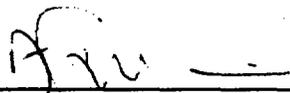


U.S. NUCLEAR REGULATORY COMMISSION  
OBSERVATION AUDIT REPORT QA-98-01  
OF  
THE U.S. DEPARTMENT OF ENERGY  
OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT  
OFFICE OF QUALITY ASSURANCE OF THE UNITED STATES GEOLOGICAL SURVEY  
(AUDIT USGS-ARP-98-01)

 2/17/98

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## 1.0 INTRODUCTION

A member of the U.S. Nuclear Regulatory Commission, Division of Waste Management, Geosciences staff observed the U. S. Department of Energy (DOE), Office of Civilian Radioactive Waste Management (OCRWM), Office of Quality Assurance (OQA), performance-based audit of U.S. Geological Survey (USGS). The audit, USGS-ARP-98-01, was conducted on October 28-30, 1997, for work performed by the USGS Office and its experts on the subject of Probabilistic Seismic Hazard Analysis (PSHA).

The objective of this performance-based audit by OQA was to evaluate the adequacy and effectiveness of implementation of the Scientific Expert Elicitation Process Quality Assurance Program requirements in the development of the deliverable for Work Breakdown Structure 1.2.3.2.8.3.6, "Probabilistic Seismic Hazard Analysis," and the technical evaluation of the elicitation product.

The U.S. Nuclear Regulatory Commission staff's objective was to gain confidence that USGS is properly implementing the requirements of the Quality Assurance (QA) programs in accordance with the OCRWM Quality Assurance Requirements and Description (QARD: DOE/RW-333P) and Title 10 of the Code of Federal Regulations (10 CFR), Part 60, Subpart G (which references 10 CFR Part 50, Appendix B).

This report addresses the effectiveness of the OQA audit and the adequacy of implementation of established procedures, plans, and QA controls in the audited areas of the USGS PSHA activities.

## 2.0 MANAGEMENT SUMMARY

NRC staff has determined that OQA Audit USGS-ARP-98-01 was useful and productive. The audit was organized and conducted in a professional manner. The audit team members were qualified in the QA and technical disciplines, and the assignments and checklist items were adequately described in the audit plan.

The audit team concluded that the USGS QA program had been satisfactorily implemented. No deficiencies, but some recommendations, were reported at the exit meeting. The NRC staff agrees with the audit team's conclusion, findings, and recommendations.

## 3.0 AUDIT PARTICIPANTS

### 3.1 NRC

Abou-Bakr K. Ibrahim      Observer (Technical Specialist)

### 3.2 DOE/OQA

Richard L. Weeks	Audit Team Leader (ATL)
William J. Glasser	ATL in Training
Robert P. Hasson	Auditor
David F. Fenster	Technical Specialist

### 3.3 State of Nevada

None

### 3.4 USGS

Tom Chaney	Engineering Assurance Chief
Robert Craig	Technical Project Officer
Martha Mustard	Hydrologist
Bruce Parks	Team Chief, Seismotectonics
Patricia Sheaffer	QA Implementation Specialist
John Whitney	Tectonics Chief

### 3.5 MANAGEMENT AND OPERATING CONTRACTOR (M&O)

Richard Quittmeyer	Woodward Clyde Federal Services, Site Program Operations Staff
Carl Stepp	Woodward Clyde Federal Services, Probabilistic Seismic Hazards Analysis, Project Director
Ivan Wong	Woodward Clyde Federal Services, Probabilistic Seismic Hazards Analysis, Deputy Project Director

## 4.0 REVIEW OF THE AUDIT AND AUDITED ORGANIZATION

This audit of the USGS was conducted in accordance with OCRWM Quality Assurance Procedure (QAP) 18.2, "Internal Audit Program;" QAP 16.1Q, "Performance/Deficiency Reporting;" and AP-16.2Q, "Corrective Action and Stop Work." NRC staff observation of this audit was based on the NRC procedure, "Conduct of Observation Audits," issued October 6, 1989.

### 4.1 Scope of the Audit

The following program elements were audited:

1. Program Effectiveness
2. QA Program Implementation of the Elicitation Procedure
3. Adequacy of the Elicitation Process
4. Technical Evaluation of the Elicitation Product

The Key Technical Issue associated with the audit is Structural Deformation and Seismicity.

### 4.2 Conduct of Audit

The audit was performed in a professional manner. Audit team personnel were prepared and demonstrated a good knowledge of the QA programs and procedures. The audit plan identified this as a performance-based audit in which the evaluation process and product acceptability would be based on:

- 1) Satisfactory completion of the critical process steps,
- 2) Acceptable results and quality of the end product,
- 3) Documentation that substantiates quality of products,
- 4) Performance of trained and qualified personnel, and
- 5) Implementation of applicable QA program elements.

The audit included the technical evaluation of the data, the completeness of the database, the process of reconciling different expert opinions, and the documentation of the experts' input.

The OQA audit team and the NRC observer caucused at the end of each day. Also, meetings of the audit team and USGS management (with NRC observer present) were held each morning to discuss the then-current audit status and preliminary findings.

