in Gallons = Total Volume in cubic feet x 7.48

  _____ft^3 *x* 7.48 = _____ gallons ⟵ **Total Capacity**

(3) CALCULATING GALLONS OF FUEL PER INCH WITHIN A VERTICAL CYLINDRICAL TANK

- ✓ Calculate total tank capacity following the steps outlined above:

  Total Capacity = _____ gallons

- ✓ Calculate gallons per foot by dividing the total capacity by the height of the tank:

  Total Capacity/Height of tank= Gallons per foot

  _____gallons/ _____ft = _____ gallons per foot

- ✓ Calculate gallons per inch by dividing the calculated gallons per foot by 12 in/ft:

(Gallons per foot)/12= Gallons per inch

_____gallons per foot / 12 = _____ gallons/inch

- ✓ Most tank gauging equipment is referenced by eights of an inch. Divide gallons/inch by eight to calculated the amount of liquid in each eighth of an inch:

Gallons per inch/8= Gallons per 1/8 inch

_____gallons per foot /8= _____gallons per 1/8 inch

DETERMINING SAFE GAUGE HEIGHT

The Safe Gauge Height (SGH) is the volume the tank can safely hold to allow for expansion due to temperature variations. Once the tank total storage (shell) capacity has been determined, the SGH should be determined and stenciled on the tank, usually near the gauging port and the side of the tank. Tanks should NOT be filled over the SGH.

•In summer the SGH is usually 90% of the tanks total storage capacity. This allows room for expansion due to heat.

•In winter the SGH is usually 95% of the tanks total storage capacity as well some room for expansion.

To calculate SGH:

- ✓ Determine the tanks total capacity following steps previously outlined

Total Capacity = _____ gallons

- ✓ Multiply the total capacity by either 0.90 or 0.95 to determine SGH at 90% and SGH at 95%

90% SGH = Total Capacity x 0.90

90% SGH = _____ gallons x 0.90 = _____ gallons

90% SGH

95% SGH = Total Capacity x 0.95

95% SGH = _____ gallons x 0.95 = _____ gallons

95% SGH

B. Tank Gauging and Temperature Corrections

Gauging product levels in the tank is critical for keeping accurate material inventory. Based on manual gauge readings, the operator can determine the total volume of fuel remaining in the tank.

MANUAL GAUGE READINGS

Manual gauge readings are taken with a tape and plumb bob or dip stick, from a roof mounted vapor tight gauge hatch. Manual gauge readings allow for the operator to determine remaining fuel levels and check for water at the bottom of the tank.

Follow the procedure below for manual tank level measurements:

- ✓ Use dark tapes to measure clear liquids such as diesel and light colored tapes to measure heavy fuels and crude oil.
- ✓ Before taking measurements, check the tape for cracks and make sure the printing is legible.
- ✓ Be sure to ground the tape before dropping the plumb bob into the tank and drop the bob slowly.
- ✓ Lower the plumb bob until it just contacts the bottom of the tank.
- ✓ Wind up the gauging tape and note the liquid line. If it is difficult to see, "gauging paste" may be used to clearly identify where the line of liquid cuts across the gauging tape.
- ✓ Dip the tank until you get the same reading twice and then write down your reading.

DETERMINE GROSS GALLONS REMAINING

Once you have recorded your manual gauge reading you can determine the total volume of fuel remaining within a tank. The total volume can also be called the **gross volume** within the tank and can be determined using (1) tank capacity charts, (2) online calculators, or (3) manual hand calculations.

(1) Tank Capacity Charts

Newer facilities with manufactured tanks should have capacity charts for each type of tank within the facility. Tank capacity charts list incremental fuel depths and corresponding volumes of fuel remaining in the tank. To use the charts simply find the depth that you measured during your manual gauge reading and then write down the capacity listed for that depth.

(2) Online Tools

If you do not have a tank capacity chart, there are online tools that you can use to generate your own tank charts and calculate volumes. Online calculators use tank shapes and dimensions. Note that these online calculators give **estimated values** and will not be as accurate as information provided by tank manufacturers.

- **Tank Capacity Chart**
  Using the following online calculator can help you develop a tank capacity chart.
  https://halltank.com/tank-charts/

To use this online tool:

- ✓ Select the correct tank shape.
- ✓ Select the correct tank orientation.
- ✓ Select the output increment that matches your gauging equipment increments.
- ✓ Give tank diameter and length measurements **in inches.**
- ✓ Select number of rows per page.
- ✓ Click the "Get Capacity Chart" button to view your chart.

- **Overall Tank Capacity and Fill Volumes**
  Using the following online calculator can help you calculate overall tank capacity based on your tank dimensions and fill volumes based on your manual gauge measurements. *https://www.calculatorsoup.com/calculators/construction/tank.php*

  To use this online tool:

  - ✓ Select the correct type of tank.
  - ✓ Type in measured tank dimensions. The required dimensions will depend on what shape of tank you have.
  - ✓ Type in the depth of fuel you recorded from your manual tank gauge.
  - ✓ Click the "Calculate" button.
  - ✓ The answer box will give you your **total volume**, which is the total tank capacity and the **filled volume**, which is the volume of fuel remaining in the tank.

(3) Manual Hand Calculations

If your facility does not include tank capacity charts, and you do not have internet access to use online tools you will have to manually calculate remaining volumes based on your manual gauge reading and the total tank capacity. The calculations you have to do will depend on the shape of your tank.

- Vertical Cylindrical Tank
  - ✓ Determine how many gallons per 1 inch by following steps outlined in Part A of this section.
  - ✓ Record your manual gauge reading.
  - ✓ Multiply your manual gauge reading by your calculated value for gallons per inch. Make sure your gauge measurement is recorded in inches.
    Manual Gauge Reading x gallons per inch = Volume Remaining

- Horizontal Cylindrical Tank
  - ✓ Determine the overall tank capacity by following steps outlined in Part A of this section.
  - ✓ Record your manual gauge reading **in inches.**
  - ✓ Record the measured diameter of your tank **in inches**.

- ✓ Calculate your Height-Diameter Ratio by dividing the recorded gauge height by the measured diameter of your tank.

  Manual Gauge Reading/Measured tank Diameter= H/D Ratio

- ✓ Look for your calculated ratio in the depth factor table in Appendix C and write down the corresponding depth factor.
- ✓ Calculate gallons remaining by multiplying the depth factor by the total tank capacity.

  Gallons Remaining = Depth Factor x Total Tank Capacity

TEMPERATURE CORRECTION FACTORS

Once you determine the gallons of fuel remaining within a tank, you can apply a temperature correction factor. Fuel volumes expand when temperatures are above 60°F and shrink when temperatures are below 60°F. To account for these volume fluctuations, operators can apply a temperature correction factor to the **gross volume** to calculate a **net volume**. The net volume is the total amount of fuel at 60°F.

- ✓ To determine the net volume you must have a gross fuel volume and a temperature of the product when the gross fuel volume was recorded.
- ✓ The correction factor can be found in in the table included in Appendix C based on the temperature and type of product (gasoline or diesel).
- ✓ Multiply the gross volume by the correction factor to determine the net volume.

  Net Volume = Gross Volume x Correction Factor

2.3 Preserving Fuel Quality

The operator is responsible for maintaining fuel quality while it is stored and as it is dispensed. Fuel quality can be compromised with the presence of water and exposure to dust, dirt, and other sediments. Fuel quality can also be compromised if it sits for a long period of time.

Fuel quality can be preserved by:

- Establishing a maintenance program to ensure water and sediment is routinely removed from storage tanks. (See Section 3 of this manual on how to remove water and sediment).
- Regularly checking and changing filters and strainers.
- Emptying and cleaning tanks every 10-15 years.
- Planning fuel usage and storage so that it will be used within 1-5 years and replaced with fresh fuel.
- Using additives to improve fuel storage life such as fungicides/biocides, anti-oxidants, and fuel stability foam.
- Installing water-blocking filters on fuel dispensers and fuel supply lines to power plant generator engines.

3 Periodic Maintenance Procedures

Proper maintenance will extend the useful life of your facility and reduce risk of costly and damaging spills. Proper maintenance of your facility includes:

- Routine Monthly and Annual Inspections
- Required Testing
- Part Replacements
- Water Management
- Proper Record Keeping

3.1 Inspections

Facility inspections are the best way to identify problems that could lead to system failures, leaks and large spills. Inspections must be conducted on a regular basis in a standardized way. If a facility is manned, informal inspections should be done on a daily basis when the operator walks through to open and close the facility. Formal inspections should be completed and documented on a monthly and annual basis. The operator or other personnel that are knowledgeable of the specific equipment and operating procedures within the facility can complete monthly and annual inspections.

In addition to routine monthly and annual inspections, certain components of the facility should be examined by a certified inspector.

The following provides more detailed descriptions on monthly inspections, annual inspections, and certified inspector inspections.

A. Monthly Inspections

Monthly inspections should include assessments of the following items:

1. General Housekeeping
2. Safety Equipment
3. Security Equipment
4. ASTs and their appurtenances
5. Piping System (including all fittings, valves, and pumps)
6. Secondary Containment
7. Spill Prevention and Response Plans in Place
8. State/Federal Requirements are met

When conducting a formal inspection it is important to use a checklist. A general AST Facility monthly inspection form is included in Appendix B. This form may be copied for your use and revised based on the equipment and major components unique to your facility.

When filling out the checklist, be sure to document what the deficiency is and the corrective action required to fix the problem. You may need to report significant problems to higher management.

The following discussions provide more detailed descriptions of what to look for during your monthly inspection based on the AST Facility Monthly Inspection Form provided in Appendix B.

(1) General Housekeeping

Is the facility clean and clear of unnecessary items? It is important to keep facilities clean and free of unnecessary items because clutter will hinder clean up in the event of a leak or spill. Large items such as drums, lumber and other objects can damage pipes, dent tanks and provide homes for unwanted animals.

(2) Safety Equipment

Is the safety equipment in place and are safety precautions followed? Safety at AST facilities is of the utmost importance and can save lives, prevent injuries, and protect property and the environment. When assessing your safety equipment be sure to check:

2a-Fire Extinguishers

There should be an adequate number of fire extinguishers in logical, appropriate locations. Verify the fire extinguishers are easily accessible and fully charged. All tank farm operators should have portable fire extinguisher training.

2b-No Smoking Signs

"No Smoking" or "No Smoking Permitted" signs should be posted in strategic locations within the facility.

2c-Danger and Warning Signs

Danger and Warning signs: Individuals entering the facility should be warned of potential dangers. Signs restricting entry to authorized persons should be posted in visible locations. Other signs such as "Danger Flammable Liquids" should also be posted.

(3) Security Equipment

AST facility owners and operators should employ security measures to prevent vandals, unwanted individuals and animals from entering the tank farm. Aside from damage unwanted individuals may cause, there are liability issues to consider. When assessing your security equipment be sure to check:

3a-Fencing

Is there a fence around the facility? The fence must be intact and the gates must be locked when unattended. Verify any chain-link fabric and barbed wire are not damaged.

3b-Lighting

Does the facility have a lighting system? Lighting is important so workers can see their way around the facility and to keep intruders out. Lights should provide adequate illumination and be in good working order.

