



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

1200 New Jersey Ave, S.E.
Washington, D.C. 20590

Mr. John C. Keppel
4234 North Main Street, Unit 502
Fall River, MA 02720

JUL 07 2010

Mr. Michael L. Miozza
84 Holland Street
Fall River, MA 02720

**RE: Request for Written Interpretation on the Applicability of 49 C.F.R. Part 193 to
Proposed Waterfront Liquefied Natural Gas Plant in the City of Fall River,
Massachusetts**

Dear Mr. Keppel and Mr. Miozza:

You have asked for a written interpretation on three questions related to Weaver's Cove Energy, LLC's (Weaver's Cove or the Company) proposal to build a waterfront liquefied natural gas (LNG) plant (Fall River Plant or the Plant) in the City of Fall River, Massachusetts (Fall River). In particular, you ask whether the Company's use of the SOURCE5 source term model to calculate the flammable vapor gas dispersion exclusion zone for the onshore portion of the Fall River Plant complies with 49 C.F.R. § 193.2059. You also ask whether its use of a certain thermal radiation flux value to calculate the thermal radiation exclusion zone for that same portion of the Plant complies with 49 C.F.R. § 193.2057. Finally, you ask whether Weaver's Cove's failure to submit an Emergency Response Plan (ERP) is a violation of 49 C.F.R. Part 193.

While our regulations do not mandate the use of a particular source term model, we conclude that SOURCE5 can no longer be used to comply with our vapor gas dispersion exclusion zone requirements. We further conclude that the Company used the proper thermal radiation flux value to calculate the thermal radiation exclusion zone for the onshore portion of the Plant, and that it is not yet required to submit an ERP.

Background

In December 2003, Weaver's Cove Energy filed an application with the Federal Energy Regulatory Commission (FERC) to build the Fall River Plant.¹ In that application, the Company certified that it would comply with 49 C.F.R. Part 193 in siting, designing, constructing, operating, and maintaining the Plant. Weaver's Cove also used SOURCE5 and the thermal

¹ *Weaver's Cove Energy, LLC*, 112 FERC P 61070 (July 15, 2005) (Kelly, Comm'r, dissenting). According to the record in the FERC proceeding, Shell Oil Products US and its affiliates previously operated a petroleum terminal and oil refinery on the proposed site, and the Commonwealth of Massachusetts has designated it as appropriate for water-dependant industrial uses. *Weaver's Cove Energy, LLC*, 112 FERC P at 61527-61529.

radiation flux values specified in the NFPA 59A: Standard for the Production, Storage, and Handling of LNG, 2001 Edition (2001 NFPA 59A) to determine the dimensions of the thermal radiation and vapor gas dispersion exclusion zones for the Fall River Plant. On July 15, 2005, FERC issued an order conditionally approving the project.²

In January 2009, Weaver's Cove filed another application with FERC to modify the design of the Fall River Plant by replacing its shoreline marine berth and cargo transfer system with the Mount Hope Bay (MHB) Transfer System, an offshore marine berth and 4.25-mile subsea PIP LNG Transfer System. As none of your questions relate to that proposal, this letter does not address the MHB Transfer System.

Question 1

You first ask whether Weaver's Cove's use of SOURCE5 to calculate the flammable vapor gas dispersion exclusion zone for the onshore portion of the Fall River Plant complies with the requirements in 49 C.F.R. § 193.2059. Before answering that question, we will briefly examine the history of our siting requirements and discuss some recent developments in the field of consequence modeling.

In 1980, the U.S. Department of Transportation's (USDOT) Materials Transportation Bureau (MTB) issued the original federal minimum standards for siting LNG facilities.³ Those standards required an operator or governmental authority to control the property within an "exclusion zone" to protect the public from the adverse effects of thermal radiation and flammable vapor gas dispersion in the event of an LNG release.⁴ They also specified the mathematical models that had to be used in calculating the dimensions of these exclusion zones.⁵

In the case of vapor gas dispersion, our 1980 regulations incorporated the Gaussian line-source (GLS) model described in appendix B of a 1974 technical report, "Evaluation of LNG Vapor Control Methods,"⁶ and prescribed the conditions that had to be followed in executing that

² *Weaver's Cove Energy, LLC*, 112 FERC P at 61546-61547.

