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Performance Gap Comparison of Process Safety Management Consensus Standards and Regulatory Requirements for LNG Facilities

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Acknowledgement and Appreciation

The research project team expresses its sincere thanks to PHMSA and to PHMSA's Agreement Officer Representative Mr. Matthew Valerio. As outlined in this report, this project's analysis of potential Process Safety Management-related improvements to LNG facility operations, NFPA 59A or regulations is quite topical and timely, and Mr. Valerio's insights, input and comments throughout this project greatly supported this project and advancing PHMSA's objective to enhance safety.

The research project team also expresses its sincere thanks to the members of this project's Technical Advisory Panel (TAP), and the support of the companies for which they work or previously worked:

- David Anderson, when as Corporate Manager, Asset Integrity Management & Reliability, Cheniere Energy Inc.
- John Bugno II, P.E., Chemical Engineer, LNG Branch 2, U.S. Federal Energy Regulatory Commission (FERC)
- Christopher Conlon, Process Safety Director, National Grid US
- Scott Mills, Manager, Process Engineering, Cameron LNG
- Shawn Murphy, Team Lead, LNG Market Access, Shell International Exploration and Production
- Paul Nielson, Manager, Regulatory Compliance, Cheniere Energy Inc.
- Kevin Ritz, Senior Gas Engineering Technical Specialist, BGE, an Exelon Company
- Tony Scaraggi, when as Vice President and Plant Manager of Everett LNG Facility/Distrigas of MA division of Exelon Generation
- Liliana Silvera, Process Safety Engineer, U.S. Dept. of Labor Occupational Safety and Health Administration (OSHA)
- Susan Stritter, Principal Compliance Specialist, Everett LNG Facility/Distrigas of MA division of Exelon Generation

This project TAP worked very closely with the project team and with PHMSA during the entire duration of this project, participated in approximately eight web conferences, and provided numerous insightful comments, highly detailed reviews, input and perspectives on the draft analysis, survey questions and summary reports in order to help guide the project and advance the most impactful potential PSM-related updates.

A hearty *Thank You* from the research project team for your time, support, input and insignts!

- Rich Kooy, P.E., Senior Institute Engineer, Project Manager/Principal Investigator, GTI
- Rupesh Muthyala, Senior Risk Engineer, GTI
- Ernest Lever, R&D Director, Energy Delivery, GTI
- Filippo Gavelli, Ph.D., P.E., Consultant, Blue Engineering and Consulting
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Executive Summary

This project evaluated consensus standards, best practices, and regulatory requirements related to process safety management (PSM) topics to support DOT PHMSA's strategy to update its regulatory requirements for safety management systems for LNG facilities in 49 CFR Part 193. The project commenced on August 1, 2018, and supported PHMSA as it responded to President Trump's April 10, 2019 Executive Order to initiate a rulemaking to update 49 CFR 193.

At PHMSA's direction, the analysis primarily focused on comparing PSM-related requirements in 49 CFR 193 and its primary incorporated-by-reference industry standard NFPA 59A *Standard for the Production, Storage, and Handling of Liquefied Natural Gas* to those in: 1) 29 CFR 1910.119 (OSHA's PSM Standard); and 2) API Recommended Practice 1173 *Pipeline Safety Management Systems*. The project team also reviewed more than 15 additional leading global references related to PSM as supplementary resources to help ensure a robust and thorough analysis for PHMSA.

The project was guided by a knowledgeable and supportive Technical Advisory Panel (TAP), which included representatives from PHMSA, OSHA, FERC, and leading LNG facility operators: BGE, an Exelon Company; Cameron LNG; Cheniere; Everett LNG Facility/Distrigas of MA division of Exelon Generation; National Grid; and Shell International Exploration & Production. The TAP was highly engaged, met approximately every quarter, and provided very detailed and valuable feedback and input.

The analysis considered both the 2001 edition of NFPA 59A that is currently incorporated by reference in 49 CFR 193 as well as the 2019 edition. Several members of the project TAP or project team participate on the Technical Committee on Liquefied Natural Gas for NFPA 59A either as an official member, alternate member or other supporting role. At the agency level, PHMSA and FERC also actively participate on this Technical Committee and provide input to shape future editions of NFPA 59A. For that and other reasons, paths for implementing recommendations from this analysis could include proposed revisions to 49 CFR 193 but also proposed revisions to NFPA 59A, in order to build consensus on changes to this primary LNG industry standard which 49 CFR 193 incorporates by reference.

The project team performed a line-by-line comparison of requirements using 29 CFR 1910.119 as a baseline reference and as the structure to organize information in a detailed comparison table as well as in this summary report. In total, the analysis identified 156 individual PSM items, of which approximately 85 potential gaps were identified for consideration.

Input from LNG facility operators beyond the TAP members was gathered using an on-line survey. The survey size was limited to nine recipients in order to conform to the *Paperwork Reduction Act of 1995* as per 5 CFR 1320.3(c), but the nine respondents provided a good balance to represent operators of both LNG terminals as well as small scale LNG facilities used for utility peak shaving or merchant plant operation. The survey was prepared in close partnership with PHMSA and the TAP. After consolidation and streamlining, it asked questions about 39 potential gaps, along with the opportunity for qualitative comments. For two topics, the gap questions were posed in two different ways, including one multiple-choice question. A 100% response rate from nine operators was achieved. Survey recipients were provided with background information, including the detailed comparison table.

The majority of operators thought that 35 of the 39 potential gaps should be addressed either by voluntary action or through revision to NFPA 59A or 49 CFR 193. Responses differed fairly widely about the preferred course of action.

The majority of operators thought that 16 of the 39 potential gaps should be addressed by either revising 49 CFR 193 or NFPA 59A. These are provided in the body of the report, and pertain to specific topics related to Mechanical Integrity, Process Hazard Analysis, Process Safety Information, Management of Change, Emergency Planning and Response, Contractors, and Employee Participation.

The majority of operators thought that there should be an increased allowance in 49 CFR 193 for operators to use Recognized And Generally Accepted Good Engineering Practices (RAGAGEP) as a basis for establishing equipment inspection, testing and preventative maintenance, although approximately 33% of operators want this *as an option* and don't want RAGAGEP-based language to completely replace prescriptive requirements. Their response was quite consistent when the question was asked on a stand-alone basis or when asked about 25 specific individual components or classes of components for which 49 CFR 193 currently provides prescriptive frequencies and requirements.

Recommendations to enhance safety management system aspects in 49 CFR 193 are:

- Consider incorporating the 2019 edition of NFPA 59A by reference in 49 CFR 193, which would address some of the potential gaps identified in this analysis.
- Consider incorporating in 49 CFR 193 an increased allowance for operators to use RAGAGEP as a basis for establishing equipment inspection, testing and preventative maintenance related to ensuring mechanical integrity, *while retaining* the current prescriptive requirements as alternative means of compliance. Allowing increased optional use of a RAGAGEP basis to establish and implement a mechanical integrity program would appear to be:
    - consistent with 29 CFR 1910.119;
    - consistent with 49 CFR 193 in the sense that 49 CFR 193.2605(a) "Maintenance procedures" specifies a RAGAGEP basis for those components for which no prescriptive requirements are otherwise provided in 49 CFR 193;
    - consistent with revisions to the relevant industry consensus standard NFPA 59A, such as the change in the 2019 edition to revise inspection interval requirements as now specified in §18.10.10.7.

  An increased RAGAGEP allowance should include well-defined bases for acceptance of various components, in order to establish consistent test intervals and eliminate potential confusion for regulators and LNG operators; for example, referencing a recognized standard such as API RP 576 *Inspection of Pressure-Relieving Devices* for frequency of testing some components such as referenced by Section 18.10.10.7.2 of NFPA 59A (2019 edition).

  If broader incorporation of a RAGAGEP basis for mechanical integrity is not to be considered, then it is recommended to consider the optional allowance of a RAGAGEP basis for specific components such as certain component relief valves identified in the body of this report.

Recommendations to enhance safety management system aspects in future revisions to either 49 CFR 193 or NFPA 59A are:

- Consider incorporating potential expanded requirements related to Process Hazard Analyses (PHAs), which may include methodologies to perform a PHA and required content, the minimum frequency to update and revalidate a PHA, the team composition and expertise required to perform a PHA, and requirements on an operator to establish a system to promptly address a team's findings and recommendations regarding a PHA;
- Consider establishing "Process Safety Information" as a defined category in 49 CFR 193, or supporting consensus efforts to move related content from Appendix §A.3.3.9 of the 2019 edition NFPA 59A into an appropriate chapter in order to establish enforceability;
- Consider incorporating potential expanded requirements related to incident investigations beyond PHMSA's current reporting requirements, which may include qualifications and composition of incident investigation teams, minimum contents in incident investigation reports, addressing report findings and recommendations, and document retention;

- Consider establishing "Management of Change" as a defined term and establishing requirements, or proposing that a future edition of NFPA 59A revise Section 4.6 of the 2019 edition from "Engineering Review of Changes" to "Management of Change", and consider potential additional requirements in that section related to management of change;
- Consider potential expanded requirements related to expanded emergency planning and response requirements, such as periodic tabletop exercises, field exercises, and emergency response notification tests;
- Consider establishing additional requirements related to commissioning referenced in §18.7 of the 2019 edition of NFPA 59A (if incorporated by reference) or to a newly-established Pre Startup Safety Review (PSSR) requirement. Also, consider clarifying when Commissioning or PSSR requirements should apply to situations beyond initial startup - - such as facilities that have been substantially modified or out of service for extended periods (using well-defined terminology);
- Consider establishing if the operator's procedures must include a procedure to manage its own process safety and the potential minimum content of that procedure, which may include requirements to periodically self-evaluate its compliance to its procedure, self-audit its procedure to manage process safety, document its efforts to correct deficiencies identified in past audits, and the minimum number of compliance audit reports to retain;
- Consider other topics identified in the body of the Final Report.

The above recommendations for consideration arise from comparing 49 CFR 193 with NFPA 59A to voluntary standard 29 CFR 1910.119 (and to 40 CFR 68 for a few topics). The body of the report provides additional information regarding the differing approaches of the two primary regulations, to aid context as potential revisions to NFPA 59A or 49 CFR 193 may be considered.

The project team consisted of Gas Technology Institute ("GTI") and Blue Engineering and Consulting ("BLUE"). GTI led all project activities except for outreach to LNG facility operators to take a survey. BLUE led the outreach to survey recipients, summarized the survey results, and supported other activities.

Introduction

Project Objective

The overall objective of this project was to evaluate consensus standards, best practices, and regulatory requirements for process safety management (PSM) to support PHMSA's strategy to update its regulatory requirements for safety management systems for LNG facilities. The project deliverables are intended to support PHMSA in its ongoing efforts to improve safety management systems and reduce risk.

Project Scope

The project scope directly addressed PHMSA's solicitation topic for this research project, which was:

> "PHMSA promulgated regulations setting federal safety standards for LNG facilities in 1980 at 49 C.F.R. Part 193 (PHMSA LNG regulations). Since that time, safety management systems have greatly advanced. This project should review the current requirements and practices to propose a path forward to incorporate critical safety advances. The scope of the research should include:
>
> - Review voluntary standards such as:
>   - API RP 1173; and
>   - Occupational Safety and Health Administration 29 CFR Part 1910.119;
> - Survey industry safety management systems to gain an understanding of existing practices;
> - Determine the goals;
> - Perform gap analysis between desired state and CFR Part 193, NFPA Standard 59A (2001), "Standard for the Production, Storage, and Handling of Liquefied Natural Gas" (NFPA 59A) and other codes; and
> - Identify and prioritize gaps to be mitigated and decide how they should be addressed.
>
> The results are anticipated to support the strategy to update regulatory requirements for safety management systems, which have greatly advanced since PHMSA LNG regulations were first promulgated in 1980. The timeline for such a solution should be 1-2 years."

Project Context

The need for this research was identified at PHMSA's Pipeline Safety Research & Development Forum held in Cleveland, OH on Nov. 16-17, 2016. As a result, PHMSA issued Research Announcement solicitation #DTPH5617RA00002 on April 15, 2017, which contained the above research project solicitation topic.

While the Department of Energy, the University of Texas, and the Congressional Research Service have commented as follows about the safety record of LNG facilities, this project addressed PHMSA's solicitation topic to consider how it may incorporate critical safety advances since 1980.

- "For more than 40 years, the safety record of the global LNG industry has been excellent, due to attention to detail in engineering, construction, and operations."[1]
- "The LNG industry has an excellent safety record."[2]
- "…LNG has had a record of relative safety for the last 45 years…"[3]

PHMSA's solicitation topic references that "safety management systems have greatly advanced" since 49 CFR 193 became law. Examples of relevant advancements and developments include:

- 1980: 49 CFR 193 (PHMSA LNG regulations) became law
- 1992: 29 CFR 1910.119 (OSHA PSM regulations) became law

- 1998: 40 CFR 68 (EPA Risk Management Plan RMP regulations) became law
- 2007: AIChE CCPS *Guidelines for Risk Based Process Safety* issued
- 2012: CSChE *Process Safety Management Standard 1st Edition* issued
- 2015: API Recommended Practice 1173 *Pipeline Safety Management Systems* (PSMS) issued
- 2017: CSA Z767-17 *Process Safety Management Standard* issued
- 2017: Industry efforts to adopt API RP 1173 included creation of a joint industry "Pipeline SMS" team comprised of APGA, AGA, API, INGAA, AOPL and CEPA to represent the gathering, transmission, and distribution sectors of the North American natural gas and liquids pipeline industry. As one example of this coordinated effort, www.pipelinesms.org contains a variety of tools and guidance documents to assist operators on their journey to develop and implement programs to adopt API RP 1173.
- 2019: AGA's Board of Directors approved a resolution recommending that all AGA members implement Pipeline Safety Management Systems (PSMS) or API RP 1173.[4]

Relevant developments during 2019 also included President Trump's April 10, 2019 Executive Order to the Secretary of Transportation to initiate a rulemaking to update 49 CFR 193[5] as well as other events summarized in the section below entitled "Impact from Research Results."

Project Methodology

The project team consisted of Gas Technology Institute ("GTI") and Blue Engineering and Consulting ("BLUE"). GTI led all project activities except for the outreach to LNG facility operators to take a survey. BLUE led the outreach to survey recipients and summarized the survey results; BLUE also reviewed and commented on all other deliverables prepared by GTI.

GTI and BLUE proposed and executed a project methodology that followed the structure specified in PHMSA's solicitation provided above, but that expanded it with the following additional aspects in order to provide deeper insights and more robust results for PHMSA:

- Included the 2019 edition as well as the 2001 edition of NFPA 59A in the gap analysis comparison between the desired state and current state;
- Included a review and analysis of a wide spectrum of secondary references and potential voluntary standards in addition to the primary voluntary standards identified in PHMSA's solicitation, and augmented the manual subject matter expert review by of both the primary and secondary voluntary standards with artificial intelligence (AI) approach review method;
- Created a very detailed item-by-item tabular matrix analysis approach to evaluate 156 individual PSM topics, and in a format that rigorously compared 49 CFR 193 against 29 CFR 1910.119 as a baseline;
- Conducted a detailed, formalized, on-line survey of LNG facility operators in order to gather their input about the desired PSM states;
- While incorporating a Technical Advisory Panel (TAP) was a contract requirement, the project team sought and was grateful to be able to assemble a highly knowledgeable TAP that provided very valuable input and guidance during the entire duration of the project.

Primary Regulation and Recommended Practice Compared

As defined by PHMSA in its solicitation, the two primary voluntary documents to which 49 CFR 193 (in conjunction with the referenced standard NFPA 59A, 2001 edition) was to be compared were:

- 29 CFR 1910.119 (OSHA Process safety management of highly hazardous chemicals standard)
- API Recommended Practice 1173, *Pipeline Safety Management Systems*, 1st Edition, 2015

29 CFR 1910.119 as Voluntary Standard

Having been established in law since 1992, OSHA's PSM standard represents a primary comparison point to DOT PHMSA's LNG regulations in 49 CFR 193 and obviously a significant body of past and current best practices and regulations related to PSM. OSHA's PSM standard applies to those companies that deal with any of more than 130 specific toxic and reactive chemicals in listed quantities; it also includes flammable liquids and gases in quantities of 10,000 pounds or more.

LNG facilities are *specifically exempted* from the requirements of OSHA 29 CFR 1910.119. OSHA's interpretation on December 9, 1998 states that "OSHA has concluded that current OPS regulations address the hazards of fire and explosion in the gas distribution and transmission process. Accordingly, OSHA has determined that the agency is precluded from enforcing the PSM rule over the working conditions associated with those hazards".[6]

Ms. Liliana Silvera, a Process Safety Engineer for OSHA participated in the TAP for this project. For context regarding this project's effort, she pointed out that the top four categories of violations cited when enforcing OSHA's PSM standard under OSHA's Chemical Facilities National Emphasis Programs (NEP) are:

- Mechanical Integrity – 29 CFR 1910.119(j)
- Process Safety Information – 29 CFR 1910.119(d)
- Operating Procedures – 29 CFR 1910.119(f)
- Process Hazard Analysis – 29 CFR 1910.119(e)

An analysis of OSHA data available from the U.S. Department of Labor by *Inspection Engineering* magazine in January 2019 and shown in Figure 1 provides a helpful illustration of this.[7]

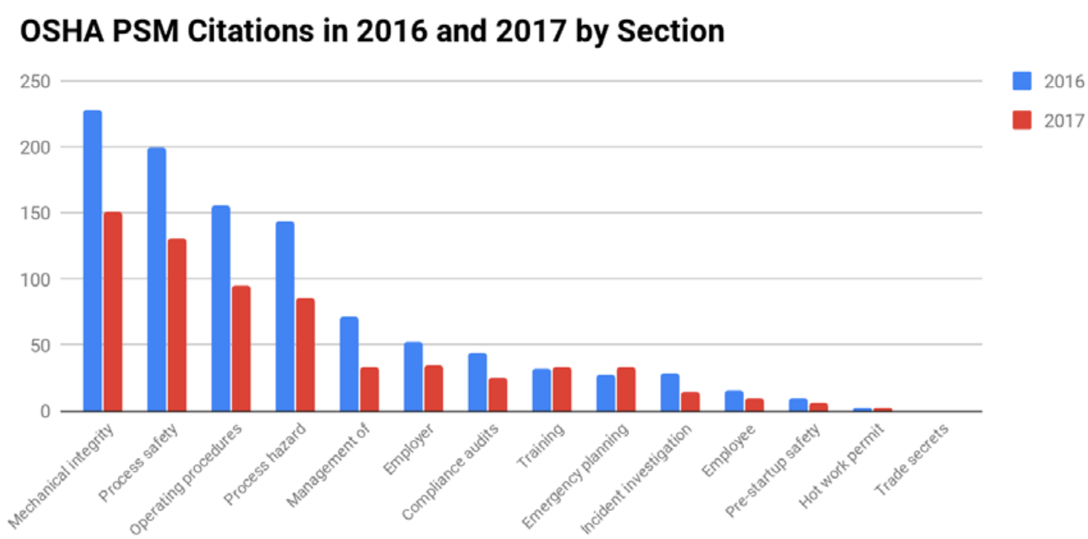


Figure 1 OSHA PSM Citations in 2016 and 2017 by Section

In Figure 1, a number of the names of OSHA's PSM elements are truncated (e.g. "Process safety" rather than "Process Safety Information", "Process hazard" rather than "Process Hazard Analysis", and "Management of Change" rather than "Management of") but this analysis by *Inspection Engineering* is relevant and illustrative. The results are across all industry sectors governed by OSHA's PSM standard, but of course *exclude* LNG facilities.

No directly comparable data is available for LNG facilities, in part since 49 CFR 193 does not contain directly-similar requirements. Like OSHA, PHMSA actively enforces its safety regulations, as it notes on its website:

> "PHMSA periodically inspects each LNG facility under its jurisdiction for compliance with Part 193. During the inspections, PHMSA reviews operator records to determine if facility equipment has been properly maintained and if the operator has developed and follows operation, maintenance, security, and emergency procedures that ensure the continued safe operation of the facility. PHMSA enforces violations it finds. Enforcement can include civil penalties or orders directing action. In addition, if PHMSA finds conditions that are hazardous, it can require expeditious corrections of the conditions through corrective action orders."[8]

The reader is referred to PHMSA's Enforcement Activity webpage[9] and other summarizing information[10] if a reader seeks more information relevant to Figure 1 but for LNG facilities. It is noted for the reader's understanding that many of PHMSA's enforcement actions listed on PHMSA's Enforcement Activity webpage pertain to 49 CFR 192 or other regulations rather than to 49 CFR 193.

For a different point of comparison to Figure 1, it is noted that only three incidents occurred at LNG facilities during all of 2016 and 2017 that were reported to PHMSA under its reportable incident requirements.[11] A PHMSA reportable incident is not necessarily an indication that a violation has occurred. Any violations issued associated with a PHMSA reportable incident are based upon an incident investigation, and not all incident investigations result in violations.

API RP 1173 as Voluntary Standard

The development and issuance of API RP 1173 in 2015 marked a significant milestone in the development and application of pipeline safety management systems (PSMS) for the pipeline industry. Many of the principles contained in this pipeline-focused safety management system standard are likewise relevant to process safety management (PSM) and safety management systems (SMS) in general.

Development of API RP 1173 was prompted in part by a recommendation from the National Transportation Safety Board (NTSB), following the results of an accident investigation. When API issued RP 1173, the NTSB highlighted in a news release that API's action to develop and release RP 1173 exceeded NTSB's recommendation to facilitate the development of a safety management system standard specific to the pipeline industry.[12]

PHMSA supported the development of a PSMS national consensus standard, such as through its efforts organizing a public workshop on April 22, 2015[13] and other means.

As noted earlier, support to adopt API RP 1173 across various sectors of the pipeline industry has grown, including participation by APGA and AGA in the Pipeline SMS organization (www.pipelinesms.org) beginning in 2017. Another example of support came from AGA's Board of Directors when it approved a resolution on May 21, 2019 recommending that all AGA members implement PSMS or API RP 1173.

Additional Regulations, Standards and Recommended Practices Considered

Related FERC Requirements

Some LNG facilities are regulated by FERC[14], and FERC is responsible for authorizing the siting and construction of onshore and near-shore LNG import or export facilities under Section 3 of the Natural Gas Act. This project did not attempt to address or incorporate FERC's PSM-related requirements in its analysis, nor was this activity required or requested to be done in this PHMSA-funded research effort. However, the project team did include in the analysis of prioritized gaps and mitigation strategies some comparative references to some of FERC's requirements - - in particular some of the PSM-related requirements for siting contained in FERC's orders and in FERC's *Guidance Manual for Environmental Report Preparation, Volume II, LNG Facility Resource Reports 11 &13 Supplemental Guidance.*[15] In addition, the reader is referred to other pertinent requirements by FERC such as in §§ 153.3, 153.8(a)(5)-(7), 153.20(b), 157.6(d), 157.14(a)(7), 157.21(f), 380.12(m), 380.12(o), and 385.2005(a)(1)-(3) of 18 CFR.

40 CFR 68 as Voluntary Standard

LNG facilities are *specifically exempted* from the requirements of 40 CFR 68 (EPA Risk Management Plan regulations) since they are a transportation activity,[16] although the EPA (along with many other federal agencies) plays an important role in the approval and permitting of LNG projects whether the approval is for the development of a new project or the expansion of an existing project. This may include for example, serving as a cooperating agency to assist FERC in the preparation of an Environmental Assessment or Environmental Impact Statement.

This project did not attempt to address or incorporate PSM-related regulatory requirements in 40 CFR 68 in its analysis, nor was this activity required or requested to be done in this PHMSA-funded research effort. In addition to the above exemption, there is much similar content in 29 CFR 1910.119 and 40 CFR 68.

However, the project team did include in this analysis a few notable concepts from 40 CFR 68, in consultation with the project TAP. And, some recent relevant developments regarding proposed revisions to 40 CFR 68 were noted in the review of prioritized gaps and mitigation strategies.

Additional Voluntary Standards and Recommended Practices Considered

Tasks 1.3 and 1.4 of the project were specifically included by the project team in its proposal/statement of work to formally review a significant number of additional voluntary standards and recommended practices. The project team's goal was to expand upon PHMSA's solicitation to consider "other codes" by seeking to gain insights for PHMSA from a wide number of related PSM developments that have occurred in the last 10 or so years, in order to further inform the development of the desired goals and state for various PSM topics. This effort included a review of:

- AIChE CCPS - *Guidelines for Risk Based Process Safety*, 2007
- AIChE CCPS - *Guidelines for Implementing Process Safety Management, 2nd Edition*, 2016
- CAN/CSA - Z767-17, *Process Safety Management*, 2017
- CSChE - *Process Safety Management Standard, 1st Edition*, 2012
- CSChE - *Process Safety Management Guide, 4th Edition*, 2012
- CSChE - *Managing the Health and Safety Impacts of Organizational Change*, 2004
- CSChE - *Guidelines for Site Risk Communication, 3rd Edition*, 2012
- CSChE - *Risk Assessment* - *Recommended Practices for Municipalities and Industry*, 2004

- IOGP 415 - *Asset Integrity – the key to managing major incident risks*, 2018
- IOGP 456 - *Process Safety – Recommended Practice on Key Performance Indicators*, 2018
- IOGP 460 - *Cognitive Issues associated with Process Safety and Environmental Incidents*, 2012
- IOGP 544 - *Standardization of Barrier Definitions*, 2016
- UK HSE HSG65 - *Managing for Health and Safety*, 2013
- UK HSE HSG254 - *Developing Process Safety Indicators*, 2006

The project team supplemented its manual review of these references using its subject matter expertise with an Artificial Intelligence (AI) methodology. Some of the referenced standards and documents are quite lengthy with significant technical detail. An AI methodology is useful to help analyze the degree of detail, specificity, gaps and overlaps in primary standards, regulations and recommended best practices. The efforts in this project leveraged GTI's ongoing research in the application of natural language processing (NLP) to generate knowledge from technical reports in the energy infrastructure space. One such application developed by GTI that was used in this project is the Technical Report Query Assistant (TRQA), which combines topic modeling methods, such as latent semantic analysis, latent Dirichlet analysis and deep learning language embedding techniques to semantically query libraries of technical reports and determine gaps in knowledge for a topic of interest.

The project team summarized its review, analysis and findings in a separate document entitled "Summary of Secondary Topical Standards and Regulations", which was submitted to PHMSA on April 30, 2019.

Some of the high-level findings from this analysis related to the potential gaps included:

- Consider human factors as one of the PSM elements when designing the PSM system framework of an organization. An effective PSM program requires an understanding of human error so that systems can be designed to avoid its occurrence or mitigate its consequences.
- Consider implementing risk criteria and defining tolerance limits for what is an acceptable risk, unacceptable risk and as low as a reasonably practicable risk. Establishing risk criteria will enable organizations to implement effective risk-based mitigative measures and promote optimal resource allocation.
- Consider developing an incident investigation report template for the investigations teams, in order to enable a consistent, repeatable and verifiable process to generate incident reports across various investigations. This report template should establish an explicit link between the causes and the recommendations. This will enable organizations to learn from incidents and share the lessons learned to both internal and external stakeholders across one or more facilities.
- Consider establishing a well-cataloged document control management system in a central location for the storage and retrieval of all process safety information. This will enable the process safety personnel easy and timely access to process safety information when required to support ongoing operations.

Additional references that were subsequently reviewed included:

- API RP 754 - *Process Safety Indicators for the Refining and Petrochemical Industries*, 2017

More information from this summary is provided in Appendix E.

Many of the key insights from this overall review arose from either AIChE CCPS - *Guidelines for Risk Based Process Safety* or CAN/CSA - Z767-17, *Process Safety Management*. Key insights from this review were discussed with PHMSA and the project TAP, and then applied in this project's analysis in the Gap Analysis Matrix Table in the column entitled "Other Related Requirements".

Summary

The review of the additional regulations, voluntary standards and recommended practices generated six topics that did not also arise from consideration of 29 CFR 1910.119 and API RP 1173, but supported the analysis overall. More specifically:

- 150 of the 156 topics reviewed in this project analysis arose in comparison to 29 CFR 1910.119 and API RP 1173, and some of the language to describe these topics was informed through this review; for example, to add examples of cognitive/human factor considerations in the description of potential gap OP-14.
- Six of the 156 topics reviewed in this project analysis arose solely from the review of additional voluntary standards and recommended practices

This review underscored the body of knowledge regarding safety management systems that has developed since 1980, helped illustrate alignment of the topics considered in this analysis to that body of knowledge, and identified some additional key topics for consideration for potential revisions to NFPA 59A, 49 CFR 193, or an operator's voluntary practice.

Gap Analysis Development and Results

The project team proposed and utilized a very detailed item-by-item tabular matrix analysis approach to evaluate numerous individual PSM topics, and in a structure that rigorously compared 49 CFR 193 in conjunction with NFPA 59A against 29 CFR 1910.119 and API RP 1173 as primary comparison points while allowing for other key PSM concepts and insights to be incorporated.

Organization of PSM Topics

The PSM topics in the Matrix Table analysis were organized in a manner to follow OSHA's 14 PSM elements and the order in which that content appears in 29 CFR 1910.119. This was done in order to:

- be consistent with and directly responsive to PHMSA's solicitation
- compare the current PSM regulatory requirements of the two federal agencies DOT and OSHA to assist in identifying potential gaps specifically from a regulatory perspective
- help ensure that no items were overlooked in this important aspect of this comparison

Alignment of Differing PSM Element Categories

The names of PSM elements or categories in API RP 1173 differ from those used in 29 CFR 1910.119, so it was necessary to align the differing content in some manner.

Similarly, the names of PSM elements or categories used in AIChE CCPS *Guidelines for Risk Based Process Safety* (considered a leading well-known and well-recognized voluntary PSM reference used in the chemical process industry) further differ from those used in 29 CFR 1910.119, so it was necessary to also align that differing content when considering key concepts from AIChE CCPS *Guidelines for Risk Based Process Safety*.

To do so, the content was organized in the manner shown in Table 1. Since 29 CFR 1910.119 (OSHA PSM) was the primary U.S. regulatory reference used to compare PSM requirements in 49 CFR 193 and identify potential gaps, OSHA's PSM categories formed the primary basis for this project's terminology. Some of the names of OSHA's 14 PSM elements were slightly expanded when used in this project analysis, in order to incorporate the content from either API RP 1173 or AIChE CCPS RBPS in a logical manner. For clarity, those expansions are noted in parenthesis.

Specific PSM topics were labeled with acronyms based on the name of the PSM category used in this project analysis, followed by a sequential number. The acronyms are listed below, in the order that the topics appear in this analysis and consistent with the order in 29 CFR 1910.119.

EP	Employee Participation (and Stakeholder Engagement)
PSI	Process Safety Information
PHA	Process Hazard Analysis (incl. Risk Management)
OP	Operating Procedures (and Documentation)
TR	Training (and Competence)
CON	Contractors
PSSR	Pre-Startup Safety Review
MI	Mechanical Integrity
HWP	Hot Work Permit
MOC	Management of Change

II Incident Investigation (incl. Learning)

EPR Emergency Planning and Response (incl. Fire Protection and Security)

CA Compliance Audits (incl. Metrics, Review and Improvement)

TS Trade Secrets

Table 1 Comparison of Various Leading PSM Elements/Categories including as Used in this Analysis, and Visually Organized by the Pillars of AIChE CCPS RPBS

OSHA 29 CFR 1910.119 14 PSM Elements	**PSM Categories Used in this Analysis** (expansions to OSHA Elements in parenthesis)	**API RP 1173 (2015) 10 PSM Elements**	**AIChE CCPS RBPS (2007) 20 PSM Elements**
			Pillar 1: Commit to Process Safety
Employee Participation	Employee Participation (and Stakeholder Engagement)	Leadership and Management Commitment (Sec. 5)	Process Safety Culture (1)
			Compliance with Standards (2)
			Process Safety Competency (3)
			Workforce Involvement (4)
		Stakeholder Engagement (Sec. 6)	Stakeholder Outreach (5)
			Pillar 2: Understand Hazards and Risk
Process Safety Information	Process Safety Information		Process Knowledge Management (6)
Process Hazard Analysis	Process Hazard Analysis (incl. Risk Management)	Risk Management (Sec. 7)	Hazard Identification and Risk Analysis (7)
Trade Secrets	Trade Secrets		
			Pillar 3: Manage Risk
Operating Procedures	Operating Procedures (and Documentation)	Operational Controls (Operating Procedures Sec. 8.1)	Operating Procedures (8)
		Documentation and Record Keeping (Sec. 14)	
			Safe Work Practices (9)
			Conduct of Operations (15)
Mechanical Integrity	Mechanical Integrity	Operational Controls (System Integrity Sec. 8.2)	Asset Integrity and Reliability (10)
Contractors	Contractors	Operational Controls (Use of Contractors Sec. 8.4)	Contractor Management (11)
Training	Training (and Competence)	Competence, Awareness and Training (Sec. 13)	Training and Performance Assurance (12)
Management of Change	Management of Change	Operational Controls (Management of Change Sec. 8.3)	Management of Change (13)
Pre-Startup Safety Review	Pre-Startup Safety Review		Operational Readiness (14)
Emergency Planning and Response	Emergency Planning and Response (incl. Fire Protection and Security)	Emergency Preparedness and Response (Sec. 12)	Emergency Management (16)
Hot Work Permit	Hot Work Permit		
			Pillar 4: Learn from Experience
Incident Investigation	Incident Investigation (and Learning)	Incident Investigation, Evaluation and Lessons Learned (Sec. 9)	Incident Investigation (17)
Compliance Audits	Compliance Audits (incl. Metrics, Review and Improvement)	Safety Assurance (Sec. 10)	Auditing (19)
		Management Review and Continuous Improvement (Sec. 11)	Management Review and Continuous Improvement (20)
			Measurement and Metrics (18)

Gap Language Relevant to Desired PSM State

Care was taken by the project team when defining and describing a potential gap to use language and terminology that would help support consensus-building, productive dialogue about a potential desired PSM state, and that would "align well" with the current wording in 49 CFR 193 and NFPA 59A if PHMSA chose to address a potential gap through proposed regulatory action or by advancing with the NFPA 59A Technical Committee consensus revisions in NFPA 59A. For example, a potential gap would refer to an operator's own procedures related to maintaining process safety management rather than to generic references to PSM requirements (such as described by 29 CFR 1910.119), and use relevant terminology (e.g. "operator" rather than "employer"). Input from TAP members regarding this issue was especially helpful when draft versions of the tabular matrix analysis were reviewed with the TAP.

Gap Analysis Matrix Table

PHMSA and the project TAP provided significant detailed reviews of several versions of the tabular matrix analysis from February 2019 through December 2019, including a series of telephone calls and group discussions.

In summary, the analysis identified 156 individual PSM topics, of which there were approximately 85 potential gaps for further consideration.

Those results and details are provided in the attachment to Appendix B.

Survey of LNG Facility Operators

Purpose

PHMSA's solicitation for this project effort included to "survey industry safety management systems to gain an understanding of existing practices."

While this aspect of the project analysis could have been addressed in various ways, GTI and BLUE sought to maximize the value of this aspect and conducted a thorough survey of LNG facility operators with the intent to strengthen the development of consensus industry standards and help ensure that deep insights would be developed for decision-makers at PHMSA as regulatory promulgation for 49 CFR 193 is considered. The survey recipients and companies represented brought valuable specialty expertise and insights in: LNG safety management systems; consensus global standards and regulations; operations and maintenance issues unique to LNG hazards; past internal company assessments of best PSM practices as well consequences and probabilities of failure; identifying and implementing preventive and mitigative measures; and other topics relevant to LNG facilities and PSM. In short, developing a comprehensive, well-formed survey provided an important method for their expertise to be represented in this project's analysis - - to augment the additional expertise provided by the LNG facility operators represented on the project TAP, and to support the continued development of consensus industry standards and potential alignment with regulatory updates. The survey of LNG facility operators provided an important additional context for PHMSA as the desired PSM goals and state for various issues are assessed.

The primary intent, as stated in the project team's proposal/statement of work, was to survey LNG facility operators. The project team's proposal/statement of work did allow for the survey ("interviews") to also be performed by PHMSA and other regulators as directed by PHMSA, but no federal agencies participated in the survey. Instead, representatives from OSHA and FERC participated actively in the project TAP and provided direct input to PHMSA and the project team in that manner.

Size and Balance

The survey size was limited to nine recipients in order to conform to the federal requirements of the *Paperwork Reduction Act of 1995* as per 5 CFR 1320.3(c), which PHMSA specifically emphasized to the project team. The project team had originally envisioned a larger survey size.

Because the survey size was limited to only nine recipients, the project team sought to achieve the maximum feasible balance of input from operators varying in size and operational parameters - - ranging from large LNG terminal operators to small-scale LNG facility operators, and from utility-owned to for-profit operators. The project team targeted to achieve the following breakdown of survey responses, after consultation with and agreement of PHMSA and the project TAP:

- 4 LNG Terminal Operators
- 4 LNG Small Scale Peak Shaving Facility Operators
- 1 LNG Small Scale Merchant Facility Operator

In addition, terminal operators were targeted to include a mix of large-scale exporters as well as the Everett LNG import terminal which operates on a legacy site and on a smaller footprint.

All TAP members were given the option for their company to participate in the survey.

Methodology

The method to perform the survey was refined and enhanced during the project. The original intent as identified in the project team's proposal/statement of work was that written surveys would be distributed. As a result, some initial consideration was given to distributing the tabular spreadsheet and requesting that survey responses be provided directly in the tabular spreadsheet. But the format of the survey was revised to be an on-line format after considering the very large number of potential gaps that had been identified, the format of some potential responses, and after discussion and input from PHMSA and the project TAP. To efficiently create an effective on-line survey, the project team employed the following steps:

1. Multiple drafts of the content of the survey were first developed in a word processing format, and reviewed by PHMSA and the TAP. The good feedback, teamwork and suggestions resulting from this process generated revisions related to topics such as the grouping of questions, the rating scale used for responses, and various specific phrases or terminology used.
2. After being finalized in word processing format, the content was transferred to an on-line survey software.

Where it was deemed feasible, related questions were grouped together in order to reduce the total number of survey questions. Care was taken to avoid (as feasible) grouping questions about PSM topics or potential gaps that arose separately from 29 CFR 1910.119 rather than API RP 1173, in order to maintain line of sight as to whether the origin was a regulation or voluntary recommended practice. To help the understanding of the survey recipient, the source document was cited in the survey and more detailed information was available in the Gap Analysis Matrix Table.

The on-line survey format allowed each participant to take the survey when convenient, and they could enter and exit at will until they concluded the survey. The format for the answers was a standard Yes/No format; however, different levels of the criticality of the identified gap were also asked when responding Yes. Participants were able to provide comments to supplement their numerical answers for nearly every question.

Participants were asked in advance if they would like to participate in the survey. All responded positively, and formal invitations were then individually sent by email that contained a link to the survey. Each recipient received a unique URL so that the progress of each individual survey response could be tracked.

After the survey was initially distributed, BLUE subsequently contacted each recipient individually by email to:

- confirm that they received the survey link
- re-confirm their intent to respond to the survey
- encourage them to consult with their colleagues when developing their response on behalf of their entire organization
- provide background information to help their understanding, which included:
    - the survey in pdf form, in order to help them prepare responses in advance
    - the detailed Gap Analysis Matrix Table, in order to provide the underlying analysis
    - a pdf of a presentation that provided more background information
    - a link to PHMSA's public information webpage for this research project

After allowing time for responses, BLUE attempted to contact the survey recipients by telephone in order to inquire if they had any other observations or recommendations regarding the survey, PSM-related issues, or their desired state of PSM practices that were not sufficiently addressed by the survey. No significant comments or feedback was provided by the survey recipients during these calls.

Content

The order of the survey questions generally followed the order of the content in 29 CFR 1910.119 and likewise in the Gap Analysis Matrix Table.

The survey incorporated multiple questions in order to seek input from LNG operators about a key issue that some LNG facility operators expressed interest in - - namely, if a future revision to 49 CFR 193 may potentially allow operators to have more reliance on “Recognized And Generally Accepted Good Engineering Practices” (RAGAGEP) when performing equipment inspection, testing and preventative maintenance rather than the prescriptive basis that 49 CFR 193 currently primarily utilizes. This question was posed both as an overall question up-front (question #2) as well as specifically for individual equipment items later in the survey (question #80).

Not all the potential gaps in the Gap Analysis were selected as questions for the survey, in part so that the size of the survey would be reasonable. In consultation with PHMSA, potential gaps that would be addressed if PHMSA were to incorporate by reference the 2019 edition of NFPA 59A were excluded from the survey. Also, a few topics that did not seem to merit the survey respondent’s time were excluded from the survey, after the project team reviewed and discussed those topics with PHMSA and the project TAP.

After consolidation and streamlining, the survey asked questions about 39 potential gaps (with identical quantative answer options), along with the opportunity for qualitative comments. Of course, the complete analysis of potential gaps remains available to PHMSA and others in Appendix B: Gap Analysis Matrix Table.

Response Options to Most Survey Questions

For most of the questions in the survey, the respondent could select from the following quantitative responses when asked - - Should this potential gap be addressed?:

- ☐ Yes, address via a potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that that 49 CFR 193 will be revised to incorporate by reference this future edition of NFPA 59A.
- ☐ Yes, address via a potential revision to 49 CFR 193 (on the assumed basis that 49 CFR 193 has been revised to incorporate by reference the 2019 edition of NFPA 59A), and at this level of importance/priority vs. other topics in this survey:
  - ☐ 3 High Priority
  - ☐ 2 Medium Priority
  - ☐ 1 Low Priority
- ☐ Yes, address via a voluntary practice by operator
- ☐ No:
  - ☐ No need to address gap, because gap is incorrectly stated; in reality, there is no gap
  - ☐ No need to address gap, because gap is of negligible importance
  - ☐ No single answer or approach applies to all situations, or another reason

Exceptions to the above were for survey question nos. 2 (MI-36 through MI-38), 80 (multiple), and 81 (multiple).

Response Options to Survey Question 2

For survey question no. 2, the respondent could select from the following quantitative responses:

- ☐ Yes, but only if the current primarily prescriptive-based requirements remain and additional RAGAGEP-based regulatory language provides an optional alternate means of conformance. Address at this level of importance/priority vs. other topics in this survey:
  - ☐ 3 High Priority

☐ 2 Medium Priority

☐ 1 Low Priority

☐ Yes, and in general replace prescriptive-based requirements with RAGAGEP-based regulatory language. Address at this level of importance/priority vs. other topics in this survey:

☐ 3 High Priority

☐ 2 Medium Priority

☐ 1 Low Priority

☐ No

Response Options to Survey Questions 80 and 81

Survey question no. 80 was a multiple-choice question crafted to ask resondents about the topic of potential increased allowance for RAGAGEP-based approach to ensure mechanical integrity, but in a much more granular manner than over-arching question no. 2. This intent of question no. 80 was to see if there were any particular components for which there was greater or less interest in allowing a RAGAGEP-based approach to ensure the mechanical integrity of that component.

Survey question no. 81 was included as another way for the respondent to comment about the relative importance of this topic, by selecting from the following quantitative responses:

☐ Yes, and address at this level of importance/priority vs. other topics in this survey:

☐ 3 High Priority

☐ 2 Medium Priority

☐ 1 Low Priority

☐ No

Responses

Respondents

All nine companies that were surveyed submitted a response. Table 2 summarizes the companies that were surveyed, and the role of the individual that submitted the response for their organization.

Table 2 Survey Respondents

Facility Type	Company	Respondent's Title
Small Scale Peak Shaving	National Grid	Lead Engineer
Small Scale Peak Shaving	NiSource	Manager, Operations Compliance
Small Scale Peak Shaving	Piedmont Natural Gas	Director of Supplemental Gas
Small Scale Peak Shaving	Southern Company Gas	Director
Small Scale Merchant	Stabilis Energy	Senior Vice President, Operations
Terminal	Cameron LNG	Manager, Regulatory and Compliance
Terminal	Everett LNG Terminal	Regulatory Compliance Specialist
Terminal	Freeport LNG	Director LNG Technology, Operations and Projects
Terminal	Shell International E&P	Senior LNG Process Engineer, LNG Design

Responses were anonymized but were categorized as responding on behalf of either a terminal or small scale LNG facility operator.

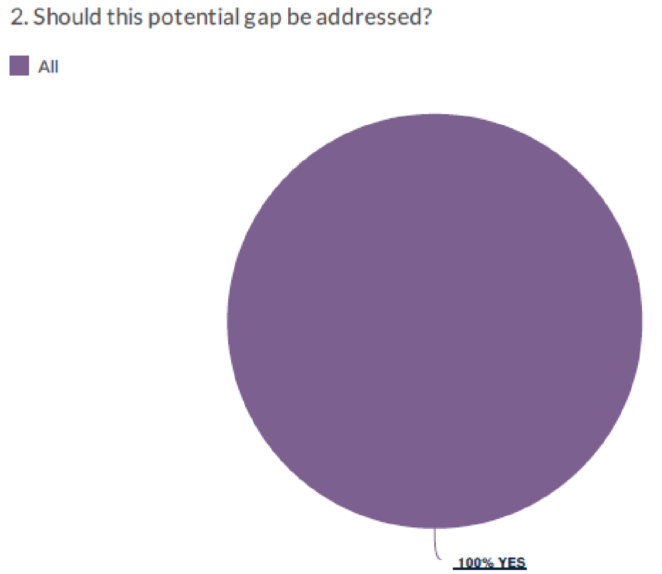
The survey questions and the complete responses are provided in Appendix C and D. A brief summary is provided below.

Responses to Survey Question 2

Survey question no. 2 addressed one of the key topics spotlighted during this project analysis - - namely, regarding potential revisions to 49 CFR 193 for increased allowance upon a RAGAGEP-based approach to ensure mechanical integrity. Response to survey question no. 2 was unanimously in favor of adding RAGAGEP-based language in 49 CFR 193, with:

- 33% of respondants want RAGAGEP language added *only if it is an alternate means* of compliance to the current primarily prescriptive requirements.
- 67% of respondants want RAGAGEP language to in general replace the current primarily prescriptive requirements.

Figure 2 excerpted from Appendix D and graphically summarizes these responses.



Response	Total Responses	Percent
YES — In general replace prescriptive based requirements with RAGAGEP based regulatory language. — 2 Medium Priority	3	33.3%
YES — In general replace prescriptive based requirements with RAGAGEP based regulatory language. — 3 High Priority	3	33.3%
YES — But only if the current primarily prescriptive based requirements remain and additional RAGAGEP based regulatory language provides an optional alternate means of conformance — 2 Medium Priority	2	22.2%
YES — But only if the current primarily prescriptive based requirements remain and additional RAGAGEP based regulatory language provides an optional alternate means of conformance — 3 High Priority	1	11.1%

Figure 2 Response to Survey Question 2

Responses to Most Survey Questions

The following figures summarize the quantitative responses to virtually all other survey questions. In general:

- there was support from the respondents to address many of the potential gaps identified in this analysis;
- broadly speaking, it appears that some of the areas where there was higher consensus as expressed in "yes" responses include Mechanical Integrity, Process Safety Information, Process Hazard Analysis, Employee Participation and Incident Investigation;
- opinions differed on many topics if enhanced adoption would be best accomplished through voluntary practice or through revisions to 49 CFR 193 or NFPA 59A (on the presumed basis that 49 CFR 193 would incorporate that revised version of NFPA 59A).

Of course a number of the potential gaps were identified in comparison to API RP 1173 and other voluntary standards, so one would anticipate that respondents might recommend that these remain as a voluntary practice.

A brief description of the figures is:

- Figure 3 summarizes all responses in the order of the survey questions. Since the survey questions are in the order of PSM categories (and in sequential order of OSHA's PSM categories in 29 CFR 1910.119), this figure provides a useful way to understand the overall responses across the 14 PSM categories by looking top-to-bottom and using the acronym prefixes to identify the PSM categories.
- Figure 4 sorts all responses in the order of those that had the highest total number of "yes" responses. This figure provides a useful way to understand where there was the highest consensus that a topic should be addressed, whether through: revision to 49 CFR 193; revision to NFPA 59A (on the presumed basis that 49 CFR 193 would incorporate by reference that revision of NFPA 59A); or through voluntary practice. The majority of operators thought that 35 of the 39 gaps should be addressed either by voluntary action or through revision to NFPA 59A or 49 CFR 193.
- Figure 5 sorts all responses in the order of those that had the highest total number of "yes" responses through either a revision to 49 CFR 193 or to NFPA 59A (on the presumed basis that 49 CFR 193 would incorporate by reference that revision of NFPA 59A). This figure provides a useful way to understand where there was the highest consensus that a topic should be addressed through a revision to regulation - - either as a direct revision to 49 CFR 193 or if incorporated by reference in NFPA 59A. The majority of operators thought that 16 of the 39 gaps should be addressed by either revising 49 CFR 193 or NFPA 59A.
- Figure 6 sorts all responses in the order of those that considered this topic to be the highest priority to be considered in a revision to 49 CFR 193. While the response to survey question no. 2 it is not included in Figure 6 (since it had a different answer format), Figure 2 shows that it is the very highest priority of the survey respondents since:
    - 33% of respondents ranked it as high priority that a revision to 49 CFR 193 allow increased allowance upon a RAGAGEP-based approach to ensure mechanical integrity of equipment - - i.e. higher than the maximum 22% response for all other topics.
    - 100% of respondents ranked it as either a high or medium priority - - i.e. higher than the maximum 66% response for any other topic (which was for MI-12, which directly pertains to proposed RAGAGEP-based approach for a specific related component).

- Figure 7 summarizes the responses only from LNG small scale facilty operators, with responses presented in the order of the survey questions. This figure can be compared to Figure 8 and to Figure 3 to help visually spot differences between the responses of small scale facility operators to terminal operators and to the aggregate response, respectively.
- Figure 8 summarizes the responses only from LNG terminal operators, with responses presented in the order of the survey questions. This figure can be compared to Figure 7 and to Figure 3 to help visually spot differences between the responses of terminal operators to small scale facility facility operators and to the aggregate response, respectively.

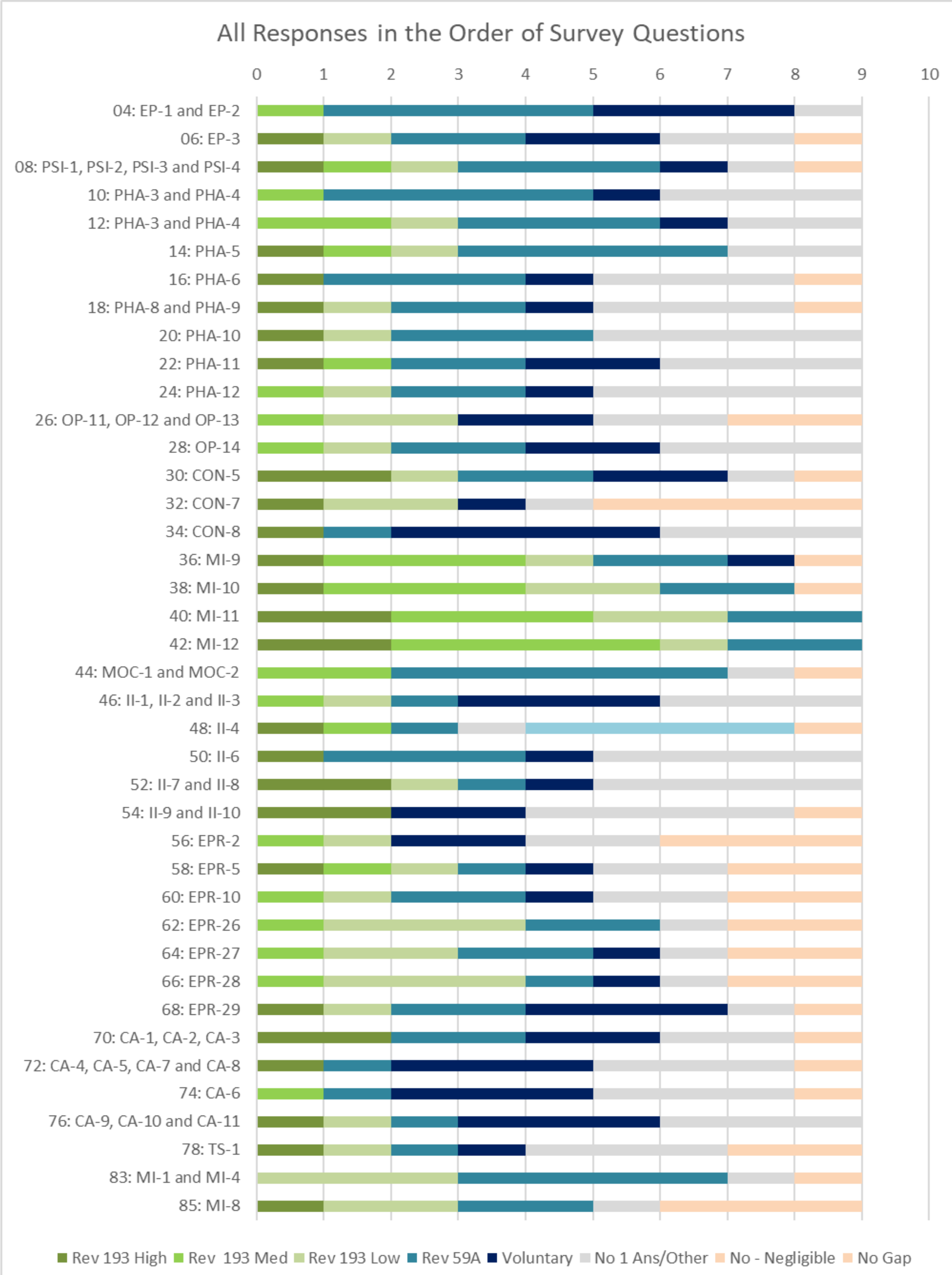


Figure 3 All Responses in the Order of Survey Questions

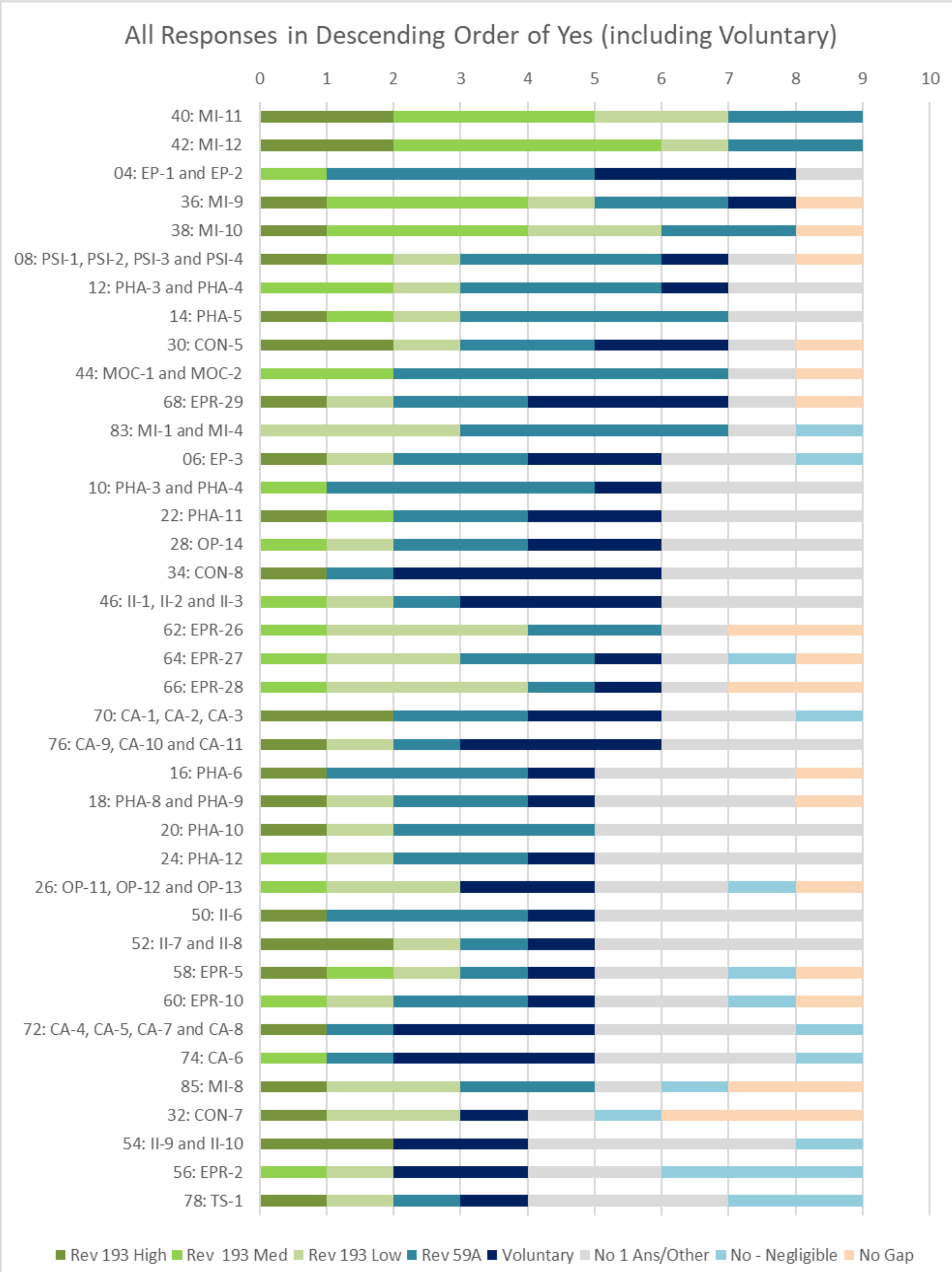


Figure 4 All Responses in Descending Order of Yes (including Voluntary)

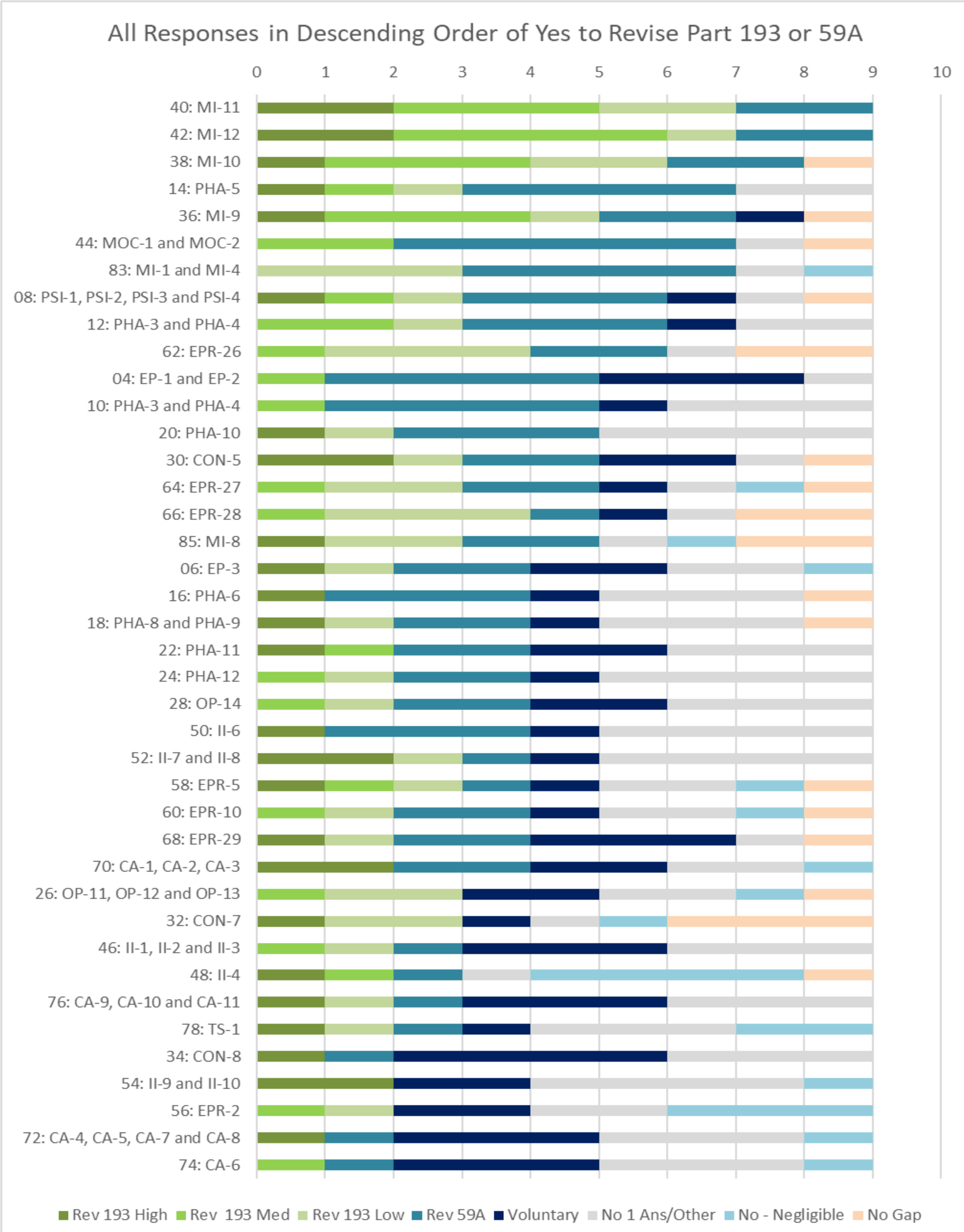


Figure 5 All Responses in Descending Order of Yes to Revise 49 CFR Part 193 or 59A

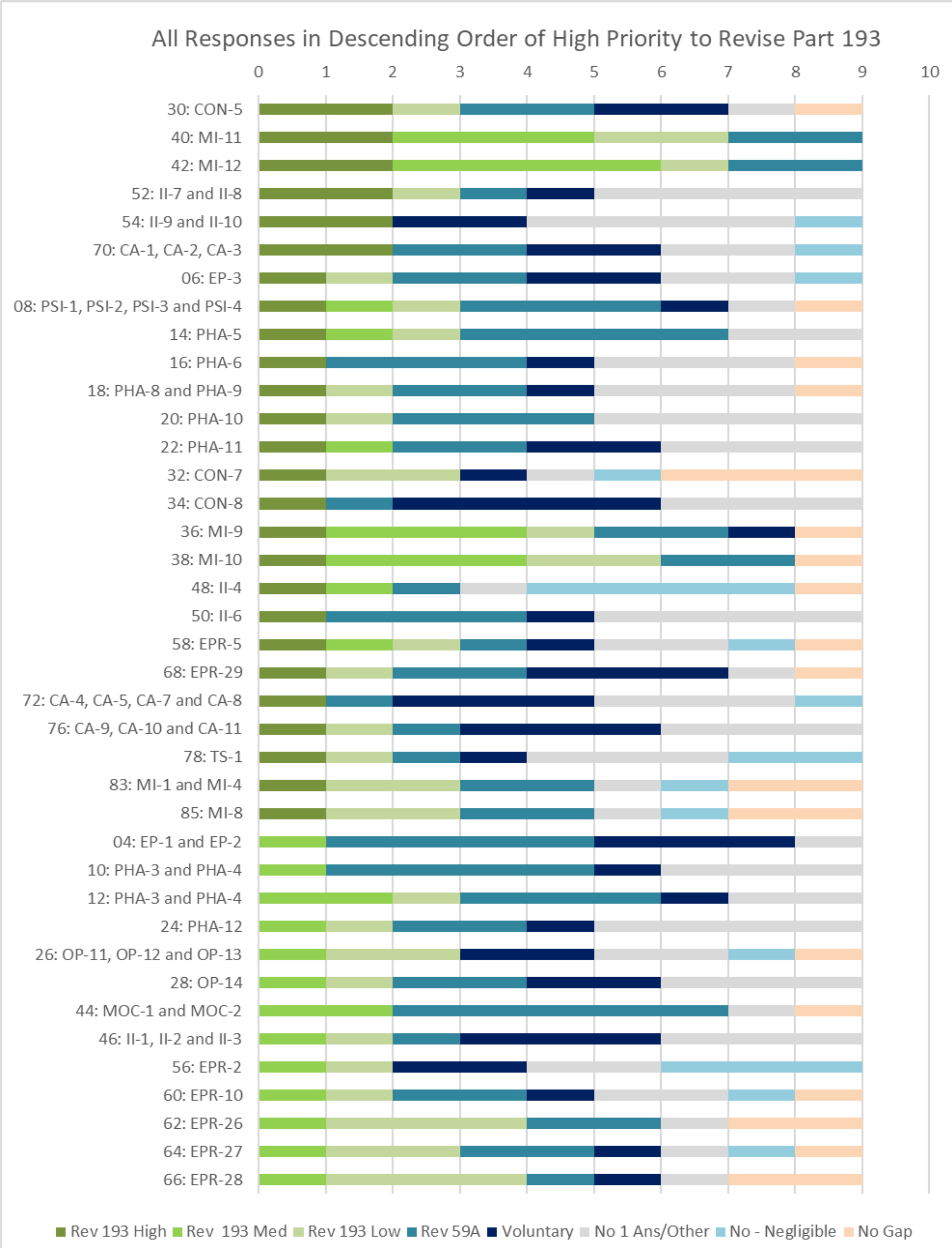


Figure 6 All Responses in Descending Order of High Priority to Revise 49 CFR Part 193

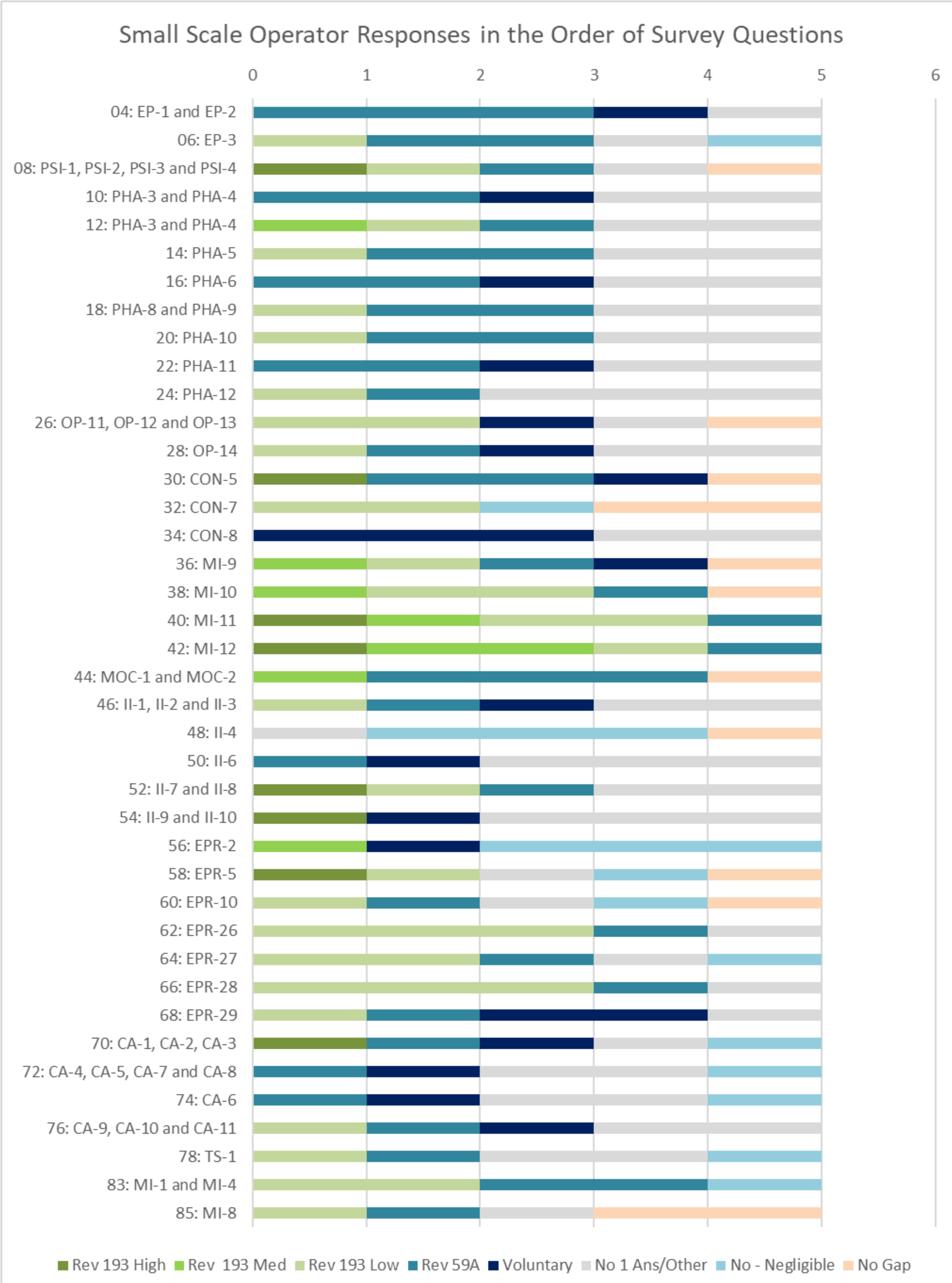


Figure 7 Small Scale Operator Responses in the Order of Survey Questions

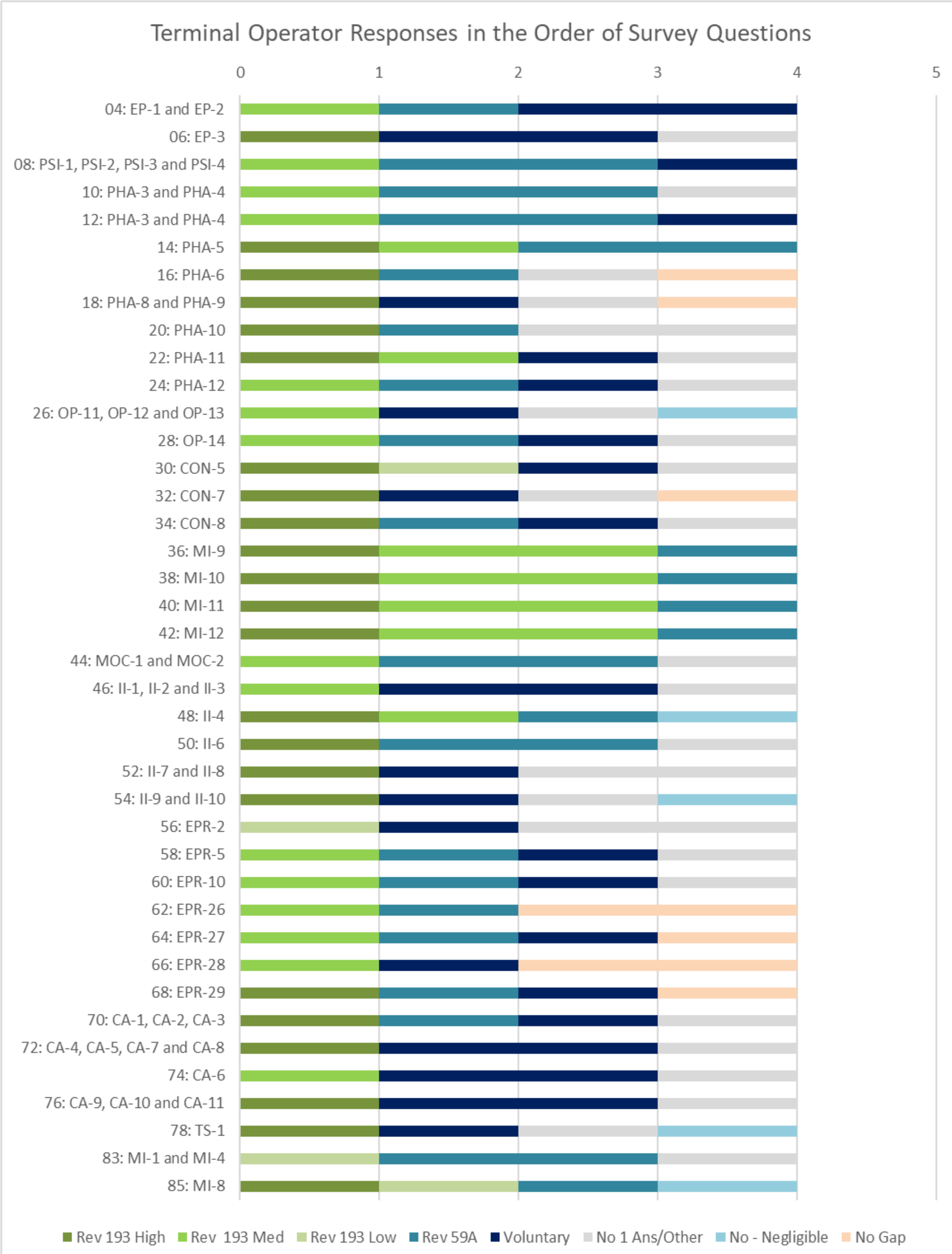


Figure 8 Terminal Operator Responses in the Order of Survey Questions

Responses to Survey Question 80

Figure 9 on the following page summarizes the responses to question 80. In general the responses were quite consistent with Figure 2 - - approximately 33-44% would like RAGAGEP-based language to be optionally available, while 56-66% would like to replace the current prescriptive requirements with RAGAGEP based language. The responses by specific components or activity did not vary significantly, except perhaps for the frequency to inspect and test control systems in service, but not normally in operation (e.g. automatic shutdown devices such as automatic shutdown devices, and control systems for internal shutoff valves for bottom penetration tanks. Appendix D provides the complete survey response and more details.

Concluding Remark

The reader is reminded that the survey sample was quite small (only nine responses) in order to comply with 5 CFR 1320.3(c).

Despite this limitation, the survey respondents represent an excellent cross-section of LNG operators. The responses provide more information to support the refinement of industry consensus standards such as NFPA 59A and the consideration of future updates to 49 CFR 193.

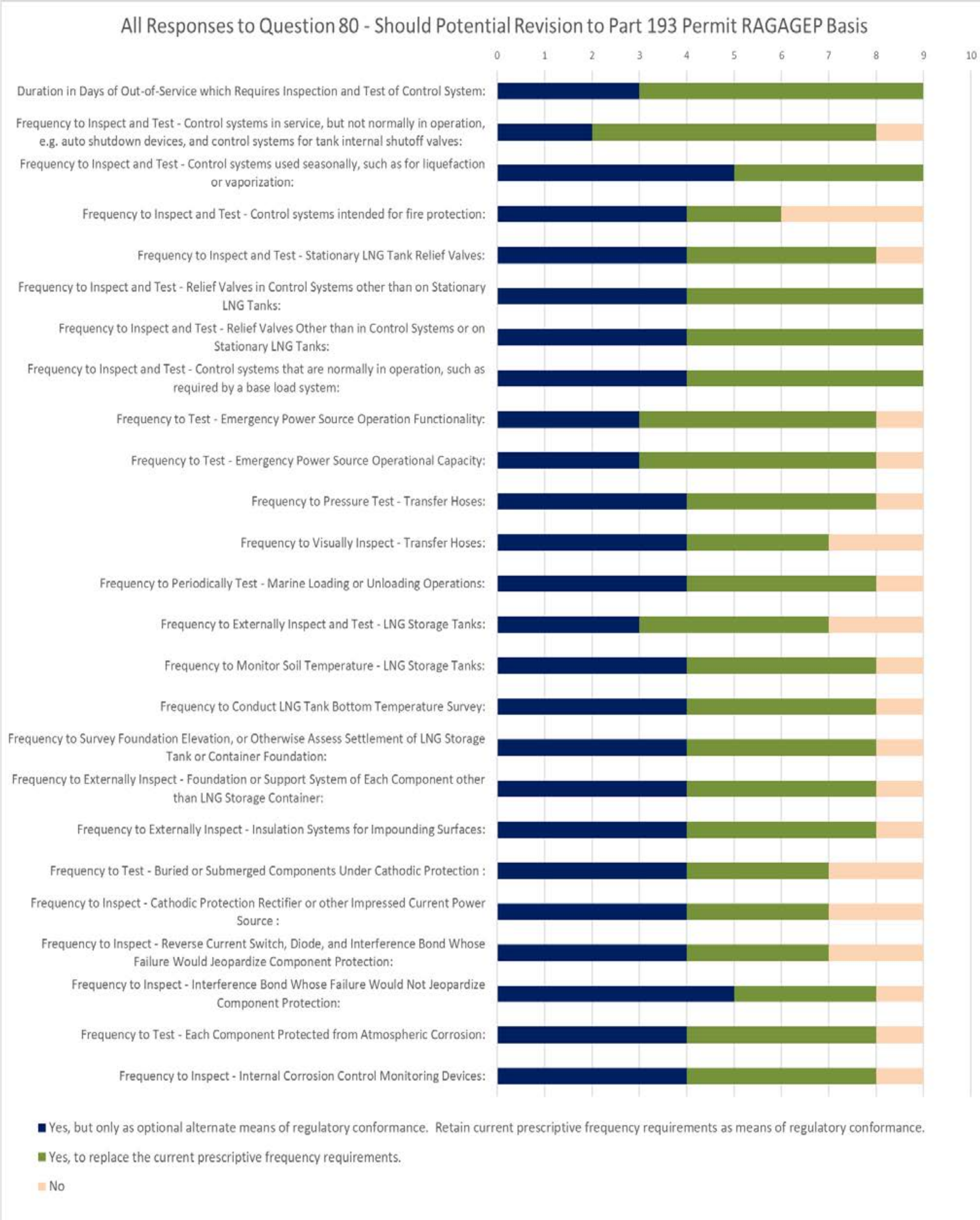


Figure 9 All Responses to Question 80 – Should a Potential Revision to Part 193 Permit RAGAGEP Basis for Mechanical Integrity Inspection or Tests of Specific Components

Prioritized Gaps and Mitigation Strategies

Potential gaps were ranked as higher rather than lower priority for further review and consideration if:

- the potential gap arose in comparison to another PSM-related federal regulation (i.e., OSHA 29 CFR 1910.119 or EPA 40 CFR 68), with the exceptions of potential gaps TS-1 and PSSR-1
- industry participants on the project TAP identified it as a very high priority for consideration - - notably the topic of potential increased use of RAGAGEP to ensure Mechanical Integrity of equipment (pertinent to numerous MI gaps)
- industry trade associations have previously formally petitioned regarding those topics (gap nos. MI-10, MI-11, and MI-12).

Differences or “gaps” that arose when comparing 49 CFR 193 to a voluntary industry recommended practice were not prioritized in this summary since those voluntary recommended practices are not regulations. However, they were ranked in priority by the respondents to the industry survey, and detailed information is available in the survey responses provided in Appendix D and in the prior figures.

Potential gaps and mitigation strategies are summarized below. The content in this section is organized by OSHA’s 14 PSM categories, as slightly expanded in the analysis used in this project. Please refer to the project Appendix B: Gap Analysis Matrix Table for the complete description of each potential gap.

Employee Participation

Higher-Priority Potential Gaps and Possible Mitigation Strategies

Must Operator have a Written Plan of Action to Implement Employee Participation in Process Safety Management Requirements? And Operator's Engagement with Employees and Other Internal Stakeholders (EP-1 and EP-2)

There is no apparent requirement in 49 CFR 193 that an operator's procedures must require an operator to consult with its employees during the operator's periodic review or preparation of its procedures and manuals for emergency response, purging, commissioning, product transfer, maintenance, and other operations, including the assessment of potential hazards, risks and emergencies at or adjacent to its facility, and also to permit employees to access relevant non-confidential information. This observation arises from a comparison of 49 CFR 193 to 29 CFR 1910.119(c)(1), 29 CFR 1910.119(c)(2), and Sections 5.2, 5.3, 5.4.1, 5.4.2, 5.4.3, 5.6, 6.1, 6.2, 10.3, and 15.7 of API RP 1173.

Potential mitigation strategies are to:

- Support inclusion of language in an upcoming edition of NFPA 59A that addresses the potential gap that arises directly from comparison to 29 CFR 1910.119, on the assumption that 49 CFR 193 will be revised to incorporate by reference that edition.
- Consider a revision to 49 CFR 193 that addresses the potential gap that arises directly from comparison to 29 CFR 1910.119.
- Establish another mechanism to encourage voluntary conformance to API RP 1173.

Operator’s responses to related survey questions nos. 4-5 indicate nearly unanimous support to address this topic (89% in favor), and strong preference (78% in favor) that this be done either as a revision to NFPA 59A or as a voluntary practice. Since aspects of this topic arose from a comparison to 29 CFR 1910.119, it appears to merit further consideration by PHMSA.

Lower-Priority Potential Gaps

No lower-priority potential gaps in this PSM category were specifically identified.

Potential Gaps Substantially Addressed in 2019 Edition of NFPA 59A

No potential gaps related to this PSM category were identified as being addressed in the 2019 edition of NFPA 59A in a superior manner to the content in the 2001 edition.

Potential Gaps if Compared to a Voluntary Industry Recommended Practice

Operator's Management Leadership Commitment (EP-3)

There is no apparent requirement in 49 CFR 193 that elements of an operator's management leadership procedures must include to:

- identify the titles of the individual company executives, managers and other key personnel positions that are accountable for establishing and implementing procedures related to maintaining process safety management, supporting continuous safety improvement initiatives, and providing oversight;
- establish and track leading and lagging key performance indicators or other high-level performance measures that regularly measure the operator's safety performance; and
- perform a review of operator's processes and efforts to improve its safety and its risk management results at least once per year, including an assessment of which performance goals and objectives have been met, and integrating the findings into the next iteration of continuous improvement of the operator's procedure related to maintaining process safety management.

This observation arises from a comparison of 49 CFR 193 to Sections 5, 10, and 11 of API RP 1173. Establishing and maintaining leadership commitment is undoubtedly a foundational element to support an effective process safety management program, but it may be difficult to enforce through regulation.

Operator's responses to related survey questions nos. 6-7 indicate differing opinions regarding the need to address this topic (67% in favor).

This observation arises principally from a comparison of 49 CFR 193 to API RP 1173. Accordingly, it may perhaps be best addressed through mechanisms to encourage conformance to that RP.

Operator's Engagement with External Stakeholders (EP-4)

There may be an opportunity for an operator to further engage with external community stakeholders and specifically communicate regarding high-level views of its facility and safety operations, and the operator's risk management efforts and its communications personnel. This topic was considered in the project analysis, but it was deemed not to merit including in the project survey.

This concept arises principally from a comparison of 49 CFR 193 to Sections 6.1 and 6.3 of API RP 1173. Accordingly, it may perhaps be best addressed through mechanisms to encourage conformance to that RP.

Process Safety Information

Higher-Priority Potential Gaps and Possible Mitigation Strategies

Required Content for Operator to Maintain (PSI-1, PSI-2, PSI-3, and PSI-4)

While "Process Safety Information" ("PSI") is not a defined term in either 49 CFR 193 or NFPA 59A (2001 or 2019), an operator must provide and implement information related to process safety as prescribed in 49 CFR 193.2713(a)(1) through its procedures to train permanent maintenance, operating, and supervisory personnel. Additional related requirements on LNG facility operators include the requirements of 29 CFR 1910.1200, and specifically the requirements to provide safety data sheets for process chemicals that meet the requirements of 29 CFR 1910.1200(g). Nevertheless, the existing requirements of 49 CFR 193 may not specify or clearly state the requirement on an operator to compile:

- process safety information which pertains to the highly hazardous chemicals in the process, such as:
  - Hazardous effects of inadvertent mixing of different materials that could foreseeably occur.
- process safety information which pertains to the technology of the process, such as:
  - A block flow diagram or simplified process flow diagram; and
  - Process chemistry.
- process safety information which pertains to the equipment in the process, such as:
  - Piping and instrument diagrams (P&IDs); and
  - Material and energy balances for processes.

This observation arises from a comparison of 49 CFR 193 to 29 CFR 1910.119(d).

Appendix §A.3.3.9 of the 2019 edition of NFPA 59A summarizes recommended facility documentation; this includes:

- Piping and instrument diagrams (P&ID's);
- Electrical classification;
- Relief system design and design basis;
- Design codes and standards employed;
- Material and energy balances; and,
- Safety systems (e.g., interlocks, detection, or suppression systems).

But Appendix §A.3.3.9 is informational and not required. Nor does 49 CFR 193 currently incorporate by reference the 2019 edition of NFPA 59A. Potential mitigation strategies are to:

- Support inclusion of language in an upcoming edition of NFPA 59A that addresses this potential gap, on the assumption that 49 CFR 193 will be revised to incorporate by reference that edition.
- Consider a revision to 49 CFR 193.

For FERC-regulated LNG facilities, an application for authorization to construct, operate, or modify must be submitted (e.g., proposed new construction or substantial modification) under 18 CFR 153.8 and 18 CFR 380.12(o), and requirements include submission of Resource Report 13. Resource Report 13 contains this type of process safety information. More detailed requirements are included, for example, in Appendix 13.A through 13.2 of FERC's *Guidance Manual for Environmental Report Preparation for Applications Filed Under the Natural Gas Act.*[17]

The project team observed that all of the process safety information identified as a potential gap has in fact typically been present at LNG facilities that the project team has visited during their careers. Nevertheless, potential future revisions to NFPA 59A might be to:

- Move related content from Appendix §A.3.3.9 into an appropriate chapter in order to establish the enforceability
- Consider establishing a defined category of "Process Safety Information."

Operator's responses to related survey questions nos. 8-9 indicate relatively strong support to address this topic (78% in favor), but opinions differed about whether this should be done by regulation, standards updates, or voluntary practice. Since this topic arose from a comparison to 29 CFR 1910.119, it appears to merit further consideration by PHMSA.

Lower-Priority Potential Gaps

No lower-priority potential gaps in this PSM category were specifically identified.

Potential Gaps Substantially Addressed in 2019 Edition of NFPA 59A

No potential gaps related to this PSM category were identified as being addressed in the 2019 edition of NFPA 59A in a superior manner to the content in the 2001 edition.

Potential Gaps if Compared to a Voluntary Industry Recommended Practice

No potential gaps related to this PSM category were identified as arising from a comparison of 49 CFR 193 to voluntary industry recommended practices such as principally API RP 1173.

Process Hazard Analysis (including Risk Management)

Higher-Priority Potential Gaps and Possible Mitigation Strategies

Methodology to Conduct PHA, and Overall Content of PHA (PHA-3 and PHA-4)

29 CFR 1910.119(e)(2) and 29 CFR 1910.119(e)(3) specify methodologies that are appropriate to identify and evaluate the hazards of the process being analyzed in a PHA.

Since neither 49 CFR 193 nor the 2001 edition of NFPA 59A contains a specific requirement to perform a PHA, they, of course, do not specify a methodology to perform a PHA or its required content. But 49 CFR 193.2509 and §11.3.3 of the 2001 edition of NFPA 59A requires operators to anticipate both controllable and uncontrollable emergencies and develop emergency response procedures to address with an effective emergency response. In addition, hazards and risks are addressed in prescriptive facility siting requirements such as equipment spacing, vapor concentration, and thermal flux at the property line, and many other hazard prevention requirements are directly defined or incorporated by reference.

The 2019 edition of NFPA 59A specifies in §5.3.2 a methodology to perform a PHA, as well as related plant siting and other information in §5.3, §17.3, and other sections. But §5.3.2 tends to focus on design spills and proper calculation of thermal, fire, explosion, and flammable/toxic vapor dispersion impacts. Section 5.3.2 does not specify other methodologies to determine and evaluate the hazards of the process being analyzed. Details of the alternate option to perform a Quantitative Risk Assessment rather than a PHA are specified in Chapter 19.

In summary, existing requirements of 49 CFR 193 (or even §5.2.1, §17.3.1.2 or other requirements in NFPA 59A 2019 edition, if incorporated by reference in 49 CFR 193) may not specify or clearly define that the methodology used by an operator to perform a process hazard analysis be equivalent to all of the requirements in 29 CFR 1910.119(e)(2) and 29 CFR 1910.119(e)(3), i.e.:

(2) The operator shall use one or more of the following methodologies that are appropriate to determine and evaluate the hazards of the process being analyzed.

- (i) What-If;
- (ii) Checklist;
- (iii) What-If/Checklist;
- (iv) Hazard and Operability Study (HAZOP):
- (v) Failure Mode and Effects Analysis (FMEA);

(vi) Fault Tree Analysis; or

(vii) An appropriate equivalent methodology.

(3) The process hazard analysis shall address:

(i) The hazards of the process;

(ii) The identification of any previous incident which had a likely potential for catastrophic consequences in the workplace;

(iii) Engineering and administrative controls applicable to the hazards and their interrelationships such as appropriate application of detection methodologies to provide early warning of releases. (Acceptable detection methods might include process monitoring and control instrumentation with alarms, and detection hardware such as hydrocarbon sensors.);

(iv) Consequences of failure of engineering and administrative controls;

(v) Facility siting;

(vi) Human factors; and

(vii) A qualitative evaluation of a range of the possible safety and health effects of failure of controls on employees in the workplace.

For FERC-regulated LNG facilities, an application for authorization to construct, operate, or modify must be submitted (e.g., proposed new construction or substantial modification) under 18 CFR 153.8 and 18 CFR 380.12(o), and requirements include submission of Resource Report 13. Requirements for process hazard analyses are included, for example, in Appendixes 13.G.1 of FERC's *Guidance Manual for Environmental Report Preparation for Applications Filed Under the Natural Gas Act*.[18] This requirement to provide a PHA is for the initial design, and there is no requirement to update/revalidate the PHA every five years or after process modifications.

This observation arises principally from a comparison of 49 CFR 193 to 29 CFR 1910.119, although the reader is also referred to sections 7.1, 7.3, and 7.4 of API RP 1173, which address risk management.

Potential mitigation strategies are to:

- Support inclusion of language in an upcoming edition of NFPA 59A that addresses the potential gap that arises directly from comparison to 29 CFR 1910.119, on the assumption that 49 CFR 193 will be revised to incorporate by reference that edition.
- Consider a revision to 49 CFR 193 that addresses the potential gap that arises directly from comparison to 29 CFR 1910.119.

Operator's responses to related survey questions nos. 10-13 indicate some or relatively strong support regarding the need to address this topic (67-78% in favor), and the manner of doing so if addressed. Since this potential gap arose in part from a comparison to 29 CFR 1910.119, this topic appears to merit further consideration by PHMSA.

Qualifications of Team that Conducts PHA (PHA-5)

29 CFR 1910.119(e)(4) specifies the team composition and expertise required to perform a PHA.

Since neither 49 CFR 193 nor the 2001 edition of NFPA 59A contains a specific requirement to perform a PHA, they, of course, do not specify the team composition and expertise required to perform a PHA. But 49 CFR 193.2509 and §11.3.3 of the 2001 edition of NFPA 59A require operators to anticipate both controllable and uncontrollable emergencies and develop emergency response procedures to address effective emergency response. In addition, hazards and risks are addressed in prescriptive requirements such as equipment spacing, flammable/toxic vapor concentration, and thermal flux at the property line, and many other hazard prevention requirements are directly defined or incorporated by reference.

The 2019 edition of NFPA 59A does not specify the team composition and expertise required to perform a PHA, although §4.6 “Engineering Review of Changes” requires "a qualified person" from each of six engineering disciplines.

In summary, existing requirements of 49 CFR 193 may not specify or clearly state that the required composition and expertise of the operator’s team that conducts a PHA must be equivalent to those specified in 29 CFR 1910.119(e)(4), i.e., that a PHA shall be performed by a team with expertise in engineering and process operations, and the team shall include at least one employee who has the experience and knowledge specific to the process being evaluated. Also, at least one member of the team must be knowledgeable in the specific PHA methodology being used.

This observation arises principally from a comparison of 49 CFR 193 to 29 CFR 1910.119, although the reader is also referred to as §10.2.2 of API RP 1173, which includes related requirements of personnel who perform audits.

Potential mitigation strategies are to:

- Support inclusion of language in an upcoming edition of NFPA 59A that addresses the potential gap that arises directly from comparison to 29 CFR 1910.119, on the assumption that 49 CFR 193 will be revised to incorporate by reference that edition.
- Consider a revision to 49 CFR 193 that addresses the potential gap that arises directly from comparison to 29 CFR 1910.119.

Operator’s responses to related survey questions nos. 14-15 indicate relatively strong support to address this topic (78% in favor), but differing opinions about the preferred method to potentially address this topic. Since this potential gap arose in part from a comparison to 29 CFR 1910.119, this topic appears to merit further consideration by PHMSA.

Minimum Frequency to Update PHA (PHA-10)

29 CFR 1910.119(e)(6) specifies a minimum frequency to update and revalidate a PHA.

Since neither 49 CFR 193 nor the 2001 edition of NFPA 59A contains a specific requirement to perform a PHA, they, of course, do not specify a frequency to update and revalidate a PHA. Section 49 CFR 193.2017 requires that all plans and procedures must be reviewed at intervals not exceeding 27 months, but at least once every 2 calendar years. Some LNG facility operators may interpret that a PHA falls within the category of “plans and procedures”, so there may be an opportunity for PHMSA to clarify the applicability of the requirements of 49 CFR 193.2017 to PHAs.

The 2019 edition of NFPA 59A does not specify a minimum frequency to update and revalidate a PHA. In contrast, section 19.2.4 requires that Quantitative Risk Assessments be reassessed every 5 years or as required by the Authority Having Jurisdiction.

Section 7.5 of API RP 1173 refers to risk assessments (and not specifically PHAs) but requires risk management results to be reviewed and updated annually, including by top management as per section 7.6.

Section 6.3.10 of CAN/CSA-Z767-17 *Process Safety Management* refers to risk assessments and not specifically PHAs, but requires risk assessments to be revalidated in a period not to exceed 5 years from the date of the previous assessment, or if there is a change to the facility, operation, or operating environment that is outside of the context of the previous risk assessment.

In summary, there is no apparent requirement in 49 CFR 193 equivalent to those in 29 CFR 1910.119(e)(6), i.e., that a PHA for the facility shall be updated and revalidated by a team at least every five (5) years after the completion of the last PHA, in order to assure that the process hazard analysis is consistent with the current process.

Potential mitigation strategies are to:

- Support inclusion of language in an upcoming edition of NFPA 59A that addresses this potential gap, on the assumption that 49 CFR 193 will be revised to incorporate by reference that edition.
- Consider a revision to 49 CFR 193.

Operator's responses to related survey questions nos. 20-21 indicate differing opinions regarding the need to address this topic (56% in favor), and if so, the manner of doing so. Since this potential gap arose in part from a comparison to 29 CFR 1910.119, this topic appears to merit further consideration by PHMSA.

Operator's Action Plan to Address PHA Findings and Recommendations (PHA-6)

29 CFR 1910.119(e)(5) specifies requirements on an operator to establish a system to promptly address a team's findings and recommendations regarding a PHA. This is, of course, only relevant if PHAs are periodically reviewed.

Since neither 49 CFR 193 nor the 2001 edition of NFPA 59A contain a specific requirement to perform a PHA, they, of course, do not specify requirements to address PHA findings and recommendations. But 49 CFR 193.2603 imposes requirements on operators to maintain components in a condition that is compatible with its operational or safety purpose, and related requirements. Some LNG facility operators may interpret that 49 CFR 193.2603 as requiring an operator to address the findings and recommendations of a PHA. So there may be an opportunity for PHMSA to clarify the applicability of the requirements of 49 CFR 193.2603 to PHAs.

In summary, there is no apparent requirement in 49 CFR 193 equivalent to those in 29 CFR 1910.119(e)(5), i.e., that an operator must establish a system to promptly address the findings and recommendations from a PHA review; assure that the recommendations are resolved in a timely manner and that the resolution is documented; document what actions are to be taken; complete actions as soon as possible; develop a written schedule of when these actions are to be completed; communicate the actions to operating, maintenance and other employees whose work assignments are in the process and who may be affected by the recommendations or actions.

Potential mitigation strategies are to:

- Support inclusion of language in an upcoming edition of NFPA 59A that addresses this potential gap, on the assumption that 49 CFR 193 will be revised to incorporate by reference that edition.
- Consider a revision to 49 CFR 193.

Operator's responses to related survey questions nos. 16-17 indicate differing opinions regarding the need to address this topic (56% in favor), and if so, the manner of doing so. Since this potential gap arose in part from a comparison to 29 CFR 1910.119, this topic appears to merit further consideration by PHMSA.

PHA Record Retention Period (PHA-11)

29 CFR 1910.119(e)(7) specifies a minimum period to retain PHA records.

Since neither 49 CFR 193 nor the 2001 edition of NFPA 59A contains a specific requirement to perform a PHA, they, of course, do not specify a minimum period to retain PHA records.

In summary, there is no apparent requirement in 49 CFR 193 equivalent to those in 29 CFR 1910.119(e)(7), i.e., that operators shall retain PHAs, as well as the documented resolution of recommendations arising from them, for the life of the facility.

Potential mitigation strategies are to:

- Support inclusion of language in an upcoming edition of NFPA 59A that addresses this potential gap, on the assumption that 49 CFR 193 will be revised to incorporate by reference that edition.
- Consider a revision to 49 CFR 193.

Operator's responses to related survey questions nos. 22-23 indicate differing opinions but some support regarding the need to address this topic (67% in favor), and the manner of potentially doing so. Since this potential gap arose in part from a comparison to 29 CFR 1910.119, this topic appears to merit further consideration by PHMSA.

Lower-Priority Potential Gaps

No higher-priority potential gaps in this PSM category were specifically identified.

Potential Gaps Substantially Addressed in 2019 Edition of NFPA 59A

Is a PHA Required? (PHA-1)

29 CFR 1910.119(e)(1) requires an employer to perform an initial process hazard analysis (hazard evaluation) on processes covered by 29 CFR 1910.119 and specifies more detail.

In comparison, there is no specific requirement in 49 CFR 193 or in the 2001 edition of NFPA 59A that a PHA must be completed. As noted previously, 49 CFR 193.2509 does require operators to anticipate both controllable and uncontrollable emergencies and develop emergency response procedures to achieve an effective emergency response. In addition, hazards and risks are addressed in prescriptive requirements such as equipment spacing, vapor concentration, and thermal flux at the property line and many other hazard prevention requirements are directly defined or incorporated by reference.

In contrast, §§ 5.2.1, 5.2.2, 5.3.2, 17.3.1.2 of the 2019 edition of NFPA 59A require that a Hazard Analysis be completed, including as part of a written plant and site evaluation plan. This is referred to as a PHA in §5.2.1 and §17.3.1.2, and "Hazard Analysis" or "Analysis" in §5.2.2 and §5.3.2. Details to perform the Hazard Analysis are specified in §5.3.2.

There are of course important confidentiality and security considerations relevant to PHAs should portions of their content appear in the public domain. So, it is recommended that confidentiality and security issues be given significant consideration in any future regulatory promulgation related to PHAs and risk assessments. It was noted that in its December 19, 2019, RMP Reconsideration Final Rule, the EPA stated that:

> "The changes in the emergency coordination provisions primarily ensure that coordination occurs in a more secure manner than under the 2017 requirements. We have substituted the open-ended and somewhat vague ability of emergency response organizations to obtain any information "relevant to" local emergency response planning for a requirement to provide information "necessary for" the development and implementation of the local emergency plan. "Necessary for" tracks more closely the terms of EPCRA 303(d)(3) and 40 CFR 68.95(c) of the pre-2017 RMP rule."[19]

Potential Gaps if Compared to a Voluntary Industry Recommended Practice

Must Operator Maintain a Process to Identify Threats?, and Risk Prevention and Mitigation Analysis (PHA-8 and PHA-9)

There is no apparent requirement in 49 CFR 193 (or even in the NFPA 59A 2019 edition, if incorporated by reference in 49 CFR 193) that an operator should consider the following when performing a process hazard analysis:

- lessons learned (both internal and external);
- identifying high consequence areas and possible events;
- establishing and maintaining an ongoing process to identify threats to the LNG facility; and
- identifying and evaluating various risk prevention and mitigation measures, which may include analyzing the adequacy of response times of employees as well as external organizations, considering the establishment of an incident command center, and evaluating multiple response scenarios.

Operator's responses to related survey questions nos. 18-19 indicates differing opinions regarding the need to address this topic (56% in favor), and if so, the manner to do so.

This concept arises principally from a comparison of 49 CFR 193 to Sections 7.3 and 7.4 of API RP 1173. Accordingly, it may perhaps be best addressed through mechanisms to encourage conformance to that RP.

Must Operator Establish an Acceptable Risk Criteria? (PHA-12)

Section 6.3.8 of CAN/CSA-Z767 requires facility operators to establish risk criteria. Establishing such criteria is also incorporated in chapter 9.2.3 of AIChE CCPS *Guidelines for Risk-Based Process Safety*.

Since 49 CFR 193 and the 2001 edition of NFPA 59A primarily address risk management on a prescriptive basis, they do not require facility operators to establish risk criteria.

The 2019 edition of NFPA 59A identifies acceptable risk criteria in Section 19.9 in the context of preparing Quantitative Risk Assessments. This does not necessarily prevent an operator from establishing its own acceptable risk criteria, nor does it require an operator to do so.

In summary, there is no apparent requirement in 49 CFR 193 that an operator establishes its risk tolerance criteria for acceptable, unacceptable, and conditionally tolerable risk levels when performing PHAs or other risk assessments.

Operator's responses to related survey questions nos. 24-25 indicate differing opinions regarding the need to address this topic (56% in favor), and if so, the manner to do so.

This concept arises principally from a comparison of 49 CFR 193 to AIChE CCPS *Guidelines for Risk-Based Process Safety* and CAN/CSA-Z767. Accordingly, it may perhaps be best addressed through mechanisms to encourage conformance to those voluntary standards and industry best practice documents.

Operating Procedures (including PSM System Documentation)

Higher-Priority Potential Gaps and Possible Mitigation Strategies

No higher-priority potential gaps in this PSM category were specifically identified.

Lower-Priority Potential Gaps

No lower-priority potential gaps in this PSM category were specifically identified.

Potential Gaps Substantially Addressed in 2019 Edition of NFPA 59A

No potential gaps related to this PSM category were identified as being addressed in the 2019 edition of NFPA 59A in a superior manner to the content in the 2001 edition.

Potential Gaps if Compared to a Voluntary Industry Recommended Practice

Operator's PSM System Documentation - Document Control Procedures, Record Control Procedures, and Minimum Content? (OP-11, OP-12, and OP-13)

There is no apparent requirement in 49 CFR 193 that an operator must have its own procedure to manage process safety, which must include methods such as the following to control documents that describe its system or processes to manage safety:

- be reviewed and approved for adequacy prior to issue or re-issue, by the responsible persons or management position identified in the documents;
- show the current revision status and identify changes;
- be legible and readily identifiable;
- be readily available and accessible to personnel; and
- be removed from all points of issue or use, or be otherwise marked to assure against unintended use if they are retained for any purpose if the document becomes obsolete.

Also, that the operator's documentation of its system or process to manage safety must also include maintaining a procedure to control records that demonstrate conformance of its operations to the procedure that it uses to manage safety, and that the procedure shall:

- identify the controls and responsibilities to identify, collect, store, protect, retrieve, retain and dispose of records;
- require that records remain legible, identifiable, and retrievable; and
- specify the record retention time.

Also, the operator's documentation of its procedure to manage safety must include:

- operator's stated overall safety objectives and policies;
- regulatory and other requirements applicable to process safety management;
- operator's procedures to conform with regulatory and other requirements applicable to process safety management, including the operator's own requirements;
- documents required by its process safety management system;
- records that demonstrate conformance to the requirements of the process safety management system; and
- other records that the operator has identified to show the effectiveness of its process safety management system.

Operator’s responses to related survey questions nos. 26-27 indicate differing opinions regarding the need to address this topic (56% in favor), as well as differing opinions about methods to potentially address it.

These observations arise from a comparison of 49 CFR 193 to Sections 14.1, 14.2, and 14.3 of API RP 1173. Accordingly, it may perhaps be best addressed through mechanisms to encourage conformance to that RP.

Should Operator's Periodic Updates of its Operating Procedures Specifically Consider Cognitive Issues/Human Factors? (OP-14)

There is no apparent requirement in 49 CFR 193 that an operator's periodic updates to its operating plans and procedures required by 49 CFR 193.2017 must include a methodology to consider human factors and the role of people in facility operation and their support of safety-critical systems, which may for example include:

- Review practices and tools used to maintain real-time awareness of safety margins
- Adopt practices to identify and understand safety-critical human tasks along with operational and management practices that enable operators to perform tasks reliably
- Review options for ensuring independent challenge to safety-critical decisions within their own operations

Specific examples may relate to:

- general access and egress
- facility layout requirements for operability and maintainability
- human-machine interfaces (e.g. Digital Control Systems screens)
- valve access
- control center and room design
- signage and labeling
- general work environment (lighting, noise, heat, etc.)

Operator's responses to related survey questions nos. 28-29 indicate some support (67% in favor) to address this topic, and differ in opinion regarding the method to potentially do so.

This observation arises from a comparison of 49 CFR 193 to IOGP Report No. 460 *Cognitive Issues Associated with Process Safety and Environmental Issues*.[20] Accordingly, it may perhaps be best addressed through mechanisms to encourage conformance to that RP.

Training (including Competence)

Eleven elements were evaluated in the Matrix Table related to training (including competency). No significant potential gaps were identified in 49 CFR 193 when compared to the primary and secondary references.

Higher-Priority Potential Gaps and Possible Mitigation Strategies

No higher-priority potential gaps in this PSM category were specifically identified.

Lower-Priority Potential Gaps

It was noted that 49 CFR 193.2719 requires training records to be maintained for one year after personnel is no longer assigned duties at the LNG plant, whereas this period is two years in the 2001 and 2019 editions of NFPA 59A.

Potential Gaps Substantially Addressed in 2019 Edition of NFPA 59A

No potential gaps related to this PSM category were identified as being addressed in the 2019 edition of NFPA 59A in a superior manner to the content in the 2001 edition.

Potential Gaps if Compared to a Voluntary Industry Recommended Practice

No potential gaps related to this PSM category were identified as arising from a comparison of 49 CFR 193 to voluntary industry recommended practices such as principally API RP 1173.

Contractors

Higher-Priority Potential Gaps and Possible Mitigation Strategies

Operator Responsibilities - Operator Responsibilities - Tracking Injury and Illness of Designer, Fabricator or Constructor? (CON-7)

There are no apparent requirements in 49 CFR 193 that an operator must receive or maintain an injury and illness log related to work done while at the operator's facility by designers, fabricators, installers, inspectors, constructors, or those performing testing. This observation arises from a comparison of 49 CFR 193 to 29 CFR 1910.119(h)(2)(vi).

Potential mitigation strategies are to:

- Support inclusion of language in the next edition of NFPA 59A that addresses this potential gap, on the assumption that 49 CFR 193 will be revised to incorporate by reference that next edition.
- Consider a revision to 49 CFR 193.

Operator's responses to related survey questions nos. 32-33 indicate limited support (44% in favor) to address this topic and differ in opinion regarding the method to address it. Since this potential gap arose in part from a comparison to 29 CFR 1910.119, this topic appears to merit further consideration by PHMSA.

Operator Responsibilities - Evaluate Performance of Designer, Fabricator, and Constructor with respect to PSM Requirements? (CON-5)

There is no apparent requirement in 49 CFR 193 that an operator must periodically evaluate the safety performance of personnel utilized for construction, installation, inspection, testing, operations, or maintenance. This observation arises from a comparison of 49 CFR 193 to 29 CFR 1910.119(h)(3)(iv) and to Section 8.4(e) of API RP 1173.

Potential mitigation strategies are to:

- Support inclusion of language in an upcoming edition of NFPA 59A that addresses the potential gap that arises directly from comparison to 29 CFR 1910.119, on the assumption that 49 CFR 193 will be revised to incorporate by reference that edition.
- Consider a revision to 49 CFR 193 that addresses the potential gap that arises directly from comparison to 29 CFR 1910.119.
- Establish another mechanism to encourage voluntary conformance to API RP 1173.

Operator's responses to related survey questions nos. 30-31 indicate relatively strong support (78% in favor) to address this topic but differ in opinion regarding the method to address it. Since aspects of this potential gap arose in part from a comparison to 29 CFR 1910.119, this topic appears to merit further consideration by PHMSA.

Lower-Priority Potential Gaps

No lower-priority potential gaps in this PSM category were specifically identified.

Potential Gaps Substantially Addressed in 2019 Edition of NFPA 59A

No potential gaps related to this PSM category were identified as being addressed in the 2019 edition of NFPA 59A in a superior manner to the content in the 2001 edition.

Potential Gaps if Compared to a Voluntary Industry Recommended Practice

Operator Responsibilities - Learn from the Designer, Fabricator or Constructor (CON-8)

There is no apparent requirement in 49 CFR 193 that an operator must define and document a process for operator to receive "lessons learned" suggestions and recommendations that are voluntarily provided from designers, fabricators, inspectors, constructors or those performing testing that pertain to potential improvements in process safety at the operator's facility, and for operator to review and assess any appropriate course of action. This observation arises from a comparison of 49 CFR 193 to Section 8.4(c) of API RP 1173.

Operator’s responses to related survey questions nos. 34-35 indicate some support (67% in favor) to address this topic, and strongly prefer that this be done either as a revision to NFPA 59A or as a voluntary practice.

This concept arises principally from a comparison of 49 CFR 193 to API RP 1173. Accordingly, it may perhaps be best addressed through mechanisms to encourage conformance to that RP.

Pre-Startup Safety Review

Higher-Priority Potential Gaps and Possible Mitigation Strategies

No higher-priority potential gaps in this PSM category were specifically identified.

Lower-Priority Potential Gaps

When is a Pre-Startup Safety Review Required? (PSSR-1)

While a Pre-Startup Safety Review is not a defined term in 49 CFR 193 or NFPA 59A (2001 or 2019), inspections and tests are required before any component is placed in service, and plans and procedures must be updated when a component is changed significantly, or a new component is installed and at intervals not exceeding 27 months, but at least once every 2 calendar years. For example, see §193.2303, §193.2017, and §193.2619.

Opinions of the project TAP members sometimes differed regarding the degree to which the current requirements in 49 CFR 193 meet the intent of the PSSR requirements in 29 CFR 1910.119(i), and therefore the degree and priority (higher vs. lower) of this potential gap.

For the reader’s understanding, 29 CFR 1910.119(i) requires that:

> (1) The employer shall perform a pre-startup safety review for new facilities and for modified facilities when the modification is significant enough to require a change in the process safety information.
>
> (2) The pre-startup safety review shall confirm that prior to the introduction of highly hazardous chemicals to a process:
>
> (i) Construction and equipment is in accordance with design specifications;
>
> (ii) Safety, operating, maintenance, and emergency procedures are in place and are adequate;
>
> (iii) For new facilities, a process hazard analysis has been performed and recommendations have been resolved or implemented before startup; and modified facilities meet the requirements contained in management of change requirements.

(iv) Training of each employee involved in operating a process has been completed

PHMSA may want to consider establishing “Pre-Startup Safety Review” as a defined term in a future revision to 49 CFR 193. Alternate terminology such as “Commissioning Requirements” rather than “Pre-Startup Safety Review” may be preferable, since doing so would aid alignment of terminology in §18.7 of the 2019 edition of NFPA 59A.

Likewise, there may be an opportunity to clarify in a future edition of NFPA 59A or in a revision to 49 CFR 193 when PSSR or Commissioning requirements should apply to situations beyond initial startup; for example, such as perhaps when facilities that have been substantially modified or out of service for extended periods of time (with both aspects needing to be well-defined).

Potential Gaps Substantially Addressed in 2019 Edition of NFPA 59A

No potential gaps related to this PSM category were identified as being addressed in the 2019 edition of NFPA 59A in a superior manner to the content in the 2001 edition.

Potential Gaps if Compared to a Voluntary Industry Recommended Practice

No potential gaps related to this PSM category were identified as arising from a comparison of 49 CFR 193 to voluntary industry recommended practices such as principally API RP 1173.

Mechanical Integrity

The methodology or specified frequency to inspect, test, or survey specific equipment items has been a significant past discussion topic by industry. In this analysis, thirty-eight specific elements related to Mechanical Integrity in PSM were evaluated in the Matrix Table. Both a general question and specific questions were posed regarding the manner of enforcing mechanical integrity through regulations, as described in the following text.

Higher-Priority Potential Gaps and Possible Mitigation Strategies

Increased Opportunity for an Operator to use Recommended and Generally Accepted Good Engineering Practices (RAGAGEP) for Mechanical Integrity, as an Alternate Methodology to Many Current Prescriptive Inspection and Test Requirements (MI-1 through MI-38)

29 CFR 1910.119(j)(4)(ii) and 29 CFR 1910.119(j)(4)(iii) specifies that procedures for inspection and tests performed on process equipment must follow recognized and generally accepted good engineering practices (RAGAGEP). Also, 29 CFR 1910.119(d)(3)(ii) requires employers to document that equipment in OSHA PSM-covered processes comply with RAGAGEP. OSHA has provided detailed clarifications regarding the definition and application of RAGAGEP in Process Safety Management, including most recently on May 11, 2016.[21]

49 CFR 193.2605 “Maintenance procedures” also specifies a RAGAGEP approach for maintenance procedures - - specifically in 49 CFR 193.2605(a). However, 49 CFR 193 also specifies prescriptive inspection and test frequencies and requirements for many different particular equipment items in LNG facilities. For example, twenty-five test or maintenance equipment frequencies are listed in survey question #80 as shown in Figure 9.

The survey response to the related overarching survey question no. 2 as well as to item-specific question nos. 80-81 indicate unanimous support from operators to address the overall issue, and very strong support when the same question was posed for numerous individual components.

But a key point is that a significant number of operators (33% of survey recipients) don’t want prescriptive requirements to be completely replaced with RAGAGEP-based language in a potential revision to 49 CFR 193 language. Feedback from operators (either informally or as comments noted in the survey results) indicates that reasons to retain an option to conform to prescriptive requirements while additionally allowing RAGAGEP-based conformance can include (in some cases) simplicity or to avoid potentially inconsistent or conflicting interpretations in regulatory oversight. This point is also consistent with the answers to suvey question no. 80, which shows that operators may prefer using a RAGAGEP-based method of conformance to regulations for certain components rather than for others.

Potential mitigation strategies are to:

- Consider a revision to 49 CFR 193, which allows optional use of RAGAGEP-based conformance.
- Possibly support inclusion of language in an upcoming edition of NFPA 59A that addresses this potential gap, on the assumption that 49 CFR 193 will be revised to incorporate by reference that edition.

This topic certainly remains one of high interest by operators and appears to merit further consideration by PHMSA.

An increased RAGAGEP allowance should include well-defined bases for acceptance of various components, in order to establish consistent test intervals and eliminate potential confusion for regulators and LNG operators; for example, referencing a recognized standard such as API RP 576 *Inspection of Pressure-Relieving Devices* for frequency of testing some components such as referenced by Section 18.10.10.7.2 of NFPA 59A (2019 edition).

