



Department of Energy

Washington, DC 20585

NOV 7 1991

Mr. John Linehan, Acting Director
Repository Licensing and Quality
Assurance Project Directorate
Division of High-Level
Waste Management
Office of Nuclear Material
Safety and Safeguards
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Linehan:

Enclosed is an updated version of the report outlining the quality assurance concerns expressed by Mr. Sam Singer, a former employee of Science Applications International Corporation who worked on the U.S. Department of Energy Yucca Mountain Site Characterization Project and the actions taken by the Project Office to address these concerns. The enclosed report reflects DOE's view that Mr. Singer's concerns are, in fact, concerns. This is in contrast to the terminology used in the older version of the report, submitted in John Gilray's memorandum to Jim Kennedy on November 20, 1989 in which he discussed the resolution of the Singer "allegations." Attached to Mr. Gilray's memorandum was a memorandum (dated October 26, 1989) from Ed Wilmot to Carl Gertz transmitting a report within which these concerns were incorrectly identified as "allegations."

The enclosed report concludes that the concerns raised by Mr. Singer have been thoroughly investigated, and they have not impacted any technical products produced by the Yucca Mountain Project Office (YMPO). Several recommendations have been implemented to enhance future technical products.

If you have any questions regarding the enclosure, please contact Linda Desell of my staff at FTS 896-1462.

Sincerely,

Dwight Shelor
Acting Associate Director for
Systems and Compliance
Office of Civilian Radioactive
Waste Management

Enclosure:

9106180213 910607
PDR WASTE PDR
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WM-11
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R. Loux, State of Nevada
C. Gertz, DOE/YMPO/NV
M. Baughman, Lincoln County, NV
D. Bechtel, Clark County, NV
S. Bradhurst, Nye County, NV
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All include on staff

REPORT ON CONCERNS EXPRESSED BY SAM SONGER 10/7/77
& 9106180221 910607 UCID -21867

Rec'd. w/tr. dtd. 9/10/87
Accession No. 9106180213

received with letter dtd
6/7/91

REPORT ON CONCERNS EXPRESSED BY SAM SINGER

The following report presents the results of a review and evaluation of two concerns presented on several KLAS-TV (Channel 8) newscasts between February 10-12, 1988. An earlier version of this report, included in a letter dated October 26, 1989, (enclosure 1) from Edwin Wilmot to Carl Gertz, and a follow-up letter from Donald Horton to Carl Gertz, dated November 9, 1989, referred to the concerns as "allegations" and contained an analysis of and recommendations regarding those concerns.

The purpose of this report and the enclosures is to provide a complete synopsis and record of the responses to the concerns and to clarify and revise certain aspects of the October 26, 1989, report. We believe this October 1989 report omitted relatively minor but important aspects of the events it describes and did not adequately reflect the views of all of the participants involved. A second report, dated August 12, 1988, (enclosure 2) also addressed two other concerns identified by Sam Singer that dealt with Quality Assurance (QA) Audit 86-6 and Geological Core Samples. This report also described those concerns as "allegations." Except for the clarifications contained in this summary, the discussions and recommendations contained in the previous reports are still valid.

The concerns were identified and made public by Sam Singer, a former employee who held the position of QA Engineer for Science Applications International Corporation (SAIC) on the Yucca Mountain Site Characterization Project Office (YMPO). As a part of its contract with the U.S. Department of Energy, SAIC was tasked during the time frame covered by the subject concerns with QA implementation and monitoring of the various project participants, which included such functions as QA audits and surveillances of project activities.

Following the publication of the concerns, SAIC undertook an independent evaluation. This independent evaluation was conducted by senior SAIC staff members who were not connected with YMPO. The report of that evaluation contained recommendations that were subsequently implemented as described in the October 26, 1989, report. The concerns are summarized below and relevant discussion is provided in the following text:

A. J-13 Water Samples

The concern identified an apparent lack of evidence that the water was under any controls and stated that the water being utilized in various test activities could have been tap water.

Discussion

Sam Singer was never directly involved in activities related to the collection of water samples. Lawrence Livermore National Laboratory (LLNL) was requested by YMPO to provide the various reports and technical papers that dealt with this issue in order for the YMPO technical staff to evaluate them. LLNL did provide these reports as requested, and they have since been evaluated as noted above. YMPO has stated that certain

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confirmatory tests need to be performed. YMPO also has taken the position that neither the selection of Well J-13 as the reference groundwater nor the use of Well J-13 water in previous tests in itself requires that only water from Well J-13 be used in tests. The use of surrogate or synthetic J-13 water is acceptable if it can be demonstrated that its composition corresponds to the reference water, or that its composition is known and appropriate for the intended purposes of the test.

To assure the qualification of existing data, LLNL was directed to conduct the following actions:

1. Using standard statistical methods, determine the variance of the published chemical compositions of the reputed J-13 water. This statistical analysis must take into account the precision of the analyses.
2. Perform limited confirmatory tests for data needed for licensing and derived from tests that used either Well J-13 water or water that conformed to reference J-13 water. These tests should, under approved QA procedures, use Well J-13 water collected, labeled, stored, shipped, and analyzed by standard methods prior to use. Specifically, confirmatory tests for spent fuel dissolution and glass release are to be included.
3. Perform a statistical analysis following these tests to determine whether the results of the earlier tests belong to the same population as the confirmatory results. During this analysis, any variation in the composition of Well J-13 water must be taken into account.

Several of these actions have been performed by LLNL and are described in the enclosed report (UCID-21867) (enclosure 3). Future site characterization activities using J-13 water, including sampling and additional analyses, will be conducted as quality activities.

B. Mineral Resources at Yucca Mountain

Sam Singer's assertion was that an SAIC geologist had prepared a draft version of part of the Site Characterization Plan (SCP) dealing with the characterization of mineral resources containing statements contrary to project management desires and that this section of the SCP was modified without allowing the original author an opportunity to review the modified section.

Discussion

The SCP was prepared by the U.S. Department of Energy (DOE) in accordance with the requirements of Section 13(b)(1)(A) of the Nuclear Waste Policy Act to summarize the information collected to date about the geologic conditions at the site; to describe the conceptual designs for the

repository and the waste package; and to present the plans for obtaining the geologic information necessary to determine the suitability of the site for a repository. A preliminary assessment of mineral resources at Yucca Mountain was included in the initial drafts as well as the Consultation Draft Site/Characterization Plan (CD/SCP) that was issued in January 1988 and the statutory SCP that was issued in December 1988.

In September 1985, the DOE was completing the EA and beginning to work on an initial draft of the SCP. At that time, a draft of Chapter 1 of the SCP, including Section 1.7 (Mineral and Energy Resources) prepared by the U.S. Geological Survey (USGS) (the participant programmatically responsible for preparation) was ready for review. In the view of the USGS and the DOE, the draft did not include an adequate Section 1.7 and SAIC was informally asked to prepare a version of the SCP Section 1.7 that addressed the U.S. Nuclear Regulatory Commission (NRC) guidance as specified in Regulation Guide 4.17. Ed Oakes, an SAIC employee working on the Technical and Management Support Services (T&MSS) Project in non-dedicated status as part of the environmental group, was asked to prepare a draft of the section following the guidance in NRC Regulation Guide 4.17. Ed Oakes prepared the section and it was submitted to a technical review group charged with review of Chapter 1 of the SCP. Sam Singer was concerned with the results of that review and subsequent activities in the preparation of the SCP.

In response to these concerns, this report will first address the separate report that was prepared by sources with no direct involvement with YMPO, briefly discuss relevant aspects of the issue, and discuss the actions taken with respect to the conclusions and recommendations of the independent SAIC evaluation.

The following three conclusions were stated in the report prepared by the independent SAIC evaluators:

1. The SCP as it exists at this date (August 1988) has technical validity in those areas examined by this investigation. This relies heavily on Ed Oakes' conclusion that the current draft is essentially the same as his original September 1985 draft. It also depends on adequate resolution of concerns expressed in Ed Oakes' memo of July 1988 (see "Recommendations" below).
2. The current (revision 2) version of the Site Characterization Plan Management Plan (SCPMP) and its attendant procedures are adequate. Areas to strengthen implementation do exist and are described below.
3. The SCP development process as it existed in 1985-7 had the potential to produce a flawed process and results. The process allowed Ed Oakes' professional opinions to be subverted for a period of time.

The three conclusions reached by the independent SAIC evaluation panel resulted in a number of recommendations, which are stated below.

1. Management attention at YMPO must stress adherence to established procedures. This includes prompt review and resolution of comments. Time constraints appear to be the most probable causes of procedure violation. If procedures do not provide realistic requirements or schedules, they should be changed instead of violated.
2. Positive actions are needed to assure management and staff understand the existing procedures. A two-pronged approach is recommended. First, procedures should be simplified. This is particularly true of Quality Management Procedure (QMP)-06-03, Document Review/Acceptance/Approval. Second, an aggressive program of training and indoctrination is needed to assure adequate and consistent understanding.
3. A procedure for resolving "differing professional opinion" is needed. Continued development is needed with stress on training/indoctrination and a method for disclosing and resolving differing opinions in a non-adversarial manner.
4. Additional mechanisms for surfacing technical and quality issues should be developed. "Ombudsman" routes could be provided for all staff. Particular emphasis should be placed on QA department personnel's rights and obligations to surface such issues.
5. Ed Oakes' residual concerns should be handled via the procedures of Revision 2 of the SCPMP.

Discussion

The DOE developed an annotated outline for the SCP and met with the NRC to discuss it in February 1985; subsequent to that, the DOE developed Project Office and Headquarters SCP Management Plans. These Management Plans were not in place at the time of preparation of the initial draft SCP sections; the review in which Ed Oakes participated was not conducted under a formal SCP Management Plan. Chapter 1 was, however, subsequently reviewed under the SCP Management Plan. The YMPO's SCPMP was specifically designed with group consensus in mind; a formal dispute resolution mechanism was embodied in this concept. That comment resolution process attempted to obtain resolution at the level of the author and commenter. Means for evaluating unresolved comments to a program review group were provided.

During the review of the initial draft SCP sections, several problems were identified with Section 1.7, as submitted. First, Regulation Guide 4.17 calls for the use of a specific methodology for mineral resource evaluation (USGS Bulletin 1450a as revised by USGS Circular 831). The method used by Ed Oakes to prepare the initial draft was a non-standard technique, published only in abstract form. Regulation Guide 4.17 calls for a synopsis of the site,

reviewing all relevant materials to the extent available such that (1) resource potential of the site could be compared with other comparable areas containing resources, (2) a tabulation of total resources describing the methods used in the tabulation for the site could be provided, and (3) the description and location of any past or present oil and gas wells in the candidate area could be provided. The technical review group, which was chaired by Dr. William Twenhofel, an independent consultant, rejected the non-standard assessment methodology used and did not judge the information provided about the candidate site adequate in relation to that required by Regulation Guide 4.17. Ed Oakes was subsequently offered an opportunity to review the revised section which was to be reviewed under the controls of the SCPMP.

The project records clearly indicate that the decision to not participate in completion of the Consultation Draft (CD)/SCP was made by Ed Oakes, albeit his role would have been as reviewer, rather than lead author. There is no formal correspondence directed either to the designated manager of the T&MSS effort in support of the preparation of the SCP, or to Dr. W. Twenhofel, the chairman of the committee that reviewed the draft of SCP Chapter 1, indicating that Ed Oakes wished to dispute the conclusions of the review committee to include a mineral resource assessment methodology other than the one he proposed.

It is not the intent of this evaluation to take issue with the findings and recommendations of the independent evaluation panel, although clearly there are differing view points about whether in fact there was a mechanism for Ed Oakes to elevate his concerns, or if in fact he even had a desire to elevate his concerns. There is sufficient evidence in the project files to support the point that Mr. Oakes was afforded an opportunity to voice his dissenting opinion. The project records indicate that the decision not to participate in the formal review of the CD/SCP, which was prepared under an approved management plan that included a process for elevating disputed comment resolution to successively higher levels of management, was made by Ed Oakes. The mechanisms for formal dispute resolution that were incorporated in the SCP Management Plan were admittedly somewhat intimidating, especially for a subordinate staff member. In that context the recommendations of the independent evaluation panel are appropriate.

Action Taken

The following provides information regarding what actions have been taken with respect to the recommendations described above resulting from the independent report:

1. Management has always stressed the importance of working within the existing procedural framework that has been developed on the Yucca Mountain Site Characterization Project (YMP). While time constraints might have compounded the situation, the geologist in question was approached on more than one occasion to re-review this particular section and declined the opportunity.

