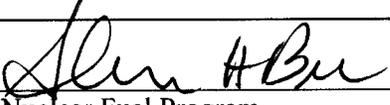




National Spent Nuclear Fuel Program

## ENGINEERING ANALYSIS

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Revision: 5  
Eff. Date: 03/27/08  
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DAR No.: NSNF-739

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Date: 03-13-08

### I. PURPOSE AND SCOPE

This procedure establishes the responsibilities and processes for planning engineering analysis activities, approving the analysis plan, and performing the analysis. As applicable, *model* (see glossary) development and approaches to *model validation* (see glossary) are planned and documented using the methods and criteria established by this procedure.

### II. SUMMARY

This procedure addresses planning and performing model validation; or the checking of electronically formatted information not otherwise controlled by National Spent Nuclear Fuel Program (NSNFP) procedures. This procedure also addresses planning and performing independent reviews and checks of NSNFP engineering products for appropriateness of the assumptions, inputs, and calculations using personnel and analytical techniques different from those employed in the original analysis. This procedure supplements the planning described by procedure NSNFP 2.05, Planning/Quality Assurance Program Applicability Evaluations (PAE) and supplements the review criteria described by procedure NSNFP 3.04, Engineering Documentation.

### III. PROCEDURE

#### A. Planning

- PSO Technical Staff 1. Complete an Analysis Plan (NSNFP Form 3.03-1) when:
- A model will be used in the analytical approach that requires validation or
  - Electronically formatted information that is complex will be used as input or output of the analysis or
  - The Program Support Organization (PSO) Manager stipulates the performance of documented independent review and checking as communicated by an approved Document Action Request.
  - Stipulated for a specific analysis task by a NSNFP Planning/Quality Assurance Program Applicability Evaluation

*NOTE: Additional planned and documented independent reviews and checking may be stipulated in addition to reviews conducted to the criteria in NSNFP Procedure 3.04, due to the importance, complexity, degree of standardization, or state of the art nature of the task.*



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- PSO Technical Staff
2. Obtain a unique number for the analysis plan from NSNFP Document Control, and obtain review and approval of the Analysis Plan by the PSO quality engineer and the responsible technical lead.
  3. Coordinate with NSNFP Document Control to distribute the approved analysis plan by posting it to the NSNFP Webpage.

### B. Model Validation

- PSO Technical Staff
1. Using the criteria in Attachment A, Model Development/Validation Criteria, plan the analysis to ensure that a separately documented validation is performed for each of the following phases of model progression, as applicable.
    - *Conceptual model* (see glossary)
    - *Mathematical model* (see glossary)
    - *Process model* (see glossary)
    - *Abstractioned model* (see glossary)
    - *System model* (see glossary).
  2. Computer software used to develop or execute the model shall be qualified.
    - a. Unqualified software may be used to produce preliminary output that may be used in preliminary technical products, subject to the following controls:
      - (1) Unqualified software used to produce preliminary output shall be identified to SCM for the purpose of tracking the preliminary application of in-process software that is anticipated to be controlled per SCM procedures once it is qualified.
      - (2) Use of all outputs from unqualified software shall be documented and tracked in accordance with the procedure for management of technical product inputs.
      - (3) Outputs from unqualified software shall be appropriately identified as To Be Verified (TBV) or TBV-Temp in accordance with the procedure for management of technical product inputs.
      - (4) When unqualified software has been qualified and baselined, all preliminary data runs shall be rerun using the qualified software for comparison with the preliminary outputs.

PSO Technical  
Staff

- (a) If outputs are identical, then update the preliminary output with the final output in accordance with the governing technical product procedure.
- (b) If the outputs are not identical, then supersede the preliminary output with the output from the qualified software in accordance with the governing technical procedure.
- (c) The results of the comparisons and subsequent actions shall be documented within the technical product.

(5) Responsible managers, leads, checkers, and quality engineering representatives for technical products shall ensure that all software used within the technical product has been qualified and baselined prior to final approval of the technical product in accordance with the governing technical product procedure.

b. Use of unqualified software under these provisions is strictly limited to use within preliminary technical products in direct support of OCRWM activities related to obtaining a license to construct a repository, including rework in support of the License Application. No other use of these provisions shall be permitted for any other purpose.

3. Plan model validation activities by using any of the following methods.

PSO Technical  
Staff

- a. Corroborate model results with information acquired from field experiments, analogue studies, or laboratory experiments.
  - (1) Conduct field or laboratory experiments in accordance with NSNFP Procedure 11.01, Testing.
  - (2) Ensure that information used to develop or calibrate a model is not used to validate a model.
- b. Conduct independent technical review of the model in accordance with NSNFP Procedure 6.01.
- c. Perform confirmation studies using validation-test model prediction prior to comparison with field or laboratory information.
- d. Compare model results with the results from implementation of an alternative model.
- e. Calibrate with experimental information sets, including the review of model calibration parameters for reasonableness and consistency in explanation of all relevant data.

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**C. Checking Electronic Information**

- PSO Technical Staff 1. Identify checking functions within the Analysis Plan that are needed to verify the following, as applicable.
- The completeness and accuracy of the information incorporated in the analysis as input, including subsequent changes. Where data originates from the alternate use of suppliers without a documented QA Program, said data are unqualified, and if used as input produce unqualified output.
- PSO Technical Staff
- The completeness and accuracy of the information transferred from other media and sources including copying of raw data from a notebook.
  - The completeness and accuracy of final output information to be made available in electronic format for use by others internally or externally.

