



U.S. Department
of Transportation

Pipeline and Hazardous Materials
Safety Administration

1200 New Jersey Avenue SE
Washington DC 20590

February 8, 2018

VIA CERTIFIED MAIL AND FAX TO: (703) 375-6000

Mr. Douglas D. Shanda
President, Sabine Pass Liquefaction, LLC &
Senior Vice President, Operations, Cheniere Energy, Inc.
700 Milam Street
Suite 1900
Houston, TX 77002

CPF No. 4-2018-3001H

Dear Mr. Shanda:

Enclosed please find a Corrective Action Order (CAO) issued by the Pipeline and Hazardous Materials Safety Administration (PHMSA), Office of Pipeline Safety (OPS), in the above-referenced case. It requires Sabine Pass Liquefaction, LLC, to take certain corrective actions with respect to LNG tanks in the Sabine Pass Liquefaction Facility operating in Cameron Parish, Louisiana, that experienced an LNG and natural gas release on January 22, 2018.

Service of this CAO is being made by certified mail and facsimile. Service of the CAO by electronic transmission is deemed complete upon transmission and acknowledgement of receipt, or as otherwise provided under 49 C.F.R. § 190.5. The terms and conditions of this Order are effective upon completion of service.

Sincerely,

Alan K. Mayberry
Associate Administrator
for Pipeline Safety

Enclosure: CAO

cc: Ms. Linda Daugherty, Deputy Associate Administrator for Field Operations, OPS
Mr. Frank Causey, Acting Region Director, Southwestern Region, OPS
Mr. Jack A. Fusco, President and Chief Executive Officer, Cheniere Energy, Inc.
Mr. Paul Nielson, Lead Advisor, Compliance, Cheniere Energy, Inc.

² Tank S-102 has also experienced releases of LNG from the inner tank into the annular space, but Tank S-102 is not included as one of the “Affected Tanks” described below.

experienced releases of LNG from the inner tank into the annular space. This raises the possibility that the conditions which resulted in the Incident may be present in multiple tanks.

Sabine reported no injuries or fatalities as a result of the Incident, and there were no reported fires or explosions. The cause of the Incident has not yet been determined. Pursuant to 49 U.S.C. § 60117, PHMSA, Office of Pipeline Safety (OPS), has initiated an investigation of the Incident. The preliminary findings of the agency's ongoing investigation are as follows:

Preliminary Findings:

- Sabine owns and operates two major LNG terminals, i.e., the Sabine Pass Facility and the Corpus Christi LNG Terminal. The Sabine Pass Facility is located on a site consisting of more than 1,000 acres along the Sabine Pass River between Texas and Louisiana in Cameron Parish, Louisiana. The nearest town is Johnson Bayou, Louisiana. There are approximately 500 Sabine employees and contractors onsite to support the Facility's operations.
- There are two berths and five LNG storage tanks at the Facility. All five LNG storage tanks were designed by Mitsubishi Heavy Industries, Ltd. (MHI). Tanks S-101, S-102, and S-103 were fabricated by Matrix Service, Inc., from 2005-2008 and placed in service in 2008. Tanks S-104 and S-105 were fabricated by Zachry Industrial, Inc., from 2006-2009 and placed in service in 2009. The Facility has been used for import since 2008, and liquefaction capabilities have been going into service for export since 2016.³ All tanks tie into an interconnected boil-off gas system.
- The Incident occurred in Tank S-103, one of the five on-site storage tanks that each have 3.4 billion cubic feet equivalent capacity (Bcfe) for LNG (total of 17 Bcfe). PHMSA was notified of the release of LNG from Tank S-103 via NRC Report No. 1202595, but only after PHMSA initiated its investigation into the release did PHMSA learn that Tank S-101 had also experienced releases of LNG into its annular space, and was actively leaking natural gas vapors at 14 sites along the base of the tank. (Tank S-103 and Tank S-101 are referred to herein as the "Affected Tanks.")
- On January 22, 2018, Sabine workers discovered a release of LNG from Tank S-103. Tank S-103 experienced a release of LNG into the annulus and the LNG eventually escaped through four separate cracks in the outer tank and pooled in the secondary containment area surrounding the tank. Exposure of LNG to the carbon steel outer tank resulted in cooling of the outer tank wall to a temperature far below its design temperature of -25° F. These cracks propagated to a length of approximately one to six feet in length in a short amount of time, because when steel fails at low temperatures, it fails in a brittle manner. Brittle failures do not leak before failing so there is no warning before failure.

