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CGA P-28—2022

OSHA PROCESS SAFETY MANAGEMENT AND EPA RISK MANAGEMENT PLAN GUIDANCE DOCUMENT FOR BULK LIQUID HYDROGEN SUPPLY SYSTEMS

FIFTH EDITION

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Work Item 18-047
Hydrogen Technology Committee

NOTE—Technical changes from the previous edition are underlined.

NOTE—Appendices A and B (Normative) are a requirement.

NOTE—Appendices C, D, E, F, G, H, I, and J (Informative) are for information only.

FIFTH EDITION: 2022
FOURTH EDITION: 2014
THIRD EDITION: 2009
SECOND EDITION: 2003
FIRST EDITION: 1998

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1 Introduction

The U.S. Occupational Safety and Health Administration (OSHA) Process Safety Management (PSM) standard and the U.S. Environmental Protection Agency (EPA) Risk Management Program (RMP) rule require that some U.S. industrial gas facilities comply with these regulations. For the purpose of this publication, OSHA PSM refers to Title 29 of the U.S. *Code of Federal Regulations* (29 CFR) Part 1910.119, "Process Safety Management of Highly Hazardous Chemicals", and EPA RMP refers to Title 40 of the *U.S. Code of Federal Regulations* (40 CFR) Part 68, "Chemical Accident Prevention Provisions" [1, 2].[1]

PSM and RMP regulations require that companies develop a program to prevent accidental releases of regulated toxic and flammable substances and to reduce the severity of releases, which could occur [1]. Hydrogen is one regulated flammable substance under this regulation. Both OSHA PSM and EPA RMP regulations are intended to prevent or lessen consequences of a catastrophic release of a regulated substance from a covered process. Processes are defined broadly to encompass any activity involving a chemical including any use, storage, manufacturing, handling, on-site movement of chemicals, or any combination of these activities. This definition of process also includes any group of vessels that are interconnected and separate vessels that are located so a regulated substance could be involved in a potential release. Transportation activities regulated by the U.S. Department of Transportation (DOT), including pipelines, are excluded from coverage [3].

While PSM requirements focus on facility and worker safety, RMP requirements are concerned with the possible effects on the community outside the facility in the event of a catastrophic fire or loss of containment at the facility. The RMP rule requires the implementation of a risk management program for all covered processes at facilities containing regulated substances above threshold quantities. In addition, the RMP rule requires covered sites to register with EPA and submit a risk management plan. There are no such requirements under PSM. Also, PSM does not allow a tiered approach and requires a 14-element prevention program for all covered processes.

The RMP rule requires the implementation of a risk management program for all covered processes at stationary sources containing regulated substances above threshold quantities. A full RMP is comprised of a hazard assessment, a management system, a prevention program, and an emergency response program. However, the RMP rule allows for a tiered approach to regulating stationary sources subject to the rule. There are three tiers or program levels. The placement of a facility into one of the three regulatory tiers is based on the facility's accidental release history, its offsite impact potential, and types of processes operated at the site. In short, a facility that presents a greater risk to offsite receptors shall comply with more stringent requirements than those that present a lower risk to offsite receptors. Appendix A compares regulatory requirements for each tier, known as programs 1, 2, and 3. The RMP rule requires the submission of a risk management plan document. The plan document summarizes the key elements of the RMP at the stationary source.

More details about the application of OSHA PSM and EPA RMP to hydrogen supply systems and other compressed gas and cryogenic fluid systems can be found in CGA P-29, *Guideline for Application of OSHA PSM and EPA RMP to the Compressed Gas Industry* [4]. CGA P-29 gives examples of covered systems and details about calculating threshold quantities of covered compressed gases.

2 Purpose

This publication is designed to help owners and operators of liquid hydrogen bulk tanks comply with PSM and RMP rules in addition to the requirements of CGA H-5, *Standard for Bulk Hydrogen Supply Systems (an American National Standard)* [5]. CGA H-5 refers to NFPA 55, *Compressed Gases and Cryogenic Fluids Code*, for the minimum setback distances between bulk hydrogen systems and exposures [5, 6]. The distances for worst-case release scenarios in 7.3 and alternative release scenarios in 7.4 of this publication are not intended to replace the NFPA 55 setback distances [6].

3 Scope

Hydrogen is a PSM and RMP regulated flammable substance at a threshold quantity of 10 000 lb (4536 kg). PSM and RMP rules apply when the total weight of hydrogen in the bulk tank plus the weight of hydrogen in the process

[1] References are shown by bracketed numbers and are listed in order of appearance in the reference section.

meets or exceeds 10 000 lb (4536 kg). More details about calculating the 10 000 lb (4536 kg) system threshold quantity can be found in Appendix B.

PSM regulations apply to processes with chemicals at or above a threshold quantity listed in Appendix A of 29 CFR Part 1910.119 or to processes with flammable or combustible liquids in quantities of 10 000 lb (4536 kg) or more. Hydrogen is not listed in Appendix A of 29 CFR Part 1910.119, but it is considered a flammable gas. Hydrogen is covered by OSHA PSM when it is present in quantities greater than 10 000 lb (4536 kg).

RMP regulations are different and apply only to processes that use chemicals in amounts larger than the quantities listed in its Tables 1 and 2 (toxic substances) and Tables 3 and 4 (flammable substances). Hydrogen is listed in its Tables 3 and 4 at a 10 000 lb (4536 kg) threshold quantity. Therefore, hydrogen is covered by RMP regulations when it is present in quantities greater than 10 000 lb (4536 kg) [2].

