

A-1165

LPDR-  
WM-10(2)  
WM-11(2)  
WM-16(2)

**Sandia National Laboratories**

Albuquerque, New Mexico 87185

February 15, 1987

Ms. Sandra Wastler  
Repository Projects Branch  
Division of Waste Management  
U.S. Nuclear Regulatory Commission  
7915 Eastern Avenue  
Silver Spring, MD 20910

FEB 17 AM 12:24

Dear Ms. Wastler:

Enclosed is the summary of activities during January 1987 for FIN# A1165. If you have any questions please feel free to contact me at (FTS) 844-8368 or Robert Guzowski at (FTS) 844-3583.

Sincerely,

*Robert M. Cranwell*

Robert M. Cranwell, Supervisor  
Waste Management Systems  
Division 6431

RMC:6431

Enclosure

Copy to:  
Office of the Director, NMSS  
Attn: Program Support  
Robert Browning, Director  
Division of Waste Management  
Seth Coplan  
Division of Waste Management  
John Randall  
Division of Radiation Programs and  
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6400 R. C. Cochrell  
6430 N. R. Ortiz  
6431 R. M. Cranwell  
6431 R. V. Guzowski

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WM-RES  
WM Record File  
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WM Project 10, 11, 16  
Docket No. \_\_\_\_\_  
PDR ✓  
XLPDR ✓ (B, N, S)

Distribution:  
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(Return to WM, 623-SS)

3631

PROGRAM: Licensing-Methodology Assistance

FIN#: A-1165  
Task I

CONTRACTOR: Sandia National  
Laboratories

BUDGET PERIOD: 10/86 -  
9/87

NMSS PROGRAM MANAGER: S. Wastler

BUDGET AMOUNT: - ? -

CONTRACT PROGRAM MANAGER: R. M. Cranwell

FTS PHONE: 844-8368

PRINCIPAL INVESTIGATORS: R. M. Cranwell  
R. V. Guzowski

FTS PHONE: 844-8368  
FTS PHONE: 844-3583

#### PROJECT OBJECTIVE

To assist in the overall development and integration of the licensing assessment methodology.

#### ACTIVITIES DURING JANUARY 1987

As part of the integration project, the components of the performance assessment (Figure 1) are being reviewed to determine the topics that need to be considered by the NRC. In addition, areas where computer codes need to be developed or adopted will be identified. During January, the components on Source Term, Radiation, Brine Migration, Facility Design, Scenarios, and Scenario Probability were reviewed. A review of the Radiolysis component that was started in December was completed.

Of the components above, references to computer codes were found for Source Term. The most commonly used codes to keep track of radionuclide inventory are ORIGEN and ORIGEN2. A code named RICE was used in a report published by the National Radiological Protection Board (U. K.). The results for this and the other components are preliminary. A document search or review of NRC and DOE reports to locate where codes have been used or are being developed has not been conducted at this time.

S. Wastler requested a technical review of the report "Demonstration Of Methodology For Waste Package Performance Assessment" by Aerospace Corporation. R. Guzowski completed the review of the report in January, and E. Bonano is expected to complete his review in early February. R. Cranwell will review the report in February. All of the comments will be submitted with the February monthly.

Revisions to the 189 for A1165 were completed in January. A copy of the revised document accompanies this monthly report.

