Enc In Rec'd B6985

426.1B6985/PB/86/12/17

DEC 17 1986

MEMORANDUM FOR: Robert E. Browning, Director
Division of Waste Management

Nick Costanzi, Chief
Waste Management Branch
Division of Radiation Programs

John T. Greeves, Chief
Engineering Branch
Division of Waste Management

Philip S. Justus, Acting Chief
Geotechnical Branch
Division of Waste Management

FROM: John J. Linehan, Acting Chief
Repository Projects Branch
Division of Waste Management

SUBJECT: REQUEST FOR REVIEW OF CONTRACT NRC 02-81-026, BENCHMARKING OF COMPUTER CODES AND LICENSING ASSISTANCE, CORSTAR, (FIN B6985)

We request your review of the enclosed Project Descriptive Summary and Statement of Work for completion of work underway on the benchmarking contract named above. Delays caused by difficulties in obtaining codes in a timely manner necessitate continuation of the work into FY87 to obtain the benchmarking reports on waste package codes and repository design codes (Tasks 4 and 5) and the annotated user's manuals under the technology transfer task (Task6). Please provide your comments to Pauline Brooks (X74797) by December 24, 1986.

Thank you.

ORIGINAL SIGNED BY

John J. Linehan, Acting Chief
Repository Projects Branch
Division of Waste Management

Enclosures:
PDS/SOW

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NMSS SUBJ
B-6985 CF

8701003 2\ (5)H

OFFICIAL CONCURRENCE AND DISTRIBUTION RECORD

MEMORANDUM FOR: R. E. Browning, Director
DWM

Nick Costanzi, Chief
WMB

John Greeves, Chief
WMEG

Philip Justus, Acting Chief
WMGT

FROM: J. Linehan, Acting Chief
WMRP

SUBJECT: REQUEST FOR REVIEW OF CONTRACT NRC 02-81-026, BENCHMARKING OF COMPUTER CODES AND LICENSING ASSISTANCE, CORSTAR, (FIN B6985)

DATE: DEC 17 1986

DISTRIBUTION

WM/SF 3426.1	NMSS RF	RBrowning, WM	MBell, WM
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PBrooks & r/f	~~PDR~~	~~LPDR (B,N,S,)~~	

CONCURRENCES

ORGANIZATION/CONCUREE	INITIALS	DATE CONCURRED
WM/RP PBrooks	ppb	86/12/17
WM/RP SCoplan	[illegible]	86/12/17
WM/RP JLinehan	[illegible]	86/12/17

Dispatched by RP
Rec'd DCC - 12/18/86

Enc to Memo DAI'D 2-17-86, To: REB, NC, JTG, PST, From: Lindham

PROJECT DESCRIPTIVE SUMMARY

OFFICE: NMSS

DATE: 86/12/15
PPSAS NO.: 5134
PRIORITY: 1

PROJECT TITLE: Benchmarking for Computer Codes and Licensing Assistance

FIN NO.: B6985

TYPE OF CONTRACT: Competitive

CONTRACTOR: CorSTAR, Research, Inc. (formerly Teknekron Research, Inc.)

ESTIMATED PERIOD OF PERFORMANCE: 9/15/81 - 12/31/86

PROJECT MANAGER: Pauline P. Brooks

FY BUDGET ($K):	FY82	FY83	FY84	FY85	FY86	FY87
PRIOR:	1002.8	600	750	0	0	0
OPERATING:	0	0	0	400	80	264
FOLLOW-ON:	0	0	0	0	0	0

SCOPE OF WORK:

The contractor will provide independent evaluation of models and codes beginning with those involved in the NRC assessment of DOE pre-licensing documents, (e.g., environmental assessments). The models and codes also include those which DOE proposes to use in preparing their license application, and those which will be exercised by the NRC in evaluating DOE's submissions. The code evaluation will include the quality of the physical models which drive the code, and the limitations of both these physical models and the mathematical techniques by which the code uses the models to predict long-term repository performance.

The contractor will establish a method for performing the code evaluations, including development of benchmark problems with known solutions, learn to operate appropriate codes, and then conduct the benchmarking evaluations. Following their option) for use by the staff. In FY84 major emphasis was on evaluating waste package codes. This work was continued in FY85 and work on evaluating repository design codes and waste package codes was begun. In FY86,

*The Benchmarking contract is scheduled to end in CY86, following the DOE schedule for SCR. Work may continue beyond this date as an option, but at a greatly reduced cost. The total approved funding for this contract is $3,750 K. The budgeted funding by year has been increased in early years to reduce funding requirements after 1982.

work continued in all areas and technology transfer task was initiated. FY87 funding will allow completion of benchmarking of waste package codes and repository design codes under Tasks 4 and 5 and preparation of master tapes and annotated user's manuals under the technology transfer task (Task 6). Interpretation of the results of the codes exercised by the contractor is the responsibility of the NMSS staff.

USER NEED:

This project is necessary to provide NRC with an independent review of model and computer code reliability, accuracy and applicability. The project will also provide the skill and manpower required to assist in reviewing pre-licensing documents in a timely manner. If this study is not undertaken, the NRC would be remiss by not fully understanding the limitations of a major licensing tool.

PRODUCTS:

The following reports are being provided for repository siting, radiological assessment, repository design, waste packages, and overall systems: model summary report, report on parameters and variables used in the models, benchmark problems, and benchmark problem solutions, analysis, and results. Examples of reports already published include: "A Summary of Computer Codes for Radiological Assessment" (NUREG/CR-3209), "A Summary of Repository Design Models" (NUREG/CR-3450), "Benchmark Problems for Repository Siting Models" (NUREG/CR-3097), and "Parameters and Variables Appearing in Repository Siting Models (NUREG/CR-3066). In addition, master tapes containing the versions of computer codes as tested and the inputs for test problems and annotated user's manuals will be provided to the NRC for its use in independently assessing DOE's analyses.

CONTINUATION OF PROJECTS:

This project is not a continuation of any previous project.

PRIOR AND CURRENT RELATED NRC PROJECTS:

Other work sponsored by NRC primarily involves code development rather than benchmarking. Current computer codes are being developed and verified at SNLA (FIN A-1166). If modifications appear to be necessary as a result of work under FIN B-6985 they will be incorporated into SNLA's codes under their code maintenance task.

When the TOUGH code was redefined and verified at the University of California at Berkeley (FIN B-3109), two of the problems used for verification were taken from the FIN B-6985 benchmark problem set. Under FIN A-1166, (successor to FIN A-1192), "Development of a Methodology for Risk Assessment of Nuclear Waste Isolation in Alternate Geologic Media" codes are being developed. These were assessed under FIN B-6694, "Waste Management Technical Review." This work is not being duplicated.

PROJECT DESCRIPTIVE SUMMARY

DATE: 86/12/15

JUSTIFICATION FOR SOURCE SELECTED AND DISCUSSION OF ALTERNATIVES:

N/A This is a competitive contract.

INTERAGENCY COORDINATION AND INTEREST

See memorandum from Hubert J. Miller to Donna Mattson dated December 19, 1985.

NRC OFFICE/REGION COORDINATION:

This project will continue to be coordinated with the Office of Research.

ARTICLE I - STATEMENT OF WORK

1.0 BACKGROUND

The NRC is developing models and computer codes for supporting regulations and for performing reviews of proposed nuclear waste management systems. Department of Energy (DOE) also is idependently developing models and computer codes to assess repository sites and designs. As a part of model and code development, a procedure for independent evaluation of the reliability of these models and codes is required. Codes must be evaluated to determine the limitations of theories, and the reliability of supporting empirical relations and laboratory tests used for evaluation of long-term repository performance. Following evaluation of the codes, those which are valid shall be exercised as an option under this contract, as appropriate, in the review of site characterization reports.

Since the geologic environment provides the final barrier for isolation of radioactive wastes, a thorough analysis of the hydrologic transport and thermal/mechanical interactions in the geologic media surrounding potential repositories is essential to a complete assessment of potential hazards. Because the analysis deals with a complex and long-term problem, it inevitably involves models and codes. Models provide the framework to incorporate the most important processes that will be active in a repository, thereby permitting prediction of repository behavior. In order to evaluate these models, the NRC must establish a method for evaluating the accuracy, appropriateness and completeness of the assumptions and techniques used in developing the models.

Once the contractor has a working knowledge of the codes and the codes are acquired, the contractor will be required to assist the NRC both in-house and at the contractor facilities in conducting licensing analyses.

2.0 WORK REQUIRED--PHASE I

2.1 Task 1 - Literature Search

The contractor shall review models which deal with repository siting, dosimetry, repository design, waste package performance, and overall systems as detailed in the following subtasks. The siting codes shall have the highest priority. Work on the other types of codes will be performed in the above sequence. Subject to the excercise of the option for Phase II, all tasks described through Task 6 will be performed for each type of code. Of the siting codes, those for bedded salt, domed salt and basalt shall be evaluated first, followed by those for granite, tuff, and argillaceous rocks. The objectives of Task 1 are to determine which numerical models, analytical solutions, field and laboratory data are relevant and available and summarize them as per the list below. The models shall be classified on the basis of: 1) general approach; 2) the procedure for obtaining solutions to model problems; 3) the physical process or processes represented; and 4) the five areas previously mentioned, i.e., siting, dosimetry, repository design, waste package performance, and overall systems codes.

The contractor shall submit to the NRC for approval a trial code summary using the DNET code from Sandia Laboratory. This trial summary shall permit the NRC to review and provide technical direction to the contractor as needed to ensure the utility of the remainder of the work.

While the trial code summary is being reviewed, work shall proceed on other codes only up to the point of preparing interim reports on each of the codes. The project officer will provide technical direction on the interim reports as part of the review of the trial code summary. The trial code summary and

summaries for other codes must include but are not limited to the following:

I. Summary of Code

- A. Purpose
- B. Scope
- C. Authors
- D. What the code does
- E. NRC technical questions or issues which can be resolved by running this code
- F. Restrictions on use: (Proprietary, partially proprietary, license rights, etc., costs and method of acquisition such as buy or lease)

II. Summary of Findings

- A. General Critique
- B. Salient Characteristics
- C. Overall Adequacy
- D. Major Deficiencies
- E. Applicability to Medium
- F. Any sensitivity analyses which have been performed.
- G. Code Validation
- H. Field Verification

III. General Description

- A. Operating Characteristics (including systems requirements)
- B. Description of the Model
- C. Inputs
- D. Outputs
- E. Data Requirements
- F. Available Documentation

IV. Review of Theory

A. Equations

B. Numerical Approximations

C. Probabilistic or statistical aspects

D. Assumptions, simplifications (matrix requirements, i.e. nodal spacing)

E. Structure and level of detail

F. Major Variables

G. Applicability, limitations, validity, completeness

H. Derivations and references

I. Acceptance and Adequacy

This summary should be constructed so that it is amenable for updating at a future date.

NRC Contract #NRC-04-80-178 with Science Applications Inc. (SAI) titled, "Fuel Cycle Project Review," has been initiated to assess several of the above mentioned categories on the Sandia Computer Codes. The contractor shall not duplicate the SAI work, but shall use it as appropriate, in making the assessments of the Sandia Codes required by this Benchmarking contract. The project officer shall provide a list of these codes to the contractor. A copy of the SOW for contract #NRC-04-80-178 is attached hereto. (See attachment number 8).

2.1.1 Subtask 1.1

The contractor shall compile summaries, in the form of an interim report for each code, of all applicable numerical codes and analytical solutions found in the literature search, beginning with the following codes:

Sandia Nat'l Lab. (SLA)	Battelle Pacific NW Lab. (PNL)	Rockwell Hanford Operations
SWIFT	FE3DGW	CHAINT
ONET	GETOUT	SEMTRA
NWFT	VTT	
	MNT	
	PATHS	
	PABLM	
	REPOSITORY RELEASE SCENARIO	

2.1.2 Subtask 1.2

The Contractor shall determine what data are necessary to evaluate the codes and analytical solutions for which summaries have been compiled. For each type of code, the Contractor shall provide the NRC with an interim report on the data set to be used for the benchmarking task (Task 3). The contractor shall identify the source of the data and shall justify the selection of the data. The contractor shall propose an outline of each interim report for this subtask for approval to the NRC PO prior to submitting the report.

2.2 Task 2 - Code Selection

The contractor shall submit a letter report to identify which codes should be benchmarked and to discuss whose facilities are most appropriate for the benchmarking task (Task 3) based on cost effectiveness and timeliness. These codes may be run (1) on the NRC computer facilities, (2) at the contractor's facilities, or (3) at the facilities of the owner of the code. The NRC and the contractor shall meet to discuss the recommendations in the letter report.

