Sandia National Laboratories
Albuquerque, New Mexico 87185

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November 15, 1986

Mr. John Peshel
Engineering Branch
Division of Waste Management
U.S. Nuclear Regulatory Commission
7915 Eastern Avenue
Silver Spring, MD 20910

Dear Mr. Peshel:

The enclosed monthly report summarizes the activities during the month of October for FIN A-1755.

If you have any questions, please feel free to contact me at FTS 844-8368 or L. R. Shipers at FTS 846-3051.

Sincerely,

Robert M. Cranwell

Robert M. Cranwell
Supervisor
Waste Management Systems
Division 6431

RMC:6431

Enclosure

Copy to:
Office of the Director, NMSS
Attn: Program Support Branch
6400 R. C. Cochrell
6430 N. R. Ortiz
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6431 L. R. Shipers
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3553

PROGRAM: Coupled Thermal-Hydrological-Mechanical Assessments and Site Characterization Activities for Geologic Repositories

FIN#: A-1755

CONTRACTOR: Sandia National Laboratories

BUDGET PERIOD: 10/86 - 9/87

DRA PROGRAM MANAGER: J. Peshel

BUDGET AMOUNT: 250K

CONTRACT PROGRAM MANAGER: R. M. Cranwell

FTS PHONE: 844-8368

PRINCIPAL INVESTIGATOR: L. R. Shipers

FTS PHONE: 846-3051

PROJECT OBJECTIVES

To provide technical assistance to NRC in the assessment of coupled thermal-hydrological-mechanical phenomena and site characterization activities for high-level waste repositories.

ACTIVITIES DURING OCTOBER 1986

Activities and Accomplishments

Funding in the amount of $40K was received from NRC on October 16, 1986. Work resumed on this project on that date.

Work progressed in two areas during the month of October. In the first, the analysis of the shaft/shaft liner at BWIP was continued. Conceptual models of both a two-dimensional axisymmetric shaft simulation (Figure 1) and a two-dimensional horizontal cross-section (Figure 2) were developed. A STEALTH 2D input data set for the two-dimensional model of a horizontal cross-section of a shaft was prepared. A listing of this data file is included as Attachment I. To avoid the necessity of individually specifying the rectangular coordinates of the interior nodes, a computer program (NTRAN) based upon an eight point averaging scheme was written to calculate the interior nodal locations for the transition from a cylindrical to a rectangular boundary. The nodal distribution generated by this program is shown in Figure 3. This nodal generation program was incorporated in STEALTH 2D using updates. A floppy disk containing the node generation program (NTRAN) and an accompanying screen graphics grid plotting program (NTPLT) is included with this report. It was difficult to locate mechanical property data for cement grouts. However, an SNLA report (SAND81-0065) does contain information from which representative data may be inferred. The problem is ready to be analyzed with STEALTH 2D. For the cross-section selected, unequal horizontal stress components can be prescribed and/or calculated. The boundary stresses have been chosen to be consistent with the in-situ stress field at the proposed repository depth. The objective of the calculation is to

predict the stress distribution in and around the liner and to identify zones of potential failure.

