Memorandum

DATE: February 12, 1996

TO: SWCF-A Records Center: SWCF-A:WBS
1.2.07.1:PDD:QA:SALADO:PKG1: Brine Compressibility

FROM: Randy Roberts, INTERA Inc.

RE: Brine Compressibility

The attached record package contains brine compressibility
data for Salado Formation brine. The data in this record
package was collected by Principle Investigators for input to
the WIPP Data Entry Form and for use by Performance
Assessment personnel making parameter estimates. The
record package was prepared in accordance with WIPP
Quality Assurance Procedure (QAP) 17-1, WIPP QA Records
Source Requirements.

SWCF-A:WBS 1.2.07.1:PDD:QA:SALADO:PKG1: Brine
Compressibility

INTERA

A Duke Engineering & Services Company

RECORD PACKAGE:

SALADO PARAMETERS REQUIRED FOR BRAGFLO:

BRINE COMPRESSIBILITY

Purpose: The data in this package was collected by Principle Investigators for input to the WIPP Data Entry Form and for use by Performance Assessment personnel making parameter estimates.

Date of Record: January 19, 1996

Author/ Organization: Randy Roberts, INTERA Inc. (505) 246-1600

Recipient: NWM Records Center

File Code: SWCF-A:WBS1.2.07.1:PDD:QA:SALADO:
                            PKG1:BRINE COMPRESSIBILITY

RECORD PACKAGE:

SALADO PARAMETERS REQUIRED FOR BRAGFLO:

BRINE COMPRESSIBILITY

SWCF-A:WBS1.2.07.1:PDD:QA:SALADO:PKG1:BRINE COMPRESSIBILITY

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I. Parameter No. (id): 48
II. Data/Parameter: Brine Compressibility
III. Parameter id (idpram): COMPRES
IV. Material: Brine
V. Material Id (idmtrl): BRINESAL
VI. Units: 1/Pa
VII. Distribution Information:
    A. Category and Subcategory:

    B. Mean: 3.1E-10

    C. Median:

    D. Standard Deviation:

    E. Maximum:

    F. Minimum:

    G. Number of Data Points: 1

VIII. Data Collection and Interpretation Information:
    A. Data Source Information:
        1. Data Source:
        Investigator Judgement

        2. Supporting Explanation:
        The compressibility of saturated sodium-chloride brine with dissolved-solids concentrations apporximately equal to those collected under the BSEP was estimated using Figure D.19 in Earlougher, ^{x} which plots fluid compressibility versus temperature for brines containing 300,000 ppm NaCl dissolved in distilled water at various pressures and assuming no solution gas. For the limited temperature range of 26° to 29° C observed during the underground-permeability-testing program at WIPP, the formation-brine compressibility can be assumed to be essentially invariant and insensitive to temperature. For the pressure ranges observed during testing, fluid compressibilty at 27° C interpolated from the curves shown on the figure ranges from 2.75×10^{-10} Pa^{-1} at 9.8 Mpa to 3.1×10^{-10} Pa^{-1} at 2.5 Mpa.

        The fluid compressibility derived from Earlougher assumes brine with no dissolved gas. Earlougher urther shows that the compressibility of water saturated with methane at 25o C is about 5 to 12 percent higher over a pressure range from 2.5 to 9.8 Mpa than that of the same water with no dissolved gas. Gas present in the Salado Formation is largely nitrogen,

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rather than methane. However, Cygan showed that nitrogen solubility in brine is slightly lower than that of methane. Therefore, the effect of dissolved nitrogen on brine compressiblity should be slightly less than the effect of dissovled methane. Based on these data, we estimate that the amount of gas potentially in solution at the pressures observed during the permeability tests might increase the compressibility of the gas-brine solution by a maximum of about ten percent.

After considering the foregoing information, a single formation-fluid-compressibility value of 3.1×10^{-10} Pa^{-1} was selected.

3. References for selection:
Earlougher, R. C., Jr. 1977. *Advances in Well Test Analysis*. Monograph Volume 5.

B. Data Collection
    1. Data Collection or Test Method: N/A
    2. Assumptions Made During Testing: N/A
    3. Standard Error of Measurements of Tests Performed: N/A
    4. Form of the Raw Data: N/A
    5. References Related to Data Collection: N/A
    6. QA Status of the Data: N/A
C. Interpretation of the Data:
    1. Was the interpretation made with reference to previous work? N/A
    2. Was the interpretation made by using newly performed calculations? N/A
    3. Form of interpreted data: N/A
    4. Assumptions made during interpretation: N/A
    5. Name of codes used for data interpretation: N/A
    6. QA status of codes used to interpret data: N/A
    7. References related to data interpretation: N/A
    8. For interpretations made by using newly performed calculations provide N/A documentation that the requirements of QAP 9-1 were followed: N/A
    9. For routine calculations were the requirements of QAP 9-5 followed: N/A

IX. Correlation with other parameters: