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Standard for the Installation of Oil Burning Equipment

NFPA 31 - 1978

Chapter 1 General Provisions

1-1 Definition of Terms.

1-1.1 For the purpose of this installation standard, the following terms shall be interpreted in accordance with the following definitions.

Air Heater. An indirect-fired appliance intended to supply heated air for space heating and other purposes, but not intended for permanent installation.

Antiflooding Device. A primary safety control which causes the flow of fuel to be shut off upon a rise in fuel level or upon receiving excess fuel, and which operates before the hazardous discharge of fuel can occur.

Appliances, Industrial.

(a) **Low-Heat Industrial Appliance.** An industrial appliance such as a commercial cooking range, pressing machine boiler at any pressure, bake oven, candy furnace, stereotype furnace, drying and curing appliance, and other process appliances in which materials are heated or melted at temperatures (excluding flue-gas temperatures) not exceeding 600°F. Appliances otherwise classed as medium-heat appliances may be considered as low-heat appliances if not larger than 100 cu ft in size excluding any burner equipment and blower compartment.

(b) **Medium-Heat Industrial Appliance.** An industrial appliance such as an annealing furnace (glass or metal), charcoal furnace, galvanizing furnace, gas producer, commercial or industrial incinerator, and steam boiler operating at over 50 psig pressure when such appliance is larger than 100 cu ft in size, and other furnaces classified as medium-heat appliances in accordance with nationally recognized good practice. Appliances otherwise classed as medium-heat appliances may be considered as low-heat appliances if not larger than 100 cu ft in size excluding any burner equipment and blower compartment.

I-2
10/17/84
50-400-01

NUCLEAR REGULATORY COMMISSION
Docket No. 50-400 Official Ex. No. 2
In the matter of Sharon Harris
Staff _____ IDENTIFIED ☒
Applicant ☒ RECEIVED ☒
Intervenor _____ REJECTED _____
Cont'g Off'r _____ DATE 10-17-84
Contractor _____ Witness _____
Other _____
Reporter WRB



1-10 Fuel Oil.

1-10.1 The grade of fuel oil used in a burner shall be that for which the burner is approved and as stipulated by the manufacturer. Crankcase oil or any oil containing gasoline shall not be used. For use of oil fuels other than those defined herein, see 1-2.3.

NOTE: The label of Underwriters Laboratories Inc. stipulates for each burner the grade of fuel oil for which the burner is listed.

1-10.2 Where heavy oils are used, provision shall be made for maintaining the oil at the proper atomizing temperature. Automatically operated burners requiring the preheating of oil shall be arranged so that no oil can be delivered for combustion until the oil is at a suitable atomizing temperature.

1-10.3 Except as permitted in 1-2.3, no steam coil operating at a pressure greater than 15 lbs per sq in. gauge shall be installed in an oil tank. When a pressure reducing valve is used to limit the steam pressure 15 psi or less: (a) a relief valve set at not more than 5 psi above the normal pressure in the coil shall be provided, and (b) provision shall be made to limit the steam temperature to 250°F.

NOTE: Tank heaters which are connected so that the condensate or water is not returned to the boiler are preferred.

1-10.4 Hot water coils may be installed in oil tanks provided they are connected to indirect heaters and provisions are made to limit the water temperature to 250°F.

1-10.5 Electric heaters may be installed in oil tanks provided they are equipped with approved thermostats designed to prevent the oil from exceeding its minimum flash point.

1-10.6 When heaters are installed in an oil tank, provisions shall be made to prevent the oil level in the tank from dropping to a point which exposes the surface of the heater.

Chapter 2 Tank Storage**2-1 Design and Construction of Tanks.****2-1.1 Materials.**

2-1.1.1 Tanks shall be built of steel except as provided in 2-1.1.2 through 2-1.1.5.

2-1.1.2 Tanks for underground service may be built of material other than steel.

2-1.1.3 Tanks built of materials other than steel shall be designed to specifications embodying principles recognized as good engineering design for the material used and shall be approved by the authority having jurisdiction.

2-1.1.4 Unlined concrete tanks may be used for above-ground or underground service for fuel oils having a gravity of 40 degrees API or heavier. Concrete tanks shall be built in accordance with sound engineering practice.

2-1.1.5 Tanks may have combustible or noncombustible linings.

2-1.2 Fabrication.

