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**MAR 22 1984**

MEMORANDUM FOR: Hubert J. Miller, Chief  
 Repository Projects Branch  
 Division of Waste Management

Malcolm R. Knapp, Chief  
 Geotechnical Branch  
 Division of Waste Management

John T. Greeves, Acting Chief  
 Engineering Branch  
 Division of Waste Management

FROM: Warren R. Rehfeldt  
 Repository Projects Branch  
 Division of Waste Management

SUBJECT: DOE/NRC STATUS WORKSHOP ON BWIP GEOLOGY, MARCH 13-15, 1984

Attached are the Summary Meeting Notes on the above workshop which was held in Richland, Washington. These meeting notes provide the principal comments made at the workshop by the NRC and BWIP participants. The Workshop Objectives and Agenda are also attached. Viewgraphs presented by BWIP and the NRC are contained in a separate document which will be filed in the DCC. (In addition, each NRC staff participant has a set of viewgraphs.)

WM Record File 101 WM Project 10  
 Docket No. \_\_\_\_\_  
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**Original Signed By:**  
 Warren Rehfeldt  
 Repository Projects Branch  
 Division of Waste Management

Enclosures: 3, as stated

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	: WRR		WM-10			
NAME	: WRR	: HJMiller				
DATE	: 3/21/84	: 3/27/84				06820

## AGENDA

### DOE/NRC STATUS WORKSHOP ON GEOLOGY -- BASALT WASTE ISOLATION PROJECT

- Date:** March 13-15, 1984
- Place:** Richland, Washington
- Purpose:**
- (1) To discuss the BWIP Geosciences program: status, plans, deliverables, methods.
  - (2) To discuss geological issues itemized in the Draft Site Characterization Analysis and by other subsequent consultant reviews and critiques.
- Objectives:**
- (1) To collect data and review information compiled by BWIP geological investigations to date.
  - (2) To examine methods of ongoing and planned geological investigations.
  - (3) To work toward an agreed upon approach to address concerns.
- Participants:** NRC Staff and Contractors - R. Wright, K. Westbrook, P. Justus, W. Rehfeldt, B. Rice, B. Stemons, L. McKague, R. Whitney, and D. Chung
- DOE - D. Dahlem, J. Mecca, A. Lassila
- BWIP - G. Hunt, S. Price, P. Long, A. Tallman, B. Sagar, J. Bazemore
- State of Washington - to be announced
- Yakima Indian Nation - to be announced
- Confederated Tribes of the Umatilla Indian Reservation - to be announced
- U.S. Geological Survey - to be announced
- Public

Tuesday, March 13, 1984 Hanford House

8:00 - 8:30	Introductory Remarks	DOE/NRC
8:30 - 9:15	Overview of Geologic Characterization Activity	BWIP
9:15 - 9:30	Break	
9:30 - 12:00 (Break ~10:45)	Summary of Tectonic Characterization Subactivity	BWIP
12:00 - 12:30	Geologic Inputs to Licensing Decisions	NRC
12:30 - 1:30	Lunch	
1:30 - 3:30 (Break ~2:45)	Summary of Lithologic Characterization Subactivity	BWIP
3:30 - 4:00	Discussion of Comments on RHO-BW-ST-28 P (Draft)	NRC
4:00 - 4:15	Break	
4:15 - 5:00	Performance Assessment and Scenario Identification	BWIP
5:00 - 5:45	Annotated Site Characterization Plan Outline, Section 3.0	DOE/BWIP/NRC
5:45 - 6:00	Concluding Remarks/Adjournment	All Participants (DOE/BWIP/NRC/ Others)
6:00	Caucus	NRC

Wednesday, March 14, 1984 Peoples Bank Bldg, 3rd Floor Conf Rm

8:00 - 9:00	Discussion of RHO-BW-ST-19 P	NRC
9:00 - 9:30	Break	
9:30 - 5:00	Staff Discussion	BWIP/NRC

Thursday, March 15, 1984 Peoples Bank Bldg, 5th Floor Conf Rm

8:00 - 10:00	Discussion of Agreements, Dis- agreements, Concerns, Data Needs	All Participants (DOE/BWIP/NRC/ Others)
10:00 - 12:00	Wrap-up and Adjournment	DOE/BWIP/NRC

