



UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON NUCLEAR WASTE
WASHINGTON, D.C. 20555-0001

December 22, 2004

MEMORANDUM TO: ACNW Members
ACNW Staff

FROM: *Michele S. Kelton*
Michele S. Kelton
Technical Secretary, ACNW

SUBJECT: CERTIFIED MINUTES OF THE 153RD MEETING OF THE ADVISORY
COMMITTEE ON NUCLEAR WASTE (ACNW) SEPTEMBER 22-23, 2004

The proposed minutes of the subject meeting have been certified as the official record of the proceedings for that meeting.

Attachment:
Certified Minutes of the 153rd
Meeting, September 22-23, 2004

cc J. Larkins, ACRS/ACNW
H. Larson, ACNW/ACNW
A. Bates, SECY (O-16C1)
S. Jones, NMSS (T-8A23)
J. Dixon-Herrity, EDC (O-16E15)



UNITED STATES
NUCLEAR REGULATORY COMMISSION
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WASHINGTON, D.C. 20555-0001

MEMORANDUM TO: Michele S. Kelton, Technical Secretary
Advisory Committee on Nuclear Waste

FROM: Michael T. Ryan, Chairman
Advisory Committee on Nuclear Waste

SUBJECT: PROPOSED MINUTES OF THE 153RD MEETING OF THE
ADVISORY COMMITTEE ON NUCLEAR WASTE (ACNW)
SEPTEMBER 22-23, 2004

I certify that based on my review of these minutes¹, and to the best of my knowledge and belief, I have observed no substantive errors or omissions in the record of this proceeding subject to the comments noted below

Comments

Michael T. Ryan,
Acting Chairman

12/22/04

Date

¹ Minutes of 153rd meeting held on September 22-23, 2004, dated December 22, 2004.



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MEMORANDUM TO: Michael T. Ryan, Chairman
Advisory Committee on Nuclear Waste

FROM: *Michele S. Kelton*
Michele S. Kelton, Technical Secretary
Advisory Committee on Nuclear Waste

SUBJECT: PROPOSED MINUTES OF THE 153RD MEETING OF THE
ADVISORY COMMITTEE ON NUCLEAR WASTE (ACNW)
SEPTEMBER 22-23, 2004

Enclosed are the proposed minutes of the 153rd meeting of the ACNW. This draft is being provided to give you an opportunity to review the record of this meeting and provide comments. Your comments will be incorporated into the final certified set of minutes as appropriate. Please provide your corrections and comments to me.

Please note that these minutes are being issued in two parts: (1) main body (working copy form) and (2) appendices. The appendices are being sent only to those members who have requested them.

A copy of the certified minutes with appendices will be forwarded to each member.

Enclosure: As stated

cc w/o Encl. 2: ACNW Members
ACNW Staff
J. Larkins. ACRS/ACNW

CONTENTS

	<u>Page</u>
I. Chairman's Report (Open)	1
II. Working Group on the Evaluation of Igneous Activity and Its Consequences at a Geologic Repository at Yucca Mountain, Nevada (Open)	2

APPENDICES

- A *Federal Register* Notice
- B Meeting Agenda
- C Meeting Attendees
- D Future Agenda
- E List of Documents Provided to the Committee and Meeting Notebook Contents

CERTIFIED

12/22/2004

By MICHAEL T. RYAN

Issued: 12/22/04

**CERTIFIED MINUTES OF THE 153RD MEETING OF THE
ADVISORY COMMITTEE ON NUCLEAR WASTE
SEPTEMBER 22-23, 2004**

The U.S. Nuclear Regulatory Commission (NRC) Advisory Committee on Nuclear Waste (ACNW or the Committee) held its 153rd meeting on September 22-23, 2004, at the Suncoast Hotel, Ballroom A, 9090 Alta Drive, Las Vegas, Nevada. The ACNW published a notice of this meeting in the *Federal Register* on September 16, 2004 (69 FR 55846) (Appendix A). This meeting served as a forum for attendees to discuss and take appropriate action on the items listed in the agenda (Appendix B). The entire meeting was open to public attendance.

A transcript of selected portions of the meeting is available in the NRC's Public Document Room at One White Flint North, Room 1F19, 11555 Rockville Pike, Rockville, Maryland. Copies of the transcript are available for purchase from Neal R. Gross and Co., Inc., 1323 Rhode Island Avenue, NW., Washington, DC 20005. Transcripts may also be downloaded from, or reviewed on, the Internet at <http://www.nrc.gov/reading-rm/doc-collections/acnw/tr/> at no cost.

ACNW Chairman, Dr. Michael T. Ryan, and Members, Dr. Ruth F. Weiner and Mr. Allen Croff attended this meeting. For a list of other attendees, see Appendix C.

I. CHAIRMAN'S REPORT (OPEN)

[Dr. John Larkins was the Designated Federal Official for this portion of the meeting.]

Dr. Ryan, ACNW Chairman, convened the meeting at 8:07 a.m. and briefly reviewed the agenda. He also stated that the meeting was being conducted in conformance with the Federal Advisory Committee Act. In addition, Dr. Ryan asked members of the public who were present and had something to contribute to the meeting to inform the ACNW staff so that time could be allocated for them to speak. He concluded his report by noting the following items of interest.

- On August 16, 2004, President Bush announced his intention to appoint Drs. B. John Garrick and George Hornberger to the Nuclear Waste Technical Review Board (NWTRB). Dr. Garrick was designated the NWTRB Chairman. We regret their resignation from the Committee and wish them well in their new endeavor with the U.S. Department of Energy (DOE). The Committee Vice-Chair, Dr. Ryan, has assumed chairmanship of the ACNW.

MINUTES
153RD ACNW MEETING
SEPTEMBER 22-23, 2004

- Marvin Sykes, ACRS Senior Staff Engineer, has been selected to fill a branch chief position in the NRC'S Division of Reactor Safety, Region I, and will depart for his new position in mid-November.
- The Nuclear Energy Institute (NEI) has appealed the July court decision that stated that the U.S. Environmental Protection Agency's (EPA's) 10 CFR Part 197's 10,000-year timeframe found in 10 CFR Part 197 was not consistent with the National Academy of Sciences (NAS) 1995 findings and recommendations. The Justice Department, after consulting with DOE and the EPA, will *not* appeal the decision. The Justice Department stated: "We believe the Court set forth a workable framework for moving forward and that continued litigation is not the best course to follow."

On September 2, 2004, the U.S. Court of Appeals denied, without comment, the Nuclear Energy Institute's petition for a rehearing. That decision takes effect in 1 week unless further appeals are filed.

- In an August 24, 2004 letter to Karen D. Cyr, General Counsel, NRC, the State of Nevada stated that "docketing of the LA is impossible until: (1) EPA and the NRC issue new rules that conform to the Court decision and the NAS 1995 report, and (2) DOE submits a tendered application with a full evaluation of compliance with the new standards."
- On August 31, 2004, NRC's Atomic Safety Licensing Board ruled that on June 30, 2004, DOE failed to meet NRC regulations to make available all documentary material related to Yucca Mountain. This ruling granted the State of Nevada motion to strike DOE's certification of documents. This means that the earliest DOE can docket DOE's Yucca Mountain LA is March 2005 (6 months after DOE's certification that all its documents are electronically available and posted on the Licensing Support Network).
- On August 31, 2004, DOE reported that they have now satisfactorily addressed and responded to all 293 key technical issues (KTIs).

II. WORKING GROUP ON THE EVALUATION OF IGNEOUS ACTIVITY AND ITS CONSEQUENCES AT A GEOLOGIC REPOSITORY AT YUCCA MOUNTAIN, NEVADA

[Mr. Michael Lee was the Designated Federal Official for this part of the meeting.]

The ACNW has been tracking developments related to the evaluation and modeling of a disruptive igneous event at the Yucca Mountain, Nevada, site for several years. Among other things, the NRC's regulations found at 10 CFR Part 63 require the evaluation of igneous activity and its consequences. For the purposes of the required assessments, both the DOE and the

**MINUTES
153RD ACNW MEETING
SEPTEMBER 22-23, 2004**

NRC staffs have treated the probability and consequences of igneous activity (IA) independently. The Committee is on record as not agreeing with this dichotomy, preferring that the staff address the issue by applying the concept of the *risk triplet*¹ (see Kaplan and Garrick, 1981).

The objectives of the working group meeting were to (a) increase ACNW's technical understanding of staff plans to evaluate the likelihood and consequences of disruptive igneous events at the proposed Yucca Mountain repository; (b) better understand NRC staff expectations regarding the DOE's consequence analyses; (c) identify aspects of those analyses that may warrant further study; and (4) complement previous working group meetings that relate to performance assessments of Yucca Mountain. There were also discussions of the technical bases (measurements, analyses, and interpretations) necessary to conduct the requisite assessments, the role of risk insights in the development of technical bases, and the impact of outstanding technical issues on the resolution of agreements. An ACNW panel of invited experts offered a number of suggestions and observations regarding the assessments and evaluations that will underpin the volcanism-related dose calculations that need to be included in a DOE license application.

Like earlier ACNW working groups, the IA working group focused on those activities both underway and planned which were intended to increase confidence in evaluating repository performance. Three technical sessions were planned for this WGS: (a) the probability of future basaltic dikes intersecting a potential repository (hereafter the Probability Panel), (b) the interaction of a volcanic event intersecting a waste disposal drift and mobilizing radioactive material from waste packages (hereafter the Consequence Panel); and (c) the dosimetric consequences of subsequent dispersal of radioactive material (hereafter the Dose Modeling Panel). Representatives of the NRC staff and its technical assistance contractor, the Center for Nuclear Waste Regulatory Analyses (CNWRA), the ACNW staff, the Electric Power Research Institute (EPRI), the Los Alamos National Laboratory (LANL), the Sandia National Laboratories (SNL), the Oak Ridge National Laboratory (ORNL), and the University of Utah participated in the meeting by making technical presentations.

Representatives from DOE's Yucca Mountain Project Office² and the State of Nevada were invited to make presentations as well, but declined.

About 15 presentations, covering these three aspects of the analyses, were made by the staff representatives identified above, consistent with the scope of the meeting (see Attachment 1). Following each of the presentations, a panel of invited experts, knowledgeable of the issues under review discussion, queried the presenters and offered their opinions on and reactions to the information being discussed. These knowledgeable experts were as follows.

¹What can happen? How likely is it? What are the outcomes?

²Dr. Robert Budnitz, representing DOE, later noted that the Department declined to participate in this public meeting because it was about to submit its License Application to receive authorization to construct a geologic repository at Yucca Mountain.

**MINUTES
153RD ACNW MEETING
SEPTEMBER 22-23, 2004**

Probability and Consequence Panel Discussions

Dr. Robert Budnitz	Lawrence Livermore National Laboratory ³
Dr. Bruce Crowe ⁴	LANL
Dr. William Hinze	Professor Emeritus, Purdue University
Dr. Bruce Marsh	Johns Hopkins University (JHU)
Dr. William Melson	Scientist Emeritus, The Smithsonian Institution

Dose Modeling Panel Discussions

Dr. Lynn Anspaugh	University of Utah
Dr. Keith Eckerman	ORNL
Dr. Fred Harper	SNL

To a limited extent, stakeholders and members of the public commented on the discussions that took place during the sessions. Also in attendance and participating in the discussions were two recently appointed members of the NWTRB—Drs. B. John Garrick (NWTRB Chairman) and George Hornberger—both formerly of the ACNW. The 2-day working group meeting ended with epilogue comments and observations by Dr. David Johnson, ABS Consulting, Inc. (Irvine, California). The subject of his talk was the Kaplan-Garrick risk triplet concept. It was based on his observations of the earlier panel presentations and discussions, and reflected his preliminary views on how effectively the risk triplet had been applied to the evaluation and modeling of potentially disruptive igneous events in the Yucca Mountain region.

September 23, 2004: Greeting and Introductions

Following some introductory remarks, the ACNW's Chairman Dr. Ryan introduced the members of the first WGS panel.

Technical Session Discussions: Probability of an Igneous Event

There were three presentations in the first technical session. The presentations examined different types of approaches investigators might use to estimate the probability of an igneous event in the Yucca Mountain Region.

³On rotational detail to DOE's Office of Civilian Radioactive Waste Management through December 2005.

⁴Probability Panel only.

**MINUTES
153RD ACNW MEETING
SEPTEMBER 22-23, 2004**

NRC Perspectives on Volcanism Modeling Issues

The first technical presentation was made by Dr. John Trapp, a Senior Volcanologist in NRC's Division of High-Level Waste Repository Safety (DHLWRS). In his introductory remarks, Dr. Trapp noted that the NRC staff would limit the scope of its presentations to material that was publicly available and would not be making any pre-decisional statements with respect to DOE programs or other ongoing work at the Department. Dr. Trapp provided an overview of the geology of the Yucca Mountain region, highlighting aspects of the volcanic record that, from the NRC staff's perspective, were important to the modeling of IA activity and its consequences. He also explained how subsequent CNWRA presentations over the course of the meeting, by Drs. Brittain Hill and Donald Hooper, would provide more detail on the material he introduced.

The second presentation in this session was made by Dr. Brittain Hill, the principal CNWRA investigator for IA. The focus of his presentation was a discussion of the computational tool developed by the CNWRA staff—referred to as PVHA-YM (Connor et al., 2002)—that is used to generate the probability estimates of igneous activity for NRC's performance assessment computer code. As background, Dr. Hill reminded the audience that in the first instance there was a regulatory basis in Part 63 for the estimation of IA in the Yucca Mountain region that DOE is to address in any potential license application. He also expressed the view that depending how they are defined, temporal and spatial uncertainties in the geologic record (i.e., the number, age, and location of past igneous events) can have profound effects on the estimates. As an expert system, the PVHA-YM computer code integrates different types of geologic information to produce graphical estimates of the (annual) volcanic probability that a subsurface igneous intrusion would intersect the footprint of the proposed repository. During his presentation, Dr. Hill identified the types and kinds of information available in the local geologic record that the CNWRA/NRC staff believes are important to defining the probability of an igneous event in the region. Using the PVHA-YM computer code as well as certain assumptions about the interpretation of the local geologic record, Dr. Hill reported that the NRC/CNWRA preferred (single value) estimate of probability that a subsurface igneous intrusion would intersect the footprint of the proposed repository would be on the order of 10^{-7} events/yr.⁵ Consistent with its independent review role, Dr. Hill also explained how the PVHA-YM computer code could be used by the NRC staff to address the temporal and spatial uncertainties in the geologic record and test competing alternative conceptual models with respect to the interpretation of information currently available (e.g., existing geologic data sets). Finally, Dr. Hill suggested that the existing uncertainties associated with undetected volcanic features in the region can increase NRC/CNWRA preferred probability estimates by a factor of 10.

⁵More precisely, the likelihood of future basaltic dike intersection of the repository footprint expressed in terms of intersecting events per year.

**MINUTES
153RD ACNW MEETING
SEPTEMBER 22-23, 2004**

During and following his presentation, Dr. Hill responded to questions and comments from some of the WGM participants and invited experts.⁶ At times, he was assisted in his responses by Dr. Trapp. Many of the questions concerned how the interpretation of the geologic record subjectively could be used to generate different probability estimates using the PVHA-YM computer code. During these discussions, Dr. Trapp reminded the meeting participants that the responsibility for developing the needed probability estimates used in the performance assessments rested with DOE, in the first instance, as the potential licensee and not with the NRC staff. For its part, it was noted that the NRC staff had supported the development of the PVHA-YM computer code in an effort to independently evaluate the robustness of those DOE probability estimates.

1996 Probabilistic Volcanic [Hazards] Analysis: One Subject Matter Expert's Perspective

The second presentation was made by Dr. Bruce Crowe, of LANL. Prior to 1996, Dr. Crowe was the principal IA investigator for DOE's Yucca Mountain site characterization program. During that time, he was also 1 of 10 subject matter experts contributing to the 1996 Probabilistic Volcanic Hazards Analysis (PVHA). See Geomatrix Consultants and TRW, Inc. (1996). That analysis was a formal expert elicitation. It produced a series of probability distributions which were later aggregated into a composite distribution that was sampled during the execution of DOE's total system performance assessment (TSPA) computer code. The 1996 PVHA exercise currently stands as the principal technical basis for DOE's preferred TSPA probability estimates. The focus of Dr. Crowe's his presentation how to calculate the probability of an igneous event in the Yucca Mountain region. He described the approach he used as part of the 1996 PVHA elicitation process. Dr. Crowe also summarized the geologic record of volcanism in the Yucca Mountain region, and based on that review, expressed the opinion that the geologic record of volcanism in the Yucca Mountain region is limited. Given the same (albeit limited) geologic data, different subject matter experts have reached different opinions on the probability of volcanism in the region. In describing the 1996 PVHA elicitation process, Dr. Crowe noted that most of the subject matter experts' estimates of the probability of an intrusive igneous event in the region ranged from 10^{-9} to 10^{-10} events/yr based on interpretive differences concerning the significance and meaning of the local geologic record, suggesting that the likelihood of igneous activity taking place in the region were extremely small. Based on his own assessments, Dr. Crowe identified his preferred range for the probability of igneous activity in the region. His preferred range was slightly narrower than the aggregate range reported in the 1996 PVHA, on the order of 10^{-7} to 10^{-9} events/yr.

⁶During and following each of the technical presentations at the WGM, the speakers responded to comments and questions on the content of their presentation material from the working group session panelists, ACNW Members, and members of the audience. A meeting transcript was made to capture the discussions verbatim, including the question and answer sessions. Proceedings of this WGS will also be published as a conference proceedings (NUREG/CP) and will contain highlights of these discussions.