2-1.2.1 Tanks may be of any shape or type consistent with sound engineering design.

2-1.2.2 Metal tanks shall be welded, riveted and caulked, brazed, or bolted, or constructed by use of a combination of these methods. Filler metal used in brazing shall be nonferrous metal or an alloy having a melting point above 1,000°F and below that of the metal joined.

2-1.2.3 Tanks shall be used under substantially atmospheric pressure and shall be built in accordance with approved standards of design. Atmospheric tanks may be built in accordance with:

(a) Underwriters Laboratories Inc., *Standard for Steel Above-ground Tanks for Flammable and Combustible Liquids*, UL 142-1972; *Standard for Steel Underground Tanks for Flammable and Combustible Liquids*, UL 58-1972; or *Standard for Steel Inside Tanks for Oil-Burner Fuel*, UL 80-1974.

(b) American Petroleum Institute Standard No. 650, *Welded Steel Tanks for Oil Storage*, Sixth Edition, 1977.

2-1.2.4 Tanks built according to Underwriters Laboratories Inc. requirements in 2-1.2.3(a) may be used for operating pressures not exceeding 1 psig and shall be limited to 2.5 psig under emergency venting conditions.

2-1.2.5 The tank shall be designed for the maximum static head which will be imposed when the vent or fill pipe is filled with oil. The maximum static head so imposed on tanks built in accordance with 2-1.2.3(a) shall not exceed 10 psig at the bottom of the tank.

2-1.2.6 Pressure tanks if required to conform to 2-1.2.5 shall be built in accordance with the principles of the ASME Boiler and Pressure Vessels Code, Section VIII Pressure Vessels, Division 1 or 2, 1977 Edition, and Addenda dated Summer 1977 and Winter 1977.

2-2 Installation of Underground Tanks (Including Tanks Under Buildings).

2-2.1 Only a tank complying with the construction provisions of Standard UL 58 [see 2-1.2.3(a)] or as provided in 2-1.2.6 shall be buried underground.

2-2.2 Excavation for underground tanks shall be made with due care to avoid undermining of foundations of existing structures. Underground tanks or tanks under buildings shall be so located with respect to existing building foundations and supports that the loads carried by the latter cannot be transmitted to the tank. The distance from any part of a tank storing fuel oil to the nearest wall of any basement, pit or property line shall be not less than 1 ft.

2-2.3 An underground tank shall be set on a firm foundation and surrounded with at least 6 in. of noncorrosive inert materials such as clean sand, earth or gravel well tamped in place. The tank shall be placed in the hole with care since dropping or rolling the tank into the hole can break a weld, puncture or damage the tank metal or scrape off the protective coating of coated tanks. A tank shall be covered with a minimum of 2 ft of earth, or shall be covered with not less than 1 ft of earth on top of which shall be placed a slab of reinforced concrete not less than 4 in. thick. When underground tanks are, or are likely to be, subjected to traffic, they shall be protected against damage from vehicles passing over them by at least 3 ft of earth cover, or 18 in. of well-tamped earth, plus 6 in. of reinforced concrete or 8 in. of asphaltic concrete. When asphaltic or reinforced concrete paving is used as part of the protection, it shall extend at least 1 ft horizontally beyond the outline of the tank in all directions.

2-2.4 Corrosion protection for the tank and its associated buried piping shall be provided by one or more of the following methods: (1) use of protective coatings or wrappings, (2) cathodic protection, or (3) corrosion resistant materials of construction.

2-2.5 Underground tanks shall be equipped with an open vent or an automatically operated vent, arranged to discharge to the open air. Vent openings and vent pipes shall be of ample size to prevent abnormal pressure in the tank during filling but not smaller than the pipe size specified in Table 2-1.

Table 2-1

Capacity of Tank, U.S. Gallons	Approx. Imperial Gallons	Diameter of Vent, Iron Pipe Size
500 or less	500 or less	1¼ inches
501 to 3,000	501 to 2,500	1½ inches
3,001 to 10,000	2,501 to 8,300	2 inches
10,001 to 20,000	8,301 to 16,600	2½ inches
20,001 to 35,000	16,601 to 29,000	3 inches

NOTE: Where tanks are filled by the use of a pump through tight connections, a vent pipe not less in size than the discharge of the pump shall be used.

2-2.6 Except as provided in 3-8.8, all connections to an underground tank shall be made through the top of the tank.