HLW MEETING

NRC/DOE  
PARTICIPANTS  
AND CONTRACTORS  
WITH NRC

PROJECT: BWIP  
MEETING TITLE: Geology Wrokshop  
LOCATION: Richland, Washington  
DATE: 13 - 15 March, 1984

NRC AFFILIATED ATTENDEES:

<u>NAME</u>	<u>ORGANIZATION</u>	<u>PROGRAM AREA</u>
P. Justus	NRC/WMG	Geology/Geophysics
K. Westbrook	NRC/WMG	Geology/Geophysics
B. Rice	NRC/WMG	Geology/Geophysics
E. Zurflueh	NRC/RES	Geoscience/Research
R. Wright	NRC/WMRP	Repository Projects
W. Rehfeldt ✓	NRC/WMRP	Repository Projects
D. Chung	LLNL	Seismo-Tectonics
D. Emerson	LLNL	Seismo-Tectonics
B. Slemmons	LLNL	Seismo-Tectonics
D. Galster	COE	Engineering Geology
R. Whitney	LLNL	Seismo-Tectonics
<i>ED LEVINE</i> Geophysical Contractor	<i>WESTON GEOPHYSICS</i> <del>To be determined</del>	Geophysical Methods

cc: R. E. Browning

SUMMARY MEETING NOTES

DOE/NRC STATUS WORKSHOP ON GEOLOGY  
Richland, Washington  
March 13-15, 1984

Developments:

This DOE/NRC status/workshop provided an opportunity for an overview of progress at the Basalt Waste Isolation Project in the areas of geology, seismic and tectonic studies, geophysical surveys, and natural resource evaluations. Considerable discussion focused on tectonic models and their role as a tool in site characterization.

These summary meeting notes provide the principal comments made at this meeting by the NRC and BWIP participants.

The attachments supporting these meeting notes are:

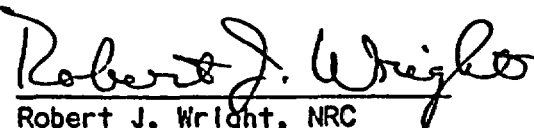
Attachment 1 - Workshop Objectives and Agenda

Attachment 2 - Attendees

Attachment 3 - (separate document) Viewgraphs Presented by  
BWIP and the NRC



O. L. Olson, DOE-RL  
March 15, 1984



Robert J. Wright, NRC  
March 15, 1984

## NRC COMMENTS

### o Tectonic Models

Tectonic models to encompass the regional tectonics are tools that can be used for predictive assessments, and to assess potentially disruptive scenarios. In our opinion, tectonic modeling is needed to examine the origin of existing structures and ongoing deformations. Tectonic models may be used to evaluate geologic data to assess many of the favorable and potentially adverse conditions in 10 CFR 60.122.

Tectonic models represent an appropriate approach to the determination of disruptive and non-disruptive scenarios affecting health and safety for both pre-closure activities and post-closure, long-term stability. Further, tectonic model development provides an approach to accomplish these goals:

- 1) integrate existing geologic and tectonic data
- 2) guide data collection efforts
- 3) provide input and performance assessment scenarios
- 4) provide a basis for sensitivity analyses
- 5) provide a mechanism for handling new data
- 6) facilitate synthesis of data and concepts
- 7) permit predictions of tectonic activity
- 8) provide input to repository design.

Tectonic models are prepared in order to:

- (A) understand the interrelationships of faults, folds, volcanic features and other tectonic elements
- (B) help evaluate regional tectonic controls/constraints to a local tectonic model
- (C) help tie regional tectonic features/processes into plate tectonic features/processes.

The material in item (A) above can be used as a tool to:

- (a) help determine the maximum credible earthquake, or controlling earthquake
- (b) help determine ground motion at site

- (c) help determine the potential for surface and subsurface displacements at site
- (d) help determine the potential for secondary seismic hazards at the site, such as landslides, spalling, rock-bursts, liquefaction, and hydrologic effects.
- (e) predict long-term geologic stability.

The material in item (B) above can be used to:

- (a) identify and constrain magnitude of features in item (A).
- (b) provide a check on reasonableness of interrelationships in item (A).

