

U.S. DEPARTMENT OF ENERGY
OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT

U.S. NUCLEAR WASTE TECHNICAL REVIEW BOARD

SUBJECT: PATH TO AN INTEGRATED TSPA-VA

PRESENTER: DR. ABE VAN LUIK

**PRESENTER'S TITLE
AND ORGANIZATION:**

**TECHNICAL SYNTHESIS TEAM LEADER
U.S. DEPARTMENT OF ENERGY
YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT OFFICE
LAS VEGAS, NEVADA**

TELEPHONE NUMBER: (702)794-1424

**ARLINGTON, VA
OCTOBER 9, 1996**

Outline

- **Total System Performance Assessment-Viability Assessment (TSPA-VA) approach**
- **The abstraction process**
- **The role of the TSPA-VA peer review**
- **The role of planned and proposed expert elicitations**

Planning of TSPA-VA

- **Past and current sensitivity analyses to evaluate alternative conceptual models in cooperation with the Site Investigations Program are preparatory to TSPA-VA**
- **The objective is to ensure that TSPA-VA captures the process-level modeling being performed by the site, engineering, and environmental functions of the Project**
- **External experts are to be involved**
 - **Through focused expert elicitations**
 - **Through a comprehensive peer review**

A TSPA-VA Plan was Completed

- **Defines overall approach, roles, and responsibilities**
- **Discusses method of ensuring that the most representative process models are abstracted into TSPA-VA**
- **Presents for each process model to be abstracted:**
 - **Current status of abstraction**
 - **NRC's treatment in IPA-2 or recent communication**
 - **Relevant uncertainties**
 - **Sources of information**
 - **Expected output from abstraction process**
 - **Key personnel**
 - **Schedule**

Approach to TSPA-VA

- **Form abstraction and testing teams of process model development and performance assessment staff to ensure proper testing and use of models and appropriate bounding of uncertainties**
- **Supplement in-house expertise with expert elicitation to quantify uncertainty in process models**
- **Focus TSPA analyses on key attributes consistent with previous TSPA experience, the Waste Containment and Isolation Strategy and the NRC's key technical issues**

Schedule of TSPA-VA

Process Model Abstraction Workshops	10/96 - 3/97
Process Model Sensitivity Analyses	1/97 - 10/97
Document Process Model Abstraction	9/97 - 3/98
TSPA-VA “Reference Case” Analysis	11/97 - 1/98
TSPA-VA Sensitivity Analysis	1/98 - 4/98
TSPA-VA Documentation	4/98 - 8/98
TSPA-VA Peer Review	1/97 - 3/99

Model Abstractions for Total System Performance Assessment

- **TSPA results need to properly reflect results from highly detailed and computationally intensive site and engineered system process models**
- **It is neither efficient nor reasonable to incorporate all the complexity inherent in each of the process models in a probabilistic TSPA calculation**
- **Abstracted models are employed as surrogates for comprehensive process models, maintaining the essential elements of the process model, including key interdependencies**

Process Model Abstraction/Testing Activities

- **Waste form degradation**
- **Waste form mobilization**
- **Waste package degradation**
- **Near field environment**
- **Thermo-hydrology**
- **Unsaturated zone flow**
- **Saturated zone flow and transport**
- **Unsaturated zone transport**
- **Biosphere**
- **Disruptive FEP's (volcanism, tectonism, criticality)**

TSPA - VA Teams

- **TSPA Core Team (TCT)**
 - **Composition: TSPA analysts and management**
 - **Objectives:**
 - » **to ensure utility of results for use in TSPA**
 - » **to integrate results from all abstraction testing activities**
- **Abstraction Core Team (ACT)**
 - **Composition: performance assessment subsystem modeler(s), TCT representative, site/design representative(s)**
 - **Objective: to plan and manage abstraction/testing activity**

Workscope for Abstraction/Testing Activities

- **Preparation and planning (ACT)**
 - 1. Expand and summarize current information**
 - 2. Develop information on current abstraction of process**
 - 3. Select workshop participants and disseminate information from 1 and 2**
 - 4. Plan and schedule workshop**
 - 5. Synthesize comments and suggestions generated by 3**

Workscope for Abstraction/Testing Activities

(continued)

