a. Truck loading facilities generally consist of a concrete containment or drip pad with drain tied into the site industrial waste system, strainer, pump, filter, meter, control valve, truck overfill protection systems, meter prover connections, dry-break hose coupling, and piping. Dispensing may be through a fuel resistant hose or a pantograph style loading arm.

16.2.5.3 Tank Car Loading Facilities

a. Tank car loading facilities are generally designed for top loading of tank cars and include a containment system consisting of concrete containment, concrete drip pads, track pans, or any combination of these. Often the tank car unloading and loading facilities are combined in lieu of building two separate structures. As with the unload rack, the gangways are used for accessing the top of the tank cars where the operator can then lower a load arm into the tank car through the manway. Again the designer should confirm that the cage provides the required track clearance as specified by the railroad client's documented standards. Cages that are horizontally adjustable should also be considered to reduce the need for repositioning due to differing tank car sizes. The load arm must include a high level sensor to automatically shut down the loading system when the tank car reaches the full level and to ensure it is not overfilled. Additionally, the load arm shall be locked into the loading position or shall be otherwise restrained in the loading position to prevent it from rising up, out of the top of the tank car manway as a reaction to the fuel flow against the elbow. Upstream of the load arm, is an automatically operated valve, meter, prover connections and pump.

16.2.6 Storage Tanks

16.2.6.1 General

a. It is recommended that the tank itself be constructed in accordance with current API-650 Specifications for Welded Steel Oil Tanks. (AREA 1990)
b. For large installations, above ground cylindrical welded steel storage tanks are generally used. Although the use of underground tanks is discouraged, underground tanks may save the cost of dikes and allow the ground above to be used for other purposes such as roadways. Underground tanks are more expensive to install, however. The registration, monitoring of tank systems (i.e. inventories, monitoring wells, etc.), and testing systems (i.e. tank integrity, piping cathodic protection, tank cathodic protection, etc.) are making this option a less desirable option in large installations. (AREA 1990)
c. Adequate storage should be available for reserve in the event of interruption of delivery from normal sources of supply. Consult with the client to ensure adequate reserve is available. A risk analysis should be performed based on the available sources of supply and the chance for interruption of service to determine the required capacity. (AREA 1990)
d. Floating roofs or fixed and/or semi-fixed foam fire protection systems may be required by the local authority having jurisdiction.

e. Storage tanks must have adequate containment as required by codes adopted by the local authority having jurisdiction. Containment can be concrete, geomembrane liner, earthen (if sufficiently impermeable) or double wall tank shell.
f. It is recommended that two tanks equaling the required storage capacity be installed in lieu of a single tank. This facilitates the ability to perform future inspection out of service inspections or unforeseen tank outages.

16.2.7 Pumphouses

a. Pumping equipment may be outside, covered with a roof or canopy only, or be completely enclosed. Ensure compliance with all fire codes in the design of pumping facilities. Pumps and associated equipment are usually located on concrete with drainage tied into the industrial wastewater collection system. Pumphouses generally contain dispensing pumps, filtration, metering, flow control and electrical equipment, which may share functions or space with any of the other fuel handling facilities at the yard.

Section 16.3 Site Considerations (2021)

16.3.1 Macro Site Selection

a. In broad terms, the location of a site is based on railroad operating plans. The number of trains passing a given location, the status of their fuel supply and the time in schedule available for fueling are factors that enter into macro site selection. Also entered into consideration are the availability and cost of fuel.

16.3.2 Micro Site Selection

a. Once the general area for a fueling facility is determined, micro site selection is governed by the following factors:
    - Availability of space for the train. Main line fueling facilities are either on the main line or on sidings adjacent to it. The train will trail the locomotives being fueled. Present day train lengths, including locomotives, can approach 8,000 to 16,000 feet. This space must be available without fouling adjacent tracks. The fueling facility must be at the end of the site in the direction of travel. For example, if the train is east bound, it should be at the east end of the site. If trains traveling both directions are to be served, there must be space for trailing trains in both directions.
    - Site Selection must also consider continuing railroad operation during construction. Tracks may have to be taken out of service to facilitate construction of the facility. Also, temporary tracks may be necessary to provide a path around the new fueling facility during construction.
    - Ideally, the fueling facility and one locomotive length each side of the facility should be on tangent track.
    - The facility and the trailing track should be on substantially level land. The site should be graded and structures provided so that storm water drains away from the platform.

- Space must be available at or near the site for ancillary facilities such as access roads, pipelines, fueling crew facilities and support facilities such as pumps and tanks.
- Conventionally, locomotives are located at the front end of trains. If distributed power is used, the presence of locomotives at the rear or other positions will have to be accommodated. Typically, the facility design will permit fueling the front end locomotives only. The other locomotives can be added at strategic locations already fueled and can be detached for fueling. An alternative is to fuel the front end locomotives at a fixed fueling facility and the distributed locomotives by some form of truck fueling.
- Geotechnical considerations may also influence site selection.

b. Chapter 14 of the AREMA Manual gives guidance for track design in yards and terminals.

Section 16.4 Services Provided (2021)

16.4.1 Facility Size

a. The size of a fueling facility is determined by the frequency of fueling and by the size of the locomotive consists being serviced. Verify the typical consist size, which generally varies from 3 to 5 locomotives. With the advent of higher powered locomotives and distributed power, the number of locomotives in a consist will tend to diminish. The number of tracks in a facility depends on train traffic. The most common number is two, and facilities with eight tracks exist.

b. Facility length should be sufficient to fuel all locomotives in the maximum anticipated consist simultaneously. At present, the maximum length of an individual locomotive is approximately eighty feet. If five of these locomotives are anticipated, a total platform length of 425 feet is indicated, allowing some space on the ends for crossings, ramps, sanitary dumps and so on. Crossings on the end should allow for crossing in front of equipment outside of specified clear zones.

c. Track spacing for multi-track facilities is dictated by the requirements of fuel oil cranes and traffic on the platform. The most common track spacing is twenty six to thirty feet. Fuel column standards fit track spacing between 18 and 32 feet. Wider track spacing results in a reduction of the track length that can be covered by an individual fuel crane. These considerations apply only to platforms where the fuel cranes are located between the two tracks. Some railroads find it convenient to place the fuel cranes outside the two tracks. In this case, track spacing can be more flexible. The platform equipment should be located in conformance with State/Provincial clearance regulations.

d. Consider track spacing for DTL truck access to distributed power.

