2.4 References for Extracts in Mandatory Sections.


Submitter Information Verification

Submitter Full Name: Sonia Barbosa
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Submittal Date: Fri Apr 03 12:34:04 EDT 2015

Committee Statement

Committee Statement: Update edition year for NFPA 52.
Response Message: [Not Specified]
5.3.1.1
Provisions shall be made to minimize the potential of accidental discharge of LNG at containers, pipelines containing LNG, and other equipment such that a discharge from any of these does not endanger adjoining property or important process equipment and structures or reach waterways. LNG containers shall be provided with one of the following methods to contain any release:

1. An impounding area surrounding the container(s) that is formed by a natural barrier, dike, impounding wall, or combination thereof complying with 5.3.2 and 5.3.3.
2. An impounding area formed by a natural barrier, dike, excavation, impounding wall, or combination thereof complying with 5.3.2 and 5.3.3, plus a natural or man-made drainage system surrounding the container(s) that complies with 5.3.2 and 5.3.3.
3. Where the container is constructed below or partially below the surrounding grade, an impounding area formed by excavation complying with 5.3.2 and 5.3.3.
4. Secondary containment as required for double or full containment tank systems complying with 5.3.2 and 5.3.3.

Submitter Information Verification

Submitter Full Name: Dan Gorham
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Street Address:
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Submittal Date: Wed Mar 04 11:15:50 EST 2015

Committee Statement

Committee Statement: Specific listing of secondary containment as provided by double and full containment was added (as further qualified by 5.3.2 and 5.3.3) for direct reference by 5.3.2.5 (2).
5.3.2.5*
Dikes and impounding walls shall meet the following requirements:

(1) Dikes, impounding walls, drainage systems, and any penetrations thereof shall be designed to withstand the full hydrostatic head of impounded LNG or flammable refrigerant, the effect of rapid cooling to the temperature of the liquid to be confined, any anticipated fire exposure, and natural forces, such as earthquakes, wind, and rain.

(2) Where the outer shell of a double-wall tank complies with the requirements of 5.3.1.1, the dike shall be either the outer shell or as specified in 5.3.1.1.

The containment integrity of such an outer shell can be affected by an inner tank failure mode, an additional impounding area that otherwise satisfies the requirements of 5.3.1.1 shall be provided.

Supplemental Information

<table>
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<th>Description</th>
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<td>59A_A.5.3.2.5_SR-13.docx</td>
<td></td>
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</tbody>
</table>

Submitter Information Verification

Submitter Full Name: Dan Gorham
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Street Address: 
City: 
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Zip: 
Submittal Date: Wed Mar 04 11:17:35 EST 2015

Committee Statement

Committee Statement: The definition of full containment and double containment tanks requires containment of liquid in the event of an inner tank failure. Therefore, this requirement is struck because it would only be triggered if the container didn’t meet the definition of full or double containment. Text was added to Annex A for further explanation to the user of the standard.

The basis for the reference to crack arrest properties can be found in publications including the following:

GRI Crack Arrest Properties of 9% Nickel Cryogenic Steels, June 1986 (GRI 86/0103). (available through the Gas Research Institute)

Section 7.2.1.1 requires compliance with API 625. API 625 paragraph 5.6 requires the selection of storage concept to be based on a risk assessment. API 625 Annex C discusses implications of a release of liquid from the primary liquid container and provides specific discussion related to each containment type. API 625 Annex D provides guidance for selection of storage concepts as part of the risk assessment including external and internal events and hazards to be evaluated. Paragraph D.3.2.2 discusses the possibility of sudden failure of the inner tank and advises “if extra protection from brittle fracture” (or unabated ductile crack propagation) “is desired, the general practice is to increase the” primary container toughness. Available materials meeting the required specifications of API 620 Appendix Q (and this standard) for LNG service are considered to have crack-arrest properties at LNG service temperature and stress levels. Therefore, rapid failure of a steel primary container meeting this standard is not considered credible.
5.3.2.6
Double and full containment tank systems shall be designed and constructed such that in the case of a spill and secondary container fire, the secondary container wall will contain the LNG for the duration of the fire.

(A) In the case of a fire confined to the inner tank, the secondary container wall shall retain sufficient structural integrity to prevent collapse, which can cause damage to and leakage from the primary container.