**D. Independent Review and Checking**

- PSO Technical Staff a. Include methods in the Analysis Plan that ensure independent reviews and checks to evaluate the appropriateness of the assumptions, inputs, and calculations using personnel and analytical techniques different from those employed in the original analysis.
- PSO Technical Staff

**E. Performing Analyses**

- PSO Technical Staff 1. Perform analyses, addressing each of the items identified on the Analysis Plan.
2. Ensure that any testing is performed in accordance with NSNFP Procedure 11.01, Testing.
3. Ensure mathematical results are accurate by using one of the following methods
- a. Control analysis software and develop software routines or macros in accordance with NSNFP Procedure 19.01, Software Control, when individually hand checking the mathematical results is not planned
  - b. Individually hand check the results of calculations obtained through methods not subject to NSNFP Procedure 19.01, Software Control, e.g., manufacturer preprogrammed desktop calculators.
    - (1) Document the hand checking performed using engineering documentation in accordance with NSNFP Procedure 3.04, Engineering Documentation.

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## F. Complete Documentation

- PSO Technical Staff
1. Prepare documentation in accordance with NSNFP Procedure 3.04, Engineering Documentation, and include the Analysis Plan by reference, as applicable.
  2. The dimensional accuracy and completeness of design drawings and specifications shall be checked and documented.
  3. Model documentation shall provide an accounting for uncertainties and variabilities in parameter values and provide the technical basis for parameter ranges, probability distributions, or bounding values used in process, abstracted, and system models used in (or supporting) the post-closure performance assessment or other end use stipulated by NSNFP.
  4. When the analysis plan has been executed, notify NSNFP Document Control to cancel distribution of the document by removing it from the NSNFP Webpage.

## IV. REFERENCES

None.

## V. DEFINITIONS

Terms appearing in italics followed by the notation "see glossary" are defined in the NSNFP Documents Manual Introduction and Glossary.

## VI. ATTACHMENTS

Attachment A, Model Development/Validation Criteria

## VII. QUALITY RECORDS

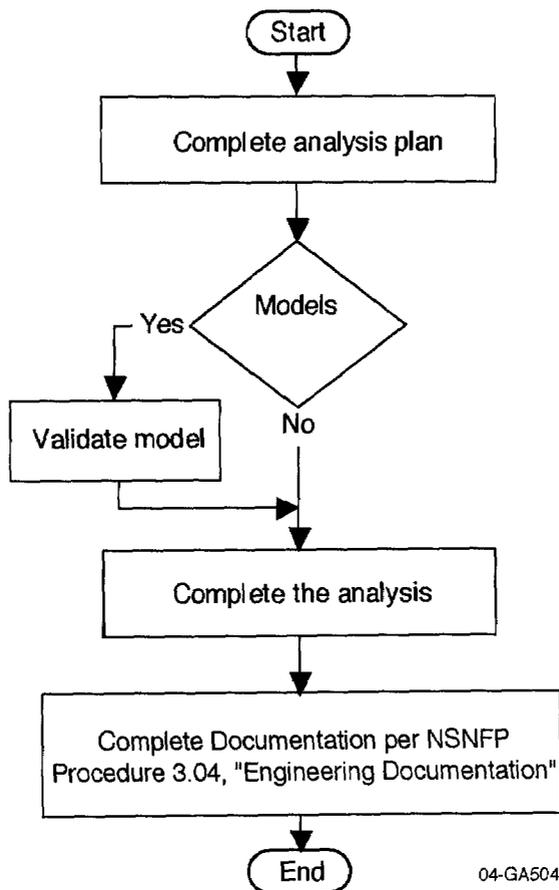
The following quality records generated as a result of this procedure require retention in accordance with the identified classification and NSNFP Procedure 17.01.

### Lifetime

- A. Analyses Plan

### Nonpermanent

None.

**VIII. PROCEDURE FLOW DIAGRAM**

04-GA50465-08

## Attachment A Model Development/Validation Criteria

The planning documentation shall be *transparent* (see glossary) and shall address each of the following items and criteria. The criteria for model validation shall be established to reduce, to the extent practical, the uncertainties inherent in the model and to demonstrate that the phenomenon, process, or system being represented by the model is sufficiently well understood to support the model's intended use.

- a. Definition of the objective (intended use) of the model.

Define the importance of the model for assessing repository system performance.

- b. Description of conceptual model and scientific basis as well as alternatives for the selected conceptual model. Include rationale for not selecting alternatives.

Criteria used to establish the adequacy of the scientific basis for the model shall be consistent with the model application and justified.

- c. Results of literature searches and other applicable background information.

- d. Identification of inputs and their sources.

- e. Identification of and rationale for assumptions that are made to develop or apply the model, including model idealizations as well as those assumptions that support the input to the model and impact model results.

- f. Discussion of mathematical and numerical methods that are used in the model, including governing equations, formulas, and algorithms, and their scientific and mathematical basis.

- g. Identification of any associated software used, computer calculations performed, and basis to permit traceability of inputs and outputs.

- h. Discussion of initial and/or boundary conditions.

- i. Discussion of model limitations (e.g., information available for model development, valid ranges of model application, spatial and temporal scaling).

- j. Discussion of model uncertainties (conceptual model, mathematical model, process model, abstraction abstracted model, system model, parameters) and how they affect the model.

- k. Criteria used to demonstrate that the model is sufficiently accurate for its intended use shall be consistent with parameter uncertainties and justified.

Describe the relative level of confidence for the model.

- l. Define the supporting documentation needed to substantiate validation of the model.

- m. Identification of the validation methods to be used as selected from NSNFP Procedure 3.03 Step III.B.2.

- n. Identification of the originator, reviewer, and approver.