2. An effort to simplify document review procedures within the YMPO was undertaken. Training was conducted on the document review procedure to assure a consistent and thorough understanding of those requirements. It should be noted, however, that the preparation of the SCP was not governed by the requirements of project review procedures (QMP-06-03 at that time), but was prepared in accordance with the requirements of the SCP Management Plan, which had equivalent controls.
3. YMPO procedures for the preparation, review, and approval of documents presenting DOE positions and policy all must, and do, contain mechanisms for ensuring that disputes between staff members are elevated to appropriate management levels and are resolved accordingly. However, it is not clear if there is an obvious need for a separate procedure to resolve differing technical opinions. Such a procedure could be difficult to implement, and possibly could be viewed as an attempt to suppress the important exchange of ideas and information that is vital to the success of the project.
4. Recently, there has been increased attention in the program to situations that have the potential to suppress personnel concerns. Now in place are several ways in which project personnel can and should voice their concerns over such issues on the YMP. They are as follows:
 - a) DOE - Office of Inspector General Employee Hotline. This notice is posted on bulletin boards throughout YMPO areas and encourages personnel to utilize this service if they should have an awareness of fraud, waste, or mismanagement.
 - b) Resolution of SAIC Employee Concerns - A number of programs have been implemented by SAIC that enables their employees to openly and freely express their concerns without fear of reprisals. These programs are described in the T&MSS resource manual and on bulletin boards, announced by memos to the staff, and discussed at staff meetings. The programs include Answer Line, a two-way confidential communication channel between T&MSS staff and management. Answer Line is intended to give T&MSS employees an opportunity to communicate confidentially with T&MSS Management. T&MSS employees can submit a query (defined as any question, comment, concern, or opinion expressed by a T&MSS employee and relating to that employee's job or the T&MSS work environment) to Answer Line, and the program coordinator of Answer Line will direct it to management. Answer Line is designed to protect the employee's identity before, during, and after the communication process. Through Answer Line, employees can submit a query to management without fear of adverse consequences. The programs also include a formal process to notify supervisors and other parties of concerns, which in turn implements a coordinated

concern resolution process, and the establishment of an ethics committee that employees are free to contact and a hotline to report concerns.

- c) The YMPO has, in addition to the above, developed an HQ Procedure for the Reporting and Resolution of Quality Concerns. Although this procedure has yet to be distributed, a memo has been issued describing the methodology for employees wishing to express any concerns they have with the conduct of activities on the project that they consider unethical, incorrect, improper, or inappropriate in any way. When issued, this procedure will also be available as a method for reporting employee concerns. Current DOE plans are for the implementation of this program during July, 1991.
 - d) Also in place is an HQ QA Administrative Procedure, (QAAP) 16.1 that deals with corrective action requests to ensure that conditions adverse to quality are promptly identified and corrected. This procedure is a more formal process in that the documentation generated as a result of its use becomes part of the project records.
5. Ed Oakes' residual concerns revolve around the basis that the "long-term" mineral assessment of Yucca Mountain should, to the extent possible, be based on the favorability of the geological environment for specific types and sizes of mineral accumulations, and that the evaluation should be largely devoid of current economics associated with mineral extraction, and should include the Paleozoic rocks beneath Yucca Mountain. The Mineral Resource investigations in the SCP (Section 8.3.1.9.3) recognize that the evaluations required by 10 CFR Part 60 involve a sophisticated evaluation of mineral resource exploitation at times in the distant future. Independent HQ-selected consultants participated with YMPO scientists in the preparation of the SCP Section 1.7, as well as Section 8.3.1.9.3. The group was able to develop a consensus approach to the problem of mineral resource evaluation, including extrapolations into the future. It may be relevant to note that in the current program all comments to the DOE on the SCP will be tracked and resolved, through the process described in AP-1.14, "Disposition of Comments on the Site Characterization Program".

In conclusion, the YMPO offers the following observations related to the cited concerns:

1. Well J-13 Water

- o The YMPO has taken the position that confirmatory testing will need to be performed if the data are determined to be needed for licensing.

- o The YMPO's position is that any water of the same composition as Well J-13, within reasonable analytical uncertainty, may be used as long as it is determined to be appropriate for the purposes of the test being conducted.
- o Future actions will be performed as needed as quality activities in conjunction with ongoing work.

2. Mineral Survey of Yucca Mountain

- o The draft of Chapter 1 of the SCP did not include an adequate Section 1.7 and SAIC was asked to prepare a version that addressed NRC guidance as specified in Regulation Guide 4.17. The method described by Ed Oakes did not meet the specifications of Regulation Guide 4.17, which called for identification of a specific methodology for mineral resource evaluation. The Technical Review Group, which was chaired by Dr. William Twenhofel, an independent consultant, rejected the non-standard assessment used by Ed Oakes and did not judge the information provided about the candidate site adequate in relation to that required by Regulation Guide 4.17. Ed Oakes declined requests to provide comments on the revised SCP section.
- o The project records clearly indicate that the decision to not participate in completion of the CD/SCP was made by Ed Oakes, albeit his role would have been as reviewer rather than lead author.
- o The YMPO SCP Management Plan was specifically designed with group consensus in mind; a formal dispute resolution mechanism was embodied in this concept.
- o There were means provided for elevating unresolved comments to a program review group, and assuring that the resolution of such disputed comments was documented and records of such resolutions were placed in the SCP project files.

In closing, the concerns have been thoroughly investigated and it is determined that they have not impacted the technical products produced by the project. The investigations provided several recommendations, which in turn, resulted in actions taken by the YMPO to enhance its future technical products. Should the results of future tests on Well J-13 water indicate that previous data are unusable, a revised testing program may be initiated if appropriate.

Enclosures:

1. Ltr, Wilmot to Gertz, dtd 10/26/89
2. Ltr, Blaylock to Gertz, dtd 8/12/88
3. Report of the Committee to Review the Use of J-13 Well Water in NNWSI, dtd 1/90



Department of Energy

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 QA

OCT 26 1989

Carl P. Gertz, Project Manager, YMP, NV

YUCCA MOUNTAIN PROJECT OFFICE (PROJECT OFFICE) ALLEGATION REPORT TO THE
 U.S. NUCLEAR REGULATORY COMMISSION

- References:
- (1) Letter, Ramspott to Gertz, dtd. 5/24/88
 - (2) Letter, Blaylock to Gertz, dtd. 8/12/88
 - (3) Memo, Penland to Estella, dtd. 4/18/88
 - (4) Memo, Nelson to Distribution, dtd. 9/27/89
 - (5) Letter, Little to Jardine, dtd. 10/2/89
 - (6) Letter, Jardine to Little, dtd. 8/11/89
 - (7) Memo, Voegele to Distribution, dtd. 9/25/89
 - (8) Memo, Oakes to Nolan, dtd. 7/26/89

Enclosed is the report on the remaining two allegations that were presented in February 1988 on several KLAS-TV (Channel 8) newscasts. These allegations were made with respect to the Yucca Mountain Project Quality Assurance (QA) Program and are as follows:

1. J-13 Water Samples
2. Mineral Survey of Yucca Mountain

Details of these areas of concern are contained in the report. In addition, letters and backup data to support the Project Office position are provided.

In summary, I feel that this report on the allegations is suitable to refute all questions/concerns dealing with the QA aspects brought forth as noted.

Should you require any additional data, please contact me at 794-7137.



Edwin L. Wilmot, Acting Director
 Quality Assurance Division
 Yucca Mountain Project Office

YMP:ELW-480

Enclosure:
 Report on Allegations

OCT 26 1989

Carl P. Gertz

-2-

cc w/encl:

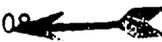
Ralph Stein, HQ (RW-30) FORS

D. E. Shelor, HQ (RW-3) FORS

J. H. Nelson, SAIC, Las Vegas, NV, 517/T-04

R. J. Bahorich, W, Las Vegas, NV, 517/T-12

G. P. Fehr, SAIC, Las Vegas, NV, 517/T-12

J. W. Estella, SAIC, Las Vegas, NV, 517/T-08 

REPORT ON ALLEGATIONS

The following report presents an evaluation of the two remaining "allegations" presented on several KLAS-TV (Channel 8) newscasts between February 10-12, 1988, that have been under review/evaluation in order to present a complete and final report on those allegations. An earlier report (see Reference 2) addressed the first two allegations that dealt with QA Audit 86-6 and Geological Core Samples.

The allegations were made by Mr. Sam Singer, a former employee who held a position as a Quality Assurance (QA) Engineer for Science Applications International Corporation (SAIC) on the Yucca Mountain Project. As a part of its contract with the U.S. Department of Energy, SAIC is tasked with QA implementation and monitoring of the various Project Participants and includes such functions as QA Audits and surveillances of project activities.

The allegations are summarized and discussion relevant to the concerns are provided in the following text:

A. J-13 Water Samples

This allegation was that there was no evidence that the water was under any controls, and that the water being utilized in various test activities could have been tap water.

Discussion

Mr. Singer was never directly involved in activities related to the collection of water samples. Lawrence Livermore National Laboratory (LLNL) was requested by the Yucca Mountain Project Office (Project Office) to provide the various reports, technical papers, that dealt with this issue in order for the Project Office technical staff to evaluate them. This evaluation was included as part of reference 2. LLNL did provide these reports (Reference 1) as requested and they have since been evaluated as noted above. The Project Office has stated that certain confirmatory tests need to be performed (see Reference 5). The Project Office also has taken the position (Reference 5) that neither the selection of well J-13 as the reference ground water nor the use of well J-13 water in previous tests in itself requires that only water from well J-13 be used in tests. The most significant aspect by the Project Office position is that any water of the same composition as that of well J-13, within reasonable analytical uncertainty, may be used. Thus, the use of surrogate or synthetic J-13 water is acceptable if it can be demonstrated that its composition corresponds to the reference water.

To assure the qualification of existing data, LLNL has been directed to conduct the following actions:

1. Using standard statistical methods, determine the variance of the published chemical compositions of reputed J-13 water. This statistical analysis must take into account the precision of the analyses.

2. Perform the limited confirmatory tests indicated in the attachment to Reference 6 for data needed for licensing and derived from tests that used either well J-13 water or water that conformed to reference J-13 water. These tests should, under approved Quality Assurance (QA) Level I procedures, use well J-13 water collected, labeled, stored, shipped, and analyzed by standard methods prior to use. Specifically, confirmatory tests for spent fuel dissolution and glass release are to be included.
3. Perform a statistical analysis following these tests to determine whether the results of the earlier tests belong to the same population as the confirmatory results. During this analysis, any variation in the composition of well J-13 water must be taken into account.

These actions will be performed as a QA Level I activity in conjunction with ongoing work.

B. Mineral Resources at Yucca Mountain

Mr. Singer's allegation was that an SAIC geologist had prepared a draft version of the Site Characterization Plan (SCP) dealing with the characterization of mineral resources containing statements contrary to project management desires, and that this section of the SCP was modified without allowing the original author sufficient review time for the modified section.

Discussion

The preliminary assessment of mineral resources at Yucca Mountain formed the basis for a part of the Site Characterization Plan Consultation Draft (SCPCD) that was issued in January 1988. This Site Characterization Plan (SCP) was prepared by the U.S. Department of Energy (DOE) in accordance with the requirements of Section 13(b) (1) (A) of the Nuclear Waste Policy Act to summarize the information collected to date about the geologic conditions at the site; to describe the conceptual designs for the repository and the waste package; and to present the plans for obtaining the geologic information necessary to determine the suitability of the site for a repository.

In response to this allegation, this report will first address the separate report that was prepared by sources with no direct involvement with the Yucca Mountain Project (see Reference 3) and the actions taken with respect to the conclusions, and recommendations that the report presented. It will then present additional information from project related sources (Reference 7).

The following three conclusions were stated in the report prepared by this independent source:

1. The Site Characterization Plan (SCP) as it exists at this date (August 1988) has technical validity in those areas examined by this investigation. This relies heavily on Mr. Oakes conclusion that the current draft is essentially the same as his original September 1985 draft. It also depends on adequate resolution of concerns expressed in Mr. Oakes' memo of July 1988 (see "Recommendations" below).
2. The current (Rev. 2) version of the Site Characterization Plan Management Plan and its attendant procedures are adequate. Areas to strengthen implementation do exist and are described below.
3. The SCP development process as it existed in 1985-7 had the potential to produce a flawed process and results. The process allowed Ed Oakes' professional opinions to be subverted for a period of time.

Potential flaws and problem areas identified above resulted in the recommendations stated below.

1. Management attention at the Yucca Mountain Project must stress adherence to established procedures. This includes prompt review and resolution of comments. Time constraints appear to be the most probable causes of procedure violation. If procedures do not provide realistic requirements or schedules, they should be changed instead of violated.
2. Positive actions are needed to assure management and staff understand the existing procedures. A two pronged approach is recommended. First, procedures should be simplified. This is particularly true of QMP-06-03, Document Review/Acceptance/Approval. Second, an aggressive program of training and indoctrination is needed to assure adequate and consistent understanding.
3. A procedure for resolving "Differing Professional Opinion" is needed. Continued development is needed with stress on training/indoctrination and a method for disclosing and resolving differing opinions in a non-adversarial manner.
4. Additional mechanisms for surfacing technical and quality issues should be developed. "Ombudsman" routes could be provided for all staff. Particular emphasis should be placed on QA department personnel's rights and obligations to surface such issues.
5. Ed Oakes' residual concerns (see Reference 8) should be handled via the procedures of Rev. 2 of the SCPMP.

