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I. PURPOSE AND SCOPE

The objective of National Spent Nuclear Fuel Program (NSNFP) engineering analyses is to interpret existing information and develop other technical information needed to support the mission of the NSNFP.

This procedure applies to planning and performing analysis activities that are used to generate results that will be relied on to make key programmatic decisions or to protect the safety of personnel or the environment. Analysis activities may include development and interpretation of information, including the results of one or more models and one or more calculations.

II. SUMMARY

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.

III. PROCEDURE

A. Planning

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1. Complete the Analysis Plan (Form 3.03-1).

   a. When a model will be used in the analytical approach, prepare the Analysis Plan, using the criteria in Attachment A, Model Development/Validation Criteria.

   b. When electronically formatted information will be used as part of the analysis input or as the distribution method for analysis output, identify checking functions needed to verify the following, as applicable.

      - The completeness and accuracy of the information incorporated in the analysis as input, including subsequent changes.

      - The completeness and accuracy of the information transferred from other media and sources including copying of raw data from a notebook.

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- The completeness and accuracy of final output information to be made available in electronic format for use by others internally or externally.

2. Obtain review and approval of the Analysis Plan by the quality engineer and the responsible technical lead.

B. Model Validation

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1. 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)
   - *Abstraction model* (see glossary)
   - *System model* (see glossary).

2. Conduct model validation activities by any of the following methods.

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a. Corroborate model results with information acquired from field experiments, analogue studies, or laboratory experiments.

   (1) Conduct field or laboratory experiments in accordance with PSO 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 PMP 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.

C. Performing Analyses

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1. Perform analyses, addressing each of the items identified on the Analysis Plan.

2. Ensure that any testing is performed in accordance with PSO 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 PSO 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 PSO 19.01, Software Control, e.g., manufacturer preprogrammed desktop calculators.

      (1) Document the hand checking performed using an engineering design file in accordance with PSO 3.04, Engineering Documentation.

D. Complete Documentation

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1. Prepare documentation in accordance with PSO 3.04, Engineering Documentation, and include the Analysis Plan by reference.

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. RECORDS

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

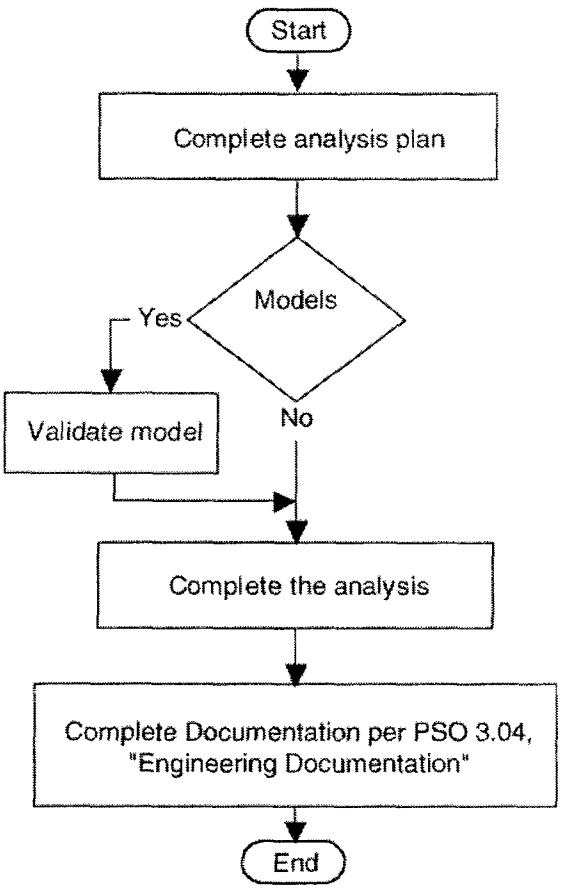
Lifetime

A. Analyses Plan

Nonpermanent

None.

VIII. PROCEDURE FLOW DIAGRAM



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 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 procedure PSO 3.03 Step III.B.2.

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