Frequency to Inspect and Test - Stationary LNG Tank Relief Valves (MI-10)

It was noted that 49 CFR 193.2619 provides more onerous requirements than either the 2001 or 2019 editions of NFPA 59A, by requiring that stationary LNG tank relief valves be inspected and tested at least once each calendar year, not exceeding 15 months, in comparison to the requirement in the 2001 and 2019 editions of NFPA 59A to inspect and test these every two calendar years, with intervals not exceeding 30 months.

A related petition was submitted to PHMSA by industry trade associations AGA and INGAA on May 10, 2018.[22]

Potential mitigation strategies are to:

- Consider a revision to 49 CFR 193, which aligns the testing requirement in 49 CFR 193.2619 with the 2001 and 2019 editions of NFPA 59A. Potential optional use of RAGAGEP-based means of to ensure the mechanical integrity of this component may also be considered.

Operator's responses to related survey questions nos. 38-39 indicate very strong support (89% in favor) to address this topic. This topic certainly remains one of high interest by operators and appears to merit further consideration by PHMSA.

Frequency to Inspect and Test - Relief Valves in Control Systems other than on Stationary LNG Tanks (MI-11)

It was noted that 49 CFR 193.2619, by requiring that relief valves in controls systems other than on stationary LNG tanks be inspected and tested at least once each calendar year, not exceeding 15 months provides more onerous requirements than either:

- the requirement in the 2001 edition of NFPA 59A to inspect and test these every two calendar years, with intervals not exceeding 30 months, and
- the requirements in §18.10.10.7 in the 2019 edition of NFPA 59A which specify
    - inspection intervals either in accordance with either API 510 *Pressure Vessel Inspection Code* or ANSI/NB-23, *National Board Inspection Code, Part 2, Inspection* (the reader is referred to NFPA 59A for more specific details and complete requirements)

- o set-point testing intervals either (1) not exceeding five years, plus three months, or (2) at a frequency in accordance with API RP 576, *Inspection of Pressure-Relieving Devices* (the reader is referred to NFPA 59A for more specific details and complete requirements)

A related petition was submitted to PHMSA by industry trade associations AGA and INGAA on May 10, 2018.[23]

Potential mitigation strategies are to:

- Consider a revision to 49 CFR 193, which aligns the testing requirement in 49 CFR 193.2619 with the 2001 or 2019 editions of NFPA 59A. Potential optional use of RAGAGEP-based means to ensure the mechanical integrity of this component may also be considered.

Operator's responses to related survey questions nos. 40-41 indicate unanimous support to address this topic. This topic remains of high interest by operators and appears to merit further consideration by PHMSA.

Frequency to Inspect and Test - Relief Valves Protecting Hazardous Fluid Components other than in Control Systems or on Stationary LNG Tanks (MI-12)

It was noted that 49 CFR 193.2619, by requiring that relief valves protecting hazardous fluid components other than in controls systems or on stationary LNG tanks are inspected and tested at least once each calendar year, not exceeding 15 months provides more onerous requirements than either:

- the requirement in the 2001 edition of NFPA 59A to inspect and test these every five calendar years, with intervals not exceeding 63 months, and
- the requirements in §18.10.10.7 in the 2019 edition of NFPA 59A which specify
  - o inspection intervals either in accordance with either API 510 *Pressure Vessel Inspection Code* or ANSI/NB-23, *National Board Inspection Code, Part 2, Inspection* (the reader is referred to NFPA 59A for more specific details and complete requirements)
  - o set-point testing intervals either (1) not exceeding five years, plus three months, or (2) at a frequency in accordance with API RP 576, Inspection of Pressure-Relieving Devices (the reader is referred to NFPA 59A for more specific details and complete requirements)

A related petition was submitted to PHMSA by industry trade associations AGA and INGAA on May 10, 2018.[24]

Potential mitigation strategies are to:

- Consider a revision to 49 CFR 193, which aligns the testing requirement in 49 CFR 193.2619 with the 2001 or 2019 editions of NFPA 59A. Potential optional use of RAGAGEP-based means to ensure the mechanical integrity of this component may also be considered.

Operator's responses to related survey questions nos. 42-43 indicate unanimous support to address this topic. This topic remains of high interest by operators and appears to merit further consideration by PHMSA.

Definition of Process Equipment to Have Required Mechanical Integrity, and Method to Inspect and Test - Process Equipment (MI-1 and MI-4)

29 CFR 1910.119(j)(1) identifies the specific types of process equipment for which mechanical integrity requirements apply, such as by the inspection and testing requirements in 29 CFR 1910.119(j)(4).

49 CFR 193.2007 defines components more broadly than the specific types of process equipment identified by OSHA in 29CFR1910.119(j)(1). Specific existing requirements in 49 CFR 193 to enforce

mechanical integrity include, for example, those in 49 CFR 193.2603 "General" and 49 CFR 193.2605 "Maintenance procedures."

Additional requirements to ensure mechanical integrity are incorporated by reference in the 2001 edition of NFPA 59A such as in §6.9, §9.6, §10.15, §11.5 and other elements throughout the standard by equipment maintenance, inspection and tests, and other means. In addition, mechanical integrity inspections and test requirements are specified for equipment or components unique to LNG facilities in the 2001 edition of NFPA 59A.

Likewise, additional requirements to ensure mechanical integrity are incorporated by reference in the 2019 edition of NFPA 59A, such as in Chapter 18 and other elements throughout the standard by equipment maintenance, inspection and tests, and other means. In addition, mechanical integrity inspections and test requirements are specified for equipment or components unique to LNG facilities in the 2019 edition of NFPA 59A.

Nevertheless, some may consider if the definition of "component" in 49 CFR 193 could be refined to more specifically include "process equipment" such as limited by OSHA's definition in 29 CFR 1910.119(j)(i):

- Pressure vessels and storage tanks;
- Piping systems (including piping components such as valves);
- Relief and vent systems and devices;
- Emergency shutdown systems;
- Controls (including monitoring devices and sensors, alarms, and interlocks) and,
- Pumps.

Potential mitigation strategies are to:

- Support inclusion of language in an upcoming edition of NFPA 59A that addresses this potential gap, on the assumption that 49 CFR 193 will be revised to incorporate by reference that edition.
- Consider a revision to 49 CFR 193.

Operator's responses to related survey questions nos. 83-84 indicate some support (67% in favor) to address this topic, but differing opinions about the manner to do so. Since this topic arose in part from a comparison to 29 CFR 1910.119, it appears to merit further consideration by PHMSA.

Lower-Priority Potential Gaps

Frequency to Inspect and Test - Control Systems Used Seasonally, such as for Liquefaction or Vaporization (MI-8)

A topic was identified as a potential clarification (i.e., not a potential gap as such) in the requirements in 49 CFR 193.2619(c). Namely, should a potential future revision in 49 CFR 193.2619(c) be considered to enhance the understanding that the requirements in 49 CFR 193.2619(c) apply only to peak-shaving or other non-base-load facility operations?

For example, consideration of alternate language for 49 CFR 193.2619(c) might include: Control systems used seasonally, such as for liquefaction or vaporization when only used on a seasonal basis, must be inspected and tested before use each season.

Operator's responses to related survey questions nos. 85-86 indicate differing opinions regarding the need to address this topic (56% in favor), and differing opinions about potential manners to do so.

Frequency to Conduct LNG Tank Bottom Temperature Survey (MI-21)

It was noted that §4.1.7.5 of the 2001 edition of NFPA 59A specifies the frequency to periodically conduct an LNG tank bottom survey as 12 months, whereas the 2019 edition of NFPA 59A does not appear to specify a minimum frequency to conduct an LNG tank bottom survey. The 2019 edition of NFPA 59A does contain other related requirements in §§ 18.6.2.1, 8.4.11.5.1, 8.4.11.7, 11.6.2 and 18.6.2.2. A potential future revision to NFPA 59A may be to specify a minimum frequency to periodically conduct an LNG tank bottom survey.

Potential Gaps Substantially Addressed in 2019 Edition of NFPA 59A

Frequency to Inspect and Test - Control Systems in Service, but Not Normally in Operation, such as Automatic Shutdown Devices, and Control Systems for Internal Shutoff Valves for Bottom Penetration Tanks (MI-7)

This topic pertains in part to the overall issue discussed above regarding potential allowance in a future revision to 49 CFR 193 for an operator to optionally use a RAGAGEP-based approach rather than the current prescriptive requirement in 49 CFR 193 to establish the frequency to inspect and test this specific equipment item.

Section 18.10.10.7 of the 2019 edition of NFPA 59A specifically allows operators to use one of several recognized engineering standards to establish this frequency, instead of the prescriptive frequencies specified in 49 CFR 193.2619(c) and the 2001 edition of NFPA 59A. If a revision to 49 CFR 193 incorporates by reference the 2019 edition of NFPA 59A, then a RAGAGEP-based approach will be allowed if that revision to 49 CFR 193 also removes the current prescriptive frequency requirement in 49 CFR 193.2619(c).

Frequency to Inspect and Test - Control Systems Intended for Fire Protection (MI-9)

This topic pertains to the overall issue discussed above regarding potential allowance in a future revision to 49 CFR 193 for an operator to optionally use a RAGAGEP-based approach rather than the current prescriptive requirement in 49 CFR 193 to establish the frequency to inspect and test this specific equipment item.

Section 18.10.10.4 of the 2019 edition of NFPA 59A specifically allows operators to use one of several recognized engineering standards to establish this frequency, instead of the prescriptive frequencies specified in 49 CFR 193.2619(c). The language in Section 18.10.10.4 of the 2019 edition of NFPA 59A defines the recognized engineering standards more clearly than §10.15.4.5(c) and §11.5.5(c) of the 2001 edition of NFPA 59A.

Frequency to Test - Marine Loading or Unloading Operations (MI-18)

It was noted that neither 49 CFR 193 or the 2001 edition of NFPA 59A specifies a frequency to periodically test marine loading or unloading operations.

In comparison, sections 15.8.7 and 18.10.7 of the 2019 edition of NFPA 59A require periodic testing.

This is a potential gap in the sense that a potential future revision of 49 CFR 193 to incorporate by reference the 2019 edition of NFPA 59A would add this requirement.

However, adding a requirement to 49 CFR 193 related to marine loading and unloading operations would likely fall outside the current scope of 49 CFR 193, which as per §193.2001(b)(3) does not apply to "In the case of a marine cargo transfer system and associated facilities, any matter other than siting pertaining to the system or facilities between the marine vessel and the last manifold (or in the absence of a manifold, the last valve) located immediately before a storage tank." Therefore, this review highlights the need that PHMSA may need to clarify the applicability of sections 15.8.7 and 18.10.7 if, in the future, it incorporates by reference in 49 CFR 193 the 2019 edition of NFPA 59A.

The Marine Transfer Area is regulated by 33 CFR 127, which requires testing the transfer system, including piping, hoses, and loading arms, under 33 CFR 127.407.

Frequency to Monitor Soil Temperature Under LNG Storage Tanks (MI-20)

It was noted that the 2001 edition of NFPA 59A in §4.1.7.3 and §11.3.4.2 specifies the frequency to periodically monitor the performance of a tank foundation heating system and soil temperature as seven days, whereas the 2019 edition of NFPA 59A in §18.6.2.1 requires this be every day.

This is a potential gap in the sense that a potential future revision of 49 CFR 193 to incorporate by reference the 2019 edition of NFPA 59A would increase the frequency of this requirement to match the current (2019) requirements of NFPA 59A.

Frequency to Survey Foundation Elevation, or Otherwise Assess Settlement of LNG Storage Tank or LNG Container Foundation (MI-22)

It was noted that the 2001 edition of NFPA 59A in §4.1.7.6 and §11.5.5.1(g) only requires to "periodically" monitor the settlement of an LNG container foundation, whereas the 2019 edition of NFPA 59A in §18.6.2.2 requires that this be done every three years. Additional requirements apply after an operating basis earthquake (or major meteorological disturbance), and (in the case of the 2019 edition) after an indication of an abnormally cool area.

This is a potential gap in the sense that a potential future revision of 49 CFR 193 to incorporate by reference the 2019 edition of NFPA 59A would add this requirement and specify a minimum frequency.

Frequency to Inspect - Reverse Current Switch, Diode, and Interference Bond Whose Failure Would Jeopardize Component Protection (MI-27)

It was noted that the requirements in the 2019 edition of NFPA 59A specified in §18.6.2.1 conform with 49 CFR 193.2635(c), whereas §11.5.6.4(c) in the 2001 edition of NFPA 59A do not and are less stringent.

This is not a potential gap since 49 CFR 193.2635(c) governs. Rather, this comment merely notes the alignment between the current requirements of 49 CFR 193 and the 2019 edition of NFPA 59A.

Must Operator Retain Records of Materials of Construction for Components, Buildings, Foundations and Support Systems for Containment of LNG or other Hazardous Fluids? (MI-34)

It was noted that sections 4.9.1 and 4.9.2 of the 2019 edition of NFPA 59A specifically require maintaining records of materials of construction for components, buildings, foundations, and support systems used for containment of LNG or other hazardous liquids, and thus align with §193.2119, whereas the 2001 edition of NFPA 59A does not appear to specifically maintain records of materials of construction other than for piping in §6.6.5 and drawings, charts, and records of plant equipment in §11.2.

This is not a potential gap since 49 CFR 193.2635(c) governs. Rather, this comment merely notes the alignment between the current requirements of 49 CFR 193 and the 2019 edition of NFPA 59A.

Potential Gaps if Compared to a Voluntary Industry Recommended Practice

No potential gaps related to this PSM category were identified as arising from a comparison of 49 CFR 193 to voluntary industry recommended practices such as principally API RP 1173.

Hot Work Permit

Higher-Priority Potential Gaps and Possible Mitigation Strategies

No higher-priority potential gaps in this PSM category were specifically identified.

Lower-Priority Potential Gaps

No lower-priority potential gaps in this PSM category were specifically identified.

Potential Gaps Substantially Addressed in 2019 Edition of NFPA 59A

Are Hot Work Permits Required? (HWP-1)

There is no specific requirement for Hot Work Permits by that designated name in the 2001 edition of NFPA 59A, although there are operating procedures required to ensure safety to persons and property and general safety while repairs are carried out, whether the equipment is in operation. No hot work is permitted in loading or unloading areas when product transfer is in progress. See, for example, §§ 10.15.4.2.2(3), 10.15.4.4, 11.3.2(8), 11.5.2.2(3), 11.5.4, 10.15.3.6.1(c) and 11.4.5.1(c).

In contrast, §4.11.2 and §8.4.8.2.6 of the 2019 edition of NFPA 59A imposes limitations on hot work and specifies conformance to NFPA 51B *Standard for Fire Prevention During Welding, Cutting, and Other Hot Work*.

Potential Gaps if Compared to a Voluntary Industry Recommended Practice

No potential gaps related to this PSM category were identified as arising from a comparison of 49 CFR 193 to voluntary industry recommended practices such as principally API RP 1173.

Management of Change

Higher-Priority Potential Gaps and Possible Mitigation Strategies

Is a Management of Change Procedure Required, and Considerations and Content in an Operator's MOC Procedures (MOC-1 and MOC-2)

In general, management of change (MOC) is a management system to identify, review and approve all modifications to equipment, procedures, programs, raw materials, processing conditions, and organizational and staffing changes (other than equipment replacement in kind), and prior to implementation to help ensure that changes are properly analyzed, documented and communicated to personnel. MOC is one of the 14 PSM elements in OSHA 29 CFR 1910.119, and is one of the 20 elements in the CCPS RBPS Management system, in its set of foundational pillars to manage risk.

While "Management of Change" is not a defined term in either 49 CFR 193 or NFPA 59A (2001 or 2019), they contain substantial requirements to keep procedures and records up to date after changes are made. The reader is referred, for example, to 49 CFR 193.2017 "Plans and procedures", 49 CFR 193.2603 "General" and 49 CFR 193.2304 "Corrosion control overview".

The 2019 edition of NFPA 59A incorporated new content in Section 4.6 entitled "Engineering Review of Changes," but that content may not fully reflect the requirements in OSHA 29 CFR 1910.119.

In addition, API RP 1173 Section 8.3, entitled "Management of Change" recommends that pipeline operators maintain a procedure for MOC.

FERC-regulated LNG facilities for which an application for authorization to construct, operate or modify is submitted (e.g., proposed new construction or substantial modification) are required by 18 CFR 153.8 and 18 CFR 380.12 to submit an environmental report, which must include the submission of a Management of Change procedure. In addition, MOC procedures and sample forms for changes after the operation of the project has commenced must be provided.[25]

In summary, there is no apparent requirement in 49 CFR 193 that an operator's facility procedures must include a procedure to manage temporary or permanent changes (except for "replacements in kind") to process chemicals, technology, equipment, and procedures. And that these procedures must include minimum content such as:

- The technical basis and reason for the proposed change;
- Impact of change on safety and health;
- Modifications to operating procedures;
- The necessary time period for the change;
- Authorization requirements for the proposed change;
- Secure necessary work permits; and
- Documentation requirements to manage change.

This observation arises from a comparison of 49 CFR 193 to 29 CFR 1910.119(l) and API RP 1173.

Potential mitigation strategies are to:

- Support inclusion of language in an upcoming edition of NFPA 59A that addresses the potential gap that arises directly from comparison to 29 CFR 1910.119, on the assumption that 49 CFR 193 will be revised to incorporate by reference that edition.
- Consider a revision to 49 CFR 193 that addresses the potential gap that arises directly from comparison to 29 CFR 1910.119.
- Establish another mechanism to encourage voluntary conformance to API RP 1173.

Operator's responses to related survey questions nos. 44-45 indicate relatively strong support (78% in favor) to address this topic, and most would prefer that this be done as a revision to NFPA 59A. Since aspects of this topic arose in part from a comparison to 29 CFR 1910.119, it appears to merit further consideration by PHMSA.

Lower-Priority Potential Gaps

No lower-priority potential gaps in this PSM category were specifically identified.

Potential Gaps Substantially Addressed in 2019 Edition of NFPA 59A

Employee Involvement and Training in an Operator's MOC Process (MOC-4)

As noted in the Matrix Table, current content in 49 CFR 193 (such as 49 CFR 193.2705 and 49 CFR 193.2707) that pertains to specifying qualification and training requirements for those employees with job tasks that are affected by a change may be additionally supported by some content in the 2019 edition of NFPA 59A (such as the review required by §4.6.1 and additional requirements). A potential future revision to NFPA 59A may be to insert language that more specifically addresses requirements equivalent to 29 CFR 1910.119(l)(3).

Potential Gaps if Compared to a Voluntary Industry Recommended Practice

No potential gaps related to this PSM category were identified as arising from a comparison of 49 CFR 193 to voluntary industry recommended practices such as principally API RP 1173.

Incident Investigation (and Learning)

Higher-Priority Potential Gaps and Possible Mitigation Strategies

Definition of Incident, and Threshold of Incident Size that Operator Must Investigate? And Must Near-Misses Be Investigated? (II-1, II-2, and II-3)

Requirements to investigate incidents are specifically identified in 49 CFR 193.2515. Other relevant requirements include reporting safety-related conditions as specified in 49 CFR 191.23.

But it was noted that there is no apparent requirement in 49 CFR 193 that an operator shall have its own procedure to investigate each incident which resulted in, or could reasonably have resulted in a catastrophic release of a highly hazardous chemical in the workplace, that must not otherwise be investigated under 49 CFR 193.2515. This observation arises from a comparison of 49 CFR 193 to 29 CFR 1910.119(m)(1) and to Section 9.1.1 of API RP 1173.

It was also noted that EPA, in its Dec. 19, 2019, RMP Reconsideration Final Ruling[26] rescinded its 2017 requirement to consider "near miss" events in Program 2 and 3 incident investigations:

> "EPA is deleting the term ''near miss'' that was added in the Amendments rule. The term was added in order to further clarify those incidents which could reasonably have resulted in a catastrophic release and are also subject to investigation. However, EPA's lack of specificity about what it meant by ''near miss'' contributed to confusion about the incident investigation requirement rather than clarity. EPA does not have a record showing significant benefits of the added prevention program provisions. Without such benefits, EPA believes it is better to take its traditional approach of maintaining consistency with OSHA PSM. The creation of additional complexity and burden associated with new provisions where EPA has not demonstrated any benefit is evidence of their impracticability and unreasonableness. EPA does not wish to have the incident investigation requirements diverge from those in OSHA's PSM standard. Removing the language will prevent undue burden in complying with process safety requirements that would result from introducing a duplicative requirement for investigations."

Potential mitigation strategies include:

- Support inclusion of language in an upcoming edition of NFPA 59A that addresses the potential gap that arises directly from comparison to 29 CFR 1910.119, on the assumption that 49 CFR 193 will be revised to incorporate by reference that edition.
- Consider a revision to 49 CFR 193 that addresses the potential gap that arises directly from comparison to 29 CFR 1910.119.
- Establish another mechanism to encourage voluntary conformance to API RP 1173.

Operator's responses to related survey questions nos. 46-47 indicate some support (67% in favor) regarding the need to address this topic, although only two of nine respondents (22%) preferred that this be done as a revision to 49 CFR 193. Since aspects of this topic arose from a comparison to 29 CFR 1910.119, it appears to merit further consideration by PHMSA.

Qualification and Composition of Incident Investigation Team (II-6)

There is no apparent requirement in 49 CFR 193 that an operator's incident investigation procedure must include requirements for the qualifications and composition of the incident investigation team, with a minimum requirement to have: at least one person knowledgeable in the process involved, including a contract employee if the incident involved work done by contract employees; and other persons with appropriate knowledge and experience to thoroughly investigate and analyze the incident. This observation arises from a comparison of 49 CFR 193 to 29 CFR 1910.119(m)(3).

Potential mitigation strategies are to:

- Support inclusion of language in an upcoming edition of NFPA 59A that addresses this potential gap, on the assumption that 49 CFR 193 will be revised to incorporate by reference that edition.
- Consider a revision to 49 CFR 193.

Operator’s responses to related survey questions nos. 50-51 indicate differing opinions regarding the need to address this topic (56% in favor), although only one of nine respondents (11%) preferred that this be done as a revision to 49 CFR 193. Since this topic arose from a comparison to 29 CFR 1910.119, it appears to merit further consideration by PHMSA.

Minimum Content of Operator's Incident Investigation Report, and Operator's Learning from Operator's Recent Incidents (II-7 and II-8)

There is no apparent requirement in 49 CFR 193 that an operator's incident investigation procedure must include elements such as:

- identifying findings and lessons learned;
- utilizing an investigation report template the attempts to identify clear links between causes and recommendations, e.g., by using a logic tree, cause-and-effect tree, time-based cause-and-effect chart, or causal factor chart;
- assessing the effectiveness of emergency response procedures, equipment, and processes;
- recommending changes to processes, procedures, training, resource allocation, and risk assessment processes including consequence analysis and failure rate probabilities;
- reviewing the incident investigation report with personnel whose job tasks are relevant to the incident findings (including contract employees where applicable), including contributing factors, findings, lessons learned and recommendations;
- documenting resolutions and corrective actions; and
- tracking and completing actions to improve safety systems, control systems and risk assessment processes arising from the investigation results and lessons learned

This observation arises from a comparison of 49 CFR 193 to 29 CFR 1910.119(m)(4), 29 CFR 1910.119(m)(5), and Sections 9.1.2 and 9.2 of API RP 1173.

It was noted that EPA, in its Dec. 19, 2019, RMP Reconsideration Final Ruling[27] eliminated its prior requirement “to conduct and document a root cause analysis after an RMP reportable accident or a near miss” during incident investigations.

Potential mitigation strategies are to:

- Support inclusion of language in an upcoming edition of NFPA 59A that addresses the potential gap that arises directly from comparison to 29 CFR 1910.119, on the assumption that 49 CFR 193 will be revised to incorporate by reference that edition.
- Consider a revision to 49 CFR 193 that addresses the potential gap that arises directly from comparison to 29 CFR 1910.119.
- Establish another mechanism to encourage voluntary conformance to API RP 1173.

Operator’s responses to related survey questions nos. 52-53 indicate differing opinions regarding the need to address this potential gap (56% in favor), and differing opinions on whether it should be addressed as a revision to 49 CFR 193, a revision to NFPA 59A, or as a voluntary practice. Since this potential gap arose in part from a comparison to 29 CFR 1910.119, this topic appears to merit consideration by PHMSA.

Lower-Priority Potential Gaps

No significant lower-priority potential gaps in this PSM category were specifically identified. It was observed that the requirement in 49 CFR191.5(a) to report an incident in 1 hour which is more rigorous than that in 29 CFR 1910.119. This is pointed out for completeness and without comment.

Potential Gaps Substantially Addressed in 2019 Edition of NFPA 59A

No potential gaps related to this PSM category were identified as being addressed in the 2019 edition of NFPA 59A in a superior manner to the content in the 2001 edition.

Potential Gaps if Compared to a Voluntary Industry Recommended Practice

Operator's Learning from Operator's Past Incidents, and Operator's Learning from External Incidents (II-9 and II-10)

There is no apparent requirement in 49 CFR 193 that an operator's incident investigation procedure must include the following elements:

- performing a review and reassessment five years after incidents that were reportable under 49 CFR 191.15, to identify any subsequent lessons learned, what changes the operator has made from those past incident investigations to prevent reoccurrence of incident, and other impacts; and
- identifying and internally reviewing lessons learned from incidents external to the operator at least annually.

Operator’s responses to related survey questions nos. 54-55 indicate limited support regarding the need to address this topic (44% in favor).

This observation arises from a comparison of 49 CFR 193 to Sections 9.3 and 9.4 of API RP 1173. Accordingly, it may perhaps be best addressed through mechanisms to encourage conformance to that RP.

Emergency Planning and Response (including Fire Protection, Personnel Safety, and Security)

Higher-Priority Potential Gaps and Possible Mitigation Strategies

Minimum Frequency to Exercise Emergency Response Notification Mechanism (EPR-26)

There is no apparent requirement in 49 CFR 193.2509(3) “Emergency procedures” that an operator must conduct an exercise of the LNG facility's emergency response notification mechanisms at least once each calendar year and maintain a written record of each notification exercise conducted over the last five years. The notification exercises may be as part of the tabletop and field exercises that involve simulated accidental releases. This observation arises from a comparison of 49 CFR 193 to 40 CFR 68.96(a).

Potential mitigation strategies are to:

- Support inclusion of language in an upcoming edition of NFPA 59A that addresses this potential gap, on the assumption that 49 CFR 193 will be revised to incorporate by reference that edition.
- Consider a revision to 49 CFR 193.

Operator’s responses to related survey questions nos. 62-63 indicate some support regarding the need to address this topic (67% in favor), and with a diverse opinion whether any change should be done via a revision to NFPA 59A, as voluntary practice or as a potential revision to 49 CFR 193. Since this topic arose from a comparison of 40 CFR 68.96, it appears to merit further consideration by PHMSA.

Minimum Frequency to Conduct Field Exercise Involving Simulated Accidental Release of a Regulated Substance (EPR-27)

There is no apparent requirement in §193.2509(3) "Emergency procedures" that an operator must conduct field exercises involving the simulated accidental release of a regulated substance (i.e., toxic substance release or release of a regulated flammable substance involving a fire and/or explosion) in the following manner:

- *Frequency*. As part of coordination with local emergency response officials, the owner or operator shall consult with these officials to establish an appropriate frequency for field exercises.
- *Scope*. Field exercises shall involve tests of the source's emergency response plan, including the deployment of emergency response personnel and equipment. Field exercises should include: Tests of procedures to notify the public and the appropriate Federal, state, and local emergency response agencies about an accidental release; tests of procedures and measures for emergency response actions including evacuations and medical treatment; tests of communications systems; mobilization of facility emergency response personnel, including contractors, as appropriate; coordination with local emergency responders; emergency response equipment deployment; and any other action identified in the emergency response program, as appropriate.

This observation arises primarily from a comparison of 49 CFR 193 to 40 CFR 68.96(b).

Prior to a Final Rule announced by the EPA on Dec. 19, 2019, 40 CFR 68.96(b) required that the owner or operator "consult with these officials to establish an appropriate frequency for field exercises, but at a minimum, shall conduct a field exercise at least once every ten years." In its Dec. 19, 2019, final ruling, EPA revised this requirement since the "requirement for sources to have field exercises at least every ten years is impracticable because the burden it would impose on many local emergency response organizations with multiple RMP-covered facilities and small counties with limited resources – many of whom in rural areas are volunteers."[28] EPA's Final Rule cited 12,542 facilities affected by 40 CFR 68[29], which may be a point of consideration in comparison to the more than 110 LNG facilities in the U.S.[30] when considering the degree of burden potentially placed on local emergency responders.

In comparison, article 7.4.6(b) of CAN/CSA-Z767-17 specifies that a full-scale exercise that engages all relevant internal and external groups occurs at least once every five years or after a significant change is made.

Potential mitigation strategies are to:

- Support inclusion of language in an upcoming edition of NFPA 59A that addresses this potential gap, on the assumption that 49 CFR 193 will be revised to incorporate by reference that edition.
- Consider a revision to 49 CFR 193.

Related survey questions no. 64 was based on the regulatory language in 40 CFR 68.96(b) prior to Dec. 19, 2019, since this project's survey was issued prior to that date.

Operator's responses to related survey questions nos. 64-65 indicate some support regarding the need to address this topic (67% in favor) and with differing opinions whether any change should be made via a revision to NFPA 59A, as voluntary practice or as a potential revision to 49 CFR 193. Since this topic arose from a comparison of 40 CFR 68.96, it appears to merit further consideration by PHMSA.

Minimum Frequency to Conduct Tabletop Exercise Involving Simulated Accidental Release of a Regulated Substance (EPR-28)

There is no apparent requirement in §193.2509(3) "Emergency procedures" that an operator must conduct tabletop exercises of its emergency response procedures involving the simulated accidental release of a flammable, toxic or other regulated substance in the following manner:

- *Frequency.* As part of coordination with local emergency response officials, the owner or operator shall consult with these officials to establish an appropriate frequency for tabletop exercises, and shall conduct a tabletop exercise before December 21, 2026, and at a minimum of at least once every three years thereafter.
- *Scope.* Tabletop exercises shall involve discussions of the source's emergency response plan. The exercise should include discussions of: Procedures to notify the public and the appropriate Federal, state, and local emergency response agencies; procedures and measures for emergency response including evacuations and medical treatment; identification of facility emergency response personnel and/or contractors and their responsibilities; coordination with local emergency responders; procedures for emergency response equipment deployment; and any other action identified in the emergency response plan, as appropriate.

This observation arises from a comparison of 49 CFR 193 to 40 CFR 68.96(b).

Potential mitigation strategies are to:

- Support inclusion of language in an upcoming edition of NFPA 59A that addresses this potential gap, on the assumption that 49 CFR 193 will be revised to incorporate by reference that edition.
- Consider a revision to 49 CFR 193.

Operator's responses to related survey questions nos. 66-67 indicate some support regarding the need to address this topic (67% in favor) and with differing opinions, whether any change should be made via a revision to NFPA 59A, as voluntary practice or as a potential revision to 49 CFR 193. Since this topic arose from a comparison of 40 CFR 68.96, it appears to merit further consideration by PHMSA.

Must Operator Prepare an Evaluation Report after Each Emergency Response Tabletop Exercise or Field Exercise? (EPR-29)

There is no apparent requirement in §193.2509(3) "Emergency procedures" that an operator must prepare an evaluation report within 90 days of each Tabletop or Field exercise of its emergency response procedures involving the simulated accidental release of a flammable, toxic or other regulated substance, with the report to include: a description of the exercise scenario; names and organizations of each participant; an evaluation of the exercise results including lessons learned; recommendations for improvement or revisions to the emergency response exercise program and emergency response program; and a schedule to promptly address and resolve recommendations. This observation arises from a comparison of 49 CFR 193 to 40 CFR 68.96.

Potential mitigation strategies are to:

- Support inclusion of language in the next edition of NFPA 59A that addresses this potential gap, on the assumption that 49 CFR 193 will be revised to incorporate by reference that next edition.
- Consider a revision to 49 CFR 193.

Operator's responses to related survey questions nos. 68-69 indicates relatively strong support to address this topic (78% in favor), and with differing opinions whether any change should be made via a revision to NFPA 59A, as voluntary practice or as a potential revision to 49 CFR 193. Since this topic arose from a comparison of 40 CFR 68.96, it appears to merit further consideration by PHMSA.

Lower-Priority Potential Gaps

No lower-priority potential gaps in this PSM category were specifically identified.

Potential Gaps Substantially Addressed in 2019 Edition of NFPA 59A

Minimum Frequency in Years that Emergency Procedures and Contingency Plans Must be Reviewed (EPR-13)

It was noted that §193.2017(c) requires all plans and procedures to be reviewed and updated at intervals not exceeding 27 months, but at least once every 2 calendar years, or when a component is changed significantly or a new component is installed. In comparison, §18.4.8 of the 2019 edition of NFPA 59A requires that emergency procedures and contingency plans be reviewed annually, and revised as necessary.

This is a potential gap in the sense that a potential future revision of 49 CFR 193 to incorporate by reference the 2019 edition of NFPA 59A would conform the frequency specifically to review emergency procedures and contingency plans to the lower one-year frequency defined in the current version of the NFPA 59A consensus industry standard.

Minimum Time in Months to Install Modified, Expanded or Replaced Fire Protection Systems or Equipment if Required by an Updated Fire Protection Evaluation (EPR-15), and Minimum Time in Months to Install New Fire Protection Systems if Required by an Updated Fire Protection Evaluation (EPR-16)

It was noted that §16.2.1.4 of the 2019 edition of NFPA 59A establishes minimum time periods to install modified, expanded, replaced or new fire protection systems, if required by an updated fire protection evaluation. No similar requirement was identified in 49 CFR 193 or the 2001 edition of NFPA 59A.

This is a potential gap in the sense that a potential future revision of 49 CFR 193 to incorporate by reference the 2019 edition of NFPA 59A would establish the related minimum time periods defined in the current version of the NFPA 59A consensus industry standard.

Must Operators Ensure that a Cybersecurity Vulnerability Assessment is Performed? (EPR-24), and Minimum Frequency in Months to Update Cybersecurity Vulnerability Assessment (EPR-25)

It was noted that §11.7.2 of the 2019 edition of NFPA 59A requires that a cybersecurity vulnerability assessment of the process control systems and safety instrumented systems be conducted and reviewed every 2 years not to exceed 27 months or at intervals determined by the AHJ, and revised as necessary. No similar requirement was identified in 49 CFR 193 or the 2001 edition of NFPA 59A.

This is a potential gap in the sense that a potential future revision of 49 CFR 193 to incorporate by reference the 2019 edition of NFPA 59A would establish requirements for cybersecurity vulnerability assessments, and establish minimum time periods for updates, consistent with the current version of the NFPA 59A consensus industry standard.

Potential Gaps if Compared to a Voluntary Industry Recommended Practice

Emergency Response Procedure Minimum Elements - Scenario Planning Considerations (EPR-2)

There is no apparent requirement in 49 CFR 193.2509 “Emergency procedures” that the types of emergencies other than fires that may reasonably be expected to occur at an LNG plant that the operator must consider and plan for also include pandemic outbreaks.

Operator’s responses to related survey questions nos. 56-57 indicate limited support regarding the need to address this topic (44% in favor), and whether that should be via a revision to NFPA 59A, as voluntary practice or as a potential revision to 49 CFR 193.

Most survey responses were submitted in January and February 2020, and prior to the global outbreak of Covid-19.

This observation arises principally from a comparison of 49 CFR 193 to Section 12.a) of API RP 1173. Accordingly, it may perhaps be best addressed through mechanisms to encourage conformance to that RP. Alternatively, this topic appears to merit review and discussion by the Technical Committee of NFPA 59A or others given the current events related to Covid-19 as well as the 2003 SARS virus.

Emergency Response Procedure Minimum Elements – Emergency Evacuations (EPR-5)

There is no apparent requirement in 49 CFR 193.2509(4) "Emergency procedures" that an operator's cooperation with appropriate local officials in evacuations shall include that operator's emergency procedures must account for all employees after evacuation.

Operator's responses to related survey questions nos. 58-59 indicate differing opinions regarding the need to address this topic (56% in favor).

This observation arises principally from a comparison of 49 CFR 193 to Section 12.a) of API RP 1173. Accordingly, it may perhaps be best addressed through mechanisms to encourage conformance to that RP. Alternatively, this topic probably merits review and discussion by the Technical Committee of NFPA 59A or others.

Emergency Response and Fire Protection Training - Initial Training and Drills (EPR-10)

There is no apparent requirement in 49 CFR 193.2509(3) "Emergency procedures" that an operator's coordination with appropriate local officials in preparation of an emergency evacuation plan shall include that operator must extend an invitation to an external agency or organization to participate in training or drills at least every 24 months not to exceed 27 months.

Operator's responses to related survey questions nos. 60-61 indicate differing opinions regarding the need to address this topic (56% in favor).

This observation arises principally from a comparison of 49 CFR 193 to Section 12.a) of API RP 1173. Accordingly, it may perhaps be best addressed through mechanisms to encourage conformance to that RP. This topic may also merit review and discussion by the Technical Committee of NFPA 59A, or others.

Compliance Audits (including Metrics, Review, and Improvement)

Higher-Priority Potential Gaps and Possible Mitigation Strategies

Must Operators Audit its Compliance to its PSM/Risk Management Processes? and Minimum Frequency in Years that Operator Must Audit its Compliance to PSM/Risk Management Process Requirements, and Qualifications of Audit Team (CA-1, CA-2, CA-3)

There is no apparent requirement in 49 CFR 193 that an operator must certify that it has self-evaluated its compliance with its own procedure to manage its process safety at least every three years in order to verify that, in its opinion, its procedure is adequate and is being followed. Also, the compliance audit is to be conducted by at least one person knowledgeable in the process.

This potential gap is, of course, in the context that 49 CFR 193 does not currently contain a requirement for an operator to have a procedure to implement process safety management. The reader is also referred to gap #OP-11.

This observation arises from a comparison of 49 CFR 193 to 29 CFR 1910.119(o)(1) and 29 CFR 1910.119(o)(2).

Potential mitigation strategies are to:

- Support inclusion of language in an upcoming edition of NFPA 59A that addresses this potential gap, on the assumption that 49 CFR 193 will be revised to incorporate by reference that edition.

- Consider a revision to 49 CFR 193.

Operator's responses to related survey questions nos. 70-71 indicates some support to address this topic (67% in favor) and differing opinions about how it should be addressed (if addressed at all). Since this potential gap arose in part from a comparison to 29 CFR 1910.119, this topic appears to merit further consideration by PHMSA.

Must Audits be Documented?, and Must Operator Have Defined Response Times to Address Audit Findings?, and Must Audit and Management Review Records be Retained? (CA-9, CA-10 and CA-11)

There is no apparent requirement in 49 CFR 193 that an operator's procedure to audit its procedure to manage process safety must include that:

- a report of the findings of the audit shall be developed;
- the operator shall promptly determine and document an appropriate response to each of the findings of the compliance audit and document that deficiencies have been corrected, and
- the operator shall retain the two (2) most recent compliance audit reports.

Similarly, this potential gap is, of course, in the context that 49 CFR 193 does not currently contain a requirement for an operator to have a procedure to implement process safety management. The reader is again referred to gap #OP-11.

This observation arises from a comparison of 49 CFR 193 to 29 CFR 1910.119(o)(3), 29 CFR 1910.119(o)(4), 29 CFR 1910.119(o)(5) and to Sections 10.2.4, 10.2.6, 10.3 and 11.3 of API RP 1173.

Potential mitigation strategies are to:

- Support inclusion of language in an upcoming edition of NFPA 59A that addresses this potential gap that arises directly from comparison to 29 CFR 1910.11, on the assumption that 49 CFR 193 will be revised to incorporate by reference that edition.
- Consider a revision to 49 CFR 193 that addresses the potential gap that arises directly from comparison to 29 CFR 1910.11.
- Establish another mechanism to encourage voluntary conformance to API RP 1173.

Operator's responses to related survey questions nos. 76-77 indicate some support to address this topic (67% in favor) and prefer that this be done either as a revision to NFPA 59A or as a voluntary practice.

This observation arises from a comparison of 49 CFR 193 to 29 CFR 1910.119 and API RP 1173. Since aspects of this potential gap arose in part from a comparison to 29 CFR 1910.119, this topic appears to merit further consideration by PHMSA.

Lower-Priority Potential Gaps

No lower-priority potential gaps in this PSM category were specifically identified.

Potential Gaps Substantially Addressed in 2019 Edition of NFPA 59A

No potential gaps related to this PSM category were identified as being addressed in the 2019 edition of NFPA 59A in a superior manner to the content in the 2001 edition.

Potential Gaps if Compared to a Voluntary Industry Recommended Practice

Must Operator Evaluate Safety Culture in Audit?, and Must Operator Evaluate PSM System Maturity in Audit?, and Must Operator Establish Leading and Lagging Key Performance Indicators to Measure

Performance of PSM Process Maturity?, and Must Operator Establish a Procedure to Identify, Collect and Analyze Data Relevant to its PSM Program Effectiveness? (CA-4, CA-5, CA-7 and CA-8)

There is no apparent requirement in 49 CFR 193 that an operator's self-audit of its compliance to its procedure to manage process safety must include:

- assessing the operator's safety culture; and
- confirming that the procedure includes identifying, collecting, and analyzing data generated from operations and maintenance, integrity management, audits and evaluations, operator's management reviews, and other relevant sources related to the suitability and effectiveness of the operator's procedure to manage process safety; and
- assessing whether leading and lagging key performance indicators (KPIs) have been established and maintained to measure the effectiveness of an operator's procedure to effectively and adequately manage process safety and risk; and
- assessing if a multi-tiered level framework of process KPIs may enhance process safety; and
- assessing whether the expected progress toward effective risk management and improved safety performance is being achieved; and
- evaluating the maturity of the operator's procedure to manage process safety.

Operator's responses to related survey questions nos. 72-73 differing opinions regarding the need to address this topic (56% in favor).

This concept arises principally from a comparison of 49 CFR 193 to Sections 5 and 11 of API RP 1173 although significantly-related content is also contained for example in CAN/CSA-Z767-17 *Process Safety Management* (e.g. Section 8.4.1 requires leading and lagging KPIs), UK HSE *Developing Process Safety Indicators,* IOGP *Process Safety – Recommended Practice on Key Performance Indicators,* and AIChE CCPS *Guidelines for Risk Based Process Safety* and *Guidelines for Implementing Process Safety Management*. Accordingly, it may perhaps be best addressed through mechanisms to encourage conformance to API RP 1173.

Must Operator Establish and Maintain Reporting and Feedback Structure? (CA-6)

There is no apparent requirement in 49 CFR 193 that an operator's self-audit of its compliance to its procedure to manage process safety must include:

- assessing if a reporting and feedback process for employees and contractors has been established and maintained, including consideration of the benefits and drawbacks of an anonymous reporting system; and
- assessing if reporting and feedback are being monitored to identify new and emerging risks to consider in the risk evaluation and risk mitigation aspects of the operator's procedure.

Operator's responses to related survey questions nos. 74-75 indicate differing opinions regarding the need to address this topic (56% in favor).

This concept arises principally from a comparison of 49 CFR 193 to Sections 5 and 11 of API RP 1173. Accordingly, it may perhaps be best addressed through mechanisms to encourage conformance to that RP.

Trade Secrets

Higher-Priority Potential Gaps and Possible Mitigation Strategies

No higher-priority potential gaps in this PSM category were specifically identified.

Lower-Priority Potential Gaps

Availability of Trade Secrets to Inform PSM Processes (TS-1)

There is no apparent requirement in 49 CFR 193 that an operator's procedure to manage process safety must require an operator to make its trade secret information available to those persons responsible for compiling information related to process safety information, those assisting in the development of the process hazard analysis, those responsible for developing operating procedures, and those involved in incident investigations, emergency planning and response, and compliance audits, without regard to possible trade secret status of such information. If necessary, the trade secret information can be made available under a confidentiality agreement.

This observation arises from a comparison of 49 CFR 193 to 29 CFR 1910.119(p).

In general, the potential gap TS-1 is not considered as relevant to LNG facility operations as it is to other chemical operations, e.g., to make a commercial product such as *Coca-Cola®* or a proprietary chemical formulation.

Operator’s responses to related survey questions nos. 78-79 indicates that 56% do not see a need to address this topic (44% in favor), which supports the comment above that, in general, this appears to a lower-priority potential gap. Nevertheless, since this potential gap arose in part from a comparison to 29 CFR 1910.119, this topic appears to merit further consideration by PHMSA.

Potential Gaps Substantially Addressed in 2019 Edition of NFPA 59A

No potential gaps related to this PSM category were identified as being addressed in the 2019 edition of NFPA 59A in a superior manner to the content in the 2001 edition.

Potential Gaps if Compared to a Voluntary Industry Recommended Practice

No potential gaps related to this PSM category were identified as arising from a comparison of 49 CFR 193 to voluntary industry recommended practices such as principally API RP 1173.

Summary, Recommendations and Impact

Summary

The project results summarized below are listed in the approximate order represented in the order of "yes" responses to survey questions shown in Figure 4 (i.e. those potential gaps that should be addressed voluntary action or through revision to NFPA 59A or 49 CFR 193) and on the basis defined above for higher vs. lower priority. Figure 4 shows that the majority of operators surveyed (i.e. five or more) thought all but four of the gaps surveyed should be addressed either by voluntary action or through revision to NFPA 59A or 49 CFR 193.

More specific to potential regulatory or standards revisions, Table 3 adds the titles to the topics (shown on Figure 5) for which the majority of operators surveyed thought should be addressed by either revising NFPA 59A or 49 CFR 193. For simplicity, the topics are listed in categories.

Table 3 Potential PSM Gaps for which Majority of Operators Responded to Address with Revision to 49 CFR 193 or NFPA 59A

No.	Topic
MI-11	Frequency in Months to Inspect and Test - Relief Valves in Control Systems other than on Stationary LNG Tanks
MI-12	Frequency in Months to Inspect and Test - Relief Valves other than in Control Systems or on Stationary LNG Tanks
MI-10	Frequency in Months to Inspect and Test - Stationary LNG Tank Relief Valves
MI-9	Frequency in Months to Inspect and Test - Control systems intended for fire protection
MI-8	Frequency in Months to Inspect and Test - Control systems used seasonally, such as for liquefaction or vaporization
MI-1 and MI-4	Definition of Process Equipment to Have Required Mechanical Integrity, and Method to Inspect and Test - Process Equipment
PHA-3 and PHA-4	Methodology to Conduct PHA, and Overall Content of PHA
PHA-5	Qualifications of Team that Conducts PHA
PHA-10	Minimum Frequency in Years to Update Process Hazard Analysis
PSI-1, PSI-2, PSI-3, and PSI-4	Required Process Safety Information Content for Operator to Maintain
MOC-1 and MOC-2	Is a Management of Change Procedure Required?, and Considerations and Content in MOC Procedures
EPR-26	Minimum Frequency in Years to Exercise Emergency Response Notification Mechanism
EPR-27	Minimum Frequency in Years to Conduct Field Exercise Involving Simulated Accidental Release of a Regulated Substance
EPR-28	Minimum Frequency in Years to Conduct Tabletop Exercises Involving Simulated Accidental Release of a Regulated Substance
CON-5	Operator Responsibilities - Evaluate Performance of Designer, Fabricator and Constructor with respect to PSM Requirements
EP-1 and EP-2	Must Operator have a Written Plan of Action to Implement Employee Participation in Process Safety Management Requirements? And Operator's Engagement with Employees and Other Internal Stakeholders

Notable Areas of Differences and Potential Gaps Between 49 CFR 193 (including 2001 edition of NFPA 59A) and Voluntary Standard 29 CFR 1910.119

Some of the more notable differences and potential gaps between 49 CFR 193 and 29 CFR 1910.119 appeared to be in the following PSM categories, and are summarized for completeness. For context regarding these differences, the reader is reminded that 49 CFR 193 (with 2001 edition of NFPA 59A incorporated by reference) contains numerous detailed requirements for LNG facilities related to primary and secondary containment, separation distances, safeguard systems and other process safety aspects that do not appear for other facilities in 29 CFR 1910.119, and also that OSHA's December 9, 1998 interpretation concluded that "that current OPS regulations address the hazards of fire and explosion in the gas distribution and transmission process".

Mechanical Integrity (MI-1 through MI-38)

An important topic addressed in this analysis is the significant difference or "gap" in how 49 CFR 193 and 29 CFR 1910.119 specify their methodologies to inspect, test, or survey specific equipment items in order to maintain mechanical integrity. In summary:

- 29 CFR 1910.119(j)(4)(ii) and 29 CFR 1910.119(j)(4)(iii) specifies that procedures for inspection and tests performed on process equipment must follow Recognized And Generally Accepted Good Engineering Practices (RAGAGEP). Also, 29 CFR 1910.119(d)(3)(ii) requires employers to document that equipment in OSHA PSM-covered processes comply with RAGAGEP. OSHA has provided detailed clarifications regarding the definition and application of RAGAGEP, specifically as it applies to Process Safety Management.
- 49 CFR 193.2605(a) "Maintenance procedures" also specifies a RAGAGEP approach for maintenance procedures in general. However, 49 CFR 193 also specifies prescriptive inspection and test frequencies and requirements for many particular LNG facility components or classes of components. For example:
    - 38 specific elements related to Mechanical Integrity in PSM were evaluated in the Gap Analysis Matrix Table
    - 25 test or maintenance equipment frequencies are listed in survey question #80
- The methodology to inspect, test, or maintain specific equipment items has been an ongoing discussion topic by LNG facility operators. For example, INGAA and AGA submitted a formal request to PHMSA entitled "Joint Petition for Rulemaking on Pressure Relief Device (PRD) Testing Requirements" on May 10, 2018.

Key findings from this analysis are summarized in these survey responses from LNG facility operators indicate:

- There was unanimous support from operators for 49 CFR 193 to allow an increased use of a RAGAGEP basis for establishing and implementing mechanical integrity programs, in response to the related overarching survey question nos. 2-3. See Figure 2.
- There was also very strong support from operators for this when the same question was posed in a different manner for numerous individual components in survey question no. 80. See Figure 9.
- A key point is that a significant fraction of facility operators (33% of survey recipients) do not want prescriptive requirements to be completely replaced with RAGAGEP-based language in a potential revision to 49 CFR 193. Feedback from operators (either informally or as comments noted in the survey results) indicates that reasons to retain an option to conform to prescriptive requirements while additionally allowing RAGAGEP-based conformance can include simplicity

and to avoid potential inconsistent or conflicting interpretations in regulatory oversight. See Figure 2 and Figure 9.

While this topic pertains to a wide variety of equipment components, the three specific components listed below appear to be of high interest to LNG facility operators as illustrations of the reasons for considering including RAGAGEP-based language in a potential revision to 49 CFR 193:

- Frequency to Inspect and Test - Stationary LNG Tank Relief Valves (MI-10)
- Frequency to Inspect and Test - Relief Valves in Control Systems other than on Stationary LNG Tanks (MI-11)
- Frequency to Inspect and Test - Relief Valves other than in Control Systems or on Stationary LNG Tanks (MI-12)

A second general topic noted in this analysis was a difference or “gap” in how 49 CFR 193 and 29 CFR 1910.119 identify the specific types of process equipment for which mechanical integrity must be maintained. PHMSA may want to consider if the definition of “component” in 49 CFR 193 could be refined to more specifically include “process equipment” such as OSHA’s definition in 29 CFR 1910.119(j)(i).

Two additional potential gaps were identified for PHMSA’s consideration but appeared to be of lower priority: 1) to clarify if the requirements in 49 CFR 193.2619(c) apply only to peak-shaving or other non-base-load facility operations, and 2) if in a revision to 49 CFR 193 the minimum frequency to periodically conduct an LNG tank bottom survey should be specified if §4.1.7.5 of the 2001 edition of NFPA 59A is no longer incorporated by reference.

Process Hazard Analyses (PHA-1, PHA-2, PHA-3, PHA-4, PHA-5, PHA-6, PHA-10, PHA-11)

49 CFR 193 specifies many prescriptive requirements for equipment inspection, testing and maintenance that are specific to LNG facilities containing flammable products in the cryogenic form in order to reduce hazards and protect public safety, and which have helped yield an excellent safety record overall for the U.S. LNG industry. 49 CFR 193.2509 and §11.3.3 of the 2001 edition of NFPA 59A requires operators to anticipate both controllable and uncontrollable emergencies and develop emergency response procedures to address with an effective emergency response. In addition, hazards and risks are addressed in prescriptive facility siting requirements such as equipment spacing, vapor concentration and thermal flux at the property line, and many other hazard prevention requirements are directly defined or incorporated by reference. Some examples of the detailed prescriptive requirements contained in 49 CFR 193 are listed in Figure 9.

In comparison, 29 CFR 1910.119 is a performance-based standard that covers a large spectrum of chemical facilities nationwide (e.g. petroleum refineries, petroleum terminals, natural gas extraction facilities, ammonia refrigeration, explosive and pyrotechnic manufacturing and chemical manufacturing) and includes requirements for PHAs as part of its regulations to establish effective safety management systems - while providing far fewer detailed prescriptive requirements.

Requirements related to PHAs that are reflected in 29 CFR 1910.119 but do not appear to be specified in 49 CFR 193 include:

- that a PHA be performed, as per 29 CFR 1910.119(e)(1)
- the methodologies to perform a PHA and required content, as per 29 CFR 1910.119(e)(2) and 29 CFR 1910.119(e)(3)
- the team composition and expertise required to perform a PHA, as per 29 CFR 1910.119(e)(4)

- requirements on an operator to establish a system to promptly address a team's findings and recommendations regarding a PHA, as per 29 CFR 1910.119(e)(5)
- the minimum frequency to update and revalidate a PHA, as per 29 CFR 1910.119(e)(6)
- the minimum period to retain PHA records, as per 29 CFR 1910.119(e)(7)

It was noted that:

- The 2019 edition of NFPA 59A requires a PHA to be completed prior to initial operation, so if PHMSA were to revise 49 CFR 193 to incorporate that edition by reference then that potential gaps PHA-1 and PHA-2 with 29 CFR 1910.119(e)(1) would be eliminated
- Applications to FERC for authorization to construct, operate or modify a FERC-regulated LNG facility under 18 CFR 153.8 and 18 CFR 380.12(o) include the requirement to submit Resource Report 13, which contains a requirement for a PHA to be performed
- Sections 7.1, 7.3, and 7.4 of API RP 1173 also address effective risk management through an operator's voluntary practices

There are of course important confidentiality and security considerations relevant to PHAs created for LNG facilities since they are critical energy infrastructure - - should portions of the PHA content appear in the public domain. Therefore, it is recommended that confidentiality and security issues be given significant consideration in any future regulatory promulgation related to PHAs or other risk assessments. The project team's analysis noted some key relevant comments from the EPA in this regard, in the EPA's December 19, 2019 RMP Reconsideration Final Rule.

Survey responses from LNG facility operators regarding a potential course of action differed on each of the above topics, in part since PHAs are not currently required in 49 CFR 193 or NFPA 59A (2001). The details of the survey responses are provided in Appendix D and Figures 3-8.

Process Safety Information (PSI-1, PSI-2, PSI-3, and PSI-4)

"Process Safety Information" is a defined term in 29 CFR 1910.119 but is not a defined term in 49 CFR 193 or in NFPA 59A (2001 or 2019). Therefore, 49 CFR 193 does not contain requirements comparable to 29 CFR 1910.119(d). However, 49 CFR 193 requires an operator to compile and make available information related to process safety as prescribed in 49 CFR 193.2713(a)(1) through its procedures to train permanent maintenance, operating, and supervisory personnel. Additional related requirements on LNG facility operators include the requirements of 29 CFR 1910.1200, and specifically the requirements to provide safety data sheets that meet the requirements of 29 CFR 1910.1200(g).

It was noted that:

- Appendix §A.3.3.9 of the 2019 edition of NFPA 59A summarizes recommended facility documentation, but is informational and not enforceable.
- Applications to FERC for authorization to construct, operate or modify a FERC-regulated LNG facility under 18 CFR 153.8 and 18 CFR 380.12(o) include the requirement to submit Resource Report 13, which contains process safety information.

Operator's responses to related survey questions nos. 8-9 indicate relatively strong support to address this topic, but opinions differed about whether this should be done by regulation, standards updates, or voluntary practice. Options to address this topic could include, for example, including a defined category of "Process Safety Information" in 49 CFR 193, or incorporating by reference a future edition of NFPA 59A that has moved related content from Appendix §A.3.3.9 into an appropriate chapter in order to establish enforceability.

Incident Investigation (II-1, II-2, II-3, II-6, II-7, II-8)

Requirements to investigate incidents at LNG facilities are specifically identified in 49 CFR 193.2515, and relevant requirements include reporting safety-related conditions as specified in 49 CFR 191.23.

But requirements related to incident investigations in 29 CFR 1910.119 that do not appear to be contained in 49 CFR 193 include:

- that an operator investigate each incident which resulted in or could reasonably have resulted in a catastrophic release of a highly hazardous chemical in the workplace, as per 29 CFR 1910.119(m)(1)
- that an operator's incident investigation team have certain qualifications and composition, as per 29 CFR 1910.119(m)(3)
- that an incident report be prepared and contain certain elements, as per 29 CFR 1910.119(m)(4)
- that an operator establish a system to promptly address and resolve the incident report findings and recommendations, and that resolutions and corrective actions shall be documented, as per 29 CFR 1910.119(m)(5)
- that the report be reviewed with all affected personnel whose job tasks are relevant to the incident findings including contract employees where applicable, as per 29 CFR 1910.119(m)(6)
- that incident reports be retained for a certain minimum period of time, as per 29 CFR 1910.119(m)(7)

It was also noted that the EPA, in its Dec. 19, 2019, RMP Reconsideration Final Ruling, rescinded its 2017 requirement to consider “near miss” events in Program 2 and 3 incident investigations.

Survey responses from LNG facility operators regarding a potential course of action differed on each of the above topics. The details of the survey responses are provided in the body of this report.

Management of Change (MOC-1 and MOC-2)

Management of Change (MOC) is one of OSHA’s 14 PSM elements in 29 CFR 1910.119. OSHA’s requirements related to MOC are contained in 29 CFR 1910.119(l).

MOC is also one of the 20 elements in the CCPS RBPS management system, in its set of foundational pillars to manage risk.

In addition, Section 8.3 of API RP 1173 entitled “Management of Change” recommends that pipeline operators maintain a procedure for MOC.

FERC-regulated LNG facilities for which an application for authorization to construct, operate or modify is submitted (e.g., proposed new construction or substantial modification) are required by 18 CFR 153.8 and 18 CFR 380.12 to submit an environmental report, which must include the submission of a MOC procedure. In addition, MOC procedures and sample forms for changes after the operation of the project has commenced must be provided.

In contrast, “Management of Change” is not a defined term in either 49 CFR 193 or NFPA 59A (2001 or 2019 editions), although they contain substantial requirements to keep procedures and records up to date after changes are made. The 2019 edition of NFPA 59A incorporated new content in Section 4.6 entitled “Engineering Review of Changes,” but that content may not fully reflect the requirements in OSHA 29 CFR 1910.119(l).

Survey responses from LNG facility operators indicate relatively strong support (78% in favor) to address this topic, and most would prefer that this be done as a revision to NFPA 59A.

Emergency Planning and Response (EPR-26, EPR-27, EPR-28 and EPR-29)

No significant potential gaps related to emergency planning and response procedures were identified when 49 CFR 193 including NFPA 59A 2001 edition was compared to 29 CFR 1910.119. But members of the project TAP highlighted that the emergency planning and response procedures contained in 40 CFR 68 (EPA RMP) were especially relevant to consider since similar language is not contained in 29 CFR 1910.119. Requirements related to emergency planning and response in 40 CFR 68 that do not appear to be contained in 49 CFR 193 include:

- that an operator must conduct an exercise of the LNG facility's emergency response notification mechanisms at least once each calendar year and maintain a written record of each notification exercise conducted over the last five years, as per 40 CFR 68.96(a),
- that an operator must conduct field exercises involving the simulated accidental release of a regulated substance in the manner described in 40 CFR 68.96(b)
- that an operator must conduct tabletop exercises of its emergency response procedures involving the simulated accidental release of a flammable, toxic or other regulated substance in the manner described in 40 CFR 68.96(b)
- that an operator must prepare an evaluation report within 90 days of each tabletop or field exercise of its emergency response procedures

Operator's responses to related survey questions indicate some support regarding the need to address this topic but with differing opinions whether any change should be made via a revision to NFPA 59A, as voluntary practice, or as a potential revision to 49 CFR 193.

Pre-Startup Safety Review (PSSR-1)

"Pre-Startup Safety Review" is a defined term in 29 CFR 1910.119 but is not a defined term in 49 CFR 193 or in NFPA 59A (2001 or 2019). Therefore, 49 CFR 193 does not contain requirements comparable to 29 CFR 1910.119(i). However, 49 CFR 193 requires inspections and tests before any component is placed in service, and plans and procedures must be updated when a component is changed significantly, or a new component is installed and at intervals not exceeding 27 months, but at least once every 2 calendar years.

Opinions of the project TAP members sometimes differed regarding the degree to which the current requirements in 49 CFR 193 meet the intent of the PSSR requirements in 29 CFR 1910.119(e), and therefore the degree and priority (higher vs. lower) of addressing this potential gap. PHMSA could consider establishing "Pre-Startup Safety Review" as a defined term in a future revision to 49 CFR 193, or alternatively clarifying the scope of requirements for "Commissioning" (such as in §18.7 of the 2019 edition of NFPA 59A, if a future revision of 49 CFR 193 incorporates by reference the 2019 edition of NFPA 59A).

Beyond the issue of potentially formalizing more defined requirements for a Commissioning or PSSR, there also appears to be an opportunity to clarify when Commissioning or PSSR requirements should apply to situations beyond initial startup; for example, such as perhaps when facilities that have been substantially modified or out of service for an extended period of time (using well-defined terminology).

Contractors (CON-5 and CON-7)

There is no apparent requirement in 49 CFR 193 that an operator must periodically evaluate the safety performance of personnel utilized for construction, installation, inspection, testing, operations, or maintenance. In other words, requirements comparable to 29 CFR 1910.119(h)(3)(iv).

Also, there are no apparent requirements in 49 CFR 193 that an operator must receive or maintain an injury and illness log related to work done while at the operator's facility by designers, fabricators, installers, inspectors, constructors, or those performing testing. In other words, requirements comparable to 29 CFR 1910.119(h)(2)(vi).

Survey responses from LNG facility operators regarding a potential course of action differed on each of the above topics. The details of the survey responses are provided in the body of this report.

Operating Procedures, Employee Participation, and Compliance Audits Pertaining Specifically to PSM (EP-1, EP-2, CA-1, CA-2, CA-3, CA-9, CA-10 and CA-11)

Since PSM is not directly called out or defined either in 49 CFR 193 or in NFPA (2001 or 2019) as either a principle or management practice, there is, of course, no apparent requirement in 49 CFR 193 that:

- An operator's procedures must include a procedure to manage its process safety. While this potential gap arises in part from a comparison to voluntary standard API RP 1173, it, of course, also arises in part from the fact that a non-LNG process facility of comparable size would need to conform to the procedures and requirements of 29 CFR 1910.119.
- An operator must consult with its employees and their representatives on the conduct and development of PHAs and other elements of PSM, and provide PHAs and other information that is relevant to PSM. In other words, requirements comparable to 29 CFR 1910.119(c).
- An operator must certify that it has self-evaluated its compliance with its own procedure to manage its process safety at least every three years, in order to verify that, in its opinion, its procedure is adequate and is being followed. Also, the compliance audit is to be conducted by at least one person knowledgeable in the process. In other words, requirements comparable to 29 CFR 1910.119(o)(1) and 29 CFR 1910.119(o)(2).
- An operator's procedures must include a practice to periodically audit its procedure to manage process safety which must include: a report of the findings of the audit shall be developed; the operator shall promptly determine and document an appropriate response to each of the findings of the compliance audit, and document that deficiencies have been corrected; and the operator shall retain the two (2) most recent compliance audit reports. In other words, requirements comparable to 29 CFR 1910.119(o)(3), 29 CFR 1910.119(o)(4), 29 CFR 1910.119(o)(5).

Survey responses from LNG facility operators regarding a potential course of action differed on each of the above topics. Those details are provided in the body of this report. Potential paths forward will, of course, differ if a future revision to 49 CFR 193, or perhaps NFPA 59A, establishes "Process Safety Management" as a defined term.

As noted in the introduction to this report, voluntary adoption by operators to the recommended PSMS principles and processes laid out in API RP 1173 continues to build and take effect.

Limited Potential Gaps Between 49 CFR 193 (including 2001 edition of NFPA 59A) and Voluntary Standard 29 CFR 1910.119

Trade Secrets

No potential gaps related to trade secrets were deemed significant in this project's comparison of 49 CFR 193 to 29 CFR 1910.119. Requirements such as 29 CFR 1910.119(p) would impose requirements on LNG facility operators to make trade secret information available, but this was deemed of limited relevancy to LNG facilities.

Training

No potential gaps related to training were deemed significant in this project's comparison of 49 CFR 193 to 29 CFR 1910.119.

Potential Gaps Addressed if 49 CFR 193 Incorporates by Reference the 2019 Edition of NFPA 59A

Mechanical Integrity (MI-7, MI-9, MI-18, MI-20, MI-22, MI-27, MI-34)

It was noted that six potential gaps related to Mechanical Integrity that were observed when 49 CFR 193 was compared to 29 CFR 1910.119 or the current (2019) consensus edition of NFPA 59A would apparently be substantially addressed if a revision of 49 CFR 193 incorporates by reference the 2019 edition of NFPA 59A.

Emergency Planning and Response (EPR-13, EPR-15, EPR-16, EPR-24, EPR-25)

It was noted that five potential gaps related to Emergency Planning and Response that were observed when 49 CFR 193 was compared to 29 CFR 1910.119 or the current (2019) consensus edition of NFPA 59A would apparently be substantially addressed if a revision of 49 CFR 193 incorporates by reference the 2019 edition of NFPA 59A.

Hot Work Permit (HWP-1)

Hot Work Permit is one of OSHA's 14 PSM elements. OSHA's related requirements appear in 29 CFR 1910.119(k). In contrast, there is no specific requirement pertaining to the use of Hot Work Permits by that name in the 2001 edition of NFPA 59A or in 49 CFR 193, although there are operating procedures required to ensure safety to persons and property general safety while repairs are carried out, whether or not the equipment is in operation.

It was noted that this potential gap would apparently be substantially addressed if a revision of 49 CFR 193 incorporates by reference the 2019 edition of NFPA 59A, since §4.11.2 and §8.4.8.2.6 of the 2019 edition of NFPA 59A impose limitations on hot work and specifies conformance to NFPA 51B *Standard for Fire Prevention During Welding, Cutting, and Other Hot Work.*

Some Notable Areas Where Other Voluntary Practices Can Further Support PSM for LNG Facilities

Employee Participation - - as Expressed through Operator's Management Leadership Commitment, and Engagement with External Stakeholders (EP-3 and EP-4)

Broadly speaking, there is a general consensus that commitment and involvement of an organization's senior management, and engagement with the external community stakeholders, are keys to successful PSM programs. This observation is drawn from voluntary standards such as API RP 1173, but reinforced in many other leading PSM references.

Compliance Audits Pertaining Specifically to PSM (CA-4, CA-5, CA-6, CA-7, and CA-8)

Numerous PSM voluntary standards and recommended practice stress the need for measurement of PSM program performance and status, reporting and feedback, and continuous improvement. This includes regular self-audits of topics such as: safety culture; collection of useful and representative data; using effective leading and lagging Key Performance Indicators; evaluating program maturity; and other factors. This observation is drawn from voluntary standards such as: API RP 1173; AIChE CCPS RBPS; CAN/CSA-Z767-17; UK HSE *Developing Process Safety Indicators;* and IOGP *Process Safety – Recommended Practice on Key Performance Indicators*.

Emergency Planning and Response (EPR-2, EPR-5, and EPR-10)

Items that do not appear to be addressed in 49 CFR 193 but were noted as recommended voluntary practice included to: consider pandemic outbreaks in emergency planning processes; account for all employees after evacuation; and extend an invitation to an external agency or organization to participate in training or drills at least every 2 calendar years, not to exceed 27 months. This observation is drawn from voluntary standards such as Section 12.a of API RP 1173.

Operating Procedures (OP-14)

An operator's operating plans and procedures can benefit from considering human factors and the role of people in facility operation and their support of safety-critical system. This observation is drawn from voluntary standards such as IOGP Report No. 460 *Cognitive Issues Associated with Process Safety and Environmental Issues*.

Incident Investigations - - Specifically Learning from Operator's Past Incidents, and External Events (II-9 and II-10)

It may be beneficial for operators to have a formal process to review and reassess after five years any incidents that were reportable under 49 CFR 191.15, to identify any subsequent lessons learned, what changes the operator has made from those past incident investigations, and other impacts. A related process to identify and internally review lessons learned from incidents external to the operator at least annually may also be beneficial. This observation is drawn from voluntary standards such as API RP 1173.

Contractors (CON-8)

It may be beneficial for operators to have a formal process to receive "lessons learned" suggestions and recommendations that are voluntarily provided from designers, fabricators, inspectors, constructors or those performing testing that pertain to potential improvements in process safety at the operator's facility, and for an operator to review and assess any appropriate course of action. This observation is drawn from voluntary standards such as Sections 9.3 and 9.4 of API RP 1173.

Recommendations

Recommendations to enhance safety management system aspects in 49 CFR 193 are:

- Consider incorporating the 2019 edition of NFPA 59A by reference in 49 CFR 193, which would address some of the potential gaps identified in this analysis
- Consider incorporating in 49 CFR 193 an increased allowance for operators to use a RAGAGEP basis for equipment inspection, testing and maintenance related to ensuring mechanical integrity, *while retaining* the current prescriptive requirements as alternative means of compliance. Allowing increased optional use of a RAGAGEP basis to perform mechanical integrity would appear to be:
    - consistent with 29 CFR 1910.119
    - consistent with 49 CFR 193 in the sense that 49 CFR 193.2605(a) “Maintenance procedures” specifies a RAGAGEP basis for those components for which no prescriptive requirements are otherwise provided in 49 CFR 193
    - consistent with revisions to the relevant industry consensus standard NFPA 59A, such as the change in the 2019 edition to revise inspection interval requirements as now specified in §18.10.10.7.

An increased RAGAGEP allowance should include well-defined bases for acceptance of various components, in order to establish consistent test intervals and eliminate potential confusion for regulators and LNG operators; for example, referencing a recognized standard such as API RP 576 *Inspection of Pressure-Relieving Devices* for frequency of testing some components such as referenced by Section 18.10.10.7.2 of NFPA 59A (2019 edition).

If a broader incorporation of a RAGAGEP basis to perform mechanical integrity is not to be considered, then recommend considering the optional allowance of a RAGAGEP basis for specific components such as the:

- Stationary LNG Tank Relief Valves (MI-10)
- Relief Valves in Control Systems other than on Stationary LNG Tanks (MI-11)
- Relief Valves other than in Control Systems or on Stationary LNG Tanks (MI-12)

Recommendations to enhance safety management system aspects in either 49 CFR 193 or in future revisions to NFPA 59A are:

- Consider establishing potential expanded requirements related to PHAs, which may include methodologies to perform a PHA and required content, the minimum frequency to update and revalidate a PHA, the team composition and expertise required to perform a PHA, and requirements on an operator to establish a system to promptly address a team's findings and recommendations regarding a PHA;
- Consider establishing "Process Safety Information" as a defined category in 49 CFR 193, or supporting consensus efforts to move related content from Appendix §A.3.3.9 of the 2019 edition NFPA 59A into an appropriate chapter in order to establish enforceability;
- Consider establishing potential expanded requirements related to incident investigations beyond PHMSA's current reporting requirements, which may include qualifications and composition of an incident investigation teams, minimum contents in incident investigation reports, addressing report findings and recommendations, and document retention;
- Consider establishing "Management of Change" as a defined term and establishing requirements, or proposing that a future edition of NFPA 59A revise Section 4.6 of the 2019 edition from "Engineering Review of Changes" to "Management of Change" ", and consider potential additional requirements in that section related to management of change;
- Consider potential expanded requirements related to expanded emergency planning and response requirements, such as periodic tabletop exercises, field exercises, and emergency response notification tests;
- Consider establishing additional requirements related to commissioning referenced in §18.7 of NFPA 59A or to a newly-established PSSR requirement. Also, consider clarifying when commissioning or PSSR requirements should apply to situations beyond initial startup - - such as when facilities that have been substantially modified or out of service for extended periods of time (using well-defined terminology);
- Consider establishing if the operator's procedures must include a procedure to manage its own process safety and the potential minimum content of that procedure, which may include requirements to periodically self-evaluate its compliance to its procedure, self-audit its procedure to manage process safety, document its efforts to correct deficiencies identified in past audits, and the minimum number of compliance audit reports to retain;
- Consider other topics listed in the body of this report.

The above recommendations for consideration arise from comparing 49 CFR 193 with the 2001 edition of NFPA 59A to 29 CFR 1910.119 (and to 40 CFR 68 for a few topics). The body of this report provides additional information regarding the differing approaches of the two primary regulations, to aid context as potential revisions to NFPA 59A or 49 CFR 193 may be considered.

Of the above, the specific gaps that the majority of operators thought should be addressed by either revising 49 CFR 193 or NFPA 59A are shown in Table 3, which is derived from Figure 5.

Impact from the Research Results

The results from this research project helped directly inform and strengthen the development of consensus industry standards, and provided information for decision-makers highly pertinent to the formation of proposed rulemaking for 49 CFR 193 related to PSM.

During this project, significant developments that occurred related to PSM included a series of explosions in buildings in Merrimack Valley, MA on Sept. 13, 2018 due to excessive pressure in natural gas delivery lines. Calls for more rigorous adoption of API RP 1173 subsequently took place, such as U.S. Senate Bill 1097 introduced on April 9, 2019 entitled "Leonel Rondon Pipeline Safety Act" which would require operators of gas distribution pipelines "to develop and implement a pipeline safety management systems framework in accordance with API RP 1173".[31]

Two very direct impacts from this research project are summarized below.

Supporting PHMSA's Development of Proposed Rulemaking for 49 CFR 193

PHMSA established this research project effective August 1, 2018 - - more than eight months prior to President Trump's Executive Order dated April 10, 2019.

While PSM topics are, of course, only one aspect of PHMSA's pending notice of proposed rulemaking related to 49 CFR 193, this project provided input into considering revisions to the PSM aspects. A comprehensive first draft of this project's PSM Gap Analysis Matrix Table was provided to PHMSA on January 31, 2019 - - more than two months before the President's Executive Order on April 10, 2019. A final draft of this project's PSM Gap Analysis Matrix Table was provided to PHMSA on June 25, 2019. Additional small refinements were later provided to PHMSA as the industry survey was being prepared.

Having established a long-standing active program of conducting Pipeline Safety Research & Development Forums, and then taking action on the outcomes of the Forums, PHMSA had through this project identified a number of findings related to potential PSM gaps in 49 CFR 193 to help inform its process to develop rulemaking for 49 CFR 193.

Supporting Potential Revisions in the 2022 and Future Editions of NFPA 59A

Draft results from this project were available to help inform potential revisions to the 2022 edition of NFPA, and hopefully, further, align this prevailing industry standard which 49 CFR 193 incorporates by reference with other current PSM-related best practices. Several members of the project TAP or team participate on the *Technical Committee on Liquefied Natural Gas* for NFPA 59A either as an official member, alternate member or in another supporting role, including for example Kevin Ritz, Sue Stritter, Anthony Scaraggi, Filippo Gavelli, and Phil Suter. In addition, FERC and PHMSA staff are members of that Technical Committee, and those agencies were represented on this project's TAP. Through this participation, advance input was available to support discussions regarding revisions to the 2022 edition.

Results of this analysis can also support consensus-building discussions regarding proposed revisions to future editions of NFPA 59A beyond the 2022 edition.

Appendix A: Acronyms

Acronym	Description
AGA	American Gas Association
AIChE	American Institute of Chemical Engineers
AOPL	Association of Oil Pipe Lines
APGA	American Public Gas Association
API	American Petroleum Institute
CA	Compliance Audits
CCPS	Center for Chemical Process Safety
CEPA	Canadian Energy Pipeline Association
CFR	Code of Federal Regulation
CON	Contractors
CSA	CSA Group, formerly the Canadian Standards Association
CSChE	Canadian Society for Chemical Engineering
DOT	Department of Transportation
EP	Employee Participation
EPA	Environmental Protection Agency
EPR	Emergency Planning and Response
FERC	Federal Energy Regulatory Commission
GTI	Gas Technology Institute
HWP	Hot Work Permit
II	Incident Investigation
INGAA	Interstate Natural Gas Association of America
IOGP	International Association of Oil and Gas Producers (earlier acronym: OGP)
ISO	International Organization for Standardization
MI	Mechanical Integrity
MOC	Management of Change
NFPA	National Fire Protection Association
NTSB	National Transportation Safety Board
OP	Operating Procedures
OPS	Office of Pipeline Safety
OSHA	Occupational Safety and Health Administration
PHA	Process Hazard Analysis
PHMSA	Pipeline and Hazardous Material Safety Administration
PSI	Process Safety Information
PSM	Process Safety Management
PSMS	Pipeline Safety Management Systems
PSSR	Pre-Startup Safety Review
RAGAGEP	Recognized And Generally Accepted Good Engineering Practices
RBPS	Risk-Based Process Safety
RP	Recommended Practice
SMS	Safety Management Systems
TS	Trade Secrets
UK HSE	United Kingdom Health and Safety Executive

Appendix B: Gap Analysis Matrix Table

The detailed gap analysis matrix table results developed in this project is separately attached below.

Group#	Item #	PSM Subcategory Topic	Requirements of 29 CFR 1910.119 (Actual Text, or [Summary*]+Actual Text) [*Summary sometimes included to assist comparisons to other references.]	Requirements of 49 CFR 193 (Actual Text, or [Summary*]+Actual Text) [*Summary sometimes included to assist comparisons to other references.]	Requirements of NFPA 59A 2001 [Summary]	Requirements of NFPA 59A 2019 [Summary]	Requirements of API RP 1173 (2015) [Summary]	Other related requirements (Actual Text, or [Summary*]+Actual Text)	Potential Gaps in Current 49 CFR 193 (referencing 2001 edition of NFPA 59A, plus 2006 edition for §193.2101(b) and 193.2321(b))	Potential Gaps in a Future Revision to 49 CFR 193 if it incorporates 2019 edition of NFPA 59A by reference
		Employee Participation (and Stakeholder Engagement)	**Employee Participation (and Stakeholder Engagement)**	**Employee Participation (and Stakeholder Engagement)**	**Employee Participation (and Stakeholder Engagement)**	**Employee Participation (and Stakeholder Engagement)**	**Employee Participation (and Stakeholder Engagement)**	**Employee Participation (and Stakeholder Engagement)**	**Employee Participation (and Stakeholder Engagement)**	**Employee Participation (and Stakeholder Engagement)**
EP	1	Must Operator have a Written Plan of Action to Implement Employee Participation in Process Safety Management Requirements?	[Yes.] §1910.119(c)(1) Employers shall develop a written plan of action regarding the implementation of the employee participation required by this paragraph.	[No specific requirement.]	[No specific requirement.]	[Article 4.6 "Engineering Review of Changes" requires that "a qualified person from each of the following disciplines" review proposed alterations of replacements of components, but no other specific requirement for operator to consult with employees in other aspects of implementing process safety was identified. A.18.3.11 does list an AIChE CCPS reference that provides guidelines for a Management of Change procedure, but this occurs in for informational purposed only in Annex A Explanatory Material.]	[Yes. Per §5.3, §5.4.1, §5.4.2, §5.4.3, §6.1, §6.2, §10.3, and §15.7]		Could specify that operator's procedures require operator to consult with its employees during the operator's periodic review or preparation of its procedures and manuals for emergency response, purging, commissioning, product transfer, maintenance and other operations, including the assessment of potential hazards, risks and emergencies at or adjacent to its facility, and also to permit employees to access relevant non-confidential information.	Could specify that operator's procedures require operator to consult with its employees during the operator's periodic review or preparation of its procedures and manuals for emergency response, purging, commissioning, product transfer, maintenance and other operations, including the assessment of potential hazards, risks and emergencies at or adjacent to its facility, and also to permit employees to access relevant non-confidential information.
EP	2	Operator's Engagement with Employees and Other Internal Stakeholders	§1910.119(c)(2) Employers shall consult with employees and their representatives on the conduct and development of process hazards analyses and on the development of the other elements of process safety management in this standard. §1910.119(c)(3) Employers shall provide to employees and their representatives access to process hazard analyses and to all other information required to be developed under this standard.	[No specific requirement.]	[No specific requirement. Operators are required to inform employees and other stakeholders of hazards (e.g. §1.4, §2.3.4, §10.15.5 and §11.6.1) but there is no specific recommendation or requirement to provide a Process Hazard Analysis to employees, their representatives, or other internal stakeholders, or consult with them on its development.]	[No specific requirement. A Process Hazard Analysis and Written Plant and Site Evaluation is required to be developed (e.g. §5.2.1 and §17.3.1.2), or QRA developed using Chapter 19, but there is no specific recommendation or requirement to consult with employees, their representatives, or other internal stakeholders regarding the conduct and development of process hazards analyses and on the development of the other elements of process safety management. Operators are required to inform employees and other stakeholders of hazards (e.g. §18.11.2) but there is no specific recommendation or requirement to provide the Process Hazard Analysis and Written Plant and Site Evaluation to to employees, their representatives, or other internal stakeholders, or consult with them on its development.]	[The operator shall establish and maintain processes to communicate the importance of meeting requirements of the PSM system to apropriate functions within the organization, and for employees and contractor personnel to raise concerns to management and make recommendations for improvements in risk identification, prevention, and mitigation. Employees and contractors shall understand the policies, goals, objectives, and procedures pertinent to their work that are driven by the PSM. All employees must be supported by all levels of management. On the other hand, all employees must must follow the procedures, identify and reveal risks and failures in order to prevent catastrophic events, and identify potential improvements. Per §5.2, §5.4.3, §5.6 and §6.2]		Could specify that operator's procedures require operator to consult with its employees during the operator's periodic review and preparatoin of its procedures and manuals for emergency response, purging, commissioning, product transfer, maintenance and other operations, including the assessment of potential hazards, risks and emergencies at or adjacent to its facility, and also to permit employees to access relevant non-confidential information.	Could specify that operator's procedures require operator to consult with its employees during the operator's periodic review and preparatoin of its procedures and manuals for emergency response, purging, commissioning, product transfer, maintenance and other operations, including the assessment of potential hazards, risks and emergencies at or adjacent to its facility, and also to permit employees to access relevant non-confidential information.
EP	3	Operator's Management Leadership Commitment	[No specific requirement.]	[No specific requirement.]	[No specific requirement.]	[No specific requirement.]	[Elements of operator's management leadership (by top management and/or all management) include: - provide sufficient resources and budget planning for employees and contractors to implement PSM policies, goals, objectives, processes, procedures, training and systems throughout the year - identify individual executives, managers and other key personnel who are accountable for developing and implementing PSM elements, supporting continuous improvement initiatives, and providing oversight - create, assess and continuously improve a positive safety culture in employees and contractors that includes a commitment to effective PSM, mutual trust, engagement, sharing of information and evaluation of new technologies that may enhance process safety; including promoting PSM initiatives through employee performance review, recognition, incentives and discipline - establish, implement, maintain and improve PSM policies, goals, objectives, processes, procedures, training and systems that directly connect to day-to-day activities - establish management processes that address regulatory and legislative requirements for pipeline safety and their impact on the PSM process - communicate management's commitment to the PSM process to internal and external stakeholders - establish and track leading and lagging key performance indicators and other high-level performance measures that regularly measure the operator's PSM system and the operator's performance and safety culture - review the operator's PSM program and its risk management results at least once per year, including an assessment of which performance goals and objectives have been met, and integrating the findings into the next iteration continuous improvement of the PSM program Per §5, §10 and §11]		Could specify that elements of operator's management leadership procedures must include: - identify the titles of the individual company executives, managers and other key personnel positions that are accountable for establishing and implementing operator's procedures related to maintaining process safety, supporting continuous safety improvement initiatives, and providing oversight; - establish and track key leading and lagging performance indicators or other high-level performance measures that regularly measure the operator's safety performance; and - performing a review of operator's processes and efforts to improve its safety and its risk management results at least once per year, including an assessment of which performance goals and objectives have been met, and integrating the findings into the next iteration of continuous improvement of the operator's procedure related to maintaining process safety management.	Could specify that elements of operator's management leadership procedures must include: - identify the titles of the individual company executives, managers and other key personnel positions that are accountable for establishing and implementing operator's procedures related to maintaining process safety, supporting continuous safety improvement initiatives, and providing oversight; - establish and track key leading and lagging performance indicators or other high-level performance measures that regularly measure the operator's safety performance; and - performing a review of operator's processes and efforts to improve its safety and its risk management results at least once per year, including an assessment of which performance goals and objectives have been met, and integrating the findings into the next iteration of continuous improvement of the operator's procedure related to maintaining process safety management.
EP	4	Operator's Engagement with External Stakeholders	No specific requirement	§193.2509 Emergency procedures. ... (b) To adequately handle each type of emergency identified under paragraph (a) of this section and each fire emergency, each operator must follow one or more manuals of written procedures. The procedures must provide for the following: ... (3) Coordinating with appropriate local officials in preparation of an emergency evacuation plan, which sets forth the steps required to protect the public in the event of an emergency, including catastrophic failure of an LNG storage tank. (4) Cooperating with appropriate local officials in evacuations and emergencies requiring mutual assistance and keeping these officials advised of: (i) The LNG plant fire control equipment, its location, and quantity of units located throughout the plant; (ii) Potential hazards at the plant, including fires; (iii) Communication and emergency control capabilities at the LNG plant; and (iv) The status of each emergency.	[Operators must liaison with appropriate local authorities such as police, fire department, or municipal works and inform them of the emergency plans and their role in emergency situations. Per §10.15.2(5) and §11.2(5)]	[Operators must liaison with appropriate local authorities such as police, fire department, or municipal works and inform them of the emergency plans and their role in emergency situations. And Operator must make its security assessment available to the AHJ on a nonpublic basis. Per §16.8.1.2 and 18.2.2(6)]	[The operator shall: - maintain a two-way communication process and plan that provides information, engages with regulatory bodies, and handles feedback from representatives of the public. - identify external stakeholders via appropriate company and public processes, events, social media, or other methods. - communicate to external stakeholders about its risk management objectives, risk management efforts, risk managment performance measures, communication personnel, and high-level views of its safety operations. Per §6.3 and §6.1]		Not deemed to be a significant gap. The operator is already required by 49CFR193.2509 to cooordinate with appropriate local officials in preparation of an emergency evacuation plan, cooperate with appropriate local officials in evacuations and emergencies requiring mutual assistance, and advise those officials. In addition, NFPA 59A imposes similar requirements. The only potential gap may be for operator to identify additional external community stakeholders with whom the operator can also communicate with regarding high-level views of its facility and safety operations, and the operator's risk management efforts and its communications personnel.	Not deemed to be a significant gap. The operator is already required by 49CFR193.2509 to cooordinate with appropriate local officials in preparation of an emergency evacuation plan, cooperate with appropriate local officials in evacuations and emergencies requiring mutual assistance, and advise those officials. In addition, NFPA 59A imposes similar requirements. The only potential gap may be for operator to identify additional external community stakeholders with whom the operator can also communicate with regarding high-level views of its facility and safety operations, and the operator's risk management efforts and its communications personnel.
		Process Safety Information	**Process Safety Information**	**Process Safety Information**	**Process Safety Information**	**Process Safety Information**	**Process Safety Information**	**Process Safety Information**	**Process Safety Information**	**Process Safety Information**
PSI	1	Must Operator Compile and Provide Process Safety Information?	[Yes] § 1910.119(d) Process Safety Information. In accordance with the schedule set forth in paragraph (e)(1) of this section, the employer shall complete a compilation of written process safety information before conducting any process hazard analysis required by the standard. The compilation of written process safety information is to enable the employer and the employees involved in operating the process to identify and understand the hazards posed by those processes involving highly hazardous chemicals. This process safety information shall include information pertaining to the hazards of the highly hazardous chemicals used or produced by the process, information pertaining to the technology of the process, and information pertaining to the equipment in the process.	[The operator's requirement to compile and make available information related to process safety is prescribed in §193.2713(a)(1). Additional related requirements on LNG facility operators include the requirements of 29CFR1910.1200, and specifically the requirements to provide safety data sheets meeting the requirements of 29 CFR 1910.1200(g).] §193.2713 Training: operations and maintenance. (a) Each operator shall provide and implement a written plan of initial training to instruct— (1) All permanent maintenance, operating, and supervisory personnel— (i) About the characteristics and hazards of LNG and other flammable fluids used or handled at the facility, including, with regard to LNG, low temperatures, flammability of mixtures with air, odorless vapor, boiloff characteristics, and reaction to water and water spray; (ii) About the potential hazards involved in operating and maintenance activities; and (iii) To carry out aspects of the operating and maintenance procedures under §§193.2503 and 193.2605 that relate to their assigned functions; ...	[No specific requirement. The Operator must provide this type of process safety information as part of requirements to provide operating procedures and training, but there is no specific requirement that operators compile and make available Process Safety Information.]	[No specific requirement. The Operator must provide this type of process safety information as part of requirements to provide operating procedures and training, but there is no specific requirement that operators compile and make available Process Safety Information. Appendix §A.3.3.9 summarizes recommended facility documentation, but is informational and not required. This includes information pertaining to the technology of the process and information pertaining to the equipment in the process, but does not specifically list the hazards of the highly hazardous chemicals used or produced by the process (e.g. Safety Data Sheets).]	[No specific requirements.]		Could consider more specifically requiring that operators compile and make available Process Safety Information, such as those items defined in §1910.119(d) which may not be directly identified in 49CFR193 or NFPA 59A..	Could consider more specifically requiring that operators compile and make available Process Safety Information, such as those items defined in §1910.119(d) which may not be directly identified in 49CFR193 or NFPA 59A..
PSI	2	Required Content - Highly Hazardous Chemicals in the Process	§ 1910.119(d)(1) Information pertaining to the hazards of the highly hazardous chemicals in the process. This information shall consist of at least the following: (i) Toxicity information; (ii) Permissible exposure limits; (iii) Physical data; (iv) Reactivity data: (v) Corrosivity data; (vi) Thermal and chemical stability data; and (vii) Hazardous effects of inadvertent mixing of different materials that could foreseeably occur. NOTE: Safety data sheets meeting the requirements of 29 CFR 1910.1200(g) may be used to comply with this requirement to the extent they contain the information required by this subparagraph.	[The operator's requirement to compile and make available information related to process safety is prescribed in §193.2713(a)(1). The definitions in §193.2007 include any gas which is toxic or corrosive, and any hazardous liquid that is flammable or toxic. Additional related requirements on LNG facility operators include the requirements of 29CFR1910.1200, including specifically the requirements to provide safety data sheets that meet the requirements of 29CFR1910.1200(g) as identified in the note in §1910.119(d)(1). Required content for Safety Data Sheets in 29CFR1910.1200(g) includes: i) Section 1, Identification; (ii) Section 2, Hazard(s) identification; (iii) Section 3, Composition/information on ingredients; (iv) Section 4, First-aid measures; (v) Section 5, Fire-fighting measures; (vi) Section 6, Accidental release measures; (vii) Section 7, Handling and storage; (viii) Section 8, Exposure controls/personal protection; (ix) Section 9, Physical and chemical properties; (x) Section 10, Stability and reactivity; (xi) Section 11, Toxicological information; (xii) Section 12, Ecological information; (xiii) Section 13, Disposal considerations; (xiv) Section 14, Transport information; (xv) Section 15, Regulatory information; and (xvi) Section 16, Other information, including date of preparation or last revision.] §193.2713 Training: operations and maintenance. (a) Each operator shall provide and implement a written plan of initial training to instruct— (1) All permanent maintenance, operating, and supervisory personnel— (i) About the characteristics and hazards of LNG and other flammable fluids used or handled at the facility, including, with regard to LNG, low temperatures, flammability of mixtures with air, odorless vapor, boiloff characteristics, and reaction to water and water spray; (ii) About the potential hazards involved in operating and maintenance activities; and (iii) To carry out aspects of the operating and maintenance procedures under §§193.2503 and 193.2605 that relate to their assigned functions; ...	[Operators must have procedures in place and provide training to personnel about the characteristics and hazards of LNG and other hazardous fluids involved in operating and maintaining the facility, including the serious danger from frostbite that can result upon contact with LNG or cold refrigerants, flammability of mixtures with air, odorless vapor, boil-off characteristics, reaction to water and water spray; knowledge of facilities and fluids being handled; and the potential hazards involved in operating activities. Per §1.4, §2.3.4, §10.15.5, and §11.2]	[Operators must provide training to personnel about the characteristics and hazards of LNG and other hazardous fluids involved in operating and maintaining the facility, including the serious danger from frostbite that can result upon contact with LNG or cold refrigerants, asphyxiants, flammability of mixtures with air, odorless vapors, boiloff characteristics, and reactions with water. Per §18.11.2(2)]	[No specific requirements.]		Could consider more specifically requiring that operators compile and make available this process safety information which pertains to the highly hazardous chemicals in the process: - Hazardous effects of inadvertent mixing of different materials that could foreseeably occur.	Could consider more specifically requiring that operators compile and make available this process safety information which pertains to the highly hazardous chemicals in the process: - Hazardous effects of inadvertent mixing of different materials that could foreseeably occur.

Group#	Item #	PSM Subcategory Topic	**Requirements of 29 CFR 1910.119** (Actual Text, or [Summary*]+Actual Text) [*Summary sometimes included to assist comparisons to other references.]	**Requirements of 49 CFR 193** (Actual Text, or [Summary*]+Actual Text) [*Summary sometimes included to assist comparisons to other references.]	**Requirements of NFPA 59A 2001** [Summary]	**Requirements of NFPA 59A 2019** [Summary]	**Requirements of API RP 1173** (2015) [Summary]	**Other related requirements** (Actual Text, or [Summary*]+Actual Text)	**Potential Gaps in Current 49 CFR 193** (referencing 2001 edition of NFPA 59A, plus 2006 edition for §193.2101(b) and 193.2321(b))	**Potential Gaps in a Future Revision to 49 CFR 193 if it incorporates 2019 edition of NFPA 59A by reference**
PSI	3	Required Content - Process Technology Information	§ 1910.119(d)(2) Information pertaining to the technology of the process. (i) Information concerning the technology of the process shall include at least the following: (A) A block flow diagram or simplified process flow diagram (see appendix B to this section); (B) Process chemistry; (C) Maximum intended inventory; (D) Safe upper and lower limits for such items as temperatures, pressures, flows or compositions; and, (E) An evaluation of the consequences of deviations, including those affecting the safety and health of employees. (ii) Where the original technical information no longer exists, such information may be developed in conjunction with the process hazard analysis in sufficient detail to support the analysis.	§193.2713 Training: operations and maintenance. (a) Each operator shall provide and implement a written plan of initial training to instruct— (3) All operating and appropriate supervisory personnel— (i) To understand detailed instructions on the facility operations, including controls, functions, and operating procedures; and (ii) To understand the LNG transfer procedures provided under §193.2513. (b) A written plan of continuing instruction must be conducted at intervals of not more than two years to keep all personnel current on the knowledge and skills they gained in the program of initial instruction. §193.2503 Operating procedures. Each operator shall follow one or more manuals of written procedures to provide safety in normal operation and in responding to an abnormal operation that would affect safety. The procedures must include provisions for: (a) Monitoring components or buildings according to the requirements of §193.2507. (b) Startup and shutdown, including for initial startup, performance testing to demonstrate that components will operate satisfactory in service. (c) Recognizing abnormal operating conditions. (d) Purging and inerting components according to the requirements of §193.2517. (e) In the case of vaporization, maintaining the vaporization rate, temperature and pressure so that the resultant gas is within limits established for the vaporizer and the downstream piping. (f) In the case of liquefaction, maintaining temperatures, pressures, pressure differentials and flow rates, as applicable, within their design limits for: (1) Boilers; (2) Turbines and other prime movers; (3) Pumps, compressors, and expanders; (4) Purification and regeneration equipment; and (5) Equipment within cold boxes. (g) Cooldown of components according to the requirements of §193.2505.	[Operators must have procedures in place and provide training to personnel about the basic operations carried out at the facility, and upper and lower design limits for such items as temperatures, pressures, or flow rates. Per §10.15.2, §10.15.5, §11.2, §11.3 and §11.6]	[Operators must have procedures in place and provide training to personnel about the basic operations carried out at the facility, and safe upper and lower design limits for such items as temperatures, pressures, or flow rates. And an analysis of the consequences of deviations, including those affecting the safety and health of employees, must be performed. Appendix §A.3.3.9 summarizes recommended facility documentation, but is informational and thus not required; this includes process flow and utility flow diagrams, heat and material balances, piping and instrumentation diagrams, plot plan, unit plot plan, elevation drawings, 3D drawings, isometric drawings, and other drawings that provide a depiction of plant and facility layout. Per §5.2.2, §17.3.1.3, §18.3.6, §18.3.7, and §18.3.8]	[No specific requirements.]		Could consider more specifically requiring that operators compile and make available this process safety information which pertains to the technology of the process: - A block flow diagram or simplified process flow diagram; and - Process chemistry.	Could consider more specifically requiring that operators compile and make available this process safety information which pertains to the technology of the process: - A block flow diagram or simplified process flow diagram; and - Process chemistry.
PSI	4	Required Content - Process Equipment Information	§ 1910.119(d)(3) Information pertaining to the equipment in the process. (i) Information pertaining to the equipment in the process shall include: (A) Materials of construction; (B) Piping and instrument diagrams (P&ID's); (C) Electrical classification; (D) Relief system design and design basis; (E) Ventilation system design; (F) Design codes and standards employed; (G) Material and energy balances for processes built after May 26, 1992; and, (H) Safety systems (e.g. interlocks, detection or suppression systems). (ii) The employer shall document that equipment complies with recognized and generally accepted good engineering practices. (iii) For existing equipment designed and constructed in accordance with codes, standards, or practices that are no longer in general use, the employer shall determine and document that the equipment is designed, maintained, inspected, tested, and operating in a safe manner.	§193.2013 References the codes and standards which are incorporated by reference partly or wholly in 49CFR§193. §193.2017 Plans and procedures. (a) Each operator shall maintain at each LNG plant the plans and procedures required for that plant by this part. The plans and procedures must be available upon request for review and inspection by the Administrator or any State Agency that has submitted a current certification or agreement with respect to the plant under the pipeline safety laws (49 U.S.C. 60101 et seq.). In addition, each change to the plans or procedures must be available at the LNG plant for review and inspection within 20 days after the change is made. (b) The Associate Administrator or the State Agency that has submitted a current certification under section 5(a) of the Natural Gas Pipeline Safety Act with respect to the pipeline facility governed by an operator's plans and procedures may, after notice and opportunity for hearing as provided in 49 CFR 190.206 or the relevant State procedures, require the operator to amend its plans and procedures as necessary to provide a reasonable level of safety. (c) Each operator must review and update the plans and procedures required by this part— (1) When a component is changed significantly or a new component is installed; and (2) At intervals not exceeding 27 months, but at least once every 2 calendar years. §193.2119 Records Each operator shall keep a record of all materials for components, buildings, foundations, and support systems, as necessary to verify that material properties meet the requirements of this part. These records must be maintained for the life of the item concerned. §193.2304 Corrosion control overview. (a) Subject to paragraph (b) of this section, components may not be constructed, repaired, replaced, or significantly altered until a person qualified under §193.2707(c) reviews the applicable design drawings and materials specifications from a corrosion control viewpoint and determines that the materials involved will not impair the safety or reliability of the component or any associated components. (b) The repair, replacement, or significant alteration of components must be reviewed only if the action to be taken— (1) Involves a change in the original materials specified; (2) Is due to a failure caused by corrosion; or (3) Is occasioned by inspection revealing a significant deterioration of the component due to corrosion.	[Operators must keep up-to-date drawings of plant equipment, showing all revisions made after installation, and maintain drawings, charts, and records of plant equipment. Per §10.15.2, §11.2, §11.3.1 and §11.3.2. Requirements for materials of construction and records retention are provided in many locations, including §2.2.2.4, §2.7, §4.1.2.2, §4.3.3, §5.2, §6.2, and §6.6.5. Requirements for electrical classification are provided for example in Table 7.6.2. Requirements for relief valve sizing and design basis are provided for example in §4.2.2.3(d), §4.7, §5.4, §6.8, §10.3.6(c), §10.12.4, and §11.5.1.9. Requirements for ventilation system design are provided for example in §2.3.2.1 and §2.3.2.2. Requirements that specify applicable codes and standards are listed throughout NFPA 59A, and a summary list appears in Chapter 12 Referenced Publications. Requirements for safety systems (e.g. interlocks, detection or suppression systems) are provide for example in §8.3, §9.1, §9.2, §9.3, §10.7, §10.12.4, §10.15.4.4, §11.5.5, §11.5.6, and include related procedures required for example in the Operating Manual specified in §10.15.3.2. Equipment maintenance and piping test records must be kept as long as the equipment is in service per §10.15.4.7 and §6.6.2, and inspection and test records must be kept for at least five years per §11.3.8 and §11.5.7.]	[Operators must keep up-to-date drawings of plant equipment, showing all revisions made after installation, and maintain drawings, charts, and records of plant equipment and materials of construction. Per for example §4.9.1, §18.2.2, §18.3.7 and §18.3.8. Requirements for materials of construction and records retention are provided in many locations, including §4.5, §4.9, §7.3.3, §8.3.1.1, §8.4.16.1.3, §8.5.1.8.2, §9.3.1, and §10.8.5.2. Requirements for electrical classification are provided for example in Table 11.9.2 Figure 7.6.2, and Figure 11.9.2. Requirements for relief valve sizing and design basis are provided for example in §9.5, §10.10, §7.3.7, §8.4.10, §8.5.1.3.4, §8.5.1.4.5, §8.5.1.5.3, §9.5, and §10.10. Requirements for ventilation system design are provided for example in §12.7. Requirements that specify applicable codes and standards are listed throughout NFPA 59A, and a summary list appears in Chapter 2 Referenced Publications. Requirements for safety systems (e.g. interlocks, detection or suppression systems) are provide for example in §8.4.8.2.6, §8.4.11.5.3, §10.4.2.6, §11.2, §11.7, §11.8, §13.12.2, §15.4, §16.3, §16.5, §16.6, §17.3.2, and include related procedures required for example in the Operating Manual specified in §18.3. Equipment equipment inspection and test record, including piping test records must be kept as long as the equipment is in service per §10.8.5 and §18.12.13, and maintenance records must be kept for at least five years per §18.12.1. Records of materials of construction of components, buildings, foundations and support system used to contain LNG or other hazardous liquids must be maintained for thier lifetime, per §4.9] Also, Appendix §A.3.3.9 summarizes recommended facility documentation, but is informational and not required; this includes: Piping and instrument diagrams (P&ID's); Electrical classification; Relief system design and design basis; Design codes and standards employed; Material and energy balances; and, Safety systems (e.g. interlocks, detection or suppression systems).]	[The pipeline operator shall maintain procedures for the safe operation of each facility. Per §8.1.2]		Could consider more specifically requiring that operators compile and make available this process safety information which pertains to the equipment in the process: - Piping and instrument diagrams (P&ID's); and - Material and energy balances for processes.	Could consider more specifically requiring that operators compile and make available this process safety information which pertains to the equipment in the process: - Piping and instrument diagrams (P&ID's); and - Material and energy balances for processes.
		Process Hazard Analysis (incl. Risk Management)	**Process Hazard Analysis (incl. Risk Management)**	**Process Hazard Analysis (incl. Risk Management)**	**Process Hazard Analysis (incl. Risk Management)**	**Process Hazard Analysis (incl. Risk Management)**	**Process Hazard Analysis (incl. Risk Management)**	**Process Hazard Analysis (incl. Risk Management)**	**Process Hazard Analysis (incl. Risk Management)**	**Process Hazard Analysis (incl. Risk Management)**
PHA	1	Is a Process Hazard Analysis Required?	[Yes.] § 1910.119(e)(1) The employer shall perform an initial process hazard analysis (hazard evaluation) on processes covered by this standard. The process hazard analysis shall be appropriate to the complexity of the process and shall identify, evaluate, and control the hazards involved in the process. Employers shall determine and document the priority order for conducting process hazard analyses based on a rationale which includes such considerations as extent of the process hazards, number of potentially affected employees, age of the process, and operating history of the process.	[No, not specifically, but §193.2509 requires operators to anticipate both controllable and uncontrollable emergencies and develop emergency response procedures to address with an affective emergency response. In addition, hazards and risks are addressed in prescriptive requirements such as equipment spacing, vapor concentration and thermal flux at property line, and many others as directly defined or Incorporated by Reference.] §193.2509 Emergency procedures. (a) Each operator shall determine the types and places of emergencies other than fires that may reasonably be expected to occur at an LNG plant due to operating malfunctions, structural collapse, personnel error, forces of nature, and activities adjacent to the plant. (b) To adequately handle each type of emergency identified under paragraph (a) of this section and each fire emergency, each operator must follow one or more manuals of written procedures. The procedures must provide for the following: (1) Responding to controllable emergencies, including notifying personnel and using equipment appropriate for handling the emergency. (2) Recognizing an uncontrollable emergency and taking action to minimize harm to the public and personnel, including prompt notification of appropriate local officials of the emergency and possible need for evacuation of the public in the vicinity of the LNG plant. (3) Coordinating with appropriate local officials in preparation of an emergency evacuation plan, which sets forth the steps required to protect the public in the event of an emergency, including catastrophic failure of an LNG storage tank. (4) Cooperating with appropriate local officials in evacuations and emergencies requiring mutual assistance and keeping these officials advised of: (i) The LNG plant fire control equipment, its location, and quantity of units located throughout the plant; (ii) Potential hazards at the plant, including fires; (iii) Communication and emergency control capabilities at the LNG plant; and (iv) The status of each emergency.]	[No, not specifically by that name, but §11.3.3 requires operators to anticipate both controllable and uncontrollable emergencies and develop emergency response procedures to address with an affective emergency response. There is also a recommended (not required) risk analysis for Safe Shutdown Earthquake seismic loading condition in Appendix §B.3.3. Hazards and risks are also addressed in prescriptive requirements such as equipment spacing, vapor concentration and thermal flux at property line, such as per §2.2.3, §9.1.2 and §9.7.3.]	[Yes, per §5.2.1, §5.2.2, §5.3.2, §17.3.1.2 including as part of a written plant and site evaluation plan. Details to perform the Hazard Analysis are specified in §5.3.2. In addition, §18.4.2, §18.4.3, and §18.4.4 requires operators to anticipate both controllable and uncontrollable emergencies and develop emergency response procedures to address with an affective emergency response.]	[Yes, although identified as Risk Assessment and not Process Hazard Analysis. Per §7.3]		No PHA required by that name. Some may view this as an potential gap when compared to current 49 CFR 193.	No apparent gap.
PHA	2	Timing to Conduct Initial PHA	§ 1910.119(e) Process hazard analysis. (1) The employer shall perform an initial process hazard analysis (hazard evaluation) on processes covered by this standard. The process hazard analysis shall be appropriate to the complexity of the process and shall identify, evaluate, and control the hazards involved in the process. Employers shall determine and document the priority order for conducting process hazard analyses based on a rationale which includes such considerations as extent of the process hazards, number of potentially affected employees, age of the process, and operating history of the process. The process hazard analysis shall be conducted as soon as possible, but not later than the following schedule: (i) No less than 25 percent of the initial process hazards analyses shall be completed by May 26, 1994; (ii) No less than 50 percent of the initial process hazards analyses shall be completed by May 26, 1995; (iii) No less than 75 percent of the initial process hazards analyses shall be completed by May 26, 1996; (iv) All initial process hazards analyses shall be completed by May 26, 1997. (v) Process hazards analyses completed after May 26, 1987 which meet the requirements of this paragraph are acceptable as initial process hazards analyses. These process hazard analyses shall be updated and revalidated, based on their completion date, in accordance with paragraph (e)(6) of this section.	[While no specific requirement to perform a Process Hazard Analysis is specified by name, the requirements of §193.2509 apply before operations can commence, as well as addressing the hazards and risks in prescriptive requirements such as equipment spacing, vapor concentration and thermal flux at property line, and many others as directly defined or Incorporated by Reference.]	[While no specific requirement to perform a Process Hazard Analysis is specified by name, the requirements of §11.3.3 apply before operations can commence, as well as addressing the hazards and risks in prescriptive requirements such as equipment spacing, vapor concentration and thermal flux at property line, and many others as directly defined or Incorporated by Reference.]	[Before construction, since a Process Hazard Analysis is required for plant siting. Per §5.2]	[Before construction or within 12 months of operation. Since risk assessments must be reviewed and updated annually, the first risk assment must occur within 12 months of operation, if not prior to construction. No other specific requirements. Based on §7.5]		No apparent gap.	No apparent gap.