³ See Liquefied Natural Gas Facilities; New Federal Safety Standards, 45 Fed. Reg. 9184 (Feb. 11, 1980); Liquefied Natural Gas Facilities; Reconsideration of Safety Standards for Siting, Design, and Construction, 45 Fed. Reg. 57402, 57418 (Aug. 28, 1980) (denying, in part, and granting, in part, a petition for reconsideration).

⁴ LNG Facilities; Federal Safety Standards, Development of New Standards, 44 Fed. Reg. 8142, 8142 (February 8, 1979) (describing the hazards associated with LNG).

⁵ 49 C.F.R. §§ 193.2057, 2059 (1980). Subpart B also authorized the use of alternative thermal radiation or vapor gas dispersion models that "[h]a[d] been evaluated and verified by testing at a scale, considering scaling effects, appropriate for the range of application; . . . submitted to the Director for approval, with supportive data as necessary to demonstrate validity; and . . . received approval by the Director." 49 C.F.R. §§ 193.2057(c)(2), 2059(c). The Director referenced in these requirements was the head of MTB, 49 C.F.R. § 1.3(b)(8) (1980), an entity then-organized within USDOT's Research and Special Programs Administration. 49 C.F.R. § 190.3(d) (1980) (defining Materials Transportation Bureau).

⁶ 49 C.F.R. § 193.2059(c).

model. A method for determining the vaporization design rate, or source term, for input into the 1974 GLS model was one of those conditions.⁷

In February 1997, MTB's successor and our predecessor, the Research and Special Programs Administration (RSPA), replaced the 1974 GLS model with the current vapor gas dispersion model, the DEGADIS Dense Gas Dispersion Model (DEGADIS),⁸ and modified our regulations to allow operators to satisfy our vaporization design rate requirements by using an "equivalent personal computer program,"⁹ which led to the widespread use of SOURCE5 by the U.S. LNG industry.¹⁰ In March 2000, RSPA also repealed our vaporization design rate requirements "to allow operators more flexibility in computing" the formation of the source term, i.e., the physical phenomena that occur immediately after an LNG release, but prior to atmospheric dispersion.¹¹

There have been some significant technical studies on source term and vapor gas dispersion modeling in the past five years. Specifically, at the request of the National Fire Protection Association's (NFPA) Fire Protection Research Foundation (FPRF), the United Kingdom Health

⁷ 49 C.F.R. § 193.2059(d). As recently described by a panel of experts:

The dispersion of releases of hazardous fluids through from loss of containment to dilution below hazardous levels can be simply considered as comprising two stages: source term formation and atmospheric dispersion. The former occurs immediately after release when the behaviour of the fluid is dominated by conditions under which the fluid was stored and the particular conditions of release. Further downstream, as the influence of the source decays, the atmosphere becomes increasingly important and controls fluid behaviour.

In LNG hazard assessments these two stages are usually modelled separately by a source term model and a dispersion model. The output from the source term model, specifying the state of the fluid at that stage, is used as input to the dispersion model.

Ivings, et al., LNG Source Term Models for Hazard Analysis: A review of the State-of-the-Art and an Approach to Model Assessment, p. vi (Mar. 2009) (on file with PHMSA).

⁸ Liquefied Natural Gas Regulations—Miscellaneous Amendments, 62 Fed. Reg. 8402 (Feb. 25, 1997) (incorporating "the model described in the Gas Research Institute Report GRI-89/0242 . . . , 'LNG Vapor Dispersion Prediction with the DEGADIS Dense Gas Dispersion Model.'").

⁹ 62 Fed. Reg. at 8404 (amending 49 C.F.R. § 193.2059(d)(1)(ii) to state that "[i]n determining variations in the vaporization rate due to surface contact, the time necessary to wet 100 percent of the impounding floor area shall be determined by equation C-9 in the 1974 AGA report titled "Evaluation of LNG Vapor Control Methods," or by using an equivalent personal computer program based on equation C-9 or by an alternative model which meets the requirements of §193.2057(c)(2)(ii) through (iv).").

