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## Procedure Planning for Science Activities

C. A. Schneider

W. W. Watson

*Lead Laboratory Interface*

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**PROCEDURE**

DOC.20070302.0001

**PLANNING FOR SCIENCE ACTIVITIES**

**LP-2.29Q-BSC**

**Revision 2 ICN 1**

Effective Date: 03/16/2007

Preparer: 

C. A. Schneider

3/1/07  
Date

Approval: 

W. W. Watson  
Manager, Lead Lab Interface

3/1/07  
Date

**CHANGE HISTORY**

<b><u>Revision Number</u></b>	<b><u>Interim Change No.</u></b>	<b><u>Effective Date</u></b>	<b><u>Description of Change</u></b>
2	1	03/16/2007	Reordered Change History to chronological order to comply with AP-15.Q Section 7.0. Replaced references to LP-12.1Q-BSC with CO-PRO-1001. Replaced references to LP-SIII.11Q-BSC with PA-PRO-0304. Modified text in Sections 6.1 and 6.2 to remove references to the "Q-List" in response to Condition Report 9872. Included a process step in Section 4. to follow CC-PRO-2001 when preclosure function information is used to address Condition Report 9688.
2	0	10/02/2006	Revision to support implementation of the Quality Management Directive, QA-DIR-10, and lead laboratory transition. Removed references to source requirements documents such as Quality Assurance Requirements and Description, DOE/RW-0333P, and the Augmented Quality Assurance Program (AQAP), DOE/RW-0565. Removed National Laboratories from the applicability statement. Added transition statement for existing work plans. Removed references to Field Work Packages and Project Engineer. Updated definitions to align with source requirements document definitions. Removed references to Department Manager and reassigned responsibilities to the Responsible Manager. Updated interfacing procedure references. Added text on the determination of quality levels for the scientific activity. Added interface for reporting nonconforming samples identified during testing activities. Changed the responsibility for development, approval, and maintenance of this procedure to the Lead Laboratory Interface Manager.

**CHANGE HISTORY (Continued)**

<b><u>Revision Number</u></b>	<b><u>Interim Change No.</u></b>	<b><u>Effective Date</u></b>	<b><u>Description of Change</u></b>
1	0	05/30/2006	<p>Changed responsibilities for the procedure to the Performance Assessment Manager on the cover page and in Subsection 4.1. Updated interfacing procedure references where appropriate. Added definition of Unexpected Test Results in Section 3.0 and added text in Attachment 3 for addressing unexpected test results (Condition Report 6783). Added text in Subsection 5.1.2 and Attachment 3 to address scoping activities (Condition Report 6822). Added text in Paragraph 5.1.2 and Attachment 3 to address identification of requirements from the Requirements Management System (Condition Report 7831). Removed use of AP-5.1Q forms in the review of Technical Work Plans and added use of PA-PRO-0601 (Condition Report 7240). Added text in Attachment 3, Section 2.2, and added Attachment 4 to provide guidance regarding conduct of technical review for model validation purposes (Condition Report 7641). Clarified requirements for records in Subsection 6.0. Added review criteria to be used during the review of the Technical Work Plan in Paragraph 5.2.1. Added clarification in text in Attachment 3, Section 2.2 for alignment to LP-SIII.10Q-BSC for the goals of model validation associated with adequacy and accuracy (Condition Report 6921). Clarified text for the use of change bars in Paragraph 5.1.3 d) (Condition Report 7937). Added requirement in Paragraph 5.2.1 b) to include the organization providing input to the planned activities to be included as reviewers to better implement the requirement of Quality Assurance Requirements and Description, DOE/RW-0333P, Section III.2.1 B (Condition Report 7828). Clarified used of terms "science activities" in Section 1.0 and Paragraph 5.2.2 1) to align better with other interfacing procedures (Condition Report 7827). Made other changes, as appropriate.</p>

**CHANGE HISTORY (Continued)**

<u>Revision Number</u>	<u>Interim Change No.</u>	<u>Effective Date</u>	<u>Description of Change</u>
0	2	09/19/2005	Interim change for clarification of expectations for model validation justification in Attachment 2, Subsection 2.2 of the Technical Work Plan Content to better align with Quality Assurance Requirements and Description, DOE/RW-0333P, requirement Supplement III.2.6.F.1 (Condition Report 4986) and made minor text clarification in use of terms in Attachment 3.
0	1	07/18/2005	Interim Change Notice to correct applicability statement in the second paragraph of Section 2.0 associated with the use of Scientific Investigation Test Plans (reference Condition Report 6073), to update interfacing procedure reference from AP-SV.1Q to LP-SV.1Q-BSC, and to update reference titles.
0	0	01/17/2005	Initial issue. Supersedes AP-2.27Q, Planning for Science Activities. Changed to incorporate Document Action Requests D21155 (to support the Administrative Procedure to Line Procedure Conversion Initiative to transition all pre-approved Administrative Procedures to Bechtel SAIC Company, LLC Line Procedures in accordance with Bechtel Interoffice Memorandum No. 1116043940 date 11/30/04), D21331 (change reference from AP-2.12Q to LP-2.12Q-BSC), D21402 (change reference from AP-PMC-005 to LP-PMC-026-BSC), and D22354 (change reference from AP-SIII.1Q to LP-SIII.11Q-BSC).

