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CENTER FOR NUCLEAR WASTE REGULATORY ANALYSES

TRIP REPORT

SUBJECT: Attend NWTRB Meeting Regarding Seismic and Volcanic Hazards, 20-5702-441 and Meet with LLNL Staff Regarding the SEISM 1 Code, 20-5702-425.

DATE/PLACE: NWTRB Meeting, 8-9 March 1994, Holiday Inn, Burlingame, CA. 20-5702-441
LLNL Staff Meeting, 7 March, 1994, LLNL, Livermore, CA. 20-5702-425

AUTHOR: Renner B. Hofmann

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TRIP REPORT

SUBJECT: Attend NWTRB Meeting Regarding Seismic and Volcanic Hazards and Meet with LLNL Staff Regarding the SEISM 1 Code.

DATE/PLACE: NWTRB Meeting, 8-9 March 1994, Holiday Inn, Burlingame, CA.
LLNL Staff Meeting, 7 March, 1994, LLNL, Livermore, CA.

AUTHOR(S): Renner B. Hofmann

PERSONS PRESENT:

NWTRB Meeting - CNWRA: R.B. Hofmann, C.B. Connor, B.E. Hill; NRC/NMSS: K.I. McConnell, A.K. Ibrahim, J.S. Trapp, S. McDuffy, J. Park (of P.A.); NRC/NRR: G.V. Giese-Koch; NRC/RES: A.J. Murphy. There were about 150 attendees/participants. An attendance list was not provided. The attached agenda provides the names of participants.

LLNL Meeting - CNWRA: R.B. Hofmann, NRC/NMSS: A.K. Ibrahim; LLNL: B. Davis, D.L. Bernreuter, J. Savy.

BACKGROUND AND PURPOSE OF TRIP:

NRC (K.I. McConnell) requested that CNWRA send appropriate representatives because probabilistic analysis of Yucca Mountain Seismic and Volcanic hazards were to be discussed and these discussions may impact CNWRA's program in these areas. C.B. Connor was requested, by Dr. L. Reiter of the NWTRB, to present the results of his work on volcanic probabilities. A.K. Ibrahim requested a meeting with LLNL staff at the time of the NWTRB meeting because of difficulties we were having in using their SEISM 1 computer code and their convenient location with respect to the NWTRB meeting. LLNL staff proposed that we meet on Monday, March 7, before the NWTRB meeting.

SUMMARY OF PERTINENT POINTS AND ACTIVITIES:

NWTRB Meeting

DOE participants argued that the use of large storage containers for spent fuel mitigated the earthquake hazard. NWTRB's Dr. North, however, disagreed to the effect that no evidence supporting this contention had been presented and that the decision to use large containers had caused previous analytical and design work to be negated. Dr. North was disturbed by the lack of seismic analysis by DOE and that only previously argued methodology was to be presented in their three part Topical Report. Other DOE participants, Drs. Budnitz and Cornell (consultant to the NWTRB), stated that there was no place for a deterministic seismic analysis of the potential Yucca Mountain repository. Dr. McConnell of the

NRC, however, stated that both deterministic and probabilistic methods would be required. I did not ascertain that these issues were resolved at this meeting but the positions of the NRC, DOE and NWTRB were clearly stated. J. Whitney of the USGS provided a summary of fault dating information that may be useful in SEISM 1 sensitivity studies. J.C. Stepp (affiliation not stated) asked to make a presentation following the NWTRB presentations. He was granted 5 minutes to discuss a method of probabilistic disaggregation by spectral bands that he is proposing. Richard Quittmayer of Woodward-Clyde (DOE consultants) had stated during his presentation on the DOE's Topical Report concerning seismic analysis methodology that Stepp would talk on ASCE's document. Some Board members termed the Topical Report a "tropical paradise". They stated that they wanted details and results and that DOE should get serious and be specific.