¹⁰ In 1991, the Gas Technology Institute released "GRI-92/0534: Spread and Vaporization of LNG," a report that described a computer program intended for the calculation of the vaporization rate of spilled LNG. The original computer program, SOURCE1, was revised several times, and the U.S. LNG industry eventually began using the final version, SOURCE5, for determining source strength inputs for DEGADIS.

¹¹ Pipeline Safety: Incorporation of Standard NFPA 59A in the Liquefied Natural Gas Regulations 65 Fed. Reg. 10950, 10953 (March 1, 2000). In that same final rule, we also authorized the use of another vapor gas dispersion model, FEM3A, "to account for additional cloud dilution which may be caused by the complex flow patterns induced by tank and dike structure . . ." 49 C.F.R. § 193.2059(a). As your question does not relate to FEM3A, that model is not addressed in this letter.

& Safety Executive’s Health & Safety Laboratory prepared a pair of reports on these subjects. The authors of those reports, a group with expertise in consequence modeling evaluation, concluded that SOURCE5 suffers from two deficiencies—i.e., it does not accurately represent the likely effects of (1) pool spreading and the resulting flammable vapor flashing or (2) vapor accumulation within impoundments.¹² According to the FPRF report, those deficiencies could lead to an under-prediction of the distance of a vapor gas exclusion zone for an LNG plant.

Turning to your question, our siting requirements no longer specify the vaporization design rates that must be used as the input for DEGADIS. We eliminated that regulation a decade ago “to allow operators more flexibility in computing” the formation of the source term, subject to our continuing obligation to evaluate the suitability of those models based on the best available scientific and technical evidence.

In that regard, our regulations state that “[f]lammable vapor-gas dispersion distances must be determined in accordance with the model described in the Gas Research Institute report GRI-89/0242 . . . ‘LNG Vapor Dispersion Prediction with the DEGADIS Dense Gas Dispersion Model.’”¹³ GRI-89/042 further states that DEGADIS is subject to certain “limitations,” including that it “models vapor dispersion only” and, by necessity, “requires the user to specify vaporization rates for liquid spills.”¹⁴

To comply with our vapor gas exclusion zone requirements, the vaporization rates specified as the input for DEGADIS must have a credible scientific basis.¹⁵ Otherwise, a user could select whatever source term is likely to produce the most favorable outcome, e.g., the smallest or largest possible exclusion zone, or even at random. That would not be consistent with the limitations described in GRI-89/042, as incorporated into our siting requirements by reference, or our statutory obligation to protect the public from the hazards associated with operating an LNG plant.¹⁶

The authors of the FPRF reports found that using SOURCE5 as the input for DEGADIS may lead to non-conservative hazard predictions. That finding, rendered by a group of experts in consequence modeling evaluation, should be given the utmost consideration, and we must respond by doing what is necessary to ensure public safety. Accordingly, we conclude that

¹² M.J. Iving et al., Evaluating Vapor Dispersion Models for Safety Analysis of LNG Facilities Research Project: Technical Report 8-10 (Apr. 2007) (on file with PHMSA); Ivings, et al., LNG Source Term Models for Hazard Analysis: A review of the State-of-the-Art and an Approach to Model Assessment (Mar. 2009) (on file with PHMSA); see also National Association of State Fire Marshals, Review of the LNG Vapor Dispersion Model Evaluation Protocol (Jan. 2009) (on file with PHMSA); National Association of State Fire Marshals, Review of the LNG Source Term Models for Hazard Analysis: A Review of the State-of-the-Art and an Approach to Model Assessment (Jun. 2009) (on file with PHMSA).

¹³ 49 C.F.R. § 193.2059(a).

¹⁴ GRI Report 89/0242 at 87 (underline in original).

¹⁵ *Id.* (further noting that the “[p]roper characterization of vaporization rates as a function of time are extremely important for specifying the proper release mode . . . and the source strength.”).