16.4.2 Services

a. By definition, a fueling facility dispenses diesel fuel. Facilities can also dispense lube oil and radiator water.

b. Additional services may include:

- Sand is also often dispensed. See Chapter 6, Part 6 for further information on sanding.
- Locomotive sanitary waste removal is also often provided.
- Inspection pits for access to the underside of locomotives are sometimes provided, most commonly on service platforms. They may be necessary if the facility provides required periodic locomotive inspections.
- Rarely, journal oil is dispensed. It is only practical if inspection pits are provided.
- Provision is also sometimes made for minor running repairs.
- Brake shoe change out.

16.4.3 Platform Design Criteria

a. Fueling platforms have the following functions:

- Provide a safe working platform for personnel
- Protect the environment against contamination by fuel and other fluids
- Provide support for equipment

b. The following configurations for platforms are common. Choice among them depends on the frequency of fueling operations and on the locomotive inspections and repairs that will be performed during fueling. A mix of configurations can be used on individual platforms. For example, inspection pits need not be placed on all tracks nor are they necessary for the full length of the platform:

Platforms without inspection pits:

- Concrete track support continuous with concrete platform
- Track ballasted-Track pans – Concrete aprons
- Track on deep stone fill with liner – fueling equipment on concrete slab

Platforms with inspection pits:

- Pits between rails
- Pits between rails and on field side of rails

c. Track pans can be steel or concrete.

d. If the platform supports the tracks, it should be designed for loading by trains. It should be recognized that some trains will not stop for fueling. Therefore, the platform will be designed for the train speed desired. Cooper E80 loading is a common criterion. See AREMA Manual, Chapter 8, Part 27 for information on the design of track support. Special attention may need to be paid to the transition between the rigid concrete support and the ballasted track at the ends of the platform to accommodate the difference in track modulus. Depending on geotechnical conditions, the track slab might be directly supported from the ground or pilings might be required.

e. Platform width must be coordinated with track spacing.

f. Space on the platform needs to be allocated to equipment and usually to a utility trench providing piping and electrical cables to the equipment or support columns for overhead racks. It may be necessary to provide for forklift or motorized cart traffic on the platform.

g. If a gantry sanding system is used, space on the aprons must be allocated for gantry rails. Supports are necessary for electrical supply to the gantry.

h. The most convenient platform level for fueling operations is at the top of rail. This position places the locomotive fueling port about four feet above the platform. If minor repairs are to be made on the locomotive trucks, platform level is often placed 16 inches below top of rail. (see Figure 6-16-1)

i. Concrete aprons should be provided on the field side of the outside tracks. They may be necessary to support sanding equipment, for motorized cart traffic or for personnel performing inspections or repairs. These aprons should also drain to the industrial wastewater system.

j. Inspection pit depth under the locomotive is usually about four feet six inches below top of rail. This depth is a compromise between many conflicting requirements. Other depths have been used. If service pits are provided on the field side of the rail, depth is usually about three feet below top of rail. Consider side access to pits for egress requirements.

k. Freeze protection for water piping is necessary in most climates. Electric heat tracing is most common.

l. Cold protection for oil piping is necessary only in very severe climates and in cases where the oil can sit stagnant for long times. The pour temperature of the oil should be determined and an estimate made of the minimum oil temperature in piping.

m. The utility trench can be covered with grating if heating is not required. Alternatives are steel or concrete covers. Traffic loading requirements should also be considered. Consider removal for maintenance.

n. In cold climates, glycol heating of the platform can be provided. Glycol heating systems consist of plastic piping buried in the platform, with pumps and a heater located adjacent to the platform.

o. De-icing agents may be used on platforms.

p. Expansion joint material and water stop material must be oil resistant.

q. Some fueling facilities place track on stone fill approximately three feet deep. The bottom of the stone fill is sloped toward a drain connection to an oil/water separator. The stone fill is contained by a plastic liner.

16.4.4 Overhead Structures

a. A canopy can be provided over the fueling platform. The primary function of the canopy is to prevent rain water from getting on the platform and increasing flow in the industrial waste system. If a canopy is provided, it must have adequate ventilation systems to prevent locomotive exhaust fumes from being inhaled by fueling personnel.

b. An overhead structure is also often provided to support piping (especially sand piping) and electrical conduits.

c. A gantry for sanding, if that system is used, constitutes an overhead structure.

d. Overhead structure must not impinge on the train clearance envelope. See AREMA Manual Chapter 28 for minimum clearance requirements.

16.5 Equipment (2021)

16.5.1 Storage Tanks

16.5.1.1 General

a. For vertical field erected tanks, refer to the most current API-650 Specifications for Welded Steel Oil Tanks. (AREA 1990) For shop fabricated vertical or horizontal tanks, refer to the applicable UL document.
b. In the past, the EPA has not regulated No.2 diesel fuel for vapor recovery, however, some state or local requirements are more stringent than federal requirements and should be checked before installation. There are requirements for products with high vapor pressures like gasoline, however. (AREA 1990)

16.5.1.2 Recommended Appurtenances (AREA 1990)

a. Water drains should be equipped with a method of collecting the water draw off. The draw off should go to a valved, pumpable sump so water can be discharged to an oil separator or treatment facility. By using a valve in the sump, oil from a tank failure is prevented from directly entering the wastewater treatment system. By using a manually operated pump and visual inspection of the sump contents, oil entering the treatment system can also be minimized. (AREA 1990) Water draw off valves should be frost proof, and water draw off piping may need to be heat traced and insulated. Valves associated with water draw-off are required to be locked.
b. Manways should be provided for access and to provide for adequate ventilation during cleaning and inspection activities. (AREA 1990)
c. Temperature compensated level indicators to assist in providing inventory balance and low level pump protection. (AREA 1990)
d. Vents should be designed in accordance with the most recent API Venting Guide. (AREA 1990) This includes normal and emergency venting measures. Vents should be accessible and inspectable.
e. Ladders or steps should be provided to the roof and meet OSHA requirements. (AREA 1990)

f. OSHA requires fall protection on the top of the tank. This may be continuous handrail or tie off points. Continuous handrail is recommended to facilitate inspection activities.
g. An fusible link valve (internal or external) may be provided in the outlet pipe to automatically close in the event of fire and when required by state or local fire laws. (AREA 1990)
h. A high level switch should be provided to stop delivery to the tank (by closing valves and/or stopping pumps) and/or sound an alarm to prevent tank overflow. (AREA 1990)
i. Means of overfill prevention is recommended to be independent of the normal operating instrumentation.
j. Diesel fuel oil storage tanks should be wire grounded per API requirements, and such grounds should be thoroughly checked. (AREA 1990)
k. Storage tanks supported on grade should be cathodically protected, with protection tested at recommended intervals. (AREA 1990)
l. Means of leak detection below the tank floor.
m. Stairs in lieu of ladders are recommended.