Volcanic probabilities were also discussed. DOE participants argued that they had performed enough research in this technical area and had found the risk to be trivial. Dr. Ho and others from the State of Nevada and Dr. Connor from CNWRA presented results of studies to the contrary. DOE stated that the matter would have to be approached using a probabilistic analysis of expert opinion regarding data analysis methods. These discussions suggest that application of techniques like those employed in the SEISM 1 code will also be made for probabilistic volcanic hazards. There were questions regarding the interface between volcanic and seismic hazards, including possible fault control of vent alignments. Professor George Thompson of Stanford U. (a DOE consultant) indicated that extension of the Basin and Range tectonic province was accommodated either by normal faulting or through igneous injection. Because the Yucca Mountain area is seismically quiet compared with much of the Basin and Range tectonic province, he suggested that igneous injection might be the predominant method of accommodating extension in this area. More detail concerning volcanic activity probabilities will be addressed in the separate trip report by C.B. Connor and B.E. Hill of CNWRA. Handouts were prepared for most of the presentations. They are available with the author of this trip report.

LLNL Meeting

Despite moving to another building and preparation for a late-in-the-day trip to NRC, B. Davis agreed to meet with Dr. Ibrahim and me. I had sent copies of our input data and attenuation functions using e-mail. This was found to be more extensive than desired so Davis had prepared a simplified one-fault test case for Yucca Mountain and developed seismic hazard graphs from it. Eastern U.S. attenuation functions were used and reasonable results obtained. However, the output from these functions indicated an average or 50th percentile acceleration maximum of about 3,000 cm/sec² rather than the approximately 980 cm/sec² values originally supplied by the eastern U.S. experts. These results were in accord with the calculations we had made independently but had assumed were in error. I checked with the author of one of the eastern U.S. attenuation curves, by telephone after the meeting, to verify that the submitted maximum accelerations were in the 980 cm/sec² range. D. Bernreuter talked with us briefly. He currently has a consulting contract with NRC/NRR. He stated that the eastern U.S. formulae in our version of the SEISM 1 code were curve fits to the data from which each of the eastern ground motion experts had derived their attenuation curves and were not curve fits to their attenuation functions. Unless magnitudes greater than 7.5 and distances less than 10 km are important to eastern U.S. analysis, the hazard difference resulting from 3g and 1g maximum accelerations would not be expected to be large. These differences could be larger however, for the Yucca Mountain site.

The matter of QA and configuration control for the modified SEISM 1 code, however, appears to be a larger effort than anticipated because of undocumented code characteristics and requirements.

B. Davis also supplied a graphing routine for SEISM 1 attenuation functions on disk. Dr. J. Savy recommended that we contract to use the LLNL data base and gain the benefit of advice in using SEISM 1 that accompanies such a contract. This could help in our documenting the code for NRC and CNWRA use. Currently we have no means of paying LLNL staff for time they spend answering our questions. Dr. Savy stated also that such a contract would not permit access to source code because it is under development and is not quality controlled by LLNL at this time. There could be a potential for conflict of interest problems with such a contract.

IMPRESSION/CONCLUSIONS:

Disagreement on probabilistic and seismic hazard analysis methodology still exists between DOE and NRC. The differences appear to be in clearer focus as a consequence of this meeting. Their resolution is likely to incorporate expert opinion concerning volcanic data analysis methods and probabilistic analysis. NWTRB seems less than satisfied with DOE's progress in making calculations, acquiring data and technically justifying conclusions.

After reviewing the printouts provided by B. Davis, I believe the visit to LLNL was useful in determining their approach to attenuation functions and that we will now be able to proceed with the SEISM 1 test analysis without further concern about the units used within the program.

PROBLEMS ENCOUNTERED: None noted.

PENDING ACTIONS: None anticipated.

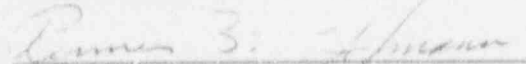
RECOMMENDATIONS:

Further attendance by CNWRA staff at appropriate NWTRB and ACNW meetings.

REFERENCES:

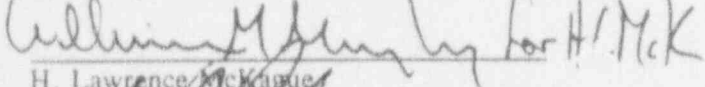
Attached NWTRB Agenda and file of meeting handouts kept by the author of this report.

