

U.S. Department of Energy
Office of Civilian Radioactive Waste Management

Status of Model Validation

Presented to:

DOE/NRC Quarterly QA Meeting

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**YUCCA
MOUNTAIN
PROJECT**

Legacy of Mountain - 7/4

Outline

- **Background**
- **Historical Perspective**
- **Provide current information on model validation status**
- **Model validation documentation issues**
- **Summary of causes and path to resolution**
- **Summary**

Background: Models at YMP

- **Analysis Model Reports (AMRs)**
- **AMRs describe the development, testing, and use of models**
- **Model requirements, including validation, are procedurally controlled**
- **Models are not software, although implementation of the model may be through software**

Historical Perspective

- **Prior to 1998, models and modeling were not explicitly procedurally controlled**
- **A Corrective Action Request (CAR) (LVMO-98-C-010) was initiated to place procedural controls on models and modeling**
- **Procedure AP-3.10Q, *Analyses and Models*, was developed and implemented in 1999**
- **Initial products (AMRs) were produced using AP-3.10Q in 1999**
- **Audits performed in 1999 indicated deficiencies in implementation of AP-3.10Q with respect to the distinction between modeling and analysis**
- **AP-3.10Q was revised and training conducted in early 2000**

Historical Perspective (cont.)

- **AMR production continued with the completion of 122 AMRs**
- **Further audits indicated model validation was being inadequately documented and resulted in five Deficiency Reports (DRs)**
 - **LVMO-00-D-046 (closed by incorporation into D-119)**
 - **LVMO-00-D-119 (open - commitment to revise AP-3.10Q)**
 - **LVMO-00-D-151 (closed)**
 - **LVMO-01-D-007 (open)**
 - **BSC-01-D-050 (open)**

Historical Perspective (cont.)

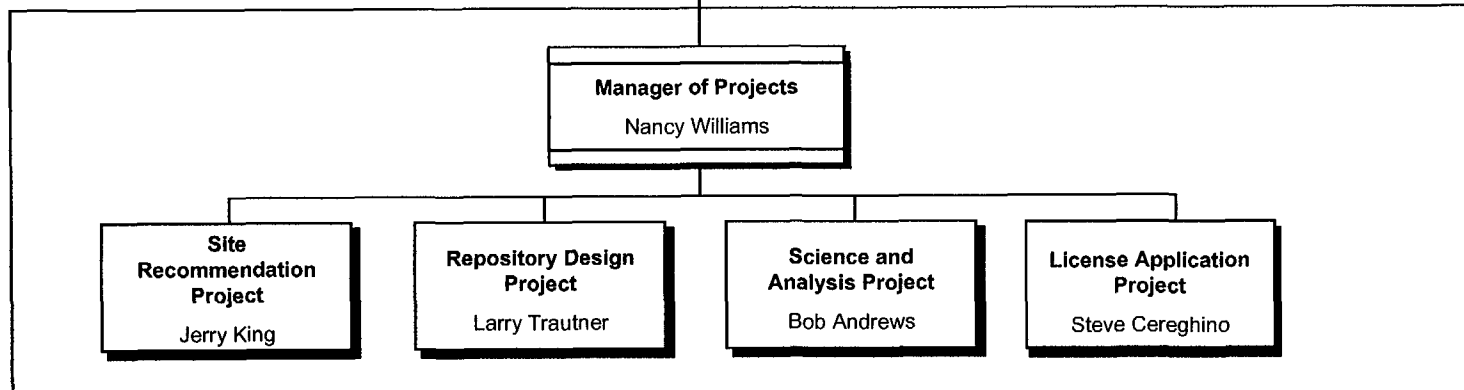
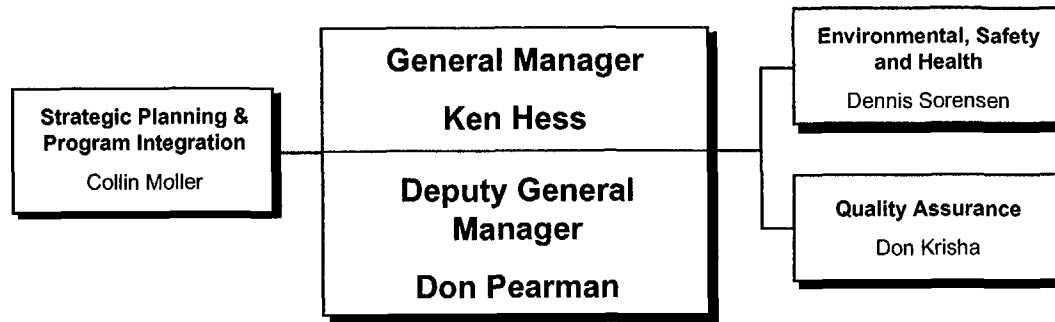
- **Suspect Trending Investigation Report (STIR) BSC-01-004 was initiated on March 15, 2001**
 - **Review of AMRs issued between December 1999 through April 2001**
 - **Repetitive deficient conditions and examples of inadequate documentation**
 - **Planned revisions to AP-3.10Q have not been timely**
 - **STIR recommendation that a CAR be issued**