## **1.0 PURPOSE**

This procedure establishes responsibilities and process for preparation, review, approval, revision/cancellation, and distribution of work plans for scientific investigation activities, including modeling, scientific laboratory and field testing activities, scientific analyses, and other science related documents and technical products. Plans for other activities may be completed in accordance with the requirements of this procedure, as directed by management.

## **2.0 APPLICABILITY**

This procedure applies to individuals who prepare, revise, review, or approve plans for science activities.

Existing work plans (technical work plans) developed and approved under a prior version of this procedure are not required to be revised to comply with the requirements of this revision. Any future changes to work plans will be developed and approved using the requirements of the most current version of this procedure.

This procedure does not apply to administrative and support activities that may be associated with the subject scientific activities. Examples of such activities include:

- Infrastructure and support activities that are governed by other implementing procedures (e.g., document control, records management, procedure development, procurement, and configuration management)
- Program Management and Integration overhead accounts; management and oversight activities
- Human resource-related activities, such as personnel performance appraisals, personnel placement, and employee assistance
- Programmatic, cost estimating, and project control activities, such as financial, resource, program, cost, and schedule planning and monitoring
- Oral and written reports of work status (e.g., weekly and monthly reports or presentations)
- Administration activities, such as facilities/space management, motor pool operations, reprographics services, mail services, telecommunications, supplies, and recycle management.

For work activities performed by a subcontractor, the requirements for a Technical Work Plan (TWP) shall be identified in the procurement document scope of work, as applicable.

### 3.0 **DEFINITIONS**

- 3.1 *Activity***—An organized or supervised action performed to complete a specific task or function (e.g., modeling, scientific analyses, scientific testing, or preparation of documents/products).
- 3.2 *Continuous Use Software***—Any software employed on an uninterrupted basis, such as data acquisition software used to collect data and/or process control software used to take some action based on the data.
- 3.3 *Field Testing***—Any testing activity that requires site preparation (e.g., excavation and surface or subsurface drilling), instrumentation, and subsequent observation or measurement to collect data or information to support project work activities.
- 3.4 *Higher Level Planning***—Documents that identify the requirements and overall work scope that is to be passed on to sub-organizations tasked with implementing the work scope.
- 3.5 *Independent Technical Reviewer***—As used in this procedure in Paragraph 5.2.2, a qualified individual other than the TWP Manager technically competent in the subject area of the document undergoing review responsible for confirming the adequacy, accuracy, and completeness of TWPs supporting scientific analyses and models.
- 3.6 *Laboratory Testing***—A non-field testing activity that uses laboratory methods, techniques, and equipment to collect data or information to support project work activities.
- 3.7 *Level of Confidence***—Assigned to models based on the effect that model uncertainty could have on estimates of mean annual dose (of radiation). The level of confidence required for a model is linked to the importance of the model (Attachment 1, Levels of Model Importance, Validation, and Confidence).
- 3.8 *Level of Model Importance***—Determined by the model's relative impact on the potential performance of the repository system (Attachment 1, Levels of Model Importance, Validation, and Confidence) and linked to the required level of confidence. Models that are more important require more extensive validation documentation and less important models.
- 3.9 *Level of Validation***—A consequence based on the level of importance assigned to the model. Validation and confidence-building are synonymous.
- 3.10 *Lower Level Planning***—Documents that provide specific details needed to perform a portion of the larger work scope identified in higher level planning.
- 3.11 *Model Validation***—A process used to establish confidence that a mathematical model and its underlying conceptual model adequately represent with sufficient accuracy the phenomenon, process, or system in question.

- 3.12 **Occurrence of Off-Normal Events**—Unplanned event occurring during the test that could have an impact on the testing results such as seismic activity, rock falls, or other phenomena.
- 3.13 **Pre-Test Prediction**—Development of a predictive model(s), analysis, or calculation(s) undertaken in advance of conducting a scientific testing activity in order to predict or forecast the expected test results or outcomes for subsequent comparison against actual test results or outcomes.
- 3.14 **Scientific Investigation**—An analysis consisting of an explanation, observation, identification, description, or experimental study either of natural phenomena or of engineered materials that describe the postclosure repository system or its performance.
- 3.15 **Technical Work Plan (TWP)**—A lower-level planning document for an activity, or a logical grouping of related activities described and controlled by higher level planning.
- 3.16 **Unanticipated Test Conditions**—Differences between the test environment and test equipment configuration defined in the TWP and the observed conditions.
- 3.17 **Unexpected Test Results**—Parameter values obtained from measurements or observations that meet the definitions of unexpected test results as documented in the TWP.

