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DEPARTMENT OF TRANSPORTATION

Pipeline and Hazardous Materials Safety Administration

[Docket No. PHMSA-2024-0180, (Notice No. 2024-15)]

Hazardous Materials: Request for Feedback on Determining the Effectiveness of Pressure Relief Devices (PRDs) on Composite Overwrapped Pressure Vessels (COPVs)

AGENCY: Pipeline and Hazardous Materials Safety Administration (PHMSA), Department of Transportation (DOT).

ACTION: Notice; request for information.

SUMMARY: PHMSA is publishing this notice to solicit information to evaluate the test design for proposed bonfire tests on fully charged composite overwrapped pressure vessels (COPVs) with different pressure relief devices; seek input on how test results could inform design guidelines for COPVs; and solicit feedback on the impacts of possible updates for design guidelines.

DATES: Interested parties are invited to submit comments on or before **[INSERT DATE 90 DAYS AFTER PUBLICATION IN THE FEDERAL REGISTER]**. Comments received after that date will be considered to the extent possible.

ADDRESSES: You may submit comments identified by the Docket Number PHMSA-2024-0180 by any of the following methods:

- *Federal eRulemaking Portal*: https://www.regulations.gov. Follow the instructions for submitting comments.
- *Fax*: 1-202-493-2251.
- *Mail*: Docket Management System; U.S. Department of Transportation, West Building, Ground Floor, Room W12–140, Routing Symbol M–30, 1200 New Jersey Avenue, SE, Washington, DC 20590.

- *Hand Delivery*: Docket Management System; Room W12-140 on the ground floor of the West Building, 1200 New Jersey Avenue, SE, Washington, DC 20590, between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays.

Instructions: All submissions must include the agency name and Docket Number [PHMSA-2024-0180] for this notice. To avoid duplication, please use only one of these four methods. All comments received will be posted without change to the Federal Docket Management System (FDMS) and will include any personal information you provide.

Docket: For access to the dockets to read background documents or comments received, go to http://www.regulations.gov or DOT's Docket Operations Office (see **ADDRESSES**).

Privacy Act: In accordance with 5 U.S.C. 553(c), DOT solicits comments from the public. DOT posts these comments, without edit, including any personal information the commenter provides, to http://www.regulations.gov, as described in the system of records notice (DOT/ALL–14 FDMS), which can be reviewed at http://www.dot.gov/privacy.

Confidential Business Information (CBI): CBI is commercial or financial information that is both customarily and actually treated as private by its owner. Under the Freedom of Information Act (FOIA) (5 U.S.C. 552), CBI is exempt from public disclosure. If your comments responsive to this notice contain commercial or financial information that is customarily treated as private, that you actually treat as private, and that is relevant or responsive to this notice, it is important that you clearly designate the submitted comments as "CBI." Please mark each page of your submission containing CBI as "PROPIN." Submissions containing CBI should be sent to Andrew Leyder, Pipeline and Hazardous Materials Safety Administration, U.S. Department of Transportation, 1200 New Jersey Avenue, SE, Washington, DC 20590-0001. Any commentary that PHMSA receives that is not specifically designated as CBI will be placed in the public docket for this notice.

FOR FURTHER INFORMATION CONTACT: Andrew Leyder, Office of Hazardous Materials Safety, Research, Development & Technology, by phone at 202-360-0664, by e-mail

at andrew.leyder@dot.gov, or by mail at Pipeline and Hazardous Materials Safety Administration, U.S. Department of Transportation, 1200 New Jersey Avenue, SE, Washington, DC 20590-0001.

SUPPLEMENTARY INFORMATION:

I. Purpose

PHMSA is publishing this notice to (1) solicit information to evaluate the test design for proposed bonfire tests on fully charged composite overwrapped pressure vessels (COPVs) with different Pressure Relief Devices; (2) seek input on how test results could inform design guidelines for COPVs; and (3) solicit feedback on the impacts of possible updates for design guidelines.

II. Background

Pressure relief devices (PRDs) are standard equipment on all compressed natural gas containers. The function of a PRD is to vent the compressed gases in the case of a fire, preventing rupture and the subsequent high-pressure gas release with a possible ignition and explosion. If the gas is released at high-pressure in certain environments, the result could be catastrophic. Therefore, PRD design and manufacture must offer a degree of protection and reliability that meets or exceeds that of the cylinder to provide the proper degree of safety. Pressure vessels can be constructed using metal (e.g., steel or aluminum) or composite material (i.e., cylinder/tube is wrapped with continuous filaments held with metallic/polymer liners). Pressure vessels used for transporting flammable gases are equipped with PRDs to prevent explosions or ruptures during a fire. Per the Compressed Gas Association (CGA) pamphlet S1.1, both metallic pressure vessels and COPVs are typically equipped with CG-4 or CG-5 devices. These PRDs are designed to activate under a combination of excess temperature and pressure during a fire. The CG-4 device is more sensitive to temperature as it uses a fusible metal plug that melts at a lower temperature than those used in a CG-5 device.

Though there have been issues of premature activation, PRDs historically have been used without major problems. Stainless steel DOT-approved cylinders are proven to be fire-resistant for 20 minutes without significant loss of yield strength. Due to heat conduction through these steel cylinders, the PRDs may be activated before cylinder rupture when exposed to excessive heat.

