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Procedure Models

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PROCEDURE

MODELS

LP-SIII.10Q-BSC

Revision 1 ICN 1

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Manager, Lead Laboratory Interface — Date: 9/26/06

CHANGE HISTORY

Revision Number	Interim Change No.	Effective Date	Description of Change
0	0	02/07/2005	Initial issue. Supersedes AP-SIII.10Q, *Models*. Changed to allow Administrative Change Notices to be made to Model Reports (corrective action for Condition Reports 4161, action step 001; 4170, action step 001; and 4236, action step 001) and to incorporate Document Action Requests D19390 (provide clarification for records requirements), D21332 (partial corrective action for Condition Report 4196 to clarify conditions for software exemption from qualification and documentation requirements of LP-SI.11Q-BSC, *Software Management*), D21157 (to support the administrative procedure to line procedure conversion initiative to transition pre-approved administrative procedures to Bechtel SAIC Company, LLC line procedures in accordance with Interoffice Memorandum No. 1116043940 dated 11/30/04), D21330 (change reference from AP-2.12Q to LP-2.12Q-BSC), D21826 (change reference from AP-2.14Q to LP-2.14Q-BSC), D22032 (submit native file to Document Control), D22353 (change reference from AP-SIII.1Q to LP-SIII.11Q-BSC), and D22371 (change reference from AP-3.15Q to LP-3.15Q-BSC).
0	1	06/24/2005	Interim Change Notice to modify text in Step 5.5a)1) on submittal of product output to the Technical Data Management System (Condition Report 5600); clarified use of alphanumeric pagination in Step 5.7.3f) and Attachment 2 associated with Administrative Change Notice; and updated interfacing procedure references.
0	2	09/19/2005	Interim Change Notice to modify the definition of Abstraction in Subsection 3.1; clarification of responsibilities and expectations for model validations activities in Subsection 5.3 and corrected numbering references as a result of changes to Subsection 5.3 (Condition Report 4961); corrected reference to Subsection 5.18 in Paragraph 5.7.1; and made other minor changes.

CHANGE HISTORY (Continued)

Revision Number	Interim Change No.	Effective Date	Description of Change
1	0	05/30/2006	Changed responsibilities for the procedure to Performance Assessment Manager on the cover page and in Subsection 4.1. Updated interfacing procedure references where appropriate. Clarified Step 5.4.6 c) for the signing of back check copies and added electronic mail notification of processing of Administrative Change notice as a record in Section 6.0 (Condition Report 5723). Clarified actions required associated with product output in Paragraph 5.5.1 and 5.6.1 (Condition Report 5110). Incorporated various changes associated with definitions and scientific analyses changes (Condition Report 5230). Added new Paragraph 5.5.2 associated with the review of product output Data Tracking Numbers (Condition Report 5484). Provided clarification in Step 5.2.1 l) for use of cancelled/superseded documents (Condition Report 6407). Added review criteria in Step 5.4.8 c) associated with performance of interdisciplinary type reviews (Condition Report 7583). Added clarification in Attachment 2 for documentation impacts associated with assumptions, constraints, bounds, or limits on inputs for improvement in implementation of *Quality Assurance Requirements and Description*, DOE/RW-0333P, Section III.2.6 B.5 requirements (Condition Report 7829). Added text in Step 5.2.1 i) and Paragraph 5.4.3 associated with the documentation and verification of use of exempt software (Condition Report 7816). Added additional wording in Section 5.0 text and Attachment 2 associated with peak dose. Added additional text and requirements for technical review in Step 5.3.2 a) 5) and Attachment 2 (Condition Report 7641). Added clarification in Step 5.2.1 c) for the responsibilities of the Originator in model documentation (Condition Report 7851). Added additional information in Step 5.2.1 k) for planning on the use of data obtained from outside sources (Condition Report 7867). Added clarification in Step 5.2.1 a) for the discussion of information documented in a Scientific Notebook (Condition Report 6491). Other changes as needed.

CHANGE HISTORY (Continued)

Revision Number	Interim Change No.	Effective Date	Description of Change
1	1	10/02/2006	Interim Change Notice to clarify reference to interfacing procedure IT-PRO-0011 in Attachment 2, Section 3. Removed the reference and interface to the Quality Assurance checklist procedure QA-PRO-1062 in Paragraphs 5.4.4a), 5.4.12d), and 7.0t) and removed the completed Quality Engineering Checklists as a record in Subsection 6.2 as directed by Quality Assurance. Change to support implementation of the lead lab transition. Removed references to source requirement documents such as the *Quality Assurance Requirements and Description*, DOE/RW-0333P, and the *Augmented Quality Assurance Program (AQAP)*, DOE/RW-0565. Removed National Laboratories from the applicability. Added clarification for the use and documentation of software. Updated definition in Section 3.0 to align with source requirements documents. Changed responsibility for procedure preparation, change, and approval to the Lead Laboratory Interface Manager. Updated interfacing procedure references. Other minor changes.

1.0 PURPOSE

This procedure establishes the responsibilities and process for documenting activities that constitute scientific investigation modeling. Planning requirements for conducting modeling are contained in LP-2.29Q-BSC, *Planning for Science Activities*.

2.0 APPLICABILITY

This procedure applies to individuals who perform and document modeling.

For the purposes of this procedure, the term models also applies to activities supporting performance assessment for periods beyond 10,000 years based on the proposed U.S. Nuclear Regulatory Commission Rule 10 CFR 63.114 (b), Requirements for Performance Assessment, that extends the applicability of performance assessment to the period after 10,000 years.[1]

Implementation of conceptual models into new mathematical models, or into mathematical models undergoing change, must be documented in accordance with this procedure. Mathematical model development, validation, and initial use, as well as any related work required to accomplish these tasks, shall be documented within the model(s) document. Use LP-SIII.9Q-BSC, *Scientific Analyses*, if you are going to perform an analysis that does not require developing or revising an existing model.

Scientific analyses and calculations are documented in accordance with LP-SIII.9Q-BSC. Design analyses are documented in accordance with EG-PRO-3DP-G04B-00037, *Calculations and Analyses*. Development, revision, configuration management, verification and validation, and/or qualification of software are documented separately in accordance with IT-PRO-0011, *Software Management*; IT-PRO-0012, *Qualification of Software*; and/or IT-PRO-0013, *Software Independent Verification and Validation*.

3.0 DEFINITIONS

3.1 ***Abstraction***–The process of developing a simplified representation of a natural or engineered system or process for incorporation into a model of the geologic repository. The abstraction may reduce the numbers of dimensions, eliminate time dependence, or simplify the original representation or natural phenomena. The corresponding result may be a response surface, a set of discrete elements, or other representation.

3.2 ***Administrative Change Notice (ACN)***–Minor changes to a document that clarify and strengthen existing discussion and have no effect on methods employed, direct input sources, and product output or results (e.g., technical content of the conclusion section or product output Data Tracking Number [DTN] identification or values). If the change would impact the methods, direct input sources, or product output or results, then the change shall not be performed as an ACN.

[1] Proposed Nuclear Regulatory Commission Rule 10 CFR 63.114 (b) will require review for impact when it becomes final, and change to this procedure may be required.