The following provides information regarding what actions have been taken with respect to the recommendations described above resulting from the independent report:

Discussion and Action Taken

1. Management has always stressed the importance of working within the existing procedural framework that has been developed on the Yucca Mountain Project. While time constraints might have compounded the situation, the geologist in question was approached on more than one occasion to re-review this particular section and declined the opportunity.
2. There are currently efforts underway to simplify QMP-06-03 within the Project Office. Training was conducted on the current version and when the new/simplified revision is distributed, training will also be required to assure a consistent and thorough understanding of those requirements. However, it shall be noted that the preparation of the SCP was not governed by the requirements of QMP-06-03, but was prepared in accordance with the requirements of the SCP Management Plan.
3. The Project Office has initiated and drafted a procedure to deal with differing professional opinions. Administrative Procedure AP-5.23Q, "Technical Clarification/disputes Procedure" is in the preparation stage but as of yet has not been distributed.
4. There currently exist several ways in which project personnel can and should voice their concerns over such issues on the Yucca Mountain Project. They are as follows:
 - a) U.S. Department of Energy - Office of Inspector General Employee Hotline. This notice is posted on bulletin boards throughout the Project Office areas and encourages personnel to utilize this service if they should have an awareness of fraud, waste, or mismanagement.
 - b) SAIC Hotline - This notice is also posted on bulletin boards within the Project Office facilities to provide a mechanism in which personnel are requested to report their concerns on contract irregularities, performance problems, or violations of company policies that are not being addressed.

- c) Answer Line - An avenue for confidential communication between Technical and Management Support Services (T&MSS) employees and managers. The purpose of Answer Line is that it is intended to give T&MSS employees another opportunity to communicate confidentially with T&MSS Management. T&MSS employees can submit a query (defined as any question, comment, concern, or opinion expressed by a T&MSS employee and relating to that employee's job or the T&MSS work environment) to Answer Line, and the Program Coordinator of Answer Line will direct it to management. Answer Line is designed to protect the employee's identity before, during, and after the communication process. Through Answer Line, employees can submit a query to management without fear of adverse consequences.
 - d) The Project Office has in addition to the above, developed an Administrative Procedure AP-5.8Q titled "Reporting and Resolution of Quality Concerns." Although this procedure has yet to be distributed, a memo has been issued (Reference #4) describing the methodology for employees wishing to express any concerns they have with the conduct of activities on the Project that they consider unethical, incorrect, improper, or inappropriate in any way. When issued, this procedure will also be available as a method of reporting employee concerns.
 - e) Also in place are two Quality Management Procedures QMP-15-01, and QMP-16-03 which deal with "Control of Nonconformances" and the "Standard Deficiency Reporting System" respectively. These procedures are a more formal process in that the documentation generated as a result of their use becomes part of the Project records.
5. Ed Oakes' residual concerns revolve around the basis that the "long-term" mineral assessment of the Yucca Mountain should, to the extent possible, be based on the favorability of the geological environment for specific types and sizes of mineral accumulations, and that the evaluation should be largely devoid of current economics associated with mineral extraction, and should include the Paleozoic rocks beneath Yucca Mountain. The Mineral Resource investigations in the SCP (Section 8.3.1.9.3) recognize that the evaluations required by 10CRF60 involve a sophisticated evaluation of mineral resource exploitation at times in the distant future. Independent HQ-selected consultants participated with the Project Office scientists in the preparation of the SCP Section 1.7, as well as Section 8.3.1.9.3. The group was able to develop a consensus approach to the problem of mineral resource evaluation, including extrapolations into the future.

In conclusion, the Project Office offers the following related to the allegations:

1. Well J-13 Water

- o The Project Office has taken the position that confirmatory testing will need to be performed.
- o The most significant aspect of the Project Offices' position being that any water of the same composition as well J-13, within reasonable analytical uncertainty may be used.
- o The above actions will be performed as a QA Level I activity in conjunction with ongoing work.

2. Mineral Survey of Yucca Mountain

- o The draft of Chapter 1 of the SCP did not include an adequate Section 1.7 and SAIC was asked to prepare a version that addressed NRC guidance as specified in Reg. Guide 4.17. The method described by Mr. Oakes did not meet the specifications of Reg. Guide 4.17 which called for identification of a specific methodology for mineral resource evaluation. The Technical Review Group, which was chaired by Dr. William Twenhoffel, an independent consultant, rejected the non-standard assessment used by Mr. Oakes and did not judge the information provided about the candidate site adequate in relation to that required by Reg Guide 4.17. Mr. Oakes declined requests to provide comments on the revised SCP section.
- o The Project Office SCP Management Plan was specifically designed with group consensus in mind; formal dispute resolution mechanism was embodied in this concept.
- o There were means provided for elevating unresolved comments to a program review group, and assuring that the resolution of such disputed comments was documented and records of such resolutions were placed in the SCP Project files.

In closing, these allegations have been thoroughly investigated and it is determined that they have not yet impacted the final technical products produced by the Project. The investigations provided several recommendations, which in turn, resulted in action taken by the Project Office that will enhance its technical products. Should the results of the confirmatory tests on Well J-13 water show unfavorable, a course of action will then be planned.



Department of Energy

Nevada Operations Office

P. O. Box 98518

Las Vegas, NV 89193-8518

AUG 12 1988

NN1.880812.0002

Carl P. Gertz, Project Manager, WMPO, NV

WASTE MANAGEMENT PROJECT OFFICE (WMPO) ALLEGATION RESPONSE TO THE U.S. NUCLEAR REGULATORY COMMISSION (NRC)

References: (1) Matrix for Audit Finding Numbers
 (2) Letter, Vieth to Dudley, dtd. 5/11/86
 (3) Letter, Gertz to Technical Project Officers, dtd. 1/12/88
 (4) Letter, Gertz to Hayes, dtd. 2/19/88
 (5) Letter, Blaylock to Gertz, dtd. 5/10/88
 (6) Letter, Ramspott to Gertz, dtd. 5/24/88
 (7) Memorandum, Penland to Estella, dtd. 4/18/88

Enclosed is the response to recent allegations that were presented in February 1988 on several KLAS-TV (Channel 8) newscasts. These allegations were made with respect to the Nevada Nuclear Waste Storage Investigations (NNWSI) Projects Quality Assurance (QA) Program, and revolved around the following four issues:

1. Audit Report 86-6 of the WMPO
2. Geologic Core Samples
3. J-13 Water Samples
4. Mineral Survey of Yucca Mountain

Details of these areas of concern are contained in the report. In addition, letters and back-up data to support the Project Office position are provided.

In summary, I feel that this response to the allegations is suitable to refute all questions/concerns dealing with the QA aspects brought forth as noted.

Should you require any additional data, please feel free to contact me at 794-7913.

James Blaylock

James Blaylock

Project Quality Manager

Waste Management Project Office

WMPO:JB-3212

Enclosure:
 Response to Allegations

AUG 12 1988

Carl P. Gertz

-2-

cc w/encl:
M. E. Spaeth, SAIC, Las Vegas, NV
S. H. Klein, SAIC, Las Vegas, NV
Stephen Metta, SAIC, Las Vegas, NV
J. W. Estella, SAIC, Las Vegas, NV
S. P. Nolan, SAIC, Las Vegas, NV
M. B. Blanchard, WMPO, NV
E. L. Wilmot, WMPO, NV
R. E. Monks, WMPO, NV
W. B. Mansel, WMPO, NV
C. E. Hampton, WMPO, NV

The following report represents an evaluation of the "allegations" presented on several KLAS-TV (Channel 8) newscasts between February 10-12, 1988. This report is at this time only a status report as additional backup data is being gathered to support the WMPO evaluation of these allegations. Additional details and a final report will be issued upon receipt of the backup information.

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This report discusses the four issues that were identified during the newscasts and also describes the evaluation and current status of these allegations. The four issues are as follows:

(1) QA Audit 86-6 conducted on the Waste Management Project Office (WMPO) in Las Vegas, Nevada.

Introductory remarks made by George Knapp of KLAS-TV during his interview with Sam Singer (former SAIC employee) on February 10, 1988, indicated that a number of serious deficiencies were found during the audit and of 49 findings, only 29 made it into the final report. The implication was made that WMPO/DOE wanted to "cover-up" deficiencies within its own organization. This is unfounded. The audit report (86-6) of the internal audit dated October 2, 1986, contains a table (exhibit-1) which shows that the number of deficiencies found was 58 (not 49). It is typical during all QA Audits to group problems of a similar type, because these deficiencies are usually examples of a singular deficiency associated with a particular process and/or activity. Thus, the initial 58 findings were consolidated into 29 deficiencies. This facilitates a response from the deficient organization and simplifies identification of the action necessary to preclude these problems from occurring again.

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Encl.

(2) GEOLOGICAL CORE SAMPLES

On February 25, 1986, a surveillance was performed at the U.S. Geological Survey (USGS) Nevada Test Site (NTS) Core Library (see attached surveillance # WMPO/NV-SR-86-022, Exhibit 2). The surveillance team consisted of representatives from both WMPO/DOE and SAIC/Technical & Management Support Services. The team was checking the validity of data resulting from gathered samples.

Based upon information obtained during the performance of this surveillance, it was determined that a variety of deficiencies existed in core sample control activities. These deficiencies included procedural noncompliance, procedural inadequacies, failure to generate adequate documentation to support traceability of the core from the drill hole to the core boxed in the USGS-NTS Core Library, and failure to protect the core from access by unauthorized personnel. The report further directed the Sample Overview Committee (SOC) to suspend issuance of all NNWSI Project-related core samples until the deficiencies described in the report were resolved. Mr. Singer was never directly involved in the surveillance or interpretation of scientific data resulting from the geologic core samples. He did not review data from either a technical or quality perspective. There was no attempt to cover-up this deficiency. In fact, the problem was discussed in open forums with both the U.S. Nuclear Regulatory Commission and State of Nevada representatives present. More importantly, the problem was recognized and corrective action has been instituted to assure the problem will not recur.

A comprehensive review of all records and logs for USW-G4 (which was agreed as the best documented hole) has revealed that the method of handling, storage, and identification of core do not meet licensing requirements, i.e., implementation of a QA Program meeting the requirements of 10CFR60, subpart-G (reference letter JB-777 dated 1-12-88 exhibit-3) The core samples collected may be used as corroborative data or, at a later date, as primary data if this is found to be acceptable through procedures for the qualification of existing data not generated under a 10CFR60, subpart-G QA program (reference letter JB-118 dated 2/19/88, exhibit-4) As a separate effort, steps are being taken to ensure standard drilling practices are developed for future activities to avoid problems of this nature (reference letter JB-1980 dated 5-10-88, exhibit-5)

(3) J-13 WATER SAMPLES

Mr. Singer was never directly involved in activities related to the collection of water samples. The only deficiency related to water sample collection involved the application of Nevada Tests Site (NTS) procedures to the actual collection process. Under the NNWSI QA Program, this was found to be in violation and corrective action has been implemented. There has never been a condition where samples have been falsified. In support of this position, Lawrence Livermore National Laboratory (LLNL) has provided the WMPO with its reply regarding water samples used for testing (see letter NNM: 88-090 dated 5-24-88, exhibit-6). This letter clearly shows that due to chemical analysis differences between J-13 water, NTS tap water, and/or LLNL tap water, the possibility of using anything but J-13 water is impossible.

The conclusion is that LLNL does not feel the statements as presented by Mr. Singer have any validity and that they are unfounded. The documentation that LLNL has referenced, and will provide, will be evaluated by the WMPO Technical staff to ensure it meets project guidelines. This effort should be completed by August 1, 1988.

(4) MINERAL STUDY OF YUCCA MOUNTAIN

Mr. Singer stated that he was in a position to hear, at one time, that a geologist at SAIC (Las Vegas) had written a report concerning the mineral and geologic wealth/value of Yucca Mountain. It was further stated that this geologist was told that WMPO/SAIC did not want any mineral content specified.

The mineral survey conducted at Yucca Mountain formed the basis for a part of the Site Characterization Plan Consultation Draft (SCPCD) that was issued in January 1988.

This Site Characterization Plan (SCP) was prepared by the U.S. Department of Energy (DOE) in accordance with the requirements of Section 13(B) (1) (A) of the Nuclear Waste Policy Act to summarize the information collected to date about the geologic conditions at the site; to describe the conceptual designs for the repository and the waste package; and to present the plans for obtaining the geologic information necessary to demonstrate the suitability of the site for repository.

The aforementioned geologist involved with the mineral survey of Yucca Mountain will review the data as presented in the SCP consultation draft and determine whether it is consistent with his original submittal. In addition, a separate report investigating the allegations concerning mineral resources evaluation will be conducted by sources with no direct involvement with the NWSI Project (see memorandum, Penland to Estella dated 4-18-88, exhibit-7). The letter identifies a draft outline and proposed schedule. This information, when completed, will be presented to the WMPO in the final report.

IN CONCLUSION, WMPO OFFERS THE FOLLOWING:

- (1) The 86-6 audit of WMPO did not warrant a "Stop Work" order based strictly upon the "number of findings as they had little or no impact on the quality of scientific and/or technical work being performed.
- (2) The Geologic Core samples in question will not be utilized for determining the suitability for licensing Yucca Mountain as the repository, unless they meet the strict guidelines established by the NRC for acceptance of data not generated under a 10CFR60 subpart G QA Program and found acceptable under that criteria.
- (3) J-13 water samples would not, and could not be falsified due to chemical analysis differences between J-13 water, NTS Tap water, and/or LLNL Tap water.

(4) The mineral survey information of Yucca Mountain as presented in the Site Characterization Plan/Consultative Draft will be reviewed by the geologist originally responsible for that data, and he will determine whether it is consistent with what he prepared and submitted.

