

Sandia National Laboratories

Albuquerque, New Mexico 87185

April 15, 1988

Dr. Daniel Galson
Operations Branch
Division of High-Level Waste Management
Office of Nuclear Materials Safety
and Safeguards
U.S. Nuclear Regulatory Commission
Mail Stop 4D16
Washington, DC 20555

Dear Dr. Galson:

Enclosed is the March 1988 monthly report for FIN A1165. If you have any questions or comments, please feel free to contact me at (FTS) 844-8368, E. J. Bonano at (FTS)844-5303, or P. A. Davis at (FTS)846-5421.

Sincerely,



Robert M. Cranwell, Supervisor
Waste Management Systems
Division 6416

RMC:6416

Enclosure

Copy to:

Office of the Director, NMSS
Attn: Program Support
Robert Browning, Director
Division of High-Level Waste Management
Seth Coplan
Division of High-Level Waste Management
John Randall
Division of Engineering
6410 N. R. Ortiz
6416 R. M. Cranwell
6416 E. J. Bonano
6416 P. A. Davis

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A-1165 DCD

*A1165
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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: R. M. Cranwell FTS PHONE: 844-8368

PRINCIPAL INVESTIGATORS: E. J. Bonano FTS PHONE: 844-5303
P. A. Davis FTS PHONE: 846-5421

PROJECT OBJECTIVE

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

ACTIVITIES DURING MARCH 1988

Sandia staff working on FIN A1165 participated in a meeting on Performance Assessment with NRC staff and management held March 15 and 16 at Sandia National Laboratories, Albuquerque. P. Davis, co-principal investigator for FIN A1165, gave a presentation summarizing the objectives and activities under this program. Preparation of this presentation required approximately one day.

Subtask 1.1

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

Most of the activity in this subtask during the month of March was associated with the preparation of this report. The following individuals worked on it: E. Bonano, P. Davis, I. Hall, C. Harlan, D. Gallegos, L. Paul, K. Wahi, M. Goodrich, and R. Guzowski. The report was completed in time and forwarded to the NRC PM. The extensive discussions in this report have allowed Sandia to complete a large portion of the work required for the formal report on the licensing assessment methodology. In addition, the discussion on the modeling efforts required to address each of the requirements in both 10 CFR Part 60 and 40 CFR Part 191 (Chapter 2 of the letter report) satisfies the completion of the letter report on modeling efforts to support a license application (see Subtask 1.3).

II. Critical parameters and components for licensing assessment

The preparation of this formal report is, for all practical purposes, a revision of the interim letter report completed in March. Sandia

expects the NRC staff to review the letter report and prepare comments that will be addressed by Sandia as part of the preparation of the formal report. Given that the letter report includes more detailed discussions than originally anticipated, Sandia estimates that the formal report is approximately 70% complete.

Subtask 1.2

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

Work on this report was initiated as part of the preparation of the interim report in Subtask 1.1. As the preparation of that letter report progressed, codes were being identified and compiled. Consequently, this report is about 10% complete at this time.

Subtask 1.3

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

As was discussed above (Subtask 1.1), Sandia believes that the discussion in Chapter 2 of the letter report on the overall licensing assessment methodology directly satisfies the objectives of this letter report. Consequently, a separate letter report summarizing modeling efforts needed to support a license application for a HLW repository would be a repetition of Chapter 2 of the interim report in Subtask 1.1. This issue will be discussed at the upcoming program review for FIN A1165.

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

No activity.

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

No activity.

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

Even though, formal review of this document has not begun, the document has been reviewed as part of preparing the interim report on Subtask 1.1 and in the preparation of presentations given on March 15 - 16.

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

No activity.

Subtask 1.4

I. Performance assessment program reviews

No activity during March.

Management Issues

Of the \$10K discrepancy on staff time found and reported in the February monthly progress report, \$5K have been corrected. These changes are reflected in the budget reports for March. The remainder \$5K should be corrected during April.

Even though Sandia did not request an extension in the due date for the interim report on Subtask 1.1, it is felt that an extension will be necessary in the due dates for the remaining reports in FIN A1165. This extension is needed because, at NRC's request, the completion of the review guides for the SCP took approximately 2 1/2 months longer than initially anticipated. As a result, completion of the letter report on the overall licensing assessment methodology required that the work in other NRC HLW programs be pre-empted. A request will be made to NRC at the upcoming program review for an extension of the deadlines across the board.

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

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)	3.7	10.8
II. Direct Loaded Labor Costs	38	100
Materials and Services	0	2
ADP Support (computer)	0	0
Subcontracts	40	52
Travel	2	4
G&A	8	16
Other (computer roundoff)	-2	+1
	<u> </u>	<u> </u>
TOTAL COSTS	86*	175

III. Funding Status

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

*Includes \$5K of staff-time charges that need to be corrected.

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: R. M. Cranwell

FTS PHONE: 844-8368

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

FTS PHONE: 844-5303
FTS PHONE: 846-5421

PROJECT OBJECTIVE

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

ACTIVITIES DURING MARCH 1988

Subtask 2.1

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

A paper was published in Science by J. E. Campbell and R. M. Cranwell which summarizes the approach advocated by Sandia for the assessment of compliance with the EPA's containment requirement. This paper will serve as the basis for the report that will be prepared under this subtask. Based on this paper, the report is approximately 10% complete.

Subtask 2.2

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

No activity. Sandia is still waiting for written NRC comments on the scoping document prepared last FY. It is anticipated that the report can be completed four months after receipt of the comments.

Subtask 2.3

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

The start-up of this subtask has been delayed because the consultants that will assist Sandia in this activity are still involved in the completion of NUREG-1150 - the Reactor Risk Reference Document. This issue will be discussed with NRC at the upcoming program review.

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.

A new section on expert opinion was written for inclusion in this report. All suggested changes have been incorporated into a revised version of the report. At this time, Sandia only needs to examine problem areas discussed at the last meeting of the PAAG scenario working group. This report is practically complete.

Subtask 2.6

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

A hand-written draft of this report has been prepared and will be examined by Sandia staff. This report seems to be about 45-50% complete.

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

No activity this month. Sandia feels that the contents of this report will be a repetition of sections of the report on expert judgement to be prepared under Subtask 2.3. Consequently, a request will be made to NRC at the upcoming program review that the report on expert judgement for estimating data and parameter uncertainty be eliminated in lieu of the related sections in the report in Subtask 2.3.

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

No activity.

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

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 -----	2.3 -----
II. Direct Loaded Labor Costs	1	28
Materials and Services	0	1
ADP Support (computer)	0	0
Subcontracts	7	19
Travel	3	8
G&A	1	6
Other (computer roundoff)	-1 -----	-1 -----
TOTAL COSTS	11	61

III. Funding Status

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

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: R. M. Cranwell

FTS PHONE: 844-8368

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

FTS PHONE: 844-5303
FTS PHONE: 846-5421

PROJECT OBJECTIVE

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

ACTIVITIES DURING FEBRUARY 1988

Subtask 3.1

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

No activity this month. This report is essentially complete with the exception that the chapters in hydrology and geochemistry need to be removed.

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 this month.

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

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	0.7
II. Direct Loaded Labor Costs	0	8
Materials and Services	0	0
ADP Support (computer)	0	0
Subcontracts	14	24
Travel	0	0
G&A	1	3
Other (computer roundoff)	0	0
TOTAL COSTS	15	35

III. Funding Status

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

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: R. M. Cranwell FTS PHONE: 844-8368

PRINCIPAL INVESTIGATORS: E. J. Bonano FTS PHONE: 844-5303
P. A. Davis FTS PJONE: 846-5421

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 FEBRUARY 1988

Subtask 4.5

C. Harlan and G. Wilkinson attended the Waste Management 88 conference in Tucson, Az on March 1-3 and presented a paper titled "Quality Assurance and Maintenance of Waste Management Computer Software." The paper describes the implementation of the QA Plan (NUREG/CR-4369) at Sandia. Copies of the transparencies used in the presentation are included as an attachment to this monthly progress report.

P. Davis and C. Harlan provided some consulting to Larry Flournoy of InSitu, Inc. (NRC Contractor) on the SWIFT II code.

As a result of the reappropriation of funds originally under Task 4 to Task 5 the following code-maintenance efforts planned for FY88 will not be carried out:

1. QA and installation of the Dosimetry and Health Effects (DHE) code.
2. Correction of errors identified in SWIFT II, testing of the version against the 8 sample problems, and release of a new version of the code including informal documentation.
3. Generalization and integration of the Code Coupler Programs in support of applying a performance assessment methodology.
4. Guarantee of reproducibility of results obtained with computer codes described in published reports and papers (This is considered part of QA according to NUREG/CR-4369).
5. Routine maintenance of the existing software libraries at Sandia and INEL.

6. Modifications to existing software library due to major changes in hardware either at Sandia or INEL (Sandia will phase out the CDC computer system in which the software library resides by June 1989.).

Management Issues

A total of \$45K were reappropriated from this task to Task 5. Costs in the amount of \$5K incurred under FIN A1158 have been moved to Task 4. At present all funds in this task have been spent.

FIN A1165, Task IV - Maintenance and Management of PA Codes
 Subcase 1183.040
 March 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)	.3 —	.3 —
II. Direct Loaded Labor Costs	2	2
Materials and Services	0	0
ADP Support (computer)	0	0
Subcontracts	5	5
Travel	0	0
G&A	0	0
Other (computer roundoff)	0 —	0 —
TOTAL COSTS	7	7

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

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: R. M. Cranwell FTS PHONE: 844-8368

PRINCIPAL INVESTIGATORS: E. J. Bonano FTS PHONE: 844-5303
P. A. Davis FTS PHONE: 846-5421

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 MARCH 1988

No activity this month.

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

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)	0.0	3.6
II. Direct Loaded Labor Costs	0	33
Materials and Services	0	0
ADP Support (computer)	0	0
Subcontracts	-9	30
Travel	0	2
G&A	0	8
Other (computer roundoff)	0	-1
	<u> </u>	<u> </u>
TOTAL COSTS	-9	72

III. Funding Status

<u>Prior FY Carryover</u>	<u>FY 88 Projected Funding Level</u>	<u>FY 88 Funds Received to Date</u>	<u>FY 88 Funding Balance Needed</u>
None	\$90K	\$90K	\$None

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: R. M. Cranwell

FTS PHONE: 844-8368

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

FTS PHONE: 844-5303
FTS PHONE: 846-5421

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 MARCH 1988

No activities.

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

THIS IS AN ESTIMATE ONLY AND MAY NOT MATCH THE INVOICES SENT TO NRC B
 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	-1	0
G&A	0	0
Other (computer roundoff)	0	0
TOTAL COSTS	----- -1	----- 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

FIN A1165
 Total for Case 1183.000
 March 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)	4.0 -----	16.7 -----
II. Direct Loaded Labor Costs	41	171
Materials and Services	0	3
ADP Support (computer)	0	0
Subcontracts	57	131
Travel	4	13
G&A	10	33
Other (computer roundoff)	-3	-1
	-----	-----
TOTAL COSTS	109*	350

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

*Includes \$5K of staff-time charges that need to be corrected.

**QUALITY ASSURANCE
AND MAINTENANCE
OF
WASTE MANAGEMENT
COMPUTER SOFTWARE**

C. P. HARLAN AND G. F. WILKINSON

WASTE MANAGEMENT SYSTEMS DIVISION 6416

SANDIA NATIONAL LABORATORIES

ALBUQUERQUE, NM 87185

DEMONSTRATION OF A HIGH-LEVEL WASTE REPOSITORY PERFORMANCE ASSESSMENT

- **BEDDED SALT SITE**

**R. M. Cranwell et al.,
Risk Methodology for Geologic Disposal of Radioactive
Waste; Final Report, NUREG/CR-2452, SAND 81-2573,
Sandia National Laboratories, Albuquerque, NM, 1987.**