16.5.1.3 Tank Containment

a. The very bottom layer of the tank foundation and the dike should be made of an impermeable or impervious material such as oil resistant geomembrane liner or at the minimum, clay, as required by the local jurisdiction having authority. The liner should be installed on a well prepared base as directed by the manufacturer. This normally consists of a sand cushion and/or a geotextile to prevent damage to the geomembrane liner. This will help prevent oil which could leak from the storage lank from entering the environment. (AREA 1990, edited)

16.5.1.4 Painting of Tanks

a. All oil storage tanks should be painted to prevent corrosion of the exterior of the tank. It is recommended to use white paint because this reflects rather than absorbs heat from the sun and tends to prevent fuel degradation during hot weather. (AREA 1990)
b. The interior bottom and bottom three feet of the tank should be coated with a rust resistant material which will protect the steel from corrosive residues and water which may accumulate in the bottom of the tank. This coating should also be compatible with oil so the product inside the tank does not degrade the coating. (AREA 1990)
c. For safety, it is recommended that an antiskid paint be used for the areas on the tank roof normally accessed for maintenance. In the past, sand was broadcast on the roof into the standard paint used for the tanks, but is no longer recommended. This system reduces paint adherence to the steel substrate which leads to premature paint failure and inevitable corrosion of the tank roof.

16.5.1.5 Grounding

a. Depending on contents of the storage tank (fuel, oil), tank grounding may be required for three fundamental reasons: for dissipation of static buildup or charge, for lightning protection and for electrical safety.

16.5.2 Pumping

a. Centrifugal pumps are generally used for dispensing operations. Positive displacement style pumps such as sliding vane are generally utilized for offloading activities where suction lift or self-priming is required.
b. Ensure adequate net positive suction head is maintained.
c. Locomotive dispensing is generally done between 200 and 350 gpm. The flow and shut off properties of the fueling nozzle must be carefully considered in setting the pressure and corresponding flow rate at the dispensing point. Consult with the fuel nozzle, fuel crane, and locomotive manufacturer.
d. Tank truck and tank car offload, as well as tank truck and tank car fill are generally done around 300 gpm.
e. A bypass arrangement is usually needed for an installation where multiple diesel units must be filled quickly and concurrently. The purpose of the bypass is to maintain the lowest pipeline pressure consistent with fuel delivery demand, and to minimize the shock as fuel nozzles are suddenly closed at the fueling platform. In addition, it provides a minimum flow through the pump to prevent it from overheating. A relief valve/automatic control valve is located on the discharge side of the pump on the inlet side of the filter and is set to maintain a sufficient pressure in the header at the fueling area to permit full fuel delivery to the most remote fuel outlet. Fueling pumps are normally started prior to fueling operations and precautions should be taken to prevent the pump and fuel from heating by friction during this no delivery period. It is preferable that the bypass discharge should extend back to the storage tank, but in some instances, it may be advantageous to return it only as far as the pump suction. The bypass valve should be hydraulically operated, pilot controlled, modulated type, activated by line pressure through a pilot control system, opening fast to maintain steady line pressure and closing gradually as locomotive fuel outlets are opened, to prevent high pressure surges in the pump system. Bypass piping design should also include specific measures to prevent hydraulic hammer in the system. (AREA 1990)
f. A timer, pressure switch, or flow switch can be used to automatically stop the pump. (AREA 1990)

16.5.3 Piping Systems

a. This section covers the piping from receiving facilities to storage to outbound fueling up to the connection to the locomotive. Generally, oil distribution piping can be installed above or below ground. Pipe installed above ground is generally more acceptable because leaks can be easily spotted. All underground piping should be protected against corrosion. In addition, periodic pressure testing of underground lines should be done in addition to inventory balancing or other form of leak detection to detect underground leaks. (AREA 1990)
b. Diesel locomotive fuel tanks range from less than 3,000 gallons to the 20,000 gallon fuel tender cars. Piping should be sized so the time required to fuel is at an acceptable level. Multiple fuel nozzles on one header and fueling rates from 200 to 300 gpm per locomotive should be considered. (AREA 1990).

c. Piping systems should be sized to keep system pressures below 100 psi. Pressure reducing valves may be required to reduce the pressure at the dispensing point to the rated pressure of the fueling nozzle.

d. The following materials are recommended for piping on the platform. Piping in support systems off the platform, such as oil supply piping, may be different because such piping is in a less well controlled environment. Railroad piping systems work in a harsh environment with loadings from passing trains. Pipe materials which would be satisfactory in other environments, particularly buried pipe, may not be suitable for railroad service due to ground transmitted vibration.