#### 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) TWP Manager
  - c) Independent Technical Reviewer

#### 5.0 **PROCESS**

Acronyms and abbreviations used in this procedure are defined in Attachment 2, Acronyms and Abbreviations.

##### **PROCESS OUTLINE**

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<b>5.1 PREPARING THE TWP</b> .....	<b>7</b>
<b>5.2 REVIEWING THE TWP</b> .....	<b>9</b>
<b>5.3 APPROVING THE TWP</b> .....	<b>11</b>
<b>5.4 REVISING OR CANCELING TWP(S)</b> .....	<b>11</b>
<b>5.5 DISTRIBUTING TWP(S)</b> .....	<b>12</b>

## 5.1 PREPARING THE TWP

### 5.1.1 Responsible Manager:

- a) Review the higher level planning (i.e., Integrated Project Schedule milestone, baseline, and strategic planning documents). Ensure TWP(s) are prepared for scientific investigation activities. TWPs may control a single activity or multiple related activities.
- b) Identify requirements allocated to the work plan activities that will be included in the TWP as obtained from the Requirements Management System (RQ-PRO-1000, *Managing Requirements*).
- c) If scoping activities are needed to assist in the development of the scientific approach or the choice of technical methods for activities described in the TWP, these activities may be conducted prior to approval of the TWP. These scoping activities shall be described in Section 1 of the TWP, Work Scope, as a separate section entitled "Description of Scoping Activities." Include a description of the controls that will be applied to the scoping activities. For those scoping activities that are carried forward into the technical product, ensure that adequate documentation is included to support the qualification status of the activities, as appropriate.
- d) Assign a TWP Manager (the Responsible Manager may perform the responsibilities of the TWP Manager).
- e) For any TWP that specifies use of U.S. Geological Survey (USGS) resources, coordinate with and obtain TWP approval from the USGS Technical Project Officer (TPO) or designee.

### 5.1.2 TWP Manager:

Searching the Lessons Learned Notification database in Lotus Notes for applicable lessons learned is recommended when developing work plans, and when developing lessons learned regarding work plans, as appropriate.

- a) For activities that use electronic media to store or manipulate information, complete an evaluation in accordance with IT-PRO-0009, *Control of the Electronic Management of Information*. An IT-PRO-0009 evaluation may control a single activity or multiple related activities.
- b) If applicable, initiate an Environmental Baseline Review with Environmental, Safety and Health, in conjunction with AP-EM-010, *Environmental Baseline Review*.

- c) Obtain a document identifier (DI) sequence number from Document Control in accordance with RM-PRO-2001, *Document Control*. Place the DI number, along with the revision indicator, on the cover sheet and on each page of the TWP.
- d) Prepare or revise the TWP using Attachment 3, TWP Content, for information on content that the TWP needs to address. The standardized template in the Office of Civilian Radioactive Waste Management (OCRWM) Style Manual on the BSC Intranet is the recommended format.
  - 1) If appropriate, assign the task of preparing portions of the draft TWP to principal investigators, scientific investigation integrators, model developers, work scope managers, or other staff members to ensure needed detail is included in the TWP. The TWP Manager is responsible for the integration and completeness of the TWP when multiple contributors assist in developing the TWP.
  - 2) For Interim Change Notices (ICNs) to approved TWPs, place black vertical lines (change bars) in page margins to identify the locations of changes. For revisions to approved TWPs (i.e., the revision number increases), place black vertical lines in page margins to identify location of changes, if the number of changes makes this practical. Change bars are not required when the TWP has been substantially rewritten.
  - 3) For TWPs that plan model development activities, determine the appropriate times during the model development process for the Responsible Manager to review model validation quality issues with the model report Originator, Checker, and Independent Technical Reviewer. Document the schedule for these reviews in the applicable TWP that governs the modeling activities.

## 5.2 REVIEWING THE TWP

### 5.2.1 TWP Manager:

- a) Prepare a review package for the draft TWP that includes the completed IT-PRO-0009 evaluation. The organization requesting the review shall make pertinent background information or data available to the reviewers if the information is not readily available.
- b) Initiate a review of the TWP in accordance with PA-PRO-0601, *Document Review*.

- 1) Include the BSC Quality Engineering Representative, implementing organizations, organizations providing input to the planned activities, and customer organizations in the review. Include the USGS TPO in reviews of draft TWP's involving USGS resources. Designate an Independent Technical Reviewer for reviews of TWP's for scientific analyses and models.
- 2) Review criteria established (PA-PRO-0601) for the TWP shall include as a minimum:
  - TWP content complies with Attachment 3.
  - Information in the TWP is applicable to the TWP's intended purpose.
  - Information in the TWP is technically adequate and complete in the context of the TWP's intended purpose.
  - Information in the TWP is correct (e.g., identification of applicable procedures and implementing documents, equipment needed for testing, and interfacing organizations).
  - Results of activities described in the TWP will be sufficiently accurate for their intended purpose and use.
- 3) Individuals other than the preparer shall perform the review. Reviewers shall be technically competent in the subject area of the document being reviewed.