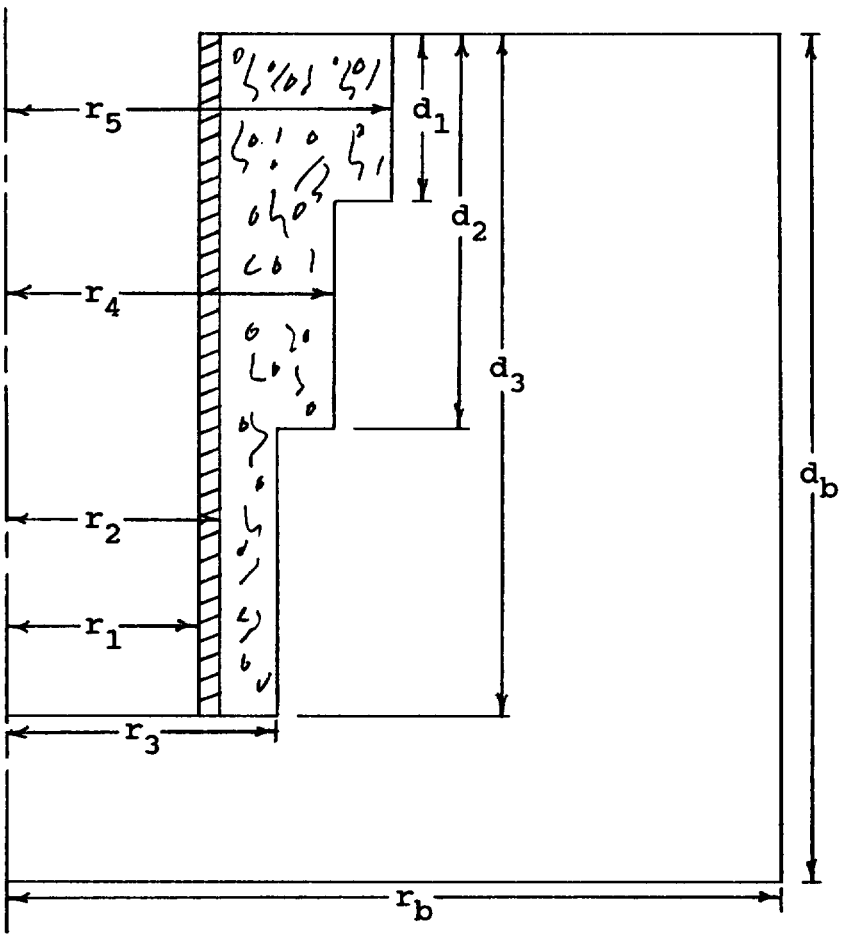
In the second area, discussions with the NRC and SNLA personnel and outside code developers continued to examine the feasibility of installing thermomechanical codes at the INEL Computer Facility. This effort has been partially successful in that verbal permission was obtained from M. Gross of SAIC to transfer the Waste Isolation (W.I.) version of STEALTH 2D to the INEL facility; this version is presently being used at SNLA. A written authorization for NRC's use of the W.I. version is expected in the near future. In addition, EPRI will issue a version of STEALTH 3D along with a "license" for its use. It should be noted as stated in the previous monthly report, that the 3D code is a general purpose version that will require certain modifications before it can be used for repository applications.

Travel

None.

Problems Encountered

The monthly cost estimate does not reflect the $40K received on October 16, 1986. Also, the negative balance costed is not a carryover of funds for the project. It reflects contractor costs for FY 86 which have not yet been costed.



r_1 = finished shaft inside radius
r_2 = finished hole radius
r_3 = radius of excavated hole to final depth, d_3
r_4 = radius of excavated hole to depth d_2
r_5 = radius of excavated hole to depth d_1
r_b = radius of outer boundary of model
d_b = depth to bottom boundary of model

Note: 1. $(r_2 - r_1)$ is the liner thickness which could be a function of depth
2. $(r_3 - r_2)$, $(r_4 - r_2)$, and $(r_5 - r_2)$ represent cement grout thicknesses behind the liner upto depths d_3, d_2, and d_1, respectively.