- **Workshop**
 - **Present current TSPA representation of process (TCT)**
 - **Present current state of process information (ACT)**
 - **Develop and prioritize list of analyses to refine and enhance TSPA model**
 - **Select analyses, schedule activity, define resources**
- **Conduct analyses**

Key TSPA-VA Model Abstractions

Process Model

Key Output in Abstraction

Unsaturated
zone hydrology

Percolation/seepage flux

Thermal hydrology

Humidity, temperature

Waste package
degradation

Containment time

Radionuclide
mobilization

Solubility, diffusive/
advective flux

Components of TSPA-VA

Process Model

Unsaturated
zone transport

Saturated
zone hydrology

Biosphere

Disruptive
features/events

Key Output

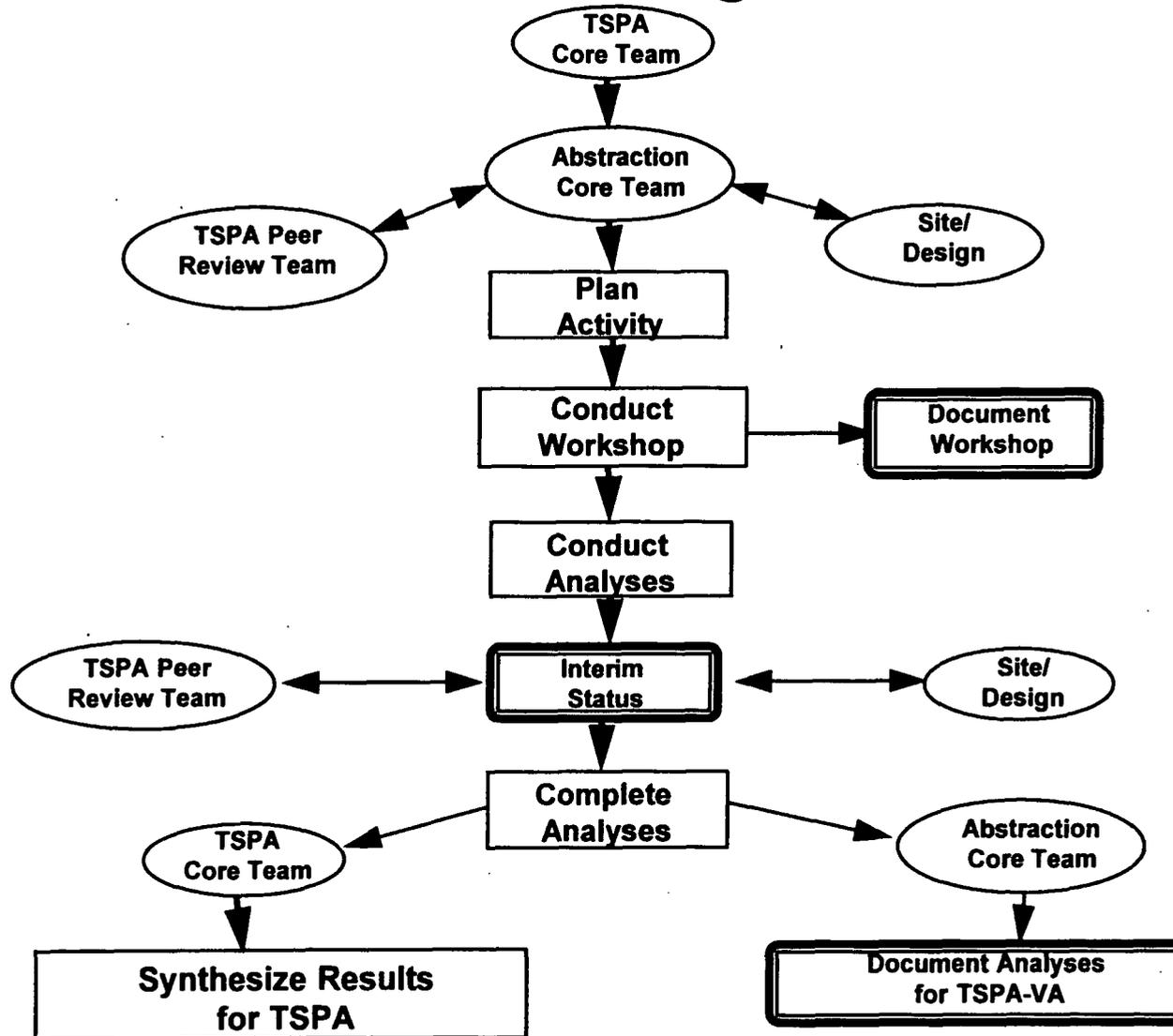
Advective velocity
distribution

Dilution

Dose conversion factors

Probability, effects

Proposed Work Flow Diagram for Abstraction/Testing Activities



Proposed Workshop Dates

- **Waste form degradation** 03/03/97 - 03/06/97
- **Waste form mobilization** 03/03/97 - 03/06/97
- **Waste package degradation** 12/02/96 - 12/04/96
- **Near field environment** 03/07/97 - 03/11/97
- **Thermo-hydrology** 12/18/96 - 12/20/96
- **Unsaturated zone flow** 12/16/96 - 12/18/96
- **Saturated zone flow and transport** 11/18/96 - 11/20/96
- **Unsaturated zone transport** 03/05/97 - 03/07/97
- **Biosphere** 06/02/97 - 06/04/97
- **Disruptive FEP's (volcanism, tectonism, criticality)** 12/09/96 - 12/11/96