2.3 Task 3 - Design Benchmark Problems

The objective of this task is to provide the NRC with an independent method,

which includes both a physical description and a numerical description (e.g., nodal spacing), that could be used for comparison of model results. The problems shall include:

1. Those with known analytical solutions.
2. Hypothetical problems that would illustrate a wide range of geologic and hydrologic conditions, both generic and specific, and also a wide range of conditions for both repository and waste package design.
3. Problems based on physical experiments or field situations.

   The problems shall address the following:

   A. Model accuracy for simple problems.

   B. Model reliability for complex problems.

   C. Model applicability to actual field situations.

The contractor shall describe the benchmark problems in detail in the form of an interim report, one for each type of code identified in Task 1. It is foreseen that there may be several subtypes of codes involved under each major type of code. These subtypes may require separate benchmarking problems. For example siting codes may involve, saturated flow codes, fracture flow codes, transport codes and heat conduction or convection codes. In a letter report, the contractor shall recommend which subtypes of codes require individual benchmarking problems. The contractor shall justify selection of subtypes and the necessity for separate benchmark problems. The contractor shall submit a proposed outline of each report in accordance with the attached list of deliverables. The first report shall contain problems which apply to DNET and similar siting codes. Draft and final reports shall be submitted to the NRC as indicated in the attached schedule.

3.0 OPTION: PHASE II - Perform Tasks 4 through 6

If the NRC exercises the option to require Phase II efforts, the option will be exercised separately for each type of code (for example, for the dosimetry codes or siting codes). The contractor shall perform work on any one or more of the following tasks:

3.1 Task 4 - Solve Benchmark Problems

Based upon the selection of codes, facilities, and benchmarking problems by the Government, the contractor shall be provided codes available to the Government as Government Furnished Property and the contractor shall be directed to obtain those codes not provided by the Government.

The contractor shall proceed with putting the codes on line. The contractor shall immediately notify the Project Officer (by telephone or in person), and confirm in the Monthly Progress Report, of any problems encountered in obtaining the codes or in putting them on line. The contractor shall also include information on the source of the codes and costs and time involved in obtaining the codes and in putting them on line in the applicable Monthly Progress Reports.

The contractor shall then use codes and analytical solutions identified for benchmarking to solve the benchmark problems. The contractor shall document the solutions to the benchmark problems in a letter report.

All computer programming efforts under this contract shall conform to 'FORTRAN78' the ANSI Standard X3.9-1978. Contract deliverables shall include available documentation of all programming according to FIPS 38 2-12-78 and ANSI Standard N-413. Waiver to these requirements can be obtained through the PO with the concurrence of the Division of ADPS, NRC.

For all benchmark problems, a file must be provided on magnetic tape in a standard format, to be specified by the NRC PO, that can be used as input to the program being benchmarked.

3.2 Task 5 - Analyze and Describe Results

From the results of the analyses performed in previous tasks, the Contractor shall review codes and analytical solutions based on the following questions:

1. Can this code or analytical solution accurately solve the equations it was designed for?
2. Does the conceptual basis of the code or analytical solution represent the true physical process?

The contractor shall analyze and describe the results and make recommendations (as per the following list) on codes or analytical solutions, as well as methodologies for future comparisons and for further research in the form of an interim report for each type of code. In addition to answering questions 1 and 2 above, each report shall include, but is not limited to, the following content:

I. Review of the Inputs
   - A. Precision
   - B. Deficiencies
   - C. Inaccuracies
   - D. Parameter definitions

II. Review of the Implementation
   - A. Algorithms
   - B. Numerical techniques
   - C. Assumptions
   - D. Limitations
   - E. Precision (bound uncertainty)
   - F. Possible errors or inaccuracies
   - G. Appropriateness of the technique

III. Review of Results and Outputs
   - A. Direct checks--energy, mass conservation, etc.
   - B. Comparison with other information

C. Consistency.

D. Independent verification

E. Advise on what key regulatory problems may be resolved with this code that cannot be resolved in other ways.

F. Advise and make recommendations as to results which may affect technical directives, licensing actions, or regulations.

G. Advise and make recommendations as to specific improvements which the code may require. The contractor shall not make these improvements.

H. Computer time required (C.P.U. or other similar measures of system resources)

In addition to the above interim reports, an abrieviated summary following the outline described above will be submitted in the monthly letter reports for those problems solved during the reporting period.

3.3 Task 6 - Technology Transfer

The contractor shall make codes, which the NRC identifies, available to the NRC along with appropriate documentation and instruction for the NRC staff to become proficient and to be able to transfer proficiency to succeeding staff. The contractor and NRC shall come to a mutual agreement on a delivery schedule for codes and documentation. The contractor shall deliver codes and documentation and shall provide instruction to NRC staff in accordance with the schedule determined by the NRC after discussion with the contractor. The schedule shall be made a part of the contract by modification. The contractor must comply with all applicable FIPS PUBS such as 11, 24, 30 and 38 and Federal Property Management Regulations 41 CFR 101-36, specifically the Federal Software Exchange Program.

4.0 OPTIONS: PHASE III- PERFORM TASKS 7 THROUGH 10

The NRC Contracting Officer may exercise the option to require the contractor to perform work on any one or more of the following tasks:

4.1 Task 7 - Aid in Site Characterization Reviews

This task is intended to provide aid in the performance assessment pertaining to near field and regional hydrology and geology, to repository scale analyses, to system modelling and to scenario analyses.

The objectives of this task are to assist the NRC as needed with the review of performance analysis sections of site characterization reports and to exercise the benchmarked NRC codes at the direction of the NRC to start applying these codes as early as possible to sites for which a Site Characterization Report is anticipated. The site characterization report review will include a review of the DOE models, may include actually running these codes and may include performing other analyses as requested by the NRC, using preliminary data presente in the Site Characterization Reports or other DOE reports. This may include sensitivity analyses if so requested by the NRC. The Contractor shall submit a report presenting the results of the review of the Performance Analysis Sections of the Site Characterization Report within two (2) months after receipt of each Site Characterization Report from the NRC. The Contractor shall also submit a report which will summarize the results of any analyses performed by the Contract and advise the NRC staff as to evaluation of releases to the accessible environme Appended will be a complete printout of computer analyses performed. This report be due four (4) months after receipt of the Site Characterization Report.

4.2 Task 8 - Maintain Data Base

The Contractor shall maintain a data base file, using information provided by the NRC PO, including appropriate codes, on each site to be submitted for site charac

erization. The Contractor shall perform analyses of the data as directed by the NRC PO. It is anticipated that the data base will be maintained on the NRC computer facilities with access provided by the NRC. It is also anticipated that both the data base and the codes will be continuously upgraded as better data and better understanding of the physical phenomena become available. The Contractor is responsible for accurately incorporating the data into the data base. All preliminary site data should be incorporated into the data base prior to the receipt of the specific Site Characterization Report. The expected schedule of reviews to be initiated is given below.

SCHEDULE OF REVIEW FOR SITE CHARACTERIZATION REPORTS

March 1982	Hanford Site
October 1982	Domed Salt Site
December 1983	Bedded Salt Site
February 1984	Nevada Test Site
September 1984	Hard Rock Site

The Contractor shall report any changes or additions to the data base in the monthly letter reports.

4.3 Task 9 - Review Semi Annual Progress Reports

The Contractor shall review the Performance Analysis sections of the Semi Annual Progress Reports received by the NRC during Site Characterization and identify any potential code related problems which may arise from additional information received. The Contractor shall submit a report presenting the results of this review within two (2) months after receipt of each Semi Annual Progress Report from the NRC.

4.4 Task 10 - Update Previous Tasks

The Contractor shall recommend whether results of previous tasks need updating in light of any new information received from the NRC PO, and proceed with the updating as directed by the NRC PO. The contractor shall provide these recommendations in a letter report.

Note: It is anticipated that prior to the exercise of any of the options, the Government will require the contractor to submit a proposal to implement the option(s); subject to negotiation and agreement of the parties prior to authorization to commence work. Pending exercise of the option(s) by the Government, the contractor is not authorized to commence work for either phase II or III.