Figure 1. Two-Dimensional Axisymmetric Shaft Model

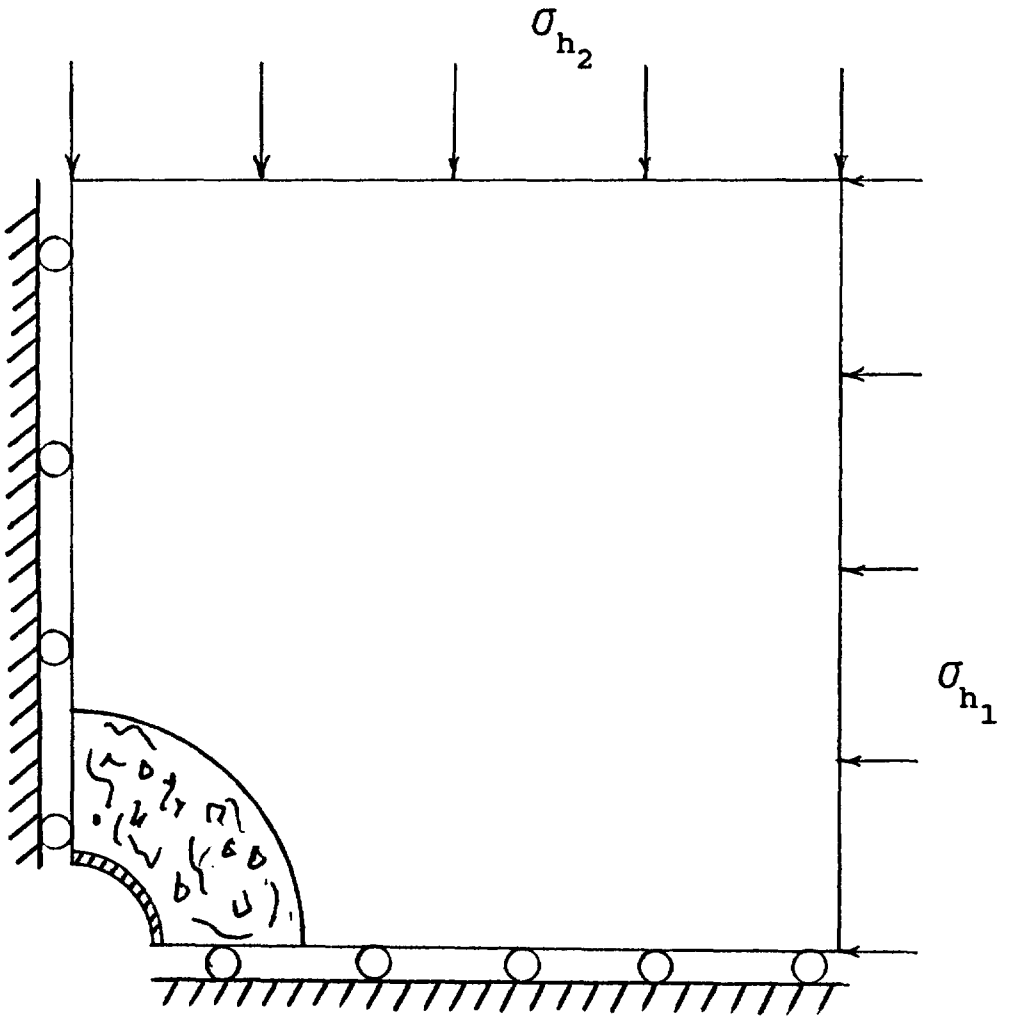


Figure 2. Two-Dimensional Model of