(4) Aboveground Storage Tanks (ASTs) and their Appurtenances

Aboveground storage tanks are the most important component of an AST facility. They should be maintained in good working condition. Be sure to fill out an inspection form for **each** tank. This applies to all tanks within the facility. When assessing your AST be sure to check:

4a-Tank Integrity

Are there any visible leaks or drips from the tanks? Are there stains on the ground around the base of the tank? Check seams and welds. All leaks must be stopped and repairs made by a qualified technician with proper equipment.

4b-Signs of Corrosion

Are there any signs of corrosion? Look for damaged coatings, rust and rough textures at welds, and shell seams.

You can remove surface rust and loose paint with a wire brush and apply touch-up paint as required. Painting should only be performed in warm and dry weather (above freezing, no rain).

Pipe Corrosion

Tank Corrosion

4c-Cathodic Protection Systems

Cathodic protection systems help prevent corrosion. If your facility includes internal sacrificial anodes for cathodic protection, during tank maintenance cleaning, the anodes should be checked to see if there is sufficient metal left on the anode and replace the anode if needed.

If your cathodic protection system uses impressed current, you can check to see if the system is turned on. A certified cathodic protection system inspector should inspect the cathodic protection system to insure the system is functioning properly.

4d-Grounding

Check that grounding wire is connected to the tank and leads to a rod or other ground. If the wire is damaged or not fully connected, replace it and secure the connections.

4e-Signage

Each tank should be labeled with the name of the product stored (diesel, gasoline, etc.) and the storage capacity in gallons. There should also be a sign showing it is a flammable or combustible product.

4f-Paint

Paint protects the tank from exposure to the elements and reduces corrosion. Check for peeling, blistering or chipping.

4g-Tank Vents

Check to make sure the normal vents are clear and there is no debris, snow or ice plugging them. Pressure/Vacuum vents need to be checked to make sure the vents are clear and there is no debris, snow or ice plugging them and should be checked for proper operation by a certified tank inspector.

4h-Emergency Vents

Make sure emergency vent lids lift freely.

4i-Gauges

Check to make sure gauges are not damaged, are in their proper orientation, and working properly. You may need to calibrate your gauges to align with your manual gauge readings. CLICK HERE to view a short video explaining how to calibrate a clock gauge.

4j-Overfill Devices

Manually trigger switches to ensure overfill alarms are working properly.

4k-Check for Water

Check the tank for water through the gauge hatch. Note if there is water present and remove if required. Refer to Section 3 of this manual for information on how and when water can be removed from your tank.

4l-Foundations

Check to see that the tank foundation is in good condition. If beams are used, are they cracked or rotten. Is the foundation level? Are there signs the foundation is washing out or damaged in other ways?

(5) Piping System (including all fittings, valves, and pumps)

The piping system includes all fittings, joints, valves, and pumps used to move product through the facility. When assessing your piping system be sure to check:

5a-Pipe Integrity

Are there any drips, leaks or visible stains around pipe joints, pumps, meters, filters, valves or hoses? Pay special attention to flex connections and look for joints that do not line up.

Make note of damaged or leaking parts and replace as soon as possible.

5b-Signs of Corrosion

Are there any signs of corrosion? Look for rust and rough textures at joints connecting valves, pipes, and other fittings.

You can remove surface rust and loose paint with a wire brush and apply touch-up paint as required. Painting should only be performed in warm and dry weather (above freezing, no rain).

5c-Cathodic Protection

A certified cathodic protection system inspector should inspect the cathodic protection system to insure the system is functioning properly.

5d-Pipe Supports

Are pipe supports adequate and in good condition? Check for sagging and cracking pipes due to insufficient support and rusting or rotting pipe supports.

Note any issues, tighten or replace any loose, missing or damaged supports.

5e-Valves

Are there any signs of leaks from the valves? Can the valves be turned completely on and off to stop product flow? Are the valves protected from falling ice and snow, vehicle and foot traffic? Verify all normally closed valves are locked in the closed position.

5f-Protection

Check that the pipes are protected from falling ice and snow and from vehicular and foot traffic.

5g-Coatings

If the pipes are coated, wrapped or painted, check for wear, tears and chipping. Clean and repair pipe coating as required.

5h-Dispenser Unit

Visually inspect the dispenser unit, hoses, nozzles and accessories. Look for leaks or damage and replace any worn or non-operational accessory. Check that nozzles can be turned off completely to stop the flow of product. Replace the fuel dispenser filter annually, or if you notice a reduction in flows. CLICK HERE to view a short video explaining how to replace a typical fuel dispenser filter.

5i-Control Panel

Check the control panel for damage. Verify doors are closed tight. Verify operation of all switches, buttons, and lamps. Test emergency shutoff switches. CLICK HERE to view a short video explaining how to reset the power beaker. Repairs to the control panel must be performed under the direction of a qualified technician (journeyman electrician).

(6) Secondary Containment

The purpose of secondary containment is to hold any product should there be a spill. It is important that this area be of sufficient size and have the ability to hold spilled oil.

6a-Dike Integrity

Are there any cracks, holes or other damage to the containment dike walls? Repair as needed.

6b-Liner Integrity

Is the secondary containment area lined with a synthetic liner? Is the liner in good condition or are there any rips, tears or non-essential holes in it? If the liner is not waterproof, it will not hold spilled product. **(Note: if the liner is holding rainwater, it is probably in good condition and needs to be drained.)**

6c-Clear of Water, Snow, Ice, or Vegetation

Is the secondary containment clear of standing water, ice and snow? If water or ice is in the containment area, there could be overflow if a tank failed. Snow could hide leaked or spilled product and vegetation could damage liner material and hamper clean up.

If your facility uses tanks with built-in secondary containment such as double-wall, or self-diked tanks, be sure to remove any water collected within the exterior walls.

(7) Spill Prevention and Response Plans in Place

It is important to be prepared should a spill occur. Quick response can reduce the amount of oil spill thus reducing health and environmental damage and saving money. Refer to Sections 6 and 7 of this manual for more detailed discussions on spill prevention and response.

7a-Response Plan

Does the facility have a response plan and is it located at the facility? Each facility must have plans to deal with emergencies and all the facility operators and workers should be familiar with them.

7b-Response Equipment

Is the response equipment located at the site and is it in good working order? Do operators know how to use it? A minimum amount of oil spill response equipment should be located in specific areas of the facility and operators should know where it is located and how to use it. Appendix B includes a sample spill response equipment checklist.

(8) State/Federal Requirements are Met

8a-ADEC Placards

Placards include ADEC phone numbers and where to report spills. When inspecting the facility make sure the signs are clearly posted.

8b-EPA SPCC and FRP Plans

Depending on the location and size of your facility you may be required by the United States Environmental Protection Agency (EPA) to have a Spill Prevention Control and Countermeasures (SPCC). Some facilities will also need a Facility Response Plan (FRP). Both plans must contain specific information. In the case of the SPCC, the document is certified by a registered professional engineer and must be signed by facility management indicating acceptance and implementation. When inspecting the facility, check to see if a current copy of the required plan is easily accessible.

8c-USCG

The United States Coast Guard (USCG) requires facilities that receive fuel from marine vessels to submit a Letter of Intent to Operate and have an Operations Manual and Facility Response Plan. When conducting the facility inspection, check for current copies of these documents. The USCG also requires safety equipment such as fire extinguishers, "Smoking Prohibited" signs, and response equipment and material to be located at the facility.

B. Certified Inspections

Aside from routine facility inspections, it is a good practice to have ASTs examined by certified inspectors on a regular basis. ASTs must be maintained and inspected to a recognized national standard. There are two primary inspection standards depending on the tank. For horizontal tanks that were built in a shop and then transported to the facility, the Steel Tank Institute Standard SP-001 is the primary standard to use. For conventional vertical tanks built on site, the American Petroleum Institute Standard, API 653, is the primary standard to use. These standards are designed for certified inspectors to follow for comprehensive AST periodic internal and external inspections. Each standard has set inspection intervals based on the size, configuration of the tank and the prior inspection results. These intervals should be followed. More frequent or additional inspections should be considered if there is evidence of a leak,

changes in the tank are evident or any other reason why the operator believes an internal inspection is needed.

Facility operators are not expected to conduct such rigorous inspections. Many problems or potential problems can be identified with simple monthly inspections previously discussed. However, with training and certification for “HAZWOPER” and “confined space entry”, operators can conduct cursory internal inspections. For these inspections, tanks should be emptied and cleaned and the inside examined for holes and corrosion. Only trained and experienced persons should conduct internal inspections. Under no circumstances should anyone else enter the tank.

If your system uses a cathodic protection system, you must have a National Association of Corrosion Engineers (NACE) certified technician with proper equipment perform any testing. The cathodic protection system should be tested annually, or as recommended by a qualified technician.

3.2 Required Testing

The integrity of ASTs and associated piping systems should be tested on a regular basis. Tests should be performed by qualified technicians with proper equipment.

A. Tanks

You will not always be able to detect weaknesses in your tank from your monthly inspections. To ensure that your tank walls are appropriate thicknesses a certified inspector can perform Ultra-sonic Thickness testing. To test the strengths of welded seams, the tank can be vacuum tested, again by a certified inspector.

External AST inspection by a certified tank inspector is recommended every evert 10 years and internal AST inspection by a certified tank inspector is recommended every evert 20 years.

B. Pipeline Integrity Testing

If your facility receives fuel deliveries through barge services, and/or if it includes buried pipelines, annual pressure tests must be performed. U.S. Coast Guard regulations require any piping between the marine header connection and the secondary containment are to be hydrostatically tested annually. All other piping in the tank farm should also be test annually.

All piping requiring testing must be tested prior to receiving new fuel deliveries for the year. Additional testing may also be required if leaks are observed, piping is damaged, or significant repairs or alterations have been made.

When pressure testing piping, take steps to protect pumps, dispensers, meters, filters and hoses from high pressures. Close all isolation valves as required and remove any pressure relief valves from the sections being tested. Testing pipes with air can be hazardous and is not recommended. Pipeline integrity testing should only be performed using a hydrostatic test method.

Pressure tests can only be completed by qualified technicians with proper equipment. Be sure to obtain test results and file with your records.

3.3 Common Part Replacements

When replacing parts refer to the tank farm operation manual and the parts manufacture's installation manual. It is recommended to have common replacement parts on hand.

A. Filter Replacement

Fuel dispenser filters and fuel pipe system filters will need to be replaced when the fuel flow reduction is noted or annually. CLICK HERE to view a short video explaining how replace a typical fuel piping system filter.

B. Gaskets and Replacement Bolts

Over time, flange connections may develop leaks and require gasket replacement. CLICK HERE to view a short video explaining how replace a typical flange gasket.

C. Strainers

Fuel strainers are typically installed on the inlet side of pumps. The strainers capture debris in the fuel before it can enter and damage the pump. CLICK HERE to view a short video explaining how clean a fuel strainer.