- Oil systems: Carbon Steel ASTM A53 Underground oil piping should be double wall or wrapped as well as cathodically protected.
- Sanitary Waste: Ductile Iron AWWA C151 (below ground), PVC (vacuum sewage system)
- Industrial Waste: Ductile Iron AWWA C151 or fusion bonded HDPE
- Wash Water: Carbon Steel ASTM A53
- Potable Water (e.g. eye wash): Copper ASTM B88
- Radiator Water: Carbon Steel ASTM A53
- Platform Heating: Plastic Hose (in platform)

e. When selecting gasket or joint sealant material, consideration of the chemical composition is needed. Diesel fuel will typically contain portions of "aromatics" such as benzene, toluene and xylene. These aromatics are aggressive in their reaction on most typical gasketing materials so care will need to be exercised. Additional consideration to gasket material selection is required if biodiesel is expected or in cold climates.

f. Welded joints are preferable for above ground steel piping. (AREA 1990)

g. While welded steel pipe is the preferable choice for both above and below ground piping, other pipe such as cast iron, suitable plastic or steel pipe with extruded coatings of PVC is also used. It should be sized to hold friction losses as low as practicable. Joints may be welded, flanged, socket, mechanical joint type with bolts, or press type using suitable gaskets. Threaded connections are not recommended.

h. Depth of bury for underground pipe and use of casings are covered under Section 5.1- Specifications for pipelines conveying flammable substances, contained in Part 5, Chapter 1 of the AREA Manual. (AREA 1990) [need the current AREMA Manual reference]

i. Leaks in underground fuel oil lines are difficult to detect and can result in considerable product loss, soil and groundwater contamination, and subsequent expensive pollution problems. Regulations require that underground piping be coated with an anti-corrosive preservative and to wrap the pipe with tarred or plastic wrapping either before or during installation. Additional precautious are to backfill around the pipe with sand, use cathodic protection, or non-rusting pipe, i.e., plastic. Pressure testing similar to water line testing covered by AWWA specifications is recommended. Regulation 40 CFR Part 280, Underground Storage Tanks, applies. (AREA 1990) Many other commercially available leak detection systems are available and should be considered for all buried piping. Note that some jurisdictions require double wall piping.

j. Supports for above ground piping should be spaced as necessary to provide sufficient structural support. (AREA 1990) A pipeline stress analysis should be considered to properly design the pipe support type (fixed or moveable) and the footings for the pipe supports. Stresses on the piping should be minimized, especially at equipment and storage tank connections.
k. Thermal expansion can be a problem in above ground piping especially when the fluid is trapped between two closed valves. If this is the case, a pressure relief valve is recommended to alleviate this. (AREA 1990) Pressure relief should be provided on all sections that can isolated.
l. A transient surge analysis of the piping system should be done to determine whether or not surge suppression is required on systems that have dispensing nozzles, automatic shutoff valves and/or emergency pump shut down systems which can stop the flow of fuel quickly. Surge suppression in the form of nitrogen filled bladder tanks may be required to prevent surges exceeding the design pressures of the system.

16.5.4 Fuel Receipt Equipment

a. Oil receiving facilities should include provisions to pump the product into on site storage tanks, if required, as well as metering facilities for inventory control. The value of inventory control is twofold. First, it maintains economic integrity on fuel purchases. Second, it provides an early warning system for fuel leakage. (AREA 1990)
b. A receiving facility should include or consider the following:
    - A quick disconnect flitting so the tank truck or barge can be connected to the facility piping. (AREA 1990)
    - A check valve to prevent spillage from the pipe onto the collection facility. (AREA 1990)
    - A mesh strainer should be installed on the suction side of the pump to prevent foreign matter from entering the pump or meter. (AREA 1990)
    - A permanent transfer pump is recommended especially when receiving product by tank truck since on board truck pumps can cause the incoming fuel meter to read high. The transfer pump should be designed to accommodate the size of the fuel meter as well as to prevent unnecessary delay of trucks. (AREA 1990)
    - An air elimination system to prevent the fuel meter from reading air which results in inaccurate inventory control. (AREA 1990) The air eliminator is usually vented back into the system downstream of the meter.
    - A temperature compensated fuel meter to assist in inventory control. Piping should be included so the fuel meter can be calibrated periodically. (AREA 1990)
    - A ticket printer should be provided outside the pump house so each load can be recorded. All other equipment except the piping connection should be inside a locked building to prevent tampering. Telemetry equipment is available to transmit this data to a central inventory control point. (AREA 1990)

16.5.5 Fuel Loading Equipment

a. A loading facility should include or consider the following:

- A quick disconnect flitting so the tank truck or barge can be connected to the facility piping. (AREA 1990)
- A check valve to prevent spillage from the pipe onto the collection facility. (AREA 1990)
- A mesh strainer should be installed on the suction side of the pump to prevent foreign matter from entering the pump or meter. (AREA 1990)
- A permanent transfer pump is recommended. The transfer pump should be designed to accommodate the size of the fuel meter as well as to prevent unnecessary delay of trucks. (AREA 1990)
- A temperature compensated fuel meter to assist in inventory control. Piping should be included so the fuel meter can be calibrated periodically. (AREA 1990)
- A ticket printer should be provided outside the pump house so each load can be recorded. All other equipment except the piping connection should be inside a locked building to prevent tampering. Telemetry equipment is available to transmit this data to a central inventory control point. (AREA 1990)

16.5.6 Dispensing Equipment

16.5.6.1 Diesel Fuel

a. Diesel fuel cranes almost universally conform to the pattern shown in Figure 6-16-1. Operators position the fuel nozzle in the locomotive fueling port and start fuel flow by operating a local pushbutton. The nozzle is designed to shut off automatically when the tank is full. Such cranes can operate within a radius from the crane position. The radius is determined by crane size. The designer must determine what portion of the platform fuel cranes should serve and position cranes accordingly. Crane positioning should account for some overlap of coverage of the fueling point to ensure complete coverage of the fueling platform.
b. The AAR has developed a fuel nozzle to increase fueling rate and to decrease the incidence of fuel spills. It depends on a matching fuel port on the locomotive and level measuring provisions on the locomotive. The fuel crane nozzle must be selected to fit the locomotives to be fueled.
c. Fuel oil systems should be designed for the following characteristics:
    - Conventional fuel oil nozzles are positioned in the locomotive by an operator. The nozzle is opened by the operator, and turns off automatically when the tank is full. The fuel oil nozzle may be unattended when fueling. The operator may also have to push a button to turn on the fuel oil pumps.
    - If an AAR Standard fueling system is used, the operator latches the fuel nozzle to the locomotive and also attaches the signal module.
d. Spacing should be provided to handle various classes of locomotives. Counterbalance type arrangements provide easier handling of the final hose connection and make it safer to handle. The length of and number of outlets at the fueling facility should consider the total number of units to be fueled on one track at one time. (AREA 1990)
e. A quick opening quarter turn plug or ball type valve should be installed between the header and pressure reducing valve for emergency shut off in case of hose rupture or nozzle and coupling