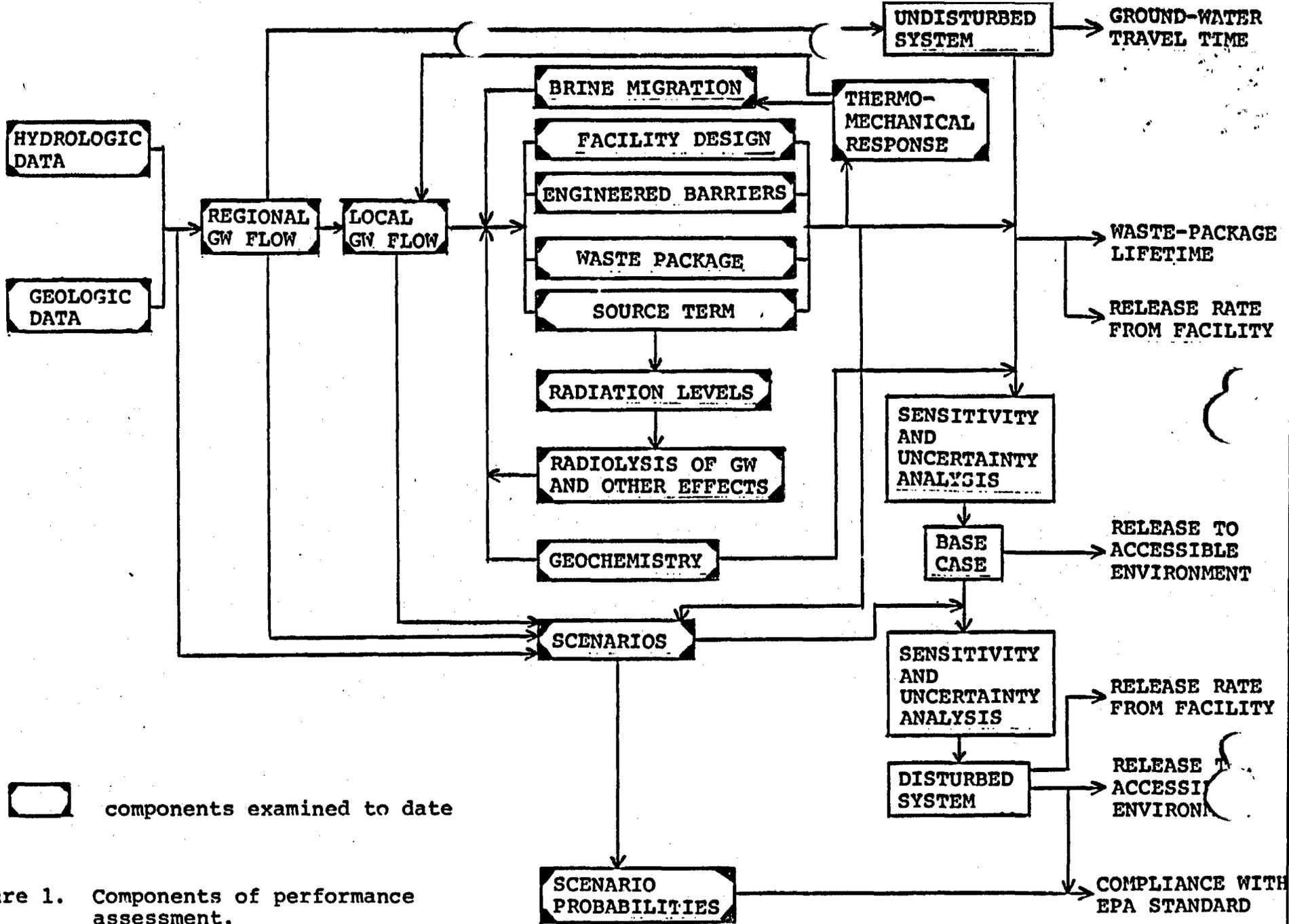


Figure 1. Components of performance assessment.

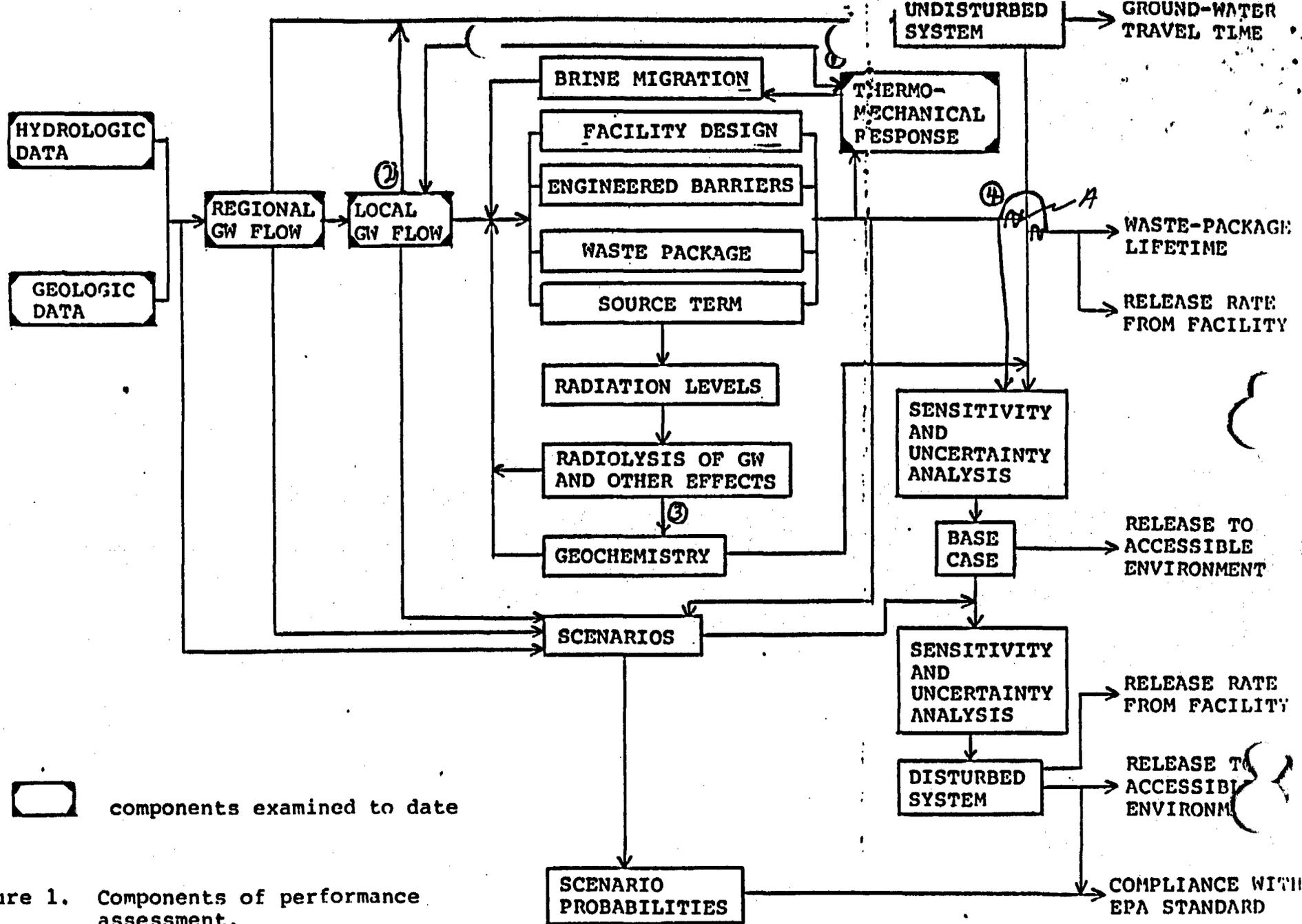
With respect to your comments on the November monthly, Figure 1 was a preliminary effort at defining the components of a performance assessment and their interrelationship. Suggestions as to modifications and/or improvements are encouraged. In response to the specific comments:

1. The input into the Thermomechanical (TM) Response component is dependent on the Brine Migration down through Geochemistry components. In addition, these components and the TM Response require input from the Local Ground-Water Flow component. Having the Local Flow feed into the Facility-Design through Source-Term bracket is meant to indicate that the Local Flow is an important contributor to all components to the right of the Local Flow box. TM Response is dependent on the facility and waste being present. As a result, Local Flow must be through the facility rather than directly into TM Response.

2. Local Flow should feed directly into the Undisturbed System. Because the Local Flow will be used to determine ground-water travel time, and Regional Flow is used to determine Local Flow, an arrow connecting Local Flow and the Undisturbed System should replace the Regional Flow-Undisturbed System connection.

3. The intent of the arrow from Radiolysis to the line from Geochemistry to Local Flow was to show that Radiolysis could be considered with or without geochemistry. Inclusion of the additional arrow between Radiolysis and Geochemistry should make this intent clearer.

4. For the reasons pointed out in the comment, the addition of a Very Near-Field component has been considered immediately to the right of Local Flow. A box at this location hopefully would be interpreted as meaning that all of the Very Near-Field data and output would be present at Junction A (see figure). Sensitivity And Uncertainty Analysis could be moved to a location between Junction A and the arrow to Waste-Package Lifetime. These modifications are under consideration.



**PROGRAM:** Monitor/Review Aspects of DOE and  
Other National and International  
Waste Management Programs

**FIN#:** A-1165  
Task II

**CONTRACTOR:** Sandia National  
Laboratories

**BUDGET PERIOD:** 10/86 -  
9/87

**NMSS PROGRAM MANAGER:** S. Wastler

**BUDGET AMOUNT:** -?-

**CONTRACT PROGRAM MANAGER:** R. M. Cranwell

**FTS PHONE:** 844-8368

**PRINCIPAL INVESTIGATORS:** R. M. Cranwell  
R. V. Guzowski

**FTS PHONE:** 844-8368  
**FTS PHONE:** 844-3583

**PROJECT OBJECTIVE**

To monitor and review the performance-assessment aspects of DOE and other national and international management programs.

**ACTIVITIES DURING JANUARY 1987**

No activity.

PROGRAM: Probability Techniques

FIN#: A-1165  
Task III

CONTRACTOR: Sandia National  
Laboratories

BUDGET PERIOD: 10/86 -  
9/87

NMSS PROGRAM MANAGER: S, Wastler

BUDGET AMOUNT: -?-

CONTRACT PROGRAM MANAGER: R. M. Cranwell

FTS PHONE: 844-8368

PRINCIPAL INVESTIGATORS: R. M. Cranwell  
R. V. Guzowski

FTS PHONE: 844-8368  
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#### PROJECT OBJECTIVE

To identify techniques for assigning probabilities to geologic processes and events.

#### ACTIVITIES DURING JANUARY 1987

R. Holland's Geochemistry chapter (Chapter 10) for the Probability Techniques Report was received in January. The chapter is in preliminary review and should be ready for submittal to the NRC in early March.

With the exception of the Geochemistry chapter, Executive Summary, and the Introduction, the rest of the report will be submitted to formal Sandia review in February.

NRC comments on the chapters on Thermomechanical Effects (Chapter 3) and Seismic-Hazard Assessment (Chapter 8) have not been received.

PROGRAM: Short-Term Technical Assistance

FIN#: A-1165  
Task IV

CONTRACTOR: Sandia National  
Laboratories

BUDGET PERIOD: 10/86 -  
9/87

NMSS PROGRAM MANAGER: S. Wastler

BUDGET AMOUNT: -?-

CONTRACT PROGRAM MANAGER: R. M. Cranwell

FTS PHONE: 844-8368

PRINCIPAL INVESTIGATORS: R. M. Cranwell  
R. V. Guzowski

FTS PHONE: 844-8368

FTS PHONE: 844-3583

PROJECT OBJECTIVE

To provide general technical assistance on waste-management matters on the request of the NMSS PM.

ACTIVITIES DURING JANUARY 1987

No activity.

A-1165, Task I  
 1183.010  
 January 1987

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)	0.4 ---	1.7 ---
II. Direct Loaded Labor Costs	4	15
Materials and Services	0	5
ADP Support (computer)	0	0
Subcontracts	-1	-1
Travel	0	0
G&A	0	2
Other (computer roundoff)	-1 ---	0 ---
TOTAL COSTS	2	21

III. Funding Status

Prior FY Carryover -----	FY 87 Projected Funding Level -----	FY 87 Funds Received to Date -----	FY 87 Funding Balance Needed -----
4K	--	-0-	--

\* information on funding for FY87 not available.

A\*1165, Task II  
 1183.020  
 January 1987

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)	0.0 ---	0.4 ---
II. Direct Loaded Labor Costs	1	6
Materials and Services	0	0
ADP Support (computer)	0	0
Subcontracts	**6	7
Travel	0	1
G&A	1	2
Other (computer roundoff)	-1	-1
	-----	-----
TOTAL COSTS	7	15

III. Funding Status

Prior FY Carryover -----	FY 87 Projected Funding Level -----	FY 87 Funds Received to Date -----	FY 87 Funding Balance Needed -----
51	--	-0-	--

\* information on funding for FY87 not available.

\*\* these charges result from payment of invoices from work performed in previous months.

A-1165, Task III  
 1183.030  
 January 1987

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)	0.1 ---	0.5 ---
II. Direct Loaded Labor Costs	1	5
Materials and Services	0	0
ADP Support (computer)	0	0
Subcontracts	0	5
Travel	0	1
G&A	-2	-1
Other (computer roundoff)	-1	0
	-----	-----
TOTAL COSTS	-2	10

III. Funding Status

Prior FY Carryover -----	FY 87 Projected Funding Level -----	FY 87 Funds Received to Date -----	FY 87 Funding Balance Needed -----
-0-	--	-0-	--

\* information on funding for FY87 not available

A-1165, Task IV  
 1183.040  
 January 1987

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)	0.1 ---	0.5 ---
II. Direct Loaded Labor Costs	1	6
Materials and Services	0	0
ADP Support (computer)	0	0
Subcontracts	0	0
Travel	1	1
G&A	0	1
Other (computer roundoff)	0	1
	-----	-----
TOTAL COSTS	2	9

III. Funding Status

Prior FY Carryover -----	FY 87 Projected Funding Level -----	FY 87 Funds Received to Date -----	FY 87 Funding Balance Needed -----
8K	--	-0-	--

\* information on funding for FY87 not available.

A-1165

Total for 1183.010, 1183.020, 1183.030, and 1183.040.  
January 1987

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

	<u>Current Month</u>	<u>Year -to- Date</u>
I. Direct Manpower (man-months of charged effort)	0.6	3.1
II. Direct Loaded Labor Costs	7	32
Materials and Services	0	5
ADP Support (computer)	0	0
Subcontracts	5	11
Travel	1	3
G&A	-1	4
Other (computer roundoff)	-3	0
TOTAL COSTS	9	55

III. Funding Status

<u>Prior FY Carryover</u>	<u>FY 87 Projected Funding Level</u>	<u>FY 87 Funds Received to Date</u>	<u>FY 87 Funding Balance Needed</u>
\$138K	\$513K	-0-	\$375K

**PROJECT AND BUDGET PROPOSAL FOR NRC WORK**

DATE

PROJECT TITLE

TECHNICAL ASSISTANCE FOR PERFORMANCE ASSESSMENT

DOE PROPOSING ORGANIZATION

Sandia National Laboratories, Albuquerque, NM 87185

FORECAST MILESTONE CHART: Scheduled to Start - - Completed (Shown in Quarter Year)  
PROVIDE ESTIMATED DOLLAR COST FOR EACH TASK FOR EACH FISCAL YEAR

TASK		FY 87				FY 88				FY 89				FY				FY				
		1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	
1. Assisting in the Development of the Licensing Assessment Methodology	SCHEDULE																					
	COST		263 K			303 K				330 K												
2. Review of Performance Assessment Aspects of DOE Programs	SCHEDULE																					
	COST		50 K			50 K				50 K												
3. Identifying Techniques for Probability Assignment	SCHEDULE																					
	COST		150 K			200 K																
4. Short-Term Technical Assistance	SCHEDULE																					
	COST		50 K			50 K				50 K												
	SCHEDULE																					
	COST																					
<b>TOTAL ESTIMATED PROJECT COST</b>			513 K			603 K				430 K												

PROJECT DESCRIPTION: (Provide narrative descriptions of the following topics in the order listed. Attach on plain paper to this NRC Form 189. If an item is not applicable, so state.)

1. OBJECTIVE OF PROPOSED WORK
2. SUMMARY OF PRIOR EFFORTS
3. WORK TO BE PERFORMED AND EXPECTED RESULTS
4. DESCRIPTION OF ANY FOLLOW-ON EFFORTS
5. RELATIONSHIP TO OTHER PROJECTS
6. REPORTING SCHEDULE
7. SUBCONTRACTOR INFORMATION
8. LIST NEW CAPITAL EQUIPMENT REQUIRED
9. DESCRIBE SPECIAL FACILITIES REQUIRED
10. CONFLICT OF INTEREST INFORMATION

SEE NRC MANUAL CHAPTER 1102 FOR ADDITIONAL INFORMATION

APPROVAL AUTHORITY-SIGNATURE

DATE

*NSkill  
SWastler*

NRC FORM 189 (3-81)	U.S. NUCLEAR REGULATORY COMMISSION  <b>PROJECT AND BUDGET PROPOSAL FOR NRC WORK</b>	DATE OF PROPOSAL  <input checked="" type="checkbox"/> NEW <input type="checkbox"/> REVISION NO.
------------------------	---	--

<b>PROJECT TITLE</b>  TECHNICAL ASSISTANCE FOR PERFORMANCE ASSESSMENT	<b>FIN NUMBER</b> A-1165
<b>NRC OFFICE</b> Nuclear Material Safety and Safeguards	<b>NRC B&amp;R NUMBER</b> 50-19-03-01
<b>DOE CONTRACTOR</b> Sandia National Laboratories	<b>CONTRACTOR ACCOUNT NUMBER</b> DE-AC04-76DP00789
<b>SITE</b> Albuquerque, NM 87185	<b>DOE B&amp;R NUMBER</b> 401001050