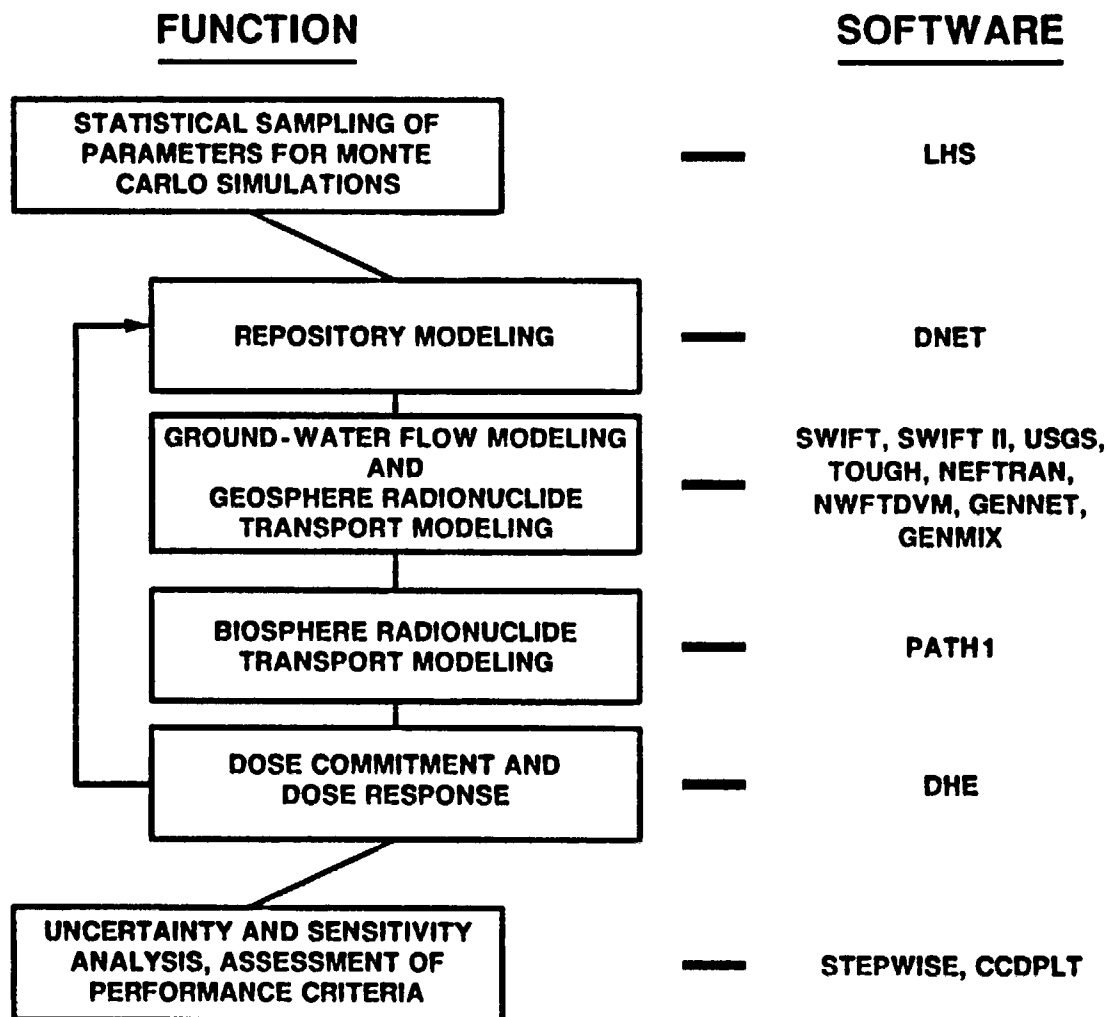
- **BASALT SITE**

**E. J. Bonano et al.,
Demonstration of a Performance Assessment Methodology
for High-Level Waste Disposal in Basalt Formations,
NUREG/CR-4759, SAND 86-2325, Sandia National Laboratories,
Albuquerque, NM, (to be published).**

- **TUFF SITE**

Methodology is being developed

RELATIONSHIP OF SOFTWARE IN A HIGH-LEVEL WASTE REPOSITORY PERFORMANCE ASSESSMENT



REASONS FOR A QA PLAN

The potential use of evaluation software in NRC licensing and regulation requires:

- **Confidence in results generated by the software**
- **Retrievability of all versions of a code, even though they may not be executable on the current hardware**
- **Traceability of any modifications made to the standard version of a code for specific applications**
- **Reproducibility of results generated and published in reports**
- **Justifiability of conclusions drawn from code results**

QA PLAN, NUREG / CR-4369

Quality Assurance (QA) Plan for Computer Software Supporting the U.S. Nuclear Regulatory Commission's High-Level Waste Management Program

Developed for the NRC by Sandia National Laboratories

Published January 1987

Authors: G. F. Wilkinson and G. E. Runkle

APPROACH

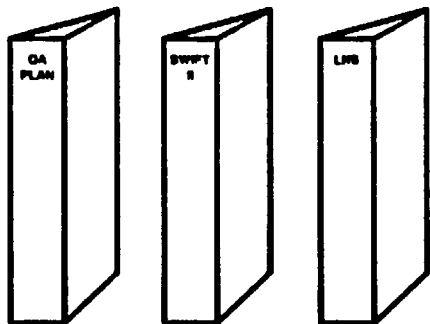
- **Maintain standard versions of codes, User's Manual or Self-Teaching Curriculum, Sample problems, execution procedures**
- **Maintain non-standard versions of codes, trace of modifications to the standard version, any data files used in producing published results**
- **Record code errors, release new code versions, document changes, inform NRC**
- **Backup or archive all files**

QA ENFORCEMENT THROUGH THE MANUSCRIPT REVIEW PROCESS

**QA COORDINATOR MUST SIGN-OFF TO
GUARANTEE REQUIREMENTS ARE MET**

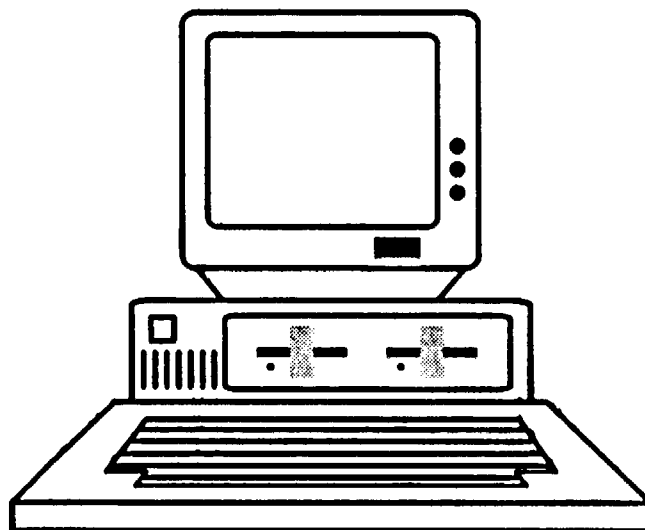
- **USER'S MANUAL FOR A NEW CODE**
 - **User's Manual Must comply with NUREG/CR-0856**
 - **QA Coordinator provided with code and sample problems**
- **REPORT CONTAINING NUMERICAL RESULTS**
 - **QA Coordinator provided with version of code used and data files**
 - **Ensure reproducibility of results**