**MINUTES
153RD ACNW MEETING
SEPTEMBER 22-23, 2004**

In responding to questions, Dr. Crowe said that probabilities outside of his preferred range were not geologically credible based on the local geologic record as well as published literature. Dr. Crowe expressed the view that the ongoing work at DOE to interpret new aeromagnetic data and drill some suspected anomalies identified as part of that work might be valuable from the perspective of basic science, he maintained that the fundamental probability distribution developed as a result of the earlier 1996 PVHA exercise is not likely to change given the paucity of volcanic evidence in the region. Alternatively, Dr. Crowe suggested that the uncertainty associated with the consequences of magma/repository interactions were much more significant in terms of understanding overall repository performance and thus should be the principal focus of staff investigations.

[It should be noted that DOE is relying on the Probabilistic Volcanic Hazards Analysis (or PVHA, Geomatrix Consultants and TRW, Inc., 1996) as a technical foundation document for its analysis of igneous activity. The frequency estimates generated by the PVHA expert panel relied on exposed (igneous) rock exposures and magnetic anomalies known from an earlier low-resolution aeromagnetic survey in the region, and were estimated to be on the order of $\sim 10^{-6}$ to $\sim 10^{-7}$ per year, suggesting that the likelihood of igneous activity taking place in the region was extremely small. However, because the PVHA was based on the elicited judgment of experts and because of the limited existing geologic information, the NRC staff has been concerned that new geologic information could have an influence on the PVHA experts' original judgments. Recently, the probability issue was the focus of renewed staff attention when the U.S. Geological Survey published an aeromagnetic survey of the Crater Flats area that revealed the presence of several previously unknown anomalies. See Blakely et al. (2000). These anomalies were not considered by DOE's original PVHA expert panel and may represent buried centers of past volcanic activity. As part of the KTI resolution process, DOE agreed to conduct a new Crater Flats aeromagnetic survey, and the agreed-to geophysical survey was completed in early 2004. The next phase of the analyses will be for DOE to review the data and determine which anomalies it will drill in an effort to identify and date buried volcanic basalt. If buried basalts are located in the targeted anomalies, and dated, DOE would need to determine what effect, if any, this "new" geologic information would have on the 1996 PVHA elicitation results. It was recently learned that DOE has decided to update the original 1996 PVHA using most, if not all, of the same subject matter experts, including Dr. Crowe. Previously, DOE reported that the earliest an elicitation could be repeated and factored into DOE's TSPA analyses would be sometime in the first half of fiscal year 2006. During the working group meeting, there was repeated reference to the Crater Flats aeromagnetic survey as well as some discussion of an earlier September 21, 2004, DOE/NRC Appendix 7 meeting to discuss the 2004 geophysical survey results.]

**MINUTES
153RD ACNW MEETING
SEPTEMBER 22-23, 2004**

Alternative Views on the Likelihood of an Igneous Event in the Yucca Mountain Region

The final presentation in the first session was by Mr. Neil Coleman, a Senior Staff Scientist with NRC's ACNW.⁷ Mr. Coleman summarized the findings of a *Geophysical Research Letters* journal paper of which he was the coauthor on statistical tests and model results to evaluate published claims regarding the likelihood of future basaltic dike intersection. In that paper (Coleman et al., 2004), the authors analyzed past volcanism on four geologic time scales: 13 million years before present (ybp), 1,000,000 ybp, 100,000 ybp, and present-day conditions. As background, it was noted that published claims, from a variety of investigators using different analytical techniques, for the probability of an intrusive igneous event in the region can range from 10^{-6} to 10^{-10} events/yr. Mr. Coleman first reviewed key aspects of the local geologic record considered important to their analysis, then presented the results. To determine whether published dike penetration rates (λ) of greater than 2×10^{-7} events/yr are plausible, Coleman and his coauthors first calculated the implied basaltic dike intrusion rate. Their result was based on the fact that drilling and geologic mapping associated with repository characterization have found no evidence of basaltic dike intrusion over the last 13 million years. Their calculations suggest for λ equal to 2.3×10^{-7} events/yr, the number of expected intrusive igneous dikes would be 3, and the probability of at least one penetration is 0.95. At λ equal to 1×10^{-6} events/yr, the number of expected number of intrusive igneous dikes would be 13, and the probability of at least one penetration is 0.999998. No dikes have been found in the potential repository footprint, therefore a dike penetration rate of greater than 2×10^{-7} events/yr would be inconsistent with exploration information.

To further analyze the potential for an intrusive igneous event, Coleman et al. exercised the PVHA-YM computer code and ten data sets developed by the NRC and CNWRA staffs. Some of these data sets include magnetic anomalies (5 to 15) that are assumed to be buried volcanoes. They then estimated the number of volcanoes that should have erupted in the Yucca Mountain region given repository penetration frequencies of 10^{-6} , 10^{-7} , and 10^{-8} events/yr. For 10^{-8} events/yr, 40 to 190 volcanoes should have erupted in the region in the last 1 million years. Only eight are known in the last 1.8 million years. Mr. Coleman et al., also examined whether the Lathrop Wells volcano, which erupted ~80 ybp, may have been the start of a new pulse of volcanism. There is no evidence to support this because the PVHA-YM code results indicate 4 to 19 events should have occurred in the last 100,000 years given a penetration rate of 10^{-6} /yr. Only one is known. Therefore 10^{-6} /yr fails tests of volcanism recurrence over several time spans. The implications of this validation exercise were that some published claims of repository intersection frequency were not realistic, i.e., evidence-based.

⁷The views expressed in that paper are the authors' and do not reflect any judgment or determination by the ACNW.

**MINUTES
153RD ACNW MEETING
SEPTEMBER 22-23, 2004**

Working Group Roundtable Discussion: Summary of ACNW Member and Consultant Observations

Dr. Ryan asked the working group session panel members and members of the Committee to comment on the first series of presentations. Their comments were as follows:

- The record of volcanic activity in the Yucca Mountain region represents a relatively small geologic data set. Although this record has been the subject of extensive study, knowledgeable experts continue to reach different opinions on the probability of volcanism in the region.
- Published estimates of (annual) volcanic probability that a subsurface igneous intrusion could intersect the footprint of the proposed repository during the next 10,000 years continue to suggest that this is a very low-probability event.
- Bayesian statistical methods can be useful in determining the value of new geologic information in the estimation the probability of igneous activity.
- DOE plans to update the 1996 PVHA may not yield improved estimates of probability in the Yucca Mountain region. However, updating this expert elicitation may reduce some of the uncertainties associated with the PVHA, which would have a positive impact on (i.e., reduce) the overall risk estimate.

Dr. Budnitz had two comments. First, he said that DOE's forthcoming license application to construct a geologic repository at Yucca Mountain is risk-informed and that the Department has addressed the guidance set forth by the NRC staff in the Yucca Mountain Review Plan (the YMRP, NUREG-1804) and the accompanying acceptance criteria. Moreover, he expressed the view that the technical bases in that application are "strong," implying the bases can withstand critical scrutiny. As regards the earlier references to the 1996 PVHA, he noted that DOE intends to repeat the elicitation using recently obtained aeromagnetic data from the Crater Flats area. Independent of the PVHA update, DOE will decide what magnetic anomalies it will drill for the purposes of geologic age dating. Dr. Budnitz also suggested that additional confirmatory work be undertaken by the Department in the years ahead, in other technical areas, subject to the availability of resources.

Stakeholder and Public Comments

The only public comments made during the first session were offered by Dr. John Kessler representing EPRI. Dr. Kessler reinforced the observation made earlier by Dr. Crowe that greater benefits in overall uncertainty reduction would be achieved by improving the modeling of magma/repository interactions (i.e., consequences), rather than by updating of the 1996 PVHA.

**MINUTES
153RD ACNW MEETING
SEPTEMBER 22-23, 2004**

Technical Session Discussions:

Consequences of an Igneous Event

The second technical session concerned staff approaches to the modeling of magma/repository interactions.

NRC Perspectives on the Modeling of Magma/Repository Interactions

The first presentation in this session was conducted by Dr. Hill. He described the NRC staff approach to the modeling of magma/repository interactions, including the theoretical underpinning to the models. (See Mohanty et al., 2002, for a current description of the staff's overall approach to the independent modeling efforts in this area.) The principal technical basis for the consequence model currently in NRC's performance assessment computer code (TPA code) can be found in Woods et al. (2002). There have been some recent improvements in key parameter distributions in NRC's computer code based on more recent work sponsored by the CNWRA (i.e., Woods et al., 2004; Bokhove et al., 2004). The principal focus of this new work is to improve the staff's understanding of the thermal-mechanical environment to which waste package canisters might be exposed during an intrusive igneous event. Of particular interest to the staff is the transient behavior of the waste package environment during the waste package entrainment phase. Dr. Hill highlighted recent improvements in modeling this behavior, and explained how these improvements are likely to bound any consequence scenario advanced in the DOE license application. In summary, the number of waste packages (a sampled parameter of less than 1 percent of the repository inventory) affected by an intrusive igneous event is a function of volcanic conduit diameter (also a sampled parameter). No performance credit is given to the waste package once it is entrained; all of its contents are available for mixing with the volcanic tephra produced by the volcano. Dr. Hill also discussed the CNWRA's views regarding the significance of volatiles to this underpinning (i.e., Luhr and Housh, 2002) and CNWRA's belief that water content affects magma behavior within a waste emplacement drift.

2002 Recommendations of the DOE-Sponsored Internal Peer Review Committee on Igneous Activity in the Yucca Mountain Region

To address the KTI agreement process, DOE directed its technical assistance contractor Bechtel-SAIC in early 2002 to form an independent peer review panel⁸ to review the adequacy of the Department's technical programs (both underway and planned), to address concerns related to estimating the consequences of intrusive igneous activity at the site. An interim report by the DOE-sponsored Igneous Activity Consequences Peer Review (ICPR) Panel was published in

⁸Consisting of R.J. Budnitz (from Engineering Risk Analysis, California, until September 2002), Dr. Frank J. Spera (University of California at Santa Barbara), E. Detournay (University of Minnesota), L.G. Gustin (U.S. Geological Survey), J.R.A. Pearson (Schlumberger Cambridge Research, United Kingdom), and A.M. Rubin (Princeton University).

**MINUTES
153RD ACNW MEETING
SEPTEMBER 22-23, 2004**

August 2002 (Budnitz et al., 2002); the final report was published in February 2003 (Detournay et al., 2003). The ACNW had been previously briefed on that panel's recommendations (at its 147th meeting, in November 2003). The Committee used this working group meeting to explore the basis for some of the panel's consequence modeling recommendations in more detail.⁹ In particular, there was an interest in better understanding the panel's views concerning what level of improvement in consequence modeling might be achievable over the next several years. However, before beginning the second session technical presentations for the second session, Dr. Ryan reported that a presentation concerning that panel's recommendations had been dropped from the meeting agenda at the last minute owing to the unavailability of any of the ICPR Panel members. Dr. Ryan reminded the working group meeting attendees that the ICPR had previously briefed the Committee (as well as the NWTRB) on the recommendations, and this discussion was a matter of record for those who were interested in reviewing it.

Alternative Views on the Modeling of Magma/Repository Interactions at Yucca Mountain

Dr. Matt Kozak, from Monitor Scientific, represented EPRI for this portion of the discussions. For several years, EPRI has been conducting independent performance assessments. In his opening remarks, Dr. Kozak observed that one of the goals of the EPRI work was to conduct independent analyses in areas heretofore not fully evaluated by either the DOE or the NRC staffs.

Concerning the issue of volcanism in the Yucca Mountain region, it was noted that in 2004, EPRI published its long-awaited analysis of the consequences of intrusive igneous activity in the Yucca Mountain region on a potential geologic repository. Dr. Kozak noted that the primary focus of EPRI's 2004 analysis was on the modeling of consequences, EPRI having initially determined that it could add a little more to the technical debate on probability.

Dr. Kozak introduced the EPRI study by describing the sequence of events that would take place during a hypothetical igneous event. For the purposes of the analysis, the EPRI team decided to organize these events for more detailed analysis. In particular, the EPRI team was interested in modeling waste package failure mechanisms in response to contact with or emersion in magma-like of fluids. Magma is expected to undergo (transient) physical changes as it enters a waste emplacement drift. To establish the initial boundary conditions for the intrusive magma, EPRI

⁹In general, the ICPR Panel found that DOE's performance assessment conceptual model of igneous activity at Yucca Mountain was adequate and reasonable. However, the ICPR Panel expressed the view that major advances in the understanding of localized magma-drift interactions at the site would not be available within the next 3 years (the timeframe during which DOE had been expected to submit its license application) and therefore did not recommend alteration of current DOE IA consequence models and computer codes. However, the ICPR Panel did make 29 specific recommendations, in the form of additional technical analyses that the panel thought DOE should conduct in order to reduce uncertainties in those models and codes.

**MINUTES
153RD ACNW MEETING
SEPTEMBER 22-23, 2004**

outfitted the SAGE finite-element computer code¹⁰ to model coupled heat-mass transport phenomena within the waste emplacement drifts. Having established the initial conditions within the drifts, EPRI used the ABACAS/EXPLICIT finite-element computer code to model the effects of magma on entrained waste packages. Having considered a range of magma-produced conditions, EPRI concluded that the current DOE waste package canister design would not fail under the range of scenarios considered in the EPRI report. Dr. Kozak also noted that one of the unique aspects of the EPRI 2004 analysis was that it considered some preliminary data from a nickel-chromium corrosion study it had sponsored.¹¹ In summary, EPRI found in its analysis that between one and nine waste packages would fail, resulting in a dose about nine orders of magnitude lower than that reported by DOE in its performance assessments supporting the site recommendation decision.

Having concluded that only a few (if any) waste package canisters would fail under the conditions assumed, EPRI decided to look at the behavior (performance) of other aspects of the repository system *assuming* waste package failures. Using NRC's ASHPLUME computer code, EPRI looked at doses associated with tephra ash distributions. Assuming variations in different input parameters (volcano eruption magnitudes, energies, column heights, etc.), EPRI found that 80 percent of its computer realizations had no negligible accumulation of ash in the RMEI (the reasonably maximally exposed individual) location. When there was ash accumulation, EPRI determined that the ash particulates were not in the respirable range; therefore, there was no simulated dose. Overall, Dr. Kozak expressed the view that many of the conservatisms in the mainstream (DOE and NRC) Yucca Mountain performance assessments are in fact biases leading to pessimistic results.

Working Group Roundtable Discussion: Summary of ACNW Member and Consultant Observations

There was no roundtable discussion per se after the EPRI presentation. Rather, Dr. Kozak responded to specific questions and comments from the ACNW members and working group session panel members on various aspects of the EPRI analysis. At times, he was assisted in his responses by Drs. Megan Morrissey (Colorado School of Mines) Michael Sheridan (University of Buffalo) and Mick Apted (Monitor Scientific), and Dr. Kessler also representing EPRI. The questioning of the EPRI representatives was expanded to include questions from the NRC and ACNW staff and members of the public.

¹⁰Initially developed for nuclear weapons testing programs.

¹¹Owing to the lack of published information in this area, EPRI decided to conduct emersion testing of C-22 metal coupons in molten magma. Dr. Kozak noted that the results of this testing are to be published sometime over the next year.

**MINUTES
153RD ACNW MEETING
SEPTEMBER 22-23, 2004**

September 24, 2004 - Greeting and Introductions

Following some brief introductory remarks, Dr. Ryan discussed the working group meeting agenda for the day.

Technical Session Discussions: Biosphere Doses Due to Disruptive Igneous Events

During its 148th meeting in February 2004, the ACNW conducted a working group meeting to examine issues related to the calculation of biosphere doses as part of a Yucca Mountain performance assessment. Committee recommendations from that meeting were transmitted to the Commission in a separate letter report.¹² From that WGM, the Committee learned that previous performance assessment analyses for a potential igneous event have shown that the inhalation pathway dominates the dose calculation, the key parameters being mass loading and exposure duration. Mass loading, in particular, was identified as a sensitive and uncertain parameter. Other modeling areas recommended for special attention are factors such as the density, particle size distribution, and solubility (within the lungs) of the ash that would be produced and subsequently resuspended and inhaled. Also important is the partitioning of radionuclides among particles of a specific size range.¹³

The objective of this session of the WGM was to continue some of the discussions that began at the Committee's 148th meeting. The dose session included five presentations on some of the previously identified issues in more detail.

NRC Staff Perspective on Challenges to Modeling Doses due to Disruptive Igneous Events

The first presentation was by Dr. Keith Compton, a Systems Performance Analyst in NRC's DHLWRS. His presentation focused on key assumptions and approximations in the staff's independent dose modeling efforts as part of NRC's overall performance assessment work. As with the earlier NRC/CNWRA presentations, Dr. Compton said that his presentation would be limited to material that was already publicly available and he would not be making any pre-decisional statements with respect to DOE programs or other ongoing work at the Department.

¹²Entitled "Working Group Session on Biosphere Dose Calculations," dated May 3, 2004.

¹³While the impacts of the initial release are important, the February Biosphere Working Group also learned that parameter values related to chronic exposure scenarios need careful evaluation. These specifically include the mechanisms of deposition of the airborne ash, its potential for resuspension once deposited, and the rate of aging of the deposited ash, especially the determination of a realistic estimate of its half-time for availability for resuspension.