### **5.2.2 Independent Technical Reviewer:**

Review TWP's in accordance with Paragraph 5.2.1 to determine:

- 1) Whether the implementing procedure(s) identified is appropriate for developing the product(s) (e.g., models and model documentation are developed in accordance with LP-SIII.10Q-BSC, *Models*; scientific analyses and calculations developed in accordance with LP-SIII.9Q-BSC, *Scientific Analyses*; scientific activities documented in accordance with PA-PRO-0304, *Scientific Notebooks*; and scientific technical reports developed in accordance with PA-PRO-0313, *Technical Reports*)
- 2) Whether the intended use for the product has been identified
- 3) Whether the needed level of confidence has been identified for the model(s) and if the level of confidence is appropriate for the intended use of the model(s)

- 4) Whether model validation plans are adequate and appropriate to obtain the level of confidence required by the model's relative importance to the potential performance of the repository system
- 5) Whether validation criteria are identified for modeling activities, and are appropriate for the intended use and for the level of confidence to be obtained for the model
- 6) Whether an appropriate level of detail has been provided for scientific testing to support performance to conduct the activity in the field or laboratory.

### **5.2.3 TWP Manager:**

- a) Document responses to comments, including rationale for not including or partially including comments.
- b) Modify the review draft of the TWP to reflect resolution of comments to be addressed.
- c) Obtain reviewers' acceptance of comment responses.
- d) Elevate any unresolved comments to the next level(s) of management of the TWP Manager and reviewers until resolution is achieved, and document the resolution.

## **5.3 APPROVING THE TWP**

### **TWP Manager:**

- a) Prepare the final TWP.
- b) Sign and date the TWP, indicating approval.
- c) Obtain the signature and date of the USGS TPO, if required, or state "not applicable."
- d) Obtain the signature and date of the Responsible Manager.

## **5.4 REVISING OR CANCELING TWP(S)**

### **5.4.1 Responsible Manager:**

Review any proposed changes to determine if there is a change to the baseline and/or a need for a revision or ICN to the TWP(s). Minor changes (i.e., no significant changes in work scope and/or conceptual approach) do not require a revision or ICN to the TWP but may be documented in the technical product described in the TWP.

**5.4.2 TWP Manager:**

- a) Revise or ICN the TWP(s) in accordance with Subsections 5.1 through 5.3, as applicable. No more than five ICNs shall be issued against a TWP revision.
  - 1) Work scope changes that are not the result of annual higher level planning and that impact the existing baseline shall be processed in accordance with PC-PRO-1080, *Baseline Change Control*.
  - 2) Initiate an Environmental Baseline Review in accordance with AP-EM-010 for any changes that impact the existing baseline.
- b) If desired and if the entire TWP is not being revised, use alphanumeric page designators (e.g., 10a) 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.
- c) If the work scope has been completed or has been deleted from the baseline in accordance with applicable procedures, cancel TWPs no longer relevant to the project in accordance with RM-PRO-2001. Obtain electronic mail acknowledgement from users prior to cancellation.

**5.5 DISTRIBUTING TWP(S)**

**TWP Manager:**

Upon completion, revision, or cancellation of TWP(s):

- 1) Issue or cancel the TWP in accordance with RM-PRO-2001. Submit native files to Document Control when issuing or changing a TWP.
- 2) Submit records to the Records Processing Center in accordance with Section 6.0.

## **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**

NOTE: The TWP may have a QA designator or a discussion of the applicability of the QA program that indicates whether or not the document should be treated as a QA record.

To be submitted as part of the records package for a TWP that is related to an item or barrier that is important to safety or important to waste isolation:

Document Review Records generated by PA-PRO-0601

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

The approved TWP

### **6.2 NON-QA LONG-TERM RECORDS**

NOTE: The TWP may have a QA designator or a discussion of the applicability of the QA program that indicates whether or not the document should be treated as a QA record.

To be submitted as part of the records package for a TWP that is **not** related to an item or barrier that is important to safety or important to waste isolation:

Document Review Records generated by PA-PRO-0601

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

The approved TWP

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

Draft TWP

Comment sheets (including resolutions) generated by PA-PRO-0601

Documentation of decision of escalated comments generated by PA-PRO-0601

To be submitted as an individual record for each TWP, if applicable:

Hard copy print out(s) of electronic mail acknowledgement(s) of TWP cancellation from users

