U.S. Department
of Transportation
**Pipeline and Hazardous
Materials Safety
Administration**

1200 New Jersey Avenue, SE
Washington, DC 20590

May 24, 2022

Mr. Juan Carlos Rivadeneira
CH-IV
11700 Katy Freeway
Suite 1350
Houston, TX 77079

Dear Mr. Rivadeneira:

In a letter to the Pipeline and Hazardous Materials Safety Administration (PHMSA), dated February 28, 2022, you requested an interpretation of the federal pipeline safety regulations in 49 Code of Federal Regulations (CFR) Part 193 with respect to the applicability of § 193.2167 to buried liquefied natural gas (LNG) piping systems.

In your letter you quoted the applicable provisions for enclosed impounding systems found in the pipeline safety regulations, and the 2001 and 2019 editions of the National Fire Protection Association 59A Standard for the Production, Storage, and Handling of Liquefied Natural Gas (NFPA 59A-2001[1] and NFPA 59A-2019[2], respectively). You noted that § 193.2167, NFPA 59A-2001, and NFPA 59A-2019 all recognize the hazards involved with the use of enclosed LNG impoundment systems and, therefore, prohibit the use of such systems or provide specific requirements for the safe design of such systems. You explained that enclosed LNG impounding systems can result in confined vapor explosions resulting from the mixture of LNG vapors and oxygen from the atmosphere. You opined that the prohibition on the use of covered impounding systems in § 193.2167 was to reduce the risk of confined vapor explosions due to the mixture of LNG vapors with air in enclosed volumes.

Therefore, you reasoned that § 193.2167 should only be applied to covered impoundment systems where air is expected or can be present under normal operating conditions. You asserted that buried LNG piping is not open to the atmosphere and does not have empty voids in between the piping and soil where LNG vapors from a leak could concentrate with ambient air leading to a confined vapor explosion. You stated that even if LNG or LNG vapors were to surface to grade, the LNG would then be unconfined and would not result in the kind of vapor explosion § 193.2167 was designed to prevent.

[1] Incorporated by reference into Part 193. *See,* § 193.2013(g)(1)).

[2] NFPA 59A-2019 is not incorporated by reference into Part 193.

Asserting the same line of reasoning, you argued that a buried LNG pipeline surrounded completely by soil with a concrete slab directly placed on top of the soil, such as a buried piping installation crossing a road, is also not an enclosed impoundment system. As you explained, in this scenario, there is no empty void in between the soil and concrete slab that is open to atmosphere where ambient air and LNG vapors can form an explosive mixture in a confined volume.

You further contended that for a buried pipeline to become a closed impoundment system such as those prohibited by § 193.2167, the soil impoundment over the pipeline, exposed to the atmosphere, would need to be covered or congested in such a manner that LNG vapors could mix with ambient air in a confined or congested volume. You explained that for LNG vacuum jacketed piping, the soil surrounding the outer jacket will also serve as the impoundment system where 1) the outer pipe is not used for LNG impoundment, and 2) where the vacuum jacketed pipe does not affect the prescribed design spills, impoundment determinations, or other hazard calculations.

Concluding, based on the inherent differences between an enclosed impoundment system and buried piping, you asked if § 193.2167 applies to buried LNG piping.

Part 193 prescribes safety standards for LNG facilities used in the transportation of gas by a pipeline that is subject to the pipeline safety laws (49 U.S.C. 60101 et seq.) and Part 192 of this chapter. *See* § 193.2001(a). Section 193.2167 is specifically found in Subpart C, Design, of Part 193, which incorporates by reference NFPA 59A–2001. *See* § 193.2101. If there is a conflict between Part 193 and NFPA 59A–2001, the requirements in Part 193 prevail.

The applicable definitions and requirements in 49 CFR Part 193 and NFPA 59A-2001 are as follows:

> § 193.2007 - Definitions.
>
> *Impounding space* means a volume of space formed by dikes and floors which is designed to confine a spill of hazardous liquid.
>
> *Impounding system* includes an impounding space, including dikes and floors for conducting the flow of spilled hazardous liquids to an impounding space.
>
> § 193.2167 Covered systems.
>
> A covered impounding system is prohibited except for concrete wall designed tanks where the concrete wall is an outer wall serving as a dike.
>
> NFPA 59A-2001 Section 2.2.2.3
>
> Enclosed drainage channels for LNG shall be prohibited.

Exception: Container downcomers used to rapidly conduct spilled LNG away from critical areas shall be permitted to be enclosed if they are sized for the anticipated liquid flow and vapor formation rates.

Part 193 does not require buried LNG piping to have an impoundment system. However, if an operator has an impoundment system, pursuant to § 193.2167 a covered impounding system is prohibited except for concrete wall designed tanks where the concrete wall is an outer wall serving as a dike. This requirement applies to all impoundment systems without consideration of atmospheric exposure. Therefore, a buried LNG piping system with a covered impoundment system or vacuum jacketed piping, where the secondary pipe serves as the impoundment system, is prohibited under § 193.2167.

If an operator desires to have buried LNG piping with a covered impoundment system or vacuum jacketed piping, the operator may seek a special permit to deviate from the prohibition against covered impoundment systems in § 193.2167.

If we can be of further assistance, please contact Tewabe Asebe at 202-366-5523.

Sincerely,

JOHN A GALE

Digitally signed by JOHN A GALE
Date: 2022.05.24 14:09:32 -04'00'

John A. Gale
Director, Office of Standards
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February 28, 2022

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Request for Interpretation of 49 CFR §193.2167

Dear Mr. Gale,

This letter is a formal request for written interpretation from the Pipeline and Hazardous Materials Safety Administration of Title 49 Code of Federal Regulations Part 193. This interpretation is requested to clarify the intent and applicability of §193.2167 to buried liquefied natural gas ("LNG") piping systems.

