

CENTER FOR NUCLEAR WASTE REGULATORY ANALYSES

TRIP REPORT

SUBJECT: 91st ACNW Meeting, Focus on Igneous Activity (20-5708-461).

DATE/PLACE: April 22, 1997; 2 White Flint, Washington, D.C.

AUTHORS: Brittain E. Hill, Charles B. Connor

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BACKGROUND AND PURPOSE OF TRIP:

The Advisory Committee on Nuclear Waste (ACNW) will prepare a report to the Commission regarding the status of the Igneous Activity (IA) investigations in the Yucca Mountain Region (YMR). Committee members were interested in learning more about the results of the February 22-23, 1997 Technical Exchange on IA with the Department of Energy (DOE), and remaining differences in technical positions between the DOE, Nuclear Regulatory Commission (NRC), and State of Nevada. The ACNW also wanted to examine the assumptions, sensitivities and robustness of models used to calculate initial dose estimates for volcanic activity through the proposed repository. The central focus of the meeting was to evaluate the significance of differing technical results as to effect on calculated dose to the Amargosa Desert Critical Group.

SUMMARY OF PERTINENT POINTS:

An agenda for the meeting is attached. Copies of the presentations are available from the authors. The full transcript of the meeting is available through the ACNW Web page (<http://www.nrc.gov/ACRSACNW>) at <http://www.nrc.gov/glimpse/mfs/25/an970422>.

Introductory comments were made by John Trapp (NRC), who provided a synopsis of concerns regarding the DOE-sponsored Probabilistic Volcanic Hazards Assessment (PVHA) (Geomatrix, 1996). Trapp described how a new, dose-based standard has shifted emphasis away from the simple probability of occurrence for an event to evaluation of risk for the event (i.e., dose times probability). He emphasized the NRC position that, regardless of NRC concerns with some technical bases used in the PVHA, the DOE is free to use whatever information they desire to make a licensing case. NRC, however, will consider the full range of available information to make licensing decisions.

Chuck Connor, Center for Nuclear Waste Regulatory Analyses (CNWRA), presented an overview of recent CNWRA work on the geologic setting of the YMR igneous system and on probability model development. This was the same material presented at the February 1997 Technical Exchange with the DOE. Discussions focused on interpretation of ground magnetic data recently collected by CNWRA staff in Amargosa Desert and Crater Flat, Nevada. These data indicate that buried volcanic centers in the region may be more common than previously suspected. ACNW members indicated that calculations should be done to assess the significance of these new data and that some evaluation should be made of the likelihood of additional buried volcanoes being mapped during future field investigations. Connor also

discussed the regional setting of basaltic volcanism and the application of nonhomogeneous Poisson probability models to the volcanic hazard analysis.

Tim Sullivan (DOE) provided introductory remarks that focused on PVHA and the status of the DOE IA program. Sullivan indicated the DOE volcanism synthesis report will be issued at the end of FY97 and that the project integrated safety assessment (PISA) will provide an integrated discussion of all information relevant to IA. The PISA should be issued in early FY98. DOE has terminated most activities associated with IA, according to Sullivan, based on conclusions that volcanism is not a key technical issue for performance at Yucca Mountain. DOE believes the PVHA provides the basis for probability subissue closure. Based on low risks calculated for IA in previous DOE total system performance assessments (TSPA) and NRC initial dose calculations, DOE also believes that the IA consequence subissue is rapidly approaching closure.

Kevin Coppersmith (Geomatrix Consultants) provided an overview of the PVHA. This overview covered essentially the same information as his presentation at the February 1997 Technical Exchange. Coppersmith also presented the results of a hazard sensitivity study, which resulted from new information presented at the Technical Exchange. In summary, the revised larger volume of the Little Cones in Crater Flat and the occurrence of additional buried volcanoes in Amargosa Desert resulted in a negligible (less than 1 percent) change in the mean annual frequency of intersection from PVHA.