COGNIZANT PERSONNEL	ORGANIZATION	FTS PHONE NUMBER	PERIOD OF PERFORMANCE
NRC PROJECT MANAGER Sandra Wastler	NMSS	427-4780	STARTING DATE 10/01/86
OTHER NRC TECHNICAL STAFF			COMPLETION DATE 9/30/89
DOE PROJECT MANAGER			
CONTRACTOR-PROJECT MANAGER D. J. McCloskey/N. R. Ortiz	6400/6410	846-0834/844-5644	
PRINCIPAL INVESTIGATOR(S) R. M. Cranwell - Program Manager R. V. Guzowski	6416 6416	844-8638 844-3583	

STAFF YEARS OF EFFORT (Round to nearest tenth of a year)	FY 86	FY 87	FY 88	FY 89	FY
Direct Scientific/Technical	1.5	2.4	2.5	2.0	
Other Direct (Graded)	--	--	--	--	
<b>TOTAL DIRECT STAFF YEARS</b>	<b>2.0</b>	<b>2.4</b>	<b>2.5</b>	<b>2.0</b>	

COST PROPOSAL					
	FY 86	FY 87	FY 88	FY 89	
Direct Salaries	207 K	266 K	288 K	240 K	
Material and Services (Excluding ADP)	5 K	0 K	0 K	0 K	
ADP Support	7 K	20 K	21 K	21 K	
Subcontracts	100 K	150 K	200 K	100 K	
Travel Expenses					
Foreign					
Domestic	20 K	10 K	10 K	10 K	
Indirect Labor Costs	--	--	--	--	
Other (Specify) IR&D Assessment	9 K	19 K	29 K	20 K	
GPE Surcharge	1 K	3 K	3 K	2 K	
General and Administrative ( %)	--	45 K	52 K	37 K	
<b>TOTAL OPERATING COST</b>	<b>300 K</b>	<b>513 K</b>	<b>603 K</b>	<b>430 K</b>	
CAPITAL EQUIPMENT FIN CHARGED: _____					
<b>TOTAL PROJECT COST</b>		<b>513 K</b>	<b>603 K</b>	<b>430 K</b>	

	OCTOBER	NOVEMBER	DECEMBER	JANUARY	FEBRUARY	MARCH
FY <u>87</u>						
MONTHLY FORECAST EXPENSE	34 K	34 K	34 K	34 K	33 K	33 K
	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER
	33 K	33 K	33 K	33 K	33 K	33 K

## OBJECTIVES OF PROPOSED WORK

### Background

The DOE has the responsibility to design, construct, and operate a high-level radioactive waste (HLW) repository. In addition, DOE must demonstrate that the facility complies with the standards and regulations established or to be established by the EPA (40 CFR Part 191) and the NRC (10 CFR Part 60) and with the Nuclear Waste Policy Act of 1982. These standards and regulations include requirements on waste-package lifetime, release rate from the subsurface facility, ground-water travel time from the subsurface facility to the accessible environment, individual and ground-water protection, and containment of the HLW for more than 10,000 years. Further, the EPA standard is a risk-based standard requiring an identification of potentially disruptive events and processes and an estimation of the probability of occurrence of these events and processes.

Regulations of the geologic disposal of HLW requires that the NRC perform an independent assessment of DOE compliance with standards and regulations sufficient to provide reasonable assurance of safety. Such an assessment must be based on a thorough understanding of the relevant phenomena and processes that affect the performance of a geologic repository both during and after waste emplacement operations. Effective regulation also requires providing timely guidance to DOE, especially in consultations during the time prior to submittal of a license application. Thus, the objectives of this proposed work are to assist the NRC in four areas of license assessment. These four areas (tasks) are:

1. To assist the NRC in the development and implementation of a licensing assessment methodology (LAM);
2. To monitor and review the performance-assessment aspects of DOE and international waste management programs;
3. To identify, analyze, and where necessary develop techniques for determining the probability of occurrence of potentially disruptive events and processes that may affect repository performance; and
4. To provide short-term technical assistance to the NRC whenever, requested.

The LAM will include the tools and techniques necessary to assess the performance of both the pre- and postclosure phases of a HLW repository. Specific capabilities will include:

DRAFT - INFORMAL AND PRELIMINARY AND AS SUCH  
MAY CONTAIN ERRORS NOT YET CORRECTED. FOR  
INTERNAL USE PRIVATE DISTRIBUTION AND NOT FOR  
EXTERNAL RELEASE WITHOUT CONSENT OF AUTHORS.

1. a methodology for assessing the form the preclosure operations of an HLW repository;
2. a methodology for identifying potentially disruptive events and processes for the postclosure period of an HLW repository, and assigning probabilities to these events and processes;
3. the capability for determining a source term from the repository for use in far-field simulations. Included will be the capability to assess waste-package lifetime and release rates from the engineered facility;
4. a far-field methodology for use in assessing ground-water travel times, individual and ground-water protection requirements, and cumulative releases to the accessible environment; and
5. the capability for assessing uncertainties and incorporating these uncertainties into a compliance assessment with the standards and the regulations.

## 2. SUMMARY OF PRIOR EFFORTS

This program is a continuation of previous work under A-1165. The activities for Tasks 1 and 3 took new directions at the beginning of FY85.

Prior efforts under Task 1 were in two areas: (1) development of an Information Management System (IMS) with data on high-level waste disposal related projects funded by the NRC, and (2) development of subnets contributing to an overall diagram showing the relationships of NRC projects and development activities necessary for the NRC to evaluate the DOE construction license application, which is expected in about 1990. Recent activity involved the initial stages in developing a licensing assessment methodology.

Efforts under Task 2 have included extensive review of published DOE-sponsored research related to performance assessment. Additional reviews were conducted of similar activities sponsored by other national and international agencies. A specific international benchmarking program (INTRACOIN) was followed closely to determine the importance and applicability of this activity to the NRC performance-assessment program. SNLA staff have participated in DOE/NRC Performance Assessment Workshops, in order to evaluate techniques and results of DOE data collections programs. Document reviews have included: the Nuclear Waste Isolation Project Performance Assessment Plan; reports on the use of Delphi analysis and a disruptive scenario analysis by

Rockwell Hanford operations; the salt repository project performance-assessment plan; the performance assessment portions of the final Environmental Assessment reports for the Richton, Vacherie, Cyprus Creek, and Hanford sites; and the use of multiattribute utility analysis in the selection of candidate sites for characterization (DOE/RW-0074).

Task 3 efforts have included the analysis of hypothetical repository sites in these geologic media to check on the ability of existing performance-assessment techniques to evaluate compliance with the draft EPA standard (40CFR191). The EPA standard was reviewed, and the impact of the NRC Rule 10CFR60 on meeting the EPA standard was evaluated. Reports produced included a scoping document on uncertainties and a scoping document on techniques for determining probabilities of potentially disruptive events and processes. More recent activity has concentrated on efforts to identify techniques for determining the probabilities of potentially disruptive events and processes occurring at repository sites. A panel of experts was assembled to do a literature review to identify existing techniques for assessing probabilities of potentially disruptive events and processes. A report summarizing the findings of this panel is currently under development.

Previous efforts under Task 4 were short-term activities identified as crucial to the NRC in the period of performance to date. Efforts of a review nature included: review of corrosion data of waste-package materials; evaluation of waste-package reliability; review of the waste-package and geochemistry sections of the Basalt Site Characterization Report; and a review of the application of geostatistics to the Nevada nuclear waste site characterization. A report produced under this task is Assessing Compliance with EPA High-Level Waste Standard: An Overview. In addition, a short-course on performance assessment was presented for NRC personnel in FY86.

### 3. WORK TO BE PERFORMED AND EXPECTED RESULTS

#### TASK 1: Provide Assistance to the NRC in the Development and Implementation of the Licensing Assessment Methodology

This task will continue assistance to the NRC in the development and implementation of an overall licensing assessment methodology (LAM). The LAM should have the tools and techniques necessary to assist the NRC in the following regulatory needs:

1. the capability to evaluate DOE's Safety Analysis Reports (SARs) in order to assess compliance with 10 CFR Part 60 and 40 CFR Part 191 (release to the accessible environment);

2. the capability to assess the DOE demonstration that HLW packages will comply with long-term radionuclide containment requirements as defined in 10 CFR Part 60;
3. the capability to assess DOE's demonstration that the engineered facility and waste package will comply with the release rate criterion of 10 CFR Part 60;
4. the capability to identify and assess the uncertainties pertaining to the performance and assessment of performance of a geologic repository.
5. the capability to assess the risk from the preclosure operations of an HLW repository;
6. the capability to develop and screen scenarios for candidate repository sites;
7. the capability of assessing probabilities of potentially disruptive events and processes; and
8. the capability of determining the ground-water travel time from the engineered facility to the accessible environment.

In response to these needs, the NRC initiated three programs on performance assessment: (1) waste package, (2) engineered barriers, and (3) far field. The waste-package work was being done by Aerospace Corporation and is to be reassigned. Golder Associates was working on engineered barriers, although the program was dropped and not reassigned. SNLA is doing the far-field work. A program on preclosure activities needs to be initiated and the engineered-barrier work reassigned.

The LAM requires the capability of assessing all the components of a performance assessment. To accomplish this, a tracking of the status of all components if a LAM is necessary as well as determining whether the finished products of the various components are of suitable quality and are compatible with each other. In order to track these requirements, the following scheme will be followed:

- Determination of the components of a performance assessment (PA);
- NRC to decide which components of GPA will be handled independently from DOE and which will be reviewed;
- Review each component to determine all elements for all sites that constitute each component [overlap of elements between two or more components will occur];

- NRC to determine which elements will be handled independently and which will be reviewed [independent includes experimentation and/or code development];
- Develop a means of tracking the status, accountability, and quality of the elements of each component;
- Identify where computer codes need to be used;
- Develop a means of tracking the status, accountability, and documentation of each code [both NRC-developed and those adopted from other sources];
- Determine the data needs of each code;
- Determine if the data being collected or available are of adequate type, quality, and quantity for each code;
- For codes in sequence, determine if the output and format of the output from one code are appropriate for input into the next code;
- Review all documents and reports for adequate treatment of topics, data, assumptions, etc. [earlier work may not be adequate in light of more recent developments]; and
- Summarize existing documents and reports [many are out of print and summaries will provide an overview of previous work to new personnel].

Reviews conducted under this task should recognize the need for flexibility in the evolving methodologies and should include an evaluation of the adaptability of the methodologies to future improvements resulting from research and technical assistance programs. All evaluations under this task will be based on the issue-identification methodology presented in Appendix C of NUREG-0960, "Draft Site Characterization Analysis."

