

June 27, 1995

MEMORANDUM TO: C. William Reamer
Office of the General Counsel

FROM: John Austin, Chief
Performance Assessment & Hydrology Branch
Division of Waste Management, NMSS

SUBJECT: EXAMPLES OF LICENSING AND APPEAL BOARD REACTIONS TO THE USE
OF ELICITED EXPERT JUDGMENT

Following the June 21, 1995, Commission briefing on expert elicitation, Janet Kotra of my staff spoke briefly with you regarding assertions that elicited judgments had "never" been used in licensing. In preparing for the Commission briefing, Dr. Kotra noted that she had run across a meeting summary of DOE's 1992 workshop on expert judgment, where Leon Reiter (formerly of the NRC staff and now with the Nuclear Waste Technical Review Board) had presented a number of examples from NRC licensing cases where elicited expert judgment had been introduced. At Dr. Kotra's request, Dr. Reiter has provided the attached summary and vignettes which clearly assert that elicited expert judgment has been used and defended successfully in several NRC licensing board hearings.

As you know, the Division of Waste Management staff is preparing a draft staff technical position (STP) on this topic and hopes to circulate a complete draft for in-house review in early August. I request that OGC review the attached material and evaluate its relevance for inclusion in the Background or Regulatory Framework sections of the draft STP. I would appreciate your comments by July 14, 1995.

Attachments: As stated

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M. Federline, DWM
M. Lee, PAHB/DWM

Contact: Janet P. Kotra, PAHB/DWM
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Presentation at Expert Judgement Workshop..November 1992

1. Summary of points made at January 1991 ACNW workshop. Based on experience in regulating seismic issues at nuclear power plants. Main point; the issue is not whether expert judgement has been used but rather how. It has always been used but in different modes: implicit vs explicit
if explicit then..
informal vs formal
deterministic vs probabilistic
single vs multiple experts

2. Feeling that many were uneasy with the use of expert judgement. For this meeting I decided to reread Seth Coplan's statement at workshop and particularly Jim Wolf's statement at ACNW expert judgement workshop in June 1992. Jim Wolf gave several examples of experts who had appeared before Boards and whose views had been rejected by the boards after scrutiny. How then would a Board react to polled or elicited expert judgement, when experts weren't able to testify at the hearing? I decided to focus my remarks today on my experience in using polled expert judgement in programmatic regulatory decision making and defending it at licensing Board hearings.

3. Area of use.. hard decisions on seismic vulnerability of existing nuclear power plants in the central and eastern U. S. Problem..seismic hazard is relatively unknown (why and where of future earthquakes are problematic), perceptions change, large earthquakes have occurred in past at several locations and new earthquakes occur.. sometimes bringing surprises. Staff reverted to multiple expert-probabilistic estimates of hazard because normal use of deterministic, single-valued estimates were held hostage to changing perceptions and new events. two programs carried out for the NRC.

4 Systematic evaluation program (1979-1981). Systematic evaluation of 11 old plants in the U.S. to see if changes are required to assure safety. Seismic hazard estimated by LLNL/TERA using seismicity expert panel. Although the individual experts were known, their individual inputs (seismic source zones, recurrence statistics, and maximum magnitude) were not identified. Although there were discussions among the experts, justification for each input parameter was not required so as not to hinder incorporation of the full uncertainty. Ground motion expert panel used but formal elicitation was not carried out in this case. Results were aggregated into single hazard curve. Aggregated hazard was compared against several deterministic estimates to provide assurance that we were in the right ball park. Modifications were made to several estimates to take these differences into account. I will talk about my experience in defending the SEP hazard estimates in front of licensing and appeal boards.

