# Second Revision No. 422-NFPA 30-2022 [ Global Comment ]

[SEE CHANGES IN CHAPTERS 21, 22, 23 AND 26]

**21.7.1.5**

An underground tank shall be equipped with overfill prevention equipment ~~that will either alert the transfer operator when the tank is no more than 90 percent full by triggering an audible and visual high-level alarm or automatically shut off the flow of ignitible (flammable or combustible) liquid into the tank when the tank is no more than 95 percent full.~~designed to accomplish at least one of the following:

(1) Automatically shut off the flow of ignitible (flammable or combustible) liquid into the tank when it is no more than 95 percent full

(2) Alert the transfer operator when the tank is no more than 90 percent full by either restricting flow or triggering a high-level alarm

(3) Restrict flow 30 minutes before overfilling or alert the transfer operator with a high-level alarm one minute before overfilling, or automatically shut off flow into the tank before any tank top fittings are exposed to the stored liquid

**21.7.1.5.1**

Other methods of overfill protection shall be permitted ~~as~~if approved by the authority having jurisdiction.

**21.7.1.5.2***

Where used, overfill prevention devices shall be listed or approved *(see 21.7.1.5.3)*.

**A.21.7.1.5.2**

UL/ULC 2583, *Fuel Tank Accessories for Flammable and Combustible Liquids,* contains functional testing requirements for overfill prevention devices to ensure they meet the alarm or shutoff functions at the tank capacity levels in 21.7.1.5 at the time of installation.

**21.7.1.5.3**

The requirement in 21.7.1.5.2 does not apply to tanks for upstream production liquids.

**22.11.4.5**

Means shall be provided to prevent overfilling by sounding an alarm when the liquid level in the tank ~~reaches~~is no more than 90 percent of capacity ~~and~~or by automatically stopping delivery of liquid to the tank when the liquid level in the tank ~~reaches~~is no more than 95 percent of capacity.

**22.11.4.5.1**

In no case shall these provisions restrict or interfere with the functioning of the normal vent or the emergency vent.

**22.11.4.5.2***

When used, overfill prevention devices shall be listed or approved *(see 22.11.4.5.2.1).*

**A.22.11.4.5.2**

UL/ULC 2583, *Fuel Tank Accessories for Flammable and Combustible Liquids*, contains functional testing requirements for overfill prevention devices to ensure they meet the alarm or shutoff functions at the tank capacity levels in 22.11.4.5 at the time of installation.

**22.11.4.5.2.1**

The requirement in 22.11.4.5.2 does not apply to tanks in API 620, *Design and Construction of Large, Welded, Low-pressure Storage Tanks*, and API 650, *Welded Tanks for Oil Storage*, or tanks for upstream production liquids.

**23.11 Control of Spills from Underground Storage Tanks. ~~(Reserved)~~**

Prevention of overfilling the tank shall comply with the requirements of 21.7.1.5 or other methods approved by the authority having jurisdiction.

**26.7 Overfill Protection Requirements.**

Overfill protection requirements shall be as specified in Chapters 21 and 22.

## Supplemental Information

| File Name | Description | Approved |
|---|---|---|
| 30_SR-422_Tank_Accessories_Global.docx | for staff use | |

## Submitter Information Verification

**Committee:** FLC-TAN

**Submittal Date:** Thu Jul 21 21:01:49 EDT 2022

## Committee Statement

**Committee Statement:** A comprehensive review was conducted of all applicable NFPA 30 and NFPA 30A overfill prevention requirements for both aboveground and underground storage tanks (ASTs and USTs). This review also included a review of the EPA UST regulations used to develop NFPA 30 and NFPA 30A requirements. Some deviations in overfill protection processes and fill levels between ASTs and USTs, and NFPA 30 and NFPA 30A were deemed appropriate due to the fundamental differences between ASTs and USTs, as well as differences between the specific smaller tanks covered by NFPA 30A and that of larger tanks in broader applications in NFPA 30. All UST overfill requirements in NFPA 30 were revised to at least meet the Federal EPA UST Regulations. The following revisions were made.

• The re-written requirements in 21.7.1.5 improve comprehension and are the same except another option that is available under EPA was added as option C.

• New requirement 21.7.1.5.2 was added for consistency with new 22.11.4.5.2 to require listed or approved overfill prevention devices if installed on underground shop-fab tanks due to their critical safety function(s) already required in 21.7.1.5. New annex A.21.7.1.5.2 identifies standards which evaluate these devices to meet functional safety new and after expected use conditions.

• New requirement 23.11.1 was added to reinforce the requirements for UST overfill prevention options already in 21.7.1.5.

• New requirement 22.11.4.5.2 was added to require Listed or Approved overfill prevention devices if installed on shop-fab tanks due to their critical safety function(s) already required in 22.11.4.5. The proposal also makes revisions to

a) eliminate the need for both an alarm at no more than 90% and shutoff at no more than 95%, and

b) permit actuation of either at tank fill levels below the maximum values to better align with EPA Regs and practical use.

New annex A.22.11.4.5.2 identifies standards which evaluate these devices to meet functional safety new and after expected use conditions.

Additional requirements indicate that these requirements are not applicable to tanks used in upstream production fluids because these tanks have their own devices that are certified by the tank manufacturer.

**Response Message:** SR-422-NFPA 30-2022

## Second Revision No. 425-NFPA 30-2022 [ Global Comment ]

[REMOVING SECTIONS IN THE FLC-TAN CHAPTERS RELATED TO UNSTABLE LIQUIDS].

~~22.4.2.2~~

~~A tank storing unstable liquid shall be separated from any other tank containing either an unstable liquid or a Class I, Class II, or Class III liquid (any FP or BP) by a distance not less than one-half the sum of their diameters.~~

~~22.7.1.3~~

~~If unstable liquids are stored, the effects of heat or gas resulting from polymerization, decomposition, condensation, or self-reactivity shall be taken into account.~~

~~24.4.7~~

~~Tanks in which unstable liquids are stored shall be separated from potential fire exposures by a clear space of at least 25 ft (7.6 m) or by a wall having a fire resistance rating of not less than 2 hours.~~

### Supplemental Information

| File Name | Description | Approved |
|---|---|---|
| 30_SR-425_Unstable_Liquids_Global_TAN.docx | for staff use | |

### Submitter Information Verification

**Committee:** FLC-TAN

**Submittal Date:** Mon Jul 25 11:48:01 EDT 2022

### Committee Statement

**Committee Statement:** This revision correlates with the removal of unstable liquids from NFPA 30 scope as decided by all of the Technical Committees.

