



# Technical and Legal Requirements for Gas Storage Field Safety

Ms. Heike Bernhardt, Technical Director, DEEP.KBB

Mr. William S. Garner, Jr., Shareholder, Greenberg Traurig, LLP

HOST ASSOCIATION



PROUDLY SUPPORTED BY



HOST PARTNERS



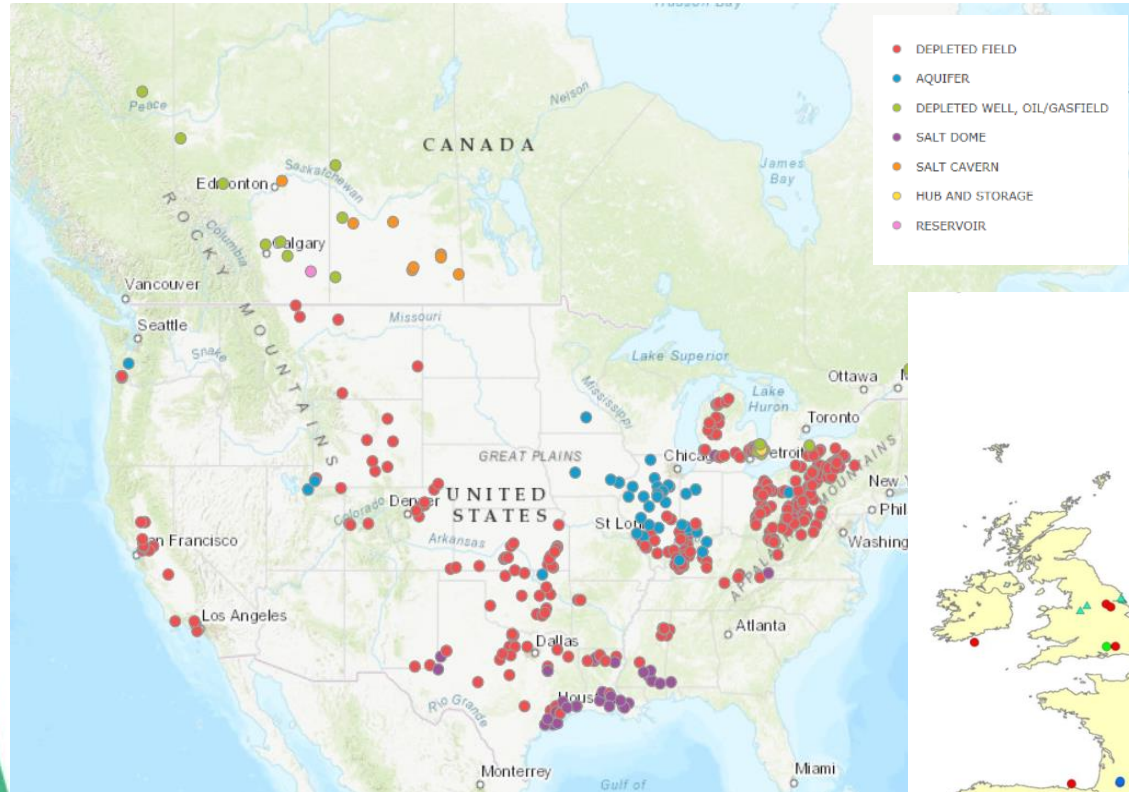
PRINCIPAL SPONSORS



# Content

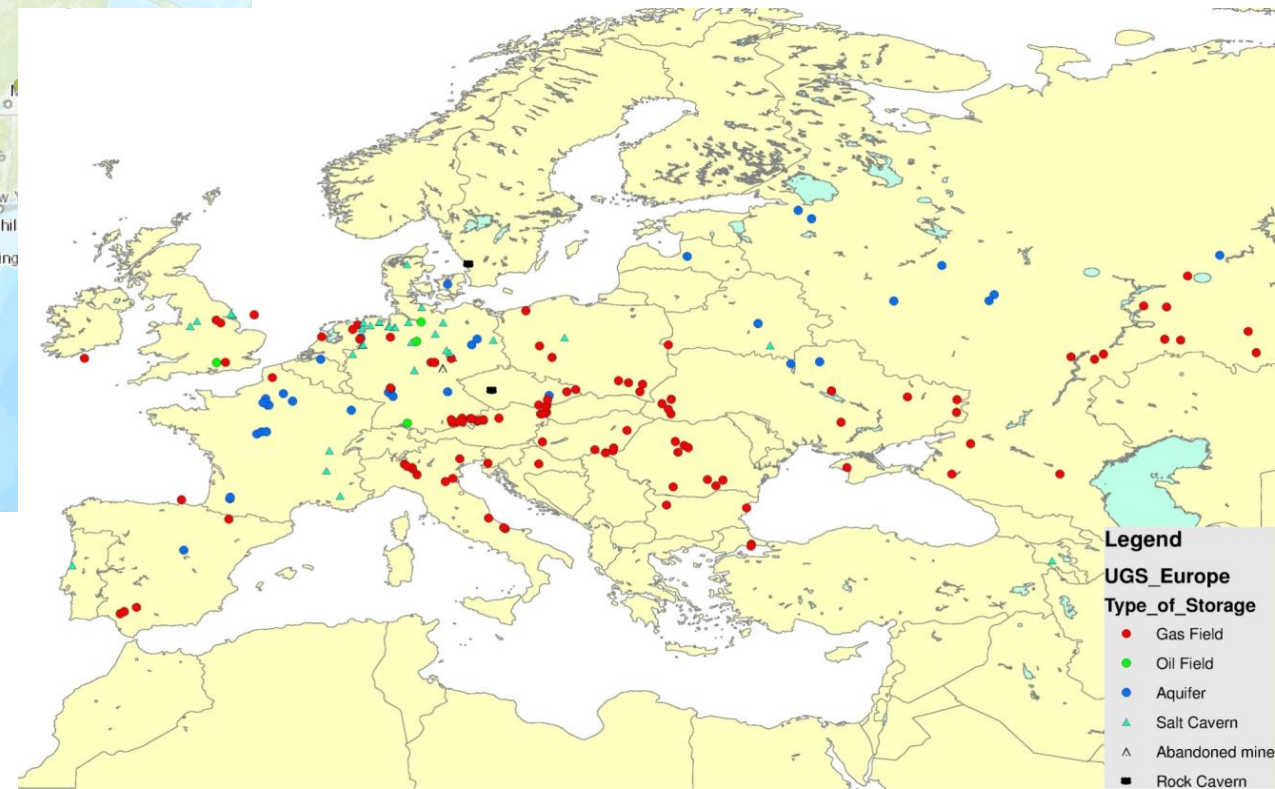
- Introduction to Underground Gas Storage
  - Locations and Storage Types
- Development of Technical Standards
- Storage Integrity Concept
- Interdependency of Technical and Legal Requirements
- Overview of Legal Requirements
- Conclusion

# Location with Underground Gas Storage in North America & Europe



- Worldwide distribution:
  - Depleted hydrocarbon fields (81%)
  - Aquifers (13%)
  - Salt caverns (6%)