CODE MAINTENANCE COMPONENTS



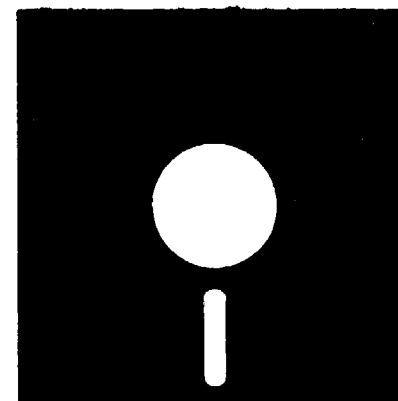
PHYSICAL LIBRARY

**REPORTS, PROCEDURES, LISTINGS
SAMPLE PROBLEM
INPUT AND OUTPUT**



SOFTWARE LIBRARY

**CODES, SAMPLE PROBLEMS
INTERACTIVE ON-LINE HELP**



SYSTEM BACKUP

**MAGNETIC TAPE
DISKETTES**

```

      QQQQQQ      UU      UU      AA      LL      |IIIIIIII|      BBBBDDDD
      QQQQQQQ     UU      UU      AAAA     LL      |IIIIIIII|      BBBBDDDD
      QQ      QQ  UU      UU      AA  AA     LL      |I  I  I|      DD      DD
      QQ      QQ  UU      UU      AA      AA     LL      |I  I  I|      BBBBDDDD
      QQ      QQ  UU      UU      AA      AA     LL      |I  I  I|      BBBBDDDD
      QQ      QQ  UU      UU      AA      AA     LL      |I  I  I|      DD      DD
      QQ      QQ  UU      UU      AA      AA     LL      |I  I  I|      DD      DD
      QQ      QQ  UU      UU      AA      AA     LL      |I  I  I|      DD      DD
      QQQQQQQ     UU      UU      AA      AA     LL      |IIIIIIII|      BBBBDDDD
      QQQQQQ  Q   UU      UU      AA      AA     LL      |IIIIIIII|      BBBBDDDD
      QQQQQQ      UU      UU      AA      AA     LL      |IIIIIIII|      BBBBDDDD
  
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 WASTE MANAGEMENT.**

**FOR INFORMATION ON THESE CODES, PRESS RETURN
 TO CONTINUE...**

88A6000.46

MENU FOR QUALIB DOCUMENTATION:

- | | |
|----------------------|-----------------------|
| 1 - SWIFT | 11 - PATH1 |
| 2 - SWIFT II | 12 - DNE |
| 3 - NWFTDYM | 13 - TOUGH |
| 4 - GENNET | 14 - CCDPLY |
| 5 - GENMIX | |
| 6 - NEFTAN | |
| 7 - DNET | |
| 8 - LHS | |
| 9 - USGS | |
| 10 - STEPWISE | 20 - EXIT MENU |

(SELECT A NUMBER AND PRESS RETURN)

88A6000.45

QUALIB DOCUMENTATION ON SWIFT II AS OF OCT 1, 1987:

SWIFT II INTERNAL DOCUMENTATION:

CODE NAME	SWIFT II
VERSION	RELEASE 4.84
DESCRIPTION	SWIFT II (SANDIA WASTE-ISOLATION, FLOW AND TRANSPORT MODEL) IS A DUAL POROSITY FULLY TRANSIENT 3D MODEL WHICH SOLVES THE COUPLED EQUATIONS FOR FLUID FLOW, HEAT TRANSPORT, BRINE TRANSPORT, AND RADIONUCLIDE TRANSPORT. THE FIRST THREE PROCESSES ARE COUPLED VIA FLUID DENSITY AND VISCOSITY. TOGETHER THEY PROVIDE THE VELOCITY FIELD ON WHICH THE FOURTH PROCESS DEPENDS.
LANGUAGE	ANSI STANDARD FORTRAN, VERSION 66
HARDWARE	CDC CYBER 76 SERIES MACHINES
LIBRARIES	NONE USED
EVOLUTION	INTERA TECHNOLOGIES, INC. 1975-1982 GEOTRAMS, INC. 1982-1984
DOCUMENTATION	(1) THEORY AND IMPLEMENTATION NUREG/CR-3328, SAND83-1159 (2) DATA INPUT GUIDE NUREG/CR-3162, SAND83-0242 (SELF-TEACHING CURRICULUM NUREG/CR-3925, SAND84-1586
SANDIA CONTACTS	PAUL A. DAVIS CHARLENE L. HARLAN GINGER F. WILKINSON

88A6000.40

SWIFT II FILES:

SWIFT II - SWIFT II (VERSION 4.04) UPDATE FORMAT
SWIISRC - SWIFT II SOURCE TO UPDATE PROCESSOR
SWIICMP - SWIFT II COMPILE FILE
