

PROGRAM:        Licensing-Methodology Assistance

FIN A1165  
Task I

CONTRACTOR:    Sandia National  
                 Laboratories

BUDGET PERIOD: 10/87 -  
                 9/88

NMSS PROGRAM MANAGER:        D. Galson

BUDGET AMOUNT: \$248K

CONTRACT PROGRAM MANAGER:    N. R. Ortiz

FTS PHONE:    844-5644

PRINCIPAL INVESTIGATORS:    E. J. Bonano  
                                 P. A. Davis

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#### PROJECT OBJECTIVE

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

#### ACTIVITIES DURING JUNE 1988

E. Bonano participated in the seventh meeting of the Probabilistic Safety Assessment Codes Users Group (PSAC). The meeting was held from June 20th through June 23rd in Braunschweig, Germany. A letter report summarizing his observations was forwarded to the NMSS PM on July 1st.

In response to a request from D. Galson, the NMSS former PM, to N. Ortiz dated June 6th, Sandia prepared a table that will be used from this point forward to present expenditures on a report by report basis. This table will also present an estimate of the report completion status. A sample of the table was forwarded to the NRC PM on July 1st. The complete table will be discussed with NRC staff on July 22nd.

#### Subtask 1.1

I. Interim report: compilation of parameters and components of an overall licensing assessment methodology and development of a tracking scheme.

Sandia is still waiting for NRC comments on this report. As a result of responses to these comments the final report discussed below will be prepared.

#### II. Critical parameters and components for licensing assessment

Following the response to the comments on the interim report above, this formal report will be a revised version of the former. SNLA expects to submit the draft of this report to NRC within 2 months following the receipt of NRC comments on the interim report. It is

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Sandia's understanding that no further work will be performed on the tracking scheme beyond a description in writing of the approach suggested. During the month of June, Sandia staff and contractors working in this report conducted several meetings as well as initiated some revisions of the report based on internal reviews of the interim report. The main topic discussed in these meetings was deciding on how to define "importance" from the point of view of parameters required to exercise performance assessment models. Arriving at a consensus on the definition of importance is imperative for the completion of this formal report since the basic difference between the report and its predecessor (interim report) is the identification and ranking of important variables. Attached to this monthly is a draft definition of importance and a discussion of its meaning. We look forward to receiving any comment the NRC would have on this topic.

### Subtask 1.2

#### I. Compilation, comparison, and evaluation of computer codes for licensing assessment

In order to efficiently gather as much information on as many codes as possible, we are coordinating this effort with two other NRC projects here at Sandia. These projects are the Low-Level Waste Program (FIN A1764) and the High-Level Waste Research Program (FIN A1266). The LLW program is involved in identifying and evaluating codes to be used for LLW performance assessment and the HLW program has been performing comparative studies on unsaturated flow and transport codes. From now on these efforts will be coordinated to avoid unnecessary duplication of effort in identifying and evaluating codes.

### Subtask 1.3

#### I. Modeling efforts needed to support a HLW repository license application

This report has been merged with the formal report in subtask 1.1.

#### II. Processes for which validated models will not exist at the time of a HLW repository license application.

A final outline for this report is in progress. This outline will be discussed with the NRC program manager at an upcoming meeting.

#### III. Recommended approaches for evaluating the application of HLW disposal system models

This report will provide a set of guidelines to NRC staff to follow in the evaluation of models used by DOE. The expected due date is 11/30/88.

#### IV. Review of the NRC's modeling strategy document for HLW performance assessment

Several of the staff members performed a cursory review of the modeling strategies document. A more detailed review will be conducted in the future.

V. A technical basis for NRC review of HLW repository modeling programs

No activity.

Subtask 1.4

I. Performance assessment program reviews

No activity this month.

PROGRAM: Identification and Analysis of  
Uncertainties

FIN A1165  
Task II

CONTRACTOR: Sandia National  
Laboratories

BUDGET PERIOD: 10/87 -  
9/88

NMSS PROGRAM MANAGER: D. Galson

BUDGET AMOUNT: \$495K

CONTRACT PROGRAM MANAGER: N. R. Ortiz

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PRINCIPAL INVESTIGATORS: E. J. Bonano  
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#### PROJECT OBJECTIVE

To identify, analyze, and recommend generic methodologies for treating uncertainties associated with performance assessments of HLW repositories.