Typically, large hydrogen systems are covered by both PSM and RMP regulations. However, in certain cases only one or neither of these regulations can apply:

- PSM regulations exempt retail facilities that have been typically defined as locations that receive more than one half of their income from direct sales to outside customers (for example, a commercial gasoline service station); and
- RMP regulations do not apply to the storage of flammable gases that are used for fuel.

The responsibility for compliance with these regulations is typically that of the end use customer (i.e., the process owner). This is because the customer normally operates the liquid hydrogen supply system daily and, more so than the gas supplier personnel, is the most likely to be involved in an incident involving a release. However, since industrial gas employees visit these installations periodically to perform maintenance and to deliver hydrogen into the system, the hydrogen supplier shall cooperate with customers in fulfilling the regulation requirements.

Both regulations apply only to equipment used for permanent storage of gas at customer locations, where permanent equipment is different from transportation equipment. However, some transportation equipment is covered if it is left on-site. For example:

- Weight of hydrogen in a liquid hydrogen trailer is not added to that in the storage tank if the trailer is only used for delivering hydrogen and is not left on-site for supplying hydrogen to a customer. If the tank alone has less than 10 000 lb (4536 kg) but the tank and delivery trailer have a combined weight of greater than 10 000 lb (4536 kg), the system is not covered by these regulations; or
- If a liquid hydrogen trailer is left on-site to deliver hydrogen to the customer (such as using a liquid trailer with a portable vaporizer), and the weight of hydrogen is greater than 10 000 lb (4536 kg), then the system is covered by these regulations. Liquid trailers generally hold less than 10 000 lb (4536 kg) of hydrogen.

Temporary or portable liquid hydrogen tank is covered if it has greater than 10 000 lb (4536 kg) of hydrogen.

Nonconnected hydrogen storage systems are not covered if each one individually is less than 10 000 lb (4536 kg) of hydrogen and are far enough apart that an incident occurring at one storage system would not affect another.

Typically, a tank with a nominal gross volume of 18 000 gal (68 140 L) or less holds less than 10 000 lb (4536 kg) of hydrogen and is excluded from PSM and RMP regulations. Appendix C of this publication lists regulatory sections and a breakdown of responsibility between the hydrogen supplier and the hydrogen customer.

This publication provides generic information necessary to support the hazard assessment and the process hazard analysis (PHA) portion of the prevention program. Specifically, it includes a typical system flow diagram (TSFD), a typical system HAZOP, and offsite consequence analysis (OCA) information for a bulk liquid hydrogen system. Tables and charts for assessments of appropriate worst-case and alternative-case release scenarios are also included. In addition, information is provided to assist in the development and submission of a typical risk management plan.

Under RMP, the consequences of a worst-case scenario and an alternate-release scenario for each covered process shall be modeled. Off-site impact on public or environmental receptors or both shall be determined. No such modeling is required under PSM.

Under RMP, a risk management plan that includes information about a facility's hazard assessment, prevention program, and emergency response program shall be submitted to EPA. This plan is available for public review. Under PSM, no submittals to OSHA are required, and PSM information does not enter the public record. Facilities covered by the RMP rule shall also:

- Compile and report a history of accidental releases for the 5 years before the submission of the RMP plan as provided in 40 CFR 68.42 [2];
- Develop a management system to oversee the implementation of all elements of the RMP for program 2 or program 3 regulated processes as provided in 40 CFR 68.15 [2];
- Determine one of three program levels to assign the covered process as provided in 40 CFR 68.10 and comply with the applicable program level general requirements as provided in 40 CFR 68.12. Details for program 2 are provided in 40 CFR 68.48 through 68.60, and program 3 details are provided in 40 CFR 68.65 through 68.87 [2];
- Develop and implement an emergency response program for the purpose of protecting public health and the environment as provided in 40 CFR 68.95, except as provided in paragraph (b) of 40 CFR 68.90 [2]; and
- Prepare and submit a single RMP as provided in 40 CFR 68.150 that includes the information required by 40 CFR 68.155 through 68.185 for all covered processes [2].

As illustrated previously, this publication does not represent a total RMP nor does it provide all the information required in a complete risk management plan submission. It also does not provide a complete program for compliance with PSM regulations in the workplace. The nature of this publication is to provide guidance only and not to present a complete or model program for complying with PSM and RMP regulations. Each individual company shall exercise its own judgment regarding how they use this publication and how they achieve PSM and RMP compliance.

4 Definitions

4.1 Publication terminology

4.1.1 Shall

Indicates that the procedure is mandatory. It is used wherever the criterion for conformance to specific recommendations allows no deviation.

4.1.2 Should

Indicates that a procedure is recommended.

4.1.3 May

Indicates that the procedure is optional.

4.1.4 Will

Is used only to indicate the future, not a degree of requirement.

4.1.5 Can

Indicates a possibility or ability.

4.2 Technical definitions

4.2.1 Level of risk

Magnitude of a risk or combination of risks, expressed in terms of the combination of consequences and their likelihood.

4.2.2 Risk evaluation

Process of comparing the results of risk analysis with risk criteria to determine whether the risk and/or its magnitude is acceptable or tolerable.