3.4 Water Management

A. Water Removal from Secondary Containment Dikes

Storm water that accumulates within a secondary containment area must be removed regularly. As a rule of thumb, water should be removed after every heavy rainfall and any time the depth is greater than 2 inches. CLICK HERE to view a short video showing how to drain water from a secondary containment area. Follow the steps outlined below to properly remove water from your containment area.

- ✓ Only trained facility operators should perform storm water removal. Storm water levels must be monitored and after every rain event. Remove water only during hours of daylight.
- ✓ Look for any sheen on top of the water. If you notice sheen, it means there is some leaked fuel product mixed with the water that you will have to remove prior to draining.
- ✓ To remove fuel resting at the top of the water surface use sorbents to soak up the product. Be sure to properly dispose of all used sorbents.
- ✓ All used sorbent should be drained through a hand wringer. The water/fuel mixture should be captured for proper disposal. Contaminated sorbents should be burned in a smart ash burner or properly disposed of in the community landfill.
- ✓ Pump water out of the containment area using a sump pump. The sump pump should include a hose leading out of the diking area. Check the electric cords supplying power to the pump for any frays or other damage. If the pump is not working, check the screen and make sure it is not blocked by leaves or other debris.

- ✓ As soon as water has been removed, turn the pump off.
- ✓ Make sure all leaves or other debris is removed from the containment area and properly disposed of.
- ✓ Record the date, time draining started, and time draining was completed in a water drainage log. If there was sheen on the surface, record how you cleaned it up before you removed the storm water.

B. Water Removal from Storage Tanks

When water collects at the bottom of a storage tank it can affect fuel quality and compromise the integrity of the tank. As a rule of thumb it should be removed whenever it is detected. During inventory gauging, you should always check for the presence of water in your tanks.

Water within storage tanks is removed using a tank drain at the bottom of the tank or a water draw from the top of the tank. CLICK HERE to view a short video showing how to remove water from an AST. Follow the steps outlined below to properly remove water from your AST.

(1) Tank Drain

- ✓ Locate water drain valve, it should be at the bottom of one end of the tank.
- ✓ Remove the locked endcap on the tank water drain valve.
- ✓ Place a bucket at the end of the pipe to collect the water.
- ✓ Open the valve and let water slowly flow out of the drain pipe into the bucket.
- ✓ When water has been removed, close the drain valve and replace the end cap.
- ✓ Check to see if all the water has been removed with gauging paste. If there is still water in the tank, repeat steps outlined above.
- ✓ Any water/fuel mixture collected from the tank water removal activity must be disposed of properly. Diesel/water fuel mixtures can be allowed to separate, and the diesel fuel can be disposed of in a smart ash burner. Gasoline/water fuel mixtures can be separated in a fuel water separator.

(2) Water Draw

- ✓ Locate water draw connection at the top of the tank.
- ✓ Remove threaded end cap.
- ✓ Install hand pump and manually pump water out of the tank into a bucket.
- ✓ Check to see if all the water has been removed with gauging paste. If there is still water in the tank keep pumping.
- ✓ Once all the water has been removed, remove the hand pump and replace the threaded end cap.
- ✓ Any water/fuel mixture collected from the tank water removal activity must be disposed of properly. Diesel/water fuel mixtures can be allowed to separate, and the diesel fuel can be disposed of in a smart ash burner. Gasoline/water fuel mixtures can be separated in a fuel water separator.

3.5 Recordkeeping

Records of all activities pertaining to the facility should be kept on location. These include but are not limited to:

COPIES OF INSPECTIONS

- Operator inspections
- Government inspections
- AST inspection reports
- Cathodic protection inspection reports

MAINTENANCE RECORDS

- Any major work done at the facility or on the tanks
- Annual hydrostatic test results
- As-built facility plans

OPERATOR TRAINING REPORTS

- Any training courses the operator attends

REPORTS OF SPILLS AT THE FACILITY

- Spill Prevention and Countermeasures (SPCC) Plans (EPA)
- Facility Response Plans (EPA, USCG)
- Letter of Intent to Operate (USCG)
- Operation Manual (USCG)
- Declaration of Inspection (USCG)
- Spill Notification Placard (ADEC)

FUEL INVENTORY RECORDS

- Fuel deliveries
- Manual gauging records
- Retail sales

GOVERNMENT REQUIRED RECORDS

- Spill Prevention and Countermeasures (SPCC) Plans (EPA)
- Facility Response Plans (EPA, USCG*)
- Letter of Intent to Operate (USCG*)
- Operation Manual (USCG*)
- Declaration of Inspection (USCG*)
- Spill Notification Placard (ADEC)

*USCG requirement if fuel is received by a marine vessel.

4 Common Tank/Facility Failures

Facility failures can cause major economic, environmental, and health impacts. This section highlights common causes and sources of leaks and spills and highlights the importance of proper operation and maintenance.

A. Operator Errors

It is the facility owner's responsibility to provide training opportunities for the operator. Once properly trained, it is the operator's responsibility to ensure that fuel transfer procedures are followed and that the facility is regularly inspected, tested, and maintained. The operator must take pride in the operation of their AST facility.

Poor transfer procedures such as not regularly monitoring tank levels, not properly isolating tanks through valve control, and not maintaining proper contact between delivery personnel can lead to fuel spills and leaks at the facility. Risks associated with poor transfer procedures can be avoided by having a clear written procedure that is followed every time there is a fuel transfer. Operators should know which valves close which tanks, which valves are typically left open to allow flow, and which valves are typically left closed.

Facilities should be inspected on a regular basis and the operator should keep records of all inspections. One of the most common issues that leads to a failure within the facility is when deficiencies are noted during an inspection, but the proper corrective action is not taken. If a part needs replaced, replace it. It is much cheaper in the long run to replace single components than a whole facility.

B. AST Problems

Monthly and annual inspections can help the operator identify issues that can lead to tank failures. It is important to take these inspections seriously. The most common culprits leading to tank failures include:

- **Interior Corrosion:** One of the main causes of corrosion on the interior of the tank is from water that settles at the bottom of the tank. It is important to routinely check for and remove water from your ASTs to prevent corrosion.
- **Exterior Corrosion:** Damage to the tank exterior coatings and direct contact with the ground can lead to surface rust and pitting of the tank exterior shell. Tank exterior shells should not be allowed to contact the ground. Any signs of rust or damage to the tank exterior coating should be quickly repaired.
- **Inadequate Tank Foundations:** Tanks that are not supported on tank saddles and a steel skid can roll over if the tank foundation and blocking is damaged. Tanks that are not supported on a stable foundation can over time, settle into the ground, leading to exterior tank corrosion from contact with the ground.
- **Improper Venting:** Improper tank venting can cause tanks to collapse in on themselves or rupture. As fuel levels and temperatures change in an AST, vapor pressures inside the tank can

increase or decrease. Vents allow air to flow into the tank and vapors to flow out of the tank and maintain a safe tank interior pressure.

During routine inspections, you may not be able to identify weakening tank walls or seams, or deficiencies in cathodic protection systems. It is important to have your facility tested and checked by certified inspectors.

C. Facility Piping Problems

Failures within the piping system can be managed by performing routine inspections and annual pressure tests. The most common culprits leading to failures in the piping system include:

- **Exterior Pipe Corrosion:** Pipes that are in direct contact with the ground, have damaged coatings, or are buried without corrosion protection, have a risk for corrosion.
- **Inadequate Pipe Supports:** Sagging or over-stressed pipes are prone to stress cracking, especially at threaded pipe joints and fixed connections.
- **Flex Fittings:** Flex fittings can be over stressed and fail from pipe misalignment or pipe expansion from temperature changes.
- **Threaded Pipe Joints:** Threaded pipe joints require a thread sealant to seal the pipe joint. As the sealant degrades over time or if the pipe joint is overstressed, threaded pipe joints can start to leak. Threaded joints should be routinely checked for leaks and repaired if required.
- **Vehicle Damage:** Fuel pipe systems are often installed next to vehicle traffic areas. Improperly marked fuel pipe systems can be easily damaged.
- **Valve Failures:** Damaged or worn out valves that leak or do not properly open and close can have serious impacts on how the system is operated, leading to fuel spills. If a valve is not shutting all the way, the operator cannot isolate parts of the system.

D. Secondary Containment Problems

Secondary containment is the last line of defense in the event of a large spill. If your tank farm's secondary containment is damaged, and fuel products are spilled in the containment area, the area around the tank farm will be contaminated. The most common problems that can affect the functionality of your secondary containment system include:

- **Inadequate or No Secondary Containment:** Single-wall fuel storage tanks are required to have a secondary containment system that will hold the entire tank's contents plus additional storage capacity for rainwater.
- **Torn or Punctured Secondary Containment System Liners:** A damaged liner will not be able to capture a fuel spill. Product will leak through tears and holes and flow out of the containment area. If the secondary containment system does not hold water after a rain event, some part of the liners is damaged.

- **Damaged Dike Walls:** Dike walls can be damaged from vehicles, heavy equipment, ground settlement and erosion from storm events. Make sure you are inspecting your walls and repairing any breaches.

5 Safety

AST facilities have several potential hazards. Operators should know what safety measures to take to avoid accidents and injuries from these hazards. Major topics covered under this section include:

- Fire and Explosion Safety/Prevention
- Facility Safety
- Personal Safety

5.1 Fire and Explosion Safety/Prevention

One of the biggest risks at a bulk fuel facility is that of fire or explosions caused by spills, pent up fumes, or numerous other factors. Fires and explosion risks can be greatly reduced by following the procedures outlined in previous sections. However, certain extra measures must still be taken to protect personnel and customers from accidental fuel or fume ignition.

A. Fire Protection

Petroleum products are flammable and many are also explosive if vapors are allowed to build up. Mitigating fire and explosion risks start with the operator but everyone involved with the facility, all the way down to the final end-users, must be involved with maintaining a safe facility.

- ✓ Facilities are designed and built with fire safety involved and are required to receive approval from the State Fire Marshal. Do not make any modifications to the facility layout without first consulting with the Fire Marshal or other authority having jurisdiction over your facility.
- ✓ Ensure that fire extinguishers are rated to extinguish “B” type fires. Fire extinguishers will have a letter code (for example: “ABC”) written on the label which corresponds to the different types of fires they are rated to extinguish. Place fire extinguishers in strategic locations throughout the facility and inspect them monthly for proper charge and pressure. Document inspections on the attached inspection card. All tank farm operators should be trained on how to use a portable fire extinguisher.
- ✓ Do not smoke in or around the AST facility. Post signs in conspicuous places stating that there is no smoking allowed throughout the facility. Ensure that customers do not smoke in or around dispensing facilities.
- ✓ Do not allow open flames or potential spark sources in or around the AST facility. Sparks or open flames can ignite flammable vapors and cause an explosion.
- ✓ Do not store nonessential items or materials such as empty gas cans, jerry jugs, used rags, or other items that can start or spread a fire at the AST facility.

Electrical Grounding

Proper grounding of AST facilities will help to mitigate accidental sparking due to static electricity buildup. Operators should periodically inspect grounding systems to ensure a continuous electrical connection

between tanks, pipes, electrical equipment, etc. and the facility's grounding system. Improper grounding of equipment can lead to explosions if fuel vapors build up and are ignited by a spark.