#### ACTIVITIES DURING JUNE 1988

##### Subtask 2.1

I. Recommended techniques for assessing compliance with the EPA's HLW repository containment requirement (40CFR191.13)

No Activity.

##### Subtask 2.2

I. Identification, evaluation, quantification, and reduction of uncertainty in HLW repository performance assessments: a preliminary report.

SNLA is addressing the NRC comments on this report. The response to these comments will be provided to the NRC, along with the final report by September 30, 1988.

##### Subtask 2.3

I. Elicitation and use of expert judgement in dealing with uncertainty in HLW repository performance assessments.

A meeting is scheduled for July 25th and 26th to begin work on this report. This meeting will involve Ralph Keeny (USC), Detlof von Winterfeldt (USC), Steve Hora (U. of Hawaii), the relevant Sandia staff, and the NRC program manager.

##### Subtask 2.4

I. Methods for analyzing uncertainty in HLW repository performance assessment models.

No Activity.

II. Approaches to building confidence in HLW repository performance assessment models.

No Activity.

Subtask 2.5

I. Methodology for scenario development and screening.

No Activity.

Subtask 2.6

I. Recommended methodologies for the analysis of data and parameter uncertainty in HLW repository performance assessment.

Work on this report involved the review and revision of Alan Gutjhar's chapter on uncertainty in ground-water flow which was part of the subtask 3.1 report. This chapter will become a section in the subtask 2.6 report.

II. The use of expert judgement to estimate data and parameter uncertainty.

This report has been merged with the formal report on Subtask 2.3.

III. Identification, analysis, quantification, and reduction of data and parameter uncertainty in HLW repository performance assessment.

No Activity.

IV. Uncertainty and sensitivity analysis in ground-water flow modelling.

A meeting was held with Randy Hanson of the USGS Tucson office to discuss the simulations to be performed under this task. The available geologic and hydrologic data for the site were discussed and decisions were made concerning the conceptual model to be used, the codes to be used, and the appropriate discretizations. The actual data will be provided on IBM diskettes during July.

V. Recommended procedures for obtaining data and parameter uncertainty from site characterization data.

No Activity.

PROGRAM: Probability Techniques

FIN A1165  
Task III

CONTRACTOR: Sandia National  
Laboratories

BUDGET PERIOD: 10/87 -  
9/88

NMSS PROGRAM MANAGER: D. Galson

BUDGET AMOUNT: \$240K

CONTRACT PROGRAM MANAGER: N. R. Ortiz

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PRINCIPAL INVESTIGATORS: E. J. Bonano  
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#### PROJECT OBJECTIVE

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

#### ACTIVITIES DURING JUNE 1988

##### Subtask 3.1

I. Techniques for estimating probabilities of events and processes affecting the performance of geologic repositories: a literature review.

A draft copy of this report has been sent to the NRC program manager. The report is also going through the internal Sandia review process. This process is expected to take about 2 months.

##### Subtask 3.2

I. Recommended techniques for estimating probabilities of events and processes affecting the performance of geologic repositories: assessing compliance with the EPA's containment requirements (40CFR191.13).

No activity.

PROGRAM: Maintenance and Management  
of PA Codes

FIN A1165  
Task IV

CONTRACTOR: Sandia National  
Laboratories

BUDGET PERIOD: 10/87 -  
9/88

NMSS PROGRAM MANAGER: D. Galson

BUDGET AMOUNT: \$5K

CONTRACT PROGRAM MANAGER: N. R. Ortiz

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PRINCIPAL INVESTIGATORS: E. J. Bonano  
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#### PROJECT OBJECTIVE

To provide for a program of computer code maintenance and configuration management for codes developed for the NRC's HLW performance assessment program.

#### ACTIVITIES DURING JUNE 1988

##### Subtask 4.5

No Activity.

PROGRAM: Technical Assistance for SCP Review

FIN A1165  
Task V

CONTRACTOR: Sandia National  
Laboratories

BUDGET PERIOD: 10/87 -  
9/88

NMSS PROGRAM MANAGER: D. Galson

BUDGET AMOUNT: \$45K

CONTRACT PROGRAM MANAGER: N. R. Ortiz

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PRINCIPAL INVESTIGATORS: E. J. Bonano  
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#### PROJECT OBJECTIVE

To develop internal staff guidance for review of the draft consultation SCP's and final SCP's in the area of performance assessment, to review selected parts of the draft and final SCP's, and to review NRC staff comments on selected parts of the draft and final SCP's.