The material in item (C) above can be used to:

- (a) provide a basis for evaluation of regional tectonic controls.

Tectonic modeling should involve the following:

- 1) evaluation of all relevant data and concepts, whether used or rejected
- 2) analysis of uncertainty of all data and concepts input
- 3) analysis of uncertainty introduced by assumptions and simplifications
- 4) analysis of limitations of the model
- 5) consideration of alternative models, including existing WPPSS models.

o Tectonic Characterization

Technical Objectives 1 and 2, in considering the "controlled zone," do not appear to incorporate features of potential importance such as the full length of the RAW (Rattlesnake Mountain). The evaluation of structures from well outside the "controlled zone" may affect the long term stability of the RRL and impact repository design. 10 CFR 60 requires that processes be assessed which may affect the repository and "controlled area" regardless of the distance at which the events or processes occur.



o Tectonic Characterization Plan

The tectonic characterization plan appears less than complete. Seismic data outside the Columbia Plateau equivalent to proposed structural studies are needed over a large area of the Pacific Northwest. Structural and seismic studies of a given area should be done to a commensurate degree.

o Gravity Station Systems

The north-south gravity gradient and derivative maps of the area where RAW intersects the western edge of the Pasco Basin west of the RRL could allow up to 2-3 km of post-basalt, right-oblique slip displacement. The gravity station data are sparse there. To provide adequate definition of the amount and/or direction of possible lateral offset, a closer gravity station net should be considered. This is important because selection of appropriate tectonic models may be affected.

o Yakima Barricade Study

The purpose, status, and plans appear to represent a reasonable approach to these important matter. A possible tie to the RAW appears to need assessment.

o Seismic Surveillance

The presentation of tectonic characterization includes a location map - "University of Washington Regional Seismic Surveillance Network Stations" and location map - "Hanford Site Surface Seismic Surveillance Stations."

The addition of one or more station locations to the seismic networks of U of W, Rockwell and WPPSS is recommended, particularly at location(s) south-southwest of Rattlesnake Mountain. A southwest dip of thrust faults or reverse-oblique faults is postulated for RAW. Hypocenters on a structure of this geometry would have poor resolution of location and depth, with the present network. An area between Prosser and Yakima has a higher density of epicenters on maps in ST-19P. Better resolution of future seismic activity in this area would also be accomplished with such additional stations.

o Seismicity Impact

Study of the impact of seismicity on the stability of an underground repository (re: SA-269-P) appears to be making good progress. Some assumptions presented in the original draft document are improved.

o Swarm Earthquakes

We recommend that earthquake swarms be explained in terms of cause as well as temporal and spatial progression. This is important to complete an assessment of the local seismic and tectonic picture.

o Growth Rate Curves

We consider the stratigraphic analyses in the Ringold and younger sediments to determine deformation rates, of high importance in establishing the character of deformation during the last 10 million years. This is a subject of uncertainty. For example, the growth rate curve presents new information on the Saddle Mountains area which is interpreted to indicate that rates show little change over the past 14 million years. However, the error box for Taunton Bench can imply a major change of deformation rate if the values in the upper left and lower right corners of the error box are used. The lower right corner value suggests a recent increase in deformation rates, whereas the upper left value indicates a recent decrease in rate. The suggestion by BWIP of uniform deformation rates in the Pasco Basin needs elaboration.

o Pursuit of Exploration Well Data

The geological and geophysical data that could be gained from wells in the Yakima Fold Belt, such as the Shell Oil Company well in the Saddle Mountains and wells completed earlier, should be pursued with vigor. Also, the opportunity for the wells to be reoccupied as magnetotelluric base stations should be investigated. This could enhance the information on deep geologic structures; provide a better basis for magnetotelluric interpretations; and in interpretation of other geologic and geophysical data.

o Geologic Characterization

Two planning documents relating to geologic site characterization and determination of geologic stability were shown to be on critical path for decisions concerning the Exploratory Shaft and breakout construction. These are the Lithologic Characterization Plan and the Tectonic Characterization Plan. To facilitate timely NRC comments and feed-back during formulation of these plans, they should be transmitted to the NRC as soon as practicable.