I would also like to mention a more sophisticated and far reaching program that was carried out for the NRC by LLNL (John Savy was part of this) in the latter part of the 1980's. It provided estimates for close to 100 nuclear power plants east of the Rocky mountains. It was initiated to address concerns about the likelihood of an earthquake the size of the 1886 Charleston, South Carolina event reoccurring at other locations in the eastern U. S. and eventually played a role in the ongoing severe accident evaluation for all U. S. nuclear power plants. We also felt it would be good to have another independent study on which we could base our views and we suggested to the electric utility industry that they commission their own study. This resulted in the EPRI program which Robin McGuire will describe later. Although these latter programs for eliciting expert judgment have played major parts in the NRC's seismic decision making I am not aware that they have been a subject in any licensing Board hearing.

5. Lacrosse Hearing (LBP-81-7) at 13 NRC 257 (1981). Issue is there undue risk at reactor from liquefaction during earthquake? The NRC had issued a show cause order which could shut down plant.

Board first needed to determine that single-valued, deterministic seismic licensing criteria (Appendix A 10CFR Part 100) did not apply to this older plant and was free to use its own judgement.

Staff used SEP estimates. Read from findings of fact p 276.

Staff questioned as to how the project was carried out, the staff choice of a ground motion model, the effects of soil amplification not included in the hazard study, and the impact on the estimates of an earthquake that occurred after the polling. In other words the Board was not interested in the individual rationales of each expert. Rather, it viewed the issue as a difficult one and had no problem with multiple aggregated view. It wanted to know more about the rationale for those items not elicited.

The utility supplied its own estimate of seismic hazard (Robin McGuire). There was some difference in the results and the Board wanted to know the reasons for this.

Board agreed with the SEP (and McGuire) estimates and concluded that there was no undue risk in operating plant during the time period of concern.

6. Big Rock Point Hearing (LBP-84-32) at 20 NRC 601 (1984). Issue is expansion of spent fuel pool and rupture of pool due to the seismic instability of the overhead crane.

Board relied upon previous determination that Appendix A to 10 CFR Part 100 need not apply.

Staff provided testimony

Read description on p. 655. Board noted credentials of experts, lending credence to the study.

As in Lacrosse the Board was not concerned with elicited views but devoted a lot of time to those that were not. For example how the staff treated soil amplification, how the

methodology treated uncertainty. The latter was an issue of particular interest because at least one of the Board members had been involved in an extensive hearing on probabilistic risk assessment at Indian point. Read quote from E-16.

In this case there were no utility hazard studies. The Board sought solace in that the staff had compared the results with deterministic studies and general arguments about the low hazard at Big Rock Point. Board found that SEP estimates were appropriate.

7. Seabrook Appeal Board. The Commission instructed the Appeals Board to reexamine a probabilistic approach used by an intervenor in previous hearings. In contrast to Lacrosse and Big Rock Point, Seabrook is in a zone of relatively high hazard in the eastern U.S. Seismic hazard estimates developed by SEP for Seabrook were brought into testimony as a back up, but were not used by the Board because the issue was the proper use of Appendix A to 10 CFR part 100. Of particular interest was the fact that the intervenor, the prime witness for the utility, and a special witness brought in by the Board were all members of the expert panels used by the study. The staff was in a particularly strong position to argue that its hazard estimates really represented the range of views in the scientific community.

8. Conclusions:

1. The use of polled (elicited) expert judgement has been used and defended successfully in several licensing board hearings.

2. The Boards did not seem to be hampered by the absence of the individual experts. The Boards were not particularly interested in scrutinizing these experts.

3. The Boards showed a great deal of interest, and required the most justification, for those inputs not arrived at through the elicitation of multiple experts.

4. One Board which was very interested in uncertainty had no problem, as did the other, in accepting the use of aggregated results, that is, those derived by the combination of different expert inputs.

5. One Board made use of the fact that the experts had strong qualifications from the professional community and came from diverse organizations (not related to the applicant).

6. Witnesses had to be able to defend the methodological assumptions, and assess the impact of hypotheticals and new developments.

7. The Boards took comfort when there were other studies and simple arguments that could be used to support the conclusions drawn. The witness had to explain the source of any differences.