**MINUTES
153RD ACNW MEETING
SEPTEMBER 22-23, 2004**

In summary, the staff's conditional dose analysis does not take into account the probability of a volcanic event. The staff assumes that the event has taken place. NRC's TPA code is structured around the traditional risk assessment model to estimate health effects – i.e., release, transport, exposure, and dosimetry. The TPA code has a number of subroutines or computational modules (i.e., VOLCANO, ASHPLUME, ASHRMOVO, and DCAGS) that perform the intermediate calculations leading to the dose calculation. Dr. Compton discussed these modules. All of these computational modules have been described in Mohanty et al. (2002). After reviewing these modules, Dr. Compton said that americium-241 and the plutonium isotopes are the dominant contributor to peak dose (at a time equal to 300 years), due to inhalation. Dr. Compton highlighted a key NRC assumption that 100 percent of the inventory in the sampled number of entrained waste packages becomes available for the dose assessment. Another key assumption highlighted by Dr. Compton is that the ash-laden wind always blows toward the receptor location, the justification being that remobilized ash or contaminated material would ultimately be transported to the RMEI location by geomorphic processes. Another key assumption by the NRC staff is that NRC's models assume some nonrespirable material by virtue of particle size is nonetheless respirable and available for dose calculations. Lastly, Dr. Compton presented some dose assessment results produced from NRC's TPA code.¹⁴ During and following his presentation, Dr. Compton responded to questions and comments from some of the working group meeting participants, ACNW Members, and invited experts. At times, he was assisted in his responses by Mr. Timothy McCartin and Drs. Hill and Codell (DHLWRS). Many of the questions concerned the staff's treatment of mass loading, constant wind direction resuspension, and remobilization issues.

Fluvial Remobilization of Tephra Along Fortymile Wash, Yucca Mountain

The second presentation was by Dr. Hooper who presented results from a recent CNWRA study of tephra ash remobilization (Hooper, 2004) and explained how those results were factored into NRC's TPA computer code.

As background, Dr. Hooper noted that Fortymile Wash was the principal drainage system in the Yucca Mountain region, connecting the repository site with the RMEI location at Lathrop Wells. Because of the low rates of precipitation (less than 6 in annually), the drainage system is ephemeral. The low rates of precipitation produce low volumes of sediment. In his ash remobilization study Dr. Hooper also reviewed the mass balance approach used to evaluate tephra remobilization following a volcanic event, and how this approach had been bench-marked against natural analog sites found elsewhere. In summary, the CNWRA remobilization model is based on a fluvial and aeolian process models. This model estimates that the ash removal rate in the Fortymile Wash flow system is between 3 and 30 cubic meters annually, depending on the amount of precipitation, with higher rates in the years initially following a postulated eruption. After 80,000 years, Dr. Hooper estimates that all tephra produced from a postulated igneous event has been transported to the RMEI location at Lathrop Wells.

¹⁴Specifically TPA version 4.1J.

**MINUTES
153RD ACNW MEETING
SEPTEMBER 22-23, 2004**

Following his presentation, Dr. Hooper responded to questions and comments from some of the WGM participants, ACNW Members, and invited experts.

Invited Speakers

As noted earlier, at the ACNW's February 2004 meeting, an ACNW panel of invited experts offered several recommendations for the respective staffs to consider in the modeling of doses due to disruptive igneous events. To explore some of the identified issues in more detail, three subject matter experts were invited to make presentations to the ACNW at this WGM. The experts were Drs. Fred Harper (SNL), Lynn Anspaugh (University of Utah) and Keith Eckerman (ORNL).

Perspectives on Aerosol Modeling Issues

The first presentation was by Dr. Harper. He presented some results of unclassified atmospheric dispersion experiments at SNL. Among other things, these experiments examine the particle size distributions of ceramics, metals, salts, and powders aerosolized during explosive events. The pressures being studied by SNL investigators were on the order of gigapascals (10^9 newtons/m²). By comparison, estimated pressure levels typically associated with an volcanic igneous event are in the mega-pascal range (10^6 newtons/m².)

In summary, Dr. Harper suggested particle size distributions are a function of the material type and explosive energy. With more energy (pressure, stress), you get higher explosive velocities, which produces smaller particle sizes. For metals, for example, at the giga-pascal energy levels, particle size distribution was principally in the greater than 10^4 microns. Metals tend to spall during explosive events. For ceramics, at the same energy level, experimental evidence has shown that it is difficult to generate particle size distributions of less than 10^1 micron range. Ceramics tend to fracture during explosive events. Overall, most materials fragment rather than break down into finer grained materials during explosive events. Dr. Harper also noted that some materials agglomerate by fusing with other materials (i.e., sand) following an explosive event, producing larger particle distributions. The phenomena could be considered "shock conglomeration."

Perspectives on Resuspension Modeling Issues

The second presentation was made by Dr. Anspaugh. He focused on resuspension studies at former nuclear weapons test sites (in Nevada and on some of the Pacific islands). He provided an overview of the models that have been published in the literature, citing a recently published journal paper he coauthored (Anspaugh et al., 2002). He noted that most models are based on empirical data rather than theory, suggesting that the theory of resuspension is not well understood. Dr. Anspaugh said a key feature common to all of these models is that they show rapid exponential declines in activity as a function of time, usually on the order of days. In fact, most resuspension curves published in the literature were asymptotic within 100 days.

**MINUTES
153RD ACNW MEETING
SEPTEMBER 22-23, 2004**

Following his general comments, Dr. Anspaugh also had some specific comments concerning the DOE and NRC resuspension models. Regarding the DOE model, Dr. Anspaugh said that the model appeared to be reasonable; however, it appeared that the model had not been published in the peer-reviewed literature. If it had, it would, in the speaker's opinion, improve the technical/legal pedigree of the model for the purposes of licensing. With respect to the NRC resuspension model, his review (albeit preliminary), suggested that it was "exceptionally" conservative. Dr. Anspaugh recommended that the two competing models be reconciled and validated against real data.

Perspectives on Resuspension Modeling Issues

The final presentation was by Dr. Eckerman. The focused on inhalation dose modeling, particularly on how radioactive particles enter the human respiratory system and are subsequently adsorbed by the circulatory system. He reviewed the dosimetry modeling approach recommended by the International Commission on Radiation Protection (ICRP) used to look at his particular dose path scenario. As part of this review, he also highlighted the background guidance used by Federal agencies in the U.S. concerning the principles and policies of radiation protection, specifically Federal Guidance Report Nos. 11 and 12 (see, Eckerman et al., 1988; and Eckerman and Ryman, 1993). Eckerman reminded the audience that the biokinetic and dosimetric models used in preparing these bases for these Federal reports are based largely on methodologies recommended by the ICRP and cited in ICRP publications. Specifically Nos. 26 (ICRP 1977) and 30 (ICRP 1979, 1980). Dr. Eckerman also highlighted some of the key parameter assumptions for aerosol particles used to estimate inhalation dose and some of the uncertainties in the overall modeling framework. He discussed the behavior of some actinides and plutonium in the human body.

In response to a question, Dr. Eckerman said one of the weaknesses of the existing dosimetry models is that the sinus-gastrointestinal sorption track needs to be better accounted for. He said the ICRP is working on an amendment in this area.

Working Group Roundtable Discussion: Summary of ACNW Member and Consultant Observations

Dr. Ryan asked the working group session panel members and members of the Committee to comment on the third series of presentations. Their comments were as follows:

- It is important to understand the broader repository system that is being modeled and the relative importance of processes in that system before decisions are made as to which detailed processes are to be studied. Absent this understanding, there is to potential to study noncritical issues.
- Improvements in the realism of the consequence modeling and dose assessments are likely to yield greater reductions in overall uncertainty estimates than additional refinements to existing igneous probability calculations.

**MINUTES
153RD ACNW MEETING
SEPTEMBER 22-23, 2004**

- Reductions in uncertainties in the dose estimates can be achieved by improving the realism of redistribution and remobilization models and parameters. For example, reliance on fixed (deterministic) parameters and processes tends to obscure the effect on dose outcomes.
- Many aspects of the required dose calculations are prescribed by regulation, sometimes through the use of surrogate performance measures. It would be useful for the HLW analysts to estimate dose using real performance measures rather than surrogate measures. These alternative analyses may better describe the "real" risk impact of repository operations "vis-a-vis dose."¹⁵

Dr. Budnitz said that the Department has addressed the guidance set forth by the NRC staff in the YMRP and its attendant acceptance criteria in DOE's forthcoming license application. He said that because there is no absolutely precise and accurate means of measuring the physical world, scientists and engineers tend to rely on abstractions. The Department has confidence in the abstractions and models it has developed in its forthcoming license application. They are consistent with the acceptance criteria in the YMRP, and therefore he believes they are sufficient for their intended purpose. If and when new information becomes available, the Department will improve the realism in its models to increase confidence and reduce uncertainty.

Comments From Stakeholder Organizations

Ms. Judy Treichel, representing the Nevada Nuclear Waste Task Force, requested time to address both the working group session panel and the ACNW. She questioned whether it was appropriate for DOE to submit a LA before the PVHA update is completed (currently scheduled for sometime in 2006), implying that the LA would contain out-of-date knowledge regarding the likelihood of volcanic events. She also asked whether the waste package canister would be susceptible to the effects of corrosion. In her view, susceptibility to corrosion could affect the site's ability to isolate waste.

Later during the WGM, in response to comments from Ms. Judy Treichel, Mr. Eric Smistead (DOE) noted that the aeromagnetic survey and subsequent PVHA update were viewed by the Department as confirmatory work and not intended to be the technical basis for the application, now nearing completion.

¹⁵In particular, it was noted that based on commercial nuclear power reactor risk assessment experience, the use of surrogate risk measures has biased those analyses and has not provided a true assessment of public health effects

**MINUTES
153RD ACNW MEETING
SEPTEMBER 22-23, 2004**

Working Group Meeting Epilogue Comments

At the end of the working group meeting, Dr. David Johnson was asked by the ACNW to comment on the issues discussed. Dr. Johnson commented with the caveat that he is a risk assessment practitioner who is not knowledgeable of all of the details of the HLW program. His initial impressions from what he heard and observed were as follows:

- Existing igneous consequence analyses appear to be fragmented and lack integration. There appears to be a focus on modeling what is known rather than what is unknown. The framework for integrating the overall scope of the igneous consequence analyses can be improved by focusing on what the end-state measure of risk is. He recommended a more integrated, top-down analytical approach than the one currently in place. In the example being discussed at the working group meeting, it appears that inhalation dose to a member of the RMEI is the end-state measure of interest, and would serve as a useful starting point for the overall analysis.
- Based on the information presented at the meeting, it appears that the volcanism hazard at Yucca Mountain is reasonably well known. Decisionmakers need to know if the uncertainties in existing information are such that current probability estimates can change by an order of magnitude to less than 10^{-7} events/yr, which could have an impact on estimated risk.
- A less well known area appears to be consequence modeling. There appears to be divergent opinion on competing waste package container failure scenarios and differences in defining the radionuclide source term associated with a particular (preferred) failure scenario.
- More should be done to identify the uncertainties in process knowledge and the supporting analyses and the potential impacts of these uncertainties on outcomes. The identification of uncertainties would help to improve the integration of the overall igneous consequence analyses. It would also benefit decisionmakers who need to understand the limitations of the information being used for a particular regulatory decision. He referred to a symposium paper on how to improve the integration of performance assessments without obscuring insights and results. See Reiter, 2004.

The meeting adjourned at 7 p.m.

**MINUTES
153RD ACNW MEETING
SEPTEMBER 22-23, 2004**

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MINUTES
153RD ACNW MEETING
SEPTEMBER 22-23, 2004

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APPENDIX A

55846

Federal Register / Vol. 69, No. 179 / Thursday, September 16, 2004 / Notices

may be entered in the proceeding on the requestor/petitioner's interest. The petition must also identify the specific contentions which the petitioner/requestor seeks to have litigated at the proceeding.

Each contention must consist of a specific statement of the issue of law or fact to be raised or controverted. In addition, the petitioner/requestor shall provide a brief explanation of the bases for the contention and a concise statement of the alleged facts or expert opinion which support the contention and on which the petitioner intends to rely in proving the contention at the hearing. The petitioner/requestor must also provide references to those specific sources and documents of which the petitioner is aware and on which the petitioner intends to rely to establish those facts or expert opinion. The petition must include sufficient information to show that a genuine dispute exists with the applicant on a material issue of law or fact. Contentions shall be limited to matters within the scope of the amendment under consideration. The contention must be one which, if proven, would entitle the petitioner to relief. A petitioner/requestor who fails to satisfy these requirements with respect to at least one contention will not be permitted to participate as a party.

Those permitted to intervene become parties to the proceeding, subject to any limitations in the order granting leave to intervene, and have the opportunity to participate fully in the conduct of the hearing.

If a hearing is requested, the Commission will make a final determination on the issue of no significant hazards consideration. The final determination will serve to decide when the hearing is held. If the final determination is that the amendment requests involve no significant hazards consideration, the Commission may issue the amendments and make them immediately effective, notwithstanding the request for a hearing. Any hearing held would take place after issuance of the amendments. If the final determination is that the amendment requests involve a significant hazards consideration, any hearing held would take place before the issuance of any amendment.

Nontimely requests and/or petitions and contentions will not be entertained absent a determination by the Commission or the presiding officer of the Atomic Safety and Licensing Board that the petition, request and/or the contentions should be granted based on a balancing of the factors specified in 10 CFR 2.309(a)(1)(i)-(viii).

A request for a hearing or a petition for leave to intervene must be filed by: (1) First class mail addressed to the Office of the Secretary of the Commission, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, Attention: Rulemaking and Adjudications Staff; (2) courier, express mail, and expedited delivery services: Office of the Secretary, Sixteenth Floor, One White Flint North, 11555 Rockville Pike, Rockville, Maryland, 20852, Attention: Rulemaking and Adjudications Staff; (3) E-mail addressed to the Office of the Secretary, U.S. Nuclear Regulatory Commission, HEARINGDOCKET@NRC.GOV; or (4) facsimile transmission addressed to the Office of the Secretary, U.S. Nuclear Regulatory Commission, Washington, DC, Attention: Rulemakings and Adjudications Staff at (301) 415-1101, verification number is (301) 415-1966. A copy of the request for hearing and petition for leave to intervene should also be sent to the Office of the General Counsel, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, and it is requested that copies be transmitted either by means of facsimile transmission to 301-415-3725 or by email to OGCMailCenter@nrc.gov. A copy of the request for hearing and petition for leave to intervene should also be sent to Jonathan Rogoff, Esquire, Vice President, Counsel & Secretary, Nuclear Management Company, LLC, 700 First Street, Hudson, WI 54016, the attorney for the licensee.

For further details with respect to this action, see the application for amendments dated December 23, 2003, which is available for public inspection at the Commission's PDR, located at One White Flint North, File Public Area O1 F21, 11555 Rockville Pike (first floor), Rockville, Maryland. Publicly available records will be accessible from the Agencywide Documents Access and Management System's (ADAMS) Public Electronic Reading Room on the Internet at the NRC Web site, <http://www.nrc.gov/reading-rm/adams.html>. Persons who do not have access to ADAMS or who encounter problems in accessing the documents located in ADAMS, should contact the NRC PDR Reference staff by telephone at 1-800-397-4209, 301-415-4737, or by e-mail to pdr@nrc.gov.

Dated at Rockville, Maryland, the 9th day of September 2004.

For the Nuclear Regulatory Commission
L. Mark Padovani,
Project Manager, Section 1, Project
Directorate III, Division of Licensing Project
Management, Office of Nuclear Reactor
Regulation.

[FR Doc. 04-20851 Filed 9-15-04, 8:45 am]

BILLING CODE 7590-01-P

NUCLEAR REGULATORY COMMISSION

Advisory Committee on Nuclear Waste, Subcommittee Meeting on Planning and Procedures; Notice of Meeting

The ACNW Subcommittee on Planning and Procedures will hold a meeting on September 24, 2004, at the Suncoast Hotel (Fairway 2 Room), 9090 Alta Drive, Las Vegas, Nevada.

The entire meeting will be closed to public attendance pursuant to 5 U.S.C. 552b(c) (2) and (6) to discuss organizational and personnel matters that relate solely to internal personnel rules and practices of ACNW, and information the release of which would constitute a clearly unwarranted invasion of personal privacy.

The Subcommittee will continue to discuss self-assessment of ACNW performance in CY 2004, potential operational areas for improved effectiveness, and other activities related to the conduct of ACNW business.

Further information regarding this meeting can be obtained by contacting Mr. Howard J. Larson, Assistant Director for ACNW/Team Leader (telephone 301/415-6805), between 7:30 a.m. and 4 p.m. (e.t.).

Dated: September 9, 2004

Michael R. Snodgrass,

Acting Associate Director for Technical Support, ACNS/ACNW.

[FR Doc. 04-20858 Filed 9-15-04, 8:45 am]

BILLING CODE 7590-01-P

NUCLEAR REGULATORY COMMISSION

Advisory Committee on Nuclear Waste (ACNW); Notice of Meeting

The Advisory Committee on Nuclear Waste (ACNW) will hold its 153rd meeting on September 22-23, 2004, at the Suncoast Hotel (Ballroom A), 9090 Alta Drive, Las Vegas, Nevada.

The entire meeting will be open to public attendance.

