Underground Natural Gas Storage Safety Regulation

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Abstract

PHMSA adopted regulations for the underground storage of natural gas. Prior to the issuance of the December 2016 Interim Final Rule (IFR), PHMSA regulatory oversight ended at the injection points for storage facilities and did not include any equipment beyond that point. The IFR prescribes safety requirements that apply to all underground storage operation and include downhole facilities, wells, wellbore tubing, and casing. The scope and applicability of the regulations are discussed in this paper.

Underground Natural Gas Storage Safety Regulation

PHMSA adopted regulations for the safety of underground natural gas storage (UGS). Under the scope of the new regulations, operators are required to develop procedures and practices for newly constructed and existing underground natural gas storage facilities that include operations, maintenance, threat identification, monitoring, assessment, site security, emergency response, preparedness, training, and recordkeeping. The regulatory language incorporates references for two industry recommended practices (RPs): API RP 1170 and API RP 1171. API RP 1170 addresses solution-mined salt caverns, and API RP 1171 addresses depleted hydrocarbon reservoirs and aquifer reservoirs. PHMSA's IFR changed all non-mandatory references to mandatory provisions in order to enforce the rule.

Due to the change to mandatory provisions, operators were given the opportunity to request exceptions to those mandatory provisions. In order to be considered for an exception, an operator would need to provide justification and supporting documentation from a subject matter expert (SME) to show why a provision is neither practicable nor necessary for safety with respect to specified underground storage facilities or equipment. The request must be dated and approved by a senior executive officer, Vice President, or higher company officer with responsibility for the underground natural gas storage facility. It is anticipated that PHSMA may issue advisory bulletins or notify operators advising them of variances that have frequently been deemed not acceptable and should be avoided under most circumstances.

With the adoption of industry practices as part of the rulemaking process, it was necessary for PHMSA to make the industry standards available for operators to follow without placing an undue burden on them. The read-only versions of the two RPs are on API's website:

http://www.api.org/Publications-Standards-and-Statistics/Publications/Government-cited-Safety-Documents

History of Underground Storage

Records show that the first underground storage facility began operating in the United States as early as 1916. Since that time, the operation has grown to over 400 active UGS facilities in the U.S., operated by approximately 120 companies. Most of the gas storage (over 80 percent) is in depleted oil or natural gas reservoirs. The remaining 20 percent is a combination of non-potable aquifers and salt caverns. Many state oil and gas regulatory agencies have required some type of permitting, drilling, and operational requirements for decades; however, there has not been any federal safety oversight for the facilities. The first discussions regarding the safety of underground storage in the federal safety arena were initiated after an accident that occurred in Brenham, Texas on April 7, 1992.

At the time of the Brenham accident, underground storage facilities were not regulated for safety by PHMSA. The Railroad Commission of Texas, Oil & Gas Division, had permitting authority over the drilling and operation of the cavern with limited safety provisions, similar to the PHMSA regulatory environment. The Brenham storage cavern, a solution-mined salt formation, was used to store LPG liquid for Seminole Pipeline Company. The release and explosion investigation included representatives from the National Transportation Safety Board (NTSB). In their final accident report, NTSB made recommendations for the safety of such facilities (NTSB/PAR 93/01). Several years after the explosion, PHMSA conducted a hearing in July 1994 in Houston, Texas. As a follow-up to the hearing, PHMSA contracted a study to summarize the underground hydrocarbon storage industry. It was concluded, at that time, that PHMSA's pipeline safety regulations included all piping and equipment up to the last valve on the wellhead. While

PHMSA had legislative authority to go beyond the wellhead, they chose, at that time, to limit the safety oversight to the wellhead injection point. PHMSA issued its first advisory bulletin, ADB-97-04, addressing underground storage in July 1997. The advisory bulletin was issued to provide notice to the underground storage industry about the availability of guidance materials regarding the design and operating guidelines for UGS and the applicable state and federal regulations. PHMSA's bulletin advised operators to follow the applicable state and federal safety standards.

In October 2015, an uncontrolled leak was discovered in a natural gas storage well in an area designated as Porter Ranch just outside of Los Angeles. The underground natural gas storage facility, operated by Southern California Gas Company, was unable to contain the release for over four months. In February 2016 a relief well was drilled to stop the leak. The California Division of Oil Gas and Geothermal Resources in the Department of Conservation (DOGGR), had regulatory authority of the well at the time of the accident; while the California Public Utilities Commission had regulatory authority for the above ground piping.