Hazard Communication Safety Data Sheets

The United States Occupational Safety and Health Administration (OSHA) requires that manufacturers, distributors, or importers of chemicals, including petroleum products, provide Hazard Communication Safety Data Sheets (SDS) (formerly known as Material Safety Data Sheets, or MSDS) that are kept onsite for each product stored at the facility. Employees should know their locations and the hazards associated with each product.

Additional information on SDS can be found at the following links:

https://www.osha.gov/Publications/OSHA3493QuickCardSafetyDataSheet.pdf

https://www.osha.gov/Publications/OSHA3492QuickCardLabel.pdf

https://www.osha.gov/Publications/OSHA3491QuickCardPictogram.pdf

5.2 Facility Safety

Maintaining a safe AST facility goes beyond just preventing slips, trips, and falls. Ensure that equipment is properly labeled, safety devices are functionally maintained, and proper communication is maintained.

General Operation and Safety Procedures

- ✓ Check that signs and labels are legible and in clear view for both facility operators and customers. If signs are dirty or worn, clean or replace them accordingly.
- ✓ Maintain open communications within the facility and with local emergency services.
  - Utilize two-way radio communication with other AST facility personnel and emergency services. Cell phone communication can be unreliable at times.
  - Keep an open channel with local emergency services.
- ✓ Maintain safety equipment in proper working order.
  - Verify that tank overfill devices, level indicators, and alarms are functioning as intended.
  - Always know where emergency shutoff switches are located. Ensure that they are clearly marked.
  - Fuel shutoff valves and their locations should also be clearly marked.
- ✓ Maintain facility security. Keep all unauthorized people out of the facility unless they are escorted by facility employees.
  - Ensure that all gates are closed and locked when the facility is not in use.
  - Change burned out lights as soon as they are spotted.
  - Verify that valves, tank lids, dispensing equipment, etc. are properly secured and locked when not in use.

5.3 Personal Safety

Personal safety is for more than just keeping you safe. Beyond protecting you from fuel spillage, cuts, object drops, or the weather, it also helps other people see where you are so that they can avoid you while operating equipment, or make sure that they are performing their duties in a safe manner.

Safety Equipment/Concepts

- ✓ Wear shoes with an OSHA certified safety toe.
- ✓ Wear eye protection when appropriate, particularly during fuel transfers.
- ✓ Wear hearing protection when appropriate.
- ✓ Wear gloves when working in cold temperatures or when handling materials or objects that may cause injury.
- ✓ Keep walkways and stairs free of ice and debris to avoid trips and falls.
- ✓ Make yourself aware of your surroundings. If someone is operating equipment, maintain verbal communications and eye contact as appropriate.
- ✓ Do not drink alcohol when on duty.

Additional information on safety equipment can be found at the following link:

https://www.osha.gov/OshDoc/data_Hurricane_Facts/construction_ppe.pdf

Climbing Onto Tanks and Tie-on Mechanisms

Sometimes it will be necessary to climb onto the tank to open inspection hatches, check safety valves, obtain fuel samples, or perform visual tank inspections. If use of a ladder is required to climb onto the tank the operator will need to properly secure the ladder base and use a spotter to ensure proper climbing safety. If the tank is not equipped with a fall protection guardrail, the operator must wear a fall protection harness and maintain 100% tie-off at all times. This means that there are two attachment points on the harness, one of which must be clipped in to ensure proper protection against falls.

Additional information on ladder and fall protection safety can be found at the following link:

https://www.osha.gov/Publications/OSHA3903.pdf

Confined Space Entry

It may sometimes be necessary for AST operators to enter confined spaces. Entry into confined spaces should not be taken lightly. This is a two-person operation that requires certain techniques to be followed so that in the event of an emergency the worker entering the confined space can be removed quickly, and without requiring the spotter to enter the space. Only personnel certified to enter confined spaces may perform work that requires them to enter into confined spaces. If you are unsure if a space is classified as a “confined space” do not risk it!

More information on confined spaces can be found at the following link:

https://www.osha.gov/OshDoc/data_Hurricane_Facts/confined_space_permit.pdf

Basic First Aid

Quick responses to accidents can save lives and prevent serious injuries. It is a good idea for AST facility operators to have basic first aid training.

- ✓ First aid training should include basic emergency response and cardiopulmonary resuscitation (CPR), if you have the proper training.
- ✓ Facility personnel should know the location of first aid kits and be familiar with their contents.

Some basic first aid responses for fuel incidents include:

- ✓ Vapor inhalation – move to fresh air immediately
- ✓ Skin contact with fuel – remove affected clothing and wash skin with clean water
- ✓ Eye contact with fuel – flush with clean water and seek medical help
- ✓ Ingestion of fuel – do NOT induce vomiting, seek immediate medical help
- ✓ For more direction on what to do in the event of a fire, contact with skin, eyes or inhalations, refer to SDS data sheets specific to the products within your facility.

6 Spill Preparedness

6.1 Facility Analysis and Inspection

Review your facility to identify areas and activities most likely to have a spill. Consider:

- ✓ Amount and type of product stored.
- ✓ Normal patterns of fuel usage such as distribution, transfers, etc.
- ✓ Direction spilled oil would flow.
- ✓ Sensitive areas to protect in the case of a spill.

Make a detailed labeled diagram or refer to your specific tank farm operation manual and identify high risk locations and areas where activities such as fuel transfer and distribution occur. Also, mark areas most susceptible to damage. The diagram should include, but is not limited to:

- ✓ All tanks to include bulk and day tanks.
- ✓ Piping including valves and headers.
- ✓ Secondary containment area.
- ✓ All buildings, fences, lights and location of fire extinguishers.
- ✓ Dispensing areas.
- ✓ Fire extinguishers
- ✓ Environmentally sensitive areas.
- ✓ Emergency shut-off switches.
- ✓ Spill flow paths.

6.2 Spill Response Equipment and Materials

Your facility review will help you to prepare for spills. The size, location, type of spill, and whether a spill is on land or water, will determine the response equipment you should have on hand as well as the spill response training necessary to respond to spills at the facility.

The following are examples of materials to have on hand and measures to take to reduce the impact in the event a spill occurs. Spill response materials and equipment should be placed in secure but readily accessible locations near potential spill areas.

Spill type	Preparedness materials and measures
Spills to land	sorbent pads, sorbent boom, picks, shovels, heavy-duty large trash bags
Spills to water	skirted boom, boats, anchors and rope, skimmers, sorbent boom
Spills during fuel transfer	catchment basins, booms and sorbent pads

Spills from leaks in the system	sorbent pads, drip pans, catchment basins, repair and patch materials

A. Spill Response Equipment and Materials Checklist

Appendix B includes a list of basic equipment and materials that should be kept on hand and readily available to respond to spills. You can use these lists to keep track of what you have in your spill kit to help you know when you need to order new supplies. These lists are basic and should be modified for your individual facility per your facilities SPCC plan.

All employees should know the location of all spill response equipment and materials and know how to use the equipment and materials in the case of a spill.

6.3 Operator Preparedness Training

The severity of spills can be minimized if operators are properly trained in facility operations and spill response, including proper use of spill response equipment and materials. It is recommended that facilities develop written training plans for each of their operators.

Areas of spill preparedness training include:

- ✓ **Operations:** Operators must be qualified and competent for conducting normal routine operations.
- ✓ **Inspections:** Operators must be familiar with the facility and its operations. This will enable them to conduct regular inspections and be able to recognize problems.
- ✓ **Maintenance:** Operators must be qualified to perform regular preventive maintenance. When necessary, a specialist should be called in.
- ✓ **Spill Preparedness:** Operators must be trained in procedures for storage, maintenance, inspection and periodic testing of oil spill response equipment and materials.
- ✓ **Spill Response:** Operators must be trained in deployment of spill response equipment and materials, safety, first aid, spill reporting, and response actions. At a minimum, they should participate in annual drills.
- ✓ **Hazardous Material Handling (HAZMAT):** Operators must be trained in safety, be aware of potential hazards and proper fuel handling procedures.
- ✓ **First Aid/Cardiopulmonary Resuscitation (CPR):** Operators should have basic first aid training with emphasis on identifying and responding to health emergencies due to fuel exposure. It is a good idea for operators to know CPR.

6.4 Spill Response Plans

Facility spill response plans should be working documents. Operators and responders should be familiar with their location and contents. These plans should:

- ✓ List whom to notify, along with telephone numbers, of a spill or call for help.
- ✓ Describe the actions to be taken in the event of a spill.
- ✓ Describe deployment strategies for spill response equipment and materials.

- ✓ Discuss the protection of critical and sensitive areas.
- ✓ Describe the recovery of spilled product.
- ✓ Describe the proper management of recovered product and contaminated soil and other materials such as sorbents.
- ✓ Discuss safety considerations.

6.5 Community Spill Response Program

The Alaska Department of Environmental Conservation (ADEC) provides immediate response capability in many villages and communities in Alaska. This service is available because of partnership agreements with local communities, spill response cooperatives and response action contractors. The intent of the agreements is to give local communities and villages the ability for immediate spill response. This is necessary to immediately contain and control releases to reduce the impact on public health and the environment as other responders or resources are traveling to the site. These agreements include stationing response packages in specified areas and providing training to local responders in equipment use.

Each response package is under the control of the State On-Scene Coordinator for the area in which it is located. Packages include spill response material and equipment for the types of hazards that exist in the area. An example of a spill response container inventory is included at the end of this section. In the event of a spill, the situation will be assessed and the response managed by ADEC area staff or by personnel responsible under a "Local Response Agreement." More information concerning the Community Spill Response Program can be found here: *http://dec.alaska.gov/spar/ppr/local_resp.htm*

7 Spill Response and Reporting

7.1 Detecting Oil Spills

Sometimes oil spills are not as easy to detect, as one would think. The following are some tips to help determine if you have spills or leaks at your facility:

- ✓ Visible spilled product on the ground.
- ✓ Sheen on water.
- ✓ There is a smell of fuel in the air.
- ✓ The inventory does not reconcile.
- ✓ Dead or oiled fish, birds or small mammals.
- ✓ Dead vegetation around the facility.
- ✓ There is a smell or taste in the drinking water.
- ✓ Sounds such as spraying liquids, a high pitch release from a pressure vessel, etc.
- ✓ Staining on the outside of tanks or pipes, especially at seams or joints.

Spills can happen anywhere but most often from tops of tanks during overfills, at the bottom of tanks due to corrosion, and from any connection to the tank from pipes. Pipes can leak from any connection or valve. Dispensing areas and fuel transfer points require additional attention due to the risk of operator error.

7.2 Spill Response

When you determine that you have a spill at your facility, immediate action must be taken. This section is a description of recommended steps to take and whom to notify. Appendix B includes a **"Spill Response Checklist"** which is an abbreviated version of this section. The checklist may be copied, modified for your facility, and used as you see fit.

Note: The procedures outlined should be considered recommendations. Every spill is different and your response should be guided by your capabilities and equipment limitations.