In contrast, COPVs are more heat-insulating; the internal pressure of the cylinder typically will not reach PRD activating pressures before the resin in the COPV shell begins to fail. Consequently, COPVs will often rupture at lower internal pressures than their metallic counterparts because of hull breakdown, and the CG-4 and CG-5 PRDs never reach burst pressures.

On February 11, 2018, a fire incident occurred involving a COPV hydrogen tube trailer equipped with Type CG-5 PRDs. A subsequent National Transportation Safety Board (NTSB) investigation (NTSB incident report number NTSB/HZM-19/02 PB2019-101398) indicated that the Type CG-5 PRDs installed on these COPVs had a lower setting than is required under CGA PRD standard CGA S1.1. The lower set pressure of the Type CG-5 PRDs resulted in premature activation of the devices and caused a fire. The fire then spread to adjacent COPVs, which had CG-5 PRDs that did not function correctly, resulting in an explosion of several additional COPVs. NTSB determined that while a correctly rated CG-5 PRD may have reduced the risk of fire initiation, the CG-5 PRD would not have prevented the COPVs from exploding due to exposure to high heat temperatures.

The NTSB report for this incident is available online at 59258 (ntsb.gov). NTSB directed PHMSA to work with CGA to develop design guidelines for tube trailer pressure relief device vent systems in Recommendation H-19-21. To address that recommendation, a systematic evaluation of alternative PRDs in COPVs is necessary. There are alternative PRDs (e.g., CG-9 and CG-10) that use thermal activation rather than the pressure/temperature combination for activation. These PRDs are commonly used on NGV-2 composite tubes, which have different

design specifications and operating conditions than COPVs regulated under the Hazardous Materials Regulations (49 CFR parts 171 through 180). To evaluate whether thermally activated PRDs are effective alternatives for COPVs, PHMSA is proposing a test design for various PRDs subjected to bonfire tests on COPVs.

III. Request for Feedback

The objective of this project is to assess the effectiveness of various PRDs when subjected to bonfire tests on fully charged COPVs. The test results will determine the optimal number, type, and location of PRDs to install in fully charged COPVs. The goal is to prevent potential cylinder ruptures similar to the one described in the NTSB investigation and recommendations reports. These test results can inform future pressure vessel design guidelines. The specified COPVs are:

a. Type 3 COPVs with 16″ outside diameter, 120″ length, and 5,400-psig test pressure.
b. Type 4 COPVs with 16″ outside diameter, 120″ length, and 5,400-psig test pressure.

PRDs to be tested are CG-4, CG-5, CG-9, and CG-10 PRDs that meet the requirements set forth in pamphlet S1.1 of the CGA.

Bonfire testing will be completed under four different pressure vessel configurations at three different locations for each PRD. Each bonfire will be applied for a minimum of 30 minutes.

- One type 3 COPV with a CG-4 PRD at each end will be used, with the center of the fire at three different locations (PRD exposed to fire 6″ and 10″ away from the fire).
- One type 4 COPV with a CG-5 PRD at each end will be used, with the center of the fire at three different locations (PRD exposed to fire 6″ and 10″ away from the fire).

- A steel pipe with a CG-9 PRD will be used, with the center of the fire at three different locations (PRD exposed to fire 6″ and 10″ away from the fire).
- A steel pipe with a CG-10 PRD will be used, with the center of the fire at three different locations (PRD exposed to fire 6″ and 10″ away from the fire).
- One type 4 COPV with a CG-9 PRD at each end will be used, with the center of the fire at three different locations (PRD exposed to fire 6″ and 10″ away from the fire).
- One type 4 COPV with a CG-10 PRD at each end will be used, with the center of the fire at three different locations (PRD exposed to fire 6″ and 10″ away from the fire).

PHMSA requests comment on the following questions to assist in our evaluation of the proposed research and development with a scope as specified above.

1. Would the results from the proposed testing adequately inform design specifications for vent systems?
2. Is the number of COPV tubes in the above test matrix adequate for a representative test of the COPV, or should additional COPV tubes be tested to ensure replicability?
3. Is a bonfire test of at least 30 minutes sufficient to test activation of the PRDs? If not, what would be a sufficient minimum duration to test PRD activation?
4. Should a minimum bonfire temperature be specified to test PRD activation? If so, what should the minimum bonfire temperature be?
5. Is the number of bonfire tests (one for each configuration) sufficient to test PRD effectiveness? If not, how many replicates of the test should be conducted?
6. Would testing at 6″ and 10″ away from the center of the fire be sufficient to capture differences in fire location from the PRDs? If not, what fire distances/locations are recommended?

7. Should different operating pressures be tested? If so, what other pressures should be tested?
8. Do the proposed COPV/PRD combinations provide an accurate comparison of temperature/pressure-activated PRDs to temperature-activated PRDs? If not, which COPV/PRD combinations should also be considered in addition to the above testing matrix?
9. What other variables, if any, should be included in testing?
10. Are there other existing safety concerns about COPVs and PRDs that PHMSA should be aware of?
11. What, if any, are the cost impacts of using CG-9 or CG-10 PRDs on COPVs instead of CG-4 or CG-5?
12. How common is the current use of CG-9 or CG-10 PRDs for COPVs used to transport flammable gases?
13. Should the allowable PRDs for COPVs used to transport flammable gases be limited to CG-9 or CG-10?

Issued in Washington, DC on March 14, 2025.

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Pipeline and Hazardous Materials Safety Administration.

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