Group#	Item #	PSM Subcategory Topic	Requirements of 29 CFR 1910.119 (Actual Text, or [Summary*]+Actual Text) [*Summary sometimes included to assist comparisons to other references.]	Requirements of 49 CFR 193 (Actual Text, or [Summary*]+Actual Text) [*Summary sometimes included to assist comparisons to other references.]	Requirements of NFPA 59A 2001 [Summary]	Requirements of NFPA 59A 2019 [Summary]	Requirements of API RP 1173 (2015) [Summary]	Other related requirements (Actual Text, or [Summary*]+Actual Text)	Potential Gaps in Current 49 CFR 193 (referencing 2001 edition of NFPA 59A, plus 2006 edition for §193.2101(b) and 193.2321(b))	Potential Gaps in a Future Revision to 49 CFR 193 if it incorporates 2019 edition of NFPA 59A by reference
PHA	3	Methodology to Conduct PHA	§ 1910.119(e)(2) The employer shall use one or more of the following methodologies that are appropriate to determine and evaluate the hazards of the process being analyzed. (i) What-If; (ii) Checklist; (iii) What-If/Checklist; (iv) Hazard and Operability Study (HAZOP); (v) Failure Mode and Effects Analysis (FMEA); (vi) Fault Tree Analysis; or (vii) An appropriate equivalent methodology.	[NA. No formal requirement for the methodology to perform a Process Hazard Analysis, but §193.2509 requires operators to anticipate both controllable and uncontrollable emergencies and develop emergency response procedures to address with an affective emergency response. In addition, hazards and risks are addressed in prescriptive requirements such as equipment spacing, vapor concentration and thermal flux at property line, and many others as directly defined or Incorporated by Reference. Hazards and risks are addressed in prescriptive requirements such as equipment spacing, vapor concentration and thermal flux at property line, and many others as directly defined or Incorporated by Reference.]	[NA. No formal requirement to perform Process Hazard Analysis, but §11.3.3 requires operators to anticipate both controllable and uncontrollable emergencies and develop emergency response procedures to address with an affective emergency response. Hazards and risks are addressed in prescriptive requirements such as equipment spacing, vapor concentration and thermal flux at property line, and many others as directly defined or Incorporated by Reference.]	[Details to perform PHA are specified in §5.3.2, with related plant siting and other information in §5.3, §17.3 and other sections. But §5.3.2 tends to focus on design spills and proper calculation of thermal, fire, explosion and vapor dispersion impacts. Section 5.3.2 does not specify other methodologies to determine and evaluate the hazards of the process being analyzed. Details of the alternate option to perform a Quantitative Risk Assessment are specified in Chapter 19.]	[A variety of risk management tools can be used, but they must consider the likelihood and severity of threats. The operator shall identify potential unintended releases or abnormal operating conditions shall be based on data and information, as well as knowledge and experience with similar facilities. The operator shall maintain a process to identify threats that are posed by operations and the operating environment, and consider conditions that have changed since prior assessments as well as potential multiple interacting threats. An operator must gather data and maintain a data inventory, identify data gaps, and evaluate data quality. Per §7.3 and §7.1]		Could consider specifying that the methodology used to perform a Process Hazard Analysis follow §1910.119(e)(2): The operator shall use one or more of the following methodologies that are appropriate to determine and evaluate the hazards of the process being analyzed. (i) What-If; (ii) Checklist; (iii) What-If/Checklist; (iv) Hazard and Operability Study (HAZOP): (v) Failure Mode and Effects Analysis (FMEA); (vi) Fault Tree Analysis; or (vii) An appropriate equivalent methodology.	Could specify any prescribed differences or clarifications relevant to Chapter 5 or 19, and more specifically could consider specifying that the methodology used to perform a Process Hazard Analysis follow §1910.119(e)(2): The operator shall use one or more of the following methodologies that are appropriate to determine and evaluate the hazards of the process being analyzed. (i) What-If; (ii) Checklist; (iii) What-If/Checklist; (iv) Hazard and Operability Study (HAZOP): (v) Failure Mode and Effects Analysis (FMEA); (vi) Fault Tree Analysis; or (vii) An appropriate equivalent methodology.
PHA	4	Overall Content of PHA	§ 1910.119(e)(3) The process hazard analysis shall address: (i) The hazards of the process; (ii) The identification of any previous incident which had a likely potential for catastrophic consequences in the workplace; (iii) Engineering and administrative controls applicable to the hazards and their interrelationships such as appropriate application of detection methodologies to provide early warning of releases. (Acceptable detection methods might include process monitoring and control instrumentation with alarms, and detection hardware such as hydrocarbon sensors.); (iv) Consequences of failure of engineering and administrative controls; (v) Facility siting; (vi) Human factors; and (vii) A qualitative evaluation of a range of the possible safety and health effects of failure of controls on employees in the workplace.	[NA. No formal requirement for the methodology to perform a Process Hazard Analysis, but §193.2509 requires operators to anticipate both controllable and uncontrollable emergencies and develop emergency response procedures to address with an affective emergency response. In addition, hazards and risks are addressed in prescriptive requirements such as equipment spacing, vapor concentration and thermal flux at property line, and many others as directly defined or Incorporated by Reference. Hazards and risks are addressed in prescriptive requirements such as equipment spacing, vapor concentration and thermal flux at property line, and many others as directly defined or Incorporated by Reference.]	[NA. No formal requirement to perform Process Hazard Analysis, but §11.3.3 requires operators to anticipate both controllable and uncontrollable emergencies and develop emergency response procedures to address with an affective emergency response. Hazards and risks are addressed in prescriptive requirements such as equipment spacing, vapor concentration and thermal flux at property line, and many others as directly defined or Incorporated by Reference.]	[Details of methodology to perform PHA are specified in §5.3.2, with related plant siting and other information in §5.3, §17.3 and other sections, which include consideration of: - The hazards of the process - Engineering and administrative controls applicable to the hazards and their interrelationships such as appropriate application of detection methodologies to provide early warning of releases. (Acceptable detection methods might include process monitoring and control instrumentation with alarms, and detection hardware such as hydrocarbon sensors.) - Consequences of failure of engineering and administrative controls - Facility siting - A qualitative evaluation of a range of the possible safety and health effects of failure of controls on employees in the workplace. Human error issues are identified and addressed in the context of QRAs; e.g. in A.19.11.1(12).]	[Risk identification, assessment and management prevention analyses should consider: lessons learned (both internal and external); procedures, authorities, responsibilities and accountabilities; equipment operability, including control systems and materials; training, drills and response scenarios; response time adequacy; response capabilities (internal and external) and coordination with incident command system; identifying high consequence areas and possible events. Per §7.4]		Could consider specifying that when a Process Hazard Analysis is performed it shall address the items in § 1910.119(e)(3): (i) The hazards of the process; (ii) The identification of any previous incident which had a likely potential for catastrophic consequences in the workplace; (iii) Engineering and administrative controls applicable to the hazards and their interrelationships such as appropriate application of detection methodologies to provide early warning of releases. (Acceptable detection methods might include process monitoring and control instrumentation with alarms, and detection hardware such as hydrocarbon sensors.); (iv) Consequences of failure of engineering and administrative controls; (v) Facility siting; (vi) Human factors; and (vii) A qualitative evaluation of a range of the possible safety and health effects of failure of controls on employees in the workplace. Could alternatively consider specifying that a Process Hazard Analysis address the following specific items from § 1910.119(e)(3): ... (ii) The identification of any previous incident which had a likely potential for catastrophic consequences in the workplace; ... (vi) Human factors; and (vii) A qualitative evaluation of a range of the possible safety and health effects of failure of controls on employees in the workplace. and these items from API RP 1173: - consider lessons learned (both internal and external); - identifying high consequence areas and possible events.	Could specify any prescribed differences or clarifications relevant to Chapter 5 or 19. An example of the former could be that the PHA analysis specified in 5.3.2 and in other sections include consideration of: human factors; and the identification of any previous incident which had a likely potential for catastrophic consequences in the workplace. Could consider specifying that when a Process Hazard Analysis is performed it shall address the items in § 1910.119(e)(3): (i) The hazards of the process; (ii) The identification of any previous incident which had a likely potential for catastrophic consequences in the workplace; (iii) Engineering and administrative controls applicable to the hazards and their interrelationships such as appropriate application of detection methodologies to provide early warning of releases. (Acceptable detection methods might include process monitoring and control instrumentation with alarms, and detection hardware such as hydrocarbon sensors.); (iv) Consequences of failure of engineering and administrative controls; (v) Facility siting; (vi) Human factors; and (vii) A qualitative evaluation of a range of the possible safety and health effects of failure of controls on employees in the workplace. Could alternatively consider specifying that a Process Hazard Analysis address the following specific items from § 1910.119(e)(3): ... (ii) The identification of any previous incident which had a likely potential for catastrophic consequences in the workplace; ... (vi) Human factors; and (vii) A qualitative evaluation of a range of the possible safety and health effects of failure of controls on employees in the workplace. and these items from API RP 1173: - consider lessons learned (both internal and external); - identifying high consequence areas and possible events.
PHA	5	Qualifications of Team that Conducts PHA	§ 1910.119(e)(4) The process hazard analysis shall be performed by a team with expertise in engineering and process operations, and the team shall include at least one employee who has experience and knowledge specific to the process being evaluated. Also, one member of the team must be knowledgeable in the specific process hazard analysis methodology being used.	[NA. No formal requirement for the methodology to perform a Process Hazard Analysis, but §193.2509 requires operators to anticipate both controllable and uncontrollable emergencies and develop emergency response procedures to address with an affective emergency response. In addition, hazards and risks are addressed in prescriptive requirements such as equipment spacing, vapor concentration and thermal flux at property line, and many others as directly defined or Incorporated by Reference. Hazards and risks are addressed in prescriptive requirements such as equipment spacing, vapor concentration and thermal flux at property line, and many others as directly defined or Incorporated by Reference.]	[NA. No formal requirement to perform Process Hazard Analysis, but §11.3.3 requires operators to anticipate both controllable and uncontrollable emergencies and develop emergency response procedures to address with an affective emergency response. Hazards and risks are addressed in prescriptive requirements such as equipment spacing, vapor concentration and thermal flux at property line, and many others as directly defined or Incorporated by Reference.]	[No specific requirement, although §4.6 Engineering Review of Changes requires "a qualified person" from each of six engineering disciplines.]	[No specific requirements, but audit personnel may include external professionals or internal personnel not involved in the work of the PSMS or the operations being audited. Operators must engage in benchmarking with other operators and publicly available information. Per §10.2.2]		Could consider specifying requirements for qualifications of Personnel to conduct a Process Hazard Analysis follow § 1910.119(e)(4): The process hazard analysis shall be performed by a team with expertise in engineering and process operations, and the team shall include at least one employee who has experience and knowledge specific to the process being evaluated. Also, one member of the team must be knowledgeable in the specific process hazard analysis methodology being used.	Could consider specifying requirements for qualifications of Personnel to conduct a Process Hazard Analysis follow § 1910.119(e)(4): The process hazard analysis shall be performed by a team with expertise in engineering and process operations, and the team shall include at least one employee who has experience and knowledge specific to the process being evaluated. Also, one member of the team must be knowledgeable in the specific process hazard analysis methodology being used.
PHA	6	Operator's Action Plan to Address PHA Findings and Recommendations	§ 1910.119(e)(5) The employer shall establish a system to promptly address the team's findings and recommendations; assure that the recommendations are resolved in a timely manner and that the resolution is documented; document what actions are to be taken; complete actions as soon as possible; develop a written schedule of when these actions are to be completed; communicate the actions to operating, maintenance and other employees whose work assignments are in the process and who may be affected by the recommendations or actions.	[No requirement specifically related to addressing PHA findings and recommendations, but the general requirements of §193.2603 and remedial corrosion measures of §193.2637 will be relevant.] §193.2603 General. (a) Each component in service, including its support system, must be maintained in a condition that is compatible with its operational or safety purpose by repair, replacement, or other means. (b) An operator may not place, return, or continue in service any component which is not maintained in accordance with this subpart. (c) Each component taken out of service must be identified in the records kept under §193.2639. (d) If a safety device is taken out of service for maintenance, the component being served by the device must be taken out of service unless the same safety function is provided by an alternate means. (e) If the inadvertent operation of a component taken out of service could cause a hazardous condition, that component must have a tag attached to the controls bearing the words “do not operate” or words of comparable meaning. §193.2637 Remedial measures. Prompt corrective or remedial action must be taken whenever an operator learns by inspection or otherwise that atmospheric, external, or internal corrosion is not controlled as required by this subpart.	[No specific requirement.]	[No specific requirement, other than obvious need to revise a LNG plant design during its siting approval or construction phase, if a PHA identifies an issue that would otherwise preclude a regularly approval to proceed with construction or gain final approval to introduce natural gas. In contrast, §1910.119(e)(5) includes addessing findings and recommendations from PHAs performed on operating facilities. A related but different item is that for operating facilities that are planning construction or alterations, §4.6 Engineering Review of Changes requires that "a qualified person" from each of six engineering disciplines review the design drawings and specifications to determine that safety or reliability will not be impaired.]	[The operator defines the frequency to review the Key Performance Indicators that measure the performance of the PSM system/process, and take remedial action. Per §10.4]		Could require operator to establish a system to promptly address the findings and recommendations from a process hazard analysis review; assure that the recommendations are resolved in a timely manner and that the resolution is documented; document what actions are to be taken; complete actions as soon as possible; develop a written schedule of when these actions are to be completed; communicate the actions to operating, maintenance and other employees whose work assignments are in the process and who may be affected by the recommendations or actions.	Could require operator to establish a system to promptly address the findings and recommendations from a process hazard analysis review; assure that the recommendations are resolved in a timely manner and that the resolution is documented; document what actions are to be taken; complete actions as soon as possible; develop a written schedule of when these actions are to be completed; communicate the actions to operating, maintenance and other employees whose work assignments are in the process and who may be affected by the recommendations or actions.
PHA	7	Quality of Data Gathering that Must Support PHA	[No specific requirements (other than the qualifications of audit team).]	[§193.2639 requires operator to keep maintenance records, and also maintain related periodic inspection and testing records per NFPA 59A 2001.] §193.2639 Maintenance records. (a) Each operator shall keep a record at each LNG plant of the date and type of each maintenance activity performed on each component to meet the requirements of this part. For each LNG facility that is designed and constructed after March 31, 2000 the operator shall also maintain related periodic inspection and testing records that NFPA-59A-2001 (incorporated by reference, see §193.2013) requires. Maintenance records, whether required by this part or NFPA-59A-2001, must be kept for a period of not less than five years. (b) Each operator shall maintain records or maps to show the location of cathodically protected components, neighboring structures bonded to the cathodic protection system, and corrosion protection equipment. (c) Each of the following records must be retained for as long as the LNG facility remains in service: (1) Each record or map required by paragraph (b) of this section. (2) Records of each test, survey, or inspection required by this subpart in sufficient detail to demonstrate the adequacy of corrosion control measures.	[Specific requirements to inspect, test, maintain and record assets are required such as by §10.15.4.1.1, §10.15.4.7.1, §11.5.1.1, §11.5.1.2, §11.5.2.1, §11.5.7.1, and §11.5.7.2]	[The basis and method to perform a Process Hazard Analysis are specifed in Chapter 5 and specifically §5.3.2 (e.g. Table 5.3.2.3 Design Spill). The basis and method to perform a Quantitative Risk Assessment are specifed in Chapter 19, including Table 19.6.1 Failure Rate Database. Specific requirements to inspect, test, maintain and record assets are required such as by §18.9.1, §18.9.2, §18.9.3, §18.10.13.1.3 and §18.12]	[The operator shall maintain an inventory of its assets and environment in proximity. Data over the plant life cycle shall be considered and shall be updated based on work performed and as needed during the life of the plant. The operator shall regularly identify data gaps and evaluate data quality as part of its ongoing risk assessment and continuous improvement process. Incident data including causes shall be considered. Per §7.2]		No apparent gap.	No apparent gap.
PHA	8	Must Operator Maintain a Process to Identify Threats?	[No specific requirement.]	[No specific requirement focused identifying threats. Per §193.2017, all plans and procedures must be reviewed at intervals not exceeding 27 months, but at least once every 2 calendar years.] §193.2017 Plans and procedures. ... (c) Each operator must review and update the plans and procedures required by this part— (1) When a component is changed significantly or a new component is installed; and (2) At intervals not exceeding 27 months, but at least once every 2 calendar years.	[No specific requirement.]	[No specific requirement.]	[Yes. Per §7.3]		Could consider requiring operator establish and maintain an ongoing process to identify threats to the LNG facility.	Could consider requiring operator establish and maintain an ongoing process to identify threats to the LNG facility.
PHA	9	Risk Prevention and Mitigation Analysis	[No specific requirement.]	[No specific requirement.]	[No specific requirement.]	[No specific requirement.]	[The PHA should identify and evaluate various risk prevention and mitigation measures, which may include analysis of the adequacy of response times of employees as well as external organizations, considering to establish an incident command center, and multiple response scenario evaluations. Per §7.4]		Could consider specifying requirement that the PHA should identify and evaluate various risk prevention and mitigation measures, which may include analysis of the adequacy of response times of employees as well as external organizations, considering to establish an incident command center, and multiple response scenario evaluations.	Could consider specifying requirement that the PHA should identify and evaluate various risk prevention and mitigation measures, which may include analysis of the adequacy of response times of employees as well as external organizations, considering to establish an incident command center, and multiple response scenario evaluations.

Group#	Item #	PSM Subcategory Topic	**Requirements of 29 CFR 1910.119** (Actual Text, or [Summary*]+Actual Text) [*Summary sometimes included to assist comparisons to other references.]	**Requirements of 49 CFR 193** (Actual Text, or [Summary*]+Actual Text) [*Summary sometimes included to assist comparisons to other references.]	**Requirements of NFPA 59A 2001** [Summary]	**Requirements of NFPA 59A 2019** [Summary]	**Requirements of API RP 1173** (2015) [Summary]	**Other related requirements** (Actual Text, or [Summary*]+Actual Text)	**Potential Gaps in Current 49 CFR 193** (referencing 2001 edition of NFPA 59A, plus 2006 edition for §193.2101(b) and 193.2321(b))	**Potential Gaps in a Future Revision to 49 CFR 193 if it incorporates 2019 edition of NFPA 59A by reference**
PHA	10	Minimum Frequency in Years to Update PHA (or QRA)	[For PHA: 5] §1910.119(e)(6) At least every five (5) years after the completion of the initial process hazard analysis, the process hazard analysis shall be updated and revalidated by a team meeting the requirements in paragraph (e)(4) of this section, to assure that the process hazard analysis is consistent with the current process.	[No specific requirement focused on PHA (or QRA). Per §193.2017, all plans and procedures must be reviewed at intervals not exceeding 27 months, but at least once every 2 calendar years.] §193.2017 Plans and procedures. ... (c) Each operator must review and update the plans and procedures required by this part— (1) When a component is changed significantly or a new component is installed; and (2) At intervals not exceeding 27 months, but at least once every 2 calendar years.	[No specific requirement.]	[For PHA: There is no requirement to periodically update a PHA. For QRA: Every 5 years, or as required by AHJ, as per §19.2.4. Related requirements for fire protection aspect of a PHA or QRA include that §16.2.1.3 requires that the fire protection evaluation for existing plants be reviewed and updated at intervals not exceeding two calendar years, but at least every 27 months. Related requirements for construction or significant alteration of components aspect of a PHA or QRA include that §4.6 Engineering Review of Changes requires "a qualified person" from each of six engineering disciplines review thedesign drawings and specifications and determine that the design will not impair the safety or reliability of any component before constructed or significantly altered.]	[1 Per §7.5]		Could consider specifying requirement comparable to §1910.119(e)(6) i.e.: The process hazard analysis for the facility shall be updated and revalidated by a team at least every five (5) years after the completion of the last PHA, in order to: review the last PHA to determine if any new regulatory requirements or emerging issues or threats have occurred since last PHA; assure that the PHA is consistent with the current process and address any changes made to the process since the last PHA; apply data and information gained from operations, maintenance, and integrity-related work inspection and testing; and incorporate learnings from incidents or safety-related reports that occurred since the last PHA.	Could consider specifying requirement comparable to §1910.119(e)(6) i.e.: The process hazard analysis for the facility shall be updated and revalidated by a team at least every five (5) years after the completion of the last PHA, in order to: review the last PHA to determine if any new regulatory requirements or emerging issues or threats have occurred since last PHA; assure that the PHA is consistent with the current process and address any changes made to the process since the last PHA; apply data and information gained from operations, maintenance, and integrity-related work inspection and testing; and incorporate learnings from incidents or safety-related reports that occurred since the last PHA.
PHA	11	PHA Record Retention Period	Life of Process Per § 1910.119(e)(7) Employers shall retain process hazards analyses and updates or revalidations for each process covered by this section, as well as the documented resolution of recommendations described in paragraph (e)(5) of this section for the life of the process.	[No specific requirement.]	[No specific requirement.]	[No specific requirement.]	[No specific requirement.]		Could consider specifying that Process Hazard Analyses records be retained for the life of the facility.	Could consider specifying that Process Hazard Analyses records be retained for the life of the facility.
PHA	12	Must Operator Establish an Acceptable Risk Criteria?	[No specific requirement.]	[No specific requirement.]	[No specific requirement.]	[No specific requirement.]	[No specific requirement.]	Operators can establish their risk tolerance criteria for acceptable, unacceptable and conditionally tolerable risk levels. Some examples include developing a risk matrix, to identify a specific range of severity and likelihood or some absolute risk criterion like, not to exceed 10-4 events/year of a worker fatality at the facility. Additionally, risk tolerance criteria should enable the risk analysis team in the decision-making process of implement preventive and mitigative measures. This risk criteria can be separate from risk levels identified in references such as Figures 19.10.2 of NFPA 59A 2019 edition. As per Pillar 4.2.2 of AIChE CCPS (or chapter 9.2.3 of AIChE CCPS Guidelines for Risk-Based Process Safety). Also per Section 6.3.8.1 of CAN/CSA-Z767.	Could consider requiring that operator's Process Hazard Analysis include operator's definition of its risk tolerance criteria for acceptable, unacceptable and conditionally tolerable risk levels.	Could consider requiring that operator's Process Hazard Analysis include operator's definition of its risk tolerance criteria for acceptable, unacceptable and conditionally tolerable risk levels.
		Operating Procedures (and Documentation)	**Operating Procedures (and Documentation)**	**Operating Procedures (and Documentation)**	**Operating Procedures (and Documentation)**	**Operating Procedures (and Documentation)**	**Operating Procedures (and Documentation)**	**Operating Procedures (and Documentation)**	**Operating Procedures (and Documentation)**	**Operating Procedures (and Documentation)**
OP	1	Must Operating Procedures by Developed and Maintained?	[Yes] § 1910.119(f) Operating Procedures § 1910.119(f)(1) Operating Procedures The employer shall develop and implement written oPerating procedures that provide clear instructions for safely conducting activities involved in each covered process consistent with the process safety information and shall address at least the following elements.	[Yes] § 193.2017 Plans and procedures § 193.2017(a) Plans and procedures: Each operator shall maintain at each LNG plant the plans and procedures required for that plant by this part. The plans and procedures must be available upon request for review and inspection by the Administrator or any State Agency that has submitted a current certification or agreement with respect to the plant under the pipeline safety laws (49 U.S.C. 60101 et seq).	[Yes Per §10.15.1, §10.15.2, §10.15.3.1 and other sections.]	[Yes Per §18.2.1, §18.2.2, and other sections.]	[Yes Per §8.1.1 According to RP 1173, pipelines are designed, constructed, operated, and maintained with a methology that complies with all applicable regulations. Properly designed, constructed, operated and maintained systems are developed by clearly defined operational control systems.]		No apparant gap.	No apparant gap.
OP	2	Can Regulator Modify Operating Procedures?	[No specific requirement.]	[Yes] Per § 193.2017(b) Plans and procedures: The Associate Administrator or the State Agency that has submitted a current certification under section 5(a) of the Natural Gas Pipeline Safety Act with respect to the pipeline facility governed by an oPerator's plans and procedures may, after notice and opportunity for hearing as provided in 49 CFR 190.206 or the relevant State procedures, require the oPerator to amend its plans and procedures as necessary to provide a reasonable level of safety.	[No specific requirement.]	[No specific requirement.]	[No specific requirement.]		No apparant gap.	No apparant gap.
OP	3	Can Employee Stop Work or Seek Permission to Deviate from Procedure if They Think an Unsafe Condition Will Otherwise Occur?	[No specific requirement.]	[Operating Procedures must recognize abnormal operating conditions per §193.2503(c), which would include unsafe conditions. Deviating from procedures would be a violation of the regulation.] §193.2503 Operating procedures. Each operator shall follow one or more manuals of written procedures to provide safety in normal operation and in responding to an abnormal operation that would affect safety. The procedures must include provisions for: (a) Monitoring components or buildings according to the requirements of §193.2507. (b) Startup and shutdown, including for initial startup, performance testing to demonstrate that components will operate satisfactory in service. (c) Recognizing abnormal operating conditions. (d) Purging and inerting components according to the requirements of §193.2517. (e) In the case of vaporization, maintaining the vaporization rate, temperature and pressure so that the resultant gas is within limits established for the vaporizer and the downstream piping. (f) In the case of liquefaction, maintaining temperatures, pressures, pressure differentials and flow rates, as applicable, within their design limits for: (1) Boilers; (2) Turbines and other prime movers; (3) Pumps, compressors, and expanders; (4) Purification and regeneration equipment; and (5) Equipment within cold boxes. (g) Cooldown of components according to the requirements of §193.2505.	[Operating Procedures must recognize abnormal operating conditions per §10.15.3.2 and §11.3.2, which would include unsafe conditions. Deviating from procedures would be a violation of the regulation.]	[Operating Procedures must recognize abnormal operating conditions per §18.3.8, which would include unsafe conditions. Deviating from procedures would be a violation of the regulation. See also §A.4.2 and §A.18.2.1]	[Yes. An employee shall have authority to stop work and seek permission to deviate from a procedure in cases where he or she believes that following a procedure will cause an unsafe condition. Per §8.1.1]		No apparant gap.	No apparant gap.
OP	4	Content of Operating Procedures - Steps for Each Operating Phase	§1910.119 (f) Operating procedures. (1) The employer shall develop and implement written operating procedures that provide clear instructions for safely conducting activities involved in each covered process consistent with the process safety information and shall address at least the following elements. (i) Steps for each operating phase: (A) Initial startup; (B) Normal operations; (C) Temporary operations; (D) Emergency shutdown including the conditions under which emergency shutdown is required, and the assignment of shutdown responsibility to qualified operators to ensure that emergency shutdown is executed in a safe and timely manner. (E) Emergency Operations; (F) Normal shutdown; and, (G) Startup following a turnaround, or after an emergency shutdown. ...	[Each operator shall follow written procedures to provide safety in normal operation and in responding to an abnormal operation that would affect safety, including provisions for the following operations: Monitoring components or buildings according to the requirements of §193.2507. Startup and shutdown, including for initial startup, performance testing to demonstrate that components will operate satisfactory in service according to the requirements of §193.2507. Recognizing abnormal operating conditions according to the requirements of §193.2507. Purging and inerting components according to the requirements of §193.2517. Cooldown according to the requirements of §193.2505 Emergency procedures according the requirements of §193.2509 Transfer procedures according the requirements of §193.2513 Temporary and mobile operations according the requirements of §193.2019] §193.2503 Operating procedures. Each operator shall follow one or more manuals of written procedures to provide safety in normal operation and in responding to an abnormal operation that would affect safety. The procedures must include provisions for: (a) Monitoring components or buildings according to the requirements of §193.2507. (b) Startup and shutdown, including for initial startup, performance testing to demonstrate that components will operate satisfactory in service. (c) Recognizing abnormal operating conditions. (d) Purging and inerting components according to the requirements of §193.2517. (e) In the case of vaporization, maintaining the vaporization rate, temperature and pressure so that the resultant gas is within limits established for the vaporizer and the downstream piping. (f) In the case of liquefaction, maintaining temperatures, pressures, pressure differentials and flow rates, as applicable, within their design limits for: (1) Boilers; (2) Turbines and other prime movers; (3) Pumps, compressors, and expanders; (4) Purification and regeneration equipment; and (5) Equipment within cold boxes. (g) Cooldown of components according to the requirements of §193.2505. §193.2505 Cooldown. (a) The cooldown of each system of components that is subjected to cryogenic temperatures must be limited to a rate and distribution pattern that keeps thermal stresses within design limits during the cooldown period, paying particular attention to the performance of expansion and contraction devices.	[Each operator shall follow one or more manuals of written procedures to provide safety in normal operation and in responding to an abnormal operation that would affect safety. The procedures must include provisions for the following operations: Startup and shutdown, including for initial startup, performance testing to demonstrate that components will operate satisfactory in service; Recognizing abnormal operating conditions and specifying appropriate responses; Purging and inerting components; Cooldown; Emergency procedures; Transfer procedures; Temporary and mobile operations; Ensuring plant security; and Monitoring operation by planned, periodic inspctions and by watching or listening for warning alarms. Per §10.15.3.2, §10.15.3.3, §2.3.4(c) and related requirements in other sections.]	[Each operator shall follow one or more manuals of written procedures to provide safety in normal operation and in responding to an abnormal operation that would affect safety. The procedures must include provisions for the following operations: Startup and shutdown, including for initial startup, performance testing to demonstrate that components will operate satisfactory in service; Recognizing abnormal operating conditions and specifying appropriate responses; Purging and inerting components; Cooldown; Emergency procedures; Transfer procedures; Temporary and mobile operations; Ensuring plant security; and Monitoring operation by planned, periodic inspctions and by watching or listening for warning alarms. Per §18.3.4, §18.3.5, §18.4, §18.5, §18.6.4, §18.6.5, §18.6.5.1, §18.18.7 and related requirements in other sections.]	[Content of operating procedures must include safe operation for: initial start-up; normal operation; temporary and emergency operations; normal and emergency shutdowns; and start-up operations. Per §8.1 .2]		No apparant gap.	No apparant gap.

Group#	Item #	PSM Subcategory Topic	**Requirements of 29 CFR 1910.119** (Actual Text, or [Summary*]+Actual Text) [*Summary sometimes included to assist comparisons to other references.]	**Requirements of 49 CFR 193** (Actual Text, or [Summary*]+Actual Text) [*Summary sometimes included to assist comparisons to other references.]	**Requirements of NFPA 59A 2001** [Summary]	**Requirements of NFPA 59A 2019** [Summary]	**Requirements of API RP 1173** (2015) [Summary]	**Other related requirements** (Actual Text, or [Summary*]+Actual Text)	**Potential Gaps in Current 49 CFR 193** (referencing 2001 edition of NFPA 59A, plus 2006 edition for §193.2101(b) and 193.2321(b))	**Potential Gaps in a Future Revision to 49 CFR 193 if it incorporates 2019 edition of NFPA 59A by reference**
OP	5	Content of Operating Procedures - - Operating Limits for Processes	§1910.119 (f) Operating procedures. (1) The employer shall develop and implement written operating procedures that provide clear instructions for safely conducting activities involved in each covered process consistent with the process safety information and shall address at least the following elements. ... (ii) Operating limits: (A) Consequences of deviation; and (B) Steps required to correct or avoid deviation. ...	[Written procedures must specify maintaining operating limits specifically for vaporization and liquefaction. Consequences of deviation are considered in siting, emergency procedures, and other aspects of plant design and operation.] Per §193.2503 Operating procedures. Each operator shall follow one or more manuals of written procedures to provide safety in normal operation and in responding to an abnormal operation that would affect safety. The procedures must include provisions for: ... (e) In the case of vaporization, maintaining the vaporization rate, temperature and pressure so that the resultant gas is within limits established for the vaporizer and the downstream piping. (f) In the case of liquefaction, maintaining temperatures, pressures, pressure differentials and flow rates, as applicable, within their design limits for: (1) Boilers; (2) Turbines and other prime movers; (3) Pumps, compressors, and expanders; (4) Purification and regeneration equipment; and (5) Equipment within cold boxes. (g) Cooldown of components according to the requirements of §193.2505.	[The procedures must include provisions for: Ensuring that each control system properly operates within its design limits; In the case of vaporization, maintaining the vaporization rate, temperature and pressure so that the resultant gas is within limits established for the vaporizer and the downstream piping. In the case of liquefaction, maintaining temperatures, pressures, pressure differentials and flow rates, as applicable, within their design limits for: Boilers; Turbines and other prime movers; Pumps, compressors, and expanders; Purification and regeneration equipment; and Equipment within cold boxes. Cooldown of components. Consequences of deviation are considered in siting, emergency procedures, and other aspects of plant design and operation. Per §10.15.3.2, §10.15.3.4.1, §11.3.2, §11.3.5.1, §2.3.4(c) and other sections]	[The procedures must include provisions for: Ensuring that each control system properly operates within its design limits; In the case of vaporization, maintaining the vaporization rate, temperature and pressure so that the resultant gas is within limits established for the vaporizer and the downstream piping. In the case of liquefaction, maintaining temperatures, pressures, pressure differentials and flow rates, as applicable, within their design limits for: Boilers; Turbines and other prime movers; Pumps, compressors, and expanders; Purification and regeneration equipment; and Equipment within cold boxes. Cooldown of components. Consequences of deviation are considered in siting, emergency procedures, and other aspects of plant design and operation. Per §18.3.6, §18.3.7, §18.3.8 and other sections]	[Identify operating limits that relate directly to safety Per §8.1.2]		No apparent gap.	No apparent gap.
OP	6	Content of Operating Procedures - - Safety and Health Considerations, Safety Systems, and Safe Work Practices	§1910.119 (f) Operating procedures. (1) The employer shall develop and implement written operating procedures that provide clear instructions for safely conducting activities involved in each covered process consistent with the process safety information and shall address at least the following elements. ... (iii) Safety and health considerations: (A) Properties of, and hazards presented by, the chemicals used in the process; (B) Precautions necessary to prevent exposure, including engineering controls, administrative controls, and personal protective equipment; (C) Control measures to be taken if physical contact or airborne exposure occurs; (D) Quality control for raw materials and control of hazardous chemical inventory levels; and, (E) Any special or unique hazards. (iv) Safety systems and their functions. ... (4) The employer shall develop and implement safe work practices to provide for the control of hazards during operations such as lockout/tagout; confined space entry; opening process equipment or piping; and control over entrance into a facility by maintenance, contractor, laboratory, or other support personnel. These safe work practices shall apply to employees and contractor employees. 29CFR1910.1200(g) and Appendix D put requirements for composition and other quality control of raw materials on relevant manufacturer, importer and distributor.	§193.2511 Personnel safety. (a) Each operator shall provide any special protective clothing and equipment necessary for the safety of personnel while they are performing emergency response duties. (b) All personnel who are normally on duty at a fixed location, such as a building or yard, where they could be harmed by thermal radiation from a burning pool of impounded liquid, must be provided a means of protection at that location from the harmful effects of thermal radiation or a means of escape. (c) Each LNG plant must be equipped with suitable first-aid material, the location of which is clearly marked and readily available to personnel.	[Operating procedures must include: - Properties of, and hazards presented by, the chemicals used in the process; - Precautions necessary to prevent exposure, including engineering controls, administrative controls, and personal protective equipment; - Control measures to be taken if physical contact or airborne exposure occurs; - Any special or unique hazards. - Safety systems and their functions. - Safe work practices that control hazards during operations such as: lockout/tagout; confined space entry; opening process equipment or piping; and control over entrance into a facility by maintenance, contractor, laboratory, or other support personnel. These safe work practices shall apply to employees and contractor employees. Per §9.7, §9.8.1, §10.15.3.2(7), §10.15.4.1.7, §11.3.2(8), and §11.5.1.8]	[Operating procedures must include: - Properties of, and hazards presented by, the chemicals used in the process; - Precautions necessary to prevent exposure, including engineering controls, administrative controls, and personal protective equipment; - Control measures to be taken if physical contact or airborne exposure occurs; - Any special or unique hazards. - Safety systems and their functions. - Safe work practices that control hazards during operations such as: lockout/tagout; confined space entry; opening process equipment or piping; and control over entrance into a facility by maintenance, contractor, laboratory, or other support personnel. These safe work practices shall apply to employees and contractor employees. Per §16.7, §17.14, §18.3.4, §18.3.5, §18.3.6, §18.3.7, §18.5.1(6), §18.10.2]	[No specific requirement.]		No apparent gap.	No apparent gap.
OP	7	Detailed Content of Operating Procedure - - Minimum Advance Notice in Weeks to State Agency Regarding Planned Mobile or Temporary LNG Facilites Used Other Than for Peakshaving Application, for Service Maintenance During Gas Pipeline Systems Repair/Alteration	[No specific requirements.]	[2] §193.2019 Mobile and temporary LNG facilities. (a) Mobile and temporary LNG facilities for peakshaving application, for service maintenance during gas pipeline systems repair/alteration, or for other short term applications need not meet the requirements of this part if the facilities are in compliance with applicable sections of NFPA-59A-2001 (incorporated by reference, see §193.2013). (b) The State agency having jurisdiction over pipeline safety in the State in which the portable LNG equipment is to be located must be provided with a location description for the installation at least 2 weeks in advance, including to the extent practical, the details of siting, leakage containment or control, fire fighting equipment, and methods employed to restrict public access, except that in the case of emergency where such notice is not possible, as much advance notice as possible must be provided.	[No specific requirement.]	[No specific requirement.]	[No specific requirement.]		No apparent gap.	No apparent gap.
OP	8	Must Operating Procedures be Readily Accessible to All Employees?	[Yes Per §1910.119(f)] §1910.119(f) Operating procedures … (2) Operating procedures shall be readily accessible to employees who work in or maintain a process.	[Yes. Per §193.2017] §193.2017 Plans and procedures. (a) Each operator shall maintain at each LNG plant the plans and procedures required for that plant by this part. The plans and procedures must be available upon request for review and inspection by the Administrator or any State Agency that has submitted a current certification or agreement with respect to the plant under the pipeline safety laws (49 U.S.C. 60101 et seq.). In addition, each change to the plans or procedures must be available at the LNG plant for review and inspection within 20 days after the change is made.	[Yes. Per §10.15.3.1 and §11.3.1]	[Yes. Per §18.3.2 and §18.3.10]	[No specific requirement.]		No apparent gap.	No apparent gap.
OP	9	Frequency in Months to Review Operating Procedures	[12, or earlier if a significant change is made or new equipment installed Per §1910.119(f)] § 1910.119(f) Operating procedures (3) The operating procedures shall be reviewed as often as necessary to assure that they reflect current operating practice, including changes that result from changes in process chemicals, technology, and equipment, and changes to facilities. The employer shall certify annually that these operating procedures are current and accurate.	[24 not to exceed 27, or earlier if a significant change is made or new equipment installed Per §193.2017(c)] §193.2017(c) Plans and procedures: Each operator must review and update the plans and procedures required by this part §193.2017(c)(1) Plans and procedures: When a component is changed significantly, or a new component is installed §193.2017(c)(2) Plans and procedures: At intervals not exceeding 27 months, but at least once every 2 calendar years.	[No minimum frequency is specified; rather, as required by changes in equipment or procedures or operating conditions. Per §10.15.3.1 Manual of Operating Procedures Per §10.15.2(3) Per §11.2(3) Basic Requirements. Per §11.3.1 Manual of Operating Procedures.]	[No minimum frequency is specified; rather, as required by changes in equipment or procedures or operating conditions. Per §18.3.3]	[12, or earlier if based on the identified risk level. Per §8.1.3]		No apparent gap. While one could consider reducing the period in 49CFR193 from 24 to 12 months, or earlier if based on the identified risk level, to match 29CFR1910.119 and API RP 1173; this contradicts a risk-based review methodology used in industry-consensus standard NFPA 59A. In that context, the current requirement in 49CFR193 of 24 months appears reasonable.	No apparent gap. While one could consider reducing the period in 49CFR193 from 24 to 12 months, or earlier if based on the identified risk level, to match 29CFR1910.119 and API RP 1173; this contradicts a risk-based review methodology used in industry-consensus standard NFPA 59A. In that context, the current requirement in 49CFR193 of 24 months appears reasonable.
OP	10	Timeliness in Days to Update Operating Procedures After a Change is Made	[No specific requirement.]	[20 or less] §193.2017 Plans and procedures. (a) Each operator shall maintain at each LNG plant the plans and procedures required for that plant by this part. The plans and procedures must be available upon request for review and inspection by the Administrator or any State Agency that has submitted a current certification or agreement with respect to the plant under the pipeline safety laws (49 U.S.C. 60101 et seq.). In addition, each change to the plans or procedures must be available at the LNG plant for review and inspection within 20 days after the change is made.	[No specific requirement.]	[No specific requirement.]	[No specific requirement.]		Could survey operators if they have any comments about 20 day period, or if period should be lengthened for certain types of changes. For example, if it could create any unintended consequences due to nature of changes and differing levels of review.	Could survey operators if they have any comments about 20 day period, or if period should be lengthened for certain types of changes. For example, if it could create any unintended consequences due to nature of changes and differing levels of review.

Group#	Item #	PSM Subcategory Topic	**Requirements of 29 CFR 1910.119** (Actual Text, or [Summary*]+Actual Text) [*Summary sometimes included to assist comparisons to other references.]	**Requirements of 49 CFR 193** (Actual Text, or [Summary*]+Actual Text) [*Summary sometimes included to assist comparisons to other references.]	**Requirements of NFPA 59A 2001** [Summary]	**Requirements of NFPA 59A 2019** [Summary]	**Requirements of API RP 1173** (2015) [Summary]	**Other related requirements** (Actual Text, or [Summary*]+Actual Text)	**Potential Gaps in Current 49 CFR 193** (referencing 2001 edition of NFPA 59A, plus 2006 edition for §193.2101(b) and 193.2321(b))	**Potential Gaps in a Future Revision to 49 CFR 193 if it incorporates 2019 edition of NFPA 59A by reference**
OP	11	Operator's PSM System Documentation - Document Control Procedures	[No specific requirement.]	[There is no specific requirement related to an operator's program to manage its process safety, but requirements to maintain, control and provide access to the plans and procedures that provide information that supports process safety management are specified in 49CFR193.] §193.2017 Plans and procedures. (a) Each operator shall maintain at each LNG plant the plans and procedures required for that plant by this part. The plans and procedures must be available upon request for review and inspection by the Administrator or any State Agency that has submitted a current certification or agreement with respect to the plant under the pipeline safety laws (49 U.S.C. 60101 et seq.). In addition, each change to the plans or procedures must be available at the LNG plant for review and inspection within 20 days after the change is made. (b) The Associate Administrator or the State Agency that has submitted a current certification under section 5(a) of the Natural Gas Pipeline Safety Act with respect to the pipeline facility governed by an operator's plans and procedures may, after notice and opportunity for hearing as provided in 49 CFR 190.206 or the relevant State procedures, require the operator to amend its plans and procedures as necessary to provide a reasonable level of safety. (c) Each operator must review and update the plans and procedures required by this part— (1) When a component is changed significantly or a new component is installed; and (2) At intervals not exceeding 27 months, but at least once every 2 calendar years. §193.2503 Operating procedures. Each operator shall follow one or more manuals of written procedures to provide safety in normal operation and in responding to an abnormal operation that would affect safety. The procedures must include provisions for: (a) Monitoring components or buildings according to the requirements of §193.2507. (b) Startup and shutdown, including for initial startup, performance testing to demonstrate that components will operate satisfactory in service. (c) Recognizing abnormal operating conditions. (d) Purging and inerting components according to the requirements of §193.2517. (e) In the case of vaporization, maintaining the vaporization rate, temperature and pressure so that the resultant gas is within limits established for the vaporizer and the downstream piping. (f) In the case of liquefaction, maintaining temperatures, pressures, pressure differentials and flow rates, as applicable, within their design limits for: (1) Boilers; (2) Turbines and other prime movers;	[There is no specific requirement related to an operator's program to manage its process safety, but requirements to maintain, control and provide access to the plans and procedures that provide information that supports process safety management are specified in NFPA 59A 2001 edition. Operators must keep up-to-date drawings of plant equipment, showing all revisions made after installation, and maintain drawings, charts, and records of plant equipment. Per §10.15.2, §11.2, §11.3.1 and §11.3.2]	[There is no specific requirement related to an operator's program to manage its process safety, but requirements to maintain, control and provide access to the plans and procedures that provide information that supports process safety management are specified in NFPA 59A 2019 edition. Operators must keep up-to-date drawings of plant equipment, showing all revisions made after installation, and maintain drawings, charts, and records of plant equipment and materials of construction. Per for example §4.9.1, §18.2.2, §18.3.7 and §18.3.8 Also, Appendix §A.3.3.9 summarizes recommended facility documentation, but is informational and not required; this includes: Piping and instrument diagrams (P&ID's); Electrical classification; Relief system design and design basis; Design codes and standards employed; Material and energy balances; and, Safety systems (e.g. interlocks, detection or suppression systems).]	[The operator shall maintain a procedure to control documents required by its PSM system, and the procedure shall require that the documents: - be reviewed and approved for adequacy prior to issue or re-issue, by the responsible persons or management position identified in the documents; - show the current revision status and identify changes; - be legible and readily identifiable; - be readily available and accessible to personnel; and - be removed from all points of issue or use, or be otherwise marked to assure against unintended use if they are retained for any purpose, if the document becomes obsolete. Per §14.1]		Could require that operator must have a procedure to manage process safety, which must include methods to control documents that describe its system or processes to manage safety: - be reviewed and approved for adequacy prior to issue or re-issue, by the responsible persons or management position identified in the documents; - show the current revision status and identify changes; - be legible and readily identifiable; - be readily available and accessible to personnel; and - be removed from all points of issue or use, or be otherwise marked to assure against unintended use if they are retained for any purpose, if the document becomes obsolete.	Could require that operator must have a procedure to manage process safety, which must include methods to control documents that describe its system or processes to manage safety: - be reviewed and approved for adequacy prior to issue or re-issue, by the responsible persons or management position identified in the documents; - show the current revision status and identify changes; - be legible and readily identifiable; - be readily available and accessible to personnel; and - be removed from all points of issue or use, or be otherwise marked to assure against unintended use if they are retained for any purpose, if the document becomes obsolete.
OP	12	Operator's PSM System Documentation - Record Control Procedures	[No specific requirement.]	[There is no specific requirement related to an operator's program to manage its process safety, but requirements to maintain, control and provide access to the plans and procedures that provide information that supports process safety management are specified in 49CFR193.] §193.2017 Plans and procedures. (a) Each operator shall maintain at each LNG plant the plans and procedures required for that plant by this part. The plans and procedures must be available upon request for review and inspection by the Administrator or any State Agency that has submitted a current certification or agreement with respect to the plant under the pipeline safety laws (49 U.S.C. 60101 et seq.). In addition, each change to the plans or procedures must be available at the LNG plant for review and inspection within 20 days after the change is made. (b) The Associate Administrator or the State Agency that has submitted a current certification under section 5(a) of the Natural Gas Pipeline Safety Act with respect to the pipeline facility governed by an operator's plans and procedures may, after notice and opportunity for hearing as provided in 49 CFR 190.206 or the relevant State procedures, require the operator to amend its plans and procedures as necessary to provide a reasonable level of safety. (c) Each operator must review and update the plans and procedures required by this part— (1) When a component is changed significantly or a new component is installed; and (2) At intervals not exceeding 27 months, but at least once every 2 calendar years. §193.2503 Operating procedures. Each operator shall follow one or more manuals of written procedures to provide safety in normal operation and in responding to an abnormal operation that would affect safety. The procedures must include provisions for: (a) Monitoring components or buildings according to the requirements of §193.2507. (b) Startup and shutdown, including for initial startup, performance testing to demonstrate that components will operate satisfactory in service. (c) Recognizing abnormal operating conditions. (d) Purging and inerting components according to the requirements of §193.2517. (e) In the case of vaporization, maintaining the vaporization rate, temperature and pressure so that the resultant gas is within limits established for the vaporizer and the downstream piping. (f) In the case of liquefaction, maintaining temperatures, pressures, pressure differentials and flow rates, as applicable, within their design limits for: (1) Boilers; (2) Turbines and other prime movers;	[There is no specific requirement related to an operator's program to manage its process safety, but requirements to maintain, control and provide access to the plans and procedures that provide information that supports process safety management are specified in NFPA 59A 2001 edition. Operators must keep up-to-date drawings of plant equipment, showing all revisions made after installation, and maintain drawings, charts, and records of plant equipment. Per §10.15.2, §11.2, §11.3.1 and §11.3.2]	[There is no specific requirement related to an operator's program to manage its process safety, but requirements to maintain, control and provide access to the plans and procedures that provide information that supports process safety management are specified in NFPA 59A 2019 edition. Operators must keep up-to-date drawings of plant equipment, showing all revisions made after installation, and maintain drawings, charts, and records of plant equipment and materials of construction. Per for example §4.9.1, §18.2.2, §18.3.7 and §18.3.8 Also, Appendix §A.3.3.9 summarizes recommended facility documentation, but is informational and not required; this includes: Piping and instrument diagrams (P&ID's); Electrical classification; Relief system design and design basis; Design codes and standards employed; Material and energy balances; and, Safety systems (e.g. interlocks, detection or suppression systems).]	[The operator shall maintain a procedure to control records that demonstrate conformance of its operations to its PSM system, and the procedure shall: - identify the controls and responsibilities to identify, collect, store, protect, retrieve, retain and dispose of records; - require that records remain legible, identifiable, and retrievable; and - specify the record retention time. Per §14.2]		Could require that the operator must maintain a procedure to control records that demonstrate conformance of its operations to the procedure that is uses to manage safety, and that the procedure shall: - identify the controls and responsibilities to identify, collect, store, protect, retrieve, retain and dispose of records; - require that records remain legible, identifiable, and retrievable; and - specify the record retention time.	Could require that the operator must maintain a procedure to control records that demonstrate conformance of its operations to the procedure that is uses to manage safety, and that the procedure shall: - identify the controls and responsibilities to identify, collect, store, protect, retrieve, retain and dispose of records; - require that records remain legible, identifiable, and retrievable; and - specify the record retention time.
OP	13	Operator's PSM System Documentation - Minimum Content	[No specific requirement.]	[There is no specific requirement related to an operator's program to manage its process safety, but requirements to maintain, control and provide access to the plans and procedures that provide information that supports process safety management are specified in 49CFR193.] §193.2017 Plans and procedures. (a) Each operator shall maintain at each LNG plant the plans and procedures required for that plant by this part. The plans and procedures must be available upon request for review and inspection by the Administrator or any State Agency that has submitted a current certification or agreement with respect to the plant under the pipeline safety laws (49 U.S.C. 60101 et seq.). In addition, each change to the plans or procedures must be available at the LNG plant for review and inspection within 20 days after the change is made. (b) The Associate Administrator or the State Agency that has submitted a current certification under section 5(a) of the Natural Gas Pipeline Safety Act with respect to the pipeline facility governed by an operator's plans and procedures may, after notice and opportunity for hearing as provided in 49 CFR 190.206 or the relevant State procedures, require the operator to amend its plans and procedures as necessary to provide a reasonable level of safety. (c) Each operator must review and update the plans and procedures required by this part— (1) When a component is changed significantly or a new component is installed; and (2) At intervals not exceeding 27 months, but at least once every 2 calendar years. §193.2503 Operating procedures. Each operator shall follow one or more manuals of written procedures to provide safety in normal operation and in responding to an abnormal operation that would affect safety. The procedures must include provisions for: (a) Monitoring components or buildings according to the requirements of §193.2507. (b) Startup and shutdown, including for initial startup, performance testing to demonstrate that components will operate satisfactory in service. (c) Recognizing abnormal operating conditions. (d) Purging and inerting components according to the requirements of §193.2517. (e) In the case of vaporization, maintaining the vaporization rate, temperature and pressure so that the resultant gas is within limits established for the vaporizer and the downstream piping. (f) In the case of liquefaction, maintaining temperatures, pressures, pressure differentials and flow rates, as applicable, within their design limits for: (1) Boilers; (2) Turbines and other prime movers;	[There is no specific requirement related to an operator's program to manage its process safety, but requirements to maintain, control and provide access to the plans and procedures that provide information that supports process safety management are specified in NFPA 59A 2001 edition. Operators must keep up-to-date drawings of plant equipment, showing all revisions made after installation, and maintain drawings, charts, and records of plant equipment. Per §10.15.2, §11.2, §11.3.1 and §11.3.2]	[There is no specific requirement related to an operator's program to manage its process safety, but requirements to maintain, control and provide access to the plans and procedures that provide information that supports process safety management are specified in NFPA 59A 2019 edition. Operators must keep up-to-date drawings of plant equipment, showing all revisions made after installation, and maintain drawings, charts, and records of plant equipment and materials of construction. Per for example §4.9.1, §18.2.2, §18.3.7 and §18.3.8 Also, Appendix §A.3.3.9 summarizes recommended facility documentation, but is informational and not required; this includes: Piping and instrument diagrams (P&ID's); Electrical classification; Relief system design and design basis; Design codes and standards employed; Material and energy balances; and, Safety systems (e.g. interlocks, detection or suppression systems).]	[The operator's PSM system documentation shall include: - operator's stated overall safety objectives and policies; - regulatory and other requirements applicable to PSM; - operator's procedures to conform with regulatory and other requirements applicable to PSM, including operator's own requirements; - documents required by the PSM system; - records that demonstrate conformance to the requirements of the PSM system; and - other records that the operator has identified to show the effectiveness of its PSM system. Per §14.3]		Could require that operator's documentation of its procedure to manage safety must include: - operator's stated overall safety objectives and policies; - regulatory and other requirements applicable to process safety management; - operator's procedures to conform with regulatory and other requirements applicable to process safety management, including operator's own requirements; - documents required by its process safety management system; - records that demonstrate conformance to the requirements of the process safety management system; and - other records that the operator has identified to show the effectiveness of its process safety management system.	Could require that operator's documentation of its procedure to manage safety must include: - operator's stated overall safety objectives and policies; - regulatory and other requirements applicable to process safety management; - operator's procedures to conform with regulatory and other requirements applicable to process safety management, including operator's own requirements; - documents required by its process safety management system; - records that demonstrate conformance to the requirements of the process safety management system; and - other records that the operator has identified to show the effectiveness of its process safety management system.
OP	14	Should Operator's Periodic Updates of its Operating Procedures Specifically Consider Cognitive Issues/Human Factors?	[No specific requirement.]	[No specific requirement.]	[No specific requirement.]	[There is no specific requirement, although in an informational Appendix A article A.11.7.1 references (1) API Pub I 770, A Manager's Guide to Reducing Human Errors and (16) ISA RP 60.3, Human Engineering for Control Centers, and article A.19.6.2(6) and A.19.11.1(12) discusses human actions/errors]	[No specific requirement.]	Recommendations of IOGP Report No. 460 identify the importance of understanding the role of people in the operation and their support of safety-critical systems, in parallel with engineering solutions and that facilites in summary broadly should: - Review practices and tools used to maintain real-time awareness of safety margins - Adopt practices to identify and understand safety-critical human tasks along with operational and management practices that enable operators to perform tasks reliably - Review options for ensuring independent challenge to safety-critical decisions within their own operations Specific examples may relate for example to: - general access and egress - facility layout requirements for operability and maintainability - human machine interfaces - valve access - control center and room design - signage and labeling - general work environment (lighting, noise, heat, etc.) Per (in part) from IOGP 460 "Cognitive Issues Associated with Process Safety and Environmental Incidents", July 2012, developed by IOGP's Human Factors Sub-Committee.	Could consider requiring that an operator's periodic updates to its operating plans and procedures as required by 49CFR193.2017 must include a methodology to consider human factors and the role of people in facility operation and their support of safety-critical systems, which may include: - Review practices and tools used to maintain real-time awareness of safety margins - Adopt practices to identify and understand safety-critical human tasks along with operational and management practices that enable operators to perform tasks reliably - Review options for ensuring independent challenge to safety-critical decisions within their own operations Specific examples may relate for example to: - general access and egress - facility layout requirements for operability and maintainability - human machine interfaces (e.g. Digital Control Systems screens) - valve access - control center and room design - signage and labeling - general work environment (lighting, noise, heat, etc.)	Could consider requiring that an operator's periodic updates to its operating plans and procedures as required by 49CFR193.2017 must include a methodology to consider human factors and the role of people in facility operation and their support of safety-critical systems, which may include: - Review practices and tools used to maintain real-time awareness of safety margins - Adopt practices to identify and understand safety-critical human tasks along with operational and management practices that enable operators to perform tasks reliably - Review options for ensuring independent challenge to safety-critical decisions within their own operations Specific examples may relate for example to: - general access and egress - facility layout requirements for operability and maintainability - human machine interfaces (e.g. Digital Control Systems screens) - valve access - control center and room design - signage and labeling - general work environment (lighting, noise, heat, etc.)

Group#	Item #	PSM Subcategory Topic	**Requirements of 29 CFR 1910.119** (Actual Text, or [Summary*]+Actual Text) [*Summary sometimes included to assist comparisons to other references.]	**Requirements of 49 CFR 193** (Actual Text, or [Summary*]+Actual Text) [*Summary sometimes included to assist comparisons to other references.]	**Requirements of NFPA 59A 2001** [Summary]	**Requirements of NFPA 59A 2019** [Summary]	**Requirements of API RP 1173** (2015) [Summary]	**Other related requirements** (Actual Text, or [Summary*]+Actual Text)	**Potential Gaps in Current 49 CFR 193** (referencing 2001 edition of NFPA 59A, plus 2006 edition for §193.2101(b) and 193.2321(b))	**Potential Gaps in a Future Revision to 49 CFR 193 if it incorporates 2019 edition of NFPA 59A by reference**
		Training (and Competence)	**Training (and Competence)**	**Training (and Competence)**	**Training (and Competence)**	**Training (and Competence)**	**Training (and Competence)**	**Training (and Competence)**	**Training (and Competence)**	**Training (and Competence)**
TR	1	Operations, Maintenance, Security and Fire Protection Personnel - Qualifications in addition to Physical Ability and Health	[No specific requirement.]	§193.2711 Personnel health: Each operator shall follow a written plan to verify that personnel assigned operating, maintenance, security, or fire protection duties at the LNG plant do not have any physical condition that would impair performance of their assigned duties. The plan must be designed to detect both readily observable disorders, such as physical handicaps or injury, and conditions requiring professional examination for discovery.	[No specific requirement.]	[No specific requirement.]	[Personnel must an appropriate level of competence related to education, training, knowledge, and experience. Per §13]		No apparant gap.	No apparant gap.
TR	2	Operations and Maintenance Personnel - Qualifications in addition to Physical Ability and Health	[No specific requirements beyond training]	§193.2707 Operations and maintenance. (a) Each operator shall utilize for operation or maintenance of components only those personnel who have demonstrated their capability to perform their assigned functions by— (1) Successful completion of the training required by §§193.2713 and 193.2717; and (2) Experience related to the assigned operation or maintenance function; and (3) Acceptable performance on a proficiency test relevant to the assigned function. (b) A person who does not meet the requirements of paragraph (a) of this section may operate or maintain a component when accompanied and directed by an individual who meets the requirements. (c) Corrosion control procedures under §193.2605(b), including those for the design, installation, operation, and maintenance of cathodic protection systems, must be carried out by, or under the direction of, a person qualified by experience and training in corrosion control technology.	[LNG plant personnel shall have: Received applicable training; Experience related to assigned duties. Per §11.6.6]	[LNG plant personnel shall have: Received applicable training; Experience related to assigned duties Qualifications to inspect and monitor corrosion control systems (as applicable) Per §10.8.4.1, §18.10.13.6.1(3)(4)(5), §18.11.2, §18.11.3]	[Those personnel whose responsibilities impact process safety must have competent education, training, knowledge, and experience, and be updated as necessary regarding: elements of PSM system/process applicable to their jobs; problems or opportunities related to PSM systems/processes; new or changing risks related to PSM systems/processes; potential consequences if PSM systems/processes are not followed. Per §13]		No apparant gap.	No apparant gap.
TR	3	All Personnel (e.g. incl. Janitorial, Security etc.) - Initial Training Content	[No specific requirements for all plant personnel]	§193.2713 Training: operations and maintenance. (a) Each operator shall provide and implement a written plan of initial training to instruct— (2) All Personnel— (i) To carry out the emergency procedures under §193.2509 that relate to their assigned functions; and (ii) To give first-aid;	[Carrying out the emergency procedures that relate to their duties at the LNG plant, and provide first aid. Per §11.6.1]	[The written plan to train all personnel shall include: basic facility operations; characteristics and potential hazards of LNG used or handled at the facility, including low temperatures, asphyxiants, flammability of mixtures with air, odorless vapor, boiloff characteristics, reaction to water and water spray, and danger from frostbite; methods to carry out their duties and operating and maintenance procedures; how to carry out emergency procedures as it relates to their functions; Per §18.11.1, §18.11.2, §18.11.3, §18.11.4]	[No specific requirements, since the requirements to ensure competence, awareness and training are for those personnel "whose responsibilities fall within the scope of the PSMS". Per §13]		No apparant gap.	No apparent gap, as long as §193.2713 is retained.
TR	4	Operations Personnel - Initial Training Content	[The written plan to initially train operators shall include: basic facility operations (overview of process); operating procedures including emergency operations including shutdown; specific potential safety and health hazards; safe work practices applicable to employee's job. Per §1910.119(g)] §1910.119(g) Training—(1) Initial training. (i) Each employee presently involved in operating a process, and each employee before being involved in operating a newly assigned process, shall be trained in an overview of the process and in the operating procedures as specified in paragraph (f) of this section. The training shall include emphasis on the specific safety and health hazards, emergency operations including shutdown, and safe work practices applicable to the employee's job tasks. (ii) In lieu of initial training for those employees already involved in operating a process on May 26, 1992, an employer may certify in writing that the employee has the required knowledge, skills, and abilities to safely carry out the duties and responsibilities as specified in the operating procedures.	[The written plan to initially train operations personnel shall include: characteristics and potential hazards of LNG used or handled at the facility, including low temperatures, flammability of mixtures with air, odorless vapor, boiloff characteristics, and reaction to water and water spray; potential hazards involved in operating activities; basic facility operations; methods to carry out their duties and operating and maintenance procedures; LNG transfer procedures; fire prevention, including understanding fire control plans, fire drills, fire control duties potential causes and areas of fires, consequences; recognizing when assistance is needed to maintain security. Per §193.2713 and §193.2717] §193.2713 Training: operations and maintenance. (a) Each operator shall provide and implement a written plan of initial training to instruct— (1) All permanent maintenance, operating, and supervisory personnel— (i) About the characteristics and hazards of LNG and other flammable fluids used or handled at the facility, including, with regard to LNG, low temperatures, flammability of mixtures with air, odorless vapor, boiloff characteristics, and reaction to water and water spray; (ii) About the potential hazards involved in operating and maintenance activities; and (iii) To carry out aspects of the operating and maintenance procedures under §§193.2503 and 193.2605 that relate to their assigned functions; and ... (3) All operating and appropriate supervisory personnel— (i) To understand detailed instructions on the facility operations, including controls, functions, and operating procedures; and (ii) To understand the LNG transfer procedures provided under §193.2513. §193.2717 Training: fire protection. (a) All personnel involved in maintenance and operations of an LNG plant, including their immediate supervisors, must be trained according to a written plan of initial instruction, including plant fire drills, to: (1) Know the potential causes and areas of fire; (2) Know the types, sizes, and predictable consequences of fire; and (3) Know and be able to perform their assigned fire control duties according to the procedures established under §193.2509 and by proper use of equipment provided under §193.2801. (c) Plant fire drills must provide personnel hands-on experience in carrying out their	[The written plan to train operations personnel shall include: characteristics and potential hazards of LNG used or handled at the facility, including low temperatures, flammability of mixtures with air, odorless vapor, boiloff characteristics, reaction to water and water spray, and danger from frostbite; potential hazards involved in operating activities; basic facility operations; methods to carry out their duties and operating and maintenance procedures; LNG transfer procedures; detailed instructions on mobile LNG operations; fire prevention, including understanding fire control plans, potential causes and consequences and other training specified by NFPA 600; recognizing when assistance is needed to maintain security; how to carry out emergency procedures; how to provide first aid; Per §1.4, §2.3.4, §9.1.2(9), §10.15.5.1, §10.15.5.2, §10.15.5.6, §11.6.1, §11.6.2, §11.6.6]	[The written plan to train operations personnel shall include: characteristics and potential hazards of LNG used or handled at the facility, including low temperatures, asphyxiants, flammability of mixtures with air, odorless vapor, boiloff characteristics, reaction to water and water spray, and danger from frostbite; potential hazards involved in operating activities; facility operations, including controls, functions, and operating procedures; methods to carry out their duties and operating and maintenance procedures; purging practices and principles; LNG transfer procedures (if applicable to their task); detailed instructions on mobile LNG operations (if applicable to their task); how to carry out emergency procedures. Per §4.1, §18.11.1, §18.11.2, §18.11.2.1, §18.11.2.2, §18.11.2.3, §18.11.3, §18.11.4]	[The pipeline operator must define the need for and provide training to enable development and implementation of the PSM elements. Per §13]		No apparant gap.	No apparant gap.
TR	5	Maintenance Personnel - Initial Training Content	[The written plan to initially train maintenance personnel shall include: basic facility operations (overview of process); specific potential safety and health hazards; safe work practices applicable to employee's job. Per 1910.119(j)(3)] 1910.119(j)(3) Training for process maintenance activities. The employer shall train each employee involved in maintaining the ongoing integrity of process equipment in an overview of that process and its hazards and in the procedures applicable to the employee's job tasks to assure that the employee can peform the job tasks in a safe manner.	[The written plan to train maintenance personnel shall include: characteristics and potential hazards of LNG used or handled at the facility, including low temperatures, flammability of mixtures with air, odorless vapor, boiloff characteristics, and reaction to water and water spray; potential hazards involved in operating and maintenance activities; methods to carry out their duties and operating and maintenance procedures; fire prevention, including understanding fire control plans, fire drills, fire control duties potential causes and areas of fires, consequences; recognizing when assistance is needed to maintain security. Per §193.2713 and §193.2717] §193.2713 Training: operations and maintenance. (a) Each operator shall provide and implement a written plan of initial training to instruct— (1) All permanent maintenance, operating, and supervisory personnel— (i) About the characteristics and hazards of LNG and other flammable fluids used or handled at the facility, including, with regard to LNG, low temperatures, flammability of mixtures with air, odorless vapor, boiloff characteristics, and reaction to water and water spray; (ii) About the potential hazards involved in operating and maintenance activities; and (iii) To carry out aspects of the operating and maintenance procedures under §§193.2503 and 193.2605 that relate to their assigned functions; and ... §193.2717 Training: fire protection. (a) All personnel involved in maintenance and operations of an LNG plant, including their immediate supervisors, must be trained according to a written plan of initial instruction, including plant fire drills, to: (1) Know the potential causes and areas of fire; (2) Know the types, sizes, and predictable consequences of fire; and (3) Know and be able to perform their assigned fire control duties according to the procedures established under §193.2509 and by proper use of equipment provided under §193.2801. (c) Plant fire drills must provide personnel hands-on experience in carrying out their duties under the fire emergency procedures required by §193.2509.	[The written plan to train maintenance and personnel shall include: characteristics and potential hazards of LNG used or handled at the facility, including low temperatures, flammability of mixtures with air, odorless vapor, boiloff characteristics, reaction to water and water spray, and danger from frostbite; potential hazards involved in operating activities; basic facility operations; methods to carry out their duties and operating and maintenance procedures; LNG transfer procedures; detailed instructions on mobile LNG operations; fire prevention, including understanding fire control plans, potential causes and consequences and other training specified by NFPA 600; recognizing when assistance is needed to maintain security; how to carry out emergency procedures; how to provide first aid; Per §1.4, §2.3.4, §9.1.2(9), §10.15.5.1, §10.15.5.2, §10.15.5.6, §11.6.1, §11.6.2, §11.6.6]	[The written plan to train maintenance personnel shall include: characteristics and potential hazards of LNG used or handled at the facility, including low temperatures, asphyxiants, flammability of mixtures with air, odorless vapor, boiloff characteristics, reaction to water and water spray, and danger from frostbite; potential hazards involved in operating activities; basic facility operations; methods to carry out their duties and operating and maintenance procedures; detailed instructions on mobile LNG operations (if applicable to their task); how to carry out emergency procedures. Per §4.1, §18.11.1, §18.11.2, §18.11.2.1, §18.11.2.2, §18.11.2.3, §18.11.3, §18.11.4]	[The pipeline operator must define the need for and provide training to enable development and implementation of the PSM elements. Per §13]		No apparant gap.	No apparant gap.

Group#	Item #	PSM Subcategory Topic	**Requirements of 29 CFR 1910.119** (Actual Text, or [Summary*]+Actual Text) [*Summary sometimes included to assist comparisons to other references.]	**Requirements of 49 CFR 193** (Actual Text, or [Summary*]+Actual Text) [*Summary sometimes included to assist comparisons to other references.]	**Requirements of NFPA 59A 2001** [Summary]	**Requirements of NFPA 59A 2019** [Summary]	**Requirements of API RP 1173** (2015) [Summary]	**Other related requirements** (Actual Text, or [Summary*]+Actual Text)	**Potential Gaps in Current 49 CFR 193** (referencing 2001 edition of NFPA 59A, plus 2006 edition for §193.2101(b) and 193.2321(b))	**Potential Gaps in a Future Revision to 49 CFR 193 if it incorporates 2019 edition of NFPA 59A by reference**
TR	6	Supervisory Personnel - Initial Training Content	[No specific requirements.]	[The written plan to initially train supervisory personnel shall include: characteristics and potential hazards of LNG used or handled at the facility, including low temperatures, flammability of mixtures with air, odorless vapor, boiloff characteristics, and reaction to water and water spray; potential hazards involved in operating activities; basic facility operations; methods to carry out their duties and operating and maintenance procedures; LNG transfer procedures Per §193.2713 and §193.2717] §193.2713 Training: operations and maintenance. (a) Each operator shall provide and implement a written plan of initial training to instruct— (1) All permanent maintenance, operating, and supervisory personnel— (i) About the characteristics and hazards of LNG and other flammable fluids used or handled at the facility, including, with regard to LNG, low temperatures, flammability of mixtures with air, odorless vapor, boiloff characteristics, and reaction to water and water spray; (ii) About the potential hazards involved in operating and maintenance activities; and (iii) To carry out aspects of the operating and maintenance procedures under §§193.2503 and 193.2605 that relate to their assigned functions; and ... (3) All operating and appropriate supervisory personnel— (i) To understand detailed instructions on the facility operations, including controls, functions, and operating procedures; and (ii) To understand the LNG transfer procedures provided under §193.2513. §193.2717 Training: fire protection. (a) All personnel involved in maintenance and operations of an LNG plant, including their immediate supervisors, must be trained according to a written plan of initial instruction, including plant fire drills, to: (1) Know the potential causes and areas of fire; (2) Know the types, sizes, and predictable consequences of fire; and (3) Know and be able to perform their assigned fire control duties according to the procedures established under §193.2509 and by proper use of equipment provided under §193.2801. (c) Plant fire drills must provide personnel hands-on experience in carrying out their duties under the fire emergency procedures required by §193.2509.	[The written plan to train supervisory personnel shall include: characteristics and potential hazards of LNG used or handled at the facility, including low temperatures, flammability of mixtures with air, odorless vapor, boiloff characteristics, reaction to water and water spray, and danger from frostbite; potential hazards involved in operating activities; basic facility operations; methods to carry out their duties and operating and maintenance procedures; LNG transfer procedures; detailed instructions on mobile LNG operations; fire prevention, including understanding fire control plans, potential causes and consequences and other training specified by NFPA 600; recognizing when assistance is needed to maintain security; how to carry out emergency procedures; how to provide first aid; Per §1.4, §2.3.4, §9.1.2(9), §10.15.5.1, §10.15.5.2, §10.15.5.6, §11.6.1, §11.6.2, §11.6.6]	[The written plan to train supervisory personnel shall include: characteristics and potential hazards of LNG used or handled at the facility, including low temperatures, asphyxiants, flammability of mixtures with air, odorless vapor, boiloff characteristics, reaction to water and water spray, and danger from frostbite; potential hazards involved in operating activities; facility operations, including controls, functions, and operating procedures; methods to carry out their duties and operating and maintenance procedures; purging practices and principles; LNG transfer procedures (if applicable to their task); detailed instructions on mobile LNG operations (if applicable to their task); how to carry out emergency procedures. Per §4.1, §18.11.1, §18.11.2, §18.11.2.1, §18.11.2.2, §18.11.2.3, §18.11.3, §18.11.4]	[The pipeline operator must define the need for and provide training to enable development and implementation of the PSM elements. Per §13]		No apparant gap.	No apparant gap.
TR	7	Operations and Maintenance Personnel - Minimum Frequency in Years for Refresher Training	[3 §1910.119(g)(2)] §1910.119(g)(2)Refresher training Refresher training shall be provided at least every three years, and more often if necessary, to each employee involved in operating a process to assure that the employee understands and adheres to the current operating procedures of the process. The employer, in consultation with the employees involved in operating the process, shall determine the appropriate frequency of refresher training.	[2 Per §193.2713(b)] §193.2713(b) Training (Operations and maintenance): A written plan of continuing instruction must be conducted at intervals of not more than two years to keep all personnel current on the knowledge and skills they gained in the program of initial instruction	[2 Per §10.15.5.3 and §11.6.3]	[2 Per §18.11.6.1]	[As necessary; no frequency specified. Per §13]		No apparant gap.	No apparant gap.
TR	8	Operations and Maintenance Personnel - Refresher Training Content	[Assure that the employee understands and adheres to the current operating procedures of the process. Per §1910.119(g)(2)] §1910.119(g)(2) Refresher training. Refresher training shall be provided at least every three years, and more often if necessary, to each employee involved in operating a process to assure that the employee understands and adheres to the current operating procedures of the process. The employer, in consultation with the employees involved in operating the process, shall determine the appropriate frequency of refresher training.	[Keep all personnel current on the knowledge and skills they gained in the program of initial instruction Per §193.2713(b)] §193.2713(b) Training: operations and maintenance: A written plan of continuing instruction must be conducted at intervals of not more than two years to keep all personnel current on the knowledge and skills they gained in the program of initial instruction	[No specific requirements.]	[No specific requirements.]	[As necessary; no frequency specified. Per §13]		No apparant gap.	No apparant gap.
TR	9	Must Training Records Be Kept?	[Yes Per §1910.119(g)(3)] §1910.119(g)(3)Training documentation The employer shall ascertain that each employee involved in operating a process has received and understood the training required by this paragraph. The employer shall prepare a record which contains the identitiy of the employee understood the training.	[Yes Per §193.2719] §193.2719 Training: records. (a) Each operator shall maintain a system of records which— (1) Provide evidence that the training programs required by this subpart have been implemented; and (2) Provide evidence that Personnel have undergone and satisfactorily completed the required training programs. (b) Records must be maintained for one year after Personnel are no longer assigned duties at the LNG plant.	[Yes Per §11.6.4 and §10.15.5.4]	[Yes Per §18.12.4]	[Yes Per §13]		No apparant gap.	No apparant gap.
TR	10	Minimum Duration in Years to Maintain Employee's Training Records After Employee is No Longer Assigned Duties at the LNG Plant	[No specific requirement.]	[1 Per §193.2719] §193.2719 Training: records. (b) Records must be maintained for one year after personnel are no longer assigned duties at the LNG plant.	[2 Per §10.15.5.5 and §11.6.5]	[2 Per §18.12.14]	[No specific requirement.]		Could conform records retention period to match NFPA 59A (2001). (1 year in 49CFR193 vs 2 years in NFPA 59A 2001 and 2019)	Could conform records retention period to match NFPA 59A (2001). (1 year in 49CFR193 vs 2 years in NFPA 59A 2001 and 2019)
TR	11	Portable LNG Equipment Operator Qualifications - Operator Experience	[No specific requirement.]	[No specific requirement.]	[At least one operator must be qualified by both experience and training. Per §2.3.4(b)]	[At least one operator must be qualified by both experience and training. Per §14.1(3)]	[No specific requirement.]		No apparant gap.	No apparant gap.
		Contractors	**Contractors**	**Contractors**	**Contractors**	**Contractors**	**Contractors**	**Contractors**	**Contractors**	**Contractors**
CON	1	Applicability of this Part	1910.119(h) Contractors—(1) Application. This paragraph applies to contractors performing maintenance or repair, turnaround, major renovation, or specialty work on or adjacent to a covered process. It does not apply to contractors providing incidental services which do not influence process safety, such as janitorial work, food and drink services, laundry, delivery or other supply services.	[No specific definition.]	[No specific definition.]	[No specific definition.]	[Activities on the pipeline affected by PSM requirements which the operator elects to outsource. Per 8.4]		No apparant gap.	No apparant gap.
CON	2	Operator Responsibilities - Evaluating and Selecting the Designer, Fabricator or Constructor	1910.119(h)(2) Employer responsibilities. (i) The employer, when selecting a contractor, shall obtain and evaluate information regarding the contract employer's safety performance and programs.	§193.2703 Design and fabrication. For the design and fabrication of components, each operator shall use— (a) With respect to design, persons who have demonstrated competence by training or experience in the design of comparable components. (b) With respect to fabrication, persons who have demonstrated competence by training or experience in the fabrication of comparable components. §193.2705 Construction, installation, inspection, and testing. (a) Supervisors and other personnel utilized for construction, installation, inspection, or testing must have demonstrated their capability to perform satisfactorily the assigned function by appropriate training in the methods and equipment to be used or related experience and accomplishments.	[Operators should select designers, fabricators, and constructors who are competent in the design, fabrication and/or construction of LNG containers, process equipment, cryogenic equipment, piping systems,refrigerant storage and handling equipment, loading and unloading facilities, fire protection equipment, and other components of the facility. Per §2.4.1, 2.4.4 and §10.2.5]	[Operators should select designers, fabricators, and constructors who are and qualified by training or experience and accomplishments. Per §4.2.2 and §A.4.2 (specifically item (2) at bottom of §A.4.2)]	[No specific requirement.]		No apparant gap.	No apparant gap.

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CON	3	Operator Responsibilities - Informing the Designer, Fabricator and Constructor of Hazards and Emergency Action Plan	1910.119(h)(2)(ii) The employer shall inform contract employers of the known potential fire, explosion, or toxic release hazards related to the contractor's work and the process. 1910.119(h)(2)(iii) TThe employer shall explain to contract employers the applicable provisions of the emergency action plan required by paragraph (n) of this section..	[Designers, Fabricators and Constructors who work on maintaining an operating facility are required to receive training regarding hazards and emergency procedures. See for example §193.2707(a)(1) which requires successful completion of the training required by §§193.2713 and 193.2717.] §193.2703 Design and fabrication. For the design and fabrication of components, each operator shall use— (a) With respect to design, persons who have demonstrated competence by training or experience in the design of comparable components. (b) With respect to fabrication, persons who have demonstrated competence by training or experience in the fabrication of comparable components. §193.2705 Construction, installation, inspection, and testing. (a) Supervisors and other personnel utilized for construction, installation, inspection, or testing must have demonstrated their capability to perform satisfactorily the assigned function by appropriate training in the methods and equipment to be used or related experience and accomplishments. (b) Each operator must periodically determine whether inspectors performing construction, installation, and testing duties required by this part are satisfactorily performing their assigned functions. §193.2707 Operations and maintenance. (a) Each operator shall utilize for operation or maintenance of components only those personnel who have demonstrated their capability to perform their assigned functions by— (1) Successful completion of the training required by §§193.2713 and 193.2717; and (2) Experience related to the assigned operation or maintenance function; and (3) Acceptable performance on a proficiency test relevant to the assigned function. (b) A person who does not meet the requirements of paragraph (a) of this section may operate or maintain a component when accompanied and directed by an individual who meets the requirements. (c) Corrosion control procedures under §193.2605(b), including those for the design, installation, operation, and maintenance of cathodic protection systems, must be carried out by, or under the direction of, a person qualified by experience and training in corrosion control technology.	[No specific requirement.]	[No specific requirement.]	[Operator shall provide to contractors: safety policy training and orientation; information about risks at the work site. Per §8.4(d) and §8.4(f)]		No apparant gap.	No apparant gap.
CON	4	Operator Responsibilities - Control Access to Facility by Designer, Fabricator and Constructor	1910.119(h)(2)(iv) The employer shall develop and implement safe work practices consistent with paragraph (f)(4) of this section, to control the entrance, presence and exit of contract employers and contract employees in covered process areas.	§193.2903 Security procedures. Each operator shall prepare and follow one or more manuals of written procedures to provide security for each LNG plant. The procedures must be available at the plant in accordance with §193.2017 and include at least: ... (e) Methods for determining which persons are allowed access to the LNG plant; (f) Positive identification of all persons entering the plant and on the plant, including methods at least as effective as picture badges;	[The operator security system shall prevent entry by unauthorized persons. Per §9.8.1]	[The operator security system shall prevent entry by unauthorized persons. Per §16.8.2 and §18.5.1]	[No specific requirement.]		No apparant gap.	No apparant gap.
CON	5	Operator Responsibilities - Evaluate Performance of Designer, Fabricator and Constructor with respect to PSM Requirements	1910.119(h)(2)(v) The employer shall periodically evaluate the performance of contract employers in fulfilling their obligations as specified in paragraph (h)(3) of this section.	[No specific requirement focused on a PSM-related performance evaluation, but it may be interpreted at least in part to be included in §193.2605(c) and §193.2705. However, the reporting requirements in §191.23 are not the type of near-miss observations cited in] §193.2605 Maintenance procedures. (c) Each operator shall include in the manual required by paragraph (b) of this section instructions enabling personnel who perform operation and maintenance activities to recognize conditions that potentially may be safety-related conditions that are subject to the reporting requirements of §191.23 of this subchapter. §193.2705 Construction, installation, inspection, and testing. ... (b) Each operator must periodically determine whether inspectors performing construction, installation, and testing duties required by this part are satisfactorily performing their assigned functions.	[No specific requirement.]	[Operator shall periodically determine that construction, installation, and testing inspectors are satisfactorily performing their assigned functions, but there is no obligation on fabricators, constructors, installers and those performing testing beyond inspectors of those disciplines. Per §4.2.2.1]	[Operator shall evaluate the Contractor's safety performance. Per §8.4(e)]		Could more specifically require that toperator must periodically evaluate the safety performance of personnel utilized for construction, installation, inspection, testing, operations or maintenance.	Could more specifically require that toperator must periodically evaluate the safety performance of personnel utilized for construction, installation, inspection, testing, operations or maintenance.
CON	6	Operator Responsibilities - Evaluate Performance of Designer, Fabricator and Constructor with respect to Compliance to non-PSM-related Requirements	No specific requirement	§193.2705 Construction, installation, inspection, and testing. (b) Each operator must periodically determine whether inspectors performing construction, installation, and testing duties required by this part are satisfactorily performing their assigned functions.	[Supervision must be provided to ensure conformance of facility and components with this standard. Per §2.4.2 and §2.4.4 and §10.2.5]	[Operator shall periodically determine the peformance of construction, installation, and testing inspectors. Per §4.2.2.1]	[Operator must establish accountability for Contractor's performance, and MOC procedure. Per §8.4(b) and §8.4(d)]		No apparent gap.	No apparent gap.
CON	7	Operator Responsibilities - Tracking Injury and Illness of Designer, Fabricator or Constructor	1910.119(h)(2)(vi) The employer shall maintain a contract employee injury and illness log related to the contractor's work in process areas.	[No specific requirement.]	[No specific requirement.]	[No specific requirement.]	[No specific requirement.]		Could require that the operator must receive or maintain an injury and illness log related to work done while at operator's facility by designers, fabricators, installers, inspectors, constructors or those performing testing.	Could require that the operator must receive or maintain an injury and illness log related to work done while at operator's facility by designers, fabricators, installers, inspectors, constructors or those performing testing.
CON	8	Operator Responsibilities - Learn from the Designer, Fabricator and Constructor	[No specific requirement.]	[Operators are specifically required to have procedures in place enabling personnel who perform operation and maintenance activities to recognize conditions that potentially may be safety-related conditions, as per §193.2605(c).] §193.2605 Maintenance procedures. (a) Each operator shall determine and perform, consistent with generally accepted engineering practice, the periodic inspections or tests needed to meet the applicable requirements of this subpart and to verify that components meet the maintenance standards prescribed by this subpart. (b) Each operator shall follow one or more manuals of written procedures for the maintenance of each component, including any required corrosion control. The procedures must include: (1) The details of the inspections or tests determined under paragraph (a) of this section and their frequency of performance; and (2) A description of other actions necessary to maintain the LNG plant according to the requirements of this subpart. (c) Each operator shall include in the manual required by paragraph (b) of this section instructions enabling personnel who perform operation and maintenance activities to recognize conditions that potentially may be safety-related conditions that are subject to the reporting requirements of §191.23 of this subchapter.	[No specific requirement.]	[No specific requirement.]	[Operator should incorporate lessons learned by Contractor into the operator's operations. Per §8.4(c)]		Could require operator to define and document a process for operator to receive "lessons learned" suggestions and recommendations voluntarily provided from designers, fabricators, inspectors, constructors or those performing testing that pertain to potential improvements in process safety at the operator's facility, and for operator to review and assess any appropriate course of action.	Could require operator to define and document a process for operator to receive "lessons learned" suggestions and recommendations voluntarily provided from designers, fabricators, inspectors, constructors or those performing testing that pertain to potential improvements in process safety at the operator's facility, and for operator to review and assess any appropriate course of action.
CON	9	Designer, Fabricator and Constructor Responsibilities - Training and Documentation for their Employees	1910.119(h)(3)(i) The contract employer shall assure that each contract employee is trained in the work practices necessary to safely perform his/her job. 1910.119(h)(3)(ii) The contract employer shall assure that each contract employee is instructed in the known potential fire, explosion, or toxic release hazards related to his/her job and the process, and the applicable provisions of the emergency action plan. 1910.119(h)(3)(iii) The contract employer shall document that each contract employee has received and understood the training required by this paragraph. The contract employer shall prepare a record which contains the identity of the contract employee, the date of training, and the means used to verify that the employee understood the training.	[Designers, Fabricators and Constructors who work on maintaining an operating facility are required to receive training regarding hazards and emergency procedures. See for example §193.2707(a)(1) which requires successful completion of the training required by §§193.2713 and 193.2717.] §193.2703 Design and fabrication. For the design and fabrication of components, each operator shall use— (a) With respect to design, persons who have demonstrated competence by training or experience in the design of comparable components. (b) With respect to fabrication, persons who have demonstrated competence by training or experience in the fabrication of comparable components. §193.2705 Construction, installation, inspection, and testing. (a) Supervisors and other personnel utilized for construction, installation, inspection, or testing must have demonstrated their capability to perform satisfactorily the assigned function by appropriate training in the methods and equipment to be used or related experience and accomplishments. (b) Each operator must periodically determine whether inspectors performing construction, installation, and testing duties required by this part are satisfactorily performing their assigned functions. §193.2707 Operations and maintenance. (a) Each operator shall utilize for operation or maintenance of components only those personnel who have demonstrated their capability to perform their assigned functions by— (1) Successful completion of the training required by §§193.2713 and 193.2717; and (2) Experience related to the assigned operation or maintenance function; and (3) Acceptable performance on a proficiency test relevant to the assigned function. (b) A person who does not meet the requirements of paragraph (a) of this section may operate or maintain a component when accompanied and directed by an individual who meets the requirements. (c) Corrosion control procedures under §193.2605(b), including those for the design, installation, operation, and maintenance of cathodic protection systems, must be carried out by, or under the direction of, a person qualified by experience and training in corrosion control technology. §193.2713 Training: operations and maintenance. (a) Each operator shall provide and implement a written plan of initial training to	[No specific requirement.]	[No specific requirement.]	[No specific requirement.]		No apparent gap.	No apparent gap.

Group#	Item #	PSM Subcategory Topic	**Requirements of 29 CFR 1910.119** (Actual Text, or [Summary*]+Actual Text) [*Summary sometimes included to assist comparisons to other references.]	**Requirements of 49 CFR 193** (Actual Text, or [Summary*]+Actual Text) [*Summary sometimes included to assist comparisons to other references.]	**Requirements of NFPA 59A 2001** [Summary]	**Requirements of NFPA 59A 2019** [Summary]	**Requirements of API RP 1173** (2015) [Summary]	**Other related requirements** (Actual Text, or [Summary*]+Actual Text)	**Potential Gaps in Current 49 CFR 193** (referencing 2001 edition of NFPA 59A, plus 2006 edition for §193.2101(b) and 193.2321(b))	**Potential Gaps in a Future Revision to 49 CFR 193 if it incorporates 2019 edition of NFPA 59A by reference**
CON	10	Designer, Fabricator and Constructor Responsibilities - Evaluate Employee Performance	1910.119(h)(3)(iv) The contract employer shall assure that each contract employee follows the safety rules of the facility including the safe work practices required by paragraph (f)(4) of this section.	[No specific requirement in this regard, but §193.2703 and §193.2705 are applicable] §193.2703 Design and fabrication. For the design and fabrication of components, each operator shall use— (a) With respect to design, persons who have demonstrated competence by training or experience in the design of comparable components. (b) With respect to fabrication, persons who have demonstrated competence by training or experience in the fabrication of comparable components. §193.2705 Construction, installation, inspection, and testing. (a) Supervisors and other personnel utilized for construction, installation, inspection, or testing must have demonstrated their capability to perform satisfactorily the assigned function by appropriate training in the methods and equipment to be used or related experience and accomplishments.	[No specific requirement in this regard, but operators should select designers, fabricators, and constructors who are competent in the design, fabrication and/or construction of LNG containers, process equipment, cryogenic equipment, piping systems,refrigerant storage and handling equipment, loading and unloading facilities, fire protection equipment, and other components of the facility. Per §2.4.1, 2.4.4 and §10.2.5]	[No specific requirement in this regard, but operators should select designers, fabricators, and constructors who are and qualified by training or experience and accomplishments. Per §4.2.2 and §A.4.2 (specifically item (2) at bottom of §A.4.2)]	[No specific requirement.]		No apparant gap. Difficult to suggest language with sufficient clarity for regulatory enforcement. Could for example require operator to document designer's, fabricator's or constructor's confirmation that its employee's performance evaluation includes the employee's following of safe work practices identified by the operator, but that would impossible for operator to verify.	No apparant gap. Difficult to suggest language with sufficient clarity for regulatory enforcement. Could for example require operator to document designer's, fabricator's or constructor's confirmation that its employee's performance evaluation includes the employee's following of safe work practices identified by the operator, but that would impossible for operator to verify.
CON	11	Designer, Fabricator and Constructor Responsibilities - Informing Operator	1910.119(h)(3)(v) The contract employer shall advise the employer of any unique hazards presented by the contract employer's work, or of any hazards found by the contract employer's work.	[No specific requirement in this regard, but §193.2703 and §193.2705 are applicable] §193.2703 Design and fabrication. For the design and fabrication of components, each operator shall use— (a) With respect to design, persons who have demonstrated competence by training or experience in the design of comparable components. (b) With respect to fabrication, persons who have demonstrated competence by training or experience in the fabrication of comparable components. §193.2705 Construction, installation, inspection, and testing. (a) Supervisors and other personnel utilized for construction, installation, inspection, or testing must have demonstrated their capability to perform satisfactorily the assigned function by appropriate training in the methods and equipment to be used or related experience and accomplishments.	[No specific requirement in this regard, but operators should select designers, fabricators, and constructors who are competent in the design, fabrication and/or construction of LNG containers, process equipment, cryogenic equipment, piping systems,refrigerant storage and handling equipment, loading and unloading facilities, fire protection equipment, and other components of the facility. Per §2.4.1, 2.4.4 and §10.2.5]	[No specific requirement in this regard, but operators should select designers, fabricators, and constructors who are and qualified by training or experience and accomplishments. Per §4.2.2 and §A.4.2 (specifically item (2) at bottom of §A.4.2)]	[No specific requirement.]		No apparant gap. Difficult to suggest language with sufficient clarity for regulatory enforcement. Could require operator to require designer, fabricator or constructor that it must advise the operator of any unique hazards presented or found by the their work, but that would be impossible for operator to verify.	No apparant gap. Difficult to suggest language with sufficient clarity for regulatory enforcement. Could require operator to require designer, fabricator or constructor that it must advise the operator of any unique hazards presented or found by the their work, but that would be impossible for operator to verify.
		Pre-Startup Safety Review	**Pre-Startup Safety Review**	**Pre-Startup Safety Review**	**Pre-Startup Safety Review**	**Pre-Startup Safety Review**	**Pre-Startup Safety Review**	**Pre-Startup Safety Review**	**Pre-Startup Safety Review**	**Pre-Startup Safety Review**
PSSR	1	When a Pre-Startup Safety Review is Required	§1910.119(i) Pre-startup safety review (1) The employer shall perform a pre-startup safety review for new facilities and for modified facilities when the modification is significant enough to require a change in the process safety information. ...	[A pre-startup safety review is not a defined term, but inspections and tests are required before any component is placed in service, and plans and procedures must be updated when a a component is changed significantly or a new component is installed and at intervals not exceeding 27 months, but at least once every 2 calendar years. Per §193.2303, §193.2017 and §193.2619] § 193.2303 Construction acceptance: No person may place in service any component until it passes all applicable inspections and tests prescribed by this subpart and NFPA-59A-2001 (incorporated by reference, see §193.2013). §193.2017 Plans and procedures. (a) Each operator shall maintain at each LNG plant the plans and procedures required for that plant by this part. The plans and procedures must be available upon request for review and inspection by the Administrator or any State Agency that has submitted a current certification or agreement with respect to the plant under the pipeline safety laws (49 U.S.C. 60101 et seq.). In addition, each change to the plans or procedures must be available at the LNG plant for review and inspection within 20 days after the change is made. (b) The Associate Administrator or the State Agency that has submitted a current certification under section 5(a) of the Natural Gas Pipeline Safety Act with respect to the pipeline facility governed by an operator's plans and procedures may, after notice and opportunity for hearing as provided in 49 CFR 190.206 or the relevant State procedures, require the operator to amend its plans and procedures as necessary to provide a reasonable level of safety. (c) Each operator must review and update the plans and procedures required by this part— (1) When a component is changed significantly or a new component is installed; and (2) At intervals not exceeding 27 months, but at least once every 2 calendar years. §193.2619 Control systems. (a) Each control system must be properly adjusted to operate within design limits. (b) If a control system is out of service for 30 days or more, it must be inspected and tested for operational capability before returning it to service. (c) Control systems in service, but not normally in operation, such as relief valves and automatic shutdown devices, and control systems for internal shutoff valves for bottom penetration tanks must be inspected and tested once each calendar year, not exceeding 15 months, with the following exceptions: (1) Control systems used seasonally, such as for liquefaction or vaporization, must	[A pre-startup safety review is not a defined requirement, but requirements for operation include that: - Construction and equipment is in accordance with design specifications, and personnel utilized for construction, installation, inspection, or testing must be competent in the design, fabrication, and construction; - Safety, operating, maintenance, and emergency procedures are in place and are adequate; - For new facilities, performance testing to demonstrate that components will operate satisfactory in service; - Training of each employee involved in operating a process has been completed. - Equipment has been properly isolated and purged of combustible mixtures. Per §2.4.4, §6.7, §10.2.5, §10.15.3.2, §10.15.3.4, §11.3.2, §11.3.6 plus many referenced design and construction codes for components and equipment.]	[A pre-startup safety review is not a defined requirement, but requirements for commissioning and operation include that: - Construction and equipment is in accordance with design specifications, and personnel utilized for construction, installation, inspection, or testing must be competent in the design, fabrication, and construction; - Safety, operating, maintenance, and emergency procedures are in place and are adequate; - For new facilities, performance testing to demonstrate that components will operate satisfactory in service; - Training of each employee involved in operating a process has been completed. - Equipment has been properly isolated and purged of combustible mixtures. - Prior to startup of facilities, a commissioning plan is developed to test and verify that all components are functional within their design ranges, and piping, boilers, pressure vessels, control systems and related instrumentation are commissioned in accordance with recognized standards. Per §4.2.2, §18.3.4, §18.3.5, §18.4, §18.7 plus many referenced design and construction codes for components and equipment.]	[A pre-startup safety review is not a defined requirement, but inspections are required prior to start-up of equipment. Per §8.2.3]		Could specify that a Pre-Startup Safety Review is specifically required, and the conditions that it is required to be performed in addition to putting a component or plant in service, such as perhaps such as perhaps for facilities that have been substantially modified.	Could clarify that the Commissioning requirements in §18.7 apply to situations beyond initial startup such as perhaps for facilities that have been substantially modified.
PSSR	2	Required Content in a Pre-Startup Safety Review	§1910.119(i) Pre-startup safety review ... (2) The pre-startup safety review shall confirm that prior to the introduction of highly hazardous chemicals to a process: (i) Construction and equipment is in accordance with design specifications; (ii) Safety, operating, maintenance, and emergency procedures are in place and are adequate; (iii) For new facilities, a process hazard analysis has been performed and recommendations have been resolved or implemented before startup; and modified facilities meet the requirements contained in management of change, paragraph (l). (iv) Training of each employee involved in operating a process has been completed.	[A pre-startup safety review is not a defined requirement by that name, but requirements for operation include that: - Construction and equipment is in accordance with design specifications, and personnel utilized for construction, installation, inspection, or testing must have demonstrated their capability to perform satisfactorily the assigned function by appropriate training in the methods and equipment to be used or related experience and accomplishments; - Safety, operating, maintenance, and emergency procedures are in place and are adequate; - Training procedures are in place and are adequate; - For new facilities, performance testing to demonstrate that components will operate satisfactory in service; - Equipment has been properly isolated and purged of combustible mixtures. Per §193.2303, §193.2503, §193.2703, §193.2705 and §193.2713(b)] §193.2303 Construction acceptance. No person may place in service any component until it passes all applicable inspections and tests prescribed by this subpart and NFPA-59A-2001 §193.2503 Operating procedures. Each operator shall follow one or more manuals of written procedures to provide safety in normal operation and in responding to an abnormal operation that would affect safety. The procedures must include provisions for: (b) Startup and shutdown, including for initial startup, performance testing to demonstrate that components will operate satisfactory in service. §193.2703 Design and fabrication. For the design and fabrication of components, each operator shall use— (a) With respect to design, persons who have demonstrated competence by training or experience in the design of comparable components. (b) With respect to fabrication, persons who have demonstrated competence by training or experience in the fabrication of comparable components. §193.2705 Construction, installation, inspection, and testing. (a) Supervisors and other personnel utilized for construction, installation, inspection, or testing must have demonstrated their capability to perform satisfactorily the assigned function by appropriate training in the methods and equipment to be used or related experience and accomplishments. (b) Each operator must periodically determine whether inspectors performing construction, installation, and testing duties required by this part are satisfactorily	[A pre-startup safety review is not a defined requirement by that name, but requirements for operation include that: - Construction and equipment is in accordance with design specifications, and personnel utilized for construction, installation, inspection, or testing must be competent in the design, fabrication, and construction; - Safety, operating, maintenance, and emergency procedures are in place and are adequate; - For new facilities, performance testing to demonstrate that components will operate satisfactory in service; - Training of each employee involved in operating a process has been completed. - Equipment has been properly isolated and purged of combustible mixtures. Per §2.4.4, §6.7, §10.2.5, §10.15.3.2, §10.15.3.4, §11.3.2, §11.3.6 plus many referenced design and construction codes for components and equipment.]	[A pre-startup safety review is not a defined requirement by that name, but requirements for commissioning and operation include that: - Construction and equipment is in accordance with design specifications, and personnel utilized for construction, installation, inspection, or testing must be competent in the design, fabrication, and construction; - Safety, operating, maintenance, and emergency procedures are in place and are adequate; - For new facilities, performance testing to demonstrate that components will operate satisfactory in service; - Training of each employee involved in operating a process has been completed. - Equipment has been properly isolated and purged of combustible mixtures. - Components that are constructed or repaired, replaced or altered due to failure, inspection or change, or significantly change, must be reviewed by qualified persons from six different disciplines to ensure that safety or reliability will not be impaired. - Prior to startup of facilities, a commissioning plan is developed to test and verify that all components are functional within their design ranges, and piping, boilers, pressure vessels, control systems and related instrumentation are commissioned in accordance with recognized standards. Per §4.2, §4.6, §18.3.4, §18.3.5, §18.4, §18.7 plus many referenced design and construction codes for components and equipment.]	[A pre-startup safety review is not a defined requirement by that name, but requirements for operation include that: - Construction is in accordance with design specifications; - Safety, operating, maintenance, and emergency procedures are in place and are adequate; - Operating procedures shall be defined for both initial start-up of new or modified facilities, and start-up following maintenance or outage. Per §8.1.2 and §8.2.3]		No apparent gap.	No apparent gap.
		Mechanical Integrity	**Mechanical Integrity**	**Mechanical Integrity**	**Mechanical Integrity**	**Mechanical Integrity**	**Mechanical Integrity**	**Mechanical Integrity**	**Mechanical Integrity**	**Mechanical Integrity**
MI	1	Definition of Process Equipment to Have Required Mechanical Integrity	§1910.119(j) Mechanical integrity—(1) Application. Paragraphs (j)(2) through (j)(6) of this section apply to the following process equipment: (i) Pressure vessels and storage tanks; (ii) Piping systems (including piping components such as valves); (iii) Relief and vent systems and devices; (iv) Emergency shutdown systems; (v) Controls (including monitoring devices and sensors, alarms, and interlocks) and, (vi) Pumps.	§193.2007 Definitions. As used in this part: ... Component means any part, or system of parts functioning as a unit, including, but not limited to, piping, processing equipment, containers, control devices, impounding systems, lighting, security devices, fire control equipment, and communication equipment, whose integrity or reliability is necessary to maintain safety in controlling, processing, or containing a hazardous fluid. §193.2603 General. (a) Each component in service, including its support system, must be maintained in a condition that is compatible with its operational or safety purpose by repair, replacement, or other means. (b) An operator may not place, return, or continue in service any component which is not maintained in accordance with this subpart. (c) Each component taken out of service must be identified in the records kept under §193.2639. (d) If a safety device is taken out of service for maintenance, the component being served by the device must be taken out of service unless the same safety function is provided by an alternate means. (e) If the inadvertent operation of a component taken out of service could cause a hazardous condition, that component must have a tag attached to the controls bearing the words "do not operate" or words of comparable meaning.	[Mechanical integrity is addressed by equipment maintenance, inspection and tests, as described in general in §6.9, §9.6, §10.15, §11.5 and other elements throughout the standard. In addition, many mechanical integrity requirements are specified for equipment or components unique to LNG facilities.]	[Mechanical integrity is addressed by equipment maintenance, inspection and tests, as described in general in §18 and other elements throughout the standard. In addition, many mechanical integrity requirements are specified for equipment or components unique to LNG facilities.]	[Pipeline systems and safety-related equipment connected to the pipeline system such as relief valves, regulators, etc. Per §8.2]		No apparent overall gaps but include an open-ended question in survey regarding the definition of "component" in 49CFR193. Some specific potential individual gaps are defined in the rows below.	No apparent overall gaps but include an open-ended question in survey regarding the definition of "component" in 49CFR193. Some specific potential individual gaps are defined in the rows below.

Group#	Item #	PSM Subcategory Topic	**Requirements of 29 CFR 1910.119** (Actual Text, or [Summary*]+Actual Text) [*Summary sometimes included to assist comparisons to other references.]	**Requirements of 49 CFR 193** (Actual Text, or [Summary*]+Actual Text) [*Summary sometimes included to assist comparisons to other references.]	**Requirements of NFPA 59A 2001** [Summary]	**Requirements of NFPA 59A 2019** [Summary]	**Requirements of API RP 1173** (2015) [Summary]	**Other related requirements** (Actual Text, or [Summary*]+Actual Text)	**Potential Gaps in Current 49 CFR 193** (referencing 2001 edition of NFPA 59A, plus 2006 edition for §193.2101(b) and 193.2321(b))	**Potential Gaps in a Future Revision to 49 CFR 193 if it incorporates 2019 edition of NFPA 59A by reference**
MI	2	Must Written Procedures Be Kept?	[Yes] § 1910.119(j)(2) Written procedures: The employer shall establish and implement written procedures to maintain the on-going integrity of process equipment.	[Yes] §193.2605 Maintenance procedures. ... (b) Each operator shall follow one or more manuals of written procedures for the maintenance of each component, including any required corrosion control. The procedures must include: (1) The details of the inspections or tests determined under paragraph (a) of this section and their frequency of performance; and (2) A description of other actions necessary to maintain the LNG plant according to the requirements of this subpart. (c) Each operator shall include in the manual required by paragraph (b) of this section instructions enabling personnel who perform operation and maintenance activities to recognize conditions that potentially may be safety-related conditions that are subject to the reporting requirements of §191.23 of this subchapter.	[Yes. Mechanical integrity is addressed by required written equipment maintenance procedures and manuals, as described in general in §10.15.4, §10.15.4.2 and §11.5.2.]	[Yes. Mechanical integrity is addressed by required written equipment maintenance procedures and manuals, as described in general in §18.2.1, §18.2.2, §18.3.5, §18.3.6 and other sections.]	[Yes, written procedures must be maintained in order to control maintenance in accordance with the design and purchase specifications. Per §8.2, including §8.2.2 and §8.2.4]		No apparant gap.	No apparant gap.
MI	3	Training for Process Maintenance Activities	§1910.119(j)(3) Training for process maintenance activities: The employer shall train each employee involved in maintaining the on-going integrity of process equipment in an overview of that process and its hazards and in the procedures applicable to the employee's job tasks to assure that the employee can Perform the job tasks in a safe manner.	§193.2713 Training: operations and maintenance. (a) Each operator shall provide and implement a written plan of initial training to instruct— (1) All permanent maintenance, operating, and supervisory personnel— (i) About the characteristics and hazards of LNG and other flammable fluids used or handled at the facility, including, with regard to LNG, low temperatures, flammability of mixtures with air, odorless vapor, boiloff characteristics, and reaction to water and water spray; (ii) About the potential hazards involved in operating and maintenance activities; and (iii) To carry out aspects of the operating and maintenance procedures under §193.2503 and §193.2605 that relate to their assigned functions; and ... §193.2617 Repairs. (a) Repair work on components must be performed and tested in a manner which: (1) As far as practicable, complies with the applicable requirements of Subpart D of this part; and (2) Assures the integrity and operational safety of the component being repaired. (b) For repairs made while a component is operating, each operator shall include in the maintenance procedures under §193.2605 appropriate precautions to maintain the safety of personnel and property during repair activities.	[The written plan to train maintenance and personnel shall include: characteristics and potential hazards of LNG used or handled at the facility, including low temperatures, flammability of mixtures with air, odorless vapor, boiloff characteristics, reaction to water and water spray, and danger from frostbite; potential hazards involved in operating activities; basic facility operations; methods to carry out their duties and operating and maintenance procedures; LNG transfer procedures; detailed instructions on mobile LNG operations; fire prevention, including understanding fire control plans, potential causes and consequences and other training specified by NFPA 600; recognizing when assistance is needed to maintain security; how to carry out emergency procedures; how to provide first aid; Per §1.4, §2.3.4, §9.1.2(9), §10.15.5.1, §10.15.5.2, §10.15.5.6, §11.6.1, §11.6.2, §11.6.6]	[The written plan to train maintenance personnel shall include: characteristics and potential hazards of LNG used or handled at the facility, including low temperatures, asphyxiants, flammability of mixtures with air, odorless vapor, boiloff characteristics, reaction to water and water spray, and danger from frostbite; potential hazards involved in operating activities; basic facility operations; methods to carry out their duties and operating and maintenance procedures; detailed instructions on mobile LNG operations (if applicable to their task); how to carry out emergency procedures. Per §4.1, §18.11.1, §18.11.2, §18.11.2.1, §18.11.2.2, §18.11.2.3, §18.11.3, §18.11.4]	[The pipeline operator must define the need for and provide training to enable development and implementation of the PSM elements. Per §13]		No apparant gap.	No apparant gap.
MI	4	Method to Inspect and Test - Process Equipment (as defined in 29CFR1910.119(j))	§1910.119(j)(4) Inspection and testing. (i) Inspections and tests shall be performed on process equipment. (ii) Inspection and testing procedures shall follow recognized and generally accepted good engineering practices.	§193.2605 Maintenance procedures. (a) Each operator shall determine and perform, consistent with generally accepted engineering practice, the periodic inspections or tests needed to meet the applicable requirements of this subpart and to verify that components meet the maintenance standards prescribed by this subpart. (b) Each operator shall follow one or more manuals of written procedures for the maintenance of each component, including any required corrosion control. The procedures must include: (1) The details of the inspections or tests determined under paragraph (a) of this section and their frequency of performance; and (2) A description of other actions necessary to maintain the LNG plant according to the requirements of this subpart. (c) Each operator shall include in the manual required by paragraph (b) of this section instructions enabling personnel who perform operation and maintenance activities to recognize conditions that potentially may be safety-related conditions that are subject to the reporting requirements of §191.23 of this subchapter. §193.2303 Construction acceptance. No person may place in service any component until it passes all applicable inspections and tests prescribed by this subpart and NFPA-59A-2001 (incorporated by reference, see §193.2013). §193.2507 Monitoring operations. Each component in operation or building in which a hazard to persons or property could exist must be monitored to detect fire or any malfunction or flammable fluid that could cause a hazardous condition. Monitoring must be accomplished by watching or listening from an attended control center for warning alarms, such as gas, temperature, pressure, vacuum, and flow alarms, or by conducting an inspection or test at intervals specified in the operating procedures. §193.2619 Control systems. (a) Each control system must be properly adjusted to operate within design limits.	[Overall Requirement: Periodically inspect or tests, or both, every component and its support system using generally accepted engineering practice in order to ensure that each component is in good operating condition. Numerous requirements to inspect and test specific equipment are provided such as identified in this table. Per §10.15.4.1]	[Overall Requirement: Periodically inspect or tests, or both, every component and its support system using generally accepted engineering practice in order to ensure that each component is in good operating condition. Numerous requirements to inspect and test specific equipment are provided such as identified in this table. Per §4.2.2.1 and §18.9.3]	[Overall Requirement: The operator must ensure that pipeline systems and safety-related equipment connected to the pipeline system are designed, manufactured, fabricated, installed, operated, maintained, inspected, and tested in a manner consistent with the specified requirements, regulations, and applicable standards, through the operator's quality control, inspection and maintenance procedures and its design and purchase specifications. Per §8.2]		No apparant gap, but include an open-ended question in survey regarding the definition of "component" in 49CFR193.	No apparant gap, but include an open-ended question in survey regarding the definition of "component" in 49CFR193.
MI	5	Frequency in Months to Inspect & Test - Process Equipment (as defined in 29CFR1910.119(j))	§1910.119(j)(4)(iii) The frequency of inspections and tests of process equipment shall be consistent with applicable manufacturers' recommendations and good engineering practices, and more frequently if determined to be necessary by prior operating experience.	§193.2605 Maintenance procedures. (a) Each operator shall determine and perform, consistent with generally accepted engineering practice, the periodic inspections or tests needed to meet the applicable requirements of this subpart and to verify that components meet the maintenance standards prescribed by this subpart. ... §193.2007 Definitions. As used in this part: ... Component means any part, or system of parts functioning as a unit, including, but not limited to, piping, processing equipment, containers, control devices, impounding systems, lighting, security devices, fire control equipment, and communication equipment, whose integrity or reliability is necessary to maintain safety in controlling, processing, or containing a hazardous fluid.	[Overall Requirement: Periodically inspect or tests, or both, every component and its support system in accordance with generally accepted engineering practice and as often as is necessary to ensure that each component is in good operating condition. Numerous requirements to inspect and test specific equipment are provided such as identified in this table. Per §10.15.4.1]	[Overall Fequirement: Periodically inspect or tests, or both, every component and its support system in accordance with generally accepted engineering practice and as often as is necessary to ensure that each component is in good operating condition. Numerous requirements to inspect and test specific equipment are provided such as identified in this table. Per §4.2.2.1 and §18.9.3]	[Overall Requirement: The operator must ensure that pipeline systems and safety-related equipment connected to the pipeline system are designed, manufactured, fabricated, installed, operated, maintained, inspected, and tested in a manner consistent with the specified requirements, regulations, and applicable standards, through the operator's quality control, inspection and maintenance procedures and its design and purchase specifications. Per §8.2]		No apparant gap.	No apparant gap.
MI	6	Duration in Days of Out-of-Service which Requires Inspection and Test of Control System	[No specific requirement. §1910.119(j)(4)(iii) provides overall requirement.] §1910.119(j)(4)(iii) The frequency of inspections and tests of process equipment shall be consistent with applicable manufacturers' recommendations and good engineering practices, and more frequently if determined to be necessary by prior operating experience.	[30] §193.2619(b) If a control system is out of service for 30 days or more, it must be inspected and tested for operational capability before returning it to service.	[30 Per §10.15.4.5 and §11.5.5.1]	[30 Per §18.10.10.1]	[No Specific Requirement, beyond Overall Requirement: The operator must ensure that pipeline systems and safety-related equipment connected to the pipeline system are designed, manufactured, fabricated, installed, operated, maintained, inspected, and tested in a manner consistent with the specified requirements, regulations, and applicable standards, through the operators's quality control, inspection and maintenance procedures and its design and purchase specifications. Per §8.2]		No apparant gap.	No apparant gap.
MI	7	Frequency in Months to Inspect and Test - Control systems in service, but not normally in operation, such as automatic shutdown devices, and control systems for internal shutoff valves for bottom penetration tanks	[No specific requirement. §1910.119(j)(4)(iii) provides overall requirement.] §1910.119(j)(4)(iii) The frequency of inspections and tests of process equipment shall be consistent with applicable manufacturers' recommendations and good engineering practices, and more frequently if determined to be necessary by prior operating experience.	[12 not to exceed 15] §193.2619(c) Control systems in service, but not normally in operation, such as relief valves and automatic shutdown devices, and control systems for internal shutoff valves for bottom penetration tanks must be inspected and tested once each calendar year, not exceeding 15 months, with the following exceptions (1) Control systems used seasonally, such as for liquefaction or vaporization, must be inspected and tested before use each season. (2) Control systems that are intended for fire protection must be inspected and tested at regular intervals not to exceed 6 months. (d) Control systems that are normally in operation, such as required by a base load system, must be inspected and tested once each calendar year but with intervals not exceeding 15 months. (e) Relief valves must be inspected and tested for verification of the valve seat lifting pressure and reseating.	[12 not to exceed 15 Per §11.5.5.1(d)]	[Inspection intervals either: 12 month frequency external inspection either per Section 2 of ANSI/NB-23, National Board Inspection Code, Part 2, Inspection (including listed conditions that can be observed on the valves externally); or per API 510, Pressure Vessel Inspection Code: In-service Inspection, Rating, Repair, and Alteration. Set-point testing intervals either: 60 month frequency not to exceed 63; or per API RP 576, Inspection of Pressure-Relieving Devices. Per §18.10.10.7]	[No Specific Requirement, beyond Overall Requirement: The operator must ensure that pipeline systems and safety-related equipment connected to the pipeline system are designed, manufactured, fabricated, installed, operated, maintained, inspected, and tested in a manner consistent with the specified requirements, regulations, and applicable standards, through the operators's quality control, inspection and maintenance procedures and its design and purchase specifications. Per §8.2]		No apparant gap, but there may be an opportunity for an operator to optionally use a RAGAGEP-based approach such as defined in 2019 edition of NFPA 59A.	No apparant gap.
MI	8	Frequency in Months to Inspect and Test - Control systems used seasonally, such as for liquefaction or vaporization	[No specific requirement. §1910.119(j)(4)(iii) provides overall requirement.] §1910.119(j)(4)(iii) The frequency of inspections and tests of process equipment shall be consistent with applicable manufacturers' recommendations and good engineering practices, and more frequently if determined to be necessary by prior operating experience.	[Before each season Per §193.2619(c)(1)] §193.2619(c) Control systems in service, but not normally in operation, such as relief valves and automatic shutdown devices, and control systems for internal shutoff valves for bottom penetration tanks must be inspected and tested once each calendar year, not exceeding 15 months, with the following exceptions: (1) Control systems used seasonally, such as for liquefaction or vaporization, must be inspected and tested before use each season. (2) Control systems that are intended for fire protection must be inspected and tested at regular intervals not to exceed 6 months.	[Before each season Per §11.5.5.1(b)]	[Before each season Per §18.10.10.3]	[No Specific Requirement, beyond Overall Requirement: The operator must ensure that pipeline systems and safety-related equipment connected to the pipeline system are designed, manufactured, fabricated, installed, operated, maintained, inspected, and tested in a manner consistent with the specified requirements, regulations, and applicable standards, through the operators's quality control, inspection and maintenance procedures and its design and purchase specifications. Per §8.2]		No apparant gap, but wording in regulation could be potentially clarified such as: (1) Control systems used seasonally, such as for liquefaction or vaporization when only used on seasonal basis, must be inspected and tested before use each season.	No apparant gap, but wording in regulation could be potentially clarified such as: (1) Control systems used seasonally, such as for liquefaction or vaporization when only used on seasonal basis, must be inspected and tested before use each season.

