

Underground Natural Gas Storage

Past, Present and Future

September 27, 2016

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US DOT/PHMSA

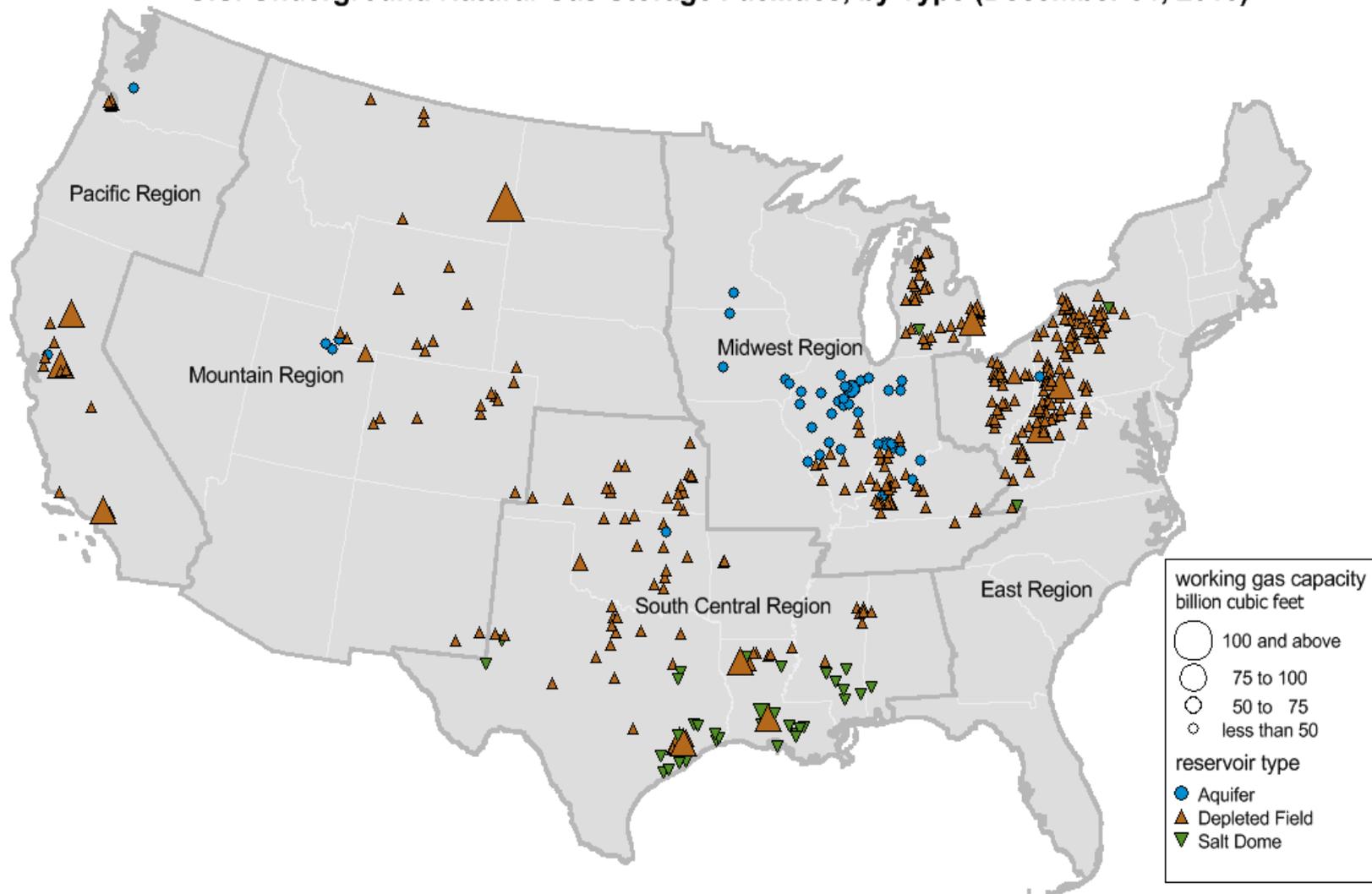
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U.S. Underground Natural Gas Storage Facilities, by Type (December 31, 2015)



Source: US Energy Information Administration



Central Region

State	Anticipated State Regulated	Anticipated PHMSA Regulated
ND	0	0
SD	0	0
NE	0	1
KS	2	15
MN	0	1
IA	0	4
MO	1	0
WI	0	0
IL	20	8
MI	25	19
IN	17	4
Total	65	51