3.3 ***Assumption***–A statement or proposition that is taken to be true or representative in the absence of direct confirming data or evidence, or those estimations, approximations, and/or limitations made during model development (such as when expanding the range of variables to achieve conservatism).

3.4 ***Checker***–A qualified individual other than the Originator, technically competent in the subject area of the document undergoing checking, responsible for confirming adequacy, accuracy, and completeness of the model documentation.

3.5 ***Editorial Correction***–Modifications made to a document that have no impact on outputs such as correcting grammar, spelling, or typographical errors; renumbering sections or attachments; and updating organizational titles. Editorial corrections do not affect the chronological sequence of work or the fundamental process, or change responsibilities.

3.6 ***Hand Calculation***–An engineering or scientific calculation prepared by a technically qualified person that is documented (i.e., sources of information for inputs, assumptions, calculation methods, units of calculation, and conclusions) such that a technically qualified person could replicate the calculation manually or through the use of a spreadsheet or other mathematical software using standard mathematical functions without recourse to the originator of the calculation or the checker.

3.7 ***Independent Technical Reviewer***–As used in this procedure, a qualified individual other than the Checker and Originator technically competent in the subject area of the document undergoing review responsible for confirming the adequacy, accuracy, and completeness of the model validation portion of the model documentation.

3.8 ***Lead***–The individual assigned by the Responsible Manager to control a model activity and having responsibility for assignment of personnel performing activities associated with the model.

3.9 ***Model***–A depiction of a system, phenomenon, or process including any hypotheses required to describe the process or system or explain the phenomenon or process. Model development typically progresses from conceptual to mathematical models. Mathematical model development typically progresses from process, to abstraction, and to system models.

3.10 ***Model, Abstraction***–A model that reproduces or bounds the essential elements of a more detailed process model and captures uncertainty and variability in what is often, but not always, a simplified or idealized form.

3.11 ***Model, Conceptual***–A set of qualitative assumptions used to describe a system or subsystem for a given purpose. Assumptions for the model are compatible with one another and fit the existing data within the context of the given purpose of the model. Such a model may consist of concepts related to geometrical elements of the object (size or shape); dimensionality (one-, two-, or three-dimensional); time dependence (steady-state or transient); applicable conservation principles (mass, momentum, energy); applicable constitutive relations, significant processes, natural laws, and boundary conditions; and initial conditions. Conceptual models may be implemented into mathematical models.

3.12 ***Model, Mathematical***–A mathematical representation of a conceptual model.

3.13 ***Model, Process***–A depiction or representation of a process, along with any hypotheses required to describe or to explain the process.

3.14 ***Model, System***–A collection of interrelated mathematical models that represent the overall geologic repository or overall component subsystem of the geologic repository.

3.15 ***Model Validation***–A process used to establish confidence that a mathematical model and its underlying conceptual model adequately represents with sufficient accuracy the phenomenon, process, or system in question.

3.16 ***Product Output***–Output of an approved technical product that has been developed in accordance with procedures in effect on or after 06/30/1999. This includes internally developed data that are based on and traceable to direct inputs from approved technical products.

3.17 ***Originator***–A technically competent individual designated to perform a model activity and to prepare the model documentation and assigned the responsibility for ensuring the adequacy, accuracy, and completeness of the model documentation. For the purpose of this procedure, an all-inclusive term for a preparer, modeler, or investigator.

3.18 ***Responsible Manager***–The individual having management responsibility for a model activity, for assigning a Lead to the model activity, and for approving the model documentation.

3.19 ***Revision***–A method of changing model documentation to make changes other than ACNs or editorial changes.

3.20 ***Scientific Analysis***–A documented study that 1) defines, calculates, or investigates scientific phenomena or parameters; 2) evaluates performance of components or aspects of the overall geologic repository; or 3) solves a mathematical problem by formula, algorithm or other numerical method. A scientific analysis may involve numerical manipulations that are not part of a previously developed and validated mathematical model (per LP-SIII.10Q-BSC) if the choice of method is evident from standard scientific practice, approach, or method. A scientific analysis may also use a previously developed and validated mathematical model (per LP-SIII.10Q-BSC), within the mathematical model's intended use and stated limitations, but may not revise the mathematical model in order to complete the scientific analysis, except as required to conduct performance assessments for the period after 10,000 years. An analysis can be performed as part of a model developed in accordance with this procedure (LP-SIII.10Q-BSC) or using LP-SIII.9Q-BSC.

3.21 ***Sensitivity***–The degree to which the model results are affected by changes in a selected model input.

3.22 ***Software***–Computer programs and associated documentation and data pertaining to the operation of a computer system.

3.23 ***To Be Verified (TBV)***–The Identification of information that is preliminary, needs to be re-evaluated, and/or needs confirmation.

3.24 ***Traceability***–The ability to trace the history, application, or location of an item and like items or activities by means of recorded identification.

3.25 ***Transparent***–A document that is sufficiently detailed as to purpose, method, assumptions, inputs, conclusions, references, and units, such that a person technically qualified in the subject can understand the document and ensure its adequacy without recourse to the originator.

3.26 ***Visual Inspection***–Visual inspection of a commercial-off-the-shelf (COTS) software file pertains to checking the concept, logic, and implementation of the logic that yields numerical results. Because most, if not all, COTS software files are based on concepts, logic, and implementation, visual inspection then means checking each of these three components to ensure they are accurate and complete.

4.0 RESPONSIBILITIES

4.1 The Manager, Lead Laboratory Interface, is responsible for the preparation, change, and approval of this procedure.

4.2 The following organizations or positions are responsible for activities identified in Section 5.0 of this procedure:

a) Responsible Manager
b) Lead
c) Originator
d) Checker
e) Quality Engineering Representative (QER)
f) Reviewing Organization
g) Independent Technical Reviewer

5.0 PROCESS

Modeling, by its nature, is an iterative process. This procedure establishes in the specific subsections those action steps that must be completed sequentially but does not require all action steps to be completed in sequential order. Specific action steps that must be completed before other action steps may begin are identified. Acronyms and abbreviations used in this procedure are defined in Attachment 1, Acronyms and Abbreviations. The use of the singular identification of Originator, Checker, and QER in this procedure implies one or more individuals performing these responsibilities.

PROCESS OUTLINE

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5.1 PLANNING

The Technical Work Plan (TWP) must be completed before beginning action steps in Paragraph 5.1.1.

5.1.1 **Responsible Manager**:

a) Control the development, validation, checking, documentation, change, and key technical activities of the model activity in accordance with the requirements of this procedure. A Lead may be assigned to control these functions.

b) If a Lead has been assigned, provide the Lead with the applicable TWP prepared in accordance with LP-2.29Q-BSC.

5.1.2 **Responsible Manager** or **Lead**:

a) Review the TWP for the Work Package associated with the model to be developed. If the TWP requires revision, ensure that it is completed in accordance with LP-2.29Q-BSC.

1) Ensure the applicable TWP includes adequate planning for model validation, including the identification of the intended purpose of the model, the needed level of confidence for the model, the criteria to be used to determine that the appropriate level of confidence has been met, and the plans for post-development model validation activities including plans for technical review per Subsection 5.3 (if any). Planning requirements for developing and validating models are contained in LP-2.29Q-BSC.