³ See <http://www.cheniere.com/terminals/sabine-pass/>. Current as of 2/6/2018.

- Upon discovery of the Incident, Sabine isolated Tank S-103, commenced de-inventorying of LNG from the tank, and lowered the pressure in the tank annulus and boil-off gas system. The level of LNG in the inner tank is currently oscillating between 1-3 feet to maintain the thermal condition needed for the inner nickel steel tank which contains the LNG. The operator's Emergency Management Team (EMT) was deployed to control the access point to Tank S-103 around the clock. The EMT has real-time monitoring and reporting for gas emissions, and is maintaining 24-hour coverage around the containment dike. The area around Tank S-103 was roped-off to limit potential ignition sources and the road closest to the tank was closed to vehicle traffic. Sabine also notified the occupants of the adjacent property of the situation. Sabine then issued "hot work" permits so that personnel could enter the area where there are gas vapors to better assess the tank. The fire and water systems were not activated. Other plant operations continue as normal.
- Both the Federal Energy Regulatory Commission (FERC) and PHMSA have responded to the scene to assess the situation.
- The vertical through-wall cracks in approximately four separate areas on the carbon steel outer shell of Tank S-103 were a result of the exposure of the outer wall to liquid at temperatures significantly below the outer tank's design temperature of -25° F. However, the cause of the release of LNG into the annulus is unknown. No external cracking was observed on any other tanks to date. To date, neither Tank S-103 nor Tank S-101 has been completely removed from LNG service.
- After initiating its investigation, PHMSA received from Sabine a copy of a prior investigative report that Sabine commissioned from Matrix and received in March 2017. That report documented 11 past upsets (dating from 2008-2016) on Tank S-103 and surmised that under certain flow conditions, when using the bottom fill line, LNG might splash over the top of the inner tank into the annular space ("geyser-type effect"). The operator has indicated that it believes this geyser-type effect also occurred on Tank S-101, as both tanks are designed and operated in the same manner.
- Tanks S-104 & S-105 appear to be unaffected by the Incident on January 22, 2018 as reported by the operator.
- Unintended releases of LNG are rare and are described as "low-frequency, high-consequence" events.
- To date, Sabine has been unable to correct the long-standing safety concerns described above involving the Affected Tanks, cannot validate the exact source or amount of the LNG that may have leaked into the annulus of the Affected Tanks, and cannot identify the circumstances that allowed the LNG to escape containment in the first place. Unintentional release of LNG can result in a serious hazard to people and property.

Determination of Necessity for Corrective Action Order and Right to Hearing:

Section 60112 of Title 49, United States Code, provides for the issuance of a Corrective Action Order, after reasonable notice and the opportunity for a hearing, requiring corrective action, which may include the suspended or restricted use of a pipeline facility, physical inspection, testing, repair, replacement, or other action, as appropriate. The basis for making the determination that a pipeline facility is hazardous and requiring corrective action is set forth both in the above-referenced statute and 49 C.F.R. § 190.233.

Section 60112, and the regulations promulgated thereunder, provide for the issuance of a Corrective Action Order without prior opportunity for notice and hearing upon a finding that failure to issue the Order expeditiously will likely result in serious harm to life, property or the environment. In such cases, an opportunity for a hearing will be provided as soon as practicable after the issuance of the Order.

The Sabine Pass Facility is governed by Section 60101 of Title 49, United States Code, as detailed in 49 C.F.R. Section 193.

After evaluating the foregoing preliminary findings of fact and considering the ongoing investigation of the Incident, I find that the continued operation of the Affected Tanks without corrective measures is or would be hazardous to life, property and the environment. Additionally, after considering the presence of approximately 500 Sabine employees and contractors onsite, the potential for disruption to major transportation modes (including highways and waterways), the hazardous nature of the product being stored, the unpredictability of brittle failures and ignition sources, the newly-discovered history (2008-2016) of similar problems that have been present since the Facility came on-line, the uncertainties as to the cause of the Incident, and the ongoing investigations to determine the cause of the Incident, I find that a failure to issue this Order expeditiously to require immediate corrective action would result in likely serious harm to life, property, and the environment.

