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Albuquerque, New Mexico 87185

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WM Project 10, 11, 16
Docket No.
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Distribution: Joan Tiblet
NATARAJA
STILL
(Return to WM, 623-SS) J3

Dr. M. S. Nataraja
Engineering Branch
Division of Waste Management
U.S. Nuclear Regulatory Commission
7915 Eastern Avenue
Silver Spring, MD 20910

Dear Dr. Nataraja:

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

If you have any questions, please feel free to contact either myself at FTS 844-8368 or E. J. Bonano at FTS 844-5303.

Sincerely,

Margaret Chu for
R. M. Cranwell

R. M. Cranwell
Supervisor
Waste Management Systems
Division 6431

RMC:6431:jm

Enclosure

Copy to:
6400 R. C. Cochrell
6430 N. R. Ortiz
6431 R. M. Cranwell
6431 E. J. Bonano
6431 K. K. Wahi

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PDR WMRES EXISANL
A-1755 PDR

2283

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

FIN#: A-1755

CONTRACTOR: Sandia National Laboratories

BUDGET PERIOD 10/84-9/85

DRA PROGRAM MANAGER: M. S. Nataraja

BUDGET AMOUNT: 365K

CONTRACT PROGRAM MANAGER: R. M. Cranwell

FTS PHONE: 844-8368

PRINCIPAL INVESTIGATOR: E. J. Bonano

FTS PHONE: 844-5303

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 JULY 1984

Activities and Accomplishments

During the month of July, activities continued on applying analytical and numerical techniques to solve different repository design-related problems. A sensitivity study is underway to quantify the interaction between adjacent drifts in basalt at repository depth. Although the results have not been analyzed yet, a printout of two boundary element solutions is attached. In each case, two drifts of 5m x 4m cross-section (in a plane-strain geometry) in basalt at a depth of 800m are modeled. These drifts are 6m apart (i.e., the central pillar is 6m thick). In one case, the horizontal to vertical in-situ stress ratio is 2, and in the other, this ratio is 0.5. Shear failure is indicated along the drift walls when typical elastic and strength properties are used. This finding is preliminary and has many qualifications. we plan to carry out a parametric study by varying drift spacing, material properties, and stress ratio. This analysis is expected to be complete in mid-September. To save on computer costs, the DNET II code has been modified to run on an IBM PC. This will permit shaft seal failure analyses to be performed without relying on main frame computers. A verification of the PC version of DNET II is near completion.

K. Wahi attended meetings in Silver Spring, Maryland on July 16-18, 1985. These meetings were on topics of Retrievability and Exploratory Shaft Facility. A trip report is attached.

Travel

K. Wahi travelled to Silver Spring, Maryland on July 16-18 to attend meetings on Retrievability and Exploratory Shaft facility.

Problems Encountered

None.

August 1, 1985

Trip Report

Meetings were held in Silver Spring, Maryland on July 16, 17, and 18, 1985 in which Krishan Wahi participated as the SNLA representative at NRC's request. The July 16 and 17 meetings were pre-meetings between NRC and its consultants on topics of Exploratory Shafts (ES) and Retrievability. The July 18 meeting was with DOE to discuss generic ES Facility topics and the plans for ES Facility site-specific workshops.

The pre-meeting on July 16 on ES was chaired by M. Nataraja (NRC). It involved discussions on the appropriateness and completeness of the five broad agenda items proposed by DOE for the July 18 meeting. Prior to this meeting, Engineer's International (EI) had prepared a list of additional issues to be considered. These were issues that were either missing from the proposed agenda or needed further elaboration under an existing broader subject of discussion. A revised list of ES Facility Topics was prepared after debating EI's candidate list and comments by other participants. It was planned that the changes and/or additions would be conveyed to DOE at the July 18 meeting.

The July 17 pre-meeting on Retrievability was chaired by Naiem Tanious of the NRC staff. A Position Paper on retrievability that has been prepared by DOE and submitted to NRC for comment, was the basis of discussions during this meeting. Input was sought from the consultants and NRC staff on their concerns with the Position Paper. DOE's use of the phrase "proof-of-principle" in the context of demonstrating retrievability seemed to concern every participant. Further clarification will be requested from DOE. Another important concern is DOE's apparent emphasis on retrievability being an equipment problem rather than an access problem, particularly in a salt medium.

The meeting with DOE on ES Facility topics took place on July 18. M. Nataraja (NRC) and M. Frei (DOE) were the primary spokesmen for their respective organizations. M. Nataraja presented an overview of what information and issues NRC expects DOE to address during the upcoming site-specific meetings on ES Facility. He pointed to NRC's Draft Generic Technical Positions (DGTPs) on design, licensing methodology, in-situ testing, and borehole and shaft seals. M. Frei referred to the May 30 management meeting to bring focus to the scope of this and future ESF meetings. The five broad agenda items pertaining to generic ESF topics are:

I. Rationale and criteria for selection of the location, construction method, and testing for the ES;

II. Rationale and criteria used to determine subsurface layout and space requirements;

III. Repository interface with ES;

IV. Plans and provisions to control any adverse safety-related effects from ES construction and testing;

V. Quality assurance.

Dean Stucker (DOE) made a presentation on DOE's ESF Program Policy and Design Assumptions. Copies of the vugraphs used were made available. J. Greeves remarked that the schedule implied by the Mission Plan was very ambitious and expressed concern about having adequate, quality data to support the license application. This was followed by DOE presentations on each of the five topics listed above.

Steve Webster (SRPO) presented material relevant to Topic I. It was suggested by M. Nataraja that a third point be added to the outline under Topic I; namely, testing during ES Construction. Tom Wintczak (BWIP) addressed Topic II. Questions were raised by NRC and their consultants on lack of discussions on representativeness, coupled testing, use of performance allocation in developing data needs, and on consistent use of terminology related to period of testing. Dennis Irby (DOE/NV) presented Topic III information. A question was raised regarding the application of QA to ESF; the response was that QA will be applied at the same level as for a repository shaft. Steve Webster (SRPO) discussed Topic IV. NRC raised questions regarding (1) the benchmarking of decisions against performance objectives, (2) plans for borehole plugging/sealing, and (3) contingency plans. Carl Newton (DOE/HQ) addressed Topic V (QA Program). M. Frei commented that DOE will not be able to talk about the Q-list during the planned meetings on ES construction and testing, but the intent is to cover it in the design meetings(s). M. Nataraja suggested that "schedule considerations" be made an agenda item, so that there would be six (I to VI) items altogether. M. Frei did not agree to Nataraja's suggestion, but it was agreed that the issue would be addressed under another item. Vugraphs of all DOE presentations were provided at the start of each talk.

Site-specific presentations were made by Dennis Irby (NNWSI), Dave Squires (BWIP), and Steve Webster (SRPO). An overview of what would be discussed during the site-specific ESF workshops was given by each speaker. Squires noted that no specific date had been set for the workshop on the BWIP in-situ testing. Webster pointed out that due to changes in the planned

construction method for the salt site, certain issues may have changed substantially. In his presentation Webster went through a chart that gave tentative "completion dates" for resolution of issues related to construction plans and procedures. It would be useful for the other projects to provide similar information. Meeting minutes were prepared by the management at the end of the meeting.

Following are K. Wahi's (SNLA) specific observations, questions, or concerns.

- Will the data from "license application review phase testing" (an item in the Generic ESF Topics hand out) be in any way supplementing the license application?

- The terms "mitigate" and "minimize" have been used in the program design assumptions (vugraph #11) in reference to adverse impacts. The terms have different connotations, and it should be made clear by DOE as to which one corresponds to their objective.

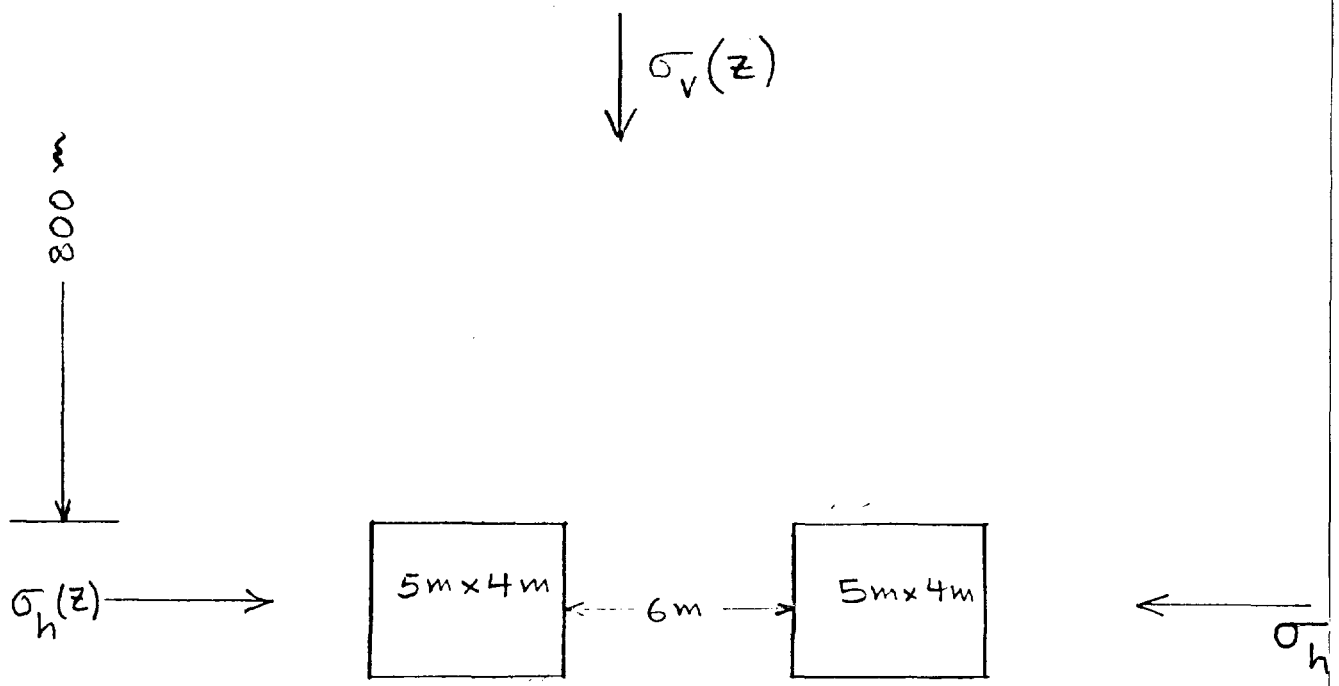
- One concern that has been expressed by a number of consultants is the ability to perform the planned in-situ tests in the scheduled time-frame. A similar, but more important, concern is whether the test plan itself is being "short-changed" due to the schedule constraints. In other words, will some important tests be left out or not planned for sufficient duration because of schedule?