2) If a previously developed model is to be used outside of its intended use, limitation, or range of validity, justification and plans for validation shall be provided in the applicable TWP.

3) Ensure that the applicable TWP includes adequate planning (per LP-SIII.2Q-BSC, *Qualification of Unqualified Data*) for any required data qualification activities.

b) Assign an Originator to perform the modeling activity (the Lead may assume the Originator's responsibilities; however, the Lead may not assume the Checker's or Reviewer's responsibilities when acting as the Originator) and provide the originator the applicable TWP.

5.2 DOCUMENTATION

It is not necessary for the action steps to be performed sequentially.

5.2.1 Originator:

a) The modeling activity and associated tasks shall be performed in accordance with the applicable TWP and applicable procedures. Scientific notebooks may be used in the modeling activity in accordance with LP-SIII.11Q-BSC, *Scientific Notebooks*. Include references to, or information from, scientific notebooks as necessary to ensure transparency and traceability of the modeling documentation.

b) Obtain a document identifier (DI) sequence number for the model documentation from Document Control in accordance with RM-PRO-2001, *Document Control.*

c) Document the model using the annotated outline in Attachment 2, Model Documentation Outline. Information presented in the model documentation shall be transparent and traceable to permit data reduction by other qualified individuals. The standardized LP-SIII.10Q-BSC template in the Office of Civilian Radioactive Waste Management Style Manual on the BSC Intranet is the recommended format. If a section in the annotated outline is not applicable, indicate that it is not applicable after the title and provide a rationale for non-applicability.

d) If any information with regard to naval fuel is included in the model document, have the Resident Manager for the Naval Nuclear Propulsion Program review the model to ensure no unauthorized Naval Reactors information is included in the model document.

e) Document product input in accordance with PA-PRO-0301, *Managing Technical Product Inputs*, using the Document Input Reference System (DIRS).

f) Complete the appropriate sections of Attachment 3, Model Signature Page/Change History, in accordance with the instructions.

g) Ensure documentation is legible and in a form suitable for reproduction, filing, and retrieval.

h) Ensure software usage in model development and application is controlled and documented in accordance with IT-PRO-0011. Describe the software use in the model documentation according to Section 3 of Attachment 2.

i) Ensure solutions to an analysis used to support the model, written using the standard functions of COTS software programs (e.g., the standard deviation functions in Excel and MathCad) is documented in sufficient detail to allow a

technically qualified person to reproduce or verify the results by visual inspection or hand calculations, including the following:

- Name and version of the COTS software program
- Software Tracking Number
- Inputs
- Outputs
- Application software options (e.g., options for the Excel solver function)
- Other information (e.g., operation environment, comments or remarks that may include references to external documents, texts, monographs, and handbooks as necessary) that would be required for a technically qualified person to reproduce the work.

j) Document the qualification of unqualified project data, developed in accordance with LP-SIII.2Q-BSC, as described in Section 6 of the Model Documentation Outline.

k) Data obtained from outside sources that are not established facts must be demonstrated to be suitable for the specific application. When appropriately justified, these data are considered qualified for use within the technical product. The qualification process shall be planned and documented by describing the extent to which the data demonstrate properties of interest, factors considered, and basis of the decision to qualify the data. Apply one or more of the following factors as acceptance criteria to document and justify qualification of the data:

- Reliability of data source
- Qualifications of personnel or organizations generating the data
- Prior uses of the data
- Availability of corroborating data.

If relevant data from external sources are evaluated against the above factors and determined not to meet a criterion, describe the basis for this decision and whether the data were justified using an alternative factor (i.e., acceptance criteria), or exclude from the model. It should be noted that external source data may still be qualified in accordance with LP-SIII.2Q-BSC (rather than suitable for intended use within the document text) when deemed appropriate.

l) Input obtained from the product output of a document under document control (e.g., RM-PRO-2001 control) that has been cancelled or superseded must be demonstrated to be suitable for intended use and justified within the technical product. The model may obtain inputs from other cancelled or superseded

documents but may not cite an input from a previous version of itself. When appropriately justified, these inputs are considered qualified for intended use within the product. If the document and the product output have been cancelled or superseded, the reason for cancellation or supersession must be included in the justification for use of the input. One or more of the following factors shall be used as acceptance criteria to document and justify the inputs are qualified and suitable for intended use:

- Reliability of input source
- Qualifications of personnel or organizations generating the input
- Extent to which the input demonstrate the properties of interest
- Prior uses of the input
- Availability of corroborating input.

m) Unqualified software that has been registered for usage in accordance with IT-PRO-0011 may be used prior to qualification to develop a preliminary output. Document and control the preliminary output in accordance with AP-SIII.3Q, *Submittal and Incorporation of Data to the Technical Data Management System*. Repeat the work producing the preliminary output to produce final output with qualified software in accordance with Paragraph 5.2.lh) of this procedure. Make a comparison between the preliminary and final outputs. If the outputs are identical, then document the comparison and update the preliminary output with the final output on the Technical Data Information Form (from AP-SIII.3Q). If the outputs are not identical, then document the comparison and supersede the DTN of the preliminary output with a new DTN containing the final output in accordance with AP-SIII.3Q.

n) Register the usage of unqualified software prior to use to produce the preliminary output in accordance with IT-PRO-0011.

5.2.2 Responsible Manager:

Ensure that the Originator has completed the appropriate steps as outlined in Paragraph 5.2.1.

5.3 MODEL VALIDATION

It is not necessary for the action steps to be performed sequentially.

5.3.1 Originator:

a) Identify and document the intended purpose, and any limitations for the model as described in Section 1 of the Model Documentation Outline.

b) Document the criteria used to determine that the needed level of confidence for the model has been met as described in Section 7 of the Model Documentation Outline.

1) The criteria used to establish the adequacy of the scientific basis for the model must be explicit, consistent with the intended use of the model, and justified in the documentation.

2) The criteria used to demonstrate that the model is sufficiently accurate for its intended use must be consistent with parameter uncertainties and must be justified in the documentation. If a conservative model is used, it must be demonstrated that the model a) is conservative with respect to alternative models and b) is consistent with available data and scientific understanding.

c) If validation activities are to extend beyond the documented completion of the current model, include a description of future activities that are to be completed and a justification for extending model validation in accordance with Section 7 of the Model Documentation Outline.

d) Validate the model to the level of confidence required in accordance with the TWP and Paragraph 5.3.2a) of this procedure.

e) Document model validation as described in Section 7 of the Model Documentation Outline.

f) Validate mathematical models for their intended purpose and stated limitations, and to the level of confidence required by the model's relative importance to the potential performance of the repository system. Validation is required for all mathematical models and their underlying conceptual models (validation is not required for conceptual models not implemented in mathematical models).

g) Include documentation of decisions or activities that are implemented to generate confidence in the model during model development, including the following:

1) Selection of input parameters and/or input data, and a discussion of how the selection process builds confidence in the model.

2) Description of calibration activities, and/or initial boundary condition runs, and/or run convergences, and a discussion of how the activity or activities build confidence in the model. Include a discussion of impacts of any run non-convergences.

3) Discussion of the impacts of uncertainties to model results.