#### ACTIVITIES DURING JUNE 1988

No activity this month.



PROGRAM: Short-Term Technical Assistance

FIN A1165  
Task VI

CONTRACTOR: Sandia National  
Laboratories

BUDGET PERIOD: 10/87 -  
9/88

NMSS PROGRAM MANAGER: D. Galson

BUDGET AMOUNT: \$64K

CONTRACT PROGRAM MANAGER: Nr. R. Ortiz

FTS PHONE: 844-5644

PRINCIPAL INVESTIGATORS: E. J. Bonano  
P. A. Davis

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#### PROGRAM OBJECTIVE

To provide, on short notice, general technical assistance on HLW matters related to Tasks 1 through 5 that would not be provided in the normal course of the work in these tasks.

#### ACTIVITIES DURING JUNE 1988

No activity this month.

FIN A1165  
 Total for Case 1183.000  
 June 1988

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)	2.3 ---	27.8 ---
II. Direct Loaded Labor Costs	23	262
Materials and Services	0	10
ADP Support (computer)	1	1
Subcontracts	54	249
Travel	2	22
G&A	9	56
Other (computer roundoff)	-1	-2
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TOTAL COSTS	88	598

### III. Funding Status

Prior FY Carryover -----	FY 88 Projected Funding Level -----	FY 88 Funds Received to Date -----	FY 88 Funding Balance Needed -----
\$267K	\$1067K	\$800K	None

FIN A1165, Task I - Licensing Methodology Assistance  
 Subcase 1183.010  
 June 1988

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)	1.2 ---	18.3 ---
II. Direct Loaded Labor Costs	11	165
Materials and Services	0	9
ADP Support (computer)	0	0
Subcontracts	-12	37
Travel	1	11
G&A	0	23
Other (computer roundoff)	0	-1
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TOTAL COSTS	0	244

### III. Funding Status

Prior FY Carryover -----	FY 88 Projected Funding Level -----	FY 88 Funds Received to Date -----	FY 88 Funding Balance Needed -----
\$68K	\$248K	\$180K	None

FIN A1165, Task II - Identification and Analysis of Uncertainties  
 Subcase 1183.020  
 June 1988

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)	1.1 ---	4.6 ---
II. Direct Loaded Labor Costs	12	51
Materials and Services	0	1
ADP Support (computer)	1	1
Subcontracts	53	87
Travel	1	9
G&A	7	15
Other (computer roundoff)	-1	0
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TOTAL COSTS	73	164

### III. Funding Status

Prior FY Carryover -----	FY 88 Projected Funding Level -----	FY 88 Funds Received to Date -----	FY 88 Funding Balance Needed -----
\$60K	\$495K	\$435K	None

FIN A1165, Task III - Probability Techniques  
 Subcase 1183.030  
 June 1988

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 ---
II. Direct Loaded Labor Costs	0	11
Materials and Services	0	0
ADP Support (computer)	0	0
Subcontracts	5	45
Travel	0	0
G&A	1	5
Other (computer roundoff)	0	1
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TOTAL COSTS	6	62

### III. Funding Status

Prior FY Carryover -----	FY 88 Projected Funding Level -----	FY 88 Funds Received to Date -----	FY 88 Funding Balance Needed -----
\$120K	\$190K	\$70K	None

FIN A1165, Task IV - Maintenance and Management of PA Codes  
 Subcase 1183.040  
 June 1988

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 —	.3 —
II. Direct Loaded Labor Costs	0	2
Materials and Services	0	0
ADP Support (computer)	0	0
Subcontracts	5	29
Travel	0	0
G&A	1	3
Other (computer roundoff)	0 —	0 —
TOTAL COSTS	6	32

### III. Funding Status

Prior FY Carryover -----	FY 88 Projected Funding Level -----	FY 88 Funds Received to Date -----	FY 88 Funding Balance Needed -----
None	\$5K	\$5K	None

FIN A1165, Task V - Technical Assistance for SCP Review  
 Subcase 1183.050  
 June 1988

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 ---	3.6 ---
II. Direct Loaded Labor Costs	0	33
Materials and Services	0	0
ADP Support (computer)	0	0
Subcontracts	3	51
Travel	0	2
G&A	0	10
Other (computer roundoff)	0 ---	0 ---
TOTAL COSTS	3	96