- The decision to go to two exploratory shafts and the two-phase plan appears not to have affected the location. In addition, the plan to incorporate the ES into repository design should have some influence on the location. DOE should be asked to explain if and how the above changes have influenced the ESF location. In addition, the plan to incorporate the ES into repository design should have some influence on the location. DOE should be asked to explain if and how the above changes have influenced the ESF location.

ATTACHMENT

July, 85

BOUNDARY ELEMENT MODEL — TWO ADJACENT DRIFTS



$$\frac{\sigma_h}{\sigma_v} = k$$

Case 1: $k = 2.0$

Case 2: $k = 0.5$

(Nominal properties of basalt have been used)

Units of stress are MPa (1 MPa = 145 psi)

Units of displacement are meters

Failure Criterion: $\frac{\sigma_1}{\sigma_c} = \frac{\sigma_3}{\sigma_c} + \sqrt{m\frac{\sigma_3}{\sigma_c} + s}$

B>
1

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* * * * * * * * * * * * * * * * * * *
* 2-D STRESS ANALYSIS BY THE BOUNDARY ELEMENT METHOD *
*  PLANE STRAIN CONDITIONS, FICTITIOUS STRIP LOADS   *
* * * * * * * * * * * * * * * * * * *
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drift interaction calculation 1 (7/29/85)

CODE OF PROBLEM TYPE = 2

Compressive strength — Strength Parameters Hoek & Brown crit.

ROCK PROPERTIES SIGC, RM, S = , 200.00000 2.50000 .00500

NSEG, KXS, KZS, NCYC, NSL = 8 0 0 15 4

DELN, E MODULUS, RNU = 1.000 67794.000 .260

Young's Mod. (MPa) — Poisson's Ratio

CODE OF THE ANALYSIS IN HOMOGENOUS GRAVITATIONAL MEDIA

GAMMA, HORZ. STR RATIO = .027 2.000

ELEMENTS	CENT X (FIRST-X)	CENT Z (FIRST-Z)	THET1 (LAST-X)	THET2 (LAST-Z)	RADIUS	RATIO	PSI
5	-8.000	804.000	-3.000	804.000			
4	-3.000	804.000	-3.000	800.000			
5	-3.000	800.000	-8.000	800.000			
4	-8.000	800.000	-8.000	804.000			
5	3.000	804.000	8.000	804.000			
4	8.000	804.000	8.000	800.000			
5	8.000	800.000	3.000	800.000			
4	3.000	800.000	3.000	804.000			

1 NN = 0

STRESSES AND DISPLACEMENTS , AND FAILURE CRITERION AT CENTERS OF BOUNDARY ELEMENTS

I	CX	CZ	SIG1	SIG3	ALPHA	UX	UZ
1	-7.500	804.000	92.1	-.767E-04	90.000	.838E-03	-.968E-03

F.O.S= .154 BETA= 27.423 SHEAR FAILURE

factor of safety

2	-6.500	804.000	54.1	-.114E-03	-90.000	.553E-03	-.143E-02
F.O.S=	.261	BETA= 22.867		SHEAR FAILURE			
3	-5.500	804.000	48.4	-.129E-03	-90.000	.427E-03	-.158E-02
F.O.S=	.292	BETA= 21.937		SHEAR FAILURE			
4	-4.500	804.000	51.1	-.145E-03	-90.000	.319E-03	-.150E-02
F.O.S=	.277	BETA= 22.386		SHEAR FAILURE			
5	-3.500	804.000	82.7	-.204E-03	90.000	.994E-04	-.111E-02
F.O.S=	.171	BETA= 26.503		SHEAR FAILURE			
6	-3.000	803.500	48.0	.389E-04	90.000	-.109E-02	-.218E-03
F.O.S=	.295	BETA= 21.870		SHEAR FAILURE			
7	-3.000	802.500	19.8	.226E-04	90.000	-.159E-02	-.407E-04
F.O.S=	.714	BETA= 15.163		SHEAR FAILURE			
8	-3.000	801.500	19.8	.803E-05	90.000	-.159E-02	.571E-04
F.O.S=	.714	BETA= 15.163		SHEAR FAILURE			
9	-3.000	800.500	47.9	.265E-04	90.000	-.109E-02	.235E-03
F.O.S=	.295	BETA= 21.858		SHEAR FAILURE			
10	-3.500	800.000	82.5	-.248E-04	-90.000	.996E-04	.113E-02
F.O.S=	.172	BETA= 26.474		SHEAR FAILURE			
11	-4.500	800.000	50.9	-.268E-04	-90.000	.319E-03	.152E-02
F.O.S=	.278	BETA= 22.355		SHEAR FAILURE			
12	-5.500	800.000	48.2	-.297E-04	-90.000	.428E-03	.160E-02
F.O.S=	.293	BETA= 21.906		SHEAR FAILURE			
13	-6.500	800.000	53.9	-.272E-04	-90.000	.554E-03	.145E-02
F.O.S=	.262	BETA= 22.836		SHEAR FAILURE			
14	-7.500	800.000	91.8	-.546E-04	90.000	.838E-03	.984E-03
F.O.S=	.154	BETA= 27.394		SHEAR FAILURE			
15	-8.000	800.500	44.5	-.192E-04	90.000	.226E-02	.547E-04
F.O.S=	.318	BETA= 21.246		SHEAR FAILURE			
16	-8.000	801.500	11.3	-.683E-05	90.000	.289E-02	-.111E-04
F.O.S=	1.249	BETA= N.A		NO FAILURE			
17	-8.000	802.500	11.3	-.154E-04	90.000	.289E-02	.305E-04
F.O.S=	1.249	BETA= N.A		NO FAILURE			
18	-8.000	803.500	44.6	.156E-04	90.000	.226E-02	-.351E-04
F.O.S=	.317	BETA= 21.262		SHEAR FAILURE			
19	3.500	804.000	82.7	-.237E-03	-90.000	-.994E-04	-.111E-02
F.O.S=	.171	BETA= 26.503		SHEAR FAILURE			
20	4.500	804.000	51.1	-.183E-03	-90.000	-.319E-03	-.150E-02
F.O.S=	.277	BETA= 22.386		SHEAR FAILURE			
21	5.500	804.000	48.4	-.179E-03	-90.000	-.427E-03	-.158E-02
F.O.S=	.292	BETA= 21.937		SHEAR FAILURE			
22	6.500	804.000	54.1	-.164E-03	-90.000	-.553E-03	-.143E-02
F.O.S=	.261	BETA= 22.867		SHEAR FAILURE			
23	7.500	804.000	92.1	-.108E-03	-90.000	-.838E-03	-.968E-03
F.O.S=	.154	BETA= 27.423		SHEAR FAILURE			

24	8.000	803.500	44.6	-.677E-04	90.000	-.226E-02	-.352E-04
F.O.S=	.317	BETA= 21.262		SHEAR FAILURE			
25	8.000	802.500	11.3	-.773E-04	89.999	-.289E-02	.304E-04
F.O.S=	1.249	BETA= N.A		NO FAILURE			
26	8.000	801.500	11.3	-.100E-03	89.999	-.289E-02	-.111E-04
F.O.S=	1.249	BETA= N.A		NO FAILURE			
27	8.000	800.500	44.5	-.164E-03	90.000	-.226E-02	.547E-04
F.O.S=	.318	BETA= 21.246		SHEAR FAILURE			
28	7.500	800.000	91.8	.229E-04	-90.000	-.838E-03	.984E-03
F.O.S=	.154	BETA= 27.394		SHEAR FAILURE			
29	6.500	800.000	53.9	.221E-04	-90.000	-.554E-03	.145E-02
F.O.S=	.262	BETA= 22.836		SHEAR FAILURE			
30	5.500	800.000	48.2	.738E-05	-90.000	-.428E-03	.160E-02
F.O.S=	.293	BETA= 21.906		SHEAR FAILURE			
31	4.500	800.000	50.9	-.117E-04	-90.000	-.319E-03	.152E-02
F.O.S=	.278	BETA= 22.355		SHEAR FAILURE			
32	3.500	800.000	82.5	-.781E-05	90.000	-.996E-04	.113E-02
F.O.S=	.172	BETA= 26.474		SHEAR FAILURE			
33	3.000	800.500	47.9	-.112E-04	-90.000	.109E-02	.235E-03
F.O.S=	.295	BETA= 21.858		SHEAR FAILURE			
34	3.000	801.500	19.8	-.271E-04	-90.000	.159E-02	.571E-04
F.O.S=	.714	BETA= 15.163		SHEAR FAILURE			
35	3.000	802.500	19.8	-.286E-04	-90.000	.159E-02	-.407E-04
F.O.S=	.714	BETA= 15.163		SHEAR FAILURE			
36	3.000	803.500	48.0	.000	90.000	.109E-02	-.218E-03
F.O.S=	.295	BETA= 21.870		SHEAR FAILURE			