(B) The tanks shall also be designed and constructed such that in the case of a fire in the primary or secondary container of an adjacent tank, the secondary container shall retain sufficient structural integrity to prevent collapse, which can cause damage to and leakage from the primary container.

5.3.2.7
Double and full containment tank systems shall also be designed and constructed such that in the case of a fire in the primary or secondary container of an adjacent tank, the secondary container shall retain sufficient structural integrity to prevent collapse, which can cause damage to and leakage from the primary container.

Submitter Information Verification

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State: [ Not Specified ]
Zip: [ Not Specified ]
Submittal Date: Thu Mar 05 16:35:48 EST 2015

Committee Statement

Committee Statement: This condition is already covered by the parent text 5.3.2.6 by referring to double containment. If the secondary container caused leakage from the primary container, it still needs to contain the liquid from the primary container.

Since Full Containment was struck from 5.3.2.6, a new paragraph number which applies to both double and full containment needed. All fires in adjacent tanks are applicable.
5.3.4.2
Full and double construction LNG storage containers containment tank systems of greater than 70,000 gal (265 m³) water capacity shall be separated from adjoining LNG storage containers such that a fire in one container or impoundment an adjacent single or double containment impoundment or from a design spill will not cause loss of containment from adjacent containers. This shall be accomplished by ensuring that no part of the adjacent storage container roof, walls, or its impoundment structure reaches a temperature at which the strength of the material of the container roof, wall, or its impoundment is reduced to a level where the LNG tank, roof, or impoundment loses its structural integrity. The application of engineering analyses shall be used to determine this temperature by including the following conditions in the analyses:

(1) The analyses shall be performed for a fire involving the complete loss of containment of the primary liquid container to an impoundment area that complies with the requirements of 5.3.2.1

A fire involving the complete loss of containment of a container to an impoundment area that complies with the requirements of 5.3.2.1

A fire over the whole surface of the liquid contained in the tank, assuming the roof is completely lost

(2) The analyses shall account for the following:

(a) The duration of the fire, the radiant heat emission characteristics of the fire, and the physical attributes of the fire under the anticipated atmospheric conditions

(b) The atmospheric conditions producing the maximum separation distances shall be used except for conditions that occur less than 5 percent of the time based on recorded data for the area and using a LNG fire model in accordance with 5.3.3.4

(c) Active or passive systems to reduce thermal heat flux incident on the surface or to limit the surface temperature

(d) The materials, design, and methods of construction of the target LNG tank being analyzed

Submitter Information Verification

Submitter Full Name: Dan Gorham
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Street Address: 
City: 
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Submittal Date: Thu Mar 05 16:40:04 EST 2015

Committee Statement

Committee Statement: The correct term for tank types was added. The adjacent tank fire for which full and double containment tanks are to be protected against is limited to impoundments of single and double containment tank types and spill impoundments.

Proper terms for the type of tank are used to reduce confusion. The adjacent tank fire is from the impoundment / secondary containment area. There is no need to define the event further.
### Second Revision No. 11-NFPA 59A-2015 [ Section No. 7.2.1.1 ]

#### 7.2.1.1

Storage tank systems shall comply with the requirements of API 625, *Tank Systems for Refrigerated Liquefied Gas Storage*, and the additional provisions of this chapter. The API 625 risk assessment shall be approved by the AHJ.

### Submitter Information Verification

- **Submitter Full Name:** Dan Gorham  
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- **Submittal Date:** Wed Mar 04 10:01:13 EST 2015

### Committee Statement

- **Committee Statement:** This requirement assures the risk assessment includes all risks to the satisfaction of the AHJ.  
- **Response Message:** There have been concerns about some of the scenarios chosen for the risk assessment.
Fixed electrical equipment and wiring installed within the classified areas specified in Table 10.7.2 shall comply with Table 10.7.2 and Figure 10.7.2(a) through Figure 10.7.2(f) and shall be installed in accordance with NFPA 70.