Accordingly, this Corrective Action Order mandating immediate corrective action is issued without prior notice and opportunity for a hearing. The terms and conditions of this Order are effective upon receipt.

Within 10 days of receipt of this Order, Respondent may request a hearing, to be held as soon as practicable, by notifying the Associate Administrator for Pipeline Safety in writing, with a copy to the Director, Southwestern Region, PHMSA (Director). If a hearing is requested, it will be held telephonically or in-person in Houston, Texas, unless a different location is expressly agreed to in writing by the Director.

After receiving and analyzing additional data in the course of this investigation, PHMSA may identify other corrective measures that need to be taken. Respondent will be notified of any additional measures required and, if appropriate, PHMSA will consider amending this Order. To the extent consistent with safety, Respondent will be afforded notice and an opportunity for a hearing prior to the imposition of any additional corrective measures.

Required Corrective Actions:**Definitions:**

Affected Tanks – Means Respondent's Tank S-103 and Tank S-101 and their Tank Systems at the Facility.

Director – Means the Director, Pipeline and Hazardous Materials Safety Administration, Office of Pipeline Safety, Southwest Region.

Remove from Service – Means to isolate and purge hydrocarbons so that the internal and external environment is in such a state where inspection, assessment and remedial repair work can safely occur.

Tank System – Means the tank system for each LNG tank at the Facility and includes the nickel steel inner tank and the carbon steel outer tank and related facilities and appurtenances.

Pursuant to 49 U.S.C. 60112, I hereby order Sabine to immediately take the following corrective actions for the Affected Tanks:

1. **Remove from Service:** Within seven days following receipt of this Order, Sabine must provide to the Director, for approval, a timeline and plan for removing the Affected Tanks from service.
2. **Work Plan:** Within 30 days following receipt of this Order, Sabine must develop and submit a detailed comprehensive work plan that includes tank-specific purging plans, a root-cause analysis plan, a detailed repair and modification plan, a continuing operation plan for facilities that remain in service, and a plan to return the Affected Tanks to service (Work Plan). This plan must be submitted to the Director for prior approval.
3. **Qualified Independent Third-Parties:** Sabine must engage the services of qualified independent third-parties to assist in the development of the Work Plan and to perform the work in the approved Work Plan. Sabine must submit the proposed third-party experts and their qualifications to the Director for prior concurrence. The third parties performing the work identified in the Work Plan must provide all reports to the Director at the same time as they are provided to Sabine.
4. **Root Cause Failure Analysis:** Within 120 days following receipt of this Order, Sabine must complete a root cause failure analysis (RCFA) that is facilitated and validated by an independent third-party vendor acceptable to the Director. The RCFA must document all contributory factors and the decision-making process. Sabine must submit a final report of the RCFA to the Director, including any

lessons learned and whether the findings are applicable to other tanks within the Facility.

5. **Review of Other Tank Systems:** Within 60 days of the completion of the final RCFA, Sabine must evaluate Tank S-102, Tank S-104 and Tank S-105 and their Tank Systems within the Facility to determine if they are subject to the same causal factors identified in the RCFA. Sabine must document this evaluation, describe what actions will be taken to address the results of the evaluation, and submit the documentation to the Director. If the evaluation finds that the other tanks are subject to the same causal factors, Sabine must explain how it will ensure these other tanks are operated safely while they develop the Work Plan under the requirements of #2 above.
6. **Return to Service:** Sabine may not return to service the Affected Tanks until authorized to do so by the Director. Prior to returning the Affected Tanks to service, Sabine must develop a fitness-for-service plan, that meets the requirements of API RP 579-1 / ASME FFS-1, *Fitness-For-Service* (3rd edition), issued in June 2016; complete all permanent repairs in accordance with 49 C.F.R. § 193.2617 and API Standard 653, *Tank Inspection, Repair, Alteration, and Reconstruction* (5th edition), issued in November 2014; and complete all recommendations from the RCFA.
7. **Emergency Response Plan and Training Review.** Sabine must review and assess the effectiveness of its emergency response plan and emergency response training with regards to the Incident. This must include on-scene response, support, coordination, and communication with state and local emergency responders and public officials. Sabine must amend its emergency response plan and emergency training, if necessary, to reflect the results of this review. The documentation of this review must be available for inspection by PHMSA or provided to the Director, if requested.

