



UNITED STATES
NUCLEAR REGULATORY COMMISSION
 WASHINGTON, D. C. 20553-0001

April 26, 1995

MEMORANDUM TO: Michael J. Bell, Chief
 ENGB/DWM/NMSS

John H. Austin, Chief
 PAHB/DWM/NMSS

FROM: John S. Trapp, Sr. Geologist *JST*
 ENGB/DWM/NMSS

Janet P. Kotra, Project Manager *JPK*
 PAHB/DWM/NMSS

SUBJECT: TRIP REPORT - FIRST WORKSHOP OF DOE'S PROBABILISTIC VOLCANIC
 HAZARD ANALYSIS PROJECT

On February 22-23, 1995, John Trapp of the Engineering and Geosciences Branch and Janet Kotra of the Performance Assessment and Hydrology Branch attended, as observers, the first of four workshops being conducted by DOE on Expert Elicitation for Probabilistic Volcanic Hazard Assessment (PVHA). Attached to this memorandum is the official summary of this workshop. A complete set of workshop overheads and summary materials are available from Trapp or Kotra, for review, by interested parties.

As stated above, this was the first of four workshops that will address concerns related to obtaining probabilities for disruption of the Yucca Mountain site by igneous activity. The primary focus of this workshop was the identification of data necessary to conduct these probabilistic assessments. Future workshops will focus on the actual models used and on alternative interpretations thereof. The project will culminate in the generation of probabilistic estimates elicited from the panel, the results of which will be discussed in a final summary workshop.

The project is directed by Kevin Coppersmith of Geomatrix Consultants. Because of his strong background in similar projects in the area of seismic hazard assessment, Coppersmith appears to be well suited to undertake this role. In opening the workshop, he presented an overview of the process used to select the expert panel, presented the ground rules for expert interaction throughout the project, and discussed, in general terms, the expert elicitation process that would be used.

Following these opening remarks was a more detailed overview of the elicitation process presented by Peter Morris who will serve as the normative expert throughout the project. As a part of this preliminary training of the expert panel, Morris discussed the treatment of uncertainty, the objectives of expert elicitation, and the roles and responsibilities of the various types of

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experts participating in the project. He emphasized that over the course of the workshops, the substantive experts will be called upon to act both as experts and, alternatively, as proponents of their own and opposing viewpoints. Morris also stressed that the ultimate purpose is not to achieve consensus, but, instead, to accurately document the state of scientific knowledge of the probability of volcanism at Yucca Mountain and of the degree of uncertainty associated with its estimation.

While the NRC staff attends these workshops as observers only, time has been set aside for observer comments. All of the Geomatrix personnel associated with this project have endeavored to ensure that the NRC staff's concerns are understood, and appear to have a sincere interest in seeing to it that the PVHA project yields information useful, not just to DOE, but to the NRC as well. For example, following the original session, Trapp alerted Coppersmith that the actual statement of the problem was not in accord with regulatory needs. At the following session, Coppersmith restated the problem in a manner consistent with regulatory requirements.

Two potential problems deserve mention. Based on draft Yucca Mountain procedures and on procedures developed by Sandia for use by DOE for the WIPP project, it would appear that DOE may be at odds with its own procedures for the selection of an expert panel. While the choice of several of the panel members appears questionable when viewed against these procedures, the inclusion of Bruce Crowe of Los Alamos, in particular, appears to create the potential for a conflict of interest. DOE will need to explain in detail how it intends to compensate for any biases which might result from the fact that one of the panel members is the primary developer of DOE's models for volcanic probability at Yucca Mountain.

An additional concern relates to information given to the panel. Included in this information is a background report which is intended to serve as a starting point for review. This background paper is essentially a summary taken from the Los Alamos Volcanism Status Report. Review of the original paper resulted in compilation of over 80 pages of comments by the CNWRA and 8 major areas of concern by the NRC. While the NRC is in the process of conducting a scoping review of this revised paper, preliminary conclusions are that the NRC and CNWRA comments have not been addressed. Use of this paper, and a summary report which relies on this paper, as an unbiased summary of the status of understanding of volcanic studies and resultant probabilities, has the possibility of biasing the panel. Based on the data requests of the panel (see Tables 1 and 2 of the attached Summary), it would appear that this potential problem may be minimized.

If there are any questions, please contact either John Trapp at 415-8063 or Janet Kotra at 415-6674.

Attachments: As stated

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An additional concern relates to information given to the panel. Included in this information is a background report which is intended to serve as a starting point for review. This background paper is essentially a summary taken from the Los Alamos Volcanism Status Report. Review of the original paper resulted in compilation of over 80 pages of comments by the CNWRA and 8 major areas of concern by the NRC. While the NRC is in the process of conducting a scoping review of this revised paper, preliminary conclusions are that the NRC and CNWRA comments have not been addressed. Use of this paper, and a summary report which relies on this paper, as an unbiased summary of the status of understanding of volcanic studies and resultant probabilities, has the possibility of biasing the panel. Based on the data requests of the panel (see Tables 1 and 2 of the attached Summary), it would appear that this potential problem may be minimized.