2-2.7 An underground tank shall be provided with means for gauging. (See 3-6.)

2-3 Installation of Unenclosed Supply Tank Inside Building.

2-3.1 An unenclosed supply tank inside of a building shall conform to the following provisions:

2-3.1.1 A supply tank not larger than 10 gal shall be specifically approved for the purpose.

2-3.1.2 An approved safety can may be used as a storage tank.

2-3.1.3 A supply tank larger than 10 gal but not larger than 660 gal shall meet the construction provisions of Standard UL 80 [see 2-1.2.3(a)], or as provided in 2-1.2.5.

2-3.1.4 A supply tank shall be of such size and shape that it can be installed in and removed from the building as a unit.

2-3.2 The size and location of unenclosed tanks inside of any building or any one portion of a building separated from other portions by a fire wall shall be in accordance with the following:

2-3.2.1 Not more than six safety cans may be located in any one or more stories of a building. No such safety can shall have an individual capacity exceeding 5 gal.

2-3.2.2 A supply or storage tank located above the lowest story, cellar or basement shall not exceed 60 gal capacity and the total capacity of tanks so located shall not exceed 60 gal.

2-3.2.3 A supply tank shall be not larger than 660 gal. Not more than one 660-gal tank or two tanks of aggregate capacity of 660 gal or less shall be connected to oil-burning appliances and the aggregate capacity of such tanks installed in the lowest story, cellar, or basement of a building and unenclosed shall not exceed 1,320 gal, unless separation is provided for each 660 gal of tank capacity. Such separation shall consist of an unpierced masonry wall or partition extending from the lowest floor to the ceiling above the tank or tanks and shall have a fire resistance rating of not less than 2 hrs. See Appendix A, Figure A-3 for further details.

2-3.3 An unenclosed supply tank not larger than 10 gal shall be placed not less than 2 ft horizontally from any source of heat either in or external to the appliance being served but in any case shall be located so that the temperature of the oil in the tank will not exceed 25°F above room temperature.

2-3.4 An unenclosed supply tank larger than 10 gal shall be placed not less than 5 ft from any fire or flame either in or external to any fuel-burning appliance, nor shall such a tank obstruct quick and safe access to any utility service meters, switch panels and shutoff valves.

2-3.5 An unenclosed supply tank shall be securely supported by rigid noncombustible supports to prevent settling, sliding or lifting.

2-3.6 When a supply tank larger than 10-gal capacity is provided with an opening in the bottom for use as a burner supply connection or as a drain, the tank shall be pitched toward the opening with a slope of not less than 1/4 in. per ft of length.

2-3.7 A shutoff valve shall be provided immediately adjacent to the burner supply connection at the bottom of a supply tank.

2-3.8 A supply tank larger than 10-gal capacity shall be provided with an open vent pipe not smaller than the pipe size specified in Table 2-1 and a fill pipe, both terminating outside the building.

2-3.9 A supply tank provided with fill and vent pipes shall be equipped with a gauging device. (See Section 3-6.)

2-3.10 Any unused opening in a tank equipped with fill and vent pipes shall be closed vapor tight by a pipe plug or cap screwed up tightly.

2-3.10.1 Two supply tanks connected to the same burner as permitted by 2-3.2.3 may be cross-connected and provided with a single fill and a single vent pipe as described in Appendix A.

2-4 Installation of Enclosed Supply Tanks Inside Buildings.

2-4.1 A supply tank larger than 660-gal capacity shall be enclosed when installed inside of a building.

2-4.2 Tankage inside of a building in excess of that permitted in unenclosed tanks by 2-3.2.3 shall be enclosed.

2-4.3 Regardless of enclosure, a supply or storage tank located above the lowest story, cellar, or basement shall not exceed 60-gal capacity and the total capacity of tanks so located shall not exceed 60 gal.

2-4.4 Only a tank meeting the construction provisions of Standards UL 58 and UL 80 [see 2-1.2.3(a)], or as provided in 2-1.2.6, shall be installed enclosed inside of a building.

2-4.5 Enclosed tanks in buildings shall be in accordance with the following:

2-4.5.1 In buildings of other than fire-resistive construction the gross capacity of the tank(s) shall be not more than 10,000 gal.

2-4.5.2 In buildings of fire-resistive construction the gross capacity of the tank(s) shall be not more than 15,000 gal.