5.3.2 Responsible Manager or **Lead**:

a) Ensure that mathematical models undergo model validation activities after the model has been developed. The model validation activities completed after the model has been developed shall be dependent upon and consistent with the model's intended use and required level of confidence and shall include one or more of the following, consistent with those delineated in the applicable TWP:

1) Corroboration of model results with data acquired from the laboratory, field experiments, analog studies, or other relevant observations, not previously used to develop or calibrate the model.

2) Corroboration of model results with other model results obtained from the implementation of mathematical models.

3) Corroboration of model results with information published in refereed journals or literature provided that data used to develop and calibrate a model shall not be used to validate a model.

4) Peer Review per PA-PRO-0201, *Peer Review*.

5) Technical review, planned in the applicable TWP, according to the instructions provided in LP-2.29Q-BSC, Attachment 4. Documentation of the selection of the reviewers shall be included as an appendix to the relevant model report.

6) Corroboration of abstraction or system model results to the results of the validated mathematical model(s) from which the abstraction or system model was derived, including corroboration with results of auxiliary analyses used to provide additional confidence in system model results.

7) Corroboration of pre-test model predictions to data collected during subsequent, associated testing.

b) Technical review through publication in a refereed professional journal or review by an external agency, documented by the external agency, may be used to demonstrate additional confidence in the model, if publication or review is used in conjunction with one or more of the model validation activities described in Step 5.3.2a).

5.3.3 Originator:

If a model that has been adequately validated on the basis of actions taken in Paragraphs 5.3.1 and 5.3.2 will be extended to provide input to or conduct performance assessments for the period after 10,000 years, describe modifications, if any, required to address regulatory requirements and any associated numerical manipulations required to conduct the assessment. Document per Attachment 2, Model Documentation Outline. Describe modifications and numerical

manipulations in Section 6 and document assessment results in Section 8. Models that are adequately validated for 10,000-year assessments are assumed to be valid for assessments for the period after 10,000 years.

5.4 CHECK AND REVIEW

It is not necessary for the action steps to be performed sequentially. However, all action steps through Paragraph 5.4.6, with the exception of Paragraph 5.4.3a)2), must be completed before beginning action steps in Paragraphs 5.4.7 through 5.4.13. A second exception is the Total System Performance Assessment for the License Application. For this large multi-volume document, it may not be appropriate to wait until all volumes are checked before commencing the review per PA-PRO-0601. In those instances, the responsible manager for the development of the Total System Performance Assessment shall document his approval for a volume to proceed into review and specifically state how checking will be completed as additional volumes become available and how the review per PA-PRO-0601 will be managed.

5.4.1 **Responsible Manager** or **Lead**:

Assign a Checker to check the model documentation. The Originator, Lead, or Responsible Manager may not perform the checking function.

5.4.2 **Originator**:

Provide to the Checker and QER (an optional Models Checklist, Form 1098 on the BSC Intranet Automated Form System, may be completed by the Originator):

1) Check copies of the model documentation. Clearly indicate on the Model Signature Page/Change History one copy as the “Checker Check Copy” and one copy as the “QER Check Copy.”

2) The DIRS report.

3) Other supporting information and documentation that may be requested by the Checker or QER. Lengthy or large supporting documentation or files may be provided to the Checker or QER in advance of the check package submittal.

5.4.3 **Checker**:

a) Check the model documentation ensuring that (an optional Models Checklist, Form 1098 on the BSC Intranet Automated Form System, may be completed by the Checker):

1) The content and output of the model are technically adequate, complete, accurate, and correct.

2) Software, if used, is adequate for its intended use; is identified by the software tracking number, title, and revision/version number; and has

been controlled and documented in accordance with IT-PRO-0011, IT-PRO-0012, and/or IT-PRO-0013.

3) Unqualified software used to produce preliminary output has been registered for use in accordance with IT-PRO-0011.

4) Solutions to an analysis used to support the model written using the standard functions of COTS software program (e.g., the standard deviations functions in Excel and MathCad) can be reproduced or verified through visual inspection or hand calculations.

5) Appropriate technical product inputs were selected, correctly identified in the model documentation and on the DIRS report, cited, and incorporated in the modeling activity in accordance with PA-PRO-0301.

6) Corroborating data, models, or information is clearly identified and is documented in accordance with PA-PRO-0301.

7) Any assumption, data undergoing qualification per LP-SIII.2Q-BSC, or other input values are clearly identified and justified.

8) TBV tracking numbers and Unresolved Reference Number tracking numbers, if required, are included in DIRS in accordance with PA-PRO-0301.

9) The implications of uncertainties and restrictions are discussed and are evaluated within the model documentation.

10) The assumptions, constraints, bounds, or limits on the inputs are identified in the model documentation, and their impact on the results are described and assessed in the documentation.

11) The discussion of scientific approach and/or technical methods is documented.

12) The referencing is thorough, accurate, and complete, including appropriate project tracking numbers (e.g., records accession numbers and/or DTNs) and is consistent with the DIRS report.

13) For models extended to support performance assessment for periods after 10,000 years, a description of any modifications required to address regulatory requirements and discussion of numerical manipulations necessary to conduct the assessment.

14) Justification and model validation documentation are provided for using a previously developed model outside of its intended purpose, limitations, or range of validity.

15) Data, information exchange documents, and drawings used as direct input are verified to their home information system or controlled source (Technical Data Management System [TDMS] data are verified to TDMS DTNs via TDMS intranet, documents such as information exchange documents, drawings, etc., are verified to the Controlled Document Information System).

16) Validation has been completed in accordance with the applicable TWP and the requirements of this procedure.

17) All errata, initiated in accordance with AP-16.1Q, *Condition Reporting and Resolution*, and documented against previous model document revisions/changes, if any, are incorporated in the model documentation.

18) Any work performed to develop a preliminary output using software in scoping and bounding determination, feasibility studies, prototype methodology development, or similar activities, as allowed by IT-PRO-0011, is adequately documented. A checker comment shall be made documenting that additional checking is required when the work producing the final output is documented in the model report. The check of the work producing the final output may be performed following the review per PA-PRO-0601.

b) Clearly and legibly write, or mark electronically, comments on the Checker Check Copy or indicate that there are no comments. Comments may be documented separately if keyed to the Check Copy and if comment documentation is signed, dated, and attached to the Check Copy.

c) Initial and date the Checker Check Copy of the Model Signature Page/Change History and return the documentation to the Originator.

5.4.4 QER:

a) Perform a quality assurance (QA) check to ensure compliance with this procedure and the applicable TWP.

b) Clearly and legibly write, or mark electronically, comments on the QER Check Copy or indicate that there are no comments. Comments may be documented separately if keyed to the Check Copy and if comment documentation is signed, dated, and attached to the Check Copy.

c) Initial and date the QER Check Copy of the Model Signature Page/Change History and return the documentation to the Originator.

5.4.5 Originator:

a) Resolve comments with the Checker and QER and document the resolution by mark up of the applicable Check Copy, including the proposed resolution for

accepted comments and the rationale for comments not incorporated or only partially incorporated. Use additional pages as necessary. Resolution may be documented separately if keyed to the applicable Check Copy and the resolution documentation is signed, dated, and attached to the Check Copy.

b) Elevate unresolved comments to the next levels of management of the Originator and Checker or QER until resolution is achieved and document the resolution. Resolution may be documented separately if keyed to the applicable Check Copy. If unable to achieve resolution, the process contained in GM-DSK-2020, *Resolution of Differing Professional Opinion*, may be implemented.

c) Modify the original model documentation, as required, to incorporate comment resolution.

d) Denote the modified model documentation (back check copy) by revising the alphanumeric revision number.

e) Provide the back check copy, DIRS report, and applicable Check Copy to the Checker and QER.