**Response Message:** SR-425-NFPA 30-2022

## Second Revision No. 426-NFPA 30-2022 [ Global Comment ]

[SEE EXPLOSION CONTROL REVISIONS RELATED TO THE FLC-TAN CHAPTERS].

**21.6.3 Management of Fire and Explosion Hazards.**

The extent of required fire and explosion ~~prevention and~~ control ~~procedures and measures provided for tank storage facilities~~ shall be determined ~~by an engineering evaluation of the installation and operation, followed by the application of recognized fire and explosion prevention and process engineering principles. The evaluation shall include, but not be limited to, the following:~~ in accordance with 6.4.1.2.3.

~~(1) Analysis of fire and explosion hazards of the facility~~

~~(2) Analysis of local conditions, such as exposure to and from adjacent properties, flood potential, or earthquake potential~~

~~(3) Facility, fire department, or mutual aid response~~

**24.4.5**

Where a storage tank building has an exterior wall facing an exposure, the distances in Table 24.4.2 shall be permitted to be modified as follows:

(1) Where the wall is a blank wall having a fire resistance rating of not less than 2 hours, separation distance between the storage tank building and its exposure shall not be required to be greater than 25 ft (7.6 m).

(2) Where a blank wall having a fire resistance rating of not less than 4 hours is provided, the distance requirements of Table 24.4.2shall not apply.

(3) *~~Where Class IA liquids [FP < 73°F (22.8°C) and BP < 100°F (37.8°C)] or unstable liquids are stored, the exposing wall shall have explosion resistance in accordance with recognized engineering standards, and deflagration venting designed in accordance with NFPA 68 shall be provided in the nonexposing walls and roof.~~

~~**A.24.4.5(3)**~~

~~See NFPA 68 for information on deflagration venting.~~

**24.4.6**

If the explosion control methods provided in NFPA 68 are used, the wall facing an exposure shall be pressure resistant unless another approach in accordance with Section 6.8 is approved.

**24.5.4**

~~Storage tank buildings where Class IA liquids [FP < 73°F (22.8°C) and BP < 100°F (37.8°C)] are stored shall be designed to direct flame, combustion gases, and pressure resulting from a deflagration away from important buildings or occupied areas through the use of damage-limiting construction. The damage-limiting~~

~~construction design shall be in accordance with NFPA 68 and shall be acceptable to the authority having jurisdiction.~~The extent of required damage-limiting construction for storage tank buildings shall be determined in accordance with 6.4.1.2.3 and Section 6.8.

~~**A.24.5.4**~~

~~See NFPA 68 for information on deflagration venting.~~

**24.12 Explosion Control.~~(Reserved)~~**

The extent of required explosion control shall be determined in accordance with 6.4.1.2.3.

**25.12 Explosion Control.~~(Reserved)~~**

The extent of required explosion control shall be determined in accordance with 6.4.1.2.3.

## Supplemental Information

| File Name | Description | Approved |
|---|---|---|
| 30_SR-426_Explosion_Control_Global_TAN.docx | for staff use | |

## Submitter Information Verification

**Committee:** FLC-TAN

**Submittal Date:** Mon Jul 25 11:57:05 EDT 2022

## Committee Statement

**Committee Statement:** This revision correlates the requirements of explosion control within the document. The prescriptive requirement in 24.4.6 was altered to allow additional approaches because there are other approaches to explosion control rather than those specifically called out in NFPA 68 that are acceptable.

**Response Message:** SR-426-NFPA 30-2022

## Second Revision No. 459-NFPA 30-2022 [ Global Comment ]

[SEE CHAPTER 27 CHANGES REGARDING "SECONDARY CONTAINMENT PIPING" AND ITS USE IN THIS CHAPTER.]

**27.1.1**

This chapter shall apply to the design, installation, testing, operation, and maintenance of piping systems for liquids or flammable vapors. Such piping systems shall include, but not be limited to, pipe, tubing, flanges, bolting, gaskets, valves, fittings, flexible connectors~~,~~; the pressure-containing parts of other components including, but not limited to, expansion joints and strainers~~,~~; and devices that serve such purposes as mixing, separating, snubbing, distributing, metering, control of flow, or secondary containment piping.

**27.2.5* Secondary ContainmentPiping.**

~~Containment that is external to and separate from the primary piping system.~~A pipe system installed around a primary pipe system that can be tested and monitored for leaks and which often includes containment sumps.

**A.27.2.5**

Secondary containment piping systems often include containment sumps. Examples of secondary containment piping include double-wall and coaxial piping.

**27.4.6.1**

Piping systems of nonmetallic materials, including piping systems incorporating secondary containment piping, shall be designed and built in accordance with recognized standards of design or approved equivalents and shall be installed in accordance with 27.4.4.

**27.6.2* Load-Bearing Supports.**

Load-bearing piping supports that are located in areas with a high fire exposure risk shall be protected by one or more of the following:

(1) Drainage to a safe location to prevent ignitible (flammable or combustible) liquid from accumulating under pipeways *(see also, Section 6.12)*

(2) Fire-resistive construction

(3) Fire-resistant protective coatings or systems

(4) Water spray systems designed and installed in accordance with NFPA 15

(5) Other alternate means acceptable to the authority having jurisdiction

### Supplemental Information

| File Name | Description | Approved |
|---|---|---|
| 30_SR-459_Ch._27_Piping_changes_.docx | for staff use | |

## Submitter Information Verification

**Committee:** FLC-TAN

**Submittal Date:** Wed Aug 17 13:49:59 EDT 2022

## Committee Statement

**Committee Statement:** These changes correlate with others made throughout the code regarding containment, drainage and spill control. To clarify the definition of "secondary containment" used throughout NFPA 30, the word "piping" was added to this term to be specific regarding secondary containment piping compared to general secondary containment. Additional changes are made to clarify the use of secondary containment piping in Chapter 27.

**Response Message:** SR-459-NFPA 30-2022

# Second Revision No. 468-NFPA 30-2022 [ Global Comment ]

[SEE ATTACHED FILE CHANGES TO TABLE 22.4.2.1 NOTES AND A NEW ANNEX F].

## Supplemental Information

| File Name | Description | Approved |
|---|---|---|
| 30_SR-468_Tank_Spacing_Global.docx | for staff use | |
| 30_Global_SR-468_Annex_F-new.pdf | for ballot | |

## Submitter Information Verification

**Committee:** FLC-TAN

**Submittal Date:** Mon Aug 22 13:38:56 EDT 2022

## Committee Statement

**Committee Statement:** There have been many incidents where a tank fire on one tank quickly spread to the adjacent tanks and most of these escalations are in tanks that are 150 feet in diameter or less. There are many causes of tank fire spread beyond that of radiation, including inadequate emergency response, maintenance, and lack of water. A detailed risk evaluation should consider several factors, including the potential effects of thermal radiation, when evaluating tank spacing.