o Probabilistic Analysis

Elements of a probabilistic analysis which results in probability distribution of radionuclide release limits were presented by Rockwell. This is an important development that needs consideration and discussion at a later time, perhaps at a performance assessment workshop.

o Sample Log Form

The revised field log form developed subsequent to the April 1983 NRC/DOE workshop appears to contain the elements necessary to describe the core appropriately for engineering purposes. While there is no specific place for entering of drilling fluid level data, we recommend that such data be entered in the "remarks" column in addition to fluid loss data.

o Natural Resources

Natural resources need assessment as required by 10 CFR 60.122(c)(17) and 10 CFR 60.21(c)(13).

o Geophysical Anomaly Status File

To take advantage of the information contained in the various geophysical data sets, and to form a basis for regional interpretations, a combined and integrated interpretation by different disciplines is recommended. We support the development of a "geophysical anomaly status file" to track geophysical anomalies. We understand that an assessment of potential implications of each geophysical anomaly will be determined through joint review by geophysicists, geologists and hydrologists. A fully documented assessment may permit evaluation of the significance of individual geophysical anomalies, or groups of anomalies, to be integrated into the development and interpretation of structural, tectonic, and hydrologic models.

o Magnetic Data

For an understanding of significance of magnetic data a comprehensive interpretation is recommended. Such an interpretation should point out the significant lineaments that exist on the map; the boundaries between areas of different magnetic character; and other features. This will provide a framework for the analysis of individual anomalies. An evaluation now could be useful to give direction to the detailed efforts in the planning stage.

o Qualitative and Quantitative Interpretations

The BWIP use of both qualitative and quantitative analyses (interpretations) for gravity and magnetic data appears appropriate. Both types of analyses should be incorporated in the evaluation of subsurface structures. A synthesis of the results of magnetotelluric, gravity, magnetic and seismic surveys should be used in the development of tectonic models.

o Evaluation of Magnetotelluric Data

BWIP continues to evaluate the use of the magnetotelluric (MT) technique for deep exploration and has determined that the earlier BWIP data is of fair to poor quality, in comparison with state-of-art improvements and developments of the technique, such as real time processing. The planned purchase of a recently acquired MT data set in the area east of the Hanford Site should allow an evaluation of potential benefits to the BWIP project from future MT surveys on the Hanford Site.

MT interpretations are affected by the configuration of the conductive layer above the basalt in the Hanford area. It should, therefore, be advantageous to acquire near-surface resistivity data, for example by D-C resistivity methods or perhaps by other methods such as transient EM if determined to be appropriate. These data should enhance the interpretation of new MT data and also should form a useful addition to the general data base. Gravity and stratigraphic information may help to control the processing and modeling of MT data.

o Proposed Refraction Survey

In previous refraction studies on the Hanford Site, it has been observed that seismic energy is not efficiently transmitted to and from the basalt surface due to the velocity structure of the Ringold and overlying sediments. The problem is maximized at recording locations where the sediments are thickest. In order to help ensure the acquisition of high quality refraction data along the proposed SW-NE seismic line, it is recommended that BWIP consider seismic energy sources be located in the basalt. This may be economically accomplished by selecting shot hole location in areas of relatively shallow basalt.

o Geophysical Logs

In borehole DC-16C, the trace of the PNL neutron-neutron log over the interval of 3,640 to 3,840 feet shows a correlation between lower count rate and hole radius enlargement, as indicated by the caliper log. Interpretations of porosity based on the neutron-neutron log should be viewed with caution when: (1) radius enlargement is indicated by an accompanying caliper log or (2) no caliper log is available.

o Reprocessed Seismic Reflection Data

The reprocessed seismic reflection data in and around the RRL show potential anomalous features in the subsurface structure of the reference repository location. The significance of the anomalies must be reviewed with a better understanding of the seismic data collection and processing techniques used, along with other available data.

INFORMATION NEEDS - DOE TO NRC

- o Lists of available data that support various plans, such as the tectonic characterization plan, to be provided to the NRC at the time draft plans are submitted for review.
- o Lists of kinds of data available to be reviewed at a data review to be held, as appropriate at a future date.
- o Summary chart of boreholes to include collar elevations, total depth, and whether the boreholes are cored.
- o RHO-BW-SA-289 P, seismic residuals and velocity structure.
- o SD-BWI-DP-039, March 1984.
- o Preprint of article to be published in Tectonics by Reidel on Paleomagnetism.