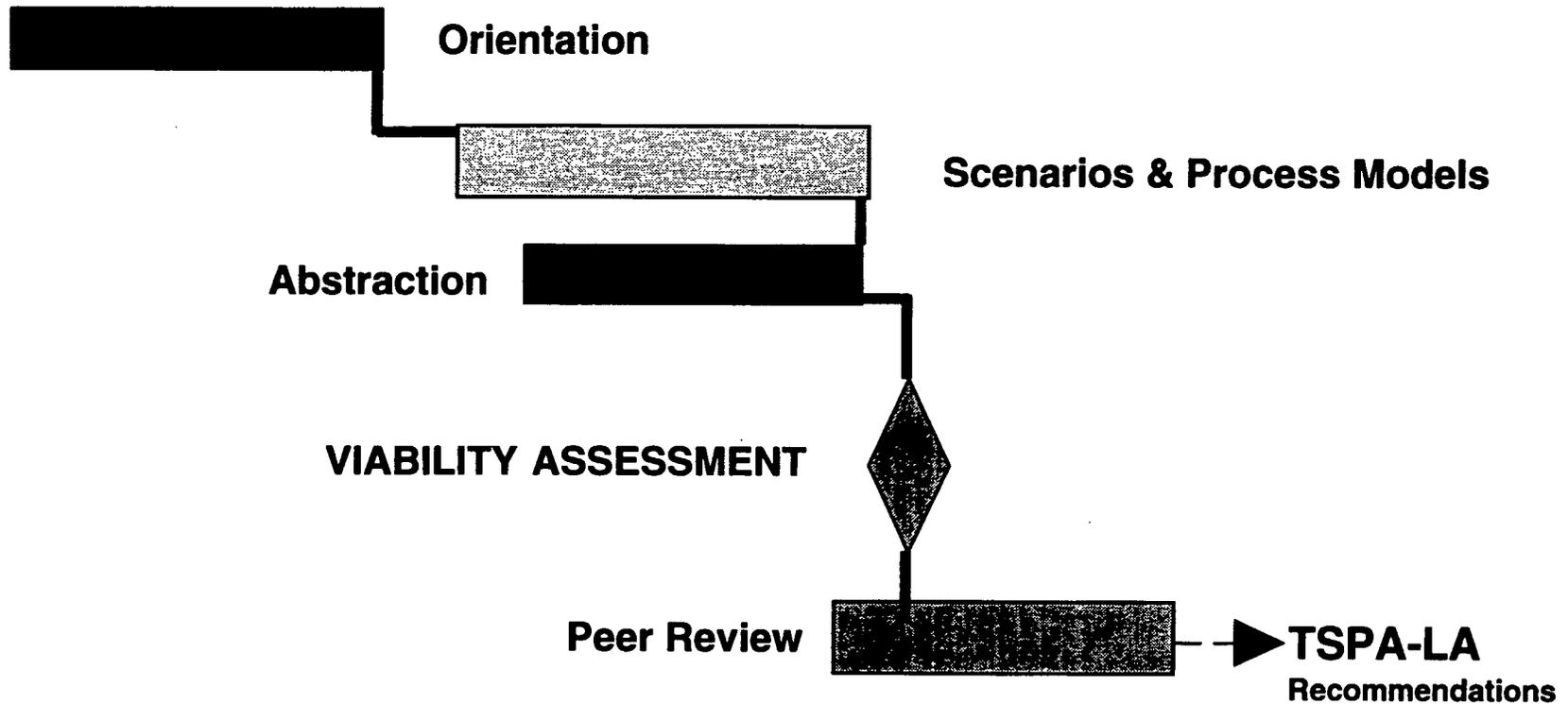
TSPA Peer Review

The approach for and input to the TSPA-VA will be reviewed in depth using a combination of expert elicitation and peer review to provide guidance for the development of the TSPA-LA

Key Phases of TSPA Peer Review

- **Orientation (10/96 - 6/97)**
 - **Convene peer review panel; introduce Program**
- **Scenario and process models (10/97 - 6/98)**
 - **Review site and design process models**
- **Model abstraction (1/98 - 6/98)**
 - **Review abstraction process into PA models**
- **TSPA peer review (6/98 - 3/99)**
 - **Review TSPA-VA; prepare guidance for TSPA-LA**

TSPA Peer Review Schedule



Preliminary Activities

- **Convene peer review panel**
 - Letter request to various professional organizations for nominations of qualified candidates for the peer review panel
 - Technical specialities needed and the requirements for the peer review will be defined in the letter
 - DOE will select peer reviewers from the list of nominations, considering expertise, interest, and availability
- **Let contracts for panel members**
- **Peer review panel chairperson develops a peer review plan in accordance with DOE procedures**

Orientation Phase

- **After the peer review plan has been approved, DOE will brief the peer review panel on TSPA 1991, 1993, 1995, and subsequent modeling activities**
- **The peer reviewers will review these modeling activities in detail and make preliminary observations on the modeling plans, documentation of approach, and assumptions for TSPA-VA**

Scenario and Process Model Phase