§193.2167 states that:

> *A covered impounding system is prohibited except for concrete wall designed tanks where the concrete wall is an outer wall serving as a dike.*

Similarly, the National Fire Protection Association 59A Standard for the Production, Storage, and Handling of Liquefied Natural Gas ("NFPA 59A") 2001 edition ("NFPA 59A-2001"), Chapter 2.2 provides requirements regarding the use of enclosed LNG drainage channels. NFPA 59A-2001 Section 2.2.2.3 states:

> *Enclosed drainage channels for LNG shall be prohibited.*
>
> *Exception: Container downcomers used to rapidly conduct spilled LNG away from critical areas shall be permitted to be enclosed if they are sized for the anticipated liquid flow and vapor formation rates.*

Although not considered by Part 193, the 2019 edition of NFPA 59A ("NFPA 59A-2019"), Chapter 13, provides specific requirements for installation of enclosed impounding systems. NFPA 59A-2019, Section 13.5 states that:

Enclosed impounding systems for piping shall be prohibited except for where they met one of the following conditions:

(1) The system is sealed from the atmosphere, filled with an inert gas, and instrumentation and controls are provided to maintain pressures at a safe level and to monitor gas concentrations.

(2) Pipe-in-pipe is installed in accordance with 10.13.3.2.

NFPA 59A-2019, Section 10.13.3.2, states that:

If the outer pipe also functions as the secondary containment system, the following shall apply:

(1) The outer pipe shall be designed to contain the inner pipe product upon any release from the inner pipe.

(2) The outer pipe shall be designed, fabricated, examined, and tested in accordance with the requirements of ASME B31.3, Process Piping.

(3) The outer pipe shall include a stress analysis of the mechanical forces and thermal shock upon a release from the inner pipe.

§193.2167, NFPA 59A-2001 and NFPA 59A-2019, all recognize the hazards involved with the use of enclosed LNG impoundment systems and therefore, prohibit the use of such systems or provide specific requirements for the safe design of such systems. Enclosed LNG impounding systems can result in confined vapor explosions resulting from the mixture of LNG vapors and oxygen from the atmosphere. This hazard is clearly recognized by the design requirements in NFPA 59A-2019, Section 13.5, which specifically address the need to prevent air ingress to the enclosed impounding system, eliminating the risk of confined vapor explosions as the LNG vapors become an ignitable mixture when ambient air is present. Two industry examples where LNG vapor (natural gas) leaked into confined spaces and formed an explosive mixture with air include:

(1) The October 1944 East Ohio Gas Company incident where LNG from a failed storage tank spilled onto residential streets and storm sewer systems resulting in a fire and explosions within the sewer system.

(2) The 1978 Cove Point LNG Receiving Terminal incident where LNG leaked through an inadequately tightened LNG pump electrical penetration seal, vaporized, passed through 200 feet of underground electrical conduit and entered the substation. The natural gas-air mixture within the substation was ignited, resulting in a confined explosion.

Consistent with LNG industry codes and safe practices, §193.2167 prohibits the use of covered impounding systems to reduce the risk of confined vapor explosions due to the mixture of LNG vapors with air in enclosed volumes. Therefore, §193.2167 should only be applied to covered impoundment systems where air is expected or can be present under normal operating conditions, for example, an aboveground LNG trench with a cover or an underground drainage system that is open to atmosphere.

A buried LNG pipeline is not open to the atmosphere and does not have empty voids in between the pipeline and soil where LNG vapors from a leak could concentrate with ambient air leading to a confined vapor explosion. Even if LNG or LNG vapors would surface to grade, the hazardous fluid would then be unconfined and would not result in a vapor explosion (where no congestion is present above the area) such as that prevented by §193.2167.

Similarly, a buried pipeline surrounded completely by soil with a concrete slab directly placed on top of the soil, such as a buried pipeline installation crossing a road, is not an enclosed impoundment system, as there is no empty void in between the soil and concrete slab that is open to atmosphere where ambient air and LNG vapors can form an explosive mixture in a confined volume.

Furthermore, §193.2007 defines an *Impounding Space* as:

> *a volume of space formed by dikes and floors which is designed to confine a spill of hazardous liquid.*

On a buried LNG pipeline, the soil surrounding the pipeline provides the volume of space to confine the spill. A pipeline that has a leak or has failed cannot provide containment to itself; it is the soil around the pipeline that confines the spill. For a buried pipeline to become a closed impoundment system such as those prohibited by §193.2167, the soil (impoundment) over the pipeline, exposed to atmosphere, would need to be covered or congested in such a manner that LNG vapors could mix with ambient air in a confined or congested volume. For example, a buried LNG pipeline routed along a congested process area or inside a building.

For buried LNG vacuum jacketed piping, the soil surrounding the outer jacket will also serve as the impoundment system where:

a) the outer pipe is not used for LNG impoundment, and
b) where the vacuum jacketed pipe does not affect the prescribed design spills, impoundment determinations, or other hazard calculations.[1]

For the same reasons described above, this impoundment system is not “covered” as prohibited by §193.2167.

Based on the hazard prevented by §193.2167 and NFPA 59A, and the inherent differences between an enclosed impoundment system that could lead to a confined explosion and a buried pipeline, we would like to confirm that §193.2167 does not apply to buried LNG pipeline installations such as those described in this interpretation request.

I am available for future discussions as needed. Thank you for your assistance and I look forward to hearing from you soon.

JUAN CARLOS RIVADENEIRA
Engineer

[1] See PHMSA, *LNG Plant Requirements: Frequently Asked Questions*, D4, (last updated: October 23, 2017). available at: https://www.phmsa.dot.gov/pipeline/liquified-natural-gas/lng-plant-requirements-frequently-asked-questions.