

CENTER FOR NUCLEAR WASTE REGULATORY ANALYSES

TRIP REPORT

SUBJECT: Cities on Volcanoes 2 Meeting

DATE/PLACE: February 11–16, 2001, at Auckland, New Zealand

AUTHOR: Brittain Hill

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PERSONS PRESENT: About 300 international participants

BACKGROUND AND PURPOSE OF TRIP:

Cities on Volcanoes is an international organization that addresses a wide range of issues associated with volcanic hazard and risk in populated areas. In addition to volcanologists, Cities on Volcanoes meetings bring together international experts in risk assessment and education, emergency management, public policy, and the insurance industries. The Cities on Volcanoes meetings provide a unique forum to discuss how advances in volcanology can be implemented in societal decisions, in addition to a strong program in current volcanological research.

Participation in this meeting supports NRC goals for nuclear waste safety through evaluation of long-term volcanic risk. Some of the key methods and data used by the CNWRA to evaluate risks from igneous activity have never been presented to the volcanological community. Participation and discussions in the Cities on Volcanoes meeting allowed for peer evaluation of these data, which builds confidence that appropriate methods are being used to support NRC programs. Presentations also demonstrated that the modeling approach used by the NRC for licensing decisions is based on realistic models and data, which have been reviewed and discussed by international experts in volcanology. Finally, presentation at this meeting supported public confidence that the NRC independently develops a wide range of techniques to evaluate safety issues.

SUMMARY OF PERTINENT POINTS

Based on presentations at this and other recent meetings, probabilistic risk assessment techniques are rarely used in volcanic areas. Presenters from the insurance industry and emergency management stressed the need to develop better understandings of the likelihood of future volcanic events, and quantify the range of hazards associated with these events. In contrast, few of the volcanological presentations addressed the frequency of past events, or even attempted to constrain the likelihood of future volcanic events. Most of the presentations also were based on empirical observations around currently active volcanoes, with hazards zones determined by the distribution of a limited number of past events. These evaluations tend to focus on the largest past eruptions, which leave the most widely distributed and readily preserved deposits. The potential for small eruptions usually is neglected in these hazard analyses.

Many presentations at the Cities on Volcanoes meeting focused on the development of process models for individual volcanic events. Although these models give some representation of the physical conditions associated with a single volcanic event, the models are generally deterministic and involve fitting parameters to produce realistic looking results. Model verification (i.e., comparison with known events) is rarely discussed, and few researchers are taking a probabilistic approach to evaluate model and data uncertainty or to represent a likely range of future events. In contrast, NRC-sponsored models for ash dispersion have been verified, and a range of realistic parameters are used to calculate a distribution of potential future events.

The probabilistic hazard approach used to support NRC risk evaluations appears directly applicable to hazard and risk mitigation in volcanic areas. One particular strength in this approach is that a range of past eruption characteristics can be evaluated, including relatively frequent, potentially low hazard events. Public safety officials can use this range of hazards to develop appropriate mitigation and evacuation strategies, rather than relying on a worst-case scenario. Insurance companies in particular need a range of future hazards in order to set appropriate insurance rates. These probabilistic hazard and risk methods appear directly applicable to the insurance and reinsurance industries.

Hill presented the results and technical bases of several recent CNWRA investigations for (i) modifications to a parallelized version of ASHPLUME that uses a stratified wind-field to calculate 3D tephra dispersal patterns, (ii) detailed airborne particle concentrations measured above basaltic tephra-fall deposits at Cerro Negro, Nicaragua, and (iii) techniques used to determine eruption style and calculate tephra volumes for extinct and eroded volcanoes in the Yucca Mountain region. Each of these topics received many favorable comments and requests for data or publications. No adverse comments were received about the methods or data presented at the meeting. Presentations and interactions at this meeting reinforce confidence that models and data used to evaluate volcanic risks at the proposed Yucca Mountain repository site are generally accepted by the international volcanological community and represent high-quality science.

As a result of past and ongoing CNWRA technical investigations, Hill was asked by the President of the International Association of Volcanology and Chemistry of the Earth's Interior (IAVCEI) to form and lead an IAVCEI Working Group on development of quantitative methods for volcanic tephra-fall hazards analysis. This working group will evaluate the ASHPLUME model used in NRC performance assessments and currently available alternative models. Model evaluations will include verification with a variety of well documented volcanic eruptions. Once available models are evaluated, the goal of the working group is to acquire external funding and develop an integrated tephra-hazard model that can run on a remotely accessible computer host. Hill's participation in the IAVCEI Working Group will directly benefit the NRC by providing an external, objective evaluation of alternative tephra-dispersal models to ASHPLUME. This evaluation will provide confidence that an appropriate model is being used to evaluate tephra dispersion in performance assessments of the proposed repository site at Yucca Mountain, and ensure that appropriate uncertainties are associated with model results.

CONCLUSIONS:

Work conducted at the CNWRA in support of the NRC high-level waste program is at the leading edge of quantitative volcanic risk assessment techniques. Models and data currently used to evaluate tephra dispersion, airborne particle concentrations, and dispersal characteristic of Yucca Mountain region volcanoes appears reasonable and acceptable to the international volcanological community. Probabilistic volcanic hazard and risk techniques used for the NRC program appear directly applicable to current needs of the

reinsurance industry, as well as public health and safety officials. Collaboration with the IAVCEI working group on tephra dispersion may provide a mechanism to leverage our current modeling approach into an appropriate tool for insurance industry work.

PROBLEMS ENCOUNTERED:

None.

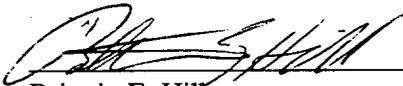
PENDING ACTIONS:

Hill will draft a short proposal to IAVCEI for approval of a working group for tephra hazard modeling. This proposal will be reviewed by the IAVCEI executive committee for formal recognition by IAVCEI.

RECOMMENDATIONS:

Participation in international meetings demonstrates that NRC-sponsored investigations have been presented to a wide range of volcanology experts. Continued participation provides the opportunity for international review, and potential improvements, to needed models and data. Cities on Volcanoes meetings also provide a unique opportunity to discuss how volcanological research can be used by government agencies and private companies to evaluate short- and long-term hazards and develop mitigation strategies. Further participation in Cities on Volcanoes meetings will provide additional perspectives on use of volcanological research and associated uncertainties by other agencies. Collaboration with the IAVCEI working group on tephra dispersion modeling will provide additional tests of the validity of ASHPLUME for modeling volcanic eruptions, in addition to an evaluation of alternative modeling approaches. This collaboration thus will benefit the NRC program, in addition to strengthening CNWRA efforts in funding extramural work.

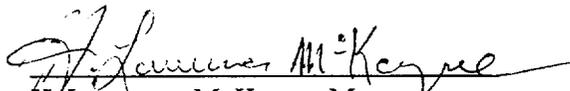
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Brittain E. Hill
Senior Research Scientist

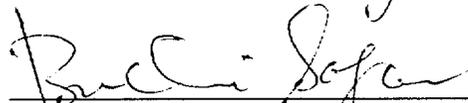
April 9, 2001
Date

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