Group#	Item #	PSM Subcategory Topic	**Requirements of 29 CFR 1910.119** (Actual Text, or [Summary*]+Actual Text) [*Summary sometimes included to assist comparisons to other references.]	**Requirements of 49 CFR 193** (Actual Text, or [Summary*]+Actual Text) [*Summary sometimes included to assist comparisons to other references.]	**Requirements of NFPA 59A 2001** [Summary]	**Requirements of NFPA 59A 2019** [Summary]	**Requirements of API RP 1173** (2015) [Summary]	**Other related requirements** (Actual Text, or [Summary*]+Actual Text)	**Potential Gaps in Current 49 CFR 193** (referencing 2001 edition of NFPA 59A, plus 2006 edition for §193.2101(b) and 193.2321(b))	**Potential Gaps in a Future Revision to 49 CFR 193 if it incorporates 2019 edition of NFPA 59A by reference**
MI	9	Frequency in Months to Inspect and Test - Control systems intended for fire protection	[No specific requirement. §1910.119(j)(4)(iii) provides overall requirement.] §1910.119(j)(4)(iii) The frequency of inspections and tests of process equipment shall be consistent with applicable manufacturers' recommendations and good engineering practices, and more frequently if determined to be necessary by prior operating experience.	[6] §193.2619(c) Control systems in service, but not normally in operation, such as relief valves and automatic shutdown devices, and control systems for internal shutoff valves for bottom penetration tanks must be inspected and tested once each calendar year, not exceeding 15 months, with the following exceptions: (1) Control systems used seasonally, such as for liquefaction or vaporization, must be inspected and tested before use each season. (2) Control systems that are intended for fire protection must be inspected and tested at regular intervals not to exceed 6 months.	[To be inspected and tested in accordance with the applicable fire code. Per §10.15.4.5(c) and §11.5.5(c)]	[To be inspected and tested in accordance with the applicable fire code. Per §18.10.10.4]	[No Specific Requirement, beyond Overall Requirement: The operator must ensure that pipeline systems and safety-related equipment connected to the pipeline system are designed, manufactured, fabricated, installed, operated, maintained, inspected, and tested in a manner consistent with the specified requirements, regulations, and applicable standards, through the operators's quality control, inspection and maintenance procedures and its design and purchase specifications. Per §8.2]		No apparent gap, but there may be an opportunity for an operator to optionally use a RAGAGEP-based approach such as defined in 2019 edition of NFPA 59A.	Could conform 49CFR193 to NFPA 59A requirements.
MI	10	Frequency in Months to Inspect and Test - Stationary LNG Tank Relief Valves	[No specific requirement. §1910.119(j)(4)(iii) provides overall requirement.] §1910.119(j)(4)(iii) The frequency of inspections and tests of process equipment shall be consistent with applicable manufacturers' recommendations and good engineering practices, and more frequently if determined to be necessary by prior operating experience.	[12 not to exceed 15] §193.2619(c) Control systems in service, but not normally in operation, such as relief valves and automatic shutdown devices, and control systems for internal shutoff valves for bottom penetration tanks must be inspected and tested once each calendar year, not exceeding 15 months, with the following exceptions: (1) Control systems used seasonally, such as for liquefaction or vaporization, must be inspected and tested before use each season. (2) Control systems that are intended for fire protection must be inspected and tested at regular intervals not to exceed 6 months.	[24 not to exceed 30 Per §11.5.5.19(e)]	[24 not to exceed 30 Per §18.10.10.6]	[No Specific Requirement, beyond Overall Requirement: The operator must ensure that pipeline systems and safety-related equipment connected to the pipeline system are designed, manufactured, fabricated, installed, operated, maintained, inspected, and tested in a manner consistent with the specified requirements, regulations, and applicable standards, through the operators's quality control, inspection and maintenance procedures and its design and purchase specifications. Per §8.2]		Could align 49CFR193.2619 to match NFPA 59A (2001) by revising requirement to be that stationary LNG tank relief valves shall be inspected and set point tested at least once every two calendar years, with intervals not exceeding 30 months. A related petition is https://www.ingaa.org/Filings/RegulatoryFilings/34588.aspx	Could align 49CFR193.2619 to match NFPA 59A (2019).
MI	11	Frequency in Months to Inspect and Test - Relief Valves in Control Systems other than on Stationary LNG Tanks	[No specific requirement. §1910.119(j)(4)(iii) provides overall requirement.] §1910.119(j)(4)(iii) The frequency of inspections and tests of process equipment shall be consistent with applicable manufacturers' recommendations and good engineering practices, and more frequently if determined to be necessary by prior operating experience.	[12 not to exceed 15] §193.2619(c) Control systems in service, but not normally in operation, such as relief valves and automatic shutdown devices, and control systems for internal shutoff valves for bottom penetration tanks must be inspected and tested once each calendar year, not exceeding 15 months, with the following exceptions: (1) Control systems used seasonally, such as for liquefaction or vaporization, must be inspected and tested before use each season. (2) Control systems that are intended for fire protection must be inspected and tested at regular intervals not to exceed 6 months.	[24 not to exceed 30 Per §10.15.4.5(d)]	[Inspection intervals either: 12 month frequency external inspection either per Section 2 of ANSI/NB-23, National Board Inspection Code, Part 2, Inspection (including listed conditions that can be observed on the valves externally); or per API 510, Pressure Vessel Inspection Code: In-service Inspection, Rating, Repair, and Alteration. Set-point testing intervals either: 60 month frequency not to exceed 63; or per API RP 576, Inspection of Pressure-Relieving Devices. Per §18.10.10.7]	[No Specific Requirement, beyond Overall Requirement: The operator must ensure that pipeline systems and safety-related equipment connected to the pipeline system are designed, manufactured, fabricated, installed, operated, maintained, inspected, and tested in a manner consistent with the specified requirements, regulations, and applicable standards, through the operators's quality control, inspection and maintenance procedures and its design and purchase specifications. Per §8.2]		Could align 49CFR193.2619 to match NFPA 59A (2001) by revising requirement to be that relief valves in control systems other than on stationary LNG tanks shall be inspected and set point tested at least once every two calendar years, with intervals not exceeding 30 months. A related petition is https://www.ingaa.org/Filings/RegulatoryFilings/34588.aspx	Could align 49CFR193.2619 to match NFPA 59A (2019).
MI	12	Frequency in Months to Inspect and Test - Relief Valves Protecting Hazardous Fluid Components other than in Control Systems or on Stationary LNG Tanks	[No specific requirement. §1910.119(j)(4)(iii) provides overall requirement.] §1910.119(j)(4)(iii) The frequency of inspections and tests of process equipment shall be consistent with applicable manufacturers' recommendations and good engineering practices, and more frequently if determined to be necessary by prior operating experience.	[12 not to exceed 15] §193.2619(c) Control systems in service, but not normally in operation, such as relief valves and automatic shutdown devices, and control systems for internal shutoff valves for bottom penetration tanks must be inspected and tested once each calendar year, not exceeding 15 months, with the following exceptions: (1) Control systems used seasonally, such as for liquefaction or vaporization, must be inspected and tested before use each season. (2) Control systems that are intended for fire protection must be inspected and tested at regular intervals not to exceed 6 months.	[60 not to exceed 63 per §11.5.5.1(e)]	[Inspection intervals either: 12 month frequency external inspection either per Section 2 of ANSI/NB-23, National Board Inspection Code, Part 2, Inspection (including listed conditions that can be observed on the valves externally); or per API 510, Pressure Vessel Inspection Code: In-service Inspection, Rating, Repair, and Alteration. Set-point testing intervals either: 60 month frequency not to exceed 63; or per API RP 576, Inspection of Pressure-Relieving Devices. Per §18.10.10.7]	[No Specific Requirement, beyond Overall Requirement: The operator must ensure that pipeline systems and safety-related equipment connected to the pipeline system are designed, manufactured, fabricated, installed, operated, maintained, inspected, and tested in a manner consistent with the specified requirements, regulations, and applicable standards, through the operators's quality control, inspection and maintenance procedures and its design and purchase specifications. Per §8.2]		Could align 49CFR193.2619 to match NFPA 59A (2001) by revising requirement to be that relief valves other than stationary LNG tank relief valves shall be inspected and set point tested at least once every 60 months, with intervals not exceeding 63 months.	Could align 49CFR193.2619 to match NFPA 59A (2019)
MI	13	Frequency in Months to Inspect and Test - Control systems that are normally in operation, such as required by a base load system	[No specific requirement. §1910.119(j)(4)(iii) provides overall requirement.] §1910.119(j)(4)(iii) The frequency of inspections and tests of process equipment shall be consistent with applicable manufacturers' recommendations and good engineering practices, and more frequently if determined to be necessary by prior operating experience.	[12 not to exceed 15] §193.2619(d) Control systems that are normally in operation, such as required by a base load system, must be inspected and tested once each calendar year but with intervals not exceeding 15 months	[12 not to exceed 15 Per §11.5.5.1(d)]	[12 not to exceed 15 Per §18.10.10.5]	[No Specific Requirement, beyond Overall Requirement: The operator must ensure that pipeline systems and safety-related equipment connected to the pipeline system are designed, manufactured, fabricated, installed, operated, maintained, inspected, and tested in a manner consistent with the specified requirements, regulations, and applicable standards, through the operators's quality control, inspection and maintenance procedures and its design and purchase specifications. Per §8.2]		No apparant gap.	No apparant gap.
MI	14	Frequency in Months to Test - Emergency Power Source Operation Functionality	[No specific requirement. §1910.119(j)(4)(iii) provides overall requirement.] §1910.119(j)(4)(iii) The frequency of inspections and tests of process equipment shall be consistent with applicable manufacturers' recommendations and good engineering practices, and more frequently if determined to be necessary by prior operating experience.	[1] §193.2613 Auxiliary power sources. Each auxiliary power source must be tested monthly to check its operational capability and tested annually for capacity. The capacity test must take into account the power needed to start up and simultaneously operate equipment that would have to be served by that power source in an emergency.	[1 Per §10.15.4.1.4 and §11.5.1.4]	[1 Per §18.10.4]	[No Specific Requirement, beyond Overall Requirement: The operator must ensure that pipeline systems and safety-related equipment connected to the pipeline system are designed, manufactured, fabricated, installed, operated, maintained, inspected, and tested in a manner consistent with the specified requirements, regulations, and applicable standards, through the operators's quality control, inspection and maintenance procedures and its design and purchase specifications. Per §8.2]		No apparent gap.	No apparent gap.
MI	15	Frequency in Months to Test - Emergency Power Source Operational Capacity	[No specific requirement. §1910.119(j)(4)(iii) provides overall requirement.] §1910.119(j)(4)(iii) The frequency of inspections and tests of process equipment shall be consistent with applicable manufacturers' recommendations and good engineering practices, and more frequently if determined to be necessary by prior operating experience.	[12] §193.2613 Auxiliary power sources. Each auxiliary power source must be tested monthly to check its operational capability and tested annually for capacity. The capacity test must take into account the power needed to start up and simultaneously operate equipment that would have to be served by that power source in an emergency.	[12 Per §10.15.4.1.4]	[12 Per §18.10.4]	[No Specific Requirement, beyond Overall Requirement: The operator must ensure that pipeline systems and safety-related equipment connected to the pipeline system are designed, manufactured, fabricated, installed, operated, maintained, inspected, and tested in a manner consistent with the specified requirements, regulations, and applicable standards, through the operators's quality control, inspection and maintenance procedures and its design and purchase specifications. Per §8.2]		No apparent gap.	No apparent gap.
MI	16	Frequency in Months to Pressure Test - Transfer Hoses	[No specific requirement. §1910.119(j)(4)(iii) provides overall requirement.] §1910.119(j)(4)(iii) The frequency of inspections and tests of process equipment shall be consistent with applicable manufacturers' recommendations and good engineering practices, and more frequently if determined to be necessary by prior operating experience.	[12 not to exceed 15] §193.2621 Testing transfer hoses: Hoses used in LNG or flammable refrigerant transfer systems must be: §193.2621(a) Testing transfer hoses: Tested once each calendar year, but with intervals not exceeding 15 months, to the maximum pump pressure or relief valve setting	[12 not to exceed 15 Per §8.7.5]	[12 not to exceed 15 Per §15.8.6]	[No Specific Requirement, beyond Overall Requirement: The operator must ensure that pipeline systems and safety-related equipment connected to the pipeline system are designed, manufactured, fabricated, installed, operated, maintained, inspected, and tested in a manner consistent with the specified requirements, regulations, and applicable standards, through the operators's quality control, inspection and maintenance procedures and its design and purchase specifications. Per §8.2]		No apparent gap.	No apparent gap.
MI	17	Frequency to Visually Inspect - Transfer Hoses	[No specific requirement. §1910.119(j)(4)(iii) provides overall requirement.] §1910.119(j)(4)(iii) The frequency of inspections and tests of process equipment shall be consistent with applicable manufacturers' recommendations and good engineering practices, and more frequently if determined to be necessary by prior operating experience.	[Before each use, visually inspect for damage or defect.] §193.2621 Testing transfer hoses. Hoses used in LNG or flammable refrigerant transfer systems must be: (a) Tested once each calendar year, but with intervals not exceeding 15 months, to the maximum pump pressure or relief valve setting; and (b) Visually inspected for damage or defects before each use.	[Before each use, visually inspect for damage or defect. Per §8.7.5]	[Before each use, visually inspect for damage or defect. Per §15.8.6]	[No Specific Requirement, beyond Overall Requirement: The operator must ensure that pipeline systems and safety-related equipment connected to the pipeline system are designed, manufactured, fabricated, installed, operated, maintained, inspected, and tested in a manner consistent with the specified requirements, regulations, and applicable standards, through the operators's quality control, inspection and maintenance procedures and its design and purchase specifications. Per §8.2]		No apparent gap.	No apparent gap.
MI	18	Frequency to Periodically Test - Marine Loading or Unloading Operations	[No specific requirement. §1910.119(j)(4)(iii) provides overall requirement.] §1910.119(j)(4)(iii) The frequency of inspections and tests of process equipment shall be consistent with applicable manufacturers' recommendations and good engineering practices, and more frequently if determined to be necessary by prior operating experience.	[No specific requirement.]	[No specific requirement.]	[As required by the authority having jurisdiction. Per §15.8.7 and §18.10.7].	[No Specific Requirement, beyond Overall Requirement: The operator must ensure that pipeline systems and safety-related equipment connected to the pipeline system are designed, manufactured, fabricated, installed, operated, maintained, inspected, and tested in a manner consistent with the specified requirements, regulations, and applicable standards, through the operators's quality control, inspection and maintenance procedures and its design and purchase specifications. Per §8.2]	The Marine Transfer Area is regulated by 33CFR127, which requires testing the transfer system including piping, hoses, and loading arms, under 33CFR127.407. It is outide the scope of 49CFR193, as per 49CFR2001(b)(3).	No apparent gap, but there may be an opportunity to clarify testing frequency requirements.	No apparent gap.
MI	19	Frequency in Months to Extenally Inspect and Test - LNG Storage Tanks	[No specific requirement. §1910.119(j)(4)(iii) provides overall requirement.] §1910.119(j)(4)(iii) The frequency of inspections and tests of process equipment shall be consistent with applicable manufacturers' recommendations and good engineering practices, and more frequently if determined to be necessary by prior operating experience.	[No specified minimum frequency; must inspect after a major meteorological or geophyiscal disturbance, or evidence of inner tank leakage, ineffectiveness of insulation, or frost heave.] §193.2623 Inspecting LNG storage tanks. Each LNG storage tank must be inspected or tested to verify that each of the following conditions does not impair the structural integrity or safety of the tank: (a) Foundation and tank movement during normal operation and after a major meteorological or geophysical disturbance. (b) Inner tank leakage. (c) Effectiveness of insulation. (d) Frost heave.	[No specified minimum frequency; must inspect after a major meteorological or geophyiscal disturbance, or evidence of inner tank leakage, ineffectiveness of insulation, or frost heave.] Per §10.15.4.5(e), §11.5.5.1(f) and §11.5.5.1(g)]	[60 if tank is Double, Full, and Membrane Tank System (for which, concrete tank components must be externally examined), or earlier if there are obvious or potential problems. No specified minimum frequency if tank is not a Double, Full, and Membrane Tank System. Must inspect all LNG storage tanks after a major meteorological or geophyiscal disturbance, or evidence of inner tank leakage, ineffectiveness of insulation, or frost heave. Per §18.10.11.2]	[No Specific Requirement, beyond Overall Requirement: The operator must ensure that pipeline systems and safety-related equipment connected to the pipeline system are designed, manufactured, fabricated, installed, operated, maintained, inspected, and tested in a manner consistent with the specified requirements, regulations, and applicable standards, through the operators's quality control, inspection and maintenance procedures and its design and purchase specifications. Per §8.2]		No apparent gap.	No apparent gap.

Group#	Item #	PSM Subcategory Topic	**Requirements of 29 CFR 1910.119** (Actual Text, or [Summary*]+Actual Text) [*Summary sometimes included to assist comparisons to other references.]	**Requirements of 49 CFR 193** (Actual Text, or [Summary*]+Actual Text) [*Summary sometimes included to assist comparisons to other references.]	**Requirements of NFPA 59A 2001** [Summary]	**Requirements of NFPA 59A 2019** [Summary]	**Requirements of API RP 1173** (2015) [Summary]	**Other related requirements** (Actual Text, or [Summary*]+Actual Text)	**Potential Gaps in Current 49 CFR 193** (referencing 2001 edition of NFPA 59A, plus 2006 edition for §193.2101(b) and 193.2321(b))	**Potential Gaps in a Future Revision to 49 CFR 193 if it incorporates 2019 edition of NFPA 59A by reference**
MI	20	Frequency in Days to Monitor Soil Temperature - LNG Storage Tanks	[No specific requirement. §1910.119(j)(4)(iii) provides overall requirement.] §1910.119(j)(4)(iii) The frequency of inspections and tests of process equipment shall be consistent with applicable manufacturers' recommendations and good engineering practices, and more frequently if determined to be necessary by prior operating experience.	[No specific requirement.]	[7 Per §4.1.7.3 and §11.3.4.2]	[1 Per §18.6.2.1]	[No Specific Requirement, beyond Overall Requirement: The operator must ensure that pipeline systems and safety-related equipment connected to the pipeline system are designed, manufactured, fabricated, installed, operated, maintained, inspected, and tested in a manner consistent with the specified requirements, regulations, and applicable standards, through the operators's quality control, inspection and maintenance procedures and its design and purchase specifications. Per §8.2]		No apparent gap, although the current requirement in the 2001 edition is lower frequency than 2019 edition.	No apparent gap.
MI	21	Frequency in Months to Conduct LNG Tank Bottom Temperature Survey	[No specific requirement. §1910.119(j)(4)(iii) provides overall requirement.] §1910.119(j)(4)(iii) The frequency of inspections and tests of process equipment shall be consistent with applicable manufacturers' recommendations and good engineering practices, and more frequently if determined to be necessary by prior operating experience.	[No specific requirement.]	[12, and also after an operating basis earthquake and after the indication of an abnormally cool area. Per §4.1.7.5]	[No specific requirement to conduct a survey, although related requirements are in §18.6.2.1, §8.4.11.5.1, §8.4.11.7, §11.6.2, and §18.6.2.2.]	[No Specific Requirement, beyond Overall Requirement: The operator must ensure that pipeline systems and safety-related equipment connected to the pipeline system are designed, manufactured, fabricated, installed, operated, maintained, inspected, and tested in a manner consistent with the specified requirements, regulations, and applicable standards, through the operators's quality control, inspection and maintenance procedures and its design and purchase specifications. Per §8.2]		No apparent gap.	No apparent gap.
MI	22	Frequency in Years to Survey Foundation Elevation, or Otherwise Assess Settlement of LNG Storage Tank or Container Foundation	[No specific requirement. §1910.119(j)(4)(iii) provides overall requirement.] §1910.119(j)(4)(iii) The frequency of inspections and tests of process equipment shall be consistent with applicable manufacturers' recommendations and good engineering practices, and more frequently if determined to be necessary by prior operating experience.	[No specific minimum frequency. Must inspect after a major meteorological or geophysical disturbance.] §193.2609 Support systems. Each support system or foundation of each component must be inspected for any detrimental change that could impair support. §193.2623 Inspecting LNG storage tanks. Each LNG storage tank must be inspected or tested to verify that each of the following conditions does not impair the structural integrity or safety of the tank: (a) Foundation and tank movement during normal operation and after a major meteorological or geophysical disturbance. (b) Inner tank leakage. (c) Effectiveness of insulation. (d) Frost heave.	[Periodically. Must also inspect after a major meteorological or geophysical disturbance. Per §4.1.7.6 and §11.5.5.1(g)]	[3 year frequency, and also after an operating basis earthquake and after the indication of an abnormally cool area. Per §18.6.2.2]	[No Specific Requirement, beyond Overall Requirement: The operator must ensure that pipeline systems and safety-related equipment connected to the pipeline system are designed, manufactured, fabricated, installed, operated, maintained, inspected, and tested in a manner consistent with the specified requirements, regulations, and applicable standards, through the operators's quality control, inspection and maintenance procedures and its design and purchase specifications. Per §8.2]		No apparent gap, although the current requirement in the 2001 edition does not contain the minimum frequency in the 2019 edition.	No apparent gap.
MI	23	Frequency in Months to Externally Inspect - Foundation or Support System of Each Component other than LNG Storage Container	[No specific requirement. §1910.119(j)(4)(iii) provides overall requirement.] §1910.119(j)(4)(iii) The frequency of inspections and tests of process equipment shall be consistent with applicable manufacturers' recommendations and good engineering practices, and more frequently if determined to be necessary by prior operating experience.	[No specific minimum frequency.] §193.2609 Support systems. Each support system or foundation of each component must be inspected for any detrimental change that could impair support.	[12, and also after each major meteorological disturbance. Per §10.15.4.1.3, §11.5.1.3, and §11.5.5(g)]	[12, and also after each major meteorological disturbance. Per §18.10.3 and §18.10.12]	[No Specific Requirement, beyond Overall Requirement: The operator must ensure that pipeline systems and safety-related equipment connected to the pipeline system are designed, manufactured, fabricated, installed, operated, maintained, inspected, and tested in a manner consistent with the specified requirements, regulations, and applicable standards, through the operators's quality control, inspection and maintenance procedures and its design and purchase specifications. Per §8.2]		No apparent gap.	No apparent gap.
MI	24	Frequency in Months to Externally Inspect - Insulation Systems for Impounding Surfaces	[No specific requirement. §1910.119(j)(4)(iii) provides overall requirement.] §1910.119(j)(4)(iii) The frequency of inspections and tests of process equipment shall be consistent with applicable manufacturers' recommendations and good engineering practices, and more frequently if determined to be necessary by prior operating experience.	[No specific frequency.]	[12 Per §11.5.1.11]	[12 Per §18.10.5]	[No Specific Requirement, beyond Overall Requirement: The operator must ensure that pipeline systems and safety-related equipment connected to the pipeline system are designed, manufactured, fabricated, installed, operated, maintained, inspected, and tested in a manner consistent with the specified requirements, regulations, and applicable standards, through the operators's quality control, inspection and maintenance procedures and its design and purchase specifications. Per §8.2]		No apparent gap.	No apparent gap.
MI	25	Frequency in Months to Test - Buried or Submerged Components Under Cathodic Protection	[No specific requirement. §1910.119(j)(4)(iii) provides overall requirement.] §1910.119(j)(4)(iii) The frequency of inspections and tests of process equipment shall be consistent with applicable manufacturers' recommendations and good engineering practices, and more frequently if determined to be necessary by prior operating experience.	[12 not to exceed 15] §193.2635(a) Monitoring corrosion control: Each buried or submerged component under cathodic protection must be tested at least once each calendar year, but with intervals not exceeding 15 months, to determine whether the cathodic protection meets the requirements of §192.463 of this chapter	[12 not to exceed 15 Per §11.5.6.4]	[12 not to exceed 15 Per §18.10.13.6.1(3)]	[No Specific Requirement, beyond Overall Requirement: The operator must ensure that pipeline systems and safety-related equipment connected to the pipeline system are designed, manufactured, fabricated, installed, operated, maintained, inspected, and tested in a manner consistent with the specified requirements, regulations, and applicable standards, through the operators's quality control, inspection and maintenance procedures and its design and purchase specifications. Per §8.2]		No apparent gap.	No apparent gap.
MI	26	Frequency in Months to Inspect - Cathodic Protection Rectifier or other Impressed Current Power Source	[No specific requirement. §1910.119(j)(4)(iii) provides overall requirement.] §1910.119(j)(4)(iii) The frequency of inspections and tests of process equipment shall be consistent with applicable manufacturers' recommendations and good engineering practices, and more frequently if determined to be necessary by prior operating experience.	[2 not to exceed 2.5] §193.2635(b) Monitoring corrosion control: Each cathodic protection rectifier or other impressed current power source must be inspected at least 6 times each calendar year, but with intervals not exceeding 2.5 months, to ensure that it is operating properly.	[2 not to exceed 2.5 Per §11.5.6.4]	[2 not to exceed 2.5 Per §18.10.13.6.1(4)]	[No Specific Requirement, beyond Overall Requirement: The operator must ensure that pipeline systems and safety-related equipment connected to the pipeline system are designed, manufactured, fabricated, installed, operated, maintained, inspected, and tested in a manner consistent with the specified requirements, regulations, and applicable standards, through the operators's quality control, inspection and maintenance procedures and its design and purchase specifications. Per §8.2]		No apparent gap.	No apparent gap.
MI	27	Frequency in Months to Inspect - Reverse Current Switch, Diode, and Interference Bond Whose Failure Would Jeopardize Component Protection	[No specific requirement. §1910.119(j)(4)(iii) provides overall requirement.] §1910.119(j)(4)(iii) The frequency of inspections and tests of process equipment shall be consistent with applicable manufacturers' recommendations and good engineering practices, and more frequently if determined to be necessary by prior operating experience.	[2 not to exceed 2.5] §193.2635(c) Monitoring corrosion control: Each reverse current switch, each diode, and each interference bond whose failure would jeopardize component protection must be electrically checked for proper performance at least 6 times each calendar year, but with intervals not exceeding 2.5 months. Each other interference bond must be checked at least once each calendar year, but with intervals not exceeding 15 months	[12 not to exceed 15. Required for interference bonds, but no specific requirements for reverse current switches or diodes. No dfferentiation if device failure would jeopardize component protection.] Per §11.5.6.4(c)]	[2 not to exceed 2.5] Per §18.10.13.6.1(5)]	[No Specific Requirement, beyond Overall Requirement: The operator must ensure that pipeline systems and safety-related equipment connected to the pipeline system are designed, manufactured, fabricated, installed, operated, maintained, inspected, and tested in a manner consistent with the specified requirements, regulations, and applicable standards, through the operators's quality control, inspection and maintenance procedures and its design and purchase specifications. Per §8.2]		No apparent gap.	No apparent gap.
MI	28	Frequency in Months to Inspect - Interference Bond Whose Failure Would Not Jeopardize Component Protection	[No specific requirement. §1910.119(j)(4)(iii) provides overall requirement.] §1910.119(j)(4)(iii) The frequency of inspections and tests of process equipment shall be consistent with applicable manufacturers' recommendations and good engineering practices, and more frequently if determined to be necessary by prior operating experience.	[12 not to exceed 15] §193.2635(c) Monitoring corrosion control: Each reverse current switch, each diode, and each interference bond whose failure would jeopardize component protection must be electrically checked for proper performance at least 6 times each calendar year, but with intervals not exceeding 2.5 months. Each other interference bond must be checked at least once each calendar year, but with intervals not exceeding 15 months	[12 not to exceed 15. Required for interference bonds, but no specific requirements for reverse current switches or diodes. No dfferentiation if device failure would jeopardize component protection.] Per §11.5.6.4(c)]	[12 not to exceed 15] Per §18.10.13.6.1(5)]	[No Specific Requirement, beyond Overall Requirement: The operator must ensure that pipeline systems and safety-related equipment connected to the pipeline system are designed, manufactured, fabricated, installed, operated, maintained, inspected, and tested in a manner consistent with the specified requirements, regulations, and applicable standards, through the operators's quality control, inspection and maintenance procedures and its design and purchase specifications. Per §8.2]		No apparent gap.	No apparent gap.
MI	29	Frequency in Years to Test - Each Component Protected from Atmospheric Corrosion	[No specific requirement. §1910.119(j)(4)(iii) provides overall requirement.] §1910.119(j)(4)(iii) The frequency of inspections and tests of process equipment shall be consistent with applicable manufacturers' recommendations and good engineering practices, and more frequently if determined to be necessary by prior operating experience.	[3] §193.2635(d) Monitoring corrosion control: Each component that is protected from atmospheric corrosion must be inspected at intervals not exceeding 3 years	[3 Per §11.5.6.4(d)]	[3 Per §18.10.13.6.2]	[No Specific Requirement, beyond Overall Requirement: The operator must ensure that pipeline systems and safety-related equipment connected to the pipeline system are designed, manufactured, fabricated, installed, operated, maintained, inspected, and tested in a manner consistent with the specified requirements, regulations, and applicable standards, through the operators's quality control, inspection and maintenance procedures and its design and purchase specifications. Per §8.2]		No apparent gap.	No apparent gap.
MI	30	Frequency in Months to Inspect - Internal Corrosion Control Monitoring Devices	[No specific requirement. §1910.119(j)(4)(iii) provides overall requirement.] §1910.119(j)(4)(iii) The frequency of inspections and tests of process equipment shall be consistent with applicable manufacturers' recommendations and good engineering practices, and more frequently if determined to be necessary by prior operating experience.	[6 not to exceed 7.5] §193.2635(e) Monitoring corrosion control: If a component is protected from internal corrosion, monitoring devices designed to detect internal corrosion, such as coupons or probes, must be located where corrosion is most likely to occur. However, monitoring is not required for corrosion resistant materials if the oPerator can demonstrate that the component will not be adversely affected by internal corrosion during its service life. Internal corrosion control monitoring devices must be checked at least two times each calendar year, but with intervals not exceeding 7.5 months.	[6 not to exceed 7.5 Per §11.5.6.4(e)]	[6 not to exceed 7.5 Per §18.10.13.6.3.2]	[No Specific Requirement, beyond Overall Requirement: The operator must ensure that pipeline systems and safety-related equipment connected to the pipeline system are designed, manufactured, fabricated, installed, operated, maintained, inspected, and tested in a manner consistent with the specified requirements, regulations, and applicable standards, through the operators's quality control, inspection and maintenance procedures and its design and purchase specifications. Per §8.2]		No apparent gap.	No apparent gap.

Group#	Item #	PSM Subcategory Topic	**Requirements of 29 CFR 1910.119** (Actual Text, or [Summary*]+Actual Text) [*Summary sometimes included to assist comparisons to other references.]	**Requirements of 49 CFR 193** (Actual Text, or [Summary*]+Actual Text) [*Summary sometimes included to assist comparisons to other references.]	**Requirements of NFPA 59A 2001** [Summary]	**Requirements of NFPA 59A 2019** [Summary]	**Requirements of API RP 1173** (2015) [Summary]	**Other related requirements** (Actual Text, or [Summary*]+Actual Text)	**Potential Gaps in Current 49 CFR 193** (referencing 2001 edition of NFPA 59A, plus 2006 edition for §193.2101(b) and 193.2321(b))	**Potential Gaps in a Future Revision to 49 CFR 193 if it incorporates 2019 edition of NFPA 59A by reference**
MI	31	Requirement to Keep Maintenance Records - Process Equipment (as defined in 29CFR1910.119(j))	§1910.119(j)(4)(iv) The employer shall document each inspection and test that has been performed on process equipment. The documentation shall identify the date of the inspection or test, the name of the person who performed the inspection or test, the serial number or other identifier of the equipment on which the inspection or test was performed, a description of the inspection or test performed, and the results of the inspection or test.	§193.2639 Maintenance records. (a) Each operator shall keep a record at each LNG plant of the date and type of each maintenance activity performed on each component to meet the requirements of this part. For each LNG facility that is designed and constructed after March 31, 2000 the operator shall also maintain related periodic inspection and testing records that NFPA-59A-2001 (incorporated by reference, see §193.2013) requires. (b) Each operator shall maintain records or maps to show the location of cathodically protected components, neighboring structures bonded to the cathodic protection system, and corrosion protection equipment. (c) Each of the following records must be retained for as long as the LNG facility remains in service: (1) Each record or map required by paragraph (b) of this section. (2) Records of each test, survey, or inspection required by this subpart in sufficient detail to demonstrate the adequacy of corrosion control measures. ... §193.2605 Maintenance procedures. (a) Each operator shall determine and perform, consistent with generally accepted engineering practice, the periodic inspections or tests needed to meet the applicable requirements of this subpart and to verify that components meet the maintenance standards prescribed by this subpart. (b) Each operator shall follow one or more manuals of written procedures for the maintenance of each component, including any required corrosion control. The procedures must include: (1) The details of the inspections or tests determined under paragraph (a) of this section and their frequency of performance; and (2) A description of other actions necessary to maintain the LNG plant according to the requirements of this subpart.	[Operators shall have documented procedures covering operation, maintenance, and training, and maintain drawings, charts, and records of plant equipment. Per §11.2]	[Operators shall have documented procedures covering operation, maintenance, and training, and maintain drawings, charts, and records of plant equipment. And Operators must maintain test and examination records and written procedures required within this standard and within Paragraph 345.2.7 and Section 346, respectively, of ASME B3l.3, Process Piping, for the life of the piping system or until such time as a re-examination is conducted. And Operators must maintain records and certification pertaining to materials, components, and heat treatment as required by Paragraphs 34l.4.l(c) and 34l.4.3(d), and Section 346 of ASME B3l.3, Process Piping, for the life of the system. Per §18.2.2]	[No Specific Requirement, beyond Overall Requirement: The operator must ensure that pipeline systems and safety-related equipment connected to the pipeline system are designed, manufactured, fabricated, installed, operated, maintained, inspected, and tested in a manner consistent with the specified requirements, regulations, and applicable standards, through the operators's quality control, inspection and maintenance procedures and its design and purchase specifications. Per §8.2]		Could consider specifying minimum content of test documents to include, e.g.: the name of the Person who Performed the inspection or test; the serial number or other identifier of the equipment on which the inspection or test was Performed.	Could consider specifying minimum content of test documents to include, e.g.: the name of the Person who Performed the inspection or test; the serial number or other identifier of the equipment on which the inspection or test was Performed.
MI	32	Minimum Period to Retain Maintenance Records, Maps, Surveys and Inspections of Cathodically-Protected Components and Bonded Neighboring Structures, and Corrosion Protection Equipment	[No specific requirement. §1910.119(j)(4) provides overall requirement .] §1910.119(j)(4)Inspection and testing ... (iii) The frequency of inspections and tests of process equipment shall be consistent with applicable manufacturers' recommendations and good engineering practices, and more frequently if determined to be necessary by prior operating experience.	[Life of Facility] §193.2639(c) Each of the following records must be retained for as long as the LNG facility remains in service: (1) Each record or map required by paragraph (b) of this section. (2) Records of each test, survey, or inspection required by this subpart in sufficient detail to demonstrate the adequacy of corrosion control measures.	[Life of Facility Per §11.5.7.2]	[Life of Facility Per §18.12.1]	[No Specific Requirement, beyond Overall Requirement: The operator must ensure that pipeline systems and safety-related equipment connected to the pipeline system are designed, manufactured, fabricated, installed, operated, maintained, inspected, and tested in a manner consistent with the specified requirements, regulations, and applicable standards, through the operators's quality control, inspection and maintenance procedures and its design and purchase specifications. Per §8.2]		No apparent gap.	No apparent gap.
MI	33	Minimum Period in Years to Retain Maintenance Records on Equipment in LNG Facility Other Than Cathodically-Protected Components and Bonded Neighboring Structures, and Corrosion Protection Equipment	[No specific requirement. §1910.119(j)(4) provides overall requirement .] §1910.119(j)(4)Inspection and testing ... (iii) The frequency of inspections and tests of process equipment shall be consistent with applicable manufacturers' recommendations and good engineering practices, and more frequently if determined to be necessary by prior operating experience.	[5] §193.2639 Maintenance records. (a) Each operator shall keep a record at each LNG plant of the date and type of each maintenance activity performed on each component to meet the requirements of this part. For each LNG facility that is designed and constructed after March 31, 2000 the operator shall also maintain related periodic inspection and testing records that NFPA-59A-2001 (incorporated by reference, see §193.2013) requires. Maintenance records, whether required by this part or NFPA-59A-2001, must be kept for a period of not less than five years. §193.2521 Operating records Each operator shall maintain a record of results of each inspection, test and investigation required by this subpart. For each LNG facility that is designed and constructed after March 31, 2000 the operator shall also maintain related inspection, testing, and investigation records that NFPA-59A-2001 (incorporated by reference, see §193.2013) requires. Such records, whether required by this part or NFPA-59A-2001, must be kept for a period of not less than five years.	[5 Per §11.3.8]	[5 Per §18.12.1]	[No Specific Requirement, beyond Overall Requirement: The operator must ensure that pipeline systems and safety-related equipment connected to the pipeline system are designed, manufactured, fabricated, installed, operated, maintained, inspected, and tested in a manner consistent with the specified requirements, regulations, and applicable standards, through the operators's quality control, inspection and maintenance procedures and its design and purchase specifications. Per §8.2]		No apparent gap.	No apparent gap.
MI	34	Must Operator Retain Records of Materials of Construction for Components, Buildings, Foundations and Support Systems for Containment of LNG or other Hazardous Fluids?	[No specific requirement. §1910.119(j)(4) provides overall requirement .] §1910.119(j)(4)Inspection and testing ... (iii) The frequency of inspections and tests of process equipment shall be consistent with applicable manufacturers' recommendations and good engineering practices, and more frequently if determined to be necessary by prior operating experience.	[Yes] §193.2119 Records Each operator shall keep a record of all materials for components, buildings, foundations, and support systems, as necessary to verify that material properties meet the requirements of this part. These records must be maintained for the life of the item concerned.	[Yes, although as part of general requirements that do not specifically list materials of construction Per §6.6.5 and §11.2].	[Yes, each plant shall have a record of these materials of construction for components, buildings, foundations, and support systems used for containment of LNG or other hazardous liquids, and verify that the material properties meet the requirements of NFPA 59A 2019 edition. Per §4.9.1 and §4.9.2]	[No Specific Requirement, beyond Overall Requirement: The operator must ensure that pipeline systems and safety-related equipment connected to the pipeline system are designed, manufactured, fabricated, installed, operated, maintained, inspected, and tested in a manner consistent with the specified requirements, regulations, and applicable standards, through the operators's quality control, inspection and maintenance procedures and its design and purchase specifications. Per §8.2]		No apparent gap, although the 2019 edition of NFPA 59A contains more specific requirements than the 2001 edition.	No apparent gap.
MI	35	Minimum Period in Years to Retain Records of Materials of Construction for Components, Buildings, Foundations and Support Systems for Containment of LNG or other Hazardous Fluids	[No specific requirement. §1910.119(j)(4) provides overall requirement .] §1910.119(j)(4)Inspection and testing ... (iii) The frequency of inspections and tests of process equipment shall be consistent with applicable manufacturers' recommendations and good engineering practices, and more frequently if determined to be necessary by prior operating experience.	[Life of the item concerned.] §193.2119 Records Each operator shall keep a record of all materials for components, buildings, foundations, and support systems, as necessary to verify that material properties meet the requirements of this part. These records must be maintained for the life of the item concerned.	[Life of System, although as part of general requirements that do not specifically list materials of construction Per §6.6.5 and §11.2].	[Life of facility. Per §4.9.3]	[No Specific Requirement, beyond Overall Requirement: The operator must ensure that pipeline systems and safety-related equipment connected to the pipeline system are designed, manufactured, fabricated, installed, operated, maintained, inspected, and tested in a manner consistent with the specified requirements, regulations, and applicable standards, through the operators's quality control, inspection and maintenance procedures and its design and purchase specifications. Per §8.2]		No apparent gap.	No apparent gap.
MI	36	Equipment Deficiencies - Operator's Response	§1910.119(j)(5) Equipment deficiencies. The employer shall correct deficiencies in equipment that are outside acceptable limits (defined by the process safety information in paragraph (d) of this section) before further use or in a safe and timely manner when necessary means are taken to assure safe operation.	§193.2637 Remedial measures. Prompt corrective or remedial action must be taken whenever an operator learns by inspection or otherwise that atmospheric, external, or internal corrosion is not controlled as required by this subpart §193.2304 Corrosion control overview. (a) Subject to paragraph (b) of this section, components may not be constructed, repaired, replaced, or significantly altered until a Person qualified under §193.2707(c) reviews the applicable design drawings and materials specifications from a corrosion control viewpoint and determines that the materials involved will not impair the safety or reliability of the component or any associated components. (b) The repair, replacement, or significant alteration of components must be reviewed only if the action to be taken— (1) Involves a change in the original materials specified; (2) Is due to a failure caused by corrosion; or (3) Is occasioned by inspection revealing a significant deterioration of the component due to corrosion.	[Repairs of components must maintain the integrity of the component, ensure safety of personnel and property during the repair, and ensure safe operation. Per §10.15.4.4 and §11.5.4]	[Repairs of components must maintain the integrity of the component, ensure safety of personnel and property during the repair, and ensure safe operation. Per §18.10.8]	[No Specific Requirement, beyond Overall Requirement: The operator must ensure that pipeline systems and safety-related equipment connected to the pipeline system are designed, manufactured, fabricated, installed, operated, maintained, inspected, and tested in a manner consistent with the specified requirements, regulations, and applicable standards, through the operators's quality control, inspection and maintenance procedures and its design and purchase specifications. Per §8.2]		No apparent gap, but pose general question about any preference for future regulations include more reliance on RAGAGEP-type basis vs. prescriptive basis.	No apparent gap, but pose general question about any preference for future regulations include more reliance on RAGAGEP-type basis vs. prescriptive basis.
MI	37	Quality Assurance of New Plants and Equipment	§1910.119(j)(6) Quality assurance §1910.119(j)(6)(i) Quality assurance In the construction of new plants and equipment, the employer shall assure that equipment as it is fabricated is suitable for the process application for which they will be used. §1910.119(j)(6)(ii) Quality assurance Appropriate checks and inspections shall be Performed to assure that equipment is installed proPerly and consistent with design specifications and the manufacturer's instructions.	§193.2301 Scope. Each LNG facility constructed after March 31, 2000 must comply with requirements of this part and of NFPA-59A-2001 (incorporated by reference see §193.2013). In the event of a conflict between this part and NFPA 59A, this part prevails. §193.2303 Construction acceptance. No person may place in service any component until it passes all applicable inspections and tests prescribed by this subpart and NFPA-59A-2001 (incorporated by reference, see §193.2013). §193.2321 Nondestructive tests. (a) The butt welds in metal shells of storage tanks with internal design pressure above 15 psig must be nondestructively examined in accordance with the ASME Boiler and Pressure Vessel Code (BPVC) (Section VIII, Division 1)(incorporated by reference, see §193.2013), except that 100 Percent of welds that are both longitudinal (or meridional) and circumferential (or latitudinal) of hydraulic load bearing shells with curved surfaces that are subject to cryogenic temPeratures must be nondestructively examined in accordance with the ASME BPVC (Section VIII, Division 1). (b) For storage tanks with internal design pressures at 15 psig or less, ultrasonic examinations of welds on metal containers must comply with the following: (1) Section 7.3.1.2 of NFPA Std-59A-2006, (incorporated by reference, see §193. 2013); (2) Appendices C and Q of API Std 620, (incorporated by reference, see §193.2013); (c) Ultrasonic examination records must be retained for the life of the facility. If electronic records are kept, they must be retained in a manner so that they cannot be altered by any means; and (d) The ultrasonic equipment used in the examination of welds must be calibrated at a frequency no longer than eight hours. Such calibrations must verify the examination of welds against a calibration standard. If the ultrasonic equipment is found to be out of calibration, all previous weld inspections that are suspect must be reexamined.	[Quality assurance in the design, construction, fabrication, suitability and inspection of new plants and equipment is required by §2.4.2, §2.4.4, §3.4.3, §4.1.1, §4.3.4, §6.6, §10.10 and other sections, and citing prevailing national and international design standards.]	[Quality assurance in the design, construction, fabrication, suitability and inspection of new plants and equipment is required by §4.2.2, §4.2.3, and many other sections, and citing prevailing national and international design standards.]	[No Specific Requirement, beyond Overall Requirement: The operator must ensure that pipeline systems and safety-related equipment connected to the pipeline system are designed, manufactured, fabricated, installed, operated, maintained, inspected, and tested in a manner consistent with the specified requirements, regulations, and applicable standards, through the operators's quality control, inspection and maintenance procedures and its design and purchase specifications. Per §8.2]		No apparent gap, but pose general question about any preference for future regulations include more reliance on RAGAGEP-type basis vs. prescriptive basis.	No apparent gap, but pose general question about any preference for future regulations include more reliance on RAGAGEP-type basis vs. prescriptive basis.

Group#	Item #	PSM Subcategory Topic	**Requirements of 29 CFR 1910.119** (Actual Text, or [Summary*]+Actual Text) [*Summary sometimes included to assist comparisons to other references.]	**Requirements of 49 CFR 193** (Actual Text, or [Summary*]+Actual Text) [*Summary sometimes included to assist comparisons to other references.]	**Requirements of NFPA 59A 2001** [Summary]	**Requirements of NFPA 59A 2019** [Summary]	**Requirements of API RP 1173** (2015) [Summary]	**Other related requirements** (Actual Text, or [Summary*]+Actual Text)	**Potential Gaps in Current 49 CFR 193** (referencing 2001 edition of NFPA 59A, plus 2006 edition for §193.2101(b) and 193.2321(b))	**Potential Gaps in a Future Revision to 49 CFR 193 if it incorporates 2019 edition of NFPA 59A by reference**
MI	38	Quality Assurance to Maintain Materials and Equipment	§ 1910.119(j)(6)(iii) The employer shall assure that maintenance materials, spare parts and equipment are suitable for the process application for which they will be used.	§193.2603 General. (a) Each component in service, including its support system, must be maintained in a condition that is compatible with its operational or safety purpose by repair, replacement, or other means. (b) An operator may not place, return, or continue in service any component which is not maintained in accordance with this subpart. (c) Each component taken out of service must be identified in the records kept under §193.2639. (d) If a safety device is taken out of service for maintenance, the component being served by the device must be taken out of service unless the same safety function is provided by an alternate means. ... §193.2617 Repairs. (a) Repair work on components must be performed and tested in a manner which: (1) As far as practicable, complies with the applicable requirements of Subpart D of this part; and (2) Assures the integrity and operational safety of the component being repaired. (b) For repairs made while a component is operating, each operator shall include in the maintenance procedures under §193.2605 appropriate precautions to maintain the safety of personnel and property during repair activities.	[Mechanical integrity is addressed by equipment maintenance, inspection and tests, as described in general in §6.9, §9.6, §10.15, §11.5 and other elements throughout the standard. In addition, many mechanical integrity requirements are specified for equipment or components unique to LNG facilities.]	[Mechanical integrity is addressed by equipment maintenance, inspection and tests, as described in general in §18 and other elements throughout the standard. In addition, many mechanical integrity requirements are specified for equipment or components unique to LNG facilities.]	[The expertise of integrity management subject matter experts must include repair effectiveness. Per §5.6(g)]		No apparent gap, but pose general question about any preference for future regulations include more reliance on RAGAGEP-type basis vs. prescriptive basis.	No apparent gap, but pose general question about any preference for future regulations include more reliance on RAGAGEP-type basis vs. prescriptive basis.
		Hot Work Permit	**Hot Work Permit**	**Hot Work Permit**	**Hot Work Permit**	**Hot Work Permit**	**Hot Work Permit**	**Hot Work Permit**	**Hot Work Permit**	**Hot Work Permit**
HWP	1	Overview	§1910.119(k)Hot work Permit. (1) The employer shall issue a hot work permit for hot work operations conducted on or near a covered process. (2) The permit shall document that the fire prevention and protection requirements in 29 CFR 1910.252(a) have been implemented prior to beginning the hot work operations; it shall indicate the date(s) authorized for hot work; and identify the object on which hot work is to be performed. The permit shall be kept on file until completion of the hot work operations.	[No specific requirement for Hot work Permit.]	[No specific requirement for Hot Work Permit, although operating procedures require to ensure safety to persons and property general safety while repairs are carried out, whether or not equipment is in operation. No hot work is permitted in loading or unloading areas when product transfer is in progress. Per §10.15.4.2.2(3), §10.15.4.4, §11.3.2(8), §11.5.2.2(3), §11.5.4, §10.15.3.6.1(c) and §11.4.5.1(c)]	[Welding, cutting, and hot work must be conducted in accordance with 2019 edition of NFPA 51B Standard for Fire Prevention During Welding, Cutting, and Other Hot Work, with continuous flammable gas monitoring or hazard detection systems in use. Per §4.11.2 and §8.4.8.2.6]	No specific requirement.		Could consider requiring that: (1) The operator shall issue a hot work permit for hot work operations conducted on or near a covered process. (2) The permit shall document that the fire prevention and protection requirements equivalent to that in 29 CFR 1910.252(a) have been implemented prior to beginning the hot work operations; it shall indicate the date(s) authorized for hot work; and identify the object on which hot work is to be performed. The permit shall be kept on file until completion of the hot work operations.	No apparent gap.
		Management of Change	**Management of Change**	**Management of Change**	**Management of Change**	**Management of Change**	**Management of Change**	**Management of Change**	**Management of Change**	**Management of Change**
MOC	1	Is a Management of Change Procedure Required?	[Yes] 1910.119(l) Management of change. (1) The employer shall establish and implement written procedures to manage changes (except for "replacements in kind") to process chemicals, technology, equipment, and procedures; and, changes to facilities that affect a covered process.	[Not specifically by that name. There are requirements to keep procedures and records up-to-date after changes are made.] §193.2017 Plans and procedures. (a) Each operator shall maintain at each LNG plant the plans and procedures required for that plant by this part. The plans and procedures must be available upon request for review and inspection by the Administrator or any State Agency that has submitted a current certification or agreement with respect to the plant under the pipeline safety laws (49 U.S.C. 60101 et seq.). In addition, each change to the plans or procedures must be available at the LNG plant for review and inspection within 20 days after the change is made. ... (c) Each operator must review and update the plans and procedures required by this part— (1) When a component is changed significantly or a new component is installed; and (2) At intervals not exceeding 27 months, but at least once every 2 calendar years. §193.2304 Corrosion control overview. (a) Subject to paragraph (b) of this section, components may not be constructed, repaired, replaced, or significantly altered until a person qualified under §193.2707(c) reviews the applicable design drawings and materials specifications from a corrosion control viewpoint and determines that the materials involved will not impair the safety or reliability of the component or any associated components. (b) The repair, replacement, or significant alteration of components must be reviewed only if the action to be taken— (1) Involves a change in the original materials specified; (2) Is due to a failure caused by corrosion; or (3) Is occasioned by inspection revealing a significant deterioration of the component due to corrosion §193.2603 General. (a) Each component in service, including its support system, must be maintained in a condition that is compatible with its operational or safety purpose by repair, replacement, or other means. (b) An operator may not place, return, or continue in service any component which is not maintained in accordance with this subpart. (c) Each component taken out of service must be identified in the records kept under §193.2639. (d) If a safety device is taken out of service for maintenance, the component being served by the device must be taken out of service unless the same safety function is	[Not specifically by that name. There are requirements to keep procedures and records up-to-date after changes are made.] Per §10.15.1, §10.15.2, §10.15.3.1 and other sections.]	[Not specifically by that name, but there is an Engineering Review of Changes in §4.6. But Engineering Review of Changes in §4.6 pertains only to changes in components, and to the drawings and specifications for components, and does not mention: - The technical basis and reason for the proposed change; - Impact of change on safety and health; - Modifications to operating procedures; - Necessary time period for the change; - Authorization requirements for the proposed change; - Secure necessary work permits; and - Documentation requirements to manage change. There are also requirements to keep procedures and records up-to-date after changes are made. Per §4.6.1, §4.6.2, §18.2.1, §18.2.2]	[Yes. Operators must have a procedure to manage changes, whether permanent or temporary, which identifies potential risks and defines approvals before initiating changes in technology, equipment, procedures, and organizational. Per §8.3.1]		Could consider requiring operator to have its own procedure to manage temporary or permanent changes (except for "replacements in kind") to process chemicals, technology, equipment, and procedures.	Could consider requiring operator to have its own procedure to manage temporary or permanent changes (except for "replacements in kind") to process chemicals, technology, equipment, and procedures.
MOC	2	Considerations and Content in MOC Procedures	1910.119(l)(2) The procedures shall assure that the following considerations are addressed prior to any change: (i) The technical basis for the proposed change; (ii) Impact of change on safety and health; (iii) Modifications to operating procedures; (iv) Necessary time period for the change; and, (v) Authorization requirements for the proposed change.	§193.2605 Maintenance procedures. (a) Each operator shall determine and perform, consistent with generally accepted engineering practice, the periodic inspections or tests needed to meet the applicable requirements of this subpart and to verify that components meet the maintenance standards prescribed by this subpart. (b) Each operator shall follow one or more manuals of written procedures for the maintenance of each component, including any required corrosion control. The procedures must include: (1) The details of the inspections or tests determined under paragraph (a) of this section and their frequency of performance; and (2) A description of other actions necessary to maintain the LNG plant according to the requirements of this subpart. (c) Each operator shall include in the manual required by paragraph (b) of this section instructions enabling personnel who perform operation and maintenance activities to recognize conditions that potentially may be safety-related conditions that are subject to the reporting requirements of §191.23 of this subchapter.	Update Manual of Operating Procedures as required by changes in equipment or procedures or operating conditions Per 10.15.3.1 Manual of Operating Procedures. Per 11.2(3) Basic Requirements Per 11.3.1 Manual of Operating Procedures.	[The Engineering Review of Changes in §4.6 requires that design drawings and specifications for proposed changes must be reviewed by qualified individuals to confirm that safety or reliability will not impaired with respect to process, mechanical, geotechnical and civil, electrical and instrumentation, materials and corrosion, fire protection, or safety engineering. There are requirements to keep procedures and records up-to-date after changes are made. Per §4.6.1, §4.6.2, §18.2.1, §18.2.2]	MOC procedures must consider the basis for change; authorization requirements for the proposed change; potential implications; work permit requests; documentation of changes; communication to affected [personnel; necessary time for change; ensuring that personnel whose job tasks will be affected by a change are qualified and trained. Per 8.3.3]		Could consider specifying that operator's procedure to manage change must include: - The technical basis and reason for the proposed change; - Impact of change on safety and health; - Modifications to operating procedures; - Necessary time period for the change; - Authorization requirements for the proposed change; - Secure necessary work permits; and - Documentation requirements to manage change.	Could consider specifying that operator's procedure to manage change must include: - The technical basis and reason for the proposed change; - Impact of change on safety and health; - Modifications to operating procedures; - Necessary time period for the change; - Authorization requirements for the proposed change; - Secure necessary work permits; and - Documentation requirements to manage change.
MOC	3	Is a Threshold Established that Requires the MOC Process?	[No specific requirement.]	[When a component is changed significantly or a new component is installed, per §193.2017(c)(1).] §193.2017 Plans and procedures. (a) Each operator shall maintain at each LNG plant the plans and procedures required for that plant by this part. The plans and procedures must be available upon request for review and inspection by the Administrator or any State Agency that has submitted a current certification or agreement with respect to the plant under the pipeline safety laws (49 U.S.C. 60101 et seq.). In addition, each change to the plans or procedures must be available at the LNG plant for review and inspection within 20 days after the change is made. (b) The Associate Administrator or the State Agency that has submitted a current certification under section 5(a) of the Natural Gas Pipeline Safety Act with respect to the pipeline facility governed by an operator's plans and procedures may, after notice and opportunity for hearing as provided in 49 CFR 190.206 or the relevant State procedures, require the operator to amend its plans and procedures as necessary to provide a reasonable level of safety. (c) Each operator must review and update the plans and procedures required by this part— (1) When a component is changed significantly or a new component is installed; and (2) At intervals not exceeding 27 months, but at least once every 2 calendar years.	[No specific requirement.]	[Yes - - if the proposed change arises from a failure that results in loss of containment or is caused by corrosion, or a revision to an original component, or an inspection has identified significant deterioration of an original component. Per §4.6.2 and §A.16.2.1.2]	[No specific requirement.]		No apparent gap.	No apparent gap.

Group#	Item #	PSM Subcategory Topic	**Requirements of 29 CFR 1910.119** (Actual Text, or [Summary*]+Actual Text) [*Summary sometimes included to assist comparisons to other references.]	**Requirements of 49 CFR 193** (Actual Text, or [Summary*]+Actual Text) [*Summary sometimes included to assist comparisons to other references.]	**Requirements of NFPA 59A 2001** [Summary]	**Requirements of NFPA 59A 2019** [Summary]	**Requirements of API RP 1173** (2015) [Summary]	**Other related requirements** (Actual Text, or [Summary*]+Actual Text)	**Potential Gaps in Current 49 CFR 193** (referencing 2001 edition of NFPA 59A, plus 2006 edition for §193.2101(b) and 193.2321(b))	**Potential Gaps in a Future Revision to 49 CFR 193 if it incorporates 2019 edition of NFPA 59A by reference**
MOC	4	Employee Involvement and Training in MOC Process	1910.119(l)(3) Employees involved in operating a process and maintenance and contract employees whose job tasks will be affected by a change in the process shall be informed of, and trained in, the change prior to start-up of the process or affected part of the process.	[No specific requirement related to change management, but §193.2705 and §193.2707 require appropriate training for changes such as construction, installation, inspection, testing, operations and maintenance.] §193.2705 Construction, installation, inspection, and testing. (a) Supervisors and other personnel utilized for construction, installation, inspection, or testing must have demonstrated their capability to perform satisfactorily the assigned function by appropriate training in the methods and equipment to be used or related experience and accomplishments. (b) Each operator must periodically determine whether inspectors performing construction, installation, and testing duties required by this part are satisfactorily performing their assigned functions. §193.2707 Operations and maintenance. (a) Each operator shall utilize for operation or maintenance of components only those personnel who have demonstrated their capability to perform their assigned functions by— (1) Successful completion of the training required by §§193.2713 and 193.2717; and (2) Experience related to the assigned operation or maintenance function; and (3) Acceptable performance on a proficiency test relevant to the assigned function. (b) A person who does not meet the requirements of paragraph (a) of this section may operate or maintain a component when accompanied and directed by an individual who meets the requirements. (c) Corrosion control procedures under §193.2605(b), including those for the design, installation, operation, and maintenance of cathodic protection systems, must be carried out by, or under the direction of, a person qualified by experience and training in corrosion control technology.	[No specific requirement related to change management, but LNG plant personnel shall have: Received applicable training; Experience related to assigned duties. Per §11.6.6]	[Design drawings and specifications for proposed changes must be reviewed by qualified individuals to confirm that safety or reliability will not impaired with respect to process, mechanical, geotechnical and civil, electrical and instrumentation, materials and corrosion, fire protection, or safety engineering. Per §4.6.1 and §4.6.2. In addition, LNG plant personnel shall have: Received applicable training; Experience related to assigned duties Qualifications to inspect and monitor corrosion control systems (as applicable) Per §10.8.4.1, §18.10.13.6.1(3)(4)(5), §18.11.2, §18.11.3]	[Procedures shall include qualification and training of personnel affected by the change (including contractors). Per 8.3.3(h)]		Could include qualification and training requirements for the employees regarding the job tasks that are affected by the change could be specified.	No apparent gap.
MOC	5	Contractor/Contract Employee Involvement and Training in MOC Process	1910.119(l)(3) Employees involved in operating a process and maintenance and contract employees whose job tasks will be affected by a change in the process shall be informed of, and trained in, the change prior to start-up of the process or affected part of the process.	[No specific requirement related to change management, but §193.2705 and §193.2707 require appropriate training for changes such as construction, installation, inspection, testing, operations and maintenance.] §193.2705 Construction, installation, inspection, and testing. (a) Supervisors and other personnel utilized for construction, installation, inspection, or testing must have demonstrated their capability to perform satisfactorily the assigned function by appropriate training in the methods and equipment to be used or related experience and accomplishments. (b) Each operator must periodically determine whether inspectors performing construction, installation, and testing duties required by this part are satisfactorily performing their assigned functions. §193.2707 Operations and maintenance. (a) Each operator shall utilize for operation or maintenance of components only those personnel who have demonstrated their capability to perform their assigned functions by— (1) Successful completion of the training required by §§193.2713 and 193.2717; and (2) Experience related to the assigned operation or maintenance function; and (3) Acceptable performance on a proficiency test relevant to the assigned function. (b) A person who does not meet the requirements of paragraph (a) of this section may operate or maintain a component when accompanied and directed by an individual who meets the requirements. (c) Corrosion control procedures under §193.2605(b), including those for the design, installation, operation, and maintenance of cathodic protection systems, must be carried out by, or under the direction of, a person qualified by experience and training in corrosion control technology.	[No specific requirement related to change management, but LNG plant personnel shall have: Received applicable training; Experience related to assigned duties. Per §11.6.6]	[No specific requirement related to change management, but LNG plant personnel shall have: Received applicable training; Experience related to assigned duties Qualifications to inspect and monitor corrosion control systems (as applicable) Per §10.8.4.1, §18.10.13.6.1(3)(4)(5), §18.11.2, §18.11.3]	[Operators must: inform contractors of applicable PSM requirements; MOC procedure and requirements; work site risks; defined responsibility, accountability and authority for contractor's activities; process to gather lessons learned from contractor; provide safety training and orientation; assess contractor's safety performance; and communication procedures regarding risk managment. Per 8.4]		No apparent gap.	No apparent gap.
MOC	6	Timeliness in Days to Update Plans, Procedures, Information after a Change	[No specific requirement - - "update accordingly".] 1910.119(l)(4) If a change covered by this paragraph results in a change in the process safety information required by paragraph (d) of this section, such information shall be updated accordingly. 1910.119(l)(5) If a change covered by this paragraph results in a change in the operating procedures or practices required by paragraph (f) of this section, such procedures or practices shall be updated accordingly.	[20 days] §193.2017 Plans and procedures. (a) Each operator shall maintain at each LNG plant the plans and procedures required for that plant by this part. The plans and procedures must be available upon request for review and inspection by the Administrator or any State Agency that has submitted a current certification or agreement with respect to the plant under the pipeline safety laws (49 U.S.C. 60101 et seq.). In addition, each change to the plans or procedures must be available at the LNG plant for review and inspection within 20 days after the change is made.	[No specific requirement.]	[No specific requirement.]	[No specific requirement.]		No apparent gap.	No apparent gap.
		Incident Investigation (and Learning)	**Incident Investigation (and Learning)**	**Incident Investigation (and Learning)**	**Incident Investigation (and Learning)**	**Incident Investigation (and Learning)**	**Incident Investigation (and Learning)**	**Incident Investigation (and Learning)**	**Incident Investigation (and Learning)**	**Incident Investigation (and Learning)**
II	1	Definition of Incident	§1910.119(m)(1)Incident Investigation: The employer shall investigate each incident which resulted in, or could reasonably have resulted in a catastrophic release of highly hazardous chemical in the workplace.	§191.3 Definitions. ... Incident means any of the following events: (1) An event that involves a release of gas from a pipeline, gas from an underground natural gas storage facility, liquefied natural gas, liquefied petroleum gas, refrigerant gas, or gas from an LNG facility, and that results in one or more of the following consequences: (i) A death, or personal injury necessitating in-patient hospitalization; (ii) Estimated property damage of $50,000 or more, including loss to the operator and others, or both, but excluding cost of gas lost; or (iii) Unintentional estimated gas loss of three million cubic feet or more. [An Incident differs from a Safety-Related Condition as defined in §191.23.]	[No specific definition.]	[No specific definition.]	[Incidents or near-misses that had, or could have had, serious consequences. Per §9.1.1]		Could require operator shall have its own procedure to investigate each incident which resulted in, or could reasonably have resulted in a catastrophic release of highly hazardous chemical in the workplace, that do not otherwise meet the threshold of requirements to investigate under §193.2515.	Could require operator shall have its own procedure to investigate each incident which resulted in, or could reasonably have resulted in a catastrophic release of highly hazardous chemical in the workplace, that do not otherwise meet the threshold of requirements to investigate under §193.2515.
II	2	Threshold of Incident Size that Operator Must Investigate	§1910.119(m)(1)Incident Investigation: The employer shall investigate each incident which resulted in, or could reasonably have resulted in a catastrophic release of highly hazardous chemical in the workplace.	§193.2515 Investigations of failures. (a) Each operator shall investigate the cause of each explosion, fire, or LNG spill or leak which results in: (1) Death or injury requiring hospitalization; or (2) Property damage exceeding $10,000. (b) As a result of the investigation, appropriate action must be taken to minimize recurrence of the incident. (c) If the Administrator or relevant state agency under the pipeline safety laws (49 U.S.C. 60101 et seq.) investigates an incident, the operator involved shall make available all relevant information and provide reasonable assistance in conducting the investigation. Unless necessary to restore or maintain service, or for safety, no component involved in the incident may be moved from its location or otherwise altered until the investigation is complete or the investigating agency otherwise provides. Where components must be moved for operational or safety reasons, they must not be removed from the plant site and must be maintained intact to the extent practicable until the investigation is complete or the investigating agency otherwise provides.	[All safety-related malfunctions, incidents and conditions. Per §10.15.2(6) and §11.2(6)]	[All safety-related incidents. Per §18.2.2(7)]	[Investigate incidents or near-misses that had, or could have had, serious consequences. Per §9.1.1]	[An operator may consider using a tiered approach based on potential severity of the incident event. The KPI tiers in API 754 may be useful in this regard - - each organization to access their programs and develop its own policies, procedures, and framework to address their needs.]	Could require operator shall have its own procedure to investigate each incident which resulted in, or could reasonably have resulted in a catastrophic release of highly hazardous chemical in the workplace, that do not otherwise meet the threshold of requirements to investigate under §193.2515.	Could require operator shall have its own procedure to investigate each incident which resulted in, or could reasonably have resulted in a catastrophic release of highly hazardous chemical in the workplace, that do not otherwise meet the threshold of requirements to investigate under §193.2515.

Group#	Item #	PSM Subcategory Topic	Requirements of 29 CFR 1910.119 (Actual Text, or [Summary*]+Actual Text) [*Summary sometimes included to assist comparisons to other references.]	Requirements of 49 CFR 193 (Actual Text, or [Summary*]+Actual Text) [*Summary sometimes included to assist comparisons to other references.]	Requirements of NFPA 59A 2001 [Summary]	Requirements of NFPA 59A 2019 [Summary]	Requirements of API RP 1173 (2015) [Summary]	Other related requirements (Actual Text, or [Summary*]+Actual Text)	Potential Gaps in Current 49 CFR 193 (referencing 2001 edition of NFPA 59A, plus 2006 edition for §193.2101(b) and 193.2321(b))	Potential Gaps in a Future Revision to 49 CFR 193 if it incorporates 2019 edition of NFPA 59A by reference
II	3	Must Near-Misses Be Investigated?	[Yes] §1910.119(m)(1)Incident Investigation: The employer shall investigate each incident which resulted in, or could reasonably have resulted in a catastrophic release of highly hazardous chemical in the workplace.	[Any safety-related conditions must be reported as per §191.23.] §191.23 Reporting safety-related conditions. (a) Except as provided in paragraph (b) of this section, each operator shall report in accordance with §191.25 the existence of any of the following safety-related conditions involving facilities in service: (1) In the case of a pipeline (other than an LNG facility) that operates at a hoop stress of 20 percent or more of its specified minimum yield strength, general corrosion that has reduced the wall thickness to less than that required for the maximum allowable operating pressure, and localized corrosion pitting to a degree where leakage might result. (2) In the case of an underground natural gas storage facility, including injection, withdrawal, monitoring, or observation well, general corrosion that has reduced the wall thickness to less than that required for the maximum well operating pressure, and localized corrosion pitting to a degree where leakage might result. (3) Unintended movement or abnormal loading by environmental causes, such as an earthquake, landslide, or flood, that impairs the serviceability of a pipeline or the structural integrity or reliability of an underground natural gas storage facility, including injection, withdrawal, monitoring, or observation well for an underground natural gas storage facility, or LNG facility that contains, controls, or processes gas or LNG. (4) Any crack or other material defect that impairs the structural integrity or reliability of an underground natural gas storage facility or LNG facility that contains, controls, or processes gas or LNG. (5) Any material defect or physical damage that impairs the serviceability of a pipeline that operates at a hoop stress of 20% or more of its specified minimum yield strength or underground natural gas storage facility, including injection, withdrawal, monitoring, or observations well for an underground natural gas storage facility. (6) Any malfunction or operating error that causes the pressure of a pipeline or underground natural gas storage facility or LNG facility that contains or processes gas or LNG to rise above its maximum well operating pressure (or working pressure for LNG facilities) plus the margin (build-up) allowed for operation of pressure limiting or control devices. (7) A leak in a pipeline or an underground natural gas storage facility, including injection, withdrawal, monitoring, or observation well for an underground natural gas storage facility, or LNG facility that contains or processes gas or LNG that constitutes an emergency. (8) Inner tank leakage, ineffective insulation, or frost heave that impairs the structural integrity of an LNG storage tank. (9) Any safety-related condition that could lead to an imminent hazard and causes	[Yes Per §10.15.2(6) and §11.2(6)]	[Yes Per §18.2.2]	[Yes Per §9.1.1]		Could require operator shall have its own procedure to investigate each incident which resulted in, or could reasonably have resulted in a catastrophic release of highly hazardous chemical in the workplace, that do not otherwise meet the threshold of requirements to investigate under §193.2515.	Could require operator shall have its own procedure to investigate each incident which resulted in, or could reasonably have resulted in a catastrophic release of highly hazardous chemical in the workplace, that do not otherwise meet the threshold of requirements to investigate under §193.2515.
II	4	Minimum Time to Report Incident to Authorities	[No specific requirement.]	[1 hour or less to report incident by telephone or electronically. 30 days or less to file written incident report DOT Form PHMSA F 7100.3] §191.5 Immediate notice of certain incidents. (a) At the earliest practicable moment following discovery, but no later than one hour after confirmed discovery, each operator must give notice in accordance with paragraph (b) of this section of each incident as defined in §191.3. (b) Each notice required by paragraph (a) of this section must be made to the National Response Center either by telephone to 800-424-8802 (in Washington, DC, 202 267-2675) or electronically at http://www.nrc.uscg.mil and must include the following information: (1) Names of operator and person making report and their telephone numbers. (2) The location of the incident. (3) The time of the incident. (4) The number of fatalities and personal injuries, if any. (5) All other significant facts that are known by the operator that are relevant to the cause of the incident or extent of the damages. (c) Within 48 hours after the confirmed discovery of an incident, to the extent practicable, an operator must revise or confirm its initial telephonic notice required in paragraph (b) of this section with an estimate of the amount of product released, an estimate of the number of fatalities and injuries, and all other significant facts that are known by the operator that are relevant to the cause of the incident or extent of the damages. If there are no changes or revisions to the initial report, the operator must confirm the estimates in its initial report. §191.15 Transmission systems; gathering systems; liquefied natural gas facilities; and underground natural gas storage facilities: Incident report. (a) Transmission or Gathering. Each operator of a transmission or a gathering pipeline system must submit DOT Form PHMSA F 7100.2 as soon as practicable but not more than 30 days after detection of an incident required to be reported under §191.5 of this part. (b) LNG. Each operator of a liquefied natural gas plant or facility must submit DOT Form PHMSA F 7100.3 as soon as practicable but not more than 30 days after detection of an incident required to be reported under §191.5 of this part. (c) Underground natural gas storage facility. Each operator of an underground natural gas storage facility must submit DOT Form PHMSA F7100.2 as soon as practicable but not more than 30 days after detection of an incident required to be reported under §191.5. (d) Supplemental report. Where additional related information is obtained after a report is submitted under paragraph (a), (b) or (c) of this section, the operator must make a supplemental report as soon as practicable with a clear reference by date to	[No specific requirement.]	[No specific requirement.]	[No specific requirement.]	[No minimum time to report an incident was identified in EPA RMP 40CFR68.]	The requirement in §191.5 is more onerous than in 29CFR1910.119. This poses an opportunity to seek industry comment on the requirement in §191.5.	The requirement in §191.5 is more onerous than in 29CFR1910.119. This poses an opportunity to seek industry comment on the requirement in §191.5.
II	5	Timeliness to Initiatiate Incident Investigation	[48 Hours or Less] Per § 1910.119(m)(2) An incident investigation shall be initiated as promptly as possible, but not later than 48 hours following the incident.	[Initiate and complete Incident Report DOT Form PHMSA F 7100.3 as soon as practicable but not more than 30 days.] §191.15 Transmission systems; gathering systems; liquefied natural gas facilities; and underground natural gas storage facilities: Incident report. ... (b) LNG. Each operator of a liquefied natural gas plant or facility must submit DOT Form PHMSA F 7100.3 as soon as practicable but not more than 30 days after detection of an incident required to be reported under §191.5 of this part. ... (d) Supplemental report. Where additional related information is obtained after a report is submitted under paragraph (a), (b) or (c) of this section, the operator must make a supplemental report as soon as practicable with a clear reference by date to the original report.	[No specific requirement.]	[No specific requirement.]	[As promptly as possible. Per §9.1.1]		No apparent gap.	No apparent gap.
II	6	Qualification and Composition of Incident Investigation Team	§1910.119(m)(3) An incident investigation team shall be established and consist of at least one person knowledgeable in the process involved, including a contract employee if the incident involved work of the contractor, and other persons with appropriate knowledge and experience to thoroughly investigate and analyze the incident.	[No specific requirement.]	[No specific requirement.]	[No specific requirement.]	[No specific requirement.]		Could require operator's incident investigation procedure to include requirements for the qualifications and composition of incident investigation team, with minimum requirement to have: at least one person knowledgeable in the process involved, including a contract employee if the incident involved work done by contract employees; and other persons with appropriate knowledge and experience to thoroughly investigate and analyze the incident.	Could require operator's incident investigation procedure to include requirements for the qualifications and composition of incident investigation team, with minimum requirement to have: at least one person knowledgeable in the process involved, including a contract employee if the incident involved work done by contract employees; and other persons with appropriate knowledge and experience to thoroughly investigate and analyze the incident.
II	7	Minimum Content of Operator's Incident Investigation Report	§1910.119(m)(4): A report shall be prepared at the conclusion of the investigation which includes at a minimum: (i) Date of incident; (ii) Date investigation began; (iii) A description of the incident; (iv) The factors that contributed to the incident; and, (v) Any recommendations resulting from the investigation.	DOT Form PHMSA F 7100.3 "INCIDENT REPORT – LIQUEFIED NATURAL GAS (LNG) FACILITIES" specifies requirements, including for example: Date of incident; Date investigation began; Description of the incident; Factors and causes that contributed to the incident;	[No specific requirement.]	[No specific requirement.]	[Investigate: contributing factors and the cause of the incident; findings and lessons learned; the effectiveness of emergency response procedures and processes; recommended changes to processes, procedures, training, resource allocation, and risk assessment processes including consequence analysis and failure rate probabilities. Per §9.1.2]	[Incident investigation practicies should be consistent and consist of defined processes and clear expectations. Analyses should identify clear links between causes and recommendations, e.g., a logic tree, cause-and-effect tree, time-based cause and effect chart or causal factor chart. A basic outline or report template can be provided to incident investigation teams to develop consistency across investigations. Per AIChE CCPS Pillar 4.4.1 (or e.g. chapters 19.2.4 and 19.3.4 of Guidelines for Risk Based Process Safety)]	Could consider requiring operator's procedure that investigates incidents to include: - identifying findings and lessons learned; - utilizing a investigation report template the attempts to identify clear links between causes and recommendations, e.g. by using a logic tree, cause-and-effect tree, time-based cause and effect chart or causal factor chart - assessing the effectiveness of emergency response procedures, equipment and processes; - recommending changes to processes, procedures, training, resource allocation, and risk assessment processes including consequence analysis and failure rate probabilities.	Could consider requiring operator's procedure that investigates incidents to include: - identifying findings and lessons learned; - utilizing a investigation report template the attempts to identify clear links between causes and recommendations, e.g. by using a logic tree, cause-and-effect tree, time-based cause and effect chart or causal factor chart - assessing the effectiveness of emergency response procedures, equipment and processes; - recommending changes to processes, procedures, training, resource allocation, and risk assessment processes including consequence analysis and failure rate probabilities.
II	8	Operator's Learning from Operator's Recent Incidents	§ 1910.119(m)(5) The employer shall establish a system to promptly address and resolve the incident report findings and recommendations. Resolutions and corrective actions shall be documented. § 1910.119(m)(6) The report shall be reviewed with all affected personnel whose job tasks are relevant to the incident findings including contract employees where applicable.	§193.2515(b) As a result of the investigation, appropriate action must be taken to minimize recurrence of the incident	[The operator must analyze and document all safety-related malfunctions and incidents in order to determine causes and prevent recurrence. Per §10.15.2(6) and §11.2(6)]	[Operator's procedures must be revised as a result of lessons learned from an incident investigation. Per §18.2.2(3)]	[The operator must have a procedure to determine, document, track and complete actions to improve safety process and risk assessments in response to the findings, causes, contributing factors, recommendations and lessons learned from the incident investigation; this procedure will include communicating with the appropriate personnel. Per §9.2]		Could consider specifying minimum requirements in operator's procedure to implement findings from investigations, such as: - reviewing the incident investigation report with personnel whose job tasks are relevant to the incident findings (including contract employees where applicable), including contributing factors, findings, lessons learned and recommendations; - documenting resolutions and corrective actions; and - tracking and completing actions to improve safety systems, control systems and risk assessment processes arising from the investigation results and lessons learned.	Could consider specifying minimum requirements in operator's procedure to implement findings from investigations, such as: - reviewing the incident investigation report with personnel whose job tasks are relevant to the incident findings (including contract employees where applicable), including contributing factors, findings, lessons learned and recommendations; - documenting resolutions and corrective actions; and - tracking and completing actions to improve safety systems, control systems and risk assessment processes arising from the investigation results and lessons learned.
II	9	Operator's Learning from Operator's Past Incidents	[No specific requirement.]	[No specific requirement.]	[No specific requirement.]	[No specific requirement.]	[The operators must have a process to periodically review and re-assess past incident investigations that had or could have had high consequences, seeking to maximize the operator's organizational lessons learned - - including seeking new lessons learned. Per 9.3]		Could consider specifying minimum requirements in operator's incident investigation procedure to include: - performing a review and reassessment five years after incidents that were reportable under §191.15, to identify any subsequent lessons learned, what changes the operator has made from those past incident investigations, and other impacts.	Could consider specifying minimum requirements in operator's incident investigation procedure to include: - performing a review and reassessment five years after incidents that were reportable under §191.15, to identify any subsequent lessons learned, what changes the operator has made from those past incident investigations, and other impacts.

Group#	Item #	PSM Subcategory Topic	**Requirements of 29 CFR 1910.119** (Actual Text, or [Summary*]+Actual Text) [*Summary sometimes included to assist comparisons to other references.]	**Requirements of 49 CFR 193** (Actual Text, or [Summary*]+Actual Text) [*Summary sometimes included to assist comparisons to other references.]	**Requirements of NFPA 59A 2001** [Summary]	**Requirements of NFPA 59A 2019** [Summary]	**Requirements of API RP 1173** (2015) [Summary]	**Other related requirements** (Actual Text, or [Summary*]+Actual Text)	**Potential Gaps in Current 49 CFR 193** (referencing 2001 edition of NFPA 59A, plus 2006 edition for §193.2101(b) and 193.2321(b))	**Potential Gaps in a Future Revision to 49 CFR 193 if it incorporates 2019 edition of NFPA 59A by reference**
II	10	Operator's Learning from External Incidents	[No specific requirement.]	[No specific requirement.]	[No specific requirement.]	[No specific requirement.]	The operator must have a process to learn from relevant incidents and events that occured to third parties external to user's operations, such as information available from regulators such as PHMSA and NTSB, industry peer companies, public officials, emergency planning and response personnel, and the affected public. Per 9.4]		Could consider specifying minimum requirements in operator's incident investigation procedure to include: - identifying and internally reviewing lessons learned from incidents external to operator at least annually.	Could consider specifying minimum requirements in operator's incident investigation procedure to include: - identifying and internally reviewing lessons learned from incidents external to operator at least annually.
II	11	Minimum Period in Years to Retain Incident Investigation Reports	[5] § 1910.119(m)(7) Incident investigation reports shall be retained for five years.	[5] §193.2521 Operating records. Each operator shall maintain a record of results of each inspection, test and investigation required by this subpart. For each LNG facility that is designed and constructed after March 31, 2000 the operator shall also maintain related inspection, testing, and investigation records that NFPA-59A-2001 (incorporated by reference, see §193.2013) requires. Such records, whether required by this part or NFPA-59A-2001, must be kept for a period of not less than five years. §193.2011 Reporting: Incidents, safety-related conditions, and annual pipeline summary data for LNG plants or facilities must be reported in accordance with the requirements of Part 191 of this subchapter.	[No specific requirement.]	[No specific requirement.]	[No specific duration specified. Records must be maintained of investigations and resulting actions. Per §9.2]		No apparent gap.	No apparent gap.
II	12	Must Operator Develop its Own Incident Investigation Procedures, including an Investigation Report Template?	[No specific requirement.]	[No specific requirement.]	[No specific requirement.]	[No specific requirement.]	[No specific requirement.]		Could consider requiring operator to develop its own incident investigation procedure, to include a basic outline or template the promotes the identification of clear links between causes and recommendations, e.g., a logic tree, cause-and-effect tree, time-based cause-and-effect chart or causal factor chart.	Could consider requiring operator to develop its own incident investigation procedure, to include a basic outline or template the promotes the identification of clear links between causes and recommendations, e.g., a logic tree, cause-and-effect tree, time-based cause-and-effect chart or causal factor chart.
		Emergency Planning and Response (incl. Fire Protection and Security)	**Emergency Planning and Response (incl. Fire Protection and Security)**	**Emergency Planning and Response (incl. Fire Protection and Security)**	**Emergency Planning and Response (incl. Fire Protection and Security)**	**Emergency Planning and Response (incl. Fire Protection and Security)**	**Emergency Planning and Response (incl. Fire Protection and Security)**	**Emergency Planning and Response (incl. Fire Protection and Security)**	**Emergency Planning and Response (incl. Fire Protection and Security)**	**Emergency Planning and Response (incl. Fire Protection and Security)**
EPR	1	Must Operator Have a Written Emergency Response Procedure that is Readily Accessible in the Workplace?	[Yes] §1910.119(n) Emergency planning and response. The employer shall establish and implement an emergency action plan for the entire plant in accordance with the provisions of 29 CFR 1910.38. In addition, the emergency action plan shall include procedures for handling small releases. Employers covered under this standard may also be subject to the hazardous waste and emergency response provisions contained in 29 CFR 1910.120 (a), (p) and (q). IBR: §29CFR1910.38 Emergency action plans. (b) Written and oral emergency action plans. An emergency action plan must be in writing, kept in the workplace, and available to employees for review. However, an employer with 10 or fewer employees may communicate the plan orally to employees.	[Yes] §193.2509 Emergency procedures. ... (b) To adequately handle each type of emergency identified under paragraph (a) of this section and each fire emergency, each operator must follow one or more manuals of written procedures. ...	[Yes. Per e.g. §10.15.2(4), §11.2(4), §11.3.3, §9.2.4, §10.2.4]	[Yes. Per e.g. §9.2.4, §10.2.4, §18.2.2, §18.4.1, and §11.2(4)]	[Yes. Per §12]		No apparant gap.	No apparant gap.
EPR	2	Emergency Response Procedure Minimum Elements - Scenario Planning Considerations	[No specific requirement.]	§193.2509 Emergency procedures. (a) Each operator shall determine the types and places of emergencies other than fires that may reasonably be expected to occur at an LNG plant due to operating malfunctions, structural collapse, personnel error, forces of nature, and activities adjacent to the plant. ... §193.2715 Training: security. (a) Personnel responsible for security at an LNG plant must be trained in accordance with a written plan of initial instruction to: (1) Recognize breaches of security; (2) Carry out the security procedures under §193.2903 that relate to their assigned duties; (3) Be familiar with basic plant operations and emergency procedures, as necessary to effectively perform their assigned duties; and (4) Recognize conditions where security assistance is needed. (b) A written plan of continuing instruction must be conducted at intervals of not more than two years to keep all personnel having security duties current on the knowledge and skills they gained in the program of initial instruction. §193.2905 Protective enclosures. (a) The following facilities must be surrounded by a protective enclosure: (1) Storage tanks; (2) Impounding systems; (3) Vapor barriers; (4) Cargo transfer systems; (5) Process, liquefaction, and vaporization equipment; (6) Control rooms and stations; (7) Control systems; (8) Fire control equipment; (9) Security communications systems; and (10) Alternative power sources. The protective enclosure may be one or more separate enclosures surrounding a single facility or multiple facilities. (b) Ground elevations outside a protective enclosure must be graded in a manner that does not impair the effectiveness of the enclosure. (c) Protective enclosures may not be located near features outside of the facility, such as trees, poles, or buildings, which could be used to breach the security. (d) At least two accesses must be provided in each protective enclosure and be located to minimize the escape distance in the event of emergency. (e) Each access must be locked unless it is continuously guarded. During normal	[Procedures must respond to various potential types and places of emergencies that may reasonably be expected to occur at an LNG plant due to operating malfunctions, structural collapse, personnel error, forces of nature, and activities adjacent to the plant. Security provisions to protect from civil unrest are provided for example in §9.8. Per §10.15.3.3, §11.3.3, §10.2.2 and §9.8]	[Procedures should respond to various potential types and places of emergencies that may reasonably be expected to occur at an LNG plant due to operating malfunctions, structural collapse of part of an LNG facility, personnel error, forces of nature, and activities adjacent to the plant. Security provisions to protect from civil unrest are provided for example in §16.8. Per §18.4.2, §5.2.3, §17.3.1.4 and §16.8]	[Procedures shall respond to various potential types and places of emergencies that may reasonably be expected to occur (e.g. spills and releases, forces of nature, security breaches, fires, loss of off-site utilities, pandemics, and civil unrest. Per §12.a)]		Could consider clarifying that scenario analysis of potential emergencies that may reasonably be expected to occur must also include pandemics.	Could consider clarifying that scenario analysis of potential emergencies that may reasonably be expected to occur must also include pandemics.
EPR	3	Emergency Response Procedure Minimum Elements - Reporting Fire or Other Emergency	IBR: §29CFR1910.38(c)(1) Procedures for reporting a fire or other emergency;	§193.2509 Emergency procedures. (a) Each operator shall determine the types and places of emergencies other than fires that may reasonably be expected to occur at an LNG plant due to operating malfunctions, structural collapse, personnel error, forces of nature, and activities adjacent to the plant. (b) To adequately handle each type of emergency identified under paragraph (a) of this section and each fire emergency, each operator must follow one or more manuals of written procedures. The procedures must provide for the following: (1) Responding to controllable emergencies, including notifying personnel and using equipment appropriate for handling the emergency. (2) Recognizing an uncontrollable emergency and taking action to minimize harm to the public and personnel, including prompt notification of appropriate local officials of the emergency and possible need for evacuation of the public in the vicinity of the LNG plant. ...	[Procedures must provide for responding to controllable emergencies and recognizing uncontrollable emergencies, and notifying appropriate personnel and local officials. Per e.g. §10.15.3.3 and §11.3.3]	[Procedures must provide for responding to controllable emergencies and recognizing uncontrollable emergencies, and notifying appropriate personnel and local officials. Per e.g. §18.4.3 and §18.4.4]	[Procedures shall have communication plans which include requirements for internal and external notifications, and recognition and use of Unified Command/Incident Command Structure. Per §12 b), d) andf)]	[OSHA 29CFR1910.120(q)(3) requires use of a site-specific Incident Command System for emergency response operations for releases of, or substantial threats of releases of, hazardous substances without regard to the location of the hazard.]	No apparant gap.	No apparant gap.
EPR	4	Emergency Response Procedure Minimum Elements - Coordination with Local Officials and First Responders	IBR: §29CFR1910.38(c)(1) Procedures for reporting a fire or other emergency;	§193.2509 Emergency procedures. ... (b) To adequately handle each type of emergency identified under paragraph (a) of this section and each fire emergency, each operator must follow one or more manuals of written procedures. The procedures must provide for the following: ... (2) Recognizing an uncontrollable emergency and taking action to minimize harm to the public and personnel, including prompt notification of appropriate local officials of the emergency and possible need for evacuation of the public in the vicinity of the LNG plant. (3) Coordinating with appropriate local officials in preparation of an emergency evacuation plan, which sets forth the steps required to protect the public in the event of an emergency, including catastrophic failure of an LNG storage tank. (4) Cooperating with appropriate local officials in evacuations and emergencies requiring mutual assistance and keeping these officials advised of: (i) The LNG plant fire control equipment, its location, and quantity of units located throughout the plant; (ii) Potential hazards at the plant, including fires; (iii) Communication and emergency control capabilities at the LNG plant; and (iv) The status of each emergency.	[Procedures must provide for coordinating and cooperating with local officials before, during and after an emergency. Per e.g. §10.15.2(5), §10.15.3.3, §11.2(5) and §11.3.3]	[Procedures must provide for coordinating and cooperating with local officials before, during and after an emergency. Per e.g. §18.2.2, §18.4.4, §18.4.5 and §18.4.6]	[Procedures shall have communication plans which include requirements for internal and external notifications, and recognition and use of Unified Command/Incident Command Structure. Per §12 b), c) d) andf)]	[OSHA 29CFR1910.120(q)(3) requires use of a site-specific Incident Command System for emergency response operations for releases of, or substantial threats of releases of, hazardous substances without regard to the location of the hazard.]	No apparant gap.	No apparant gap.

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EPR	5	Emergency Response Procedure Minimum Elements - Emergency Evacuation	IBR: §29CFR1910.38(c)(2) Procedures for emergency evacuation, including type of evacuation and exit route assignments; IBR: §29CFR1910.38(c)(4) Procedures to account for all employees after evacuation	§193.2509 Emergency procedures. (a) Each operator shall determine the types and places of emergencies other than fires that may reasonably be expected to occur at an LNG plant due to operating malfunctions, structural collapse, personnel error, forces of nature, and activities adjacent to the plant. (b) To adequately handle each type of emergency identified under paragraph (a) of this section and each fire emergency, each operator must follow one or more manuals of written procedures. The procedures must provide for the following: ... (3) Coordinating with appropriate local officials in preparation of an emergency evacuation plan, which sets forth the steps required to protect the public in the event of an emergency, including catastrophic failure of an LNG storage tank. (4) Cooperating with appropriate local officials in evacuations and emergencies requiring mutual assistance and keeping these officials advised of: (i) The LNG plant fire control equipment, its location, and quantity of units located throughout the plant; (ii) Potential hazards at the plant, including fires; (iii) Communication and emergency control capabilities at the LNG plant; and (iv) The status of each emergency.	[Procedures must provide for coordinating and cooperating with local officials before, during and after an emergency. The plant must be designed for rapid escape of personnel in an emergency situation. Per e.g. §9.8.3, §10.15.3.3(c) and §11.3.3(3)]	[Procedures must provide for coordinating and cooperating with local officials before, during and after an emergency. The plant must be designed for rapid escape of personnel in an emergency situation. Per e.g. §16.8.3(5) and §18.4.4]	[No specific requirement.]		Could specify that operator's requirement to cooperate with appropriate local officials in evacuations shall include that operator's emergency procedures must account for all employees after evacuation.	Could specify that operator's requirement to cooperate with appropriate local officials in evacuations shall include that operator's emergency procedures must account for all employees after evacuation.
EPR	6	Emergency Response Procedure Minimum Elements - Personnel Remaining at Plant	IBR: §29CFR1910.38(c)(3) Procedures to be followed by employees who remain to operate critical plant operations before they evacuate;	[No specific requirement.]	[Procedures must provide for responding to controllable emergencies by personnel who remain at the plant. Plant personnel are equipped with training in first aid and responding to emergencies, appropriate PPE, fire fighting equipment, hazardous gas detection equipment, emergency procedure documentation, Emergency Shutdown systems and other control safeguards, and other items as required in NFPA 59A (2001). Per e.g. §10.15.3.3 and §11.3.3]	[Procedures must provide for responding to controllable emergencies by personnel who remain at the plant. Plant personnel are equipped with training in first aid and responding to emergencies, appropriate PPE, fire fighting equipment, hazardous gas detection equipment, emergency procedure documentation, Emergency Shutdown systems and other control safeguards, and other items as required in NFPA 59A (2019). Per e.g. §18.4.3]	[No specific requirement.]		No apparant gap.	No apparant gap.
EPR	7	Emergency Response Procedure Minimum Elements - Personnel Performing Rescue or Medical Duties	IBR: §29CFR1910.38(c)(5) Procedures to be followed by employees performing rescue or medical duties;	§193.2511 Personnel safety. (a) Each operator shall provide any special protective clothing and equipment necessary for the safety of personnel while they are performing emergency response duties. (b) All personnel who are normally on duty at a fixed location, such as a building or yard, where they could be harmed by thermal radiation from a burning pool of impounded liquid, must be provided a means of protection at that location from the harmful effects of thermal radiation or a means of escape. (c) Each LNG plant must be equipped with suitable first-aid material, the location of which is clearly marked and readily available to personnel. §193.2713 Training: operations and maintenance. (a) Each operator shall provide and implement a written plan of initial training to instruct— (2) All Personnel— (i) To carry out the emergency procedures under §193.2509 that relate to their assigned functions; and (ii) To give first-aid;	[Plant personnel are equipped with training in first aid and responding to emergencies, appropriate PPE, fire fighting equipment, hazardous gas detection equipment, emergency procedure documentation, Emergency Shutdown systems and other control safeguards, and other items as required in NFPA 59A 2001]. Per e.g. §9.7.1 and §9.7.2]	[Plant personnel are equipped with training in first aid and responding to emergencies, appropriate PPE, fire fighting equipment, hazardous gas detection equipment, emergency procedure documentation, Emergency Shutdown systems and other control safeguards, and other items as required in NFPA 59A 2019] Per e.g. §16.7.1 and §16.7.2]	[Emergency procedures shall address environment, health and safety protection. Per §12]		No apparant gap.	No apparant gap.
EPR	8	Emergency Response Procedure Minimum Elements - Personnel Communication Roster	IBR: §29CFR1910.38(c)(6) The name or job title of every employee who may be contacted by employees who need more information about the plan or an explanation of their duties under the plan.	[The training requirements of §193.2713 requires information be provided to all employees.] §193.2713 Training: operations and maintenance. (a) Each operator shall provide and implement a written plan of initial training to instruct— ... (2) All personnel— (i) To carry out the emergency procedures under §193.2509 that relate to their assigned functions; and (ii) To give first-aid; and ...	[The availability and duties of individual plant personnel and the availability of external response personnel during an emergency is required per §9.1.2(8).]	[The availability and duties of individual plant personnel and the availability of external response personnel during an emergency is required per §16.2.2]	[No specific requirement.]		No apparant gap.	No apparant gap.
EPR	9	Emergency Response Procedure Minimum Elements - Facility Alarm System	IBR: §29CFR1910.38(d) Employee alarm system. An employer must have and maintain an employee alarm system. The employee alarm system must use a distinctive signal for each purpose and comply with the requirements in §1910.165.	§193.2507 Monitoring operations. Each component in operation or building in which a hazard to persons or property could exist must be monitored to detect fire or any malfunction or flammable fluid that could cause a hazardous condition. Monitoring must be accomplished by watching or listening from an attended control center for warning alarms, such as gas, temperature, pressure, vacuum, and flow alarms, or by conducting an inspection or test at intervals specified in the operating procedures. §193.2519 Communication systems. (a) Each LNG plant must have a primary communication system that provides for verbal communications between all operating personnel at their work stations in the LNG plant. (b) Each LNG plant in excess of 70,000 gallons (265,000 liters) storage capacity must have an emergency communication system that provides for verbal communications between all persons and locations necessary for the orderly shutdown of operating equipment and the operation of safety equipment in time of emergency. The emergency communication system must be independent of and physically separated from the primary communication system and the security communication system under §193.2909. (c) Each communication system required by this part must have an auxiliary source of power, except sound-powered equipment.	[Facility alarm systems include Emergency Shutdown, fire, flammable gas and leak detection systems and many other requirements. Per e.g. §9.3, §10.15.3.2(10), and §11.3.4.1.]	[Facility alarm systems include Emergency Shutdown, fire, flammable gas and leak detection systems and many other requirements. Per e.g. §9.3, §10.15.3.2(1), and §11.3.4.1.]	[No specific requirement.]		No apparant gap.	No apparant gap.
EPR	10	Emergency Response and Fire Protection Training - Initial Training and Drills	IBR: §29CFR1910.38(e) Training. An employer must designate and train employees to assist in a safe and orderly evacuation of other employees. IBR: §29CFR1910.38(f) Review of emergency action plan. An employer must review the emergency action plan with each employee covered by the plan: (1) When the plan is developed or the employee is assigned initially to a job; (2) When the employee's responsibilities under the plan change; and (3) When the plan is changed.	§193.2713 Training: operations and maintenance. (a) Each operator shall provide and implement a written plan of initial training to instruct— ... (2) All personnel— (i) To carry out the emergency procedures under §193.2509 that relate to their assigned functions; and (ii) To give first-aid; §193.2717 Training: fire protection. (a) All personnel involved in maintenance and operations of an LNG plant, including their immediate supervisors, must be trained according to a written plan of initial instruction, including plant fire drills, to: (1) Know the potential causes and areas of fire; (2) Know the types, sizes, and predictable consequences of fire; and (3) Know and be able to perform their assigned fire control duties according to the procedures established under §193.2509 and by proper use of equipment provided under §193.2801. ... (c) Plant fire drills must provide personnel hands-on experience in carrying out their duties under the fire emergency procedures required by §193.2509.	[The written plan to train personnel shall include: fire prevention, including understanding fire control plans, potential causes and consequences and other training specified by NFPA 600; recognizing when assistance is needed to maintain security; how to carry out emergency procedures; how to provide first aid; and other topics. Per §9.1.2(9), §10.15.5.1, §10.15.5.2, §10.15.5.6, §11.6.1, §11.6.6]	[The written plan to train personnel shall include: fire prevention, including understanding fire control plans, potential causes and consequences and other training specified by NFPA 600; recognizing when assistance is needed to maintain security; how to carry out emergency procedures; how to provide first aid; and other topics. Per §9.1.2(9), §9.7.2 and §18.4]	[Procedure shall include training and drills, and involve outside organizations and first responders. Per §12 g)]		Could require operator to invite an external agency or organization to participate in training or drills at least every 24 months not to exceed 27 months.	Could require operator to invite external agencies or organizations to participate in training or drills at least every 24 months not to exceed 27 months.
EPR	11	Emergency Response and Fire Protection Training and Drills - Minimum Frequency in Years for Refresher Training and Drills	[No specific requirement.] IBR: §29CFR1910.38(e) Training. An employer must designate and train employees to assist in a safe and orderly evacuation of other employees. IBR: §29CFR1910.38(f) Review of emergency action plan. An employer must review the emergency action plan with each employee covered by the plan: ... (2) When the employee's responsibilities under the plan change; and (3) When the plan is changed.	[2, but as necessary to "keep all personnel current" on the knowledge and skills they gained in the program of initial instruction] §193.2713 Training: operations and maintenance. (a) Each operator shall provide and implement a written plan of initial training to instruct— ... (2) All personnel— (i) To carry out the emergency procedures under §193.2509 that relate to their assigned functions; and (ii) To give first-aid; ... (b) A written plan of continuing instruction must be conducted at intervals of not more than two years to keep all personnel current on the knowledge and skills they gained in the program of initial instruction.	[2 Per §10.15.5.3 and §11.6.3]	[2 Per §18.11.6.1]	[No specific requirement.]		No apparant gap.	No apparant gap.
EPR	12	Emergency Response Procedure Minimum Elements - Consideration of Hazardous Waste	[If facility includes Hazardous Waste, refer to the specific requirements in 29 CFR 1910.120 (a), (p) and (q)] Per § 1910.119(n) Emergency planning and response which IBRs the hazardous waste and emergency response provisions contained in 29 CFR 1910.120 (a), (p) and (q)	[No specific requirement.]	[Hazardous materials must be properly stored, but there is no specific requirement related to emergency response. Ref. §9.8.2(4)]	[Hazardous materials must be properly stored, but there is no specific requirement related to emergency response. Ref. §16.8.3(6)]	[Procedures shall address environment, health and safety protection. Per §12]		No apparant gap.	No apparant gap.

Group#	Item #	PSM Subcategory Topic	Requirements of 29 CFR 1910.119 (Actual Text, or [Summary*]+Actual Text) [*Summary sometimes included to assist comparisons to other references.]	Requirements of 49 CFR 193 (Actual Text, or [Summary*]+Actual Text) [*Summary sometimes included to assist comparisons to other references.]	Requirements of NFPA 59A 2001 [Summary]	Requirements of NFPA 59A 2019 [Summary]	Requirements of API RP 1173 (2015) [Summary]	Other related requirements (Actual Text, or [Summary*]+Actual Text)	Potential Gaps in Current 49 CFR 193 (referencing 2001 edition of NFPA 59A, plus 2006 edition for §193.2101(b) and 193.2321(b))	Potential Gaps in a Future Revision to 49 CFR 193 if it incorporates 2019 edition of NFPA 59A by reference
EPR	13	Minimum Frequency in Years that Emergency Procedures and Contingency Plans Must be Reviewed	[No specific requirement.]	[2 not to exceed 2.25, or earlier if a significant change is made or new equipment installed. On the basis that "Emergency Procedures and Contingency Plans" are included in overall "Plans and Procedures." Per §193.2017(c)] §193.2017(c) Plans and procedures: Each operator must review and update the plans and procedures required by this part §193.2017(c)(1) Plans and procedures: When a component is changed significantly, or a new component is installed §193.2017(c)(2) Plans and procedures: At intervals not exceeding 27 months, but at least once every 2 calendar years.	[No specific requirement.]	[1 Per §18.4.8]	["Periodically" review procedure to incorporate continuous improvement efforts, including a review of lessons learned. Per §12 h) and i)]		No apparant gap, although the 2019 edition of NFPA 59A specifically calls out "contingency plans" and specifies that they be reviewed annually.	No apparant gap.
EPR	14	Minimum Frequency in Years to Review Fire Protection Evaluation	[No specific requirement.]	[2 not to exceed 2.25, or earlier if a significant change is made or new equipment installed. On the basis that "Fire Proection Plan" is included in overall "Plans and Procedures." Per §193.2017(c)] §193.2017(c) Plans and procedures: Each operator must review and update the plans and procedures required by this part §193.2017(c)(1) Plans and procedures: When a component is changed significantly, or a new component is installed §193.2017(c)(2) Plans and procedures: At intervals not exceeding 27 months, but at least once every 2 calendar years.	[No specific requirement.]	[2 not to exceed 2.25, or earlier if facility is significantly altered. Per §16.2.1.3]	[No specific requirement.]		No apparant gap.	No apparant gap.
EPR	15	Minimum Time in Months to Install Modified, Expanded or Replaced Fire Protection Systems or Equipment if Required by an Updated Fire Protection Evaluation	[No specific requirement.]	[No specific requirement.]	[No specific requirement.]	[12 not to exceed 15 Per §16.2.1.4]	[No specific requirement.]		Could specify minimim time for operator to implement necessary changes to modify, expand or replace fire protection system that result from a review of fire protection evaluation.	No apparant gap.
EPR	16	Minimum Time in Months to Install New Fire Protection Systems if Required by an Updated Fire Protection Evaluation	[No specific requirement.]	[No specific requirement.]	[No specific requirement.]	[24 not to exceed 27, or as approved by AHJ Per §16.2.1.4]	[No specific requirement.]		Could specify minimim time for operator to implement necessary changes to install new fire protection system that result from a review of fire protection evaluation.	No apparant gap.
EPR	17	Physical Security Requirements	[No specific requirement.]	§193.2905 Protective enclosures. (a) The following facilities must be surrounded by a protective enclosure: (1) Storage tanks; (2) Impounding systems; (3) Vapor barriers; (4) Cargo transfer systems; (5) Process, liquefaction, and vaporization equipment; (6) Control rooms and stations; (7) Control systems; (8) Fire control equipment; (9) Security communications systems; and (10) Alternative power sources. The protective enclosure may be one or more separate enclosures surrounding a single facility or multiple facilities. (b) Ground elevations outside a protective enclosure must be graded in a manner that does not impair the effectiveness of the enclosure. (c) Protective enclosures may not be located near features outside of the facility, such as trees, poles, or buildings, which could be used to breach the security. (d) At least two accesses must be provided in each protective enclosure and be located to minimize the escape distance in the event of emergency. (e) Each access must be locked unless it is continuously guarded. During normal operations, an access may be unlocked only by persons designated in writing by the operator. During an emergency, a means must be readily available to all facility personnel within the protective enclosure to open each access. §193.2907 Protective enclosure construction. (a) Each protective enclosure must have sufficient strength and configuration to obstruct unauthorized access to the facilities enclosed. (b) Openings in or under protective enclosures must be secured by grates, doors or covers of construction and fastening of sufficient strength such that the integrity of the protective enclosure is not reduced by any opening. §193.2909 Security communications. A means must be provided for: (a) Prompt communications between personnel having supervisory security duties and law enforcement officials; and (b) Direct communications between all on-duty personnel having security duties and all control rooms and control stations. §193.2911 Security lighting. Where security warning systems are not provided for security monitoring under §193.2913, the area around the facilities listed under §193.2905(a) and each protective enclosure must be illuminated with a minimum in service lighting intensity of not less than 2.2 lux (0.2 ftc) between sunset and sunrise. §193.2913 Security monitoring. Each protective enclosure and the area around each facility listed in §193.2905(a)	[Physical security requirements such as protective enclosures, security system, illumination, warning signs, etc. are defined. Per e.g. §9.8 and more specifically §9.8.1, §9.8.2, §9.8.4.]	[Physical security requirements such as protective enclosures, security system, illumination, warning signs, etc. are defined. Per e.g. 16.8.2, 16.8.3, 16.8.5 and 16.8.6.]	[No specific requirement.]		No apparant gap.	No apparant gap.
EPR	18	Must Operator Have Written Security Procedure Manuals?	[No specific requirement.]	[Yes] §193.2903 Security procedures. Each operator shall prepare and follow one or more manuals of written procedures to provide security for each LNG plant. The procedures must be available at the plant in accordance with §193.2017	[Yes Per §10.15.3.2(9) and §11.3.2]	[Yes Per §18.3.8(4) and §18.5]	[No specific requirement. The Emergency Response Plan must consider security threats, per. §12a)]		No apparant gap.	No apparant gap.
EPR	19	Operator's Written Security Procedure Manuals - Minimum Elements	[No specific requirement.]	§193.2903 Security procedures. Each operator shall prepare and follow one or more manuals of written procedures to provide security for each LNG plant. The procedures must be available at the plant in accordance with §193.2017 and include at least: (a) A description and schedule of security inspections and patrols performed in accordance with §193.2913; (b) A list of security personnel positions or responsibilities utilized at the LNG plant; (c) A brief description of the duties associated with each security personnel position or responsibility; (d) Instructions for actions to be taken, including notification of other appropriate plant personnel and law enforcement officials, when there is any indication of an actual or attempted breach of security; (e) Methods for determining which persons are allowed access to the LNG plant; (f) Positive identification of all persons entering the plant and on the plant, including methods at least as effective as picture badges; and (g) Liaison with local law enforcement officials to keep them informed about current security procedures under this section	[No specific requirement.]	[The requirements of §193.2903 are listed in §18.5.1]	[No specific requirement.]		No apparant gap.	No apparant gap.
EPR	20	Frequency in Months to Review Security Procedures	[No specific requirement.]	[No specific requirement.]	[No specific requirement.]	24 not to exceed 27, or as determined by AHJ, or more frequently if security conditions change Per §18.5.2]	[No specific requirement.]		No apparant gap.	No apparant gap.
EPR	21	Security Personnel - Initial Training Content	[No specific requirement.]	§193.2715 Training: security. (a) Personnel responsible for security at an LNG plant must be trained in accordance with a written plan of initial instruction to: (1) Recognize breaches of security; (2) Carry out the security procedures under §193.2903 that relate to their assigned duties; (3) Be familiar with basic plant operations and emergency procedures, as necessary to effectively perform their assigned duties; and (4) Recognize conditions where security assistance is needed.	[No specific requirement.]	[Security personnel shall be trained to: (1) Recognize security breaches (2) Carry out security procedures related to their assigned functions (3) Be familiar with basic plant operations and emergency procedures as necessary to for their security function (4) Identify situations where it would be necessary to obtain assistance to maintain the security of the LNG plant Per §18.11.2.3]	[No specific requirement.]		No apparant gap.	No apparant gap.
EPR	22	Security Personnel - Minimum Frequency in Years for Refresher Training	[No specific requirement.]	[2 Per §193.2715(b)] §193.2715(b) Training (Security): A written plan of continuing instruction must be conducted at intervals of not more than two years to keep all personnel having security duties current on the knowledge and skills they gained in the program of initial instruction	[2 Per §11.6.2 and §11.6.3]	[No specific requirement.]	[No specific requirement.]		No apparant gap.	No apparant gap.
EPR	23	Must Operators Ensure that a Physical Security Assessment is Performed?	[No specific requirement.]	[No specific requirement for a physical security assessment was identified by that name, but Subpart J of 49CFR193 contains extensive requirements for security, and for example written security procedures required in §193.2903 must be reviewed and updated in accordance with §193.2017]	[No specific requirement.]	[Yes] Per §16.8.1.1]	[No specific requirement.]		No apparant gap.	No apparant gap.

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EPR	24	Must Operators Ensure that a Cybersecurity Vulnerability Assessment is Performed?	[No specific requirement.]	[No specific requirement.]	[No specific requirement.]	[Yes Per §11.7.2]	[No specific requirement.]		Could require operators to conduct and review a cybersecurity vulnerability assessment of the process control systems and safety instrumented systems.	No apparent gap.
EPR	25	Minimum Frequency in Months to Update Cybersecurity Vulnerability Assessment	[No specific requirement.]	[No specific requirement.]	[No specific requirement.]	[24 not to exceed 27 Per §11.7.2]	[No specific requirement.]		Could require operators to periodically update a cybersecurity vulnerability assessment of the process control systems and safety instrumented systems.	No apparent gap.
EPR	26	Minimum Frequency in Years to Exercise Emergency Response Notification Mechanism	[No specific requirement.]	[No specific requirement.]	[No specific requirement.]	[No specific requirement.]	[No specific requirement.]	[At least once each calendar year, per 40CFR§68.96(a)] 40CFR§68.96 Emergency response exercises. (a) Notification exercises. At least once each calendar year, the owner or operator of a stationary source with any Program 2 or Program 3 process shall conduct an exercise of the stationary source's emergency response notification mechanisms required under §68.90(a)(2) or §68.95(a)(1)(i), as appropriate. Owners or operators of responding stationary sources may perform the notification exercise as part of the tabletop and field exercises required in paragraph (b) of this section. The owner/operator shall maintain a written record of each notification exercise conducted over the last five years.	Could require an operator to conduct an exercise of the LNG facility's emergency response notification mechanisms at least one each calendar year, and maintain a written record of each notification exercise conducted over the last five years. The notification exercises may be as part of the tabletop and field exercises that involve simulated accidental releases.	Could require an operator to conduct an exercise of the LNG facility's emergency response notification mechanisms at least one each calendar year, and maintain a written record of each notification exercise conducted over the last five years. The notification exercises may be as part of the tabletop and field exercises that involve simulated accidental releases.
EPR	27	Minimum Frequency in Years to Conduct Field Exercise Involving Simulated Accidental Release of a Regulated Substance	[No specific requirement.]	[No specific requirement.]	[No specific requirement.]	[No specific requirement.]	[No specific requirement.]	[At least once every ten years, per 40CFR§68.96(b). At least once every five years or after a significant change is made, per article 7.4.6 of CAN/CSA-Z767-17.] 40CFR§68.96(b) Emergency response exercise program. The owner or operator of a stationary source subject to the requirements of §68.95 shall develop and implement an exercise program for its emergency response program, including the plan required under §68.95(a)(1). Exercises shall involve facility emergency response personnel and, as appropriate, emergency response contractors. When planning emergency response field and tabletop exercises, the owner or operator shall coordinate with local public emergency response officials and invite them to participate in the exercise. The emergency response exercise program shall include: (1) Emergency response field exercises. The owner or operator shall conduct field exercises involving the simulated accidental release of a regulated substance (i.e., toxic substance release or release of a regulated flammable substance involving a fire and/or explosion). (i) Frequency. As part of coordination with local emergency response officials required by §68.93, the owner or operator shall consult with these officials to establish an appropriate frequency for field exercises, but at a minimum, shall conduct a field exercise at least once every ten years. (ii) Scope. Field exercises shall include: Tests of procedures to notify the public and the appropriate Federal, state, and local emergency response agencies about an accidental release; tests of procedures and measures for emergency response actions including evacuations and medical treatment; tests of communications systems; mobilization of facility emergency response personnel, including contractors, as appropriate; coordination with local emergency responders; emergency response equipment deployment; and any other action identified in the emergency response program, as appropriate.	Could require an operator to conduct field exercises of its emergency response procedures involving the simulated accidental release of a flammable, toxic or other regulated substance. (i) Frequency. As part of coordination with local emergency response officials, the operator shall consult with these officials to establish an appropriate frequency for field exercises, but at a minimum, shall conduct a field exercise at least once every ten years. (ii) Scope. Field exercises shall include: Tests of procedures to notify the public and the appropriate federal, state, and local emergency response agencies about an accidental release; tests of procedures and measures for emergency response actions including evacuations and medical treatment; tests of communications systems; mobilization of facility emergency response personnel, including contractors, as appropriate; coordination with local emergency responders; emergency response equipment deployment; and any other action identified in the emergency response program, as appropriate.	Could require an operator to conduct field exercises of its emergency response procedures involving the simulated accidental release of a flammable, toxic or other regulated substance. (i) Frequency. As part of coordination with local emergency response officials, the operator shall consult with these officials to establish an appropriate frequency for field exercises, but at a minimum, shall conduct a field exercise at least once every ten years. (ii) Scope. Field exercises shall include: Tests of procedures to notify the public and the appropriate federal, state, and local emergency response agencies about an accidental release; tests of procedures and measures for emergency response actions including evacuations and medical treatment; tests of communications systems; mobilization of facility emergency response personnel, including contractors, as appropriate; coordination with local emergency responders; emergency response equipment deployment; and any other action identified in the emergency response program, as appropriate.
EPR	28	Minimum Frequency in Years to Conduct Tabletop Exercises Involving Simulated Accidental Release of a Regulated Substance	[No specific requirement.]	[No specific requirement.]	[No specific requirement.]	[No specific requirement.]	[No specific requirement.]	[At least once every three years, per 40CFR§68.96(b)] b) Emergency response exercise program. The owner or operator of a stationary source subject to the requirements of §68.95 shall develop and implement an exercise program for its emergency response program, including the plan required under §68.95(a)(1). Exercises shall involve facility emergency response personnel and, as appropriate, emergency response contractors. When planning emergency response field and tabletop exercises, the owner or operator shall coordinate with local public emergency response officials and invite them to participate in the exercise. The emergency response exercise program shall include: ... (2) Tabletop exercises. The owner or operator shall conduct a tabletop exercise involving the simulated accidental release of a regulated substance. (i) Frequency. As part of coordination with local emergency response officials required by §68.93, the owner or operator shall consult with these officials to establish an appropriate frequency for tabletop exercises, but at a minimum, shall conduct a field exercise at least once every three years. (ii) Scope. The exercise shall include discussions of: Procedures to notify the public and the appropriate Federal, state, and local emergency response agencies; procedures and measures for emergency response including evacuations and medical treatment; identification of facility emergency response personnel and/or contractors and their responsibilities; coordination with local emergency responders; procedures for emergency response equipment deployment; and any other action identified in the emergency response plan, as appropriate.	Could require an operator to conduct tabletop exercises of its emergency response procedures involving the simulated accidental release of a flammable, toxic or other regulated substance. (i) Frequency. As part of coordination with local emergency response officials required by §68.93, the owner or operator shall consult with these officials to establish an appropriate frequency for tabletop exercises, but at a minimum, shall conduct a field exercise at least once every three years. (ii) Scope. Tabletop exercises shall include discussions of: Procedures to notify the public and the appropriate federal, state, and local emergency response agencies; procedures and measures for emergency response including evacuations and medical treatment; identification of facility emergency response personnel and/or contractors and their responsibilities; coordination with local emergency responders; procedures for emergency response equipment deployment; and any other action identified in the emergency response plan, as appropriate.	Could require an operator to conduct tabletop exercises of its emergency response procedures involving the simulated accidental release of a flammable, toxic or other regulated substance. (i) Frequency. As part of coordination with local emergency response officials required by §68.93, the owner or operator shall consult with these officials to establish an appropriate frequency for tabletop exercises, but at a minimum, shall conduct a field exercise at least once every three years. (ii) Scope. Tabletop exercises shall include discussions of: Procedures to notify the public and the appropriate federal, state, and local emergency response agencies; procedures and measures for emergency response including evacuations and medical treatment; identification of facility emergency response personnel and/or contractors and their responsibilities; coordination with local emergency responders; procedures for emergency response equipment deployment; and any other action identified in the emergency response plan, as appropriate.
EPR	29	Must Operator Prepare an Evaluation Report after Each Emergency Response Tabletop Exercise or Field Exercise?	[No specific requirement.]	[No specific requirement.]	[No specific requirement.]	[No specific requirement.]	[No specific requirement.]	[Yes, within 90 days of each exercise, per 40CFR§68.96(b)] 40CFR§68.96(b) Emergency response exercise program. The owner or operator of a stationary source subject to the requirements of §68.95 shall develop and implement an exercise program for its emergency response program, including the plan required under §68.95(a)(1). Exercises shall involve facility emergency response personnel and, as appropriate, emergency response contractors. When planning emergency response field and tabletop exercises, the owner or operator shall coordinate with local public emergency response officials and invite them to participate in the exercise. The emergency response exercise program shall include: ... 3) Documentation. The owner/operator shall prepare an evaluation report within 90 days of each exercise. The report shall include: A description of the exercise scenario; names and organizations of each participant; an evaluation of the exercise results including lessons learned; recommendations for improvement or revisions to the emergency response exercise program and emergency response program, and a schedule to promptly address and resolve recommendations.	Could require an operator to prepare an evaluation report within 90 days of each Tabletop or Field exercise of its emergency response procedures involving the simulated accidental release of a flammable, toxic or other regulated substance, with the report to include: a description of the exercise scenario; names and organizations of each participant; an evaluation of the exercise results including lessons learned; recommendations for improvement or revisions to the emergency response exercise program and emergency response program; and a schedule to promptly address and resolve recommendations.	Could require an operator to prepare an evaluation report within 90 days of each Tabletop or Field exercise of its emergency response procedures involving the simulated accidental release of a flammable, toxic or other regulated substance, with the report to include: a description of the exercise scenario; names and organizations of each participant; an evaluation of the exercise results including lessons learned; recommendations for improvement or revisions to the emergency response exercise program and emergency response program; and a schedule to promptly address and resolve recommendations.
		Compliance Audits (incl. Metrics, Review and Improvement)	**Compliance Audits (incl. Metrics, Review and Improvement)**	**Compliance Audits (incl. Metrics, Review and Improvement)**	**Compliance Audits (incl. Metrics, Review and Improvement)**	**Compliance Audits (incl. Metrics, Review and Improvement)**	**Compliance Audits (incl. Metrics, Review and Improvement)**	**Compliance Audits (incl. Metrics, Review and Improvement)**	**Compliance Audits (incl. Metrics, Review and Improvement)**	**Compliance Audits (incl. Metrics, Review and Improvement)**
CA	1	Must Operators Audit its Compliance to its PSM/Risk Management Processes?	[Yes] 1910.119(o)(1) Compliance Audits. (1) Employers shall certify that they have evaluated compliance with the provisions of this section at least every three years to verify that the procedures and practices developed under the standard are adequate and are being followed.	[No specific requirement for operator to self-audit its own PSM program. Annual Report, Incident Report, and Safety-related Condition Report filings are required as per 49CFR§191.17, 49CFR§191.15, and 49CFR§191.23. Independent compliance audits by agencies using PHMSA Form 4 "Standard Inspection Report of an LNG Facility" or other forms are separate.]	[No specific requirement for operator to self-audit its own PSM program. Supervision fabrication, construction, and acceptance tests of facility components must be provided to comply with the NFPA standard. Per e.g. §2.4.2, §2.4.4 and §10.2.5]	[No specific requirement for operator to self-audit its own PSM program. Supervision fabrication, construction, and acceptance tests of facility components must be provided to comply with the NFPA standard. Per §4.2.3]	[Yes Per §10.1, §10.2.2 and §10.2.3]		Could consider requiring that an operator must certify that it has self-evaluated its compliance with its own procedure to manage process safety at least every three years, in order to verify that in its opinion its procedure is adequate and is being followed, and whether the expected progress toward effective risk management and improved safety performance is being achieved. Also, that the compliance audit be conducted by at least one person knowledgeable in the process.	Could consider requiring that an operator must certify that it has self-evaluated its compliance with its own procedure to manage process safety at least every three years, in order to verify that in its opinion its procedure is adequate and is being followed, and whether the expected progress toward effective risk management and improved safety performance is being achieved. Also, that the compliance audit be conducted by at least one person knowledgeable in the process.
CA	2	Minimum Frequency in Years that Operator Must Audit its Compliance to PSM/Risk Management Process Requirements	[3] 1910.119(o)(1) Compliance Audits. (1) Employers shall certify that they have evaluated compliance with the provisions of this section at least every three years to verify that the procedures and practices developed under the standard are adequate and are being followed.	[No specific requirement, beyond the requirements IBRd in 49CFR191.17 to Annual Report].	[No specific requirement.]	[No specific requirement.]	[3 Per §10.2.2]		Could consider requiring that an operator must certify that it has self-evaluated its compliance with its own procedure to manage process safety at least every three years, in order to verify that in its opinion its procedure is adequate and is being followed, and whether the expected progress toward effective risk management and improved safety performance is being achieved. Also, that the compliance audit be conducted by at least one person knowledgeable in the process.	Could consider requiring that an operator must certify that it has self-evaluated its compliance with its own procedure to manage process safety at least every three years, in order to verify that in its opinion its procedure is adequate and is being followed, and whether the expected progress toward effective risk management and improved safety performance is being achieved. Also, that the compliance audit be conducted by at least one person knowledgeable in the process.
CA	3	Qualifications of Audit Team	1910.119(o)(2) The compliance audit shall be conducted by at least one person knowledgeable in the process.	[No specific requirement.]	[No specific requirement.]	[No specific requirement.]	[External professionals or internal personnel not involved in the work of the PSMS or the operations being audited. Per §10.2.3 and §3.1.3]		Could consider requiring that an operator must certify that it has self-evaluated its compliance with its own procedure to manage process safety at least every three years, in order to verify that in its opinion its procedure is adequate and is being followed, and whether the expected progress toward effective risk management and improved safety performance is being achieved. Also, that the compliance audit be conducted by at least one person knowledgeable in the process.	Could consider requiring that an operator must certify that it has self-evaluated its compliance with its own procedure to manage process safety at least every three years, in order to verify that in its opinion its procedure is adequate and is being followed, and whether the expected progress toward effective risk management and improved safety performance is being achieved. Also, that the compliance audit be conducted by at least one person knowledgeable in the process.