INFORMATION NEEDS - NRC TO DOE

- o Examples of experience with neutron-neutron logs at Nevada Test Site.
- o Comments on Learning Report (BWI-C-109), "Resource Evaluation/Pasco Basin."
- o Examples of methods for presentation of "complicated" data.

BWIP SUMMARY COMMENTS

IN RESPONSE TO NRC SUMMARY COMMENTS:

- TECTONIC MODEL(S)

THE OUTLINE OF THE TECTONIC CHARACTERIZATION PLAN DOES NOT PRECLUDE THE ASSESSMENT OF SEISMIC DATA OUTSIDE THE COLUMBIA PLATEAU AND, IN FACT, THE BWIP PLANS WILL ADDRESS SUCH AN ASSESSMENT

- PURSUIT OF EXPLORATION WELL DATA

THE BWIP WILL CONTINUE TO PURSUE THE ACQUISITION OF DATA FROM EXPLORATION BOREHOLES; INCLUDING THE USE OF ONE SUCH WELL AS A MAGNETOTELLURIC BASE STATION

- SEISMICITY

THE BWIP WILL ASSESS THE NEED FOR ADDITIONAL SEISMIC SURVEILLANCE STATIONS TO ADDRESS THE SOUTHWEST DIPPING REVERSE-OBLIQUE FAULT POSTULATED FOR RAW

DISCUSSION TOPICS

- "ST-19" REVIEW
- GEOPHYSICAL INVESTIGATION  
REVIEW
- TECTONIC MODEL REVIEW
- GEOLOGIC CHARACTERIZATION  
PLANS



COMMENTS ON "ST-19" REVIEW

- REPORT IS A STATUS OF TECTONIC INVESTIGATIONS AS OF MARCH 1982
- PURPOSE WAS TO SUMMARIZE DATA, NOT TO PROPOSE PREFERRED MODELS
- TECTONIC CHARACTERIZATION PLAN WILL IDENTIFY SCHEME FOR TESTING MODELS AND IDENTIFY PRESENT DATA NEEDS FOR MODEL FORMULATION
- REPORTING OF TECTONIC MODEL DEVELOPMENT WILL BE ADDRESSED IN TECTONIC CHARACTERIZATION PLAN

GEOPHYSICAL INVESTIGATION REVIEW

- STATUS OF MAGNETOTELLURIC, GRAVITY, MAGNETIC, SEISMIC REFLECTION AND REFRACTION INVESTIGATIONS REVIEWED
- PLANS FOR ADDITIONAL WORK SUMMARIZED

## TECTONIC MODEL

- WHAT IS "IT"?
- WHAT COULD "IT" DO?
- HOW COULD "ACCEPTANCE" BE ACCOMPLISHED?

WHAT IS A TECTONIC MODEL?

- MECHANISM FOR EXPLANATION OF EMPIRICAL DATA
- MECHANISM FOR EXTRAPOLATION

WHAT COULD A TECTONIC MODEL DO?

A TECTONIC MODEL COULD PROVIDE A BASIS FOR:

- RECONCILIATION OF EXISTING DATA
- SYNTHESIZING DATA AND IDEAS
- GUIDANCE OF DATA-COLLECTION EFFORTS
- ADDRESSING/INTEGRATING NEW DATA
- SENSITIVITY ANALYSES TO BE PERFORMED (QUALITATIVE)
- INPUT TO DESIGN
- INPUT TO PERFORMANCE ASSESSMENT SCENARIOS
- PREDICTION
- RECONCILIATION OF SCALE CONSIDERATIONS

TECTONIC MODEL  
SCALE CONSIDERATIONS

MODEL "OBJECTIVES"

1. DEFINE FAULTING AND OTHER TECTONIC PROCESSES WITHIN CANDIDATE AREA
2. EXPLAIN REGIONAL TECTONIC CONTROLS FOR LOCAL TECTONIC MODEL
3. EXPLAIN REGIONAL TECTONICS FROM A GLOBAL TECTONIC STANDPOINT

MODEL "SUBOBJECTIVES"

