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NRC CONTRACT NO. 02-85-002

DESIGN REVIEWS OF HIGH LEVEL NUCLEAR WASTE GEOLOGIC REPOSITORIES

TASK ORDER NO. 005

MECHANICAL AND THERMOMECHANICAL ANALYSIS FOR REVIEW

OF THE SCPs FOR BWIP AND SRP

TECHNICAL AND COST PROPOSAL

Itasca Consulting Group, Inc.
Suite 210
1313 5th Street SE
Minneapolis, Minnesota 55414

12 March 1987

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NRC CONTRACT NO. 02-85-002

DESIGN REVIEWS

OF HIGH-LEVEL NUCLEAR WASTE GEOLOGIC REPOSITORIES

TASK ORDER NO. 005

MECHANICAL AND THERMOMECHANICAL ANALYSIS
FOR REVIEW OF THE SCPs FOR BWIP AND SRP

TECHNICAL AND COST PROPOSAL

A. Background/Objectives

This task order is intended to allow Itasca Consulting Group, Inc. to aid the NRC in preparation for the review of the Site Characterization Plans (SCPs) for BWIP and SRP. Technical assistance under this task order is to be provided in the areas of mechanical and thermomechanical analyses to support review efforts on the SCPs and conceptual design reports submitted by the U.S. Department of Energy (DOE).

B. Program Plan

The work described in this proposal consists of two tasks: (1) mechanical and thermomechanical analysis for BWIP; and (2) mechanical and thermomechanical analysis for SRP. The proposed effort addresses specific issues related to both BWIP and SRP which require computational investigation to assist with the review effort.

The work will be conducted under the supervision of the Program Manager, Dr. Roger Hart. The BWIP analysis will be performed under the direction of the BWIP senior engineer, Mark Board, and the SRP analysis will be performed under the direction of the SRP senior engineer, Loren Lorig. Quality assurance review for the BWIP analyses will be directed by Adrian Brown; Krishan Wahi will direct the the quality assurance review for the SRP analysis.

TASK 1: Mechanical and Thermomechanical Analysis for BWIP

Subtask 1 — Continuum versus Discontinuum Modeling for BWIP: BWIP is currently planning extensive use of discontinuum modeling in performance calculations of the mechanical response of the rock mass to heating and mining-induced disturbance. Its present approach is to develop a continuum constitutive law for basalt which is based on numerical experimentation using the distinct element method. This continuum material model will then be examined in light of field data from testing at the ES facility.

This task is aimed at determination of the adequacy of a continuum versus discontinuum modeling approach for problems at BWIP. To address this objective, the following questions will be investigated.

1. At what scale of analysis (i.e., canister, room, or repository) is it feasible to use the distinct element method?

2. At each scale, what effect does detail in modeling of joint structure have on the results of thermomechanical analysis? The basalt has up to approximately 20 fractures/meter. All of these fractures do not equally control the overall behavior (e.g., main column-forming cooling joints have greater effect on stress-strain response). How many of these fractures need to be modeled and at what point is a continuum model sufficient for bounding the rock mass response?

3. What general procedures are necessary for development of a continuum constitutive law based on numerical experiments using the distinct element method?

The interim results of the analyses will be presented at a one-day meeting to be held in Silver Spring, Maryland, at the conclusion of 50% of task completion. An effort of eight person-weeks is suggested for this task rather than the six person-weeks suggested in the RFP. This increase in effort is due to the need to address (3), above, which is a critical aspect of the BWIP performance assessment model development process.

Subtask 2 — Sensitivity Analyses for Key Joint Parameters at BWIP: Basalt is a highly-fractured rock, and its response to mining and heating will likely be controlled, to a large extent, by the mechanical response of the joints. An important question at the BWIP site is the extent to which the jointing controls rock mass response and which joint properties have the greatest influence on this response.

To address these questions, a parametric analysis will be conducted on the room-scale response of the rock mass for the proposed BWIP conceptual design. The following joint properties will be examined with respect to their effect on rock mass response:

(1) friction angle;
(2) cohesion;
(3) stiffness parameters;
(4) roughness; and
(5) spacing, attitude, and continuity.

The analysis will be conducted using MUDEC (Micro Universal Distinct Element Code). After 50% of the program is completed, a one-day meeting for two persons will be held in Silver Spring, Maryland, to discuss task progress. An effort of eight person-weeks rather that the six weeks suggested in the RFP is proposed. This additional two weeks is due to the number of computer runs necessary to complete this subtask.

Subtask 3 — Thermomechanical Analysis for BWIP: A detailed analysis of the canister- and room-scale thermal and mechanical response of the rock mass at BWIP will be performed using FLAC and/or MUDEC. The following problems are to be examined:

(1) the thermal regime around the emplacement borehole for horizontal and vertical emplacement schemes. The effect of canister spacing and initial power loading will be examined.;

(2) the effects of the configuration of the overpack and air gaps on the temperature within the borehole;

(3) the extent of the damaged zone around the emplacement room and canisters for the peak power loading configuration. The extent of the damaged zone for mining and thermally-induced stresses will be examined.

(4) the design and results of a room-scale heater test. Of particular interest here will be the heat load and time frame necessary to simulate the repository conditions with a relatively short-term test.

A one-day meeting for two persons will be held in Silver Spring, Maryland, when 50% of this subtask has been completed. A total engineering time of eight person-weeks will be required to complete this subtask.

Subtask 4 — The Effect of Seismic Events on Waste Emplacement Rooms and Boreholes at BWIP: A significant number of shallow micro-earthquakes occur at the Hanford site. One question which has arisen from the Hanford Environmental Assessment is the effect this seismicity will have on the stability of rooms and emplacement boreholes at the BWIP site during pre-closure time. Of particular interest is whether the stress wave will cause spalling of the opening or slip along existing discontinuities. The possible effects which will be examined include partial collapse of openings or closure of boreholes.

It will first be necessary to develop accelograms for micro-earthquakes at the BWIP site. Magnitudes and locations from the Environmental Assessment will be used with acceleration-time profiles from documented earthquakes and rockbursts. The development of the accelograms will require roughly one week of time. These will be used as far-field conditions for the MUDEC code, which will be used to examine stability of the jointed rock mass.

Two excavation geometries (room and borehole) will be examined for a minimum of two different magnitude events which bound the energy levels expected within the RRL. At least two different sets of joint friction or cohesion will be necessary to determine the effect of joint properties. To obtain a realistic idea of joint slippage, the maximum number of blocks possible with the DSI version of MUDEC will be required. A total of approximately 12 runs will be required at two days per run. Due to the present lack of an accelogram for the RRL and the extensive number of runs, six person-weeks are required for completion of this subtask rather than the four person-weeks suggested in the RFP.

Separate letter reports will be prepared for each of the four subtasks. The schedule for report submission is given in Section D.

TASK 2: MECHANICAL AND THERMOMECHANICAL ANALYSIS FOR SRP

Subtask 1 — Mechanical and Thermomechanical Analyses of DOE's Proposed Conceptual Design: The SCP-CDR which has been prepared by Fluor for the SRPO contains mechanical and thermomechanical analyses in support of conceptual design plans for a repository located in Deaf Smith County, Texas. In order to provide a comprehensive review of the SCP-CDR, it will be necessary to perform independent parallel analyses of selected calculations from this report. These analyses will permit an assessment of the computational methods used for the design.

The performance of this subtask will be accomplished in the two stages described below.

Stage 1 — Appendix 7 Visit to Review SCP-CDR

If the SCP-CDR is not available to the NRC, an Appendix 7 visit to the SRPO office in Columbus, Ohio, will be made to review the report. The visit will be made with NRC personnel from the Engineering Branch. During the visit, notes will be made on the SCP-CDR, and selected analyses will be transcribed from the report. It is estimated that this visit will require one person-week effort.

Stage 2 — Independent Parallel Analyses

Parallel analyses of selected cases found in the SCP-CDR will be performed. It is our present understanding that the majority of mechanical and thermomechanical analyses for the SCP-CDR have been conducted using the thermomechanical code STEALTH. Independent calculations of STEALTH simulations will be performed with either FLACT or MUDECT, which both incorporate the present DOE baseline creep model. It is estimated that between six and twelve analyses will be performed. The required effort for Stage 2 will be nine person-weeks.

The preliminary results of these analyses will be presented at a one-day meeting to be held in Silver Spring, Maryland, when 50% of this task is completed. A report will be prepared summarizing the results of the parallel analyses and will include an assessment of the calculations performed in support of the SCP-CDR.

Subtask 2 — Analysis of Key Parameters in Support of In-Situ Testing: Itasca is presently developing a point paper on in-situ testing specific to SRP to complement the "NRC Generic Technical Position on In-Situ Testing During Site Characterization of High-Level Repositories" (Task Order No. 002, Task 1). One part of this study is the definition of geotechnical information needs which are to be resolved by in-situ testing. In order to develop a test plan, justification is first required to ascertain which information needs are required to make a licensing decision and are obtainable with sufficient precision from in-situ testing.

In this regard, a series of scoping analyses will be conducted which will assess the sensitivity of rock mechanics parameters to the performance of various repository components. These analyses will provide a basis for developing the justification for geotechnical information needs to be resolved during in-situ testing.

The analyses will supplement the point paper and provide computational support for the definition of information needs. The analyses will comprise a parametric study of the thermomechanical performance of repository components on three problems scales: canister, room and regional. The primary objective of the study will be to provide a preliminary theoretical basis for understanding which rock mass properties and phenomena have a significant impact on induced stress and temperature distributions under repository loading conditions specific to SRP.

It is recognized that the unique feature of the SRP conditions, as compared to those of BWIP and NNWSI, is the effect of salt creep behavior on repository performance. Therefore, the creep model will be a key parameter under investigation for this study. The FLACT code, which has incorporated the present DOE baseline creep model, will be utilized for this analysis.

The analyses will be based on the geotechnical data base and repository configuration presently assumed by the SRP. Variations in properties and phenomena (e.g., creep parameters and presence of inhomogeneities) will be made over currently expected ranges. It is estimated that between four and eight analyses will be performed at each of the three problem scales.

The preliminary results of this parameter study will be presented at a one-day meeting to be held in Silver Spring, Maryland, at the completion of 50% of this task. An effort of seven person-weeks is proposed for this work. The final report, at the completion of this task, will be submitted as an appendix to the SRP in-situ testing point paper with its conclusions incorporated into the paper itself.

C. Reporting Requirements

As part of this task order, the following reports will be issued:

(1) monthly progress reports (submitted by the 20th of each month);

(2) trip reports (submitted within 15 working days of the meetings scheduled in Section D);

(3) letter reports (submitted at the completion of each subtask. A draft of each letter report will be submitted for review and comment by NRC staff); and

(4) a final report (submitted following meetings to discuss draft reports).

The schedule for report submission is given in Section D.

D. Schedule

Figure 1 illustrates the proposed schedule for completion of the subtasks defined under Task Order No. 005. The start date for this schedule corresponds to the date that authorization to proceed is received from the NRC.

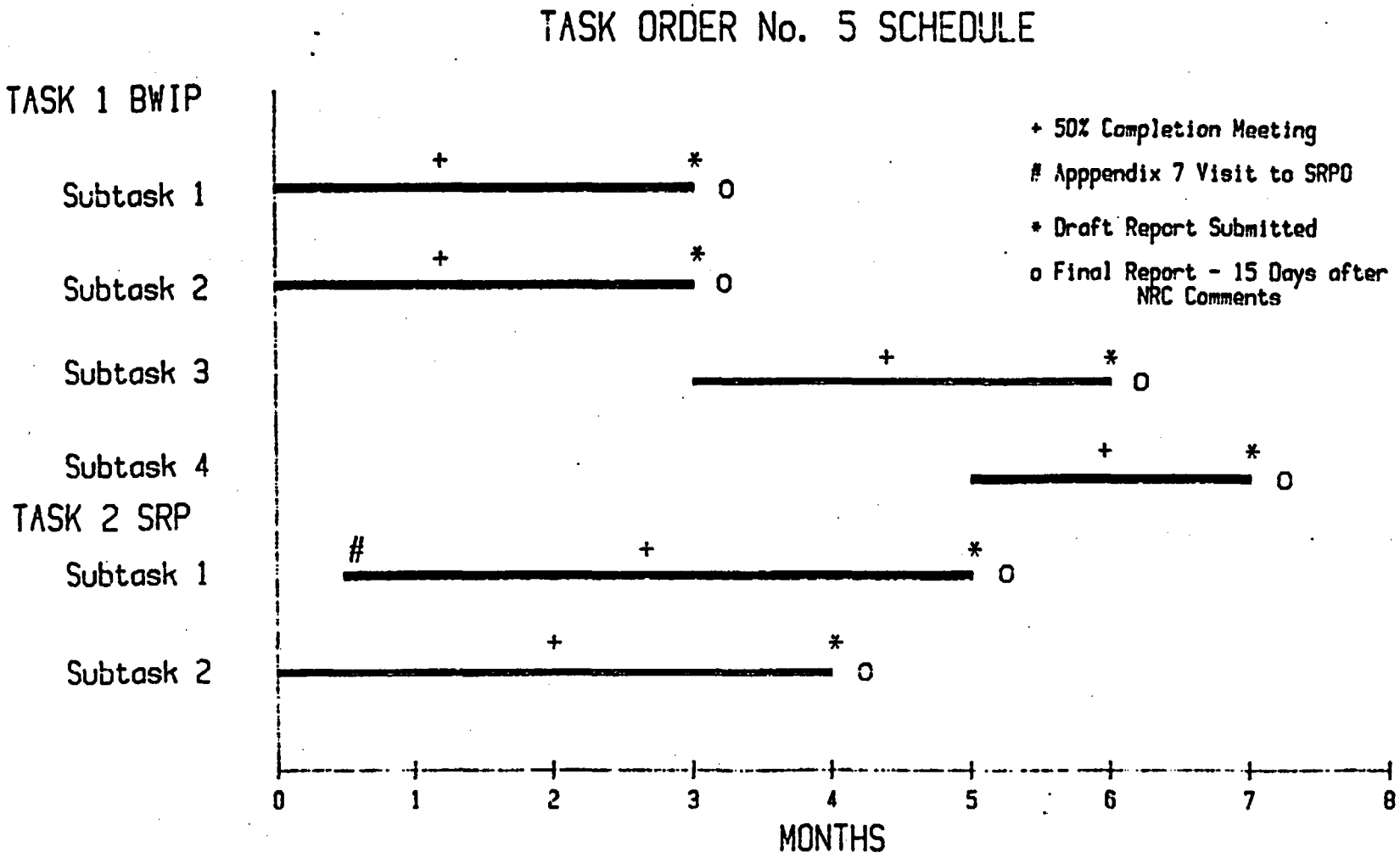

Fig. 1 Task Order No. 5 Schedule

E. Conflict of Interest

We are not aware of any current or potential conflicts of interest in completing the work outlined in this proposal. If, during the course of this task order, any information is brought to our attention that would suggest a potential conflict of interest, we will notify NRC immediately.

F. Administration

As shown on the attached cost summary sheets, the majority of the administrative and support services for this task order will be provided by Itasca at its Minneapolis office. Minor administrative support will be provided by Nuclear Waste Consultants (NWC).

G. Quality Assurance

All reports produced as a result of this task order will be reviewed by an individual not directly involved in the original analysis. Adrian Brown (NWC) will serve as QA reviewer for the BWIP studies (Task 1), and Krishan Wahi will review the SRP studies (Task 2). Standard administrative QA procedures for documentation and retrievability will be continued.

H. Cost Estimate

The cost estimate for the total task order is provided on the attached Standard Form 1411. Also included is a cost breakdown for each of the tasks (Tables 1 to 7). Where specific individuals have been identified, their actual 1987 cost rates are used. Table 8 provides a summary of the labor utilization by task.

Communication charges are quoted as 4% of direct labor. These costs include telephone, telex, and postage charges incurred during the performance of these tasks. Computer charges for hourly use of Itasca AT-type computers are quoted at $5.00/ hour.

All air travel is quoted on the basis of standard round-trip coach fares.

Respectfully submitted,

John J. Markham
Executive Vice President
Itasca Consulting Group, Inc.

attach.
jjm/ks

CONTRACT PRICING PROPOSAL COVER SHEET

1. SOLICITATION/CONT /MODIFICATION NO. NRC 02-85-002

FORM APPROVED OMB NO. 3090-0116

NOTE: This form is used in contract actions if submission of cost or pricing data is required. (See FAR 15.804-6(b))

2. NAME AND ADDRESS OF OFFEROR (Include Zip Code)

Itasca Consulting Group, Inc.
Suite 210
1313 5th Street SE
Minneapolis, Minnesota 55414

3A. NAME AND TITLE OF OFFEROR'S POINT OF CONTACT: John J. Markham

3B. TELEPHONE NO.: (612) 623-9599

4. TYPE OF CONTRACT ACTION (Check)

- [ ] A. NEW CONTRACT
- [ ] B. CHANGE ORDER
- [ ] C. PRICE REVISION/ REDETERMINATION
- [ ] D. LETTER CONTRACT
- [ ] E. UNPRICED ORDER
- [ ] F. OTHER (Specify)

5. TYPE OF CONTRACT (Check)

- [ ] FFP
- [X] CPFF
- [ ] CPIF
- [ ] CPAF
- [ ] FPI
- [ ] OTHER (Specify)

6. PROPOSED COST (A+B=C)

A. COST	B. PROFIT/FEE	C. TOTAL
$ 141,802	$ 11,344	$ 153,146

7. PLACE(S) AND PERIOD(S) OF PERFORMANCE

8. List and reference the identification, quantity and total price proposed for each contract line item. A line item cost breakdown supporting this recap is required unless otherwise specified by the Contracting Officer. (Continue on reverse, and then on plain paper, if necessary. Use same headings.)