### III. Funding Status

Prior FY Carryover -----	FY 88 Projected Funding Level -----	FY 88 Funds Received to Date -----	FY 88 Funding Balance Needed -----
None	\$90K	\$90K	\$None

FIN A1165, Task VI - Short Term Technical Assistance  
 Subcase 1183.060  
 June 1988

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 -----	0.0 -----
II. Direct Loaded Labor Costs	0	0
Materials and Services	0	0
ADP Support (computer)	0	0
Subcontracts	0	0
Travel	0	0
G&A	0	0
Other (computer roundoff)	0	0
TOTAL COSTS	0 -----	0 -----

### III. Funding Status

Prior FY Carryover -----	FY 88 Projected Funding Level -----	FY 88 Funds Received to Date -----	FY 88 Funding Balance Needed -----
\$19K	\$39K	\$20K	None



## **Important Phenomena and Parameters**

Questions have arisen as to the definition of the term "important" as applied to phenomena and parameters pertinent to high-level nuclear waste (HLW) disposal and isolation. SNLA staff has addressed this issue, as it is necessary that an accepted definition be determined in order to complete the Subtask 1.1 formal report.

Initially included in this work was a review of the report "Critical Parameters for a High-Level Waste Repository, Volume 2: Tuff," by E.P. Binnall, and others. Although the investigators for this report determined a number of parameters as being "critical," and further prioritized the criticality of these for different repository phases, we felt that their definition of "critical," (if taken to be the same as "important") was inadequate for the purposes of satisfying the criteria in the Subtask 1.1 formal report. In the context of the report by Binnall and others, "a parameter is considered to be 'critical' if a mistake in its measurement, or the inability to measure it, could lead to the wrong conclusions about the adequacy of a repository." This definition seems to imply that if a parameter is known with complete certainty, it is no longer critical. Although we agree that the uncertainty of a parameter should be considered when evaluating the importance of that parameter, we also feel that the relative impact that the parameter may have on the site's ability to show compliance with the appropriate regulations, independent of the uncertainty, should also be considered. The same argument follows for important phenomena. The report, nevertheless, does provide some useful insight as to which parameters should be considered, parameter ranges, whether or not a given parameter is site sensitive, parameter values which may signal trouble, and some sources of uncertainty in measurement.

Following the discussions with SNLA staff, it has been decided that two alternative definitions for "Important phenomena and parameters" should be considered: one for the pre-licensing phase and one during the licensing phase. The definitions are as follows:

- 1) Phenomena and parameters defined as important to the NRC staff prior to a repository license application would be those which could have a significant impact on the direction to be followed by the DOE for site characterization and modeling efforts. This would be considered a pre-licensing criterion for importance.
- 2) Phenomena and parameters defined as important at the time of licensing would be defined as those which could have a significant impact on a specific repository's ability to achieve compliance with the regulations over the given regulatory period. This would be considered a criterion for importance during the licensing process.

Both definitions are effectively based on the impact or effect, as implied by the definition of the term sensitivity, that a given phenomenon or parameter will have on repository performance. However, whereas the first definition relies on the magnitude of the current uncertainty to provide the direction to decrease this uncertainty through increased data collection or modeling efforts, the second definition incorporates the current uncertainty in the

definition of "importance" for purposes of evaluating the license application.

The importance of a given phenomenon or parameter will be site specific, scenario specific, and analysis specific and may also be a function of time. It can be based on the specific requirement or process under consideration or can be based on the overall repository performance.

A semi-quantitative definition for "importance" is given below:

$$\text{Importance} = \text{effect} * (1 + \text{coefficient of variation})$$

where the coefficient of variation is the standard deviation divided by the mean. The reasoning behind including the factor of one (1) in the coefficient of variation term is that, although a given phenomenon or parameter may be known with zero uncertainty (ideally), it may still have a large effect and would consequently be deemed important. The effect term may be based on the order of the effect (e.g., GWTT -> conductivity -> hydraulic gradient -> hydraulic head), in which case the effect would be defined as the reciprocal of the order, or may be based on sensitivity analysis, in which case the effect would be proportional to the relative impact.

Reference:

Binnall, E.P., Benson, S.M., Tsao, L., Wollenberg, H.A., Tokunga, T.K., and Didwall, E.M., 1987, "Critical Parameters for a High-Level Waste Repository, Volume 2: Tuff" : U.S. Nuclear Regulatory Commission, NUREG/CR-4161, Washington, D.C..