- DETERMINE:
- A. DESIGN BASIS EARTHQUAKE
  - B. GROUND MOTION AT SITE
  - C. SURFACE RUPTURE AT SITE
  - D. SECONDARY EARTHQUAKE HAZARDS AT SITE
  - E. LONG-TERM PERFORMANCE
- "CHECK" ON OBJECTIVE #1
- "CHECK" ON OBJECTIVE #2

AREA OF CONSIDERATION

1. REFERENCE REPOSITORY LOCATION/CONTROL ZONE
2. PASCO BASIN/SOUTH CENTRAL WASHINGTON
3. COLUMBIA PLATEAU/PACIFIC NORTHWEST

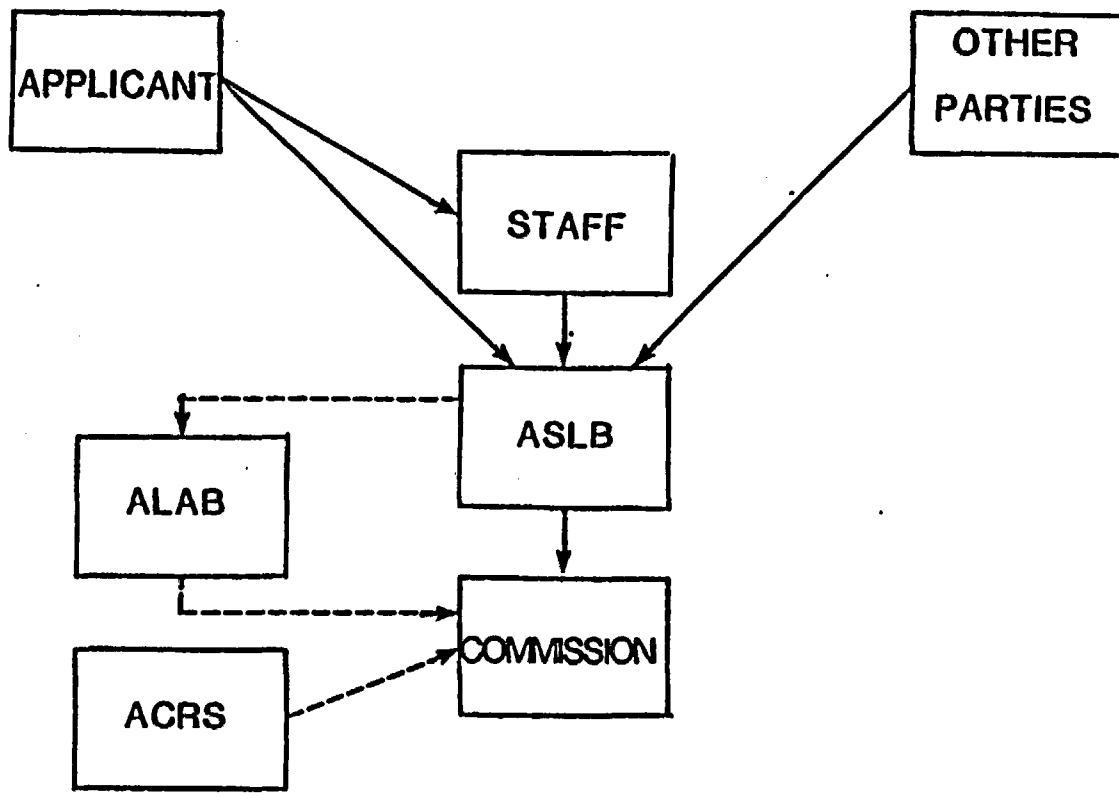
SUGGESTIONG TO GAIN MODEL "ACCEPTANCE"