The schedule for this meeting is as follows

Wednesday, September 22, 2004

(1) 8-8:10 a.m. Opening Statement

Working Group on the Evaluation of Igneous Activity and its Consequences at a Geologic Repository at Yucca Mountain, Nevada (Open)

- (2) 8:10–8:20 a.m. Greeting and Introductions
Working Group Session; 1 Geologic Considerations in the Estimation of Probability of Igneous Activity at Yucca Mountain
- (3) 8:20–8:50 a.m. NRC Perspective on Volcanism Modeling Issues
- (4) 8:50–9:50 a.m. NRC Overview of Igneous Activity in the Yucca Mountain Region
9:50–10:10 a.m. *** Break ***
- (5) 10:10–10:55 a.m. 1996 Probabilistic Volcanic Hazards Analysis: One Subject Matter Experts' Perspective
- (6) 10:55–11:40 a.m. Alternative Views on the Likelihood of an Igneous Event in the Yucca Mountain Region
11:40–1 p.m. *** Lunch ***
- (7) 1–2 p.m. Session 1 Working Group Roundtable Discussion
- (8) 2–2:30 p.m. Public Comments
2:30–2:45 p.m. *** Break ***
Working Group Session 2: Characterization of Magma/Repository Interactions
- (9) 2:45–3:30 p.m. NRC Staff Perspective on the Modeling of Magma/Repository Interactions
- (10) 3:30–4:15 p.m. 2002 Recommendations of the DOE-Sponsored Igneous Consequences Peer Review Panel: One Panelist's Perspective
- (11) 4:15–5 p.m. Alternative Views on the Modeling of Magma/Repository Interactions at Yucca Mountain
- (12) 5–6 p.m. Session 2 Working Group Roundtable Discussion
- (13) 6–6:30 p.m. Public Comments
Adjourn: Day 1

Thursday, September 23, 2004

- (14) 8–8:10 a.m. Opening Statement
Working Group Session 3; Biosphere Doses Due to Disruptive Igneous Events
- (15) 8:10–9:40 a.m. NRC Staff Perspective on Challenges to Modeling Doses due to Disruptive Igneous Events
- (16) 9:40–12 p.m. ACNW Invited Speakers on Biosphere Dose Modeling Issues
- 16.1 Perspectives on Aerosol Modeling Issues
- 16.2 Perspectives on Resuspension Modeling Issues
- 16.3 Perspectives on Dose Modeling

¹ Presentation time should not exceed 50 percent of the total time allocated for a specific agenda item. The remaining 50 percent of the time is reserved for discussion.

Issues

- 12–1 p.m. *** Lunch ***
- (17) 1–2 p.m. Session 3 Working Group Roundtable Discussion
- (18) 2–3 p.m. Presentations by Stakeholder Organizations
3–3:15 p.m. *** Break ***
- (19) 3:15–4:15 p.m. Panel and Committee Summary Discussion
- (20) 4:15–4:45 p.m. Epilogue Remarks
- (21) 4:45–5 p.m. Closing Comments by the Working Group Chairman
- (22) 5–5:30 p.m. Discussion of ACNW Letter Report
5:30–6 p.m. *** Break ***
- (23) 6–7 p.m. Future ACNW Activities/Report of the Planning and Procedures Subcommittee
Adjourn 153rd ACNW Meeting
- Procedures for the conduct of and participation in ACNW meetings were published in the *Federal Register* on October 16, 2003 (68 FR 59643). In accordance with these procedures, oral or written statements may be presented by members of the public. Electronic recordings will be permitted only during those portions of the meeting that are open to the public. Persons desiring to make oral statements should notify Mr. Howard J. Larson, Assistant Director for ACNW/Team Leader (telephone 301/415-6805), between 7:30 a.m. and 4 p.m. e.t., as far in advance as practicable so that appropriate arrangements can be made to schedule the necessary time during the meeting for such statements. Use of still, motion picture, and television cameras during this meeting will be limited to selected portions of the meeting as determined by the ACNW Chairman.

Information regarding the time to be set aside for taking pictures may be obtained by contacting the ACNW office prior to the meeting. In view of the possibility that the schedule for ACNW meetings may be adjusted by the Chairman as necessary to facilitate the conduct of the meeting, persons planning to attend should notify Mr. Larson as to their particular needs.

Further information regarding topics to be discussed, whether the meeting has been canceled or rescheduled, the Chairman's ruling on requests for the opportunity to present oral statements and the time allotted therefore can be obtained by contacting Mr. Larson.

ACNW meeting agenda, meeting transcripts, and letter reports are available through the NRC Public Document Room at pdrr@nrc.gov, or by calling the PDR at 1-800-397-4209, or from the Publicly Available Records System (PARS) component of NRC's document system (ADAMS) which is accessible from the NRC Web site at

<http://www.nrc.gov/reading-rm/adams.html> or <http://www.nrc.gov/reading-rm/doc-collections/> (ACRS & ACNW Mtg schedules/agendas).

Dated: September 10, 2004

Andrew L. Bates,

Advisory Committee Management Officer.
[FR Doc. 04-20859 Filed 9-15-04; 8:45 am]

BILLING CODE 7590-01-P

SECURITIES AND EXCHANGE COMMISSION

[Release No. 34-60338; File No. 57-05-04]

RIN 3235-AJ02

Collection Practices Under Section 31 of the Exchange Act

AGENCY: Securities and Exchange Commission.

ACTION: Notice of OMB approval of collection of information

FOR FURTHER INFORMATION CONTACT:

Michael Gaw, Senior Special Counsel, 202-942-0158, or Christopher Solgan, Attorney, 202-942-7937; Division of Market Regulation; Securities and Exchange Commission; 450 5th Street, NW., Washington, DC 20549-1001.

SUPPLEMENTARY INFORMATION: The Office of Management and Budget has approved the collection of information requirements titled "Rule 31—Section 31 transaction fees; Rule 31T—Temporary Rule regarding fiscal year 2004; Form R31—Form for reporting covered sales and covered round turn transactions under Section 31 of the Securities Exchange Act of 1934" (OMB Control No. 3235-0597). The Commission adopted Rules 31 and 31T and Form R31 in June 2004.¹

Dated: September 9, 2004.

Margaret H. McFarland,

Deputy Secretary.

[FR Doc. 04-20845 Filed 9-15-04; 8:45 am]

BILLING CODE 8010-01-P

SECURITIES AND EXCHANGE COMMISSION

Proposed Collection; Comment Request

Upon Written Request, Copies Available

From: Securities and Exchange Commission, Office of Filings and Information Services, Washington, DC 20549.

Extension:

Rule 17a-3, SEC File No. 270-025, OMB Control No. 3233-0033.

¹ See Securities Exchange Act Release No. 49928 (June 28, 2004), 69 FR 41060 (July 7, 2004).



UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON NUCLEAR WASTE
WASHINGTON, D.C. 20555-0001

September 2, 2004

AGENDA¹
153RD ACNW MEETING
SEPTEMBER 22-23, 2004



- (1) ~~8:00~~ - 8:10 a.m. **Opening Statement (MTR/JTL)**
8:07
The Chairman will open the meeting with brief opening remarks and indicate items of interest.

WORKING GROUP ON THE EVALUATION OF IGNEOUS ACTIVITY AND ITS CONSEQUENCES AT A GEOLOGIC REPOSITORY AT YUCCA MOUNTAIN, NEVADA (OPEN)

- (2) 8:10 - 8:20 a.m. **Greeting and Introductions (MTR/MPL)**
The Chairman will state the objectives for this Working Group Meeting and provide an overview of the planned technical sessions. Invited experts will also be introduced at this time.

WGS Purposes

The purposes of this Working Group Meeting are to: (1) increase ACNW's technical knowledge of staff plans to evaluate the consequences of disruptive igneous events at the proposed Yucca Mountain repository; (2) better understand NRC staff expectations regarding DOE's consequence analyses; (3) identify aspects of those analyses that may warrant further study; and (4) complement previous Working Group Meetings

**WORKING GROUP
SESSION 1**

**GEOLOGIC CONSIDERATIONS IN THE ESTIMATION OF
PROBABILITY OF IGNEOUS ACTIVITY AT YUCCA MOUNTAIN**

Areas of specific ACNW interest in Session 1 include understanding:

- The types and kinds of geologic information needed for generating probability estimates
- What are the uncertainties?
- What types of approaches yield defensible estimates?
- What is a realistic range of igneous event probabilities based on the geologic record.

¹ACNW meeting schedules are subject to change. All scheduled agenda items at this meeting are open to the public. Listed presentations may be canceled, or rescheduled to another day. If such a change would result in significant inconvenience or hardship, be sure to verify the schedule with Mr. Howard Larson at 301-415-6805 between 8:00 a.m. and 4:00 p.m. (EST) prior to the meeting

(3) 8:20 - 8:50 a.m.² **NRC Perspective on Volcanism Modeling Issues** *Trapp*
3.1 Presentation by a representative(s) of NRC's Office of Nuclear Material Safety and Safeguards' Division of Waste Management (DWM).
3.2 Discussion

(4) 8:50 - 9:50 a.m. **NRC Overview of Igneous Activity in the Yucca Mountain Region** *Hill*
4.1 Presentation by a representative(s) of NRC's DWM and/or the Center for Nuclear Waste Regulatory Analyses (CNWRA), NRC's technical assistance contractor.
4.2 Discussion

~~9:50 - 10:10 a.m.~~
~~10:00 - 10:15~~
10:20
*** BREAK ***

(5) ~~10:10 - 10:55 a.m.~~
~~10:20~~
10:25 **1996 Probabilistic Volcanic Hazards Analysis: One Subject Matter Experts' Perspective**
5.1 Scheduled presenter: Dr. Bruce Crowe (Los Alamos National Laboratory).
5.2 Discussion

(6) ✓ 10:55 - ~~11:45~~ a.m. **Alternative Views on the Likelihood of an Igneous Event in the Yucca Mountain Region**
6.1 Scheduled presenter: Mr. Neil Coleman (ACNW staff).
6.2 Discussion

✓ 11:40 - 1:00 p.m. *** LUNCH ***

²Presentation time should not exceed 50 percent of the total time allocated for a specific agenda item. The remaining 50 percent of the time is reserved for discussion.

(7) 1:00 - 2:00 p.m.
1:50
Session 1 Working Group Roundtable Discussion
Comments and observations from the panel of invited experts. The invited experts include:
Dr. Robert Budnitz - Lawrence Livermore National Laboratory³
Dr. David Johnson - ABS Consulting (Irvine, CA)
Dr. William Hinze - Purdue University (retired)⁴
Dr. Bruce Marsh - Johns Hopkins University⁴
Dr. William Melson - Smithsonian Institution (retired)⁵

1:50 - 2:05
(8) 2:00 - 2:30 p.m.
2:30 - 2:45 p.m.
2:05 - 2:45
Public Comments
*** BREAK ***

**WORKING GROUP
SESSION 2**

CHARACTERIZATION OF MAGMA/REPOSITORY INTERACTIONS

Areas of specific ACNW interest in Session 2 include understanding:

- What is likely to happen to a underground repository at Yucca Mountain, based on an interpretation of the geologic record?
- What are the prevailing conceptual models?
- How realistic are those models (also, what level of realism is achievable)?
- How pervasive are the uncertainties?
- How many waste packages are likely to be effected by a disruptive igneous event?

(9) 2:45 - 3:30 p.m.
NRC Staff Perspective on the Modeling of Magma/Repository Interactions [11:11]

- 9.1 Presentation by a representative(s) of NRC's DWM and/or the CNWRA.
- 9.2 Discussion

(10) 3:30 - 4:15 p.m.
2002 Recommendations of the DOE-Sponsored Igneous Consequences Peer Review Panel: One Panelists' Perspective

- 10.1 Scheduled presenter⁶ Dr. Emmanuel Detournay (University of Minnesota).

³On detail to DOE's Office of Civilian Radioactive Waste Management

⁴Consultant to the ACNW

⁵Consultant to the U.S. Nuclear Waste Technical Review Board.

⁶Tentative speaker.

10.2 Discussion

4:00 AM
(11) 4:15 - 5:00 p.m.

Alternative Views on the Modeling of Magma/Repository Interactions at Yucca Mountain

11.1 Discussion of the 2004 independent technical analysis sponsored by the Electric Power Research Institute (EPRI). Scheduled presenter representing EPRI: Dr. Matthew Kozak (Monitor Scientific)

11.2 Discussion

(12) 5:00 - 6:00 p.m.

Session 2 Working Group Roundtable Discussion
Comments and observations from the panel of invited experts.

(13) 6:00 - 6:30 p.m.

Public Comments

Adjourn Day 1

(14) 8:00 - 8:10 a.m.

Opening Statement (MTR/MPL)

The Chairman will open the meeting with brief opening remarks and indicate items of interest

WORKING GROUP ON THE EVALUATION OF IGNEOUS ACTIVITY AND ITS CONSEQUENCES AT THE GEOLOGIC REPOSITORY AT YUCCA MOUNTAIN, NEVADA - CONTINUED

**WORKING GROUP
SESSION 3**

BIOSPHERE DOSES DUE TO DISRUPTIVE IGNEOUS EVENTS

This session is intended as a continuation of the February 2004 ACNW Working Group Meeting on biosphere dose assessments. The focus of this session is to examine key dose modeling parameters that may effect the magnitude of calculated doses due to disruptive igneous events.

(15) 8:10 - 9:40 a.m.

NRC Staff Perspective on Challenges to Modeling Doses due to Disruptive Igneous Events

15.1 Presentations by representatives of NRC's DWM and the CNWRA.

15.2 Discussion

- (16) 9:40 a.m. - 12:00 p.m. **ACNW Invited Speakers on Biosphere Dose Modeling Issues**
Three key dose modeling areas will be examined. A break will be included in this session.
- 9:40 - 10:25 a.m. 16.1 **Perspectives on Aerosol Modeling Issues**
Scheduled presenter: Dr. Fred Harper (Sandia National Laboratories)
- 10:25 - 11:10 a.m. 16.2 **Perspectives on Resuspension Modeling Issues**
Scheduled presenter: Dr. Lynn Anspaugh (University of Utah)
- 11:10 - 12:00 p.m. 16.3 **Perspectives on Dose Modeling Issues**
Scheduled presenter: Dr. Keith Eckerman (Oak Ridge National Laboratory)
- 12:00 - 1:00 p.m. *** LUNCH ***
- (17) 1:00 - 2:00 p.m. **Session 3 Working Group Roundtable Discussion**
Comments and observations from the panel of invited experts (Drs. Harper, Anspaugh, and Eckerman).
- (18) 2:00 - 3:00 p.m. **Presentations by Stakeholder Organizations**
Upon request, representatives from stakeholder organizations and the public may make a 10 minute presentation concerning the technical material presented during this Working Group meeting. Scheduled time: 10 minutes/stakeholder organization. Each presentation would be followed by a 10 minute discussion.
- 3:00 - 3:15 p.m. *** BREAK ***
- (19) 3:15 - 4:15 p.m. **Panel and Committee Summary Discussion**
Includes closing comments and observations from the respective Working Group panelists, invited experts, and ACNW Members.
- (20) 4:15 - 4:45 p.m. **Epilogue Remarks**
Dr. David Johnson will provide his observations regarding the application of the Garrick/Kaplan "risk triplet" to the evaluation of disruptive igneous events in the Yucca Mountain Region.
- (21) 4:45 - 5:00 p.m. **Closing Comments by the Working Group Chairman (MTR/MPL)**

APPENDIX C: MEETING ATTENDEES

**153RD ACNW MEETING
SEPTEMBER 22–23, 2004**

ACNW STAFF

John Larkins
Neil Coleman
John Flack
Latif Hamdan
Michele Kelton
Howard Larson
Michael Lee
Richard Major
Richard Savio
Barbara White

CONSULTANT

J. Clarke
B. Marsh
W. Hinze

ATTENDEES FROM THE NUCLEAR REGULATORY COMMISSION

SEPTEMBER 22, 2004

J. Trapp	NMSS
T. McCartin	NMSS
J. Rubenstone	NMSS
S. Steele	NMSS
K. Compton	NMSS
R. Codell	NMSS
K. McConnell	OGC
J. Parrott	NMSS
J. Guttman	NMSS

SEPTEMBER 23, 2004

J. Trapp	NMSS
T. McCartin	NMSS
S. Steele	NMSS
K. Compton	NMSS
R. Codell	NMSS
J. Parrott	NMSS
J. Guttman	NMSS

APPENDIX C
153rd ACNW Meeting
SEPTEMBER 22-23, 2004

ATTENDEES FROM OTHER AGENCIES AND GENERAL PUBLIC

SEPTEMBER 22, 2004

D. Johnson	ABS Consulting
N. Henderson	Bechtel-SAIC Co. (BSC)
R. Budnitz	Lawrence Livermore National Lab. (LLNL)
B. Crowe	Los Alamos National Lab. (LANL)
M. Rice	Intertech/Lincoln County
K. Eckerman	Oak Ridge National Lab. (ORNL)
M. Sheridan	University at Buffalo
E. von Tiesenhausen	Clark County, NV
D. Kniev	LANL
J. Linhart	NSNFP
B. John Garrick	Nuclear Waste Technical Review Board (NWTRB)
S. Kieffer	VIVC/NWTRB
L. Reiter	NWTRB
T. Gunter	Department of Energy (DOE)
S. Frishman	State of Nevada
W. Melson	Consultant/NWTRB
B. Hill	Center for Nuclear Waste Regulatory Analyses (CNWRA)
B. Bradbury	MTS
D. Duncan	U.S. Geological Survey (USGS)
M. Kozak	Monitor Scientific
F. Harper	Sandia National Labs. (SNL)
D. Hooper	CNWRA
J. Savino	MTS
G. Hornberger	NWTRB
M. Moran	Colorado School of Mines
J. Kessler	Electric Power Research Institute (EPRI)
R. McCullum	Nuclear Energy Institute (NEI)
A. Smith	Self
E. Smistad	DOE
R. Clark	Environmental Protection Agency (EPA)
L. Marshall	Eureka County, NV
C. Hanlon	DOE
T. Buqo	Nye County, NV
C. Fairhurst	S&T OCRWM/DOE
F. Perry	LANL
G. Smith	University of Nevada at Las Vegas
A. Gill	DOE
M. Apted	Monitor Scientific
B. Terrell	DOE

APPENDIX C
153rd ACNW Meeting
SEPTEMBER 22-23, 2004

ATTENDEES FROM OTHER AGENCIES AND GENERAL PUBLIC (CONT'D)

SEPTEMBER 23, 2004

D. Johnson	ABS Consulting
N. Henderson	Bechtel-SAIC Co. (BSC)
R. Budnitz	Lawrence Livermore National Lab. (LLNL)
R. Parizek	NWTRB Consultant
M. Rice	Intertech/Lincoln County
K. Eckerman	Oak Ridge National Lab. (ORNL)
M. Sheridan	University at Buffalo
E. von Tiesenhausen	Clark County, NV
D. Kniev	LANL
B. John Garrick	Nuclear Waste Technical Review Board (NWTRB)
S. Kieffer	VIVC/NWTRB
L. Reiter	NWTRB
T. Gunter	Department of Energy (DOE)
S. Frishman	State of Nevada
W. Melson	Consultant/NWTRB
B. Hill	Center for Nuclear Waste Regulatory Analyses (CNWRA)
D. Duncan	U.S. Geological Survey (USGS)
M. Kozak	Monitor Scientific
F. Harper	Sandia National Labs. (SNL)
D. Hooper	CNWRA
J. Savino	MTS
G. Hornberger	NWTRB
M. Moran	Colorado School of Mines
J. Kessler	Electric Power Research Institute (EPRI)
R. McCullum	Nuclear Energy Institute (NEI)
A. Smith	Self
E. Smistad	DOE
R. Clark	Environmental Protection Agency (EPA)
C. Hanlon	DOE
T. Buqo	Nye County, NV
G. Smith	University of Nevada at Las Vegas
A. Gill	DOE
B. Terrell	DOE
M. Wasiolek	BSC
M. Morressy	CSM
K. Rautenstrauch	BSC
J. Daniels	LLNL
L. Anspaugh	Self

**APPENDIX E
LIST OF DOCUMENTS PROVIDED TO THE COMMITTEE**

[Note: Some documents listed below may have been provided or prepared for Committee use only. These documents must be reviewed prior to release to the public.]