#### 4.3 Timing of the Audit

NRC staff believes the general timing of the audit was appropriate for OQA to evaluate the USGS activities associated with the expert elicitation process and its implementation. OQA performed this audit while the results from PSHA are still in progress. Therefore, in the absence of a final product, another audit may be needed to ensure that the elicitation process has been successfully implemented.

#### 4.4 Examination of QA Programmatic Element

The majority of the auditing effort focused on the expert elicitation process and the technical aspects of the elicitation. Checklists were used effectively, and issues were pursued beyond the checklists when needed. The NRC observer was given ample opportunity to provide comments and ask questions.

The audit team reviewed the training and education of staff personnel responsible for the management and implementation of the expert elicitation process. The audit team found that two members of the staff had not documented their training according to the procedure, although they attended the training class. This deficiency was corrected by completing the required USGS training record form.

The audit team assessed the process used by USGS to conduct expert elicitation as compared to that discussed in NUREG-1563, and the implementation of the USGS Procedure, YMP-USGS-QMP 3.16, "Scientific Expert Elicitation," and Project Plan, YMP-USGS-EE-9701, Rev. 0, "Probabilistic Analysis of Fault Displacement and Vibratory Ground Motion and the Development of Seismic Design Bases for Yucca Mountain." The audit team found that some NUREG-1563 criteria were not addressed in the USGS procedure, such as conflict of interest, conducting the elicitation in a private setting with the presence of the generalist and normative experts, identifying unambiguous terms, and documenting the rationale for the experts' revised judgments. In a discussion with USGS management, it was indicated that the elicitation process started before the issuance of NUREG-1563, and it was too late to modify the procedure. However, USGS indicated that the NUREG-1563 guidance has been considered to the fullest extent during the elicitation process and agreed to address these concerns in the

final PSHA report. The audit team made four recommendations (#1 to #4 on the following page) for the USGS to consider.

#### 4.5 Examination of Technical Activities

The technical auditor prepared a checklist designed to evaluate the expert elicitation process and conclusions reached with respect to: seismic source zones; earthquake recurrence; maximum magnitude; attenuation functions; and the PSHA calculations.

USGS and M&O participants responded satisfactorily to the checklist questions and to additional questions as necessary.

During the audit, the audit team noticed that for most of the logic tree nodes and branches, the technical basis and rationale for the values provided were absent. The audit team asked the management team to ensure that the technical basis and the rationale for the values associated with the different branches of the logic tree are well documented in the final report. Also, the audit team indicated to management that all records and data used or generated by the different expert teams should be available to all other experts.

The audit team concluded that the technical work was adequately performed to meet project objectives. As a result of the technical evaluation, the audit team made two recommendations (#5 and #6 on the following page) for the USGS to consider.

In conjunction with the technical evaluation, the audit team evaluated the implementation of requirements described in the Project Plan, YMP-USGS-EE-9701, Rev. 0, "Probabilistic Analysis of Fault Displacement and Vibratory Ground Motion and the Development of Design Bases for Yucca Mountain." The audit team concluded that the requirements in the Project Plan were implemented; however, one recommendation (#7 on the following page) was issued regarding the records safekeeping.

#### 4.6 Audit Team Qualification and Independence

NRC staff did not evaluate the audit team qualifications against the requirements of QAP 18.1, "Auditor Qualification." However, in discussions with Bill Belke, NRC On-Site Representative and QA Specialist, he indicated that the audit team members are qualified to do the audit based on his observations of previous QA audits conducted by members of the team.

#### 4.7 NRC Staff Findings

The QA programmatic and technical portions of the audit were conducted in a professional manner, and the audit team adequately evaluated the different activities.

The checklist questions provided a basis from which to conduct the audit and reach a conclusion on the expert elicitation process.

It was clear to NRC staff that the record keeping is not well organized. Some of the records are located in Oakland, California, while others are kept in Denver, Colorado. This may be due to the fact that the PSHA is still in progress. The USGS indicated that when the PSHA is finalized, it will store all the records in one safe place.

NRC staff agrees with the OQA audit team findings summarized below.

#### 4.8 Summary of Findings

The audit team determined that USGS is satisfactorily implementing OCRWM's QA Program and process controls for the Scientific Expert Elicitation and provided the following seven recommendations:

1. USGS needs to address the potential conflict of interest issue in the PSHA final report.
2. USGS needs to identify the names of the generalist and normative experts in attendance during the elicitation process.
3. USGS needs to address how the experts' revised input will be handled in the final PSHA.
4. USGS needs to provide unambiguous definitions of terms used in the elicitation process.
5. Management needs to review the PSHA to ensure that the logic trees are well described and that the values associated with each branch of the tree and rationale for these values are well documented.
6. Management needs to ensure that all references, data, and interpretations generated or used by the experts to support decisions are available to all experts. This information should be kept as part of the project file.
7. USGS needs to ensure safekeeping of the materials used and generated during the elicitation process. A duplicate of these materials should be produced and kept in fireproof storage.