Thermal radiation modeling could indicate that increased tank spacing may be beneficial. Thermal radiation modeling can be used as part of a fire risk assessment to assess the appropriate mitigation measures for tank fires. These measures may include exposure protection such as installation of cooling rings or fixed fire water monitors; evaluating emergency response tactics and emergency response access; or locating highly flammable liquid storage closer to emergency access. A new annex provides a comparison of thermal models and discusses variables which can impact thermal modeling results.

**Response Message:** SR-468-NFPA 30-2022

**Table 22.4.2.1 Minimum Shell-to-Shell Spacing of Aboveground Storage Tanks**

| | | Fixed Roof or Horizontal Tanks | |
|---|---|---|---|
| **Tank Diameter** | **Floating Roof Tanks** | **Class I or Class II Liquids [FP < 140°F (60°C)]** | **Class IIIA Liquids [140°F (60°C) ≤ FP < 200°F (93°C)]** |
| All tanks not over 150 ft (45 m) in diameter | **1/6** × sum of adjacent tank diameters but not less than 3 ft (0.9 m) | **1/6** × sum of adjacent tank diameters but not less than 3 ft (0.9 m) | **1/6** × sum of adjacent tank diameters but not less than 3 ft (0.9 m) |
| Tanks larger than 150 ft (45 m) in diameter: | | | |
| If remote impounding is provided in accordance with 22.11.1 | **1/6** × sum of adjacent tank diameters | **1/4** × sum of adjacent tank diameters | **1/6** × sum of adjacent tank diameters |
| If open diking is provided in accordance with 22.11.2 | **1/4** × sum of adjacent tank diameters | **1/3** × sum of adjacent tank diameters | **1/4** × sum of adjacent tank diameters |

Notes:

(1) The “sum of adjacent tank diameters” means the sum of the diameters of each pair of tanks that are adjacent to each other. See also A.22.4.2.1.

(2) The separation distances in Table 22.4.2.1 are minimum requirements. Where thermal radiant heat flux modeling completed as part of an engineering evaluation shows potential escalation to adjacent tanks, distances could be increased, or mitigation measures could be implemented. *(See Annex F.)*

**A.22.4.2.1**
Where more than two tanks are involved, the sum of the diameters of each possible pair of tanks is calculated. For example, assume four tanks in a common diked area, numbered 1 through 4 clockwise from tank #1. The diameter of each pair of tanks is summed, as follows: 1 and 2, 1 and 3, 1 and 4, 2 and 3, 2 and 4, and 3 and 4.
Regarding note (2) in Table 22.4.2.1, see Section 6.4 for engineering evaluations. Tank shell and roof exposure protection (such as cooling rings) can be used on existing tanks to control exposure protection and prevent escalation.

## Annex F Using Thermal Radiation Modeling for Tank Spacing

### F.1 Introduction.
Where siting new tanks or evaluating tank spacing, thermal radiation modeling could indicate that increased tank spacing might be beneficial. Thermal radiation modeling can be used as part of a fire risk assessment to assess the appropriate mitigation measures. These measures can include exposure protection such as installation of cooling rings or fixed fire water monitors, evaluating emergency response tactics and emergency response access, or locating highly flammable liquid storage closer to emergency access. This annex should be considered as part of an overarching fire risk assessment and consists of a comparison of four thermal radiation models and a discussion on parameters that can affect model results.

### F.2 Modeling.
Four different models were used, three models owned by specialist companies and one public domain software. The three specialist company models used were Phast, Canary, and Safesite, while the public domain software used was Aloha.
The models used the following parameters:

(1) Gasoline, diesel, and ethanol

(2) Tank diameters of 20 ft (6.1 m), 50 ft (15.2 m), 100 ft (30.5 m), and 150 ft (45.7 m)

(3) Wind and Pasquill Gifford stability class conditions of 5D and 7D

(4) Thermal radiation contours at 30 kW/m$^2$, 32 kW/m$^2$, and 37.5 kW/m$^2$ where 1 kW/m$^2$ = 317 btu/hr-ft$^2$

The model results are presented in Table F.2(a) and Table F.2(b).

Table F.2(a) Range of Distances (m) (Shell to Shell) to Thermal Radiation Levels (5D Wind and Stability Condition)

| **Fuel** | **Tank Diameter (m)** | **30 kW/m² (m)** | **32 kW/m² (m)** | **37.5 kW/m² (m)** |
|---|---|---|---|---|
| Gasoline | 6 (20 ft) | 4.5–11.9 | 3.8–11.3 | 2.5–10.7 |
| | 15 (50 ft) | 5.8–12.2 | 4.8–11.8 | 1.8–10.6 |
| | 30 (100 ft) | 8.7–14.6 | 8.3–13.8 | 7.5–12.6 |
| | 45 (150 ft) | 10.5–16.1 | 10.1–15.5 | 9.0–14.3 |
| Diesel | 6 (20 ft) | 4.4–10.1 | 3.8–9.8 | 2.5–9.4 |
| | 15 (50 ft) | 3.6–19.3 | 3.4–15.2 | 2.9–6.5 |
| | 30 (100 ft) | 4.8–4.8 | 4.5–4.5 | 3.9–3.9 |
| | 45 (150 ft) | 5.7–5.7 | 5.4–5.4 | 4.7–4.7 |
| Ethanol | 6 (20 ft) | 0.7–6.7 | 0.6–6.4 | 0.6–4.9 |
| | 15 (50 ft) | 4.0–19.8 | 3.1–18.9 | 1.1–17.1 |
| | 30 (100 ft) | 1.2–34.7 | 8.8–33.2 | 4.7–29.9 |
| | 45 (150 ft) | 17.9–49.1 | 15.0–46.9 | 9.0–42.1 |