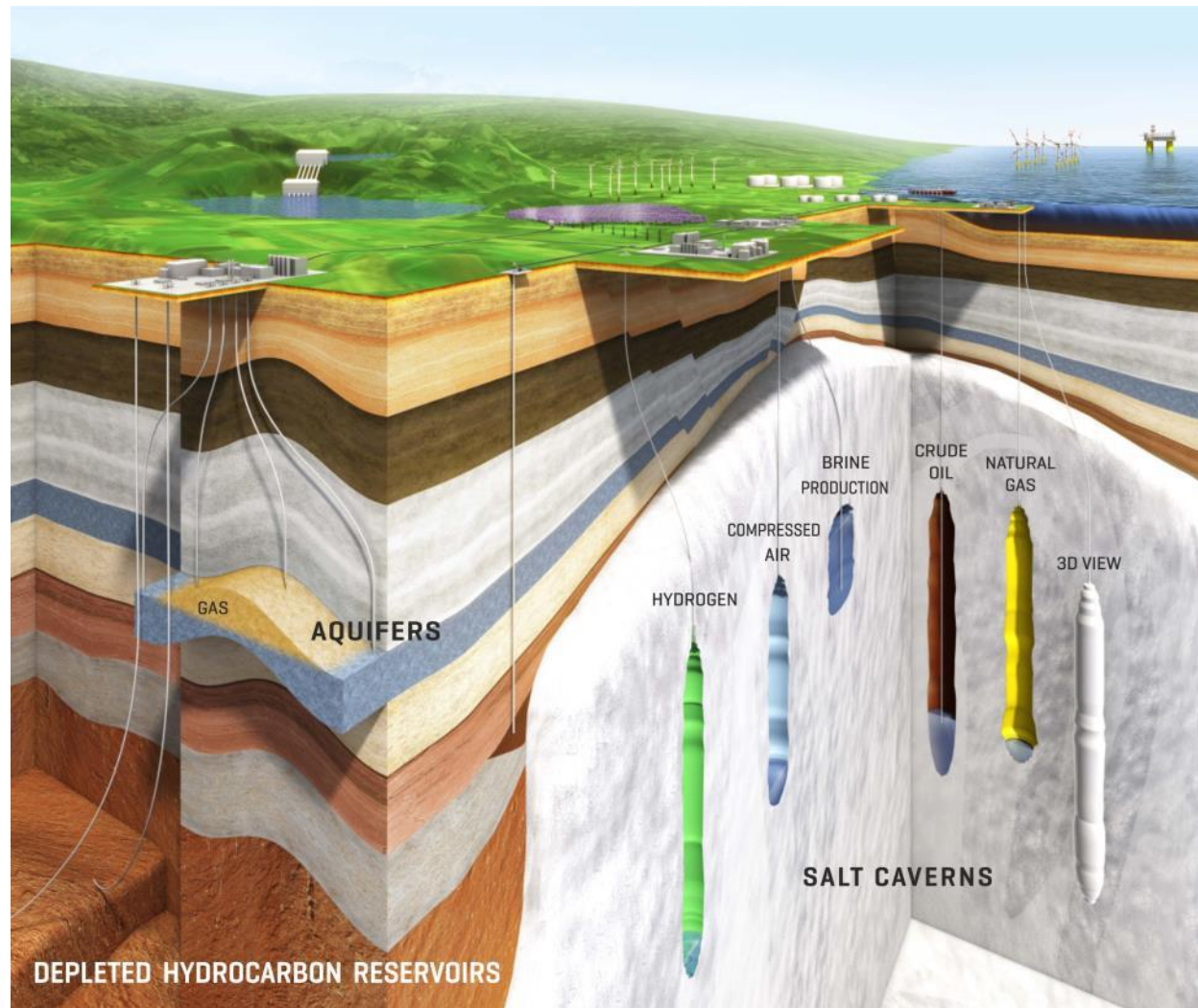
- 100 year history of natural gas storage



Legend  
UGS\_Europe  
Type\_of\_Storage  
● Gas Field  
● Oil Field  
● Aquifer  
● Salt Cavern  
△ Abandoned mine  
■ Rock Cavern