A. Initial Defense Actions

1) **Survey the incident.** From a safe distance, using senses of sight, hearing and smell, take note of:
   - ✓ Source of release (tank, pipe, valve, drum, etc.).
   - ✓ Product spilled - look at labels and markings (gasoline, diesel, etc.).
   - ✓ Occupied buildings that may be threatened.
   - ✓ Public areas and environmentally sensitive areas that may be threatened.

Safety First – Human Lives and Safety are the Most Important.

2) **Call for help.** Let others know where you are, what you are doing and what they can do to help. This may save your life as well as reduce the impact from the spill. Call:

- ✓ Facility Owner or Manager
- ✓ Local Fire Department
- ✓ Local Responders
- ✓ Local Law Enforcement
- ✓ Local Medical Personnel

3) Analyze the incident

- ✓ Collect hazard information on product spilled (refer to SDS sheets).
- ✓ Predict the likely behavior of the spilled product (flow direction, etc.) as well as what may have happened to the source container.
- ✓ Estimate the extent of the spill and the potential for harm to humans and the environment.

4) Protect the public

- ✓ Keep non-emergency and unauthorized personnel away from the facility and the spill area.
- ✓ Evacuate areas downwind and stay upwind of the spill – fumes can cause safety and health problems.
- ✓ Control the scene and ribbon off the spill area to keep the public away from the spill.
- ✓ Know when to stay away (explosive hazard, etc.).
- ✓ Have public service announcements made to ask others to avoid the facility and spill area.

5) Plan a response

- ✓ Identify response objectives based on the analysis.
- ✓ Determine initial responder and equipment needs.
- ✓ If needed, contact ADEC for access to additional response equipment located in "Local Response Containers."
- ✓ Conduct a safety briefing with all responders.

6) Protect yourself

- ✓ Wear appropriate personal protective gear.
  - o Hardhat
  - o Rubber and/or safety toed boots
  - o Respirator
  - o Disposable suit or rain gear
  - o Eye protection
  - o Neoprene gloves
- ✓ Watch out for symptoms of heat and cold stress.
- ✓ Establish personnel decontamination station prior to entry.

7) Verify spill source–determine and verify where the spill is coming from.

- ✓ Tanks
  - o Check vents for evidence of spill product from overfill or heat expansion.

- Look at tank shell seams for rupture, leaking welds, missing bolts or rivets, or any other damage or flaws.
- Check the shell to bottom seam for corrosion, leaking welds or other damage.
- Check tell-tale pipes or other leak detection devices.
- Check man-way covers and other tank penetrations for leaks.

✓ Piping
- Check to see if any pipes are cracked or broken.
- See if the valves are in the correct position – open or closed.
- Look for broken or leaky joints.
- Check connections with the tank.

Other sources – Look around to see if the spilled oil could be coming from another source such as a vehicle parked on the premises, or drums stored near or in the facility.

Planned Response Actions – Use the "BUDDY SYSTEM"

8) Control the spill

✓ Stop transferring fuel immediately if the spill occurs during a transfer.
✓ Know the location of all emergency shut off equipment, both electrical and mechanical.
✓ Close the valves upstream of the leak to stop the flow of product.
✓ Place buckets or basins under a leak from a pipe or valve.
✓ Apply a temporary patch over a leaky pipe or tank.
✓ If a spill is from a damaged tank, transfer fuel to another tank.

9) Contain the spill as soon as possible – the quicker the spill is contained, the less potential for danger to humans and less impact to the environment

✓ Use spill response tool kits – shovels, absorbents, etc.
✓ Follow deployment strategies outlined in the Spill Response Plan.
✓ For winter spills
- Pile snow to form a dike around the spilled product

✓ Dig ditches in ice and line with plastic to contain the spill
✓ For summer spills
- Use dirt and mud to form a dike around the spilled product
- Dig a ditch and line with plastic to divert product way from streams or other bodies of water and to collect fuel

✓ Pay particular attention to sensitive areas
- Drinking water sources
- Residential areas
- Commercial areas
- Fish and wildlife habitat
- Culturally sensitive areas

10) Recover and CLEAN up spilled product

Recover: Recover captured product before it hits the water by pumping to or picking it up with skimmers, vac-trucks or absorbent materials. Put the recovered product into tanks, drums or bladders.

Clean: Clean contaminated equipment, tanks, pipes or other objects in a way that controls run off **fr**om the cleaning operation.

Remove: Removed contaminated grasses, brush and other debris and place in large trash bags for proper disposal.

B. Spill Reporting

Notify Owners and Authorities – When a spill is noticed, call the following individuals and agencies immediately (Fill in the correct numbers below):

- ✓ Your Facility Owner or Manager

- The Alaska Department of Environmental Conservation *https://dec.alaska.gov/spar/ppr/spill-information/reporting*

During normal business hours:

Southern Response Area: (907) 465-5340

Central Response Area: (907) 269-3063

Northern Response Area: (907) 451-2121

Outside normal business hours:

1-800-478-9300

The National Response Center (EPA and USCG)

1-800-424-8802

Make sure signs with appropriate contact numbers are visibly posted in the facility. Also make sure notification signs are visible so others can see them in the event of a spill when the facility is closed. Notifications signs are available from ADEC free of charge.

8 Regulatory Requirements and Compliance

This section summarizes the various requirements from State and Federal agencies. Some of these regulations may not apply to your particular facility. It is the AST Operator's responsibility to familiarize themselves with the applicable regulatory requirements specific to their facility.

U.S. Environmental Protection Agency (EPA) Requirements Overview

- ✓ Spill Prevention Control and Countermeasure (SPCC) and/or Facility Response Plans
- ✓ Personnel training in the prevention, containment, removal and disposal of spilled oil
- ✓ Inspection and maintenance program to a recognized industrial standard
- ✓ Proper selection and construction of spill prevention systems which include dikes, liners, pumps, absorbent boom, etc.

Environmental Protection Agency

Law: Clean Water Act

Regulation: 40 CFR 112: Oil Pollution Prevention

https://www.epa.gov/sites/production/files/2014-04/documents/b_40cfr112.pdf

Applicability: Owners or operators of facilities engaged in drilling, producing, gathering, storing, processing, transferring or consuming oil or oil products, providing:

- ✓ The facility is non-transportation related
- ✓ Aggregate aboveground storage capacity is 1,320 gallons and the minimum container size is 55 gallons
- ✓ Facilities, which due to their location, could reasonably expect spilled oil to reach waters of the United States

A. Spill Prevention, Control and Countermeasures (SPCC) Requirements: The SPCC regulation specifies several major oil spill control requirements:

- **Secondary Containment:** diking or other structural containment or their equivalent must be provided. It must be large enough to hold the contents of the largest tank plus allowance for precipitation (usually 10% of the largest tank). Diked areas must be sufficiently impermeable to contain spilled oil.
- **Tank Installations:** must be fail-safe engineered to prevent spills. Tanks must have at least one of the following:
  - ✓ High level liquid level alarms, audio or visual

- ✓ High level liquid cutoff device
- ✓ Direct audible or code signal communication between gauge and pump station
- ✓ Fast response system for determining fuel level, this would be a computerized system or direct visual gauges

- **Tank Material and Construction:** must be compatible with stored product and local conditions such as temperature.

- **Fencing, Locks and Lighting:** Oil storage facilities must be fenced and the gate locked or guarded when the facility is unattended. Facility type and location must be considered when selecting and installing lighting. It should prevent vandalism and help detect spills at night.

- **Operations and Maintenance:** Aboveground tanks, foundations, and supports must have periodic integrity tests, using methods such as hydrostatic testing, visual inspection or non-destructive shell thickness testing. Records of test results must be kept so they may be compared and variances identified.

- **Piping Requirements:** Buried piping must have a protective coating or wrapping and must be cathodically protected. All aboveground valves and piping must be examined regularly and assessments made. Underground piping that becomes exposed must be inspected.

- **Training Requirements:** AST facility owners and operators are responsible for training oil handling personnel in operations and maintenance of equipment to prevent discharges, discharge procedures, protocol and Spill Prevention, Control and Countermeasure Plans.

- Facility owners and operators are liable for civil penalties for SPCC violations.

B. SPCC Plan Requirements: AST facilities are required to prepare SPCC Plans.

https://www.epa.gov/oil-spills-prevention-and-preparedness-regulations

These are procedural and contingency plans that play an important safety role for facility owners and operators. In case of a spill, it is necessary to have a well thought-out and systematic response and cleanup plan that can be implemented immediately.

- SPCC plans must be written and implemented before beginning operations.

- Plans must be kept at the facility if it is in operation at least four hours a day and must be available for EPA inspection.

- Plans must be prepared in accordance with good engineering practice and certified by a registered professional engineer.

- Plans must be reviewed and updated every five years.

- Plans must discuss spill prevention, staff training, inspections, security, spill reporting, equipment and operations.

- SPCC plans must describe training, equipment testing, and periodic unannounced drills. They must also describe facility personnel response actions to be carried out under the plan to ensure facility safety and to mitigate or prevent a discharge or the substantial threat of a discharge.

- Plans must provide for appropriate containment, drainage control structures or equipment at the facility to prevent discharged oil from reaching navigable waterways.

A link of the checklist that the EPA uses when reviewing SPCC plans is included:

https://www.epa.gov/sites/production/files/2014-07/documents/onshore_production_checklist_june_2014_for_web.pdf

C. Facility Response Plan: In addition to a SPCC plan, certain facilities need to prepare a Facility Response Plan (FRP).

Applicability: Facility Response Plans must be prepared by owners or operators of non-transportation related facilities that, because of their location, could reasonably cause "substantial" harm to the environment by discharging oil into or on navigable waters or adjoining shorelines. EPA considers a facility to pose a potential for causing substantial harm if it *transfers oil over water to or from vessels and has a total storage capacity greater than or equal to 42,000 gallons.*

EPA has the authority to require a facility to prepare or revise a Facility Response Plan at their discretion. Factors that the EPA considers when evaluating a facility include:

- ✓ Oil storage capacity
- ✓ Type of transfer operation
- ✓ Secondary containment
- ✓ Proximity of fish and wildlife and sensitive environments
- ✓ Proximity of drinking water intakes
- ✓ Spill history
- ✓ Age of oil storage tanks
- ✓ Other site specific considerations determined relevant by the EPA
- ✓ Petition from any person, including the general public, who believes your facility has the potential to cause substantial harm to the environment according to the above-listed considerations

A link to the flowchart the EPA provides for determining whether a Facility Response Plan is needed is *included:*

https://www.epa.gov/sites/production/files/2014-04/documents/h_frp_c1_cfr-2013-title40-vol23-part112_39.pdf

Plan Requirements: A Facility Response Plan (FRP) describes preparations, procedures, training and actions for responding to oil discharges at a facility. FRP's must:

- ✓ Be submitted to the EPA for review and approval.

- ✓ Include an emergency action plan that describes personnel and procedures in place to respond to spills.
- ✓ Describe external response resources and arrangements for responding to a worst case discharge.
- ✓ Plan for the worst-case scenario.
- ✓ Provide details of plan implementation.
- ✓ Provide training, drill exercises and self-inspections to support Facility Response Plan implementation.

D. Training: The facility owner or operator must develop and implement a training program. This must include evaluation procedures and drills and exercises for those personnel involved with oil spill response and clean-up activities.