5.0 REPORTING REQUIREMENTS

The types of reports required are (a) monthly letter progress reports, (b) interim reports, (c) final reports, and (d) letter reports. The distribution for items a through d above shall be as follows:

Linda Lehman, Project Officer, 1 copy

Office of the Director, NMSS
Attn: Program Support, 1 copy

John B. Martin, Director
Division of Waste Management, 1 copy

Contracting Officer, Technical Assistance Contracts Branch
Division of Contracts, 1 copy

5.1 MONTHLY LETTER PROGRESS REPORT

Each month, the contractor shall submit five (5) copies of a progress report in letter format which summarizes:

1. The work performed during the previous month, milestones reached, findings important to the NRC program, update of subcontractor activities;

2. Meetings attended (list personnel, date, place, purpose, and summary of conclusions or agreements reached with other attendees);

3. Potential or actual contractual problem areas and their impacts (if the schedule has slipped or if the budget will be exceeded, this shall be stated and the reasons explained):

4. The personnel time expenditures during the previous month by labor category or individuals, and;

5. Prime contractor costs and subcontractor costs, listed separately (a) during the previous month, (b) cumulative to date (fiscal year and total), and (c) projection by month for the current fiscal year. The first monthly report shall provide the initial projections, and subsequent reports shall either indicate revised projections or indicate "no change in the cost projection."

6. Monthly reports shall include a listing of subcontractor reports received th month.

5.2 INTERIM REPORTS

The format of the interim reports required by the Statement of Work herein shall be as specified for interim contractor reports in NRC Manual Chapter 3202, and shall be written in a manner consistent with "NUREG-0650, Technical Writing Style Guide."

All interim reports shall be delivered to the NRC Project Officer (PO) in draft form for review and comment. The draft shall meet the format requirements of the interim report, shall have been edited and reviewed by the contractor, and shall be ready to be published as an interim report if NRC has no comments.

The NRC PO will provide comments, if any, to the contractor within one (1) month after receipt of each report. (However, the conclusions of the report are those of the contractor only.) Copies of the revised interim reports shall be provided to NRC within sixty (60) days following receipt of NRC's comments.

In addition, copies of all subcontractor reports, generated under this contract shall be delivered to NRC as interim reports and shall be subject to review and comments and revisions, if necessary, as outlined above. These subcontractor reports shall be delivered to the PO within two (2) weeks of the contractor's receipt of them.

5.3 FINAL REPORTS

Upon completion of the work on each type of code (i.e., siting, dosimetry, repository design, waste package performance, and overall system) required in this Statement of Work (SOW) for Tasks 1 through 3, Phase I, the Contractor shall furnish five (5) copies of a draft final task report to the NMSS PO per the schedule in paragraph 8.0. The final reports for Phases II and III will be negotiated later and specified in the contract by modification. The format of these reports shall be as specified for formal contractor reports in NRC Manual Chapter 3202 and shall be written in a manner consistent with "NUREG-0650, Technical Writing Style Guide."

The NMSS PO will provide comments, if any, to the Contractor within two months of receipt of each draft final report. However, the conclusions of the reports are those of the contractor only. A reproducible master (camera-ready) copy plus five (5) additional copies shall be provided to the NMSS PO within thirty (30) days following receipt of NRC comments.

5.4 LETTER REPORTS

Two letter reports, one on identification of codes to be benchmarked and discussion of facilities (Task 2) and the other on identification of which subtypes of codes require individual benchmarking problems (Task 3) are required in the Statement of Work. These reports shall identify the contractor's recommendations and shall provide justification for the recommendations. The letter reports shall provide sufficient information such that the NRC PO can make an independent evaluation of the recommendations. It is not anticipated that these letter reports will be published under this contract.

6.0 MEETINGS AND TRAVEL

6.1 Technical Review Meetings

The contractor and any subcontractors shall provide for not greater than (a) two (2) two-day meetings with the NRC staff at the contractor facility to discuss study progress and results and (b) two (2) two-day meetings hosted by NRC in Silver Spring/Bethesda, Maryland, for each fiscal year. Such meetings will be scheduled by the NRC Project Officer at a time and

location which will be convenient to the participants involved, and the contractor will receive ten (10) working days advanced notice with complete agenda for these meetings. These meetings may be concurrent with or sequential to the Quarterly Program Reviews discussed in paragraph 6.3.

6.2 Coordination Meetings

The contractor and any subcontractors (one person for each), and the NRC Project Officer shall attend one-day (maximum) quarterly meetings to discuss program directions, potential problems, letter reports, and to coordinate the overall study effort. Such meetings will be scheduled by the Project Officer at a time and location which will be convenient to the participants involved and the contractor will receive ten (10) working days advanced notice with complete agenda for these meetings. These meetings may be concurrent with or sequential to the Technical Review Meetings discussed in paragraph 6.1 and/or the Quarterly Program Review discussed in paragraph 6.3.