Table 10.7.2 Electrical Area Classification

<table>
<thead>
<tr>
<th>Part</th>
<th>Location</th>
<th>Group D, Division</th>
<th>Extent of Classified Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>LNG storage containers with vacuum breakers</td>
<td>2</td>
<td>Entire container interior</td>
</tr>
<tr>
<td></td>
<td>Inside containers</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>LNG storage container area</td>
<td>1</td>
<td>Entire room</td>
</tr>
<tr>
<td></td>
<td>Indoors</td>
<td>1</td>
<td>Open area between a high-type dike and the container wall where dike wall height exceeds distance between dike and container walls [See see Figure 10.7.2(c).]</td>
</tr>
<tr>
<td></td>
<td>Outdoor aboveground containers (other than small containers)</td>
<td>1</td>
<td>Within 15 ft (4.5 m) in all directions from container walls and roof plus area inside a low-type diked or impounding area up to the height of the dike impoundment wall [S see Figure 10.7.2(b). ]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Outdoor belowground containers</td>
<td>1</td>
<td>Within any open space between container walls and surrounding grade or dike [S see Figure 10.7.2(d).]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>Within 15 ft (4.5 m) in all directions from roof and sides [S see Figure 10.7.2(d).]</td>
</tr>
<tr>
<td>C</td>
<td>Nonfired LNG process areas containing pumps, compressors, heat exchangers, pipelines, connections, small containers, and so forth</td>
<td>2</td>
<td>Entire room and any adjacent room not separated by a gastight partition and 15 ft (4.5 m) beyond any wall or roof ventilation discharge vent or louver</td>
</tr>
<tr>
<td></td>
<td>Indoors with adequate ventilation</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Outdoors in open air at or above grade</td>
<td>2</td>
<td>Within 15 ft (4.5 m) in all directions from this equipment and within the cylindrical volume between the horizontal equator of the sphere and grade [S see Figure 10.7.2(a).]</td>
</tr>
<tr>
<td>D</td>
<td>Pits, trenches, or sumps located in or adjacent to Division 1 or 2 areas</td>
<td>1</td>
<td>Entire pit, trench, or sump</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>Within 15 ft (4.5 m) in all directions, above grade [see Figure 10.7.2(a)]</td>
</tr>
<tr>
<td>E</td>
<td>Discharge from relief valves</td>
<td>1</td>
<td>Within 5 ft (1.5 m) in all directions from point of discharge</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>Beyond 5 ft (1.5 m) but within 15 ft (4.5 m) in all directions from point of discharge</td>
</tr>
<tr>
<td>F</td>
<td>Operational bleeds, drips, vents, or drains</td>
<td>1</td>
<td>Within 5 ft (1.5 m) in all directions from point of discharge</td>
</tr>
<tr>
<td></td>
<td>Indoors with adequate ventilation</td>
<td>1</td>
<td>Beyond 5 ft (1.5 m) and entire room and 15 ft (4.5 m) beyond any wall or roof ventilation discharge vent or louver</td>
</tr>
</tbody>
</table>
### Table 10.7.2 Extent of Classified Areas

<table>
<thead>
<tr>
<th>Part</th>
<th>Location</th>
<th>Division</th>
<th>Extent of Classified Area</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Outdoors in open air at or above grade</td>
<td>1</td>
<td>Within 5 ft (1.5 m) in all directions from point of discharge</td>
</tr>
<tr>
<td></td>
<td>Beyond 5 ft (1.5 m) but within 15 ft (4.5 m) in all directions from point of discharge</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tank car, tank vehicle, and container loading and unloading</td>
<td>1</td>
<td>Within 5 ft (1.5 m) in all directions from connections regularly made or disconnected for product transfer</td>
</tr>
<tr>
<td></td>
<td>Beyond 5 ft (1.5 m) and entire room and 15 ft (4.5 m) beyond any wall or roof ventilation discharge vent or louver</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Beyond 5 ft (1.5 m) but within 15 ft (4.5 m) in all directions from a point where connections are regularly made or disconnected and within the cylindrical volume between the horizontal equator of the sphere and grade [See Figure 10.7.2(a).]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Indoors with adequate ventilation(^c)</td>
<td>1</td>
<td>Within 5 ft (1.5 m) in all directions from connections regularly made or disconnected for product transfer</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Beyond 5 ft (1.5 m) but within 15 ft (4.5 m) in all directions from a point where connections are regularly made or disconnected and within the cylindrical volume between the horizontal equator of the sphere and grade [See Figure 10.7.2(a).]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Outdoors in open air at or above grade</td>
<td>1</td>
<td>Within 5 ft (1.5 m) in all directions from connections regularly made or disconnected for product transfer</td>
</tr>
<tr>
<td></td>
<td>Beyond 5 ft (1.5 m) but within 15 ft (4.5 m) in all directions from a point where connections are regularly made or disconnected and within the cylindrical volume between the horizontal equator of the sphere and grade [See Figure 10.7.2(a).]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>G</td>
<td>Electrical seals and vents specified in 10.7.5 through 10.7.7</td>
<td>2</td>
<td>Within 15 ft (4.5 m) in all directions from the equipment and within the cylindrical volume between the horizontal equator of the sphere and grade</td>
</tr>
<tr>
<td>I</td>
<td>Marine terminal unloading areas [See Figure 10.7.2(f).]</td>
<td>2</td>
<td>Within 15 ft (4.5 m) in all directions, above the deck, from the open sump</td>
</tr>
</tbody>
</table>