- PEER REVIEW
- WORKING GROUP(S)
- PANEL

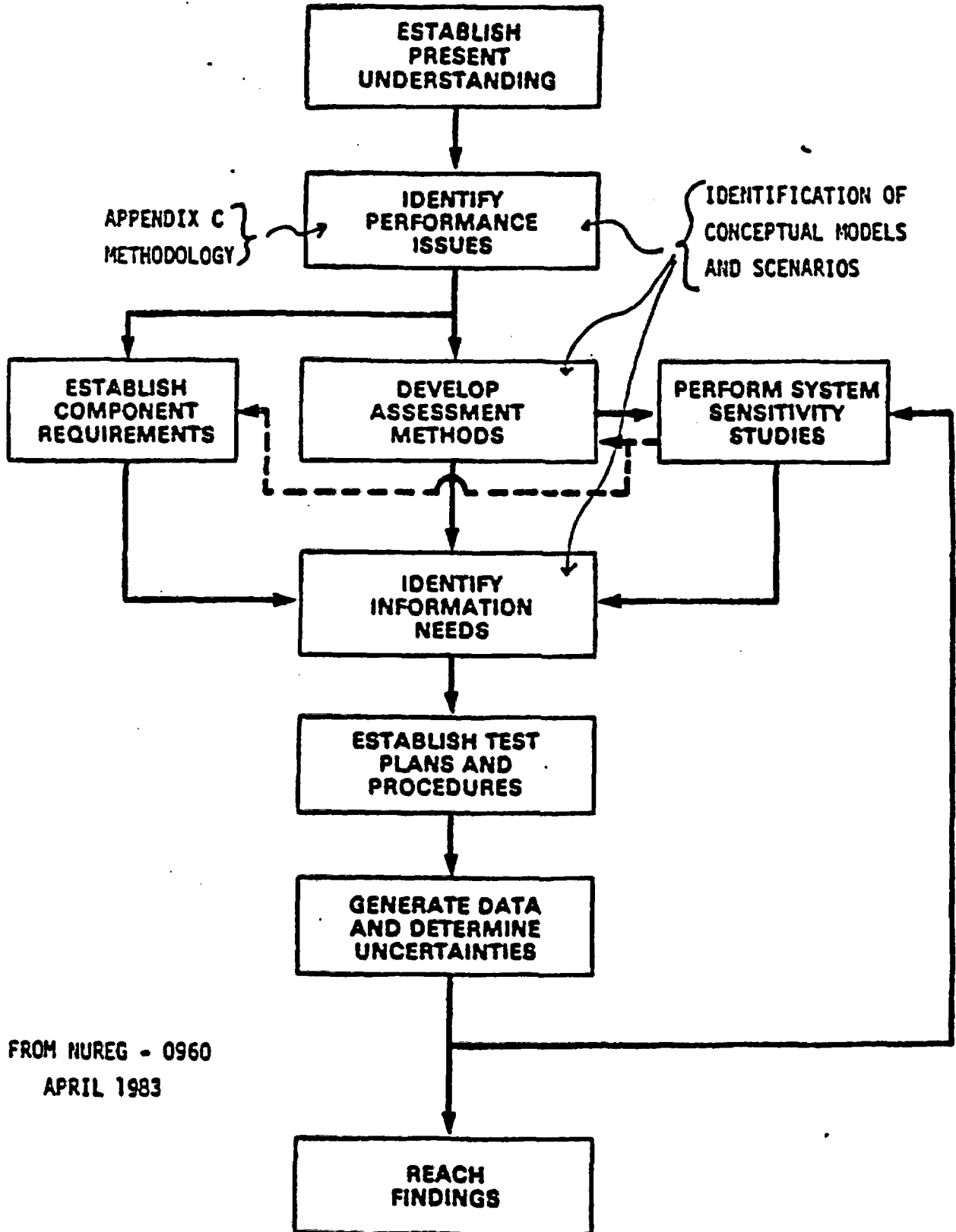
NRC OVERHEADS



10 CFR 60.21(c)(13) AN IDENTIFICATION AND EVALUATION OF THE NATURAL RESOURCES OF THE GEOLOGIC SETTING, INCLUDING ESTIMATES AS TO UNDISCOVERED DEPOSITS, THE EXPLOITATION OF WHICH COULD AFFECT THE ABILITY OF THE GEOLOGIC REPOSITORY TO ISOLATE RADIOACTIVE WASTES, UNDISCOVERED DEPOSITS OF RESOURCES CHARACTERISTIC OF THE AREA SHALL BE ESTIMATED BY REASONABLE INFERENCE BASED ON GEOLOGICAL AND GEOPHYSICAL EVIDENCE. THIS EVALUATION OF RESOURCES, INCLUDING UNDISCOVERED DEPOSITS, SHALL BE CONDUCTED FOR THE SITE AND FOR AREAS OF SIMILAR SIZE THAT ARE REPRESENTATIVE OF AND ARE WITHIN THE GEOLOGIC SETTING. FOR NATURAL RESOURCES WITH CURRENT MARKETS THE RESOURCES SHALL BE ASSESSED, WITH ESTIMATES PROVIDED OF BOTH GROSS AND NET VALUE. THE ESTIMATE OF NET VALUE SHALL TAKE INTO ACCOUNT CURRENT DEVELOPMENT, EXTRACTION AND MARKETING COSTS. FOR NATURAL RESOURCES WITHOUT CURRENT MARKETS, BUT WHICH WOULD BE MARKETABLE GIVEN CREDIBLE PROJECTED CHANGES IN ECONOMIC OR TECHNOLOGICAL FACTORS, THE RESOURCES SHALL BE DESCRIBED BY PHYSICAL FACTORS SUCH AS TONNAGE OR OTHER AMOUNT, GRADE, AND QUALITY.



HLW DECISION PROCESS



FROM NUREG - 0960  
APRIL 1983

Figure 9.1 Site characterization - program logic

NRC  
TECHNICAL CRITERIA

- MULTI-BARRIER APPROACH
- NUMERICAL PERFORMANCE OBJECTIVES
  - EPA STANDARD -- OVERALL SYSTEM
  - WASTE PACKAGE LIFETIME
  - ENGINEERED SYSTEM RELEASES
  - MINIMUM GROUNDWATER TRAVEL TIME
- QUALITATIVE SITING AND DESIGN CRITERIA

# ELEMENTS OF A CONCEPTUAL TECTONIC MODEL

Concepts + Data + Simplifying Assumptions + Judgement + Creativity + Motivation → Conceptual Model