coming loose or failing to close. If a plug valve is used, the valve should also have internal pressure relief to operate at slightly higher than normal header pressure to relieve any locked pressure build up between valve and closed nozzle due to locked in line pressure and fuel expansion due to temperature rise. (AREA 1990)

f. Final delivery of fuel oil to locomotives is made using 2 to 2-1/2 inch ID hose, maximum working pressure between 100 and 125 psi. Hose should be no longer than necessary with proper counterbalance arrangement. This will assist the employee in maneuvering the hose in making the quarter turn connection to the locomotive in a safe and efficient manner. (AREA 1990)
g. Automatic shut off nozzles should be used in all fueling operations including normal or low flow as well as high speed. Adequate protective devices should be included in the design to prevent nozzle damage through rough handling. (AREA 1990) System delivery pressures must be designed to ensure proper automatic shutoff of the nozzle.
h. Crane Masts are made up of a 4 inch riser pipe 10 to 12 feet high with a swivel joint and short horizontal extension of 2 or 1-1 /2 inch pipe at the top and a drop hose to make the final connection. Swivel joints provide operating flexibility, and the working range is adjusted by the amount of hose used. (AREA 1990)
i. Vertical Swing Masts have a double swing joint and vertical (pull down) extension pipe at top of riser, similar to an overhead (dome) unloading connection except that the hose takes the place of the suction drop pipe. Although more expensive, this type of mast provides greater working range with less hose, occupies less space, and has other operating advantages over the crane type mast. (AREA 1990)
j. Hose outlets on the bottom of overhead manifolds should be spaced as required to permit the use of relatively short hoses in fueling locomotives. Dummy fueling connections can be placed on manifold supports to hold nozzle out of the dirt and to prevent it from damage when not in use. Receptacles can include a drain directly to the oil separation system to collect oil dripping from leaky nozzles. (AREA 1990)
k. Piping at each dispensing location may include an automatic shut off valve to stop fuel supply to the nozzle when not fueling. A flow switch may also be used at each location to assist in pump on/off control.
l. If there is a normally closed valve at the dispensing location, a means of pressure relief must be installed between the valve and fuel crane/nozzle.
m. Filtration facilities should be considered to protect stored oil from contamination with dirty fuel consignment. Preliminary filtration should be standard practice as oil is delivered into storage. Alternately, filtration can be done at the locomotive fueling facility instead. (AREA 1990)
    - Filters should be replaced when fuel delivery is too low to maintain the fueling schedule and pressure loss approaches manufacturer's recommended limits. (AREA 1990) The filter vessels should have a means of monitoring the differential pressure across the filter elements. Filter change is usually done when a maximum differential pressure of 15 psi is reached. Pumping systems should be sized to account for this maximum differential pressure.
    - A drain system for the filter bowl should be designed to permit draining the filter bowl and replacing the elements without spillage upon floor or ground to cause pollution. (AREA

1990) A small gear pump is generally used to pump out the filter vessel and return the fuel to the system. Ensure that the filter vessel has adequate venting capability.

- Used filters should be collected and stored in leak proof containers for disposal by a licensed contractor or other approved disposal method. Disposal must meet federal, state, and local regulatory requirements. (AREA 1990)
- A dual fuel filtering system may be installed to permit continuity of fueling while filter replacements are being made. (AREA 1990)
- Filters should be located on the discharge side of the pump. (AREA 1990) Filters should have adequate venting capabilities for filling the filter vessel. Vessels should be filled slowly, preferably by means of tank head from the suction side of the dispensing pumps. The filter vessels should not be refilled with the dispensing pumps.

16.5.6.2 Lube Oil, Radiator Water, Compressor Oil

a. Lube oil, radiator water and compressor oil are generally dispensed from hose reel cabinets. They are designed so that an operator can grasp the dispensing nozzle while standing on a locomotive walkway. Hose reel cabinets are generally heated to keep radiator water from freezing and oil from congealing. Cabinet location must be coordinated with expected locomotive position.
b. Lube oil systems should be designed for the following characteristics:
   - Lube oil nozzles are usually manual. Operator attention is required during filling.
   - In most climates, lube oil piping must be heat traced and dispensed from heated boom cabinets.
c. Radiator water systems should be designed for the following characteristics:
   - Radiator water is usually softened water with sodium borate as a corrosion inhibitor. It does not usually contain antifreeze. Accordingly, heat tracing and heated boom cabinets are necessary. The designer should check the type of locomotive to be fueled to ensure that antifreeze is not required.
   - Since radiator water is not potable water, a back flow preventer must separate the water supply system (if it is potable) from the radiator water system.

16.5.7 Electrical and Control

a. The electrical work required for a fuel oil pumping plant consists mainly of power supply to the building, circuit breakers, starters, and a start/stop control system for the pumps. Explosion proof motors and appurtenances should be installed where Class I, Group D materials are handled. Electrical specifications depend upon the material being handled and the environment in which the equipment is located. The state and local building codes will dictate the appropriate requirements. (AREA 1990)
b. A flow control switch in conjunction with a timer limit switch will in due time stop the pump if personnel fail to do so. Start/stop control requirements vary according to local conditions. In general, automatic operation is desirable to the extent the operation can be made fail safe. (AREA 1990)

c. Lighting should be provided on the platform to obtain a level of 10 foot candles measured at the sides of the locomotives.
d. A control panel should be provided adjacent to each fuel oil crane and set of house reel cabinets to control the dispensing pumps and DFO shutoff valves. Lube oil and radiator water booms should include on/off control at the end of the booms.
e. Electrical panels must be provided on the platform to provide power to the following items. This list is typical. Not all loads may exist on a given platform and some additional ones may include:
    - Equipment control panels
    - platform heating
    - DFO shutoff valves
    - Platform and task lighting
    - hose reel rewind motors
    - 120V receptacles
    - heat tracing
    - hose reel cabinet heating
f. If a sanding system is provided, it will have its own control and power systems, electrical power must be provided to them. See Chapter 6 Part 6, Locomotive Sanding Facilities.
g. The control system on the platform provides signals to the overall fueling facility control system. The latter is usually provided in the pump house or the pump area. The control system should provide annunciation of abnormal conditions to supervisor's office and/or locally (horn and flashing light).
h. Emergency fuel oil shutoff buttons should be provided on the platform to control accidents. These buttons should be clearly identified.
i. Recommended practice is to provide a push button start/stop switch on each fueling mast with some kind of red light indicator to furnish additional visual evidence of its position. An alternate to the start/stop switch is a mercury tube switch installed on the lever arm of the loading valve which will automatically stop pump operation when the valve is closed. (AREA 1990)
j. Fueling equipment on the service platforms may require bonding to rails to preclude sparking between fuel nozzles and locomotive.