SNLA will evaluate the adequacy of current and past NRC programs in fulfilling the requirements of a particular component of the methodology on a case by case basis. SNLA will assess the products contributing to the methodology and will document any inconsistencies or omissions. SNLA will report these findings in a letter report and will include recommendations for improved integration of products.

SNLA staff will attend technical meetings, workshops, and contractor meetings related to licensing-assessment issues, upon agreement with the NMSS PM. The meetings attended under this task will be documented in a trip report that will be

submitted to the PM. The trip reports will include a discussion of the meeting's relationship to the task, a summary of the topics discussed, and recommendations for additional topics and meetings, if necessary. All comments by SNLA will be made in light of the objectives described in the previous sections.

SNLA will assist the NRC staff in the development of technical positions related to the licensing-assessment methodology. This assistance will be performed on an as-needed basis, as directed by the NMSS PM.

**TASK 2: Monitoring and Reviewing the Performance Assessment Aspects of DOE and Other National and International Waste Management Programs**

The purpose of this task is to keep the NRC informed as to what other agencies and programs are doing to the area of nuclear waste management performance assessment. With this information, the NRC can avoid duplication of efforts, benefit from the data and insights from other programs, and provide direction to the DOE in order to expedite the license application and review procedures.

SNLA will monitor and review recently completed and on-going non-NRC programs, reports, models, computer codes, and assessment techniques that may contribute to the NRC performance assessment capability. The selection of the material to be monitored and reviewed will be at the direction of the NMSS PM. Computer codes selected for review will not be run as part of the review unless directed to do so in writing by the NMSS PM. SNLA will not critique the DOE performance-assessment work being done at SNLA.

Reviews performed under Task 2 will be written by SNLA staff or by subcontractors to SNLA who are approved by the NMSS PM.

To facilitate the monitoring and reviewing of these computer codes and research programs, SNLA will participate in review meetings and trips to field sites and contractor facilities at the mutual agreement of the NMSS PM and SNLA. All contacts between SNLA and DOE or their contractors will follow the procedures agreed to by the NRC and DOE for prior notification of these contacts.

In some cases, a reviewed computer code, document, report, or program cannot be evaluated without a prior evaluation of a referenced or accompanying document. For such a case, the relevant portions of the referenced document(s) should be reviewed also. This additional review need not be performed if

the referenced document has been reviewed fully for the NRC under this contract or if a review is available to the NRC in some other form unless the reviewer has unique insights to the topic(s) covered.

Reviews of computer codes performed by SNLA under this task will evaluate the codes in terms of the guidelines provided in the NRC technical position, "Documentation of Computer Codes for High-Level Waste Management," (NUREG-0856) and the follow-up document "Quality Assurance (QA) Plan for Computer Software Supporting the U.S. Nuclear Regulatory Commission's High-Level Waste Management Program" (NUREG/CR-4369).

**TASK 3: Identifying and Analyzing Quantitative Techniques for Assigning Probabilities of Occurrence to Potentially Disruptive Events and Processes**

Activities under this task will identify, analyze, and where necessary develop quantitative techniques for determining the probability of occurrence for potentially disruptive events and process that may affect repository performance. These probabilities are necessitated by the fact that the EPA Standard is based on risk, and include naturally occurring, repository-induced, and human-induced events and processes.

The events and processes to be considered are both common to all candidate sites and site specific. A preliminary list of the phenomena to be included in this study and a brief rationale for their inclusion has already been submitted to the NRC.

Techniques available for determining probabilities must fall into one of four categories:

- axiomatic - the event or process is represented by a probability model; the available data are used as input to the model; and probabilities are assessed based on the output of the model.
- frequentist - the data on the event or process are examined for frequency patterns; probabilities are assessed based on the frequency of the data; experiments may be used to obtain data.
- modeling - conceptual and mathematical models are developed; repeated simulations of the mathematical model are performed; probabilities are assessed based on the outcome of the simulations.
- subjective - existing data are examined; probabilities are assessed based on professional judgement.

In order to determine the status of probabilistic techniques for the various events and processes, SNLA selected a panel of experts to conduct a literature review. This review was expanded to include a review of how uncertainty has been handled in addition to the probabilistic techniques. The results of this study are currently going through technical review at SNLA and the NRC.

For the task of endorsing existing probabilistic techniques and where necessary developing new techniques, SNLA will select another panel of experts that may or may not contain members of the earlier panel. One or more experts in statistical methods will be included on the panel. Other NRC contractors will be included as appropriate. A list of the experts, along with each individual's name, area of expertise, professional affiliation, and any potential conflicts of interest, will be submitted to the NRC. The NRC may choose to add or delete experts from this list. Upon agreement between SNLA and the NRC on the final list, SNLA will contact the experts and request their membership on the panel. Substitutions may be made with the approval of the NMSS PM.

Each expert will be required to identify quantitative techniques for assigning probabilities of occurrence to potentially disruptive events and processes within the panelists's field of expertise. Previously identified techniques will be evaluated as to adequacy, strengths, and weaknesses in light of the type and amount of data that can be expected for the various candidate site(s). When more than one technique is available for a particular event or process, competing techniques will be compared and evaluated.

For some events and processes, new probability techniques will be developed or preexisting techniques must be modified. A particular event or process may require more than one technique depending on the amount and type of data that can be expected for that phenomenon at the various sites. Each of the techniques that may be applicable will have a description of the conditions under which its use is recommended as the technique of choice.

