SOLUTION MINING RESEARCH INSTITUTE
3336 Lone Hill Lane
Encinitas, California 92024
USA
Country Code: 1 ◆ Voice: 858-759-7532 ◆ Fax: 858-759-7542
E-mail: smri@solutionmining.org ◆ www.solutionmining.org

Research Project Report No. 2002-3-SMRI

Summary Report
The Solution Mining Research Institute Cavern Sealing and Abandonment Program 1996 Through 2002

by

Joe L. Ratigan

SMRI CS&A Project Manager
and
SMRI Research Coordinator

February 2003

EXECUTIVE SUMMARY

The Solution Mining Research Institute (SMRI) has long recognized that there are uncertainties associated with Cavern Sealing and Abandonment (CS&A). Issues in CS&A became more focused in the SMRI as a result of knowledge gained from a series of succinct sealed well and cavern field tests performed in the late 1980s and early 1990s by Gaz de France and partially funded by the SMRI. In 1996, the SMRI initiated a long-term research program for Cavern Sealing and Abandonment issues. The SMRI CS&A Research Program started with the formation of an Advisory Committee with a broadly based membership that included cavern operators, researchers, and regulators. Funding for the research efforts was provided by the SMRI (through its membership) and was supplemented by funding from the United States Department of Energy.

The program initially focused on an assessment of exactly what is known in the scientific and commercial communities regarding cavern sealing and abandonment. This initial effort resulted in a comprehensive bibliography of the understanding and practice of cavern sealing. Following completion of the bibliography, the SMRI CS&A Research Program issued a series of Requests for Proposals (RFPs) to pursue research in the key areas of uncertainty. Contracts were awarded to study (1) salt permeability under complex stress states, (2) hydraulic and mechanical integrity of the well casing shoe through bench-scale testing, and (3) fluid/salt hydraulic and mechanical interaction in a sealed cavern through geomechanical modeling.

Six years of directed research in the SMRI CS&A Research Program has enabled the development of some very important scientific and operational observations and conclusions. Some of the significant observations and conclusions developed in the SMRI CS&A Research Program are:

- In the absence of brine thermal expansion, the vast majority of solution-mined salt caverns can be sealed and abandoned without concern for salt fracture generation or significant brine migration from the cavern.
- Prior to cavern sealing, all caverns should be kept open as long as possible and practical to ensure a minimization of the temperature difference between the salt and the internal cavern brine.
- Casing shoe integrity tests should be performed prior to sealing to ensure this potential pathway has maintained integrity comparable to that required during the cavern operational history.

Official Copyright, SMRI
Complete File Available In Library

- Tall caverns and/or caverns that must be sealed before thermal equilibrium is approached require a case-by-case evaluation of sealing strategy.
- Salt permeability at brine pressures approaching the confining salt stresses is an extremely strong function of the difference between the salt total stress and the brine pore pressure. As this difference becomes small or slightly tensile, salt permeability increases significantly (i.e., many orders of magnitude).

Official Copyright, SMRI
Complete File Available In Library