MEETING HANDOUTS

<u>AGENDA</u>	<u>DOCUMENTS</u>
<u>ITEM NO.</u>	

**WORKING GROUP ON THE EVALUATION OF IGNEOUS ACTIVITY AND ITS
CONSEQUENCES AT A GEOLOGIC REPOSITORY AT YUCCA MOUNTAIN, NEVADA**

- | | |
|----------|--|
| 3 | NRC Perspective on Volcanism Modeling Issues

1. Basic Assumptions and Significant Contributors to Risk, presented by John Trapp, NMSS [Viewgraphs] |
| 4 | NRC Overview of Igneous Activity in the Yucca Mountain Region

2. Assessing the Effects of Uncertainty on Probability Models for Future Igneous Events in the Yucca Mountain Region, presented by Brittain Hill, CNWRA [Viewgraphs] |
| 5 | 1996 Probabilistic Volcanic Hazards Analysis: One Subject Matter Experts' Perspective

3. An Out-of-Touch Look at a PVHA Model for Yucca Mountain, presented by Bruce Crowe, LANL [Viewgraphs] |
| 6 | Alternative Views on the Likelihood of an Igneous Event in the Yucca Mountain Region

4. Testing Claims About Volcanic Disruption of a Potential Repository at Yucca Mountain, presented Neil Coleman, ACNW [Viewgraphs] |
| 9 | NRC Staff Perspective on the Modeling of Magma/Repository Interactions

5. NRC Review Capabilities for Evaluation of Potential Magma-Repository Interaction Processes, presented by Brittain Hill CNWRA [Viewgraphs] |

MEETING HANDOUTS (CONT'D)

AGENDA DOCUMENTS ITEM NO.

WORKING GROUP ON THE EVALUATION OF IGNEOUS ACTIVITY AND ITS CONSEQUENCES AT A GEOLOGIC REPOSITORY AT YUCCA MOUNTAIN, NEVADA

- 11 **Alternative Views on the Modeling of Magma/Repository Interactions at Yucca Mountain**
6. Evaluation of the Igneous Extrusive Scenario, presented by Matthew Kozak, Monitor Scientific [**Viewgraphs**]
- 15 **NRC Staff Perspective on Challenges to Modeling Doses Due to Disruptive Igneous Events**
7. NRC Staff Perspective on Modeling Doses Due to Disruptive Igneous Events, presented by Keith Compton, NMSS [**Viewgraphs**]
8. First-Order Conceptual Model for Fluvial Remobilization of Tephra Along Fortymile Wash, Yucca Mountain, Nevada, presented by Donald Hooper, CNWRA [**Viewgraphs**]
- 16 **ACNW Invited Speakers on Biosphere Does Modeling Issues**
9. Brief Overview of SNL Explosive Aerosolization Experiments, presented by Fred Harper, SNL [**Viewgraphs**]
10. Perspectives on Resuspension Modeling Issues, presented by Lynn Anspaugh, University of Utah, also SNL [**Viewgraphs**]
11. Inhalation Dose Modeling, presented by Keith Eckerman, ORNL [**Viewgraphs**]
- Miscellaneous**
12. Paper prepared by Jane C. S. Long, University of Nevada, Reno, Nevada, and Rodney C. Ewing, University of Michigan, Ann Arbor, Michigan, for the *Annual Review Earth Planet. Sci.* 2004. 32:363-401, entitled "Yucca Mountain: Earth-Science Issues at a Geologic Repository for High-Level Nuclear Waste [**Handout**]
- 23 **Future ACNW Activities/Report of the Planning and Procedures Subcommittee**
13. Reconciliation of ACNW Comments and Recommendations [**Handout**]

APPENDIX E
153rd ACNW Meeting
SEPTEMBER 22-23, 2004

MEETING NOTEBOOK CONTENTS

TAB
NUMBER **DOCUMENTS**

- | | |
|-----|---|
| 1 | <ol style="list-style-type: none">1. Agenda, 153rd ACNW Meeting, September 22–23, 2004, dated September 2, 20042. Status Report3. Letter dated October 18, 1989, from Dade W. Moeller, Chairman, ACNW, to The Honorable Kenneth M. Carr, Chairman, NRC, Subject: Recommendations Dealing With Investigation of Potential Volcanism at the Yucca Mountain High-Level Waste Repository Site4. Letter dated August 24, 1994, from Martin Steindler, Chairman, ACNW, to The Honorable Ivan Selin, Chairman, NRC, Subject: Comments on High-Level Radioactive Waste Research Programs on Volcanism, Natural Analogs, and Tectonics5. Letter dated August 7, 1997, from G. John Garrick, Chairman, ACNW, to The Honorable Shirley Ann Jackson, Chairman, NRC, Subject: Comments on the NRC Program to Predict Risk From Igneous Activity at the Proposed High-Level Waste Repository at Yucca Mountain, Nevada6. Letter dated September 10, 1997, from L. Joseph Callin, Executive Director for Operations, NRC, to Dr. B. John Garrick, Chairman, ACNW, Subject: Comments on the NRC Program to Predict Risk From Igneous Activity at the Proposed High-Level Waste Repository at Yucca Mountain, Nevada7. Letter dated August 1, 2002, from George M. Hornberger, Chairman, ACNW, to The Honorable Richard A. Meserve, Chairman, NRC, Subject: Igneous Activity Issues at the Proposed Yucca Mountain Repository |
| 2.1 | <p>NRC KTI Annual Report (see accompanying CD)</p> <p>ACNW Consultant William Hinze Historic Perspectives</p> <ol style="list-style-type: none">8. Overview of the Status of the Igneous Activity Key Technical, William J. Hinze, Summary, March 15, 20029. The Igneous Activity Key Technical Issue - June 2002, William J. Hinze, Summary, June 4, 200210. Memorandum dated June 29, 2001, from William J. Hinze, to Advisory Committee on Nuclear Waste, NRC, Subject: Trip Report on DOE/NRC Technical Exchange on Igneous Activity Key Technical Issue |

**APPENDIX E
153rd ACNW Meeting
SEPTEMBER 22-23, 2004**

MEETING NOTEBOOK CONTENTS (CONT'D)

<u>TAB NUMBER</u>	<u>DOCUMENTS</u>
3	Earlier Igneous Activity Technical Exchanges 11. Memorandum dated June 29, 2001, from William J. Hinze, to Advisory Committee on Nuclear Waste, NRC, Subject: Trip Report on DOE/NRC Technical Exchange on Igneous Activity Key Technical Issue 12. Memorandum dated September 19, 2001, from William J. Hinze, to Advisory Committee on Nuclear Waste, NRC, Subject: Trip Report on DOE/NRC Technical Exchange on Igneous Activity Key Technical Issue [Internal ACNW Use Only]
4	135th ACNW Meeting Status Report 13. Status Report, 135 th ACNW Meeting, June 18-20, 2002, Potential Consequences of Igneous Disruptive Events at Yucca Mountain, Nevada
4.1	NWTRB Consultants Reports from September 2001 14. Follow-up Meeting with Board Consultants on Igneous Consequences Models 15. Summary Report to NWTRB, The Consequences of Igneous Intrusion at Yucca Mountain, Some Rock Mechanics Aspects of Dike-Repository Interaction, by Derek Elsworth, November 12, 2001 16. Memorandum dated November 21, 2001, from William G. Melson, Senior Scientist, Smithsonian Institution, and consultant to the Board on Volcanological Issues, to Leon Reiter, Seismologist, NWTRB, Subject: Responses to Questions Resulting from the November 8, 2001, Meeting at NWTRB Headquarters Regarding Igneous Intrusion Consequences 17. Review of Show Wave Models and Igneous Activity, by Meghan M. Morrissey, Dept. of Geology and Geological Engineering, Colorado School of Mines
4.2.1	ACNW June 2002 Meeting 18. Letter dated August 1, 2002, from George M. Hornberger, Chairman, ACNW, to The Honorable Richard A. Meserve, Chairman, NRC, Subject: Igneous Activity Issues at the Proposed Yucca Mountain Repository 19. Letter dated September 24, 2002, from William D. Travers, Executive Director for Operations, to George M. Hornberger, Chairman, ACNW, Subject: Igneous Activity Issues at Yucca Mountain

APPENDIX E
153rd ACNW Meeting
SEPTEMBER 22-23, 2004

MEETING NOTEBOOK CONTENTS (CONT'D)

<u>TAB</u> <u>NUMBER</u>	<u>DOCUMENTS</u>
5	ACNW Consultant Bruce Marsh 2002 Views 20. Magma at Yucca Mountain: An Overview of Magmatic Processes Potentially Critical to the High Level Waste Repository, by Bruce D. Marsh, Dept. Earth & Planetary Sciences, Johns Hopkins University, July 29, 2002
6.1	Interim Peer Review Report (see accompanying CD)
7	138th ACNW Meeting Status Report 21. Status Report with Attachments, 138 th ACNW Meeting, November 19-21, 2002, Igneous Activity Update, Including an Analysis of the EDO Response to the ACNW Letter Report on Igneous Activity Issues at Yucca Mountain
8	Summer 2003 Developments 22. Note with Attachments dated July 25, 2003, from Mike Lee, ACNW, to ACNW Members and Staff, Subject: Recent Developments Related to the Resolutions of the Igneous Activity Key Technical Issue [Internal ACNW Use Only] July 2003 Technical Exchange Slides [PowerPoint presentations can be found in the accompanying CE] 23. Agenda, DOE-NRC Technical Exchange, Response to Igneous Consequences Peer Review Report Recommendations and Igneous Activity Probability, July 1, 2003 24. Summary Highlights of the U.S. Department of Energy/U.S. Nuclear Regulatory Commission Technical Exchange on Igneous Consequences Peer Review Report Recommendations and Igneous Activity Probability, by Janet R. Schlueter, Chief, High-Level Waste Branch, Division of Waste Management, NMSS, NRC, and Joseph D. Ziegler, Acting Director, Office of License Application and Strategy, Office of Repository Development, DOE
9	147th ACNW Meeting Status Report 25. Status Report, 147 th ACNW Meeting, November 18-20, 2003, Igneous Activity

APPENDIX E
153rd ACNW Meeting
SEPTEMBER 22-23, 2004

MEETING NOTEBOOK CONTENTS (CONT'D)

<u>TAB</u> <u>NUMBER</u>	<u>DOCUMENTS</u>
9.2	26. Letter dated November 5, 2003, from Joseph D. Ziegler, Director, Office of License Application and Strategy, DOE, to Document Control Desk, NRC, regarding "Igneous Activity Agreement 1.02, Additional Information Needed 9AIN-1): U.S. Department of Energy (DOE) Position on Volcanic Hazard at Yucca Mountain, Nevada, and Plans for Confirmatory Studies
10	ACNW Biosphere Working Group 27. Letter dated May 3, 2004, from B. John Garrick, Chairman, ACNW, to The Honorable Nils J. Diaz, Chairman, NRC, Subject: Working Group Session on Biosphere Dose Calculations

APPENDIX D: FUTURE AGENDA

The Committee approved the following topics for discussion during its 154th meeting, scheduled for October 19–21, 2004:

- Working Group Review of the International Council on Radiation Protection (ICRP) June 2004 Recommendations (2 days)
- Update on the Status of the License Termination Rule (LTR)
- NRC Yucca Mountain Integrated Issue Resolution Status Report (IIRSR) Update
- ACNW 2005 Action Plan
- Preparation of ACNW Reports

PROPOSED WORKING GROUP AGENDA
(as of August 24, 2004)

WORKING GROUP ON THE EVALUATION OF IGNEOUS ACTIVITY AND ITS CONSEQUENCES AT GEOLOGIC REPOSITORY AT YUCCA MOUNTAIN (OPEN)

Sun Coast Hotel and Casino
September 22-23, 2004
Las Vegas, Nevada

<i>Time (est)</i>	<i>Item</i>	<i>Lead</i>	<i>Remarks</i>
15min	Opening Remarks	Michael T. Ryan (ACNW Chairman)	Overall focus of Working Group Meeting is to better understand what knowledge base is available for decision-making. Areas of specific ACNW interest include: <ul style="list-style-type: none"> • Realism of calculations • Areas that may require additional work
30min	NRC Perspective on Issues	JTrapp (NRC)/BHill (CNWRA)	Summary of NRC treatment of igneous activity for purpose of independent review of DOE LA. Areas of specific ACNW interest include: <ul style="list-style-type: none"> • Key assumptions, data, models, simplifications • Role of uncertainty
SESSION 1 GEOLOGIC CONSIDERATIONS IN THE ESTIMATION OF PROBABILITY OF IGNEOUS ACTIVITY AT YUCCA MOUNTAIN			Areas of specific ACNW interest include understanding: <ul style="list-style-type: none"> • Types and kinds of geologic information needed for generating probability estimates. • What are the uncertainties? • What types of approaches yield defensible estimates? • What is a realistic range of igneous probabilities based on geologic record.

<i>Time (est)</i>	<i>Item</i>	<i>Lead</i>	<i>Remarks</i>
60min	NRC Overview of Igneous Activity in the Yucca Mountain Region	JTrapp (NRC)/B Hill (CNWRA)	<ul style="list-style-type: none"> • NRC staff interpretation of geologic record in the YMR • How has staff abstracted/modeled record for purpose of probability estimation. • Staff's approach to the estimation of probability. • Treatment of uncertainties.
30min	1996 DOE Probabilistic Volcanic Hazards Analysis (PVHA)	Bruce Crowe (LANL)	<p>Perspectives offered by member(s) of the original elicitation team. Areas of specific ACNW interest include understanding:</p> <ul style="list-style-type: none"> • Why conduct an elicitation? • What were the results? • How robust is the estimate? • What geologic information was important to the decision-making?
45min	Alternative Views on the Likelihood of an Igneous Event in the YMR	Coleman, Abramson, and Marsh Paper	<ul style="list-style-type: none"> • What is different about the alternative approach? • What information/aspects of the calculation influence the calculations? • Key assumptions/limitations. • How robust are the alternative approaches/estimates?
60min	Panel Reaction and Discussion	Bill Hinze (Purdue) Bruce Marsh (JHU) Bill Melson (Smithsonian) Bob Budnitz (LLNL) Gene Smith (UNLV)	Revisit session 1 themes (above)
tbd	Stakeholder and Public Comments	Open	

<i>Time</i>	<i>Item</i>		<i>Remarks</i>
	SESSION 2 CHARACTERIZATION OF MAGMA/REPOSITORY INTERACTIONS		<p><i>Areas of specific ACNW interest include understanding:</i></p> <ul style="list-style-type: none"> • <i>What is likely to happen to a underground repository at YM based on geologic record?</i> • <i>What are the prevailing conceptual models?</i> • <i>How realistic are the models (also, what level of realism is achievable)?</i> • <i>How pervasive are the uncertainties?</i> • <i>How many waste packages are likely to be effected by disruptive igneous events?</i>
60min	NRC Staff Perspective on the Modeling of Magma/Repository Interactions	JTrapp (NRC)/B Hill (CNWRA)	<ul style="list-style-type: none"> • <i>Provide overview of NRC capability.</i> • <i>Highlight recent improvements in that capability. Also, explain how capability sufficiently bounds likely scenario.</i> • <i>Treatment of uncertainties.</i> • <i>Discuss how capability is adequate to review DOE LA.</i>
60min	2002 Recommendations of the DOE-Sponsored Internal Peer Review Committee on Igneous Activity in the YMR	TBD	<ul style="list-style-type: none"> • <i>Summarize recommendations.</i> • <i>Outline basis for recommendations.</i> • <i>Discuss views on what level of improvement in modeling might be achievable.</i>
60min	Alternative Views on the Modeling of Magma/Repository Interactions at Yucca Mountain	<p>Matt Kozak (Monitor Scientific) et al (representing EPRI)</p> <p>Bruce Marsh (JHU)</p>	<ul style="list-style-type: none"> • <i>What is different about the alternative approach?</i> • <i>What information/aspects of the calculation influence the calculations?</i> • <i>Key assumptions/limitations.</i> • <i>How robust are the alternative approaches/estimates?</i>
90min	Panel Reaction and Discussion	<p>Bill Hinze (Purdue)</p> <p>Bruce Marsh (JHU)</p> <p>Bill Melson (Smithsonian)</p> <p>Bob Budnitz (LLNL)</p>	<i>Revisit session2 themes (above)</i>