Table F.2(b) Range of Distances (m) (Shell to Shell) to Thermal Radiation Levels (7D Wind and Stability Condition)

| **Fuel** | **Tank Diameter (m)** | **30 kW/m² (m)** | **32 kW/m²(m)** | **37.5 kW/m²(m)** |
|---|---|---|---|---|
| Gasoline | 6 (20 ft) | 5.0–12.5 | 4.2–12.2 | 2.7–11.6 |
| | 15 (50 ft) | 6.4–13.8 | 6.4–13.2 | 2.7–11.9 |
| | 30 (100 ft) | 0.9–17.0 | 8.6–16.2 | 7.8–15.0 |
| | 45 (150 ft) | 11.0–19.5 | 10.5–18.8 | 9.4–17.3 |
| Diesel | 6 (20 ft) | 4.9–10.1 | 4.2–10.1 | 2.6–9.8 |
| | 15 (50 ft) | 3.7–10.7 | 3.5–9.8 | 3.0–8.0 |
| | 30 (100 ft) | 5.0–5.0 | 4.7–4.7 | 4.1–4.1 |

| Fuel | Tank Diameter (m) | 30 kW/m² (m) | 32 kW/m²(m) | 37.5 kW/m²(m) |
|---|---|---|---|---|
| | 45 (150 ft) | 6.0–6.0 | 5.7–5.7 | 4.9–4.9 |
| Ethanol | 6 (20 ft) | 0.6–7.8 | 0.6–7.0 | 0.6–5.5 |
| | 15 (50 ft) | 4.3–19.8 | 3.3–19.2 | 1.1–17.4 |
| | 30 (100 ft) | 2.3–34.7 | 9.8–33.5 | 5.1–30.5 |
| | 45 (150 ft) | 20.3–48.5 | 17.0–48.5 | 10.0–42.7 |

1 $kW/m^2$ = 317 $btu/hr\text{-}ft^2$

Some observations about the spread of the results include the following:

(1) The level of agreement for 3 of the 4 models was very good at 20 ft (6 m) diameter.

(2) The projected distance of concern from the public domain model diverged from the average of the other models significantly as the tank/pool diameter increased. The divergence increases by almost an order of magnitude with every 50 ft (15 m) increment increase in diameter.

(3) The projected distance of concern of all the other models (except the public domain model) also diverged as the tank/pool diameter increased. There are cases where the difference between the other private software models was close to an order of magnitude.

It is assumed that the primary driver of the conclusions above is that the base or root calculation method of all the models are using the same/similar equations derived from relatively small fire tests. It is possible that these models are diverging because each of them uses different assumptions or test data in scaling up the small tank/pool fire equations. Therefore, some models might be more conservative than others.

This scaling issue can be concerning from an engineering perspective as it shows one could select a model to get the results they want to achieve. However, with three of the four models being in close agreement for 20 ft (6 m) diameter tanks, there is a reasonable basis for evaluating the spacing tables regarding small tanks. The projected distances of concern for three of the four models at 20 ft (6 m) diameters are as follows:

(1) About 10–12 times the minimum shell-to-shell spacing separation 3 ft (0.9 m) allowed by Table 22.4.2.1.

(2) Approximately 5–6 times that recommended for two 20 ft (6 m) diameter located adjacent to each other.

The results of the model with the lowest distance of concern exceeded that of the table as follows:

(1) Minimum separation distance by 5–8 times

(2) Recommended spacing for two 20 ft (6 m) diameter tanks by 3–4 times

Given the convergence of the models at 20 ft (6 m) diameters and the direct/close relationship of the historical test data to tank diameter (see the *SFPE Handbook of Fire Protection Engineering*), the distances in Table 22.4.2.1 have a degree of uncertainty if the objective is to at least prevent a catastrophic failure of an adjacent tank due to radiant heat. The shell-to-shell spacing might need to be increased.

The public domain model does not account for “smoke fraction,” which is the by-products from fires. This could be one reason for the discrepancy of the public domain model when compared to the private software models.

Smoke fraction is a key factor in a pool fire, where the smoke insulates the luminous fire and, therefore, reduces the thermal radiation to the target. Fires that burn with less smoke will have higher thermal radiation, while large tank fires will probably produce more smoke and higher smoke fraction.

## F.3 Variables That Can Impact Model Results.

### F.3.1 Introduction.

It is recognized that performance-based assessments are increasingly used to assess the fire risk associated with the storage and handling of ignitible (flammable and combustible) liquids. The assessment of shell-to-shell spacing to optimize footprint and tank radius to assess the risk of fire escalation should be evaluated. Different input parameters such as wind speed, tank height, tank diameter, tank type, and stored material (liquid) properties can change the thermal exposure of the adjacent storage tank and should be considered when assessing shell-to-shell separation distances.

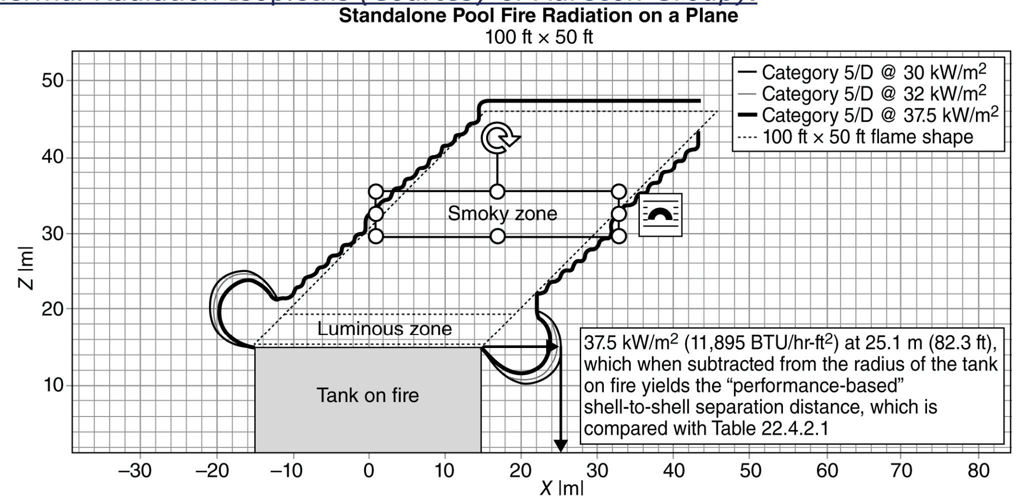
Several thermal radiation models were established and analyzed to assess the downwind thermal radiation exposure to adjacent tanks. The primary variables that impacted the downwind distance were wind speed and the material (liquid) stored in the tank. The Pasquil atmospheric stability class, ambient or stored material temperature, and atmospheric humidity have negligible impact on the results of the models.