5.4.6 Checker and **QER**:

a) Check the modified model documentation by comparing it to the applicable Check Copy.

b) Indicate acceptance of the resolution of each comment, including any comment that was not incorporated or was only partially incorporated by accepting the Originator's rationale or by providing separate justification. Initial and date each acceptance. Use additional pages as necessary. Acceptance may be documented separately if keyed to the applicable Check Copy.

c) If comments are resolved, sign and date the applicable back check copy of the Model Signature Page/Change History.

d) Return the documentation to the Originator.

5.4.7 Originator:

Prepare a review copy of the model documentation and forward it to the Responsible Manager.

5.4.8 Responsible Manager:

a) For initial review of a draft model report, initiate a review in accordance with PA-PRO-0601. For revisions to a document, see Subsection 5.7 for criteria on

determining if a review per PA-PRO-0601 is required. For ACNs, a review per PA-PRO-0601 is not required.

b) For models subject to a review per PA-PRO-0601, include as mandatory reviewers those organizations or disciplines providing input to the model documentation and organizations or disciplines that use or are affected by the model results.

c) Review criteria for the model for a review per PA-PRO-0601 shall include as a minimum:

- Information in the model documentation is applicable to the model's intended purpose.
- Information in the model documentation is technically adequate and complete in the context of the model's intended purpose.
- Information in the model documentation is correct (identification of implementing procedures, interface organizations, other documents, etc.) in the context of the intended purpose of the model.
- Results of the model activity described are sufficiently accurate for their intended purpose and use.

d) Designate an Independent Technical Reviewer to review the model validation portion of the model documentation without recourse to the Originator using the following criteria:

- Criteria for adequacy and accuracy are discussed and adequately documented per Paragraphs 5.3.1b)1) and 2).
- An appropriate level of confidence, as identified in the applicable TWP, has been obtained per Paragraph 5.3.1d).
- Confidence building during model development is adequately documented per Paragraphs 5.3.1g)1), 2), and 3).
- Post-model development validation has been completed as described in the applicable TWP according to Paragraph 5.3.2a).

e) The Independent Technical Review is a mandatory review that must always be performed, even if it is determined that a review per PA-PRO-0601 is not required. If a review per PA-PRO-0601 is conducted, the Independent Technical Review may be performed in conjunction with the review per PA-PRO-0601. In either case, the Independent Technical Review shall be documented using the appropriate review documentation per PA-PRO-0601.

f) Review model validation issues with the Independent Technical Reviewer prior to the start of the review.

g) If any information with regard to naval fuel is included in the model document, include the Resident Manager for the Naval Nuclear Propulsion Program as a mandatory reviewer on reviews per PA-PRO-0601 of the model documentation.

h) Note any software products that must be baselined before the model report can be approved or any data submitted to TDMS is finalized.

5.4.9 Reviewing Organization:

a) Complete a review of the model documentation in accordance with PA-PRO-0601.

b) If the model does not affect the reviewing organization, indicate "review declined" and return the review documentation.

5.4.10 Independent Technical Reviewer:

Complete a review of the model validation portion of the model documentation without recourse to the Originator using the criteria specified in Paragraph 5.4.8d).

5.4.11 Originator:

The action steps in this section do not apply for ACNs.

a) Resolve comments with the reviewers in accordance with PA-PRO-0601. Elevate unresolved comments to the next levels of management of the Originator and reviewers until resolution is achieved and document the resolution.

b) Develop a concurrence draft by modifying the PA-PRO-0601 review copy of the model documentation, as required, to incorporate changes resulting from the comment resolution.

c) After the PA-PRO-0601 review comments have been incorporated, provide the final concurrence copy of the model documentation to the Lead, Independent Technical Reviewer, Checker, and QER.

5.4.12 Responsible Manager/Lead, **Independent Technical Reviewer**, **Checker**, and **QER**:

The action steps in this section do not apply to ACNs.

a) Ensure that the PA-PRO-0601 review comments, as resolved, have not adversely affected the model documentation.

b) Resolve any adverse impacts with the Originator and the Reviewing Organization.

c) Indicate acceptance by signing and dating the Model Signature Page/Change History of the concurrence draft. Return the documentation to the Originator.

d) If additional checking is required when the work producing the final output is documented in the model report, the Checker must complete that additional checking of the final output prior to the approval of the model report.

5.4.13 Originator:

Request lock-out of changes to links in DIRS in accordance with PA-PRO-0301.

5.5 PRODUCT OUTPUT

5.5.1 Originator:

a) At any time during the model development, submit the following to the TDMS in accordance with AP-SIII.3Q:

1) Product Output DTNs discussed in the conclusion section that are not currently in the TDMS. Product Output discussed in other sections than the conclusion section may be submitted to TDMS as deemed appropriate by the Originator.

2) Data that have undergone a status change as a result of a qualification within the model documentation.

3) Other output may be submitted, as directed by the Responsible Manager, including unqualified results of validation and sensitivity analyses based on unqualified sources.

b) Finalize or supersede preliminary product output, if any, in accordance with AP-SIII.3Q.

5.5.2 Responsible Manager:

Ensure the reviews of product output DTNs are completed in accordance with AP-SIII.3Q. Approval of the model documentation by the responsible manager confirms these reviews are complete.

5.6 APPROVALS

5.6.1 Originator:

a) Prepare the model documentation by changing the alphanumeric designator to a numeric designator (i.e., the initial model documentation designator is “00,”

and subsequent revisions are "01," etc.) and updating the change history, as necessary.

b) Complete the Model Signature Page/Change History in accordance with the instructions in Attachment 3.

c) For product output that is in TDMS based on a previous revision, perform the following in accordance with AP-SIII.3Q:

1) If product output remained unchanged, then update the Technical Data Information Form to reflect current Analysis Model Report revision/Interim Change Notice number in the "Report Number: field."

2) If product output is revised, then supersede the previous DTN.

3) If product output no longer applies, then cancel the DTN.

d) Process the approved model report/ACN in accordance with RM-PRO-2001 and submit the native file to Document Control.

e) Submit model documentation records to the Records Processing Center in accordance with Section 6.0.

5.6.2 Responsible Manager/Lead:

a) If modifications are required as a result of the U.S. Department of Energy's review, including increasing the revision/change level indicator, ensure the development and change process defined by this procedure is followed.

b) If the model documentation resolves TBVs/Unresolved Reference Numbers, process them in accordance with PA-PRO-0301.

5.7 CHANGE CONTROL

5.7.1 All Changes

Responsible Manager:

a) Determine whether the changes to model documentation will be treated as an ACN, editorial correction, or revision as defined by Subsections 3.2, 3.5, and 3.11, respectively.

b) For revisions, a review per PA-PRO-0601 is required if the revision has a significant impact on other technical products or organizations/disciplines. Determine affected products or organizations/disciplines using the DIRS database.