<i>Time (est)</i>	<i>Item</i>	<i>Lead</i>	<i>Remarks</i>
tbd	Stakeholder and Public Comments	Open	
SESSION 3 BIOSPHERE DOSES DUE TO DISRUPTIVE IGNEOUS EVENTS			<i>This session is a continuation of the earlier ACNW WGS on biosphere dose assessments. The focus of this session is to examine key parameters that effect the magnitude of calculated doses due to disruptive igneous events. For a potential igneous event, previous analyses show that the inhalation pathway dominates, the key parameters being the mass loading and exposure duration. Mass loading, in particular, is a sensitive and uncertain parameter. Other modeling areas needing special attention are the size distribution of the airborne particles and the processes involved in the remobilization of the volcanic ash. Two areas previously recommended for priority attention are: (a) documentation of the basis for the assumed particle size concentrations of the airborne particles and (b) the basis for bounding the redistribution of ash.</i>
15min	Introductory Remarks	Mike Ryan (ACNW)	<i>As stated.</i>
60min	NRC Staff Perspective on Challenges to Modeling Doses due to Disruptive Igneous Events	Keith Compton (NRC) Don Hooper (CNWRA)	<i>Summary of staff approach to the treatment of the dose modeling scenario in NRC's TPA computer code.</i>

<i>Time (min)</i>	<i>Item</i>	<i>Speaker</i>	<i>Remarks</i>
30min	Invited Speaker No.1	Fred Harper (Sandia National Labs)	<ul style="list-style-type: none"> • <i>Expert's perspective on the types, particle sizes, and solubilities (chemical forms) of particles that might result from an igneous event (or related research on aerosol generation from explosive events).</i> • <i>Expert's views on fraction of materials from a waste package are aerosolized in disruptive igneous events (explosions).</i> • <i>Expert's views regarding realistic assumptions on fraction of HLW mass that becomes airborne, including particle size range distributions.</i>
30min	Invited Speaker No. 2	Lynn Anspaugh (University of Utah)	<ul style="list-style-type: none"> • <i>Expert's perspective on the types, particle sizes, and solubilities (chemical forms) of particles that might result from an extrusive igneous event (or related research on aerosol generation from explosive events).</i> • <i>Discuss what fraction of materials from a waste package might be aerosolized in disruptive igneous events (explosions).</i> • <i>Examine what assumption should be made for fraction of mass that goes airborne and in what particle size range.</i>
30min	Invited Speaker No. 3	Keith Eckerman (ORNL)	<ul style="list-style-type: none"> • <i>For key radionuclides (241Am, 239Pu and others), expert's perspective on how dose might vary as a function of particle size, solubility class by radionuclide, etc.</i>
45min	Panel Reaction and Discussion	Mike Ryan Fred Harper Lynn Anspaugh Keith Eckerman	<i>Revisit session3 themes (above)</i>

<i>Time (est)</i>	<i>Item</i>	<i>Lead</i>	<i>Remarks</i>
30min	Epilogue Remarks: Application of the Risk Triplet to the Evaluation of Igneous Activity in the Yucca Mountain Region	David Johnson (ABS Consulting)	
tbd	Stakeholder and Public Comments		
	Closing Comments/Adjourn	Michael T. Ryan (ACNW Chairman)	

August 24, 2004

DRAFT

STATUS REPORT
153rd ACNW MEETING
(as of August 19, 2004)

**WORKING GROUP ON THE EVALUATION OF IGNEOUS ACTIVITY AND ITS
CONSEQUENCES AT GEOLOGIC REPOSITORY AT YUCCA MOUNTAIN**

September 22-23, 2004
Sun Coast Hotel and Casino
Las Vegas, Nevada

PURPOSE: To better understand the efforts of the U.S. Department of Energy (DOE) and U.S. Nuclear Regulatory Commission (NRC) to reach closure on approaches to the modeling of a disruptive igneous event at the Yucca Mountain, Nevada, site.

LEAD MEMBERS/STAFF: George Hornberger/Mike Lee

BACKGROUND: Three technical sessions, consisting of about 15 presentations, are planned for this Working Group meeting. See attached agenda (in the **READ ME FIRST** folder¹). Earlier, two CDs (entitled "Background Reading Material"), containing key reference documents (reports, papers, presentations, etc.) relevant to each of the three sessions, was distributed to the Members, their consultants, and invited panelists. All of the reference documents contained in those CDs is publicly available. Working Group participants are not expected to review and become familiar with all 50 or so documents contained therein. Rather, participants are expected to use judgment in determining which references might be relevant to their respective areas of interest. To help make that determination, an annotated guide (attached) was prepared to describe the relevance of these key references to the technical sessions.

Many of the references cited in this *Status Report* have been previously provided to the Members. Consolidating these references and any new information in one location (the enclosed CD) is intended to expedite Member (and consultant) access to this material for the purposes of the forthcoming Working Group.

In reviewing the Working Group agenda, it will be noted that the U.S. Department of Energy (DOE) and its technical assistance contractor (Bechtel-SAIC) are not scheduled to make presentations. DOE declined the opportunity to submit prepared talks, citing the need to complete priority work on the much anticipated Yucca Mountain License Application. However, the Department is expected to make key Project staff available to contribute to the discussions and answer questions.

Finally, we are reminded that the NRC staff have relied heavily on the use of the risk insights derived from multiple performance assessment analyses to focus their pre-licensing issue resolution discussions with DOE. The staff's most recent views on the risk significance of igneous

¹ **Bold type** designates the name of a document folder or specific reference document contained in the enclosed compact disk (CD). For more information on the documents contained in the enclosed CD, a *Table of Contents* has been prepared and can be found at the end of this Status Report.

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activity-related issues² can be found in Sections 4.1.10, 4.3.11, and 4.3.13 of 2004 *Risk Insights Baseline Report*, a copy of which has been provided in the enclosed CD in a PDF format.

DISCUSSION: The ACNW has been tracking developments related to the modeling of a disruptive igneous event for several years. Earlier Committee views on the pertinent issues can be found in five past Letter Reports (contained in the **TAB1** folder). For the purposes of the required performance assessment analyses, the staffs have treated probability and consequences independently. See **TAB2.1**. (The Committee is on record not agreeing with this dichotomy, alternatively preferring that the staff address the issue by applying the "risk triplet.") Former ACNW Member Dr. William Hinze (Purdue University) prepared a comprehensive summary and analysis of the key issues after observing earlier NRC/DOE meetings and discussions. His two consultant reports can be found in the **TAB2.2** folder.

In the early 2000s, resolution of key technical issues (KTIs) received greater programmatic emphasis owing to the NRC management decision to reach closure with DOE (at the staff level) on the types and kinds of information needed to ensure a complete and high-quality License Application. See ACNW consultant reports found in **TAB3**.

Also about this time, in response to the pending publication of the NRC-sponsored paper in *Geophysical Research Letters* (Woods et al., 2002), on the modeling of magma-repository interactions, the igneous activity KTI received increased independent scrutiny. For example, the Nuclear Waste Technical Review Board (NWTRB) conducted an information-gathering session with invited consultants³ in September 2001 to examine the magma-repository modeling hypothesis advanced by Woods et al.⁴ In June 2002, the ACNW invited the NWTRB's consultants to present their views on the merits of the hypothesis. See **TAB4.1** folder. Following that meeting, ACNW consultant Dr. Bruce Marsh (Johns Hopkins University) was also asked to proffer his views (see report cited in **TAB5**). After considering all of the information, the Committee issued its most recent Letter Report on the issue, dated August 1, 2002. The staff's subsequent response was conveyed by NRC's Executive Director for Operations in a September 2002 letter. Both documents can be found in the **TAB4.2** folder.

To determine what type of technical actions would be necessary to address the KTI concerns and agreements, DOE directed its technical assistance contractor in early 2002 to form an independent peer review panel to review the adequacy of the Department's technical programs (both underway and planned). The Igneous Activity Consequences Peer Review or ICPR Panel was subsequently

²The KTI issues of concern are 1.02 (igneous event probability), 2.17 (volcanic ash redistribution), 2.18 (magma/repository interaction), 2.19 (magma/waste package interactions), and 2.20 (magma/waste form interactions).

³ Drs. Derek Elsworth/Pennsylvania State University, Meghan Morrissey/Colorado School of Mines, and William Melson/Smithsonian Institution.

⁴The Board's opinion on this issue was published in its *2001-2002 Annual Report to Congress and the Secretary of Energy* (dated April 2002). See <http://www.nwtrb.gov/reports/2001report.pdf>

formed⁵ and issued interim findings in an August 2002 report found in **TAB6.1**. In November 2002, the ACNW conducted a second information-gathering meeting to review progress in the respective programs. The discussions included reviewing the status of proposed future aeromagnetic surveys of the Crater Flats area, to the west of Yucca Mountain, as well as discussion of the ICPR Panel's interim findings. See **TAB7** folder.

During the Summer of 2003, the ACNW staff continued to monitor staff activities bearing on the issues, and prepared a status report in July 2003. Among other things, reported developments were the release of the ICPR's Final Report (**TAB6.2**) and an NRC/DOE Technical Exchange on the Department's response to that Panel's recommendations. See **TAB6.3**. The NWTRB also commented on those recommendations. See documents in the **TAB8** folder.

In November 2003, while conducting its 147th meeting in Las Vegas, the ACNW received a series of updates from DOE and Bechtel-SAIC representatives on the Department's progress in the resolution of DOE/NRC KTI agreements in this area, including the Department's positions with respect to the ICPR Panel's final report. See **TAB9.1**. (The Department's written response to the ICPR's recommendations was later provided in a letter dated January 23, 2004 - **TAB9.2**.)

ACNW AUGUST 1, 2002, LETTER REPORT (see **TAB4.2** folder): At a March 20, 2002, meeting with the Committee, the Commission expressed its interest in having the ACNW review the NWTRB's 2001 review comments on the theories advanced by Woods et al. as well as the adequacy of KTI agreements reached between NRC and DOE staffs. In June 2002, the ACNW conducted a Working Group meeting to learn more about the issues. As a result of that Working Group meeting, the Committee prepared a Letter Report for the Commission dated August 1, 2002 (found in **TAB4.2**), providing the following recommendations:⁶

- The range of estimated probabilities, $\sim 10^9$ to $\sim 10^7$ per year, of an igneous intrusion into the repository used by DOE in its performance assessment is reasonable. New information from recently completed U.S. Geological Survey (USGS) aeromagnetic surveys (O'Leary et al., 2002) needs to be evaluated more fully to determine possible changes in the appropriate probability range, but the Committee currently sees no reason to expect changes that would fundamentally alter the current conclusions of DOE's performance assessment results.
- The analysis of magma-drift interaction presented by the NRC consultants is too idealized to be of direct use in interpreting possible impacts on a hypothetical repository at Yucca Mountain. The main value of the NRC-sponsored study appears to be the elevation of the

⁵Panel Members included: R.J. Budnitz (from Engineering Risk Analysis, California), currently with DOE since September 2002; F. J. Spera (University of California at Santa Barbara) E. Detourmay (University of Minnesota); L.G. Gastin (U.S. Geological Survey); J.R.A. Pearson (Schlumberger Cambridge Research, United Kingdom); and A.M. Rubin (Princeton University).

⁶ There are a number of important issues associated with disruptive igneous activity at or near Yucca Mountain that were not considered in the ACNW's August 2002 Letter Report. In particular, the ACNW had not reviewed the dose calculations and the assumptions made therein and thus did not comment on whether this aspect of the DOE performance assessment results were reasonable.

importance of this modeling activity in technical meetings between NRC and DOE so that appropriate agreements for issue resolution, at the staff level, could be made.

- The agreements to resolve the Igneous Activity KTI provide a reasonable technical basis for proceeding with the evaluation of a potential Yucca Mountain License Application.

CURRENT KTI ISSUE STATUS:

Probability Subissue: DOE is relying on the "Probabilistic Volcanic Hazards Analysis" (or PVHA – Geomatrix Consultants and TRW, Inc., 1996) as a foundation document for its analysis of igneous activity.⁷ The frequency estimates generated by the PVHA expert panel relied on exposed (igneous) rock exposures and magnetic anomalies known from an earlier low-resolution aeromagnetic survey in the region, and were estimated to be on the order of $\sim 10^{-9}$ to $\sim 10^{-7}$ per year, suggesting that the likelihood of igneous activity taking place in the region were extremely small. However, because the PVHA was based on the elicited judgment of experts which, in turn, was linked to the availability of existing geologic information, the NRC staff have been concerned that new geologic information [i.e., new magnetic anomaly data – *vis-a-vis* Blakely et al. (2000), O'Leary et al. (2002) and/or Hill and Stamatakos (2002)] could have an influence on the PVHA experts' original judgments. Consequently, as part of the KTI resolution process, DOE agreed to have a process in place to examine the effects of new data on this and other formal expert elicitation it has relied on. Previously, the NRC staff has suggested the following with respect to the original PVHA estimates, should new magnetic anomaly data become available: (1) the estimates could remain unchanged; (2) the estimates could increase by a factor of two or so; or (3) the estimates could increase by almost an order of magnitude

DOE agreed to conduct a new Crater Flats aeromagnetic survey, and the agreed-to geophysical survey was completed in June 2004. The two staffs have scheduled an Appendix 7 meeting for September 21, 2004 (in Las Vegas), at which time the Department intends to make the basic aeromagnetic survey data publicly available. The next phase of the analyses will be for DOE to review the data and determine which anomalies it will drill in an effort to identify and date buried volcanic basalt. If buried basalts are located in the targeted anomalies, and dated, DOE would need to determine what effect, if any, this "new" geologic information would have on the original PVHA elicitation. Although the Department has not announced a decision on whether it intends to reconvene the expert elicitation, or the decision-making process it will use to make such a determination, the ACNW staff has learned that DOE has already begun to informally contact potential volcanism subject matter experts to determine their availability to participate in a possible PVHA update. Previously, DOE reported that the earliest an elicitation could be repeated and the results factored into a performance assessment would be about 2006.⁸

⁷We should be reminded that the outcome (product) of the PVHA expert elicitation process was a distribution of probability values from which DOE subsequently sampled for the purposes of its performance assessment calculations. See Bechtel-SAIC Co. (2003).

⁸The Department has taken the position that they have already satisfied the information requests made as part of the igneous activity probability agreement processes, and this new aeromagnetic work is more "confirmatory" in nature. See TAB9.3.

Consequences Subissue: As noted above, the NWTRB previously expressed concerns about the conflicting DOE-NRC consequence models, and stated their view that the NRC models may "conservative" in comparison with those of DOE. The concern arose as a result of the Woods et al. hypothesis⁹ which suggested that the expanding gas generated from a water-rich magma, entering an open drift, might cause very large overpressures and possibly damage a significant number of waste package canisters. The Board's opinion was based in large measure on a November 2001 briefing from three independent consultants retained by the NWTRB to evaluate the respective DOE and NRC modeling programs.

In early 2002, DOE directed Bechtel-SAIC to form the ICPR Panel to independently review the adequacy of its technical programs, intended to address concerns related to estimating the consequences of such activity. (The ICPR Panel also reviewed the Woods et al. hypothesis.) An interim (partial) report of the ICPR Panel's findings was published in August 2002; their final (complete) report was published in February 2003. See **TAB6.2**. In general, the ICPR Panel found that DOE's performance assessment igneous activity conceptual model was adequate and reasonable. Also, the ICPR Panel expressed the view that major advances in the understanding of localized magma-drift interactions at the site would not be available within the next three years (the time frame during which DOE is expected to submit its License Application) and therefore did not recommend alteration of current DOE models and computer codes. However, the ICPR Panel did make 29 specific recommendations, in the form of additional technical analyses, that it thought DOE should conduct in order to reduce uncertainties in the Department's volcanism models and attendant performance assessment computer codes. (As previously noted, the ICPR Panel subsequently briefed the NWTRB in May 2003. This briefing also included an independent assessment by the NWTRB's consultants.)

In briefing the ACNW on the Department's response to the ICPR Panel's recommendations, DOE representatives noted that Project staff had studied the recommendations and, in light of those recommendations, decided the main emphasis of its igneous activity modeling programs would be to address the NRC/DOE agreements necessary for the December 2004 License Application. DOE representatives also noted that:

- Recent improvements to its igneous activity consequence models and computer codes, available since the completion of the ICPR Panel's work were considered generally sufficient by DOE to address some of the panel comments and recommendations. Considering the improvements made thus far, and based on the Department's determination of the risk significance of a potential disruptive igneous event at the site, DOE believes that its (improved) igneous activity consequence module is sufficient for inclusion in a 2004 License Application.¹⁰

⁹ The staff understands that the earlier Woods et al. study has been updated. See updated references in **TAB10**.

¹⁰ DOE also observed that the dog-leg igneous intrusive scenario proposed in the Woods et al. hypothesis is not plausible and the Department does not intend to account for it in its License Application.

- The need for improvements to igneous activity consequence models and computer codes in some areas can be obviated by using conservative modeling assumptions and/or bounding parameter distributions.
- Ongoing or planned enhancements as well as focused confirmatory programs can be expected to achieve any remaining improvements sought to the consequence models and computer codes.

DOE staff also noted that the Department plans updates to the technical bases for the 1996 PVHA, consistent with the ICPR Panel recommendations and earlier agreements with the NRC staff, but these updates are not likely to be completed until after submittal of the 2004 DOE License Application.