16.5.8 Miscellaneous Systems and Equipment

16.5.8.1 Water

a. Cabinets may also be provided for platform flushing water. If provided, they are usually integrated with the boom cabinets. Such cabinets are also heated to prevent freezing.
b. Emergency eye wash stations are often provided on the platform.
c. Wash down capability.

16.5.8.2 Sanitary Waste

a. Sanitary waste can be dumped directly from the locomotives to sanitary dumps, usually located at the end of the platform. This operation will require positioning the locomotive at the dump and repositioning it for fueling. To avoid the repositioning operation, a transport wagon (“honey wagon”) is often provided.
b. Sanitary waste can also be dumped to a vacuum disposal system. Such systems consist of hoses at the locomotive, piping from the hose to a vacuum tank, vacuum pumps, filters and a mechanism to dump the vacuum tank to a sewer.

16.5.8.3 Additives (Red Dye, Lubricity Improvers, etc.)

a. Petroleum products are generally a base product such as fuel oil or lube oil with certain additives to enhance performance characteristics. Regardless of how these products are formulated or treated, it is important to prevent or minimize the inclusion of water and solid foreign matter when they are stored, handled, or used. This must be addressed whether or not the use of additives is considered. These additives include certain improvers, dispersants, detergents, antioxidants, metal deactivators, pour point depressants, wax crystal modifiers, buffers, water dispersants, and biocide. In some cases, additives are included at the factory as specified. In other cases, additives are injected by the railroad or pipeline at the site to control problems specific to their location. (AREA 1990)
b. The following are some specific problems associated with diesel fuel handling:
    - Water in the fuel causes many problems. The major one being water serves as a place for bacteria of all types to grow. This bacteria then attacks the petroleum and metal components causing a jelly type mass to develop which can plug fuel filters. In addition, injectors can become stuck, resulting in premature engine failure as well as damage to the injectors themselves. (AREA 1990)
    - If fuel is unstable, a gummy sludge is formed. This gummy mass becomes insoluble in time and precipitates in tanks and on injector part, causing them to stick. It can stick to the injector parts when they cool down, causing them to malfunction. This can result in poor combustion and possibly fuel starvation. The overall result is a poorer burned fuel which produces smoke and right of way fire potential through the emission of burning carbon particles through the locomotive stack. (AREA 1990)
    - Water can dissolve in diesel fuel in very small amounts. As the temperature of fuel decreases, this water is forced out of solution. This water can freeze below 32°F causing iced filters, strainers, and fuel lines. This reduces fuel flow and could result in engine shutdown if bad enough. (AREA 1990)
    - Wax in diesel fuel can plug fuel filters in cold weather resulting in engine shutdown. (AREA 1990)
    - Some fuels contain sulfur compounds capable of reacting with the fuel to produce acid products. These "sour fuels" can also contain dissolved gaseous sulfur which is corrosive to iron and steel in fuel storage and delivery systems. This type of fuel should be neutralized with an additive. (AREA 1990)

c. Additives can be used to increase the quality of lower grade fuels which can be obtained at a lower cost. It may be cost effective for the railroad to buy a lower grade fuel and upgrade it based upon the railroad's particular needs. The evaluation of additives must be done by people trained in the use of such materials and who are thoroughly familiar with diesel fuels. Only use products of reputable manufacturers. (AREA 1990)

d. If additives are used, additive containers may require diking and other spill control measures. Refer to manufacturer's recommendations on product literature and material safety data sheets for recommendations on proper handling procedures. Dikes and other spill control measures may be applicable. (AREA 1990)

e. Provision for additive addition should be made at the suction side of the pump. This allows the pump to mix the additive and provides for introducing treated fuel into the storage tank. (AREA 1990)

16.5.8.6 Emergency Shower/Eyewash

a. The only requirement/guidance from OSHA regarding the subject is found in 29CFR1910.151(c): *“Where the eyes or body of any person may be exposed to injurious corrosive materials, suitable facilities for quick drenching or flushing of the eyes and body shall be provided within the work area for immediate emergency use.”* In Canada, provincial regulations should be consulted.

b. It is important to remember to check with the local jurisdiction having authority to see if more stringent guidelines have been published or if ANSI Z358.1 has been officially adopted.

c. ANSI Z358.1 is mainly an equipment specification, but does contain some guidance on the use of the equipment. Some key items are as follows:
   - Flushing equipment must be located in areas that are accessible within 10 seconds (55 FT).
   - Flushing equipment must be located on the same level as the hazard and the path of travel shall be free from obstructions (including doors).
   - Tempered water (60 – 100 °F) shall be provided.
   - Protect from freezing in the winter and from scalding in the summer.

d. Performance requirements from ANSI Z358.1 are as follows:
   - Minimum flow for plumbed and portable Eyewash units is .4 GPM at 30 PSI and units must be capable of delivering a minimum of 15 minutes of flushing fluid.
   - Minimum flow for Drench Showers is 20 GPM at 30 PSI and units must be capable of delivering a minimum of 15 minutes of flushing fluid.