1) The impact of a revision is significant if it includes changes to inputs, assumptions, model description or formulation, solution methods,

parameter uncertainty, outputs, or conclusions that are directly used by the affected product or organization/discipline.

2) The impact of a revision is not significant if the logic and results of the potentially impacted technical product are unaffected by the change. Revision of descriptive information is not significant as long as the results of the technical product are unaffected.

c) When a model report is changed, the model report or ACN must be brought into compliance with current versions of relevant procedures, as applicable.

d) Editorial changes do not require checking or review. ACNs and revisions require checking. Revisions may require review as outlined above. If review is not required, the responsible manager has the discretion to choose appropriate reviewers and conduct a review per PA-PRO-0601.

e) All changes must be reviewed by the Independent Technical Reviewer to ensure that the model validation portion of the model documentation has not been adversely impacted.

f) Reviews and checks are limited to the procedurally required changes, actual changes, and the portions of the documentation affected by the changes.

5.7.2 Revisions

Originator:

a) Process revisions in accordance with the requirements of Section 5.0, except as indicated in Paragraph 5.7.1.

b) Revisions shall incorporate any ACN and/or editorial corrections in effect at the time the revision is made.

c) Indicate changes in the model documentation using one of the following:

1) A black vertical line in the margin of the page and notes clearly indicating which individual sections or subsections were revised, as applicable, and a brief description of the change in Block 13 of the Model Signature Page/Change History.

2) A note in Block 13 of the Model Signature Page/Change History indicating the entire model documentation was revised because the changes were too extensive to use Step 5.7.2c)1).

d) For less than complete revisions, use alphanumeric page designators (e.g., 10a), as necessary, to avoid repaginating subsequent pages caused by the addition of text. If alphanumeric pagination is used, identify the alphanumeric page numbers inserted in the change history for future accountability. For

clarity, alphanumeric pagination should revert back to sequential page numbers in the next complete revision.

e) Address any applicable errata, documented in accordance with AP-16.1Q in the appropriate section of the model document. List any errata addressed in the Remarks sections of the Model Signature Page/Change History.

f) Maintain the history of all previous changes to the original on Attachment 3 by updating the Change History blocks with each revision.

5.7.3 ACNs

5.7.3.1 **Originator**:

a) Process an ACN in accordance with the requirements of Section 5.0, except as indicated in Paragraph 5.7.1. Substitute Attachment 4, Model Administrative Change Notice, for Attachment 3 and "DIRS information header" for "DIRS report" throughout the process.

b) Contact the DIRS Administrator to create a DIRS information header for the ACN. If there are any reference changes resulting from the scope of the change, update the DIRS for the ACN to reflect the modified references. An ACN does not cause a change to DIRS in "user" downstream model reports.

c) Approved ACNs are automatically included in references to parent document because they are electronically linked in the Controlled Document Information System Database. There is no requirement to include the ACN when citing the parent database. However, such referencing is allowed if the document citation refers to the content of the ACN and is included within the parent document citation. ACNs should not be assigned individual DIRS numbers.

d) If a given page of the model documentation is affected by multiple ACNs, the latest ACN affecting that page shall contain all previous and current changes.

e) Include only those pages with actual changes identified by change bars, the Model Administrative Change Notice cover page, and the DIRS information header in the ACN package.

f) Use alphanumeric page designators (e.g., 10a), as necessary, to avoid repaginating subsequent pages caused by the addition of text.

g) Using the DIRS database, determine those organizations using the model documentation and its output DTNs as direct input. Notify

those organizations via e-mail that an ACN is being processed against the model documentation.

i) No more than ten ACNs shall be issued against any model documentation revision.

5.7.3.2 Checker:

Checker responsibilities are limited to ensuring that the proposed changes are accurate and appropriate, as defined by the ACN and Paragraph 5.4.3 requirements, as applicable.

5.7.3.3 Originator, **Checker**, **QER**, **Independent Technical Reviewer**, and **Responsible Manager or Lead**:

Indicate acceptance of the ACN by signing and dating the ACN.

5.7.4 Editorial Corrections (After Approval and Prior to Submittal):

5.7.4.1 Originator:

a) If the model documentation requires editorial corrections after approval and prior to submittal to Document Control, change the in-process master as follows:

1) Mark the change(s) by drawing a single line through the change(s) (i.e., pen/ink or electronic changes) and/or inserting the new or correct information.

2) Initial and date the change(s).

3) Note the change(s) in the Remarks section (Block 11) of the Model Signature Page/Change History.

b) Forward to Responsible Manager/Lead for approval.

5.7.4.2 Responsible Manager/Lead:

Indicate approval of editorial correction(s) by initialing and dating adjacent to the notation on the Model Signature Page/Change History.

5.8 CANCELLATION

Originator:

If a model is no longer relevant to the project:

1) Obtain electronic mail acknowledgement from users prior to cancellation.

2) Notify DIRS/Reference Administrator.

3) Submit a corrected Technical Data Information Form for each product output DTN to TDMS in accordance with AP-SIII.3Q. The form should identify that the document that produced the DTN is cancelled by providing a comment in the comment field.

4) Cancel the model documentation in accordance with RM-PRO-2001.

6.0 RECORDS

The records listed in Subsections 6.1 and 6.2 shall be collected and submitted to the Records Processing Center in accordance with AP-17.1Q, *Records Management*, as individual records or included in a records package, as specified.

6.1 QA RECORDS

To be submitted as part of the records package for a Model that is related to an item or barrier on the Q-List:

Document Review Records, including review criteria, if applicable, generated in accordance with PA-PRO-0601

Final copy of the DIRS report (initial issue or revision)

DIRS Information Header (ACN)

Visual Inspection Documentation

Hand Calculation Documentation

Records submitted by Document Control per RM-PRO-2001:

Approved Model Report and ACNs

6.2 NON-QA LONG-TERM RECORDS

To be submitted as part of the records package for a Model that is **not** related to an item or barrier on the Q-List:

Document Review Records, including review criteria, if applicable, generated in accordance with PA-PRO-0601

Final copy of the DIRS report (initial issue or revision)

DIRS Information Header (ACN)

Visual Inspection Documentation

Hand Calculation Documentation

Records submitted by Document Control per RM-PRO-2001:

Approved model report and ACNs

To be submitted as part of the records package for each Model:

Draft Model documentation (check copies, backcheck copies, etc.)