SWIILGO - SWIFT II COMPILED BINARIES
SWI101 - SWIFT II SELF TEACHING CURRICULUM PROBLEM 1
SWI102 - SWIFT II SELF TEACHING CURRICULUM PROBLEM 2
SWI103 - SWIFT II SELF TEACHING CURRICULUM PROBLEM 3
SWI104 - SWIFT II SELF TEACHING CURRICULUM PROBLEM 4
SWI105 - SWIFT II SELF TEACHING CURRICULUM PROBLEM 5
SWI106 - SWIFT II SELF TEACHING CURRICULUM PROBLEM 6
SWI107 - SWIFT II SELF TEACHING CURRICULUM PROBLEM 7
SWI108 - SWIFT II SELF TEACHING CURRICULUM PROBLEM 8
SWIIDOC - FILE CONTAINING DOCUMENTATION ON SWIFT II
SWIIDIM - PROCEDURE TO RE-DIMENSION SWIFT II

6000.4488A6000.43

SWIFT II EXECUTION PROCEDURE:

ATTACH,SWI1G0/UN=QUALIB
GET,TAPE5=SWI101/UN=QUALIB
RFL,0,472
LDSET,PRESET=0
SWI1G0,TAPE5,TAPE6
•
•
•
RFL,0
RETURN,*,TAPE6

(EXAMPLE USING SWI101)

(ATTACH THE EXECUTABLE BINARIES)
(SELECT SWI101 AS INPUT DATA FILE)
(REQUEST EXTENDED MEMORY)
(INVOKe THE LOADER AND PRESET CORE)
(PROVIDE LOADER WITH NAME OF BINARIES)
•
(EXECUTION IN PROGRESS)
•
(RELEASE EXTENDED MEMORY WHEN COMPLETED)
(RELEASE ALL FILES EXCEPT OUTPUT TAPE6)

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PROCEDURE TO RE-DIMENSION SWIFT II FOR LARGER PROBLEMS:

- (1) EXAMINE PAGE 5 OF OUTPUT FILE FOR A TABLE ENTITLED 'UTILIZATION OF COMMON ARRAY STORAGE'
- (2) COMPARE CURRENT CORE DIMENSIONS WITH YOUR DATA REQUIREMENTS FOR ARRAYS G, G2, G3, AND IG.
- (3) CREATE AND SAVE YOUR OWN BINARIES WITH THE FOLLOWING INTERACTIVE CONTROL STREAM:
 - (A) GET, SWHDIM / UN=QUALIB
 - (B) BEGIN, SWHDIM (THIS PROCEDURE PROMPTS YOU FOR SIZES)
 - (C) DEFINE, MYLGO (SELECT A NAME FOR BINARIES, EX, MYLGO)
 - (D) COPYDF, LGO, MYLGO (SAVE YOUR BINARIES IN YOUR AREA)
- (4) USE YOUR BINARY FILE MYLGO IN PLACE OF THE LIBRARY BINARY FILE SWHLGO.
- (5) THE REQUEST FOR EXTENDED MEMORY AT EXECUTION TIME SHOULD BE INCREASED TO REFLECT THE ADDED MEMORY. AN ESTIMATE OF THIS NUMBER IS PRINTED OUT FROM THE PROCEDURE IN STEP (3). AS AN EXAMPLE, THE RFL 0,472 REQUIREMENTS FOR THE QA VERSION OF SWIFT II WERE DETERMINED BY:
G ARRAY G2 ARRAY G3 ARRAY IG ARRAY
40000 + 30000 + 58000 + 20000 = 156000
= 472 K OCTAL
- (6) SNLA SYSTEM LIMITATIONS:
 - (A) A SINGLE COMMON BLOCK SIZE IS 131071 MAXIMUM
 - (B) THE TOTAL OF ALL FOUR ARRAY SIZES MUST NOT EXCEED 400000 (1400K OCTAL)

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**PROCEDURE TO GET A HARDCOPY OF THIS DOCUMENTATION:
GET,SWIIDOC/UN=QUALIB
(SEND THIS FILE TO YOUR PRINTER)**

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BENEFITS OF THE QA PLAN

- **NRC has been provided with standard versions of high-level waste evaluation software**
- **The requirement of sample problems provides confidence in the code results**
- **Availability of software with documentation makes reproducibility of results feasible and conclusions justifiable.**