### F.3.2 Thermal Modeling.

The radiant heat flux received by a nearby target depends on its spatial position relative to the flame, the flame surface emissive power, and the flame length and diameter. The surface emissive power of pool fires usually varies with height, particularly for smoky pool fires. Studies have shown that there are two regions of thermal emittance: a flame base zone or luminous zone, and an intermittent flame zone or smoky zone. Multizone pool fire models, such as solid cylindrical flame models, are now readily available and are capable of more accurately representing radiant emittance from pool fires when compared with traditional single-zone models and thereby are considered to provide more accurate radiation predictions in the near field. The flame length and flame tilt are estimated by empirical correlations. One source of thermal modeling information is the SFPE *Handbook of Fire Protection Engineering.*

Figure F.3.2 presents a typical pool fire model showing the different thermal radiation level isopleths and shows the luminous and smoky portions of the flame.

Figure F.3.2 Typical Thermal Radiation Isopleths *(Courtesy of Aurecon Group).*




Variables that can determine the thermal impact on the exposed adjacent tank include, but are not limited to, F.3.3 through F.3.6.

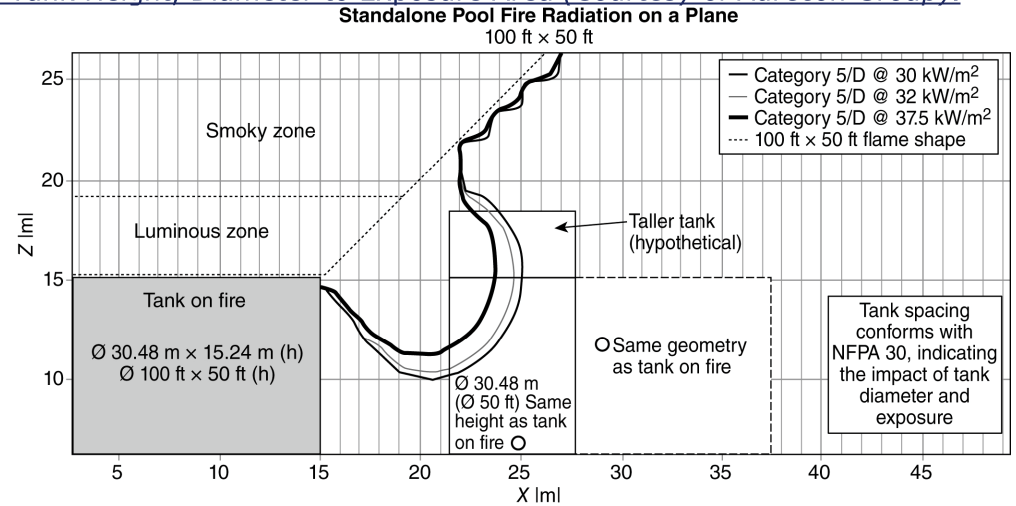
**F.3.3 Weather Conditions and Size of Fire.**

The diameter of pool fire (corresponding to the diameter of the tank) will determine the flame height. The wind speed and direction will impact the flame tilt. These two factors determine how much view factor can be seen by the exposed tank.

**F.3.4 Exposed Tank Diameter and Height.**

If the exposed tank is taller than the tank on fire, the thermal radiation view factor might impact the exposed tank shell more than the tank roof. The roof of an adjacent fixed-cone roof tank is in contact with its vapor space, whereas the tank shell is exposed to both vapor space (top) and liquid product (bottom). The taller the tank, the more of the exposed area of the tank shell will be impacted. *(See F.3.4.)*

Figure F.3.4 Impact of Tank Height, Diameter to Exposure Area *(Courtesy of Aurecon Group)*.




**F.3.5 Properties of Liquid or Product Stored.**

The type of liquid stored has a material impact on the flame properties, and thereby the radiant heat flux received by an adjacent, exposed tank. Key variables include the heat of combustion, the mass burn rate, and the vapor pressure. Additional information on common liquid's heats of combustion and mass burn rates can be found in various references.

**F.3.6 Other Factors to Consider.**

When assessing the risk of escalation, preventative and mitigation measures should be considered as part of a fire risk assessment. NFPA 551 provides guidance on performing fire risk assessments to assist in the determination of the level of fire protection mitigation required.

Other factors that can impact the decision of tank spacing include, but are not limited to, availability of an industrial emergency response team or mutual aid, proximity to the public or other societal risks, emergency response access, fixed foam extinguishing systems, tank shell and roof cooling rings for exposure protection, tank design and construction, products stored, inerting system (i.e., blanketing), and vapor recovery units (VRUs).

# Second Revision No. 481-NFPA 30-2022 [ Detail ]

Add annex to 26.4 **Identification for Emergency Responders.**

**A.26.4**

Section 26.4 requires a flammability "3" placard with the intent of signaling firefighters responding to an emergency to maintain a safe distance because tanks at these sites might not meet traditional commercial tank construction requirements. Even though the flammability hazard of the stored material might not warrant a "3" classification, the use of that designation is to be conservative for these applications. NFPA's *Fire Protection Guide to Hazardous Materials* shows a "3" for crude oil.

## Submitter Information Verification

**Committee:** FLC-TAN

**Submittal Date:** Thu Sep 29 09:16:18 EDT 2022

## Committee Statement

**Committee Statement:** This annex was mistakenly left out of the First Draft ballot and is presented here for approval.

**Response Message:** SR-481-NFPA 30-2022

## Second Revision No. 478-NFPA 30-2022 [ Section No. 21.4.3.1.1 ]

**21.4.3.1.1***

Storage tanks shall be vented to prevent the development of vacuum or pressure that can distort the tank or exceed the rated design vacuum or rated design pressure of the tank when the tank is filled or emptied or because of atmospheric temperature changes.

**21.4.3.1.1.1***

Where used, pressure-vacuum vent devices shall be listed or approved.

**A.21.4.3.1.1.1**

UL/ULC 2583, *Fuel Tank Accessories for Flammable and Combustible Liquids*, contains functional testing requirements for pressure/vacuum vent devices to ensure they meet the pressure- and vacuum-relieving pressures in 21.4.3.2 at the time of installation.

**21.4.3.1.1.2**

The requirement in 21.4.3.1.1.1 does not apply to tanks for upstream production liquids.

### Submitter Information Verification

**Committee:** FLC-TAN

**Submittal Date:** Fri Aug 26 16:24:19 EDT 2022

### Committee Statement

**Committee Statement:** NFPA 30 requires normal venting to equalize internal and external tank pressures during fill/withdraw operations and when atmospheric conditions change. This safety function preventing tank damage and leakage is typically done by using pressure/vacuum venting devices for flammable liquid tanks. Therefore, to ensure these devices consistently operate at the pressures required by 21.4.3.1 in their expected environments, listing or approval must be added.

