SOLUTION MINING RESEARCH INSTITUTE

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MEETING PAPER

PRELIMINARY COMPUTER ANALYSIS ON LONG-TERM STABILITY OF MCINTOSH SALT DOME IN RELATION TO COMPRESSED AIR ENERGY STORAGE (CAES) CAVERN DEVELOPMENT

PRESENTED BY

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ABSTRACT

ANALYSIS OF LONG-TERM STABILITY OF
SALT DOME IN RELATION TO CAES CAVERN DEVELOPMENT

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A feasibility study on development of solution-mined caverns in the McIntosh salt dome, McIntosh, Alabama, for peak power generation by means of off-peak compressed air energy storage (CAES), has been commissioned by Alabama Electric Cooperative, Inc. in association with the Electric Power Research Institute (EPRI).

The stability of McIntosh salt dome with respect to the brine-mining operations of Olin Chemical Corporation, in relation to the planned development of CAES caverns, was analyzed by means of finite element simulation using the REM computer code. In order to fully comprehend the nature and magnitude of the impact of CAES Cavern development on long-term stability of the entire salt dome structure, including all the caverns, in the absence of complete data on the stress state and material properties of the salt dome ground, a sensitivity analysis was conducted by varying combinations of stress/property input parameters.

The method of study involved construction of a REM finite element model of the McIntosh salt dome, representing the excavation geometries of the Olin brine caverns, and the geometries of the proposed CAES caverns. Extensive information gathered during the preparatory analysis work was combined to develop a preliminary finite element model of the McIntosh salt dome ground.

In order to simulate the 3-dimensional nature of the behavior, two 2-dimensional plane strain finite element meshes were constructed, representing:

1. A horizontal section through the entire salt dome, including all Olin brine caverns and CAES caverns, representing the cavern geometries at a depth of 2,750 feet below ground surface;

2. A vertical section passing through the maximum possible number of brine caverns and CAES caverns.

The vertical section finite element mesh involves 2205 4-node elements and 2337 nodes. The horizontal section mesh involves 2751 4-node elements and 2782 nodes.

The preliminary results obtained from the computer simulation runs using these vertical and horizontal section meshes are presented and discussed.

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