\(^{a}\)See Article 500 in NFPA 70 for definitions of classes, groups, and divisions. Article 505 may can be used as an alternate to Article 500 for classification of hazardous areas using an equivalent zone classification to the division classifications specified in Table 10.7.2. Most of the flammable vapors and gases found within the facilities covered by NFPA 59A are classified as Group D. Ethylene is classified as Group C. Much of the available electrical equipment for hazardous locations is suitable for both groups.

\(^{b}\)Small containers are portable and of less than 200 gal (760 L) capacity.

\(^{c}\)Ventilation is considered adequate where provided in accordance with the provisions of this standard.

**Figure 10.7.2(a) Extent of Classified Area Around Containers.**

**Figure 10.7.2(b) Dike Height Less Than Distance from Container to Dike \(H < x\).**
Figure 10.7.2(c) Dike Height Greater Than Distance from Container to Dike (H > x).

Figure 10.7.2(d) Container with Liquid Level Below Grade or Below Top of Dike.

Figure 10.7.2(e) Full Containment Container.

Figure 10.7.2(f) Classification of a Marine Terminal Handling LNG.

Supplemental Information

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<td>National Fire Protection Association Report</td>
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Committee Statement

Two section of Table 10.7.2, Parts D and I, only define the Division 1 area, but do not specify a Division 2 area adjacent to it. NFPA 70, 500.5 (B)(2) defines a Division 2 area as an area that is adjacent to a division 1 area. NFPA 30, Table 7.3.3 and NFPA 58, Table 6.23.2.2 each have similar requirements for a Division 2 area beyond the extents of a Division 1 area.

Added Division 2 information for items D and I to table 10.7.2 using existing Division 2 distance requirements from this table. Updated Figure 10.7.2(f) to show 15 ft. dimension from open sump.

Response Message:
Public Comment No. 28-NFPA 59A-2014 [Section No. 10.7.2]
12.2.1.1 Protection installed as a result of the evaluation in 12.2.2 shall be designed, engineered, installed and tested based upon fire protection equipment standards incorporated by reference adhering to the following standards:

1. NFPA 10, *Standard for Portable Fire Extinguishers*
2. NFPA 11, *Standard for Low-, Medium-, and High-Expansion Foam*
3. NFPA 12, *Standard on Carbon Dioxide Extinguishing Systems*
5. NFPA 13, *Standard for the Installation of Sprinkler Systems*
6. NFPA 14, *Standard for the Installation of Standpipe and Hose Systems*
9. NFPA 17, *Standard for Dry Chemical Extinguishing Systems*
11. NFPA 22, *Standard for Water Tanks for Private Fire Protection*
12. NFPA 24, *Standard for the Installation of Private Fire Service Mains and Their Appurtenances*
13. NFPA 72, *National Fire Alarm and Signaling Code*
15. NFPA 750, *Standard on Water Mist Fire Protection Systems*
16. NFPA 1221, *Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems*
17. NFPA 1901, *Standard for Automotive Fire Apparatus*
18. NFPA 1961, *Standard on Fire Hose*

**Supplemental Information**

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**Submitter Information Verification**

**Submitter Full Name:** Dan Gorham  
**Organization:** [ Not Specified ]  
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**City:**  
**State:**
A.12.2.1.1

Where fire protection equipment design, engineering, installation, or testing is not addressed by an NFPA code or standard, other publicly available standards should be considered for use and authorized by the AHJ, if required.
Committee Statement

Committee Statement: This revision addresses design and installation requirements for fire protection systems not previously addressed. The movement of the NFPA document lists from the Annex to the body of the texts make this enforceable code.