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

None

### **7.0 REFERENCES**

- a) AP-16.1Q, *Condition Reporting and Resolution*
- b) AP-17.1Q, *Records Management*
- c) AP-EM-010, *Environmental Baseline Review*
- d) AP-REG-009, *Reportable Geologic Condition*
- e) CO-PRO-1001, *Control of Measuring and Test Equipment*
- f) EG-PRO-3DP-G06B-00001, *Material Requisitions*
- g) EG-PRO-3DP-G06B-00002, *Subcontracts*
- h) EG-PRO-3DP-G04B-00057, *Technical Service Contracts*
- i) EG-PRO-3DP-G04T-00905, *Determination of Quality Levels*
- j) IT-PRO-0009, *Control of the Electronic Management of Information*
- k) IT-PRO-0011, *Software Management*
- l) LP-SIII.9Q-BSC, *Scientific Analyses*
- m) LP-SIII.10Q-BSC, *Models*
- n) PA-PRO-0201, *Peer Review*
- o) PA-PRO-0304, *Scientific Notebooks*
- p) PA-PRO-0313, *Technical Reports*
- q) PA-PRO-0601, *Document Review*
- r) PA-PRO-0803, *Requesting, Transferring, and Returning Yucca Mountain Project Specimens from the Sample Management Facility*
- s) PC-PRO-1080, *Baseline Change Control*
- t) RM-PRO-2001, *Document Control*
- u) RQ-PRO-1000, *Managing Requirements*

- v) *Control of Agreements*, YMP-USGS-QMP-4.02
- w) *Procurement Actions*, YMP-USGS-QMP-4.01
- x) *Risk Information to Support Prioritization of Performance Assessment Models*,  
TDR-WIS-PA-000009
- y) Office of Civilian Radioactive Waste Management Style Manual. Current version.  
<http://connect.ymp.gov/artman/publish/stylemanual.shtml>

## **8.0 ATTACHMENTS**

Attachment 1 - Levels of Model Importance, Validation, and Confidence

Attachment 2 - Acronyms and Abbreviations

Attachment 3 - TWP Content

Attachment 4 - Instructions for Technical Review for Purposes of Model Validation

## LEVELS OF MODEL IMPORTANCE, VALIDATION, AND CONFIDENCE

This attachment describes three levels of model importance and corresponding validation guidelines commensurate with each level of model importance. The levels of model importance are based on total system performance assessment (TSPA) system sensitivity analyses and conclusions presented in *Risk Information to Support Prioritization of Performance Assessment Models*, TDR-WIS-PA-000009. Although this document was developed in support of the TSPA for Site Recommendation, the methodology used to determine the level of model importance and corresponding level of validation are generally applicable to the TSPA for License Application and should be used. The information presented is historical and was used as guidance for development of the models and analysis that support the TSPA for License Application. Table 1 summarizes the levels of model validation for each TSPA component model. It is important to note that models summarized in Table 1 are TSPA component models that provide input directly to the TSPA system model. Many project models do not provide input to the TSPA system model directly, but provide input or scientific bases to the component model. For these cases, the basis of association of the model to the component model shall be defined. The level of confidence for these supporting models should be consistent with the confidence level of the TSPA component model.

LP-SIII.10Q-BSC requires that TSPA model components be validated for their intended purpose and stated limitations, and to the level of confidence required by the component's relative importance to the potential performance of the repository system. Three levels of model validation are defined as follows, with the level of validation increasing with an increasing level of model importance ranging from low to moderate to high. Models whose variation could lead to a potentially significant effect on the estimate of mean annual dose (e.g., a change greater than 1 mrem/year) should receive a high or Level III model validation. Models whose variation could lead to moderate effect on estimate of mean annual dose (less than 1 mrem/year, but greater than 0.1 mrem/year) should receive Level II model validation. Level I validation is sufficient for models of less importance to the estimate of mean annual dose.

### Level I Validation

Level I validation shall include, at a minimum, discussion of documented decisions and activities that are implemented during the model development process that build confidence and verify that a reasonable, credible, technical approach using scientific and engineering principles was taken to:

- a) Evaluate and select input parameters and/or data.
- b) Formulate defensible assumptions and simplifications.
- c) Ensure consistency with physical principles, such as conservation of mass, energy, and momentum.
- d) Represent important future state (aleatoric), parameter, and alternative model uncertainties.

- e) Ensure simulation conditions have been set up to span the range of intended use and avoid inconsistent outputs.
- f) Ensure that model predictions (performance parameters) adequately represent the range of possible outcomes, consistent with important uncertainties.

For post-model development model validation per LP-SIII.10Q-BSC, choose a single method described in Paragraph 5.3.2a) of LP-SIII.10Q-BSC, consistent with a model of limited importance to the mean annual dose.

**Level II Validation**

Level II validation shall include Level I criteria a) through f) and a single post-model development model validation method described in Paragraph 5.3.2a) of LP-SIII.10Q-BSC, consistent with a model of moderate importance to mean annual dose. Document rationale for selection of post model development activities as described in Attachment 3.