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CA	4	Must Operator Evaluate Safety Culture in Audit?	[No specific requirement.]	[No specific requirement.]	[No specific requirement.]	[No specific requirement.]	[Yes. Operators must evaluate safety culture of its organization, using methods such as surveys, interviews, observations and focus groups, and assessing factors such as how decision-making processes, procedures, information-sharing, and participation by both employees and contractors impacts the safety culture. Management shall review results and findings, and assess how safety culture can be continuously improved. Per §10.2.4]	[An operator may consider using a four-tier framework of process safety KPIs. Each organization needs to access their programs and develop its own policies, procedures, and framework to address their needs. For example: - Tier 1 is the most lagging and Tier 4 is the most leading. - Tiers 1 and 2 are suitable for nationwide public reporting and Tiers 3 and 4 are intended for internal use at individual sites. Per API RP 754 - Process Safety Indicators for the Refining and Petrochemical Industries. Or as another example: Tier 1 and 2 provide lagging indicators and Tiers 3 and 4 provide leading indicators of process safety performance; examples include: - Tier 1 or 2 apply to any loss of primary containment (LOPC) events, with greater or lesser impacts. - Tier 3 KPIs monitor performance of the barriers that prevent Tier 1 and 2 LOPC events. - Tier 4 KPIs are used to monitor the implementation and effectiveness of the management system. Per IOGP 456 - Recommended Practice on Key Performance Indicators, November 2018, by International Association of Oil & Gas Producers.]	Could consider requiring that an operator's self-audit of its compliance to its procedure to manage process safety must include: - assessing the operator's safety culture; and - confirming that the procedure includes identifying, collecting, and analyzing data generated from operations and maintenance, integrity management, audits and evaluations, operator's management reviews, and other relevant sources related to the suitability and effectiveness of the operator's procedure to manage process safety; and - assessing whether leading and lagging key performance indicators (KPIs) have been established and maintained to measure the effectiveness of operator's procedure to effectively and adequately manage process safety and risk; and - assessing if a multi-tiered level framework of process KPIs may enhance process safety; and - assessing whether the expected progress toward effective risk management and improved safety performance is being achieved; and - evaluating the maturity of the operator's procedure to manage process safety.	Could consider requiring that an operator's self-audit of its compliance to its procedure to manage process safety must include: - assessing the operator's safety culture; and - confirming that the procedure includes identifying, collecting, and analyzing data generated from operations and maintenance, integrity management, audits and evaluations, operator's management reviews, and other relevant sources related to the suitability and effectiveness of the operator's procedure to manage process safety; and - assessing whether leading and lagging key performance indicators (KPIs) have been established and maintained to measure the effectiveness of operator's procedure to effectively and adequately manage process safety and risk; and - assessing if a multi-tiered level framework of process KPIs may enhance process safety; and - assessing whether the expected progress toward effective risk management and improved safety performance is being achieved; and - evaluating the maturity of the operator's procedure to manage process safety.
CA	5	Must Operator Evaluate PSM System Maturity in Audit?	[No specific requirement.]	[No specific requirement.]	[No specific requirement.]	[No specific requirement.]	[Yes. An objective methodology must be established to evaluate the growth, development, or maturity of the PSM. Strengths and weaknesses of the processes and personnel that support PSM elements must be determined. Areas that need improvement must be clarified. Initial efforts may include a maturity assessment and gathering of deployment data and results; more mature system will utilize methods and metrics (e.g. KPIs) to ensure that the operator's efforts are comprehensive, systematic, and integrated. Per §10.2.5]		Could consider requiring that an operator's self-audit of its compliance to its procedure to manage process safety must include: - assessing the operator's safety culture; and - confirming that the procedure includes identifying, collecting, and analyzing data generated from operations and maintenance, integrity management, audits and evaluations, operator's management reviews, and other relevant sources related to the suitability and effectiveness of the operator's procedure to manage process safety - assessing whether leading and lagging key performance indicators (KPIs) have been established and maintained to measure the effectiveness of operator's procedure to effectively and adequately manage process safety and risk; and - assessing whether the expected progress toward effective risk management and improved safety performance is being achieved; and - evaluating the maturity of the operator's procedure to manage process safety.	Could consider requiring that an operator's self-audit of its compliance to its procedure to manage process safety must include: - assessing the operator's safety culture; and - confirming that the procedure includes identifying, collecting, and analyzing data generated from operations and maintenance, integrity management, audits and evaluations, operator's management reviews, and other relevant sources related to the suitability and effectiveness of the operator's procedure to manage process safety - assessing whether leading and lagging key performance indicators (KPIs) have been established and maintained to measure the effectiveness of operator's procedure to effectively and adequately manage process safety and risk; and - assessing whether the expected progress toward effective risk management and improved safety performance is being achieved; and - evaluating the maturity of the operator's procedure to manage process safety.
CA	6	Must Operator Establish and Maintain Reporting and Feedback Structure?	[No specific requirement.]	[No specific requirement.]	[No specific requirement.]	[No specific requirement.]	[Yes Per §10.3]		Could consider requiring that operator's An operator's self-audit of its compliance to its procedure to manage process safety must include: - assessing if a reporting and feedback process for employees and contractors has been established and maintained, including consideration of the benefits and drawbacks of an anonymous reporting system; and - assessing if reporting and feedback is being monitored to identify new and emerging risks to consider in the risk evaluation and risk mitigation aspects of the operator's procedure.	Could consider requiring that operator's An operator's self-audit of its compliance to its procedure to manage process safety must include: - assessing if a reporting and feedback process for employees and contractors has been established and maintained, including consideration of the benefits and drawbacks of an anonymous reporting system; and - assessing if reporting and feedback is being monitored to identify new and emerging risks to consider in the risk evaluation and risk mitigation aspects of the operator's procedure.
CA	7	Must Operator Establish Leading and Lagging Key Performance Indicators to Measure Performance of PSM Process Maturity?	[No specific requirement.]	[No specific requirement.]	[No specific requirement.]	[No specific requirement.]	[Yes Per §10.4]		Could consider requiring that an operator's self-audit of its compliance to its procedure to manage process safety must include: - assessing the operator's safety culture; and - confirming that the procedure includes identifying, collecting, and analyzing data generated from operations and maintenance, integrity management, audits and evaluations, operator's management reviews, and other relevant sources related to the suitability and effectiveness of the operator's procedure to manage process safety - assessing whether leading and lagging key performance indicators (KPIs) have been established and maintained to measure the effectiveness of operator's procedure to effectively and adequately manage process safety and risk; and - assessing whether the expected progress toward effective risk management and improved safety performance is being achieved; and - evaluating the maturity of the operator's procedure to manage process safety.	Could consider requiring that an operator's self-audit of its compliance to its procedure to manage process safety must include: - assessing the operator's safety culture; and - confirming that the procedure includes identifying, collecting, and analyzing data generated from operations and maintenance, integrity management, audits and evaluations, operator's management reviews, and other relevant sources related to the suitability and effectiveness of the operator's procedure to manage process safety - assessing whether leading and lagging key performance indicators (KPIs) have been established and maintained to measure the effectiveness of operator's procedure to effectively and adequately manage process safety and risk; and - assessing whether the expected progress toward effective risk management and improved safety performance is being achieved; and - evaluating the maturity of the operator's procedure to manage process safety.
CA	8	Must Operator Establish a Procedure to Identify, Collect and Analyze Data Relevant to its PSM Program Effectiveness?	[No specific requirement.]	[No specific requirement.]	[No specific requirement.]	[No specific requirement.]	[Yes Per §10.4]		Could consider requiring that an operator's self-audit of its compliance to its procedure to manage process safety must include: - assessing the operator's safety culture; and - confirming that the procedure includes identifying, collecting, and analyzing data generated from operations and maintenance, integrity management, audits and evaluations, operator's management reviews, and other relevant sources related to the suitability and effectiveness of the operator's procedure to manage process safety - assessing whether leading and lagging key performance indicators (KPIs) have been established and maintained to measure the effectiveness of operator's procedure to effectively and adequately manage process safety and risk; and - assessing whether the expected progress toward effective risk management and improved safety performance is being achieved; and - evaluating the maturity of the operator's procedure to manage process safety.	Could consider requiring that an operator's self-audit of its compliance to its procedure to manage process safety must include: - assessing the operator's safety culture; and - confirming that the procedure includes identifying, collecting, and analyzing data generated from operations and maintenance, integrity management, audits and evaluations, operator's management reviews, and other relevant sources related to the suitability and effectiveness of the operator's procedure to manage process safety - assessing whether leading and lagging key performance indicators (KPIs) have been established and maintained to measure the effectiveness of operator's procedure to effectively and adequately manage process safety and risk; and - assessing whether the expected progress toward effective risk management and improved safety performance is being achieved; and - evaluating the maturity of the operator's procedure to manage process safety.
CA	9	Must Audits be Documented?	[Yes] 1910.119(o)(3) A report of the findings of the audit shall be developed.	[No specific requirement, beyond the requirements IBRd in 49CFR191.17 to Annual Report].	[No specific requirement.]	[No specific requirement.]	[The results of internal audits and corrective actions must be reported to the management. The operator must establish and maintain a process to report and feedback audits to employees and contractors. A means for anonymous reporting should be considered. Management must review the results and findings, and status of corrective actions.] Per §10.2.4, §10.2.6 and §10.3]		Could consider requiring that an operator's procedure to audit its procedures to manage process safety must include that: - a report of the findings of the audit shall be developed; - the operator shall promptly determine and document an appropriate response to each of the findings of the compliance audit, and document that deficiencies have been corrected; and - the operatorshall retain the two (2) most recent compliance audit reports.	Could consider requiring that an operator's procedure to audit its procedures to manage process safety must include that: - a report of the findings of the audit shall be developed; - the operator shall promptly determine and document an appropriate response to each of the findings of the compliance audit, and document that deficiencies have been corrected; and - the operatorshall retain the two (2) most recent compliance audit reports
CA	10	Must Operator Have Defined Response Times to Address Audit Findings?	1910.119(o)(4) The employer shall promptly determine and document an appropriate response to each of the findings of the compliance audit, and document that deficiencies have been corrected.	[No specific requirement, but PHMSA Form 4 "Standard Inspection Report of an LNG Facility" allows regulatory auditor to note non-compliance items or areas of concern, which can be reviewed by employer and regulator in subsequent audits and reports.]	[No specific requirement.]	[No specific requirement.]	[Yes. Top management is to define the response time. Per §10.2.6]		Could consider requiring that an operator's procedure to audit its procedures to manage process safety must include that: - a report of the findings of the audit shall be developed; - the operator shall promptly determine and document an appropriate response to each of the findings of the compliance audit, and document that deficiencies have been corrected; and - the operatorshall retain the two (2) most recent compliance audit reports	Could consider requiring that an operator's procedure to audit its procedures to manage process safety must include that: - a report of the findings of the audit shall be developed; - the operator shall promptly determine and document an appropriate response to each of the findings of the compliance audit, and document that deficiencies have been corrected; and - the operatorshall retain the two (2) most recent compliance audit reports
CA	11	Must Audit and Management Review Records be Retained?	1910.119(o)(5) Employers shall retain the two (2) most recent compliance audit reports.	[No specific requirement.]	[No specific requirement.]	[No specific requirement.]	[Yes. Operators must be maintain the records and document the management review reports. The records must be maintained. Per §10.2.6 and §11.3]		Could consider requiring that an operator's procedure to audit its procedures to manage process safety must include that: - a report of the findings of the audit shall be developed; - the operator shall promptly determine and document an appropriate response to each of the findings of the compliance audit, and document that deficiencies have been corrected; and - the operatorshall retain the two (2) most recent compliance audit reports	Could consider requiring that an operator's procedure to audit its procedures to manage process safety must include that: - a report of the findings of the audit shall be developed; - the operator shall promptly determine and document an appropriate response to each of the findings of the compliance audit, and document that deficiencies have been corrected; and - the operatorshall retain the two (2) most recent compliance audit reports
		Trade Secrets	**Trade Secrets**	**Trade Secrets**	**Trade Secrets**	**Trade Secrets**	**Trade Secrets**	**Trade Secrets**	**Trade Secrets**	**Trade Secrets**
TS	1	Availability of Trade Secrets to Inform PSM Processes	§ 1910.119(p) Trade secrets. (p) Trade secrets. (1) Employers shall make all information necessary to comply with the section available to those persons responsible for compiling the process safety information (required by paragraph (d) of this section), those assisting in the development of the process hazard analysis (required by paragraph (e) of this section), those responsible for developing the operating procedures (required by paragraph (f) of this section), and those involved in incident investigations (required by paragraph (m) of this section), emergency planning and response (paragraph (n) of this section) and compliance audits (paragraph (o) of this section) without regard to possible trade secret status of such information. (2) Nothing in this paragraph shall preclude the employer from requiring the Persons to whom the information is made available under paragraph (p)(1) of this section to enter into confidentiality agreements not to disclose the information as set forth in 29 CFR 1910.1200. (3) Subject to the rules and procedures set forth in 29 CFR 1910.1200(i)(1) through 1910.1200(i)(12), employees and their designated representatives shall have access to trade secret information contained within the process hazard analysis and other documents required to be developed by this standard.	[No specific requirement.]	[No specific requirement.]	[No specific requirement.]	[No specific requirement.]		Could consider specifying that an operator's procedure to manage process safety must require operator to make its trade secret information available to those persons responsible for compiling information related to process safety information, those assisting in the development of the process hazard analysis, those responsible for developing operating procedures, and those involved in incident investigations, emergency planning and response, and compliance audits, without regard to possible trade secret status of such information. If necessary, the trade secret information can be made available under a confidentiality agreement.	Could consider specifying that an operator's procedure to manage process safety must require operator to make its trade secret information available to those persons responsible for compiling information related to process safety information, those assisting in the development of the process hazard analysis, those responsible for developing operating procedures, and those involved in incident investigations, emergency planning and response, and compliance audits, without regard to possible trade secret status of such information. If necessary, the trade secret information can be made available under a confidentiality agreement.

Appendix C: Industry Survey Questions

The survey questions are provided below.

Final - PHMSA LNG PSM Research Project Survey for PHMSA and TAP Review

Welcome to this survey and Thank You in advance for your participation!

Page description:

This survey is being completed as part of PHMSA Research Project #732 - - Performance Gap Comparison of Process Safety Management Consensus Standards and Regulatory Requirements for LNG Facilities, being led by GTI and with Blue Engineering and Consulting Co. as a subcontractor.

Every response is very important - - only nine(9) operators will be surveyed. The survey provides an important opportunity for operators to comment regarding current and potential regulatory requirements related to Process Safety Management (PSM) at LNG facilities, so the careful consideration of your responses is appreciated. Please seriously consider involving your operating staff as you prepare to complete the survey. Also attached is a pdf of the survey itself to help you prepare your responses in advance.

Individual responses will be held confidential and will not be identified by company name, but will be consolidated for PHMSA by GTI and Blue on an overall basis and also in these two categories:

- Responses from the surveys sent to LNG Terminal Operators
- Responses from the surveys sent to LNG Peak Shaving and Merchant Facility Operators

The survey responses are anticipated to be included in the Final Public Report of this PHMSA-funded research project.

Accompanying the survey via an email to your company is a non-public-version of the current LNG Process Safety Management Matrix Table that was developed under Research Project #732.

- It contains copyrighted material excerpted from NFPA and API documents. So please do not forward this to individuals other than those who are completing the survey or supporting your company's review of your planned responses.
- It provides information relevant to each survey question; you can refer to if you want background reference content.
- It is cross-linked to the survey by row reference numbers listed in columns A and B (e.g. "MOC-1").
- PSM topics are organized in 14 major groups that align with the 14 elements in 29CFR1910.119 (OSHA PSM) and follow the same order of those elements in 29CFR1910.119.
- There are more entries/rows in the table than are listed in the survey. The additional entries/rows reflect the entirety of the analysis.

The survey is divided into four parts:

- Section 1: Consists of just one question that provides operators an opportunity to comment if they have an overall preference about the use of prescriptive vs. performance-based language in future regulations that pertain to Process Safety Management for LNG facilities, in general.
- Section 2: Lists the gaps in the order that they appear in the accompanying LNG Process Safety Management Matrix Table, i.e. in the same order as they appear in 29CFR1910.119 (OSHA PSM).
- Section 3: Asks questions similar to the question posed in Section 1 but in a different, more specific way. Section 3 allows operators to comment if they have any specific preference about the use of prescriptive vs. performance-based language in future regulations that pertain to the frequency to inspect or test specific components in LNG facilities.

- Section 4: Asks about two topics that may not be considered as gaps per se, and lastly also provides an open-ended question to receive any other input that an operator may want to provide.

The order of the questions in Section 2 is not intended to reflect any prioritization of PSM topics or potential gaps. For context and your background information, it was noted by OSHA's representative on this project's Technical Advisory Panel that the top four categories of violations under OSHA's Chemical National Emphasis Programs (NEP) occur in these OSHA PSM categories:

- MI - Mechanical Integrity - 29CFR1910.119(j)
- OP - Operating Procedures - 29CFR1910.119(f)
- PHA - Process Hazard Analysis - 29CFR1910.119(e)
- PSI - Process Safety Information - 29CFR1910.119(d)

Blue is leading the outreach to you to:

- discuss the survey and any questions that you have before completing the survey, and
- gather additional verbal comments or feedback related to PSM gaps, PSM goals, or desired PSM states at LNG facilities that your company would like to provide in addition to your response to this survey.

Use the "Back" and "next" buttons at bottom of survey page to advance or review. Do not use the back arrow button on your web browser.

ID 449

1. Survey Respondent Information *

First Name

Last Name

Title

Company Name

Email Address

Mobile Phone

ID 445

Other information about this research project is publicly available at
Performance Gap Comparison of Process Safety Management Consensus Standards and Regulatory Requirements for LNG Facilities

Survey Section 1

ID 447

General/Overall Questions

Project Matrix Table Reference Nos: MI-36 through MI-38

Page description:
PSM Category: Mechanical Integrity
PSM Subcategory Topic: Numerous

Potential Gap in 49CFR193:

In general and other than for the specific questions asked in this survey, should potential future revisions in 49CFR193 include requirements to inspect, test and maintain equipment with more reliance on being "consistent with generally accepted engineering" as per 49CFR193.2605(a) [or similar to OSHA 29CFR§1910.119(j)(4)(iii) language and OSHA's Recognized and Generally Accepted Good Engineering Practices, RAGAGEP] rather than the many prescriptive requirements such as specified minimum frequencies in days or months?

Arising from a comparison of 49CFR193 to:

- OSHA 29CFR1910.119 PSM
- API RP 1173
- NFPA 59A 2001
- NFPA 59A 2019

ID 348

2. Should this potential gap be addressed? *

VALIDATION Max character count = 500

ID 349

3. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; threshold for requirement to apply; etc.):

SURVEY SECTION 2:

Page description:
VARIOUS TOPICS

ID 465

Project Matrix Table Reference Nos: EP-1 and EP-2

Page description:
PSM Category: Employee Participation (and Stakeholder Engagement)
PSM Subcategory Topic: Must Operator have a Written Plan of Action to Implement Employee Participation in Process Safety Management Requirements? And Operator's Engagement with Employees and Other Internal Stakeholders

Potential Gap in 49CFR193: There is no apparent requirement in 49CFR193 that:
An operator's procedures must require operator to consult with its employees during the operator's periodic review or preparation of its procedures and manuals for emergency response, purging, commissioning, product transfer, maintenance, and other operations, including the assessment of potential hazards, risks and emergencies at or adjacent to its facility, and also to permit employees to access relevant non-confidential information.

Arising from a comparison of 49CFR193 to:

- OSHA 29CFR1910.119 PSM
- API RP 1173

ID 351

4. Should this potential gap be addressed? *

VALIDATION Max character count = 500

ID 352

5. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

Project Matrix Table Reference Nos: EP-3

Page description:
PSM Category: Employee Participation (and Stakeholder Engagement)
PSM Subcategory Topic: Operator's Management Leadership Commitment

Potential Gap in 49CFR193: There is no apparent requirement in 49CFR193 that:
Elements of an operator's management leadership procedures must include:

- identify the titles of the individual company executives, managers and other key personnel positions that are accountable for establishing and implementing procedures related to maintaining process safety management, supporting continuous safety improvement initiatives, and providing oversight;
- establish and track leading and lagging key performance indicators or other high-level performance measures that regularly measure the operator's safety performance; and
- performing a review of operator's processes and efforts to improve its safety and its risk management results at least once per year, including an assessment of which performance goals and objectives have been met, and integrating the findings into the next iteration of continuous improvement of the operator's procedure related to maintaining process safety management .

Arising from a comparison of 49CFR193 to:

- API RP 1173

ID 355

6. Should this potential gap be addressed? *

VALIDATION Max character count = 500
ID 356

7. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

Project Matrix Table Reference Nos: PSI-1, PSI-2, PSI-3 and PSI-4

Page description:
PSM Category: Process Safety Information
PSM Subcategory Topic: Required Content for Operator to Maintain

Potential Gap in 49CFR193:
Existing requirements of 49CFR193 may not specify or clearly state the requirement on the operator to compile

- process safety information which pertains to the highly hazardous chemicals in the process:
  - Hazardous effects of inadvertent mixing of different materials that could foreseeably occur.
- process safety information which pertains to the technology of the process:
  - A block flow diagram or simplified process flow diagram; and
  - Process chemistry.
- process safety information which pertains to the equipment in the process:
  - Piping and instrument diagrams (P&ID's) and
  - Material and energy balances for processes.

Arising from a comparison of 49CFR193 to:

- OSHA 29CFR1910.119 PSM

ID 360

8. Should this potential gap be addressed? *

VALIDATION Max character count = 500

ID 361

9. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

Project Matrix Table Reference Nos: PHA-3 and PHA-4

Page description:
PSM Category: Process Hazard Analysis (incl. Risk Management)
PSM Subcategory Topic: Methodology to Conduct PHA, and Overall Content of PHA

Potential Gap in 49CFR193: Existing requirements of 49CFR193 (or even articles §5.2.1, §17.3.1.2 or other requirements NFPA 59A 2019 edition, if incorporated by reference in 49CFR193) may not specify or clearly state that the methodology used by an operator to perform a process hazard analysis be equivalent to all of the requirements in 29CFR1910.119(e)(2) and 29CFR1910.119(e)(3), i.e.:

(2) The operator shall use one or more of the following methodologies that are appropriate to determine and evaluate the hazards of the process being analyzed.

(i) What-If;
(ii) Checklist;
(iii) What-If/Checklist;
(iv) Hazard and Operability Study (HAZOP):
(v) Failure Mode and Effects Analysis (FMEA);
(vi) Fault Tree Analysis; or
(vii) An appropriate equivalent methodology.

(3) The process hazard analysis shall address:

(i) The hazards of the process;
(ii) The identification of any previous incident which had a likely potential for catastrophic consequences in the workplace;
(iii) Engineering and administrative controls applicable to the hazards and their interrelationships such as appropriate application of detection methodologies to provide early warning of releases. (Acceptable detection methods might include process monitoring and control instrumentation with alarms, and detection hardware such as hydrocarbon sensors.);
(iv) Consequences of failure of engineering and administrative controls;
(v) Facility siting;
(vi) Human factors; and
(vii) A qualitative evaluation of a range of the possible safety and health effects of failure of controls on employees in the workplace.

Arising from a comparison of 49CFR193 to:

- OSHA 29CFR1910.119 PSM

ID 364

10. Should this potential gap be addressed? *

VALIDATION Max character count = 500

ID 365

11. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

Project Matrix Table Reference Nos: PHA-3 and PHA-4

Page description:
PSM Category: Process Hazard Analysis (incl. Risk Management)
PSM Subcategory Topic: Methodology to Conduct PHA, and Overall Content of PHA

Potential Gap in 49CFR193: More specifically, existing requirements of 49CFR193 (or even NFPA 59A 2019 edition, if incorporated by reference in 49CFR193) may not specify or clearly state that the methodology used by an operator to perform a process hazard analysis include consideration of the following specific items from § 1910.119(e)(3):

...
(ii) The identification of any previous incident which had a likely potential for catastrophic consequences in the workplace;
...
(vi) Human factors; and
(vii) A qualitative evaluation of a range of the possible safety and health effects of failure of controls on employees in the workplace.

Arising from a comparison of 49CFR193 to:

- OSHA 29CFR1910.119 PSM

ID 366

12. Should this potential gap be addressed? *

VALIDATION Max character count = 500

ID 367

13. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

Project Matrix Table Reference Nos: PHA-5

Page description:
PSM Category: Process Hazard Analysis (incl. Risk Management)
PSM Subcategory Topic: Qualifications of Team that Conducts PHA

Potential Gap in 49CFR193: Existing requirements of 49CFR193 may not specify or clearly state that the required qualifications of the operator's team that conducts a process hazard analysis must be equivalent to those in 29CFR1910.119(e)(4), i.e. that:

> A process hazard analysis shall be performed by a team with expertise in engineering and process operations, and the team shall include at least one employee who has experience and knowledge specific to the process being evaluated. Also, one member of the team must be knowledgeable in the specific process hazard analysis methodology being used.

Arising from a comparison of 49CFR193 to:

- OSHA 29CFR1910.119 PSM

ID 368

14. Should this potential gap be addressed? *

VALIDATION Max character count = 500

ID 369

15. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

Project Matrix Table Reference Nos: PHA-6

Page description:
PSM Category: Process Hazard Analysis (incl. Risk Management)
PSM Subcategory Topic: Operator's Action Plan to Address PHA Findings and Recommendations

Potential Gap in 49CFR193: There is no apparent requirement in 49CFR193 equivalent to those in 29CFR1910.119(e)(5), i.e. that:

> An operator must establish a system to promptly address the findings and recommendations from a process hazard analysis review; assure that the recommendations are resolved in a timely manner and that the resolution is documented; document what actions are to be taken; complete actions as soon as possible; develop a written schedule of when these actions are to be completed; communicate the actions to operating, maintenance and other employees whose work assignments are in the process and who may be affected by the recommendations or actions.

Arising from a comparison of 49CFR193 to:

- OSHA 29CFR1910.119 PSM

ID 370

16. Should this potential gap be addressed? *

VALIDATION Max character count = 500

ID 371

17. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

Project Matrix Table Reference Nos: PHA-8 and PHA-9

Page description:
PSM Category: Process Hazard Analysis (incl. Risk Management)
PSM Subcategory Topic: Must Operator Maintain a Process to Identify Threats?, and Risk Prevention and Mitigation Analysis

Potential Gap in 49CFR193: Additionally, existing requirements of 49CFR193 (or even NFPA 59A 2019 edition, if incorporated by reference in 49CFR193) may not specify or clearly state the following principles from API RP 1173:
An operator must consider the following when performing its process hazard analysis:

- lessons learned (both internal and external);
- identifying high consequence areas and possible events.
- establishing and maintaining an ongoing process to identify threats to the LNG facility
- identifying and evaluating various risk prevention and mitigation measures, which may include analysis of the adequacy of response times of employees as well as external organizations, considering to establish an incident command center, and multiple response scenario evaluations.

Arising from a comparison of 49CFR193 to:

- API RP 1173

ID 372

18. Should this potential gap be addressed? *

VALIDATION Max character count = 500
ID 373

19. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

Project Matrix Table Reference Nos: PHA-10

Page description:
PSM Category: Process Hazard Analysis (incl. Risk Management)
PSM Subcategory Topic: Minimum Frequency in Years to Update Process Hazard Analysis

Potential Gap in 49CFR193: There is no apparent requirement in 49CFR193 that:

> A process hazard analysis for the facility shall be updated and revalidated by a team at least every five (5) years after the completion of the last PHA, in order to: review the last PHA to determine if any new regulatory requirements or emerging issues or threats have occurred since last PHA; assure that the PHA is consistent with the current process and address any changes made to the process since the last PHA; apply data and information gained from operations, maintenance, and integrity-related work inspection and testing; and incorporate learnings from incidents or safety-related reports that occurred since the last PHA.

Arising from a comparison of 49CFR193 to:

- OSHA 29CFR1910.119 PSM

ID 374

20. Should this potential gap be addressed? *

VALIDATION Max character count = 500

ID 375

21. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

Project Matrix Table Reference Nos: PHA-11

Page description:
PSM Category: Process Hazard Analysis (incl. Risk Management)
PSM Subcategory Topic: PHA Record Retention Period

Potential Gap in 49CFR193: There is no apparent requirement in 49CFR193 equivalent to those in 29CFR1910.119(e)(7), i.e. that:

> Operators shall retain process hazards analyses, as well as the documented resolution of recommendations arising from them, for the life of the facility.

Arising from a comparison of 49CFR193 to:

- OSHA 29CFR1910.119 PSM

ID 376

22. Should this potential gap be addressed? *

VALIDATION Max character count = 500

ID 377

23. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

Project Matrix Table Reference Nos: PHA-12

Page description:
PSM Category: Process Hazard Analysis (incl. Risk Management)
PSM Subcategory Topic: PHA Record Retention Period

Potential Gap in 49CFR193: There is no apparent requirement in 49CFR193 that:
Operator's Process Hazard Analysis shall include operator's definition of its risk tolerance criteria for acceptable, unacceptable and conditionally tolerable risk levels.

Arising from a comparison of 49CFR193 to:

- Other PSM-related reference

ID 378

24. Should this potential gap be addressed? *

VALIDATION Max character count = 500

ID 379

25. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

Project Matrix Table Reference Nos: OP-11, OP-12 and OP-13

Page description:
PSM Category: Operating Procedures (and Documentation)
PSM Subcategory Topic: Operator's PSM System Documentation - Document Control Procedures, Record Control Procedures, and Minimum Content

Potential Gap in 49CFR193: There is no apparent requirement in 49CFR193 that:

An operator must have a procedure to manage process safety, which must include methods to control documents that describe its system or processes to manage safety:

- be reviewed and approved for adequacy prior to issue or re-issue, by the responsible persons or management position identified in the documents;
- show the current revision status and identify changes;
- be legible and readily identifiable;
- be readily available and accessible to personnel; and
- be removed from all points of issue or use, or be otherwise marked to assure against unintended use if they are retained for any purpose, if the document becomes obsolete.

The operator's documentation of its system or process to manage safety must also include maintaining a procedure to control records that demonstrate conformance of its operations to the procedure that is used to manage safety, and that the procedure shall:

- identify the controls and responsibilities to identify, collect, store, protect, retrieve, retain and dispose of records;
- require that records remain legible, identifiable, and retrievable; and
- specify the record retention time.

The operator's documentation of its procedure to manage safety must also include:

- operator's stated overall safety objectives and policies;
- regulatory and other requirements applicable to process safety management;
- operator's procedures to conform with regulatory and other requirements applicable to process safety management, including operator's own requirements;
- documents required by its process safety management system;
- records that demonstrate conformance to the requirements of the process safety management system; and
- other records that the operator has identified to show the effectiveness of its process safety management system.

Arising from a comparison of 49CFR193 to:

- API RP 1173

ID 380

26. Should this potential gap be addressed? *

VALIDATION Max character count = 500

ID 381

27. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

Project Matrix Table Reference Nos: OP-14

Page description:
PSM Category: Operating Procedures (and Documentation)
PSM Subcategory Topic: Should Operator's Periodic Updates of its Operating Procedures Specifically Consider Cognitive Issues/Human Factors?

Potential Gap in 49CFR193: There is no apparent requirement in 49CFR193 that:

The operator's periodic updates to its operating plans and procedures required by 49CFR193.2017 must include a methodology to consider human factors and the role of people in facility operation and their support of safety-critical systems, which may include:

- Review practices and tools used to maintain real-time awareness of safety margins
- Adopt practices to identify and understand safety-critical human tasks along with operational and management practices that enable operators to perform tasks reliably
- Review options for ensuring independent challenge to safety-critical decisions within their own operations

Specific examples may relate for example to:

- general access and egress
- facility layout requirements for operability and maintainability
- human-machine interfaces (e.g. Digital Control Systems Screens)
- valve access
- control center and room design
- signage and labeling
- general work environment (lighting, noise, heat, etc.)

Arising from a comparison of 49CFR193 to:

- Other PSM-related reference

ID 382

28. Should this potential gap be addressed? *

VALIDATION Max character count = 500

ID 383

29. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

Project Matrix Table Reference Nos: CON-5

Page description:
PSM Category: Contractors
PSM Subcategory Topic: Operator Responsibilities - Evaluate Performance of Designer, Fabricator and Constructor with respect to PSM Requirements

Potential Gap in 49CFR193: There are no apparent requirements in 49CFR193 that:

An operator must periodically evaluate the safety performance of personnel utilized for construction, installation, inspection, testing, operations or maintenance.

Arising from a comparison of 49CFR193 to:

- OSHA 29CFR1910.119 PSM
- API RP 1173

ID 384

30. Should this potential gap be addressed? *

VALIDATION Max character count = 500

ID 385

31. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

Project Matrix Table Reference Nos: CON-7 PSM Category: Contractors PSM Subcategory Topic: Operator Responsibilities - Track Injury and Illness of Designer, Fabricator or Constructor

Page description:
PSM Category: Contractors
PSM Subcategory Topic: Operator Responsibilities - Track Injury and Illness of Designer, Fabricator or Constructor

Potential Gap in 49CFR193: There are no apparent requirements in 49CFR193 that:

The operator must receive or maintain an injury and illness log related to work done while at the operator's facility by designers, fabricators, installers, inspectors, constructors or those performing testing.

Arising from a comparison of 49CFR193 to:

- OSHA 29CFR1910.119 PSM
- API RP 1173

ID 386

32. Should this potential gap be addressed? *

VALIDATION Max character count = 500

ID 387

33. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

Project Matrix Table Reference Nos: CON-8

Page description:
PSM Category: Contractors
PSM Subcategory Topic: Operator Responsibilities - Learn from the Designer, Fabricator, and Constructor

Potential Gap in 49CFR193: There is no apparent requirement in 49CFR193 that:

An operator must define and document a process for operator to receive "lessons learned" suggestions and recommendations voluntarily provided from designers, fabricators, inspectors, constructors or those performing testing that pertain to potential improvements in process safety at the operator's facility, and for operator to review and assess any appropriate course of action.

Arising from a comparison of 49CFR193 to:

- API RP 1173

ID 388

34. Should this potential gap be addressed? *

VALIDATION Max character count = 500

ID 389

35. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

Project Matrix Table Reference Nos: MI-9

Page description:
PSM Category: Mechanical Integrity
PSM Subcategory Topic: Frequency in Months to Inspect and Test - Control systems intended for fire protection

Potential Gap in 49CFR193: There is an apparent gap in 49CFR193 that §193.2619(c) requires:

> §193.2619(c) Control systems in service, but not normally in operation, such as relief valves and automatic shutdown devices, and control systems for internal shutoff valves for bottom penetration tanks must be inspected and tested once each calendar year, not exceeding 15 months, with the following exceptions:
> …
> (2) Control systems that are intended for fire protection must be inspected and tested at regular intervals not to exceed 6 months.
>
> Whereas NFPA 59A (2001 and 2019) determine inspection and testing frequencies based on applicable fire codes, and OSHA 29CFR1910.119 determines inspection and testing frequencies to be consistent with applicable manufacturers' recommendations and good engineering practices, and more frequently if determined to be necessary by prior operating experience.

Arising from a comparison of 49CFR193 to:

- NFPA 59A 2001
- NFPA 59A 2019

ID 392

36. Should this potential gap be addressed? *

VALIDATION Max character count = 500

ID 393

37. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

Project Matrix Table Reference Nos: MI-10

Page description:
PSM Category: Mechanical Integrity
PSM Subcategory Topic: Frequency in Months to Inspect and Test - Stationary LNG Tank Relief Valves

Potential Gap in 49CFR193: There is an apparent gap in 49CFR193 that §193.2619(c) requires:

> §193.2619(c) Control systems in service, but not normally in operation, such as relief valves and automatic shutdown devices, and control systems for internal shutoff valves for bottom penetration tanks must be inspected and tested once each calendar year, not exceeding 15 months, with the following exceptions:
> …
>
> Whereas NFPA 59A (2001 and 2019) requires that stationary LNG container relief valves shall be inspected and set-point tested at least once every 2 calendar years, with intervals not exceeding 30 months, to ensure that each valve relieves at the proper setting.

Arising from a comparison of 49CFR193 to:

- NFPA 59A 2001
- NFPA 59A 2019

ID 394

38. Should this potential gap be addressed? *

VALIDATION Max character count = 500

ID 396

39. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

Project Matrix Table Reference Nos: MI-11

Page description:
PSM Category: Mechanical Integrity
PSM Subcategory Topic: Frequency in Months to Inspect and Test - Relief Valves in Control Systems other than on Stationary LNG Tanks

Potential Gap in 49CFR193: There is an apparent gap in 49CFR193 that §193.2619(c) requires:

> §193.2619(c) Control systems in service, but not normally in operation, such as relief valves and automatic shutdown devices, and control systems for internal shutoff valves for bottom penetration tanks must be inspected and tested once each calendar year, not exceeding 15 months, with the following exceptions:
> …
>
> Whereas NFPA 59A (2001) §10.15.4.5(d) requires that stationary LNG container relief valves shall be inspected and set-point tested at least once every 2 calendar years, with intervals not exceeding 30 months, to ensure that each valve relieves at the proper setting.
>
> Whereas NFPA 59A (2019) §18.10.10.7 requires
>
> - Inspection intervals either: 12 month frequency external inspection either per Section 2 of ANSI/NB-23, National Board Inspection Code, Part 2, Inspection (including listed conditions that can be observed on the valves externally); or per API 510, Pressure Vessel Inspection Code: In-service Inspection, Rating, Repair, and Alteration.
> - Set-point testing intervals either: 60 month frequency not to exceed 63; or per API RP 576, Inspection of Pressure-Relieving Devices.

Arising from a comparison of 49CFR193 to:

- NFPA 59A 2001
- NFPA 59A 2019

ID 397

40. Should this potential gap be addressed? *

VALIDATION Max character count = 500

ID 398

41. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

Project Matrix Table Reference Nos: MI-12

Page description:
PSM Category: Mechanical Integrity
PSM Subcategory Topic: Frequency in Months to Inspect and Test - Relief Valves other than in Control Systems or on Stationary LNG Tanks

Potential Gap in 49CFR193: There is an apparent gap in 49CFR193 that §193.2619(c) requires:

> §193.2619(c) Control systems in service, but not normally in operation, such as relief valves and automatic shutdown devices, and control systems for internal shutoff valves for bottom penetration tanks must be inspected and tested once each calendar year, not exceeding 15 months, with the following exceptions:
> …
>
> Whereas NFPA 59A (2001) §11.5.5.1(e) requires all other relief valves protecting hazardous fluid components shall be randomly inspected and setpoint tested at intervals not exceeding 5 years plus 3 months.
>
> Whereas NFPA 59A (2019) §18.10.10.7 requires:
>
> - Inspection intervals either: 12 month frequency external inspection either per Section 2 of ANSI/NB-23, National Board Inspection Code, Part 2, Inspection (including listed conditions that can be observed on the valves externally); or per API 510, Pressure Vessel Inspection Code: In-service Inspection, Rating, Repair, and Alteration.
> - Set-point testing intervals either: 60-month frequency not to exceed 63; or per API RP 576, Inspection of Pressure-Relieving Devices.

Arising from a comparison of 49CFR193 to:

- NFPA 59A 2001
- NFPA 59A 2019

ID 399

42. Should this potential gap be addressed? *

VALIDATION Max character count = 500

ID 400

43. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

Project Matrix Table Reference Nos: MOC-1 and MOC-2

Page description:
PSM Category: Management of Change
PSM Subcategory Topic: Is a Management of Change Procedure Required?, and Considerations and Content in MOC Procedures

Potential Gap in 49CFR193: There is no apparent requirement in 49CFR193 that:

An operator's facility procedures must include a procedure to manage temporary or permanent changes (except for "replacements in kind") to process chemicals, technology, equipment, and procedures. And that these procedures must include the following minimum content:

- The technical basis and reason for the proposed change;
- Impact of change on safety and health;
- Modifications to operating procedures;
- The necessary time period for the change;
- Authorization requirements for the proposed change;
- Secure necessary work permits; and
- Documentation requirements to manage change.

Arising from a comparison of 49CFR193 to:

- OSHA 29CFR1910.119 PSM
- API RP 1173

ID 401

44. Should this potential gap be addressed? *

VALIDATION Max character count = 500

ID 402

45. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

Project Matrix Table Reference Nos: II-1, II-2 and II-3

Page description:
PSM Category: Incident Investigation
PSM Subcategory Topic: Definition of Incident, Threshold of Incident Size that Operator Must Investigate, and Must Near-Misses Be Investigated?

Potential Gap in 49CFR193: There is no apparent requirement in 49CFR193 that:

An operator shall have its own procedure to investigate each incident which resulted in, or could reasonably have resulted in a catastrophic release of highly hazardous chemical in the workplace, that do not otherwise meet the threshold of requirements to investigate under §193.2515.

Arising from a comparison of 49CFR193 to:

- OSHA 29CFR1910.119 PSM
- API RP 1173

ID 403

46. Should this potential gap be addressed? *

VALIDATION Max character count = 500

ID 404

47. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

Project Matrix Table Reference No: II-4

Page description:
PSM Category: Incident Investigation
PSM Subcategory Topic: Minimum Time to Report Incident to Authorities

Potential Gap in 49CFR193 (by reference): The requirement in 49CFR191.5(a) to report an incident in 1 hour is more rigorous than that in 29CFR1910.119, and some operators may prefer a different reporting time requirement:

> §191.5 Immediate notice of certain incidents.
> (a) At the earliest practicable moment following discovery, but no later than one hour after confirmed discovery, each operator must give notice in accordance with paragraph (b) of this section of each incident as defined in §191.3..

Arising from a comparison of 49CFR193 to:

- OSHA 29CFR1910.119 PSM

ID 405

48. Should this potential gap be addressed? *

VALIDATION Max character count = 500

ID 406

49. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

Project Matrix Table Reference No: II-6

Page description:
PSM Category: Incident Investigation
PSM Subcategory Topic: Qualification and Composition of Incident Investigation Team

Potential Gap in 49CFR193: There is no apparent requirement in 49CFR193 that:

> An operator's incident investigation procedure must include requirements for the qualifications and composition of incident investigation team, with minimum requirement to have: at least one person knowledgeable in the process involved, including a contract employee if the incident involved work done by contract employees ; and other persons with appropriate knowledge and experience to thoroughly investigate and analyze the incident.

Arising from a comparison of 49CFR193 to:

- OSHA 29CFR1910.119 PSM

ID 407

50. Should this potential gap be addressed? *

VALIDATION Max character count = 500

ID 408

51. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

Project Matrix Table Reference No: II-7 and II-8 PSM Category: Incident Investigation PSM Subcategory Topic: Minimum Content of Incident Investigation Report, and Operator's Learning from Operator's Recent Incidents

Page description:
PSM Category: Incident Investigation
PSM Subcategory Topic: Minimum Content of Incident Investigation Report, and Operator's Learning from Operator's Recent Incidents

Potential Gap in 49CFR193: There is no apparent requirement in 49CFR193 that:
An operator's incident investigation procedure must include the following elements:

- identifying findings and lessons learned;
- utilizing an investigation report template that attempts to identify clear links between causes and recommendations, e.g. by using a logic tree, cause-and-effect tree, time-based cause-and-effect chart, or causal factor chart
- assessing the effectiveness of emergency response procedures, equipment and processes;
- recommending changes to processes, procedures, training, resource allocation, and risk assessment processes including consequence analysis and failure rate probabilities;
- reviewing the incident investigation report with personnel whose job tasks are relevant to the incident findings (including contract employees where applicable), including contributing factors, findings, lessons learned and recommendations;
- documenting resolutions and corrective actions; and
- tracking and completing actions to improve safety systems, control systems and risk assessment processes arising from the investigation results and lessons learned

Arising from a comparison of 49CFR193 to:

- OSHA 29CFR1910.119 PSM
- API RP 1173

ID 409

52. Should this potential gap be addressed? *

VALIDATION Max character count = 500
ID 410

53. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

Project Matrix Table Reference No: II-9 and II-10

Page description:
PSM Category: Incident Investigation
PSM Subcategory Topic: Operator's Learning from Operator's Past Incidents, and Operator's Learning from External Incidents

Potential Gap in 49CFR193: There is no apparent requirement in 49CFR193 that:
An operator's incident investigation procedure must include the following elements:

- performing a review and reassessment five years after incidents that were reportable under §191.15, to identify any subsequent lessons learned, what changes the operator has made from those past incident investigations, and other impacts; and
- identifying and internally reviewing lessons learned from incidents external to the operator at least annually.

Arising from a comparison of 49CFR193 to:

- API RP 1173

ID 411

54. Should this potential gap be addressed? *

VALIDATION Max character count = 500

ID 412

55. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

Project Matrix Table Reference Nos: EPR-2

Page description:
PSM Category: Emergency Planning and Response (incl. Fire Protection and Security)
PSM Subcategory Topic: Emergency Response Procedure Minimum Elements - Scenario Planning Considerations

Potential Gap in 49CFR193: There is no apparent requirement in §193.2509 “Emergency procedures” that:
The types of emergencies other than fires that may reasonably be expected to occur at an LNG plant that the operator must consider and plan for also includes pandemic outbreaks.

Arising from a comparison of 49CFR193 to:

- API RP 1173

ID 413

56. Should this potential gap be addressed? *

VALIDATION Max character count = 500

ID 414

57. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

Project Matrix Table Reference Nos: EPR-5

Page description:
PSM Category: Emergency Planning and Response (incl. Fire Protection and Security)
PSM Subcategory Topic: Emergency Response Procedure Minimum Elements – Emergency Evacuations

Potential Gap in 49CFR193: There is no apparent requirement in §193.2509(4) “Emergency procedures” that:
An operator’s cooperation with appropriate local officials in evacuations shall include that operator's emergency procedures must account for all employees after evacuation.

Arising from a comparison of 49CFR193 to:

- API RP 1173

ID 415

58. Should this potential gap be addressed? *

VALIDATION Max character count = 500

ID 416

59. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

Project Matrix Table Reference Nos: EPR-10

Page description:
PSM Category: Emergency Planning and Response (incl. Fire Protection and Security)
PSM Subcategory Topic: Emergency Response and Fire Protection Training - Initial Training and Drills

Potential Gap in 49CFR193: There is no apparent requirement in §193.2509(3) "Emergency procedures" that:

> An operator's coordination with appropriate local officials in preparation of an emergency evacuation plan shall include operator extending an invitation to an external agency or organization to participate in training or drills at least every 24 months not to exceed 27 months.

Arising from a comparison of 49CFR193 to:

- API RP 1173

ID 419

60. Should this potential gap be addressed? *

VALIDATION Max character count = 500

ID 420

61. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

Project Matrix Table Reference Nos: EPR-26

Page description:
PSM Category: Emergency Planning and Response (incl. Fire Protection and Security)
PSM Subcategory Topic: Minimum Frequency in Years to Exercise Emergency Response Notification Mechanism

Potential Gap in 49CFR193: There is no apparent requirement in §193.2509(3) "Emergency procedures" that:

> An operator must conduct an exercise of the LNG facility's emergency response notification mechanisms at least one each calendar year, and maintain a written record of each notification exercise conducted over the last five years. The notification exercises may be as part of the tabletop and field exercises that involve simulated accidental releases.

Arising from a comparison of 49CFR193 to:

- EPA 40CFR68.96

ID 421

62. Should this potential gap be addressed? *

VALIDATION Max character count = 500

ID 422

63. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

Project Matrix Table Reference Nos: EPR-27

Page description:
PSM Category: Emergency Planning and Response (incl. Fire Protection and Security)
PSM Subcategory Topic: Minimum Frequency in Years to Conduct Field Exercise Involving Simulated Accidental Release of a Regulated Substance

Potential Gap in 49CFR193: There is no apparent requirement in §193.2509(3) “Emergency procedures” that:

An operator must conduct field exercises of its emergency response procedures involving the simulated accidental release of a flammable, toxic or other regulated substance.

- (i) Frequency. As part of coordination with local emergency response officials, the operator shall consult with these officials to establish an appropriate frequency for field exercises, but at a minimum, shall conduct a field exercise at least once every ten years.
- (ii) Scope. Field exercises shall include: Tests of procedures to notify the public and the appropriate federal, state, and local emergency response agencies about an accidental release; tests of procedures and measures for emergency response actions including evacuations and medical treatment; tests of communications systems; mobilization of facility emergency response personnel, including contractors, as appropriate; coordination with local emergency responders; emergency response equipment deployment; and any other action identified in the emergency response program, as appropriate..

Arising from a comparison of 49CFR193 to:

- EPA 40CFR68.96

ID 423

64. Should this potential gap be addressed? *

VALIDATION Max character count = 500

ID 424

65. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

Project Matrix Table Reference Nos: EPR-28

Page description:
PSM Category: Emergency Planning and Response (incl. Fire Protection and Security)
PSM Subcategory Topic: Minimum Frequency in Years to Conduct Tabletop Exercises Involving Simulated Accidental Release of a Regulated Substance

Potential Gap in 49CFR193: There is no apparent requirement in §193.2509(3) "Emergency procedures" that:

An operator must conduct tabletop exercises of its emergency response procedures involving the simulated accidental release of a flammable, toxic or other regulated substance.

- (i) Frequency. As part of coordination with local emergency response officials required by §68.93, the owner or operator shall consult with these officials to establish an appropriate frequency for tabletop exercises, but at a minimum, shall conduct a field exercise at least once every three years.
- (ii) Scope. Tabletop exercises shall include discussions of: Procedures to notify the public and the appropriate federal, state, and local emergency response agencies; procedures and measures for emergency response including evacuations and medical treatment; identification of facility emergency response personnel and/or contractors and their responsibilities; coordination with local emergency responders; procedures for emergency response equipment deployment; and any other action identified in the emergency response plan, as appropriate.

Arising from a comparison of 49CFR193 to:

- EPA 40CFR68.96

ID 425

66. Should this potential gap be addressed? *

VALIDATION Max character count = 500

ID 426

67. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

Project Matrix Table Reference Nos: EPR-29

Page description:
PSM Category: Emergency Planning and Response (incl. Fire Protection and Security)
PSM Subcategory Topic: Must Operator Prepare an Evaluation Report after Each Emergency Response Tabletop Exercise or Field Exercise?

Potential Gap in 49CFR193: There is no apparent requirement in §193.2509(3) "Emergency procedures" that:

An operator must prepare an evaluation report within 90 days of each Tabletop or Field exercise of its emergency response procedures involving the simulated accidental release of a flammable, toxic or other regulated substance, with the report to include: a description of the exercise scenario; names and organizations of each participant; an evaluation of the exercise results including lessons learned; recommendations for improvement or revisions to the emergency response exercise program and emergency response program; and a schedule to promptly address and resolve recommendations.

Arising from a comparison of 49CFR193 to:

- EPA 40CFR68.96

ID 427

68. Should this potential gap be addressed? *

VALIDATION Max character count = 500

ID 428

69. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

Project Matrix Table Reference Nos: CA-1, CA-2, CA-3

Page description:
PSM Category: Compliance Audits (incl. Metrics, Review and Improvement)
PSM Subcategory Topic: Must Operators Audit its Compliance to its PSM/Risk Management Processes?, and Minimum Frequency in Years that Operator Must Audit its Compliance to PSM/Risk Management Process Requirements, and Qualifications of Audit Team.

Potential Gap in 49CFR193: There is no apparent requirement in 49CFR193 that:

An operator must certify that it has self-evaluated its compliance with its own procedure to manage process safety at least every three years, in order to verify that in its opinion its procedure is adequate and is being followed. Also, the compliance audit is conducted by at least one person knowledgeable in the process.

Arising from a comparison of 49CFR193 to:

- OSHA 29CFR1910.119 PSM

ID 429

70. Should this potential gap be addressed? *

VALIDATION Max character count = 500

ID 430

71. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

Project Matrix Table Reference Nos: CA-4, CA-5, CA-7 and CA-8

Page description:
PSM Category: Compliance Audits (incl. Metrics, Review and Improvement)
PSM Subcategory Topic: Must Operator Evaluate Safety Culture in Audit?, and Must Operator Evaluate PSM System Maturity in Audit?, Must Operator Establish Leading and Lagging Key Performance Indicators to Measure Performance of PSM Process Maturity? and Must Operator Establish a Procedure to Identify, Collect and Analyze Data Relevant to its PSM Program Effectiveness?

Potential Gap in 49CFR193: There is no apparent requirement in 49CFR193 that:
An operator's self-audit of its compliance to its procedure to manage process safety must include:

- assessing the operator's safety culture; and
- confirming that the procedure includes identifying, collecting, and analyzing data generated from operations and maintenance, integrity management, audits and evaluations, operator's management reviews, and other relevant sources related to the suitability and effectiveness of the operator's procedure to manage process safety; and
- assessing whether leading and lagging key performance indicators (KPIs) have been established and maintained to measure the effectiveness of operator's procedure to effectively and adequately manage process safety and risk; and
- assessing if a multi-tiered level framework of process KPIs may enhance process safety; and
- assessing whether the expected progress toward effective risk management and improved safety performance is being achieved; and
- evaluating the maturity of the operator's procedure to manage process safety.

Arising from a comparison of 49CFR193 to:

- API RP 1173

ID 431

72. Should this potential gap be addressed? *

VALIDATION Max character count = 500

ID 432

73. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

Project Matrix Table Reference Nos: CA-6

Page description:
PSM Category: Compliance Audits (incl. Metrics, Review and Improvement)
PSM Subcategory Topic: Must Operator Establish and Maintain Reporting and Feedback Structure?

Potential Gap in 49CFR193: There is no apparent requirement in 49CFR193 that:
An operator's self-audit of its compliance to its procedure to manage process safety must include:

- assessing if a reporting and feedback process for employees and contractors has been established and maintained, including consideration of the benefits and drawbacks of an anonymous reporting system; and
- assessing if reporting and feedback are being monitored to identify new and emerging risks to consider in the risk evaluation and risk mitigation aspects of the operator's procedure.

Arising from a comparison of 49CFR193 to:

- API RP 1173

ID 433

74. Should this potential gap be addressed? *

VALIDATION Max character count = 500

ID 434

75. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

Project Matrix Table Reference Nos: CA-9, CA-10 and CA-11

Page description:
PSM Category: Compliance Audits (incl. Metrics, Review and Improvement)
PSM Subcategory Topic: Must Audits be Documented?,and Must Operator Have Defined Response Times to Address Audit Findings?, and Must Audit and Management Review Records be Retained?

Potential Gap in 49CFR193: There is no apparent requirement in 49CFR193 that:
An operator's procedure to audit its procedure to manage process safety must include that:

- a report of the findings of the audit shall be developed;
- the operator shall promptly determine and document an appropriate response to each of the findings of the compliance audit, and document that deficiencies have been corrected; and
- the operator shall retain the two (2) most recent compliance audit reports.

Arising from a comparison of 49CFR193 to:

- OSHA 29CFR1910.119 PSM
- API RP 1173

ID 435

76. Should this potential gap be addressed? *

VALIDATION Max character count = 500

ID 436

77. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

Project Matrix Table Reference Nos: TS-1

Page description:
PSM Category: Trade Secrets
PSM Subcategory Topic: Availability of Trade Secrets to Inform PSM Processes

Potential Gap in 49CFR193: There is no apparent requirement in 49CFR193 that:

An operator's procedure to manage process safety must require operator to make its trade secret information available to those persons responsible for compiling information related to process safety information, those assisting in the development of the process hazard analysis, those responsible for developing operating procedures, and those involved in incident investigations, emergency planning and response, and compliance audits, without regard to possible trade secret status of such information. If necessary, the trade secret information can be made available under a confidentiality agreement.

Arising from a comparison of 49CFR193 to:

- OSHA 29CFR1910.119 PSM

ID 437

78. Should this potential gap be addressed? *

VALIDATION Max character count = 500

ID 438

79. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

Topic: Multiple

Page description:
PSM Category: Mechanical Integrity
PSM Subcategory: Multiple

Potential Gap in 49CFR193:

The frequencies required in 49CFR193 for the following Subcategory Topics align with the requirements of NFPA 59A 2019 (except for some differences in specified frequencies for MI-10, MI-11, and MI-12) but not a RAGAGEP basis such as in 49CFR193.2605(a) or 29CFR1910.119(j)(4)(iii).

For MI-9, 49CFR193 requires a specified frequency of testing (not to exceed 6 months) while NFPA 59A 2001 and 2019 require a RAGAGEP basis such as in 29CFR1910.119(j)(4)(iii).

VALIDATION **Min. answers = 25** *(if answered)* Min. answers per row = 1 *(if answered)*

ID 320

80. Should a potential revision of 49CFR193 permit any of the following mechanical integrity inspection or test frequencies to be performed on a RAGAGEP basis such as 49CFR193.2605(a) or in 29CFR1910.119(j)(4)(iii) rather than, or in addition to, the current prescriptive frequencies?

PLEASE CHECK ONLY ONE OF THE THREE BOXES FOR EACH LINE ITEM
*

	Yes, but only as optional alternate means of regulatory conformance. Retain current prescriptive frequency requirements as means of regulatory conformance	Yes, to replace to the current prescriptive frequency requirements	No
Duration in Days of Out-of-Service which Requires Inspection and Test of Control System	☐	☐	☐
Frequency in Months to Inspect and Test - Control systems in service, but not normally in operation, such as automatic shutdown devices, and control systems for internal shutoff valves for bottom penetration tanks	☐	☐	☐
Frequency in Months to Inspect and Test - Control systems used seasonally, such as for liquefaction or vaporization	☐	☐	☐
Frequency in Months to Inspect and Test - Control systems intended for fire protection	☐	☐	☐
Frequency in Months to Inspect and Test - Stationary LNG Tank Relief Valves	☐	☐	☐
Frequency in Months to Inspect and Test - Relief Valves in Control Systems other than on Stationary LNG Tanks	☐	☐	☐
Frequency in Months to Inspect and Test - Relief Valves Other than in Control Systems or on Stationary LNG Tanks	☐	☐	☐
Frequency in Months to Inspect and Test - Control systems that are normally in operation, such as required by a base load system	☐	☐	☐
Frequency in Months to Test - Emergency Power Source Operation Functionality	☐	☐	☐
Frequency in Months to Test - Emergency Power Source Operational Capacity	☐	☐	☐
Frequency in Months to Pressure Test - Transfer Hoses	☐	☐	☐
Frequency to Visually Inspect - Transfer Hoses	☐	☐	☐
Frequency to Periodically Test - Marine Loading or Unloading Operations	☐	☐	☐
Frequency in Months to Externally Inspect and Test - LNG Storage Tanks	☐	☐	☐

and Test - LNG Storage Tanks			
Frequency in Days to Monitor Soil Temperature - LNG Storage Tanks	☐	☐	☐
Frequency in Months to Conduct LNG Tank Bottom Temperature Survey	☐	☐	☐
Frequency in Years to Survey Foundation Elevation, or Otherwise Assess Settlement of LNG Storage Tank or Container Foundation	☐	☐	☐
Frequency in Months to Externally Inspect - Foundation or Support System of Each Component other than LNG Storage Container	☐	☐	☐
Frequency in Months to Externally Inspect - Insulation Systems for Impounding Surfaces	☐	☐	☐
Frequency in Months to Test - Buried or Submerged Components Under Cathodic Protection	☐	☐	☐
Frequency in Months to Inspect - Cathodic Protection Rectifier or other Impressed Current Power Source	☐	☐	☐
Frequency in Months to Inspect - Reverse Current Switch, Diode, and Interference Bond Whose Failure Would Jeopardize Component Protection	☐	☐	☐
Frequency in Months to Inspect - Interference Bond Whose Failure Would Not Jeopardize Component Protection	☐	☐	☐
Frequency in Years to Test - Each Component Protected from Atmospheric Corrosion	☐	☐	☐
Frequency in Months to Inspect - Internal Corrosion Control Monitoring Devices	☐	☐	☐

ID 346

81. And address at this level of importance/priority vs. other topics in this survey: *

- 3 High Priority
- 2 Medium Priority
- 1 Low Priority

ID 347

82. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; threshold for requirement to apply; etc.):

Project Matrix Table Reference Nos: MI-1 and MI-4

Page description:
PSM Category: Mechanical Integrity
PSM Subcategory Topic: Definition of Process Equipment to Have Required Mechanical Integrity, and Method to Inspect and Test - Process Equipment (as defined in 29CFR1910.119(j))

Potential Gap in 49CFR193:

Should the definition of "component" in 49CFR§193 be refined and made more succinct such as "process equipment" is clarified by OSHA in §1910.119(j)(i) through §1910.119(j)(vi)?

(j) Mechanical integrity - (1) Application. Paragraphs (j)(2) through (j)(6) of this section apply to the following process equipment:

(i) Pressure vessels and storage tanks;
(ii) Piping systems (including piping components such as valves);
(iii) Relief and vent systems and devices;
(iv) Emergency shutdown systems;
(v) Controls (including monitoring devices and sensors, alarms, and interlocks) and,
(vi) Pumps.

Arising from a comparison of 49CFR193 to:

- OSHA 29CFR1910.119 PSM

ID 439

83. Should this potential gap be addressed? *

VALIDATION Max character count = 500

ID 440

84. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

Project Matrix Table Reference Nos: MI-8

Page description:
PSM Category: Mechanical Integrity
PSM Subcategory Topic: Frequency in Months to Inspect and Test - Control systems used seasonally, such as for liquefaction or vaporization

Potential Gap in 49CFR193:

> Should a potential future revision in 49CFR§193.2619(c) be considered to enhance understanding that this requirement applies only to peak-shaving or other non-base-load facility operations, such as in this potential revision: Control systems used seasonally, such as for liquefaction or vaporization when only used on seasonal basis, must be inspected and tested before use each season?

Arising from a comparison of 49CFR193 to:

- OSHA 29CFR1910.119 PSM

ID 472

85. Should this potential gap be addressed? *

VALIDATION Max character count = 500
ID 443

86. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

PSM Category: Any PSM Subcategory Topic: Any

Page description:
Project Matrix Table Reference Nos: Not Applicable

VALIDATION Max character count = 500

ID 444

87. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

Do you want to review?

Page description:
Thank you for entering your responses. if you would like to review any of your responses, please press "Back".

ID 470

If you're ready to submit all of your responses and complete the survey, then please press "Next". You will not be able to return to your responses after doing so.

Thank You!

ID 1

Thank you for taking this survey. Your response is very important.

Appendix D: Industry Survey Response

The survey responses are provided below.

Response Counts

All

Completion Rate:	**100%**	
	Complete	9

Totals: 9

Small Scale

Completion Rate:	**100%**	
	Complete	5

Totals: 5

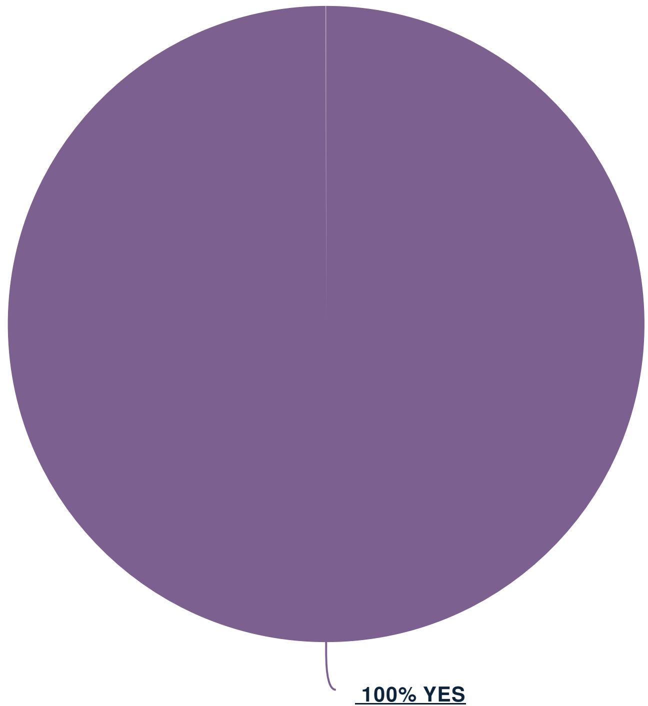
Terminals

Completion Rate:	**100%**	
	Complete	4

Totals: 4

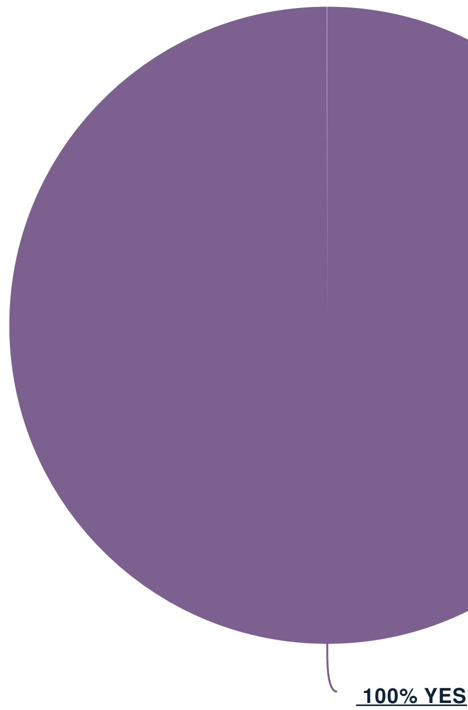
2. Should this potential gap be addressed?

All



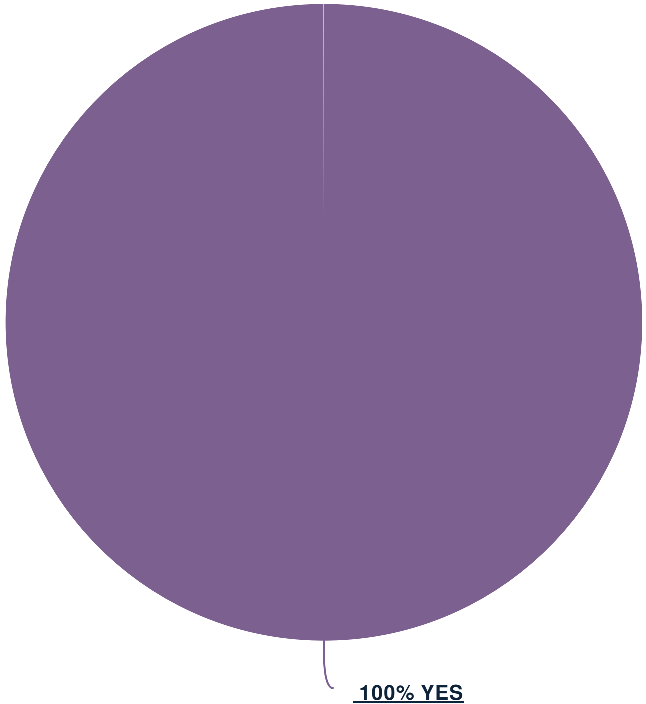
Response	Total Responses	Percent
YES — In general replace prescriptive based requirements with RAGAGEP based regulatory language. — 2 Medium Priority	3	33.3%
YES — In general replace prescriptive based requirements with RAGAGEP based regulatory language. — 3 High Priority	3	33.3%
YES — But only if the current primarily prescriptive based requirements remain and additional RAGAGEP based regulatory language provides an optional alternate means of conformance — 2 Medium Priority	2	22.2%
YES — But only if the current primarily prescriptive based requirements remain and additional RAGAGEP based regulatory language provides an optional alternate means of conformance — 3 High Priority	1	11.1%

Small Scale



Response	Total Responses	Percent
YES — In general replace prescriptive based requirements with RAGAGEP based regulatory language. — 2 Medium Priority	3	60.0%
YES — But only if the current primarily prescriptive based requirements remain and additional RAGAGEP based regulatory language provides an optional alternate means of conformance — 2 Medium Priority	2	40.0%

Terminals



Response	Total Responses	Percent
YES — In general replace prescriptive based requirements with RAGAGEP based regulatory language. — 3 High Priority	3	75.0%
YES — But only if the current primarily prescriptive based requirements remain and additional RAGAGEP based regulatory language provides an optional alternate means of conformance — 3 High Priority	1	25.0%

3. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; threshold for requirement to apply; etc.):

All

ResponseID	Response
23	Risk Based Inspection (RBI) methodology, per API 580 to be adopted in place of specified minimum frequencies inspection requirements. If RBI is performed on all vessels and hydrocarbon piping it can show that, as built, much of facility could be operated safely for extended years without need for vessel entry.
24	When referring to equipment other than relief valves, inspect, test and maintain can be referenced to manufacturer's recommendations or acceptable RAGAGEP
26	In some cases a facility may find it easier to comply with the prescriptive requirements such as testing frequencies then use an alternative means which could have unintended consequences/costs that could set you up for more risk with a regulator and their interpretation of your procedure and frequencey.
29	RAGAGEP is preferred method to keep processes and regulations up to date.
30	This is a difficult question because it is assuming that all companies will be prudent in their evaluations. Our organization does not support completely removing the prescriptive requirements, but giving an option to the Operator of documenting the reasoning behind their decision.
31	This should not be viewed as an easing of requirements. Many facilities may not have the inhouse engineering expertise to do the type of risk based inspection, testing and maintenance that RAGAGEP would require.

Small Scale

ResponseID	Response
24	When referring to equipment other than relief valves, inspect, test and maintain can be referenced to manufacturer's recommendations or acceptable RAGAGEP
29	RAGAGEP is preferred method to keep processes and regulations up to date.
30	This is a difficult question because it is assuming that all companies will be prudent in their evaluations. Our organization does not support completely removing the prescriptive requirements, but giving an option to the Operator of documenting the reasoning behind their decision.

Terminals

ResponseID	Response
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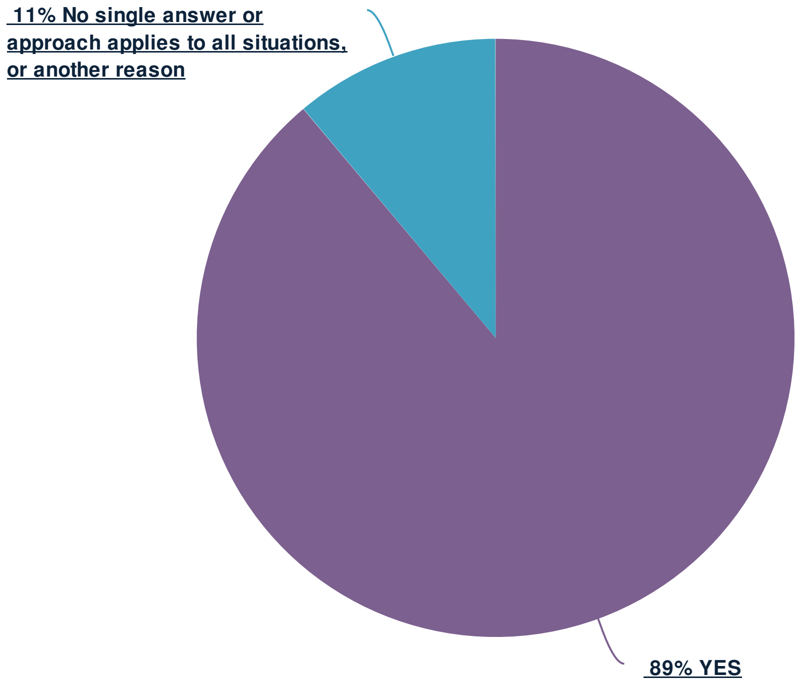
26	In some cases a facility may find it easier to comply with the prescriptive requirements such as testing frequencies then use an alternative means which could have unintended consequences/costs that could set you up for more risk with a regulator and their interpretation of your procedure and frequencey.
31	This should not be viewed as an easing of requirements. Many facilities may not have the inhouse engineering expertise to do the type of risk based inspection, testing and maintenance that RAGAGEP would require.

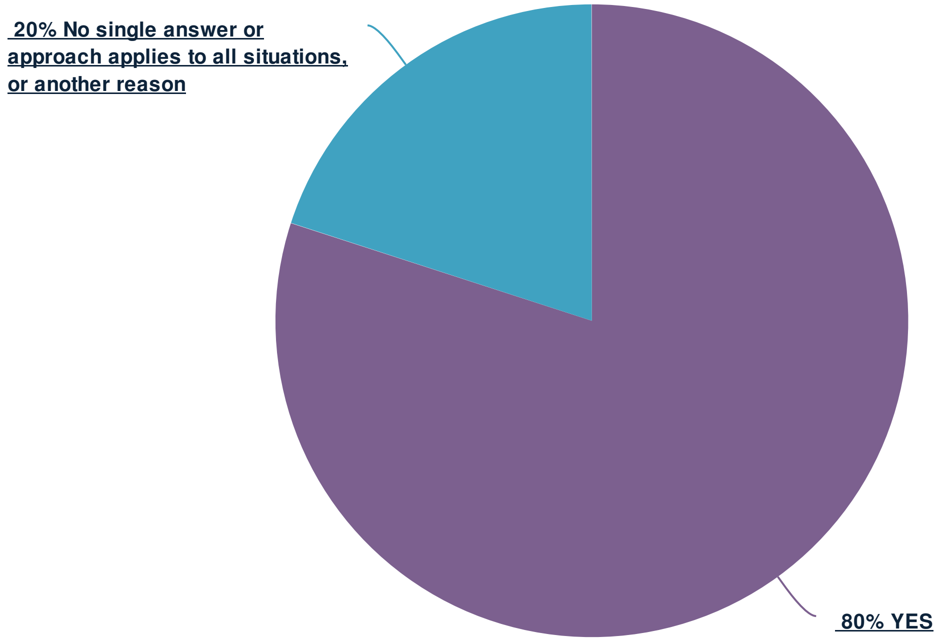
4. Should this potential gap be addressed?

All



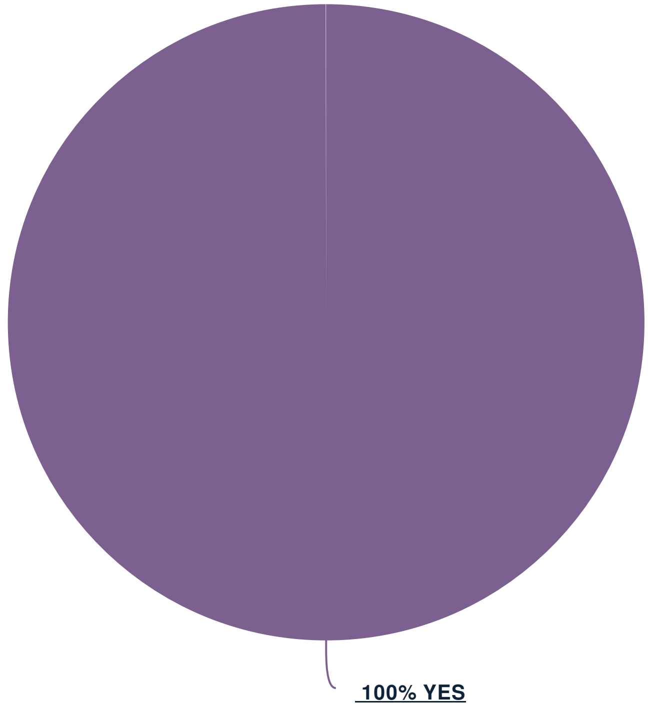
Response	Total Responses	Percent
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	4	44.4%
YES — Voluntary practice by Operator	3	33.3%
No single answer or approach applies to all situations, or another reason — NO	1	11.1%
YES — Potential revision to 49CFR193 made at #3 High Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	11.1%

Small Scale



Response	Total Responses	Percent
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	3	60.0%
No single answer or approach applies to all situations, or another reason — NO	1	20.0%
YES — Voluntary practice by Operator	1	20.0%

Terminals



Response	Total Responses	Percent
YES — Voluntary practice by Operator	2	50.0%
YES — Potential revision to 49CFR193 made at #3 High Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	25.0%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	1	25.0%

5. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

All

ResponseID	Response
23	Operations and Maintenance personnel to be integral to all procedure reviews, and to have access to all non-confidential documentation. Procedure review intervals to be based on equipment criticality.
28	The phrasing related to 'employees' is too broad, it might suggest that all employees must be consulted for each change/review. Rather it should refer to relevant or selected employee(s).
29	We would prefer that NFPA 59A be a default reference for 49CFR193
30	While consulting operator's employees in the development and review of procedures and manuals would be a best practice, it would not be prudent to require in all situations. Any operator who operates a facility safely and efficiently would require the input from the staff.
31	Frontline employees should be the Operators resource most familiar with their asset.

Small Scale

ResponseID	Response
29	We would prefer that NFPA 59A be a default reference for 49CFR193
30	While consulting operator's employees in the development and review of procedures and manuals would be a best practice, it would not be prudent to require in all situations. Any operator who operates a facility safely and efficiently would require the input from the staff.

Terminals

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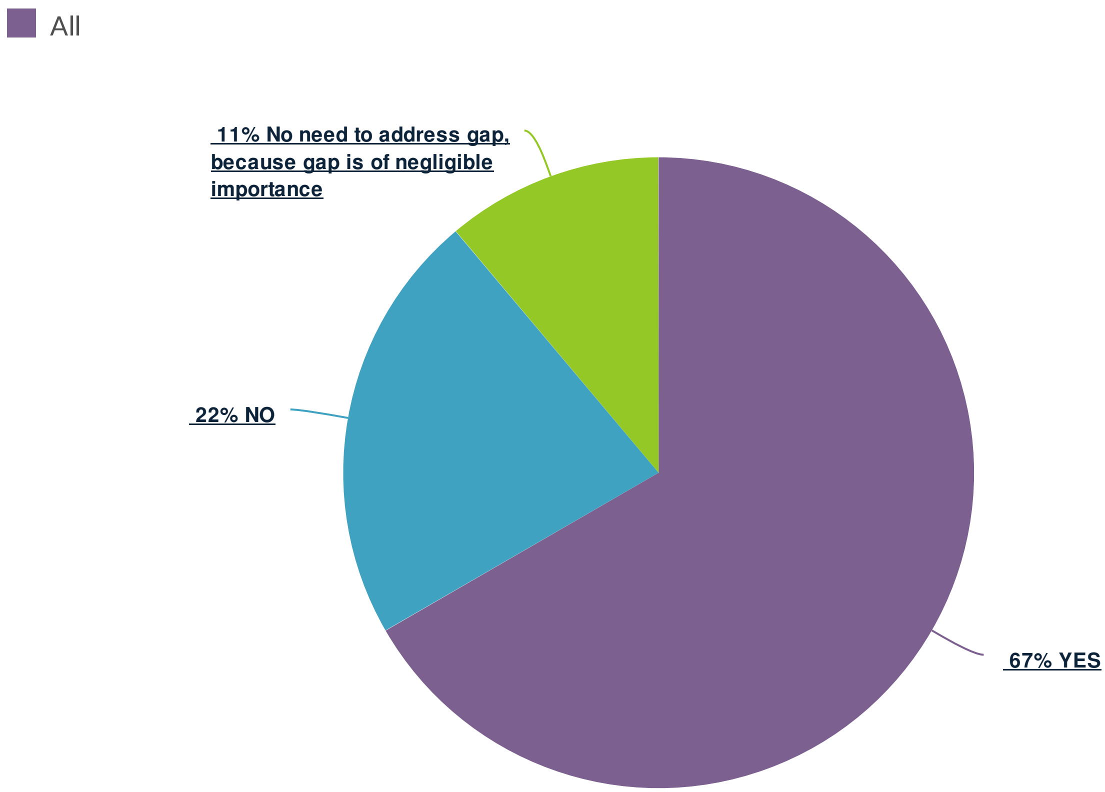
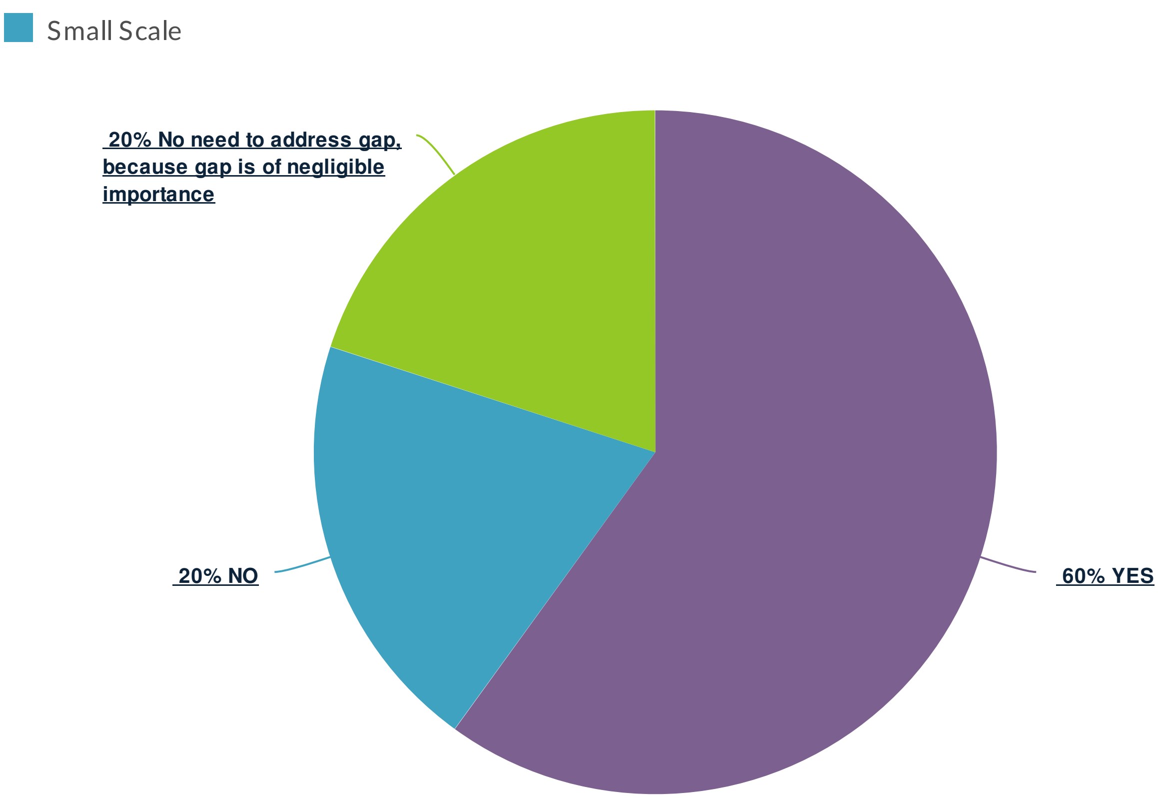
28	The phrasing related to 'employees' is too broad, it might suggest that all employees must be consulted for each change/review. Rather it should refer to relevant or selected employee(s).
31	Frontline employees should be the Operators resource most familiar with their asset.

6. Should this potential gap be addressed?

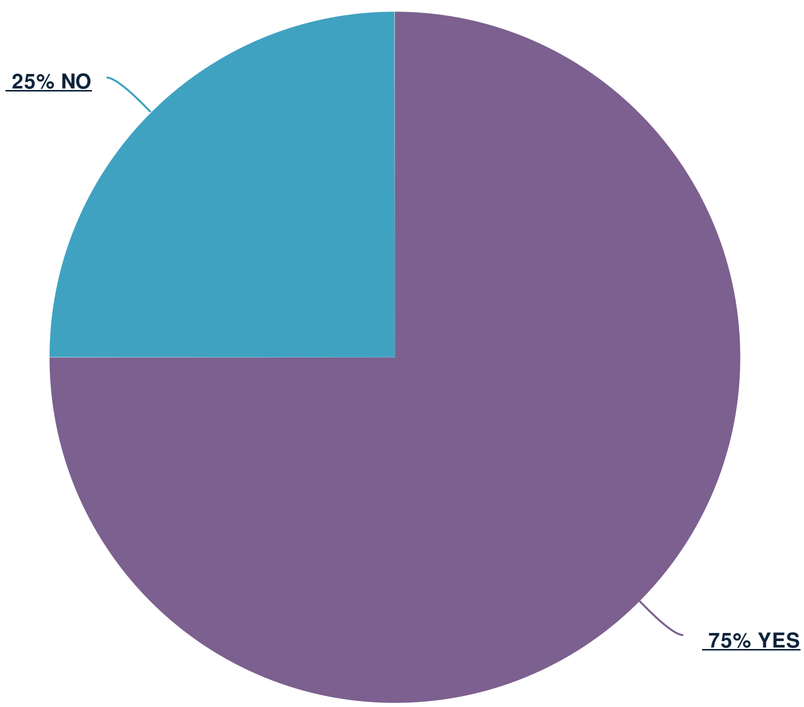


Response	Total Responses	Percent
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	2	22.2%
YES — Voluntary practice by Operator	2	22.2%
NO — No need to address gap, because gap is of negligible importance	1	11.1%
NO — No single answer or approach applies to all situations, or another reason	1	11.1%
No need to address gap, because gap is of negligible importance — NO	1	11.1%
YES — Potential revision to 49CFR193 made at #1 Low Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	11.1%
YES — Potential revision to 49CFR193 made at #2 Medium Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	11.1%



Response	Total Responses	Percent
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	2	40.0%
NO — No need to address gap, because gap is of negligible importance	1	20.0%
No need to address gap, because gap is of negligible importance — NO	1	20.0%
YES — Potential revision to 49CFR193 made at #1 Low Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	20.0%

Terminals



Response	Total Responses	Percent
YES — Voluntary practice by Operator	2	50.0%
NO — No single answer or approach applies to all situations, or another reason	1	25.0%
YES — Potential revision to 49CFR193 made at #2 Medium Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	25.0%

7. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

All

ResponseID	Response
23	All hydrocarbon processing facilities to have continuous access to a Process Safety Engineer, to facilitate risk assessments and and lead periodic reviews of inherent risk carried by the operator.
26	Safety is at the top of all LNG facilities. Most companies do this on a voluntary bases. I would suggest in its place that P&IDS and Hazard drawings for each plant be updated and reviewed in the same manor 49CFR193 requires of procedures
29	We would prefer that 49CFR193 automatically include all future versions of NFPA 59A so that there is an ongoing improvement in the regulations
30	The LNG industry, as an entirety, has an impeccable safety record. Current DOT and OSHA regulations require training, maintenance, and reporting that would perform most of the actions stated in this question.
31	There must be a clear chain of command for addressing PSM as well as indicators to measure performance and a formal review of said performance.

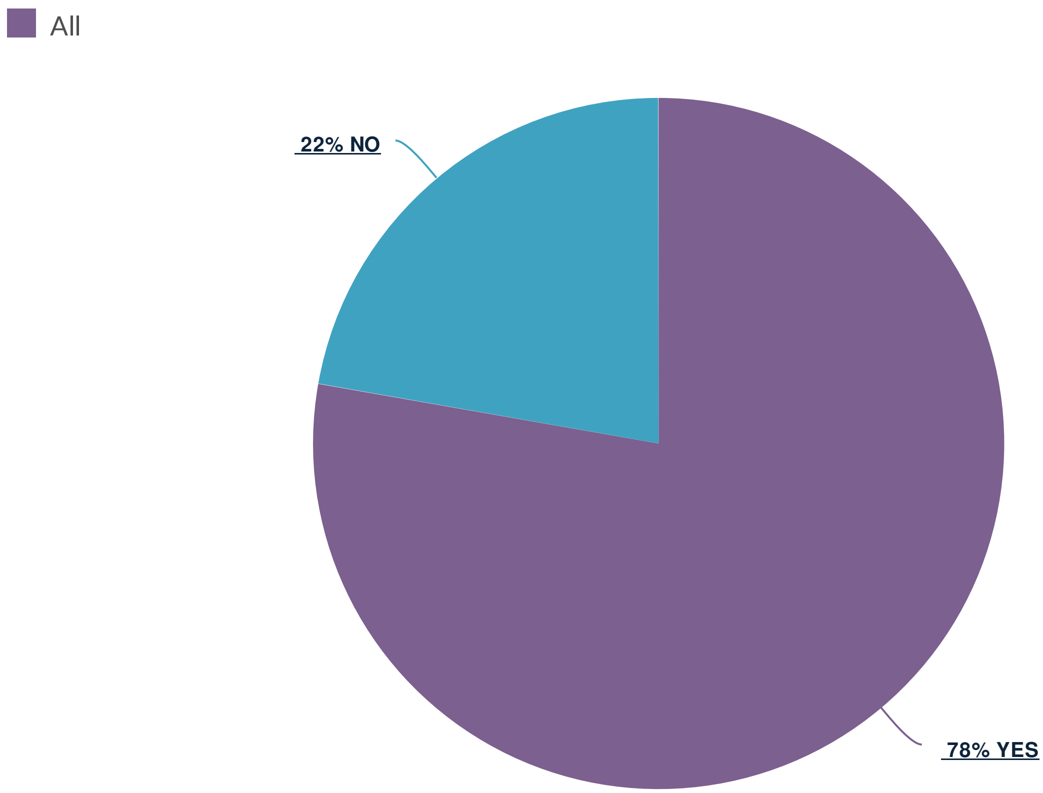
Small Scale

ResponseID	Response
29	We would prefer that 49CFR193 automatically include all future versions of NFPA 59A so that there is an ongoing improvement in the regulations
30	The LNG industry, as an entirety, has an impeccable safety record. Current DOT and OSHA regulations require training, maintenance, and reporting that would perform most of the actions stated in this question.

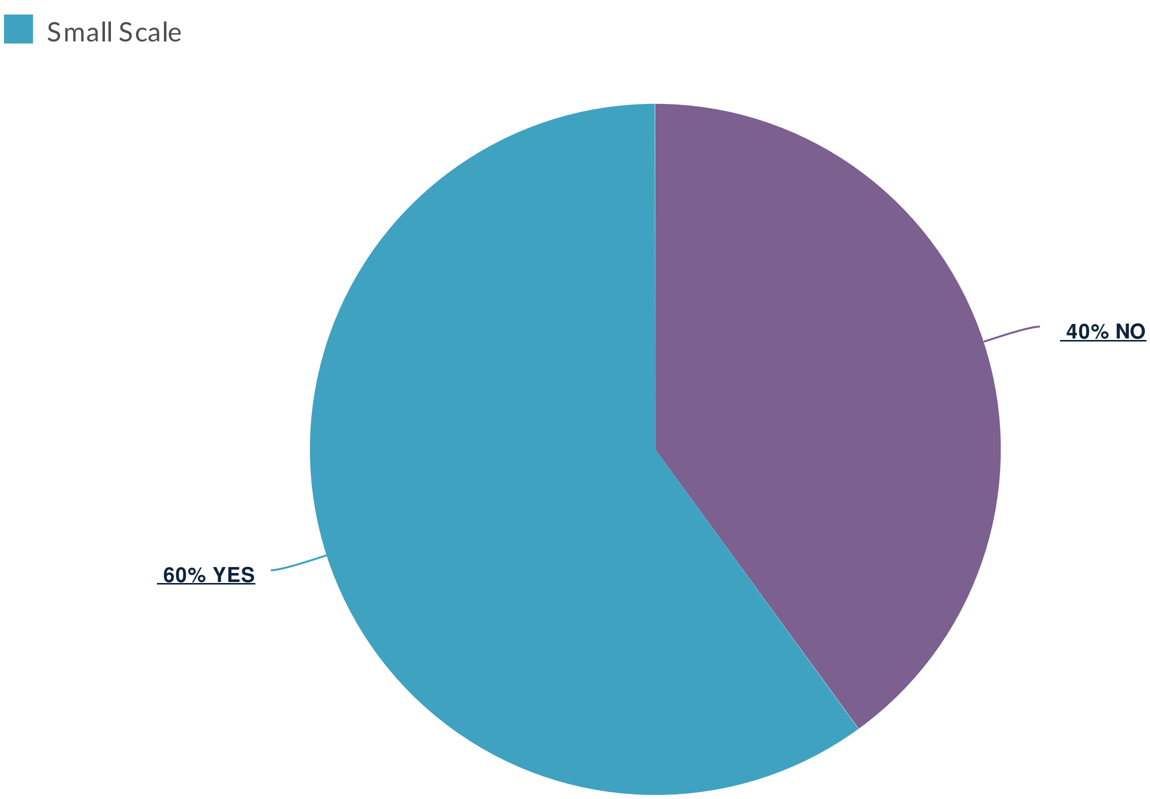
Terminals

ResponseID	Response
23	All hydrocarbon processing facilities to have continuous access to a Process Safety Engineer, to facilitate risk assessments and and lead periodic reviews of inherent risk carried by the operator.
26	Safety is at the top of all LNG facilities. Most companies do this on a voluntary bases. I would suggest in its place that P&IDS and Hazard drawings for each plant be updated and reviewed in the same manor 49CFR193 requires of procedures
31	There must be a clear chain of command for addressing PSM as well as indicators to measure performance and a formal review of said performance.

8. Should this potential gap be addressed?

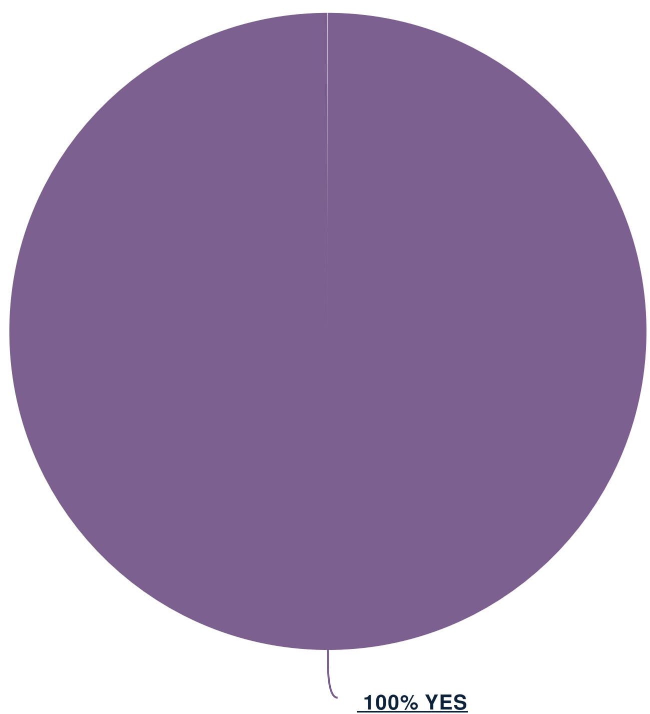


Response	Total Responses	Percent
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	3	33.3%
NO — No need to address gap, because gap is incorrectly stated; in reality, there is no gap	1	11.1%
NO — No single answer or approach applies to all situations, or another reason	1	11.1%
YES — Potential revision to 49CFR193 made at #1 Low Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	11.1%
YES — Potential revision to 49CFR193 made at #2 Medium Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	11.1%
YES — Potential revision to 49CFR193 made at #3 High Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	11.1%
YES — Voluntary practice by Operator	1	11.1%



Response	Total Responses	Percent
NO — No need to address gap, because gap is incorrectly stated; in reality, there is no gap	1	20.0%
NO — No single answer or approach applies to all situations, or another reason	1	20.0%
YES — Potential revision to 49CFR193 made at #1 Low Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	20.0%
YES — Potential revision to 49CFR193 made at #2 Medium Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	20.0%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	1	20.0%

Terminals



Response	Total Responses	Percent
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	2	50.0%
YES — Potential revision to 49CFR193 made at #3 High Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	25.0%
YES — Voluntary practice by Operator	1	25.0%

9. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

All

ResponseID	Response
30	NFPA 59A 2001 section 10.15.2 currently addresses most of these requirements. Those not covered in this section are necessary for the engineering and design of any process. Current regulations require competent persons in the design and fabrication of facilities.
31	Process Safety Information is one of the cornerstones of PSM. If you don't understand the hazards how do you mange risk to a tolerable level.

Small Scale

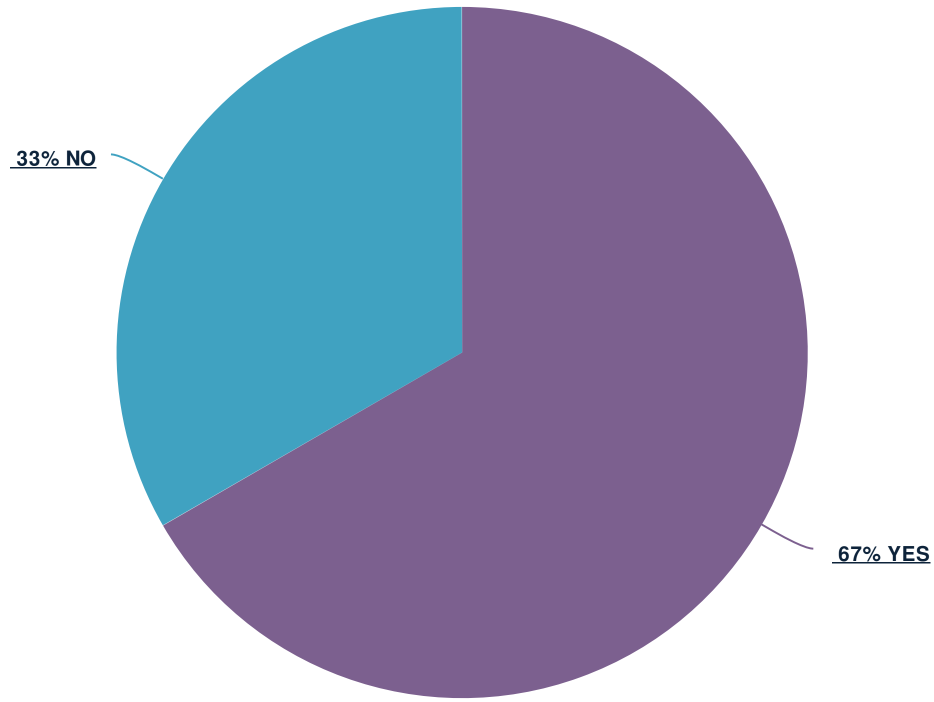
ResponseID	Response
30	NFPA 59A 2001 section 10.15.2 currently addresses most of these requirements. Those not covered in this section are necessary for the engineering and design of any process. Current regulations require competent persons in the design and fabrication of facilities.

Terminals

ResponseID	Response
31	Process Safety Information is one of the cornerstones of PSM. If you don't understand the hazards how do you mange risk to a tolerable level.

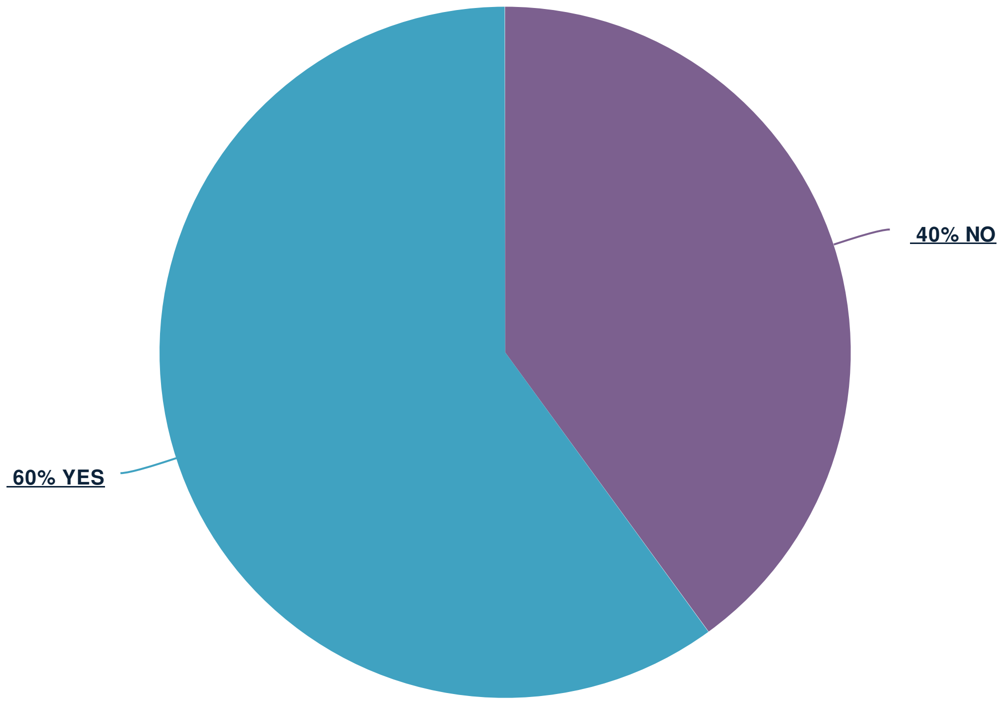
10. Should this potential gap be addressed?

All



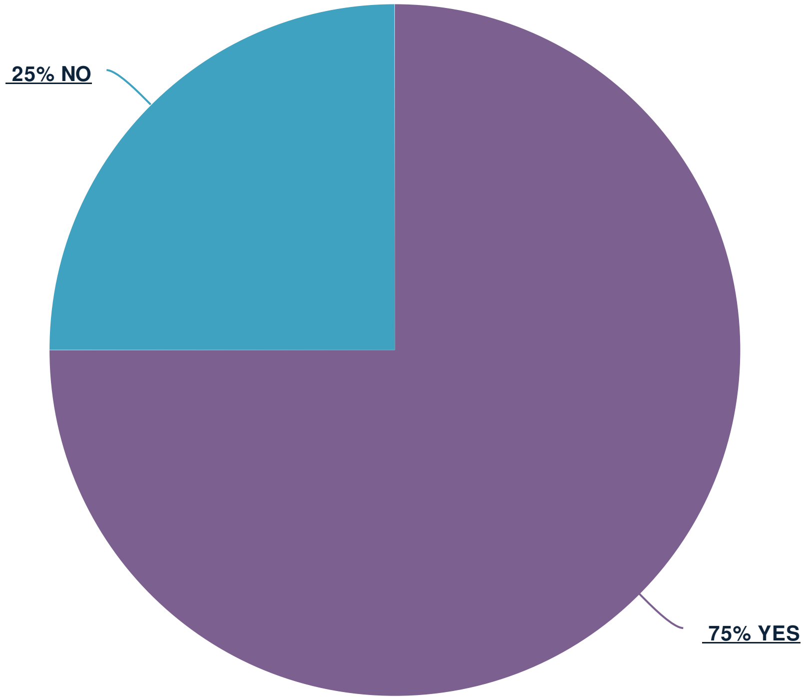
Response	Total Responses	Percent
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	4	44.4%
NO — No single answer or approach applies to all situations, or another reason	3	33.3%
YES — Potential revision to 49CFR193 made at #3 High Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	11.1%
YES — Voluntary practice by Operator	1	11.1%

Small Scale



Response	Total Responses	Percent
NO — No single answer or approach applies to all situations, or another reason	2	40.0%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	2	40.0%
YES — Voluntary practice by Operator	1	20.0%

Terminals



Response	Total Responses	Percent
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	2	50.0%
NO — No single answer or approach applies to all situations, or another reason	1	25.0%
YES — Potential revision to 49CFR193 made at #3 High Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	25.0%

11. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

All

ResponseID	Response
23	The wording says: "(2) The operator shall use one or more..." It should be compulsory to perform a HazOp.
28	follow OSHA 29CFR1910.119(e)(2)&(3)
29	We currently use a comprehensive PHA process for all facilities which is integral to our operational success and the safety of our operations. Many new operators in small scale LNG ignore or short change this valuable tool. Most hazards can be mitigated with a thorough PHA process run by experienced personnel.
30	According to a previous LOI filed from OSHA, LNG is excluded from the enforcement of PSM. This process of evaluation is a best practice for any organization, but should be voluntary for operator participation and reoccurrence of evaluation.
31	If PSI is the foundation of PSM, then PHA is the pillars that keep the roof from falling on your head.

Small Scale

ResponseID	Response
29	We currently use a comprehensive PHA process for all facilities which is integral to our operational success and the safety of our operations. Many new operators in small scale LNG ignore or short change this valuable tool. Most hazards can be mitigated with a thorough PHA process run by experienced personnel.
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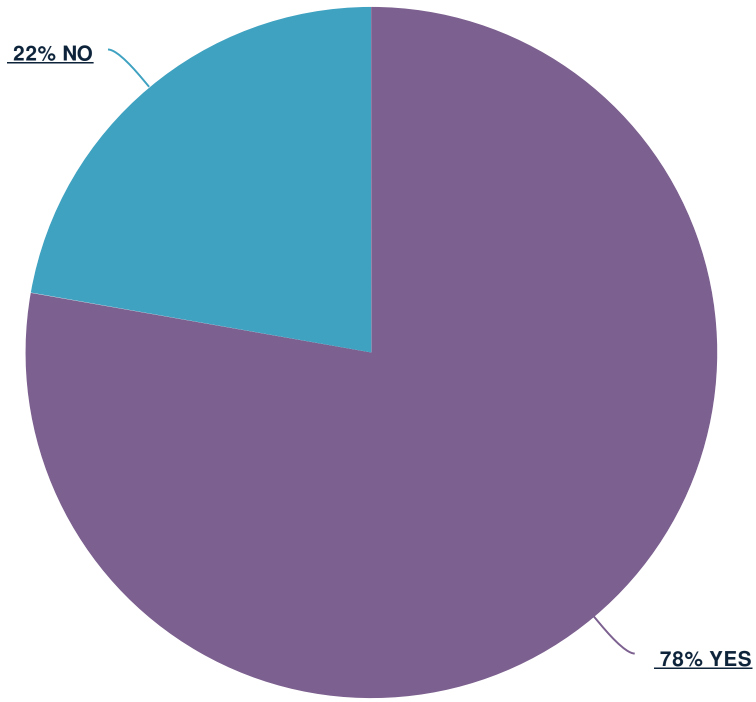
Terminals

ResponseID	Response
23	The wording says: "(2) The operator shall use one or more..." It should be compulsory to perform a HazOp.
28	follow OSHA 29CFR1910.119(e)(2)&(3)
31	If PSI is the foundation of PSM, then PHA is the pillars that keep the roof from falling on your head.

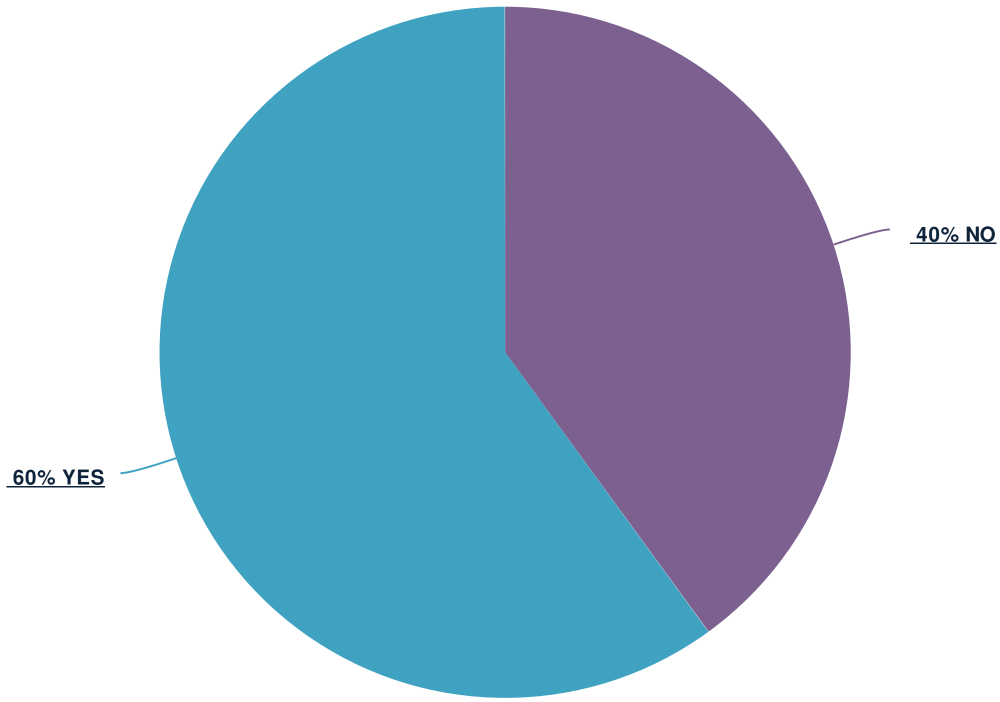
12. Should this potential gap be addressed?