1 NN = 1

STRESSES AND DISPLACEMENTS, AND FAILURE CRITERION AT INTERIOR POINTS

I	CX	CZ	SIG1	SIG3	ALPHA	UX	UZ
1	-7.500	805.000	61.8	15.0	70.051	.921E-03	-.744E-03
F.O.S=	1.663	BETA= N.A		NO FAILURE			
2	-6.500	805.000	58.0	5.02	82.004	.686E-03	-.112E-02
F.O.S=	.984	BETA= 22.698		SHEAR FAILURE			
3	-5.500	805.000	54.6	3.41	88.766	.444E-03	-.127E-02
F.O.S=	.861	BETA= 22.408		SHEAR FAILURE			
4	-4.500	805.000	55.8	5.11	-84.511	.212E-03	-.120E-02
F.O.S=	1.033	BETA= N.A		NO FAILURE			
5	-3.500	805.000	57.3	15.0	-72.669	.466E-05	-.898E-03
F.O.S=	1.795	BETA= N.A		NO FAILURE			
6	-2.000	803.500	43.5	13.1	-35.538	-.613E-03	-.498E-03
F.O.S=	2.192	BETA= N.A		NO FAILURE			

7	-2.000	802.500	35.2	5.40	-8.006	-.997E-03	-.170E-03	
F.O.S=	1.685	BETA= N.A	NO	FAILURE				
8	-2.000	801.500	35.1	5.38	8.052	-.996E-03	.187E-03	
F.O.S=	1.683	BETA= N.A	NO	FAILURE				
9	-2.000	800.500	43.3	13.0	35.519	-.612E-03	.515E-03	
F.O.S=	2.191	BETA= N.A	NO	FAILURE				
10	-3.500	799.000	57.0	14.9	72.626	.530E-05	.913E-03	
F.O.S=	1.798	BETA= N.A	NO	FAILURE				
11	-4.500	799.000	55.4	5.04	84.498	.212E-03	.121E-02	
F.O.S=	1.032	BETA= N.A	NO	FAILURE				
12	-5.500	799.000	54.3	3.35	-88.763	.444E-03	.128E-02	
F.O.S=	.859	BETA= 22.365	SHEAR FAILURE					
13	-6.500	799.000	57.7	4.95	-81.988	.686E-03	.113E-02	
F.O.S=	.982	BETA= 22.656	SHEAR FAILURE					
14	-7.500	799.000	61.4	14.9	-70.011	.920E-03	.762E-03	
F.O.S=	1.666	BETA= N.A	NO	FAILURE				
15	-9.000	800.500	47.3	9.21	-42.793	.183E-02	.410E-03	
F.O.S=	1.659	BETA= N.A	NO	FAILURE				
16	-9.000	801.500	31.2	6.56	-13.904	.234E-02	.150E-03	
F.O.S=	2.098	BETA= N.A	NO	FAILURE				
17	-9.000	802.500	31.3	6.58	13.858	.234E-02	-.130E-03	
F.O.S=	2.101	BETA= N.A	NO	FAILURE				
18	-9.000	803.500	47.5	9.28	42.805	.183E-02	-.390E-03	
.O.S=	1.661	BETA= N.A	NO	FAILURE				
19	3.500	805.000	57.3	15.0	72.669	-.466E-05	-.898E-03	
F.O.S=	1.795	BETA= N.A	NO	FAILURE				
20	4.500	805.000	55.8	5.11	84.511	-.212E-03	-.120E-02	
F.O.S=	1.033	BETA= N.A	NO	FAILURE				
21	5.500	805.000	54.6	3.41	-88.765	-.444E-03	-.127E-02	
F.O.S=	.861	BETA= 22.408	SHEAR FAILURE					
22	6.500	805.000	58.0	5.02	-82.004	-.686E-03	-.112E-02	
F.O.S=	.984	BETA= 22.698	SHEAR FAILURE					
23	7.500	805.000	61.8	15.0	-70.051	-.921E-03	-.744E-03	
F.O.S=	1.663	BETA= N.A	NO	FAILURE				
24	9.000	803.500	47.5	9.28	-42.805	-.183E-02	-.390E-03	
F.O.S=	1.661	BETA= N.A	NO	FAILURE				
25	9.000	802.500	31.3	6.58	-13.858	-.234E-02	-.130E-03	
F.O.S=	2.101	BETA= N.A	NO	FAILURE				
26	9.000	801.500	31.2	6.56	13.904	-.234E-02	.150E-03	
F.O.S=	2.098	BETA= N.A	NO	FAILURE				
27	9.000	800.500	47.3	9.21	42.793	-.183E-02	.410E-03	
F.O.S=	1.659	BETA= N.A	NO	FAILURE				
28	7.500	799.000	61.4	14.9	70.010	-.920E-03	.762E-03	
F.O.S=	1.666	BETA= N.A	NO	FAILURE				

29	6.500	799.000	57.7	4.95	81.988	-.686E-03	.113E-02
F.O.S=	.982	BETA= 22.656		SHEAR FAILURE			
30	5.500	799.000	54.3	3.35	88.763	-.444E-03	.128E-02
F.O.S=	.859	BETA= 22.365		SHEAR FAILURE			
31	4.500	799.000	55.4	5.04	-84.498	-.212E-03	.121E-02
F.O.S=	1.032	BETA= N.A		NO FAILURE			
32	3.500	799.000	57.0	14.9	-72.626	-.528E-05	.913E-03
F.O.S=	1.798	BETA= N.A		NO FAILURE			
33	2.000	800.500	43.3	13.0	-35.519	.612E-03	.515E-03
F.O.S=	2.191	BETA= N.A		NO FAILURE			
34	2.000	801.500	35.1	5.38	-8.052	.996E-03	.187E-03
F.O.S=	1.683	BETA= N.A		NO FAILURE			
35	2.000	802.500	35.2	5.40	8.006	.997E-03	-.170E-03
F.O.S=	1.685	BETA= N.A		NO FAILURE			
36	2.000	803.500	43.5	13.1	35.538	.613E-03	-.498E-03
F.O.S=	2.192	BETA= N.A		NO FAILURE			

1 NN = 2

STRESSES AND DISPLACEMENTS, AND FAILURE CRITERION AT INTERIOR POINTS

I	CX	CZ	SIG1	SIG3	ALPHA	UX	UZ
1	-7.500	806.000	53.5	17.3	74.191	.773E-03	-.678E-03
F.O.S=	2.084	BETA= N.A		NO FAILURE			
2	-6.500	806.000	55.3	11.3	80.577	.629E-03	-.888E-03
F.O.S=	1.589	BETA= N.A		NO FAILURE			
3	-5.500	806.000	54.9	9.31	87.901	.430E-03	-.100E-02
F.O.S=	1.439	BETA= N.A		NO FAILURE			
4	-4.500	806.000	53.9	11.4	-84.952	.233E-03	-.963E-03
F.O.S=	1.637	BETA= N.A		NO FAILURE			
5	-3.500	806.000	51.2	17.5	-79.205	.928E-04	-.819E-03
F.O.S=	2.189	BETA= N.A		NO FAILURE			
6	-1.000	803.500	35.8	21.4	-32.497	-.299E-03	-.466E-03
F.O.S=	3.511	BETA= N.A		NO FAILURE			
7	-1.000	802.500	37.2	13.5	-7.022	-.462E-03	-.172E-03
F.O.S=	2.600	BETA= N.A		NO FAILURE			
8	-1.000	801.500	37.2	13.4	7.042	-.462E-03	.190E-03
F.O.S=	2.598	BETA= N.A		NO FAILURE			
9	-1.000	800.500	35.7	21.3	32.422	-.298E-03	.484E-03
F.O.S=	3.511	BETA= N.A		NO FAILURE			
10	-3.500	798.000	50.7	17.3	79.156	.931E-04	.835E-03
F.O.S=	2.195	BETA= N.A		NO FAILURE			
11	-4.500	798.000	53.5	11.3	84.932	.233E-03	.979E-03
F.O.S=	1.639	BETA= N.A		NO FAILURE			

12	-5.500	798.000	54.5		9.17	-87.895	.430E-03	.102E-02
F.O.S=	1.439	BETA= N.A		NO	FAILURE			
13	-6.500	798.000	54.8		11.2	-80.545	.628E-03	.905E-03
F.O.S=	1.590	BETA= N.A		NO	FAILURE			
14	-7.500	798.000	53.0		17.1	-74.129	.772E-03	.696E-03
F.O.S=	2.089	BETA= N.A		NO	FAILURE			
15	-10.000	800.500	41.5		17.0	-48.283	.159E-02	.352E-03
F.O.S=	2.654	BETA= N.A		NO	FAILURE			
16	-10.000	801.500	34.0		17.8	-20.104	.188E-02	.144E-03
F.O.S=	3.330	BETA= N.A		NO	FAILURE			
17	-10.000	802.500	34.0		17.9	20.107	.188E-02	-.122E-03
F.O.S=	3.331	BETA= N.A		NO	FAILURE			
18	-10.000	803.500	41.7		17.1	48.337	.159E-02	-.331E-03
F.O.S=	2.653	BETA= N.A		NO	FAILURE			
19	3.500	806.000	51.2		17.5	79.205	-.928E-04	-.819E-03
F.O.S=	2.189	BETA= N.A		NO	FAILURE			
20	4.500	806.000	53.9		11.4	84.952	-.233E-03	-.963E-03
F.O.S=	1.637	BETA= N.A		NO	FAILURE			
21	5.500	806.000	54.9		9.31	-87.902	-.430E-03	-.100E-02
F.O.S=	1.439	BETA= N.A		NO	FAILURE			
22	6.500	806.000	55.3		11.3	-80.577	-.629E-03	-.888E-03
F.O.S=	1.589	BETA= N.A		NO	FAILURE			
23	7.500	806.000	53.5		17.3	-74.191	-.773E-03	-.678E-03
.O.S=	2.084	BETA= N.A		NO	FAILURE			
24	10.000	803.500	41.7		17.1	-48.337	-.159E-02	-.331E-03
F.O.S=	2.653	BETA= N.A		NO	FAILURE			
25	10.000	802.500	34.0		17.9	-20.107	-.188E-02	-.122E-03
F.O.S=	3.330	BETA= N.A		NO	FAILURE			
26	10.000	801.500	34.0		17.8	20.104	-.188E-02	.144E-03
F.O.S=	3.330	BETA= N.A		NO	FAILURE			
27	10.000	800.500	41.5		17.0	48.283	-.159E-02	.352E-03
F.O.S=	2.654	BETA= N.A		NO	FAILURE			
28	7.500	798.000	53.0		17.1	74.129	-.772E-03	.696E-03
F.O.S=	2.089	BETA= N.A		NO	FAILURE			
29	6.500	798.000	54.8		11.2	80.545	-.628E-03	.905E-03
F.O.S=	1.590	BETA= N.A		NO	FAILURE			
30	5.500	798.000	54.5		9.17	87.895	-.430E-03	.102E-02
F.O.S=	1.439	BETA= N.A		NO	FAILURE			
31	4.500	798.000	53.5		11.3	-84.932	-.233E-03	.979E-03
F.O.S=	1.639	BETA= N.A		NO	FAILURE			
32	3.500	798.000	50.7		17.3	-79.157	-.931E-04	.835E-03
F.O.S=	2.195	BETA= N.A		NO	FAILURE			
33	1.000	800.500	35.7		21.3	-32.422	.298E-03	.484E-03
F.O.S=	3.511	BETA= N.A		NO	FAILURE			

17	-11.000	802.500	32.5		25.5	34.112	.156E-02	-.883E-04
F.O.S=	4.291	BETA= N.A		NO	FAILURE			
18	-11.000	803.500	38.5		22.2	55.354	.140E-02	-.252E-03
F.O.S=	3.335	BETA= N.A		NO	FAILURE			
19	3.500	807.000	49.6		18.3	84.489	-.148E-03	-.744E-03
F.O.S=	2.321	BETA= N.A		NO	FAILURE			
20	4.500	807.000	51.6		15.3	87.579	-.257E-03	-.808E-03
F.O.S=	2.012	BETA= N.A		NO	FAILURE			
21	5.500	807.000	52.5		14.0	-87.325	-.401E-03	-.814E-03
F.O.S=	1.883	BETA= N.A		NO	FAILURE			
22	6.500	807.000	52.2		15.3	-82.029	-.544E-03	-.741E-03
F.O.S=	1.991	BETA= N.A		NO	FAILURE			
23	7.500	807.000	50.5		18.4	-78.339	-.648E-03	-.619E-03
F.O.S=	2.284	BETA= N.A		NO	FAILURE			
24	11.000	803.500	38.5		22.2	-55.354	-.140E-02	-.252E-03
F.O.S=	3.335	BETA= N.A		NO	FAILURE			
25	11.000	802.500	32.5		25.5	-34.112	-.156E-02	-.883E-04
F.O.S=	4.291	BETA= N.A		NO	FAILURE			
26	11.000	801.500	32.4		25.4	34.024	-.156E-02	.110E-03
F.O.S=	4.293	BETA= N.A		NO	FAILURE			
27	11.000	800.500	38.4		22.1	55.260	-.140E-02	.274E-03
F.O.S=	3.339	BETA= N.A		NO	FAILURE			
28	7.500	797.000	50.0		18.2	78.271	-.646E-03	.638E-03
.O.S=	2.292	BETA= N.A		NO	FAILURE			
29	6.500	797.000	51.6		15.1	81.987	-.542E-03	.759E-03
F.O.S=	1.996	BETA= N.A		NO	FAILURE			
30	5.500	797.000	52.0		13.8	87.312	-.400E-03	.831E-03
F.O.S=	1.888	BETA= N.A		NO	FAILURE			
31	4.500	797.000	51.0		15.0	-87.565	-.257E-03	.825E-03
F.O.S=	2.018	BETA= N.A		NO	FAILURE			
32	3.500	797.000	49.0		18.1	-84.455	-.148E-03	.761E-03
F.O.S=	2.330	BETA= N.A		NO	FAILURE			
33	.000	800.500	31.6		25.8	.000	.107E-07	.464E-03
F.O.S=	4.439	BETA= N.A		NO	FAILURE			
34	.000	801.500	36.6		16.5	.000	.803E-08	.181E-03
F.O.S=	2.966	BETA= N.A		NO	FAILURE			
35	.000	802.500	36.6		16.6	.000	.501E-08	-.163E-03
F.O.S=	2.967	BETA= N.A		NO	FAILURE			
36	.000	803.500	31.7		25.9	.000	.221E-08	-.447E-03
F.O.S=	4.440	BETA= N.A		NO	FAILURE			

1 NN = 4

STRESSES AND DISPLACEMENTS, AND FAILURE CRITERION AT INTERIOR POINTS

I	CX	CZ	SIG1	SIG3	ALPHA	UX	UZ
1	-7.500	808.000	49.0	19.2	81.282	.550E-03	-.565E-03
F.O.S=	2.412	BETA= N.A	NO	FAILURE			
2	-6.500	808.000	50.1	17.6	83.616	.470E-03	-.641E-03
F.O.S=	2.242	BETA= N.A	NO	FAILURE			
3	-5.500	808.000	50.5	16.8	87.052	.367E-03	-.690E-03
F.O.S=	2.172	BETA= N.A	NO	FAILURE			
4	-4.500	808.000	50.0	17.4	-89.645	.261E-03	-.698E-03
F.O.S=	2.238	BETA= N.A	NO	FAILURE			
5	-3.500	808.000	48.8	18.9	-87.663	.173E-03	-.674E-03
F.O.S=	2.398	BETA= N.A	NO	FAILURE			
6	1.000	803.500	35.8	21.4	32.498	.299E-03	-.466E-03
F.O.S=	3.511	BETA= N.A	NO	FAILURE			
7	1.000	802.500	37.2	13.5	7.022	.462E-03	-.172E-03
F.O.S=	2.600	BETA= N.A	NO	FAILURE			
8	1.000	801.500	37.2	13.4	-7.042	.462E-03	.190E-03
F.O.S=	2.598	BETA= N.A	NO	FAILURE			
9	1.000	800.500	35.7	21.3	-32.422	.298E-03	.484E-03
F.O.S=	3.511	BETA= N.A	NO	FAILURE			
10	-3.500	796.000	48.2	18.6	87.645	.172E-03	.692E-03
F.O.S=	2.410	BETA= N.A	NO	FAILURE			
11	-4.500	796.000	49.3	17.1	89.641	.261E-03	.716E-03
.O.S=	2.247	BETA= N.A	NO	FAILURE			
12	-5.500	796.000	49.8	16.6	-87.032	.366E-03	.709E-03
F.O.S=	2.181	BETA= N.A	NO	FAILURE			
13	-6.500	796.000	49.5	17.3	-83.571	.468E-03	.660E-03
F.O.S=	2.251	BETA= N.A	NO	FAILURE			
14	-7.500	796.000	48.4	18.9	-81.215	.548E-03	.584E-03
F.O.S=	2.423	BETA= N.A	NO	FAILURE			
15	-12.000	800.500	37.4	24.5	-65.550	.124E-02	.213E-03
F.O.S=	3.637	BETA= N.A	NO	FAILURE			
16	-12.000	801.500	33.2	27.6	-68.054	.133E-02	.850E-04
F.O.S=	4.393	BETA= N.A	NO	FAILURE			
17	-12.000	802.500	33.3	27.6	68.081	.133E-02	-.620E-04
F.O.S=	4.388	BETA= N.A	NO	FAILURE			
18	-12.000	803.500	37.6	24.6	65.643	.124E-02	-.190E-03
F.O.S=	3.630	BETA= N.A	NO	FAILURE			
19	3.500	808.000	48.8	18.9	87.663	-.173E-03	-.674E-03
F.O.S=	2.398	BETA= N.A	NO	FAILURE			
20	4.500	808.000	50.0	17.4	89.645	-.261E-03	-.698E-03
F.O.S=	2.238	BETA= N.A	NO	FAILURE			
21	5.500	808.000	50.5	16.8	-87.052	-.367E-03	-.690E-03
F.O.S=	2.172	BETA= N.A	NO	FAILURE			

