

Technical and Legal Requirements for Gas Storage Field Safety

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Abstract

Summary / Conclusions

There is no uniform set of natural gas storage rules, operating practices, or technical requirements. In this paper, the state of global natural gas storage regulations will be compared and contrasted with illustrations of the safety and integrity technology that may be required. Further, likely changes to the regulatory schemes will be discussed, including examples of the technologies that may need to be employed. These regulatory changes, in conjunction with evolving technologies and operational practices, will help to ensure that underground natural gas storage continues in a manner that ensures reliable natural gas service into the foreseeable future. Increasing public focus on storage integrity is creating new challenges for the industry with the possibilities for implementation of new technical standards and changing market conditions.

Background

Natural gas is a vital component of global energy supply. To ensure reliability of natural gas supply in times of high demand and as a means to hedge against commodity price fluctuations, natural gas storage has evolved over the past 100 years to become an important component of the natural gas delivery chain.

The majority of natural gas storage facilities are located in Europe, the United States and Canada in depleted oil and gas reservoirs, water aquifers and domal and bedded salt caverns. With the high-profile leak of an injection/withdrawal well at the Aliso Canyon Gas Storage Field in California two years ago, there has been a heightened awareness of the existence of gas storage facilities and increased public and governmental scrutiny of their operations, maintenance and safety.

Due to technological development and incidents at underground gas storages in recent years, views about storage integrity has evolved. As a result, technical standards for underground gas storages in the United States as well as in Europe have been revised in a manner which emphasizes storage integrity practices. Updated or completely new technical standards, such as *API Recommended Practice 1171 Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs*, *API Recommended Practice 1170 Design and Operation of Solution-mined Salt Caverns Used for Natural Gas Storage* (both published in 2015) or *European standard EN 1918 Gas infrastructure - Underground gas storage* (2016), or various national and state laws, describe recommended industry-wide technical practices in planning, construction and operation of underground gas storages with the aim to secure the storage integrity and safety. Furthermore, there are recommendations concerning risk assessments and integrity of underground gas storages by institutions such like the Interagency Task Force on Natural Gas Storage in the United States. These

standards and recommendations might lead to enhanced legal requirements for new and existing underground gas storage, which, over time, may have potential global effects.

Aims

While there are generally consistent development and operations gas storage practices across the global industry, governmental regulation varies widely. There are no uniform global operations, maintenance, safety, or environmental regulatory standards applicable to natural gas storage. Rather there are varying national, state/provincial, and, in some cases, local regulations which are enforced by governmental agencies with varying degrees of tolerance. There are stark differences between general European regulatory requirements and American/Canadian requirements. These regulations and general industry practice are under constant review, in part due to the Aliso incident, but also due to technological advancements and public policy changes.

This paper will compare and contrast the state of natural gas storage regulations as they exist globally today with illustrations of the required compliance technology. Further, it will discuss likely changes in the regulatory scheme including examples of the technology that probably will be employed. These regulatory changes, in conjunction with evolving technologies and operational practices, will help to ensure that underground natural gas storage continues in a manner that ensures reliable natural gas service into the foreseeable future.

Methods

The paper also will analyze the impact of the latest technical developments on legal regulations concerning the operation of underground gas storage facilities in the U.S. and Europe. The impact of relevant technical standards and recommendations on storage integrity will be analyzed with an explanation as to whether they have already been or will be implemented into law.

Results

There are important technological requirements and developments that exist regionally today that will be evaluated for global implementation:

- Double-barrier-systems (e.g. additional tubing inside casing)
- Emergency shutdown valves (e.g. subsurface safety valves)
- Mechanical and hydraulic integrity tests during construction and commissioning
- Evaluation and monitoring of well integrity during operation (e.g. annular pressure management, corrosion effects)
- Risk management planning (e.g. identification of potential threats and hazards)

Furthermore, it is anticipated that the following practices and technological developments might be implemented globally in the future:

- Analysis, prognosis and monitoring of subsidence
- Analysis, prognosis and monitoring of seismicity
- Abandonment management
- Use of unconventional storage media (e.g. hydrogen, helium)
- Rock mechanical effects due to high frequency cycling

A new emphasis by the public and governmental agencies on storage integrity leads to added operational challenges to the industry and the possibilities for the legal implementation of the new technical standards. These new standards will directly influence operation, flexibility, costs and the performance of natural gas storage facilities with a coincident impact on the natural gas marketplace.

Key words: technical requirements, legal requirements, legal regulations, gas storage, storage safety, storage integrity