- **PA with site and design process modelers will introduce scenarios and process models used to describe features, events, and processes**
- **Panel will review current state of process modeling**
- **Panel will issue interim letter report with impressions on the TSPA-VA and recommendations for the TSPA-LA (6/98)**

Abstraction Phase

- **PA and process modelers will present updated process-level models, as available, for TSPA-VA development**
- **Panel will review these models and the abstraction process that converts these models into PA input**
- **Panel will issue interim letter report with impressions on the TSPA-VA and recommendations for the TSPA-LA (6/98)**

TSPA Peer Review Phase

- **Panel will begin formal peer review slightly ahead of VA; will issue interim letter report with VA (8/98)**
- **Peer review will continue after VA and will conclude with final report with recommendations for the TSPA-LA (3/99)**
- **Results of peer review will be incorporated as guidance for development of TSPA-LA**

Expert Elicitation for TSPA-VA

- **Purpose**
 - **To quantify and document the uncertainties in process models to strengthen TSPA-VA**
 - **To focus on process models that are very significant to total system performance**

Concept

- **Small scale focused elicitations**
 - **Approximately six-month duration**
- **Panels will have five to six experts**
 - **will include Project experts and experts external to the Project**
- **Will follow the nine-step process outlined in the NRC's Branch Technical Position on the use of expert elicitation**