Response Message:

Public Comment No. 9-NFPA 59A-2014 [New Section after A.12.2.1]
Public Comment No. 8-NFPA 59A-2014 [Section No. 12.2.1]
12.4  Gas, Fire, and Leak Detection.

12.4.1  Areas, including enclosed buildings, that can have the presence of flammable gas, LNG or flammable refrigerant spills, and fire shall be monitored as required by the evaluation in 12.2.1.

12.4.2  Gas Detection.

12.4.2.1  Continuously monitored low-temperature sensors or flammable gas detection systems shall sound an alarm at the plant site and at a constantly attended location if the plant site is not attended continuously.

12.4.2.2  Flammable gas detection systems shall activate an audible and a visual alarm at not more than 25 percent of the lower flammable limit of the gas or vapor being monitored.

12.4.3  Fire Detectors.

12.4.3.1  Fire detectors shall activate an audible and a visual alarm at the plant site and at a constantly attended location if the plant site is not attended continuously.

12.4.3.2  If so determined by an evaluation in accordance with 12.2.1, fire detectors shall be permitted to activate portions of the ESD system.

12.4.4  Leak Detection.

12.4.4.1  Leak detection shall activate an audible and visual alarm at the plant site and at a constantly attended location if the plant is not continuously attended.

12.4.5  The detection systems shall be designed, installed, and maintained in accordance with NFPA 72.

Submitter Information Verification

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Submittal Date: Tue Mar 03 14:08:21 EST 2015

Committee Statement

Committee Statement: Low-temperature sensors are being moved to a new section in the code which specifically addresses leak detection. Revised the section title to include gas detection.

Gas and leak detection are different in the technology, objective, and quantification and should be treated independently. This new section specifies leak detection requirements which are different than gas detection requirements.

Public Comment No. 2-NFPA 59A-2014 [Section No. 12.4]
Public Comment No. 4-NFPA 59A-2014 [Section No. 12.4.4]
Public Comment No. 3-NFPA 59A-2014 [New Section after 12.4.4]
Public Comment No. 5-NFPA 59A-2014 [Section No. 12.4.2.1]
Second Revision No. 5-NFPA 59A-2015 [ Section No. 13.6.2.1 ]

13.6.2.1
The minimum distance from the edge of an impoundment or container drainage system serving aboveground and mounded containers larger than 1000 gal (3.8 m³) shall be in accordance with Table 13.6.2.1 for each of the following:

1) Nearest offsite building
2) The property line that can be built upon
3) Spacing between containers

Table 13.6.2.1 Distances from Containers and Exposures

<table>
<thead>
<tr>
<th>Container Water Capacity</th>
<th>Minimum Distance from Edge of Impoundment or Container Drainage System to Offsite Buildings and Property Lines That Can Be Built Upon</th>
<th>Minimum Distance Between Storage Containers</th>
</tr>
</thead>
<tbody>
<tr>
<td>gal/m³</td>
<td>ft/m</td>
<td>ft/m</td>
</tr>
<tr>
<td>1000–2000 3.8–7.6</td>
<td>15/4.6</td>
<td>5/1.5</td>
</tr>
<tr>
<td>≥7.6–56.8</td>
<td>25/7.6</td>
<td>5/1.5</td>
</tr>
<tr>
<td>2001–18,000 68.1</td>
<td>50/15</td>
<td>5/1.5</td>
</tr>
<tr>
<td>≥56.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18,001–30,000 ≥68.1</td>
<td>75/23</td>
<td>5/1.5</td>
</tr>
<tr>
<td>–114</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30,001–70,000 ≥114–265</td>
<td>0.7 times the container diameter [100 ft (30 m) minimum]</td>
<td></td>
</tr>
<tr>
<td>&gt;70,000 &gt;265</td>
<td></td>
<td></td>
</tr>
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Supplemental Information

File Name: 59A_Table_13.6.2.1_PC-26_SR-5.docx
Description: Table with tracked-change revisions.

Submitter Information Verification

Submitter Full Name: Dan Gorham
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Tue Mar 03 14:44:20 EST 2015

Committee Statement
13.6.3 Underground LNG tanks shall be installed in accordance with Table 13.6.3.