A. LINE ITEM NO.	B. IDENTIFICATION	C. QUANTITY	D. TOTAL PRICE	E. REF
1	Itasca labor	2,578 hrs	$ 51,678	
2	travel		6,290	
3	consultants	40 hrs	3,077	
4	subcontractor	176 hrs	15,918	
5	misc. expenses		10,061	
6	G&A		54,778	

9. PROVIDE NAME, ADDRESS, AND TELEPHONE NUMBER FOR THE FOLLOWING (If available)

A. CONTRACT ADMINISTRATION OFFICE

Defense Contract Administration Services (Twin Cities Area)
2305 Ford Parkway
St. Paul, Minnesota 55116

B. AUDIT OFFICE

Defense Contract Audit Agency
400 South 4th Street
Minneapolis, Minnesota 55414
(612) 349-3290; Doug Thomas

10. WILL YOU REQUIRE THE USE OF ANY GOVERNMENT PROPERTY IN THE PERFORMANCE OF THIS WORK? (If "Yes," identify)

- [ ] YES
- [X] NO

11A. DO YOU REQUIRE GOVERNMENT CONTRACT FINANCING TO PERFORM THIS PROPOSED CONTRACT? (If "Yes," complete Item 11B)

- [X] YES
- [ ] NO

11B. TYPE OF FINANCING (If one)

- [ ] ADVANCE PAYMENTS
- [X] PROGRESS PAYMENTS
- [ ] GUARANTEED LOANS

12. HAVE YOU BEEN AWARDED ANY CONTRACTS OR SUBCONTRACTS FOR THE SAME OR SIMILAR ITEMS WITHIN THE PAST 3 YEARS? (If "Yes," identify item(s), customer(s) and contract number(s))

- [ ] YES
- [X] NO

13. IS THIS PROPOSAL CONSISTENT WITH YOUR ESTABLISHED ESTIMATING AND ACCOUNTING PRACTICES AND PROCEDURES AND FAR PART 31 COST PRINCIPLES? (If "No," explain)

- [X] YES
- [ ] NO

14. COST ACCOUNTING STANDARDS BOARD (CASB) DATA (Public Law 91-379 as amended and FAR PART 30)

A. WILL THIS CONTRACT ACTION BE SUBJECT TO CASB REGULATIONS? (If "No," explain in proposal)

- [ ] YES
- [X] NO

small business

B. HAVE YOU SUBMITTED A CASB DISCLOSURE STATEMENT (CASB DS-1 or 2)? (If "Yes," specify in proposal the office to which submitted and if determined to be adequate)

- [X] YES
- [ ] NO

included

C. HAVE YOU BEEN NOTIFIED THAT YOU ARE OR MAY BE IN NON-COMPLIANCE WITH YOUR DISCLOSURE STATEMENT OR COST ACCOUNTING STANDARDS? (If "Yes," explain in proposal)

- [ ] YES
- [X] NO

D. IS ANY ASPECT OF THIS PROPOSAL INCONSISTENT WITH YOUR DISCLOSED PRACTICES OR APPLICABLE COST ACCOUNTING STANDARDS? (If "Yes," explain in proposal)

- [ ] YES
- [X] NO

This proposal is submitted in response to the RFP contract, modification, etc. in Item 1 and reflects our best estimates and/or actual costs as of this date.

15. NAME AND TITLE (Type)

John J. Markham
Executive Vice President

16. NAME OF FIRM

Itasca Consulting Group, Inc.

17. SIGNATURE

John J. Markham

18. DATE OF SUBMISSION

12 March 1987

NSN 7540-01-142-9845

1411-101

STANDARD FORM 1411 (10-83)
Prescribed by GSA
FAR (48 CFR) 53.215-2(c)

* U.S. GOVERNMENT PRINTING OFFICE: 1984- 436-960

Table 1

(1 of 3)

COST ESTIMATE

TASK ORDER 005

TASK NO. 1 MECHANICAL AND THERMOMECHANICAL ANALYSIS FOR BWIP
SUBTASK NO. 1 CONTINUUM AND DISCONTINUUM MODELING FOR BWIP

1. DIRECT LABOR

ITASCA LABOR	INDIVIDUAL	RATE	HOURS	COST
PROGRAM MANAGER	R. Hart	$24.04	16	$384.64
ADMIN MANAGER	L. Gaarder	$8.89	16	$142.24
	J. Markham	$25.96	16	$415.36
SR ENGINEER	M. Board	$23.56	320	$7,539.20
SECRETARIAL	K. Sikora	$10.34	30	$310.20
QUALITY ASSURANCE	K. Sikora	$10.34	16	$165.44
			414	$8,957.08

EXPENSES

2. TRAVEL

AIRFARE			
MSP-WDC	$522.00	1	$522.00
RENTAL CAR	$56.00	1	$56.00
PER DIEM	$112.00	1	$112.00
MISC EXPENSES	$35.00	1	$35.00
	TOTAL TRAVEL		$725.00

3. CONSULTANTS $0.00

4. SUBCONTRACTORS $3,979.53

5. MISC EXPENSES

COMMUNICATIONS	4% DIRECT LABOR		$358.28
COMPUTER	$5.00/HR	240	$1,200.00
REPORT PRODUCTION	2% DIRECT LABOR		$179.14
	TOTAL MISC EXPENSES		$1,737.42

TOTAL LABOR & EXPENSES $15,399.03

6. G & A EXPENSES 1.06 x DIRECT LABOR $9,494.50

Table 1 (continued)
(2 of 3)

COST ESTIMATE

TASK ORDER 005

TASK NO. 1 MECHANICAL AND THERMOMECHANICAL ANALYSIS FOR BWIP
SUBTASK NO. 1 CONTINUUM AND DISCONTINUUM MODELING FOR BWIP

TOTAL COST		$24,893.53
7. FEE OR PROFIT	8%	$1,991.48
TOTAL JOB COST		$26,885.02

Table 1 (concluded)

(3 of 3)

COST ESTIMATE

TASK ORDER 005

TASK NO. 1 MECHANICAL AND THERMOMECHANICAL ANALYSIS FOR BWIP
SUBTASK NO. 1 CONTINUUM AND DISCONTINUUM MODELING FOR BWIP

SUBCONTRACTORS	RATE	HOURS	COST
NUCLEAR WASTE CONSULTANTS			
PRIN. INVESTIGATOR	$63.00	32	$2,016.00
SR. ENGINEER	$42.00		$0.00
ENG./GEOLOGIST	$12.60		$0.00
DRAFTING	$10.50		$0.00
CLERICAL	$9.45	12	$113.40
TOTAL SUBCONTRACTED LABOR		44	$2,129.40
LABOR OVERHEAD	21.09% DIRECT LABOR		$449.09
G & A EXPENSE	20.52% DIRECT LABOR PLUS OVERHEAD		$529.11
SUBCONTRACTOR EXPENSES			
AIRFARE			
DEN-WDC	$370.00	1	$370.00
RENTAL CAR	$56.00	1	$56.00
PER DIEM	$112.00	1	$112.00
TRAVEL EXPENSES	$35.00	1	$35.00
	TOTAL TRAVEL		$573.00
MISC. EXPENSES - PHONE, COPIES, ETC.		1% DIR LABOR	$21.29
TOTAL SUBCONTRACTOR EXPENSES			$594.29
TOTAL COST			$3,701.89
SUBCONTRACTOR FEE	7.5%		$277.64
TOTAL SUBCONTRACTOR COST			$3,979.53

Table 2

(1 of 3)

COST ESTIMATE

TASK ORDER 005

TASK NO. 1 MECHANICAL AND THERMOMECHANICAL ANALYSIS FOR BWIP
SUBTASK NO. 2 SENSITIVITY ANALYSES FOR KEY JOINT PARAMETERS AT BWIP

1. DIRECT LABOR

ITASCA LABOR	INDIVIDUAL	RATE	HOURS	COST
PROGRAM MANAGER	R. Hart	$24.04	16	$384.64
ADMIN MANAGER	L. Gaarder	$8.89	16	$142.24
	J. Markham	$25.96	16	$415.36
SR ENGINEER	M. Board	$23.56	160	$3,769.60
	M. Christianson	$21.15	160	$3,384.00
SECRETARIAL	K. Sikora	$10.34	30	$310.20
QUALITY ASSURANCE	K. Sikora	$10.34	16	$165.44
			414	$8,571.48

EXPENSES

2. TRAVEL

AIRFARE MSP-WDC	$522.00	1	$522.00
RENTAL CAR	$56.00	1	$56.00
PER DIEM	$112.00	1	$112.00
MISC EXPENSES	$35.00	1	$35.00
	TOTAL TRAVEL		$725.00

3. CONSULTANTS $0.00

4. SUBCONTRACTORS $3,979.53

5. MISC EXPENSES

COMMUNICATIONS	4% DIRECT LABOR		$342.86
COMPUTER	$5.00/HR	240	$1,200.00
REPORT PRODUCTION	2% DIRECT LABOR		$171.43
	TOTAL MISC EXPENSES		$1,714.29

TOTAL LABOR & EXPENSES $14,990.30

6. G & A EXPENSES 1.06 x DIRECT LABOR $9,085.77

Table 2 (continued)
(2 of 3)

COST ESTIMATE

TASK ORDER 005

TASK NO. 1 MECHANICAL AND THERMOMECHANICAL ANALYSIS FOR BWIP
SUBTASK NO. 2 SENSITIVITY ANALYSES FOR KEY JOINT PARAMETERS AT BWIP

TOTAL COST		$24,076.07
7. FEE OR PROFIT	8%	$1,926.09
TOTAL JOB COST		$26,002.16

Table 2 (concluded)

(3 of 3)

COST ESTIMATE

TASK ORDER 005

TASK NO. 1 MECHANICAL AND THERMOMECHANICAL ANALYSIS FOR BWIP
SUBTASK NO. 2 SENSITIVITY ANALYSES FOR KEY JOINT PARAMETERS AT BWIP

SUBCONTRACTORS		RATE	HOURS	COST
NUCLEAR WASTE CONSULTANTS				
PRIN. INVESTIGATOR		$63.00	32	$2,016.00
SR. ENGINEER		$42.00		$0.00
ENG./GEOLOGIST		$12.60		$0.00
DRAFTING		$10.50		$0.00
CLERICAL		$9.45	12	$113.40
TOTAL SUBCONTRACTED LABOR			44	$2,129.40
LABOR OVERHEAD	21.09% DIRECT LABOR			$449.09
G & A EXPENSE	20.52% DIRECT LABOR PLUS OVERHEAD			$529.11
SUBCONTRACTOR EXPENSES				
AIRFARE				
DEN-WDC		$370.00	1	$370.00
RENTAL CAR		$56.00	1	$56.00
PER DIEM		$112.00	1	$112.00
TRAVEL EXPENSES		$35.00	1	$35.00
		TOTAL TRAVEL		$573.00
MISC. EXPENSES - PHONE, COPIES, ETC.			1% DIR LABOR	$21.29
TOTAL SUBCONTRACTOR EXPENSES				$594.29
TOTAL COST				$3,701.89
SUBCONTRACTOR FEE		7.5%		$277.64
TOTAL SUBCONTRACTOR COST				$3,979.53

Table 3

(1 of 3)

COST ESTIMATE

TASK ORDER 005

TASK NO. 1 MECHANICAL AND THERMOMECHANICAL ANALYSIS FOR BWIP
SUBTASK NO. 3 THERMAL MECHANICAL ANALYSIS FOR BWIP

1. DIRECT LABOR

ITASCA LABOR	INDIVIDUAL	RATE	HOURS	COST
PROGRAM MANAGER	R. Hart	$24.04	16	$384.64
ADMIN MANAGER	L. Gaarder	$8.89	16	$142.24
	J. Markham	$25.96	16	$415.36
SR ENGINEER	M. Board	$23.56	80	$1,884.80
	M. Christianson	$21.15	240	$5,076.00
SECRETARIAL	K. Sikora	$10.34	30	$310.20
QUALITY ASSURANCE	K. Sikora	$10.34	16	$165.44
			414	$8,378.68

EXPENSES

2. TRAVEL

AIRFARE MSP-WDC	$522.00	1	$522.00
RENTAL CAR	$56.00	1	$56.00
PER DIEM	$112.00	1	$112.00
MISC EXPENSES	$35.00	1	$35.00
	TOTAL TRAVEL		$725.00

3. CONSULTANTS $0.00

4. SUBCONTRACTORS $3,979.53

5. MISC EXPENSES

COMMUNICATIONS	4% DIRECT LABOR		$335.15
COMPUTER	$5.00/HR	240	$1,200.00
REPORT PRODUCTION	2% DIRECT LABOR		$167.57
	TOTAL MISC EXPENSES		$1,702.72

TOTAL LABOR & EXPENSES $14,785.93

6. G & A EXPENSES 1.06 x DIRECT LABOR $8,881.40

Table 3 (continued)

(2 of 3)

COST ESTIMATE

TASK ORDER 005

TASK NO. 1 MECHANICAL AND THERMOMECHANICAL ANALYSIS FOR BWIP
SUBTASK NO. 3 THERMAL MECHANICAL ANALYSIS FOR BWIP

TOTAL COST		$23,667.33
7. FEE OR PROFIT	8%	$1,893.39
TOTAL JOB COST		$25,560.72

Table 3 (concluded)

(3 of 3)

COST ESTIMATE

TASK ORDER 005

TASK NO. 1 MECHANICAL AND THERMOMECHANICAL ANALYSIS FOR BWIP
SUBTASK NO. 3 THERMAL MECHANICAL ANALYSIS FOR BWIP

SUBCONTRACTORS		RATE	HOURS	COST
NUCLEAR WASTE CONSULTANTS				
PRIN. INVESTIGATOR		$63.00	32	$2,016.00
SR. ENGINEER		$42.00		$0.00
ENG./GEOLOGIST		$12.60		$0.00
DRAFTING		$10.50		$0.00
CLERICAL		$9.45	12	$113.40
TOTAL SUBCONTRACTED LABOR			44	$2,129.40
LABOR OVERHEAD	21.09% DIRECT LABOR			$449.09
G & A EXPENSE	20.52% DIRECT LABOR PLUS OVERHEAD			$529.11
SUBCONTRACTOR EXPENSES				
AIRFARE				
DEN-WDC		$370.00	1	$370.00
RENTAL CAR		$56.00	1	$56.00
PER DIEM		$112.00	1	$112.00
TRAVEL EXPENSES		$35.00	1	$35.00
		TOTAL TRAVEL		$573.00
MISC. EXPENSES - PHONE, COPIES, ETC.			1% DIR LABOR	$21.29
TOTAL SUBCONTRACTOR EXPENSES				$594.29
TOTAL COST				$3,701.89
SUBCONTRACTOR FEE		7.5%		$277.64
TOTAL SUBCONTRACTOR COST				$3,979.53

Table 4

(1 of 3)

COST ESTIMATE

TASK ORDER 005

TASK NO. 1 MECHANICAL AND THERMOMECHANICAL ANALYSIS FOR BWIP
SUBTASK NO. 4 THE EFFECT OF SEISMIC EVENTS ON WASTE EMPLACEMENT ROOMS AND BOREHOLES AT BWIP

1. DIRECT LABOR

ITASCA LABOR	INDIVIDUAL	RATE	HOURS	COST
PROGRAM MANAGER	R. Hart	$24.04	12	$288.48
ADMIN MANAGER	L. Gaarder	$8.89	12	$106.68
	J. Markham	$25.96	12	$311.52
SR ENGINEER	M. Board	$23.56	60	$1,413.60
	L. Lorig	$21.15	180	$3,807.00
SECRETARIAL	K. Sikora	$10.34	30	$310.20
QUALITY ASSURANCE	K. Sikora	$10.34	12	$124.08
			318	$6,361.56

EXPENSES

2. TRAVEL

AIRFARE			
MSP-WDC	$522.00	1	$522.00
RENTAL CAR	$56.00	1	$56.00
PER DIEM	$112.00	1	$112.00
MISC EXPENSES	$35.00	1	$35.00
	TOTAL TRAVEL		$725.00

3. CONSULTANTS $0.00

4. SUBCONTRACTORS $3,979.53

5. MISC EXPENSES

COMMUNICATIONS	4% DIRECT LABOR		$254.46
COMPUTER	$5.00/HR	192	$960.00
REPORT PRODUCTION	2% DIRECT LABOR		$127.23
	TOTAL MISC EXPENSES		$1,341.69

TOTAL LABOR & EXPENSES $12,407.78

6. G & A EXPENSES 1.06 x DIRECT LABOR $6,743.25

Tabel 4 (continued)

(2 of 3)

COST ESTIMATE

TASK ORDER 005

TASK NO. 1 MECHANICAL AND THERMOMECHANICAL ANALYSIS FOR BWIP
SUBTASK NO. 4 THE EFFECT OF SEISMIC EVENTS ON WASTE EMPLACEMENT ROOMS AND BOREHOLES AT BWIP

TOTAL COST		$19,151.03
7. FEE OR PROFIT	8%	$1,532.08
TOTAL JOB COST		$20,683.11

Table 4 (concluded)
(3 of 3)

COST ESTIMATE

TASK ORDER 005

TASK NO. 1 MECHANICAL AND THERMOMECHANICAL ANALYSIS FOR BWIP
SUBTASK NO. 4 THE EFFECT OF SEISMIC EVENTS ON WASTE EMPLACEMENT ROOMS AND BOREHOLES AT BWIP

SUBCONTRACTORS		RATE	HOURS	COST
NUCLEAR WASTE CONSULTANTS				
PRIN. INVESTIGATOR		$63.00	32	$2,016.00
SR. ENGINEER		$42.00		$0.00
ENG./GEOLOGIST		$12.60		$0.00
DRAFTING		$10.50		$0.00
CLERICAL		$9.45	12	$113.40
TOTAL SUBCONTRACTED LABOR			44	$2,129.40
LABOR OVERHEAD	21.09% DIRECT LABOR			$449.09
G & A EXPENSE	20.52% DIRECT LABOR PLUS OVERHEAD			$529.11
SUBCONTRACTOR EXPENSES				
AIRFARE				
DEN-WDC		$370.00	1	$370.00
RENTAL CAR		$56.00	1	$56.00
PER DIEM		$112.00	1	$112.00
TRAVEL EXPENSES		$35.00	1	$35.00
		TOTAL TRAVEL		$573.00
MISC. EXPENSES - PHONE, COPIES, ETC.			1% DIR LABOR	$21.29
TOTAL SUBCONTRACTOR EXPENSES				$594.29
TOTAL COST				$3,701.89
SUBCONTRACTOR FEE		7.5%		$277.64
TOTAL SUBCONTRACTOR COST				$3,979.53

Table 5

(1 of 2)

COST ESTIMATE

TASK ORDER 005

TASK NO. 2 MECHANICAL AND THERMOMECHANICAL ANALYSIS FOR SRP
SUBTASK NO. 1 MECHANICAL AND THERMOMECHANICAL ANALYSES OF DOE'S PROPOSED CONCEPTUAL DESIGN
STAGE 1 APPENDIX 7 VISIT TO REVIEW SCP-CDR

1. DIRECT LABOR

ITASCA LABOR	INDIVIDUAL	RATE	HOURS	COST
PROGRAM MANAGER	R. Hart	$24.04	4	$96.16
ADMIN MANAGER	L. Gaarder	$8.89	4	$35.56
	J. Markham	$25.96	4	$103.84
SR ENGINEER	R. Hart	$24.04	40	$961.60
SECRETARIAL	K. Sikora	$10.34	4	$41.36
QUALITY ASSURANCE	K. Sikora	$10.34	2	$20.68
			58	$1,259.20

EXPENSES

2. TRAVEL

AIRFARE			
MSP-COLUMBUS	$520.00	1	$520.00
RENTAL CAR	$56.00	5	$280.00
PER DIEM	$76.00	5	$380.00
MISC EXPENSES	$35.00	1	$35.00
	TOTAL TRAVEL		$1,215.00

3. CONSULTANTS $0.00

4. SUBCONTRACTORS $0.00

5. MISC EXPENSES

COMMUNICATIONS	4% DIRECT LABOR		$50.37
COMPUTER	$5.00/HR	0	$0.00
REPORT PRODUCTION	2% DIRECT LABOR		$25.18
	TOTAL MISC EXPENSES		$75.55

TOTAL LABOR & EXPENSES $2,549.75

6. G & A EXPENSES 1.06 x DIRECT LABOR $1,334.75

Table 5 (concluded)

(2 of 2)

COST ESTIMATE

TASK ORDER 005

TASK NO. 2 MECHANICAL AND THERMOMECHANICAL ANALYSIS FOR SRP
SUBTASK NO. 1 MECHANICAL AND THERMOMECHANICAL ANALYSES OF DOE'S PROPOSED CONCEPTUAL DESIGN
STAGE 1 APPENDIX 7 VISIT TO REVIEW SCP-CDR

TOTAL COST		$3,884.50
7. FEE OR PROFIT	8%	$310.76
TOTAL JOB COST		$4,195.26

Table 6

(1 of 3)

COST ESTIMATE

TASK ORDER 005

TASK NO. 2 MECHANICAL AND THERMOMECHANICAL ANALYSIS FOR SRP
SUBTASK NO. 1 MECHANICAL AND THERMOMECHANICAL ANALYSES OF DOE'S PROPOSED CONCEPTUAL DESIGN
STAGE 2 INDEPENDENT PARALLEL ANALYSES

1. DIRECT LABOR

ITASCA LABOR	INDIVIDUAL	RATE	HOURS	COST
PROGRAM MANAGER	R. Hart	$24.04	32	$769.28
ADMIN MANAGER	L. Gaarder	$8.89	32	$284.48
	J. Markham	$25.96	32	$830.72
SR ENGINEER	R. Hart	$24.04	60	$1,442.40
	M. Christianson	$21.15	180	$3,807.00
ASST ENGINEER	M. Mack	$12.50	120	$1,500.00
SECRETARIAL	K. Sikora	$10.34	48	$496.32
QUALITY ASSURANCE	K. Sikora	$10.34	16	$165.44
			520	$9,295.64

EXPENSES

2. TRAVEL

AIRFARE MSP-WDC	$522.00	1	$522.00
RENTAL CAR	$56.00	1	$56.00
PER DIEM	$112.00	1	$112.00
MISC EXPENSES	$35.00	1	$35.00
	TOTAL TRAVEL		$725.00