Other Requirements:

8. **Request for Information of Prior Known Events:** Within 30 days following the receipt of this Order, Sabine must provide the Director with all previous known events in which any of Sabine's tank systems at the Facility were operated outside of design specifications and/or LNG has spilled into the annulus or vapor escaped from the outer tank, including conditions that existed, actions taken to mitigate events, all inspections and assessments performed to ensure the integrity of the tanks after the events, and modifications that were made to prevent future exceedances or incidents.
9. **Reporting.** Sabine must submit monthly reports to the Director that: (1) include all available data and results of the testing and evaluations required by this Order; and (2) describe the progress of the repairs or other remedial actions being

undertaken. The first monthly report is due on March 15, 2018. The Director may change the interval for the submission of these reports.

10. **Documentation of Costs.** It is requested, but not required, that Respondent maintain documentation of the costs associated with implementation of this Order. Sabine should include in each monthly report the to-date total costs associated with: (1) physical changes to Sabine's LNG tank system, including repairs, replacements and other modifications; (2) preparation and revision of procedures, studies and analyses; and (3) environmental remediation, if applicable.
11. **Approvals.** With respect to each submission that under this Order requires the approval of the Director, the Director may: (a) approve, in whole or part, the submission; (b) approve the submission on specified conditions; (c) modify the submission to cure any deficiencies; (d) disapprove, in whole or in part, the submission, directing that Sabine modify the submission; or (e) any combination of the above. In the event of approval, approval upon conditions, or modification by the Director, Respondent will proceed to take all action required by the submission as approved or modified by the Director. If the Director disapproves all or any portion of the submission, Respondent will correct all deficiencies within the time specified by the Director, and resubmit it for approval. If a resubmitted item is disapproved in whole or in part, the Director may again require Respondent to correct the deficiencies in accordance with the foregoing procedure, and the Director may otherwise proceed to enforce the terms of this Order.
12. **Extensions of Time.** The Director may grant an extension of time for compliance with any of the terms of this Order upon a written request timely submitted demonstrating good cause for an extension.
13. **Document Production.** To expedite the review and assessment of relevant documentation, Sabine must produce electronic versions (in their original format) of any and all records requested by the Director and related to this CAO in a physical medium, such CD-ROM, DVD, or flash drive, unless specifically asked to do otherwise. Since FERC and PHMSA both have jurisdiction over the Facility and are coordinating their investigations of the Incident, Sabine must provide all such records to FERC simultaneously as they are provided to PHMSA.

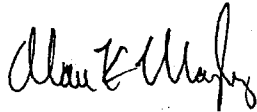
Be advised that all material you submit in response to this enforcement action is subject to being made publicly available. If you believe that any portion of your responsive material qualifies for confidential treatment under 5 U.S.C. § 552(b), along with the complete original document you must provide a second copy of the document with the portions you believe qualify for confidential treatment redacted and an explanation of why you believe the redacted information qualifies for confidential treatment under 5 U.S.C. § 552(b).

In your correspondence on this matter, please refer to "CPF No. 4-2018-3001H" and for each document you submit, please provide a copy in electronic format whenever possible. The actions required by this Order are in addition to and do not waive any requirements that apply to Respondent's pipeline system under 49 C.F.R. Parts 190 through 199, under any other order issued to Respondent under authority of 49 U.S.C. Chapter 601, or under any other provision of Federal or State law.

Respondent may appeal any decision of the Director to the Associate Administrator for Pipeline Safety. Decisions of the Associate Administrator shall be final.

Failure to comply with this Order may result in the assessment of civil penalties and in referral to the Attorney General for appropriate relief in United States District Court pursuant to 49 U.S.C. § 60120.

The terms and conditions of this Order are effective upon service in accordance with 49 C.F.R. § 190.5.



February 8, 2018

Alan K. Mayberry
Associate Administrator
for Pipeline Safety

Date Issued