United States Coast Guard (USCG) Requirements Overview

- Submission of a “Letter of Intent to Operate”
- Submission and approval of a “Facility Operations Manual” and a “Facility Response Plan”
- Facility operations must include procedures and equipment for fuel delivery from a vessel (Barge) including:
    - Designated qualified person in charge of the fuel transfer operation
    - Personnel training and response drills
    - Safety requirements
    - Record keeping

United States Coast Guard

Law: Clean Water Act and Oil Pollution Act

Regulation: 33 CFR 154 Facilities Transferring Oil or Hazardous Material in Bulk

https://www.federalregister.gov/select-citation/2016/08/23/33-CFR-154

33 CFR 156 Oil and Hazardous Material Transfer Operations

https://www.federalregister.gov/select-citation/2016/08/23/33-CFR-154

General Applicability: This law requires fixed or mobile marine transportation related (MTR) facilities that are capable of transferring oil to or from vessels with a capacity of 10,500 gallons (250 barrels) or more.

These United States Coast Guard (USCG) regulations apply to marine transportation related (MTR) facilities that:

- Are fixed facilities capable of transferring oil or hazardous material in bulk to or from a vessel with a capacity of 250 barrels (10,500 gallons) or more.

- Are mobile facilities and are used or intended to be used to transfer oil or hazardous material in bulk to or from a vessel with a capacity of 250 barrels (10,500 gallons) or more.

- Have been notified in writing by the Captain of the Port that all or portions of 33 CFR 154.735 (Safety requirements) may apply to each facility that is capable of transferring oil or hazardous material in bulk, only to or from a vessel with a capacity of less than 250 barrels (10,500 gallons).

Requirements: These bulk fuel transfer regulations require certain facilities to notify the USCG of their fuel-related activities and to prepare Operations Manuals and Facility Response Plans. The following is a summary of the USCG requirements:

- **Submit a "Letter of Intent to Operate"** to the Captain of the Port. The letter must include the name, address and telephone number of the operator as well as the name, address and geographic location of the facility.

- **Submit for review a "Facility Operations Manual":** This manual must describe how operating rules and equipment requirements will be met as well as the responsibilities of personnel who conduct the transfers.

- **Test and maintain transfer hosing and piping:** Transfer pipes and hoses must be hydrostatically tested at least once a year. Test records are to be kept at the facility.

Owners or operators are liable for oil spill removal costs as well as civil and potentially criminal penalties.

Inspections: USCG personnel conduct periodic inspections of MTR's. During these inspections they will look for:

- **Required documents** including a Letter of Intent to Operate, Facility Operations Manual, Facility Response Plans, copies of the Declaration of Inspection and results from hydrostatic tests done on transfer pipes and records for exercises (QI Notification, Spill Management Team Tabletop Exercise, and equipment deployment).

- **Safety equipment** such as fire extinguishers, lighting, fencing and "No Smoking" Signs.

- **Spill response material and equipment** making sure there is an adequate amount and noting where it is located.

Alaska Department of Public Safety (Fire Marshal) Requirements Overview

Facility plans are to be submitted for review and approval by the Fire Marshal prior to building a new facility, any repairs, alterations or changes that may affect the fire safety of the storage tank facility

Alaska Department of Public Safety
Division of Fire and Life Safety (Fire Marshal)

Law: Alaska Statute 18.70.080

www.touchngo.com/lglcntr/akstats/Statutes/Title18/Chapter70/Section080.htm

Regulation: 13 AAC 50 Fire Prevention Codes and Standards from the International Fire Code (IFC) and International Building Code (IBC)

http://www.touchngo.com/lglcntr/akstats/aac/title13/chapter050.htm

Applicability: The IFC and IBC apply to all persons without restriction unless they are specifically excluded, that store, use, dispense, mix and/or handle flammable and combustible liquids.

Requirements: The state has adopted the National Fire Protection Agency standards to regulate all building types according to their use and occupancy. The IFC has been adopted to safeguard life and property from the hazards of fire and explosion arising from storing, handling and using hazardous substances, materials and devices and from other conditions hazardous to life and property.

Before beginning construction, alterations or repairs to a facility, specifications and plans must be submitted to the state Department of Public Safety, Division of Fire and Life Safety (Fire Marshal), Plan Review Bureau for review and approval.

Alaska Department of Environmental Conservation Overview

- Spill Reporting
- Posting of spill notification information
- Cleanup and disposal of spilled product and contaminated materials

Alaska Department of Environmental Conservation

Law: Alaska Statute 46 Water, Air, Energy and Environmental Conservation

Regulation: 18 AAC 75 Article 3, Oil and Hazardous Substances Pollution Control, Discharge Reporting, Cleanup and Disposal

Click here to access the regulation: 18 AAC 75, Article 3

Applicability: The Alaska Department of Environmental Conservation (ADEC) regulations apply to all persons, without restriction, in charge of a facility or operation that has a discharge of a hazardous substance

Posting of Information: A facility that has a total storage capacity of more than 1,000 gallons, either aboveground or underground, must post an ADEC approved discharge notification placard.

http://dec.alaska.gov/media/1483/spillreportingplacard-102017.pdf

A. **Reporting Requirements:** Persons in charge of a facility or operation that has a release of a hazardous substance (including petroleum products) must report it to ADEC according to the following criteria: *http://dec.alaska.gov/spar/ppr/spill-information/reporting*

- A discharge of a hazardous substance other than oil, a discharge of any amount to water, or a discharge of oil to land in excess of 55 gallons must be reported as soon as the person has knowledge of the discharge.

- If a discharge is less than 55 gallons but more than 10 gallons, or it is more than 55 gallons but into impermeable secondary containment, it must be reported within 48 hours of the time the person has knowledge of the discharge.

B. Clean-up: Immediately upon becoming aware of a hazardous substance discharge to the lands or waters of the state, any person responsible for that discharge shall contain, clean up and dispose of the material collected using methods that have been approved by ADEC.

http://dec.alaska.gov/spar/csp/guidance/cleanup_process.pdf

C. Class 2 Facility Regulations: The Class 2 facility regulations 18 AAC 75.835 - 18 AAC 75.849 (PDF 723K) were adopted by ADEC on April 21, 2017, signed by the lieutenant governor on May 25, 2017, and have been effective as of June 24, 2017.

The purpose of the regulations is to create a statewide inventory of a newly-designated classification of aboveground storage tank facilities. Class 2 facilities do not include residential properties (i.e. home heating oil tanks.)

Class 2 Facilities Include:

- ✓ Onshore Facilities
- ✓ A storage capacity equal to or greater than 1,000 gallons and less than 420,000 gallons (Total storage capacity includes aboveground tanks 1,000 gallons and greater)
- ✓ Storage of non-crude oil (petroleum-based, motor fuels, jet fuels, heating oil, residual fuel oils, lubricants, and used oils)

Regulations require that all Class 2 facilities must complete and submit to ADEC a Class 2 Facility Registration and Notification Form. More information on Class 2 Facility Regulations and a copy of the Class 2 Facility Registration and Notification Form can be found at:

http://dec.alaska.gov/spar/ppr/prevention-preparedness/class-2-facilities/

APPENDIX A - GLOSSARY

Aboveground Storage Tank (AST) - A cylindrical container, used for storing fuels and fuel products, that is situated either horizontally or vertically and has the entire bottom supported on the ground, on saddles or other supports.

Aboveground Storage Tank Facility = ***Tank Farms =Facility***- Storage tanks, piping, secondary containment and other features associated with the tanks.

Appurtenance – Accessory attached to an AST such as, vents, hatches, overfill devices, etc.

Bulk Storage Tank – an AST with capacity greater than 12,000 gallons.

Capacity – The largest amount of fuel an AST can hold.

Cathodic Protection – A system using impressed current or sacrificial metals to prevent and reduce corrosion from occurring on tanks and piping.

Confined Space – A space that has limited openings for entry and exit, poor ventilation and could contain or produce dangerous concentration of air contaminants.

Control Panel – Electric system that governs the operation of the equipment within a facility.

Corrosion – Gradual destruction of metals caused by reactions with their environment. A common type of corrosion is rust found on iron and steel structures.

Declaration of Inspection (DOI) – A form, required by the U.S. Coast Guard, describing procedures that will be used during fuel transfer.

Dispensing Tank – an AST with capacity less than 12,000 gallons used to transfer product out of the facility.

Distribution Piping – Piping, valves and gauges between tanks at the facility and other associated tanks such as day tanks.

Fuel Header – Connection used by barge, truck or cargo plane for fuel deliveries to the tank farm.

Gross Volume –Measured volume of product inside a tank

Grounding – Safety measure to prevent people and equipment from being exposed to electric hazards. Grounding removes built up electric charge from objects by transferring the charge to the ground.

HAZWOPER – Hazardous Waste Operations and Emergency Response

Hydraulic Hammer – An event that can occur when the valves at the tank farm are shut down before pumping on the barge stops. The high pressure in the piping or hoses causes them to jump in a snake-like manner. This could cause pipes to crack or break.

Hydrostatic Test – A test, using water, to check for soundness and leaks in tanks and piping. For tanks the test consists of filling the tank with water to the maximum design liquid level and holding it there for

a period of time. For pipes and hoses the test consists of filling the pipes or hoses with water at a pressure higher than normal and leaving it there for a period of time.

Industry Standards – Documents developed by professionals, that provide guidelines for designing, operating and maintaining facilities in a safe, organized and functional manner.

Manifold Piping – Piping and valves between tanks and dispensing pump.

Meter – Measuring device used to quantify how much fuel is dispensed from a facility.

***NACE* – National Association of Corrosion Engineers -** Professional organization that publishes standard practice, test methods and material requirement standards for corrosion protection. A NACE certified inspector has completed training courses for cathodic protection and/or coating.

Net Volume – Volume of product inside a tank with temperature at 60°F. Net volume is a calculated value where a temperature correction factor is applied to the measured volume.

Safety Data Sheet (SDS) – A form, provided by manufacturers, that contain information about chemical composition, physical and chemical properties, health and safety hazards, emergency response and waste disposal. These forms were formerly called Material Safety Data Sheets (MSDS,) and it is not uncommon to see either title.

Operator – Person responsible for handling fuel and performing routine tasks at the facility.

Owner – Legal entity having control and responsibility for the operation and maintenance of a facility.

Product – the gasoline and/or diesel fuels transferred, stored, and dispensed from a tank farm.

Pump -- A mechanical device used to raise or move product into, within, and out of a facility.

Recovered Waters – Water that has gone through a cleaning process to remove fuel products.

Response Plans – A document required by the U.S. Coast Guard and Environmental Protection Agency, which describes the preparations, procedures, training and actions necessary for responding to discharges of oil at a facility.

Safe Gauge Height – How much fuel the tank can safely hold, allowing for expansion due to temperature variations.

Secondary Containment – The area around tanks that is enclosed by double walls, dikes, berms, and/or liners. It is designed to hold petroleum products should a spill occur.

