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CENTER FOR NUCLEAR WASTE REGULATORY ANALYSES

TRIP REPORT

SUBJECT: Attend DOE/USGS Workshop to Select Earthquake Scenarios for Modeling Ground Motion at Yucca Mountain, Nevada. 20-5702-441.

DATE/PLACE: 28 February and 1 March 1995 at the USGS Yucca Mountain Project Branch offices in Lakewood, Colorado.

AUTHOR: Renner B. Hofmann

PERSONS PRESENT: CNWRA: R.B. Hofmann, NRC/NMSS: A.K. Ibrahim, NWTRB: Leon Reiter. There were about 33 attendees/participants. A sign up sheet is provided. The attached agenda identifies participants and observers.

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BACKGROUND AND PURPOSE OF TRIP:

NRC (A.K. Ibrahim) requested that R. B. Hofmann attend. The topic of the workshop is important to the anticipated probabilistic fault displacement and seismic hazard analyses proposed by the DOE. Similar analyses are anticipated to be performed for use in performance assessment by the NRC/CNWRA. A total of five DOE/USGS meetings will be held on earthquake inputs to the analyses according to the USGS. An additional series of 10 or 11 meetings are anticipated by DOE concerning the use of expert opinion and probabilistic seismic hazard analyses for underground repository post-closure design. Both Hofmann and Ibrahim attended as observers and did not participate in scenario selection.

SUMMARY OF PERTINENT POINTS AND ACTIVITIES:

Drs. T. Hanks, S. Pezzopane and J. Schneider chaired the workshop. The stated objective was to select five reasonable, rational, earthquake sources to be modeled for use in hazard analyses at Yucca Mountain. The intent appeared to be to select five faults or fault combinations that might generate controlling earthquake ground motion at Yucca Mountain. Large distant faults capable of generating large earthquakes were considered, as well as smaller nearby faults, because they may produce controlling ground motion at very low frequencies. Participants were split into several groups. Each group selected several faults that they thought might produce the highest level of ground motion at Yucca Mountain.

Almost every group chose, among the several faulting scenarios presented, a hypothetical master fault located at depth under Yucca Mountain or under Frenchman Flat, that branched upward into the roughly parallel North-South striking faults in the site vicinity. An earthquake initiating on the deeper portion of this hypothetical fault, may continue upward along one of the North-South faults, e.g. Wendy Wash or Solitario Canyon, or may distribute its displacement among them. Two avenues of supporting evidence for such a scenario were discussed. One is the occurrence of the Lathrop Wells volcanic ash (about 100ka) in two of the North-South trending faults and the possibility that the same ash may have been trapped in other faults of this trend. The other arguments are that the Cedar Mountain earthquake in the Walker Lane seismic zone has widely distributed faulting, that this type of fault distribution is common in the Basin and Range tectonic province, and that a map of ruptures distributed among faults during the Cedar Mountain earthquake, overlays on Yucca Mountain to about the same scale as the North-South

oriented faults. These scenarios are almost identical to those proposed by many of the same experts during the EPRI fault hazard elicitation published in EPRI TR-102000 "Earthquake and Tectonics Expert Judgement Elicitation Project," February 1993. Kevin Coppersmith, who participated in that effort said modeling of ground motion had been performed for most of the proposed scenarios as a part of the earlier EPRI project. The other fault scenarios comprised each of the North-South trending faults. They were considered to be planar from the surface to the elastic-plastic interface about 15km deep. Several other interesting fault alignments were proposed. However, none appeared capable of producing controlling ground motion because of their distance from the site. All the groups also suggested the Death Valley-Furnace Creek fault because high magnitude events appear probable over a 10,000 year period and they would be likely to control the long period portion of a design spectrum for Yucca Mountain.

Modelers in attendance were Norman Abrahamson, Jean B. Savy, and John Schwartz. Carl Stepp, who also attended, is to manage an elicitation project for post closure PSHA by EPRI for DOE. Second day activities included lectures from field geologists, who were intimately acquainted with each of the proposed faults to be modeled, and a summary. Hand-out literature was informal and not well identified. I have copies for those who may be interested. Future meetings will consider fault modeling in more detail and the attenuation of ground motion including fault-directivity effects.

IMPRESSION/CONCLUSIONS:

The meeting was a repetition for many of the attendees, although it provided an update on fault investigations. I learned detail concerning terminology in the previously cited EPRI report that I hadn't understood when I read it some time ago. This meeting would have been a good one for CNWRA structural geologists to attend. Future ones may also be of benefit to Dr. Chowdhury's group.

PROBLEMS ENCOUNTERED: None noted.

PENDING ACTIONS: None anticipated.

RECOMMENDATIONS:

Further attendance by CNWRA staff at these and related meetings will be important if we are to perform independent probabilistic seismic or fault displacement hazard analysis. Even if this effort is not to be pursued, the meetings provide an understanding of DOE's approach to these problems that may be difficult to obtain from their publications.

REFERENCES:

Attached agenda, sign-in sheets, and file of meeting handouts kept by the author of this report.

SIGNATURES:

Renner B. Hofmann
Senior Research Scientist

DATE

CONCURRENCE SIGNATURES AND DATE:

H. Lawrence McKague
Geologic Element Manager

3/7/95
DATE

Budhi Sagar
Technical Director

3/8/95
DATE

Agenda for Workshop to Characterize Scenario Earthquakes in the Yucca Mountain Region

WORKSHOP OBJECTIVES: To select approximately five scenario earthquakes and to specify geologic constraints and associated uncertainties for input to a set of ground motion modeling exercises pertinent to the potential nuclear waste repository at Yucca Mountain, Nevada. Specifically, observable fault characteristics such as fault length, displacement and geometry will be used to constrain earthquake parameters such as magnitude, distance and focal mechanism.

February 28th (9AM to 5PM)

1. Introduction and Overview (30 min)
   - Introduction (10 min, *Pezzopane*)
   - Overview of ground motion scenario project (10 min, *Hanks*)
   - Required geologic input data and uncertainties (10 min, *Schneider*)
2. Geologic and Tectonic Framework of the Yucca Mountain Region (2 hrs, discussion led by *O'Leary, Fridrich*)
   - Tectonic models of Basin and Range faults (1 hr)
   - Tectonic models of Yucca Mountain faults (1 hr)
3. Select scenario earthquakes (faults) (4 hrs, discussion led by *Schwartz and Pezzopane*)
   - Overview of Candidate faults (30 min)
   - Nomination of 8 to 10 "straw man" scenario earthquakes (30 min)
   - Discussion and selection of 5 or 6 scenario earthquakes (3 hrs)

March 1st (9AM to 5PM)

4. Assess source properties of scenario earthquakes (5 hrs, discussion led by *Schneider*)
   - 2 or 3 local scenario earthquakes (~2 hrs)
   - 2 or 3 regional scenario earthquakes (~2 hrs)
   - Random background earthquake (~1 hr)
5. Wrap-Up Discussion/Observers Commentary (~1 hr, discussion led by *Hanks*)

List of Invited Participants

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Crone, Tony	USGS/Golden	303-273-8591
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List of Invited Observers

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