3. CONSULTANTS $3,077.00

4. SUBCONTRACTORS $0.00

5. MISC EXPENSES

COMMUNICATIONS	4% DIRECT LABOR		$371.83
COMPUTER	$5.00/HR	270	$1,350.00
REPORT PRODUCTION	2% DIRECT LABOR		$185.91
	TOTAL MISC EXPENSES		$1,907.74

TOTAL LABOR & EXPENSES $15,005.38

Table 6 (continued)

(2 of 3)

COST ESTIMATE

TASK ORDER 005

TASK NO. 2 MECHANICAL AND THERMOMECHANICAL ANALYSIS FOR SRP
SUBTASK NO. 1 MECHANICAL AND THERMOMECHANICAL ANALYSES OF DOE'S PROPOSED CONCEPTUAL DESIGN
STAGE 2 INDEPENDENT PARALLEL ANALYSES

6. G & A EXPENSES	1.06 x DIRECT LABOR	$9,853.38
TOTAL COST		$24,858.76
7. FEE OR PROFIT	8%	$1,988.70
TOTAL JOB COST		$26,847.46

Table 6 (concluded)

(3 of 3)

COST ESTIMATE

TASK ORDER 005

TASK NO. 2 MECHANICAL AND THERMOMECHANICAL ANALYSIS FOR SRP
SUBTASK NO. 1 MECHANICAL AND THERMOMECHANICAL ANALYSES OF DOE'S PROPOSED CONCEPTUAL DESIGN
STAGE 2 INDEPENDENT PARALLEL ANALYSES

CONSULTANTS	RATE	HOURS	COST
K. Wahi	$60.00	40	$2,400.00
CONSULTANT EXPENSES			
AIRFARE			
ALBUQ-WDC	$450.00	1	$450.00
RENTAL CAR	$56.00	1	$56.00
PER DIEM	$112.00	1	$112.00
TRAVEL EXPENSES	$35.00	1	$35.00
		TOTAL TRAVEL	$653.00
MISC. EXPENSES	1% DIRECT LABOR		$24.00
TOTAL CONSULTANT EXPENSES			$677.00
TOTAL CONSULTANT			$3,077.00

Table 7

(1 of 2)

COST ESTIMATE

TASK ORDER 005

TASK NO. 2 MECHANICAL AND THERMOMECHANICAL ANALYSIS FOR SRP
SUBTASK NO. 2 ANALYSIS OF KEY PARAMETERS IN SUPPORT OF IN-SITU TESTING

1. DIRECT LABOR

ITASCA LABOR	INDIVIDUAL	RATE	HOURS	COST
PROGRAM MANAGER	R. Hart	$24.04	24	$576.96
ADMIN MANAGER	L. Gaarder	$8.89	24	$213.36
	J. Markham	$25.96	24	$623.04
SR ENGINEER	R. Hart	$24.04	70	$1,682.80
	L. Lorig	$21.15	140	$2,961.00
ASST ENGINEER	M. Mack	$12.50	70	$875.00
ASSOCIATES	C. Fairhurst	$52.50	24	$1,260.00
SECRETARIAL	K. Sikora	$10.34	48	$496.32
QUALITY ASSURANCE	K. Sikora	$10.34	16	$165.44
			440	$8,853.92

EXPENSES

2. TRAVEL

AIRFARE			
MSP-WDC	$522.00	2	$1,044.00
RENTAL CAR	$56.00	2	$112.00
PER DIEM	$112.00	2	$224.00
MISC EXPENSES	$35.00	2	$70.00
	TOTAL TRAVEL		$1,450.00

3. CONSULTANTS $0.00

4. SUBCONTRACTORS $0.00

5. MISC EXPENSES

COMMUNICATIONS	4% DIRECT LABOR		$354.16
COMPUTER	$5.00/HR	210	$1,050.00
REPORT PRODUCTION	2% DIRECT LABOR		$177.08
	TOTAL MISC EXPENSES		$1,581.24

TOTAL LABOR & EXPENSES $11,885.16

Table 7 (concluded)

(2 of 2)

COST ESTIMATE

TASK ORDER 005

TASK NO. 2 MECHANICAL AND THERMOMECHANICAL ANALYSIS FOR SRP
SUBTASK NO. 2 ANALYSIS OF KEY PARAMETERS IN SUPPORT OF IN-SITU TESTING

6. G & A EXPENSES	1.06 x DIRECT LABOR	$9,385.16
TOTAL COST		$21,270.32
7. FEE OR PROFIT	8%	$1,701.63
TOTAL JOB COST		$22,971.95

Table 8

TASK ORDER No 5

PROFESSIONAL LABOR SUMMARY BY TASK

TASK	1				2			
SUBTASK	1	2	3	4	1		2	
PHASE					1	2		TOTALS
INDIVIDUAL								
R. Hart	16	16	16	12	44	92	94	290
M. Board	320	160	80	60				620
L. Lorig				180			140	320
M. Christianson		160	240			180		580
M. Mack						120	70	190
C. Fairhurst							24	24
A. Brown	32	32	32	32				128
K. Wahi						40		40
TOTALS	368	368	368	284	44	432	328	2192

CERTIFICATE OF CURRENT COST OR PRICING DATA

This is to certify that, to the best of my knowledge and belief, the cost or pricing data (as defined in Section 15.801 of the Federal Acquisition Regulation (FAR) and required under FAR Subsection 15.804-2) submitted, either actually or by specific identification in writing, to the contracting officer or to the contracting officer's representative in support of NRC 02-85-002, Task Order 5, are accurate, complete and current as of 12 March 1987. This certification includes billing and final indirect cost rates. The proposal does not include any costs which are unallowable under applicable cost principles, and all costs included in this proposal are properly allocated to this contract.

Firm: Itasca Consulting Group, Inc.

Name: John J. Markham

Title: Executive Vice President

Date of Execution: 12 March 1987