8. The Boards appeared to be comfortable with the use of polled expert judgement in an area of great uncertainty, with little relevant data and many different models.

CAVEAT: As with the use of other examples from past licensing hearings, context must be examined before applications can be made to future hearings.

Lessons Learned from Past Experience in the Use of Expert Judgment

**Presentation by Leon Reiter at the
U.S. Department of Energy Workshop
on Expert Judgment
Albuquerque, New Mexico
November 18-20, 1992**

Summary of Presentation to January 1991 ACNW Working Group

Based on experience regulating seismic issues at nuclear power plants

Expert Judgment always used - question is how

- implicit or explicit**
- formal or informal**
- deterministic or probabilistic**
- single or multiple experts**

A Prime Concern:

- **Licensing Board's negative reaction to elicited judgment**
- **Board not able to scrutinize individual experts**

Issue - Seismic hazard in the eastern and central United States

- **Some damaging earthquakes**
- **Little relevant data**
- **Many different models**
- **New and surprising earthquakes**

Systematic Evaluation Program (SEP) 1979-1981

- **Reevaluate eleven oldest nuclear power plants**
- **Seismic hazard study: LLNL/TERA**
- **Expert Panel on Seismicity**
- **Aggregated probabilistic results**
- **Comparison with deterministic estimates**

LaCrosse Hearing

- **Issue: undue risk from liquefaction**
- **Existing licensing criteria not applicable**
- **Board recognized elicited expert judgment**
- **Board primarily interested in non-elicited input**
- **Utility-based hazard study**
- **Board accepted hazard studies and found no undue risk**

**LaCrosse Boiling Water Reactor (LBP-81-7)
13 NRC 276 (1981)**

"Since there is insufficient historical earthquake experience in the central U.S. to conduct seismic hazard analyses solely on empirical data, judgment must be used in the selection and limitations of certain parameters and empirically derived relationships. In the LLL-TERA studies, experts on eastern seismicity were polled with respect to seismic zonation, frequency of earthquake occurrences, upper magnitude cutoff, and characterization and attenuation of ground motion."

Big Rock Point Hearing

- **Issue: seismic stability of overhead crane**
- **Board recognized polled expert judgment**
- **Credentials of experts**
- **Board concerned with uncertainty, non-polled input**
- **Deterministic comparisons, general hazard arguments**

Big Rock Point (LBP-84-32) 20 NRC 655 (1984)

"Since there is insufficient historical data on earthquake experience in the central United States, judgment must be exercised in the selection and limitations of certain data and empirically derived parameters. Accordingly, the methodology relies heavily on expert opinion. The study solicited expert opinion in key seismic input parameters...The experts who contributed to the study are well known in the field of geophysics, and include authorities such as Dr. G.A. Bollinger, president of the eastern section of the Seismology Society; Dr. P.W. Pomeroy, the current chairman of the Committee on Seismology of the National Academy of Sciences, and Dr. O.W. Nuttli, a leading authority on earthquakes east of the Rocky Mountains."

Big Rock Point (LBP-84-32) 20 NRC 729 (1984)

"The analysis of seismic hazard for the eastern United States was extremely difficult due to the low level of seismic activity and lack of records. Uncertainty concerning input parameters was taken into account in each expert's distribution of earthquake probability. The final results of each expert were integrated into a single hazard curve by means of weights supplied by each expert."

Conclusions

- 1. Elicited multiple expert judgment was successfully defended.**
- 2. Boards were not hampered by absence of individual experts.**
- 3. Boards were most interested in non-elicited input.**
- 4. Boards accepted aggregated results.**

Conclusions (continued)

- 5. Qualifications and diverse background of experts were important.**
- 6. Witnesses had to defend methodological assumptions and assess impacts of new developments.**
- 7. Other studies and supporting simple arguments were important.**
- 8. Boards were comfortable with elicited expert judgment in an uncertain area of science.**