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SUMMARY
WORKSHOP ON DATA NEEDS
PROBABILISTIC VOLCANIC HAZARD ANALYSIS PROJECT
YUCCA MOUNTAIN REGION, NEVADA

February 22 and 23, 1995

Phoenix, Arizona

The Workshop on Data Needs was the first in a series of four workshops being conducted for the Probabilistic Volcanic Hazard Analysis (PVHA) project. The project is sponsored by the U.S. Department of Energy (DOE) and is managed by Geomatrix Consultants. The goal of this workshop was to develop a comprehensive list of the specific data needed to make probabilistic assessments of volcanic hazard at Yucca Mountain. The approach to the workshop was to (1) identify the technical issues of most significance to probabilistic volcanic hazard analysis, (2) establish linkages between PVHA issues and the data most important to addressing the issues, (3) specify pertinent data available for the Yucca Mountain region, and (4) identify the particular data that are required by the experts to conduct the PVHA.

The overhead transparencies shown during this workshop are included with this summary, along with brief summaries of the speakers' technical presentations.

DAY 1 - WEDNESDAY, FEBRUARY 22

A welcome and introduction to the workshop was given by the PVHA project manager, Dr. Kevin J. Coppersmith of Geomatrix Consultants. He reviewed the workshop agenda and the various types of participation in the project. The members of the expert panel and the Methodology Development Team (MDT, the group that is planning and conducting the project) then introduced themselves and briefly described their areas of expertise. The

members of the expert panel are Dr. Richard W. Carlson (Carnegie Institution of Washington), Dr. Bruce M. Crowe (Los Alamos National Laboratory [LANL]), Dr. Wendell A. Duffield (U.S. Geological Survey), Dr. Richard V. Fisher (University of California, Santa Barbara, Emeritus), Dr. William R. Hackett (WRH Associates), Dr. Mel A. Kuntz (U.S. Geological Survey), Dr. Alexander R. McBirney (University of Oregon, Emeritus), Dr. Michael F. Sheridan (State University of New York at Buffalo), Dr. George A. Thompson (Stanford University), and Dr. George P.L. Walker (University of Hawaii). Members of the MDT are Kevin Coppersmith, Dr. Peter A. Morris (Applied Decision Analysis), Dr. Stephen T. Nelson (Woodward-Clyde Federal Services), Dr. Jeanne C. Nesbit (DOE), Dr. Roseanne C. Perman (Geomatrix Consultants), Dr. Richard P. Smith (Idaho National Engineering Laboratory [INEL]), Dr. J. Carl Stepp (Woodward-Clyde Federal Services), and Dr. Robert R. Youngs (Geomatrix Consultants) (who was unable to attend the workshop).

Opening statements were given by several members of the MDT. Kevin Coppersmith described the focus of the subsequent workshops, the workshops' ground rules and organization, the process used to select the panel members, and PVHA project goals. Jeanne Nesbit, project manager of the PVHA project for DOE, briefly discussed the ways that the results of this project may be used in the two major areas of DOE responsibility: (1) evaluating whether Yucca Mountain meets site suitability requirements, and (2) preparing a license application if the site is deemed suitable. She pointed out that the results of the PVHA project could also be used to evaluate where to place additional resources to reduce uncertainties. Peter Morris presented an introduction to uncertainty treatment and the process and principles of expert judgment elicitation. Kevin Coppersmith concluded the opening statements by describing the general framework of the PVHA project.

The second session included four presenters discussing the technical issues associated with PVHA methods. Chuck Connor (Center for Nuclear Waste Regulatory Analysis [CNWRA]) began the technical presentations with a talk on "Nonhomogeneous Probability Models." Both temporally and spatially dependent models were described, with specific applications to

the Yucca Mountain Site. Bruce Crowe gave the next presentation, "Perspectives for Probabilistic Volcanic Risk Assessment." He discussed various probabilistic models and the uncertainties associated with the application of each. The afternoon session commenced with a presentation by Richard Smith entitled "Summary of Technical Issues for Volcanic Hazards Assessment at the INEL." He discussed the possible analogies between the Snake River Plain Region and the Yucca Mountain Region (YMR), citing the various technical issues pertaining to the volcanic hazards assessment at INEL. Alexander McBirney gave the final presentation of the day, entitled "Statistical Data and Geologic Realism." He stressed the importance of choosing statistical models that are consistent with sound geologic observations and data.

The technical presentations were followed by a discussion of the specific technical issues that need to be addressed to carry out the volcanic hazard assessment at Yucca Mountain. A comprehensive list of these issues was compiled by the members of the expert panel and the MDT, and is provided in Table 1.