<table>
<thead>
<tr>
<th>Container Water Capacity</th>
<th>Minimum Distance from Buildings and the Adjoining Property Line That Can Be Built Upon</th>
<th>Distance Between Containers</th>
</tr>
</thead>
<tbody>
<tr>
<td>gal</td>
<td>ft</td>
<td>m</td>
</tr>
<tr>
<td>&lt;18,000</td>
<td>15</td>
<td>4.6</td>
</tr>
<tr>
<td>18,000–30,000</td>
<td>25</td>
<td>7.6</td>
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<tr>
<td>30,001–100,000</td>
<td>40</td>
<td>12.2</td>
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Submitter Information Verification

Submitter Full Name: Dan Gorham
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Tue Mar 03 14:48:10 EST 2015

Committee Statement

Committee Statement: Revise the conversion of 18,000 gallons to 68.1 cubic meters.

Response Message:
Public Comment No. 27-NFPA 59A-2014 [Section No. 13.6.3]
Both individual risks and societal risk(s) values shall be evaluated in the area around the LNG plant by using quantitative risk **analysis** (QRA) protocol. The generally accepted QRA protocol, specified in any one of the following publications shall be used in assessing the risks:


Submitter Information Verification

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Street Address:
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Submittal Date: Tue Mar 03 16:27:51 EST 2015

Committee Statement

Committee Statement: The word ‘assessment’ is changed to ‘analysis’ to better describe the protocol and methodology that are to be used. A Quantitative risk analysis (QRA) is performed, then the risk assessment is done by comparison to criteria and evaluation of the risk drivers.

Response Message:

Public Comment No. 12-NFPA 59A-2014 [Section No. 15.4.1]
15.4.2*
The selected QRA procedure shall be approved by the AHJ.

Supplemental Information

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Submitter Information Verification

- **Submitter Full Name:** Dan Gorham
- **Organization:** [ Not Specified ]
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- **Zip:**
- **Submittal Date:** Tue Mar 03 16:42:37 EST 2015

Committee Statement

- **Committee Statement:** Added new annex section to provide additional information on the QRA procedures may include.
- **Response Message:** Public Comment No. 14-NFPA 59A-2014 [Section No. 15.4.2]
A.15.4.2
The QRA procedure should include but is not limited to the methodologies, release scenario selections, assumptions, consequence models and associated validation, hazard levels (endpoints) for public impact, consequence modeling results, and calculations of event probabilities should be fully documented.
15.6.1

The annual probability of LNG and other hazardous material releases from various equipment, for scenarios identified in 15.4.1 and 15.4.2, shall be based on Table 15.6.1.

Table 15.6.1 Example Component Failure Database

<table>
<thead>
<tr>
<th>Component</th>
<th>Annual Probability of Failure</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Atmospheric cryogenic tanks</strong></td>
<td></td>
</tr>
<tr>
<td>(1) Instantaneous failure of primary container and outer shell, release of entire contents (single containment tank)</td>
<td>5E-07</td>
</tr>
<tr>
<td>(2) Instantaneous failure of primary container and outer shell, release of entire contents (double containment tank)</td>
<td>1.25E-08</td>
</tr>
<tr>
<td>(3) Instantaneous failure of primary and secondary container, release of entire contents (full containment tank)</td>
<td>1E-08</td>
</tr>
<tr>
<td><strong>Pressurized storage</strong> (Containers) — instantaneous release of entire contents</td>
<td>5E-07</td>
</tr>
<tr>
<td><strong>Pressure relief valves</strong> — outflow at the maximum rate</td>
<td>2E-05</td>
</tr>
<tr>
<td><strong>Process equipment</strong></td>
<td></td>
</tr>
<tr>
<td>(1) Pumps — catastrophic failure</td>
<td>1E-04</td>
</tr>
<tr>
<td>(2) Compressors with gasket — catastrophic failure</td>
<td>1E-04</td>
</tr>
<tr>
<td>(3) Heat exchanger — instantaneous release of entire contents from plate heat exchanger</td>
<td>5E-05</td>
</tr>
<tr>
<td><strong>Transfer equipment</strong> — rupture of loading/unloading arm</td>
<td>3E-08</td>
</tr>
<tr>
<td><strong>Piping — aboveground</strong></td>
<td></td>
</tr>
<tr>
<td>(1) Rupture for nominal diameter &lt; 3 in. (75 mm)</td>
<td>1E-06</td>
</tr>
<tr>
<td>(2) Rupture for nominal diameter from 3 in. (75 mm) up to and including &lt; nominal diameter &lt; 6 in. (150 mm)</td>
<td>3E-07</td>
</tr>
<tr>
<td>(3) Rupture for nominal diameter &gt; 6 in. (150 mm)</td>
<td>1E-07</td>
</tr>
</tbody>
</table>

