CorSTAR

A TEKNEKRON INDUSTRIES AFFILIATE

May 29, 1986

Ms. Pauline Brooks, Project Officer
Division of Waste Management
MS 623 SS
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Subject: Contract No. NRC-02-81-026
           Benchmarking of Computer Codes and Licensing Assistance
           Monthly Letter Progress Report for April 1986

Dear Pauline:

This letter contains a management level summary of progress during the month of April. Also enclosed is a Technical Status Summary further describing work performed during this period.

Task 3 - Benchmark Problem Report - Waste Package Codes

There was no significant effort on this task during April.

Tasks 4 & 5 - Siting Codes

During April, GeoTrans worked on revising the final Task 4 & 5 report. Revisions to this report are taking longer than planned. GeoTrans believes that a draft report will be available on May 23. GeoTrans submitted a computer magnetic tape containing source code for the computer codes benchmarked during this task at the end of April.

Tasks 4 & 5 - Radiological Assessment Codes

Draft copies of the final report for these tasks were submitted to the NRC by letter dated March 27, 1986. We are waiting for the NRC's comments on this report.

Tasks 4 & 5 - Repository Design Codes

All applicable codes have been procured. However, a more recent version of ADINA will be necessary to properly model the creep laws used in the Benchmark Problems. The NRC is investigating possible means of procuring the 1984 version of ADINA, and installing it at INEL. The 1981 version of ADINAT,

currently installed at Brookhaven, will also be moved to INEL. Since the INEL computer has a larger core memory than the one at Brookhaven, it is likely that the restriction in running Problem 6.3 — BWIP with ADINA will be rectified.

During the month, Acres worked on the write-ups for the ADINAT, COYOTE, DOT, MATLOC, SALT4, and VISCOT codes. In addition, Section 1 (Introduction) and Section 3 (summaries of benchmark problems) of the final report have been written up. Draft copies of all of these sections are undergoing internal review.

During the month of April, Acres contacted the NRC and obtained application materials for computer use at INEL. The application forms were completed and returned to Pauline Brooks of the NRC, who supplied some additional information and forwarded them to INEL. As of this writing, Acres has not received a response from INEL.

The lengthly delay caused by the unavailability of the ADINA and ADINAT (1981 versions) codes has caused us to fall well behind schedule in meeting the original Draft Task Summary Report deadline of March 15, 1985. Our revised deadline of May 1, 1986 is also subject to change, due to current delays caused by the procurement of ADINA (1984 version).

By the end of the reporting period, inputs for 8 of 9 STEALTH benchmark problems were debugged and executed for a few time steps. Problem 6.3 remains.

Tasks 4 & 5 - Waste Package Codes

On May 9, the NRC provided us with a copy of the computer code WAPPA-B.

Task 6 - Technology Transfer

During April, considerable effort was devoted to documenting the microcomputer solutions to benchmark problems. There is no direct solution to waste package benchmark problem 5.1. In its place, we will provide a second solution for benchmark problem 5.2.

General
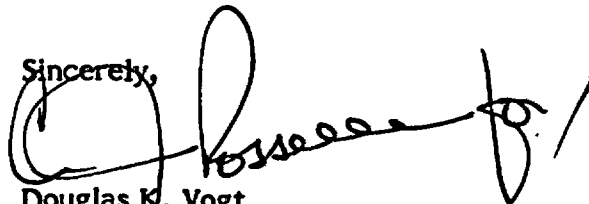
By letter dated April 29, 1986, we submitted a proposal covering the additional effort required to benchmark the 1984 version of ADINA.

Our estimate of costs through the end of April is:

Actual costs this month:	28K
Actual costs this fiscal year:	297K
Actual costs to date:	3,495K
Planned costs this fiscal year:	310K
Planned costs this month:	50K

Estimated costs include labor, labor additive, overhead, subcontractor costs, G&A and fee. These costs have not been confirmed by our accounting department.

Sincerely,

Douglas K. Vogt
Project Manager

DKV:kg

Enclosures

TECHNICAL STATUS SUMMARY

TABLE 3

MATRIX OF CODE/PROBLEM COMBINATIONS*
(Revised 12/5/85)

Legend:

- x   Benchmark Problems by Acres.
- O   Benchmark Problems by Teknekron.
- (1) Requires 2 runs, one for MATLOC and one for VISCOT.
- (2) Two-Dimensional Analysis.
- (3) Requires 3 runs, one for MATLOC and two for VISCOT.
- (4) Requires 2 runs, one for Salt and one for Basalt.
- S - Problems run for Salt.
- B - Problems run for Basalt.

	ADINA - 3D	ADINAT - 3D	DOT	HEATING	MATLOC	SPECTROM 11	SPECTROM 41	VISCOT	COYOTE	SALT 4	STEALTH
2.0 THERMAL ANALYSIS CASE PROBLEMS											
2.6 Transient Temperature Analysis of an Infinite Rectangular Bar With Anisotropic Conductivity (Schneider, 1955, pp. 261)		(2)	x	0					x		0
2.8 Transient Temperature Response to the Quench of an Infinite Slab With a Temperature-Dependent Convection Coefficient (Kreith, 1958, pp. 161)		(2)		0					x		0
2.9 Transient Temperature Response of a Slab Exposed to a Uniform Radiative Environment (Rohsenow and Hartnett, 1973, pp. 3-49)		x		0					x		0
3.0 GEOMECHANICAL ANALYTICAL PROBLEMS											
3.2 Circular Tunnel (Long Cylindrical Hole in An Infinite Medium) a) Unlined in elastic medium - biaxial stress field b) Unlined in plastic medium (Tresca) von Mises	(2)				x			x			0
3.3 Thick-Walled Cylinder Subjected to Internal and/or External Pressure c) Plane strain - creep	(2)							x			
3.5 Plane Strain Compression of an Elastic-Plastic Material von Mises; Drucker, Prager	(2)							x			0
5.0 HYPOTHETICAL REPOSITORY DESIGN PROBLEMS											
5.1 Hypothetical Very Near Field Problem	(3)	(4)	S,B	0	B			S,B (4)	S	S	0
5.2 Hypothetical Near Field Problem			(3)		x				A	x	0
5.3 Hypothetical Far Field Problem	(2)	(2)								x	0
6.0 FIELD VALIDATION PROBLEMS											
6.1 Project Salt Vault-Thermomechanical Response Simulation Problem	(2)	(2)	x					x		x	0
6.3 In Situ Heater Test-Basalt Waste Isolation Project		(2)	(1)		x			x	x		0

* From NUREG/CR-3636, Benchmark Problems for Repository Design Models, February 1984.

☑ Problems completed

◯ Problems not yet attempted

╱ Problems attempted, difficulties encountered

Attachment to Progress Report for the month of April, 1986

TECHNICAL STATUS — TASK 6

Benchmark Problems Solution Report

The benchmark problem computer program library has been expanded to 23 programs and rearranged to some extent. The analytical solution to problem RD 2.4 has been added as a basic program, while WP 2.4 and WP 3.1 have been developed as LOTUS-123 spreadsheets instead of basic programs as originally planned. The library now consists of seven FORTRAN programs, six BASIC programs, and ten LOTUS-123 worksheets.

As shown on the attached table, 21 of the programs are now in draft final form while 2 require some additional work. With respect to problem RD 3.5, the original reference was obtained, but difficulties have been encountered in developing an analytical solution for post-yield behavior. Much of the effort this month was expended on converting the CELLTRANS program to IBM-PC FORTRAN and on internal code documentation.

Final documentation has been prepared for six of the LOTUS-123 worksheets and preliminary documentation materials have been assembled for the remaining programs. The documentation for each program includes a detailed description of the theory involved, an item-by-item discussion of each portion of the program, and an example output.

Benchmark Problems Solution Report Status

SECTION	CODE TYPE	CODE NAME	CODE STATUS	DOCUMENTATION STATUS	COMMENTS
ANSIDECH	FORTRAN	ANSIDECH. EXE	FINAL	PRELIM.	ESTIMATES FISSION PRODUCT DECAY HEAT FOR RA 2.1, RA 2.2, RA 2.3.
BURNUP	FORTRAN	BURNUP.EXE	FINAL	PRELIM.	ESTIMATES FISSION BY ISOTOPE FOR RA 2.1, RA 2.2, RA 2.3.
CELLPOST	FORTRAN	CELLPOST. EXE	FINAL	PRELIM.	POST PROCESSOR FOR RA 3.0, RA 3.1, RA 3.2
CELLTRAN	FORTRAN	CELLTRAN.NIH	PRELIM.	PRELIM.	HAS BEEN CONVERTED TO IBM PC FORTRAN, NEEDS TO BE VERIFIED.
DOSEFAC	FORTRAN	DOSEFAC.EXE	FINAL	PRELIM.	DOSE FACTORS FOR RA 3.0, RA 3.1, RA 3.2
GRIDST63	BASIC	GRIDST63.BAS	FINAL	PRELIM.	STEALTH GRID GENERATOR FOR RD 5.2, RD 5.3, RD 6.1, RD 6.3
RA U234	LOTUS	RAU234.WKS	FINAL	PRELIM.	FOR USE IN RA 2.1, RA 2.2, RA 2.3, RA 2.4, RA 2.5
RD 2.4	BASIC	RD24.BAS	FINAL	PRELIM.	
RD 2.6	BASIC	RD26.BAS	FINAL	PRELIM.	
RD 2.8	BASIC	RD28.BAS	FINAL	PRELIM.	
RD 2.9	BASIC	RD29.BAS	FINAL	PRELIM.	
RD 3.2a	LOTUS	RD32A.WKS	FINAL	FINAL	
RD 3.2b	LOTUS	RD32B.WKS	FINAL	FINAL	

SECTION	CODE			DOCUMENTATION	COMMENTS
	TYPE	NAME	STATUS	STATUS	
RD 3.5	LOTUS	RD35.WKS	PRELIM.	PRELIM.	REVIEWING THE DRUCKER-PRAGER SOLUTION.
WP 2.3	BASIC	WP23.BAS	FINAL	PRELIM.	
WP 2.4	LOTUS	WP24.WKS	FINAL	PRELIM.	
WP 3.1	LOTUS	WP31.WKS	FINAL	PRELIM.	
WP 3.3	LOTUS	WP33B.WKS	FINAL	FINAL	SENT TO NRC IN 4/86 MONTHLY REPORT.
WP 3.4	LOTUS	WP34A.WKS	FINAL	FINAL	
WP 3.6	LOTUS	WP36.WKS	FINAL	FINAL	SENT TO NRC IN 4/86 MONTHLY REPORT.
WP 4.1	LOTUS	WP41.WKS	FINAL	FINAL	
WP 5.2	FORTRAN	CELLMIX.EXE	FINAL	PRELIM.	
WP 5.2	FORTRAN	RCYLDIF.EXE	FINAL	PRELIM.	