**Level III Validation**

Level III validation shall include Level II criteria and documentation that demonstrates model predictions are reasonably corroborated by at least two post-model development model validation methods described in Paragraph 5.3.2a) of LP-SIII.10Q-BSC.

Levels of model validation for each TSPA component model are summarized in Table 1.

Table 1. Guidelines of Minimum Levels of Model Validation

<b>Model Validation Area</b>	<b>TSPA Component Model</b>	<b>Level of Validation</b>
Climate and Infiltration	Climate and Infiltration	I
Unsaturated Zone Flow	Unsaturated Zone Flow	I
Seepage into Emplacement Drifts	Seepage into Emplacement Drifts	I
In-Drift Moisture and Chemistry	Invert Moisture and Chemistry	I
	Waste Package/Drip Shield Moisture and Chemistry	II
Waste Package/Drip Shield Degradation	Waste Package/Drip Shield Degradation	III/I

Table 1. Guidelines of Minimum Levels of Model Validation (Continued)

Model Validation Area	TSPA Component Model	Level of Validation
Radionuclide Release Rates and Concentrations	Radionuclide Inventory	II
	Radionuclide Screening	I
	Temperature, Amount of Water, and Chemistry in Waste Package	I
	Degradation of Waste Forms Including Cladding	I
	Concentrations of Dissolved Radionuclides and Colloid-Associated Radionuclides	II (Pu) I (Other)
	Radionuclide Transport from Waste Package to Drift Wall through Invert	I
	Drift Shadow	I
Unsaturated Zone Radionuclide Transport	Unsaturated Zone Radionuclide Transport	II
Saturated Zone Flow and Radionuclide Transport	Saturated Zone Flow and Radionuclide Transport	II
Probability of Igneous Activity	Eruptive Release Probability	III
	Groundwater Release Probability	II
Damage to Engineered Barriers by Igneous Activity	Number of Waste Packages Intersected by Conduit	III
	Number of Waste Packages Disrupted by Magma	II
Transport of Radionuclides Following Igneous Activity	Transport by Groundwater	I
	Wind Speed and Direction	II
Biosphere	Soil Thickness, Removal, and Redistribution (Igneous Activity Eruptive Release Scenario)	III
	Soil, Plant, and Ingestion Submodels (Groundwater Release Scenario)	I

BSC	Bechtel SAIC Company, LLC
DI	document identifier
DOE	U.S. Department of Energy
ICN	Interim Change Notice
OCRWM	Office of Civilian Radioactive Waste Management
SSC	structure, system, or component
TPO	Technical Project Officer
TSPA	total system performance assessment
TWP	Technical Work Plan
USGS	U.S. Geological Survey

## TWP CONTENT

### Change History

Use numerals to indicate the revision/ICN number. If the TWP is a new document, state "Initial issue" on the Change History page. If changes to the TWP are extensive, state, "Complete revision" on the Change History page, and briefly summarize the changes. Use revisions/ICNs to address changes in previously documented work scope. Provide a brief description of changes from the previous plan. If alphanumeric pagination is used, identify the alphanumeric page numbers inserted in the Change History for future accountability. Provide DI number and title for TWP(s) superseded by the revision.

### Content

In each applicable section, ensure that each bulleted item is addressed for each major activity, and, for each applicable bulleted item, ensure that each sub-bulleted item is addressed. If any section, bulleted item in an applicable section, or item sub-bulleted under an applicable bullet does not apply to the activity, state "N/A" and provide an explanation as to why it does not apply. For example, in Section 2.2, the statement "N/A - No modeling activities will be conducted," is sufficient if this is applicable to the work scope. The bullets, etc. do not need to be addressed individually.

#### 1. Work Scope

Describe the scope of work:

- State the overall technical and/or performance objectives or requirements to be met by completion of the work. TWPs may control a single activity or multiple related activities.
- Identify major activities (primary tasks), including identification of scoping activities if used to assist in the development of the scientific approach or the choice of technical methods for activities described in the TWP, and products (e.g., data qualification, modeling, scientific analyses, scientific testing). Summaries of scientific testing and associated results may be documented separately or within model/scientific analysis reports for which the scientific investigation results are a direct feed.
- Identify organizations performing work/responsible for the products.
- For scientific testing, state whether pre-test predictions will be completed. Pre-test predictions provide a set of data or information that can be compared subsequently against test results to build confidence in the adequacy and appropriateness of the technical bases for the scientific approach and technical methods underlying the testing activity. Pre-test predictions are distinct from scoping analyses or calculations that may be documented in a Scientific Notebook and undertaken to support test design prior to conducting the testing activity.

## 2. Scientific Approach or Technical Methods

Address bulleted items under Subsection 2.1 for all work activities. In addition, address bulleted items under Subsection 2.2 for modeling activities.