Supplemental Information

<table>
<thead>
<tr>
<th>File Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>59A_Table_15.6.1_PC-7_SR-9.docx</td>
<td>Table with tracked-change revisions.</td>
</tr>
</tbody>
</table>

Submitter Information Verification

Submitter Full Name: Dan Gorham
Organization: [ Not Specified ]
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City:
State:
Zip:
Submittal Date: Tue Mar 03 17:20:11 EST 2015

Committee Statement
<table>
<thead>
<tr>
<th>Committee Statement:</th>
<th>The ranges symbols for &quot;Piping - aboveground&quot; were revised to include all possible scenarios. Made primary unit inches for these values.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response Message:</td>
<td>Public Comment No. 7-NFPA 59A-2014 [Section No. 15.6.1]</td>
</tr>
</tbody>
</table>
15.10.1
Individual risk acceptability criteria specified in Table 15.10.1 shall be used.

Table 15.10.1 Criteria for Tolerability of Individual Risk (IR) from Injury Due to Exposure to Dangerous Dose or Higher

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Annual Frequency</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Zone 1</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IR $\leq 10^{-5}$</td>
<td>Not permitted: Residential, office, and retail</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Permitted: Occasionally occupied developments (e.g., pump houses, transformer stations)</td>
</tr>
<tr>
<td><strong>Zone 2</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$10^{-6} \leq IR \leq 10^{-5}$</td>
<td>Not permitted: Shopping centers, large-scale retail outlets, restaurants, etc.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Permitted: Work places, retail and ancillary services, residences in areas of 28 to 90 persons/hectare density</td>
</tr>
<tr>
<td><strong>Zone 3</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$3 \times 10^{-7} \leq IR \leq 10^{-6}$</td>
<td>Not permitted: Churches, schools, hospitals, major public assembly areas, and other sensitive establishments</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Permitted: All other structures and activities</td>
</tr>
</tbody>
</table>

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Submittal Date: Tue Mar 03 18:07:06 EST 2015

Committee Statement

Committee Statement: Revised the inequality for Zone 1 Individual Risk value. The current symbol does not allow for siting and was not the intent of the committee.
A.12.2

For information on fire extinguishing protection systems, see the following:

- NFPA 10, Standard for Portable Fire Extinguishers
- NFPA 11, Standard for Low-, Medium-, and High-Expansion Foam
- NFPA 12, Standard on Carbon Dioxide Extinguishing Systems
- NFPA 12A, Standard on Halon 1301 Fire Extinguishing Systems
- NFPA 13, Standard for the Installation of Sprinkler Systems
- NFPA 14, Standard for the Installation of Standpipe and Hose Systems
- NFPA 16, Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems
- NFPA 17, Standard for Dry Chemical Extinguishing Systems
- NFPA 20, Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems
- NFPA 22, Standard for Water Tanks for Private Fire Protection
- NFPA 24, Standard for the Installation of Private Fire Service Mains and Their Appurtenances

(1) NFPA 25, Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems
(2) NFPA 68, Standard on Explosion Protection by Deflagration Venting
(3) NFPA 69, Standard on Explosion Prevention Systems
- NFPA 72, National Fire Alarm and Signaling Code
- NFPA 750, Standard on Water Mist Fire Protection Systems
- NFPA 1961, Standard on Fire Hose
- NFPA 1962, Standard for the Inspection, Care, and Use of Fire Hose, Couplings, and Nozzles and the Service Testing of Fire Hose
- NFPA 1963, Standard for Fire Hose Connections
- NFPA 2001, Standard on Clean Agent Fire Extinguishing Systems

Submitter Information Verification

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Submittal Date: Tue Mar 24 08:35:17 EDT 2015

Committee Statement

Committee Statement: Revised A.12.2 to include fire protection system documents not addressed in the body of the standard.

Response Message: