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Meeting Paper

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CORRELATION OF CREEP BEHAVIOR OF DOMAL SALTS

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ABSTRACT

The experimentally determined creep responses of a number of domal salts have been reported in the literature. Some of these creep results were obtained using standard (conventional) creep tests. However, more typically, the creep data have come from multistage creep tests, where the number of specimens available for testing was small. An incremental test uses abrupt changes in stress and temperature to produce several time increments (stages) of different creep conditions. Clearly, the ability to analyze these limited data and to correlate them with each other could be of considerable potential value in establishing the mechanical characteristics of salt domes, both generally and specifically. In any analysis, it is necessary to have a framework of rules to provide consistency. The basis for the framework is the Multimechanism-Deformation (M-D) constitutive model. This model utilizes considerable general knowledge of material creep deformation to supplement specific knowledge of the material response of salt. Because the creep of salt is controlled by just a few micromechanical mechanisms, regardless of the origin of the salt, certain of the material parameters are values that can be considered universal to salt. Actual data analysis utilizes the methodology developed for the Waste Isolation Pilot Plant (WIPP) program, and the response of a bedded pure WIPP salt as the baseline for comparison of the domal salts. Creep data from Weeks Island, Bryan Mound, West Hackberry, Bayou Choctaw, and Big Hill salt domes, which are all sites of Strategic Petroleum Reserve (SPR) storage caverns, were analyzed, as were data from the Avery Island, Moss Bluff, and Jennings salt domes. The analysis permits the parameter value sets for the domal salts to be determined in terms of the M-D model with various degrees of completeness. In turn this permits detailed numerical calculations simulating cavern response. Where the set is incomplete because of the sparse database, reasonable assumptions permit the set to be completed. From the analysis, two distinct response groups were evident, with the salts of one group measurably more creep resistant than the other group. Interestingly, these groups correspond well with the indirectly determined creep closure of the SPR storage caverns, a correlation that probably should be expected. Certainly, the results suggest a simple laboratory determination of the creep characteristics of a salt material from a dome site can indicate the relative behavior of any potential cavern placed within that dome.

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