6.3 Quarterly Program Reviews

The contractor shall provide for four (4) each one-day management level reviews, two (2) to be held at the contractors' offices and two (2) in the Silver Spring, Maryland, area. These meetings will be oriented toward executive summary program reviews.

7.0 NRC FURNISHED MATERIAL

The NRC will furnish the following items:

a) Information about the computer system to be used by the NRC for computer codes delivered to the NRC will be sent to the contractor upon award.

b) NRC will provide the contractor with pertinent reports, data/information received from other sources which the contractor identifies as beneficial to their understanding of the study or for the running of codes identified as Task 4 as the information becomes available to NRC.

c) The NRC will provide copies of NRC codes listed in paragraph 2.1.1 and any DOE codes as they become available to NRC.

If the Government-furnished property, suitable for its intended use, is not so delivered to the contractor, the Contracting Officer shall, upon timely written request made by the contractor, and if the facts warrant such action, equitably adjust any affected provision of the contract pursuant to the procedures of "Changes" clause thereof.

8.0 LIST OF DELIVERABLES

The schedule included for the list of deliverables is complete for the SITING CODES ONLY. The types of reports listed are expected to be similar for the other categories of codes. The estimated completion time from contract award to the due date for each deliverable will be assumed approximately the same as for the Siting Schedule. The Dosimetry Code work will begin in the 1st quarter of Fiscal Year 1983, the Repository Design work will begin in the 3rd quarter of Fiscal Year 1983, Waste Package work will begin in the 1st quarter of Fiscal Year 1984 and Overall Systems Codes in the 1st quarter of Fiscal Year 1985.

ITEM	REFERENCE	PROPOSAL	COPIES	DRAFT	FINAL
1	2.1.1	Trial Code Summary	10	1/30/82	4/30/82
2	2.1.1	Model Summary Reports	10	3/30/82	6/30/82
3	2.1.2	Outline of Data Set Report	10		5/30/82
4	2.1.2	Data-Set Report	10	7/30/82	10/30/82
5	2.2	Letter Report of Recommended Code Acquisitions	5		5/30/82
6	2.3	Letter Report on Subtypes	5		7/30/82
7	2.3	Proposed Outline For Benchmark Problems	5		6/30/82
8	2.3	Benchmark Problem Report	10	8/30/82	11/30/82
9	3.1	Letter Report on Benchmark Problem Solutions	5	4/30/83	7/30/83
10	3.1	Magnetic Tape of Problem Input	1		7/30/83
11	3.2	Interim Report on Analysis and Results	10	6/30/83	9/30/83
12	3.3	Code Delivery Schedule	5	(TBD)*	
13	3.3	Schedule For Documentation and Instruction	5	(TBD)*	

*T.B.D. = To Be Determined

ITEM	REFERENCE	PROPOSAL	COPIES	DRAFT	FINAL
14	3.3	Actual Code Delivery	-	(TBD)*	
15	3.3	Instruction and Documentation	-	(TBD)*	
16	4.1	Results of the Review of Performance Assessment in SCR	5	(TBD)*	
17	4.1	Results of Analysis Performed by Contractor on SCR Data	5	(TBD)*	
18	4.3	Results of Review of Semi-Annual Progress Reports	5	(TBD)*	
19	4.4	Letter Report Recommending Updating Previous Tasks	5	(TBD)*	

*T.B.D. = To Be Determined

9.0 Contractor's Proposal

The effort specified above in the Statement of Work herein shall be performed in accordance with the Contractor's Technical Proposal number RK 81-3009/BF2, as amended, which by this reference is incorporated into and made a part of this contract as though fully set forth herein.

In the event of any conflicts or inconsistencies, the Statement of Work set forth herein shall take precedence over the Contractor's Technical Proposal.

ARTICLE II - PERIOD OF PERFORMANCE

The performance of work described in ARTICLE I hereof shall commence as of the effective date of this contract and shall continue to completion thereof, 5 years after said contract is effective, including all efforts under Phases II and III. The schedule for contract deliverables is set forth in Article I herein.