Gene Yogodzinski (Dickinson College) presented the results of work sponsored by the State of Nevada. Yogodzinski discussed an isotopic geochemical basis for the definition of the YMR igneous system, which extends the YMR igneous system south into Death Valley. This material was presented at the PVHA meetings and many PVHA members included this isotopic province in background recurrence rate calculations. It was generally excluded from more detailed PVHA models based on a lack of specific data on vent locations and ages, although several PVHA members did estimate these parameters. The significance of this YMR province definition is that volcanism within this province has remained essentially steady-state for the last 5 Ma. These data do not support probability models that appeal to an increase in Quaternary volcano recurrence rate (e.g., Ho, 1992). Yogodzinski also presented the results of recent mapping in the Citadel Mountain area of the Lunar Crater Volcanic Field, Nevada. Basaltic volcanoes in this area have erupted along range fronts and crests (elevation changes of around 400 m) over several millions of years. This supports the hypothesis that changes topography on the order of hundreds of meters (i.e., Yucca Mountain) do not provide a robust barrier to basaltic volcanic activity.

Brittain Hill (CNWRA) presented the technical bases for initial consequence models that focus on volcanic eruptions through the proposed repository. This information was presented at the February Technical Exchange with the DOE. Hill's presentation focused on the data used to quantify the amount of subsurface rock disrupted by a basaltic volcano such as Lathrop Wells, and on methods used to model the dispersion of material from basaltic volcanic eruptions. Little discussion ensued regarding the presented information, which focused heavily on the results of CNWRA studies at analog basaltic volcanoes.

Tim McCartin (NRC) presented a comparison of dose calculations from DOE's TSPA-95 and NRC's staff evaluation of the National Academy of Sciences recommendations for Yucca Mountain. Both studies provide initial mean dose calculations from an undisturbed repository, which can be used for comparison with initial dose calculations for volcanic activity. Although these studies have many differing base assumptions, mean individual drinking water doses at 5 km range from <10 mrem (DOE) to 76 mrem (NRC). DOE did not calculate dose at 30 km, however, NRC mean dose at 30 km is 14 mrem. By comparison with the 5-km dose, DOE dose at 30 km for the undisturbed repository is likely <1 mrem.

Hill then presented initial dose calculations for volcanic eruptions through the proposed repository, which were last presented at the February 1997 Technical Exchange. There were numerous discussions on clarifying the basis for critical assumptions, such as the grain size of waste particles and interactions between the waste package and ascending magma. Current dose calculations show that the risk presented by volcanism is ≤ 0.5 mrem/yr, assuming an annual probability of volcanism at the proposed repository site of 10^{-7} . Two points were made in evaluating the significance of these results. First, future volcanic activity, along with all other release processes, does not result in radiological releases that would violate a potential 100 mrem/yr standard. Second, based on current calculations, volcanic activity may be one of the only significant radiological risks from the proposed repository even with an expected risk of ≤ 0.5 mrem/yr.

Abe VanLuik (DOE) presented a summary of previous DOE TSPA studies and plans for TSPA-VA. The TSPA-VA will use results from the PVHA elicitation, recent NRC/CNWRA research on volcano dispersion, and the Los Alamos Volcanism Synthesis Report that should be finalized by the end of FY97. DOE will continue to evaluate the direct and indirect effects of igneous activity on repository performance. VanLuik initially indicated DOE would include volcanism in the TSPA-VA reference case if either consequences or risks are significant. John Garrick (ACNW) disagreed strongly with that approach and favored only a risk-based analysis, without decoupling consequences from risk. Ensuing discussions indicated that DOE will continue to analyze the consequences associated with igneous activity but, according to VanLuik, "only those things that have high consequence and reasonable sized risks will be reported in the actual nominative case of the TSPA-VA and be carried forward into the executive summary."

John Trapp (NRC) explained and expanded on the agreements reached with DOE at the February 1997 Technical Exchange on Volcanism. There was considerable discussion on the use of the PVHA results in the program and the basis for NRC disagreements with these results. In summary, DOE believes that the PVHA results provide sound, defensible basis for licensing and will use these results for TSPA-VA. Mike Bell (NRC) reiterated that DOE is free to use PVHA or whatever information they want to make their licensing case and that NRC will use that and other relevant information during reviews. Resolution of remaining open items also was discussed, with a general agreement to rapidly close open items that are no longer significant to performance issues.