¹⁶ 49 C.F.R. §§ 60102(a), (b)(2)-(3), 60103(a).

SOURCE5 can no longer be used to determine the vapor gas exclusion zone for an LNG plant, without taking appropriate actions to address the deficiencies identified in the FRPF reports.¹⁷

We cannot say how this conclusion might affect any particular proceeding,¹⁸ but note that LNG facilities must be “designed” and “constructed” in accordance with our siting requirements, and that our interpretation of what is needed to satisfy those requirements applies to any LNG facility that is not yet in existence or under construction.¹⁹

Question 2

You next ask whether Weaver’s Cove used the proper thermal radiation flux value to calculate the dimensions of the thermal radiation exclusion zone for the onshore portion of the Fall River LNG Plant. The 2001 NFPA 59A is incorporated into our siting requirements by reference, subject to regulatory preemption in the event of conflict.²⁰ The former standard lists a series of thermal radiation flux values for use in calculating the dimensions of an LNG plant’s thermal radiation exclusion zone,²¹ and there is no similar provision in our regulations.²² Accordingly, the Company’s use of the thermal radiation flux values from the 2001 NFPA 59A complies with 49 C.F.R. § 193.2057.

Question 3

Your final question is whether Weaver’s Cove has violated 49 C.F.R. Part 193 by not submitting an ERP for the Fall River LNG Plant. Our regulations do not prescribe a specific deadline for submitting an ERP,²³ and there is no such requirement in the 2001 NFPA 59A.²⁴ Therefore, Weaver’s Cove is not yet required to submit an ERP.

¹⁷ We note that conservatism is critical in developing and applying an acceptable source term model. *See In the Matter of Energy Terminal Services Corporation*, PHMSA Interp. 82-05-28 (May 28, 1982) (stating that we selected the 1974 GLS model because “it appeared to predict conservative distances in comparison with other available mathematical models[,]” that “[49 C.F.R.] § 193.2059 requires use of the model as a conservative standard of protection[,]” and that a “construction of th[at] standard [which] yields a conservative result . . . is supported by the preamble to the [February 1980] final rule”).

¹⁸ *See e.g.*, 49 U.S.C. § 60104(d)(2), (e).

¹⁹ 49 C.F.R. § 193.2005(a)-(b), 193.2051; *see Pipeline Safety: Liquefied Natural Gas Facilities; Clarifying and Updating Safety Standards*, 69 Fed. Reg. 113330, 11331-11332 (Mar. 10, 2004).

²⁰ 49 C.F.R. §§ 193.2013, 193.2051.

²¹ 2001 NFPA 59A, 2.2.3.2.

²² 49 C.F.R. § 193.2057.

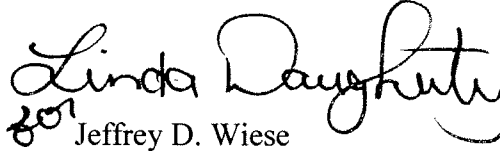
²³ 49 C.F.R. § 193.2903.

²⁴ *See* Chapter 9 of 2001 NFPA 59A; *but see* 2001 NFPA 59A, 2-1.1(d) (stating that any site-specific factors that “have a bearing on the safety of plant personnel and the surrounding public” must be reviewed, and that such a review must “include an evaluation of potential incidents and safety measures incorporated in the design or operation of the facility.”); Energy Policy Act of 2005, Pub. L. No. 109-58, § 311(e), 119 Stat. 94, 688 (Aug. 8, 2005) (requiring FERC to approve an ERP before authorizing construction of an LNG terminal).

Conclusions

In conclusion, SOURCE5 can no longer be used to comply with our vapor gas dispersion exclusion zone requirements, the Company used the appropriate thermal radiation flux value to determine the thermal radiation exclusion zone for the onshore portion of the Fall River LNG Plant, and it is not yet required to submit an ERP.

Sincerely,

Handwritten signature of Linda Daugherty in black ink. The signature is written in a cursive style and includes a small mark that looks like 'for' written over the 'L'.

Jeffrey D. Wiese
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for Pipeline Safety

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