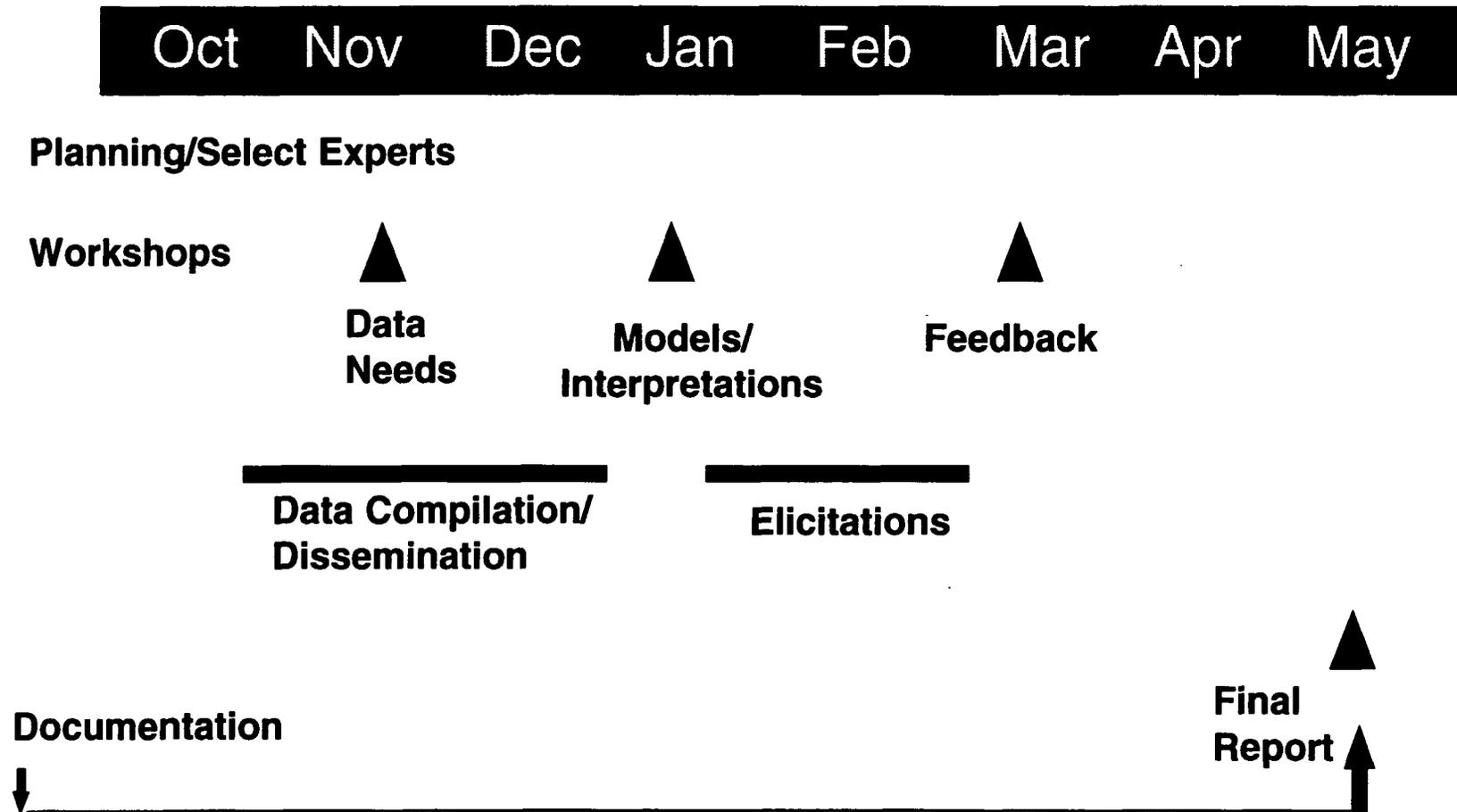
Approach

- **Complete the first elicitation**
 - **Unsaturated zone process model**
- **Propose additional process models for elicitations**
 - **Waste package degradation**
 - **Drift-scale thermohydrology**
 - **Waste form dissolution**
 - **Saturated zone hydrology**

Unsaturated Zone Expert Elicitation

- **Analyze the spatial and temporal distribution of percolation flux**
- **Focus on**
 - **Infiltration**
 - **Methods to characterize unsaturated fractured rock**
 - **Analysis and numerical modeling of fluid flow in variably saturated rock**
 - **Data and modeling uncertainties and their quantification**

Unsaturated Zone Elicitation Schedule



Status

- **An implementation plan was developed to define the objectives of the unsaturated zone expert elicitation, the panel selection criteria, and the process to be followed**
- **Letters requesting nominations for the expert panel were distributed**
- **Panel selection will begin in October**

Proposed Expert Judgment Schedule

FY 97	FY 98
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[Redacted] Unsaturated Zone

[Redacted] Waste Package Degradation

[Redacted] Thermal/Hydrology

Waste Form Dissolution **[Redacted]**

Saturated Zone Hydrology **[Redacted]**

Viability Assessment 