Tim Sullivan (DOE) described DOE's path forward for igneous activity. DOE will use the PVHA results to evaluate risks associated with igneous activity. New information regarding buried anomalies in southwest Crater Flat and Amargosa Valley and the increased volume of Little Cones, discussed at the February 1997 Technical Exchange on Volcanism, has been evaluated by DOE and shown to have an extremely minor effect (< 1 percent) change on the overall PVHA probability distribution. DOE believes that new data are unlikely to change the results of PVHA significantly and that the next step is closure of the probability subissue. DOE will continue to evaluate consequence issues and document assumptions and results in TSPA-VA, which DOE believes will lead to consequence subissue closure.

A short general discussion period followed the formal presentations. Most of the discussion focused on the use of new information in probability models and possible methods to reduce uncertainty in fundamental geologic assumptions or models. The possible effects of discovering new, buried igneous features were discussed in the context of potential significance, with apparent support to evaluate potentially significant features. The meeting ended with ACNW members thanking all participants for providing relevant and useful information at an apparently successful meeting.

Hill and Trapp attended the session on April 23 that involved discussion of an ACNW report on the status of IA investigations being prepared for the NRC Commissioners. This session was not transcribed. There is a range of opinion within ACNW regarding future work related to igneous activity, with some members concluding that PVHA provides the best and final basis for determining the probability of future igneous events and that no additional work needs to be done. Other members disagreed with this position, suggesting that investigations related to significant probability issues needs to continue. Discussions generally focused on a need to develop a better technical basis for significant parameters in consequence analyses, with a preference to let DOE take the lead in addressing technical problems. The ACNW members were pleased with NRC/CNWRA responsiveness to issues raised in the last ACNW letter on igneous activity.

IMPRESSIONS/CONCLUSIONS:

ACNW noted that the meeting, gave them the information they needed to formulate the report to the NRC Commissioners. Most of the material presented had been discussed in previous meetings or reports and no new information was presented that would change CNWRA models, data, or interpretations significantly. DOE views the probability subissue as being closed by PVHA. Only a limited amount of additional work will be done to evaluate igneous activity as part of TSPA-VA, based on the low probabilities from PVHA and limited consequences derived from previous DOE TSPAs.

There clearly was no consensus on the ACNW about recommendations to the NRC Commissioners. Some ACNW members clearly believed that the initial calculations show volcanism is not a significant risk and the NRC should close the issue. Other ACNW members believed that issue closure would be premature in that additional work clearly needs to be done.

Hill attended an informal discussion between NRC and DOE staff regarding the letter from DOE addressing points raised at the February 1997 Technical Exchange on Volcanism and possible use of the ASHPLUME code by DOE. NRC will likely provide DOE with the ASHPLUME source code and DOE will evaluate this code for possible use in TSPA-VA analyses. Numerous points of clarification were raised regarding the Technical Exchange letter, mainly focusing on interpretations of issue resolution and closure. Abe VanLuik (DOE) stated that the significance of igneous activity is being evaluated relative to a possible 100 mrem dose standard and that its relative contribution to total system dose is likely irrelevant. Thus, igneous activity is not perceived by DOE to be "significant" unless it is likely to fail a possible 100 mrem dose standard.

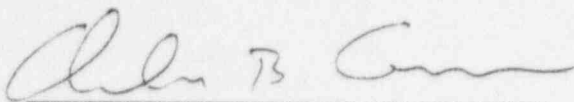
PROBLEMS ENCOUNTERED:

None.

PENDING ACTIONS:

None.

SIGNATURES:



Charles B. Connor
Senior Research Scientist

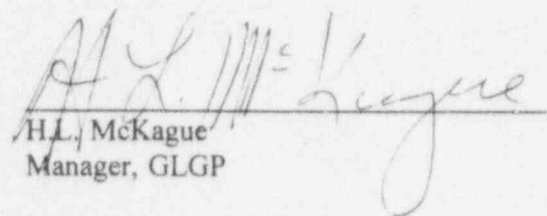
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Date



Brittain E. Hill
Research Scientist

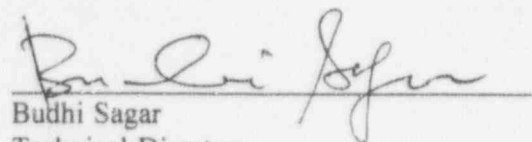
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