**Response Message:** SR-478-NFPA 30-2022

## Second Revision No. 465-NFPA 30-2022 [ Section No. 21.5.2 ]

**21.5.2*** Tightness Testing.

In addition to the tests called for in 21.5.1, all tanks and connections shall be tested for tightness after installation and before being placed in service in accordance with 21.5.2.3 through 21.5.2.11, as applicable. ~~Except for underground tanks, this test shall be made at operating pressure with air, inert gas, or water.~~

**21.5.2.1**

Except for underground tanks, ~~this~~ the test required in 21.5.2 shall be made at operating pressure with air, inert gas, or water.

**21.5.2.2** Conditions Where Field Testing Is Not Required.

~~Testing required by 21.5.2 shall not be required for a primary tank or an interstitial space that continues to maintain a factory-applied vacuum in accordance with the manufacturer's instructions. Such components shall be considered to be tight until such time that the vacuum is broken. Final tightness testing of an interstitial space shall not be required if the factory-applied vacuum is maintained until one of the following conditions is met:~~

~~For aboveground tanks, the tank is set on the site at the location where it is intended to be installed.~~

~~For underground tanks, backfill has been completed to the top of the tank.~~

**21.5.2.2.1**

Testing required by 21.5.2 shall not be required for a primary tank or an interstitial space that continues to maintain a factory-applied vacuum in accordance with the manufacturer's instructions.

**21.5.2.2.2**

Such components as stated in 21.5.2.2.1 shall be considered to be tight until such time that the vacuum is broken.

**21.5.2.2.3**

Final tightness testing of an interstitial space shall not be required if the factory-applied vacuum is maintained until one of the following conditions is met:

(1) For aboveground tanks, the tank is set on the site at the location where it is intended to be installed.

(2) For underground tanks, backfill has been completed to the top of the tank.

**21.5.2.3**

Air pressure shall not be used to test tanks that contain liquids or vapors. *(See Section 27.7 for testing pressure piping.)*

**21.5.2.4**

For field-erected tanks, the tests required by 21.5.1.1 or 21.5.1.2 shall be permitted to be considered the test for tank tightness.

**21.5.2.5**

Horizontal shop-fabricated aboveground tanks shall be tested for tightness either hydrostatically or with air pressure at not less than a gauge pressure of 3 psi (20 kPa) and not more than a gauge pressure of 5 psi (35 kPa).

**21.5.2.6**

Vertical shop-fabricated aboveground tanks shall be tested for tightness either hydrostatically or with air pressure at not less than a gauge pressure of 1.5 psi (10 kPa) and not more than a gauge pressure of 2.5 psi (17 kPa).

**21.5.2.7***

Rectangular shop-fabricated aboveground tanks shall be tested for tightness either hydrostatically or with air pressure at not less than a gauge pressure of 0.5 psi (3 kPa) and not more than a gauge pressure of 1.5 psig (10 kPa) or in accordance with the tank's listing or the manufacturer's instructions.

**21.5.2.8**

Single-wall underground tanks and piping, before being covered, enclosed, or placed in use, shall be tested for tightness either hydrostatically or with air pressure at not less than a gauge pressure of 3 psi (20 kPa) and not more than a gauge pressure of 5 psi (35 kPa).

**21.5.2.9***

Underground secondary containment tanks and horizontal aboveground secondary containment tanks shall have the primary (inner) tank tested for tightness either hydrostatically or with air pressure at not less than a gauge pressure of 3 psi (20 kPa) and not more than a gauge pressure of 5 psi (35 kPa).

**21.5.2.9.1***

The interstitial space of such tanks shall be tested either hydrostatically or with air pressure at a gauge pressure of 3 to 5 psi (20 to 35 kPa), by vacuum at 5.3 in. Hg (18 kPa), or in accordance with the tank's listing or the manufacturer's instructions.

**21.5.2.9.2**

The pressure or vacuum shall be held for not less than 1 hour or for the duration specified in the listing procedures for the tank.

**21.5.2.10***

The interstitial space of such tanks shall be tested either hydrostatically or with air pressure at a gauge pressure of 0.5 to 1.5 psi (10 to 17 kPa), by vacuum at 5.3 in. Hg (18 kPa), or in accordance with the tank's listing or manufacturer's instructions.

**21.5.2.11**

Vertical aboveground secondary containment–type tanks shall have their primary (inner) tank tested for tightness either hydrostatically or with air pressure at not less than a gauge pressure of 1.5 psi (10 kPa) and not more than a gauge pressure of 2.5 psi (17 kPa).

**21.5.2.11.1***

The interstitial space of such tanks shall be tested either hydrostatically or with air pressure at a gauge pressure of 1.5 to 2.5 psi (10 to 17 kPa), by vacuum at 5.3 in. Hg (18 kPa), or in accordance with the tank's listing or manufacturer's instructions.

**21.5.2.11.2**

The pressure or vacuum shall be held for not less than 1 hour or for the duration specified in the listing procedures for the tank.

## Submitter Information Verification

**Committee:** FLC-TAN

**Submittal Date:** Mon Aug 22 13:13:24 EDT 2022

## Committee Statement

| | |
|---|---|
| **Committee Statement:** | STI R931 has been withdrawn and its content has been merged into the latest revision of STI R912. |
| **Response Message:** | SR-465-NFPA 30-2022 |

## Second Revision No. 466-NFPA 30-2022 [ Section No. 22.4.2.4 ]

**22.4.2.3***

The minimum horizontal separation between an LP-Gas container and a Class I, Class II, or Class IIIA [FP < 200°F (93°C)] liquid storage tank shall be 20 ft (6 m).

**A.22.4.2.3**

Thermal radiation modeling completed as an engineering evaluation in Section 6.4 could demonstrate that a higher separation distance is necessary to prevent escalation. Tank shell exposure protection, such as fixed water sprays, can be used on existing tanks to control exposure and prevent escalation. Refer to NFPA 15 for additional information.

**22.4.2.3.1**

Means shall be provided to prevent Class I, Class II, or Class IIIA liquids [FP < 200°F (93°C)] from accumulating under adjacent LP-Gas containers by means of dikes, diversion curbs, or grading.

**22.4.2.3.2**

Where liquid storage tanks are within a diked area, the LP-Gas containers shall be outside the diked area and at least 10 ft (3 m) away from the centerline of the wall of the diked area.