(5) The assertions that "Shoddy Data" were upgraded and used has not been substantiated. Although the NNWSI Project does have provisions for upgrading data, it is subject to rigid procedure/requirements that are consistent with the Nuclear Regulatory Commission guidance on this issue. To date, no data has been upgraded on the NNWSI Project.

(6) A final report will be provided summarizing all technical evaluations that are currently ongoing. This report should be completed in August 1988.

SCIENCE APPLICATIONS INTERNATIONAL CORPORATION

Inter-Office Memorandum

April 18, 1988

TO: JOHN ESTELLA
FROM: JOE PENLAND
SUBJECT: ALLEGATIONS INVESTIGATION



Attached you will find the draft outline and our current schedule. Instead of expanding the outline to greater granularity, I have actually collapsed it and given a brief definition of the content.

The schedule does not include DOE interfaces. These must be managed in the T&MSS. Please feel free to alter the outline or schedule to better address your needs. However, please inform me of any changes and do not unilaterally accelerate the schedule.

cc: E. Cleveland

**REPORT ON INVESTIGATIONS INTO ALLEGATIONS
CONCERNING MINERAL RESOURCES EVALUATION IN THE SCP**

DRAFT OUTLINE

- 1.0 Introduction and Objectives
- Explain objectives of identifying any weaknesses in formal document development and review and peer review in general. Develop concrete recommendations for enhancements.
- 2.0 Background
- Brief description of SCP development process. Describe Singer allegations and the background - as supported by documentable fact - of the mineral resources evaluation.
- 3.0 Investigation Process
- Interviews
 - Identification of pertinent documentation
 - Evaluation of SCP Management Plan, Appropriate QA procedures, Peer Review Procedures.
 - Identification of any weak points
 - Development of Recommendations
- 4.0 Event Evaluation
- Present conclusions on technical validity of SCP as in final form
 - Areas of potential problems
- 5.0 Procedure Evaluations
- 6.0 Recommendations
- Procedure Changes
 - Management Oversight Recommendations
- 7.0 References

Appendices

- A - Singer Transcript (as appropriate)
- B - Pertinent Sections of Procedures

REPORT COMPLETION SCHEDULE

(REVISED 4/18/88)

- Complete Interviews (Pratt, Tunafeld) 5/3/88
- Complete Analysis of Procedures 5/9/88
- Develop Procedural Recommendations 5/16/88
- Draft Recommendations discussed with T&MSS Management 5/20/88
- Draft Report 5/25/88
- Resolution of Comments TBD
- Discussion with DOE TBD



Department of Energy

Nevada Operations Office
P. O. Box 98518
Las Vegas, NV 89193-8518
NOV 09 1989

WBS 1.2.9.3

QA RECEIVED

NOV 10 1989

Carl P. Gertz, Project Manager, YMP, NV

YUCCA MOUNTAIN PROJECT OFFICE (PROJECT OFFICE) REFERENCES RELATED TO ALLEGATION REPORT

Reference: Letter, Wilmot to Gertz, dtd. 10/26/89

Enclosed are the references that were inadvertently not included as part of the allegation report transmitted to you on October 26, 1989, dealing with J-13 Water Samples and the Mineral Resource Evaluation at Yucca Mountain.

These letters and backup data were used to support the Project Office position with respect to the allegations.

Should you require any additional data, please contact me at 794-7137.

Donald G. Horton, Director
Quality Assurance Division
Yucca Mountain Project Office

YMP:DGH-717

Enclosure:
Reference material

cc w/encl:

D. E. Shelor, HQ (RW-3) FORS
Ralph Stein, HQ (RW-30) FORS
S. R. Dippner, SAIC, Las Vegas, NV, 517/T-08
J. W. Estella, SAIC, Las Vegas, NV, 517/T-08
G. P. Fehr, SAIC, Las Vegas, NV, 517/T-12
J. R. Kirk, SAIC, Las Vegas, NV, 517/T-38
J. H. Nelson, SAIC, Las Vegas, NV, 517/T-04
R. J. Bahorich, W, Las Vegas, NV, 517/T-12



NHM:88-090

BEST AVAILABLE COPY

May 24, 1988

Carl P. Gertz, Project Manager
Waste Management Project Office
U.S. Department of Energy
P.O. Box 98518
Las Vegas NV 89193-8518

In a television interview aired on February 10, 1988, Mr. Sam Singer made false and inaccurate statements regarding Lawrence Livermore National Laboratory's performance of tests in support of the Nevada Nuclear Waste Storage Investigations. We take exception to Mr. Singer's statements and wish to set the record straight.

Below you will find LLNL's response to the specific allegations made by Mr. Singer. Supporting documentation is attached.

Issue No. 1: Mr. Singer stated, "There were (sic) no documented evidence that the water was under control." This statement is false and inaccurate. Anytime water has been collected by LLNL personnel at well J-13 a documentary record was established and maintained by the individuals sampling the water. These records are supplemented by laboratory procedures providing for chemical analyses of the water used in tests and experiments. Thus, a documented system of control exists that includes information about the sampling process and chemical composition of the water used in tests and experiments. The documentation meets the standards of the QA program in place at the time the work started on each test or experiment.

Issue No. 2: Mr. Singer stated, "It could have been tap water." This statement is false and inaccurate. The water from well J-13 has had dozens of full and partial analyses by many organizations and laboratories over a span of 25 years. It has a well-known "geochemical signature" being a sodium-bicarbonate-type water from a tuff aquifer. A glance at the attached table shows that J-13 water is readily distinguished from either Livermore, California or Mercury, Nevada tap water.

LLNL possesses records showing that analyses of the water were done at the start of most experiments and all Level I tests. These analyses were done to verify that the water used in the test had not changed during storage. These analyses also demonstrate that the correct water was used.

SAIC/T & MSS

BACKUP INFORMATION 6

MAY 27 1988

EXHIBIT

ENCLOSURE

May 24, 1988

We have collected and enclosed reports for work in which J-13 water was used in support of LLNL-NMMP activities (see attached list). Most of these are full reports of laboratory tests rather than summaries, symposium proceedings, or secondary references. On the front cover of each report pertinent pages are noted, and references to blank samples are highlighted on these pages. Use of "tap water" would be clearly evident had it been used.

Issue No. 3: Mr. Singer stated, "It was falsely upgraded and used anyway." This statement is false and inaccurate. Each LLNL collection of J-13 well water has been conducted at Quality Assurance Level III, "good professional practice." LLNL has never claimed otherwise. It has been our professional view that there was no need for forensic-level collection of J-13 water because the experimenter could always check the water prior to use. J-13 water has been used in tests and experiments ranging from QA Level I to III. In each instance when J-13 water has been used in a QA Level I activity, the water has been subject to chemical analyses using approved procedures.

If you have further questions regarding this matter please do not hesitate to contact me.



L. Ramspott
LLNL Technical Project Officer
for NNWSI

Attachments
Enclosures

xc: w/attach. w/o enc.
John Estrella, SAIC

CHEMICAL COMPOSITION OF WATER
(in ppm, except pH)

	J-13 ¹	NTS TAP WATER ²	LLNL TAP WATER ³
SiO ₂	57.8	19.0	4.4
Na	43.9	37.7	1.0
K	5.1	5.5	<1.0
Ca	12.5	45.1	5.1
Mg	1.9	21.6	.35
HCO ₃	125.3	275.1	8.3
SO ₄	18.7	54.3	2.5
NO ₃	9.6	--	1.1
Cl	6.9	16.3	2.0
F	2.2	.95	0.5
pH	7.6	7.4	6.8

¹J.M. Delany (1985) Reaction of Topopah Spring Tuff with J-13 Water: A geochemical modeling approach using the EQ3/6 reaction path code, UCRL-53631.

²I.J. Winograd and F.J. Pearson, Jr. (1976) Major carbon 14 anomaly in a regional carbonate aquifer: Possible evidence for megascale channeling, South-Central Great Basin, Water Resources Research, V.12, No. 6, p. 1125-43

³Unpublished data from Kevin Knauss' files

NNWSI Reports

Listed chronologically

- ✓ UCRL-53442 Oversby and Knauss, "Reaction of Bullfrog Tuff with J-13 Well Water at 90°C and 150°C" (September 1983)
- ✓ UCRL 53521 Knauss, "Hydrothermal Interaction Studies of Bullfrog Member Tuff Core Wafers in J-13 Water at 150°C: Quantitative Analyses of Aqueous and Solid Phases" (February 1984)
- ✓ UCRL-89475 Knauss, Oversby, and Wolery, "Post Emplacement Environment of Waste Packages" (1984)
- ✓ UCRL 53552 Oversby, "Reaction of the Topopah Spring Tuff with J-13 Well Water at 90°C and 150°C" (May 1984)
- ✓ UCRL-53574 Oversby, "Reaction of the Topopah Spring Tuff with J-13 Water at 120°C" (July 1984)
- ✓ UCRL-53576 Knauss and Beiriger, "Report on Static Hydrothermal Alteration Studies of Topopah Spring Tuff Wafers in J-13 Water at 150°C" (August 1984)
- ✓ UCRL-90818 Bates and Oversby, "The Behavior of Actinide Containing Glasses During Gamma Irradiation in a Saturated Tuff Environment" (November 1984)
- ✓ ANL-84-81 Bates and Gerding, "NNWSI Phase II Materials Interaction Test Procedure and Preliminary Results" (January 1985)
- ✓ UCRL 15723 Bates and Gerding, "NNWSI Waste Form Test Method for Unsaturated Disposal Conditions" (March 1985)
- ✓ UCRL 53629 Oversby, "The Reaction of Topopah Spring Tuff with J-13 Water at 150°C--Samples from Drill Cores USW G-1, USW GU-3, USW G-4, and UE-25h#1" (March 1985)
- ✓ UCRL-91464 Wilson and Oversby, "Radionuclide Release from PWR Fuels in a Reference Tuff Repository Groundwater" (March 1985)
- ✓ UCRL-53606 Bazan and Rego, "Parametric Testing of a DWPF Glass" (March 1985)
- ✓ UCRL-53630 Knauss, Beiriger, and Peifer, "Hydrothermal Interaction of Crushed Topopah Spring Tuff and J-13 Water at 90, 150, and 250°C Using Dickson-Type, Gold-Bag Rocking Autoclaves" (May 1985)
- ✓ UCRL-53645 Knauss, Beiriger, Peifer, and Piwinski, "Hydrothermal Interaction of Solid Wafers of Topopah Spring Tuff with J-13 Water and Distilled Water at 90, 150, and 250°C Using Dickson-Type, Gold-Bag Rocking Autoclaves" (September 1985)

- ✓ UCRL-83631 Delany, "Reaction of Topopah Spring Tuff with J-13 Water: A Geochemical Modeling Approach Using the EQ3/6 Reaction Path Code" (November 1985)
- ✓ ANL 85-62 Bates, Fischer, and Gerding, "The Reaction of Glass During Gamma Irridation in a Saturated Environment Part 1: SRL 165 Glass" (February 1986)
- ✓ HEDL-7377 Wilson, "Test Plan for Series 3 NNWSI Spent Fuel Leaching/Dissolution Tests" (April 1986)
- ✓ UCRL-53719 Van Konynenburg, "Radiation Chemical Effects in Experiments to Study the Reaction of Glass in an Environment of Gamma-Irradiated Air, Groundwater, and Tuff" (May 1986)
- ✓ ANL-85-41 Bates and Gerding, "One-Year Results of the NNWSI Unsaturated Test Procedure: SRL 165 Glass Application" (August 1986)
- ✓ UCRL-53795 Knauss and Peifer, "Reaction of Vitric Topopah Spring Tuff and J-13 Ground Water under Hydrothermal Conditions Using Dickson-Type, Gold-Bag Rocking Autoclaves" (November 1986)
- ✓ UCRL-94633 Wilson and Shaw, "Experimental Study of the Dissolution Spent Fuel at 85°C in Natural Ground Water" (December 1986)
- ✓ UCRL-21019 Wilson, "Recent Results from NNWSI Spent Fuel Leaching/Dissolution Tests" (April 1987)
- ✓ HEDL-TME-85-22 Wilson, "Results from Cycles 1 and 2 of NNWSI Series 2 Spent Fuel Dissolution Tests" (May 1987)
- ✓ UCRL-53722 Knauss, Beiriger, and Peifer, "Hydrothermal Interaction of Solid Wafers of Topopah Spring Tuff with J-13 Water at 90 and 150°C Using Dickson-Type, Gold-Bag Rocking Autoclaves: Long-Term Experiments" (May 1987)
- ✓ UCRL-21013 Wilson, "Summary of Results from the Series 2 and Series 3 NNWSI Bare Fuel Dissolution Tests" (November 1987)
- ✓ UCRL-21005 Westerman, Pitman, and Haberman, "Corrosion Testing of Type 304L Stainless Steel in Tuff Groundwater Environments" (November 1987)
- ✓ UCRL-94664 Knauss, "Zeolitization of Glassy Topopah Spring Tuff Under Hydrothermal Conditions" (1987)



Department of Energy

Nevada Operations Office
P O. Box 98518
Las Vegas, NV 89193-8518

AUG 12 1988

REFERENCE

NW1-RR0817-00007

Carl P. Gertz, Project Manager, WMPO, NV

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James Blaylock
James Blaylock
Project Quality Manager
Waste Management Project Office

WMPO:JB-3212

Enclosure:
Response to Allegations

AUG 12 1988

Carl P. Gertz

-2-

cc w/enci:

- M. E. Spaeth, SAIC, Las Vegas, NV
- S. H. Klein, SAIC, Las Vegas, NV
- Stephen Metta, SAIC, Las Vegas, NV
- J. W. Estella, SAIC, Las Vegas, NV
- S. P. Nolan, SAIC, Las Vegas, NV
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Encl.