## Causes of Uncertainty

- o faulty concepts
- o unreliable data
- o simplifying assumptions
- o poor judgement
- o failure to recognize or evaluate limitations

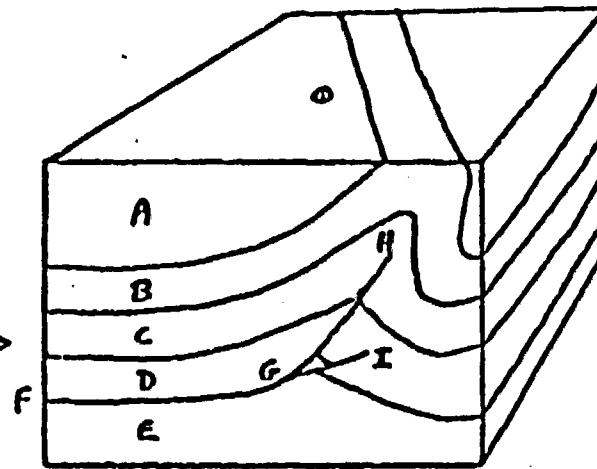
## Conceptual Input

- o regional geologic interpretations
- o plate tectonic principles
- o analogous terrain
- o existing conceptual models
- o geologic maps, cross sections and derivative maps (e.g. isopachs)

## Data Input

- o observation of rock outcrops/air photo interpretations
- o borehole logs and cores
- o geophysical surveys
- o seismicity & geodetic surveys
- o in-situ test results (strain, hydraulic properties)
- o lab test results

## CONCEPTUAL TECTONIC MODEL



## Simplifications

- o uniform thickness
- o simple contacts
- o simple structures
- o homogeneous strata
- o lateral continuity

## Limitations of this Model

- o active processes not shown
- o it's static; time dependencies not shown
- o scale and orientation not given
- o boundaries and infrastructures such as fractures not shown
- o state of stress not shown; seismicity not depicted
- o relationship to hydrology, geochemistry not shown
- o physical, chemical, mechanical properties not shown
- o no status of geologic stability
- o past history (genesis) not displayed
- o future configurations not considered
- o viable alternative models not considered

## Discussion Questions

- o Predictability. Will a vertical hole from  $\odot$  penetrate feature G/-H? Explain.
- o Validity. Is the model valid? How to demonstrate validity?
- o Significance. How significant is this model for performance assessment? How to assess significance?
- o Utility. Is this tectonic setting suitable for a repository? Explain.