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)

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SoCal Gas – Aliso Canyon Field, CA

- Well SS25 – leaked Oct. 2015 to Feb. 2016



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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, 2nd 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



Aliso Canyon Incident



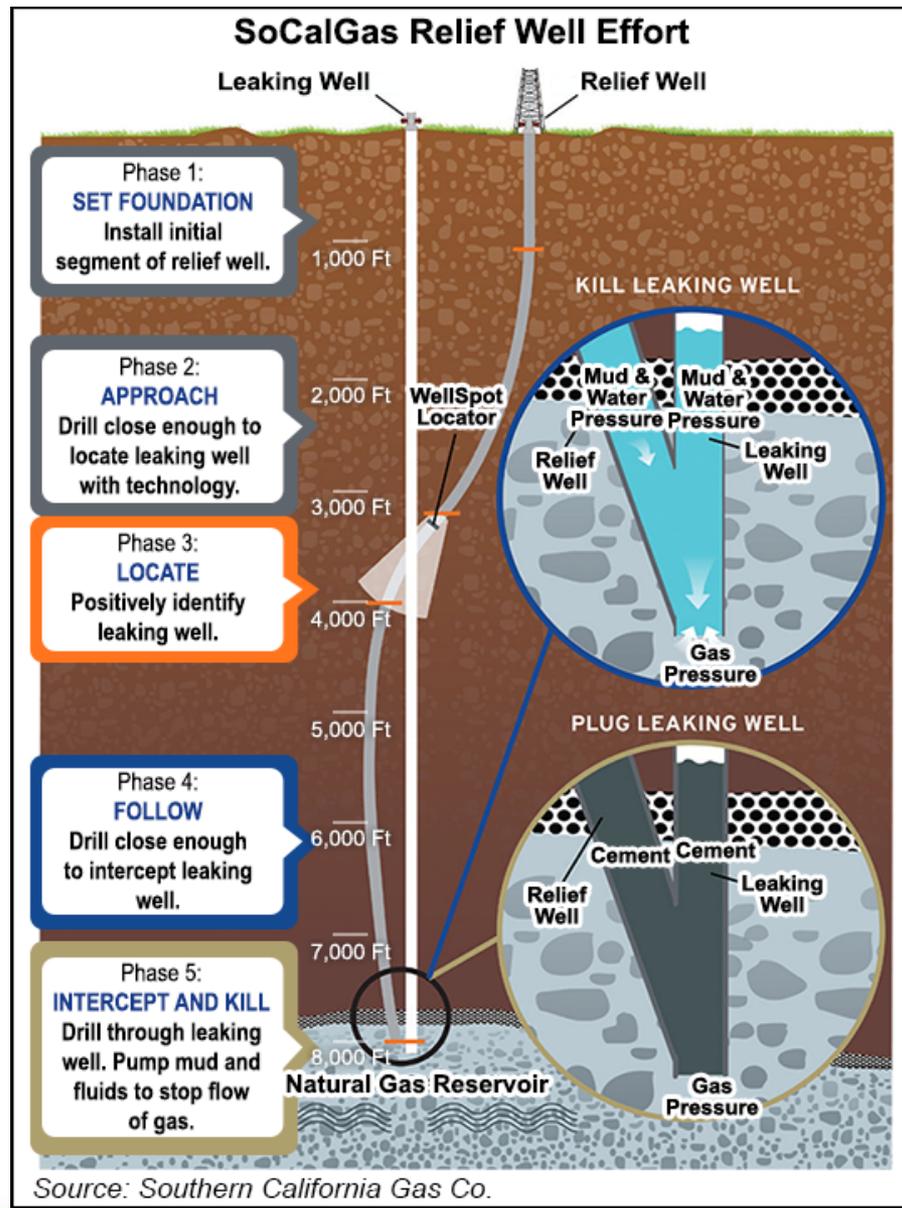
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Underlying Principles

- 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.**

<http://phmsa.dot.gov/aliso-canyon-natural-gas-leak/advisory-bulletin>



Pipes Act of 2016

- 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 1170 – Design & Operation of Solution-mined Salt Caverns: July 2015

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

<http://primis.phmsa.dot.gov/ung/index.htm>



Questions??