22	6.500	808.000	50.1		17.6	-83.617	-.470E-03	-.641E-03
F.O.S=	2.242	BETA= N.A		NO	FAILURE			
23	7.500	808.000	49.0		19.2	-81.282	-.550E-03	-.565E-03
F.O.S=	2.412	BETA= N.A		NO	FAILURE			
24	12.000	803.500	37.6		24.6	-65.643	-.124E-02	-.190E-03
F.O.S=	3.630	BETA= N.A		NO	FAILURE			
25	12.000	802.500	33.3		27.6	-68.081	-.133E-02	-.620E-04
F.O.S=	4.388	BETA= N.A		NO	FAILURE			
26	12.000	801.500	33.2		27.6	68.054	-.133E-02	.850E-04
F.O.S=	4.393	BETA= N.A		NO	FAILURE			
27	12.000	800.500	37.4		24.5	65.550	-.124E-02	.213E-03
F.O.S=	3.637	BETA= N.A		NO	FAILURE			
28	7.500	796.000	48.4		18.9	81.215	-.548E-03	.584E-03
F.O.S=	2.423	BETA= N.A		NO	FAILURE			
29	6.500	796.000	49.5		17.3	83.571	-.468E-03	.660E-03
F.O.S=	2.251	BETA= N.A		NO	FAILURE			
30	5.500	796.000	49.8		16.6	87.032	-.366E-03	.709E-03
F.O.S=	2.181	BETA= N.A		NO	FAILURE			
31	4.500	796.000	49.3		17.1	-89.641	-.261E-03	.716E-03
F.O.S=	2.247	BETA= N.A		NO	FAILURE			
32	3.500	796.000	48.2		18.6	-87.645	-.172E-03	.692E-03
F.O.S=	2.410	BETA= N.A		NO	FAILURE			
33	-1.000	800.500	35.7		21.3	32.422	-.298E-03	.484E-03
F.O.S=	3.511	BETA= N.A		NO	FAILURE			
34	-1.000	801.500	37.2		13.4	7.042	-.462E-03	.190E-03
F.O.S=	2.598	BETA= N.A		NO	FAILURE			
35	-1.000	802.500	37.2		13.5	-7.022	-.462E-03	-.172E-03
F.O.S=	2.600	BETA= N.A		NO	FAILURE			
36	-1.000	803.500	35.8		21.4	-32.497	-.299E-03	-.466E-03
F.O.S=	3.511	BETA= N.A		NO	FAILURE			

DONE

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* 2-D STRESS ANALYSIS BY THE BOUNDARY ELEMENT METHOD *
*  PLANE STRAIN CONDITIONS, FICTITIOUS STRIP LOADS   *
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drift interaction calculation 2 (7/30/85)

CODE OF PROBLEM TYPE = 2

ROCK PROPERTIES SIGC, RM, S = , 200.00000 2.50000 .00500

NSEG, KXS, KZS, NCYC, NSL = 8 0 0 15 4

DELN, E MODULUS, RNU = 1.000 67794.000 .260

CODE OF THE ANALYSIS IN HOMOGENOUS GRAVITATIONAL MEDIA

GAMMA, HORZ. STR RATIO = .027 .500

ELEMENTS	CENT X (FIRST-X)	CENT Z (FIRST-Z)	THET1 (LAST-X)	THET2 (LAST-Z)	RADIUS	RATIO	PSI
5	-8.000	804.000	-3.000	804.000			
4	-3.000	804.000	-3.000	800.000			
5	-3.000	800.000	-8.000	800.000			
4	-8.000	800.000	-8.000	804.000			
5	3.000	804.000	8.000	804.000			
4	8.000	804.000	8.000	800.000			

5	8.000	800.000	3.000	800.000
4	3.000	800.000	3.000	804.000

1 NN = 0

STRESSES AND DISPLACEMENTS , AND FAILURE CRITERION AT CENTERS OF BOUNDARY EL
EMENTS

I	CX	CZ	SIG1	SIG3	ALPHA	UX	UZ
1	-7.500	804.000	19.3	-.497E-04	-89.999	-.916E-04	-.121E-02
F.O.S=	.731	BETA= 14.999		SHEAR FAILURE			
2	-6.500	804.000	.794	.165E-04	-89.995	-.735E-04	-.165E-02
F.O.S=	17.817	BETA= N.A		NO FAILURE			
3	-5.500	804.000	.100E-03	-1.46	-.001	.102E-04	-.178E-02
F.O.S=	.274	BETA=	.000	TENSILE FAILURE			
4	-4.500	804.000	.392	.238E-04	89.999	.967E-04	-.168E-02
F.O.S=	36.092	BETA= N.A		NO FAILURE			
5	-3.500	804.000	18.6	.442E-04	90.000	.123E-03	-.126E-02
F.O.S=	.760	BETA= 14.743		SHEAR FAILURE			
6	-3.000	803.500	57.5	-.127E-03	-90.000	-.269E-03	-.371E-03
F.O.S=	.246	BETA= 23.390		SHEAR FAILURE			
7	-3.000	802.500	38.1	-.141E-03	-90.000	-.433E-03	-.951E-04
F.O.S=	.371	BETA= 19.979		SHEAR FAILURE			
8	-3.000	801.500	38.0	-.182E-03	90.000	-.433E-03	.112E-03
.O.S=	.372	BETA= 19.974		SHEAR FAILURE			
9	-3.000	800.500	57.4	-.236E-03	90.000	-.269E-03	.388E-03
F.O.S=	.246	BETA= 23.371		SHEAR FAILURE			
10	-3.500	800.000	18.6	.996E-05	-90.000	.123E-03	.128E-02
F.O.S=	.762	BETA= 14.729		SHEAR FAILURE			
11	-4.500	800.000	.396	.132E-04	89.999	.967E-04	.170E-02
F.O.S=	35.719	BETA= N.A		NO FAILURE			
12	-5.500	800.000	.100E-03	-1.45	.001	.107E-04	.180E-02
F.O.S=	.275	BETA=	.000	TENSILE FAILURE			
13	-6.500	800.000	.790	.265E-04	89.998	-.726E-04	.167E-02
F.O.S=	17.906	BETA= N.A		NO FAILURE			
14	-7.500	800.000	19.3	.500E-04	90.000	-.906E-04	.123E-02
F.O.S=	.734	BETA= 14.974		SHEAR FAILURE			
15	-8.000	800.500	55.4	-.184E-04	-90.000	.305E-03	.351E-03
F.O.S=	.255	BETA= 23.067		SHEAR FAILURE			
16	-8.000	801.500	36.1	-.271E-04	-90.000	.464E-03	.101E-03
F.O.S=	.391	BETA= 19.563		SHEAR FAILURE			
17	-8.000	802.500	36.2	-.348E-04	-90.000	.464E-03	-.802E-04
F.O.S=	.391	BETA= 19.570		SHEAR FAILURE			
18	-8.000	803.500	55.5	-.153E-04	90.000	.305E-03	-.330E-03
F.O.S=	.255	BETA= 23.090		SHEAR FAILURE			

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  19      3.500    804.000  18.6      -.204E-03   -90.000 -.123E-03  .128E-02
F.O.S=    .760     BETA= 14.743     SHEAR FAILURE

  20      4.500    804.000  .392      -.177E-03   -89.982 -.967E-04 -.168E-02
F.O.S= 36.091      BETA= N.A        NO  FAILURE

  21      5.500    804.000 -.166E-03 -1.46          -.006 -.102E-04 -.178E-02
F.O.S=    .274     BETA=    .000    TENSILE FAILURE

  22      6.500    804.000  .794      -.165E-03   -89.989  .735E-04 -.165E-02
F.O.S= 17.818      BETA= N.A        NO  FAILURE

  23      7.500    804.000  19.3      -.101E-03   -90.000  .916E-04 -.121E-02
F.O.S=    .731     BETA= 14.999     SHEAR FAILURE

  24      8.000    803.500  55.5       .737E-06    90.000 -.305E-03 -.330E-03
F.O.S=    .255     BETA= 23.090     SHEAR FAILURE

  25      8.000    802.500  36.2      -.226E-04    90.000 -.464E-03 -.802E-04
F.O.S=    .391     BETA= 19.570     SHEAR FAILURE

  26      8.000    801.500  36.1      -.465E-04    90.000 -.463E-03  .101E-03
F.O.S=    .391     BETA= 19.563     SHEAR FAILURE

  27      8.000    800.500  55.4      -.126E-03    90.000 -.305E-03  .351E-03
F.O.S=    .255     BETA= 23.067     SHEAR FAILURE

  28      7.500    800.000  19.3       .228E-04   -90.000  .906E-04  .123E-02
F.O.S=    .734     BETA= 14.974     SHEAR FAILURE

  29      6.500    800.000  .790       .306E-04   -89.992  .727E-04  .167E-02
F.O.S= 17.906      BETA= N.A        NO  FAILURE

  30      5.500    800.000  .100E-03 -1.45          -.004 -.106E-04  .180E-02
F.O.S=    .275     BETA=    .000    TENSILE FAILURE

  31      4.500    800.000  .396       .213E-04   -89.986 -.967E-04  .170E-02
F.O.S= 35.743      BETA= N.A        NO  FAILURE

  32      3.500    800.000  18.6       .588E-04   -90.000 -.123E-03  .128E-02
F.O.S=    .762     BETA= 14.728     SHEAR FAILURE