SIGNATURES:

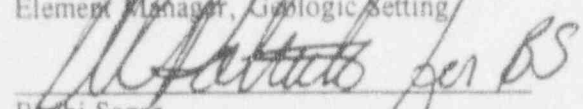

Renner B. Hofmann
Senior Research Scientist

3/16/94
Date

CONCURRENCE SIGNATURES AND DATE:


H. Lawrence McKague
Element Manager, Geologic Setting

3/16/94
Date


Bedhi Sagar
Technical Director

3/16/94
DATE



UNITED STATES
NUCLEAR WASTE TECHNICAL REVIEW BOARD
1100 Wilson Boulevard, Suite 910
Arlington, VA 22209

Agenda
Meeting of the Panel on Structural Geology & Geoengineering
Probabilistic Seismic and Volcanic Hazard Estimation

March 8-9, 1994

Holiday Inn Crowne Plaza
San Francisco Airport
600 Airport Blvd.
Burlingame, CA 94010
Tel: (415) 340-8500
Fax: (415) 340-0599

Tuesday, March 8, 1994

- | | |
|------------|---|
| 8:30 A.M. | Opening remarks
Clarence Allen
Nuclear Waste Technical Review Board (NWTRB) |
| 8:40 A.M. | Update on seismic investigations
John Whitney
U.S. Geologic Survey (USGS) |
| 9:15 A.M. | Update on volcanic investigations
Frank Perry
Los Alamos National Laboratory (LANL) |
| 9:50 A.M. | Integrated structural model of the Yucca Mountain region
Chris Fridrich, USGS |
| 10:15 A.M. | BREAK (15 minutes) |
| 10:30 A.M. | General comments on probabilistic approaches
C. Allin Cornell
Stanford University |
| 11:15 A.M. | Systems perspectives
Robert Budnitz
Future Resources Associates |
| 12:00 P.M. | LUNCH |

Tuesday, March 8 - Continued

- 1:30 P.M. Department of Energy (DOE) topical report on seismic hazard
Richard Quittmayer
Woodward-Clyde
- 2:10 P.M. Use of probabilistic seismic hazard assessment (PSHA) in the Yucca Mountain program
Tim Sullivan, DOE
- 2:30 P.M. PSHA case histories
Kevin Coppersmith
Geomatrix
- 2:55 P.M. Comments by the Nuclear Regulatory Commission (NRC)
Keith McConnell, NRC
- 3:15 P.M. BREAK (15 minutes)
- 3:30 P.M. Comments from the state of Nevada
Carl Johnson
Agency for Nuclear Projects
- 3:50 P.M. How good is PSHA?
Steve Wesnouski
University of Nevada — Reno
- 4:20 P.M. How good is PSHA?
Paul Pomeroy
Advisory Committee on Nuclear Waste
- 4:50 P.M. General comments on PSHA
Keiiti Aki
University of Southern California
- 5:30 P.M. Recess until Wednesday

Wednesday, March 9, 1994

8:30 A.M. LANL report on volcanic hazard at Yucca Mountain
Bruce Crowe, LANL

9:30 A.M. Use of probabilistic volcanic hazard assessment
(PVHA) in the Yucca Mountain program
Jeanne Nesbit, DOE

9:50 A.M. Comments by the NRC
Keith McConnell, NRC

10:10 A.M. BREAK (15 minutes)

10:25 A.M. Models of volcanic hazard at Yucca Mountain
Charles Connor
Center for Nuclear Waste Regulatory Analyses

11:00 A.M. Comments by the state of Nevada
Carl Johnson
Agency for Nuclear Projects

11:20 A.M. Alternate geologic models: their significance with
respect to the calculation of volcanic hazard at Yucca
Mountain
Eugene Smith and C.H. Ho
University of Nevada — Las Vegas

12:00 P.M. LUNCH

1:15 P.M. Sensitivity studies on volcanic hazard at Yucca
Mountain
Peter Wallmann
Golder Associates

1:40 P.M. General comments on PVHA
Michael Sheridan
State University of New York — Buffalo

2:30 P.M. Round-table discussion
Participants

4:00 P.M. Closing remarks
Clarence Allen, NWTRB