Following the Aliso Canyon incident, PHMSA issued its second Advisory Bulletin, ADB-2016-0016. PHMSA issued the advisory bulletin to inform owners and operators of underground storage facilities used for natural gas, as defined in 49 CFR Part 192, of their responsibility to review the overall integrity of the facilities to ensure the safety of the public and operating personnel, and to protect the environment. Operators were reminded to assess their operations to identify any hazards associated with a potential leak at the facility that may be caused by any one of the following events: corrosion, chemical damage, mechanical damage, or other material deficiencies in piping, tubing, casing, valves, and associated facilities. PHMSA also stressed the importance of the location and condition of valves used to shut off and isolate the system as part of the emergency response plan. This advisory bulletin was used to prepare for the public workshop

that was held in Washington, DC in July 2016. The result of the workshop and advisory bulletins resulted in the IFR issuance in December 2016.

Interstate Oil & Gas Compact Commission (IOGCC) Natural Gas Storage in Salt Caverns (1995, 1998, 2017)

The IOGCC is a multi-state regulatory commission with governors representing states involved in the production of oil and gas. Following the PHMSA July 1994 hearing, the IOGCC established a sub-committee to develop guidelines for State Agencies to address operational and safety issues associated with storing natural gas in underground in salt caverns. The subcommittee included representatives from federal and state regulators, including the Department of Energy, the National Association of Regulatory Utility Commissioners, American Gas Association, National Gas Supply Association, and Gas Research Institute. The subcommittee developed a report entitled "Natural Gas Storage in Salt Caverns - A Guide for State Regulators" (IOGCC Guide). The IOGCC Guide provides safety standards for the design, construction, and operation of gas storage caverns. The standards are useful to the industry as well as state agencies. The first edition of the guidelines was published in 1995, followed by an updated version in 1998.

In May of 2017, the StatesFirst Initiative, a joint project of the IOGCC and the Ground Water Protection Council, released a more comprehensive Guide for Underground Storage.

http://iogcc.ok.gov//Websites/iogcc/images/FINAL_UGS_report_2017-05.pdf

This document builds upon information learned since the first publication and addresses those items discussed in the API Recommended ractices. The guide was not created for regulatory purposes, but rather as an evaluation of underground storage facilities with recommendations or considerations for state and federal regulatory agencies.

Scope of PHMSA Regulations

PHMSA's approach to regulating underground natural gas storage facilities was to adopt available industry standards rather than creating a new set of standards. As part of their consideration, PHMSA reviewed the API-recommended practices and provided recognition of the natural and subsurface geological diversity, and stressed the need for in-depth, site-specific geomechanical assessments with a goal of long-term facility integrity and safety. The recommended practices include the cavern well system from the emergency shut-down valve (ESD) through the well including wellhead, casing, tubing, cement, and completion techniques, including the design and construction of the cavern itself.

API RP 1170 – Design and Operation of Solution-mined Salt Caverns Used for Natural Gas Storage (First Edition, July 2015)

API RP 1170 focuses on the design and operation of solution mined caverns. The RP has eleven sections for the well design and drilling, solution mining techniques, and operations that include monitoring and maintenance practices. The PHMSA IFR requires that UGS facilities comply with the design and construction sections of this RP beginning in July 2017. Operators with facilities in operation prior to the IFR, must have procedures in place to comply with Sections 9 Gas Storage Operations, Section 10 Cavern Integrity Monitoring, and Section 11 Cavern Abandonment by January 2018.

API RP 1171 – Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs (First Edition, July 2015)

API RP 1171 focusses on the integrity assessment and management of depleted reservoir storage. The risk-based approach to well integrity management advocated in API RP 1171 includes five steps: 1) Data Collection, Documentation and Review (Section 8.3), 2) Hazard and Threat Identification (Section 8.4), 3) Risk Assessment (Section 8.5), 4) Risk Treatment – Developing

Preventive and Mitigative Measures (Section 8.6), and 5) Periodic Review and Reassessment (Section 8.7). It is anticipated that it will take several years for operators to fully complete an integrity cycle for their underground storage facility. In PHMSA meetings and FAQs, they anticipate anywhere between three and eight years to complete the process, depending upon the complexity of the facility and operations. As described, there is a great deal of work to do to achieve the five steps mentioned above.