Spill Prevention Containment and Countermeasures (SPCC) Plans – A document required by the U.S. Environmental Protection Agency, describe training, equipment testing, drills and response actions carried out under the plan, to ensure safety of the facility and to mitigate or prevent a discharge or substantial threat of a discharge.

Sorbent – A material used to absorb liquids. For bulk fuel facility applications, sorbents are used to absorb spilt gasoline and diesel products floating on top of water. Sorbents can include brooms, pads, and rolls.

Tank Capacity Chart – Table that lists incremental fuel levels and corresponding gallons of fuel remaining in a tank based on a tank's dimensions.

Temperature Correction Factors – Table value based on temperature and type of product used to calculate net volume of a product as 60°F.

Transfer Piping – Pipes, hoses, valves and gauges associated with carrying fuel from a barge or other delivery source to tanks.

Valve – A device used to control the passage of product through piping.

APPENDIX B – BLANK FORMS AND CHECKLISTS

DAILY SYSTEM STARTUP/SHUTDOWN PROCEDURE

DISPENSING PROCEDURE

DISPENSING TANK FILLING PROCEDURE

OFFLOADING PROCEDURE

DECLARATION OF INSPECTION (DOI) FORM

MONTHLY INSPECTION CHECKLIST

SPILL RESPONSE EQUIPMENT CHECKLIST

SPILL RESPONSE PROCEDURE CHECKLIST

DAILY SYSTEM STARTUP/SHUTDOWN PROCEDURE

AT THE BEGINNING OF THE DAY

- ☐ Check for spills
- ☐ Check valve positions
- ☐ Turn on control panels
- ☐ Check storm water levels
- ☐ Check gauges in dispensing tanks

AT THE END OF THE DAY

- ☐ Turn appropriate Control Panels off
- ☐ Check valve positions
- ☐ Close and lock security gates

DISPENSING PROCEDURE

- [ ] Unlock security gate
- [ ] Open appropriate fuel dispenser valve
- [ ] Turn on dispenser pump
- [ ] Set fuel meter
- [ ] Verify meter is working
- [ ] Dispense desired quantity of fuel
- [ ] Turn off dispenser pump
- [ ] Close appropriate valves
- [ ] Lock security gate

DISPENSING TANK FILLING PROCEDURE

- ☐ Check fuel level in dispensing tank
- ☐ Check fuel level in the storage tank you will be dispensing from
- ☐ Use valves to isolate the piping between the bulk tank you will be pumping from and your dispensing tank you will be pumping into.
- ☐ Unlock and open valves between selected bulk tank and dispensing tank
- ☐ Discontinue all other transfer operations
- ☐ Turn on transfer pump
- ☐ Monitor tank levels throughout transfer
- ☐ Shut off transfer pump when dispensing tank reaches 90% full
- ☐ Close valves between bulk tank and dispensing tank

OFFLOADING PROCEDURE

BEFORE TRANSFER BEGINS

- ☐ Check product levels in EACH tank
- ☐ Develop a product receiving plan
- ☐ Walk pipeline and check for visible leak
- ☐ Confirm fire extinguishers are in place
- ☐ Remove storm water
- ☐ Check that all valves between the tanks and header are CLOSED
- ☐ Meet barge operator and go over the Declaration of Inspection (DOI)
- ☐ Determine how much fuel is above the receiving pipe inside the tank
- ☐ Ensure all personnel are available and prepared

DURING TRANSFER:

- ☐ Connect transfer hose to the header
- ☐ Open valves between marine header and designated tank to be filled
- ☐ Start transfer at a reduced rate
- ☐ Remain on site during entire transfer
- ☐ Maintain communication between barge operator at all times
- ☐ Check tank level at regular intervals
- ☐ Reduce transfer rates when nearing the SGH
- ☐ Notify Barge Personnel when transfer is almost complete
- ☐ Turn off barge pump BEFORE closing tank valves
- ☐ Close and Lock tank valves
- ☐ Repeat for each tank in the order specified in the receiving plan

WHEN TRANSFER IS COMPLETE:

- ☐ Close all valves between header and manifold
- ☐ Remove hoses from header and replace end caps
- ☐ Meet with Barge Operator and sign off on DOI
- ☐ Wait at least 30 min to gauge tanks
- ☐ Wait at least two days before checking for water within the tank.

DECLARATION OF INSPECTION FORM (DOI)

Date:	Time:	Location:
RECEIVING UNIT		
DELIVERING UNIT		
Federal regulations require the following inspections and activities to be executed by the person in charge (PIC) of a fuel transfer.		

	Deliverer		**Receiver**	
1. RED WARNING SIGNS AND SIGNALS must be displayed and visible from all points around the vessel. At night, when transferring at anchor a red light will not be displayed.				
2. FIRES, FLAMES, SMOKING AND MATCHES, if permitted, must be managed so vapors do not reach cargo. Smoking areas must be designated, inspected and safe.				
3. REPAIR WORK – in the way of any cargo spaces must be approved by the PIC.				
4. VESSELS COMING AND/OR REMAINING ALONGSIDE must have the approval of the PICs during transfers.				
5. THE MOORING must ensure the safety of the vessel and transfer device through all conditions of tide and weather.				
6. THE TRANSFER DEVICE must, when connected, be under no strain with the vessel at the limits of its moor, be properly supported, be blanked when not in use and be connected to fixed piping or equipment with an automatic back pressure nozzle.				
7. THE TRANSFER SYSTEMS must be aligned to permit the flow of fuel and closed or blanked off when not in use.				
8. THE OVERBOARD DISCHARGES/SEA SUCTIONS must be closed, lashed and sealed during transfer.				
9. SCUPPERS AND DRAINS must be mechanically closed.				
10. THE CONNECTIONS must be leak free, except packing glands providing the leakage does not exceed containment.				
11. DISCHARGE CONTAINMENT must be available or deployed, if applicable and drip pans or drain tubs be placed appropriately.				
12. MONITORING DEVICES must be in place and operable.				
13. COMMUNICATIONS must be maintained throughout the transfer				
14. THE EMERGENCY SHUTDOWN must be tested and operable prior to starting the transfer.				
15. THE PICS of both units must be at the transfer site, immediately available to oil transfer personnel, have readily available operations or procedures manuals and conduct the operations in a manner consistent with the documents.				
16. SUFFICIENT PERSONNEL must be on duty and conduct the operation as instructed in the operations manual or transfer procedures.				

DECLARATION OF INSPECTION FORM (DOI)

Date: Time: Location:				
RECEIVING UNIT				
DELIVERING UNIT				
	Deliverer		**Receiver**	
17. LANGUAGE USED must be common to both PICs, or an interpreter who is fluent in both languages, available at the transfer site.				
18. AGREEMENT TO BEGIN TRANSFER must be reached by the PICs and both of them must sign both DOIs prior to beginning the transfer				
19. LIGHTING must be available between sunset and sunrise.				
20. PRETRANSFER CONFERENCE must take place prior to the transfer and include discussion of:				
a. The product to be transferred				
b. Sequence of transfer operations				
c. Name, title, location of persons taking part in the transfer				
d. Critical details of each system				
e. Critical stages of transfer operation				
f. Federal, state and local regulations that apply to transfer				
g. Emergency procedures for each system				
h. Discharge containment procedures				
i. Discharge reporting procedures				
j. Watch and shift change procedures				
k. Transfer shutdown procedures				

PRODUCT TRANSFER SEQUENCE

	PRODUCT			QUANTITY		PSI			
First									
Second									
Third									

	Signature	Title	Time/Date
Delivering PIC			
Receiving PIC			

SIGNATURES UPON COMPLETION OF TRANSFER OPERATION

Delivering PIC			
Receiving PIC			

AST FACILITY MONTHLY INSPECTION FORM

Facility Name:

Inspector: | **Date:**

#	ITEM	PASS (P)	FAIL (F)	COMMENT/CORRECTIVE ACTION	INITIAL
1	**Housekeeping**				
1a	Housekeeping	P	F		
2	**Safety**				
2a	Fire extinguishers *Adequate, accessible, charged*	P	F		
2b	Signage: NOT SMOKING *Posted and visible*	P	F		
2c	Signage: DANGER & WARNING *Posted and visible*	P	F		
3	**Security**				
3a	Fencing *Intact and locked*	P	F		
3b	Lightning *Adequate and functioning*	P	F		
4	**Aboveground Storage Tanks**				
4a	Soundness *No visible leakage*	P	F		
4b	Signs of Corrosion *No signs of rusting or corrosion*	P	F		
4c	Cathodic Protection System	P	F		
4d	Grounding *No damage and fully connected*	P	F		
4e	Signage *product, capacity, hazard rating*	P	F		
4f	Paint *No peeling or cracking*	P	F		
4g	Normal Vents *Clear*	P	F		
4h	Emergency Vents *lift freely*	P	F		
4i	Gauges *Working, calibrated*	P	F		
4j	Overfill Devices *Tested, working*	P	F		
4i	Check for Water *Water present*	P	F		
4f	Foundations *Solid, no cracks or rotting*	P	F		

AST FACILITY MONTHLY INSPECTION FORM

Facility Name:

Inspector: | **Date:**

#	ITEM	PASS (P)	FAIL (F)	COMMENT/CORRECTIVE ACTION	INITIAL
5	**Piping System**				
5a	Soundness *No visible leakage, dips, or cracking*	P	F		
5b	Signs of Corrosion *No signs of rusting or corrosion*	P	F		
5c	Cathodic Protection System	P	F		
5d	Supports *Adequate and intact*	P	F		
5e	Valves *No visible leakage, working*	P	F		
5f	Protection *From falling snow, ice, and traffic*	P	F		
5g	Coating, Wrapping and Paint *Wear, tear, and chipping*	P	F		
5h	Dispenser Unit *Wear, leaks, rust*	P	F		
5i	Control Panel *Damage, working properly?*	P	F		
6	**Secondary Containment**				
6a	Dike Soundness *adequate*	P	F		
6b	Liner Soundness *Free of rips, tears, non essential penetrations*	P	F		
6c	Clear *No standing water, snow, ice or vegetation*	P	F		
7	**Spill Prevention and Response**				
7a	Response Plan *Located at facility*	P	F		
7b	Response Equipment *Adequate, located on site*	P	F		
8	**State/Federal Requirements are Met**				
8a	ADEC *Spill notification placard where it can be seen*	P	F		
8b	EPA	P	F		
	Spill Prevention Control and Countermeasure Plan (SPCC) on site	P	F		
	Facility Response Plan (FRP) on site	P	F		

AST FACILITY MONTHLY INSPECTION FORM

Facility Name:

Inspector: | **Date:**

#	ITEM	PASS (P)	FAIL (F)	COMMENT/CORRECTIVE ACTION	INITIAL
8c	United States Coast Guard	P	F		
	Letter of Intent to Operate on site	P	F		
	Operations Manual on site	P	F		
	Facility Response Plan (FRP) on site	P	F		
9	**Miscellaneous**				
		P	F		
		P	F		
		P	F		
		P	F		
		P	F		