(2) GEOLOGICAL CORE SAMPLES

On February 25, 1986, a surveillance was performed at the U.S. Geological Survey (USGS) Nevada Test Site (NTS) Core Library (see attached surveillance # WMPO/NV-SR-86-022, Exhibit 2). The surveillance team consisted of representatives from both WMPO/DOE and SAIC/Technical & Management Support Services. The team was checking the validity of data resulting from gathered samples.

Based upon information obtained during the performance of this surveillance, it was determined that a variety of deficiencies existed in core sample control activities. These deficiencies included procedural noncompliance, procedural inadequacies, failure to generate adequate documentation to support traceability of the core from the drill hole to the core boxed in the USGS-NTS Core Library, and failure to protect the core from access by unauthorized personnel. The report further directed the Sample Overview Committee (SOC) to suspend issuance of all NNWSI Project-related core samples until the deficiencies described in the report were resolved. Mr. Singer was never directly involved in the surveillance or interpretation of scientific data resulting from the geologic core samples. He did not review data from either a technical or quality perspective. There was no attempt to cover-up this deficiency. In fact, the problem was discussed in open forums with both the U.S. Nuclear Regulatory Commission and State of Nevada representatives present. More importantly, the problem was recognized and corrective action has been instituted to assure the problem will not recur.

A comprehensive review of all records and logs for USW-G4 (which was agreed as the best documented hole) has revealed that the method of handling, storage, and identification of core do not meet licensing requirements, i.e., implementation of a QA Program meeting the requirements of 10CFR60, subpart-G (reference letter JB-777 dated 1-12-88 exhibit-3) The core samples collected may be used as corroborative data or, at a later date, as primary data if this is found to be acceptable through procedures for the qualification of existing data not generated under a 10CFR60, subpart-G QA program (reference letter JB-118 dated 2/19/88, exhibit-4) As a separate effort, steps are being taken to ensure standard drilling practices are developed for future activities to avoid problems of this nature (reference letter JB-1980 dated 5-10-88, exhibit-5)

(3) J-13 WATER SAMPLES

Mr. Singer was never directly involved in activities related to the collection of water samples. The only deficiency related to water sample collection involved the application of Nevada Tests Site (NTS) procedures to the actual collection process. Under the NNWSI QA Program, this was found to be in violation and corrective action has been implemented. There has never been a condition where samples have been falsified. In support of this position, Lawrence Livermore National Laboratory (LLNL) has provided the WMPO with its reply regarding water samples used for testing (see letter NNM: 88-090 dated 5-24-88, exhibit-6). This letter clearly shows that due to chemical analysis differences between J-13 water, NTS tap water, and/or LLNL tap water, the possibility of using anything but J-13 water is impossible.

The conclusion is that LLNL does not feel the statements as presented by Mr. Singer have any validity and that they are unfounded. The documentation that LLNL has referenced, and will provide, will be evaluated by the WMPO Technical staff to ensure it meets project guidelines. This effort should be completed by August 1, 1988.

(4) MINERAL STUDY OF YUCCA MOUNTAIN

Mr. Singer stated that he was in a position to hear, at one time, that a geologist at SAIC (Las Vegas) had written a report concerning the mineral and geologic wealth/value of Yucca Mountain. It was further stated that this geologist was told that WMPO/SAIC did not want any mineral content specified.

The mineral survey conducted at Yucca Mountain formed the basis for a part of the Site Characterization Plan Consultation Draft (SCPCD) that was issued in January 1988.

This Site Characterization Plan (SCP) was prepared by the U.S. Department of Energy (DOE) in accordance with the requirements of Section 13(B) (1) (A) of the Nuclear Waste Policy Act to summarize the information collected to date about the geologic conditions at the site; to describe the conceptual designs for the repository and the waste package; and to present the plans for obtaining the geologic information necessary to demonstrate the suitability of the site for repository.

The aforementioned geologist involved with the mineral survey of Yucca Mountain will review the data as presented in the SCP consultation draft and determine whether it is consistent with his original submittal. In addition, a separate report investigating the allegations concerning mineral resources evaluation will be conducted by sources with no direct involvement with the NNWSI Project (see memorandum, Penland to Estella dated 4-18-88, exhibit-7). The letter identifies a draft outline and proposed schedule. This information, when completed, will be presented to the WMPO in the final report.

IN CONCLUSION, WMPO OFFERS THE FOLLOWING:

- (1) The 86-6 audit of WMPO did not warrant a "Stop Work" order based strictly upon the "number of findings as they had little or no impact on the quality of scientific and/or technical work being performed.
- (2) The Geologic Core samples in question will not be utilized for determining the suitability for licensing Yucca Mountain as the repository, unless they meet the strict guidelines established by the NRC for acceptance of data not generated under a 10CFR60 subpart G QA Program and found acceptable under that criteria.
- (3) J-13 water samples would not, and could not be falsified due to chemical analysis differences between J-13 water, NTS Tap water, and/or LLNL Tap water.

(4) The mineral survey information of Yucca Mountain as presented in the Site Characterization Plan/Consultative Draft will be reviewed by the geologist originally responsible for that data, and he will determine whether it is consistent with what he prepared and submitted.

(5) The assertions that "Shoddy Data" were upgraded and used has not been substantiated. Although the NWSI Project does have provisions for upgrading data, it is subject to rigid procedure/requirements that are consistent with the Nuclear Regulatory Commission guidance on this issue. To date, no data has been upgraded on the NWSI Project.

(6) A final report will be provided summarizing all technical evaluations that are currently ongoing. This report should be completed in August 1988.

SCIENCE APPLICATIONS INTERNATIONAL CORPORATION

Inter-Office Memorandum

April 18, 1988

TO: JOHN ESTELLA
FROM: JOE PENLAND
SUBJECT: ALLEGATIONS INVESTIGATION

Joe Penland

Attached you will find the draft outline and our current schedule. Instead of expanding the outline to greater granularity, I have actually collapsed it and given a brief definition of the content.

The schedule does not include DOE interfaces. These must be managed in the T&MSS. Please feel free to alter the outline or schedule to better address your needs. However, please inform me of any changes and do not unilaterally accelerate the schedule.

cc: E. Cleveland

**REPORT ON INVESTIGATIONS INTO ALLEGATIONS
CONCERNING MINERAL RESOURCES EVALUATION IN THE SCP**

DRAFT OUTLINE

- 1.0 Introduction and Objectives
 - Explain objectives of identifying any weaknesses in formal document development and review and peer review in general. Develop concrete recommendations for enhancements.
- 2.0 Background
 - Brief description of SCP development process. Describe Singer allegations and the background - as supported by documentable fact - of the mineral resources evaluation.
- 3.0 Investigation Process
 - Interviews
 - Identification of pertinent documentation
 - Evaluation of SCP Management Plan, Appropriate QA procedures, Peer Review Procedures.
 - Identification of any weak points
 - Development of Recommendations
- 4.0 Event Evaluation
 - Present conclusions on technical validity of SCP as in final form
 - Areas of potential problems
- 5.0 Procedure Evaluations
- 6.0 Recommendations
 - Procedure Changes
 - Management Oversight Recommendations
- 7.0 References

Appendices

- A - Singer Transcript (as appropriate)
- B - Pertinent Sections of Procedures

REPORT COMPLETION SCHEDULE

(REVISED 4/18/88)

- Complete Interviews (Pratt, Tunafeld) 5/3/88
- Complete Analysis of Procedures 5/9/88
- Develop Procedural Recommendations 5/16/88
- Draft Recommendations discussed with T&MSS Management 5/20/88
- Draft Report 5/25/88
- Resolution of Comments TBD
- Discussion with DOE TBD

SCIENCE APPLICATIONS INTERNATIONAL CORPORATION

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cc: E. Cleveland

**REPORT ON INVESTIGATIONS INTO ALLEGATIONS
CONCERNING MINERAL RESOURCES EVALUATION IN THE SCP**

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Science Applications International Corporation

REFERENCE ↓

M89-TD-BCH-052

WBS # 1.2.9.1

QA: N/A

INTEROFFICE MEMO

DATE: September 27, 1989
TO: T&MSS Staff
FROM: *Will* John H. Nelson
SUBJECT: Method for Reporting Technical or Quality Concerns

It is the objective of this organization that work conducted on the T&MSS contract for the Yucca Mountain Project in Las Vegas, NV, for the U.S. Department of Energy be conducted in a professional and workmanlike manner. It is also important that the work be performed in strict accordance with all contract requirements, specifications, regulations, and applicable laws. All T&MSS employees have the right and are expected to express any concerns they have with the conduct of activities on the Project that they consider unethical, incorrect, improper, or inappropriate in any way. Notifications of employee concerns will be addressed, appropriate resolutions will be sought, and the employee will be informed of the results.

No reprisals, intimidation, or harassment of any kind associated with any employee concern notification will be tolerated by T&MSS management. Disciplinary measures appropriate to the offense shall be applied to any employees who violate the requirements of this policy.

Please read the enclosed policy carefully, then sign the acknowledgment and return it to Personnel by October 11, 1989. If you have any questions concerning the policy, please call William Devlin at extension 7727.

JHN:BCH:lkt

Enclosure:
As stated

REPORTING OF CONCERNS OR DEFICIENCIES RELATED TO
TECHNICAL OR QUALITY ASSURANCE REQUIREMENTS

The Yucca Mountain Project will be critical to the safe long-term isolation of radioactive waste if Yucca Mountain is selected as the site of the nation's high-level radioactive waste repository. T&MSS has a special role in the Project, and our performance must be excellent for the Project and T&MSS to be successful. If concerns exist regarding our overall application of some regulatory requirements, this policy will ensure that corrective action is taken with regard to adherence to technical and quality assurance requirements.

Employees are encouraged to discuss concerns with their immediate supervisors/management and to attempt to achieve resolution by interacting with management. This communication may be informal and oral, with no need for documentation. If for any reason an employee feels that he/she cannot discuss the concern with an immediate supervisor/manager, the concern may be raised through other channels, including those listed below. Additionally, if the employee expresses a concern to an immediate supervisor/manager and the response is unsatisfactory, or if the employee believes he/she has been subject to reprisal, harassment, or intimidation as a result of raising concerns, the employee is encouraged to raise these issues through other channels. In all cases, however, when you observe what you consider a concern, it should immediately be brought to the attention of your management. The primary avenues through which concerns may be addressed include the following:

- o A higher level manager within T&MSS.
- o The Project QA Manager.
- o Corporate Management outside the Project.

SAIC:

Joe Penland (619) 458-4908

Tom Trevino (619) 458-2770

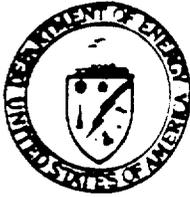
Harza:

Pete Conroy (312) 855-7558

If an employee desires to formally document a concern, or if a written response is preferred, the employee should use one of the several reporting systems currently in place for this purpose. The T&MSS AnswerLine, for instance, is available for those employees who have questions or concerns regarding T&MSS management practices and who want a response directly from T&MSS management, but who prefer to remain anonymous. The SAIC Hotline, which is primarily an avenue for addressing ethics- and quality-related concerns, will ensure that the employee receives a response from a corporate officer. As with the T&MSS AnswerLine, the employee may remain anonymous when using the SAIC Hotline. OMP-16-03, Standard Deficiency Reporting System, is available for reporting technical and/or quality assurance requirement deficiencies. The Standard Deficiency Reporting procedure is a more formal process that becomes part of the Project records. These programs are summarized below.

<u>Reporting System</u>	<u>Purpose/Objective</u>	<u>Who Responds</u>
T&MSS AnswerLine	To allow confidential inquiry or expression of concerns to T&MSS management. (Employee's identity remains anonymous.)	Queried T&MSS manager (or a manager deemed appropriate by the AnswerLine coordinator)
SAIC Hotline	To address ethics- or quality-related concerns.	SAIC corporate officer
QMP-16-03	To formally record (and address) technical or quality assurance requirement deficiencies.	QA Engineering staff

The Yucca Mountain Project Office is scheduled to issue Project Administrative Procedure AP-5.8Q, Reporting and Resolving Quality Concerns. When issued, this procedure will also be available as a method of reporting employee concerns.