As with API RP 1170, all wells designed after July 2017 must comply with all sections of the RP for design, construction, and testing. For those in service prior to the rule, operators will have one year to comply with Section 8 Risk Management for Gas Storage Operations, Section 9 Integrity Demonstration, Verification, and Monitoring Practices; Section 10 Site Security and Safety, Site Inspections, and Emergency Preparedness and Response; and Section 11 Procedures and Training.

Compliance Milestones

All underground storage operators must develop and implement a risk assessment plan for their facility by the implementation date of the IFR, January 18, 2018. After the risk assessment plan is developed, the operator can comply with the remaining requirements of the standards by development of other procedures regarding the operation and maintenance requirements discussed above. For solution-mined facilities, compliance with Sections 9, 10, and 11 of API RP 1170; and for depleted reservoir facilities compliance with Sections 8, 9, 10, and 11 of API RP 1171 is required within one year. It is important that operators make decisions regarding their facility risk assessment and threat identification process. Where necessary, preventive and mitigative measures are to be implemented based on the potentially identified risks and threats at each individual storage well within a facility.

PHMSA anticipates that the baseline risk assessments of the facilities will begin within the first year, with no more than one additional year allowed. The assessments of the facilities may take from three to eight years, all depending on the size and the operations within a specific facility.

- December 19, 2016 IFR issued
- January 18, 2017
    - IFR effective date.
    - PHMSA issued a stay of enforcement regarding implementation due to the mandatory language added to the standards.
    - 49 CFR 191.22(c) National Registry Notification to obtain an Operator Identification (OPID) for the Underground Natural Gas Storage Facility on DOT Form PHMSA F1000.1. All New Construction, Name Changes, Acquisitions and Divestitures also require notification on DOT Form PHMSA F1000.1. All underground natural gas storage facilities are required to have an OPID. Only one OPID is required per storage field.
    - Any incident that meets the reportable criteria must be reported to PHMSA on DOT Form PHMSA F7100.2 and telephonically reported as necessary.
    - Safety Related Condition Reports; added specific language for reporting on underground natural gas storage to include those instances where general corrosion that has reduced the wall thickness to less than that required for the maximum well operating pressure, or localized corrosion pitting to a degree where leakage might result
    - Drug and Alcohol program in accordance with 49 CFR Part 199

    - Operator Qualification under Part 192 not required; however compliance with API RP 1170 (Section 9.7.5) or API RP 1171 (Section 11.12).
- July 18, 2017
    - All facilities constructed after this date must comply with all provisions of API RP 1170 or API RP 1171 depending upon their applicability
    - First Annual Report Submissions due. Submitted on DOT PHMSA Form 7100.4-1; hereafter due on March 15 as with all other annual report submissions. Reporting delayed due to lagging approval by the Office of Management and Budget. PHMSA has indicated that the reports will be due several months after receiving approval. PHMSA estimates 124 operators will submit an annual report.
- January 18, 2018
    - Operators must have written procedures in place for the activities being performed under 49 CFR 192.605 addressing operation, maintenance, emergency preparedness, and any physical site work activities that are being conducted as of January 18, 2018. Moving forward, operators must develop additional procedures to include a comprehensive integrity management program and review of the applicability of the requirements within RP 1171 Sections 8, 9, 10, and 11 (for depleted reservoir) and RP 1170 Sections 9, 10, and 11 (for solution mined). In addition, operators must provide guidance on how future procedures will be developed with the assignment of roles and responsibilities to appropriate personnel, how the plan will develop with changes identified through assessments

and the application of preventive and mitigative measures, and the training in the procedures throughout the process.

- PHMSA Inspections to begin with no enforcement actions pending the stay regarding the mandatory language provisions.

Useful Links

https://primis.phmsa.dot.gov/ung/index.htm

PHMSA's information page for all Underground Storage. Contains all documents and information regarding future inspection and compliance expectations.

http://iogcc.publishpath.com/news

IOGCC's website with publications regarding Underground Natural Gas Storage and the StatesFirst initiative report.

https://www.ntsb.gov/investigations/AccidentReports/Pages/pipeline.aspx

NTSB accident reports to include the Brenham, Texas accident 93-01