Horizontal Cross-Section

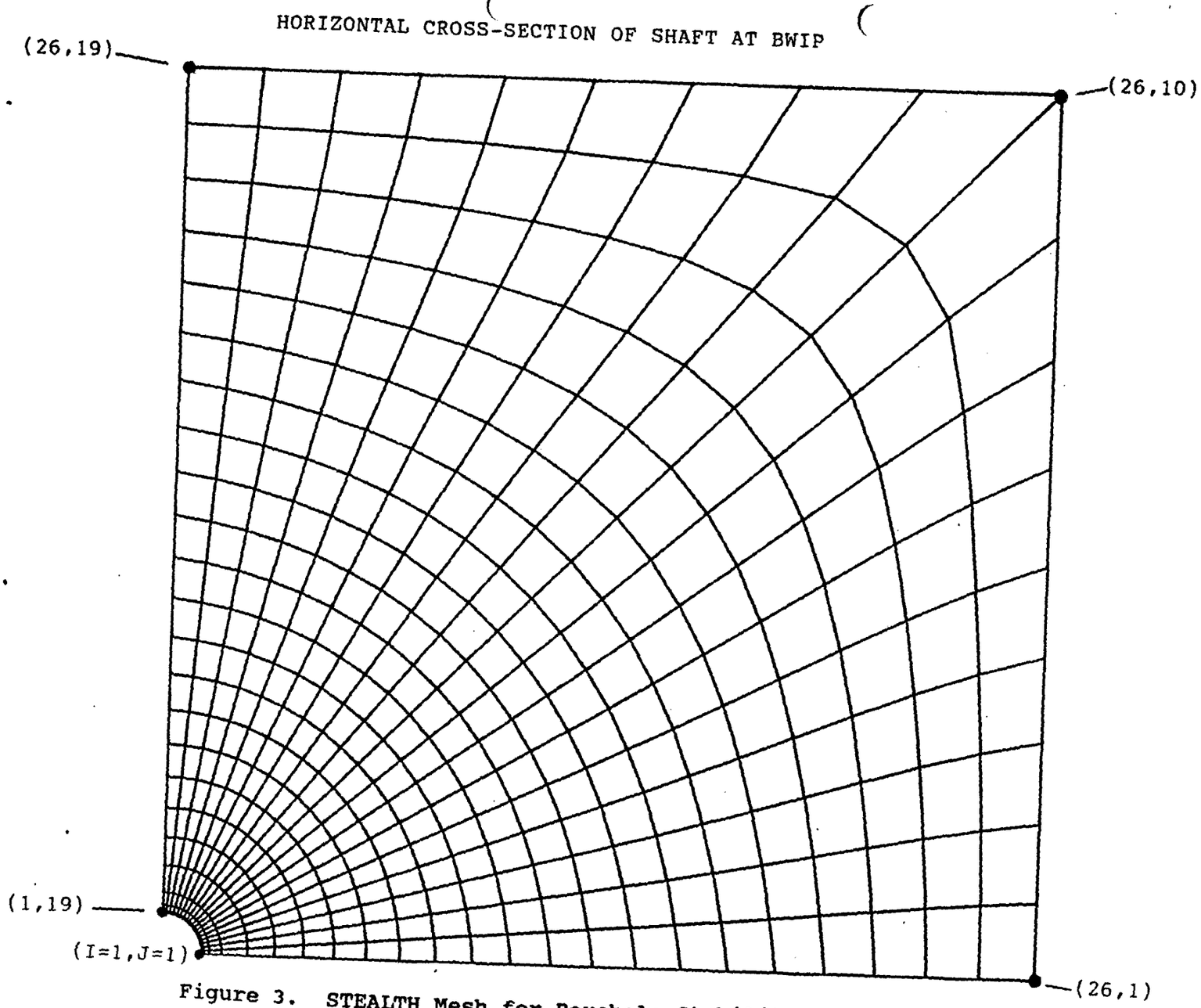


Figure 3. STEALTH Mesh for Borehole Stability Analysis (20m x 20m)