The panelists will submit their conclusions as individual chapters that will be combined into the final report. Each chapter will contain a description of the technique(s) endorsed, whether preexisting, modified, or newly developed, the circumstances under which the technique is to be used, the data requirements, and the uncertainty introduced by using a technique. References to published reviews of preexisting techniques should be included in appropriate chapters.

In general, SNLA will conduct this project on an individual rather than group basis. The NMSS PM will be notified in advance of any group meetings.

#### **TASK 4: Short-Term Technical Assistance**

SNLA will provide general technical assistance on waste management matters relating to Tasks 1 through 3, as requested in writing by the NMSS PM. The nature of this technical assistance will be to respond on relatively short notice to requests for information that is not provided in the normal course of work for the tasks as outlined in the statement of work. Scope, duration, reporting requirements, funding limits, and priorities for each short-term task will be set forth in writing by the NMSS PM. Costs for this task will not exceed six man-months of effort per year.

#### **4. DESCRIPTION OF ANY FOLLOW-ON EFFORTS**

Efforts are expected to continue in the integration (Task 1), review (Task 2), and short-term technical assistance (Task 4). The portion of Task 3 devoted to identifying existing techniques for determining probabilities of potentially disruptive events and processes for consideration in performance assessment is nearing completion. An effort to develop new techniques or to endorse existing techniques for determining these probabilities will begin in FY87.

#### **5. RELATIONSHIP TO OTHER PROJECTS**

The following past and presently active NRC contracts relate to NRC and DOE performance assessment efforts, and shall be monitored by SNLA under this contract to avoid duplication of efforts.

- B-6986 Performance of Engineered Barriers (Golder Associates)
- A-4165 Preparation of Engineering Analyses for High-Level Waste Package (Aerospace Corporation)
- A-1266 Development of a Methodology for Performance Assessment of Nuclear Waste Repositories in Geologic Media Other than Bedded Salt (Sandia)
- A-0294 Technical Assistance in Seismo-Tectonic Impacts in Repositories (Lawrence Livermore)
- A-1166 Maintenance of Computer Programs (Sandia)
- A-1755 Coupled THM Assessments and Site Characterization Activities for Geologic Repositories (Sandia)
- A-1756 Geochemical Sensitivity Studies (Sandia)
- A-1380 Pre-closure Risk Assessment (Sandia)

A-3040 Geochem Assessment of Nuclear Waste Isolation  
(Lawrence Berkeley)

A-9041 Uncertainties in Long-Term Collective Dose and  
Health Effects from Geologic Disposal of HLW (Oak  
Ridge)

## 6. REPORTING SCHEDULE

The types of reports required are monthly letter status reports, proposals, technical letter reports, and formal technical reports. Technical letter and formal technical reports shall be submitted in draft for NRC review and comment prior to being issued. In addition, SNLA will prepare program plans for Tasks 1 and 3. The program plans shall provide a list, by task, plans for Tasks 1 and 3. The program plans shall provide a list, by task, of SNLA staff and subcontractors expected to contribute to each task. The NMSS PM will provide comments on a submitted program plan to SNLA within 15 working days of its receipt. Work done under this contract shall conform to the final program plans, as agreed to by the contractor and the NMSS PM.

Monthly letter status reports will summarize (1) the work performed during the previous month, (2) personnel time expenditures during the previous month, and (3) costs generated against the work effort. All monthly reports will also contain a breakout of (1) staff months utilized; (2) costs incurred for direct salaries, material and services, ADP support, subcontracts, travel, and other costs, and (3) current obligation status information for the project. The format for this financial information will be that suggested in FORM NRC-489, Chapter NRC-1102, "Procedures for Placement of Work with the Department of Energy."

A reporting schedule is given in Table 1. No more than 30 copies of any technical letter report will be furnished to the NRC PM.

W. L. Garner, Supervisor, Technical Writing Division, SNLA, has been designated as the authorizing official for publications for NRC Form 426.

## 7. SUBCONTRACTOR INFORMATION

Subcontracts will be placed with experts in the areas of geology, hydrology, thermomechanics, and probability, as required and to the extent that this type of expertise is not available within SNLA.

## 8. CAPITAL EQUIPMENT REQUIRED

Not applicable.

10 CONFLICT OF INTEREST INFORMATION

No significant contractual or organizational relationships of SNLA, its employees, or anticipated subcontractors and/or consultants exist with industries regulated by the NRC and suppliers thereof that might give rise to an apparent or actual conflict of interest.

1. REPORTING SCHEDULE

<u>ITEM</u>	<u>REPORT TYPES</u>	<u>DRAFT DUE DATE</u>	<u>COPIES</u>
Task 1 and 3 Program Plans	Proposal	A	8
Monthly Letter Status Reports	Monthly Letter	15th of the following month	11 each
Technical Progress Reports	Technical Letter		11 each
Task 1 Final Reports	Formal Technical	Finish Task Plus 1 Month	11 each
Task 2 Letter Reports	Letter	B	11
Task 3 Final Report	Formal Technical		
Literature Review		6/30/87	11
Technique Development		8/30/88	11
Performance Assessment Program Overviews	Technical Letter	B	11 each
Task 3 Expert List	Letter	A	8 each
Task 3 Expert List	Letter	A	8 each
Subcontractor Reports, Journal Publications, and Conference Papers not included in the preceding reports	Technical Letter	B	11 each
Short-term Technical Assistance Products	B	B	B

A As agreed to by NMSS PM and SNLA upon acceptance of the 189

B As agreed to by NMSS PM and SNLA on case by case basis