2-4.5.3 The enclosure for tanks in 2-4.5.1 and 2-4.5.2 shall include walls, a floor and a top and be formed from walls, partitions, floors or floor-ceiling assemblies having a fire resistance rating of not less than 3 hours with the walls bonded to the floor. If the walls of such enclosure extend to and are bonded to the underside of a concrete floor or roof which has a fire resistance rating of not less than 3 hours, a separate top is not required for the tank enclosure.

Exception: The gross capacity of tanks may not be more than 50,000 gal in any building provided:

(a) *The individual capacity of any tank is not more than 25,000 gal.*

(b) *The tank(s) are in an enclosure having walls, a floor and a top, and constructed of assemblies having a fire resistance rating of not less than 3 hours with walls bonded to the floor.*

(c) *The tank enclosure is located in a room or area of the building cut off vertically and horizontally from other areas and floors of the building by assemblies having a fire resistance rating of not less than 2 hr. Access into the room shall be by an opening protected with a self-closing listed 3-hr (Class A) fire door. Fire doors shall be installed in accordance with NFPA 80, Standard for Fire Doors and Windows. The top and walls of the tank enclosure shall be independent of the building construction except that an exterior building wall having a fire resistance rating of not less than 3 hr may serve also as a wall of the tank enclosure.*

2-4.6 The tank shall be supported at least 4 in. above the floor by masonry saddles at least 12 in. thick, spaced not more than 8 ft on centers and extending the full width of the tank. At least 15-in. clearance shall be provided between the tank and the top and walls of the tank enclosure for the purpose of inspection and repair.

2-4.7 All connections to an enclosed supply tank having a capacity of more than 660 gal shall be made through the top of the tank, and the transfer of oil shall be by pump only and through continuous piping to and from the consuming appliances.

2-4.8 Each tank enclosure shall be provided with an opening protected by a self-closing listed 3-hr (Class A) fire door and a non-combustible liquid-tight sill or ramp at least 6 in. high. Fire doors shall be installed in accordance with NFPA 80, *Standard for Fire Doors and Windows*. If the sill or ramp is more than 6 in. high, the walls to a height corresponding to the level of oil that will be retained shall be built to withstand the lateral pressure due to the liquid head.

2-4.9 Provision shall be made for adequate ventilation of such enclosures prior to entering for inspection or repair of tanks.

2-4.10 An enclosed supply tank shall be equipped with an open vent or an automatically operated vent, terminating outside the building. Vent openings and vent pipes shall be of ample size to prevent abnormal pressure in the tank during filling but not smaller than the pipe size specified in Table 2-1.

2-4.11 An enclosed supply tank shall be provided with a gauging device. (See Section 3-6.)

2-5 Installation of Outside Aboveground Tanks Not Larger than 660 Gal.

2-5.1 The provisions of Section 2-5 do not apply to centralized oil distribution systems. (See Section 3-8.)

2-5.2 Tankage not in excess of that permitted by 2-3.2 may be installed outside aboveground in a built-up area. The tanks may be adjacent to buildings but the distance to the line of adjoining property shall be in accordance with Table 2-2. Such tanks shall be suitably protected from the weather and from physical damage incident to outside use. The tanks shall not block normal means of egress.

2-5.3 A tank not larger than 60-gal capacity may be a DOT-5 Shipping Container (drum), and so marked, a listed safety can, or a tank meeting the provisions of Standard UL 80 [see 2-1.2.3(a)], or as provided in 2-1.2.6.

2-5.4 A tank other than a DOT-5 Shipping Container having a capacity of not more than 660 gal shall meet the provisions of Standard UL 80 [see 2-1.2.3(a)], or as provided in 2-1.2.6.

2-5.5 Not more than one 660-gal tank or two tanks of aggregate capacity of 660 gal or less shall be connected to oil-burning appliances.

2-5.6 Two supply tanks connected to the same burner as permitted by 2-5.5 above may be cross-connected and provided with a single fill and a single vent as described in Appendix A but when so connected they shall be on a common slab and rigidly secured, one to the other.

2-5.7 Tanks having a capacity of 660 gal or less shall be securely supported by rigid noncombustible supports to prevent settling, sliding or lifting.

2-5.8 The filling of a portable container from a storage tank larger than 60 gal shall be by means of a hand pump only.