

The ATCO logo consists of the letters 'ATCO' in a bold, white, sans-serif font. A horizontal orange line is positioned directly beneath the letters 'A' and 'T'.

ATCO

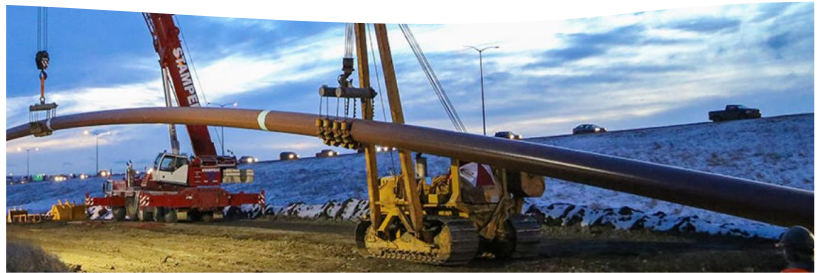
The background of the slide is a map of North America, rendered in a dark blue color with a subtle grid pattern. The map shows the outlines of the continents and major water bodies.

Study to Determine the Feasibility of Developing Salt Caverns for Hydrocarbon Storage in Western North Dakota

Presentation to North Dakota Industrial Commission OGRC
October 14, 2019
By Bob Armstrong and Jennifer Rumas

Overview

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- The Big Picture
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- Salt Cavern Study Purpose
- Benefit to State
- Study Details
- Confidentiality



ATCO – One Company, Infinite Possibilities

Established in 1947, with approximately **6,000 employees** and assets of **\$23 billion**, ATCO is a diversified global corporation delivering service excellence and innovative business solutions in:

- **Structures & Logistics** — workforce housing, innovative modular facilities, construction, site support services, and logistics and operations management
- **Energy Infrastructure** – electricity generation, transmission, and distribution; natural gas transmission, distribution and infrastructure development; energy storage and industrial water solutions; and electricity and natural gas retail sales
- **Transportation** – ports and transportation logistics
- **Commercial Real Estate**



ATCO'S Energy Storage Experience

- ATCO has developed and operated salt caverns in the Alberta Industrial Heartland for over 30 years
- We currently operate 6 natural gas caverns and 4 natural gas liquids caverns
- We have the potential to develop many more caverns



The Big Picture

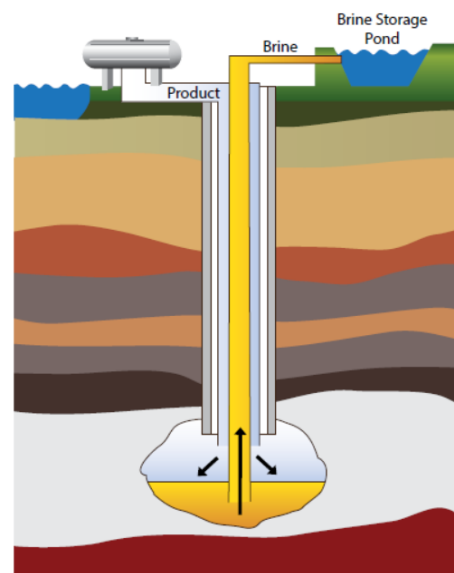


Salt Cavern Storage Uses

Salt cavern storage is reliable and cost-effective for storing large volumes of gases and liquids.

Commercial uses for salt caverns include:

- **Hydrocarbon** storage
- Storage of other **industrial gases**
- **Waste** disposal
- **Energy** Storage



Liquid Injection and Brine Removal

Study Purpose & Expected Results

PURPOSE

- Establish the technical and economic viability of developing salt caverns in western North Dakota
- In particular, the viability of hydrocarbon storage to support a large petrochemical facility
- Petrochemical development will require affordable large capacity hydrocarbon storage in the form of salt caverns

EXPECTED RESULTS

- Confirm the suitability of western North Dakota as a location for the economic development of salt cavern storage
- Determine locations in western North Dakota that salt cavern development is viable
- Establish the optimum size of cavern that can be developed
- Develop a cost estimate for developing the caverns to assess economic feasibility

Value to the State

- This study would provide significant value to the state on the feasibility of commercial salt cavern storage in western North Dakota, for a variety of uses.
- This study will specifically provide the State:
 - **Improved understanding of its geology and natural resources** and of the potential to develop its salt resources
 - Full access to comprehensive and detailed technical information about the **potential opportunities for commercial development** of its salt resources
 - **Baseline technical and economic information and knowledge that can directly support economic growth** by attracting petrochemical and other new industries which require bulk storage
 - **Enhanced marketability** of its salt formations



Incremental Value to the State

- Should the petrochemical industry be enabled by a positive outcome for the development of salt caverns, **additional benefits to the State** are enormous and include:
 - **Preservation of existing oil and gas jobs** by preventing oil production curtailment due to pipeline constraints or flaring restrictions
 - **Creation of new jobs** in new value-add industries which require cavern storage
 - Continued or increased oil production **royalties**
 - **Increased tax revenue** from economic growth
 - **Expand local economies** in the area around any developments