Department of Energy

Nevada Operations Office
P. O. Box 98518
Las Vegas, NV 89193-8518

OCT 02 1989

REFERENCE 5

WBS 1.2.9
QA

QA RECEIVED

OCT 03 1989

Leslie J. Jardine
Technical Project Officer for Yucca Mountain Project
Lawrence Livermore National Laboratory
P.O. Box 5514, L-217
Livermore, CA 94551

QUALIFICATION OF DATA ACQUIRED FROM TESTS USING WELL J-13 WATER (NN1-1990-

- References: (1) Yucca Mountain Project Quality Assurance Surveillance Report YMP-SR-88-020
(2) Memo, Voegele to Metta, dtd. 4/21/89
(3) Letter, Jardine to Little, dtd. 8/11/89
(4) Letter, Jardine to Little, dtd. 9/14/89

The Yucca Mountain Project Office (Project Office) concurs with the report transmitted with Reference 3 stating that certain confirmatory tests need to be performed. The Project Office also takes the position that neither the selection of well J-13 water as the reference ground water nor the use of well J-13 water in previous tests does in itself require that only water from well J-13 be used in tests. Rather, it means that water of the same composition as well J-13 water, within reasonable analytical uncertainty, may be used. In other words, the test water must conform to the reference if the study plan calls for reference water, but the reference itself does not necessarily have to be used. Thus, the use of surrogate or synthetic J-13 water is acceptable if it can be demonstrated that its composition corresponds to the reference.

This does not mean that study plans must be restricted to using only well J-13 water, because it is desirable to evaluate both the effect of any water that may contact the waste package, which could differ from well J-13 water and of variations in water chemistry on the performance of waste package materials.

To assure the qualification of existing data, you are directed to conduct the following actions:

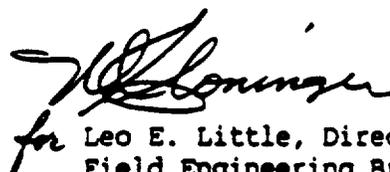
1. Using standard statistical methods, determine the variance of the published chemical compositions of reputed J-13 water. The Project Office is aware that an existing internal report from Lawrence Livermore National Laboratory may satisfy this action. This statistical analysis must take into account the precision of the analyses.

OCT 02 1989

2. Perform the limited confirmatory tests indicated in the attachment to Reference 3 for data needed for licensing and derived from tests that used either well J-13 water or water that conformed to reference J-13 water. These tests should, under approved Quality Assurance (QA) Level I procedures, use well J-13 water collected, labeled, stored, shipped, and analyzed by standard methods prior to use. Specifically, confirmatory tests for spent fuel dissolution and glass release are to be included. Other tests (e.g., water/rock interaction) that used actual or synthetic J-13 water were QA Level III activities and, therefore, do not need to be qualified.
3. Perform a statistical analysis following these tests to determine whether the results of the earlier tests belong to the same population as the confirmatory results. During this analysis, any variation in the composition of well J-13 water must be taken into account.

These actions must be performed at QA Level I in conjunction with ongoing work.

If you have any questions, please contact Michael O. Cloninger of my staff at (702) 794-7847 or FTS 544-7847, or Paul L. Cloke of Science Applications International Corporation at (702) 794-7823 or FTS 544-7823.



for Leo E. Little, Director
Field Engineering Branch
Engineering and Development Division
Yucca Mountain Project Office

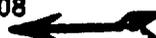
YMP:MOC-6002

Enclosures:

1. Yucca Mountain Project Quality Assurance Report (YMP-SR-88-020)
2. Memo 4/21/89 Voegele to Metta
3. Ltr 8/11/89 Jardine to Little
4. Ltr 9/14/89 Jardine to Little

cc w/encls:

- R. J. Bahorich, W, Las Vegas, NV, 517/T-37
- M. D. Voegele, SAIC, Las Vegas, NV, 517/T-03
- Stephen Metta, SAIC, Las Vegas, NV, 517/T-38
- D. B. Jorgenson, SAIC, Las Vegas, NV, 517/T-24
- M. J. Mitchell, SAIC, Las Vegas, NV, 517/T-22
- R. P. Morissette, SAIC, Las Vegas, NV, 517/T-14
- P. L. Cloke, SAIC, Las Vegas, NV, 517/T-14
- Carolyn Rutland, SAIC, Las Vegas, NV, 517/T-24
- S. P. Nolan, SAIC, Las Vegas, NV, 517/T-08





Department of Energy

Nevada Operations Office

P. O. Box 98518

Las Vegas, NV 89193-8518

WBS #1.2.9.3

"QA"

APR 28 1989

Leslie J. Jardine
Technical Project Officer for Yucca Mountain Project
Mail Stop L-204
Lawrence Livermore National Laboratory
University of California
P.O. Box 808
Livermore, CA 94550

YUCCA MOUNTAIN PROJECT QUALITY ASSURANCE SURVEILLANCE REPORT YMP-SR-88-020

Enclosed is a copy of the subject report on a surveillance conducted September 13 and 14, 1988, at the Lawrence Livermore National Laboratory (LLNL) facilities in Livermore, California. The purpose of the surveillance was to determine whether allegations regarding the control of well J-13 water used in LLNL experiments were valid. As stated in the enclosed report, it will be necessary for LLNL to comply with the requirements of AP-5.9Q, "Qualification of Data or Data Analyses Not Developed Under the Yucca Mountain Project Quality Assurance Plan," to utilize any such data or data analyses in support of licensing for the Yucca Mountain Project.

The cooperation provided to the surveillance team by the LLNL representatives contacted was appreciated.

If you have any questions regarding this surveillance, please contact me at (702) 794-7913 or FTS 544-7913.

James Blaylock
Project Quality Manager
Yucca Mountain Project Office

YMP:JB-3538

Enclosure:
YMP-SR-88-020

cc w/encl:

J. H. Nelson, SAIC, Las Vegas, NV
Stephen Metta, SAIC, Las Vegas, NV
J. W. Estella, SAIC, Las Vegas, NV
K. B. Johnson, SAIC, Las Vegas, NV
S. P. Nolan, SAIC, Las Vegas, NV
E. P. Ripley, SAIC, Las Vegas, NV
Carolyn Rutland, SAIC, Las Vegas, NV
J. A. Huston, SAIC, Las Vegas, NV

ENCLOSURE /

YUCCA MOUNTAIN PROJECT OFFICE
QUALITY ASSURANCE SURVEILLANCE REPORT
OF LAWRENCE LIVERMORE NATIONAL LABORATORY

SURVEILLANCE NUMBER YMP-SR-88-020
CONDUCTED SEPTEMBER 13-14, 1988

LAWRENCE LIVERMORE ACTIVITIES SURVEILLED:
ALLEGATIONS REGARDING THE CONTROL OF WELL J-13
WATER USED IN LAWRENCE LIVERMORE EXPERIMENTS

PREPARED BY: Stevan P. Nolan Caroleen Rutland DATE: 4/20/89 4/20/89
S. P. NOLAN/C. RUTLAND

APPROVED BY: [Signature] DATE: 4/25/89
I. W. Nolan for E.P. Ripley
DIVISION MANAGER, SURVEILLANCES 4/20/89

APPROVED BY: James Blayford DATE: 4/28/89
YMP PROJECT QUALITY MANAGER

1.0 INTRODUCTION

This report contains the results of a QA Surveillance conducted September 13 and 14, 1988, at the offices of the Lawrence Livermore National Laboratory (LLNL) in Livermore, California, in accordance with the requirements of the Project QA Program Plan YMP/88-1, Rev. 0 and Quality Management Procedure (QMP)-18-02, "Surveillance," Rev. 0. The purpose of the surveillance was to determine if allegations regarding the control of Well J-13 water samples used in LLNL experiments and tests were valid.

This surveillance was based on allegations presented in February 1988 by a former employee who held a position as a Quality Assurance Engineer (QAE) for Science Applications International Corporation (SAIC) on the Yucca Mountain Project. The allegations stated were as follows: (1) "No documented evidence that the water (J-13) was under control," (2) "It could have been tap water," and (3) "It was falsely upgraded and used anyway."

This report will address the allegation issues in the order that they are presented.

The earliest time that procedural controls were established for the collection, storage, and distribution of J-13 water was via the issue of LLNL 033-NWSSI-P 13.1 "Collection, Storage and Distribution of J-13 Water" dated 4-21-87. Any collection of J-13 water prior to the issuance of that procedure was performed via a draft version of the above-listed procedure, which was dated 10-27-86. Although tests and experiments were conducted and reports were published prior to the issuance of the above listed procedure, it was stated by LLNL representatives that the collection, handling, and distribution of J-13 water samples was accomplished in accordance with "standard professional practice."

The technical portion of the surveillance addressed only the allegation that "it could have been tap water."

The technical evaluation of the chemical analyses provided by LLNL was performed in accordance with a checklist developed per QMP-18-02, Rev. 0. The results indicate that the water used in the waste package tests and experiments is well-characterized and that its composition is well-documented by many chemical analyses over a number of years. These analyses have been published in reports covering the period from September, 1983, through November, 1987. In reviewing these analyses with the Principal Investigators (PIs) at LLNL, C. Rutland determined that the analyses of water used in waste package tests and experiments were chemically similar in composition, and therefore that the water samples were probably from the same source. The precision of these analyses is about $\pm 10\%$ and is consistent with the conclusion that all the water samples analyzed were likely to be from the same source or from at least one other source of similar composition.

The Quality Assurance (QA) portion of the surveillance was also conducted using a checklist developed from LLNL Procedure 033-NWSSI-P-13.1, Revision 0, as modified by an Interim Change Notice (dated 4/18/88). The purpose of the surveillance was to determine whether the controls now in place were sufficient. The LLNL logbook was examined to assure that the proper entries were noted with regard to the collection, storage and distribution of J-13 water samples. No discrepancies were noted in these areas. Water samples stored were properly

labeled as to well number, drum number, and date sample was taken. The logbook included many entries as to distribution of samples that contained the following information: person to whom the sample was going, sample identification, the date, serial number of drum, and quantity distributed.

The allegation that "it was falsely upgraded and used anyway" cannot have occurred due to the following provisions of the QA program:

Data or data interpretations generated as a result of activities not controlled in accordance with a 10 CFR 60, Subpart G QA Program, or activities performed before the complete implementation (acceptance by the NRC) of the Project QAP will not be used in the licensing process as primary information for items and activities important to safety and/or waste isolation unless qualified in accordance with administrative procedures meeting the guidance provided in "Qualification of Existing Data for High Level Nuclear Waste Repositories" (NRC, 1988a), or other method accepted by the NRC.

A review was also performed on the position description and qualifications of the laboratory personnel involved in the collection, maintenance and distribution of the J-13 water samples. This review of D. Peiffer and R. Fletcher's files examined their educational background and work history. An observation was noted with regard to R. Fletcher's qualifications; see Section 5.2 of this report for details.

2.0 SURVEILLANCE PERSONNEL

This surveillance was conducted by:

Steven P. Nolan - Quality Assurance Engineer - SAIC, Las Vegas, NV
Carolyn Rutland - Technical Specialist - Geochemist, SAIC, Las Vegas, NV

3.0 SUMMARY OF SURVEILLANCE RESULTS

This surveillance confirmed the existence of the published reports and documentation used in support of LLNL-Nuclear Waste Management Program with regard to the control of J-13 water samples and their collection, distribution, and usage from April 21, 1987, through the present.

The surveillance team reviewed the reports of laboratory tests performed to date where J-13 water was utilized as the testing medium. The chemical analyses performed prior to the start of the experiments were determined to be of equivalent composition and therefore the samples were probably all from the same source or from at least one other source of similar composition.

Also reviewed was the LLNL logbook containing entries on collection, storage, and distribution of J-13 water samples. No discrepancies were noted relative to implementation of LLNL Procedure 033-NWWSI-P-13.1 Rev. 0. In conclusion the requirements of AP-5.9Q must be adhered to by LLNL for the qualification of data or data analyses that will be used in support of licensing, and that were not generated under the controls of a Quality Assurance (QA) Program, as required by 10 CFR 60, subpart G.

4.0 PERSONS CONTACTED

The following LLNL personnel were contacted during the surveillance:

J. Dronkers
R. Schwartz
D. Short
K. Knauss
H. Shaw
D. Peiffer
R. Fletcher

5.0 SYNOPSIS OF STANDARD DEFICIENCY REPORTS/OBSERVATIONS

5.1 STANDARD DEFICIENCY REPORTS (SDRs)

There were no SDRs generated during this surveillance.

5.2 OBSERVATIONS

Observation No. 1

During a review of the LLNL position descriptions and qualifications, it was detected that a technical specialist position required at least a degree in the science field or equivalent experience. Technical Specialist Ron Fletcher has been with the LLNL program since November, 1985 with only a high school diploma evident in his files. Discussion with LLNL personnel indicated that an "An Equivalent" statement be added to his personnel file. The LLNL personnel contacted stated that this would be done.

6.0 REQUIRED ACTION

A written response for the observation in Section 5.2 of this report is required within 20 working days from the date of the surveillance transmittal letter.



Science Applications International Corporation

MS9-SE/DBJ-012

WBS #1.2.3.1

QA

INTER-OFFICE MEMO

DATE: April 21, 1989

TO: Steve Metta

FROM: M. D. Voegelé *M. Voegelé*

SUBJECT: Report of Surveillance of Lawrence Livermore National Laboratory (LLNL) Regarding Control of Water Samples from Well J-13

SAIC Technical staff have supported Project Office efforts to respond to allegations in February, 1988, regarding the control of water samples taken from well J-13. These allegations were: 1) "No documented evidence that the water (J-13) was under control;" 2) "It could have been tap water;" and 3) "It was falsely upgraded and used anyway." A surveillance, which included T&MS technical staff, was conducted September 13 and 14, 1988, at Lawrence Livermore National Laboratory (LLNL) to address these allegations.