  33      3.000    800.500  57.4      -.161E-04    90.000  .269E-03  .388E-03
F.O.S=    .246     BETA= 23.371     SHEAR FAILURE

  34      3.000    801.500  38.0      -.191E-04    90.000  .433E-03  .112E-03
F.O.S=    .372     BETA= 19.974     SHEAR FAILURE

  35      3.000    802.500  38.1      -.156E-04    90.000  .433E-03 -.951E-04
F.O.S=    .371     BETA= 19.980     SHEAR FAILURE

  36      3.000    803.500  57.5       .000        90.000  .269E-03 -.371E-03
F.O.S=    .246     BETA= 23.390     SHEAR FAILURE

1      NN =   1


   STRESSES AND DISPLACEMENTS, AND FAILURE CRITERION AT INTERIOR POINTS


    I       CX          CZ       SIG1       SIG3      ALPHA       UX         UZ
    1     -7.500    805.000  24.6       2.28        42.158  .190E-03 -.101E-02
F.O.S=   1.581     BETA= N.A        NO  FAILURE
```

2	-6.500	805.000	13.2		1.63	65.051	.104E-03	-.139E-02
F.O.S=	2.530	BETA= N.A		NO	FAILURE			
3	-5.500	805.000	9.52		2.06	88.927	.228E-04	-.153E-02
F.O.S=	3.904	BETA= N.A		NO	FAILURE			
4	-4.500	805.000	13.0		1.83	-65.573	-.577E-04	-.143E-02
F.O.S=	2.711	BETA= N.A		NO	FAILURE			
5	-3.500	805.000	24.7		2.39	-41.478	-.141E-03	-.107E-02
F.O.S=	1.612	BETA= N.A		NO	FAILURE			
6	-2.000	803.500	37.1		9.01	-13.547	-.122E-03	-.344E-03
F.O.S=	2.090	BETA= N.A		NO	FAILURE			
7	-2.000	802.500	37.7		3.67	-3.845	-.235E-03	-.116E-03
F.O.S=	1.296	BETA= N.A		NO	FAILURE			
8	-2.000	801.500	37.6		3.67	3.844	-.235E-03	.133E-03
F.O.S=	1.296	BETA= N.A		NO	FAILURE			
9	-2.000	800.500	37.1		8.98	13.546	-.122E-03	.362E-03
F.O.S=	2.091	BETA= N.A		NO	FAILURE			
10	-3.500	799.000	24.5		2.34	41.506	-.141E-03	.109E-02
F.O.S=	1.604	BETA= N.A		NO	FAILURE			
11	-4.500	799.000	12.9		1.77	65.609	-.575E-04	.144E-02
F.O.S=	2.688	BETA= N.A		NO	FAILURE			
12	-5.500	799.000	9.46		2.00	-88.953	.228E-04	.154E-02
F.O.S=	3.878	BETA= N.A		NO	FAILURE			
13	-6.500	799.000	13.1		1.58	-65.102	.104E-03	.141E-02
.O.S=	2.510	BETA= N.A		NO	FAILURE			
14	-7.500	799.000	24.4		2.23	-42.185	.190E-03	.103E-02
F.O.S=	1.575	BETA= N.A		NO	FAILURE			
15	-9.000	800.500	35.1		8.78	-15.193	.168E-03	.314E-03
F.O.S=	2.179	BETA= N.A		NO	FAILURE			
16	-9.000	801.500	35.2		3.71	-4.316	.276E-03	.118E-03
F.O.S=	1.394	BETA= N.A		NO	FAILURE			
17	-9.000	802.500	35.2		3.72	4.334	.276E-03	-.966E-04
F.O.S=	1.394	BETA= N.A		NO	FAILURE			
18	-9.000	803.500	35.2		8.82	15.220	.168E-03	-.293E-03
F.O.S=	2.178	BETA= N.A		NO	FAILURE			
19	3.500	805.000	24.7		2.39	41.478	.141E-03	-.107E-02
F.O.S=	1.612	BETA= N.A		NO	FAILURE			
20	4.500	805.000	13.0		1.83	65.574	.577E-04	-.143E-02
F.O.S=	2.711	BETA= N.A		NO	FAILURE			
21	5.500	805.000	9.52		2.06	-88.926	-.228E-04	-.153E-02
F.O.S=	3.904	BETA= N.A		NO	FAILURE			
22	6.500	805.000	13.2		1.63	-65.050	-.104E-03	-.139E-02
F.O.S=	2.530	BETA= N.A		NO	FAILURE			
23	7.500	805.000	24.6		2.28	-42.158	-.190E-03	-.101E-02
F.O.S=	1.581	BETA= N.A		NO	FAILURE			

24	9.000	803.500	35.2	8.82	-15.220	-.168E-03	-.273E-03
F.O.S=	2.178	BETA= N.A		NO	FAILURE		
25	9.000	802.500	35.2	3.72	-4.334	-.276E-03	-.967E-04
F.O.S=	1.394	BETA= N.A		NO	FAILURE		
26	9.000	801.500	35.2	3.71	4.316	-.276E-03	.118E-03
F.O.S=	1.394	BETA= N.A		NO	FAILURE		
27	9.000	800.500	35.1	8.78	15.193	-.168E-03	.314E-03
F.O.S=	2.179	BETA= N.A		NO	FAILURE		
28	7.500	799.000	24.4	2.23	42.185	-.190E-03	.103E-02
F.O.S=	1.575	BETA= N.A		NO	FAILURE		
29	6.500	799.000	13.1	1.58	65.102	-.104E-03	.141E-02
F.O.S=	2.510	BETA= N.A		NO	FAILURE		
30	5.500	799.000	9.46	2.00	88.953	-.228E-04	.154E-02
F.O.S=	3.878	BETA= N.A		NO	FAILURE		
31	4.500	799.000	12.9	1.77	-65.609	.575E-04	.144E-02
F.O.S=	2.688	BETA= N.A		NO	FAILURE		
32	3.500	799.000	24.5	2.34	-41.506	.141E-03	.109E-02
F.O.S=	1.604	BETA= N.A		NO	FAILURE		
33	2.000	800.500	37.1	8.98	-13.546	.122E-03	.362E-03
F.O.S=	2.091	BETA= N.A		NO	FAILURE		
34	2.000	801.500	37.6	3.67	-3.844	.235E-03	.133E-03
F.O.S=	1.296	BETA= N.A		NO	FAILURE		
35	2.000	802.500	37.7	3.67	3.845	.235E-03	-.116E-03
F.O.S=	1.296	BETA= N.A		NO	FAILURE		
36	2.000	803.500	37.1	9.01	13.547	.122E-03	-.344E-03
F.O.S=	2.090	BETA= N.A		NO	FAILURE		

1 NN = 2

STRESSES AND DISPLACEMENTS, AND FAILURE CRITERION AT INTERIOR POINTS

I	CX	CZ	SIG1	SIG3	ALPHA	UX	UZ
1	-7.500	806.000	22.3	5.52	36.927	.211E-03	-.920E-03
F.O.S=	2.691	BETA= N.A		NO	FAILURE		
2	-6.500	806.000	16.8	5.80	57.065	.141E-03	-.117E-02
F.O.S=	3.672	BETA= N.A		NO	FAILURE		
3	-5.500	806.000	13.9	6.70	88.592	.333E-04	-.128E-02
F.O.S=	4.785	BETA= N.A		NO	FAILURE		
4	-4.500	806.000	16.5	6.16	-57.256	-.739E-04	-.120E-02
F.O.S=	3.856	BETA= N.A		NO	FAILURE		
5	-3.500	806.000	22.3	5.78	-35.582	-.141E-03	-.985E-03
F.O.S=	2.755	BETA= N.A		NO	FAILURE		
6	-1.000	803.500	32.7	10.0	-6.309	-.586E-04	-.261E-03
F.O.S=	2.518	BETA= N.A		NO	FAILURE		

7	-1.000	802.500	34.9		7.43	-2.659	-.962E-04	-.897E-04
F.O.S=	2.009	BETA= N.A		NO	FAILURE			
8	-1.000	801.500	34.8		7.42	2.655	-.962E-04	.108E-03
F.O.S=	2.009	BETA= N.A		NO	FAILURE			
9	-1.000	800.500	32.6		10.0	6.309	-.585E-04	.279E-03
F.O.S=	2.519	BETA= N.A		NO	FAILURE			
10	-3.500	798.000	22.1		5.68	35.657	-.140E-03	.100E-02
F.O.S=	2.750	BETA= N.A		NO	FAILURE			
11	-4.500	798.000	16.3		6.04	57.358	-.738E-04	.122E-02
F.O.S=	3.846	BETA= N.A		NO	FAILURE			
12	-5.500	798.000	13.7		6.57	-88.648	.330E-04	.129E-02
F.O.S=	4.773	BETA= N.A		NO	FAILURE			
13	-6.500	798.000	16.6		5.69	-57.194	.141E-03	.119E-02
F.O.S=	3.666	BETA= N.A		NO	FAILURE			
14	-7.500	798.000	22.1		5.43	-37.003	.210E-03	.939E-03
F.O.S=	2.689	BETA= N.A		NO	FAILURE			
15	-10.000	800.500	29.8		10.0	-9.267	.119E-03	.208E-03
F.O.S=	2.763	BETA= N.A		NO	FAILURE			