ATTACHMENT I

```
TTL         BWIP HORIZONTAL CROSS-SECTION OF SHAFT AREA IN COHASSET
PRB                                                          1.
PRO         2.0
DTS         2.0         1.
GRD         1.0         1.0         26.0        19.0
END
MAT                                                          1.
111 COHAS   1.0         1.0
112         1.0         2.0         2.0         2.0
121         1.0         2830.0
122         1.0         1.          0.            4.96 E10
132         1.0            1.50 E8
134         1.0           2.97 E10
136         1.0            -2.9 E7
111 GROUT   2.0         1.0
112         2.0         2.0         2.0         2.0
121         2.0         1900.0
122         2.0         1.          0.           1.169 E10
132         2.0            1.50 E7
134         2.0            5.83 E9
136         2.0           -1.00 E7
111 LINER   3.0         1.0
112         3.0         2.0         2.0         2.0
121         3.0         7850.0
122         3.0         1.          0.           1.390 E11
132         3.0            2.07 E8
134         3.0           7.79 E10
136         3.0           -3.45 E8
END
GPT                                              2.0         1.0
211         1.0         1.0         1.0         0.914       0.
212         1.0         0.5         0.          2.0
212         2.0         25.0        0.          3.0
212         3.0         0.          25.         2.0
212         4.0         0.          0.5         3.0
221         1.          1.          26.         1.          19.
283         1.
END
ZON                                                          1.0
311 LINER   1.0         1.0         3.0         1.          19.0
321         1.0         3.0
322         1.0         0.99988929
341         1.           -1.539 E7 -1.539 E7 -1.539 E7
311 GROUT   2.0         3.0         6.0         1.          19.0
321         2.0         2.0
322         2.0         0.99868522
341         2.0          -1.539 E7 -1.539 E7 -1.539 E7
311 BASALT3.0           6.0         26.0        1.          19.0
321         3.0         1.0
322         3.0         0.99920225
341         3.0            -3.3 E7  -6.15 E7 -2.420 E7
END
BDY                                                          1.0
411 BSEG1   1.0         1.0         1.0         26.0        1.0
```

```
411 BSEG2 2.0        26.0       1.0        26.0       10.0
411 BSEG3 3.0        26.0       10.0       26.0       19.0
411 BSEG4 4.0        26.0       19.0       1.0        19.0
411 BSEG5 5.0        1.0        19.0       1.0        1.0
412       1.0        1.0        6.0        5.0        2.0
412 BSEG2 2.0        1.0        2.0        5.0        1.0
412 BSEG3 3.0        1.0        2.0        5.0        3.0
412       4.0        1.0        6.0        5.0        4.0
412       5.0        1.0        3.0        5.0
414       1.0                              1.0
414       3.0                              1.0
422 BSEG2 1.0        1.0
431       1.0        1.0        0.0           1.0 E19
432       1.0            3.3 E7
422 BSEG3 3.0        2.0
431       2.0        1.0        0.0           1.0 E19
432       2.0           6.15 E7
481       1.0        1.0        2.0
481       4.0        3.0        4.0
482       1.0        1.0        5.0        5.0                  0.25
482       4.0        1.0        5.0        5.0                  0.25
END
TIM
511       0.1
512       0.1        0.1
513       1.0        1.0
514       0.5
521       1000.0     150.
END
EDT                                                  1.
611       2.0
613       2.0
616       2.0
621       1.0        0.         100.0      50.0
622       1.0        26.0       1.0        19.0
623       11.0       14.0       71.0       72.0       73.0       81.0       82.0
623       83.        74.        64.        91.        93.        94.        95.
623       12.        15.
671       1.         0.         150.       2.
674       1.         1.         71.        1.         2002.
674       2.         1.         71.        1.         4010.
674       3.         1.         71.        1.         26019.
674       4.         1.         71.        1.         16010.
674       5.         1.         5.         1.
675       6.         3.                               150.
675       7.         6.                               150.
674       8.         1.         64.        1.         21009.
674       9.         1.         72.        1.         16010.
674       10.        1.         91.        1.         10010.
END
END
```

A-1755
1628.010
October 1986

THIS IS AN ESTIMATE ONLY AND MAY NOT MATCH THE INVOICES SENT TO NRC BY SANDIA'S ACCOUNTING DEPARTMENT.

		Current Month	Year -to- Date
I.	Direct Manpower (man-months of charged effort)	0.3	0.3
II.	Direct Loaded Labor Costs	3.0	3.0
	Materials and Services	0.0	0.0
	ADP Support (computer)	0.0	0.0
	Subcontracts	-13.0	-13.0
	Travel	0.0	0.0
	Other (computer roundoff)	0.0	0.0
	TOTAL COSTS	-10.0	-10.0

III. Funding Status

Prior FY Carryover	FY 87 Projected Funding Level	FY 87 Funds Received to Date	FY 87 Funding Balance Needed
None	250K	40K	210K