### 2.1 For all work activities:

- State the intended use and/or purpose of each activity and/or product if not provided in Section 1, Work Scope, if the TWP is applicable to multiple work activities. Identify the item to be tested, test requirements, and instructions for performing the test, as applicable. Identify users/customers of the outcomes from the activity.
- Describe the scientific approach and technical methods for each activity, including details of scoping activities, if used to define scientific approach or technical method.
- Identify methods for data collection, data reduction, and recording results.
- To the extent practicable, address provisions for handling unexpected test results, unanticipated test conditions, or occurrence of off-normal events during testing:
  1. Define values for parameters that would represent unexpected test results, describe outcomes that would represent unanticipated test conditions, and off-normal events, where possible. At a minimum, identify an interim review point in data acquisition and data processing to determine if there is an unexpected result.
  2. Outline a process to handle unexpected test results, unanticipated test conditions, or occurrence of off-normal events that includes:
    - a. Notification of the occurrence to the responsible manager.
    - b. Investigation, determination of validity of results, and evaluation of impacts including a determination whether action per AP-REG-009, *Reportable Geologic Condition*, is required.
    - c. Report the adverse condition in accordance with procedure AP-16.1Q, *Condition Reporting and Resolution*, if the condition could adversely affect the environment, safety, health, waste isolation, operations, or quality of items and services. Report any nonconformance associated with samples identified during testing in accordance with PA-PRO-0803, *Requesting, Transferring, and Returning Yucca Mountain Project Specimens from the Sample Management Facility*.
- Identify Features, Events, and Processes to be addressed, if any.

**2.2 Additional steps for modeling and scientific analysis activities** (see Attachment 1, Levels of Model Importance, Validation, and Confidence, for guidance regarding the levels of model importance, validation, and confidence):

- Model validation criteria for adequacy of scientific basis and accuracy for intended use shall be explicitly specified for ensuring the appropriate level of confidence has been obtained, as required by LP-SIII.10Q-BSC.
- Identify the level of confidence/validation required for each model, as required by LP-SIII.10Q-BSC.
- Identify and provide justification for the model validation activity/activities to be completed after the model has been developed, dependent upon and consistent with the model's intended use and required level of confidence, including one or more of the following:
  - 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.
  - Corroboration of model results with other model results obtained from the implementation of mathematical models.
  - 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.
  - Peer review per PA-PRO-0201, *Peer Review*.
  - Technical review planned in accordance with Attachment 4, Instructions for Technical Review for Purposes of Model Validation.
  - 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.
  - Corroboration of pre-test model predictions to data collected during subsequent, associated testing.
- Identify the schedule of review sessions addressing model validation quality issues to be conducted by the Responsible Manager with the model report Originator, Checker, and Independent Technical Reviewer.
- Identify the validation criteria to be met by the validation activities, as required by LP-SIII.10Q-BSC.

- Provide justification for use of a previously developed and validated model to complete scientific analyses, as required by LP-SIII.9Q-BSC.
- If a validated model is extended to provide input to or conduct performance assessment for the period after 10,000 years, describe modifications required to address regulatory requirements and any associated numerical manipulations required to conduct the assessment.
- Provide justification for and validation plans for use of previously developed model(s) outside of the intended use, limitations, or range of validity, as required by LP-SIII.10Q-BSC.

**3. Industry Standards, Federal Regulations, DOE Orders, Requirements, and Acceptance/Completion Criteria**

- State directly applicable standards, including industrial (e.g., American Society for Testing and Materials Standards) and/or technical standards.
- State any sections or subsections of the Code of Federal Regulations, U.S. Department of Energy (DOE) orders, and/or regulatory requirements, including Yucca Mountain Review Plan acceptance criteria, Nuclear Regulatory Commission Key Technical Issues and additional information needs to be directly addressed by the activities or product(s) not identified by existing contract or procedure interfaces, if any.
- State the provisions for determining the level of accuracy, precision, and representativeness of results of each activity.
- State applicable acceptance and/or completion criteria identified in higher level planning for each activity and product, including DOE acceptance criteria and contractor completion criteria.
- Identify requirements allocated to the science activity from the Requirements Management System (RQ-PRO-1000).
- Identify any derived requirements identified in engineering, performance assessment, or other source documents (e.g., engineering interface documents).

**4. Implementing Documents**

- Identify the specific implementing procedures that will be required to directly conduct each science activity (PA-PRO-0304, LP-SIII.9Q-BSC, LP-SIII.10Q-BSC, PA-PRO-0313, etc.), unless these are identified in lower level planning documents. If the science activity will use information from preclosure functions (e.g., repository engineering, design, operations, and preclosure safety and criticality analyses), include CC-PRO-2001, *Technical Interface Control*, as an implementing procedure. CC-PRO-2001 controls the identification and exchange of information across the organizational

boundary between preclosure functions and post-closure/scientific investigation functions (e.g., post-closure performance modeling and assessment, post-closure criticality analyses, and site-specific geotechnical, environmental, meteorological, and seismic investigations). It is not necessary to list support procedures used for traceability, procurement, calibration, qualification, condition reporting, or processing the technical products, such as those used for document control and records management (AP-16.1Q, AP-17.1Q, RM-PRO-2001, CO-PRO-1001, and IT-PRO-0009, etc.). To the extent foreseeable, identify any additional implementing documents to be developed to control and perform each activity.