16	-10.000	801.500	31.4		7.80	-3.780	.155E-03	.841E-04
F.O.S=	2.290	BETA= N.A		NO	FAILURE			
17	-10.000	802.500	31.4		7.81	3.824	.155E-03	-.621E-04
F.O.S=	2.290	BETA= N.A		NO	FAILURE			
18	-10.000	803.500	29.9		10.1	9.307	.119E-03	-.186E-03
F.O.S=	2.761	BETA= N.A		NO	FAILURE			
19	3.500	806.000	22.3		5.78	35.582	.141E-03	-.985E-03
F.O.S=	2.755	BETA= N.A		NO	FAILURE			
20	4.500	806.000	16.5		6.16	57.256	.739E-04	-.120E-02
F.O.S=	3.856	BETA= N.A		NO	FAILURE			
21	5.500	806.000	13.9		6.70	-88.591	-.333E-04	-.128E-02
F.O.S=	4.784	BETA= N.A		NO	FAILURE			
22	6.500	806.000	16.8		5.80	-57.065	-.141E-03	-.117E-02
F.O.S=	3.672	BETA= N.A		NO	FAILURE			
23	7.500	806.000	22.3		5.52	-36.927	-.211E-03	-.920E-03
F.O.S=	2.691	BETA= N.A		NO	FAILURE			
24	10.000	803.500	29.9		10.1	-9.306	-.119E-03	-.186E-03
F.O.S=	2.761	BETA= N.A		NO	FAILURE			
25	10.000	802.500	31.4		7.81	-3.823	-.155E-03	-.621E-04
F.O.S=	2.290	BETA= N.A		NO	FAILURE			
26	10.000	801.500	31.4		7.80	3.780	-.154E-03	.841E-04
F.O.S=	2.290	BETA= N.A		NO	FAILURE			
27	10.000	800.500	29.8		10.0	9.267	-.119E-03	.208E-03
F.O.S=	2.763	BETA= N.A		NO	FAILURE			
28	7.500	798.000	22.1		5.43	37.003	-.210E-03	.939E-03
F.O.S=	2.689	BETA= N.A		NO	FAILURE			

29	6.500	798.000	16.6	5.69	37.174	-.140E-03	.117E-02
F.O.S=	3.666	BETA= N.A		NO	FAILURE		
30	5.500	798.000	13.7	6.57	88.648	-.330E-04	.129E-02
F.O.S=	4.773	BETA= N.A		NO	FAILURE		
31	4.500	798.000	16.3	6.04	-57.359	.738E-04	.122E-02
F.O.S=	3.846	BETA= N.A		NO	FAILURE		
32	3.500	798.000	22.1	5.68	-35.657	.140E-03	.100E-02
F.O.S=	2.750	BETA= N.A		NO	FAILURE		
33	1.000	800.500	32.6	10.0	-6.309	.585E-04	.279E-03
F.O.S=	2.519	BETA= N.A		NO	FAILURE		
34	1.000	801.500	34.8	7.42	-2.654	.962E-04	.108E-03
F.O.S=	2.009	BETA= N.A		NO	FAILURE		
35	1.000	802.500	34.9	7.43	2.660	.962E-04	-.897E-04
F.O.S=	2.009	BETA= N.A		NO	FAILURE		
36	1.000	803.500	32.7	10.0	6.309	.586E-04	-.261E-03
F.O.S=	2.518	BETA= N.A		NO	FAILURE		

1 NN = 3

STRESSES AND DISPLACEMENTS, AND FAILURE CRITERION AT INTERIOR POINTS

I	CX	CZ	SIG1	SIG3	ALPHA	UX	UZ
1	-7.500	807.000	20.7	8.19	33.028	.195E-03	-.840E-03
.O.S=	3.559	BETA= N.A		NO	FAILURE		
2	-6.500	807.000	17.0	9.42	48.204	.135E-03	-.101E-02
F.O.S=	4.680	BETA= N.A		NO	FAILURE		
3	-5.500	807.000	14.3	11.2	85.979	.435E-04	-.108E-02
F.O.S=	6.113	BETA= N.A		NO	FAILURE		
4	-4.500	807.000	16.6	9.88	-47.371	-.466E-04	-.104E-02
F.O.S=	4.924	BETA= N.A		NO	FAILURE		
5	-3.500	807.000	20.5	8.50	-30.589	-.102E-03	-.913E-03
F.O.S=	3.661	BETA= N.A		NO	FAILURE		
6	.000	803.500	31.8	10.2	.000	-.640E-09	-.234E-03
F.O.S=	2.617	BETA= N.A		NO	FAILURE		
7	.000	802.500	33.7	8.61	.000	.640E-09	-.786E-04
F.O.S=	2.249	BETA= N.A		NO	FAILURE		
8	.000	801.500	33.6	8.59	.000	.346E-08	.965E-04
F.O.S=	2.249	BETA= N.A		NO	FAILURE		
9	.000	800.500	31.7	10.2	.000	.736E-08	.252E-03
F.O.S=	2.619	BETA= N.A		NO	FAILURE		
10	-3.500	797.000	20.3	8.36	30.742	-.102E-03	.930E-03
F.O.S=	3.665	BETA= N.A		NO	FAILURE		
11	-4.500	797.000	16.4	9.71	47.666	-.468E-04	.106E-02
F.O.S=	4.930	BETA= N.A		NO	FAILURE		

12	-5.500	797.000	14.1		10.9	-86.201	.429E-04	.110E-02
F.O.S=	6.114	BETA= N.A		NO	FAILURE			
13	-6.500	797.000	16.8		9.26	-48.493	.134E-03	.102E-02
F.O.S=	4.690	BETA= N.A		NO	FAILURE			
14	-7.500	797.000	20.5		8.05	-33.176	.193E-03	.860E-03
F.O.S=	3.567	BETA= N.A		NO	FAILURE			
15	-11.000	800.500	27.5		10.6	-4.954	.832E-04	.143E-03
F.O.S=	3.081	BETA= N.A		NO	FAILURE			
16	-11.000	801.500	28.3		9.84	-2.121	.901E-04	.584E-04
F.O.S=	2.873	BETA= N.A		NO	FAILURE			
17	-11.000	802.500	28.4		9.86	2.175	.902E-04	-.355E-04
F.O.S=	2.872	BETA= N.A		NO	FAILURE			
18	-11.000	803.500	27.5		10.6	5.001	.835E-04	-.120E-03
F.O.S=	3.079	BETA= N.A		NO	FAILURE			
19	3.500	807.000	20.5		8.50	30.589	.102E-03	-.913E-03
F.O.S=	3.661	BETA= N.A		NO	FAILURE			
20	4.500	807.000	16.6		9.88	47.371	.467E-04	-.104E-02
F.O.S=	4.924	BETA= N.A		NO	FAILURE			
21	5.500	807.000	14.3		11.2	-85.979	-.434E-04	-.108E-02
F.O.S=	6.113	BETA= N.A		NO	FAILURE			
22	6.500	807.000	17.0		9.42	-48.204	-.135E-03	-.101E-02
F.O.S=	4.680	BETA= N.A		NO	FAILURE			
23	7.500	807.000	20.7		8.19	-33.029	-.195E-03	-.840E-03
.O.S=	3.559	BETA= N.A		NO	FAILURE			
24	11.000	803.500	27.5		10.6	-5.001	-.835E-04	-.120E-03
F.O.S=	3.079	BETA= N.A		NO	FAILURE			
25	11.000	802.500	28.4		9.86	-2.175	-.902E-04	-.356E-04
F.O.S=	2.872	BETA= N.A		NO	FAILURE			
26	11.000	801.500	28.3		9.84	2.121	-.901E-04	.584E-04
F.O.S=	2.873	BETA= N.A		NO	FAILURE			
27	11.000	800.500	27.5		10.6	4.955	-.832E-04	.143E-03
F.O.S=	3.081	BETA= N.A		NO	FAILURE			
28	7.500	797.000	20.5		8.05	33.176	-.193E-03	.860E-03
F.O.S=	3.567	BETA= N.A		NO	FAILURE			
29	6.500	797.000	16.8		9.26	48.493	-.134E-03	.102E-02
F.O.S=	4.690	BETA= N.A		NO	FAILURE			
30	5.500	797.000	14.1		10.9	86.199	-.429E-04	.110E-02
F.O.S=	6.114	BETA= N.A		NO	FAILURE			
31	4.500	797.000	16.4		9.71	-47.666	.468E-04	.106E-02
F.O.S=	4.930	BETA= N.A		NO	FAILURE			
32	3.500	797.000	20.3		8.36	-30.742	.102E-03	.930E-03
F.O.S=	3.665	BETA= N.A		NO	FAILURE			
33	.000	800.500	31.7		10.2	.000	.736E-08	.252E-03
F.O.S=	2.619	BETA= N.A		NO	FAILURE			

34	.000	801.500	33.6		8.59	.000	.346E-08	.965E-04
F.O.S=	2.249	BETA= N.A		NO	FAILURE			
35	.000	802.500	33.7		8.61	.000	.640E-09	-.786E-04
F.O.S=	2.249	BETA= N.A		NO	FAILURE			
36	.000	803.500	31.8		10.2	.000	-.640E-09	-.234E-03
F.O.S=	2.617	BETA= N.A		NO	FAILURE			

1 NN = 4

STRESSES AND DISPLACEMENTS, AND FAILURE CRITERION AT INTERIOR POINTS

I	CX	CZ	SIG1		SIG3	ALPHA	UX	UZ
1	-7.500	808.000	19.9		9.94	27.642	.173E-03	-.770E-03
F.O.S=	4.108	BETA= N.A		NO	FAILURE			
2	-6.500	808.000	17.1		11.4	34.567	.123E-03	-.883E-03