The Technical Specialist on the surveillance, Carolyn Rutland, was asked to address only the technical basis of the allegation that "it could have been tap water." She examined analyses of water used in waste package tests and experiments from published reports covering the period from September, 1983, through November, 1987. The results of that technical evaluation were that (1) the water used in the waste package tests and experiments is well characterized and its composition has been well documented over a number of years; and (2) the analyses are chemically similar to each other, within a range of about + or - 10%. From these observations it was concluded that the water samples were most likely from the same source. It was also concluded that the source of the water samples used in these published analyses is probably not either Mercury, NV, or Livermore, CA, tap water, based on a comparison of analyses of tap water from both locations with the published analyses. From a technical standpoint, then, the allegation that the water used in the tests and experiments "could have been tap water" is inaccurate, at least with regard to Mercury and Livermore tap water.

The report resulting from this surveillance has not yet been issued. This delay is apparently due to some confusion regarding the scope and purpose of the surveillance, concerns raised about open SDRs from a 1986 audit of LLNL also related to documentation of control of water from well J-13, and possible implications for the use of J-13 water in tests in support of license application. These latter two issues were not part of the scope of the February, 1988 surveillance, which was to investigate the validity of the allegations.

ENCLOSURE 2

SUGGESTED REVISIONS TO DRAFT SURVEILLANCE REPORT YMP-SR-88-020

- 1) Replace paragraph 3, page 1, with the following:

The technical evaluation of the chemical analyses provided by LLNL for the surveillance was based upon a checklist per QMP-18-02, rev. 0. The results indicate that the water used in the tests and experiments is well-characterized and its composition is well-documented by many chemical analyses over a number of years. These analyses are published in twenty-seven reports covering a period from September, 1983 through November, 1987. In reviewing these analyses with the Principal Investigators at LLNL, C. Rutland determined that the water samples used in waste package tests and experiments were chemically similar in composition. The precision of these analyses is about + or - 10%, consistent with the conclusion that all the water samples analyzed were from the same source, or at least one other source of similar composition. Thus, from a technical standpoint, the statements made in L. Ramspott's letter to Carl Gertz (dtd. 5/24/88, Exhibit 1) are supported by technical analyses in the published documents reviewed. (Refer to enclosure entitled "NWSI Reports" of Exhibit 1)

- 2) Replace paragraph 2 of section 3.0, page 2, with the following:

The surveillance team reviewed the reports of laboratory tests performed to date where J-13 water was utilized as the testing medium. The chemical analyses performed prior to the start of the experiments were determined to be of equivalent composition, and therefore the water samples were probably all from the same source, or from a source having water of similar composition.

Steve Metta
M89-SE/DBJ-012
April 21, 1989
Page Two

In an attempt to bring this matter to closure and to expedite the issuance of the surveillance report, minor wording changes to the original report are suggested, as shown in the enclosure. These changes are meant to clarify the original intent and results of the surveillance, and do not alter the technical substance of the original draft report or the conclusions of the surveillance.

If it is necessary in the future to further verify the source of the J-13-composition water used in the tests and experiments conducted to date, the following approach is recommended: (1) use standard statistical methods to determine the variance of the published chemical compositions of reputed J-13 water; (2) collect a sample of water from well J-13 under approved quality level I procedures; (3) run standard chemical analyses of the water sample using approved QA and analytical procedures; and (4) statistically compare these analyses with the published analyses. If the quality level I analyses are found to be statistically indistinguishable from the published analyses, it would improve our confidence that the samples are either all from the same source, i.e. well J-13, or from at least one other source of similar composition to Well J-13.

The difference between these two conclusions is immaterial with regard to quality, as it is the composition of the water, not its source, that is important in the waste package tests and experiments. The water from well J-13 was chosen for these tests for several valid technical reasons, including the fact that it is believed to be chemically representative of the water expected at the Yucca Mountain site (the J-13 aquifer is in Topopah Spring tuff, the same unit as the repository host rock at the site). A radically different chemical composition may affect the results of the waste package tests, but the source of the water will not.

DBJ:rlv

Enclosure:
As stated

cc w encl:
M. D. Voegele
D. B. Jorgenson
C. Rutland
M. Mitchell
E. Ripley
S. P. Nolan



LLYMP8908101
August 11, 1989

WBS #1.2.9
QA

Leo E. Little, Director
Engineering and Development Division
Yucca Mountain Project
U.S. Department of Energy
P.O. Box 98518
Las Vegas NV 89193-8518

ACT 111
YMP

REFERENCE: LLYYMP8906122, Ltr L. Little to L. Jardine dated 6/13/89
(YMP:MOC-4344), NNI-1989-27575

SUBJECT: Qualification of Existing Data at Lawrence Livermore National
Laboratory

Dear Leo:

As directed by the referenced letter, we have reviewed our data and models that were obtained or developed for the Yucca Mountain Project prior to the implementation of the YMP/88-9, Rev. 2, Quality Assurance (QA) program and have compiled a preliminary list of those items that we believe will be proposed for qualification or will need to be repeated under YMP/88-9, Rev. 2, controls. In doing this we have not included existing exploratory data which were obtained under QALA III and which will not require either qualification or reacquisition.

This submittal is an LLNL action item assigned and requested by J. Hale, DOE-HQ, during the 5/23/89 Waste Package Program Review Meeting. This submittal is due at DOE-HQ by 8/22/89.

This letter is accompanied by three attachments:

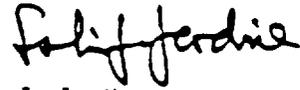
- 1) A 2-page summary table of the data and models we propose for qualification
- 2) Detailed information sheets for each of the data packages or models we propose to qualify.
- 3) A copy of a draft position paper on the qualification on the EQ3/6 thermodynamic database (submitted in 12/87 to both YMPO and DOE-HQ), which we believe should be treated as a special case.

ACTION
 C. C. Little
 REC'D IN WMPO
 8/17/89

ENCLOSURE: 3

Please contact Henry Shaw of my staff at FTS 543-4645 if you have any questions on this material.

Sincerely,



L. J. Jardine
LLNL Technical Project
Officer for YMP

LJJ/HFS:jw

Attachments

cc: M. Cloninger. YMPO



Lawrence Livermore National Laboratory

LLYMP890095
September 14, 1989

WBS #1.2.9
QA

Leo E. Little, Director
Engineering and Development Division
Yucca Mountain Project
U.S. Department of Energy
P.O. Box 98518
Las Vegas NV 89193-8518

REFERENCES: LLYMP 8908101 Ltr L. Jardine to L. Little
dtd 8/11/89
LLYMP88906122 Ltr L. Little to L. Jardine
dtd 6/13/89 (NN1-1989-2575)

SUBJECT: Qualification of Existing Data at LLNL, Revised

Dear Leo:

Attached is a revision of the information transmitted to you on August 11, 1989. The revised table and back-up information were faxed to Dick Morissette at SAIC on September 13.

Sincerely,

LLNL Technical Project
Officer for YMP

LJJ/JW:jw

Attachments

xc:

M. Cloninger, YMPO
~~MR~~ Morissette SAIC

ENCLOSURE 4

Attachment 1
Summary Table of Data/Models
Proposed for Qualification

Type of data/ model	Original QALA	Where to be used?	Source of data PI/Institution	Recommended Action	Comments
Spent Fuel Dissolution	I	Spent fuel dissolution models for PA	C. Wilson @ PNL and WHIC	Confirmatory tests already incorporated in planned test matrix. Corroborating data from international programs are available in literature.	Three series of tests (1, 2.5, 1.5 years duration) at a cost of ~\$2M. Cost to conduct technical review of relevant data set is estimated at 6 months and \$150K.
Spent Fuel Oxidation	I	Spent fuel oxidation and dissolution models for PA	R. Einziger @ PNL and WHIC	Use corroborating data from dry-bath oxidation tests (see below). Conduct limited confirmatory tests if necessary.	One series of tests (~2 years duration) at a cost of ~\$600K. Cost to conduct limited confirmation testing is 9 months and \$250K.
Spent Fuel Oxidation	I	.	R. Einziger @ PNL and WHIC	These are ongoing tests. Bring documentation and controls into compliance with YMP/88-9 Rev.2 requirements.	Two series of long-term tests (started in 12/86 and 9/88). Total cost to date ~ \$1M. Cost of bringing these tests into compliance has largely been expended in FY89.
Glass release under un- saturated con- ditions	I	Validation (short term) of glass dissolution models.	J. Bates @ ANL	These are ongoing tests, but many of the test specimens have been terminated. Bring documentation and controls into compliance with YMP/88-9 Rev.2 requirements for the remaining samples. Conduct limited confirmation tests.	Over 3 years of continuous testing at a cost of > \$600K. Limited, short-term confirmation tests could be conducted in ~1.5 years and \$150-200K.
B Q 3 / 6 thermodynamic database	Indeter- minate (liter- ature data)	PA	Numerous citations from the published literature (10 page list in small type)	Use NIST (formerly NBS) and international peer review group methods (e.g. NEA) to review and approve data.	Special case. See attached Position Paper.
Single mineral dissolution ki- netics	III	Validation of near- field geochemistry model	K. Knauss @ LLNL and A. Lasaga @ Yale Univ.	No action recommended at this time. Qualify using peer review if necessary.	Time to repeat work would be 1-year at a cost of ~\$750,000.
PANDORA-1, a waste package PA code	III	PA planning, guid- ance on WP design and site character- ization activities up to 1 st quarter FY91	D. Lappa @ LLNL	Baseline existing code, bring documenta- tion into conformance with YMP/88-9 Rev.2 requirements per the LLNL Soft- ware QA Plan (in review at YMPO)	PANDORA is a first generation systems model and computer code for PA of individual waste packages. It will be superseded by more complex and capable codes, however, it is needed in the near-term for guidance. Cost to repeat is \$900K and 15 months. Cost to qualify is \$250K and 5 months.

Type of data/ model	Original QALA	Where to be used?	Source of data PI/Institution	Recommended Action	Comments
Conceptual models for 7-ray attenuation and a cylindrical heat source.	III	Waste package PA	W. O'Connell @ LLNL	No action recommended at this time. If necessary, reevaluate and issue a confirmatory report.	These are conceptual models not used in the current version of PANDORA, but which may be needed in future versions.
Mathematical derivation of errors arising from Latin Hypercube Sampling	III	PA across the YMP	W. O'Connell @ LLNL	Reevaluate and issue a confirmatory report.	This is a strictly theoretical result and does not involve a computer code directly. Cost to qualify is \$80K and 6 months (including document reviews).
Controlled sampling method and computer code CONTROL	III	Waste package PA, and perhaps PA in other parts of the YMP	R. Thatcher @ LLNL	Reevaluate the theoretical derivation, do confirmatory numerical testing, and issue a confirmatory report. For the computer code, CONTROL, baseline existing code, bring documentation into conformance with YMP/88-9 Rev.2 requirements per the LLNL Software QA Plan (in review at YMPO)	This is a more efficient sampling method for conducting probabilistic PA calculations and an implementation of the method in a computer code. Cost to repeat is \$650K and 12 months. Cost to qualify is \$330K and 6 months.

Attachment 2
Detailed Summaries of Data/Models
Proposed for Qualification
(and References)

Tech. Area: Waste Form Modeling and Testing
Technical Area Leader: H. Shaw
Task: Spent Fuel Dissolution (WBS 1.2.2.3.1.1)

Subactivity: Semi-static dissolution tests of spent fuel

Task Leader: H. Leider

1. LLNL Activity: D-20-42
2. Original QALA: I
3. References: See attached, [1-7]
4. Are data likely to be used at QL 1?
Yes, for spent fuel dissolution model development and as data for use in those models.
5. Where likely to be used:
Models for the aqueous release of radionuclides from spent fuel used in Performance Assessment
6. Source of data (PI/Institution)
C. N. Wilson at PNL and WHC
7. Is further evaluation for NUREG-1298 recommended?
Yes. We propose to use corroborating data and confirmatory testing to qualify existing results. Our existing plans already called for confirmatory tests to be conducted at an independent laboratory (Argonne National Lab.). A technical review of the entire relevant data set may be necessary once the confirmatory data have been obtained.
8. Comments:
These data represent three series of fuel dissolution tests of 1, 1.5, and 2.5 years duration. The cost of completely duplicating these tests would exceed \$2M. The cost of obtaining confirmatory data has already been factored into our existing program. There are already independent, corroborating data obtained by similar testing programs in other countries (Sweden and Canada).

The time and cost of conducting a technical review of the data is estimated at 6 months and \$150K.