BID SCHEDULE – BFU PROJECT – STANDARD SPILL RESPONSE KIT **1/13/2004**

Quantity	Item/Description	Unit Cost	Extend. Cost
Absorbent Material and Containers			
3 ea.	Overpack Drums, 95 Gallon Poly (See Note2)		
1 ea	Open-top Drum, 55 Gallon Metal		
2 ea.	Absorbent Roll, min 30"x140' or comparable.		
2 ea.	Absorbent Pads, min 16"x20" or comparable, 100 Pieces Ea.		
6 ea.	Absorbent Boom, min 4"x40' or comparable		
2 ea.	Absorbent Sweep, 19" x 100' or comparable		
Personnel Protective Equipment			
4 pr.	Gloves, Nitrile AF18 Chem-Resist, Pairs		
4 pr.	Tyvek Suits, XL Polyethylene Coated		
4 pr.	Goggles		
4 pr.	Hardhats		
Recovery Equipment			
1 ea.	2-inch portable centrifugal pump, gas-powered, UL listed petroleum pump. Marlow Petro-Guard Model 2AM32-P or equal with 2" camlocks		
1 ea.	Discharge Hose with 2" camlocks, 100' total length		
1 ea.	Suction Hose with 2" camlocks, 50' total length		
2 ea.	Shovel		
2 ea.	Rake		
1 roll	Garbage/Disposal Bags		
Miscellaneous			
5 ea.	Fire Extinguishers, Portable, Type 3A-40BC		
2 ea.	Padlocks, keyed-alike for storage site		

TOTAL $

Notes:

1. **Absorbent material can be natural or synthetic.**
2. **Place all spill response items in overpack drums. If items will not fit within 3 overpacks then please provide 4 each overpacks and adjust price quote accordingly. Permanently label all overpack drums "SPILL RESPONSE KIT" with minimum 3" high letters.**

Partial List of Environmental Equipment and Supply Vendors

Alaska Safety 561-5661

Eagle Enterprises	562-2331
Inlet Petroleum Company	274-3835
Polar Supply	563-5000
Spill Shield International	561-6033
Unitech of Alaska	349-5142, 800-649-5859
Young's Firehouse	344-5312, 800-478-5312
Northwest Pump & Equipment	522-9595, Fax 522-9696

SPILL RESPONSE PROCEDURE CHECKLIST

ACTION	FINDINGS
1. SURVEY INCIDENT o Identify release source and product spilled o Threatened buildings, public and sensitive areas	
2. SAFETY FIRST – GET HELP o Facility owner or manager o Local Fire Department and Law Enforcement o Local responders o Local medical personnel	
3. ANALYSE THE INCIDENT o Review the SDS o Predict spill behavior o Estimate the extent of the spill	
4. PROTECT THE PUBLIC o Authorized personnel only/Ribbon off the area o Evacuate areas downwind and stay upwind o Know when to stay away	
5. PLAN A RESPONSE o Identify response objectives o Get additional response material o Conduct a safety briefing	
6. PUT ON PERSONAL PROTECTION GEAR o Disposable suit or rain gear o Hardhat and eye protection o Neoprene gloves and rubber and/or safety toed boots	
7. VERIFY SPILL SOURCE o Tanks o Piping o Other sources	
8. CONTROL THE SPILL o Stop the transfer and close valves upstream o Place catch bucket or basin under leak o Apply temporary patch	
9. CONTAIN THE SPILL o Use response tool kit following deployment strategies o Pay attention to sensitive areas	
10. RECOVER, CLEAN AND REPORT o Capture and recover product before it hits the water o Clean up product o Call the nearest ADEC office and report spill	

APPENDIX C – INVENTORY CALCULATIONS

DEPTH FACTOR CORRECTION TABLE

TEMPERATURE CORRECTION FACTOR TABLE

DEPTH FACTOR CORRECTION TABLE

Use the formula: $Ratio = \frac{H}{D}$ $where\ H = liquid\ height\ in\ tank\ and\ D = the\ overall\ diameter\ of\ the\ tank$, and then the following table in order to calculate a *depth factor*.

RATIO	DEPTH FACTOR
0.01	0.00240
0.02	0.00480
0.03	0.00914
0.04	0.01348
0.05	0.01899
0.06	0.02451
0.07	0.03110
0.08	0.03750
0.09	0.04476
0.10	0.05202
0.11	0.06000
0.12	0.06798
0.13	0.07654
0.14	0.08511
0.15	0.09417
0.16	0.10323
0.17	0.11282
0.18	0.12242
0.19	0.13238
0.20	0.14235
0.21	0.15271
0.22	0.16308
0.23	0.17377
0.24	0.18447
0.25	0.19548
0.26	0.20650

0.27	0.21784
0.28	0.22919
0.29	0.24074
0.30	0.25230
0.31	0.26401
0.32	0.27573
0.33	0.28774
0.34	0.29976
0.35	0.31191
0.36	0.32406
0.37	0.33646
0.38	0.34887
0.39	0.36120
0.40	0.37354
0.41	0.38603
0.42	0.39852
0.43	0.41263
0.44	0.42675
0.45	0.43794
0.46	0.44913
0.47	0.45684
0.48	0.46456
0.49	0.48228
0.50	0.50000
0.51	0.51272
0.52	0.52544
0.53	0.53815
0.54	0.55087
0.55	0.56356
0.56	0.57625
0.57	0.58886
0.58	0.60147
0.59	0.61396
0.60	0.62646
0.61	0.63889
0.62	0.65133
0.63	0.66363
0.64	0.67594
0.65	0.68809
0.66	0.70024
0.67	0.71225
0.68	0.72427
0.69	0.73598
0.70	0.74770
0.71	0.75925
0.72	0.77080

0.73	0.78215
0.74	0.79350
0.75	0.80441
0.76	0.81533
0.77	0.82612
0.78	0.83692
0.79	0.84728
0.80	0.85765
0.81	0.86761
0.82	0.87758
0.83	0.88717
0.84	0.89677
0.85	0.90583
0.86	0.91489
0.87	0.92345
0.88	0.93202
0.89	0.93999
0.90	0.94797
0.91	0.95523
0.92	0.96250
0.93	0.96900
0.94	0.97550
0.95	0.98101
0.96	0.98652
0.97	0.99086
0.98	0.99520

For example: if the diameter of a tank was 10' and the height of the liquid remaining in the tank was 5', it would have of ratio of $\frac{5\ feet}{10\ feet} = 0.5000$, and if the total capacity of the tank were 250 gallons, using the formula $0.50000 \times 250\ gallons$ it would follow that there is 125 gallons remaining in the tank.

TEMPERATURE CORRECTION FACTOR TABLE

Bulk Fuel Storage

FUEL VOLUME CORRECTION TO 60 F

Temp. °F	Diesel Corr. Factor	Gasoline Corr. Factor	Temp. °F	Diesel Corr. Factor	Gasoline Corr. Factor	Temp. °F	Diesel Corr. Factor	Gasoline Corr. Factor
-60	1.0600	1.0720	-12	1.0360	1.0432	36	1.0120	1.0144
-59	1.0595	1.0714	-11	1.0355	1.0426	37	1.0115	1.0138
-58	1.0590	1.0708	-10	1.0350	1.0420	38	1.0110	1.0132
-57	1.0585	1.0702	-9	1.0345	1.0414	39	1.0105	1.0126
-56	1.0580	1.0696	-8	1.0340	1.0408	40	1.0100	1.0120
-55	1.0575	1.0690	-7	1.0335	1.0402	41	1.0095	1.0114
-54	1.0570	1.0684	-6	1.0330	1.0396	42	1.0090	1.0108
-53	1.0565	1.0678	-5	1.0325	1.0390	43	1.0085	1.0102
-52	1.0560	1.0672	-4	1.0320	1.0384	44	1.0080	1.0096
-51	1.0555	1.0666	-3	1.0315	1.0378	45	1.0075	1.0090
-50	1.0550	1.0660	-2	1.0310	1.0372	46	1.0070	1.0084
-49	1.0545	1.0654	-1	1.0305	1.0366	47	1.0065	1.0078
-48	1.0540	1.0648	0	1.0300	1.0360	48	1.0060	1.0072
-47	1.0535	1.0642	1	1.0295	1.0354	49	1.0055	1.0066
-46	1.0530	1.0636	2	1.0290	1.0348	50	1.0050	1.0060
-45	1.0525	1.0630	3	1.0285	1.0342	51	1.0045	1.0054
-44	1.0520	1.0624	4	1.0280	1.0336	52	1.0040	1.0048
-43	1.0515	1.0618	5	1.0275	1.0330	53	1.0035	1.0042
-42	1.0510	1.0612	6	1.0270	1.0324	54	1.0030	1.0036
-41	1.0505	1.0606	7	1.0265	1.0318	55	1.0025	1.0030
-40	1.0500	1.0600	8	1.0260	1.0312	56	1.0020	1.0024
-39	1.0495	1.0594	9	1.0255	1.0306	57	1.0015	1.0018
-38	1.0490	1.0588	10	1.0250	1.0300	58	1.0010	1.0012
-37	1.0485	1.0582	11	1.0245	1.0294	59	1.0005	1.0006
-36	1.0480	1.0576	12	1.0240	1.0288	60	1.0000	1.0000
-35	1.0475	1.0570	13	1.0235	1.0282	61	0.9995	0.9994
-34	1.0470	1.0564	14	1.0230	1.0276	62	0.9990	0.9988
-33	1.0465	1.0558	15	1.0225	1.0270	63	0.9985	0.9982
-32	1.0460	1.0552	16	1.0220	1.0264	64	0.9980	0.9976
-31	1.0455	1.0546	17	1.0215	1.0258	65	0.9975	0.9970
-30	1.0450	1.0540	18	1.0210	1.0252	66	0.9970	0.9964
-29	1.0445	1.0534	19	1.0205	1.0246	67	0.9965	0.9958
-28	1.0440	1.0528	20	1.0200	1.0240	68	0.9960	0.9952
-27	1.0435	1.0522	21	1.0195	1.0234	69	0.9955	0.9946
-26	1.0430	1.0516	22	1.0190	1.0228	70	0.9950	0.9940
-25	1.0425	1.0510	23	1.0185	1.0222	71	0.9945	0.9934
-24	1.0420	1.0504	24	1.0180	1.0216	72	0.9940	0.9928
-23	1.0415	1.0498	25	1.0175	1.0210	73	0.9935	0.9922
-22	1.0410	1.0492	26	1.0170	1.0204	74	0.9930	0.9916
-21	1.0405	1.0486	27	1.0165	1.0198	75	0.9925	0.9910
-20	1.0400	1.0480	28	1.0160	1.0192	76	0.9920	0.9904
-19	1.0395	1.0474	29	1.0155	1.0186	77	0.9915	0.9898
-18	1.0390	1.0468	30	1.0150	1.0180	78	0.9910	0.9892
-17	1.0385	1.0462	31	1.0145	1.0174	79	0.9905	0.9886
-16	1.0380	1.0456	32	1.0140	1.0168	80	0.9900	0.9880
-15	1.0375	1.0450	33	1.0135	1.0162	81	0.9895	0.9874
-14	1.0370	1.0444	34	1.0130	1.0156	82	0.9890	0.9868
-13	1.0365	1.0438	35	1.0125	1.0150	83	0.9885	0.9862