F.O.S=	5.153	BETA= N.A		NO	FAILURE			
3	-5.500	808.000	14.5		13.6	20.376	.529E-04	-.939E-03
F.O.S=	6.727	BETA= N.A		NO	FAILURE			
4	-4.500	808.000	16.7		11.9	-30.360	-.160E-04	-.922E-03
F.O.S=	5.412	BETA= N.A		NO	FAILURE			
5	-3.500	808.000	19.6		10.2	-23.666	-.615E-04	-.849E-03
F.O.S=	4.238	BETA= N.A		NO	FAILURE			
6	1.000	803.500	32.7		10.0	6.309	.586E-04	-.261E-03
F.O.S=	2.518	BETA= N.A		NO	FAILURE			
7	1.000	802.500	34.9		7.43	2.660	.962E-04	-.897E-04
F.O.S=	2.009	BETA= N.A		NO	FAILURE			
8	1.000	801.500	34.8		7.42	-2.654	.962E-04	.108E-03
F.O.S=	2.009	BETA= N.A		NO	FAILURE			
9	1.000	800.500	32.6		10.0	-6.309	.585E-04	.279E-03
F.O.S=	2.519	BETA= N.A		NO	FAILURE			
10	-3.500	796.000	19.4		10.1	23.900	-.616E-04	.868E-03
F.O.S=	4.256	BETA= N.A		NO	FAILURE			
11	-4.500	796.000	16.4		11.7	30.907	-.164E-04	.941E-03
F.O.S=	5.444	BETA= N.A		NO	FAILURE			
12	-5.500	796.000	14.2		13.4	-22.335	.522E-04	.957E-03
F.O.S=	6.801	BETA= N.A		NO	FAILURE			
13	-6.500	796.000	16.9		11.2	-35.019	.122E-03	.903E-03
F.O.S=	5.185	BETA= N.A		NO	FAILURE			
14	-7.500	796.000	19.6		9.77	-27.862	.172E-03	.790E-03
F.O.S=	4.128	BETA= N.A		NO	FAILURE			
15	-12.000	800.500	26.1		10.9	-2.509	.581E-04	.103E-03
F.O.S=	3.300	BETA= N.A		NO	FAILURE			
16	-12.000	801.500	26.5		10.7	-1.029	.555E-04	.436E-04
F.O.S=	3.220	BETA= N.A		NO	FAILURE			

17	-12.000	802.500	26.5		10.7	1.086	.556E-04	-.199E-04
F.O.S=	3.219	BETA= N.A		NO	FAILURE			
18	-12.000	803.500	26.1		10.9	2.558	.584E-04	-.795E-04
F.O.S=	3.297	BETA= N.A		NO	FAILURE			
19	3.500	808.000	19.6		10.2	23.666	.615E-04	-.849E-03
F.O.S=	4.238	BETA= N.A		NO	FAILURE			
20	4.500	808.000	16.7		11.9	30.361	.160E-04	-.922E-03
F.O.S=	5.412	BETA= N.A		NO	FAILURE			
21	5.500	808.000	14.5		13.6	-20.378	-.529E-04	-.939E-03
F.O.S=	6.727	BETA= N.A		NO	FAILURE			
22	6.500	808.000	17.1		11.4	-34.567	-.123E-03	-.883E-03
F.O.S=	5.153	BETA= N.A		NO	FAILURE			
23	7.500	808.000	19.9		9.94	-27.642	-.173E-03	-.770E-03
F.O.S=	4.108	BETA= N.A		NO	FAILURE			
24	12.000	803.500	26.1		10.9	-2.558	-.584E-04	-.796E-04
F.O.S=	3.297	BETA= N.A		NO	FAILURE			
25	12.000	802.500	26.5		10.7	-1.086	-.556E-04	-.199E-04
F.O.S=	3.219	BETA= N.A		NO	FAILURE			
26	12.000	801.500	26.5		10.7	1.030	-.555E-04	.435E-04
F.O.S=	3.220	BETA= N.A		NO	FAILURE			
27	12.000	800.500	26.1		10.9	2.509	-.581E-04	.103E-03
F.O.S=	3.300	BETA= N.A		NO	FAILURE			
28	7.500	796.000	19.6		9.77	27.862	-.172E-03	.790E-03
F.O.S=	4.128	BETA= N.A		NO	FAILURE			
29	6.500	796.000	16.9		11.2	35.019	-.122E-03	.903E-03
F.O.S=	5.185	BETA= N.A		NO	FAILURE			
30	5.500	796.000	14.2		13.4	22.339	-.521E-04	.957E-03
F.O.S=	6.801	BETA= N.A		NO	FAILURE			
31	4.500	796.000	16.4		11.7	-30.907	.164E-04	.941E-03
F.O.S=	5.444	BETA= N.A		NO	FAILURE			
32	3.500	796.000	19.4		10.1	-23.900	.616E-04	.868E-03
F.O.S=	4.256	BETA= N.A		NO	FAILURE			
33	-1.000	800.500	32.6		10.0	6.309	-.585E-04	.279E-03
F.O.S=	2.519	BETA= N.A		NO	FAILURE			
34	-1.000	801.500	34.8		7.42	2.655	-.962E-04	.108E-03
F.O.S=	2.009	BETA= N.A		NO	FAILURE			
35	-1.000	802.500	34.9		7.43	-2.659	-.962E-04	-.897E-04
F.O.S=	2.009	BETA= N.A		NO	FAILURE			
36	-1.000	803.500	32.7		10.0	-6.309	-.586E-04	-.261E-03
F.O.S=	2.518	BETA= N.A		NO	FAILURE			

DONE

34	1.000	801.500	37.2		13.4	-7.042	.462E-03	.190E-03
F.O.S=	2.598	BETA= N.A		NO	FAILURE			
35	1.000	802.500	37.2		13.5	7.022	.462E-03	-.172E-03
F.O.S=	2.600	BETA= N.A		NO	FAILURE			
36	1.000	803.500	35.8		21.4	32.498	.299E-03	-.466E-03
F.O.S=	3.511	BETA= N.A		NO	FAILURE			

1 NN = 3

STRESSES AND DISPLACEMENTS, AND FAILURE CRITERION AT INTERIOR POINTS

I	CX	CZ	SIG1		SIG3	ALPHA	UX	UZ
1	-7.500	807.000	50.5		18.4	78.339	.648E-03	-.619E-03
F.O.S=	2.284	BETA= N.A		NO	FAILURE			
2	-6.500	807.000	52.2		15.3	82.029	.544E-03	-.741E-03
F.O.S=	1.991	BETA= N.A		NO	FAILURE			
3	-5.500	807.000	52.5		14.0	87.325	.401E-03	-.814E-03
F.O.S=	1.883	BETA= N.A		NO	FAILURE			
4	-4.500	807.000	51.6		15.3	-87.579	.257E-03	-.808E-03
F.O.S=	2.012	BETA= N.A		NO	FAILURE			
5	-3.500	807.000	49.6		18.3	-84.489	.148E-03	-.744E-03
F.O.S=	2.321	BETA= N.A		NO	FAILURE			
6	.000	803.500	31.7		25.9	.000	.221E-08	-.447E-03
F.O.S=	4.440	BETA= N.A		NO	FAILURE			
7	.000	802.500	36.6		16.6	.000	.501E-08	-.163E-03
F.O.S=	2.967	BETA= N.A		NO	FAILURE			
8	.000	801.500	36.6		16.5	.000	.803E-08	.181E-03
F.O.S=	2.966	BETA= N.A		NO	FAILURE			
9	.000	800.500	31.6		25.8	.000	.107E-07	.464E-03
F.O.S=	4.439	BETA= N.A		NO	FAILURE			
10	-3.500	797.000	49.0		18.1	84.455	.148E-03	.761E-03
F.O.S=	2.330	BETA= N.A		NO	FAILURE			
11	-4.500	797.000	51.0		15.0	87.565	.257E-03	.825E-03
F.O.S=	2.018	BETA= N.A		NO	FAILURE			
12	-5.500	797.000	52.0		13.8	-87.312	.400E-03	.831E-03
F.O.S=	1.888	BETA= N.A		NO	FAILURE			
13	-6.500	797.000	51.6		15.1	-81.987	.542E-03	.759E-03
F.O.S=	1.996	BETA= N.A		NO	FAILURE			
14	-7.500	797.000	50.0		18.2	-78.272	.646E-03	.638E-03
F.O.S=	2.292	BETA= N.A		NO	FAILURE			
15	-11.000	800.500	38.4		22.1	-55.260	.140E-02	.274E-03
F.O.S=	3.339	BETA= N.A		NO	FAILURE			
16	-11.000	801.500	32.4		25.4	-34.024	.156E-02	.110E-03
F.O.S=	4.293	BETA= N.A		NO	FAILURE			

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July 1985

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)	0.8	6.8
II. Direct Loaded Labor Costs	7.0	66.0
Materials and Services	0.0	1.0
ADP Support (computer)	0.0	2.0
Subcontracts	3.0	205.0
Travel	1.0	2.0
Other	0.0	0.0
TOTAL COSTS	11.0	276.0

Other = rounding approximation by computer

III. Funding Status

Prior FY Carryover	FY85 Projected Funding Level	FY85 Funds Received to Date	FY85 Funding Balance Needed
115K	365K	250K	None