## Submitter Information Verification

**Committee:** FLC-TAN

**Submittal Date:** Mon Aug 22 13:24:10 EDT 2022

## Committee Statement

**Committee Statement:** Computer models can identify the thermal radiation distance from the relief valve. In some cases, the radiation can reach more than 20 feet and impinge on a nearby storage tank containing Class I or II Liquids and rapidly increase the liquid's temperature. Other parameters such as tank inventory (resulting in duration), pressure, and relief valve setting may affect the time for the tank contents to increase in temperature. This addition to the requirement will notify designers to do due diligence in performing the models instead of using a 20-foot separation without giving much thought to the design parameters of the LPG tank and the storage tank.

**Response Message:** SR-466-NFPA 30-2022

## Second Revision No. 421-NFPA 30-2022 [ Section No. 22.7.3.10 ]

**22.7.3.10***

Each commercial tank venting device shall have the following information either stamped or cast into the metal body of the device or included on a metal nameplate permanently affixed to it~~.~~ :

(1) Start-to-open pressure

(2) Pressure at which the valve reaches the full open position

(3) Flow capacity at the pressure indicated by 22.7.3.10(2)

**A.22.7.3.10**

UL/ULC 2583, *Fuel Tank Accessories for Flammable and Combustible Liquids,* contains functional testing requirements for emergency vent devices to ensure they meet the relieving pressure in 22.7.3.10.2 and the minimum flow rate in 22.7.3.10.3 at the time of installation based on testing and calculations in 22.7.3.10.4 and 22.7.3.10.6 .

**22.7.3.10.1**

Where used, emergency vent devices shall be listed or approved.

**22.7.3.10.1.1**

The requirement in 22.7.3.10.1 does not apply to tanks for upstream production liquids.

**22.7.3.10.2**

If the start-to-open pressure is less than a gauge pressure of 2.5 psi (17.2 kPa) and the pressure at the full open position is greater than a gauge pressure of 2.5 psi (17.2 kPa), the flow capacity at a gauge pressure of 2.5 psi (17.2 kPa) shall also be stamped on the venting device.

**22.7.3.10.3**

The flow capacity shall be expressed in cubic feet per hour of air at 60°F (15.6°C) and an absolute pressure of 14.7 psi (101 kPa).

**22.7.3.10.4**

The flow capacity of tank venting devices less than 8 in. (200 mm) in nominal pipe size shall be determined by actual test *(see 22.7.3.10.5 )* . ~~These tests shall be permitted to be conducted by a qualified, impartial outside agency or by the manufacturer if certified by a qualified, impartial observer.~~

**22.7.3.10.5**

~~These~~ The tests referenced in 22.7.3.10.4 shall be permitted to be conducted by a qualified, impartial outside agency or by the manufacturer if certified by a qualified, impartial observer.

**22.7.3.10.6***

The flow capacity of tank venting devices equal to or greater than 8 in. (200 mm) nominal pipe size, including manway covers with long bolts, shall be determined by test or by calculation. ~~If determined by calculation, the opening pressure shall be measured by test, the calculation shall be based on a flow coefficient of 0.5 applied to the rated orifice, the rating pressure and corresponding free orifice area shall be stated, and the word *calculated* shall appear on the nameplate.~~

**22.7.3.10.7**

If the flow capacity referenced in 22.7.3.10.6 is determined by calculation, all of the following shall apply:

(1) The opening pressure shall be measured by test.

(2) The calculation shall be based on a flow coefficient of 0.5 applied to the rated orifice.

(3) The rating pressure and corresponding free orifice area shall be stated.

(4) The word calculated shall appear on the nameplate.

## Submitter Information Verification

**Committee:** FLC-TAN

**Submittal Date:** Thu Jul 21 20:16:56 EDT 2022

## Committee Statement

**Committee Statement:** NFPA 30 Sec 22.7 requires emergency venting to relieve excessive internal tank pressures due to an external fire event, which prevents tank rupture and potential BLEVE. Commercial tank venting devices (e-vents) covered under 22.7.3 require a minimum relief venting capacity per 22.7.3.3, which must be based on testing or calculations per 22.7.3.10.4 and 22.7.3.10.5 to meet additional marking requirements under 22.7.3.10. Therefore, these safety critical e-vent devices must be listed or approved to ensure they consistently operate in expected environments at the required start-to-open and full open pressures and provide adequate flow capacity as required by the above clauses.

**Response Message:** SR-421-NFPA 30-2022

## Second Revision No. 467-NFPA 30-2022 [ Section No. 22.8.1 ]

**22.8.1**

A fire-extinguishing system or exposure protection system in accordance ~~with an applicable NFPA standard~~ with NFPA 11 or NFPA 15 shall be provided or made available for a storage tank where all of the following conditions apply:

(1) The tank is a vertical atmospheric storage tank that has a capacity of 50,000 gal (190 $m^3$) or more.

(2) The tank contains a Class I liquids [FP< 100°F (37.8°C)].

(3) The tank is located in a congested area where there is an unusual exposure hazard to the tank from adjacent property or to adjacent property from the tank.

(4) The tank has a fixed-roof or a combination fixed- and floating-roof that does not meet the requirements of 22.2.2(2) or 22.2.2(3) to be classified as a floating roof tank.

### Submitter Information Verification

**Committee:** FLC-TAN

**Submittal Date:** Mon Aug 22 13:28:29 EDT 2022

### Committee Statement

**Committee Statement:** In congested areas, exposure protection with cooling rings have proven to be effective in preventing escalation of adjacent storage tanks. In some countries, like Singapore, standard SS 532-2007, The Storage of Flammable Liquids, requires cooling rings for exposure protection for tanks under 45 m (148 ft), and require emergency egress for every two rows of storage tanks. Many of these requirements stem from the 1987 Naphtha fire in Singapore which escalated to several storage tanks.

**Response Message:** SR-467-NFPA 30-2022

## Second Revision No. 469-NFPA 30-2022 [ Section No. 24.9 ]

**24.9** Containment, Drainage, and Spill Control from Storage Tank Buildings.

**24.9.1**

~~Drainage systems shall be designed to minimize fire exposure to other tanks and adjacent properties or waterways. Compliance with 24.9.2 through 24.9.6 shall be deemed as meeting the requirements of 24.9.1.~~ Where the maximum allowable quantity (MAQ) is exceeded, spill control shall be required in accordance with 6.12.2 .

**24.9.2**

~~The facility shall be designed and operated to prevent the discharge of liquids to public waterways, public sewers, or adjoining property under normal operating conditions.~~ Where the MAQ is exceeded , secondary containment shall comply with 6.12.3 and any additional requirements of Section 24.9 .