Historical Perspective (cont.)

- **CAR BSC-01-C-001 issued on May 3, 2001**
 - **“Based on the lack of progress to resolve this deficient condition through various Deficiency Reports, the area of model validation is considered to be a significant condition adverse to quality”**
 - **Recommended Actions**
 - ♦ **Identify all model AMRs**
 - ♦ **Uniquely identify and total all models**
 - ♦ **Revise AP-3.10Q to clarify Section 5.3 “Validation of Models”**

BSC Response to DRs and STIR

- **Systematic review of AMRs containing models by an independent team under Chief Science Office (CSO) oversight to be completed by August 8, 2001**
 - Unique identification of each model
 - Binning of models to determine technical adequacy
 - Bin 1 - AMR document meets AP-3.10Q, Rev2, ICN 3
 - Bin 2 - Model validation does not meet specific criteria in AP-3.10Q but additional project documentation exists to demonstrate adequate confidence in use of model (documentation problem only)
 - Bin 3 - Documentation does not exist that provides adequate confidence in model
- **Any Bin 3 models identified will result in immediate impact assessment / additional validation documentation**



Technical Support

Chief Science Officer
Michael Voegele

Engineering
Jim Whitcraft

Project Controls
Scott Hajner

Procurement
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Chief Information Officer
Charles Sharrocks

Site Services and Field Support
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BSC Response to DRs and STIR (cont.)

- **AP-3.10Q revision underway**
 - **Simplification / clarification of model validation requirements**
 - **Removal of any overly prescriptive requirements**
 - **Requirement for stand-alone section in AMR for discussion of model validation**
 - **Requirement that BSC Quality Engineering be mandatory reviewers of any model validations**
- **Preparation of Scientific Processes Guidance Manual underway by Chief Science Office**
 - **Provide additional guidance on model validation techniques**

BSC Response to DRs and STIR (cont.)

- **Training on AP-3.10Q Revision and Guidance Manual under development**
 - **Following revision of AP-3.10Q and issue of Guidance Manual**
 - **Given to all personnel performing scientific activities involving model development and validation**
 - **Will include information on assistance in model validation methods and techniques available through CSO**
- **CSO to provide assistance to personnel performing scientific activities involving model development and validation**
 - **Senior scientist(s) available through CSO who are not involved with development of subject model(s)**
 - **Includes, as appropriate, meetings with AMR authors and review of in-process work on model validation**

Corrective Action Requests

- **Formal Root Cause Analyses**
 - **Single Team Will Conduct Both Root Cause Analyses to Ensure Integration of Common Causes**
 - ◆ **Model Validation**
 - ◆ **Software Verification**
 - **Utilize TapRoot Process (Mandated by Project Procedures)**

Model Validation Documentation Issues

- **Documentation issues include:**
 - **No requirement for a single specific section of the report that contains consolidated model validation information (i.e., information spread across a number of sections) making it difficult to understand how validation was conducted**
 - **Some AMR validation discussion is unclear or lacking**
 - **Some model validations were based on methods that were not specifically recognized by the procedure**
 - **Some model validations are subjective and lack specific validation criteria**
 - **Some AMRs contain purely conceptual models which do not require validation**

Apparent Causes of Deficiencies

- **Model validation is possible with the current AP-3.10Q for some models, but not all models**
- **AP-3.10Q does not clearly describe the process of validation (“as applicable / as appropriate”)**
- **AP-3.10Q does not distinguish between validation of different types of models (conceptual, process, abstraction, system)**
- **Criteria for validation are unclear to AMR authors. When additional guidance / examples are provided, validation is greatly improved**

Conclusions

- **The model validation concerns identified to date involve documentation and not model suitability or results**
- **Independent review & binning will determine if any inadequate models exist**
- **Improvements in process requirements and additional training are being implemented for future AMRs**