All



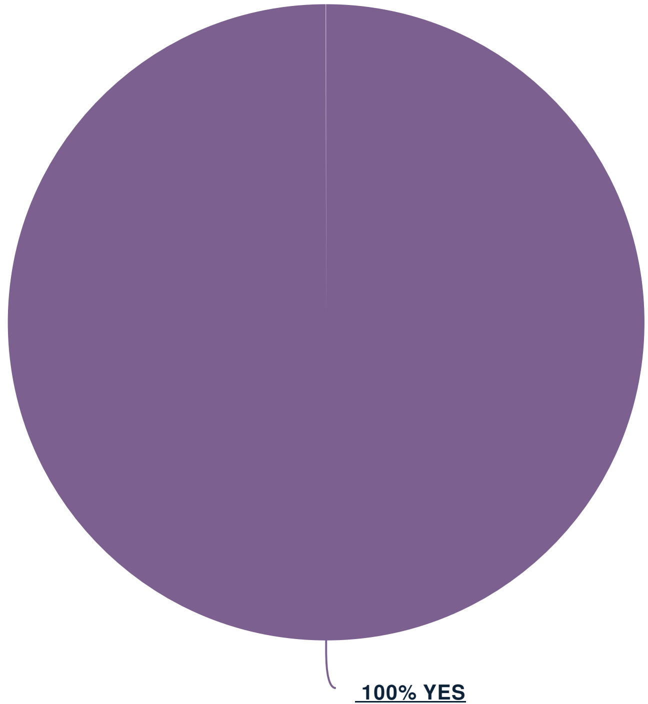
Response	Total Responses	Percent
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	3	33.3%
NO — No single answer or approach applies to all situations, or another reason	2	22.2%
YES — Potential revision to 49CFR193 made at #3 High Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	2	22.2%
YES — Potential revision to 49CFR193 made at #1 Low Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	11.1%
YES — Voluntary practice by Operator	1	11.1%

Small Scale



Response	Total Responses	Percent
NO — No single answer or approach applies to all situations, or another reason	2	40.0%
YES — Potential revision to 49CFR193 made at #1 Low Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	20.0%
YES — Potential revision to 49CFR193 made at #3 High Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	20.0%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	1	20.0%

Terminals



Response	Total Responses	Percent
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	2	50.0%
YES — Potential revision to 49CFR193 made at #3 High Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	25.0%
YES — Voluntary practice by Operator	1	25.0%

13. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

All

ResponseID	Response
23	In general, the HazOp does discuss similar incidents happening in the industry or other industry to determine the consequence of the event.
24	risks of human error should be addressed in operator's training programs and O&M procedures. high priority
30	Performing a PHA is a best practice, however it should be left to the operator to determine need. The LNG industry, as a whole, has an impeccable safety record.
31	Understanding the likelihood and consequence of system failure is key to determining the level of protection needed to prevent an incident.

Small Scale

ResponseID	Response
24	risks of human error should be addressed in operator's training programs and O&M procedures. high priority
30	Performing a PHA is a best practice, however it should be left to the operator to determine need. The LNG industry, as a whole, has an impeccable safety record.

Terminals

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23	In general, the HazOp does discuss similar incidents happening in the industry or other industry to determine the consequence of the event.
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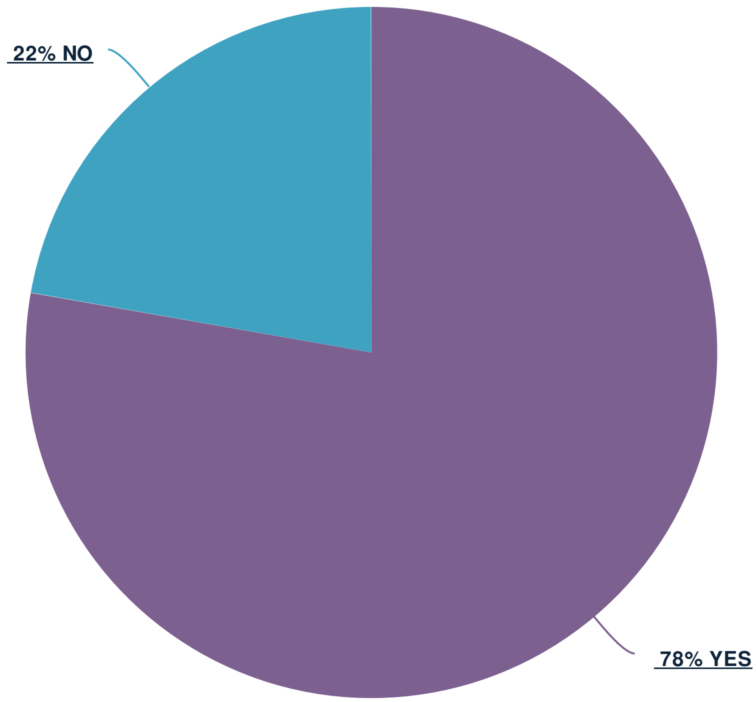
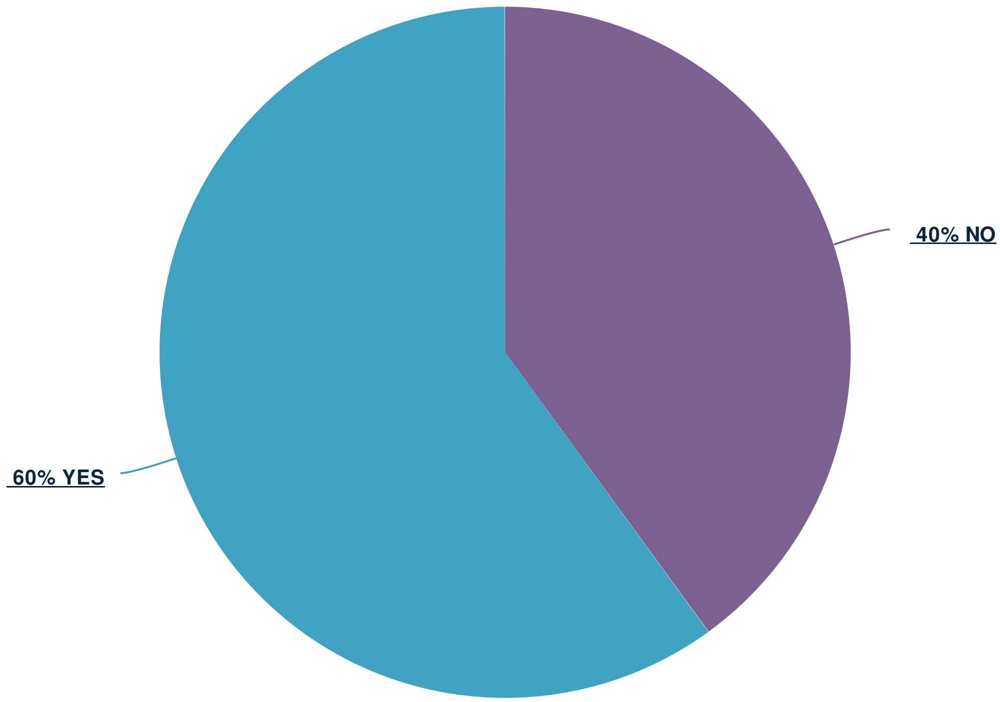
14. Should this potential gap be addressed?

All



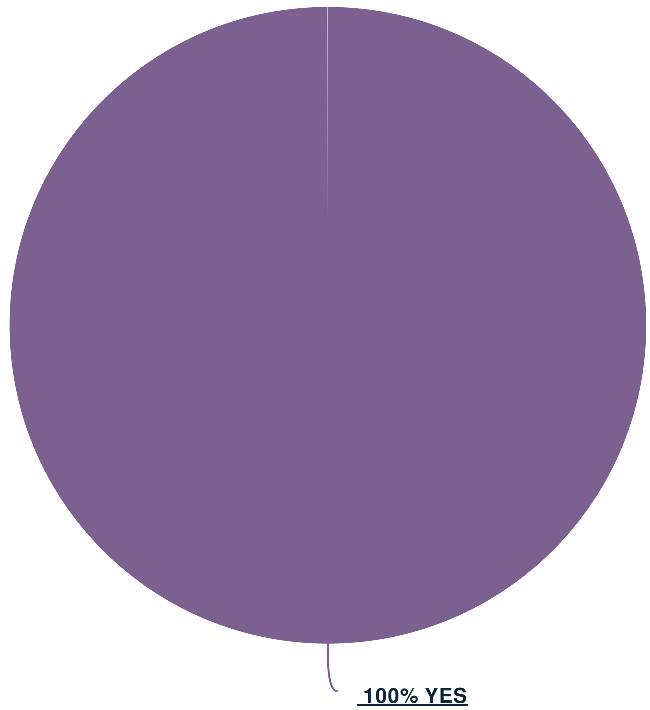
Response	Total Responses	Percent
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	4	44.4%
NO — No single answer or approach applies to all situations, or another reason	2	22.2%
YES — Potential revision to 49CFR193 made at #1 Low Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	11.1%
YES — Potential revision to 49CFR193 made at #2 Medium Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	11.1%
YES — Potential revision to 49CFR193 made at #3 High Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	11.1%

Small Scale



Response	Total Responses	Percent
NO — No single answer or approach applies to all situations, or another reason	2	40.0%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	2	40.0%
YES — Potential revision to 49CFR193 made at #1 Low Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	20.0%

Terminals



Response	Total Responses	Percent
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	2	50.0%
YES — Potential revision to 49CFR193 made at #2 Medium Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	25.0%
YES — Potential revision to 49CFR193 made at #3 High Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	25.0%

15. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

All

ResponseID	Response
26	While I believe PHA's are to be done on a voluntary basis because 49CFR193 and 59A currently address hazards and placement of equipment etc. I do that a qualified team is needed to make a hazard analysis meaningful
29	The PHA cannot be effective without experienced personnel running the process.
30	Performing a PHA is a best practice, however it should be left to the operator to determine need. The LNG industry, as a whole, has an impeccable safety record.
31	Make up of the PHA team is critical to a rigorous study.

Small Scale

ResponseID	Response
29	The PHA cannot be effective without experienced personnel running the process.
30	Performing a PHA is a best practice, however it should be left to the operator to determine need. The LNG industry, as a whole, has an impeccable safety record.

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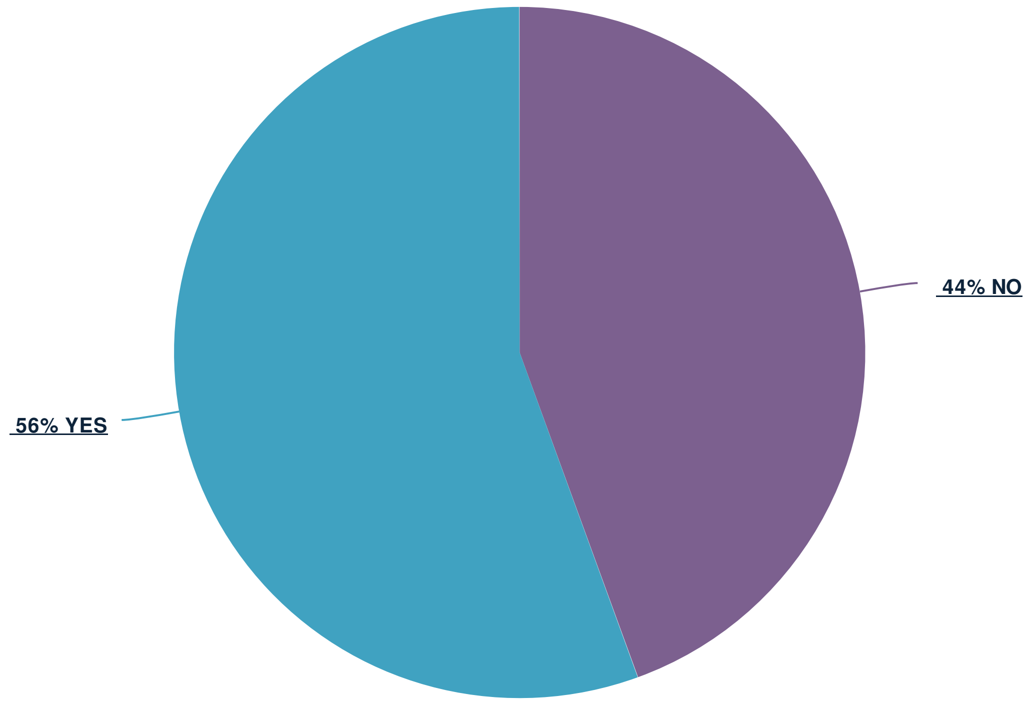
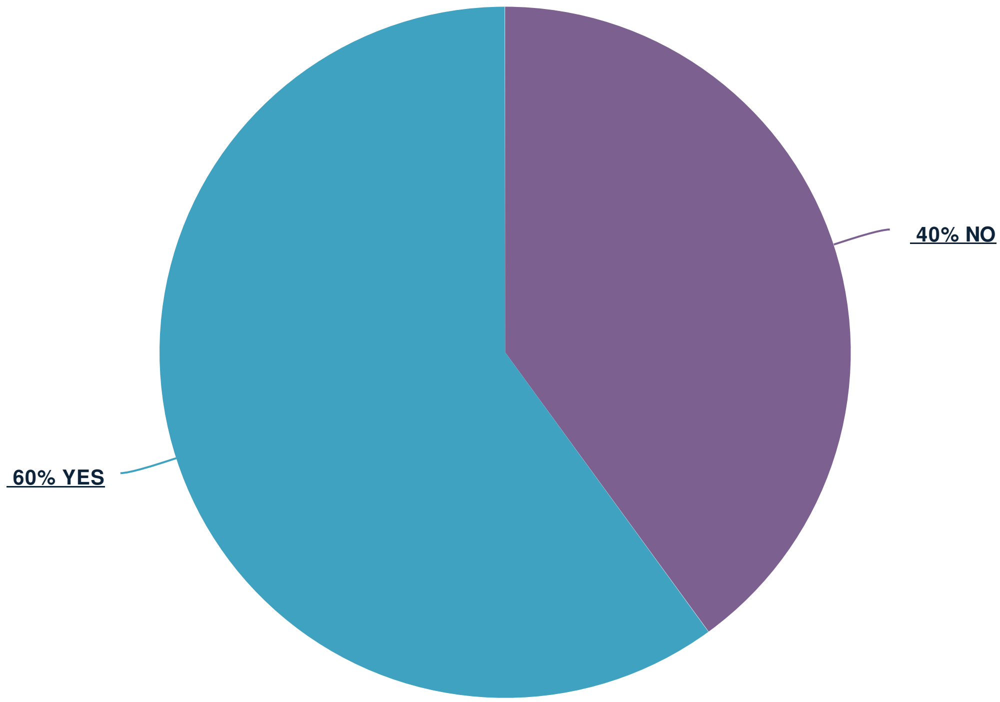
16. Should this potential gap be addressed?

All



Response	Total Responses	Percent
NO — No single answer or approach applies to all situations, or another reason	3	33.3%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	3	33.3%
NO — No need to address gap, because gap is incorrectly stated; in reality, there is no gap	1	11.1%
YES — Potential revision to 49CFR193 made at #2 Medium Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	11.1%
YES — Voluntary practice by Operator	1	11.1%

Small Scale



Response	Total Responses	Percent
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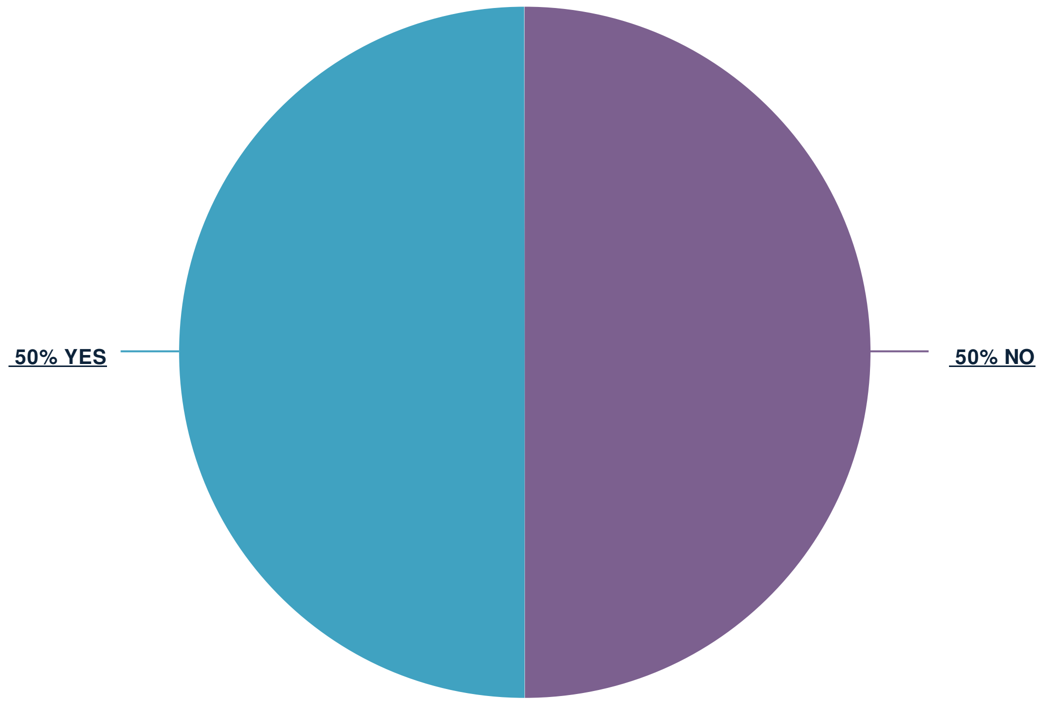
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	2	40.0%
YES — Voluntary practice by Operator	1	20.0%

Terminals



Response	Total Responses	Percent
NO — No need to address gap, because gap is incorrectly stated; in reality, there is no gap	1	25.0%
NO — No single answer or approach applies to all situations, or another reason	1	25.0%
YES — Potential revision to 49CFR193 made at #2 Medium Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	25.0%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	1	25.0%

17. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

All

ResponseID	Response
23	Process Safety Engineering Basics.
26	During the design and construction these would be required to be addressed or you could not place it into service. Also once components are in place if a change needs to be made a review is done and any gap identified 49CFR193 requires you to address it promptly.
28	We would be in favor of making this less prescriptive than the OSHA definition
30	Performing a PHA is a best practice, however it should be left to the operator to determine need. The LNG industry, as a whole, has an impeccable safety record.
31	Follow up and documentation are critical to assuring that identified hazards have been addressed and risks mitigated.

Small Scale

ResponseID	Response
30	Performing a PHA is a best practice, however it should be left to the operator to determine need. The LNG industry, as a whole, has an impeccable safety record.

Terminals

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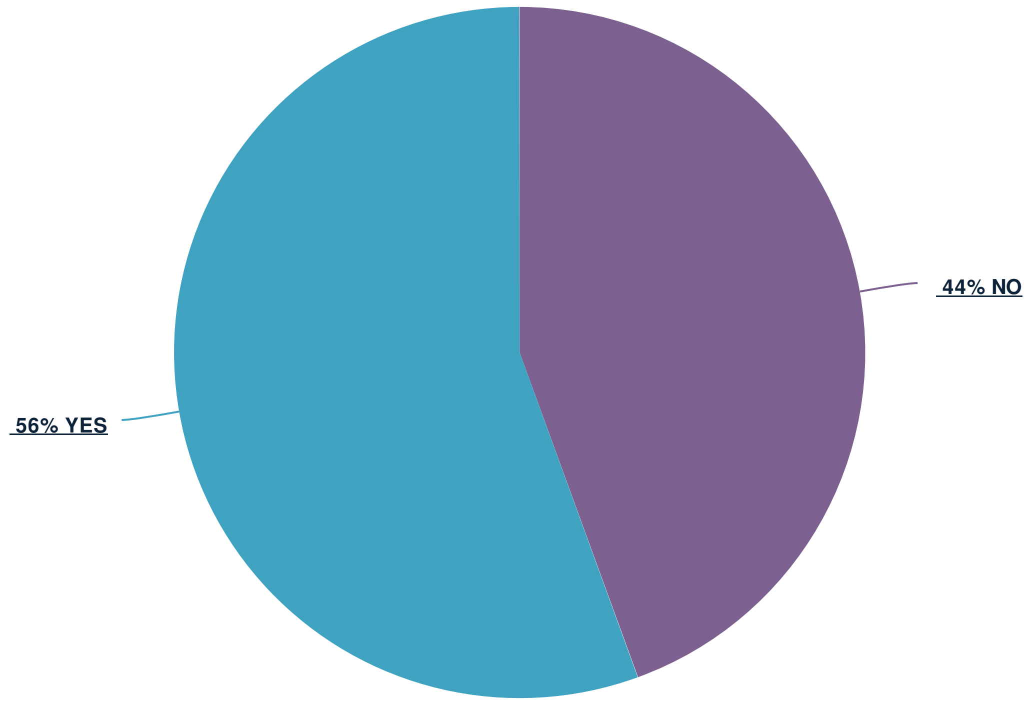
31	Follow up and documentation are critical to assuring that identified hazards have been addressed and risks mitigated.

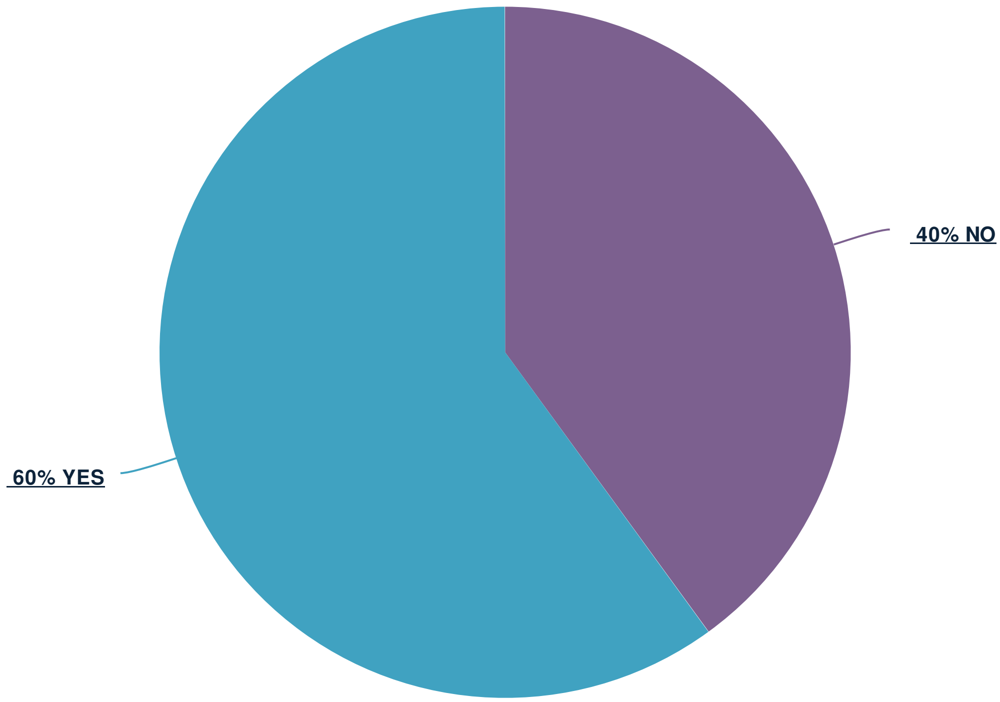
18. Should this potential gap be addressed?

All



Response	Total Responses	Percent
NO — No single answer or approach applies to all situations, or another reason	3	33.3%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	2	22.2%
NO — No need to address gap, because gap is incorrectly stated; in reality, there is no gap	1	11.1%
YES — Potential revision to 49CFR193 made at #1 Low Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	11.1%
YES — Potential revision to 49CFR193 made at #2 Medium Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	11.1%
YES — Voluntary practice by Operator	1	11.1%

Small Scale



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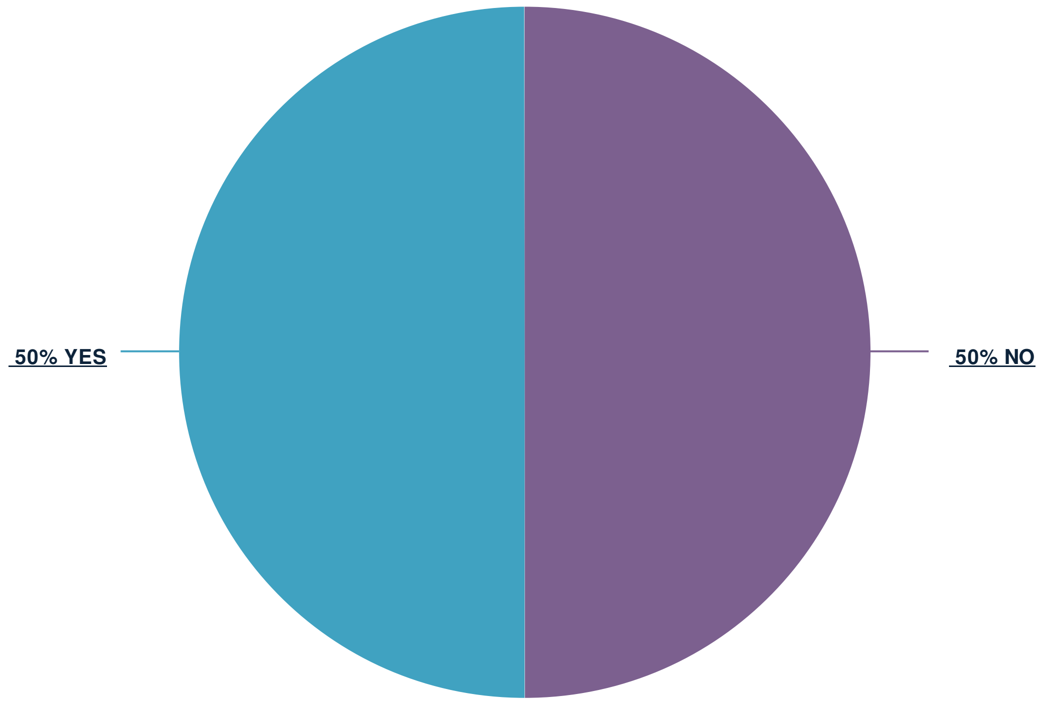
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	2	40.0%
YES — Potential revision to 49CFR193 made at #1 Low Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	20.0%

Terminals



Response	Total Responses	Percent
NO — No need to address gap, because gap is incorrectly stated; in reality, there is no gap	1	25.0%
NO — No single answer or approach applies to all situations, or another reason	1	25.0%
YES — Potential revision to 49CFR193 made at #2 Medium Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	25.0%
YES — Voluntary practice by Operator	1	25.0%

19. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

All

ResponseID	Response
23	Process Safety Engineering Basics.
26	Once an operator performs a PHA they must address their findings/risks this is done through addressing the risk, mitigating the risk, or providing emergency procedures that address the a known risk that can not be addressed or mitigated.
28	The scope of the PHA needs to dictate the level of external input consideration, the referred code clip may not be relevant to a LNG export facility
30	Performing a PHA is a best practice, however it should be left to the operator to determine need. The LNG industry, as a whole, has an impeccable safety record.
31	A healthy organization learns from incidents both internal and external. Risk mitigations saves lives and money.

Small Scale

ResponseID	Response
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Terminals

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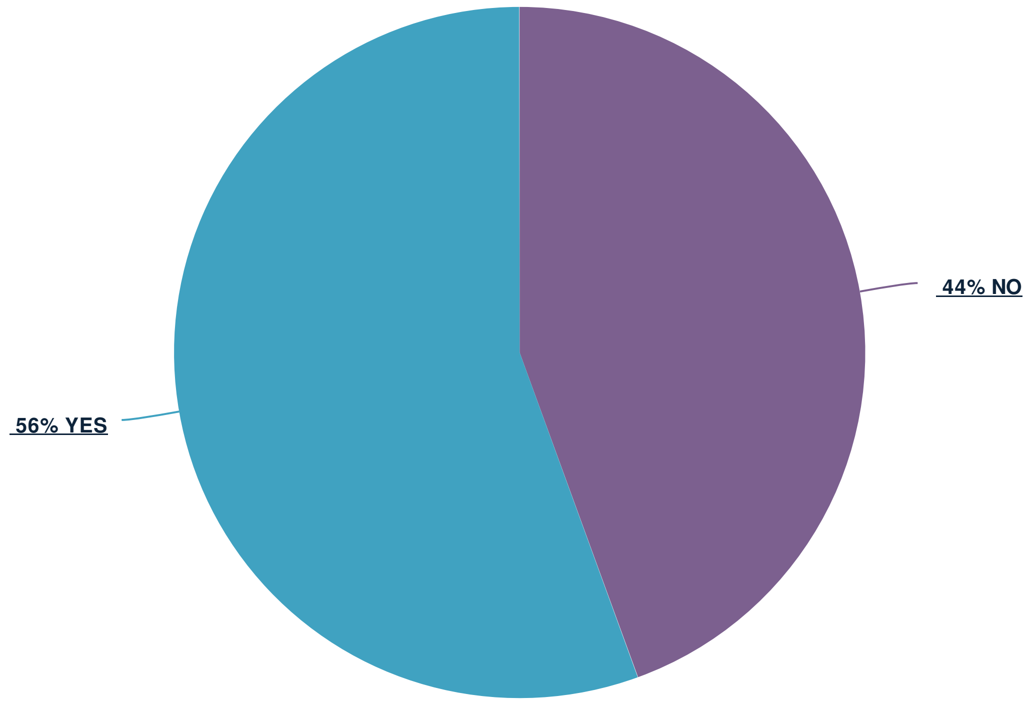
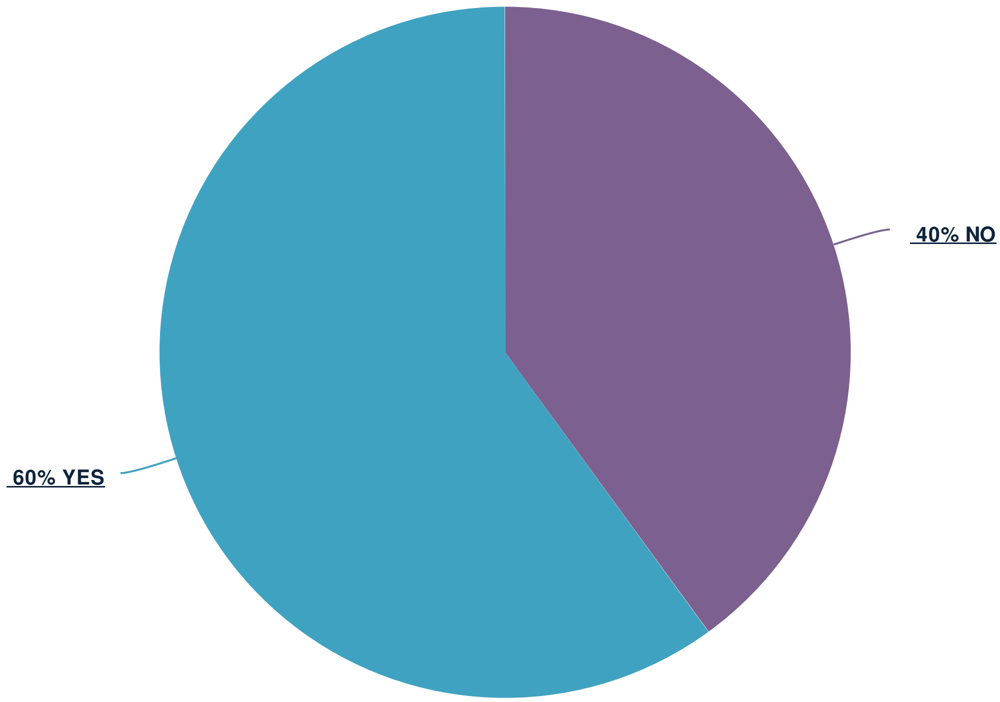
20. Should this potential gap be addressed?

All



Response	Total Responses	Percent
NO — No single answer or approach applies to all situations, or another reason	4	44.4%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	3	33.3%
YES — Potential revision to 49CFR193 made at #1 Low Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	11.1%
YES — Potential revision to 49CFR193 made at #2 Medium Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	11.1%

Small Scale



Response	Total Responses	Percent
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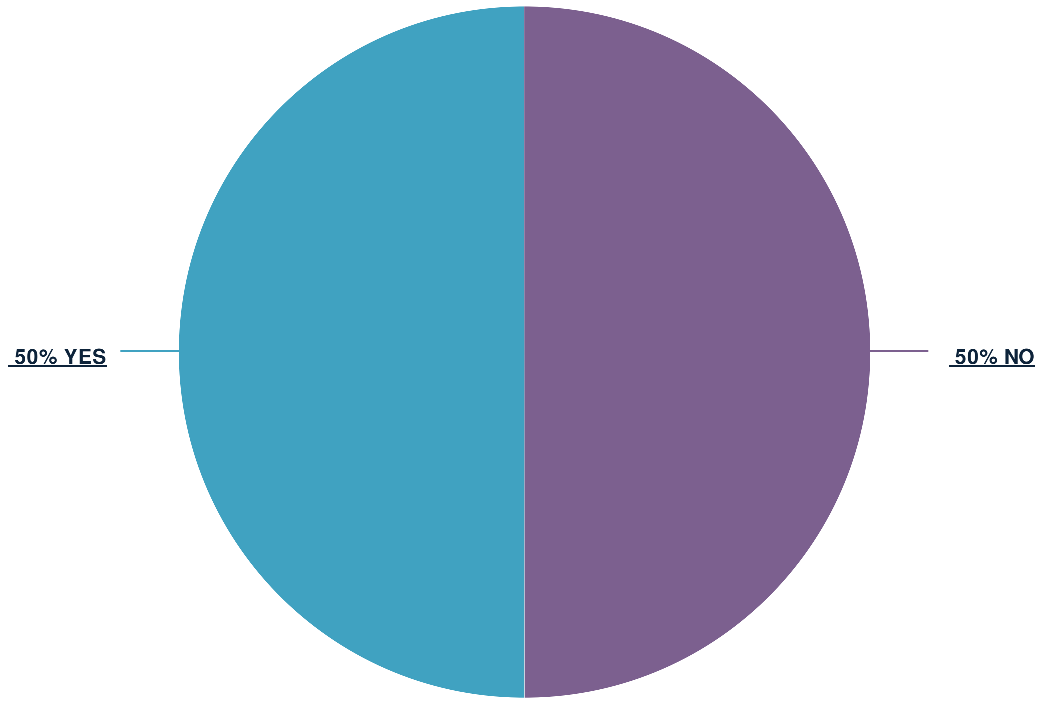
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	2	40.0%
YES — Potential revision to 49CFR193 made at #1 Low Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	20.0%

Terminals



Response	Total Responses	Percent
NO — No single answer or approach applies to all situations, or another reason	2	50.0%
YES — Potential revision to 49CFR193 made at #2 Medium Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	25.0%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	1	25.0%

21. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

All

ResponseID	Response
25	When Major Changes have occurred then Update
26	These are closed systems. Once in place you should not have to re-evaluate a PHA unless you want to re-evaluate due to technology or safety upgrades or if you are making a significant change to a system. Making a mandatory time-frame for re-evaluation will open facilities up to potential issues with regulators and could have open you up to additional requirements being imposed on the facility depending on whether you are a state or federal facility.
30	Performing a PHA is a best practice, however it should be left to the operator to determine need. The LNG industry, as a whole, has an impeccable safety record.
31	The only constant is change. PHAs must be revalidate periodically to make sure risks are still being managed appropriately.

Small Scale

ResponseID	Response
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Terminals

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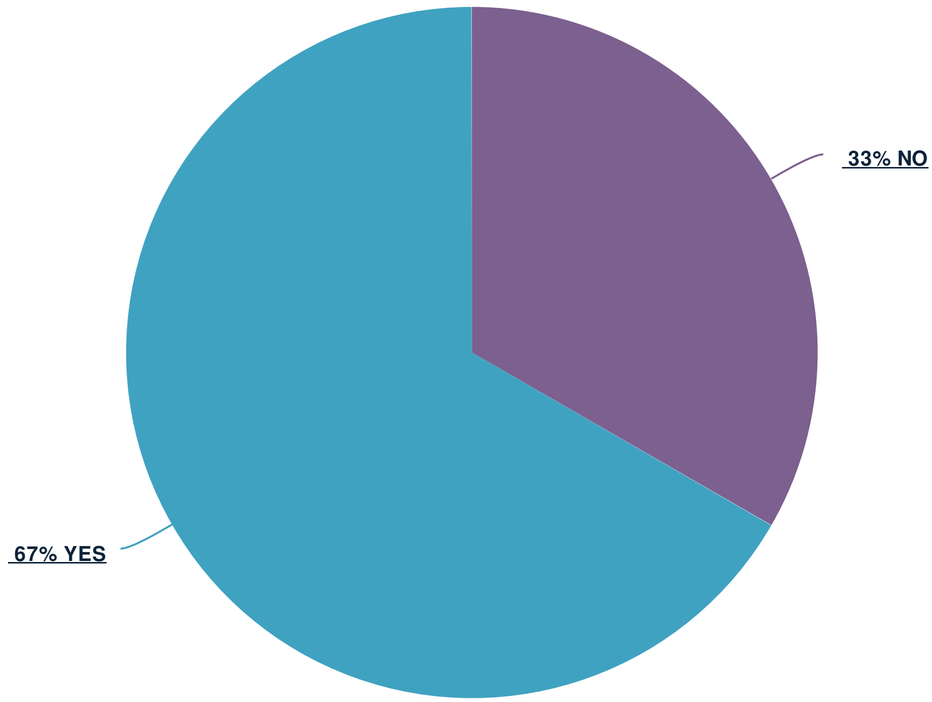
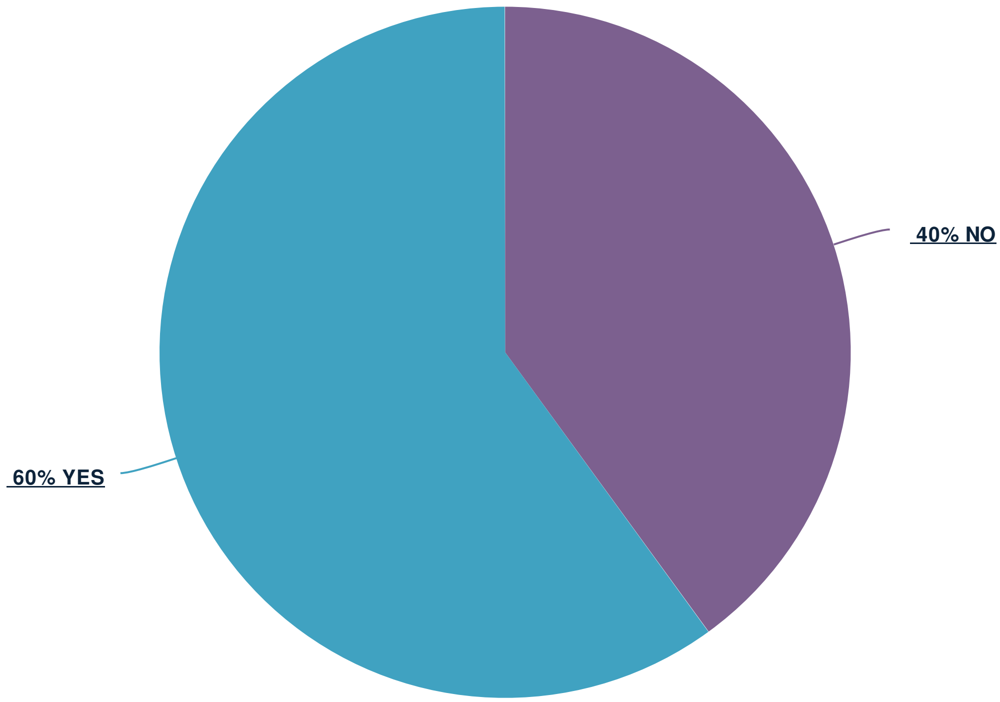
22. Should this potential gap be addressed?

All



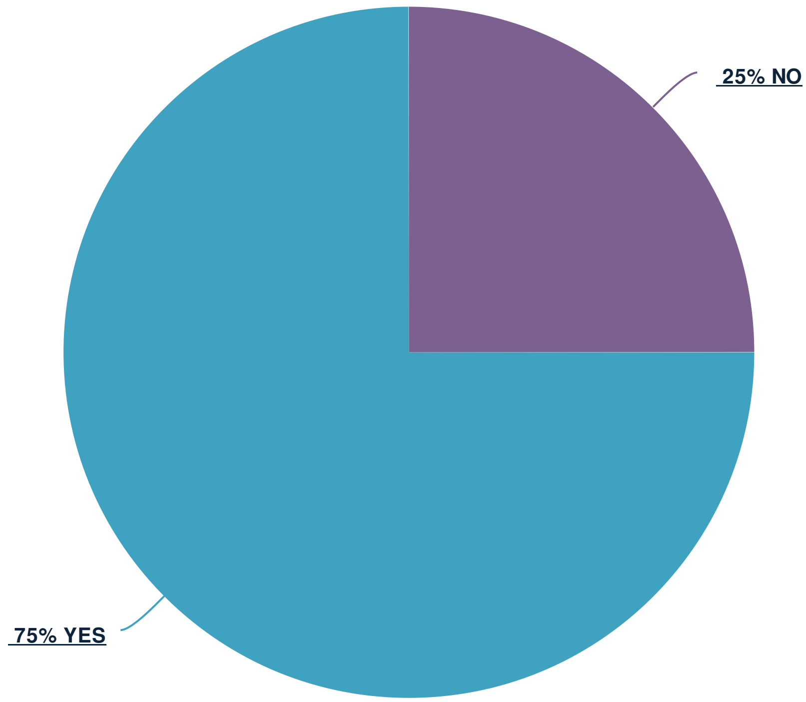
Response	Total Responses	Percent
NO — No single answer or approach applies to all situations, or another reason	3	33.3%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	2	22.2%
YES — Voluntary practice by Operator	2	22.2%
YES — Potential revision to 49CFR193 made at #2 Medium Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	11.1%
YES — Potential revision to 49CFR193 made at #3 High Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	11.1%

Small Scale



Response	Total Responses	Percent
NO — No single answer or approach applies to all situations, or another reason	2	40.0%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	2	40.0%
YES — Voluntary practice by Operator	1	20.0%

Terminals



Response	Total Responses	Percent
NO — No single answer or approach applies to all situations, or another reason	1	25.0%
YES — Potential revision to 49CFR193 made at #2 Medium Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	25.0%
YES — Potential revision to 49CFR193 made at #3 High Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	25.0%
YES — Voluntary practice by Operator	1	25.0%

23. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

All

ResponseID	Response
26	PHA's record retention should be required for the life of the facility. It is very valuable information in the design and construction process that should be treated the same as 49 CFR 193.2119
30	Performing a PHA is a best practice, however it should be left to the operator to determine need. The LNG industry as a whole, has an impeccable safety record.
31	An informed workforce is your best defense against threats, but workforces change. Help them stay informed of their predecessors analysis of hazards.

Small Scale

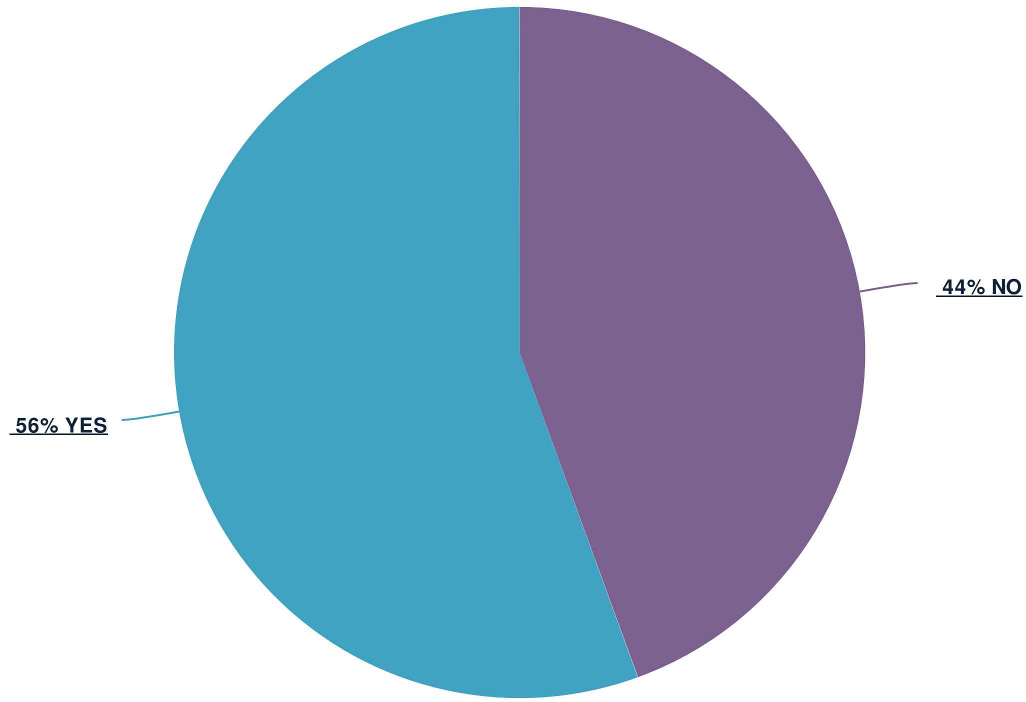
ResponseID	Response
30	Performing a PHA is a best practice, however it should be left to the operator to determine need. The LNG industry as a whole, has an impeccable safety record.

Terminals

ResponseID	Response
26	PHA's record retention should be required for the life of the facility. It is very valuable information in the design and construction process that should be treated the same as 49 CFR 193.2119
31	An informed workforce is your best defense against threats, but workforces change. Help them stay informed of their predecessors analysis of hazards.

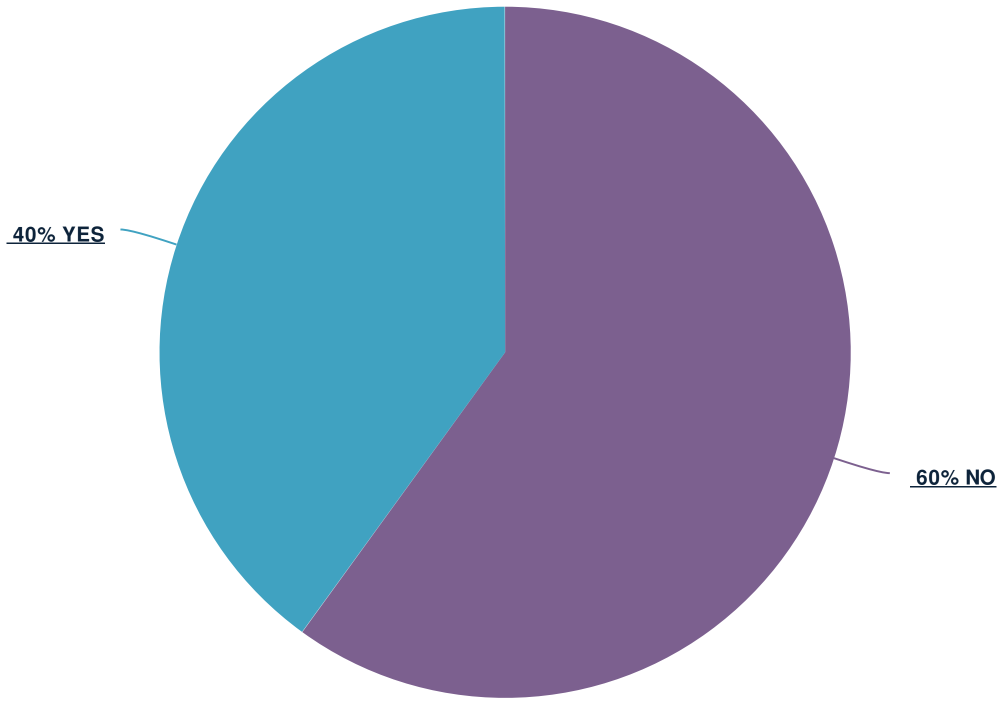
24. Should this potential gap be addressed?

All



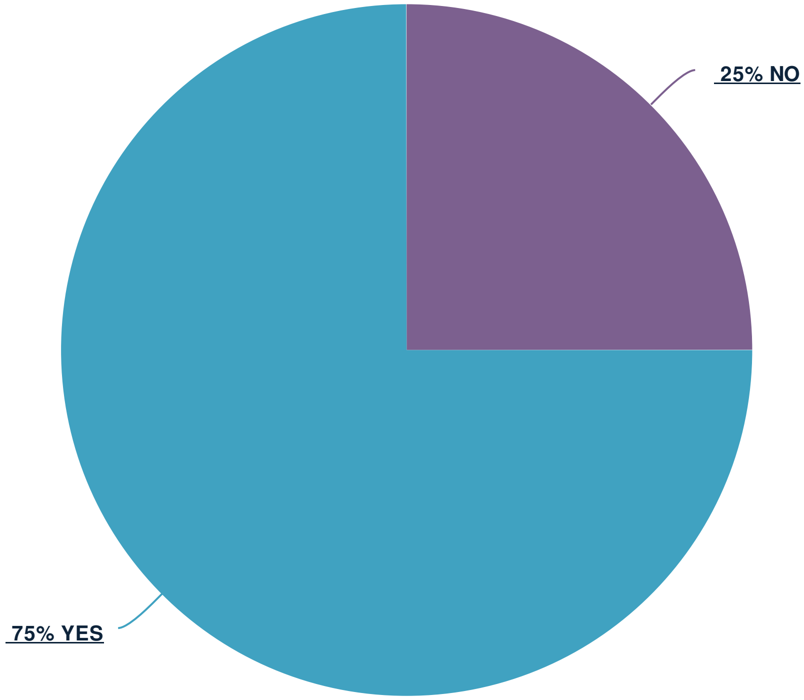
Response	Total Responses	Percent
NO — No single answer or approach applies to all situations, or another reason	4	44.4%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	2	22.2%
YES — Potential revision to 49CFR193 made at #1 Low Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	11.1%
YES — Potential revision to 49CFR193 made at #3 High Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	11.1%
YES — Voluntary practice by Operator	1	11.1%

Small Scale



Response	Total Responses	Percent
NO — No single answer or approach applies to all situations, or another reason	3	60.0%
YES — Potential revision to 49CFR193 made at #1 Low Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	20.0%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	1	20.0%

Terminals



Response	Total Responses	Percent
NO — No single answer or approach applies to all situations, or another reason	1	25.0%
YES — Potential revision to 49CFR193 made at #3 High Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	25.0%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	1	25.0%
YES — Voluntary practice by Operator	1	25.0%

25. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

All

ResponseID	Response
23	Operator's Process Hazard Analysis to be based on Operator's Risk Matrix.
30	Performing a PHA is a best practice, however it should be left to the operator to determine need. The LNG industry as a whole, has an impeccable safety record with current regulations.
31	Risk acceptance levels must be quantified in order to determine required integrity levels of safety systems.

Small Scale

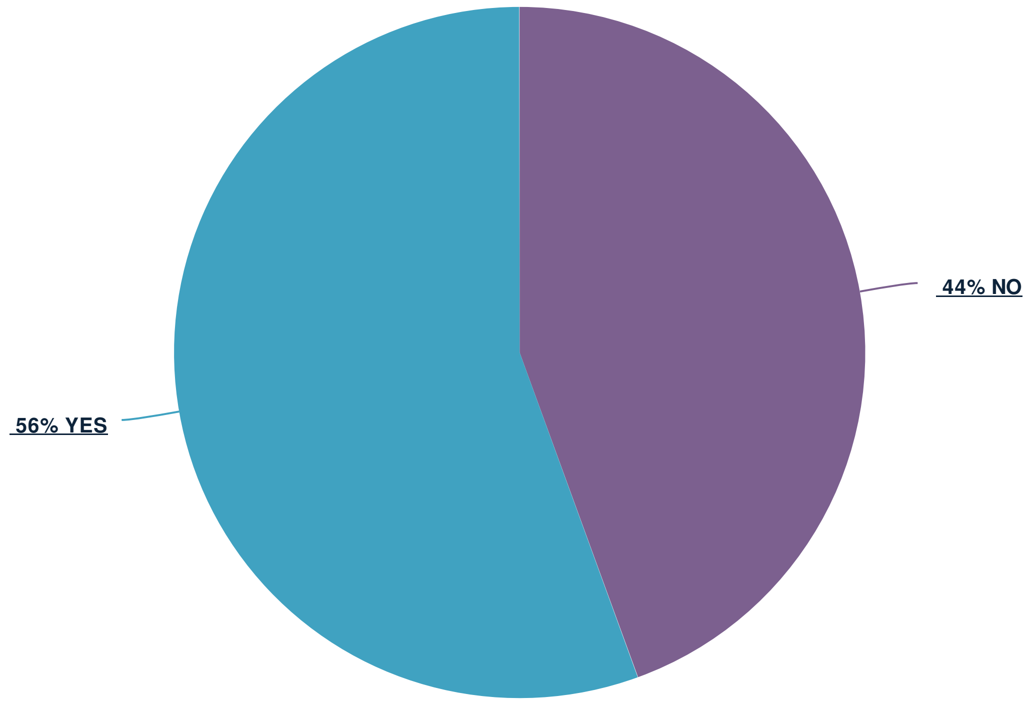
ResponseID	Response
30	Performing a PHA is a best practice, however it should be left to the operator to determine need. The LNG industry as a whole, has an impeccable safety record with current regulations.

Terminals

ResponseID	Response
23	Operator's Process Hazard Analysis to be based on Operator's Risk Matrix.
31	Risk acceptance levels must be quantified in order to determine required integrity levels of safety systems.

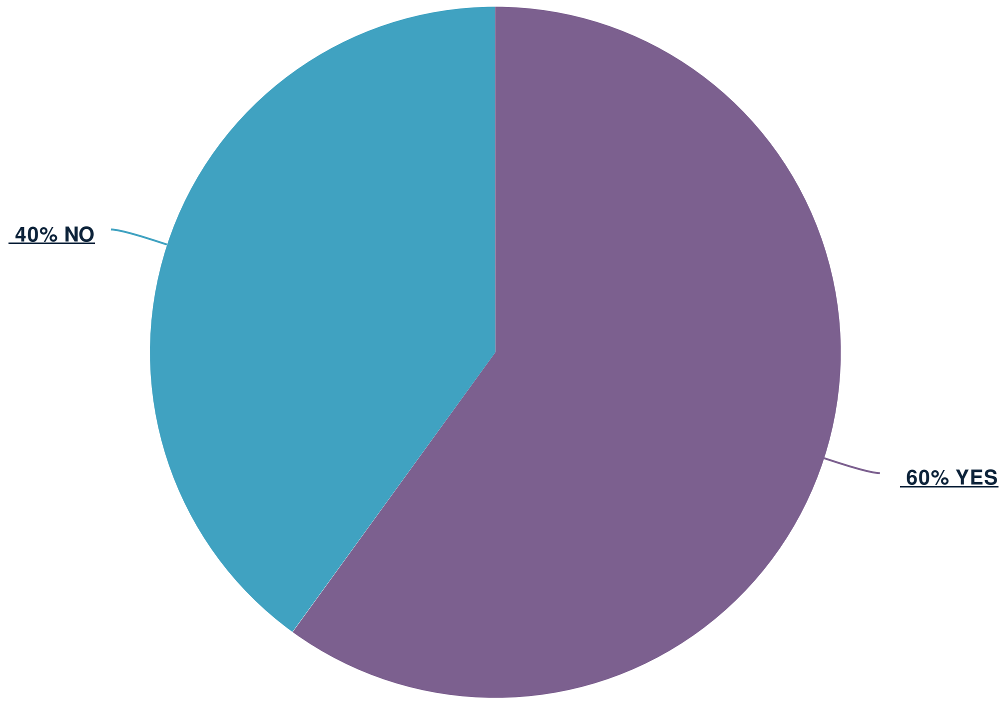
26. Should this potential gap be addressed?

All



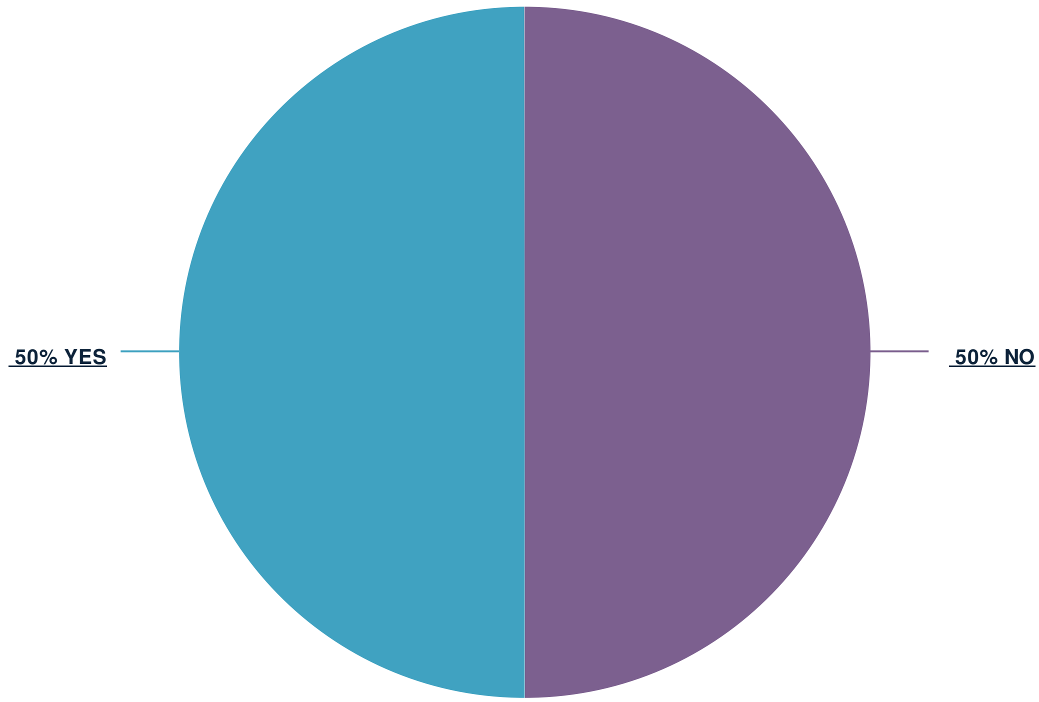
Response	Total Responses	Percent
NO — No single answer or approach applies to all situations, or another reason	2	22.2%
YES — Potential revision to 49CFR193 made at #1 Low Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	2	22.2%
YES — Voluntary practice by Operator	2	22.2%
NO — No need to address gap, because gap is incorrectly stated; in reality, there is no gap	1	11.1%
NO — No need to address gap, because gap is of negligible importance	1	11.1%
YES — Potential revision to 49CFR193 made at #3 High Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	11.1%

Small Scale



Response	Total Responses	Percent
YES — Potential revision to 49CFR193 made at #1 Low Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	2	40.0%
NO — No need to address gap, because gap is incorrectly stated; in reality, there is no gap	1	20.0%
NO — No single answer or approach applies to all situations, or another reason	1	20.0%
YES — Voluntary practice by Operator	1	20.0%

Terminals



Response	Total Responses	Percent
NO — No need to address gap, because gap is of negligible importance	1	25.0%
NO — No single answer or approach applies to all situations, or another reason	1	25.0%
YES — Potential revision to 49CFR193 made at #3 High Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	25.0%
YES — Voluntary practice by Operator	1	25.0%

27. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

All

ResponseID	Response
26	You are required to have 5 years of superseded procedures on site so while it is nice to have a clean log of all changes but not a necessary prority
30	Operators should be required to have documents readily available describing processes and systems of the facility, the question being asked is not specific enough to leave out interpretation of requirements.
31	Again PSI is your foundation, but it is useless, if employees can't access it. There must be a single point of truth, integrity of the information must be assured by competent individuals and it must be available to all employees who need it, when they need it, 24/7, 365.

Small Scale

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Terminals

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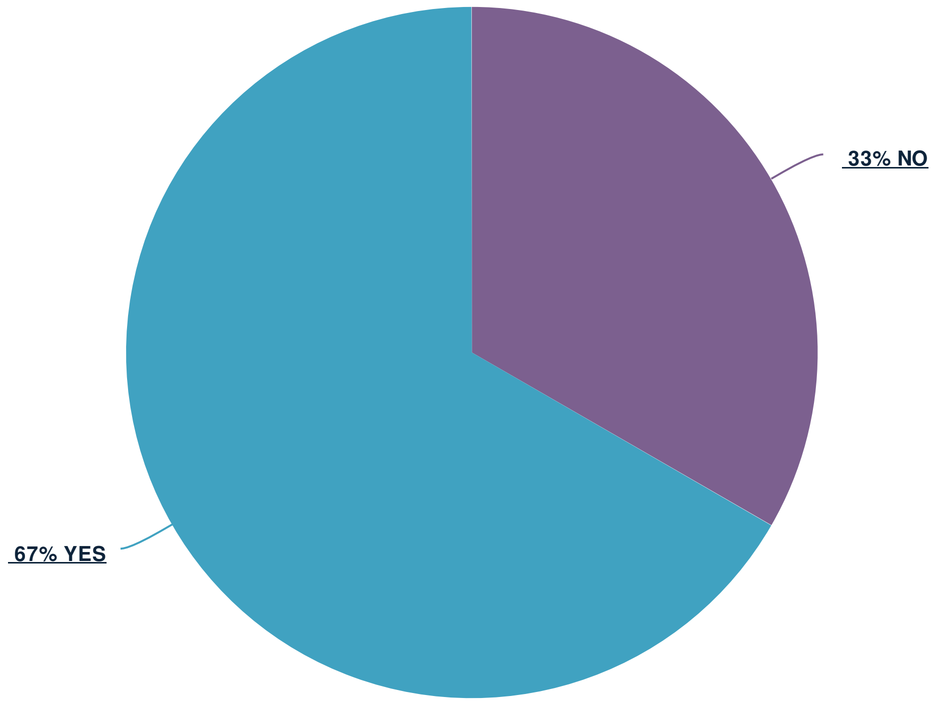
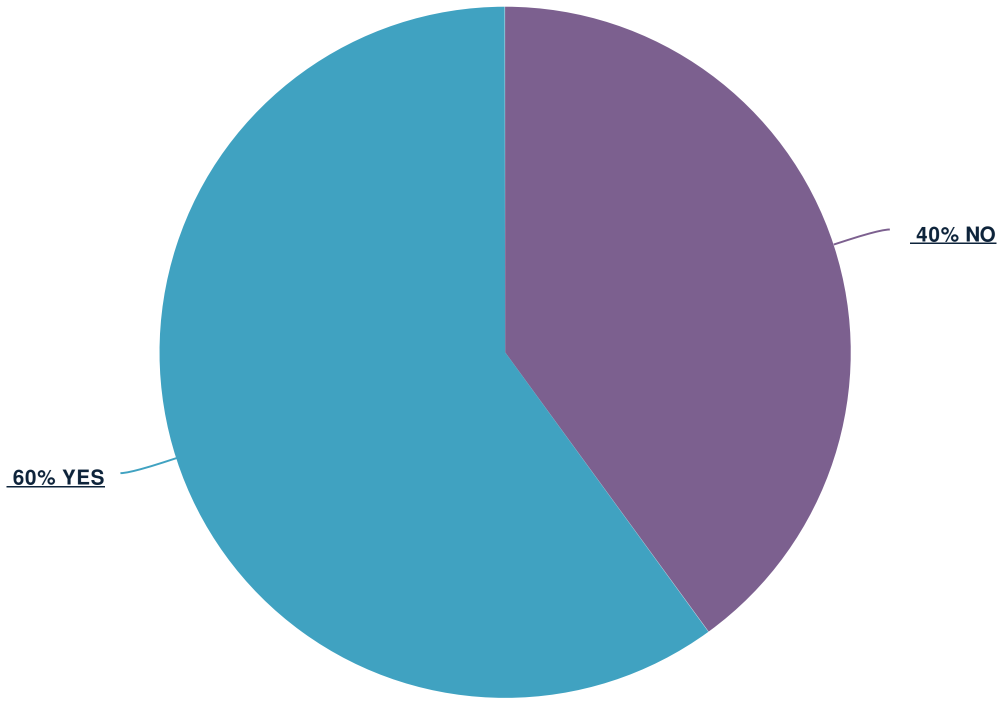
28. Should this potential gap be addressed?

All



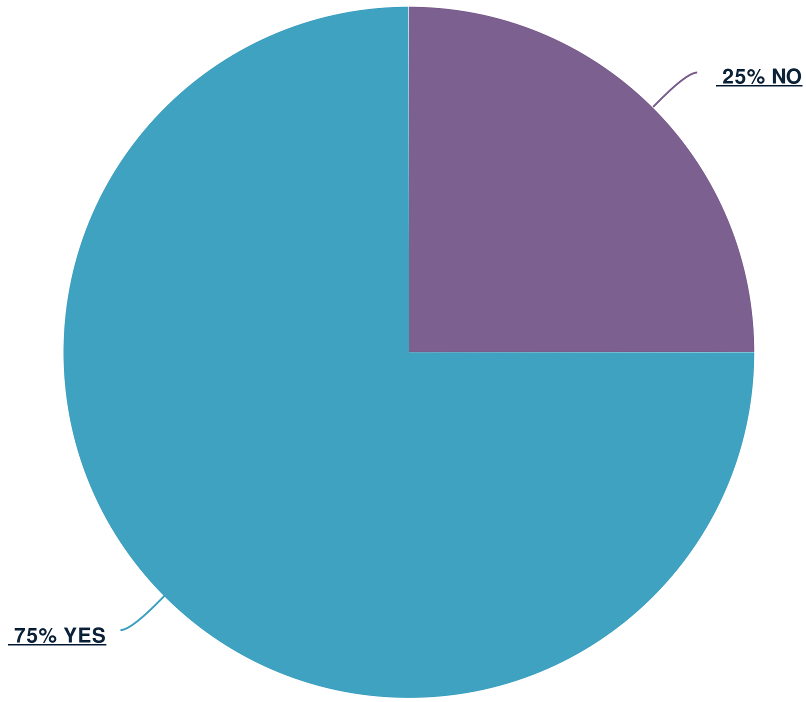
Response	Total Responses	Percent
NO — No single answer or approach applies to all situations, or another reason	3	33.3%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	2	22.2%
YES — Voluntary practice by Operator	2	22.2%
YES — Potential revision to 49CFR193 made at #1 Low Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	11.1%
YES — Potential revision to 49CFR193 made at #3 High Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	11.1%

Small Scale



Response	Total Responses	Percent
NO — No single answer or approach applies to all situations, or another reason	2	40.0%
YES — Potential revision to 49CFR193 made at #1 Low Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	20.0%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	1	20.0%
YES — Voluntary practice by Operator	1	20.0%

Terminals



Response	Total Responses	Percent
NO — No single answer or approach applies to all situations, or another reason	1	25.0%
YES — Potential revision to 49CFR193 made at #3 High Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	25.0%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	1	25.0%
YES — Voluntary practice by Operator	1	25.0%

29. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

All

ResponseID	Response
26	Each operator will have a different philosophy of what human factors apply to their plant and the methodology used in determining them. Making it prescriptive is not necessary but suggested methodology would be well placed and used if it was in an appendix of 59A
30	PSM practices are a best practice, however it should be left to the operator to determine need. The LNG industry as a whole, has an impeccable safety record.
31	A well designed LNG Plant may go years between upsets, incidents or Start-ups/Shutdowns. Practice, practice, practice, drill, drill, drill. It's people we're trying to protect, make it user friendly. Employees are not 10 feet tall, they don't have 8 foot arms and they can't see in the dark.

Small Scale

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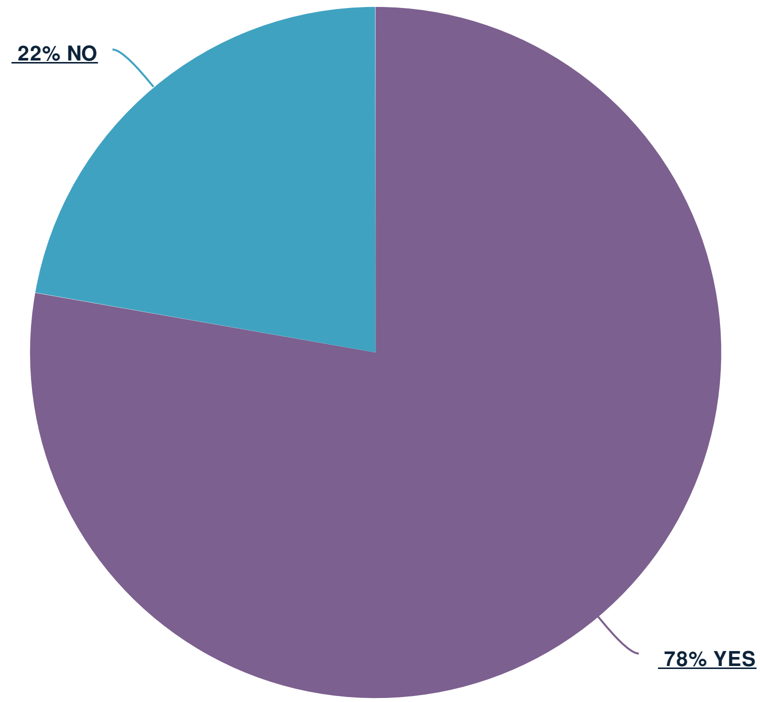
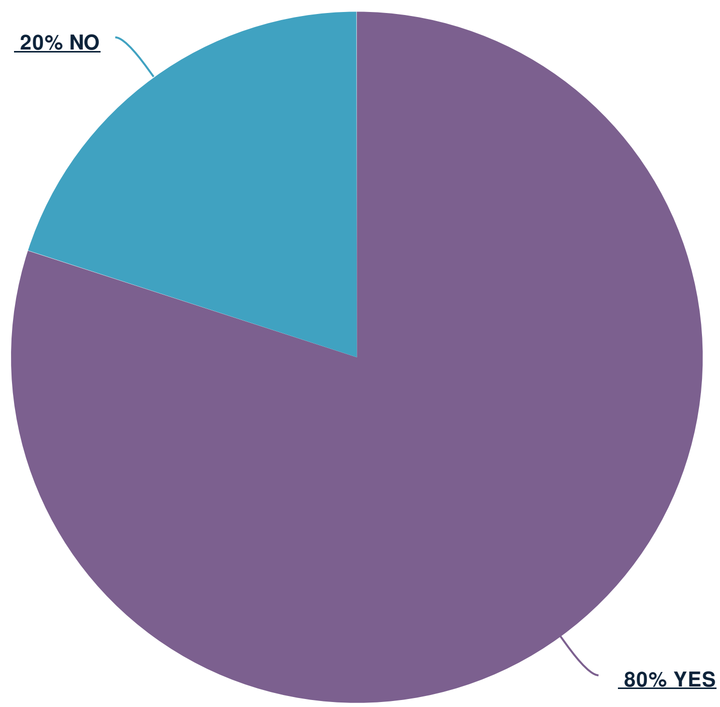
30. Should this potential gap be addressed?

All



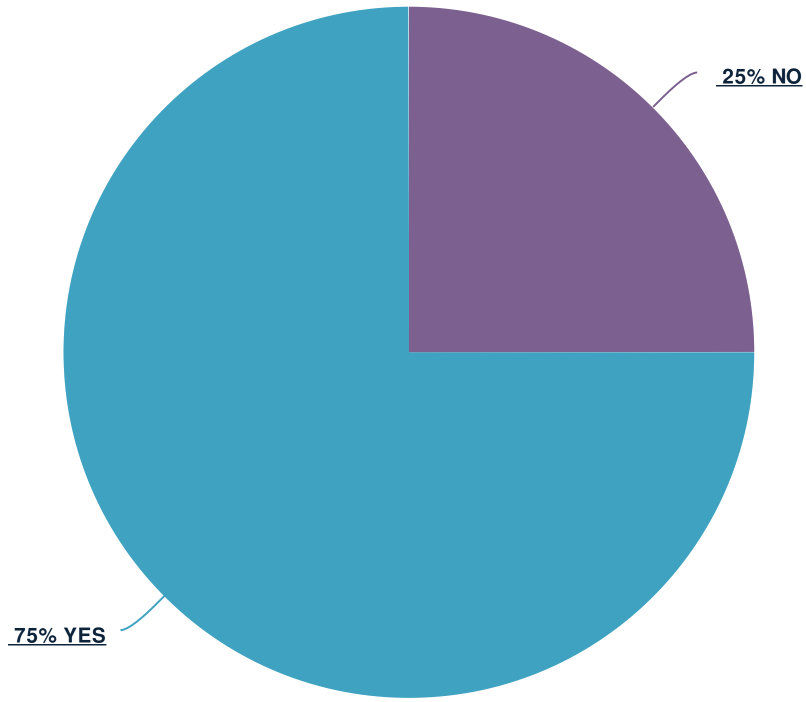
Response	Total Responses	Percent
YES — Potential revision to 49CFR193 made at #2 Medium Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	2	22.2%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	2	22.2%
YES — Voluntary practice by Operator	2	22.2%
NO — No need to address gap, because gap is incorrectly stated; in reality, there is no gap	1	11.1%
NO — No single answer or approach applies to all situations, or another reason	1	11.1%
YES — Potential revision to 49CFR193 made at #1 Low Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	11.1%

Small Scale



Response	Total Responses	Percent
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	2	40.0%
NO — No need to address gap, because gap is incorrectly stated; in reality, there is no gap	1	20.0%
YES — Potential revision to 49CFR193 made at #2 Medium Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	20.0%
YES — Voluntary practice by Operator	1	20.0%

Terminals



Response	Total Responses	Percent
NO — No single answer or approach applies to all situations, or another reason	1	25.0%
YES — Potential revision to 49CFR193 made at #1 Low Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	25.0%
YES — Potential revision to 49CFR193 made at #2 Medium Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	25.0%
YES — Voluntary practice by Operator	1	25.0%

31. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

All

ResponseID	Response
23	Prudent Operator will include safety performance evaluation of all Contractor personnel engaged at facility as part contract management Quarterly Performance Review (QPR).
28	Industry practice is using third party contractor evaluation programs to hold contract companies to higher standard, I.E. INSET
30	In today's corporate and gas industry safety environment, I don't believe this to be a gap. With companies like Aveta and ISNetworld, this analysis is performed and tracked by most organizations.
31	This applies to run and maintain contractors just as much, if not more than the original facility designer/constructor.

Small Scale

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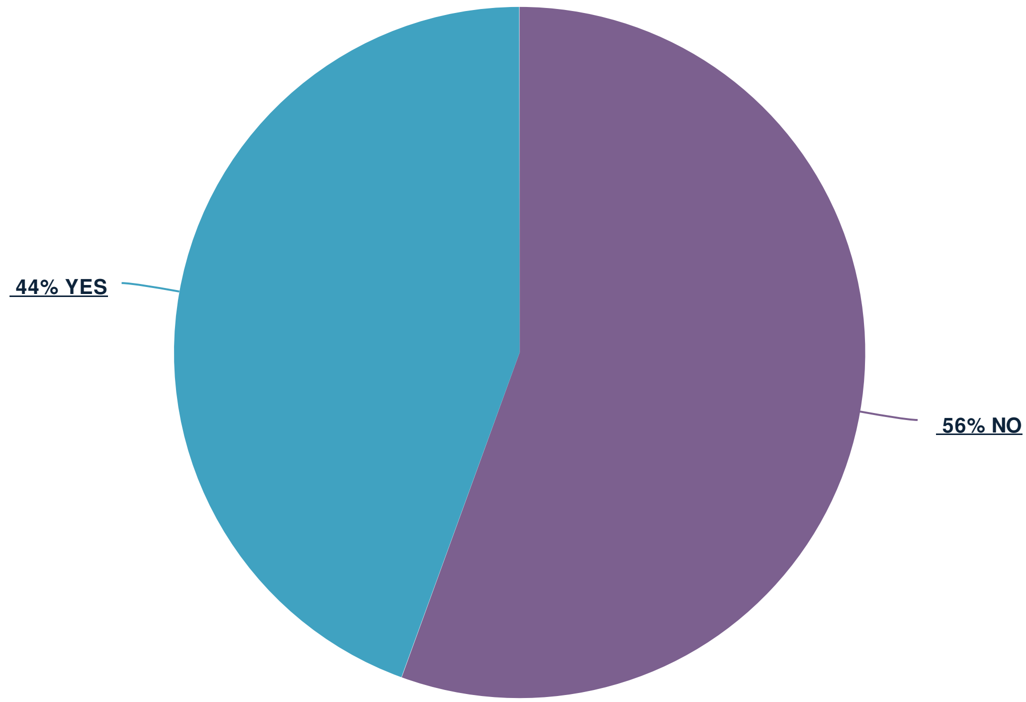
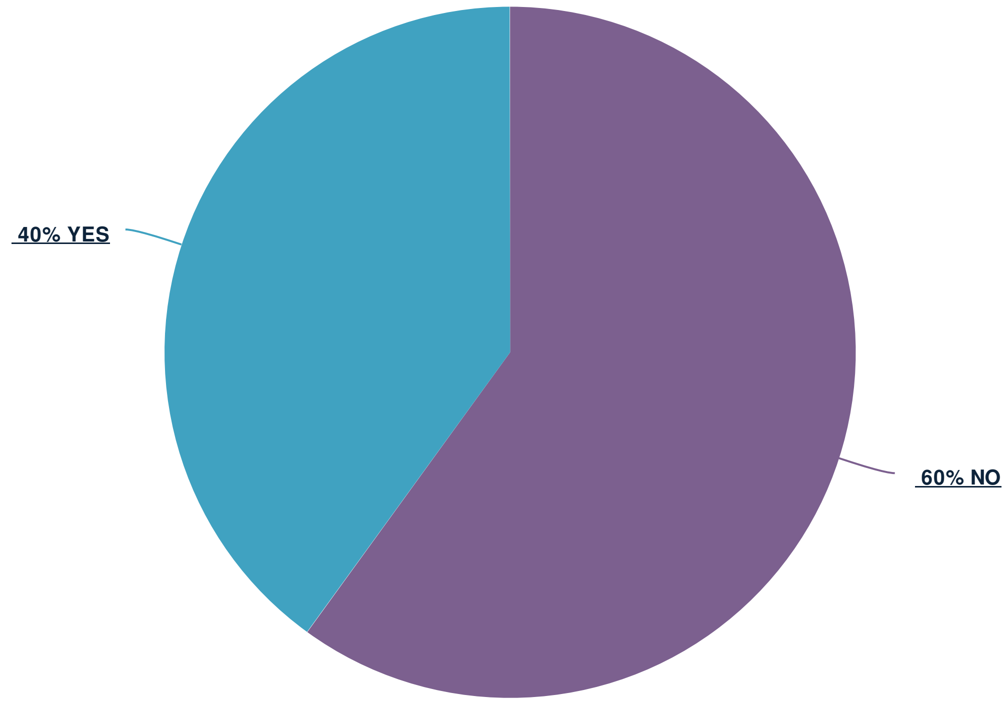
32. Should this potential gap be addressed?

All



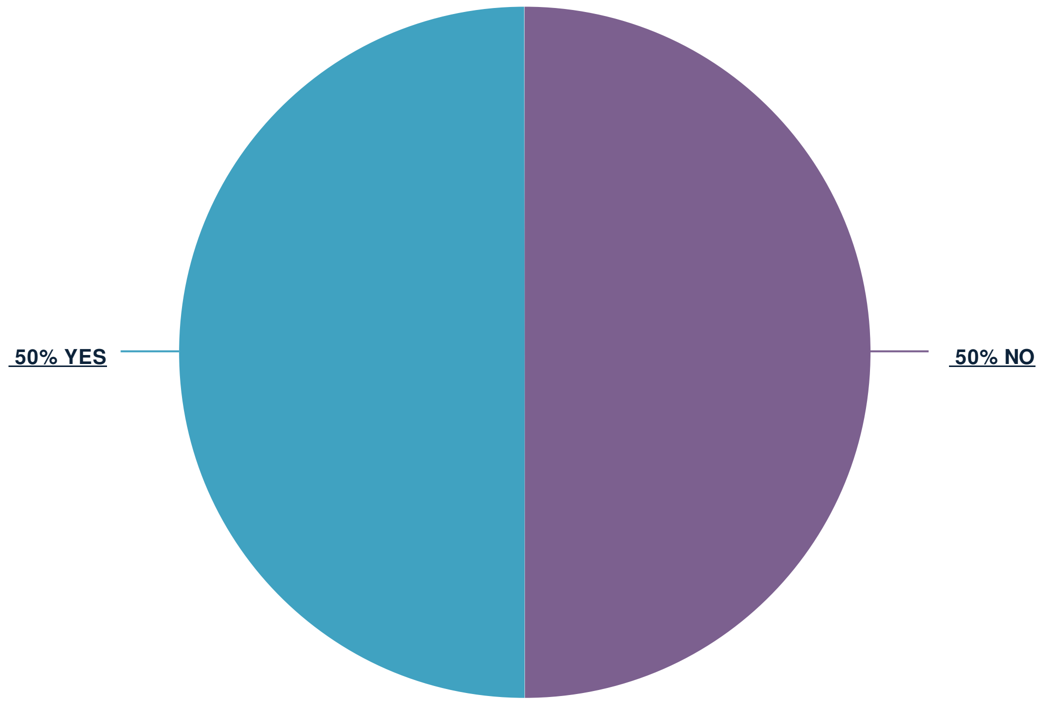
Response	Total Responses	Percent
NO — No need to address gap, because gap is incorrectly stated; in reality, there is no gap	3	33.3%
YES — Potential revision to 49CFR193 made at #1 Low Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	2	22.2%
NO — No need to address gap, because gap is of negligible importance	1	11.1%
NO — No single answer or approach applies to all situations, or another reason	1	11.1%
YES — Potential revision to 49CFR193 made at #2 Medium Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	11.1%
YES — Voluntary practice by Operator	1	11.1%

Small Scale



Response	Total Responses	Percent
NO — No need to address gap, because gap is incorrectly stated; in reality, there is no gap	2	40.0%
YES — Potential revision to 49CFR193 made at #1 Low Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	2	40.0%
NO — No need to address gap, because gap is of negligible importance	1	20.0%

Terminals



Response	Total Responses	Percent
NO — No need to address gap, because gap is incorrectly stated; in reality, there is no gap	1	25.0%
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YES — Potential revision to 49CFR193 made at #2 Medium Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	25.0%
YES — Voluntary practice by Operator	1	25.0%

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All

ResponseID	Response
24	Operators use a contractor's safety records when determining if they are willing to do business
26	Contractors are still obligated to track their injury and illness in accordance with OSHA rules. No need to have it redundantly tracked by an Operator
27	I believe this is already required by OSHA 1904.35
28	This information is captured using INSET
30	In today's corporate and gas industry safety environment, I don't believe this to be a gap. With companies like Aveta and ISNetworld, this analysis is performed and tracked by most organizations.
31	This applies to run and maintain contractors just as much, if not more than the original facility designer/constructor.

Small Scale

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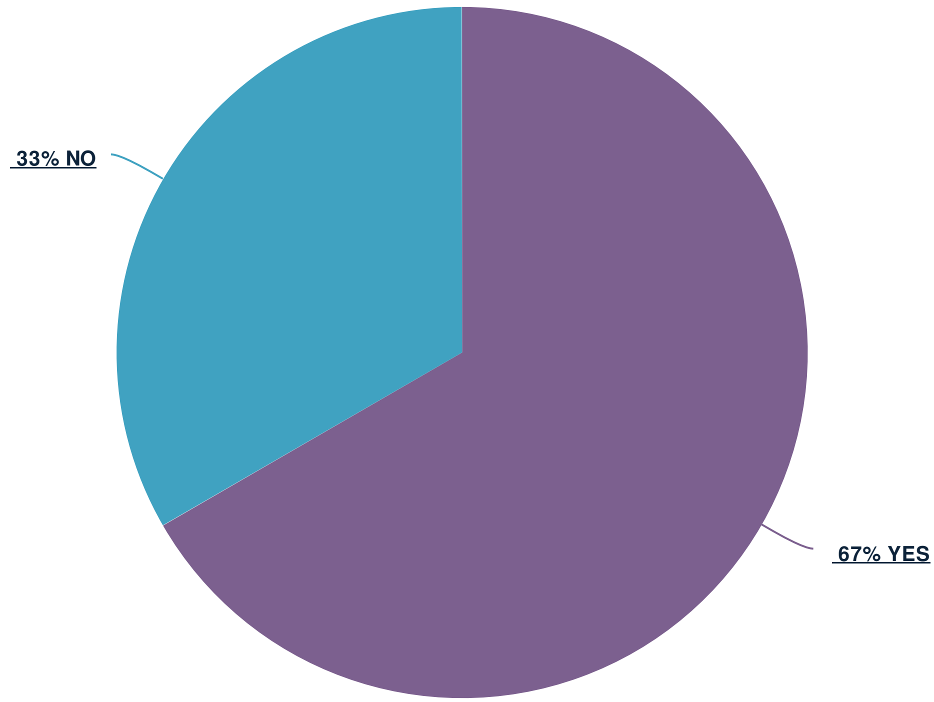
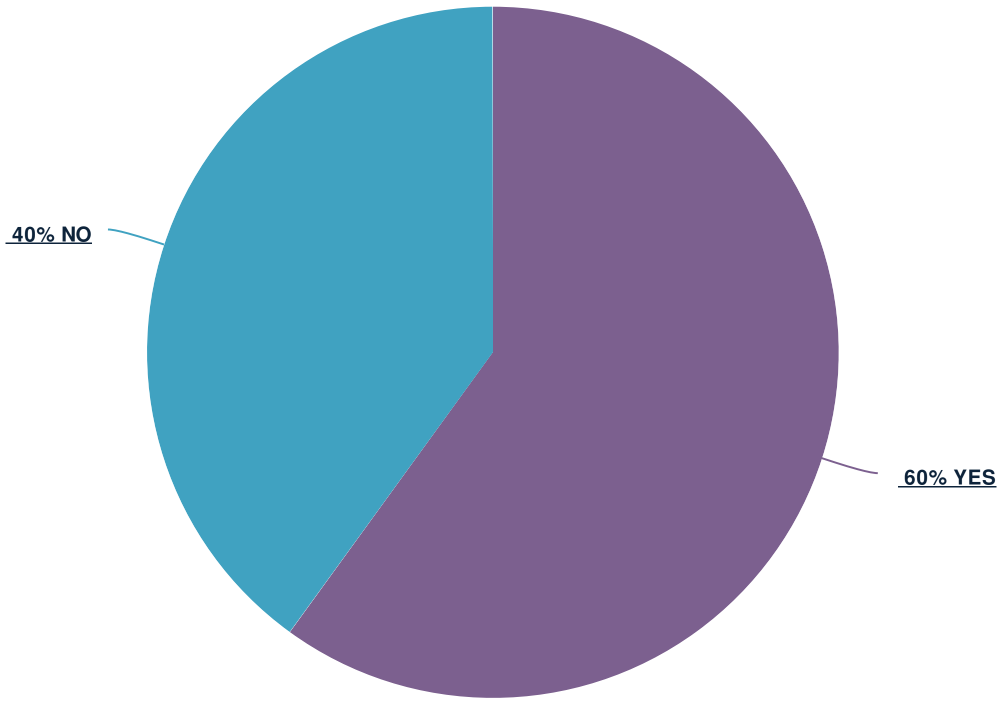
All



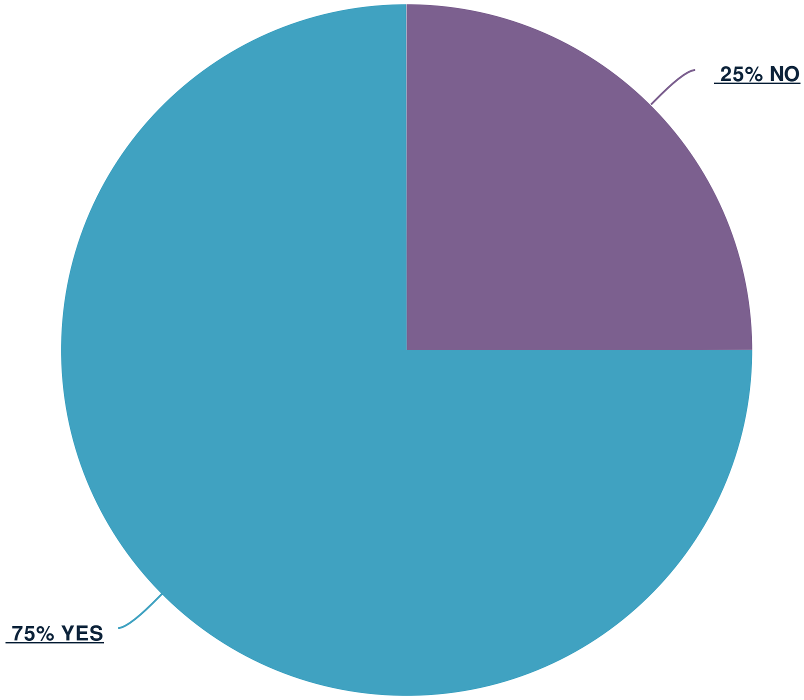
Response	Total Responses	Percent
YES — Voluntary practice by Operator	4	44.4%
NO — No single answer or approach applies to all situations, or another reason	3	33.3%
YES — Potential revision to 49CFR193 made at #2 Medium Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	11.1%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	1	11.1%

Small Scale



Response	Total Responses	Percent
YES — Voluntary practice by Operator	3	60.0%
NO — No single answer or approach applies to all situations, or another reason	2	40.0%

Terminals



Response	Total Responses	Percent
NO — No single answer or approach applies to all situations, or another reason	1	25.0%
YES — Potential revision to 49CFR193 made at #2 Medium Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	25.0%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	1	25.0%
YES — Voluntary practice by Operator	1	25.0%

35. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

All

ResponseID	Response
26	Lessons learned and suggestions and recommendations should be provided to the operator during the design phase so an operator can make an informed decision of what needs to be incorporated into a design or something that should be mitigated.
28	Contractor Safety Forums are set up to communicate any lessons learned from contractor companies.
30	We are not aware of any database in existence. The information would be valuable to any operator. This information would be considered by most designers, fabricators, inspectors, constructors, or those performing testing would be considered as proprietary and would benefit their competitors, therefore this information may be difficult to acquire.
31	This applies to run and maintain contractors just as much, if not more than the original facility designer/constructor.

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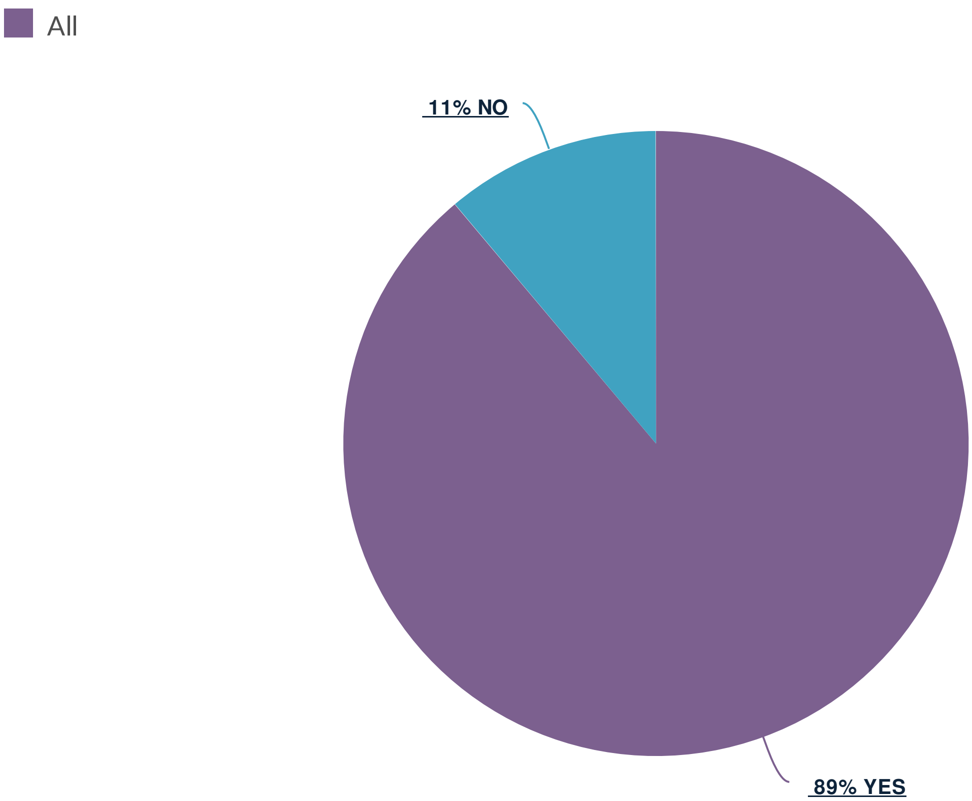
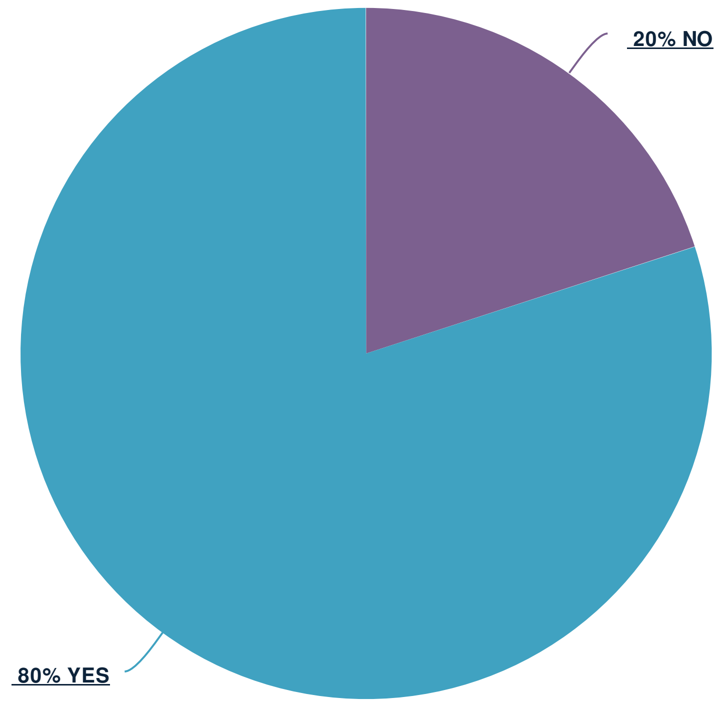
36. Should this potential gap be addressed?



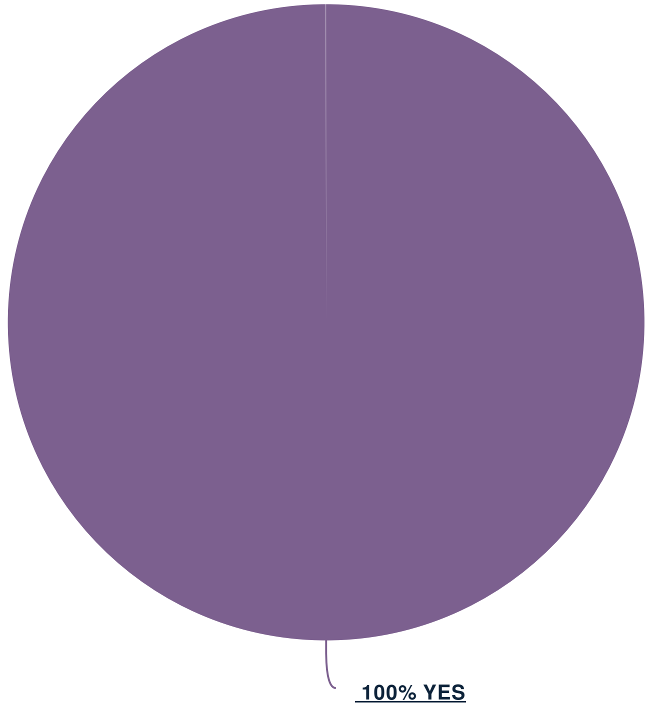
Response	Total Responses	Percent
YES — Potential revision to 49CFR193 made at #3 High Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	3	33.3%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	2	22.2%
NO — No need to address gap, because gap is incorrectly stated; in reality, there is no gap	1	11.1%
YES — Potential revision to 49CFR193 made at #1 Low Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	11.1%
YES — Potential revision to 49CFR193 made at #2 Medium Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	11.1%
YES — Voluntary practice by Operator	1	11.1%

Small Scale



Response	Total Responses	Percent
NO — No need to address gap, because gap is incorrectly stated; in reality, there is no gap	1	20.0%
YES — Potential revision to 49CFR193 made at #1 Low Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	20.0%
YES — Potential revision to 49CFR193 made at #3 High Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	20.0%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	1	20.0%
YES — Voluntary practice by Operator	1	20.0%

Terminals



Response	Total Responses	Percent
YES — Potential revision to 49CFR193 made at #3 High Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	2	50.0%
YES — Potential revision to 49CFR193 made at #2 Medium Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	25.0%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	1	25.0%

37. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

All

ResponseID	Response
23	Testing frequency for safety instrumented systems (SIS), to be based on LOPA Study findings, taking SIL ratings of individual components into consideration. Partial Stroke Testing and other simulation to be credited. Built in diagnostic capabilities, such as HART to be fully utilized.
30	We do not believe this is a gap. All fire systems are subject to the local AHJ requirements. Inspection and testing is covered in other NFPA Standards and OSHA regulations.
31	This gets back to Risk Based Inspection per RAGAGEP over prescriptive inspections, which should be utilized, if the Operator has sufficient engineering expertise available.

Small Scale

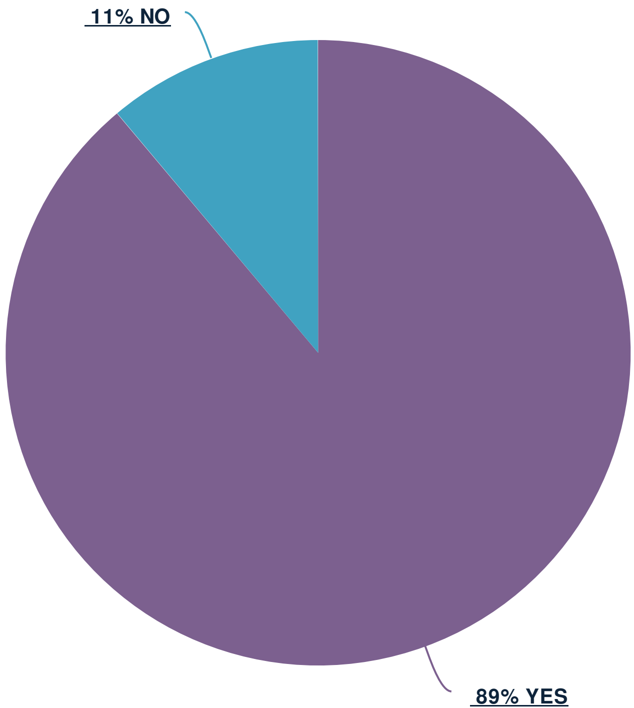
ResponseID	Response
30	We do not believe this is a gap. All fire systems are subject to the local AHJ requirements. Inspection and testing is covered in other NFPA Standards and OSHA regulations.

Terminals

ResponseID	Response
23	Testing frequency for safety instrumented systems (SIS), to be based on LOPA Study findings, taking SIL ratings of individual components into consideration. Partial Stroke Testing and other simulation to be credited. Built in diagnostic capabilities, such as HART to be fully utilized.
31	This gets back to Risk Based Inspection per RAGAGEP over prescriptive inspections, which should be utilized, if the Operator has sufficient engineering expertise available.

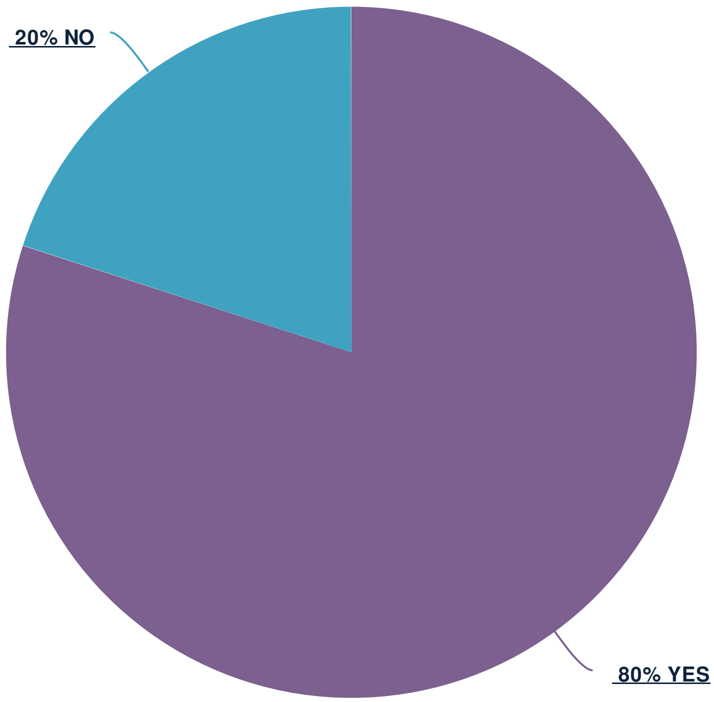
38. Should this potential gap be addressed?

All



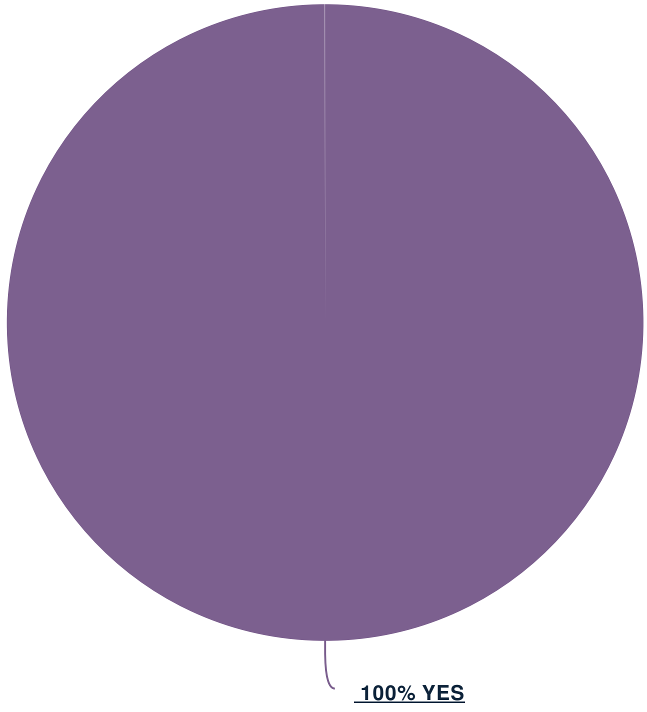
Response	Total Responses	Percent
YES — Potential revision to 49CFR193 made at #3 High Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	3	33.3%
YES — Potential revision to 49CFR193 made at #1 Low Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	2	22.2%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	2	22.2%
NO — No need to address gap, because gap is incorrectly stated; in reality, there is no gap	1	11.1%
YES — Potential revision to 49CFR193 made at #2 Medium Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	11.1%

Small Scale



Response	Total Responses	Percent
YES — Potential revision to 49CFR193 made at #1 Low Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	2	40.0%
NO — No need to address gap, because gap is incorrectly stated; in reality, there is no gap	1	20.0%
YES — Potential revision to 49CFR193 made at #3 High Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	20.0%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	1	20.0%

Terminals



Response	Total Responses	Percent
YES — Potential revision to 49CFR193 made at #3 High Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	2	50.0%
YES — Potential revision to 49CFR193 made at #2 Medium Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	25.0%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	1	25.0%

39. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

All

ResponseID	Response
23	Due clean nature of natural gas and LNG, a 24 month, not exceeding 30 months, external PSV inspection and testing regime is more than adequate to assure proper function. Exception to the above would be PSVs subjected to frequent process excursions, to be inspected more frequently. Internal inspection and replacement of soft goods or wear items, to be based on process conditions and manufacturer recommendation (typically 6 to 12 years).
30	We do not believe a gap exists because when a conflict exist between 49CFR193 and NFPA 59A, 49CFR193 prevails.
31	This gets back to Risk Based Inspection per RAGAGEP over prescriptive inspections, which should be utilized, if the Operator has sufficient engineering expertise available.

Small Scale

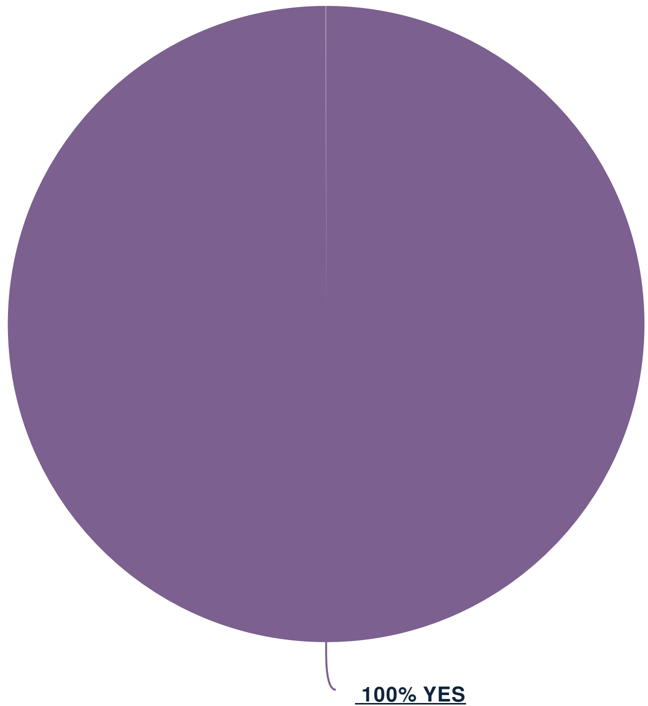
ResponseID	Response
30	We do not believe a gap exists because when a conflict exist between 49CFR193 and NFPA 59A, 49CFR193 prevails.

Terminals

ResponseID	Response
23	Due clean nature of natural gas and LNG, a 24 month, not exceeding 30 months, external PSV inspection and testing regime is more than adequate to assure proper function. Exception to the above would be PSVs subjected to frequent process excursions, to be inspected more frequently. Internal inspection and replacement of soft goods or wear items, to be based on process conditions and manufacturer recommendation (typically 6 to 12 years).
31	This gets back to Risk Based Inspection per RAGAGEP over prescriptive inspections, which should be utilized, if the Operator has sufficient engineering expertise available.

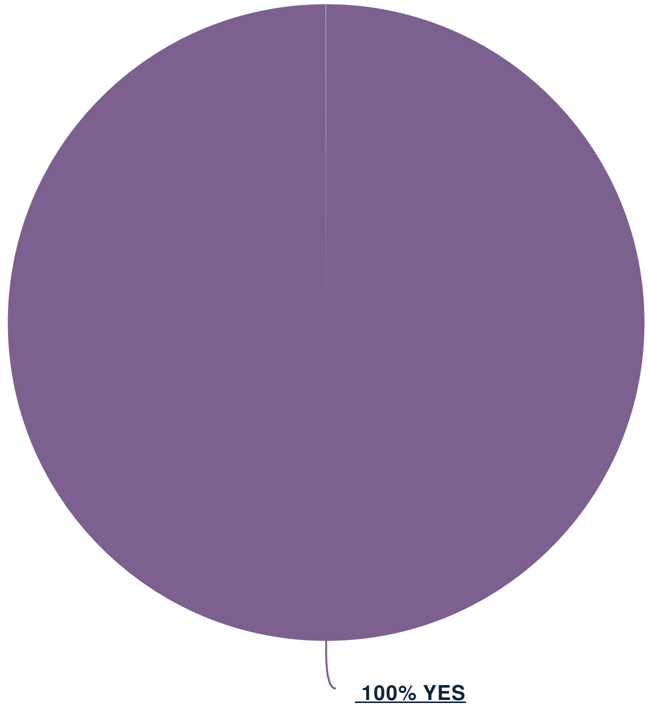
40. Should this potential gap be addressed?

All



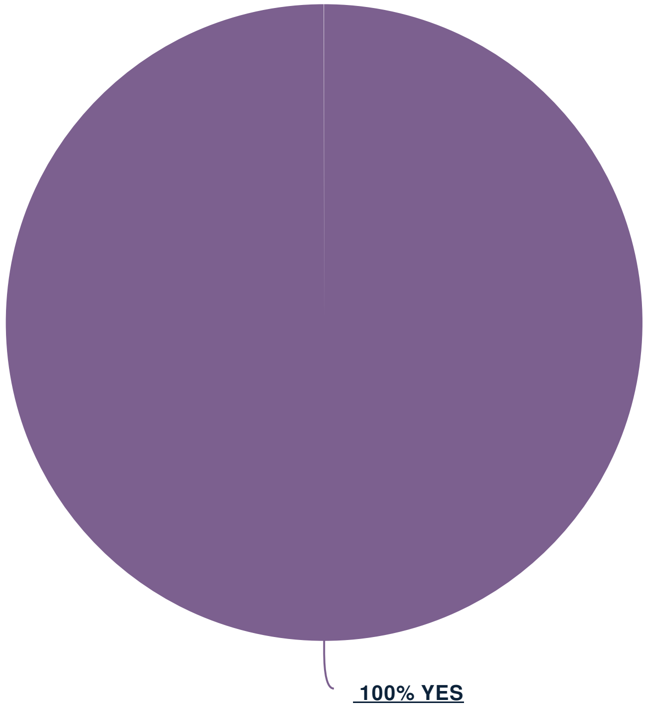
Response	Total Responses	Percent
YES — Potential revision to 49CFR193 made at #3 High Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	3	33.3%
YES — Potential revision to 49CFR193 made at #1 Low Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	2	22.2%
YES — Potential revision to 49CFR193 made at #2 Medium Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	2	22.2%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	2	22.2%

Small Scale



Response	Total Responses	Percent
YES — Potential revision to 49CFR193 made at #1 Low Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	2	40.0%
YES — Potential revision to 49CFR193 made at #2 Medium Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	20.0%
YES — Potential revision to 49CFR193 made at #3 High Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	20.0%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	1	20.0%

Terminals



Response	Total Responses	Percent
YES — Potential revision to 49CFR193 made at #3 High Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	2	50.0%
YES — Potential revision to 49CFR193 made at #2 Medium Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	25.0%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	1	25.0%

41. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

All

ResponseID	Response
23	Due nature of service, and multiple units installed, LNG Tank relief device testing to be realigned 60 months, in alignment with NFPA 59A.
26	My only comment would be to have this an either/or situation so that operators who want to keep it the same frequency can and operators that want more flexibility can manage it per NFPA 59A 2019
30	The argument can be made that the annual testing not to exceed 15 months creates an additional safety hazard. An argument may also be made that by extending the testing interval would also decrease methane emissions by reducing the need to blowdown systems for relief valve removal.
31	This gets back to Risk Based Inspection per RAGAGEP over prescriptive inspections, which should be utilized, if the Operator has sufficient engineering expertise available.

Small Scale

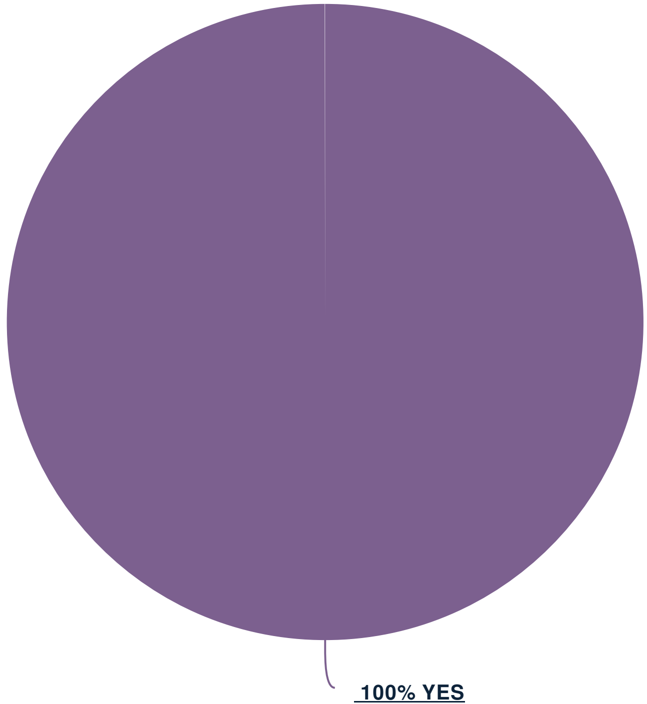
ResponseID	Response
30	The argument can be made that the annual testing not to exceed 15 months creates an additional safety hazard. An argument may also be made that by extending the testing interval would also decrease methane emissions by reducing the need to blowdown systems for relief valve removal.

Terminals

ResponseID	Response
23	Due nature of service, and multiple units installed, LNG Tank relief device testing to be realigned 60 months, in alignment with NFPA 59A.
26	My only comment would be to have this an either/or situation so that operators who want to keep it the same frequency can and operators that want more flexibility can manage it per NFPA 59A 2019
31	This gets back to Risk Based Inspection per RAGAGEP over prescriptive inspections, which should be utilized, if the Operator has sufficient engineering expertise available.

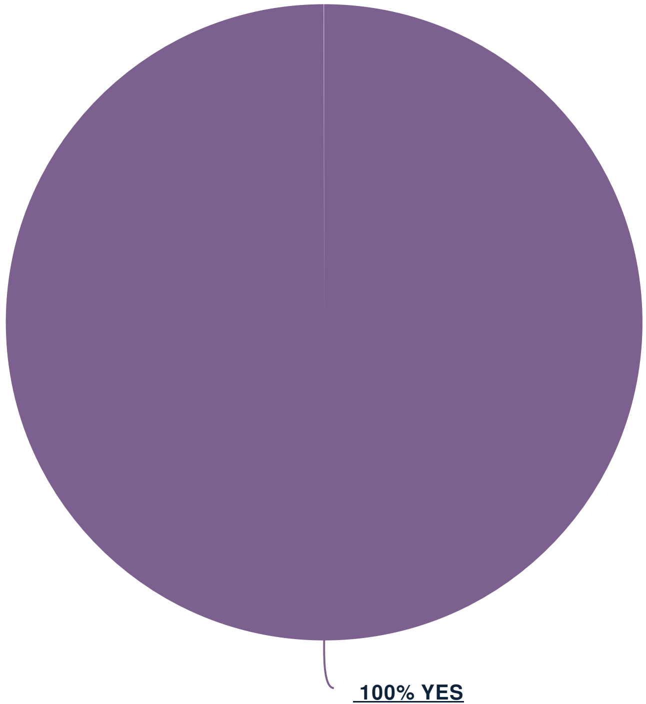
42. Should this potential gap be addressed?