Dose Modeling Subissue:

During its November 2003 Meeting, the ACNW learned that none of the ICPR Panel Members were qualified to critically review the DOE dosimetry models used to predict radioactive exposures to receptor groups from potential igneous events.

Consequently, during its 2004 Working Group meeting on Yucca Mountain biosphere dose calculations, the Committee attempted to learn more about the assumptions underpinning the dose assessments. Information presented to the meeting indicated that the igneous activity disruptive event scenario is a postulated event that contributes to dose during the time period of regulatory compliance. This being the case, the panel of invited ACNW experts recommended emphasizing the ongoing efforts to reduce the uncertainties in the values of the key model input parameters for analyzing this scenario. Of particular importance are factors such as the density, particle size distribution, and solubility (within the lungs) of the ash that would be produced and subsequently resuspended and inhaled. Also important is the partitioning of radionuclides among particles of a specific size range. The expert panel was encouraged that natural analogs are being vigorously studied and evaluated. While the impacts of the initial release are important, the values of the parameters related to chronic exposure scenarios need careful evaluation. These include the mechanisms of deposition of the airborne ash, its potential for resuspension once deposited, and the rate of aging of the deposited ash, especially the determination of a realistic estimate of its half-time for availability for resuspension. See **TAB12**.

This Working Group session is expected to explore the assumptions underpinning the igneous event dose assessments in more detail.

WORKING GROUP PRESENTATIONS: The overall focus of Working Group meeting is to better understand what knowledge base is available for decision-making in the area of igneous activity performance assessment modeling. Areas of specific ACNW interest include:

- Understanding the realism of the existing approaches and calculations; and
- Identifying areas in those approaches and calculations that may require additional work.

Three sessions are planned to focus on the treatment of probability, consequence, and dose in igneous activity performance assessment analyses.

Session 1. Probability: Areas of specific ACNW interest here include understanding:

- The types and kinds of geologic information needed for generating probability estimates;
- The uncertainties in that information;
- Identifying which analytical approaches yield defensible estimates; and
- Based on geologic record, identifying what would be a realistic range of igneous probabilities (for the time period of regulatory interest).

To address these issues, four presentations have been scheduled. The first presentation will be the NRC staff and will feature a discussion of the geologic features of the Yucca Mountain region considered to be important in the estimation of igneous event probabilities. Dr. Bruce Crowe (Los Alamos National Laboratory), former principal investigator of igneous activity in DOE's Yucca Mountain programs and a subject matter expert in the 1996 PVHA, will share his perspective on the types of geologic information that was important to the decision-making at the time the expert elicitation was conducted.¹¹ Alternative perspectives on the interpretation of the local geologic record and how it affects probability estimates will be made in two additional presentations. First, Dr. Gene Smith (University of Nevada/Las Vegas) will present his views regarding the probability issue based on earlier work sponsored by the State of Nevada (e.g., Smith et al., 2002). In the last presentation, Mr. Neil Coleman and Drs. Lee Abramson and Bruce Marsh will present a recent paper submitted to *Geophysical Research Letters* that relies on statistical methods to evaluate the probability issue.

Session 1 will be followed by a round-table discussion.

Session 2. Consequences: This session of the Working Group meeting will focus on the characterization of magma/repository interactions. Areas of specific ACNW interest include understanding:

- What is likely to happen to a underground repository at Yucca Mountain based on the geologic record?
- What are the prevailing conceptual models?
- How realistic are the models (also, what level of realism is achievable)?
- How pervasive are the uncertainties? and
- How many waste packages are likely to be effected by a disruptive igneous event?

(DOE's most recent position on the issue of magma-repository interactions can be found in the documents contained in **TAB9.4** and **TAB9.5**.)

The first presentation in the session will be by an NRC representative that provides an overview of the staff's consequence modeling capability (e.g., Mohanty et al., 2002). The ACNW staff understands that there are some recent improvements to certain key parameter distributions in

¹¹Dr. Crowe will not be expected to elaborate on how DOE subsequently treated the elicitation results in the TSPA analyses. Dr. Abe van Luik and Mr. Eric Smistad, all representing DOE, should be able to discuss the Department's post-processing of the elicitation results in DOE's TSPA as well as other discussion items addressed during the Working Group meeting. Dr. Robert Budnitz, representing Lawrence Livermore National Laboratory, will serve as an invited panelist.

changes to the code *per se*, just parameter distributions. Consequently, the staff have been asked to highlight recent improvements in that capability, and explain how they believe their modeling capability is sufficient to bound any likely consequence scenario advanced in the DOE License Application.

The second presentation in this session will be by a representative of the ICPR Panel. It is expected that the yet-to-be-named ICPR representative will summarize that Panel's recommendations (including outlining a basis for those recommendations); elaborate on the Panel's views concerning what level of improvement in consequence modeling might be achievable over the next several years; and provide an opinion on how many waste packages might likely to be affected by an intrusive igneous event.

In 2003, the Electric Power Research Institute (EPRI) recently published its long-awaited analysis of the probability and consequences of intrusive igneous events in the Yucca Mountain Region. See EPRI (2003). Dr. Matt Kozak, from Monitor Scientific, will represent EPRI and will roll-out its independent analysis.¹² Lastly, Dr. Marsh (an ACNW consultant), will present his views on the issues.

Session 2 will also be followed by a round-table discussion. A key output from the consequence modeling analysis is an estimate of the number of damaged waste packages contributing to dose. The Members may wish to ask the presenters their views on how many waste packages might likely be affected by an intrusive igneous event.

Session 3. Dose: The third and final session is intended to be a follow-up to the Committee's February 2004 Working Group on Biosphere Dose Assessments. Five presentations are currently scheduled. The first two are by Drs. Keith Compton and Don Hopper, representing the NRC staff and the Center for Nuclear Waste Regulatory Analyses (or the Center), respectively. These presentations will focus on the staff's approach to the modeling of doses due to a disruptive igneous event, and how this approach will be used by the staff to review DOE's License Application. Dr. Hooper will discuss how the results from the Center's recent tephra ash remobilization study (Hooper, 2004) have been factored into NRC's TPA computer code.

At the ACNW's February 2004 meeting, the ACNW panel of invited experts offered several recommendations for the respective staffs to consider in the modeling of doses due to disruptive igneous events (see page 6 of this Status Report – *Dose Modeling Subissue*, and TAB4.2 reference). To explore the issues in more detail, three subject matter experts have been invited to make presentations to the ACNW. The invited subject matter experts, and the proposed areas of discussion are as follows:

¹²Drs. Morrissey and Mike Sheridan (University of Buffalo), may also be in attendance at the ACNW meeting, representing EPRI

<i>Invited Expert</i>	<i>Affiliation</i>	<i>Issues to be Discussed</i>
Dr. Fred Harper	Sandia National Laboratory	<ul style="list-style-type: none"> • Expert's perspective on the types, particle sizes, and solubilities (chemical forms) of particles that might result from an igneous event (or related research on aerosol generation from explosive events). • Expert's views on fraction of materials from a waste package are aerosolized in disruptive igneous events (explosions). • Expert's views regarding realistic assumptions on fraction of HLW mass that becomes airborne, including particle size range distributions.
Dr. Lynn Anspaugh	University of Utah	<ul style="list-style-type: none"> • Expert's perspective on the types, particle sizes, and solubilities (chemical forms) of particles that might result from an extrusive igneous event (or related research on aerosol generation from explosive events). • Discuss what fraction of materials from a waste package might be aerosolized in disruptive igneous events (explosions). • Examine what assumption should be made for fraction of mass that goes airborne and in what particle size range.
Dr. Keith Eckerman	Oak Ridge National Laboratory	For key radionuclides (²⁴¹ Am, ²³⁸ Pu and others), expert's perspective on how dose might vary as a function of particle size, solubility class by radionuclide, etc.

Session 3 will be followed by a round-table discussion.

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¹³Copies of the cited references are available on the **Background Information** CDs provided earlier.

**153rd STATUS REPORT CD
TABLE OF CONTENTS**

FOLDER	FOLDER/DOCUMENT NAME	DOCUMENT NAME(S)	COMMENTS
READ ME FIRST	153rd Status Report	153 rd ACNW Status Report Working Group Agenda	
	2004 NRC Risk Insights Baseline Report	<i>As stated.</i>	
TAB01	Earlier ACNW Letter Reports	August 1, 2002 August 7, 1997 August 24, 1994 October 18, 1989 September 10, 1997	
TAB02	Igneous Activity KTI History		
TAB2.1	NRC KTI Annual Report	<i>As stated.</i>	Staff's April 2004 report.
TAB2.2	Hinze Historic Perspective	Hinze 3-15-02 Hinze 6-04-02	
TAB03	Earlier Igneous Activity Technical Exchange		
TAB3.1	NRC-DOE 2001 Technical Exchange Info	<i>As stated.</i>	NRC meeting summary from August 29-31 Technical Exchange.
TAB3.2	Hinze Technical Exchange Summaries	Hinze 6-29-01 TE Sum Hinze 9-19-01 TE Sum	Consultant's observations Consultant's observations.

FOLDER	FOLDER/DOCUMENT NAME	DOCUMENT NAME(S)	COMMENTS
TAB04	135th ACNW Meeting		
TAB4.1	135 th ACNW Status Report	<i>As stated.</i>	
TAB4.2	NWTRB Consultants Reports	<i>As stated.</i>	Six documents – consisting of reports and analyses and presentations from 2001 NWTRB Meeting.
TAB4.3	Meeting Correspondence	8-01-02 ACNW Ltr Rpt 9-24-02 EDO Response	
TAB05	Marsh 2002 Views	<i>As stated.</i>	
TAB06	ICPR Reports		
TAB6.1	ICPR Interim Report	<i>As stated.</i>	Budnitz, R.J., et al., "Yucca Mountain Igneous Consequences Peer Review Panel – Interim Report," Las Vegas, Bechtel-SAIC Co., LLC., August 23, 2002. [Prepared for DOE.]
TAB6.2	ICPR Final Report	<i>As stated. Folder containing two PDF documents.</i>	Detournay, E., et al., "Final Report of the Igneous Consequences Peer Review Panel," Las Vegas, Bechtel-SAIC Co., LLC., April 2003. [Prepared for DOE.] Detournay, E., et al., "Appendices to the Final Report of the igneous Consequences Peer Review Panel," Las Vegas, Bechtel-SAIC Co., LLC., February 2003. [Prepared for DOE.]
TAB6.3	2003 NRC DOE Technical Exchange	<i>As stated. Folder containing multiple documents.</i>	July 2003 NRC/DOE Technical Exchange meeting on the Department's response to the ICPR's Final Report
TAB07	138th ACNW Meeting		
TAB7.1	138 th ACNW Status Report	<i>As stated.</i>	Contains three attachments, below.
	Attachment 1	<i>As stated.</i>	Hinze trip report from DOE ICPR Interim Report meeting, dated 9/11/02
	Attachment 2	<i>As stated.</i>	NWTRB Consultant Letter Reports on the ICPR Final Report

FOLDER	FOLDER/DOCUMENT NAME	DOCUMENT NAME(S)	COMMENTS
	Attachment 3	<i>As stated.</i>	Hinze trip report from NRC/DOE Appendix 7 Meeting on Yucca Mountain Region magnetic survey data models, dated 10/03/02
TAB08	Summer 2003 Developments		
TAB8.1	ACNW Status Report	<i>As stated.</i>	Dated 7/25/03
TAB8.2	July 2003 Technical Exchange	Folder containing multiple documents	Most recent NRC/DOE igneous activity KYI interaction.
TAB8.3	NWTRB 06-3-03 Letter	<i>As stated.</i>	NWTRB's views on comments and recommendations from the Final ICPR report.
TAB09	147th ACNW Meeting		
TAB9.1	147 th ACNW Status Report	<i>As stated.</i>	
TAB9.2	DOE 01-23-04 Letter	<i>As stated.</i>	DOE response to comments and recommendations from the Final ICPR report.
TAB9.3	DOE 11-05-03 Letter	<i>As stated.</i>	DOE response to request for additional information related to the evaluation of igneous event probability.
TAB9.4	Technical Basis Document No 13	Folder with multiple attachments. Document responding to multiple KTI agreements.	Bechtel-SAIC Co., LLC, "Technical Basis Document No. 13: Volcanic Events," North Las Vegas, Rev., 2, November 2003. [Prepared for DOE.] and other documents.
TAB9.5	DOE 8-14-04 Letter	<i>As stated.</i>	DOE views on effects of repository structures on magma flow.
TAB10	ACNW Biosphere Working Group Recommendations	<i>As stated.</i>	Letter Report dated May 3, 2004 on biosphere dose calculations; includes discussion of igneous activity-related dose parameters.

153rd ACNW Meeting
IGNEOUS ACTIVITY WORKING GROUP

September 22-23, 2004
Las Vegas, Nevada

The purposes of this Advisory Committee on Nuclear Waste (ACNW) Working Group meeting are to focus on three key themes related to the evaluation of disruptive geologic events at a potential geologic repository at Yucca Mountain: probability, consequences, and health effects (dose). With respect to these themes, the ACNW intends to: (1) increase technical knowledge of staff plans to develop and conduct geologic activity assessments; (2) to understand NRC staff expectations for the required consequence analyses and assessments; (3) to review examples of igneous activity assessment work being planned; (4) to identify aspects of the igneous activity assessments that may warrant further study; and (5) to complement the previous Working Group sessions.

To assist the members and invited Working Group participants in preparing for this meeting, the ACNW staff has assembled some of the key technical references that will be discussed or likely referred to during the meeting. There are approximately 50 key technical references. They can be found in the two attached compact disks (CD).

The references have been organized into five folders (directories) that correspond to the three Working Group sessions as well as two reference folders containing background information. See attached index tabs. Not all references apply to all of the sessions. Also, not all Working Group participants are expected to become familiar with these references. In fact, some of the participants are likely to recognize some of the citations. Rather, the intent of this narrative is to help the invited Working Group participants understand which citations are viewed to be important by the NRC and DOE staff, and therefore help to establish a common point of

reference for Working Group participants in the forthcoming discussions.

Lastly, this narrative does not reflect an NRC staff position, or any judgment or determination by the Advisory Committee on Nuclear Waste or the NRC regarding the matters addressed or the acceptability of a license application for a geologic repository at Yucca Mountain. The limited distribution narrative is not intended to justify publication or dissemination.

Disk 1 contains 5 reference folders of background information. Folder 1 contains some General Background and Working Group participants should take a few moments to study. As part of its Formative License Application, the U.S. Department of Energy (DOE) will conduct a system performance assessment (SPA) to predict the future performance of a Yucca Mountain repository. The performance assessment would assess the ability of the site characterization work by the Department and is expected to identify the potential effects of a disruptive geologic event. DOE's most recent performance assessment was prepared for the 2002 Site Recommendation by the President. In its license application, the U.S. Nuclear Regulatory Commission (NRC) staff will independently review DOE SPA using its own performance assessment.

Questions or comments regarding this document should be directed to Michael Lee of the ACNW staff at 703-648-6337 or MFL@NRC.GOV.

Bold type designates the name of a folder or reference group and contains a link to the CD.

DOE's 2002 Site Environmental Impact Statement for Yucca Mountain includes SPA results but these results have not been separately published.

(TPA) code being developed cooperatively with the Center for Nuclear Waste Regulatory Analyses (CNWRA).

Folder 0.1 (Treatment of IA Event) contains reference documentation for both the DOE and NRC TSPAs. See Chapters 3.1 and 14, respectively, of those references. These reference documents include discussion of the respective staff approaches to the treatment of disruptive igneous events in a TSPA (e.g., probability, consequences, and dose).⁴

In order to ensure an effective and timely review of a DOE License Application, NRC's strategic planning assumptions call for pre-licensing consultations between the respective staffs, to resolve technical issues at the staff level. Folder 0.2 (Issue Status-Path Forward) contains reference information on the suite of key technical issues (KTI) applicable to the analysis of disruptive igneous events. The Connor and Hill 2000 reference outlines the principal technical concerns the NRC staff believes need to be addressed as part of DOE's site characterization work. The 2003 NRC DOE Technical Exchange (2003 NRC DOE Tech Exch) folder describes the most recent staff meeting with respect to progress in addressing these technical concerns. This reference folder also includes a meeting summary of the issues discussed. In June 2003, the ACNW was briefed on the status of DOE's igneous activity programs and the Department's path forward was outlined for the Members in the Power Point presentation entitled DOE Site and Presentation to ACNW. A number of staff agreements have also been developed as a result of the pre-licensing consultations over the years and their status was recently documented in the 2004 Agreement KTI.

⁴These two citations are likely the best all-around NRC and DOE references to consult on the treatment of igneous activity in a Yucca Mountain performance assessment.

Status reference.

For its part, the State of Nevada has observed the open pre-licensing consultation process and independently identified some technical concerns. Some of their concerns were recently expressed in a proposal to the NRC to assist the staff in their forthcoming review of the DOE License Application. The State's concerns with respect to the analysis of the consequences of igneous activity can be found in the reference entitled State of Nevada Issues.

For its part, the ACNW has monitored the respective staff programs and pre-licensing consultations. Folder 0.3 (ACNW Activities) contains reference information that describes the scope of these efforts. For example, there is an ACNW Letter Reports subfolder which contains the five letters related to the subject. (In whole or in part, the Committee has previously sent to the Commission. There also is the meeting transcription from the ACNW's June 2002 (135th) meeting designated 2002 Volcanism and Trans) with consultants representing the Nuclear Waste Technical Review Board (NWTRB) to discuss their views on igneous activity modeling issues described in a journal paper by Woods and others (2002). (See Folder 2.4 - Key NRC Documents). Also included from that meeting is a background paper applicable to the June 2002 meeting topic prepared by ACNW consultant Dr. Bruce Mars of the Johns Hopkins University. See March 2002 ACNW Paper.