# Different Gas Storage Types



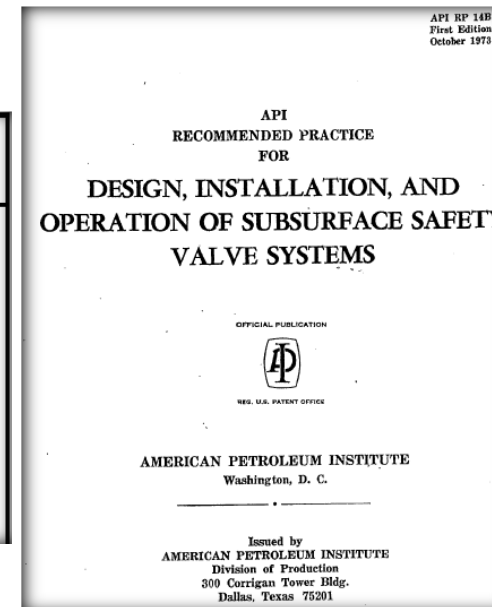
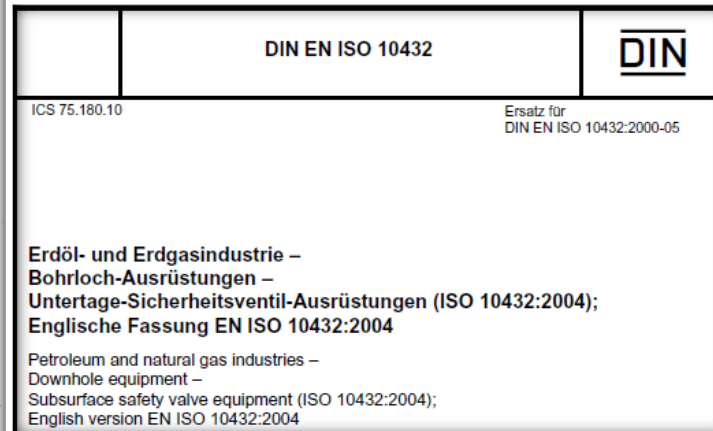
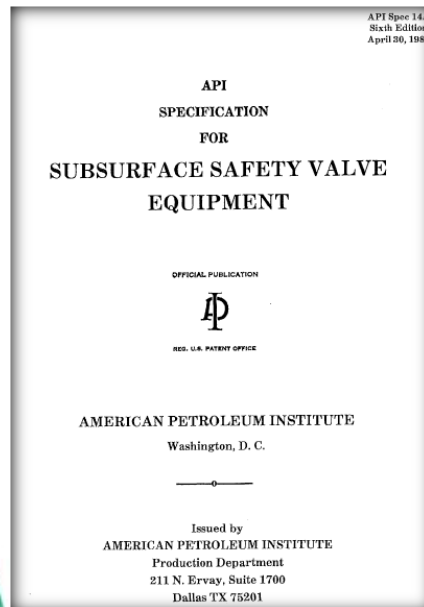
- Individual aspects:
  - geology,
  - design,
  - operation etc.

- Common aspects:
  - wells

- Common focus
  - safety

➤ **Well and storage integrity**

# Technical Standards in Europe & North America on Gas Storage Safety



## Focus on equipment and operational safety

Before?

Design  
Phase

Construction  
Phase

Operational  
Phase

After ?

## Change of Philosophy

- Existing gas storage facilities age
  - Long term operations
  - Several life cycle phases for gas storage
  - Increasing public awareness
- **To ensure safe operation and safety for employees, the public, property and the environment a different approach is needed**