All



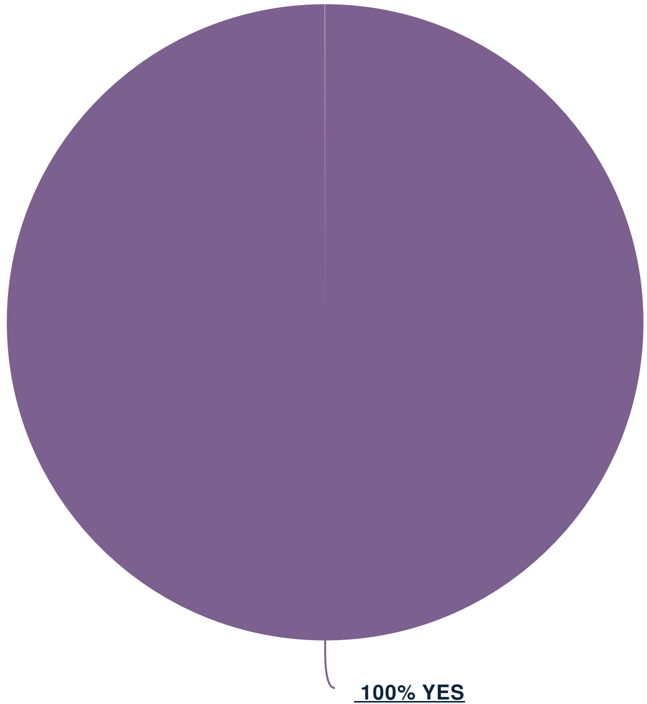
Response	Total Responses	Percent
YES — Potential revision to 49CFR193 made at #3 High Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	3	33.3%
YES — Potential revision to 49CFR193 made at #1 Low Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	2	22.2%
YES — Potential revision to 49CFR193 made at #2 Medium Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	2	22.2%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	2	22.2%

Small Scale



Response	Total Responses	Percent
YES — Potential revision to 49CFR193 made at #1 Low Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	2	40.0%
YES — Potential revision to 49CFR193 made at #2 Medium Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	20.0%
YES — Potential revision to 49CFR193 made at #3 High Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	20.0%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	1	20.0%

Terminals



Response	Total Responses	Percent
YES — Potential revision to 49CFR193 made at #3 High Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	2	50.0%
YES — Potential revision to 49CFR193 made at #2 Medium Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	25.0%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	1	25.0%

43. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

All

ResponseID	Response
23	60-month frequency not to exceed 63; or per API RP 576.
26	My only comment would be to have this an either/or situation so that operators who want to keep it the same frequency can and operators that want more flexibility can manage it per NFPA 59A 2019
30	The argument can be made that the annual testing not to exceed 15 months creates an additional safety hazard. An argument may also be made that by extending the testing interval would also decrease methane emissions by reducing the need to blowdown systems for relief valve removal.
31	This gets back to Risk Based Inspection per RAGAGEP over prescriptive inspections, which should be utilized, if the Operator has sufficient engineering expertise available.

Small Scale

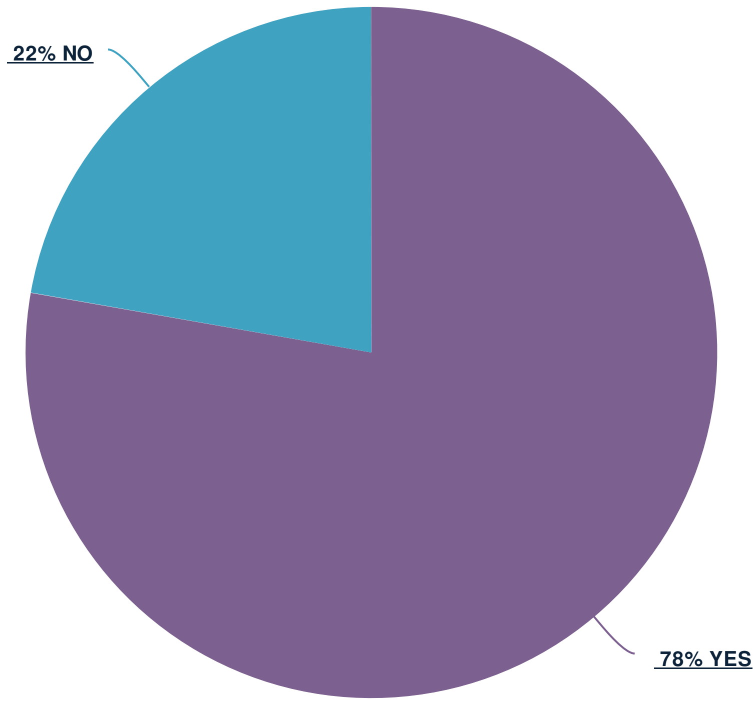
ResponseID	Response
30	The argument can be made that the annual testing not to exceed 15 months creates an additional safety hazard. An argument may also be made that by extending the testing interval would also decrease methane emissions by reducing the need to blowdown systems for relief valve removal.

Terminals

ResponseID	Response
23	60-month frequency not to exceed 63; or per API RP 576.
26	My only comment would be to have this an either/or situation so that operators who want to keep it the same frequency can and operators that want more flexibility can manage it per NFPA 59A 2019
31	This gets back to Risk Based Inspection per RAGAGEP over prescriptive inspections, which should be utilized, if the Operator has sufficient engineering expertise available.

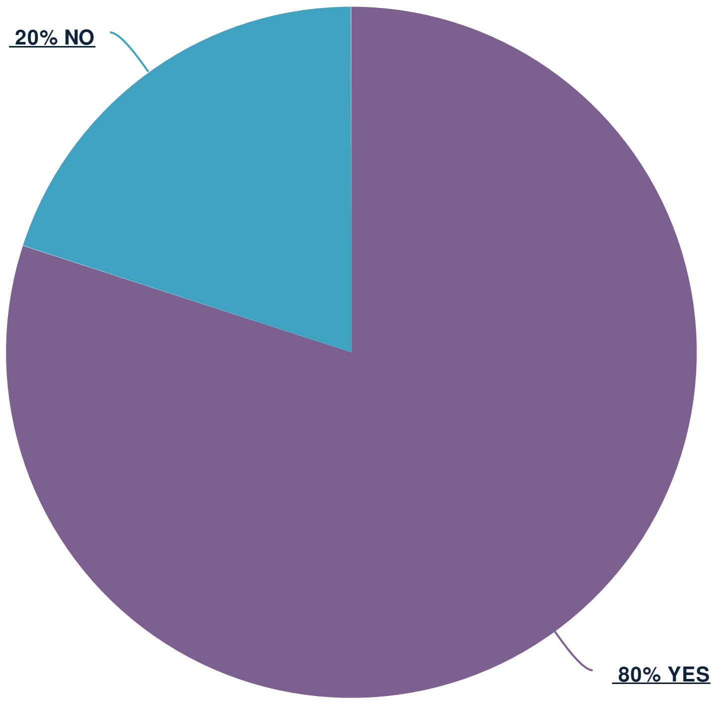
44. Should this potential gap be addressed?

All



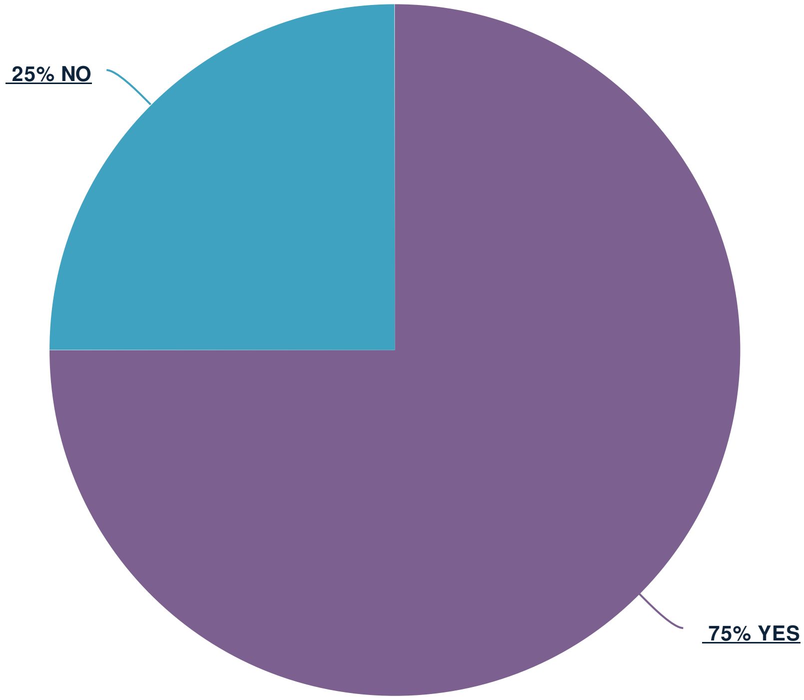
Response	Total Responses	Percent
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	5	55.6%
YES — Potential revision to 49CFR193 made at #3 High Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	2	22.2%
NO — No need to address gap, because gap is incorrectly stated; in reality, there is no gap	1	11.1%
NO — No single answer or approach applies to all situations, or another reason	1	11.1%

Small Scale



Response	Total Responses	Percent
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	3	60.0%
NO — No need to address gap, because gap is incorrectly stated; in reality, there is no gap	1	20.0%
YES — Potential revision to 49CFR193 made at #3 High Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	20.0%

Terminals



Response	Total Responses	Percent
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	2	50.0%
NO — No single answer or approach applies to all situations, or another reason	1	25.0%
YES — Potential revision to 49CFR193 made at #3 High Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	25.0%

45. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

All

ResponseID	Response
26	While 49CFR193 does address changes and most companies have their own form of MOC it could be helpful to put MOC minimum content in 59A 2022 edition appendix for facilities thinking about adopting a more formal MOC plan
30	Believe that no viable gap exists. Per 49cfr193, equipment maintenance records and operating procedures must be maintained and competent persons are to be utilized with any design or fabrication.
31	MOC is another pillar of PSM. An Operator cannot manage risk with out assuring that any changes to a facility, procedures or people is done with an eye towards Process Safety.

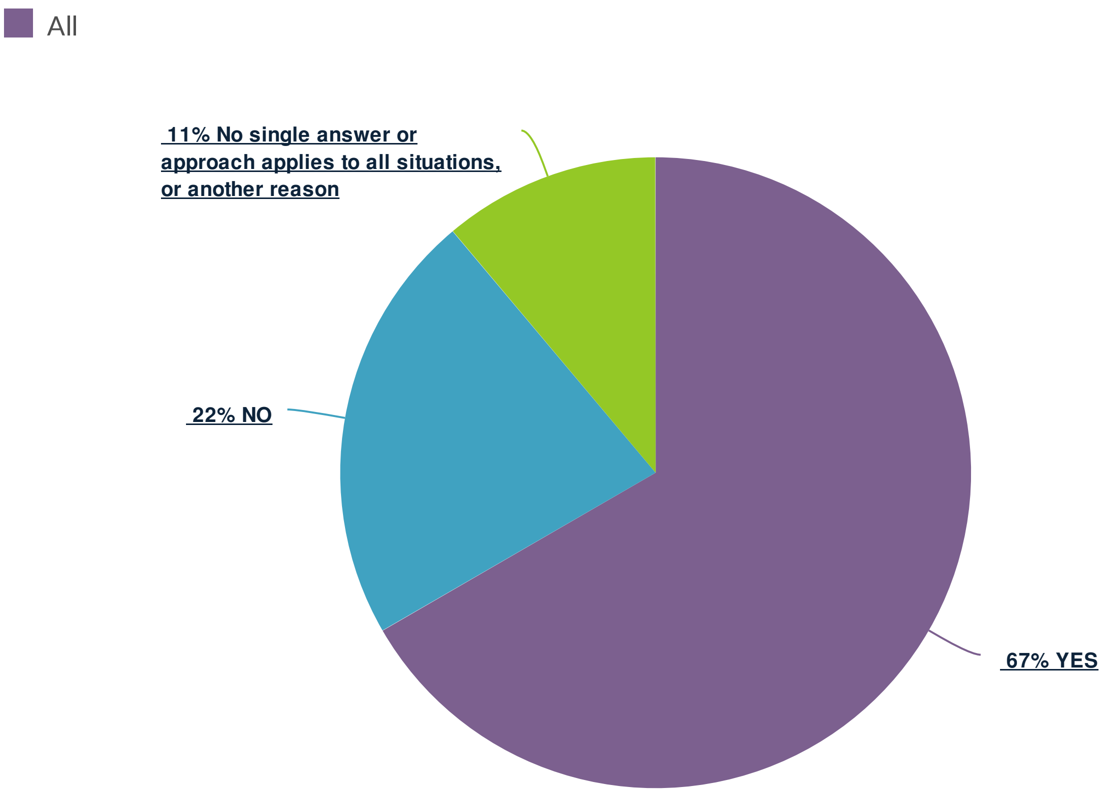
Small Scale

ResponseID	Response
30	Believe that no viable gap exists. Per 49cfr193, equipment maintenance records and operating procedures must be maintained and competent persons are to be utilized with any design or fabrication.

Terminals

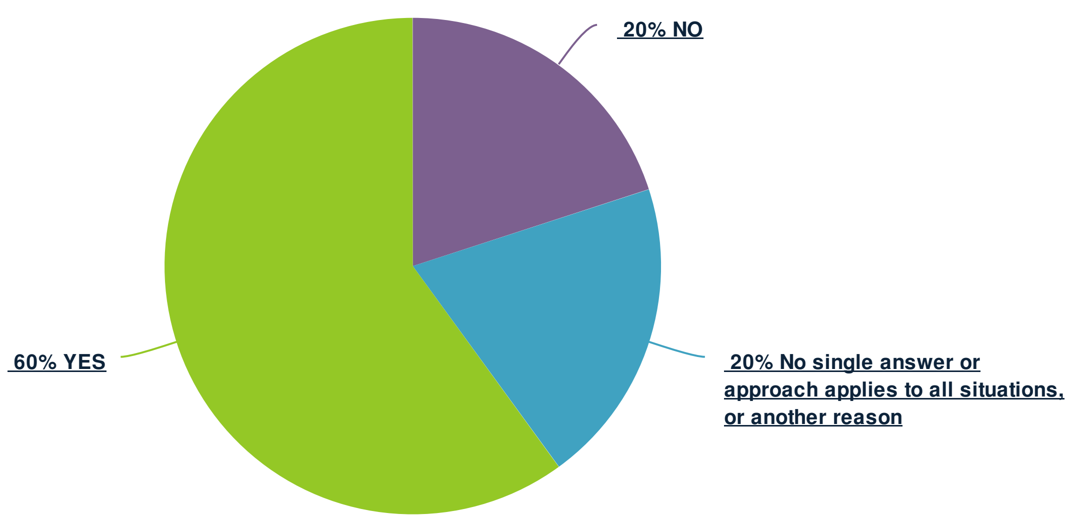
ResponseID	Response
26	While 49CFR193 does address changes and most companies have their own form of MOC it could be helpful to put MOC minimum content in 59A 2022 edition appendix for facilities thinking about adopting a more formal MOC plan
31	MOC is another pillar of PSM. An Operator cannot manage risk with out assuring that any changes to a facility, procedures or people is done with an eye towards Process Safety.

46. Should this potential gap be addressed?



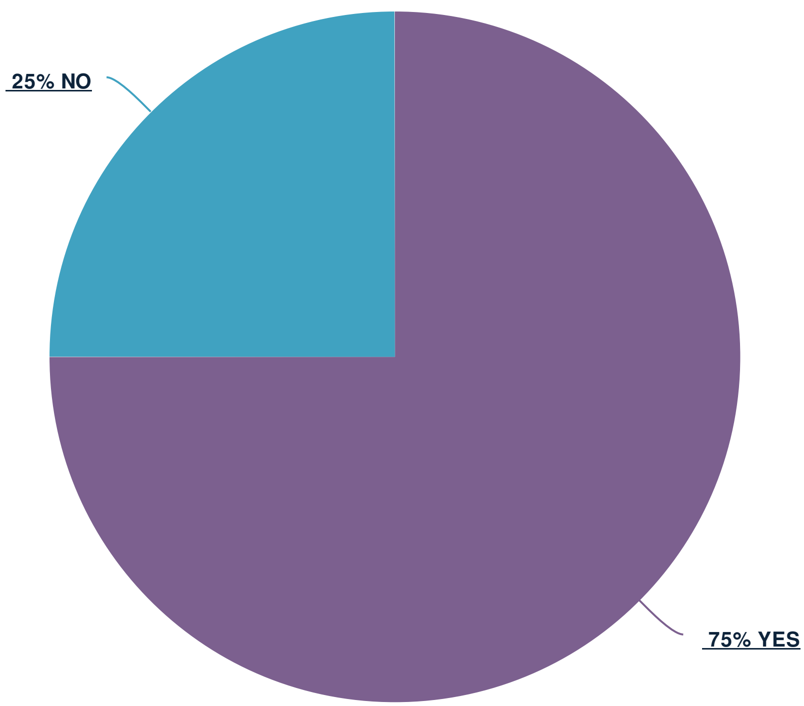
Response	Total Responses	Percent
YES — Voluntary practice by Operator	3	33.3%
NO — No need to address gap, because gap is incorrectly stated; in reality, there is no gap	1	11.1%
NO — No single answer or approach applies to all situations, or another reason	1	11.1%
No single answer or approach applies to all situations, or another reason — NO	1	11.1%
YES — Potential revision to 49CFR193 made at #1 Low Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	11.1%
YES — Potential revision to 49CFR193 made at #3 High Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	11.1%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	1	11.1%

Small Scale



Response	Total Responses	Percent
NO — No need to address gap, because gap is incorrectly stated; in reality, there is no gap	1	20.0%
No single answer or approach applies to all situations, or another reason — NO	1	20.0%
YES — Potential revision to 49CFR193 made at #1 Low Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	20.0%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	1	20.0%
YES — Voluntary practice by Operator	1	20.0%

Terminals



Response	Total Responses	Percent
YES — Voluntary practice by Operator	2	50.0%
NO — No single answer or approach applies to all situations, or another reason	1	25.0%
YES — Potential revision to 49CFR193 made at #3 High Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	25.0%

47. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

All

ResponseID	Response
27	This requirement is loosely implied by CFR 193.2503(c) and 2521, but could use some clarification
30	In today's corporate and gas industry safety environment, I don't believe this to be a gap. Near misses, root cause analysis, and apparent cause analysis studies and reporting are performed regularly in our industry.
31	Operators should follow a tiered system similar to API.

Small Scale

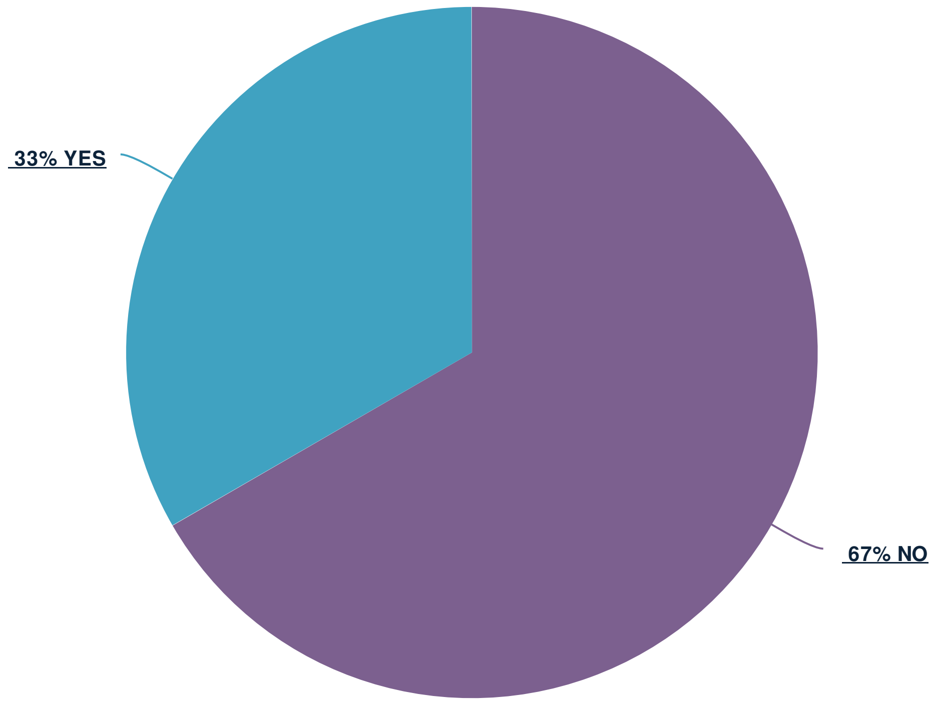
ResponseID	Response
27	This requirement is loosely implied by CFR 193.2503(c) and 2521, but could use some clarification
30	In today's corporate and gas industry safety environment, I don't believe this to be a gap. Near misses, root cause analysis, and apparent cause analysis studies and reporting are performed regularly in our industry.

Terminals

ResponseID	Response
31	Operators should follow a tiered system similar to API.

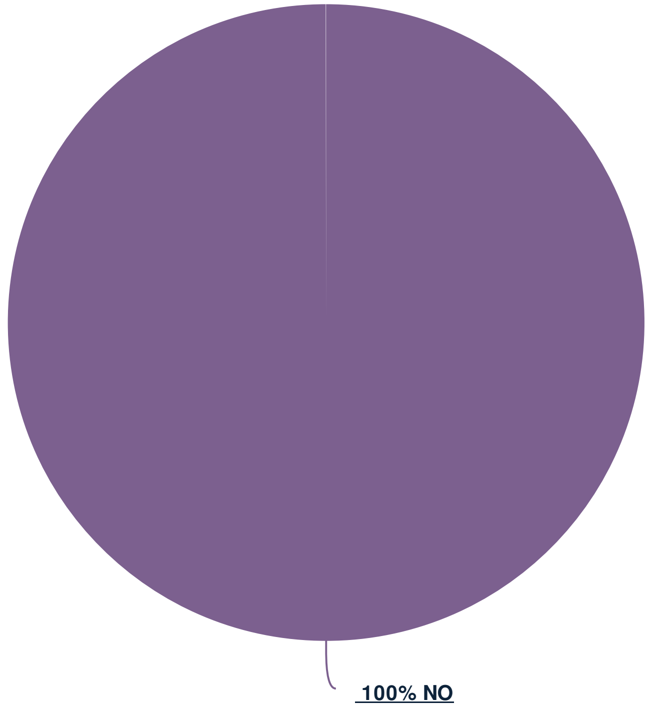
48. Should this potential gap be addressed?

All



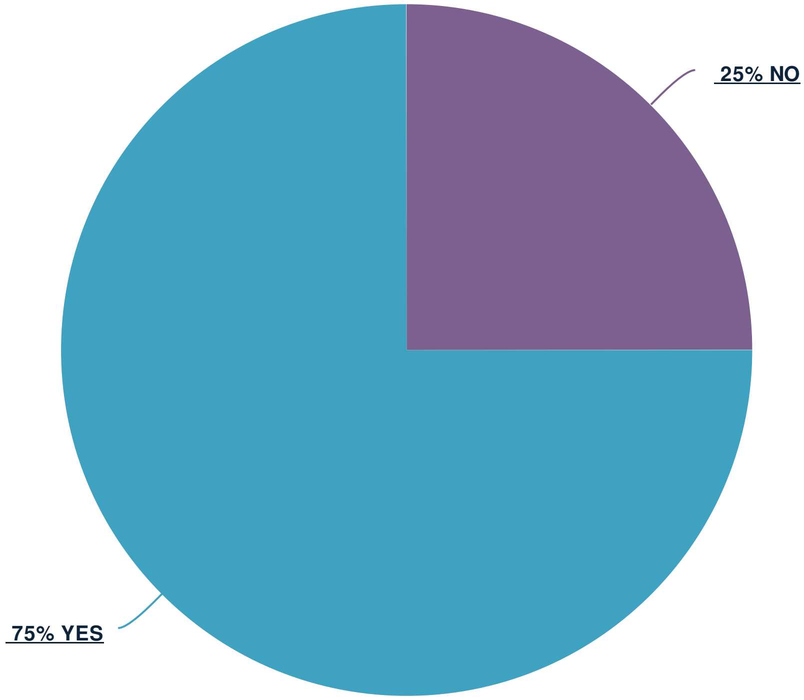
Response	Total Responses	Percent
NO — No need to address gap, because gap is of negligible importance	4	44.4%
NO — No need to address gap, because gap is incorrectly stated; in reality, there is no gap	1	11.1%
NO — No single answer or approach applies to all situations, or another reason	1	11.1%
YES — Potential revision to 49CFR193 made at #2 Medium Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	11.1%
YES — Potential revision to 49CFR193 made at #3 High Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	11.1%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	1	11.1%

Small Scale



Response	Total Responses	Percent
NO — No need to address gap, because gap is of negligible importance	3	60.0%
NO — No need to address gap, because gap is incorrectly stated; in reality, there is no gap	1	20.0%
NO — No single answer or approach applies to all situations, or another reason	1	20.0%

Terminals



Response	Total Responses	Percent
NO — No need to address gap, because gap is of negligible importance	1	25.0%
YES — Potential revision to 49CFR193 made at #2 Medium Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	25.0%
YES — Potential revision to 49CFR193 made at #3 High Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	25.0%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	1	25.0%

49. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

All

ResponseID	Response
28	Would like more flexibility on timeliness to report based on severity to prevent unnecessary reporting
30	Although this is more rigorous than other reporting time requirements, we would only wonder what public opposition would be receive should an incident occur and the reporting time was perceive to be inadequate. We are confident that the one hour notification, while being onerous to comply, would be perceived by the general public as adequate.
31	Stay with more rigorous requirement.

Small Scale

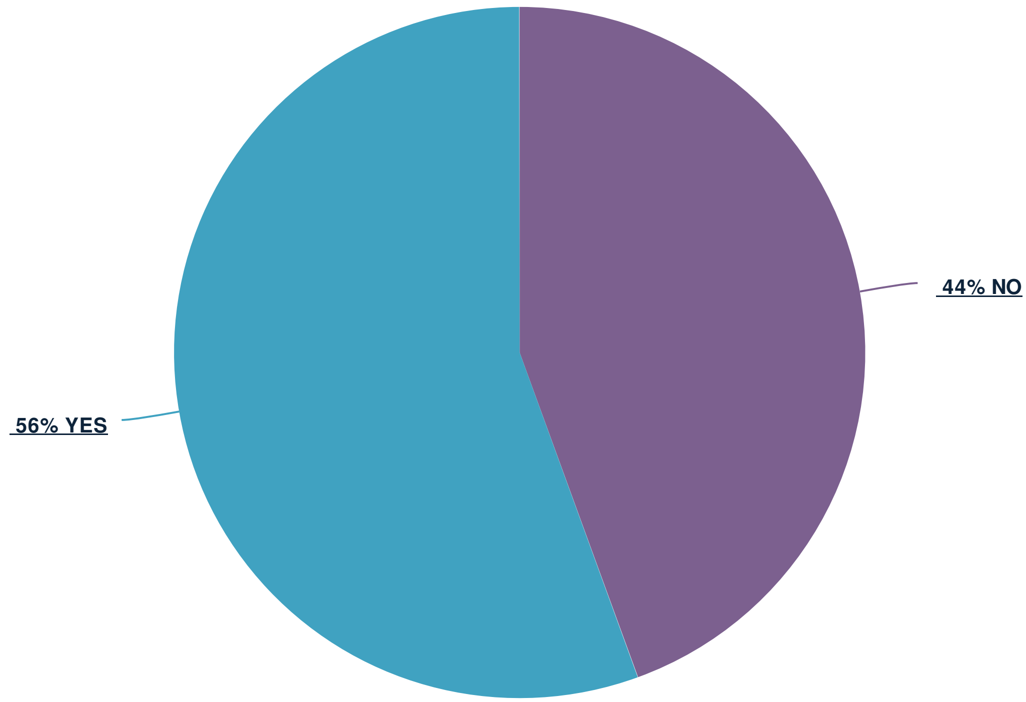
ResponseID	Response
30	Although this is more rigorous than other reporting time requirements, we would only wonder what public opposition would be receive should an incident occur and the reporting time was perceive to be inadequate. We are confident that the one hour notification, while being onerous to comply, would be perceived by the general public as adequate.

Terminals

ResponseID	Response
28	Would like more flexibility on timeliness to report based on severity to prevent unnecessary reporting
31	Stay with more rigorous requirement.

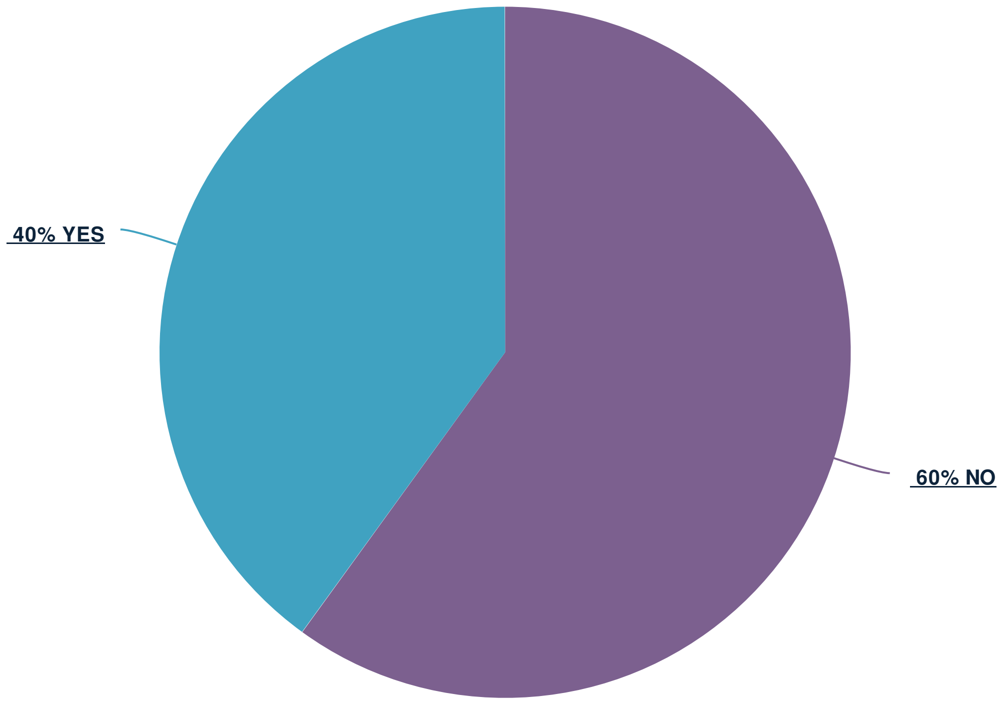
50. Should this potential gap be addressed?

All



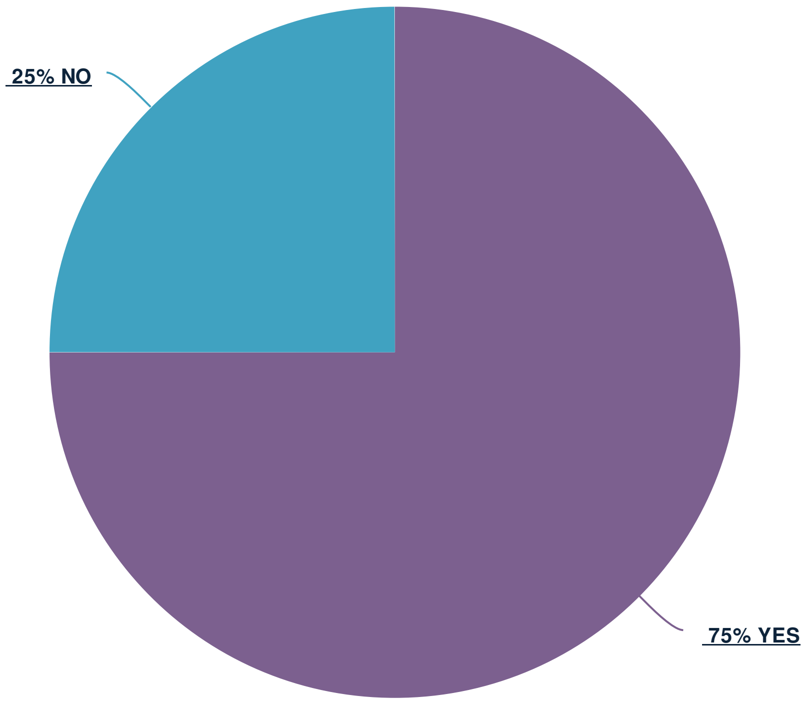
Response	Total Responses	Percent
NO — No single answer or approach applies to all situations, or another reason	4	44.4%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	3	33.3%
YES — Potential revision to 49CFR193 made at #2 Medium Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	11.1%
YES — Voluntary practice by Operator	1	11.1%

Small Scale



Response	Total Responses	Percent
NO — No single answer or approach applies to all situations, or another reason	3	60.0%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	1	20.0%
YES — Voluntary practice by Operator	1	20.0%

Terminals



Response	Total Responses	Percent
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	2	50.0%
NO — No single answer or approach applies to all situations, or another reason	1	25.0%
YES — Potential revision to 49CFR193 made at #2 Medium Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	25.0%

51. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

All

ResponseID	Response
30	Although this is a best practice, it should be left up to the operator to manage this process effectively.
31	How can an Operator's organization learn from incidents without a rigorous investigation.

Small Scale

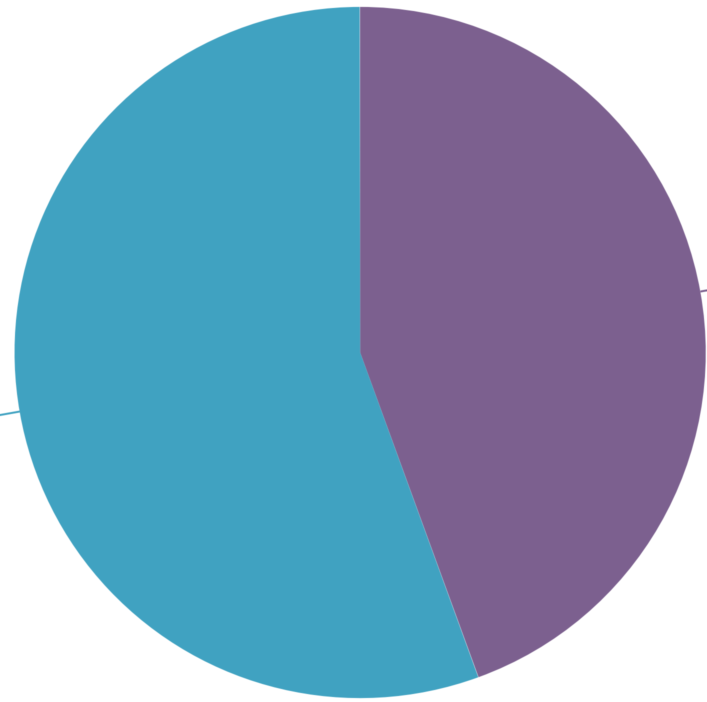
ResponseID	Response
30	Although this is a best practice, it should be left up to the operator to manage this process effectively.

Terminals

ResponseID	Response
31	How can an Operator's organization learn from incidents without a rigorous investigation.

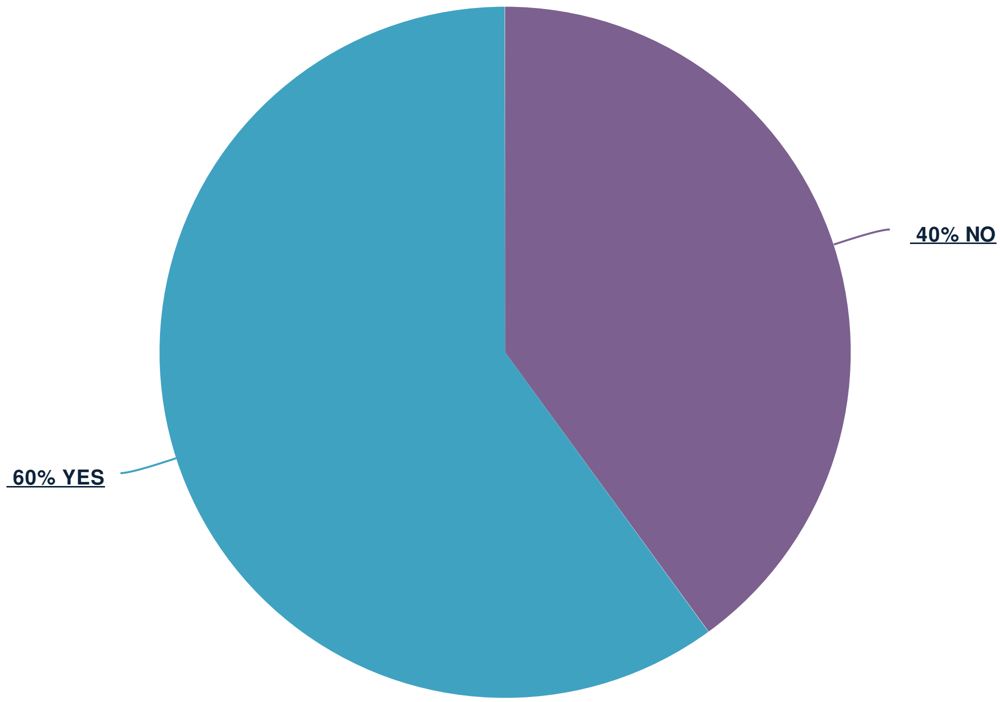
52. Should this potential gap be addressed?

All



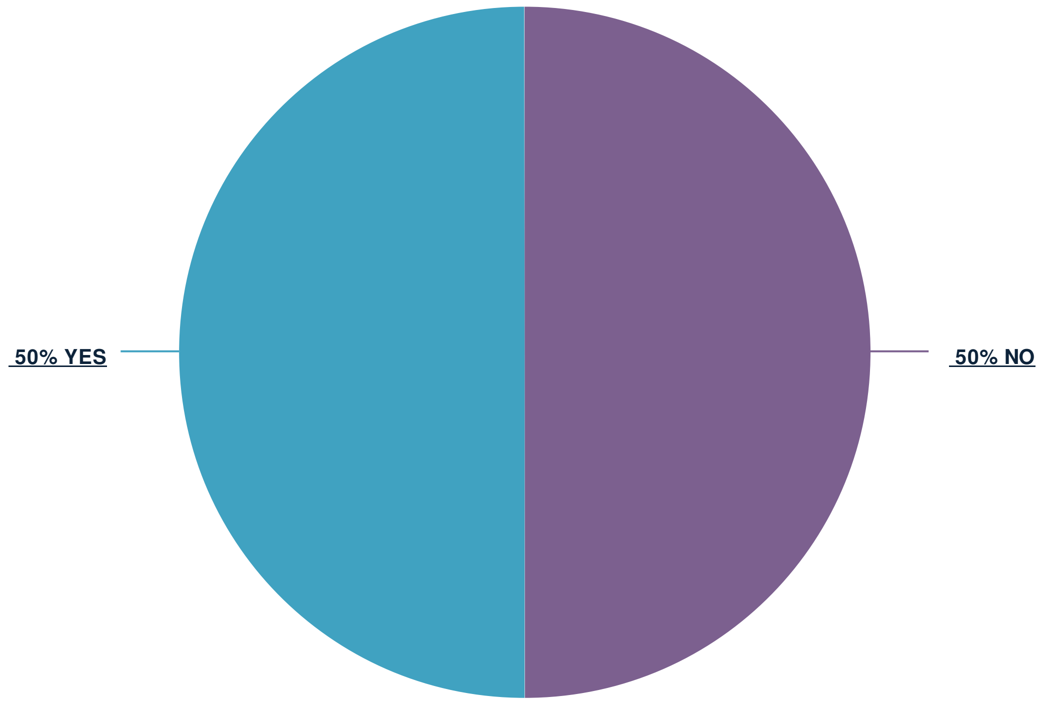
Response	Total Responses	Percent
NO — No single answer or approach applies to all situations, or another reason	4	44.4%
YES — Potential revision to 49CFR193 made at #2 Medium Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	2	22.2%
YES — Potential revision to 49CFR193 made at #1 Low Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	11.1%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	1	11.1%
YES — Voluntary practice by Operator	1	11.1%

Small Scale



Response	Total Responses	Percent
NO — No single answer or approach applies to all situations, or another reason	2	40.0%
YES — Potential revision to 49CFR193 made at #1 Low Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	20.0%
YES — Potential revision to 49CFR193 made at #2 Medium Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	20.0%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	1	20.0%

Terminals



Response	Total Responses	Percent
NO — No single answer or approach applies to all situations, or another reason	2	50.0%
YES — Potential revision to 49CFR193 made at #2 Medium Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	25.0%
YES — Voluntary practice by Operator	1	25.0%

53. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

All

ResponseID	Response
26	Each corporation has their own means of addressing findings and lessons learned the elements addressed above should be a minimum list included in appendix not a prescriptive requirement
30	Although this is a best practice, it should be left up to the operator to manage this process effectively.
31	How can an Operator's organization learn from incidents without a rigorous investigation. Follow up of actions must be driven from top down.

Small Scale

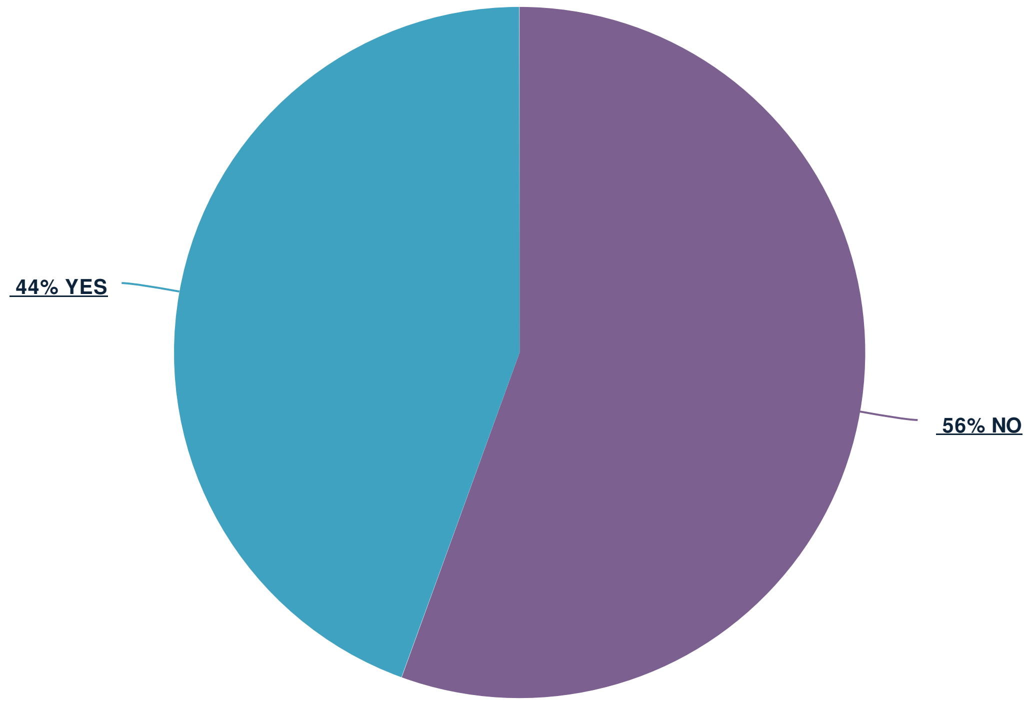
ResponseID	Response
30	Although this is a best practice, it should be left up to the operator to manage this process effectively.

Terminals

ResponseID	Response
26	Each corporation has their own means of addressing findings and lessons learned the elements addressed above should be a minimum list included in appendix not a prescriptive requirement
31	How can an Operator's organization learn from incidents without a rigorous investigation. Follow up of actions must be driven from top down.

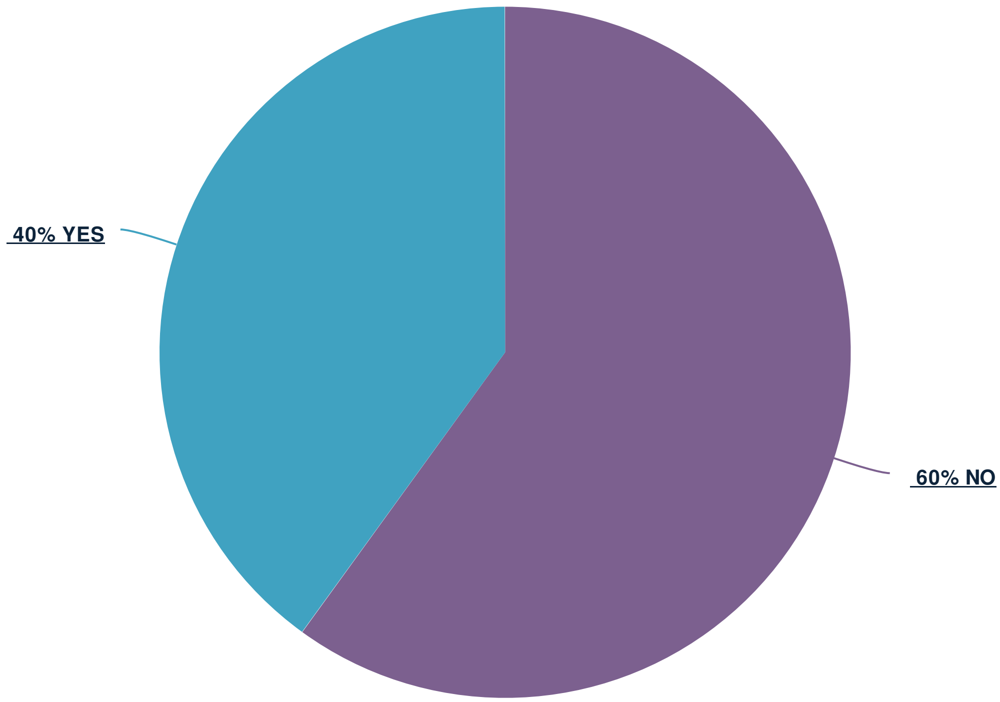
54. Should this potential gap be addressed?

All



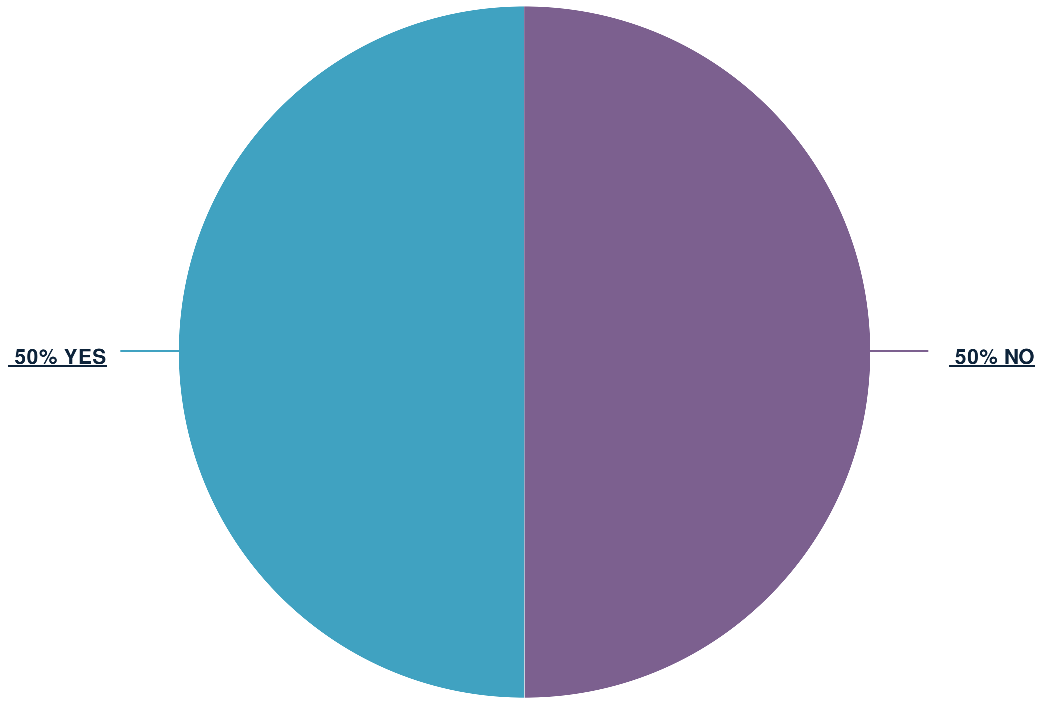
Response	Total Responses	Percent
NO — No single answer or approach applies to all situations, or another reason	4	44.4%
YES — Potential revision to 49CFR193 made at #2 Medium Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	2	22.2%
YES — Voluntary practice by Operator	2	22.2%
NO — No need to address gap, because gap is of negligible importance	1	11.1%

Small Scale



Response	Total Responses	Percent
NO — No single answer or approach applies to all situations, or another reason	3	60.0%
YES — Potential revision to 49CFR193 made at #2 Medium Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	20.0%
YES — Voluntary practice by Operator	1	20.0%

Terminals



Response	Total Responses	Percent
NO — No need to address gap, because gap is of negligible importance	1	25.0%
NO — No single answer or approach applies to all situations, or another reason	1	25.0%
YES — Potential revision to 49CFR193 made at #2 Medium Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	25.0%
YES — Voluntary practice by Operator	1	25.0%

55. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

All

ResponseID	Response
28	No standard for five year frequency, currently lesson learned from reportable incidents are addressed with corrective actions
30	Although this is a best practice, it should be left up to the operator to manage this process effectively.
31	Consider doing prior to PHA revalidation. Organizations need to set aside time to reflect and review incidents both internal and external to the organization.

Small Scale

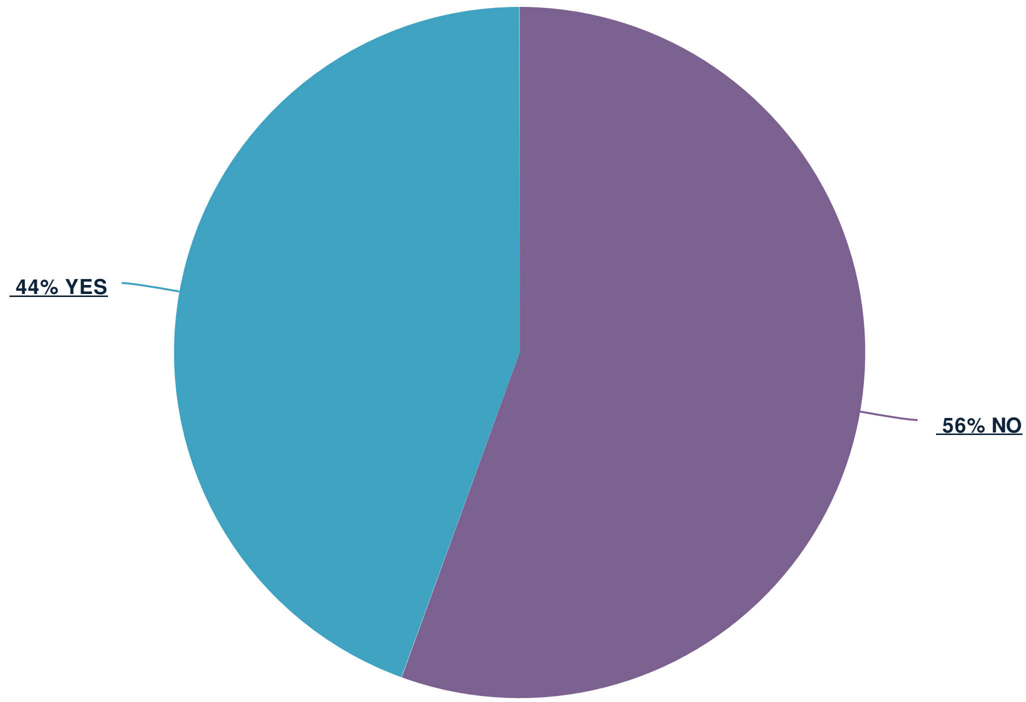
ResponseID	Response
30	Although this is a best practice, it should be left up to the operator to manage this process effectively.

Terminals

ResponseID	Response
28	No standard for five year frequency, currently lesson learned from reportable incidents are addressed with corrective actions
31	Consider doing prior to PHA revalidation. Organizations need to set aside time to reflect and review incidents both internal and external to the organization.

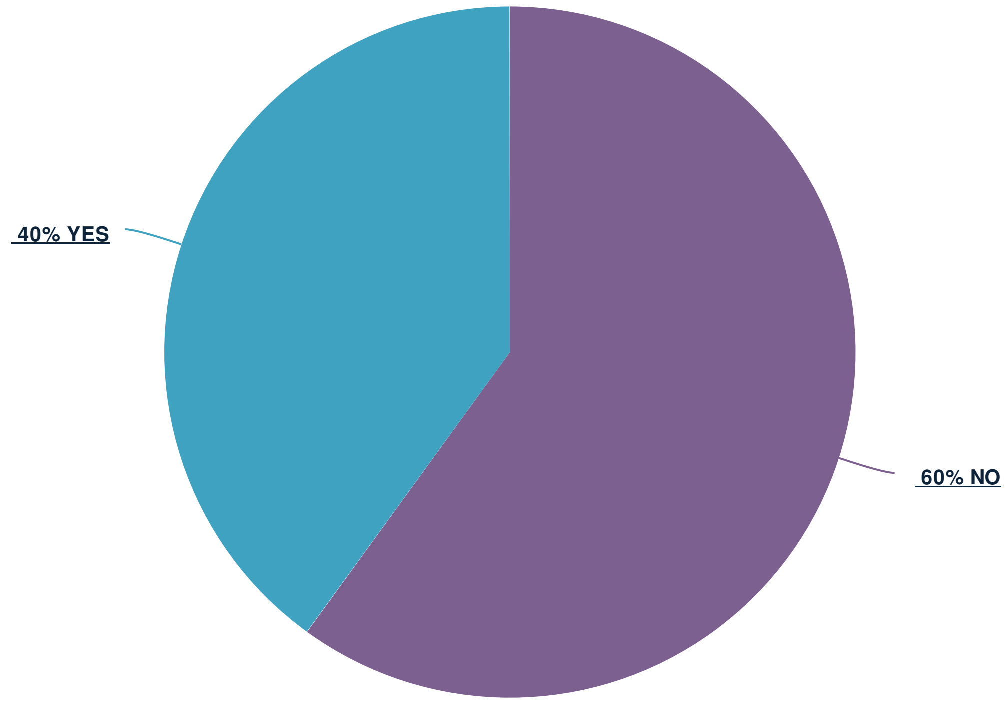
56. Should this potential gap be addressed?

All



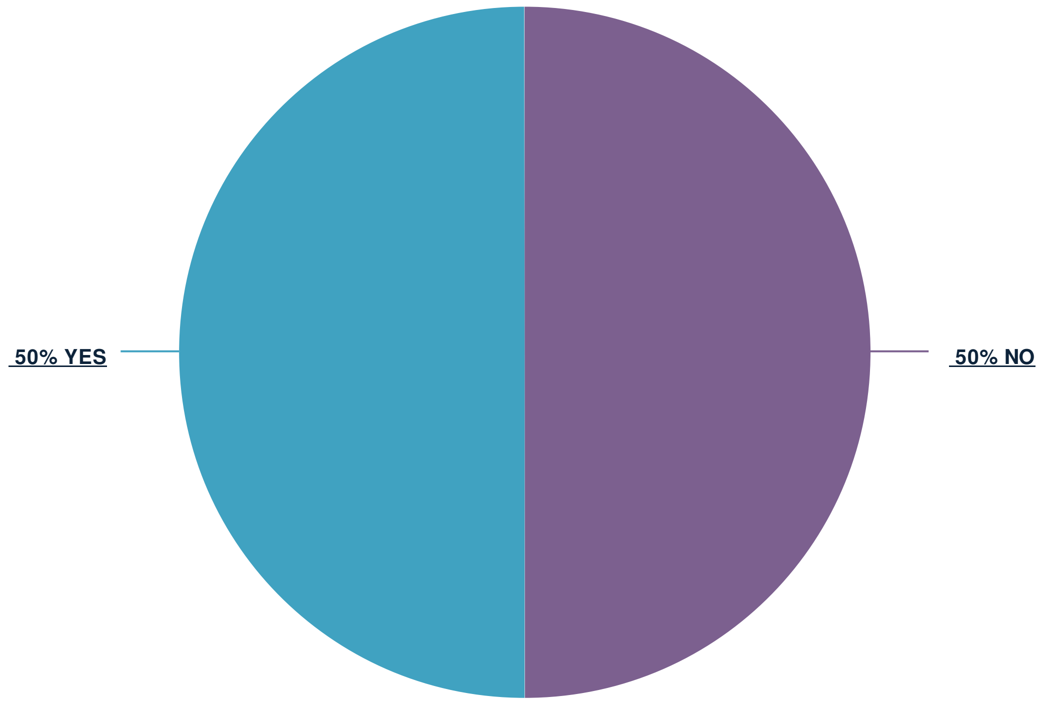
Response	Total Responses	Percent
NO — No need to address gap, because gap is of negligible importance	3	33.3%
NO — No single answer or approach applies to all situations, or another reason	2	22.2%
YES — Voluntary practice by Operator	2	22.2%
YES — Potential revision to 49CFR193 made at #1 Low Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	11.1%
YES — Potential revision to 49CFR193 made at #3 High Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	11.1%

Small Scale



Response	Total Responses	Percent
NO — No need to address gap, because gap is of negligible importance	3	60.0%
YES — Potential revision to 49CFR193 made at #3 High Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	20.0%
YES — Voluntary practice by Operator	1	20.0%

Terminals



Response	Total Responses	Percent
NO — No single answer or approach applies to all situations, or another reason	2	50.0%
YES — Potential revision to 49CFR193 made at #1 Low Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	25.0%
YES — Voluntary practice by Operator	1	25.0%

57. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

All

ResponseID	Response
30	There is no need for this analysis because the risk of this is too low to reasonably expect.
31	And any other force majeures that might leave a facility understaffed.

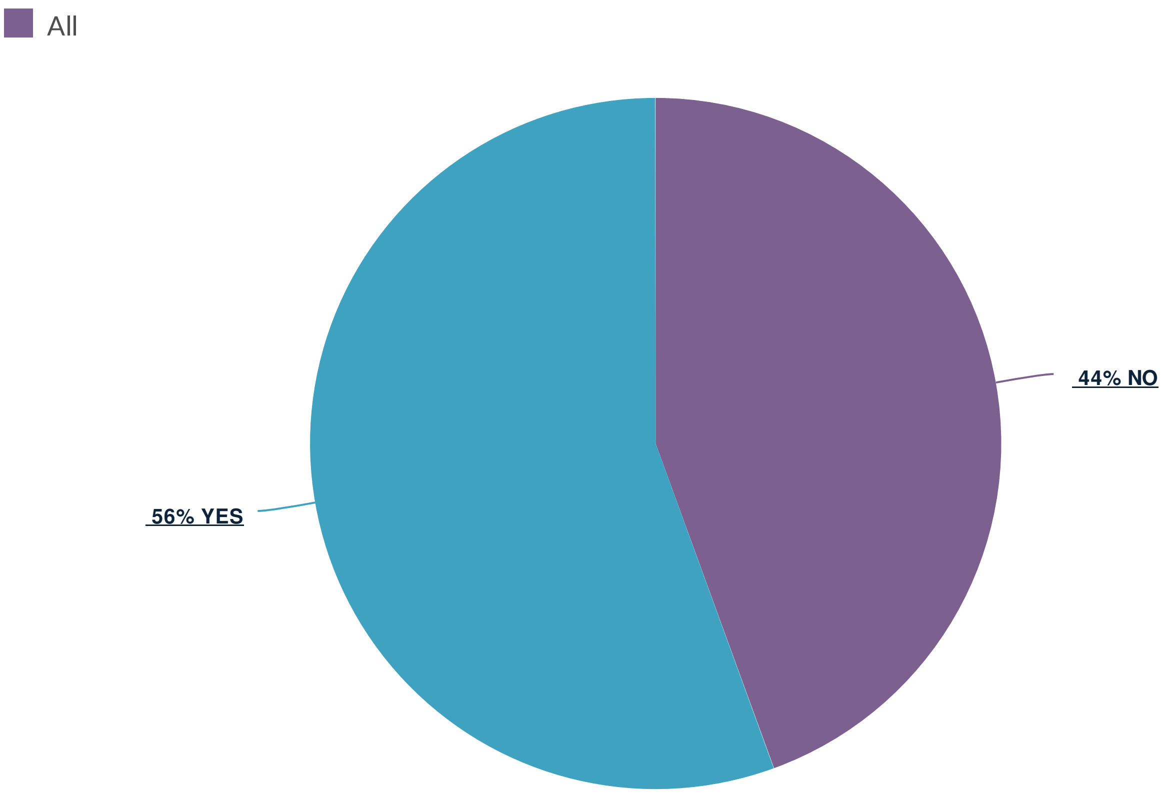
Small Scale

ResponseID	Response
30	There is no need for this analysis because the risk of this is too low to reasonably expect.

Terminals

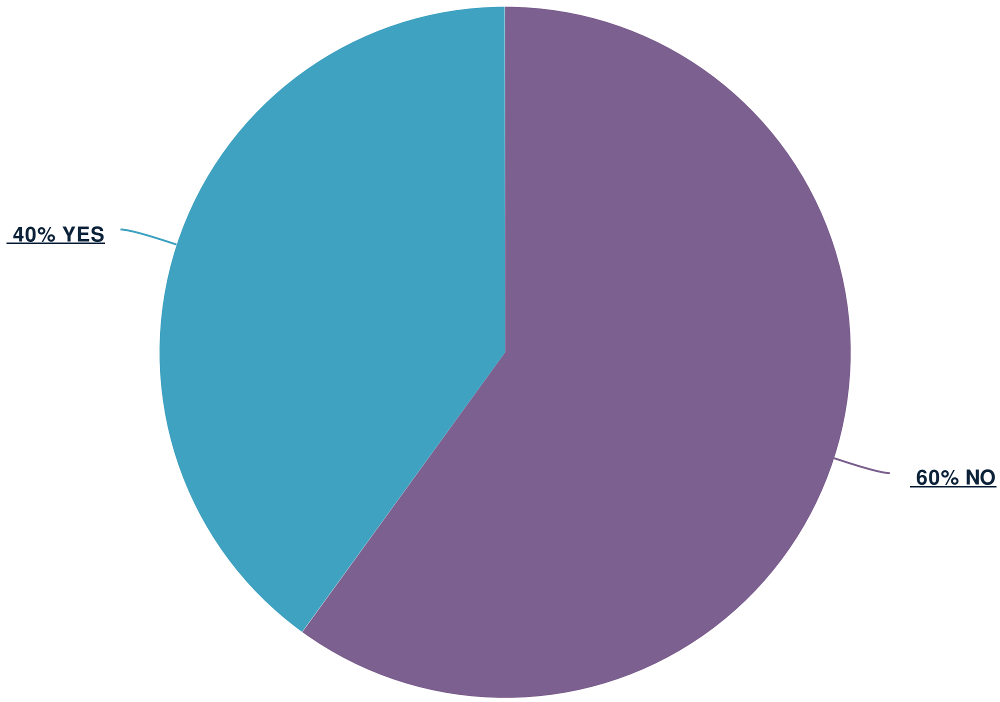
ResponseID	Response
31	And any other force majeures that might leave a facility understaffed.

58. Should this potential gap be addressed?



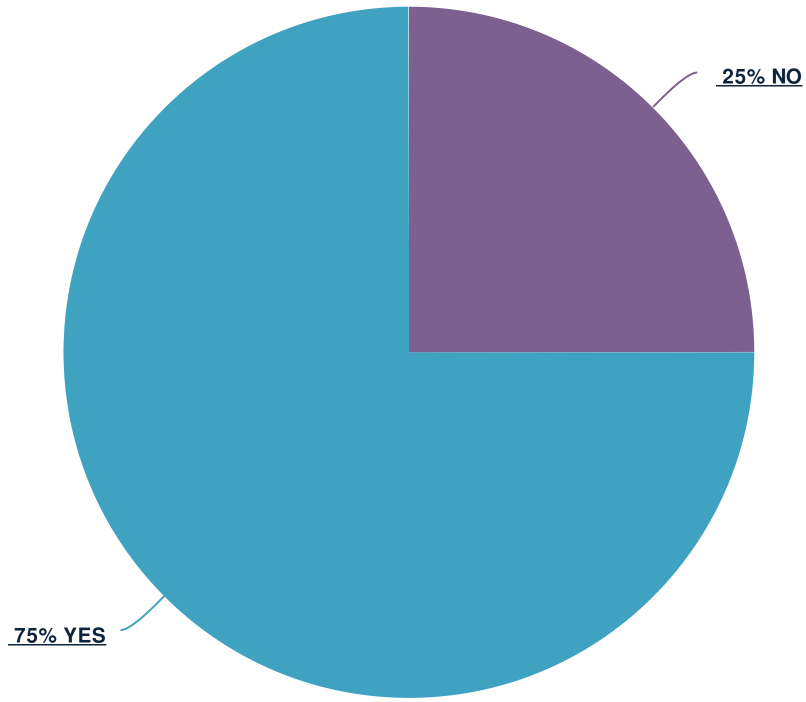
Response	Total Responses	Percent
NO — No single answer or approach applies to all situations, or another reason	2	22.2%
NO — No need to address gap, because gap is incorrectly stated; in reality, there is no gap	1	11.1%
NO — No need to address gap, because gap is of negligible importance	1	11.1%
YES — Potential revision to 49CFR193 made at #1 Low Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	11.1%
YES — Potential revision to 49CFR193 made at #2 Medium Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	11.1%
YES — Potential revision to 49CFR193 made at #3 High Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	11.1%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	1	11.1%
YES — Voluntary practice by Operator	1	11.1%

Small Scale



Response	Total Responses	Percent
NO — No need to address gap, because gap is incorrectly stated; in reality, there is no gap	1	20.0%
NO — No need to address gap, because gap is of negligible importance	1	20.0%
NO — No single answer or approach applies to all situations, or another reason	1	20.0%
YES — Potential revision to 49CFR193 made at #1 Low Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	20.0%
YES — Potential revision to 49CFR193 made at #2 Medium Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	20.0%

Terminals



Response	Total Responses	Percent
NO — No single answer or approach applies to all situations, or another reason	1	25.0%
YES — Potential revision to 49CFR193 made at #3 High Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	25.0%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	1	25.0%
YES — Voluntary practice by Operator	1	25.0%

59. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

All

ResponseID	Response
30	In today's corporate and gas industry safety environment, we don't believe this to be a gap. Company policies should cover this requirement.
31	Headcount is critical to ERP. Never send a First Responder in after someone who's no longer in the affected zone.

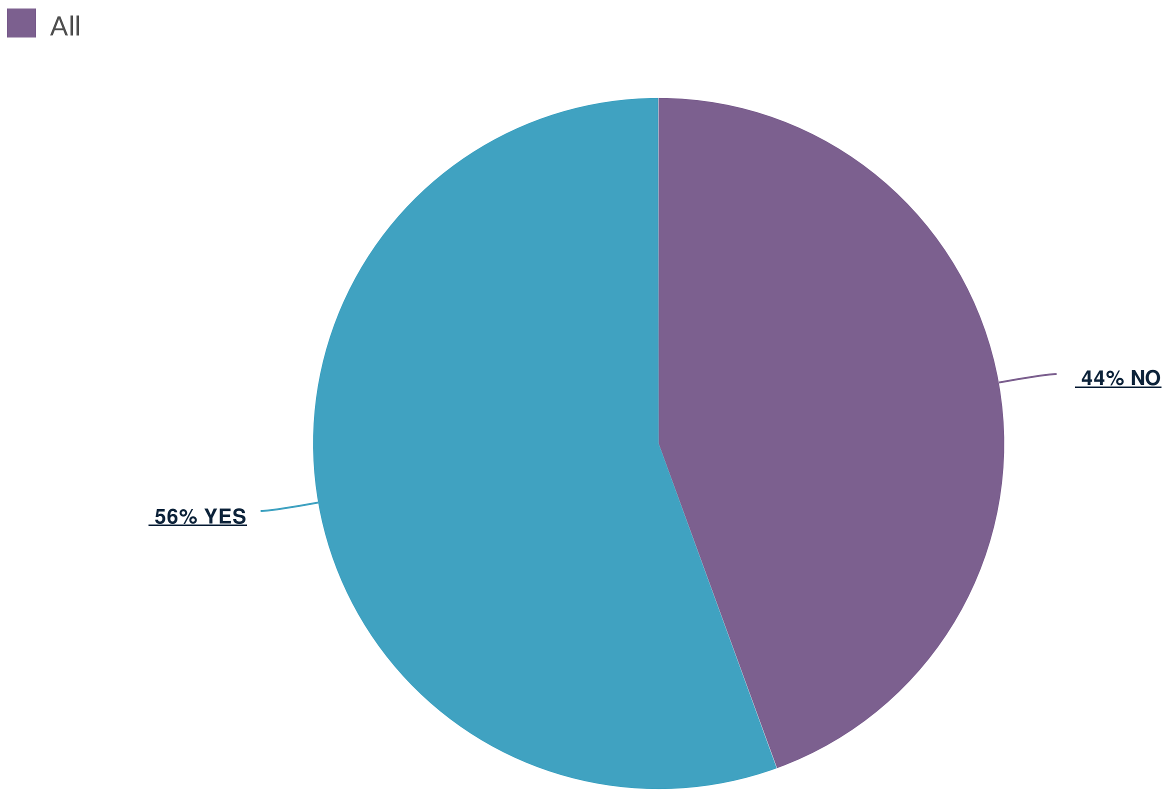
Small Scale

ResponseID	Response
30	In today's corporate and gas industry safety environment, we don't believe this to be a gap. Company policies should cover this requirement.

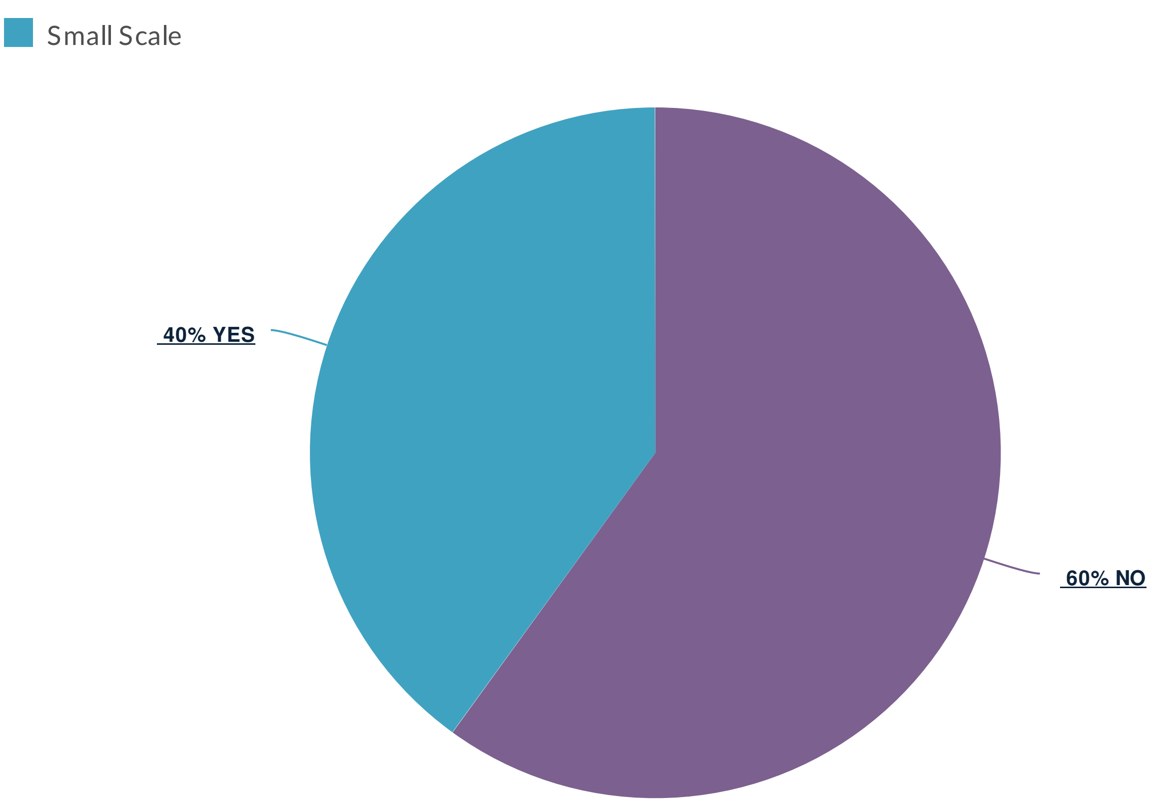
Terminals

ResponseID	Response
31	Headcount is critical to ERP. Never send a First Responder in after someone who's no longer in the affected zone.

60. Should this potential gap be addressed?

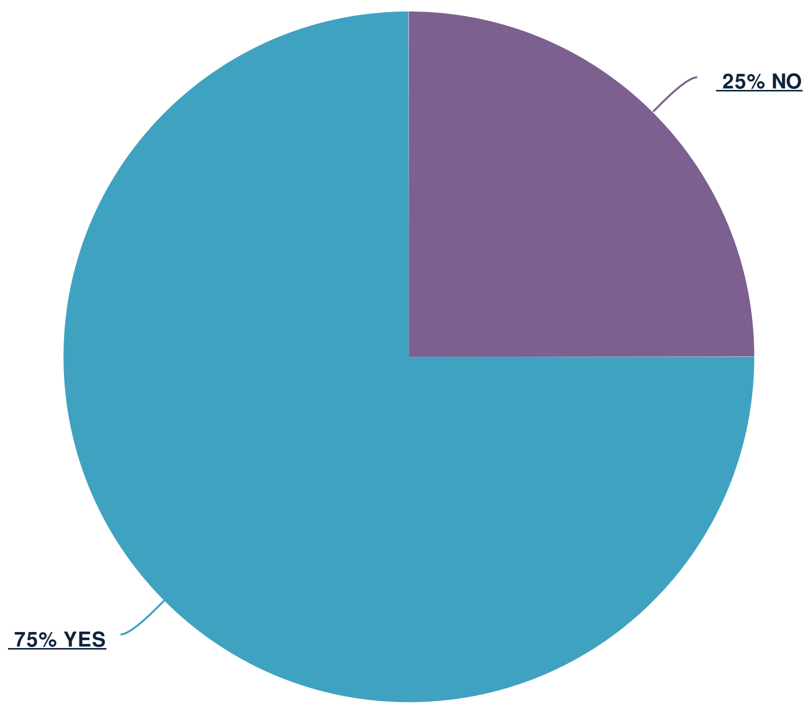


Response	Total Responses	Percent
NO — No single answer or approach applies to all situations, or another reason	2	22.2%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	2	22.2%
NO — No need to address gap, because gap is incorrectly stated; in reality, there is no gap	1	11.1%
NO — No need to address gap, because gap is of negligible importance	1	11.1%
YES — Potential revision to 49CFR193 made at #1 Low Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	11.1%
YES — Potential revision to 49CFR193 made at #3 High Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	11.1%
YES — Voluntary practice by Operator	1	11.1%



Response	Total Responses	Percent
NO — No need to address gap, because gap is incorrectly stated; in reality, there is no gap	1	20.0%
NO — No need to address gap, because gap is of negligible importance	1	20.0%
NO — No single answer or approach applies to all situations, or another reason	1	20.0%
YES — Potential revision to 49CFR193 made at #1 Low Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	20.0%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	1	20.0%

Terminals



Response	Total Responses	Percent
NO — No single answer or approach applies to all situations, or another reason	1	25.0%
YES — Potential revision to 49CFR193 made at #3 High Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	25.0%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	1	25.0%
YES — Voluntary practice by Operator	1	25.0%

61. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

All

ResponseID	Response
30	Although this is a best practice, it should be left up to the operator to manage this process effectively.
31	Coordination/training with Mutual Aid partners saves lives.

Small Scale

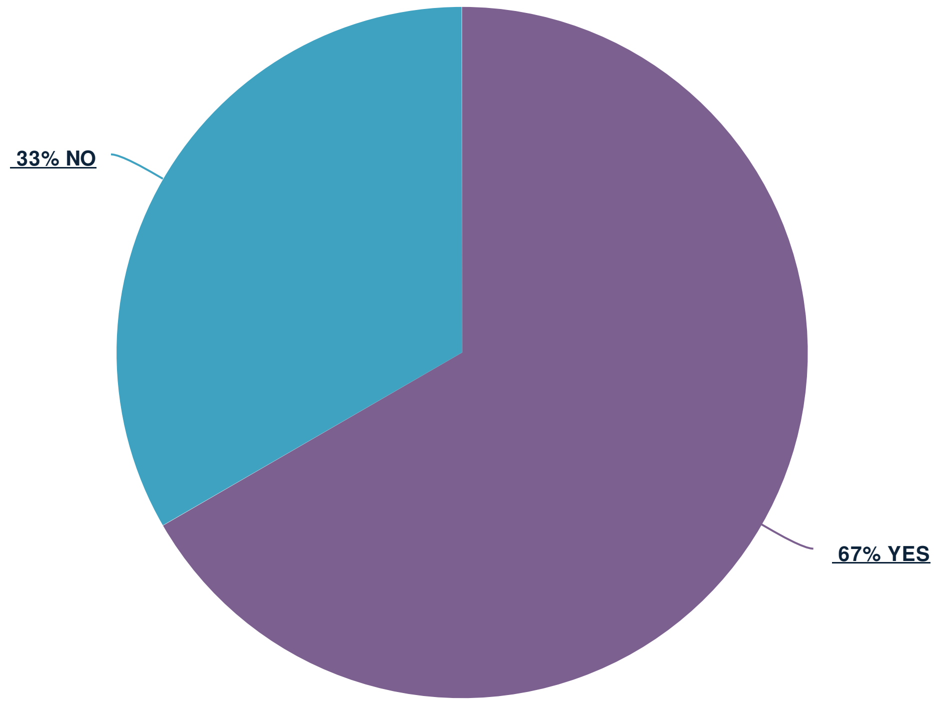
ResponseID	Response
30	Although this is a best practice, it should be left up to the operator to manage this process effectively.

Terminals

ResponseID	Response
31	Coordination/training with Mutual Aid partners saves lives.

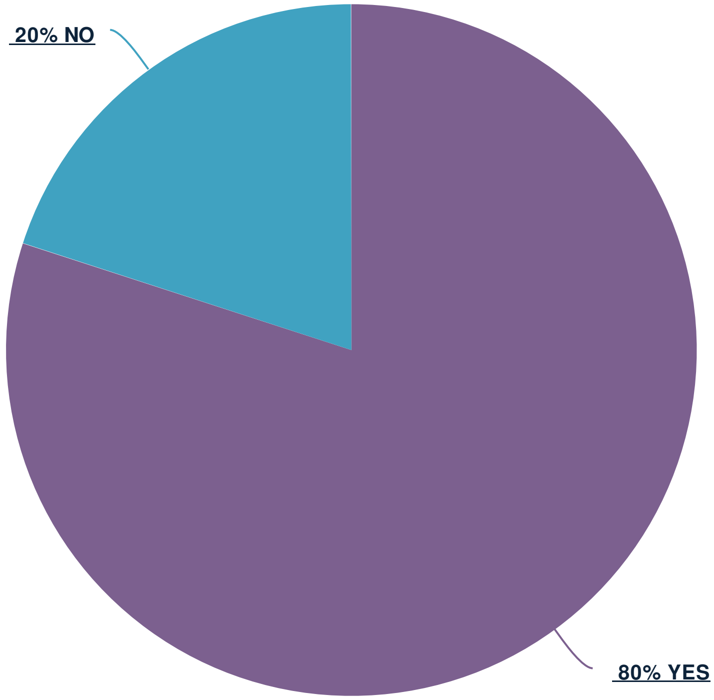
62. Should this potential gap be addressed?

All



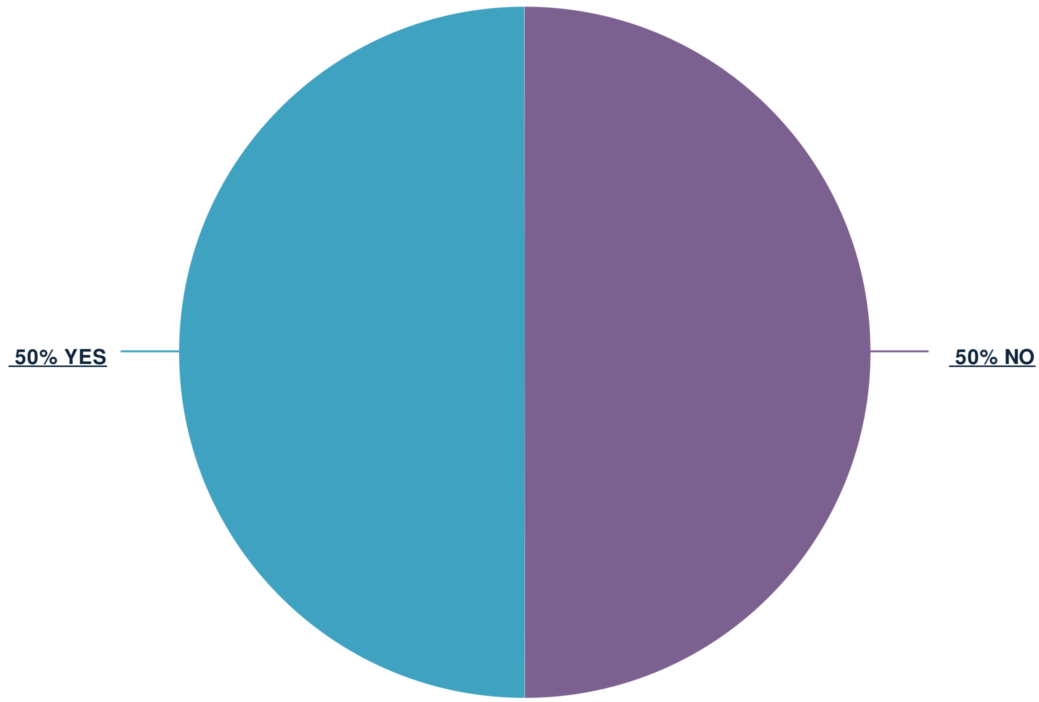
Response	Total Responses	Percent
YES — Potential revision to 49CFR193 made at #1 Low Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	3	33.3%
NO — No need to address gap, because gap is incorrectly stated; in reality, there is no gap	2	22.2%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	2	22.2%
NO — No single answer or approach applies to all situations, or another reason	1	11.1%
YES — Potential revision to 49CFR193 made at #3 High Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	11.1%

Small Scale



Response	Total Responses	Percent
YES — Potential revision to 49CFR193 made at #1 Low Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	3	60.0%
NO — No single answer or approach applies to all situations, or another reason	1	20.0%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	1	20.0%

Terminals



Response	Total Responses	Percent
NO — No need to address gap, because gap is incorrectly stated; in reality, there is no gap	2	50.0%
YES — Potential revision to 49CFR193 made at #3 High Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	25.0%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	1	25.0%

63. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

All

ResponseID	Response
26	Under training in 49 CFR 193 you are required to train your people in the event of an emergency ie fire, evacuation etc this is done at intervals not to exceed to years this would require the use of the notification mechanisms.
30	EPA guidelines and regulations shall be followed where applicable.
31	Practice Emergency Response saves time and reduces confusion in actual emergencies. You don't train firefighters after the building has caught fire.

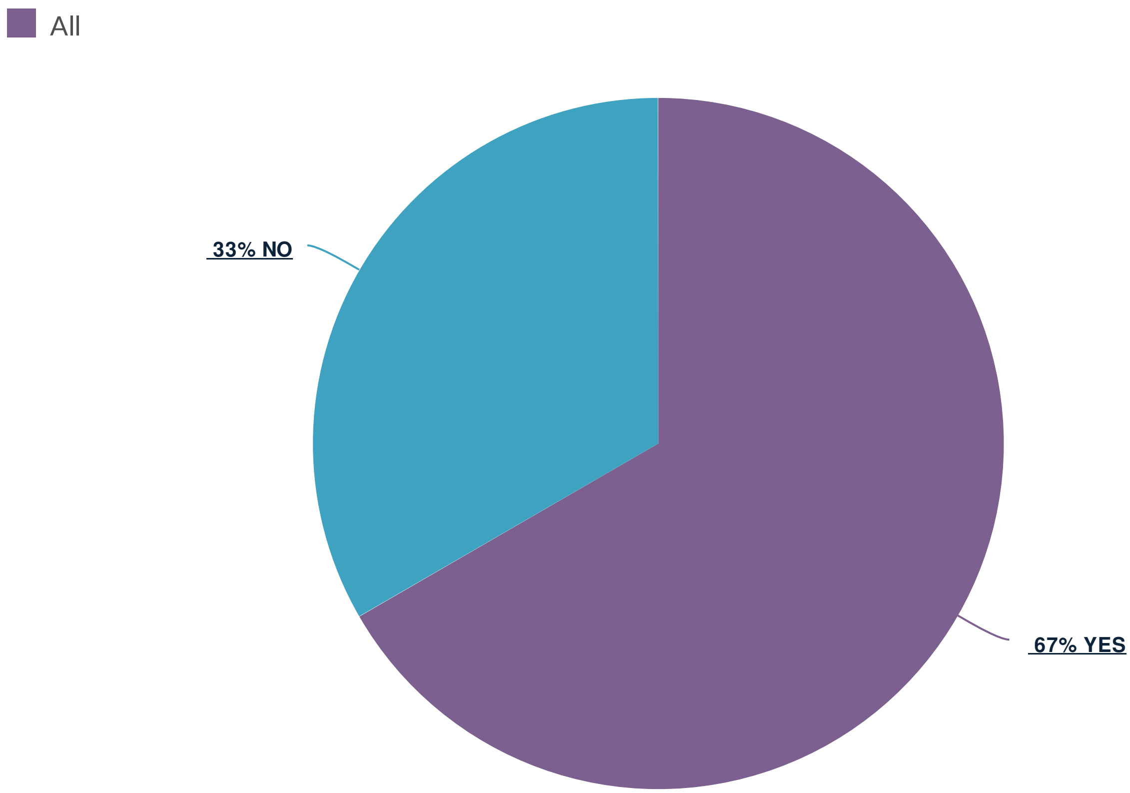
Small Scale

ResponseID	Response
30	EPA guidelines and regulations shall be followed where applicable.

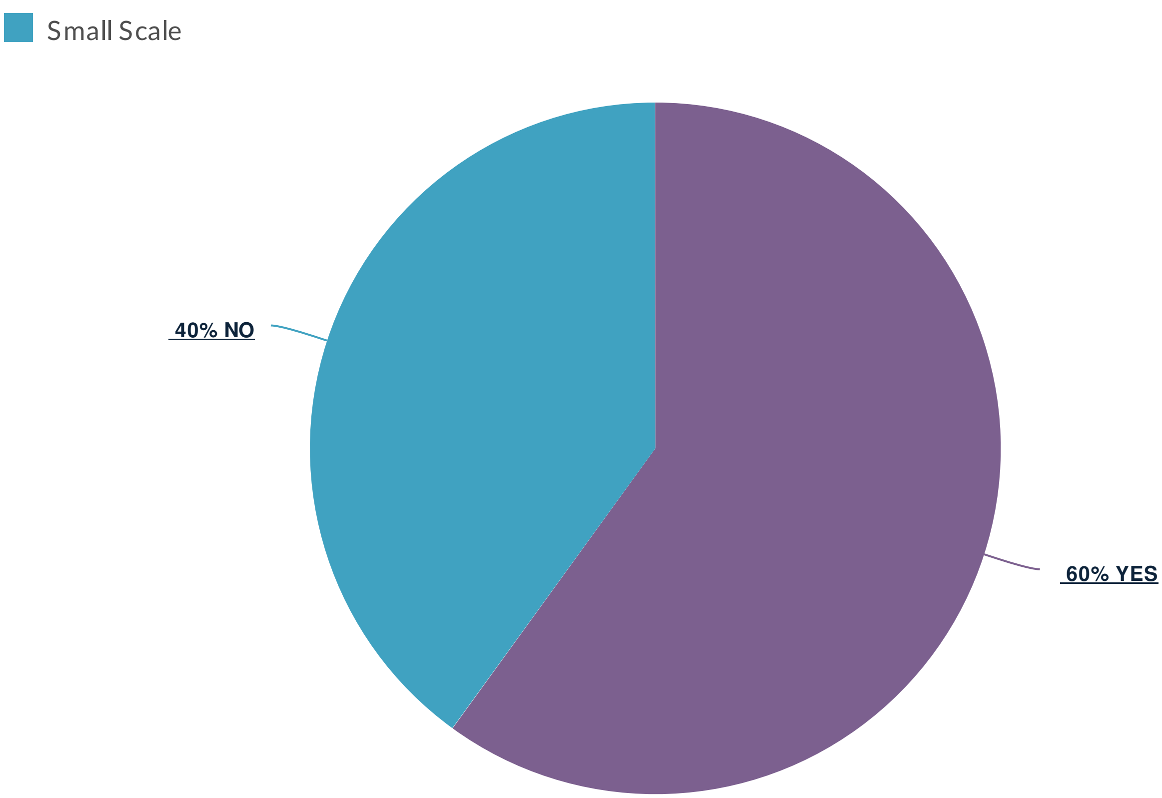
Terminals

ResponseID	Response
26	Under training in 49 CFR 193 you are required to train your people in the event of an emergency ie fire, evacuation etc this is done at intervals not to exceed to years this would require the use of the notification mechanisms.
31	Practice Emergency Response saves time and reduces confusion in actual emergencies. You don't train firefighters after the building has caught fire.

64. Should this potential gap be addressed?

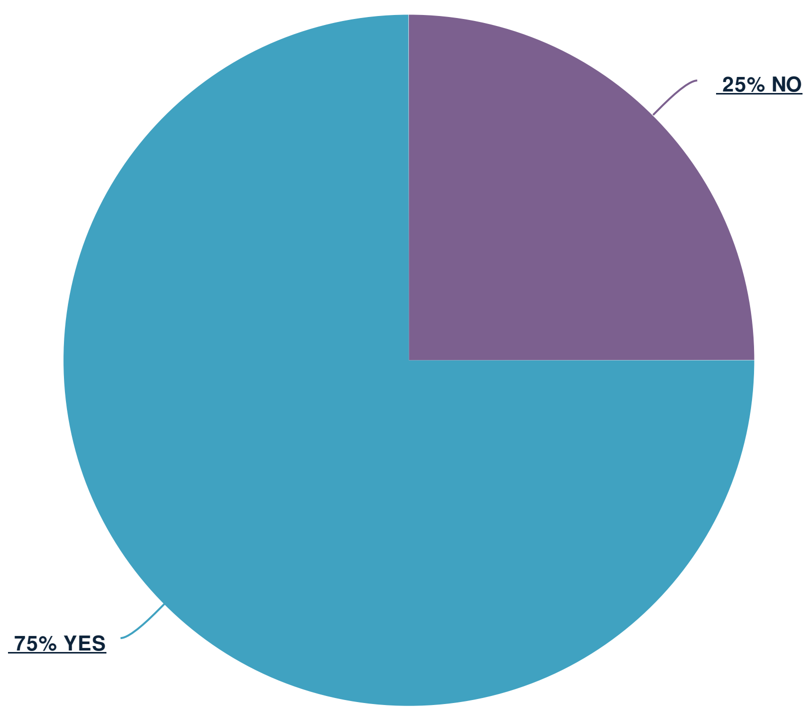


Response	Total Responses	Percent
YES — Potential revision to 49CFR193 made at #1 Low Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	2	22.2%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	2	22.2%
NO — No need to address gap, because gap is incorrectly stated; in reality, there is no gap	1	11.1%
NO — No need to address gap, because gap is of negligible importance	1	11.1%
NO — No single answer or approach applies to all situations, or another reason	1	11.1%
YES — Potential revision to 49CFR193 made at #3 High Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	11.1%
YES — Voluntary practice by Operator	1	11.1%



Response	Total Responses	Percent
YES — Potential revision to 49CFR193 made at #1 Low Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	2	40.0%
NO — No need to address gap, because gap is of negligible importance	1	20.0%
NO — No single answer or approach applies to all situations, or another reason	1	20.0%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	1	20.0%

Terminals



Response	Total Responses	Percent
NO — No need to address gap, because gap is incorrectly stated; in reality, there is no gap	1	25.0%
YES — Potential revision to 49CFR193 made at #3 High Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	25.0%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	1	25.0%
YES — Voluntary practice by Operator	1	25.0%

65. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

All

ResponseID	Response
30	EPA guidelines and regulations shall be followed where applicable.
31	Practice Emergency Response saves time and reduces confusion in actual emergencies. Coordinate and train local ER officials. You don't want someone spraying water on an LNG pool fire.

Small Scale

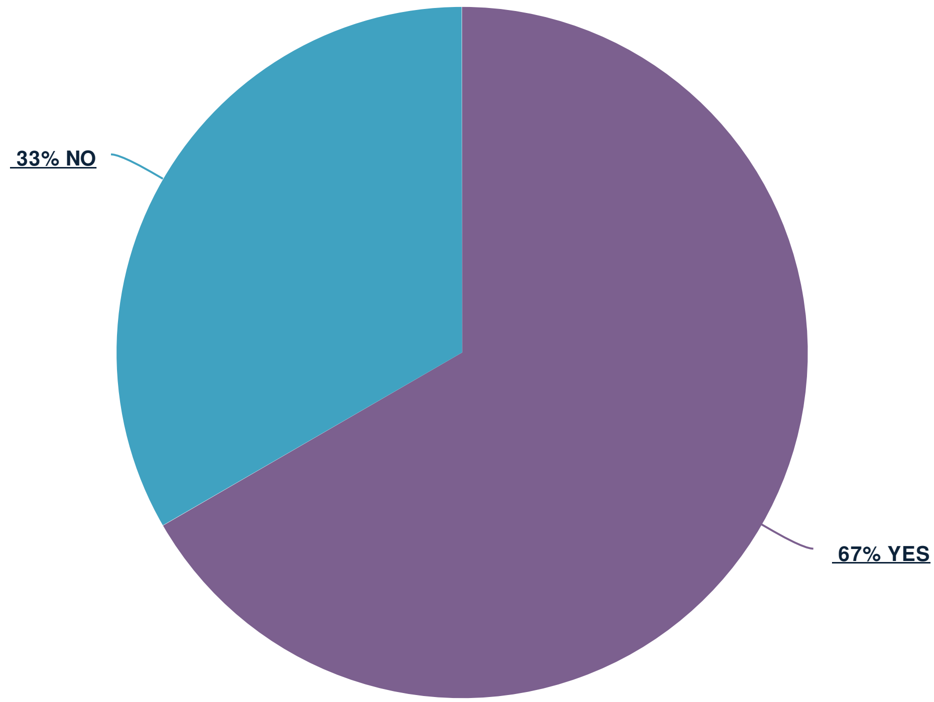
ResponseID	Response
30	EPA guidelines and regulations shall be followed where applicable.

Terminals

ResponseID	Response
31	Practice Emergency Response saves time and reduces confusion in actual emergencies. Coordinate and train local ER officials. You don't want someone spraying water on an LNG pool fire.

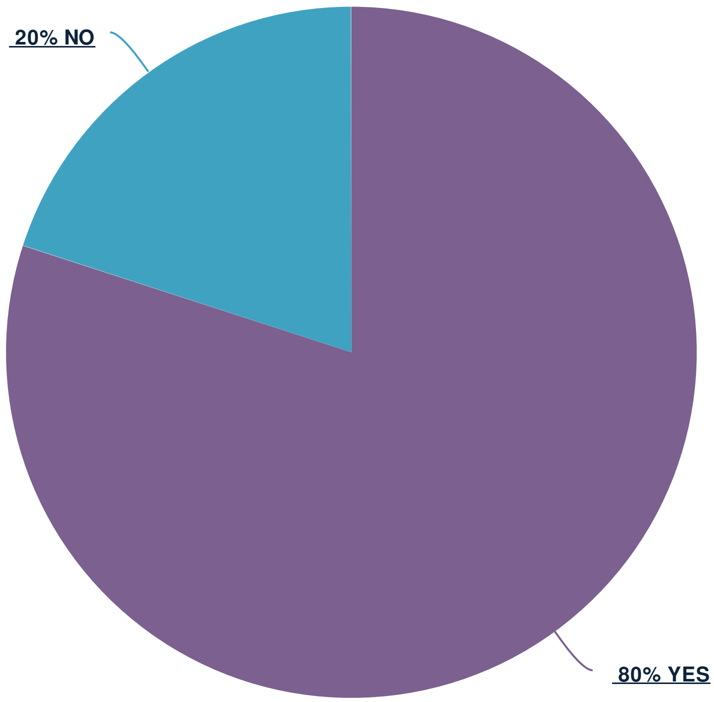
66. Should this potential gap be addressed?

All



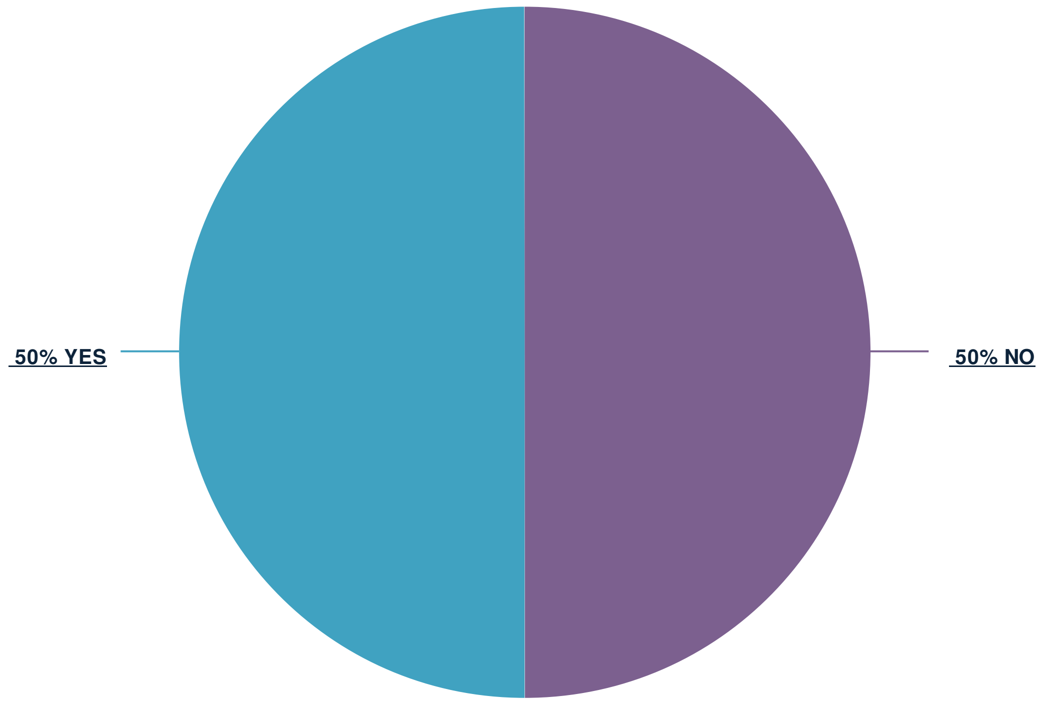
Response	Total Responses	Percent
YES — Potential revision to 49CFR193 made at #1 Low Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	3	33.3%
NO — No need to address gap, because gap is incorrectly stated; in reality, there is no gap	2	22.2%
NO — No single answer or approach applies to all situations, or another reason	1	11.1%
YES — Potential revision to 49CFR193 made at #3 High Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	11.1%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	1	11.1%
YES — Voluntary practice by Operator	1	11.1%

Small Scale



Response	Total Responses	Percent
YES — Potential revision to 49CFR193 made at #1 Low Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	3	60.0%
NO — No single answer or approach applies to all situations, or another reason	1	20.0%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	1	20.0%

Terminals



Response	Total Responses	Percent
NO — No need to address gap, because gap is incorrectly stated; in reality, there is no gap	2	50.0%
YES — Potential revision to 49CFR193 made at #3 High Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	25.0%
YES — Voluntary practice by Operator	1	25.0%

67. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

All

ResponseID	Response
26	Your training plan should address timeframe for conducting exercises/drills for emergency's at the plant. 49 CFR 193 requires you to be trained in how to respond to emergencies other than fires.
30	EPA guidelines and regulations shall be followed where applicable.
31	Practice, practice, practice, drill, drill, drill

Small Scale

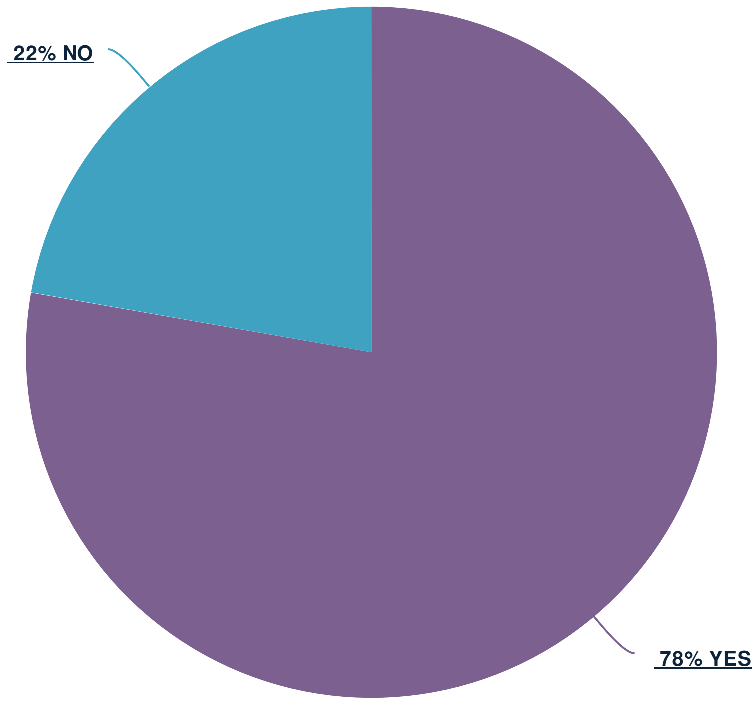
ResponseID	Response
30	EPA guidelines and regulations shall be followed where applicable.

Terminals

ResponseID	Response
26	Your training plan should address timeframe for conducting exercises/drills for emergency's at the plant. 49 CFR 193 requires you to be trained in how to respond to emergencies other than fires.
31	Practice, practice, practice, drill, drill, drill

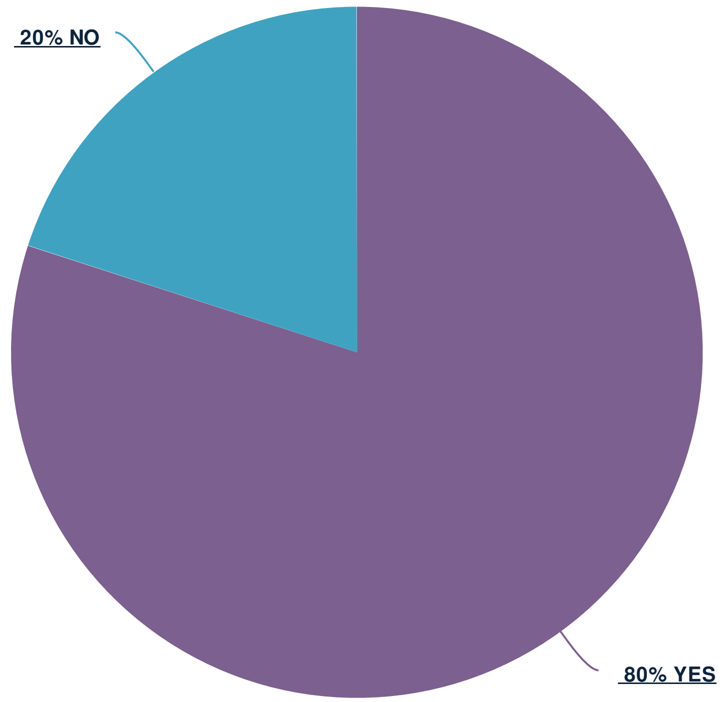
68. Should this potential gap be addressed?

All



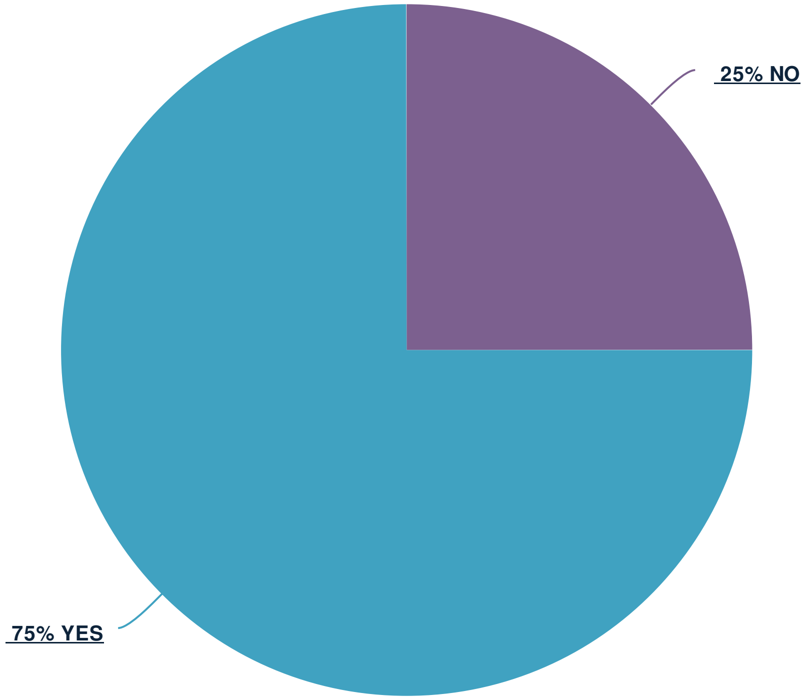
Response	Total Responses	Percent
YES — Voluntary practice by Operator	3	33.3%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	2	22.2%
NO — No need to address gap, because gap is incorrectly stated; in reality, there is no gap	1	11.1%
NO — No single answer or approach applies to all situations, or another reason	1	11.1%
YES — Potential revision to 49CFR193 made at #1 Low Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	11.1%
YES — Potential revision to 49CFR193 made at #2 Medium Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	11.1%

Small Scale



Response	Total Responses	Percent
YES — Voluntary practice by Operator	2	40.0%
NO — No single answer or approach applies to all situations, or another reason	1	20.0%
YES — Potential revision to 49CFR193 made at #1 Low Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	20.0%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	1	20.0%

Terminals



Response	Total Responses	Percent
NO — No need to address gap, because gap is incorrectly stated; in reality, there is no gap	1	25.0%
YES — Potential revision to 49CFR193 made at #2 Medium Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	25.0%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	1	25.0%
YES — Voluntary practice by Operator	1	25.0%

69. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

All

ResponseID	Response
30	EPA guidelines and regulations shall be followed where applicable.
31	Organizations do not learn without feedback.

Small Scale

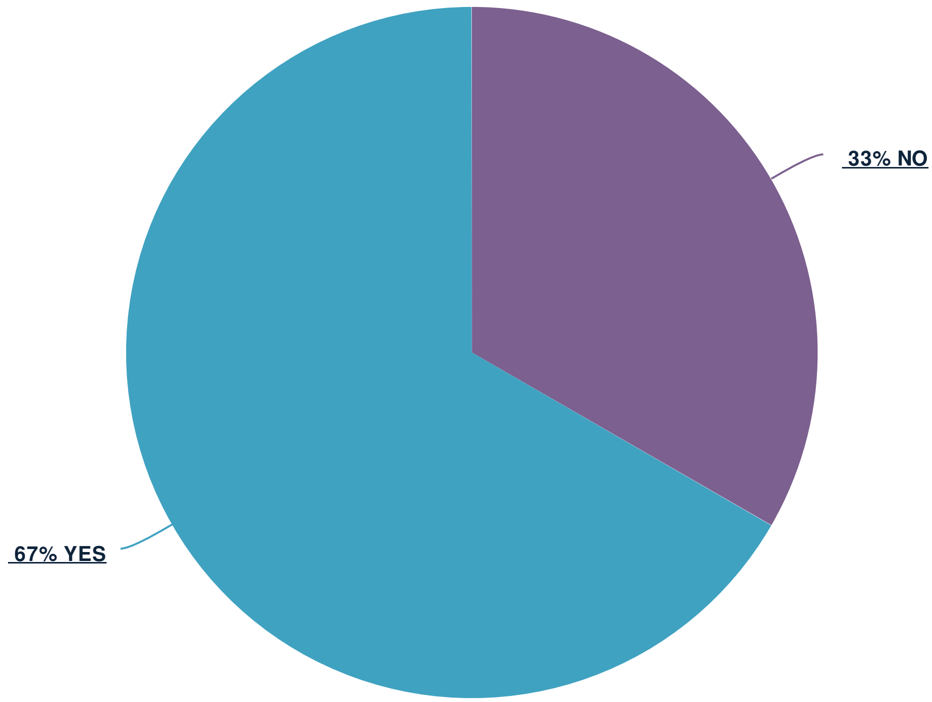
ResponseID	Response
30	EPA guidelines and regulations shall be followed where applicable.

Terminals

ResponseID	Response
31	Organizations do not learn without feedback.

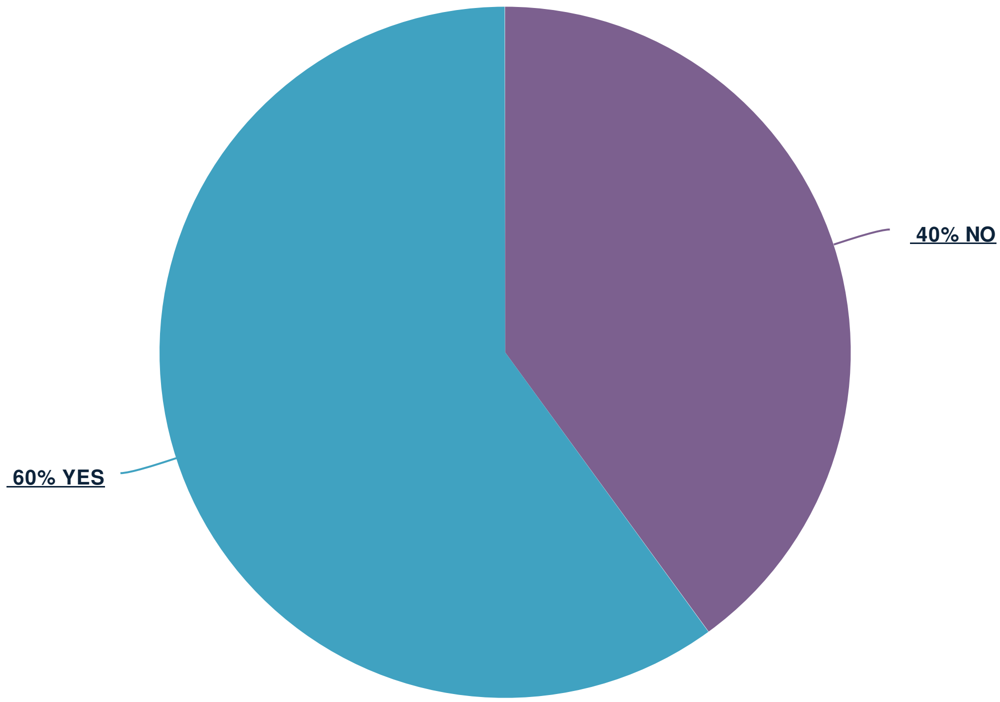
70. Should this potential gap be addressed?

All



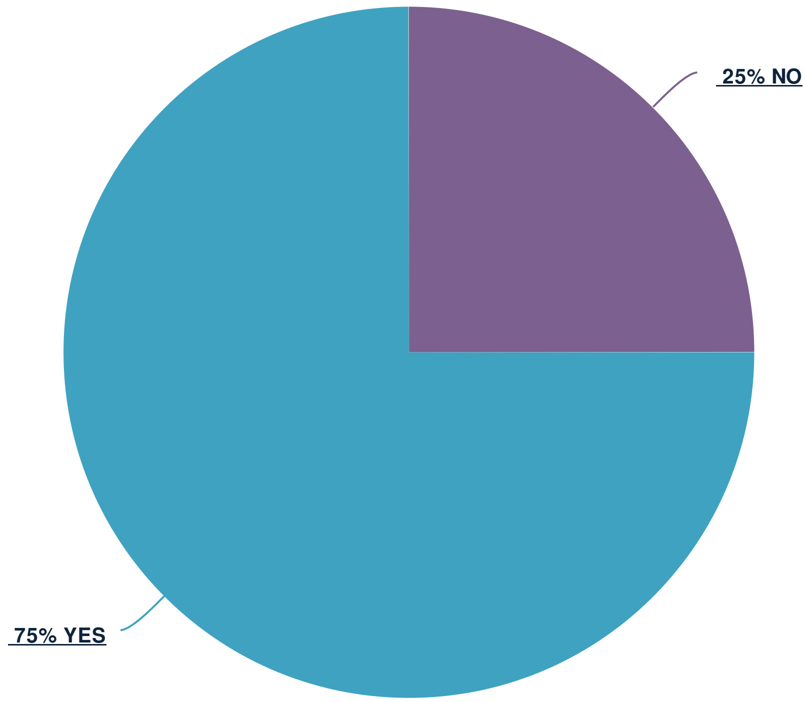
Response	Total Responses	Percent
NO — No single answer or approach applies to all situations, or another reason	2	22.2%
YES — Potential revision to 49CFR193 made at #2 Medium Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	2	22.2%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	2	22.2%
YES — Voluntary practice by Operator	2	22.2%
NO — No need to address gap, because gap is of negligible importance	1	11.1%

Small Scale



Response	Total Responses	Percent
NO — No need to address gap, because gap is of negligible importance	1	20.0%
NO — No single answer or approach applies to all situations, or another reason	1	20.0%
YES — Potential revision to 49CFR193 made at #2 Medium Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	20.0%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	1	20.0%
YES — Voluntary practice by Operator	1	20.0%

Terminals



Response	Total Responses	Percent
NO — No single answer or approach applies to all situations, or another reason	1	25.0%
YES — Potential revision to 49CFR193 made at #2 Medium Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	25.0%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	1	25.0%
YES — Voluntary practice by Operator	1	25.0%

71. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

All

ResponseID	Response
30	Although this is a best practice, it should be left up to the operator to manage this process effectively.
31	Plan, practice, review and reflect. Process Safety is no different than personnel in that regard. Leadership must have knowledge to have confidence that risks are being managed.