Lastly, Folder 0.4 (Geologic Maps) contains some selected geologic maps of the Yucca Mountain region for reference.

The Committee's June 2002 meeting resulted in a Letter Report dated August 1, 2002. The Letter Report can be found in the ACNW Letter Reports subfolder.

ACNW Working Group Session 1. Probability

Areas of specific ACNW interest in the Probability Session include understanding:

- What types and kinds of geologic information are needed for generating probability estimates?
- What are the uncertainties?
- What types of approaches yield defensible estimates?
- What is a realistic range of igneous occurrence probabilities based on the current geologic record?

Folder 1.0 contains 3 subfolders with background information applicable to this session. Folder 1.1 (Key DOE Documents) contains the 1998 Probabilistic Hazards Volcanic Hazards Analysis or PVHA (1998 DOE PVHA). This formal explanation is the principal technical basis document for the probability estimates currently found in DOE's performance assessments. The IA Characterization Framework reference describes how DOE aggregated the PVHA-generated probability distributions into specific probability estimates for the Yucca Mountain Region. Open File Reports recently published by the U.S. Geological Survey (USGS OFR 00-188 and 02-026) have led the NRC staff to suggest that the conceptual models underpinning the 1998 PVHA now need to be reexamined by the Department's analysts. The Corner and Hill 2002 ICR in Folder 1.2 (Key NRC Documents) and Connor et al 2002 in Disk 2 are the key technical documents that support the probability estimates in the Yucca Mountain Region used by the NRC staff in its performance assessment computer code. Folder 1.3 (Other References) contains three references that provide alternative views on the age of igneous features in the Yucca Mountain Region and/or the calculation of their probabilities.

ACNW Working Group Session 2. Consequences

Areas of specific ACNW interest for the Second Working Group session include understanding:

- What is likely to happen to a underground repository at Yucca Mountain based on geologic record?
- What are the prevailing conceptual models?
- How realistic are the models (also, what level of realism is achievable)?
- How pervasive are the uncertainties?
- How many waste packages are likely to be affected by disruptive igneous events?

Folder 2.0 contains 4 subfolders applicable to this session. Key technical basis documents describing how DOE has modeled the effects of disruptive igneous events in its TSPA can be found in Folder 2.1 (Key DOE Documents). DOE Technical Basis Document Number 13 TEB No. 13 is intended to be the primary source of descriptive information on how the Department's analysts have abstracted and modeled the effects of disruptive igneous events in the forthcoming Yucca Mountain License Application. This folder also contains several key supporting references (Tech Basis Doc 15 Refs) cited in that report of the same name.

In 2002, DOE elected to sponsor a peer review of its igneous consequences modeling programs by a long-standing disparate professional opinion with the NRC staff on how to realistically model this phenomenon in a Yucca Mountain performance assessment. To address these differences in opinion, several NRC/DOE KTI agreements were developed whose respective outputs are tied to the peer review recommendations and any subsequent DOE actions. See Folder 2.2, entitled DOE IA Peer Review. In

February 2003, the DOE-sponsored Igneous Consequences Peer Review (or ICPR) Panel issued its final recommendations on the modeling of potential igneous consequences at Yucca Mountain. See the 2003 Final Report (and 2003 Final Rpt Appendices) references.

Folder 2.3 (NWTRB Reports) provides an independent perspective of the modeling issues raised by Woods and others (2002) by consultants to the NWTRB.

At its 147th meeting (in November 2003), the ACNW was briefed by a member of the ICPR Panel (Dr. Frank J. Spers, University of California at Santa Barbara) who summarized the panel's 2003 comments and recommendations (FSpers Presentation to the ACNW). Generally, the DOE/ICPR Panel found that the Department's performance assessment conceptual model was adequate and reasonable for its TSPA. Also, the ICPR Panel expressed the view that major advances in the understanding of localized magma-drift interactions would not be available within the next three years and therefore did not recommend alteration of current DOE models and computer codes. However, the ICPR Panel did make 29 specific recommendations for DOE to consider to address uncertainties in its existing models and codes. In 2003, DOE representatives met with both the NWTRB and the ACNW, and discussed how the Department intended to address the panel's recommendations. See respectively Power Point® presentations in DOE SWIT Presentation to NWTRB and DOE Cline Presentation to ACNW. In the Cline Presentation, DOE has noted that the main emphasis of its igneous activity modeling programs will be to address the NRC/DOE agreements necessary for the December 2004 License Application. Nevertheless, in rebuttal to the ICPR Panel recommendations, DOE representatives stated the following:

Recent improvements to its igneous activity consequence models and computer codes, available since the completion of the ICPR Panel's work were considered generally sufficient by the Department to address some of the panel comments and recommendations. Considering the improvements made thus far, and based on the Department's determination of the risk significance of a potential disruptive igneous event at the site, DOE believes that its (improved) igneous activity consequence module is sufficient for inclusion in a 2004 License Application.

The recommended need for improvements to igneous activity consequence models and computer codes in some areas can be obviated by using conservative modeling assumptions and/or bounding parameter distributions.

Ongoing or planned enhancements as well as focused confirmatory testing can be expected to achieve any remaining improvements sought to the consequence models and computer codes.

Lastly, DOE staff has previously noted that the Department plans updates to the technical bases for the 1998 PVHA, consistent with the ICPR Panel recommendations and earlier agreements with the NRC staff, but these updates are not likely to be completed until after submittal of the DOE License Application in 2004.

The last folder in this directory, Folder 2.4, contains references considered to be key to the NRC staff to the conceptual underpinning of its igneous consequence modeling.

programs.⁶

ACNW Working Group Session 3: Doses

In February 2004, the ACNW conducted a Working Group meeting to examine issues related to the calculation of biosphere doses as part of a Yucca Mountain performance assessment. Committee recommendations resulting from that meeting were transmitted to the Commission on May 3, 2004. For a potential igneous event, previous analyses have shown that the inhalation pathway dominates, the key parameters, and the mass loading and exposure duration. Mass loading, in particular, is a sensitive and uncertain parameter. Other modeling issues needing special attention are the size distribution of the airborne particles and the processes involved in the remobilization of the volcanic ash. Two areas previously recommended for priority attention are:

(a) documentation of the basis for the assumed particle size concentrations of the airborne particles and (b) the basis for bounding the redistribution of ash. These recommendations included comments related to the modeling of biosphere doses due to a disruptive igneous event. See ACNW May 03 2004 Letter Report reference.

Descriptions of the respective staff approaches to the modeling of doses due to disruptive igneous events in the biosphere can be found in the Folder 0.1 (Treatment of IA Event) references describing both the DOE and NRC TSPAs.

However, one of the modeling issues of concern in the estimation of dose is the treatment of volcanic ash laden with radioactive material. The ONWRA Hooper 2004 Remobilization and DOE Tephra Dispersal Deposition references can provide additional insights into the respective staff modeling approaches.

Lastly, the Electric Power Research Institute (EPRI) has been conducting technical analyses (including performance assessments) independent of those of the DOE and the NRC. Folder 4.7 contains three EPRI reports that focus on the modeling and treatment of a disruptive igneous event. EPRI's views on priority technical issues in relation to overall repository performance can be found in the report of the same name. EPRI's Technical Analysis Report regarding the release of a potential disruptive igneous event scenario. EPRI's performance report can be found in a 2003 staff report entitled EPRI 2003 A Report. EPRI's technical analysis of a disruptive igneous event can be found in the reference entitled EPRI 2004 IA Report.

⁶NRC staff are expected to discuss at the meeting how this information contained in these references have influenced decisions or revisions/enhancements to NRC's TPA computer code.

CD CONTENTS INDEX TABLE

Disk	CD Folder	CD Folder Title	CD Reference	Comments
1	0.0	General Background		
	0.1	Treatment of IV Event	DOE-TRPA-SR [Folder containing multiple documents]	TRW Environmental Safety Systems, Inc., "Total System Performance Assessment for the Site Recontamination," North Las Vegas, TDR-WIS-PA-000001, December 2000. [Prepared for DOE.]
			NRC TPA 4.0 Users Guide	Mohrny, S., T.J. McCartin, and D.W. Esh, "Total System Performance Assessment (TPA) Version 4.0 Code: Module Descriptions and User's Guide," San Antonio, Center for Nuclear Waste Regulatory Analyses, January 2002. [Prepared for the NRC.]
1	0.2	Issues Status Path Lead	General and ILL 2000 [Folder containing multiple documents]	Ill, S. L., and G. B. Gentry, "Technical Basis for Resolution of the Ignorance Activity/Key Technical Issue," San Antonio, Center for Nuclear Waste Regulatory Analyses, December 2000. [Prepared for the NRC.]
			2003 NRC DOE Tech Eval [Folder containing multiple documents]	Documentation and presentations related to the July 1, 2003, Technical Exchange Meeting between the NRC and DOE on the Department's response to the ICRR Panel's recommendations.
			DOE Staffed Presentation by ACONW	DOE presentation dated November 20, 2003, to the ACONW outlining the Department's response to the ICRR Panel's recommendations.
			State of Nevada Issues	Letter dated May 10, 2004, outlining the areas (including Ignorance Activity) in a DOE License Application the could State could offer the NRC staff technical assistance in resolving.
			2004 Presentation (KTI Status)	NRC letter dated February 2, 2004, that provides a plan on the resolution of KTI agreements.
1	0.3	ACONW Activities	ACONW Letter Reports [Folder containing multiple documents]	6 other ACONW Letter Reports related to Ignorance activity in a separate folder.

Disk	CD Folder	CD-Source Title	CD Reference
			2002 Volcanism Mag Trans
			Meeting 2002 ACNWX Paper
	04	Geologic Maps	As stated
	1.0	Probability Session	
	1.1	Key DOE Documents	1998 DOE PVHA

Comments

Meeting transcript for the ACNWX's June 2002 meeting with the NWTRFS's consultants on the modeling of magnetoresistivity interpretations.

ACNWX consultant Dr. Bruce Marsh's views (dated July 2002) on magnetoresistivity interpretation issues following the ACNWX's June 2002 meeting.

Includes 2002 geologic map of the Yucca Mountain region by Porter and others (USGS Geologic Investigation Map-2755).

Geomatics Consultants and TRW, Inc., "Prebatholithic Volcanic Hazards Analysis for Yucca Mountain, Nevada, Las Vegas, Geomatics Earthquake Waste Management System Management and Operating Contract # 87A00000051717-2200-000082, Rev. 0, June 1998. [Requested for DOE.]

Buchheit-SMCC Co., LLC, "Characterization Framework for Geologic Hazards at Yucca Mountain, Nevada, North Las Vegas, NVL-WR-02-000001, Rev. 01, September 2003. [Requested for DOE.]

Shelley, B.J., and others, "Geomagnetic Survey of the Amargosa Desert, Nevada and California: A 1991 for Understanding Near-Surface Geology and Hydrology," U.S. Geological Survey Open-File Report 90-0188, 2000. [Requested for DOE.]

O'Leary, D.W., and others, "Magnetotelluric Expression of Buried Volcanoes Near Yucca Mountain, Nevada," U.S. Geological Survey Open-File Report 02-020, 2002. [Requested for DOE.]

USGS OSEP 02-188

USGS OSEP 02-188

A Characterization Framework

1998 DOE PVHA

Meeting 2002 ACNWX Paper

As stated

Probability Session

Key DOE Documents

Disk	CD Folder	CD Folder Title	CD References	Comments
1	1.2	Key AFRC Documents	Connor and Hill 1995	Connor, C.B., and B.E. Hill, "Three Nonhomogeneous Models for the Probability of Basaltic Volcanism: Application to the Yucca Mountain Region," <i>Journal of Geophysical Research</i> , 100(B6):10,107-10,125 [1995].
2			EV/UC_YM_HPT [Included folder containing either Preliminary Assessment or Final Assessment]	Connor, L., C.B. Connor, and B.E. Hill, PV-HA_YM Version 2.0 - Probabilistic Volcanic Hazards Assessment Methods for a Proposed High-Level Radioactive Waste Repository at Yucca Mountain, Nevada, San Antonio, Center for Nuclear Waste Regulatory Analyses, September 2002. [Prepared for the AFRC]
1	1.3	Other References	Smith et al 2002 GSA	Smith, E.A., D.L. Keppeler, and T. Plank, "Episodic Volcanism and Hot Spots: Implications for Volcanic Hazard Studies at the Proposed Nuclear Waste Repository at Yucca Mountain, Nevada," <i>GSA Today</i> , 12(6): 4-10 [June 2002]
			Holzer et al 1999 JGR	Holzer, M.J., and others, "The Age of Leathrop Wells Volcanic Center: An Air-Ar Dating Investigation," <i>Journal of Geophysical Research</i> , 104(B17):767-804 [1999]
			Coleman et al 2004 ORL Submittal	Coleman, N.M., L.R. Abramson, and B.D. Marsh, "Testing Claims about Volcanic Disruption of a Potential Geologic Repository at Yucca Mountain, Nevada," 2004. Paper submitted to <i>Geophysical Research Letters</i> .
1	2.0	Consequence Session		
	2.1	Key DOE Documents	TRD No. 13	Bormers-Sing-Gee, LLC, "Technical Basis Document No. 13: Basaltic Events," North Las Vegas, Rev. 2., November 2003.

Disk CD Folder CD Folder Title

CD Reference

Comments

1991 Baseline DGC-13 Field Notes, containing four documents.

Titles:
"Igneous Intrusion Impacts on Waste Packages and Waste Forms"
"Stability of Waste Packages Hit by Igneous Intrusion"
"Other DGC Intrusions"
"Characterize Eruptive Processes at Yucca Mountain, Nevada"

22 DOE Waste Review

2003 Final Report

2003 Final Report Appendix

Disbury, E. and others, "Final Report of the Igneous Consequences Peer Review Panel," Las Vegas, Nevada: SNC Co., LLC, April 2003. [Prepared for DOE].
Disbury, E. and others, "Appendices to the Final Report of the Igneous Consequences Peer Review Panel," Las Vegas, Nevada: SNC Co., LLC, February 2003. [Prepared for DOE].
Final DOE presentation dated November 2003.
Final DOE presentation dated September 2003.
Final DOE presentation dated November 2003.

23 NW LTB Reports

As printed, folder contains 5 documents prepared by early 2003.

Final DOE presentation dated November 2003.

24 Key Maps Documents

Compos and Section Map

Carroll, G.B. and G.O. Sanders, "Geophysics Review Topical Report: Application of Seismic Tomographic and Magnetic Methods to Issues in Basaltic Volcanism," San Antonio, Center for Nuclear Waste Regulatory Analysis, CNWRA 04-013, June 1994. [Prepared for use only.]
Carroll, G.B. and others, "Geologic Factors Controlling Patterns of Small Volume Basaltic Volcanism: Application to a Volcanic Hazards Assessment at Yucca Mountain, Nevada," *Journal of Geophysical Research*, 105(1):17-32 (2000).

Disk	CD Folder	CD Folder Title	CD Reference	Comments
			Hill and Stamatakos 2002	Hill, B.E., and J.A. Stamatakos, "Evaluation of Geophysical Information Used to Detect and Characterize Buried Volcanic Features in the Yucca Mountain Region," San Antonio, Center for Nuclear Waste Regulatory Analyses, June 2002. [Prepared for the NRC.]
			Woods et al 2002	Woods, A.W., and others, "Modeling Magma-Drift Intrusions at the Proposed High-Level Radioactive Waste Repository at Yucca Mountain, Nevada," <i>Geophysical Research Letters</i> , 29(13):19-1 - 19-4 (2002).
			Luhr and Hough 2002	Luhr, J.F. and Hough, J.B., "Melt Volcanic Contents in Basalts from Lathrop Wells and Red Cone Yucca Mountain Region (SW Nevada); Insights from Glass Inclusions (Abstract)," <i>EOS Transactions, American Geophysical Union Fall Meeting Supplement</i> , 83(47) (2002).
			Nichols and Butnerford 2004 688A	Nichols, M.G., and M.J. Butnerford, "Experimental Constraints on Magma Ascent Rates for the Crater Flat Volcanic Zone Hawaiiia," <i>Geology</i> , 32(6): 489-492 (June 2004).
1	3.0	Dose Session	ACNW May 05 2004 Letter Report	This Working Group Session on Biosphere Dose Calculations
			CNWRA Hooper 2004 Remobilization	Hooper, D.M., "First-Order Conceptual Model for Fluvial Remobilization of Tephra along Fortymile Wash, Yucca Mountain, Nevada," San Antonio, Center for Nuclear Waste Regulatory Analyses, February 2004. [Prepared for the NRC.]
			DOE Tephra Dispersal Deposition	Bostell, S.M.C., Do, L.L.C., "Atmospheric Dispersal and Deposition of Tephra from a Potential Volcanic Eruption at Yucca Mountain, Nevada," North Las Vegas, MDL - MCR-03-00602, Rev. 00, November 2003.

Disk	CD Folder	CD Folder Title	CD Reference	Comments
1	410	EPRM Reports	EPRM Sci Tech Priorities Fppt	Electric Power Research Institute, "Scientific and Technical Priorities at Yucca Mountain," Palo Alto, Final Report 1007335, December 2003, [Prepared by Monitor Scientific LLC, Allan Pass and Associates, and EPRM.]
			EPRM 2003 JA Report	Electric Power Research Institute, "Igneous Event Scenario," Palo Alto, Technical Update Report 1007898, December 2003, [Prepared by Monitor Scientific LLC.]
			EPRM 2004 JA Report	Electric Power Research Institute, "Potential Igneous Processes Relevant to the Yucca Mountain Repository: Extensive Database Scenario, Analysis and Implications," Palo Alto, Final Report 1008169, June 2004.