**24.9.3**

~~Except for drains, solid floors shall be liquidtight and walls shall be liquidtight where they join the floor and for at least 4 in. (100 mm) above the floor.~~ Where used, drainage shall comply with 6.12.4 .

**24.9.4**

~~Openings to adjacent rooms or buildings shall be provided with noncombustible, liquidtight raised sills or ramps at least 4 in. (100 mm) in height or shall be otherwise designed to prevent the flow of ignitible (flammable or combustible) liquids to the adjoining areas.~~ Where only Class IIIB liquids [FP ≥ 200°F (93°C)] are stored, spill control, secondary containment, and drainage shall not be required.

~~**24.9.4.1**~~

~~An open-grated trench across the width of the opening inside of the room that drains to a safe location shall be permitted to be used as an alternative to a sill or ramp.~~

**24.9.5**

~~Means shall be provided to prevent ignitible (flammable or combustible) liquid spills from running into basements.~~ Where only unsaturated polyester resins (UPRs) containing not more than 50 percent by weight of Class IC, Class II, or Class IIIA liquid [73°F (22.8°C) ≤ FP < 200°F (93°C)] constituents are stored and are protected in accordance with 16.5.3.11 , spill control, secondary containment, and drainage shall not be required.

**24.9.6***

~~The containment shall have a capacity not less than that of the largest tank that can drain into it.~~ Emergency drainage systems shall be provided to direct ignitible (flammable or combustible) liquid leakage and fire protection water to a safe location.

**A.24.9.6**

This might require curbs, scuppers, or special drainage systems to control the spread of fire. Annex A of NFPA 15 provides information on this subject.

~~**24.9.7**~~

~~Emergency drainage systems shall be provided to direct liquid leakage and fire-protection water to a safe location.~~

~~**24.9.8**~~

~~Curbs, scuppers, or special drainage systems shall be permitted to be used.~~

~~**24.9.9**~~

~~Emergency drainage systems, if connected to public sewers or discharged into public waterways, shall be equipped with traps or separators.~~

## Supplemental Information

| File Name | Description | Approved |
|---|---|---|
| 30_SR-469_Drainage_TAN.docx | Staff use only | |

## Submitter Information Verification

**Committee:** FLC-TAN

**Submittal Date:** Wed Aug 24 10:08:58 EDT 2022

## Committee Statement

**Committee Statement:** NFPA 30 applies to a broad range of occupancies and facilities which vary in size from the "mom and pop" mercantile occupancies to large industrial complexes. Users need clear guidance as to when these requirements apply and are asking for better information on how to meet the requirements when applicable. Containment, drainage, and spill control are methods of fire risk mitigation.

Section 6.12 includes the common requirements in NFPA 30 which are used in the occupancy specific chapters and allows any occupancy specific requirements to remain in the containment, drainage, and spill control sections of chapters 9, 10, 12, 13, 15, 16, 17, 18, and 24.This section also aligns drainage, containment, and spill control requirements in NFPA 30 with those found in NFPA 400 Hazardous Materials Code, and NFPA 5000 Building Construction and Safety Code, where deemed appropriate. Some requirements from 24.9 were moved to 6.12 as part of this consolidation of requirements. (See SR-470).

The technical changes were only intended to be limited to using MAQs as a trigger for providing containment, drainage, and spill control. This is to clarify confusion regarding users as to when these requirements are applicable. Also, the 10-gallon container threshold for implementing containment requirements was removed as it was deemed as excessive. Instead, the Technical Committee preferred to implement the analogous requirements in NFPA 400 for a 55-gallon threshold to implement spill containment requirements.

**Response Message:** SR-469-NFPA 30-2022

Public Comment No. 87-NFPA 30-2022 [Section No. 24.9.6]

Public Comment No. 82-NFPA 30-2022 [Section No. 24.9.3]

Public Comment No. 80-NFPA 30-2022 [Section No. 24.9.1]

Public Comment No. 88-NFPA 30-2022 [Section No. 24.9.7]

Public Comment No. 81-NFPA 30-2022 [Section No. 24.9.2]

Public Comment No. 85-NFPA 30-2022 [Section No. 24.9.4.1]

Public Comment No. 89-NFPA 30-2022 [Section No. 24.9.8]

Public Comment No. 83-NFPA 30-2022 [Section No. 24.9.4 [Excluding any Sub-Sections]]

Public Comment No. 90-NFPA 30-2022 [Section No. 24.9.9]

Public Comment No. 86-NFPA 30-2022 [Section No. 24.9.5]

## Second Revision No. 464-NFPA 30-2022 [ New Section after 26.6 ]

**26.8*** Security.

Security measures shall be in accordance with API 12R1, *Installation, Operation, Maintenance, Inspection, and Repair of Tanks in Production Service* .

**A.26.8**

Security measures in remote locations should be assessed approximately every ten years.

### Submitter Information Verification

**Committee:** FLC-TAN

**Submittal Date:** Mon Aug 22 12:48:52 EDT 2022

### Committee Statement

**Committee Statement:** During the First Draft meeting of the NFPA 30 Tanks Technical Committee in July 2021, a new chapter (Chapter 26) titled “Petroleum Production Sites” was introduced as a First Revision. This chapter introduces requirements specifically for tanks at oil extraction wells and is intended to address the sometimes-remote nature of tanks for production operations. For petroleum production sites, Chapter 26 requirements are intended to take precedence over the general storage tank requirements in Chapter 21.

CSB recommendation 2011-1-H-XX-R6 was made when NFPA 30 had overall requirements for storage tanks and did not consider the unique nature of petroleum production tanks. Section 21.7.2.2 is intended for unattended terminals where there may be a pipeline receipt and not for upstream production activities. The CSB correctly indicates that the term “isolated” as used in 21.7.2.2 does not indicate limited public access. Instead of refining this section considering CSB’s comments regarding petroleum production tanks, the committee instead refers readers to API 12R1. The committee has drafted the 26.7 requirement to reference a security standard appropriate for tanks at upstream locations.

API 12R1 (2021) section 4.7 is titled Tank and Facility Safety and Security Safety. API 12R1 Annex G is specifically on unmanned upstream facility safety considerations which is expected to address CSB concerns more suitably on unmanned petroleum production tanks in areas proximate to public access. Annex G recommends performing a security assessment, and tanks meeting the definition of a “remote location” per API 12R1 may not be required to have fencing based on this assessment. Annex A.26.7 is proposed because development may encroach upon existing production well tank batteries and additional safety measures may be warranted.

**Response Message:** SR-464-NFPA 30-2022