Section 16.6 Environmental Protection (2021)

16.6.1 General

a. In the handling of petroleum products, spills can and do occur. Generally speaking, these spills are collected in either dedicated systems for that product, or in sewers which service railroad facilities. US EPA, state, and local authorities have requirements for discharge from railroad facilities. (AREA 1990). In Canada the requirements of Environment Canada and provincial officials shall apply.

b. In the US, minimum requirements for protection of the environment from oil pollution are presented in the Code of Federal Regulations, 40CFR112, although Appendix A of 40CFR112 specifically exempts locomotive fueling systems from its requirements. The US EPA, State, and Local Environmental Agencies have requirements for design of facilities. EPA regulation, 40 CFR 112, describes recommended procedures, methods, and equipment to prevent discharges of oil from handling facilities. These regulations describe the requirements for Spill Prevention Control and Countermeasures (SPCC) plans. An SPCC plan must be prepared for each facility and a copy must be maintained at the site for all petroleum handling facilities which meet specific size requirements. SPCC plans must be prepared or updated prior to any new fuel facilities being placed into service. In some states, these requirements are administered by local agencies such as counties and water boards. (AREA 1990)
c. When a spill occurs that is not contained by the facilities designed to do so at the site, it will be necessary to implement the previously prepared Spill Prevention Control and Countermeasures (SPCC) plan as outlined in 40 CFR Part 112 EPA Regulations on Oil Pollution prevention or other contingency plans as required. People who work at petroleum handling facilities should be familiar with this plan and keep it at a designated location at all times. The SPCC plan should be revised when changes are made which affect the plan. For instance, a new response coordinator may be needed when personnel at the site change. EPA regulation 40 CFR Part 112 requires that the SPCC plan be updated at least every three years. The SPCC plan should include reporting requirements to be followed to comply with federal, state, and local regulations. (AREA 1990)
d. Areas of the facility which are subject to rainfall are also subject to 40CFR122.
e. Employees fueling locomotives should be adequately trained and qualified in their jobs with complete understanding of automatic fueling. There should be a means to detect spillage at the end of each shift, and proper action taken immediately as to the cause. (AREA 1990)
f. As recommended practice, there should be methods available for containing spills of petroleum products. Some of these methods will be incorporated into the design such as track pans, dikes, automatic shut-off devices, etc. Other considerations include absorbents, spill containment material stored at the site, and monitoring wells to be used after a spill occurs. (AREA 1990)

16.6.2 Inventory Control

a. Proper inventory control can go a long way toward preventing spills in the first place. Petroleum products are valuable. Reduced spillage means dollars saved. By monitoring fuel received, fuel on hand, and fuel dispensed, an inventory control system can be established so that fuel discrepancies can be investigated immediately. These systems can be equipped with readouts that can be read at the site. Telemetry is available so this information can be read at the local yard office or even the railroad's central office building. Discrepancies greater than a certain preset limit should be investigated, in addition, discrepancies which indicate numerous shortages in a row should be investigated. Preventing spillage saves costly environmental cleanup and could prevent fines from being levied. (AREA 1990)
b. The metering equipment should be inspected regularly to assure proper operation. The meters should be calibrated periodically (once or twice a year) depending on the amount of product

received. Outside expertise should be considered for this calibration especially if the railroad wants to use the information to dispute delivery receipts from their suppliers. (AREA 1990)

16.6.3 Secondary Containment

16.6.3.1 General

a. Various collection methods exist to collect spillage of petroleum products. These systems include track pans, concrete pads, geotextiles, etc. (AREA 1990)
b. Spill containment equipment, such as oil absorbent pads and booms to stop spills once they reach a stream, should be readily accessible as a matter of recommended practice. Personnel should be instructed in the use of this equipment and likely locations for deployment. When spills of this nature occur, it will be necessary to notify the National Response Center or EPA, and the appropriate state agency. (AREA 1990)

16.6.3.2 Unload Areas

a. Unload areas generally require a drip pad directly under the point of hose attachment to contain any incidental drips and spills. Sized containment is not required unless all of the definitions in 40CRF112 are met.

16.6.3.3 Storage Tanks

a. Single wall storage tanks must be surrounded by dikes designed to contain the contents of the tanks and any undrained stormwater within the dike. (AREA 1990) Codes generally require that when multiple tanks are present within a single contained area that the containment be sized for the largest storage tank. The volume of the storage tank considered should be the shell volume, not the volume to any overflows or high level alarms or shutoffs. Rainwater volume to be considered may be dictated by the local jurisdiction having authority. Generally, the greater of an additional 10% of freeboard or the volume of a 25 year 24 hour storm event is added. If multiple tanks within a containment area are manifolded without isolation, the overall containment must be sized for the volume of all tanks.
b. Double wall storage tanks do not require additional secondary containment.
c. Dikes should be made out of impermeable material such as clay, concrete, or plastic lining beneath a soil layer. Generally, earth dikes are used where space is readily available. Earth dikes are generally 4 to 6 feet high with a 3 foot crown and a 1-1/2:1 to 3:1 foot slope depending on the state. The dike should be capable of containing 100% of the volume including rainwater of the single largest tank within the diked area for individual tanks. The dike should be capable of containing 100%, including provisions for rainwater, of the total of all tanks within the diked area when those tanks are connected with Common piping. Where space is limited concrete or block dikes are more desirable. When space is severely restricted, a separate steel tank wall can be constructed around the tank as a dike. This would be similar to a double walled storage tank. State and local agencies have guidelines and/or regulations on dike volume, crown width, degree of imperviousness, distance from tank to dike, etc. (AREA 1990)

d. A water drain should be included in the dike. If the dike is designed to hold oil, it will also retain rainwater. This water often becomes contaminated with oil present in the dike, from draining water off the tank and small spills. A sump should be installed to drain this water to an oil separator. Note, a normally closed and locked valve or pump should be used to prevent uncontrolled discharge from the dike. Only manual controls, not automatic, should be used to control the pump in the dike. This will prevent pumping oil accidently into the separator if a tank did fail. (AREA 1990)

16.6.3.4 Loading Areas

a. Loading areas generally require sized containment. The containment should be sized for the largest expected compartment of a tanker vehicle along with the required freeboard or volume of rainwater. The containment can be designed to drain to a properly sized oil/water separator or other industrial wastewater collection and treatment system. If there is to be no treatment of the collected water prior to discharge, a normally closed and lockable valve should be used if the discharge will flow to its final point of discharge from the site. If any spillage is to be contained and not discharged immediately, remote impoundment is recommended so that the vehicle is not left in standing fuel.

16.6.3.5 Fueling Platform

a. An impermeable membrane should be provided under the fueling platform, with provision to remove contaminants from the area directly above the membrane.