Small Scale

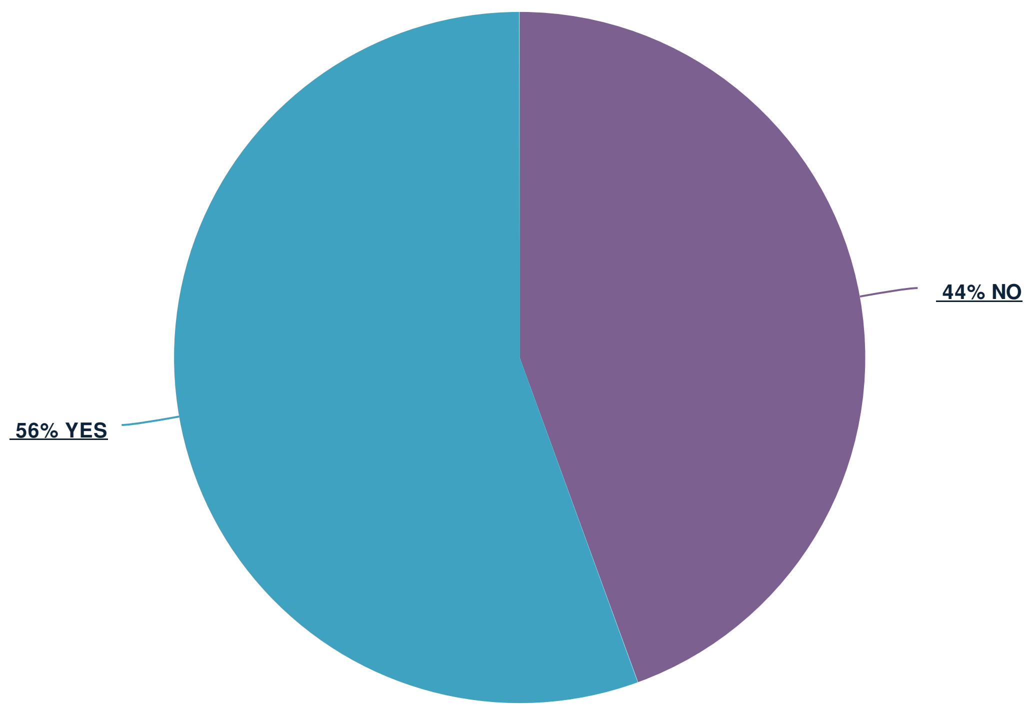
ResponseID	Response
30	Although this is a best practice, it should be left up to the operator to manage this process effectively.

Terminals

ResponseID	Response
31	Plan, practice, review and reflect. Process Safety is no different than personnel in that regard. Leadership must have knowledge to have confidence that risks are being managed.

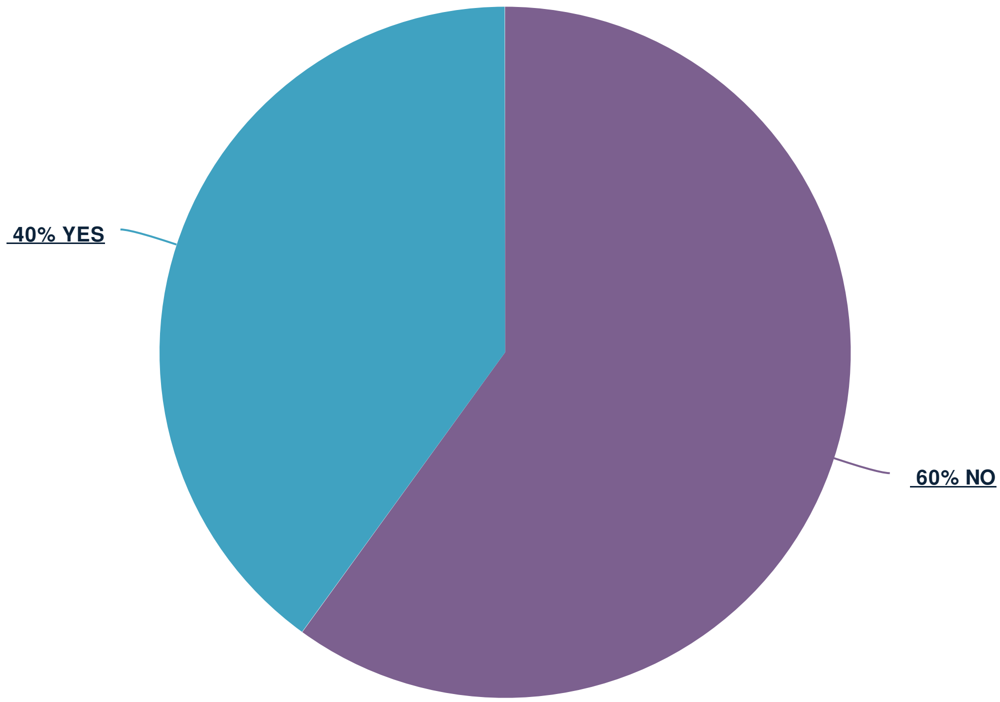
72. Should this potential gap be addressed?

All



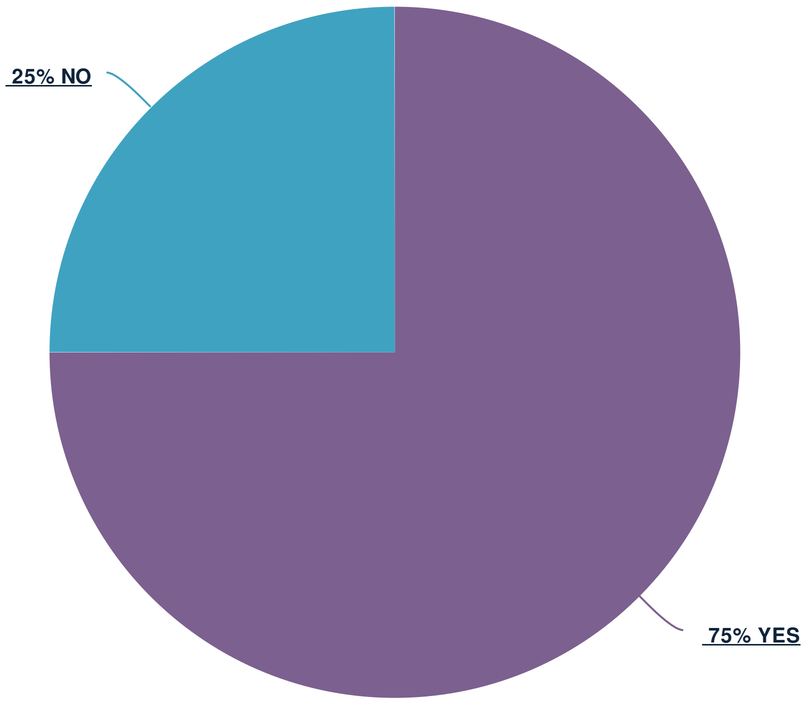
Response	Total Responses	Percent
NO — No single answer or approach applies to all situations, or another reason	3	33.3%
YES — Voluntary practice by Operator	3	33.3%
NO — No need to address gap, because gap is of negligible importance	1	11.1%
YES — Potential revision to 49CFR193 made at #2 Medium Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	11.1%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	1	11.1%

Small Scale



Response	Total Responses	Percent
NO — No single answer or approach applies to all situations, or another reason	2	40.0%
NO — No need to address gap, because gap is of negligible importance	1	20.0%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	1	20.0%
YES — Voluntary practice by Operator	1	20.0%

Terminals



Response	Total Responses	Percent
YES — Voluntary practice by Operator	2	50.0%
NO — No single answer or approach applies to all situations, or another reason	1	25.0%
YES — Potential revision to 49CFR193 made at #2 Medium Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	25.0%

73. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

All

ResponseID	Response
30	Although this is a best practice, it should be left up to the operator to manage this process effectively.
31	Plan, practice, review and reflect. Process Safety is no different than personnel in that regard. Leadership must have knowledge to have confidence that risks are being managed.

Small Scale

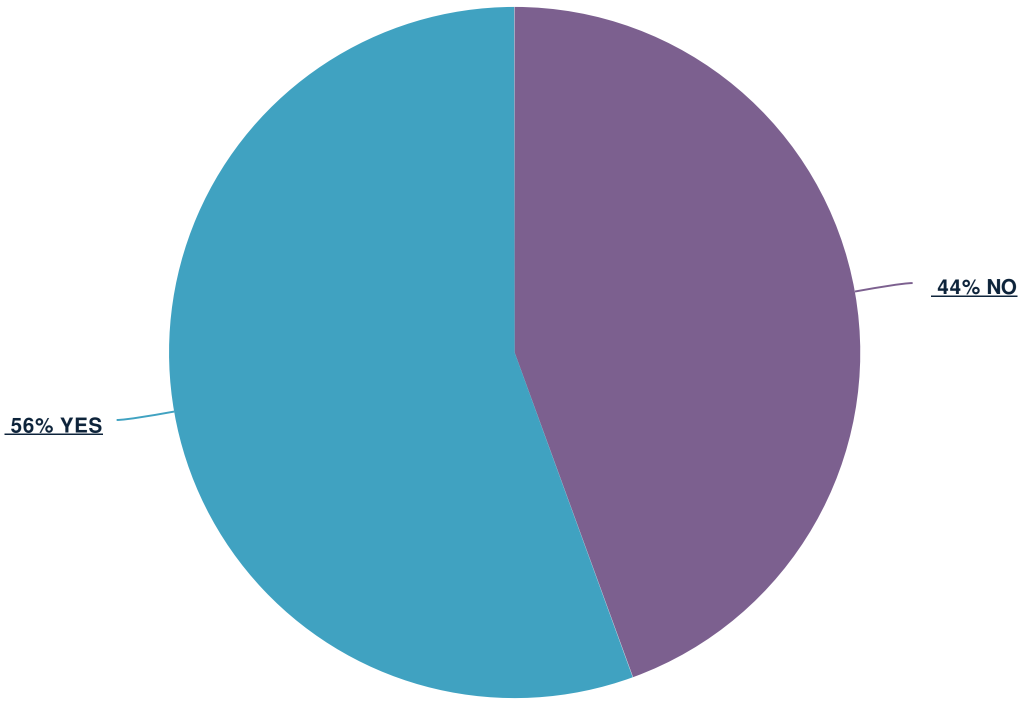
ResponseID	Response
30	Although this is a best practice, it should be left up to the operator to manage this process effectively.

Terminals

ResponseID	Response
31	Plan, practice, review and reflect. Process Safety is no different than personnel in that regard. Leadership must have knowledge to have confidence that risks are being managed.

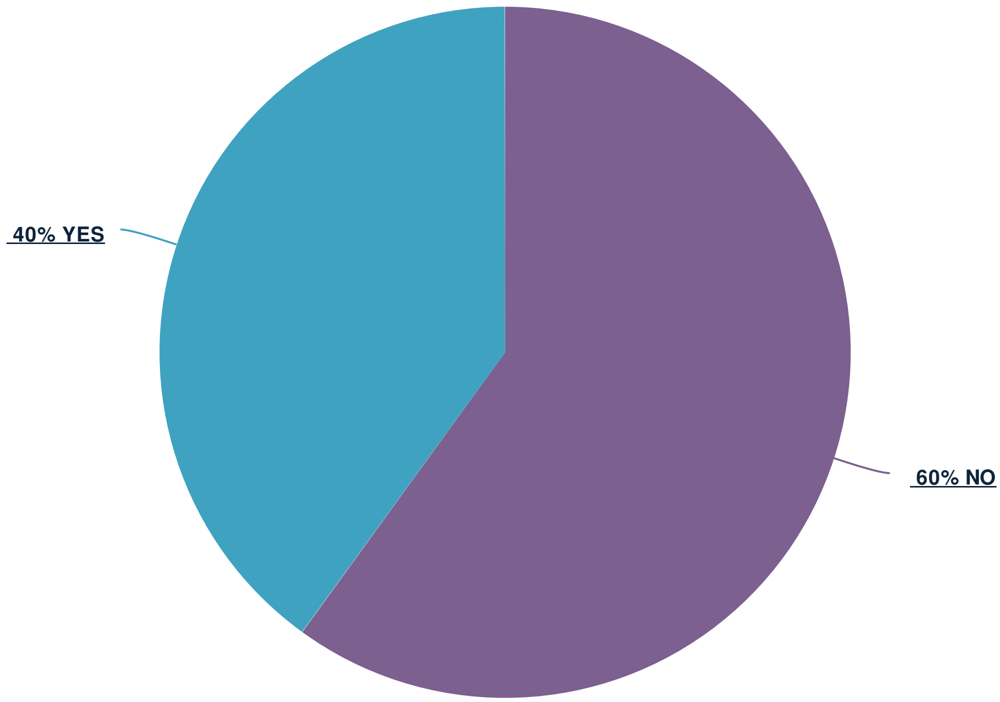
74. Should this potential gap be addressed?

All



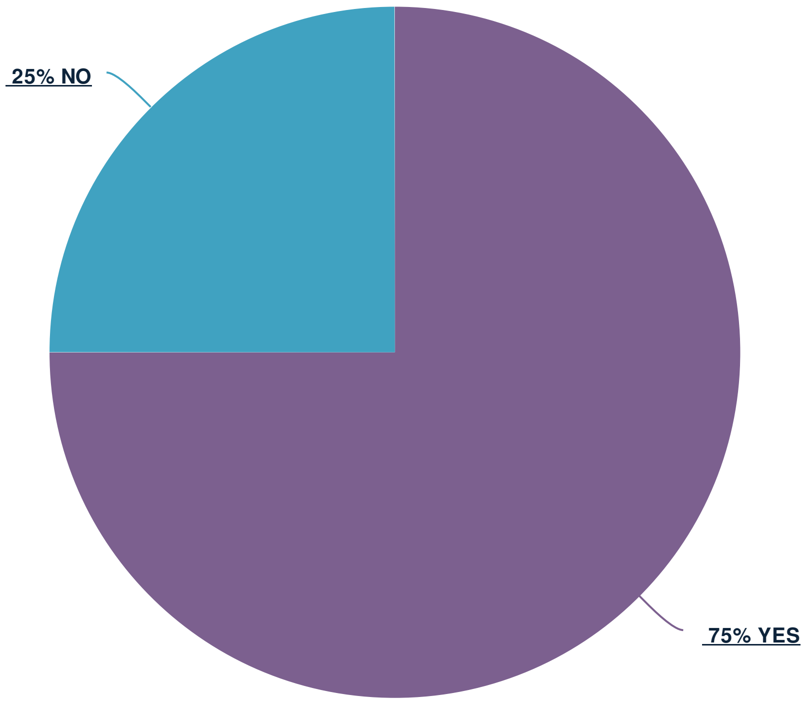
Response	Total Responses	Percent
NO — No single answer or approach applies to all situations, or another reason	3	33.3%
YES — Voluntary practice by Operator	3	33.3%
NO — No need to address gap, because gap is of negligible importance	1	11.1%
YES — Potential revision to 49CFR193 made at #3 High Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	11.1%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	1	11.1%

Small Scale



Response	Total Responses	Percent
NO — No single answer or approach applies to all situations, or another reason	2	40.0%
NO — No need to address gap, because gap is of negligible importance	1	20.0%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	1	20.0%
YES — Voluntary practice by Operator	1	20.0%

Terminals



Response	Total Responses	Percent
YES — Voluntary practice by Operator	2	50.0%
NO — No single answer or approach applies to all situations, or another reason	1	25.0%
YES — Potential revision to 49CFR193 made at #3 High Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	25.0%

75. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

All

ResponseID	Response
30	Although this is a best practice, it should be left up to the operator to manage this process effectively.
31	Frontline employees are an Operator's best tool for risk management. Employee feedback can supply early indicators or previously unknown risk.

Small Scale

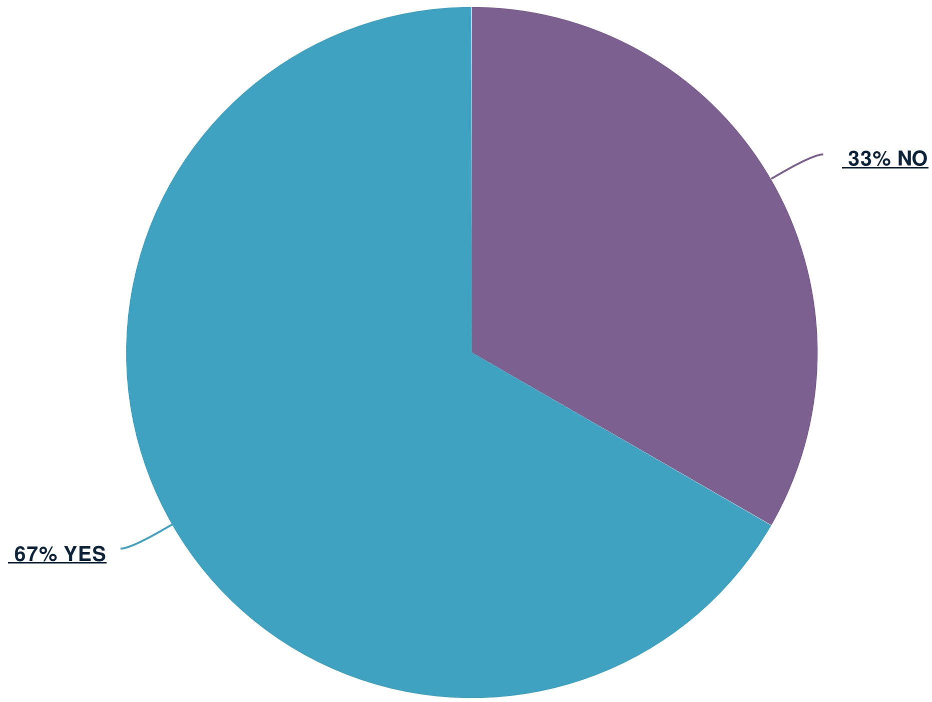
ResponseID	Response
30	Although this is a best practice, it should be left up to the operator to manage this process effectively.

Terminals

ResponseID	Response
31	Frontline employees are an Operator's best tool for risk management. Employee feedback can supply early indicators or previously unknown risk.

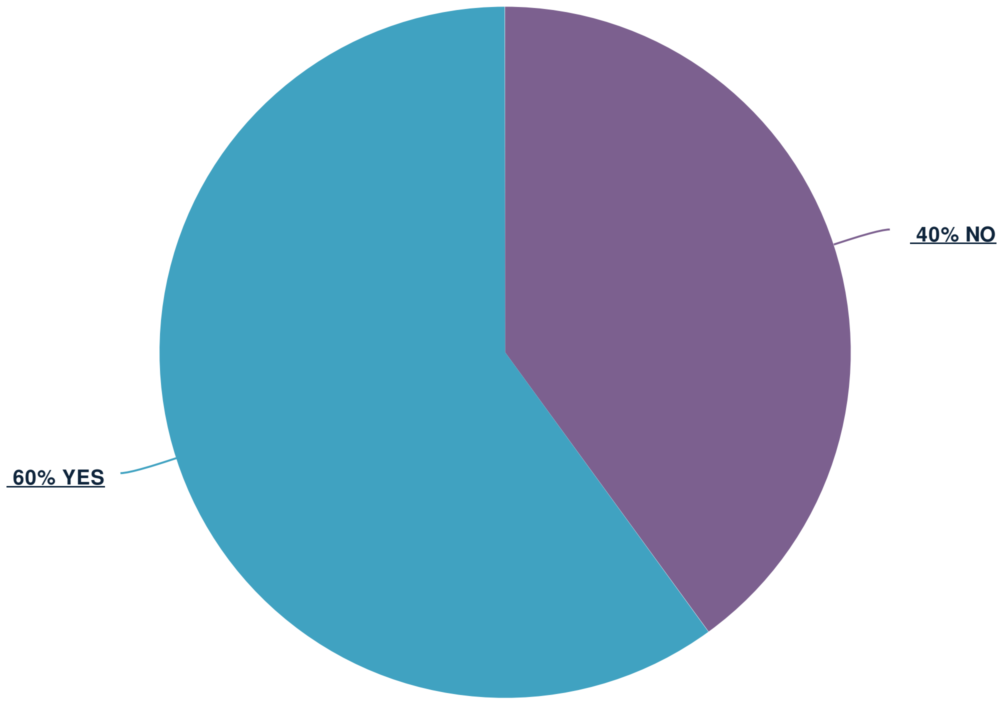
76. Should this potential gap be addressed?

All



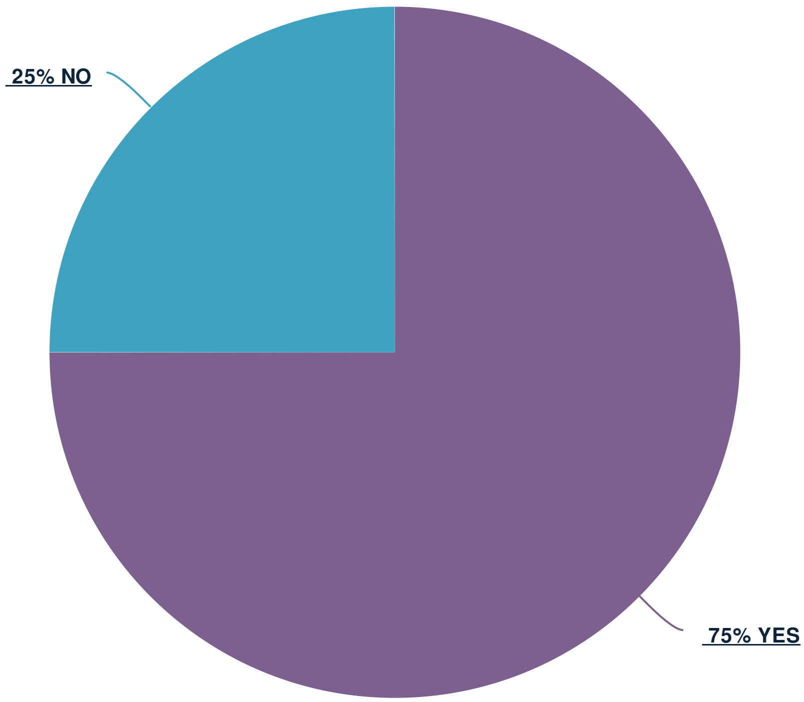
Response	Total Responses	Percent
NO — No single answer or approach applies to all situations, or another reason	3	33.3%
YES — Voluntary practice by Operator	3	33.3%
YES — Potential revision to 49CFR193 made at #1 Low Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	11.1%
YES — Potential revision to 49CFR193 made at #2 Medium Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	11.1%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	1	11.1%

Small Scale



Response	Total Responses	Percent
NO — No single answer or approach applies to all situations, or another reason	2	40.0%
YES — Potential revision to 49CFR193 made at #1 Low Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	20.0%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	1	20.0%
YES — Voluntary practice by Operator	1	20.0%

Terminals



Response	Total Responses	Percent
YES — Voluntary practice by Operator	2	50.0%
NO — No single answer or approach applies to all situations, or another reason	1	25.0%
YES — Potential revision to 49CFR193 made at #2 Medium Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	25.0%

77. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

All

ResponseID	Response
30	Although this is a best practice, it should be left up to the operator to manage this process effectively.
31	Yes, review to improve.

Small Scale

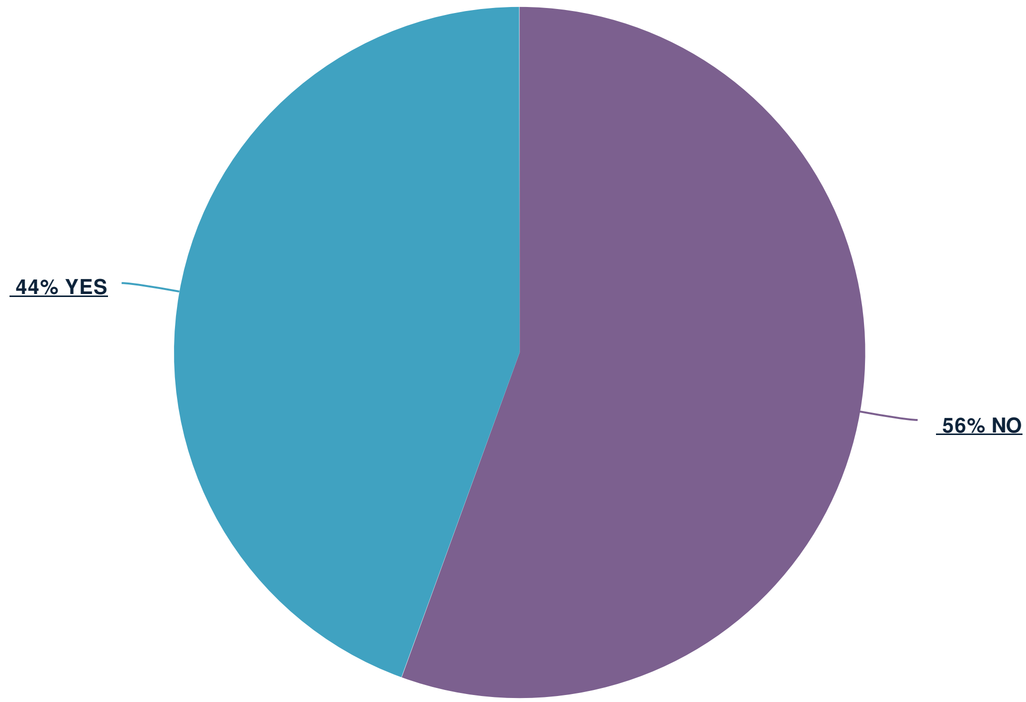
ResponseID	Response
30	Although this is a best practice, it should be left up to the operator to manage this process effectively.

Terminals

ResponseID	Response
31	Yes, review to improve.

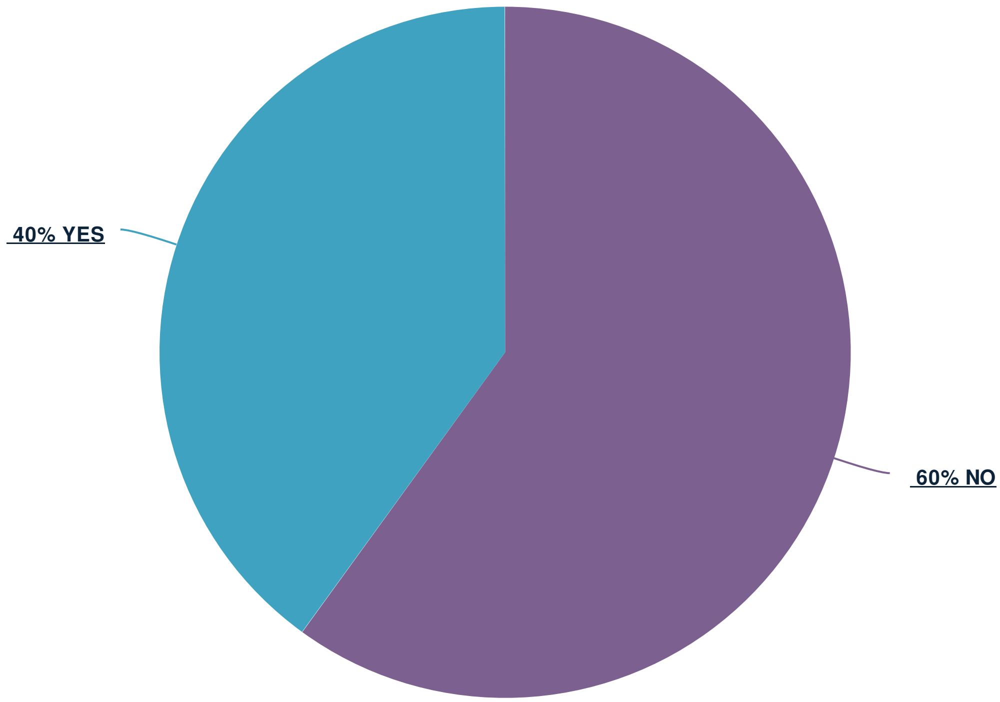
78. Should this potential gap be addressed?

All



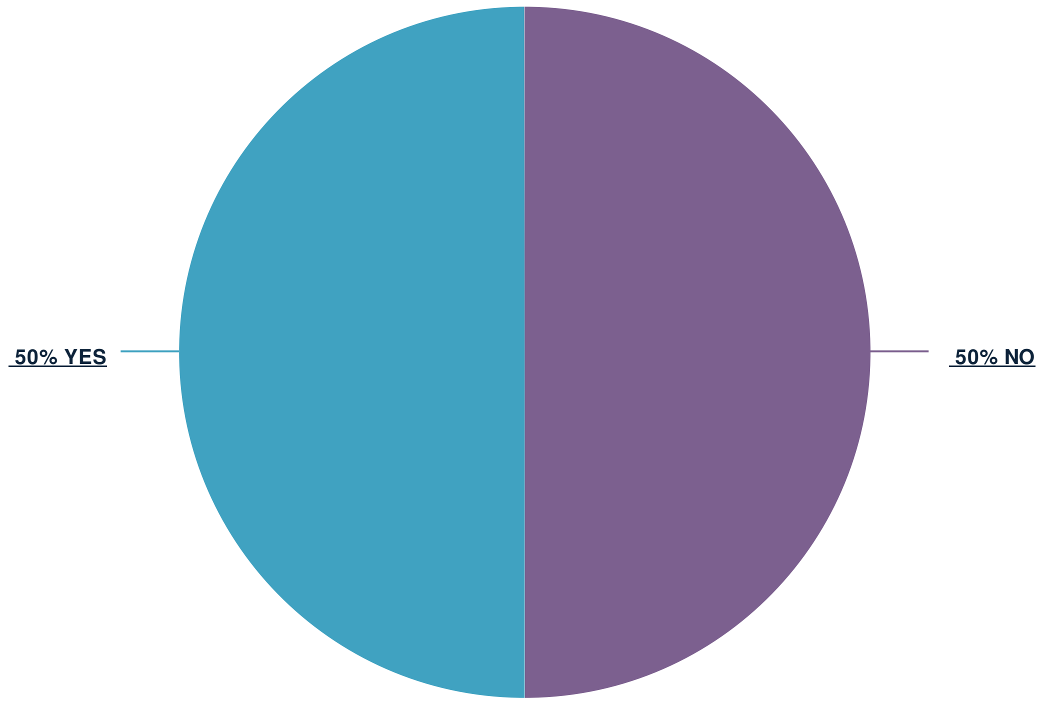
Response	Total Responses	Percent
NO — No single answer or approach applies to all situations, or another reason	3	33.3%
NO — No need to address gap, because gap is of negligible importance	2	22.2%
YES — Potential revision to 49CFR193 made at #1 Low Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	11.1%
YES — Potential revision to 49CFR193 made at #2 Medium Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	11.1%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	1	11.1%
YES — Voluntary practice by Operator	1	11.1%

Small Scale



Response	Total Responses	Percent
NO — No single answer or approach applies to all situations, or another reason	2	40.0%
NO — No need to address gap, because gap is of negligible importance	1	20.0%
YES — Potential revision to 49CFR193 made at #1 Low Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	20.0%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	1	20.0%

Terminals



Response	Total Responses	Percent
NO — No need to address gap, because gap is of negligible importance	1	25.0%
NO — No single answer or approach applies to all situations, or another reason	1	25.0%
YES — Potential revision to 49CFR193 made at #2 Medium Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	25.0%
YES — Voluntary practice by Operator	1	25.0%

79. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

All

ResponseID	Response
26	This should be done on a case by case agreement. Some companies may not feel a confidentiality agreement is the best way to proceed and may have more requirements.
31	Hazards must be fully understood to manage risk.

Small Scale

ResponseID	Response

Terminals

ResponseID	Response
26	This should be done on a case by case agreement. Some companies may not feel a confidentiality agreement is the best way to proceed and may have more requirements.
31	Hazards must be fully understood to manage risk.

80. Should a potential revision of 49CFR193 permit any of the following mechanical integrity inspection or test frequencies to be performed on a RAGAGEP basis such as 49CFR193.2605(a) or in 29CFR1910.119(j)(4)(iii) rather than, or in addition to, the current prescriptive frequencies? PLEASE CHECK ONLY ONE OF THE THREE BOXES FOR EACH LINE ITEM

	Yes, but only as optional alternate means of regulatory conformance. Retain current prescriptive frequency requirements as means of regulatory conformance	Yes, to replace to the current prescriptive frequency requirements	No	Total Checks
Duration in Days of Out-of-Service which Requires Inspection and Test of Control System				
All Checks Row Check %	3 33.3%	6 66.7%	0 0.0%	9
Small Scale Checks Row Check %	2 40.0%	3 60.0%	0 0.0%	5
Terminals Checks Row Check %	1 25.0%	3 75.0%	0 0.0%	4
Total Checks Checks % of Total Checks	6 33.3%	12 66.7%	0 0.0%	18 100.0%
Frequency in Months to Inspect and Test - Control systems in service, but not normally in operation, such as automatic shutdown devices, and control systems for internal shutoff valves for bottom penetration tanks				
All Checks Row Check %	2 22.2%	6 66.7%	1 11.1%	9

	Yes, but only as optional alternate means of regulatory conformance. Retain current prescriptive frequency requirements as means of regulatory conformance	Yes, to replace to the current prescriptive frequency requirements	No	Total Checks
Small Scale Checks Row Check %	1 20.0%	3 60.0%	1 20.0%	5
Terminals Checks Row Check %	1 25.0%	3 75.0%	0 0.0%	4
Total Checks Checks % of Total Checks	4 22.2%	12 66.7%	2 11.1%	18 100.0%

Frequency in Months to Inspect and Test - Control systems used seasonally, such as for liquefaction or vaporization

All Checks Row Check %	5 55.6%	3 33.3%	1 11.1%	9
Small Scale Checks Row Check %	3 60.0%	1 20.0%	1 20.0%	5
Terminals Checks Row Check %	2 50.0%	2 50.0%	0 0.0%	4

	Yes, but only as optional alternate means of regulatory conformance. Retain current prescriptive frequency requirements as means of regulatory conformance	Yes, to replace to the current prescriptive frequency requirements	No	Total Checks
Total Checks Checks % of Total Checks	10 55.6%	6 33.3%	2 11.1%	18 100.0%

Frequency in Months to Inspect and Test - Control systems intended for fire protection

	Yes, but only as optional alternate means of regulatory conformance. Retain current prescriptive frequency requirements as means of regulatory conformance	Yes, to replace to the current prescriptive frequency requirements	No	Total Checks
All Checks Row Check %	4 44.4%	2 22.2%	3 33.3%	9
Small Scale Checks Row Check %	3 60.0%	1 20.0%	1 20.0%	5
Terminals Checks Row Check %	1 25.0%	1 25.0%	2 50.0%	4
Total Checks Checks % of Total Checks	8 44.4%	4 22.2%	6 33.3%	18 100.0%

Frequency in Months to Inspect and Test - Stationary LNG Tank Relief Valves

	Yes, but only as optional alternate means of regulatory conformance. Retain current prescriptive frequency requirements as means of regulatory conformance	Yes, to replace to the current prescriptive frequency requirements	No	Total Checks
All Checks Row Check %	4 44.4%	5 55.6%	0 0.0%	9

	Yes, but only as optional alternate means of regulatory conformance. Retain current prescriptive frequency requirements as means of regulatory conformance	Yes, to replace to the current prescriptive frequency requirements	No	Total Checks
Small Scale Checks Row Check %	3 60.0%	2 40.0%	0 0.0%	5
Terminals Checks Row Check %	1 25.0%	3 75.0%	0 0.0%	4
Total Checks Checks % of Total Checks	8 44.4%	10 55.6%	0 0.0%	18 100.0%

Frequency in Months to Inspect and Test - Relief Valves in Control Systems other than on Stationary LNG Tanks

All Checks Row Check %	4 44.4%	5 55.6%	0 0.0%	9
Small Scale Checks Row Check %	3 60.0%	2 40.0%	0 0.0%	5
Terminals Checks Row Check %	1 25.0%	3 75.0%	0 0.0%	4

	Yes, but only as optional alternate means of regulatory conformance. Retain current prescriptive frequency requirements as means of regulatory conformance	Yes, to replace to the current prescriptive frequency requirements	No	Total Checks
Total Checks Checks % of Total Checks	8 44.4%	10 55.6%	0 0.0%	18 100.0%

Frequency in Months to Inspect and Test - Relief Valves Other than in Control Systems or on Stationary LNG Tanks

All Checks Row Check %	4 44.4%	5 55.6%	0 0.0%	9
Small Scale Checks Row Check %	3 60.0%	2 40.0%	0 0.0%	5
Terminals Checks Row Check %	1 25.0%	3 75.0%	0 0.0%	4
Total Checks Checks % of Total Checks	8 44.4%	10 55.6%	0 0.0%	18 100.0%

Frequency in Months to Inspect and Test - Control systems that are normally in operation, such as required by a base load system

All Checks Row Check %	4 44.4%	5 55.6%	0 0.0%	9

	Yes, but only as optional alternate means of regulatory conformance. Retain current prescriptive frequency requirements as means of regulatory conformance	Yes, to replace to the current prescriptive frequency requirements	No	Total Checks
Small Scale Checks Row Check %	3 60.0%	2 40.0%	0 0.0%	5
Terminals Checks Row Check %	1 25.0%	3 75.0%	0 0.0%	4
Total Checks Checks % of Total Checks	8 44.4%	10 55.6%	0 0.0%	18 100.0%
Frequency in Months to Test - Emergency Power Source Operation Functionality				
All Checks Row Check %	3 33.3%	5 55.6%	1 11.1%	9
Small Scale Checks Row Check %	2 40.0%	2 40.0%	1 20.0%	5
Terminals Checks Row Check %	1 25.0%	3 75.0%	0 0.0%	4
Total Checks Checks % of Total Checks	6 33.3%	10 55.6%	2 11.1%	18 100.0%

	Yes, but only as optional alternate means of regulatory conformance. Retain current prescriptive frequency requirements as means of regulatory conformance	Yes, to replace to the current prescriptive frequency requirements	No	Total Checks
Frequency in Months to Test - Emergency Power Source Operational Capacity				
All Checks Row Check %	3 33.3%	5 55.6%	1 11.1%	9
Small Scale Checks Row Check %	2 40.0%	2 40.0%	1 20.0%	5
Terminals Checks Row Check %	1 25.0%	3 75.0%	0 0.0%	4
Total Checks Checks % of Total Checks	6 33.3%	10 55.6%	2 11.1%	18 100.0%
Frequency in Months to Pressure Test - Transfer Hoses				
All Checks Row Check %	4 44.4%	4 44.4%	1 11.1%	9
Small Scale Checks Row Check %	3 60.0%	2 40.0%	0 0.0%	5
Terminals Checks Row Check %	1 25.0%	2 50.0%	1 25.0%	4

	Yes, but only as optional alternate means of regulatory conformance. Retain current prescriptive frequency requirements as means of regulatory conformance	Yes, to replace to the current prescriptive frequency requirements	No	Total Checks
Total Checks Checks % of Total Checks	8 44.4%	8 44.4%	2 11.1%	18 100.0%

Frequency to Visually Inspect - Transfer Hoses

	Yes, but only as optional alternate means of regulatory conformance. Retain current prescriptive frequency requirements as means of regulatory conformance	Yes, to replace to the current prescriptive frequency requirements	No	Total Checks
All Checks Row Check %	4 44.4%	3 33.3%	2 22.2%	9
Small Scale Checks Row Check %	3 60.0%	2 40.0%	0 0.0%	5
Terminals Checks Row Check %	1 25.0%	1 25.0%	2 50.0%	4
Total Checks Checks % of Total Checks	8 44.4%	6 33.3%	4 22.2%	18 100.0%

Frequency to Periodically Test - Marine Loading or Unloading Operations

	Yes, but only as optional alternate means of regulatory conformance. Retain current prescriptive frequency requirements as means of regulatory conformance	Yes, to replace to the current prescriptive frequency requirements	No	Total Checks
All Checks Row Check %	4 44.4%	4 44.4%	1 11.1%	9

	Yes, but only as optional alternate means of regulatory conformance. Retain current prescriptive frequency requirements as means of regulatory conformance	Yes, to replace to the current prescriptive frequency requirements	No	Total Checks
Small Scale Checks Row Check %	3 60.0%	2 40.0%	0 0.0%	5
Terminals Checks Row Check %	1 25.0%	2 50.0%	1 25.0%	4
Total Checks Checks % of Total Checks	8 44.4%	8 44.4%	2 11.1%	18 100.0%

Frequency in Months to Externally Inspect and Test - LNG Storage Tanks

All Checks Row Check %	3 33.3%	4 44.4%	2 22.2%	9
Small Scale Checks Row Check %	2 40.0%	2 40.0%	1 20.0%	5
Terminals Checks Row Check %	1 25.0%	2 50.0%	1 25.0%	4
Total Checks Checks % of Total Checks	6 33.3%	8 44.4%	4 22.2%	18 100.0%

	Yes, but only as optional alternate means of regulatory conformance. Retain current prescriptive frequency requirements as means of regulatory conformance	Yes, to replace to the current prescriptive frequency requirements	No	Total Checks
Frequency in Days to Monitor Soil Temperature - LNG Storage Tanks				
All Checks Row Check %	4 44.4%	4 44.4%	1 11.1%	9
Small Scale Checks Row Check %	3 60.0%	2 40.0%	0 0.0%	5
Terminals Checks Row Check %	1 25.0%	2 50.0%	1 25.0%	4
Total Checks Checks % of Total Checks	8 44.4%	8 44.4%	2 11.1%	18 100.0%
Frequency in Months to Conduct LNG Tank Bottom Temperature Survey				
All Checks Row Check %	4 44.4%	4 44.4%	1 11.1%	9
Small Scale Checks Row Check %	3 60.0%	2 40.0%	0 0.0%	5
Terminals Checks Row Check %	1 25.0%	2 50.0%	1 25.0%	4

	Yes, but only as optional alternate means of regulatory conformance. Retain current prescriptive frequency requirements as means of regulatory conformance	Yes, to replace to the current prescriptive frequency requirements	No	Total Checks
Total Checks Checks % of Total Checks	8 44.4%	8 44.4%	2 11.1%	18 100.0%

Frequency in Years to Survey Foundation Elevation, or Otherwise Assess Settlement of LNG Storage Tank or Container Foundation

	Yes, but only as optional alternate means of regulatory conformance. Retain current prescriptive frequency requirements as means of regulatory conformance	Yes, to replace to the current prescriptive frequency requirements	No	Total Checks
All Checks Row Check %	4 44.4%	4 44.4%	1 11.1%	9
Small Scale Checks Row Check %	3 60.0%	2 40.0%	0 0.0%	5
Terminals Checks Row Check %	1 25.0%	2 50.0%	1 25.0%	4
Total Checks Checks % of Total Checks	8 44.4%	8 44.4%	2 11.1%	18 100.0%

Frequency in Months to Externally Inspect - Foundation or Support System of Each Component other than LNG Storage Container

	Yes, but only as optional alternate means of regulatory conformance. Retain current prescriptive frequency requirements as means of regulatory conformance	Yes, to replace to the current prescriptive frequency requirements	No	Total Checks
All Checks Row Check %	4 44.4%	4 44.4%	1 11.1%	9

	Yes, but only as optional alternate means of regulatory conformance. Retain current prescriptive frequency requirements as means of regulatory conformance	Yes, to replace to the current prescriptive frequency requirements	No	Total Checks
Small Scale Checks Row Check %	3 60.0%	2 40.0%	0 0.0%	5
Terminals Checks Row Check %	1 25.0%	2 50.0%	1 25.0%	4
Total Checks Checks % of Total Checks	8 44.4%	8 44.4%	2 11.1%	18 100.0%
Frequency in Months to Externally Inspect - Insulation Systems for Impounding Surfaces				
All Checks Row Check %	4 44.4%	4 44.4%	1 11.1%	9
Small Scale Checks Row Check %	3 60.0%	2 40.0%	0 0.0%	5
Terminals Checks Row Check %	1 25.0%	2 50.0%	1 25.0%	4
Total Checks Checks % of Total Checks	8 44.4%	8 44.4%	2 11.1%	18 100.0%

	Yes, but only as optional alternate means of regulatory conformance. Retain current prescriptive frequency requirements as means of regulatory conformance	Yes, to replace to the current prescriptive frequency requirements	No	Total Checks
Frequency in Months to Test - Buried or Submerged Components Under Cathodic Protection				
All Checks Row Check %	4 44.4%	3 33.3%	2 22.2%	9
Small Scale Checks Row Check %	2 40.0%	2 40.0%	1 20.0%	5
Terminals Checks Row Check %	2 50.0%	1 25.0%	1 25.0%	4
Total Checks Checks % of Total Checks	8 44.4%	6 33.3%	4 22.2%	18 100.0%
Frequency in Months to Inspect - Cathodic Protection Rectifier or other Impressed Current Power Source				
All Checks Row Check %	4 44.4%	3 33.3%	2 22.2%	9
Small Scale Checks Row Check %	2 40.0%	2 40.0%	1 20.0%	5

	Yes, but only as optional alternate means of regulatory conformance. Retain current prescriptive frequency requirements as means of regulatory conformance	Yes, to replace to the current prescriptive frequency requirements	No	Total Checks
Terminals Checks Row Check %	2 50.0%	1 25.0%	1 25.0%	4
Total Checks Checks % of Total Checks	8 44.4%	6 33.3%	4 22.2%	18 100.0%

Frequency in Months to Inspect - Reverse Current Switch, Diode, and Interference Bond Whose Failure Would Jeopardize Component Protection

All Checks Row Check %	4 44.4%	3 33.3%	2 22.2%	9
Small Scale Checks Row Check %	2 40.0%	2 40.0%	1 20.0%	5
Terminals Checks Row Check %	2 50.0%	1 25.0%	1 25.0%	4
Total Checks Checks % of Total Checks	8 44.4%	6 33.3%	4 22.2%	18 100.0%

Frequency in Months to Inspect - Interference Bond Whose Failure Would Not Jeopardize Component Protection

	Yes, but only as optional alternate means of regulatory conformance. Retain current prescriptive frequency requirements as means of regulatory conformance	Yes, to replace to the current prescriptive frequency requirements	No	Total Checks
All Checks Row Check %	5 55.6%	3 33.3%	1 11.1%	9
Small Scale Checks Row Check %	3 60.0%	2 40.0%	0 0.0%	5
Terminals Checks Row Check %	2 50.0%	1 25.0%	1 25.0%	4
Total Checks Checks % of Total Checks	10 55.6%	6 33.3%	2 11.1%	18 100.0%

Frequency in Years to Test - Each Component Protected from Atmospheric Corrosion

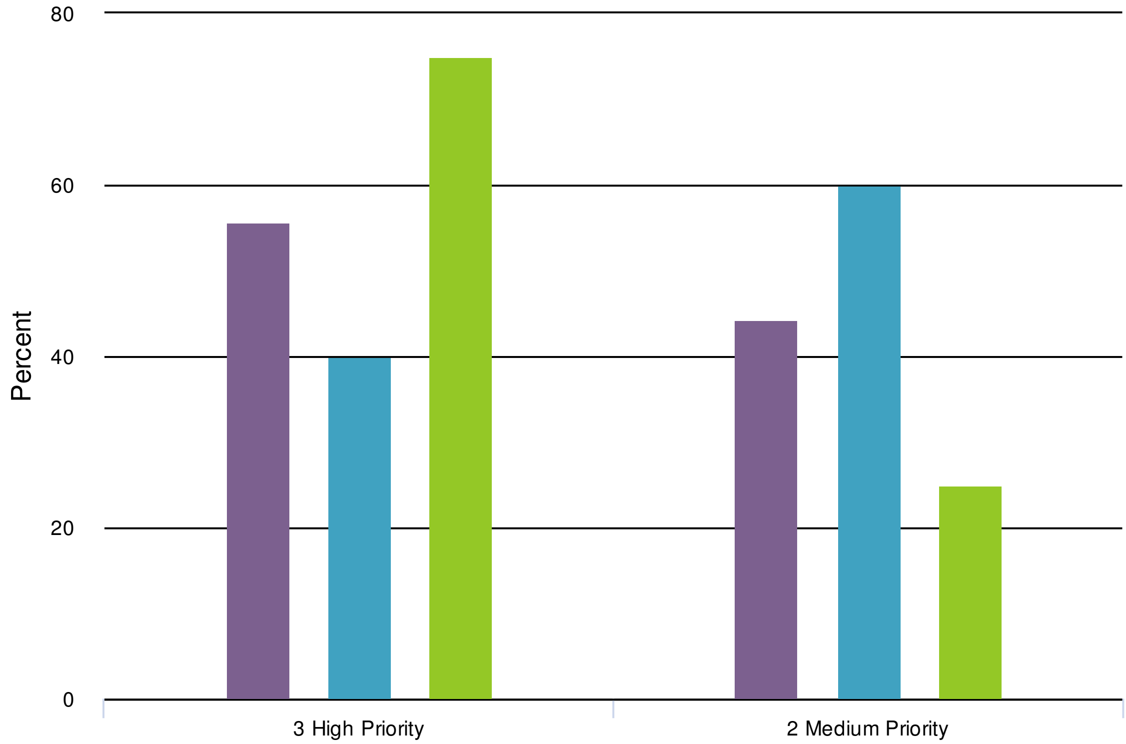
All Checks Row Check %	4 44.4%	4 44.4%	1 11.1%	9
Small Scale Checks Row Check %	3 60.0%	2 40.0%	0 0.0%	5
Terminals Checks Row Check %	1 25.0%	2 50.0%	1 25.0%	4

	Yes, but only as optional alternate means of regulatory conformance. Retain current prescriptive frequency requirements as means of regulatory conformance	Yes, to replace to the current prescriptive frequency requirements	No	Total Checks
Total Checks Checks % of Total Checks	8 44.4%	8 44.4%	2 11.1%	18 100.0%

Frequency in Months to Inspect - Internal Corrosion Control Monitoring Devices

All Checks Row Check %	4 44.4%	4 44.4%	1 11.1%	9
Small Scale Checks Row Check %	3 60.0%	2 40.0%	0 0.0%	5
Terminals Checks Row Check %	1 25.0%	2 50.0%	1 25.0%	4
Total Checks Checks % of Total Checks	8 44.4%	8 44.4%	2 11.1%	18 100.0%

81. And address at this level of importance/priority vs. other topics in this survey:



Segment	Value	Percent	% of Total	Responses
All	3 High Priority	55.6%	27.8%	5
	2 Medium Priority	44.4%	22.2%	4
		Total Responses	50%	9
Small Scale	3 High Priority	40%	11.1%	2
	2 Medium Priority	60%	16.7%	3
		Total Responses	27.8%	5
Terminals	3 High Priority	75%	16.7%	3
	2 Medium Priority	25%	5.6%	1
		Total Responses	22.3%	4

82. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; threshold for requirement to apply; etc.):

All

ResponseID	Response
28	Exception taken to the response: the second 'to' to be considered absent, we responded to this with the basis of response as "Yes, to replace the current prescriptive frequency requirements"
31	As mentioned previously, RAGAGEP would require Operators to have appropriate engineering expertise available, so it might be more advantageous for some facilities to retain the prescriptive timings.

Small Scale

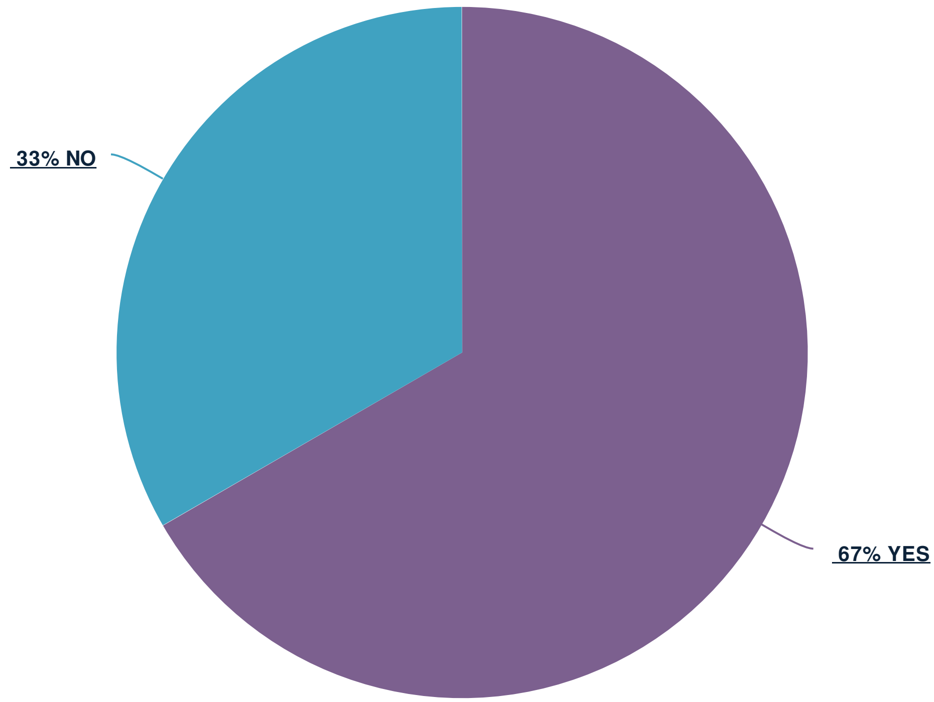
ResponseID	Response

Terminals

ResponseID	Response
28	Exception taken to the response: the second 'to' to be considered absent, we responded to this with the basis of response as "Yes, to replace the current prescriptive frequency requirements"
31	As mentioned previously, RAGAGEP would require Operators to have appropriate engineering expertise available, so it might be more advantageous for some facilities to retain the prescriptive timings.

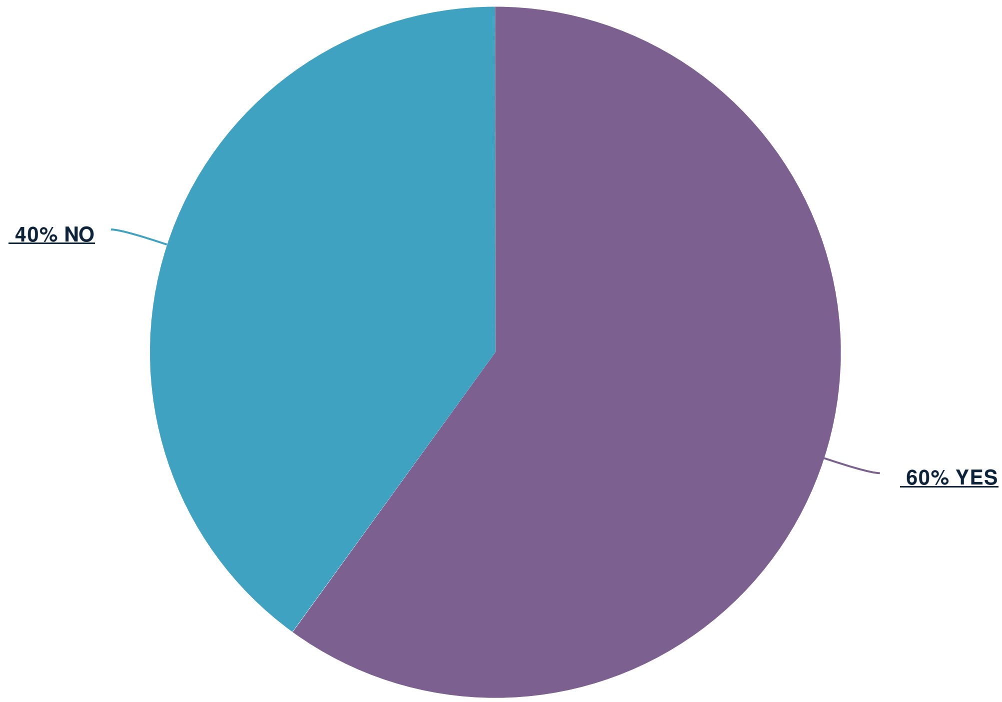
83. Should this potential gap be addressed?

All



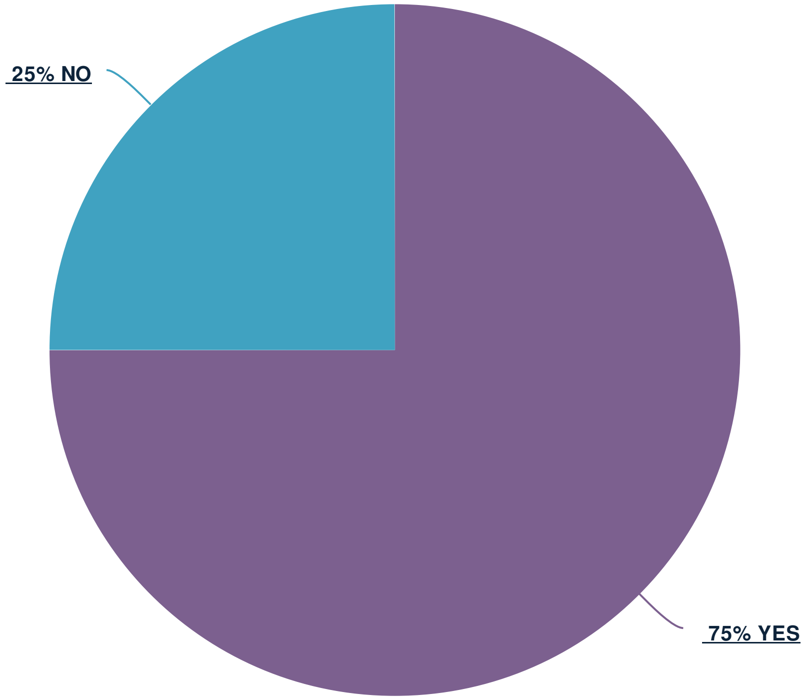
Response	Total Responses	Percent
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	4	44.4%
NO — No single answer or approach applies to all situations, or another reason	2	22.2%
YES — Potential revision to 49CFR193 made at #1 Low Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	2	22.2%
NO — No need to address gap, because gap is of negligible importance	1	11.1%

Small Scale



Response	Total Responses	Percent
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	2	40.0%
NO — No need to address gap, because gap is of negligible importance	1	20.0%
NO — No single answer or approach applies to all situations, or another reason	1	20.0%
YES — Potential revision to 49CFR193 made at #1 Low Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	20.0%

Terminals



Response	Total Responses	Percent
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	2	50.0%
NO — No single answer or approach applies to all situations, or another reason	1	25.0%
YES — Potential revision to 49CFR193 made at #1 Low Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	25.0%

84. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

All

ResponseID	Response
30	Although this is a best practice, it should be left up to the operator to manage this process effectively.
31	This one is obvious. You must tell Operators what qualifies as a component.

Small Scale

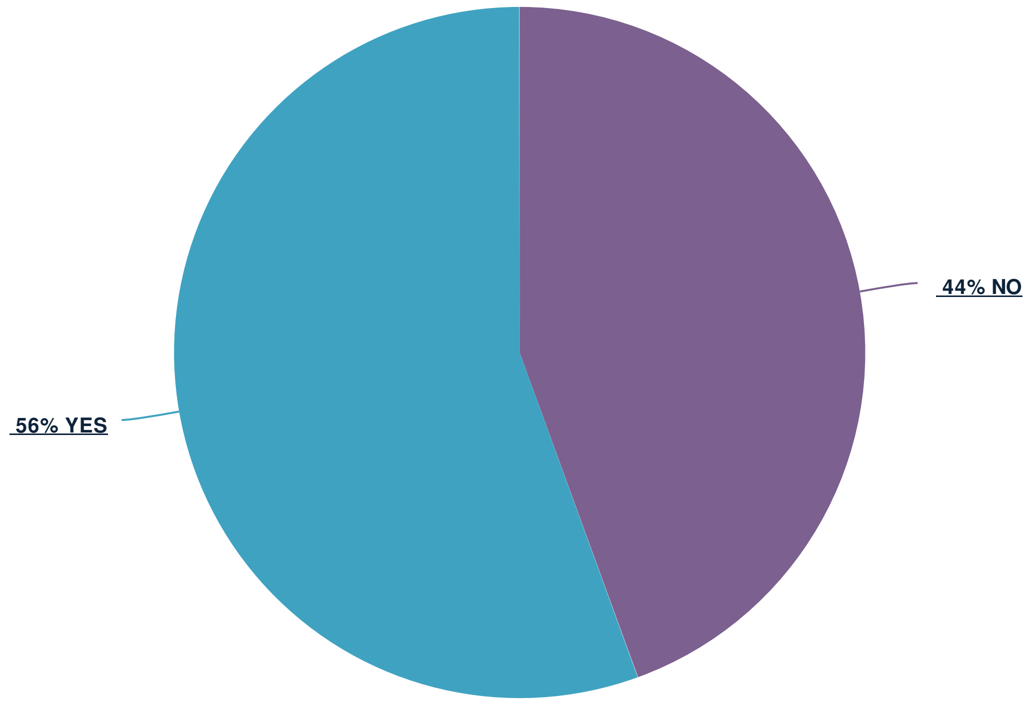
ResponseID	Response
30	Although this is a best practice, it should be left up to the operator to manage this process effectively.

Terminals

ResponseID	Response
31	This one is obvious. You must tell Operators what qualifies as a component.

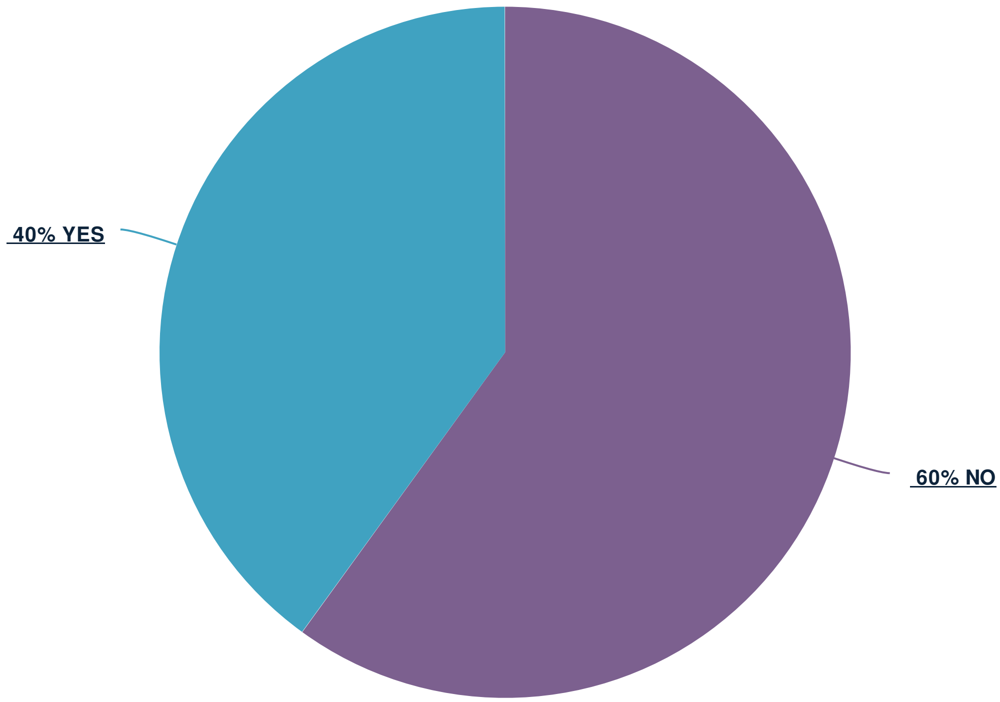
85. Should this potential gap be addressed?

All



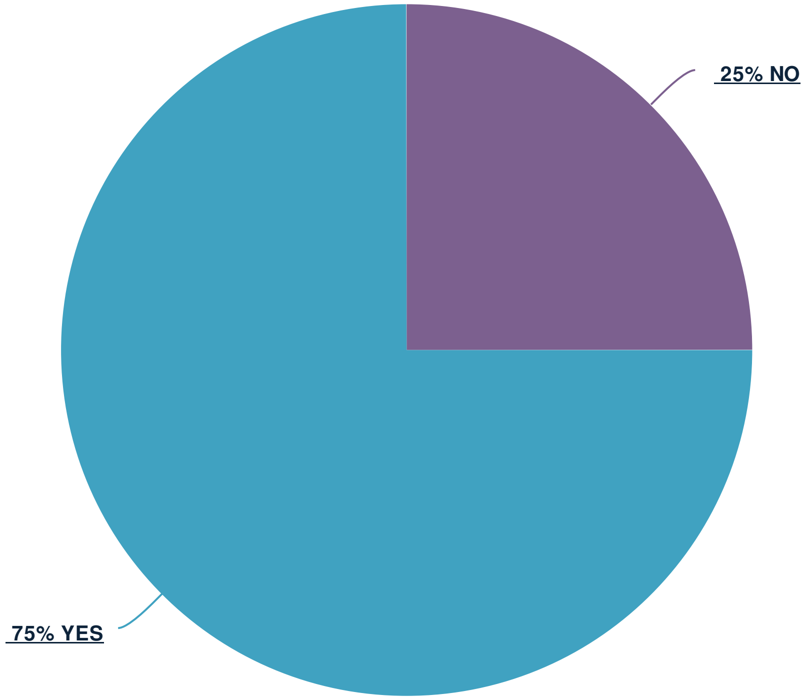
Response	Total Responses	Percent
NO — No need to address gap, because gap is incorrectly stated; in reality, there is no gap	2	22.2%
YES — Potential revision to 49CFR193 made at #1 Low Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	2	22.2%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	2	22.2%
NO — No need to address gap, because gap is of negligible importance	1	11.1%
NO — No single answer or approach applies to all situations, or another reason	1	11.1%
YES — Potential revision to 49CFR193 made at #2 Medium Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	11.1%

Small Scale



Response	Total Responses	Percent
NO — No need to address gap, because gap is incorrectly stated; in reality, there is no gap	2	40.0%
NO — No single answer or approach applies to all situations, or another reason	1	20.0%
YES — Potential revision to 49CFR193 made at #1 Low Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	20.0%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	1	20.0%

Terminals



Response	Total Responses	Percent
NO — No need to address gap, because gap is of negligible importance	1	25.0%
YES — Potential revision to 49CFR193 made at #1 Low Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	25.0%
YES — Potential revision to 49CFR193 made at #2 Medium Priority compared to other topics in this survey, on the assumed basis that 49CFR193 will be revised to IBR the 2019 edition of NFPA 59A	1	25.0%
YES — Potential revision to NFPA 59A (e.g. 2022 edition), on the assumed basis that 49CFR193 will be revised to incorporate by reference this future edition of NFPA 59A	1	25.0%

86. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

All

ResponseID	Response
30	Even though clarification is being proposed between peak-shavers and base-load, additional clarification may be needed for "seasonally". For example, if a peak shaver liquefies in the spring and then tops off in the fall, would the control systems require inspection and testing. Peak shavers are also changing the way they operate due to the increasing demand of LNG, we would like to propose annual with not to exceed 15 months.
31	Idle equipment should be inspected/tested before returning to service.

Small Scale

ResponseID	Response
30	Even though clarification is being proposed between peak-shavers and base-load, additional clarification may be needed for "seasonally". For example, if a peak shaver liquefies in the spring and then tops off in the fall, would the control systems require inspection and testing. Peak shavers are also changing the way they operate due to the increasing demand of LNG, we would like to propose annual with not to exceed 15 months.

Terminals

ResponseID	Response
31	Idle equipment should be inspected/tested before returning to service.

87. Voluntary Comment or Suggestion (e.g. could describe reasons/justifications for above reply or a desired PSM practice/requirement for this topic - - this may include recommended frequency to inspect, review or update; details of procedure; industry standard to be IBRd; the threshold for requirement to apply; etc.):

All

ResponseID	Response
30	While PSM practices are best practices and should be utilized for operational excellence, the requirements are extreme and will overburden current operators. We do not believe that they should become regulatory requirements for our industry. The LNG industry has a very good safety record, therefore it is reasonable to assume that current regulations are effective. That does not relieve the need to update and look for ways to continue to improve industry safety through regulation.

Small Scale

ResponseID	Response
30	While PSM practices are best practices and should be utilized for operational excellence, the requirements are extreme and will overburden current operators. We do not believe that they should become regulatory requirements for our industry. The LNG industry has a very good safety record, therefore it is reasonable to assume that current regulations are effective. That does not relieve the need to update and look for ways to continue to improve industry safety through regulation.

Terminals

ResponseID	Response

Appendix E: Review of Additional Voluntary PSM Standards

This appendix presents a summary the findings from a review by GTI and BLUE of additional "secondary" topical process safety management (PSM) standards, recommended best practices, and regulatory requirements beyond the "primary" regulations and voluntary standards (*i.e.*, 29 CFR 119.1910, 49 CFR 193, NFPA 59A 2001 and 2019, and API RP 1173) evaluated in this research project, in order to further support PHMSA's strategy to update regulatory requirements for safety management systems for LNG facilities in 49 CFR 193. The effort was led by GTI and reviewed by BLUE, and was performed in Tasks 1.3 and 1.4 of the project.

Methodology

The project team conducted a review of leading worldwide PSM standards and best practices manually and then programmatically using artificial intelligence (AI) to identify and prioritize potentials gaps identified in the secondary standards but not necessarily highlighted in the "primary" regulations and voluntary standards. The following documents were reviewed:

- AIChE CCPS - *Guidelines for Risk Based Process Safety*, 2007
- CAN/CSA - Z767-17, *Process Safety Management*, 2017
- CSChE - *Process Safety Management Standard, 1st Edition*, 2012
- CSChE - *Process Safety Management Guide, 4th Edition*, 2012
- CSChE - *Managing the Health and Safety Impacts of Organizational Change*, 2004
- CSChE - *Guidelines for Site Risk Communication, 3rd Edition*, 2012
- CSChE - *Risk Assessment - Recommended Practices for Municipalities and Industry*, 2004
- IOGP 415 - *Asset Integrity – the key to managing major incident risks*, 2018
- IOGP 456 - *Process Safety – Recommended Practice on Key Performance Indicators*, 2018
- IOGP 460 - *Cognitive Issues associated with Process Safety and Environmental Incidents*, 2012
- IOGP 544 - *Standardization of Barrier Definitions*, 2016
- UK HSE HSG65 - *Managing for Health and Safety*, 2013
- UK HSE HSG254 - *Developing Process Safety Indicators*, 2006

The project team supplemented its manual review of these references using its subject matter expertise with an AI methodology. Some of the referenced standards and documents are quite lengthy with significant technical detail. An AI methodology is particularly useful to help analyze the degree of detail, specificity, gaps and overlaps in primary standards, regulations and recommended best practices. The efforts in this project leveraged GTI's ongoing research in the application of natural language processing (NLP) to generate knowledge from technical reports in the energy infrastructure space. One such application developed by GTI that was used in this project is the Technical Report Query Assistant (TRQA), which combines topic modeling methods, such as latent semantic analysis, latent Dirichlet analysis and deep learning language embedding techniques to semantically query libraries of technical reports and determine gaps in knowledge for a topic of interest.

Comments by Voluntary Standard

AIChE CCPS Guidelines for Risk Based Process Safety

The Guidelines for Risk Based Process Safety (RBPS), 2007, was created by the Center for Chemical Process Safety (CCPS) to promote PSM excellence and continuous improvement throughout the industry. CCPS created RBPS as the framework for the next generation of process safety management.

This new framework builds upon the original ideas published by CCPS in the early 1990s. It integrates the industry lessons learned over the years and applies the management system principles of the plan, do, check, act and organizes them in a way that all organizations can use. In order for the RBPS to be effective, organizations should follow these guidelines and integrate its practices with elements of other management systems, so it's completely consistent with manufacturing operations, safety, health and environmental controls, security and related technical and business areas.

The purpose of these RBPS guidelines is to provide the safety professionals necessary tools they need to build and operate effective process safety management systems. These guidelines provide methods and ideas on how to design a process safety management system including:

- Correcting a deficient process safety management system and
- Improving process safety management practices.

The RBPS approach recognizes that all hazards and risks in the operation of the facility are not equal; a greater focus on resource optimization towards more significant hazards and risk is appropriate. Applying a risk-based approach enables the organization to optimize its resource planning to attend to the high-risk activities.

These guidelines offer two central strategies on how organizations can implement their process management system:

1. Use RBPS criteria to design, correct, or improve process safety management system elements.
2. Focus on process safety effectiveness as a function of performance and efficiency.

The RBPS management system is meant to address process safety issues in all operations involving the manufacture, use, or handling of hazardous substances or energy. Each organization must evaluate which physical area and phases of the process life cycle to which RBPS should be subject, using this risk-based thought process to decide the applicability in meeting process safety objectives. Per the standard, a RBPS management system should incorporate four main foundational blocks/pillars as illustrated by Figure 1:

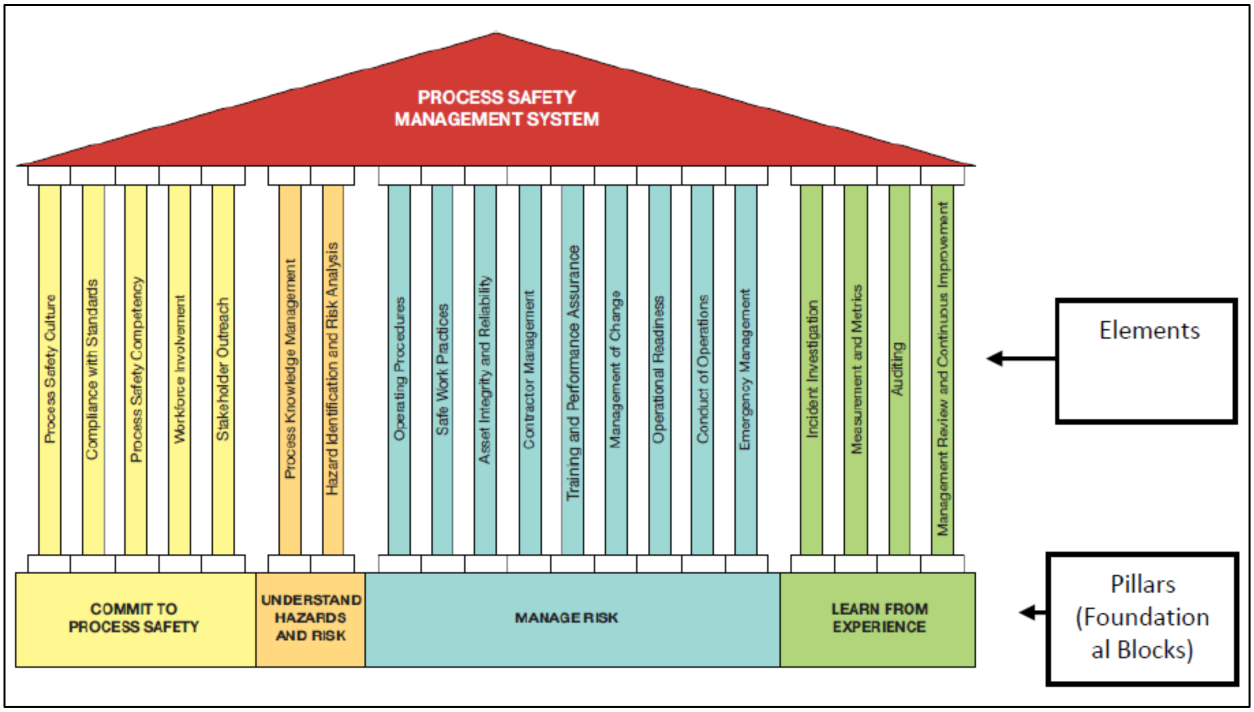


Figure 10 Foundational Blocks and Elements of RBPS Management System, CCPS

The four main foundational pillars are:

1. Commit to process safety
2. Understand hazards and risk
3. Manage risk
4. Learn from experience

These pillars are further divided into 20 elements reflecting 15 years of process safety management implementation experience and best practices from various industries.

The project team reviewed each element of this standard in reference to the appropriate element in the primary standards and identified potential gaps. Table 2 below summarizes the potential gaps identified in AIChE – CCPS beyond those already identified in the First Draft of the Matrix Table.

Table 4 Potential Gaps Identified from AIChE – CCPS

CCPS Elements	Requirement description	Potential Gap
Workforce Involvement	• Monitor the System for Effectiveness • Ensure that the workforce involvement practices remain effective.	Implement effective KPI's to monitor the system examples include, tracking number of suggestions that not been evaluated, number of accepted suggestions that have not been implemented and average/maximum

CCPS Elements	Requirement description	Potential Gap
		delinquency, percentage of suggestions accepted.
Process Safety Competency	• Review Process Safety, Competency and Adjust Plans	Consider the requirement to periodically review process safety competency efforts (e.g. every 1, 3 or 5 years) and revise the plans with the perceived needs
Process Knowledge Management	• Process Knowledge Management • Catalog Process Knowledge in a manner that facilitates retrieval • Protect and update process knowledge	Consider the requirement to catalog information and protect it from inadvertent loss. Periodic review and update to ensure accuracy and properly manage change.
Hazard Identification and Risk Analysis	• Hazard Identification and Risk Analysis • Assess Risks and Make Risk-based Decisions	Consider requiring to establishing risk criteria and define acceptable, unacceptable, and as low as reasonably practicable risk levels.
Incident Investigation	• Incident Investigation • Document Incident Investigation Results	Consider requiring incident investigation analysis to identify clear links between causes and recommendations, e.g., a logic tree, cause-and-effect tree, time-based cause and effect chart or causal factor chart. Its inclusion can significantly reduce the incident description and cause discussions.

More detailed information about each of the above gaps is provided below.

1. Workforce Involvement

Promoting the active involvement of the workforce at all levels of the organization is one of the five elements in the RBPS pillar of ***committing to process safety***. Workforce involvement is vital since workers are directly involved in protecting their own welfare. Workforce involvement either directly implements or helps reinforce several essential features of process safety culture such as individual empowerment, deference to expertise, open and effective communications, mutual trust and responsiveness.

Requirement: **6.2.3 Monitor the System for Effectiveness: Ensure that the workforce involvement practices remain effective.** Guidelines suggest, once the workforce involvement program has been established, periodic monitoring, maintenance, and corrective action is needed to keep it operating at peak performance and efficiency. Relevant metrics should be identified for monitoring the role of workforce involvement in implementing an effective RBPS for the organization.

Potential Gap: This element was evaluated against the primary element, *Employee participation, and stakeholder engagement.* Addressing this potential gap could involve considering relevant metrics to monitor the role of workforce involvement such as tracking the number of suggestions that have not been evaluated; the number of accepted suggestions that have not been implemented and average/maximum delinquency; and the percentage of suggestions acted upon.

2. Process Safety Competency

Developing, sustaining and enhancing the organization's process safety competency is one of the five elements in the RBPS pillar of ***committing to process safety***. This element enables the application of process knowledge into situations that help manage risk and improve facility performance.

Requirement: 4.1.3 Adjust Plans. Guidelines suggest periodic review (e.g. annually) of the efforts to promote process safety competency. Monitor the RBPS aspects that are working well and others that are more challenging. Adjust the plans accordingly to meet the situational needs.

Potential Gap: GTI evaluated this element against the primary element, *Training and Competency.* Addressing this potential gap could involve considering a plan to check process safety competency efforts periodically (e.g. annually or every 3-5 years) to ensure that training and competency program is effective and performing satisfactorily. Identify any important needs that should be added and terminate or refocus any existing efforts that are no longer pertinent.

3. Process Knowledge Management

Developing, documenting and maintaining process knowledge is one of two elements in the RBPS pillar of ***understanding hazards and risk***. Understanding risk depends on accurate process knowledge. This element underpins the entire concept of risk-based process safety management—RBPS methodology becomes ineffective when applied without an understanding of risk.

Requirement: 8.2.2 Catalog Process Knowledge in a Manner that Facilitates Retrieval. Guidelines suggest organizing or cataloging process knowledge that enables easy access when required. Information that cannot be efficiently accessed becomes clutter. Too often, vital information like design bases, manufacturer's drawings/data reports, specification and other process knowledge are lost due to the unorganized storage structure.

Potential Gap: This element was evaluated against the primary element, *Process Safety Information.* Addressing this potential gap could involve considering storing process knowledge in a central location and enforcing organizations to use this central source rather than storing in personal files and eliminating parallel copies. Additionally, one could consider filing documents by equipment or type of information rather than by capital project number, change authorization number, date and project leader's name and limiting access to out of date documents by periodically reviewing the accuracy of these documents.

4. Hazard Identification and Risk Analysis

A thorough hazard identification and risk analysis, or risk, system is the core element in the RBPS pillar of ***understanding hazards and risk***. To manage risk, hazards must be identified first, then evaluated and determined if the risk is tolerable or not. This element forms the basis for establishing most of the other process safety management activities across the organization.

Requirements: 9.2.3 Assess Risks and Make Risk-Based Decisions. Guidelines suggest, once hazards have been identified and the associated risks analyzed, the organizations should establish what constitutes as an acceptable and unacceptable risk. Companies must communicate its expectations on how the risk tolerance criteria will be applied in each risk analysis over the life cycle of the project.

Potential Gap: This element was evaluated against the primary element, *Process Hazard Analysis (Risk Management).* Addressing this potential gap could involve implementing a risk tolerance criterion. Some examples include developing a risk matrix, to identify a specific range of severity and likelihood or some absolute risk criterion like, not to exceed 10-4 events/year of a worker fatality at the facility. Additionally, risk tolerance criteria should enable the risk analysis team in the decision-making process of implement preventive and mitigative measures.

5. Incident Investigation

Developing, sustaining and enhancing the organization's incident investigation competency is one of the four elements in the RBPS pillar of ***learning from experience***. This element enables learning from incidents that occur over the life of a facility and sharing the lessons learned to both internal and external stakeholders across one or more facilities.

Requirement: 19.2.4 Document Incident Investigation Results. Guidelines suggest that developing an incident investigation report template that can be provided to the investigations teams would promote report consistency across various investigations. This report template needs to establish a clear link between the causes and the recommendations.

Potential Gap: This element was evaluated against the primary element, *Incident Investigation (and learning).* Addressing this potential gap could involve developing an incident investigation report template that enables consistent, repeatable, verifiable process and clearly documents the links between causes and recommendations. For example, a logic tree, such as a cause and effect tree or a time-based cause and effect chart, or a causal factor chart, can significantly reduce the incident description and cause discussions in the report. Additionally, this will enable the management to clearly assess the thoroughness and validity of the investigation.

In summary, process safety practices and safety management systems have been implemented by some companies for many years. Many companies struggle due to inadequate management system performance, resource pressures, and non-dynamic process safety results. The industry can follow these guidelines and framework established by CCPS to help build process management systems that promote excellence and continuous improvement.

CAN/CSA Z767-17 Process Safety Management

The first edition of CSA Z767, Process Safety Management was published in February 2017 and revised in August 2017. This standard was prepared and approved by the Technical Committee on Standards for PSM, under the jurisdiction of the Strategic Steering Committee on Business Management and Sustainability and has been formally approved as a National Standard of Canada by the Standards Council of Canada.

The purpose of this standard is to help organizations implement a comprehensive process safety management system for their facilities. This standard is applicable to various industry sectors and organization sizes. Per the standard, there are four foundational pillars for PSM:

1. Process safety leadership
2. Understanding hazards and risks;
3. Risk management; and
4. Review and improvement

Each pillar contains various elements. One such system of elements illustrated in the standard is shown below in Figure 3:

Process safety management elements			
Process safety leadership	**Understanding hazards and risks**	**Risk management**	**Review and improvement**
Accountability	Process knowledge and documentation	Training and competency	Investigation
Regulations, codes, and standards	Project review and design procedures	MOC	Audits process
Process safety culture	Process risk assessment and risk reduction	Process and equipment integrity	Enhancement of process safety knowledge
Conduct of operations — senior management responsibility	Human factors	Emergency management planning	Key performance indicators

Figure 11 Process Safety Management Elements, CAN/CSA Z767

These elements are similar to the 14 elements identified from the primary standards referenced in the matrix table spreadsheet:

1. Employee participation and stakeholder engagement
2. Process safety information
3. Process hazard analysis (including Risk Management)
4. Operating procedures and documentation
5. Training and competence
6. Contractors
7. Pre-startup safety review
8. Hot work permit
9. Management of change
10. Incident investigation and learning
11. Emergency planning and response (incl fire protection and security)
12. Compliance audits (incl metrics, review and improvement)
13. Trade secrets
14. Mechanical integrity

GTI reviewed each element of this standard in reference to the appropriate element in the primary standards and identified potential gaps. The table below lists the potential gaps identified for CAN/CSA-Z676.

Table 5 Potential Gaps Identified for CAN/CSA-Z767

PSM Elements	Requirement description	Potential Gap
Process knowledge and documentation	Process Knowledge and Documentation Document Control System	Could consider, Document control system to enable appropriate and timely access to the process safety information
Process Risk assessment and risk reduction	Risk Criteria	Could consider, establishing risk criteria to help manage the risk of the facilities
Process and Equipment Integrity	Establishing Safe Work Practices	Could consider adding procedures to maintain alarm and instrument management
MOC	MOC System Shall Temporary Changes shall also require that	Consider defining what constitutes a change such as temporary, emergency and what constitutes replacement in kind which is not subject to MOC. Consider including Temporary changes in addition to permanent changes, define a time limit for a temporary change, system review and approval and plan to ensure all temporary changes are returned after the end of temporary change.
Emergency Management Planning	The organization shall conduct	Consider defining frequency of training and drills on varied components of the emergency plan annually and a full-scale exercise which engages all relevant internal and external groups at least once every 5 years

Process Knowledge and Documentation

Process knowledge and documentation is one of the four PSM elements in the foundational pillar of ***understanding hazards and risks***. It pertains to the information necessary for all attributes and safeguards needed to mitigate hazards due to material properties, the process, and equipment design shall be available through the lifecycle of the facility. This element forms the foundation for implementing a risk-based process safety management programs because without an understanding of risk this methodology cannot be efficient.

<u>Requirement: 6.1 Process knowledge and documentation:</u> Guidelines suggest establishing a document control system for the process safety information that enables appropriate and timely access for those in need.

<u>Potential Gap:</u> This element was evaluated against the primary element, *Process Hazard Analysis.* Addressing this potential gap could involve establishing a document control system that enables appropriate and timely access to all the process safety information when required to support ongoing operations. For example, consider storing process knowledge documents in one or two central locations and cataloging the documents in a manner that enables easy access when necessary.

Process Risk Assessment and Risk Reduction

Process risk assessment and risk reduction is one of the four PSM elements in the foundational pillar of ***understanding hazards and risks***. Facility operators should identify the process hazards, assess the associated risks and document the process and outcomes of these analyses. In order to manage risk, process hazards need to be identified, and then the risks should be evaluated and determined to be acceptable or not. This element enables the management to implement risk-based mitigation measures and promote optimal resource allocation.

Requirement: 6.3.8.1 Risk Criteria: Guidelines suggest that facility operators engage external and internal stakeholders in establishing a risk criteria that have a tolerance limit above which the risk is intolerable, and a tolerance limit below which it is broadly tolerable and needs to be monitored but not necessarily further reduced; the remaining risks fall between these two limits, recognized as the conditionally tolerable region.

Potential Gap: This element was evaluated against the primary element, *Process Hazard Analysis.* Addressing this potential gap could involve establishing a risk criterion that clearly defines an acceptable, unacceptable and conditionally tolerable region to help manage risk for the facility. For example, the risk criteria could be qualitative or quantitative, some companies use risk matrices while others use absolute risk criterion like a risk not to exceed 10-4 events/year.

Management of Change

Management of change is one of the four elements in the foundational pillar of ***risk management***. Management of change (MOC) is defined as a management system to identify, review and approve all modifications to equipment, procedures, programs, raw materials and processing conditions and organizational and staffing changes other than replacement in kind, prior to implementation to help ensure that changes are properly analyzed, documented and communicated to personnel.

Requirement: 7.2.1 Management of Change: Guidelines suggest an organization's PSM system should include an MOC system that focuses on managing risks related to design changes and modifications to equipment, procedures, and organization. It should also define what constitutes as a temporary, change, emergency change, replacement change and change not subject to MOC. If a temporary change is made, then MOC should clearly define time limits, system for review and approval and a plan to ensure all equipment returned safely.

Potential Gap: This element was evaluated against the primary element, *Management of Change.* Addressing this potential gap could involve developing a program that clearly defines what constitutes a temporary change, emergency change, replacement change and change not subject to MOC. Additionally, consider including temporary changes in addition to permanent changes, defining time limits for a temporary change, systematic review and approval plan to restore all temporary changes back at the end of the time limit.

Emergency Management Planning

Emergency management planning is one of the four elements in the foundational pillar of ***risk management***. It is defined as an ongoing process to prevent, mitigate, prepare for, respond to and recover from an incident. This element can significantly reduce the consequences of an incident by using effective emergency planning and response. Effective emergency management saves lives, protects property and the environment and helps reassure stakeholders that the facility is well managed and operational despite an incident.

Requirement: 7.4.6 Emergency Management Planning: Guidelines suggest organizations perform mock drills and simulated emergency exercises on various components periodically (e.g. annually) and a full-scale exercise periodically (e.g. once every 5 years) or after a significant site change or expansion or more frequently as deemed appropriate.

Potential Gap: This element was evaluated against the primary element, *Emergency Planning and Response* Addressing this potential gap could involve defining the frequency of training and drills on varied components of the emergency plan annually and a full-scale drill engaging all relevant internal and external stakeholders at least once every 5 years minimum or after a significant site change or expansion or more frequently as deemed appropriate.

Please refer to the Matrix Spreadsheet for a summary of the element requirements and the potential gap recommendations.

CSChE Process Safety Management Standard, 1st Edition, 2012

The primary intent of this standard is to help the organizations identify the performance requirements that can be audited by an organization or a third party to recognize and address gaps in the overall management system. Each facility is unique, and organizations can utilize this standard to identify various policies, practices, and procedures that will help them achieve the desired results.

Figure 4 below shows the PSM elements and components recommended by this Standard that is based on the original framework developed by CCPS consisting of 12 elements. These elements are intended to work in conjunction with traditional occupational health and safety programs and applicable federal/provincial/territorial legislation or municipal regulations. An organization should evaluate the applicability of each element before deciding which ones apply to their facility.

Table 1: Elements and Components of PSM[1]

1. Accountability: Objectives and Goals
- Continuity of operations
- Continuity of systems
- Continuity of organization
- Quality process
- Control of exceptions
- Alternative methods
- Management accessibility
- Communications
- Company expectations

2. Process Knowledge and Documentation
- Chemical and occupational health hazards
- Process definition/design criteria
- Process and equipment design
- Protective systems
- Normal and upset conditions
- Process risk management decisions
- Company memory

3. Capital Project Review and Design Procedures
- Appropriation request procedures
- Hazard reviews
- Siting
- Plot plan
- Process design and review procedures
- Project management procedures and controls

4. Process Risk Management
- Hazard identification
- Risk analysis of operations
- Reduction of risk
- Residual risk management
- Process management during emergencies
- Encouraging client and supplier companies to adopt similar risk management practices
- Selection of businesses with acceptable risk

5. Management of Change
- Change of process technology
- Change of facility
- Organizational changes
- Variance procedures
- Permanent changes
- Temporary changes

6. Process and Equipment Integrity
- Reliability engineering
- Materials of construction
- Fabrication and inspection procedures
- Installation procedures
- Preventative maintenance
- Process, hardware and systems inspection and testing
- Maintenance procedures
- Alarm and instrument management
- Decommissioning and demolition procedures

7. Human Factors
- Operator-process/equipment interface
- Administrative control versus engineering control
- Human error assessment

8. Training and Performance
- Definition of skills and knowledge
- Design of operating and maintenance procedures
- Initial qualifications assessment
- Selection and development of training programs
- Measuring performance and effectiveness
- Instructor program
- Records management
- Ongoing performance and refresher training

9. Incident Investigation
- Major incidents
- Third party participation
- Follow-up and resolution
- Communication
- Incident recording, reporting and analysis
- Near-miss reporting

10. Company Standards, Codes and Regulations
- External codes/regulations
- Internal standards

11. Audits and Corrective Actions
- PSM systems audits
- Process safety audits
- Compliance reviews
- Internal/external auditors
- Corrective actions

12. Enhancement of Process Safety Knowledge
- Quality control programs and process safety
- Professional and trade association programs
- Technical association programs
- Research, development, documentation and implementation
- Improved predictive system
- Process safety resource centre and reference library

Figure 12 Elements and Components of PSM in AIChE CCPS

CSChE Process Safety Management Guide, 4th Edition, 2012

The Canadian Society for Chemical Engineering (CSChE) PSM guide was developed to provide an overview of process safety management and introduce the CSChE's PSM Standard mentioned above. A complete framework of PSM elements, originally developed by CCPS consisting of the 12 elements is recommended for each facility. Some elements or components of PSM might be less applicable to some facilities than others but depending on the nature and degree of potential hazards involved, every facility should carefully evaluate the applicability of each element provided in Figure 4, *Elements and Components of PSM*.

The project team reviewed each element of the CSChE PSM standard and guide in reference to the appropriate element in the primary standards and identified a potential gap. Both the standard and the guide recommend considering the Human Factors element in their PSM system framework. An effective PSM requires an understanding of human error so that systems can be designed to avoid its occurrence or mitigate its consequences. Human factors are a significant contributor to many process incidents and need human error assessment in three key areas: operator-process/equipment interface, administrative controls, and human error assessment.

CSChE Managing the Health and Safety Impacts of Organizational Change, 2004

CSChE developed this guideline to help facilities understand the health and safety effects of organizational change. These guidelines apply to changes in positions and functions that impact the safe operations of the facility. Organizations typically consider MOC as one of the elements in their PSM framework. MOC handles changes to the process, technology, equipment, etc. but changes to facility organization and personnel have not been addressed.

The project team reviewed this guideline in reference to the MOC element in the primary standards and recognized that primary elements didn't consider handling changes to personnel directly, but they do consider the impact of changes through other elements like training and competence, process safety information, etc. Therefore, GTI doesn't consider this requirement as a potential gap. However, each organization needs to access their programs and identify if this is a potential gap in their system and develop its own policies, procedures, and framework to address their needs.

CSChE Guidelines for Site Risk Communication, 3rd Edition, 2012

CSChE developed these guidelines through the CCPS PSM division, to help the facilities design a safe and efficient site risk communication plan. These guidelines are intended for general guidance and do not constitute a legal standard. GTI reviewed this guidance and recommends using them for their intended purpose, which is general guidance and not a standard. However, each facility needs to access their programs and identify if this is a potential gap in their system and develop its own policies, procedures, and framework to address their needs.

CSChE Risk Assessment – Recommended Practices for Municipalities and Industry,2004

The original document was prepared by Risk Assessment Expert Committee of the former Major Industrial Accidents Council of Canada (MIACC) and then transferred to the CSChE PSM division. With a focus on providing guidance in land-use planning and siting decisions, the purpose of this document is to describe a more advanced methodology for risk analysis across a much broader class of hazards and risk sources.

The project team reviewed this document in reference to the *Process Hazard Analysis* element in the primary standards and found this document to provide recommended practices on how to analyze risks of hazardous installations. It describes qualitative, semi-quantitative and quantitative methods of risk analysis and evaluation but no potential gaps were identified. However, each organization needs to access their programs and identify if this is a potential gap in their system and develop its own policies, procedures, and framework to address their needs.

IOGP 415 Asset Integrity – the Key to Managing Major Incident Risks, 2018

International Association of Oil & Gas Producers (IOGP)'s managing major incident risks task force developed this guide to help organizations minimize risks of major incidents by focusing on asset integrity management. The guidelines are particularly targeted at senior managers from a non-technical background in charge of operations. It presents an informative overview and introduction to the concepts and management of asset integrity within an organization's overall management system.

The project team reviewed this document in reference to the *Process Hazard Analysis* element in the primary standards and found the primary standards adequate in handling the various aspects of risk management. However, this guide recommends considering human factors is key in asset integrity management. More information can be found in the IOGP's Report 460, Cognitive issues associated with process safety and environmental incidents. Each organization needs to access their programs and identify if this is a potential gap in their system and develop its own policies, procedures, and framework to address their needs.

IOGP 456 Process Safety – Recommended Practice on Key Performance Indicators, 2018

IOGP developed this report for the upstream oil and gas industry to provide them some guidance on identifying leading and lagging process safety key performance indicators (KPIs). These recommended practices were also based on guidelines for indicators published by United Kingdom Health and Safety Executive (UK HSE), CCPS and the organization for Economic Co-operation and Development (OECD).

The project team reviewed this report in reference to the *Compliance Audits* element in the primary standards and understands this report is a recommended practice and not a standard. Following these recommended practices will enable companies to establish effective leading and lagging indicators that assist in monitoring performance and managing the risk of process safety events. This report recommends using a four-tier framework of process safety KPIs. Tier 1 and 2 provide lagging indicators and Tiers 3 and 4 provide leading indicators of process safety performance. Example include any loss of primary containment (LOPC) events are categorized as Tier 1 or 2 and Tier 3 KPI's monitor performance of the barriers that prevent Tier 1 and 2 LOPC events. Tier 4 KPIs are used to monitor the implementation and effectiveness of the management system. Each organization needs to access their programs and identify if this is a potential gap in their system and develop its own policies, procedures, and framework to address their needs.

IOGP 460 Cognitive Issues associated with Process Safety and Environmental Incidents, 2012

IOGP's Human Factors Sub-Committee (HFSC) developed this report after completing a study on the cognitive issues associated with process safety and environmental incidents in the oil and gas industry. The report focuses on issues operating at the individual and joint level and concentrates on psychological processes involved in the perception and assessment of operational risk, associated reasoning, judgment, decision making and interpersonal behavior.

The project team reviewed this report and understands the intent of this report is to serve as guidelines and not a standard. Based on the recommendations of the report, it is important to understand the role of people in the operation and their support of safety-critical systems requiring significant attention in parallel with engineering solutions. The report makes three recommendations:

1. Facilities should review options for ensuring independent challenge to safety-critical decisions within their own operations
2. Facilities should review practices and tools used to maintain real-time awareness of safety margins
3. Facilities should adopt practices to identify and understand safety-critical human tasks along with operational and management practices that enable operators to perform these tasks reliably.

A focus on engineering issues alone is not enough to prevent future incidents, facilities need to focus on human factors and understanding the psychological basis of human performance is critical to ensure continuous improvement. Each organization needs to access their programs and identify if this is a potential gap in their system and develop its own policies, procedures, and framework to address their needs.

3 Summary of recommendations

Issue	Objective	Recommendation
Potential for over-confidence in operational decision making at critical points; loss of situation awareness; failure to check; lack of sense of mindfulness or "chronic unease".	Improve awareness among front-line operations management of the importance of situation awareness, and how people make decisions in situations of complexity, stress and uncertainty. Required awareness is currently partly covered through the implementations of crew resource management, behavioural-based safety and safety leadership programmes. Further work is required to adequately capture the cognitive aspects of decision making.	OGP is producing a syllabus and recommended content for training in non-technical skills appropriate for drilling and related operations.
Potential for critical decisions to be based on uncertain or ambiguous information without adequate challenge or on-going review.	Find a practical means of ensuring critical decision are subject to effective challenge, especially during periods of heightened safety risk.	OGP members should review options for ensuring independent challenge to safety-critical decisions within their own operations. These reviews could consider: • Defining an independent challenge session, against a defined agenda, and with suitably trained facilitator, to be initiated at agreed points in the operational plan. The facilitator should not report to the asset operational management. The agenda should specifically document major deviations from standards, plans or technical recommendations. Facilitation of the review could be remote. • Appointing and suitably training a member of the asset senior management as independent challenger. This individual should be known to all personnel on the asset and available to the crew at any time. • Setting-up an anonymous reporting system ('hot-line') for critical periods of operations allowing any staff member to report concerns confidentially with guaranteed follow-up.
Potential for lack of awareness or sensitivity to indications that safety margins might be eroding.	Find methods of maintaining real-time awareness of where operations are located within the 'safety space'. Identify methods of increasing sensitivity to "weak signals".	OGP members should review practices used to maintain real-time awareness of safety margins. This should consider practices and tools in use within the oil & gas industry, as well as practices used in other high hazard industries. The scope should cover both awareness at the front-line operational level, as well as awareness at management level.
Potential for insufficient awareness and understanding of the psychological complexity of safety critical task	OGP members should be able to demonstrate that safety-critical human barriers will actually work and that the risk of human unreliability in performing them is ALARP.	OGP members should work towards adopting practices to identify and understand safety-critical human tasks. They should also work on the operational and management practices that should be in place to enable operators to perform these tasks reliably. That means, for example, avoidance of distractions; ensuring alertness (lack of fatigue); design to support performance of critical tasks in terms of use of automation, user interface design and equipment layout; increasing sensitivity to weak signals and providing a culture that rewards mindfulness when performing any safety critical activity.

Figure 13 Summary of Recommendations, IOGP 460

IOGP 544 Standardization of Barrier Definitions, 2016

IOGP developed this report to help standardize the types and categories of process safety barriers for the process safety workers and management. With the use of consistent and simple terminology, the companies can communicate more effectively, assist in the review of root cause analysis and ensure clarity and completeness.

The project team reviewed this report and understands the intent of this report is to serve as guidelines and not a standard. The guidelines recommend using consistent and simple terminology defining process safety barriers, such as defining two types of barriers: hardware barriers and human barriers. Hardware barriers include primary containment to address the safety system integrity and human barriers rely on the actions of people addressing the operating discipline. Each organization needs to access their programs and identify if this is a potential gap in their system and develop its own policies, procedures, and framework to address their needs.

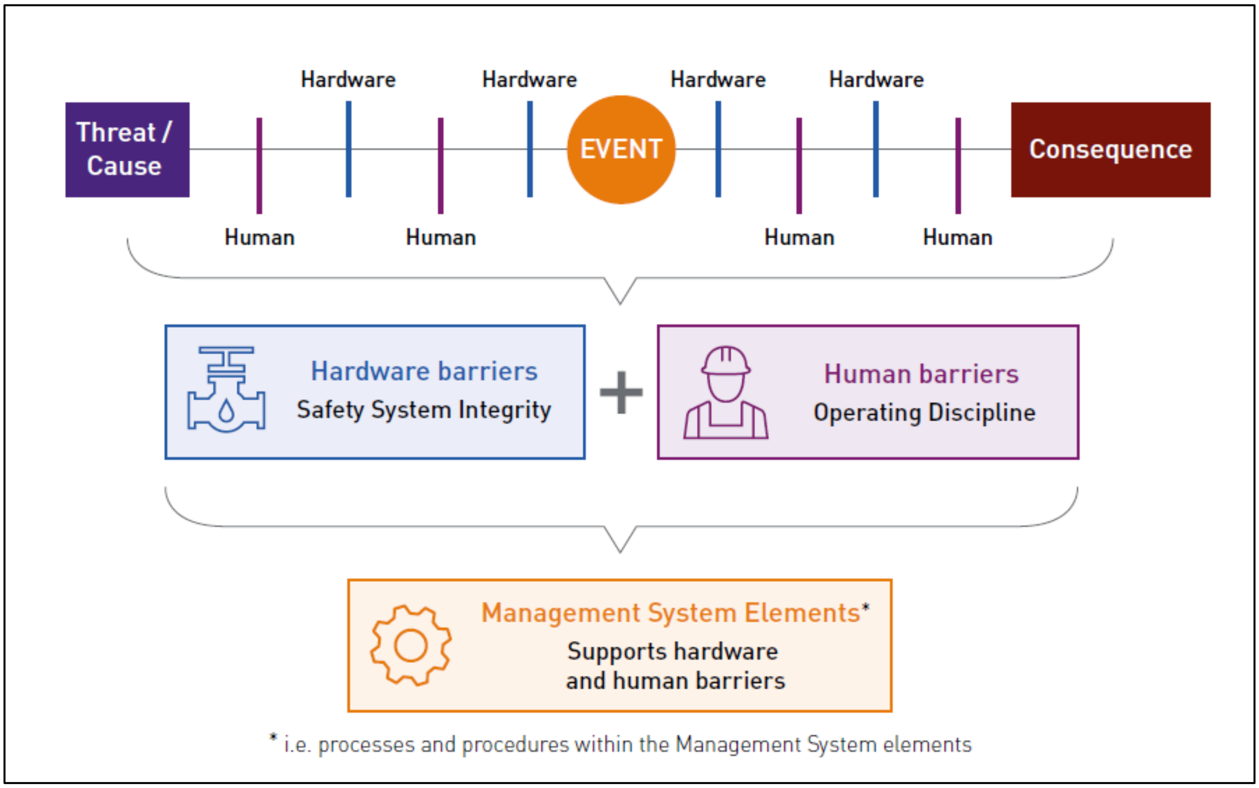


Figure 14, Process Safety Barrier Types, IOGP 544

UK HSE HSG65 Managing for Health and Safety, 3rd Edition, 2013

UK HSE developed this guidance explaining the Plan, Do, Check, Act approach and show how it can help the organization balance between the systems and behavioral aspects of management. It also treats health and safety management as an integral part of good management rather than a stand-alone system.

The project team reviewed this guidance document in reference to the process safety management system framework provided by the primary standards Figure 2. The intent of this guidance document was to present organizations a safety management system framework with the right balance between systems and behavioral aspects of management. GTI understands this is a guidance document only and not a standard and identified no potential gaps. However, some key takeaways for implementing such a framework include consideration of core elements as shown in the figure below.

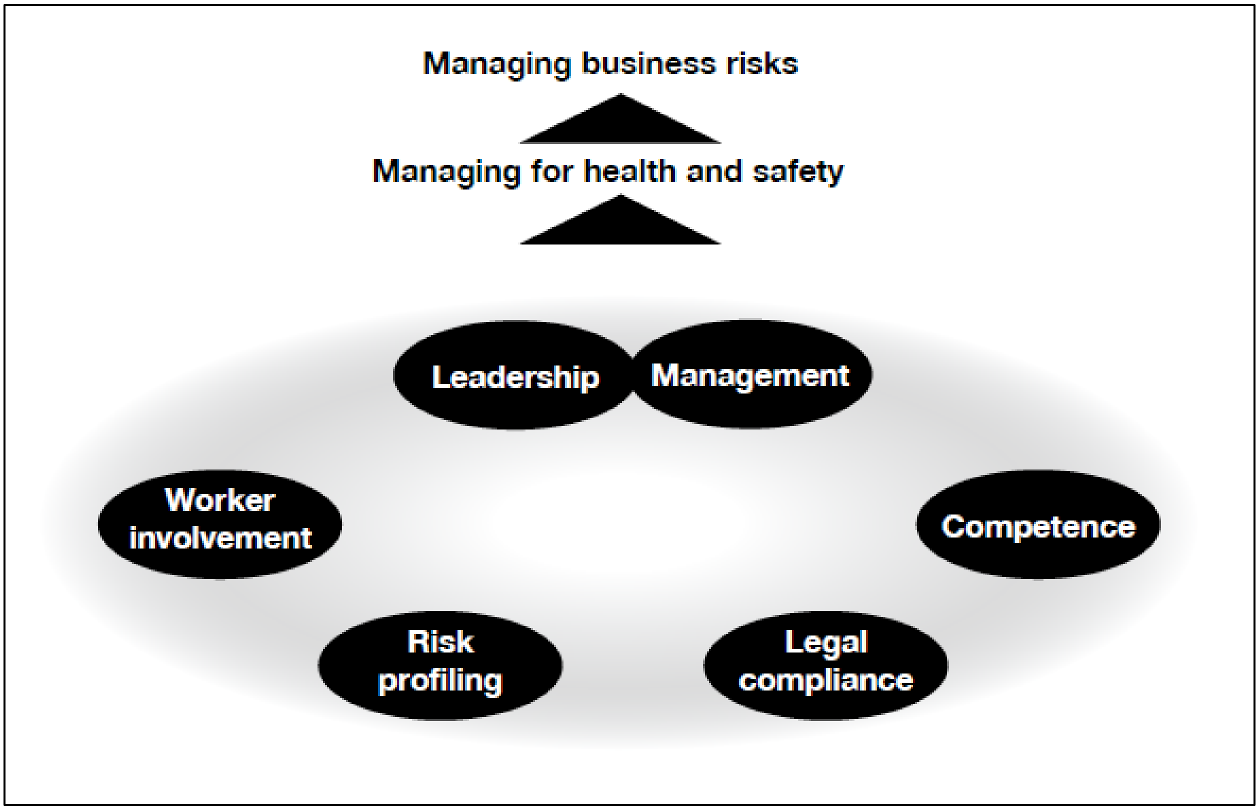


Figure 15 Core Elements for Managing Health and Safety, UK HSE HSG65

A successful implementation will require a sustained and systematic approach rather than one-off interventions. Each organization should access their programs and identify if this is a potential gap in their system and develop its own policies, procedures and framework to address their needs. It may not require a formal health and safety management system but whatever approach is used guidance document recommends using Plan, Do, Check, Act cycle.

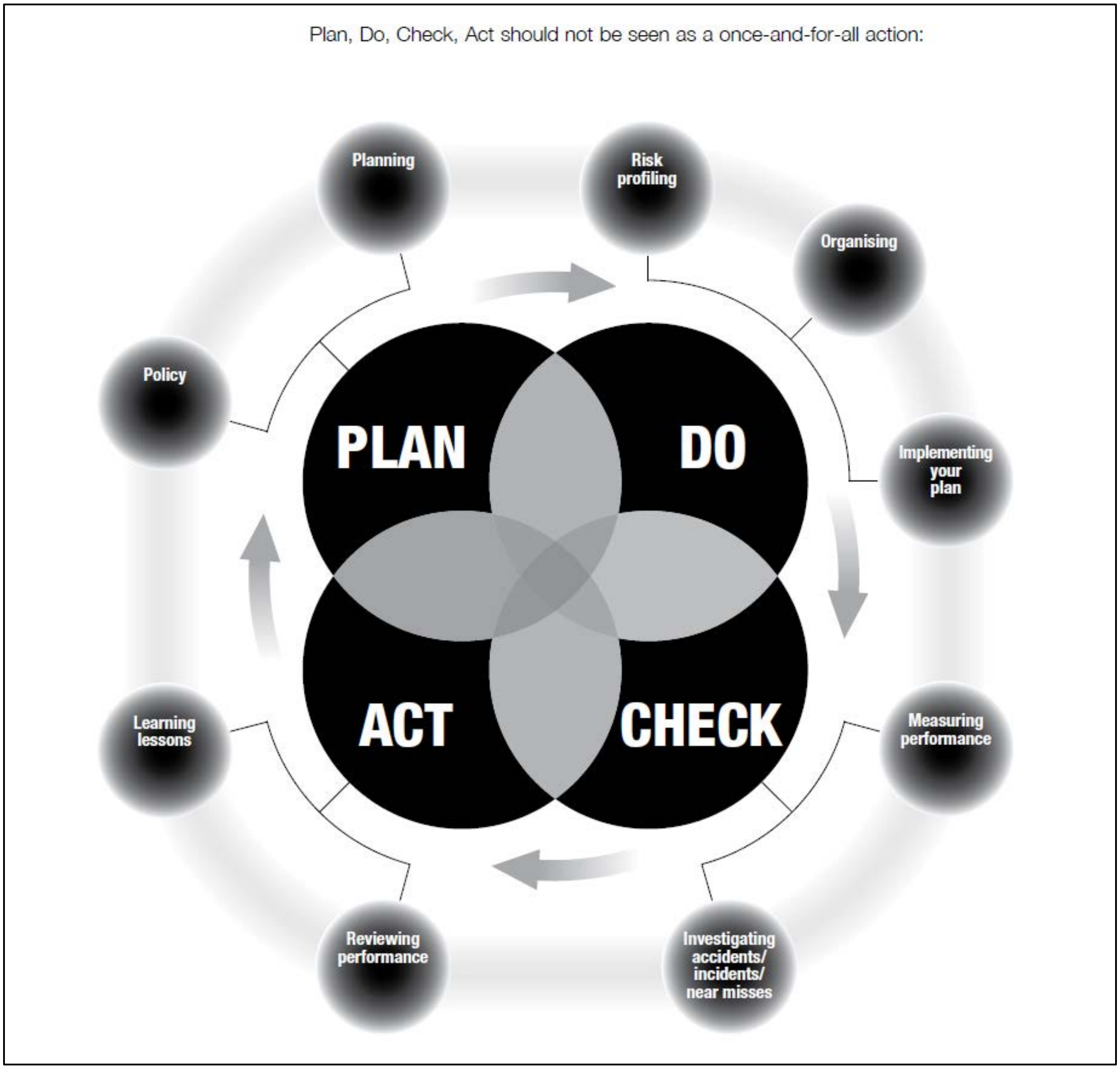


Figure 16 The Plan, Do, Check, Act Cycle, UK HSE HSG65

UK HSE HSG254 Developing Process Safety Indicators

This guide was produced jointly by UK HSE and the Chemical Industries Association (CIA) based on information and ideas from the industry. The intent of this document is to show companies how to develop key performance indicators for major hazards and ensure process safety performance is monitored and reported against these parameters.

The project team reviewed this report in reference to the *Compliance Audits* element in the primary standards and understands this report is a guide and not a standard. This report recommends using a six-stage process for implementing process safety performance indicators as outlined in the figure below. Implementing performance indicators will enable companies to monitor and manage the risk of process safety events Figure 9:

Table 1 Overview of the six steps to setting performance indicators

Step 1	Establish the organisational arrangements to implement the indicators	Appoint a steward or champion
		Set up an implementation team
		Senior management should be involved
Step 2	Decide on the scope of the measurement system. Consider what can go wrong and where.	Select the organisational level
		Identify the scope of the measurement system: ■ Identify incident scenarios - wnat can go wrong? ■ Identify the immediate causes of hazard scenarios ■ Review performance and non-conformances
Step 3	Identify the risk control systems in place to prevent major accidents. Decide on the outcomes for each and **set a lagging indicator**	What risk control systems are in place?
		Describe the outcome
		Set a lagging indicator
		Follow up deviations from the outcome
Step 4	Identify the critical elements of each risk control system, (ie those actions or processes which must function correctly to deliver the outcomes) and **set leading indicators**	What are the most important parts of the risk control system?
		Set leading indicators
		Set tolerances
		Follow up deviations from tolerances
Step 5	Establish the data collection and reporting system	Collect information - ensure information/unit of measurement is available or can be established
		Decide on presentation format
Step 6	Review	Review performance of process management system
		Review the scope of the indicators
		Review the tolerances

Figure 17 Overview of the Six Steps to Setting Performance Indicators, UK HSE HSG254

The project team understands many organizations may already have a performance measurement system in place. In such situations, using this guide as a framework to compare existing programs and deciding if improvements are needed can be very beneficial.

Conclusions

The project team conducted a review of leading worldwide PSM standards and best practices to identify and prioritize potentials gaps between the secondary standards and primary standards. The overarching purpose of the standards and best practices reviewed above is to help organizations develop a framework that enables the implementation of an effective process safety management system that can be easily audited by internal or external stakeholders to recognize and address gaps that may exist in the overall management system.

Key findings:

- Consider the Human Factors element as one of the PSM elements when designing the PSM system framework of an organization. An effective PSM program requires an understanding of human error so that systems can be designed to avoid its occurrence or mitigate its consequences.
- Consider implementing a risk criterion and defining tolerance limits for what is an acceptable risk, unacceptable risk and as low as a reasonably practicable risk. Defining a risk criterion will enable the

organizations to implement effective risk-based mitigative measures and promote optimal resource allocation.

- Consider developing an incident investigation report template for the investigations teams to enable a consistent, repeatable and verifiable process to generate incident report across various investigations. This report template needs to establish a clear linking between the causes and the recommendations. This will enable an organization to learn from incidents and sharing the lessons learned to both internal and external stakeholders across one or more facilities.
- Consider establishing a well-cataloged document control management system in a central location for the storage and retrieval of all the process safety information. This will enable the process safety personnel, easy and timely access to process safety information when required to support ongoing operations.

Appendix F: Final Financial Section

The cost of this fixed-price project was fully funded by the Government. The project team did not provide any cost share, nor was it required to.

Project expenses and billing aligned with the associated contract #693JK31810007. There were no discrepancies or variances in contributions that needed to be reconciled.

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