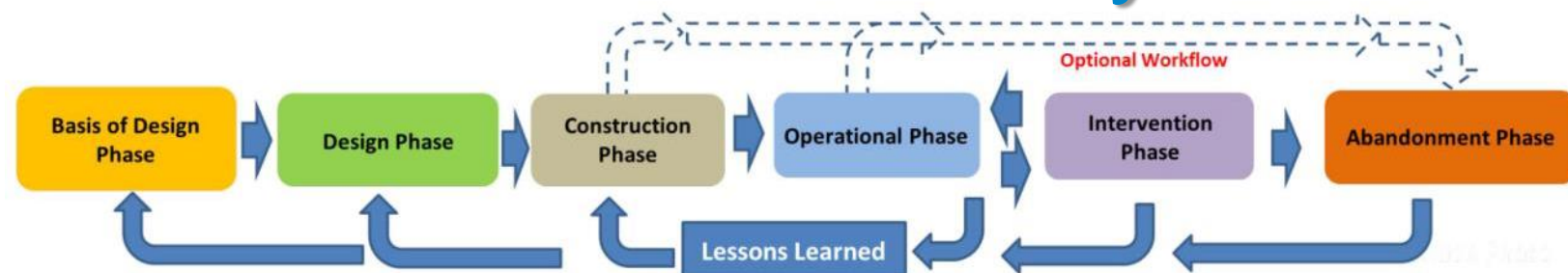
→ **Development of Integrity Concept**



# Recent Technical Standards in Europe & North America on Gas Storage Safety



## Focus on total Life Cycle



# Life Cycle

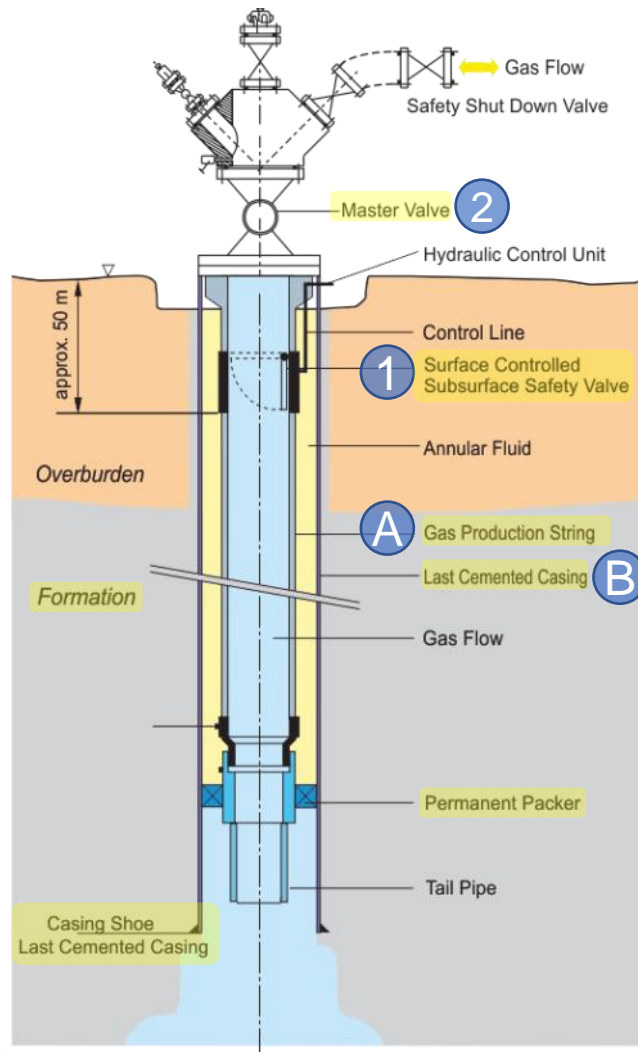
- Every storage is located, constructed and operated individually
  - individual assessment of each gas storage



Life Cycle Phases



# Integrity Aspects of Underground Gas Storage



- Several technical standards exist worldwide designed to achieve a commonly expected gas storage safety level
- These technical standards suggest a well completion design based on a clear structured safety philosophy
- Several **well barrier elements** (defined as “a component being part of a well designed to prevent fluids or gases from flowing unintentionally from a formation, into another formation or to escape at surface”)
- **“Double barrier system”**: two well barrier systems, which have to be fully independent of each other to secure well integrity

# Formalization of Industry Practices

- Technical Standards
  - Non-legal technical standards align processes in industry and reflect the current state-of-the-art
  - Technical standards generally have no binding legal character
- Legal Standards
  - Natural gas storage regulations directly relate to well integrity management and safety
  - Binding requirements as a matter of legislation or regulation
- Interdependency

# Legal Requirements

- Federal vs. State Regulation

## Federal Primacy

France  
UK  
Netherlands  
Austria  
Ukraine

## Shared Responsibility

Germany  
USA  
Canada

- Explicit guidance vs. Performance measures
- California



## Conclusion

- Over the 100+ year history of natural gas storage, various practices and requirements have developed to provide basic operating parameters and to ensure well integrity and safety standards for the protection of employees, the public, property and the environment
- Many of the practices have been adopted by technical standard or regulation
- There is not one uniform practice on how regulation is applied globally
- Double barrier philosophy is found explicitly or by implication in Europe, but only coming into practice in North America