16.6.4 Industrial Wastewater

a. Complying with environmental rules will require a waste system draining all areas subject to oil contamination. This system should include an oil water separator. Oil from the separator should be disposed of offsite. Generally, a recovered oil tank will be provided to contain the waste oil. If water from the separator is discharged to the environment an NPDES permit in accordance with 40CFR122 will be required. If discharged to a water treatment facility, the requirements of the facility and 40CFR403 "General Pretreatment Regulations for Existing and New Sources of Pollution" must be respected.

16.7 Fire Protection (2021)

16.7.1 General

a. The inherent danger of fire around a diesel fueling station is due to the formation of flammable vapors resulting from the leakage or spillage of oil. Fire prevention measures must first of all curtail the leakage and wastage and otherwise avoid practices that allow vapors to collect or exist; secondly, minimize the possibilities of ignition by faulty equipment or from careless operation; and thirdly, provide adequate fighting facilities. (AREA 1990)

16.7.2 Compliance with Governing Fire Law

a. In the absence of local, state or provincial fire regulations the design and construction of firefighting facilities should be in general accord with the National Fire Protection Association Code. (AREA 1990)

16.7.3 Construction Measures to Prevent Oil Leakage and Spillage

a. Piping. Welded pipe joints are preferable for line pipe. (AREA 1990)
b. Valves. Lubricated plug valves are the least apt to leak and are recommended over gate valves. (AREA 1990)
c. Pressure Relief. Pressure relief valves should be piped back into the storage system and not discharged to atmosphere. (AREA 1990) Special care should be taken for selection of the proper set point of relief valves in systems that have multiple relief valves cascading towards the final discharge point, normally at the storage tanks.
d. Pump Packing. Rotating pump shafts should be equipped with mechanical seals. (AREA 1990)
e. Lighting. Spillage can be curtailed by having adequate lighting for night fueling or unloading work, by having the attendant fuel only one unit at a time, and by not trying to fill the diesel engine tanks too full. (AREA 1990)
f. Paving of Fueling Areas. lt is almost impossible to avoid some spillage at the fueling points and the oil-saturated premises will soon present a serious fire hazard unless adequate counter measures are taken. The recommended practice for important stations is to provide a concrete platform under the entire fueling area, with tracks supported on stub ties. The paving must be sloped to provide quick drainage into sumps or drains which, in turn, should discharge through an oil separator. Another less expensive plan is to provide a concrete working platform with a gutter at the side of the track and install a sheet metal apron over the ends of the ties to direct spillage into the gutter. (AREA 1990)

16.7.4 Construction Measures to Minimize Accidental ignition

a. Electrical installation. Should conform to governing state or provincial and local codes. The wiring should be appropriate to the degree of hazard. Circuit breakers and motor starters should be in dust-tight, vapor-proof cases. In this connection, many railroads install switches and starters in a panel box outside the pump house. (AREA 1990)
b. Welding. The welding procedures, especially for pipe repair work, should be in conformity with American Welding Society standards. (AREA 1990)

16.7.5 Fire Protection Facilities-Portable

a. Most fires have small beginnings that can be brought under control by the quick use of hand fire extinguishers. (AREA 1990)
b. Portable Equipment. Hand fire extinguishers of appropriate size should be located both inside and outside pump houses and also convenient to unloading points and fueling areas. There should be at least two such extinguishers at the fueling area, so placed as to minimize the likelihood of both being surrounded by fire at the same time. Dry powder extinguishers are

recommended for this service. The ones located outside should be fully protected against the weather, housed in cabinets, painted red and otherwise identified. (AREA 1990)

16.7.6 Fire Protection Facilities-Permanent

a. Fuel oil fires can be extinguished by blanketing with foam, by rapid cooling with water fog, and, for a tank of fuel oil on fire, by agitation. (AREA 1990)
b. Fire Hydrants. A water supply system being available, fire hydrants, complete with accessories, should be installed convenient to all major fueling station operations, namely, unloading, storage, pumping and fueling. They should be carefully located so that in case of a major fire they will not be in an untenable locality. A single fire hydrant with two outlets and sufficient hose is minimum under ideal conditions. In many cases storage tanks will be located some distance from the other facilities and more than one hydrant will be required. Their outlets should be adaptable for use by the municipal fire department, if any. (AREA 1990)
c. Fog and Foam Nozzles. Deluge nozzles are not recommended for oil fires because the large water volume tends to spread the burning oil and the concentrated stream does not have the cooling effect needed for reducing evaporation. Fog nozzles should be used in their stead. Foam nozzles with pick-up piping and portable foam generators should also be placed in each hose house so they can be substituted quickly for the fog nozzles in case it becomes necessary to lay a foam blanket on a stubborn ground fire. (AREA 1990)
d. Stationary Foam Generators. Where fuel tanks are large and otherwise located where a fire would be extremely disastrous, the use of stationary foam generators must be considered. This should be housed in a heated building located at a distance from the danger area and be of adequate size to contain all equipment and the liquid or powdered foam stabilizer supplies. The foam chemicals are injected into the water supply in this building, and the branches from the manifold which receives the foam-treated water and piped to the various hydrants. The tops of the oil storage tanks also can be equipped with a fixed sprinkler system supplied from the manifold. The nozzles used for this type of construction should be for a combination foam and water fog, so that the latter can be used in case of failure of the foam generator or should the foam stabilizer supply be exhausted. (AREA 1990)

16.7.7 Fire Protection at Locations Removed From a Regular Water Supply

a. At such locations and, depending on the value of facilities to be protected, consideration should be given to a fire tank car of at least 10,000 gal capacity, equipped with an engine-driven fire pump, a generator for flood lighting night fires, and other firefighting equipment. The discharge head of the fire pump should be sufficient to overcome friction in 300 to 500 ft. of 2-1/2 inch fire hose, and with 50 psi excess head to furnish minimum pressure for the operation of fog nozzles. The use of foam and fog will increase the effectiveness of a fire car with its limited supply of water, and this type equipment should be incorporated. The foam generator can be a permanent pan of the car, installed next to the pump. Adequate supplies of foam liquid or powder should be stored on the car. (AREA 1990)

b. Cabinets of ample size should also be provided for the storage of hose and other equipment, i.e., nozzles, wrenches, raincoats, boots, helmets, axes, etc. These should be inspected and checked at regular intervals for presence and condition of the equipment. (AREA 1990)