The session ended with questions and short statements from some of the project participants and observers. Issues discussed included how to evaluate data loss due to the effects of erosion or burial of volcanic features, the distribution of volcanoes with respect to topography and the possible influence of neutral buoyancy. In addition, it was suggested that a paper discussing probabilistic seismic hazard analysis be read by the members of the expert panel.

DAY 2 - THURSDAY, FEBRUARY 23

The second day of the workshop began with Kevin Coppersmith leading a discussion focused on relating each of the technical issues identified the previous day to those data sets that could provide information to address that issue. A list of data was compiled during this discussion, and is provided in Table 2.

The next session included a discussion of Yucca Mountain data bases pertinent to PVHA

technical issues. Eugene I. Smith (University of Nevada, Las Vegas [UNLV]) began the presentations with a description of data for the Crater Flats region and analog studies in the Basin and Range conducted by UNLV. Brent D. Turrin (U.S. Geological Survey) gave the next talk. He presented and discussed some of the geochronological data, particularly $^{40}\text{Ar}/^{39}\text{Ar}$ data, available for the YMR. Frank V. Perry (LANL) began the afternoon session with an overview of all of the data sets gathered as part of the LANL volcanic program for each of the volcanic centers in the YMR. Victoria E. Langenheim (U.S. Geological Survey) concluded the technical presentations for the workshop. She provided an overview of all of the geophysical data sets, published and unpublished, that exist for the YMR.

Kevin Coppersmith concluded the workshop by announcing that all of the Yucca Mountain data sets presented would be compiled on a master list by Geomatrix and distributed to the expert panel members so they could chose the specific data they would like to receive.

Discussions on a variety of issues followed, with questions and comments from the observers. Topics included observations of the rafting of portions of a scoria cone on an active lava flow, the quality of available age dates, the importance of evaluating fault data from the tectonics program, and the ability to resolve various technical issues and their relevance to hazard analysis.

TABLE 1

TECHNICAL ISSUES IDENTIFIED BY THE EXPERT PANEL

WORKSHOP ON DATA NEEDS

1. Nature of YMR eruptions
2. Field relationships/mapping
3. Correlation of tectonic activity with recent or synchronous volcanism
4. Structural control of spatial distribution of regional/local volcanic features
5. Age, volume, and locations of eruptions
6. Nature of aeromagnetic anomalies
7. Reliability, quality, and uncertainty of age determinations
8. Definition of "event"
9. Model of magma generation and migration
10. Areal extent for regional recurrence rate
11. Lathrop Wells - recency and number of events
12. Polygenetic vs. monogenetic
13. Model for probability calculations - does it make a difference?
(nonhomogeneous vs. homogeneous; physical constraints)
14. Influence of regional stress field
15. Geodetic/neotectonic strain rate
16. Existence, age, and configuration of a buried magma body; silicic vs. basaltic
17. Southern Basin and Range volcanism - time/space patterns
18. Appropriate analogs

TABLE 1 - CONTINUED

19. Relation of topography to density of eruptions
20. Area of "repository"
21. Area of "event"
22. Evolution of Crater Flat - trends/volume/composition
23. Burial or loss of events - geologic record
24. Comparisons with composite cones
25. How well do models predict?
26. Archiving data bases
27. Dissemination of results

TABLE 2
DATA NEEDS FOR TECHNICAL ISSUES
WORKSHOP ON DATA NEEDS

<u>TECHNICAL ISSUE</u>	<u>DATA</u>
1	Field maps, size/shape/thickness of basalt Analogs (cinder cone roots) Pre-eruptive H ₂ O content; inclusions Viscosity indicators
2	Topographic maps
3	Fault data/recency - Ash deposits/geochemistry Detailed geologic maps
4	Regional: Geologic maps/gravity maps/(aero)magnetic maps Seismic reflection/refraction maps Local: Maps of individual vents Ground magnetic data
5	Geologic maps (all scales) Geochronology Depth information
7	Actual/raw data
9	Geochemical data H ₂ O content
10	Regional geologic maps Analogs Multiple filtered geophysical data Teleseismic data
11	Aerial photographs (various scales)
12	Geochron/geochemical data Field relationships

TABLE 2 - CONTINUED

<u>TECHNICAL ISSUE</u>	<u>DATA</u>
14	Hydrofracture data/breakouts Focal mechanisms Fault slip vectors Cinder cone alignments
15	GPS data Fault history
16	Teleseismic tomography Seismic reflection data
17	Southern Basin and Range map (Luedke & Smith)
19	Borehole/density profiles Gravity data Analogues
21	Analogues Aeromagnetic data
22	Isotopic/geochemical data Number of dikes
23	Aeromagnetic data Shallow reflection data Borehole data Quaternary geomorphic maps



**WORKSHOP ON DATA NEEDS
PROBABILISTIC VOLCANIC HAZARD ANALYSIS PROJECT
YUCCA MOUNTAIN REGION, NEVADA**

February 22-23, 1995
Phoenix, Arizona

ATTENDANCE LIST

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WORKSHOP ATTENDANCE LIST (con't)

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