Underground Natural Gas Storage

Past, Present and Future

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U.S. Underground Natural Gas Storage Facilities, by Type (December 31, 2015)

Source: US Energy Information Administration
## Central Region

<table>
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<tr>
<th>State</th>
<th>Anticipated State Regulated</th>
<th>Anticipated PHMSA Regulated</th>
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<td><strong>Total</strong></td>
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Past Accidents

• **2004 Moss Bluff** (Liberty County, TX)
  – 6 bcf release, fire
  – Well string separation, wellhead separation

• **2001 Yaggy** (downtown Hutchinson, KS)
  – Explosion, 2 fatalities
  – Casing leak, migrated 9 miles underground to downtown Hutchinson businesses & mobile home park
Yaggy, Hutchinson, Kansas, January 17, 2001
Aliso Canyon Storage Field

• Southern California Gas Company (SoCal Gas)
• 2nd largest field in the US, 86 BCF working capacity (167 BCF field capacity)
• Well drilled in 1953, converted to NG storage in 1972
• 115 wells, Pressure >2,600 psi
• Subsurface Safety Valve removed prior to 1979
• Regulated by the CA Division of Oil, Gas, & Geothermal Resources (DOGGR)
SoCal Gas – Aliso Canyon Field, CA
Aliso Canyon Storage Field Incident

• **October 23, 2015**: Natural gas leak discovered at Aliso Canyon Well SS25 in Porter Ranch, Los Angeles County, California
• **January 6, 2016**: Governor Brown issues State of Emergency
• **February 18, 2016** (118 days later): Leak permanently sealed after 7 kill attempts
• ~ **5 BCF** (97,000 tons) of natural gas was released, 2\textsuperscript{nd} largest release in US history
• ~ **5,790 households** relocated due to health concerns of odorant (mercaptans) & heavier hydrocarbons (e.g. benzene)
• **Cost**: > $600 million, as reported by Southern California Gas
Underlying Principles

- PHMSA’s primary role is to establish minimum safety standards (regulations) and to verify that the operators perform to these standards.
- Operator responsibility to understand, safely manage, and communicate the risks and changes (safety conditions) associated with their pipelines and related underground storage facilities.
- PHMSA strives to advance public awareness beyond mere compliance with the regulations.
- Focus is on performance and behavioral change.
Advisory Bulletin Feb 2016

- To remind owners and operators of underground natural gas storage facilities to consider the overall integrity of the facilities to ensure the safety of the public and operating personnel and to protect the environment.

- Operators are reminded to review their operations to identify the potential of facility leaks and failures caused by corrosion, chemical damage, mechanical damage or other material deficiencies in piping, tubing, casing, valves and associated facilities, and to review the location and operations of isolation systems, & to update emergency plans.

On June 22, 2016, the PIPES Act was enacted. The PIPES Act of 2016 amends 49 U.S.C. section 60101(a) to define “underground natural gas storage facility” as “a gas pipeline facility that stores natural gas in an underground facility, including—(A) a depleted hydrocarbon reservoir; (B) an aquifer reservoir; or (C) a solution-mined salt cavern reservoir.”

The Act requires PHMSA to issue, within two years of passage, “minimum safety standards for underground natural gas storage facilities.”

In addition, the Act expressly allows states to adopt more stringent safety standards for intrastate facilities, if such standards are compatible with the minimum standards prescribed in section 12 of the Act.
IOGCC Guide

John King, retired from MPSC, Chaired the IOGCC Committee in the mid-1990’s that created the guide for Natural Gas Storage in Salt Caverns.

API RP 1171 – Functional Integrity of Depleted Hydrocarbon Reservoirs & Aquifer Reservoirs: September 2015

Includes:
• Design of Reservoirs
• Design of Wells & Completion
• Risk Management for Gas Storage Operations
• Integrity Demonstration, Verification, and Monitoring
• Emergency Preparedness and Response
• Site Security & Safety
• Cyber Security
• Training
Interim Final Rule

Anticipated this year.
What now?

• Follow API RP 1170 and API RP 1171 voluntarily.
Planning for Compliance

Storage Field Integrity

• Leverage all available data sources to continually demonstrate functional integrity of storage assets through data integration.
Planning for Compliance

- Develop a **Risk Management Process**
- Identify **Threats/Hazards**
- Conduct a **Risk Assessment**
- Identify **Preventive and Mitigative Measures**
- Evaluate **Risk Management Effectiveness**
Planning for Compliance

Reservoir Integrity

- Characterize, monitor and manage the reservoir
- Inventory Verification
- Observation Well Monitoring
- Monitor 3rd Party Wells
Planning for Compliance

Well Integrity

• Develop, maintain, and Document Integrity of each well. This should be a detailed evaluation process.

• Includes well drilling and completion, and well control practices, maximum well operating pressure, Operations & Maintenance records, and Mechanical Integrity Testing (MIT) of each well.
Planning for Compliance

**Well Integrity**

- Internal MIT is demonstrated by pressure testing production casing-tubing annular space, and
- Using a variety of well integrity tests best suited for each well such as:
Planning for Compliance

Well Integrity

- Temperature logging
- Noise (Audio) logging
- Cement evaluation (to determine location and quality)
- High Res – MFL log (corrosion)
- Caliper log
- Downhole camera & More
Planning for Compliance

Facility Integrity

• Develop, maintain & document integrity of surface and support equipment.
• Physical & Cyber Security.
• Emergency Response Plans & coordination
Planning for Compliance

Procedures & Training

- Must have procedures for construction, completion, operation, maintenance, servicing, and workover activities and closures.
- Qualification assurance for personnel demonstrating knowledge, skills and ability.
- MOC process to promote safety.
Planning for Compliance

Public Awareness & Damage Prevention

• Education of the public on the hazards related to unintended releases, indications of a release, procedures for reporting a release and actions to be taken in the event of a release.

• Should coordinate with existing programs where possible.
What’s after the Interim Final Rule?

• Anticipated additional rule-making to address Gaps.

• We are listening to your comments, concerns and recommendations.
PHMSA UNGS web site

Underground Natural Gas Storage information link

Questions??