Checker Check Copies with Checker markup, Originator response, and Checker acceptance (Comment Sheets may be submitted in lieu of markups)

QER Check Copies with QER markup, Originator response, and QER acceptance (Comment Sheets may be submitted in lieu of markups)

Checker Comment Sheets (if markup was not used) containing comments (include Checker comments, Originator comments, and Checker acceptances)

QER Comment Sheets (if markup was not used) containing comments (include QER comments, Originator responses, and QER acceptances)

Comment Sheets (including resolutions) generated in accordance with PA-PRO-0601, if applicable

Documentation of decision of escalated comments including those generated in accordance with PA-PRO-0601, if applicable

Final concurrence copy of review draft signed and dated on Model Signature Page/Change History by Responsible Manager/Lead, Checker, QER, and Independent Technical Reviewer, as applicable

Model Checklist(s), if completed by the Originator and/or Checker

Responsible Manager for the Total System Performance Assessment (TSPA) documented approval to proceed with concurrent review and checking of large multi-volume documents, as applicable

To be submitted as individual records for each Model:

Hardcopy printout(s) of electronic mail notification that an ACN is being processed against the model documentation

Hardcopy printout(s) of electronic mail acknowledgement from users prior to cancellation of a model

6.3 NON-QA SHORT-TERM RECORDS (THREE YEARS OR LESS RETENTION)

None

7.0 REFERENCES

a) 10 CFR 63.114 (b), Requirements for Performance Assessment (proposed)

b) AP-16.1Q, *Condition Reporting and Resolution*

c) AP-17.1Q, *Records Management*

d) AP-SIII.3Q, *Submittal and Incorporation of Data to the Technical Data Management System*

e) EG-PRO-3DP-G04B-00037, *Calculations and Analyses*

f) GM-DSK-2020, *Resolution of Differing Professional Opinion*

g) IT-PRO-0011, *Software Management*

h) IT-PRO-0012, *Qualification of Software*

i) IT-PRO-0013, *Software Independent Verification and Validation*

j) LP-2.29Q-BSC, *Planning for Science Activities*

k) LP-SIII.2Q-BSC, *Qualification of Unqualified Data*

l) LP-SIII.9Q-BSC, *Scientific Analyses*

m) LP-SIII.11Q-BSC, *Scientific Notebooks*

n) LS-PRO-0203, *Q-List and Classification of Structures, Systems, and Components*

o) PA-PRO-0201, *Peer Review*

p) PA-PRO-0301, *Managing Technical Product Inputs*

q) PA-PRO-0601, *Document Review*

r) RM-PRO-2001, *Document Control*

s) Office of Civilian Radioactive Waste Management Style Manual. Current version. http://connect.ymp.gov/artman/publish/stylemanual.shtml

8.0 ATTACHMENTS

Forms attached to this procedure are controlled and distributed as full-size pages separate from this procedure and may be copied for use when implementing this procedure.

Attachment 1 - Acronyms and Abbreviations
Attachment 2 - Model Documentation Outline
Attachment 3 - Model Signature Page/Change History
Attachment 4 - Model Administrative Change Notice (Form LSIII10-1)

ACN	Administrative Change Notice
BSC	Bechtel SAIC Company, LLC
COTS	commercial-off-the-shelf
DI	document identifier
DIRS	Document Input Reference System
DTN	Data Tracking Number
QA	quality assurance
QE	Quality Engineering
QER	Quality Engineering Representative
TBV	To Be Verified
TDMS	Technical Data Management System
TSPA	Total System Performance Assessment
TWP	Technical Work Plan

MODEL DOCUMENTATION OUTLINE

If any of the following sections are not applicable to a particular model, a brief statement of non-applicability is required for documentation purposes under each heading. The document may include additional sections (e.g., an Executive Summary) to assist "users" of the model. Information presented in the model documentation shall be transparent and traceable. Document any deviation from the TWP in the appropriate section and provide justification for the deviation.

1. **Purpose**–This section shall provide the intended use of the model, the model limitations (e.g., data available for model development, valid ranges of model application, spatial and temporal scaling), and scope of the model documentation. It shall also refer to the TWP for the activity.

2. **Quality Assurance**–This section shall include the applicability of the QA program, including evaluation of associated activities in accordance with appropriate implementing procedures. If the modeling activity or tasks included in the modeling activity have been determined not to be subject to the QA Program, provide justification. Reference the TWP for the determination of quality level. If the modeling activity investigates an item or barrier on the Q-List, identify the item or barrier and its safety category as classified in accordance with the applicable implementing procedure (LS-PRO-0203, *Q-List and Classification of Structures, Systems, and Components*). This section shall identify the method(s) used to control the electronic management of data in accordance with the controls specified in the TWP and will describe any variance from the planned method(s).

3. **Use of Software**–This section shall identify software used in model development, performance, and validation as described in IT-PRO-0011. Document the use of the software including identification of the computer type, the computer program name, software tracking number, version, operating environment (including platform and operating system version), inputs, outputs, evidence of or reference to computer program verification, and range of use. Discuss the basis (or reference thereto) supporting applications of the computer program to the specific physical problem (i.e., why the software was selected) and describe any limitations on outputs due to the selected software. Document that the use of the software was consistent with the intended use and within the documented validation range of the software.

   Identify software that was used prior to qualification to develop a preliminary output.

   Software shall meet the requirements of IT-PRO-0011. Ensure solutions to analysis used to support the model, written using the standard functions of COTS software programs (e.g., the standard deviation functions in Excel and MathCad) is documented in sufficient detail to allow a technically qualified person to reproduce or verify the results by visual inspection or hand calculations, including the following:

   - Name and version of the COTS software program
   - Software Tracking Number

- Inputs
- Outputs
- Application software options (e.g., options for the Excel solver function)
- Other information (e.g., operating environment, comments, or remarks that may include references to external documents, texts, monographs, and handbooks as necessary) that would be required for a technically qualified person to reproduce the work.

4. Inputs–Project data shall be referenced by DTN when a DTN is available. Technical product inputs shall be correctly selected, identified in the model documentation, correctly cited and incorporated. Equations used in model development are not considered product inputs and shall be described with regard to source and application in Section 6. This section may contain applicable inputs as described in the following subsections.

4.1 Direct Input–The appropriateness of technical product inputs (data, models, or technical product output) directly used to develop the model shall be documented and substantiated in this section.

- Identify all technical product inputs that were used directly in the development of the model.
- Document confirmation that data used to develop the model are not used to validate the model.
- If the present study uses, revises, or changes a previously developed and validated model to complete the present study, identify all associated DTNs, accession numbers, documentation titles, and document identifying numbers, if applicable.

4.2 Criteria–List criteria identified in Section 3 of the TWP, including requirements contained in applicable Requirement Documents (such as design interface documents) and any relevant acceptance or completion criteria. Model Validation criteria should be documented in Section 7 of the model document.

4.3 Codes, Standards, and Regulations–Identify applicable codes (only if the model directly addresses federal or other code requirements), standards (e.g., American Society for Testing and Materials or Occupational Safety and Health Administration standards), and regulations used in the model by name, number, and date, including applicable revision status, using date or revision designator.

5. Assumptions–This section shall include a description of the assumptions used, in the absence of direct confirming data or evidence, to perform the model activity. Other model assumptions are described in Section 6 of the model report.

6. Model Discussion–Include a description of the system, process, or phenomenon conceptual model and the scientific, engineering, and mathematical concepts/principles on which the mathematical model is based. Establish the appropriateness of the model for the purposes and within the limitations stated in Section 1 of this attachment.

The use of a scientific notebook(s) in accordance with LP-SIII.11Q-BSC, as applicable, is allowed for documenting the model activities, but final model documentation shall be completed to the requirements of this procedure. The documentation can refer to the scientific notebook(s) by title, number, organization, records accession number, or similar information.

