I&W Brine Cavern
Feasibility Study Fact Sheet

Energy, Minerals and Natural Resources Department -- Oil Conservation Division
I&W Site, Carlsbad, New Mexico September 2014

The Feasibility Study Process at I&W

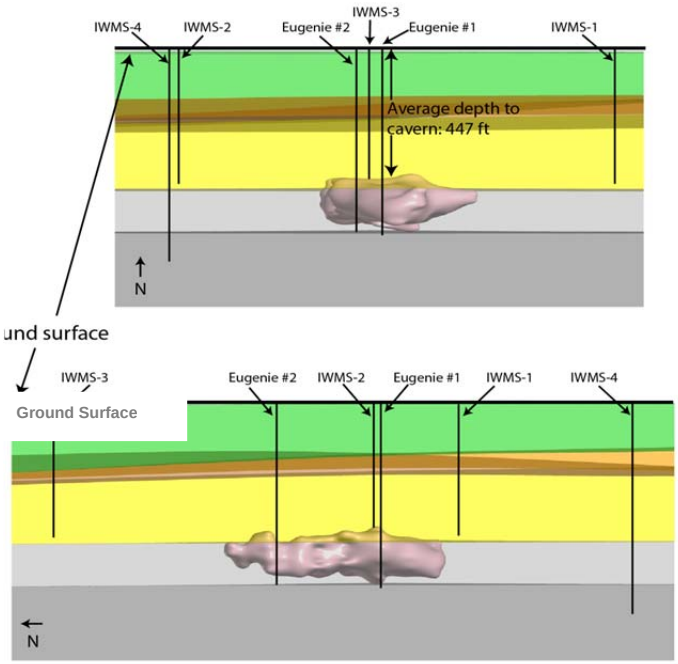
The Energy, Minerals and Natural Resources Department Oil Conservation Division prepared a Feasibility Study (FS) to characterize the nature and extent of risks posed by the I&W Brine Cavern near the "South Y" in Carlsbad, New Mexico. The Feasibility Study process organizes and presents the nature and extent of risks associated with a potential collapse of the cavern and examines technologies to mitigate or prevent a collapse. The primary objective of the FS process is to develop and evaluate alternatives that will protect the public welfare, property, and the environment

The I&W Brine Cavern is located in Carlsbad at 3005 South Canal St, adjacent to the "South Y". A solution mine operated at this location almost continuously from 1979 through July 2008. I&W Inc. produced brine through the injection of fresh water into the Salado halite formation, dissolving the salt, and extracting the brine. This process resulted in the formation of a liquid-filled underground cavern, which grew over the time of the operation. A Conceptual Site Model (CSM) was developed using data collected from the site. Based on the CSM, the underground void in the Salado Formation is approximately 200-350 feet wide, 685 feet long, and 110-180 feet high (thick).

Conceptual Site Model (CSM)

AMEC was contracted by the Oil Conservation Division to prepare the FS. An accurate CSM is a critical step in developing and screening remedial action alternatives. The CSM for the I&W Brine Cavern was developed using data gathered using a variety of direct and indirect investigation and characterization methods during previous studies (1996–2012) and combined with recent studies conducted by AMEC.

Using the data gathered from these investigations, a 3D Visualization Model was developed using Leapfrog Hydro version 2.1.1®. The modeled volume of the main cavern is estimated to be 6 million cubic feet. The average top depth of the cavern is 447 feet and the average bottom depth is 549 feet below the ground surface. The cavern is primarily contained within the salt formation; however, a small portion of the cavern extends into the claystone/gypsum above.



NOTES:
1. Cross sections are transparencies through the block model

Cavern Roof Stability

Site data and mechanical analyses were used to estimate cavern roof is stability. The factor of safety (FOS) calculated for sections of the cavern roof indicate that the cavern roof will fail if a stabilization action is not implemented. A FOS describes the structural capacity beyond the expected or actual loads. At the I&W Site, the FOS was used to compare the roof strength to the load of the overburden material. Using statistics based on variability of cavern roof material strength from test data collected, the FOS is a function of the probability of failure. The statistical evaluations of probability of failure and cavern lifespan indicate a high probability of catastrophic failure within 10 to 25 years. There is limited time to take action to prevent cavern failure and continued surface subsidence. The feasibility study provides a detailed description of remedial alternatives that could be implemented at the I&W Site.

Summary of Alternatives

The detailed analysis of alternatives for the I&W Site presents the relevant information needed to allow decision-makers to select a remedy. A partial summary of the viable alternatives is presented below.

Alternative	Long-Term Effectiveness and Permanence	Reduction of Hazards	Short-Term Effectiveness	Implementibility	Total Cost	Average Annual Cost
Institutional Controls (ICs) with Monitoring	Does not fully protect public welfare, the environment, or property	No	Continued monitoring through existing network	Easy. Limited site work	–	$240,000
Cavern Abandonment with Monitoring and ICs	Does not fully protect public welfare, the environment, or property	Possible	Cavern roof could collapse prior to implementation	Easy. Testing is required to determine if cavern abandonment can be implemented	–	$320,000
Controlled Collapse	Yes. Permanent remedy	Yes	None	Difficult. Significant risk to groundwater. Not protective of environment	$50 million	–
In Situ Fill with Monitoring and ICs	Yes. Permanent remedy	Yes	Cavern roof could collapse during evaluation and implementation and existing monitoring system would not function properly during filling	Moderate. Investigation, testing, and design are required prior to implementation	$15 to $25 million	–

Various fill materials were evaluated during the FS process. Filling was determined to be a permanent remedy that would satisfy the FS objectives regardless of fill material selected. Of the alternatives presented in the table above, fill is protective of public welfare and the environment, property, and long-term, effectiveness and permanence. Cavern abandonment would not protect public welfare, the environment and property from the threat of uncontrolled collapse, but, if properly implemented could be long-term and permanent, although it would require on-going monitoring. Institutional controls and monitoring would not fully protect human health, the environment or property, and is not long-term or permanent.

FOR MORE INFORMATION

Information related to brine wells in the state of New Mexico can be found on the Energy, Mineral and Natural Resource Department Oil Conservation Division's Brine Well Info website at http://www.emnrd.state.nm.us/OCD/brinewellinfo.html.