## 5. Equipment

- Identify the major field or laboratory systems or equipment necessary to conduct the work.
- Identify calibration (pre-test as well as applicable post-test calibration) requirements and methods for addressing instrument error. Measuring and test equipment calibration shall be documented in accordance with CO-PRO-1001, *Control of Measuring and Test Equipment*.

## 6. Records

- Provide instructions to users of the TWP to develop, maintain, collect, and submit required records generated as a result of implementing procedures and the documentation of objective evidence of the results of the work performed in accordance with AP-17.1Q.

## 7. Quality Verifications

- Identify any quality verifications, other than surveillances or audits (i.e., mandatory hold points and readiness reviews), that are required during the execution of the TWP.

## 8. Prerequisites, Special Controls, Environmental Conditions, Processes, or Skills

- Describe the quality level of the science activity based on the safety classification and functional area using the methodology defined in procedure EG-PRO-3DP-G04T-00905, *Determination of Quality Levels*. Provide justification for selection of the quality level.
- Describe any prerequisites that must be satisfied before work begins, including calibration of measuring and test equipment, and receipt of data/input(s) under development. Identify the organizations responsible for developing the input(s).
- Document the results of the evaluation required by IT-PRO-0009 and the method(s) or the implementing documents to be used for control of electronic management of information.

- State whether any special environmental controls are required to conduct the activity. For scientific testing, identify any special environmental conditions (e.g., non-ambient conditions), special construction requirements (e.g., bed/apparatus configuration), or other requirements or controls.
- Identify any special training/qualification requirements for personnel performing the work activity.

## **9. Software**

- Identify software to be used to conduct the work. Identify the associated software tracking numbers, if known.
- Indicate whether the software is qualified or unqualified.
- If continuous use software is used, specify the in-use tests to be used, the frequency of the tests, and acceptance criteria prior to use of the software. Document tests in accordance with IT-PRO-0011.

## **10. Organizational Interfaces**

- Identify any organizational interfaces, including input and customer organizations, in addition to those internal to the implementing department, and state their roles/responsibilities.

## **11. Procurement**

- Provide a description of the procurement processes pertinent to the activity, if known. If not known, identify, as a minimum, expected types of subcontract services to be procured (e.g., analytical services, calibration services, or corrosion testing services), indicate competitive versus sole source, and the estimated schedule and duration of these subcontracts.
- BSC subcontracts are identified and processed using EG-PRO-3DP-G06B-00002, *Subcontracts*. BSC Technical Service Contracts are identified and processed using EG-PRO-3DP-G04B-00057, *Technical Service Contracts*. BSC material requisitions are identified and processed using EG-PRO-3DP-G06B-00001, *Material Requisitions*.
- USGS personnel should use procurement procedures YMP-USGS-QMP-4.01, *Procurement Actions*, and YMP-USGS-QMP-4.02, *Control of Agreements*.

## **12. References**

- List references as applicable, excluding those listed as implementing documents in Section 4.

**INSTRUCTIONS FOR TECHNICAL REVIEW FOR PURPOSES  
OF MODEL VALIDATION**

1. Per LP-SIII.10Q-BSC, Paragraph 5.3.2 a) 5), the manager responsible for validating a model may elect to use technical review as a method for post-development model validation. The intent of this review is to provide input to the manager's determination regarding the adequacy of model validation but is not a substitute for a decision by the responsible manager.
2. The manager responsible for validating a model shall also be responsible for selecting technical reviewers. Reviewers chosen for purposes of this review must be independent of the development, checking, and review of the model documentation, including documents providing inputs to the model documentation being reviewed. Individuals involved in managing the work scope described in the model documentation may not serve as technical reviewers for model validation purposes.
3. In an appendix to the TWP, the manager responsible for validating a model shall define the subject matter expertise and qualifications for the reviewer(s) and establish criteria for selecting reviewers, including specific responsibilities for each reviewer. Select reviewers to ensure that subject matter experts are available to review the important elements of the model(s). Documentation of the selection of the reviewers shall be included as an appendix to the relevant model report.
4. The manager responsible for validating a model shall specify review criteria in the TWP, consistent with the intended use of the model. The responsible manager may define review criteria specific to each subject matter expert as well as general criteria, as appropriate.
5. In cases where more than one reviewer is utilized, there is no requirement for the reviewers to reach a consensus. Individual reviewers must address their assigned review criteria. When general review criteria are provided, a consensus finding for these criteria may be provided, if appropriate.
6. The manager responsible for validating a model shall provide direction to the reviewer(s) regarding the format and schedule for reporting results. The report developed by the technical reviewer(s) shall be appended to the model documentation.