Identify all the corroborating/supporting data, models, or product output used to develop the model. Identify the sources of the corroborating/supporting information. Document the qualification of unqualified project data developed in accordance with LP-SIII.2Q-BSC. Include additional discussions to substantiate input used in this section if not included in Section 4. Address any differences in direct input values between values brought forward in Section 4 and values used in this section. This information may be provided in tables, lists, or text discussing model development as long as the above provisions are met.

The following topics shall be included in this section when documenting a model:

- A detailed description of the conceptual model and the conceptual model implementation (mathematical model).
- Results of literature searches or other background information.
- For inputs to models:
  - Discuss constraints or limits on inputs and any impacts on model outputs.
  - Describe uncertainties, sources of uncertainties, and impacts of uncertainties on modeling results.
- Alternate models that were not used and the rationale for not selecting them.
- Units of measurement.
- Description of the input data used to generate input files for each model simulation.
- A discussion of initial and/or boundary conditions and an assessment of impacts of boundary conditions on model output.
- A discussion of model assumptions (other than those made in the absence of direct confirming data or evidence, documented in Section 5) and the impact of key assumptions on model output.

- A description and source for mathematical formulations, equations, algorithms, and numerical methods used in model development.

- A discussion of the results of model testing, sensitivities, and calibration activities, as applicable.

- A discussion of modifications, if any, to address regulatory requirements and any associated numerical manipulations if a previously validated model is being extended to provide input to or conduct performance assessments for the period after 10,000 years.

- Intended use of the model output.

- Comparison between the preliminary and final outputs, as applicable.

- Other software/computational methods considered and the rationale for not selecting them, as applicable.

7. Validation–The model validation documentation shall include:

- Identification of corroborating/supporting data, models, or information used to complete model validation activities. Identify the sources of the corroborating/supporting information.

- Level of model importance and required level of confidence.

- Documentation and discussion of model validation activities performed in Subsection 5.3 of this procedure.

- Results of the validation activities.

- Model validation criteria explicitly specified for ensuring the appropriate level of confidence has been obtained, consistent with Subsection 5.3 and the applicable TWP. These criteria must address adequacy of the scientific basis and accuracy of the model consistent with intended use per Paragraphs 5.3.1b)1) and 2).

- Text demonstrating that validation criteria are met consistent with the stated level of confidence required for the model.

- Any future activities that need to be accomplished for model validation and a justification for extending model validation beyond the documented completion of the current model.

Because model validation may consist of a sequence of separate activities, each model validation activity should be documented in accordance with the requirements of this procedure upon its completion.

8. Conclusions–This section shall provide a summary of the modeling activity. The conclusions, including the DTNs and product output as well as any decisions or recommendations based on the modeling activity, shall be presented in this section. Conclusions shall include any uncertainties and restrictions for subsequent use. Compliance results for both 10,000 year and for periods after 10,000 years shall be included in this section including sensitivity runs and neutralization runs, if applicable.

For modeling activities pertaining to the TSPA, the conclusions shall include a separate subsection that identifies (by table, if appropriate) and describes the product output intended for use in the TSPA Model. The product output for the TSPA shall be placed in a separate subdirectory of the product output DTN or a separate DTN that is also referenced in the subsection.

9. Inputs and References–Sources of inputs, software, DTNs, and cited references (including references used to justify assumptions) shall be provided in this section. Inputs and references include materials that support the conclusions of the model. These may include published reports, technical papers, scientific notebooks, literature searches, or other background information. The online Style Manual may be used as guidance on formatting reference lists and citations.

Appendices–Supporting documentation, such as computer output, that are lengthy or cannot be conveniently included within the main text of the documentation may be included as appendices. Computer output may be attached as hardcopy, read-only disk, or compact disk (read only memory), but must meet the requirements of AP-17.1Q. Computer output files included as appendices are exempt from page numbering, DI, and revision number requirements provided the total number of pages in each appendix (for hardcopy) or complete file information, including all file names, file dates and times, and file sizes, are documented on the appendix. Where the appendix is on computer media, the quantity and type of media shall be clearly identified on the Model Signature Page/Change History.

If applicable, Appendices shall include documentation of the selection of reviewers used for purposes of model validation per Step 5.3.2 a) 5).

BSC

Model Signature Page/Change History

Complete only applicable items.

Page iii

1. Total Pages:

2. Type of Mathematical Model

☐ Process Model ☐ Abstraction Model ☐ System Model

Describe Intended Use of Model

3. Title

4. DI (including Rev. No.):

	Printed Name	Signature	Date
5. Originator			
6. Independent Technical Reviewer			
7. Checker			
8. QER			
9. Responsible Manager/Lead			
10. Responsible Manager			

11. Remarks

EXAMPLE

Change History

12. Revision No.	13. Description of Change

INSTRUCTIONS FOR MODEL SIGNATURE PAGE/CHANGE HISTORY

Originator

1. Enter the total number of pages (including appendices).

2. Check the model type and describe the intended use of the model.

3. Enter the title of the model.

4. Enter the DI, including revision number (alphanumeric before approval, e.g., Rev. 00A).

Steps 5 through 12 occur after checking is completed and the revision/change designator is changed to a numeric designator. Names may be preprinted.

5. Print or type name; sign and date.

Independent Technical Reviewer

6. Print or type name; sign and date, indicating acceptance of the model documentation.

Checker

7. Print or type name; sign and date when all comments have been resolved and changes have been incorporated into the model documentation.

QER

8. Print or type name; sign and date when all comments have been resolved and changes have been incorporated into the model documentation.

Responsible Manager/Lead

9. Print or type name; sign and date when all reviews have been completed and all issues have been resolved. (If a Lead was not assigned, the Responsible Manager should complete this box.)

Responsible Manager

10. Print or type name; sign and date to signify approval.

Originator, Independent Technical Reviewer, Checker, QER, Lead, Responsible Manager

11. Indicate any limitations on the use of the model. The Remarks section of the review copy may also be used to document those draft documents that are in concurrent review and that were used as input (TBV).

Originator

12. Identify any revisions to this model documentation, in order, starting with Rev 00 and continuing to the latest revision.

13. For any revisions to this model documentation, enter a brief description of each change and the reason for the change (e.g., “added Appendices A and B”). If alphanumeric pagination is used, identify the alphanumeric page numbers inserted in the change history for future accountability.

BSC	**Model** **Administrative Change Notice** *Complete only applicable items.*	QA: Page 1 of 1

1. Document Number:		**2. Revision**:		**3. ACN**:	
4. Title:					
5. No. of Pages Attached					

6. Approvals:		
Preparer:	Print name and sign	Date
Checker:	Print name and sign	Date
QER:	Print name and sign	Date
Independent Technical Reviewer:	Print name and sign	Date
Responsible Manager:	Print name and sign	Date

7. Affected Pages	**8. Description of Change:**
	EXAMPLE

INSTRUCTIONS FOR MODEL ADMINISTRATIVE CHANGE NOTICE

Originator

1. Enter the document number of the model report.

2. Enter the revision number of the model report.

3. Enter the number of the ACN (alphanumeric before approval, e.g., ACN 01A)

4. Enter the title of the model report.

5. Enter number of pages attached to the cover sheet.

Preparer, Checker, QER, Independent Technical Reviewer, and Responsible Manager

6. Print or type name; sign and date, indicating acceptance of the ACN documentation.

Originator

7. List the affected pages.

8. Enter the description of change.