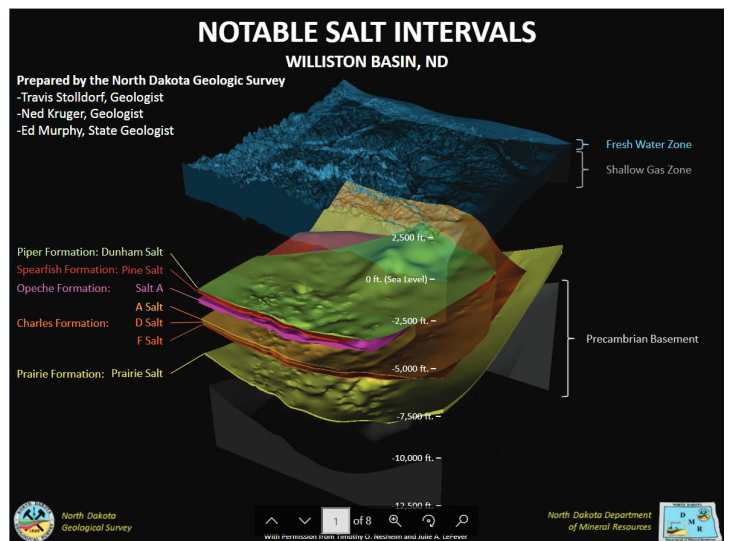


ATCO's Research in North Dakota To Date

Prior to making our application, **ATCO conducted a preliminary assessment** including:

- Review of existing papers and research
- Independent geological interpretation
- Preliminary cavern development assessment
- Preliminary assessment of access to required surface infrastructure

This preliminary feasibility study indicated **potential to develop salt caverns** in Western North Dakota

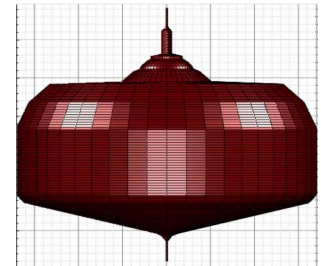


Salt Cavern Feasibility Study Overview

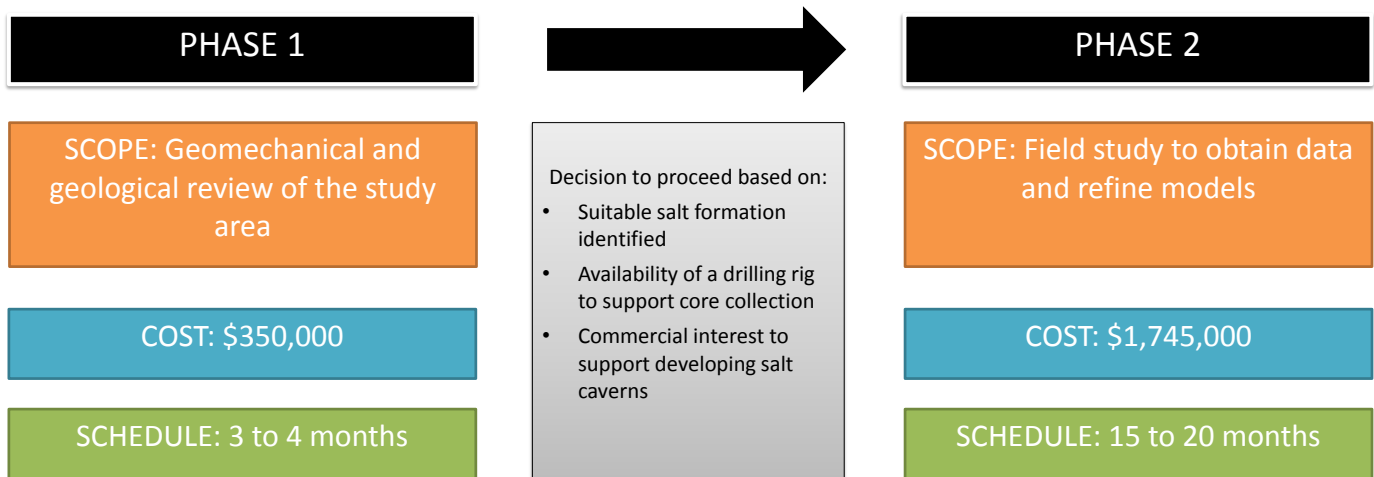
Based on these results, and to further advance this preliminary assessment, ATCO is proposing to:

- Conduct a detailed study to **confirm the potential to develop commercially viable salt caverns** using a team of specialists and local expertise
- Conduct our study in 2 Phases:
 1. A **theoretical assessment** based on 'typical' salt and rock characteristics
 2. **Validation** based on 'actual' salt and rock properties

Funding match requested is 50% of the total cost



Study Summary



Phase 1

The initial phase of the study will include:

- Detailed geological review of the suitable salt and disposal formations
- Preliminary geomechanical engineering assessment of cavern stability
- Preliminary cavern development engineering
- Overall cavern development assessment (by integrating results of the above studies)
- Interim report

Phase 1 Expected Results

- Mapping showing primary potential cavern development locations based on salt thickness
- Preliminary assessment of cavern size and stability
- Preliminary cavern development timeline and cost

Identify most probable cavern development locations for further study in Phase 2

Phase 2

The second phase of the study will use the results of the initial phase and will include:

- Selection of target location to obtain core (working with producers)
- Seismic to validate salt formation
- Collection of core samples of salt and surrounding rock zones
- Testing on salt and rock samples
- Geological, geomechanical and cavern engineering results updates
- Final assessment and report

Phase 2 Expected Results

- One location selected for detailed evaluation
- Detailed mapping of the selected location using seismic data
- Mechanical properties for the salt zone(s) and surrounding rock layers determined via core
- Detailed modeling of cavern size and stability
- Detailed modeling of cavern development and timeline

Determination of feasibility of potential to economically develop caverns

Salt Cavern Study – Confidentiality

- ATCO requests that the materials developed through the study be kept confidential for a period of four years from the start of the study
- The results of the study will provide the technical and economic roadmap to developing salt caverns in North Dakota
- Four years of confidentiality will allow ATCO the opportunity to earn a return on its investment in the study

The ATCO logo is displayed in a bold, white, sans-serif font. A thin yellow horizontal line is positioned directly beneath the letters. The logo is set against a background of a cornfield under a dramatic, purple and blue sky at dusk or dawn.

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Thank you