Tech. Area: Waste Form Modeling and Testing

Technical Area Leader: H. Shaw

Task: Spent Fuel Oxidation (WBS 1.2.2.3.1.1)

Subactivity: TGA testing

Task Leader: R. Stout

1. LLNL Activity: D-20-44
2. Original QALA: I
3. References: See attached, [8,9]
4. Are data likely to be used at QL 1?
Yes, for spent fuel oxidation model development and as data for use in those models.
5. Where likely to be used:
Models for the oxidation and release of gaseous radionuclides from spent fuel used in Performance Assessment
6. Source of data (PI/Institution):
R. Einziger at PNL and WHC
7. Is further evaluation for NUREG-1298 recommended?
Yes. We propose to use corroborating data and confirmatory testing to qualify existing results. To some extent, corroborating data may be obtained in our planned testing program as we conduct oxidation tests of different fuel types. It is likely, however, that a limited number of confirmatory tests using the same fuel types as were used previously may be necessary. In addition, we are already conducting tests (see sheet for activity D-20-45) utilizing a different test method that will provide a data set that overlaps in part with the TGA data. There are also existing data in the literature obtained at higher temperatures. All these data could be used to corroborate the previous TGA results. A technical review of the entire relevant data set may be necessary once the confirmatory data have been obtained.
8. Comments:
These data represent one series of tests on PWR spent fuel (Turkey Point and ATM-101) which lasted ~2 years and cost \$600K.

The time and cost of conducting limited confirmatory (repeated) testing is estimated at 9 months and \$250K. A technical review of the entire relevant data set is estimated to take 6 months and \$150K.

Tech. Area: Waste Form Modeling and Testing

Technical Area Leader: H. Shaw

Task: Spent Fuel Oxidation (WBS 1.2.2.3.1.1)

Subactivity: Dry-bath testing

Task Leader: R. Stout

1. LLNL Activity: D-20-45
2. Original QALA: I
3. References: See attached, [10,11,12]
4. Are data likely to be used at QL 1?
Yes, for spent fuel oxidation model development and as data for use in those models.
5. Where likely to be used:
Models for the oxidation and release of gaseous radionuclides from spent fuel used in Performance Assessment
6. Source of data (PI/Institution):
R. Einziger at PNL and WHC
7. Is further evaluation for NUREG-1298 recommended?
Yes. It should be noted that these tests are ongoing. As such, we are in the process now of bringing the documentation and control system for conducting these tests into compliance with the requirements of YMP/88-9, Rev. 2. This will involve the use of surveillances and readiness reviews.
8. Comments:
These data represent two series of tests, one which started in 12/86 (Turkey Point PWR spent fuel) and one which started in 9/88 (Cooper BWR spent fuel). The samples in the two series are running simultaneously and have been in the test continuously since their respective start dates. The cost to date for this work is ~\$1M.

Most of the cost of bringing this test into compliance with YMP/88-9, Rev. 2 requirements has already been expended in FY89.

Technical Area: Waste Form Modeling and Testing
Technical Area Leader: H. Shaw
Task: Glass Wasteform (WBS 1.2.2.3.1.2)
Task Leader: R. Ryerson (acting)

1. LLNL Activity: D-20-27
2. Original QALA: I
3. References: See attached, [13,-16]
4. Are data likely to be used at QL 1?
Yes.
5. Where likely to be used:
In conceptual model development and validation of glass release models using intermediate-term test data. These tests do not, in general, provide quantitative data that will be used in modeling, but rather, provide repository-relevant simulations of glass release mechanisms against which to compare model predictions. The resulting models will ultimately be used in Performance Assessment.
6. Source of data (PI/Institution):
J. Bates at ANL
7. Is further evaluation for NUREG-1298 recommended?
Yes. We propose conducting limited confirmatory testing of shorter duration. To the best of our knowledge, no corroborating data are available.
8. Comments:
This work represents over three years of continuous testing at a cost of >\$500K. Most of the test samples have been terminated, however, a number of samples continue to run and will continue to be tested until the time of licensing in order to provide data over as long a period as possible. The estimated time and cost to conduct a limited series of confirmation tests is 1.5 years and \$200K. This estimate is subject to considerable uncertainty as the scope of the confirmation tests has not been determined at this time.

Tech. Area: Geochemical Modeling
Technical Area Leader: R. Aines
Task: Database Development (WBS 1.2.2.5.2, in FY90 to be 1.2.1.4.5)
Task Leader: J. Johnson

1. LLNL Activity: J-20-8
2. Original QALA: Indeterminate (literature data, assembled at QALA III)
3. References: See attached [17]
4. Are data likely to be used at QL 1?
Yes, will be used to refine data used for QAL I work. This body of data is a compilation of published thermochemical constants. It is a fundamental part of the EQ3/6 geochemical modeling code.
5. Where likely to be used:
Performance Assessment. The EQ3/6 database will be used in modeling geochemical processes and interactions involving the host rock, groundwaters, container material, waste forms, and other materials that might affect the chemical environment of the waste package.
6. Source of data (PI/Institution)
Numerous workers, as published in the open literature. A printout of the database is over 550 pages of 8-point type. A listing of the references alone is 10 pages of the same small print.
7. Is further evaluation for NUREG-1298 recommended?
Yes. See attached proposed plan by LLNL to approach this problem. This plan was transmitted to both the YMP and DOE-HQ in 12/87. No comments have ever been received.
8. Comments:
This is clearly a special case that will demand special treatment. The cost, in terms of both time and dollars, to conduct even limited confirmatory testing would be prohibitive, and would not be productive due to the numerous independent data sources involved.

Technical Area: Near-field Modeling and Testing
Technical Area Leader: D. Wilder
Task: Waste Package Environment Geochemistry and Mineralogy
Task Leader: W. Glassley

1. LLNL Activity: B-20-5
2. Original QALA: III
3. References: See attached, [18-22]
4. Are data likely to be used at QL 1?
Unlikely (intended use is for model development), though possible, if needed for model validation.
5. Where likely to be used:
If needed at QAL I, would be used for model validation and long-term predictions of waste package environment geochemistry.
6. Source of data (PI/Institution):
K. Knauss at LLNL
A. Lasaga at Yale University
7. Is further evaluation for NUREG-1298 recommended?
Not at this time. If necessary, data could be qualified by peer review.
8. Comments:
This work represents approximately one year of effort on the part of several scientists and students. The cost to reproduce the data is estimated at \$750,000.

Data/Models to Be Considered for Qualification at QAL1

I.

Tech. Area: Performance Assessment (1.2.2.5.1, in FY90 to be 1.2.1.4.2)

TAL: W. O'Connell

Task: Deterministic Performance Assessment

TL: D. Lappa

1. LLNL Activity: I-20-5

Subactivity:

PANDORA-1 model and computer for system analysis of waste package performance.

2. Original QALA: 3

3. Reference:

Lappa and Hardenbrook, in review.

O'Connell, Lappa, and Thatcher. UCRL-100395 and WM89 Conference. [23]

4. Is data likely to be used at QL 1?

Yes, for any early decisions up through 1st quarter FY91 that require performance assessments as input information.

5. Where likely to be used:

Performance assessment planning, waste package design guidance, guidance on the importance of some site characterization activities.

6. Source of Data (PI / Institution):

Lappa / LLNL

7. Is further evaluation for NUREG-1298 recommended?

Yes. Documentation, baselining, technical reviews per LLNL Software QA Plan (itself in review).

8. Comments:

i. Subject: PANDORA-1 is a model and computer code for the long-term performance of individual waste packages under certain local conditions.

ii. This is not the final model, and will eventually be superceded. But for any guidance to near-term decisions and to the next steps in PA planning, this model is it.

iii. Cost to repeat: \$900 K

Time to repeat: 15 months

Cost to qualify: \$250 K

Time to qualify: 5 months

II.
 Tech. Area: Performance Assessment (1.2.2.5.1, in FY90 to be 1.2.1.4 2)
 TAL: W. O'Connell
 Task: Deterministic Performance Assessment
 TL: D. Lappa

1. LLNL Activity: I-20-5

Subactivity:

Conceptual models for gamma ray attenuation and for hollow-cylinder heat source.

2. Original QALA: 3

3. Reference:

O'Connell and Drach, 1986. [24]

4. Is data likely to be used at QL 1?

Maybe. To the extent that 1-dimensional cylindrical models are useful, these submodels will be useful.

5. Where likely to be used:

Waste package performance assessment, and activities influenced by PA results.

6. Source of Data (PI / Institution):

O'Connell / LLNL

7. Is further evaluation for NUREG-1298 recommended?

Maybe: postpone until found needed. Method: re-evaluate, issue a confirmatory report, use technical document review.

8. Comments:

These conceptual models covered parameters and designs not needed in the current system model PANDORA-1, but the subjects may be needed in future system models.

An example of a hollow-cylinder source is consolidated spent fuel packed around a central cylinder of low-activity steel hardware.

III.

Tech. Area: Performance Assessment (1.2.2.5.1. in FY90 to be 1.2.1.4.2)

TAL: W. O'Connell

Task: Probabilistic Performance Assessment

TL: W. O'Connell

1. LLNL Activity: I-20-14

Subactivity:

Practical calculation of variance of estimators arising from Latin hypercube sampling (LHS).

2. Original QALA: 3

3. Reference:

O'Connell, in review.

4. Is data likely to be used at QL 1 ?

Yes. (See comments.)

5. Where likely to be used:

Performance assessment across the Project, and activities influenced by PA results.

6. Source of Data (PI / Institution):

O'Connell / LLNL

7. Is further evaluation for NUREG-1298 recommended?

Yes. Re-evaluate, issue a confirmatory report, use technical document review.

8. Comments:

i. This theoretical result does not need a computer program.

ii. LHS has been used in nuclear-related analysis and is being used in the national OCRWM Program. The current result tells you in what conditions LHS is more efficient than simple random sampling, and how much more efficient, and so it tells you when to use LHS and when to use some other method of sampling.

iii. Cost to repeat: Not Applicable. (This is a straightforward theoretical solution to a well-defined problem. It's of the same type as, although it will never be as widely applicable as, $E = MC^2$).

Cost to qualify: \$80 K.

IV
Techn. Area: Performance Assessment (1.2.2.5.1. in FY90 to be 1.2.1.4.2)
TAL: W. O'Connell
Task: Probabilistic Performance Assessment
TL: W. O'Connell

1. LLNL Activity: I-20-14

Subactivity:

Controlled sampling method and computer code CONTROL.

2. Original QALA: 3

3. Reference:

Thatcher, in review.

O'Connell, Lappa, and Thatcher, UCRL-100395 and WM89 Conference.

4. Is data likely to be used at QL 1?

Yes. (See comments.)

5. Where likely to be used:

Performance assessment of waste package, and perhaps PA in other parts of the project.

6. Source of Data (PI / Institution):

Thatcher / LLNL

7. Is further evaluation for NUREG-1298 recommended?

Yes:

(A.) Theoretical aspect:

Re-evaluate, do confirmatory numerical testing, report, use technical document review.

(B.) Computer software:

Documentation, baselining, technical reviews per LLNL Software QA Plan (itself in review).

8. Comments:

i. Controlled sampling is a theoretical development of a more efficient sampling method. It is more efficient than Latin hypercube sampling (LHS), and is efficient over a wider range of model types (acceptance by some reviewers remains to be achieved across the wider technical community). It may replace LHS in many applications.

ii. Costs to repeat or qualify:

(a.) Theoretical aspect:

Cost to repeat: Not Applicable.

Cost to qualify: \$80 K, assuming the computer software is also qualified.

(b.) Software:

Cost to repeat: \$650 K.

Time to repeat: 12 months.

Cost to qualify: \$250 K.

Time to qualify: 6 months.

References for Data to be
Considered for Qualification at QAL I

(Bold references are data reports)

- [1] C. N. Wilson, 1983, Test Plan for Spent Fuel Cladding Containment Credit Tests, HEDL-TC-2353-2, Hanford Engineering Development Laboratory, Richland, WA.
- [2] C. N. Wilson, 1984, Results from NNWSI Series I Spent Fuel Leach Tests, HEDL-TME-84-30, Hanford Engineering Development Laboratory, Richland, WA.
- [3] C. N. Wilson, 1983, Test Plan for Series 2 Spent Fuel Cladding Containment Credit Tests, HEDL-TC-2353-3, Hanford Engineering Development Laboratory, Richland, WA.
- [4] C. N. Wilson, 1987, Results from Cycles 1 and 2 of NNWSI Spent Fuel Dissolution Tests, HEDL-TME-85-22, Hanford Engineering Development Laboratory, Richland, WA.
- [5] C. N. Wilson, (in prep), Results from NNWSI Series 2 Bare Fuel Dissolution Tests, WHC-EP-0019, Westinghouse Hanford Co, Richland, WA.
- [6] C. N. Wilson, 1986, Test Plan for Series 3 NNWSI Spent Fuel Leaching/Dissolution Tests, HEDL-7577, Hanford Engineering Development Laboratory, Richland, WA.
- [7] C. N. Wilson, (in prep), Results from NNWSI Series 3 Spent Fuel Dissolution Tests. WHC-EP-0121, Westinghouse Hanford Co., Richland, WA.
- [8] R. E. Einziger and R. E. Woodley, 1986, Test Plan for Series 2 Thermogravimetric Analyses of Spent Fuel Oxidation, HEDL-7556, Hanford Engineering Development Laboratory, Richland, WA.
- [9] R. E. Woodley, R. E. Einziger, and H. C. Buchanan, 1988, Measurement of the Oxidation of Spent Fuel Between 140°C and 225°C by Thermogravimetric Analysis, WHC-EP-0107, Westinghouse Hanford Co., Richland, WA.
- [10] R. E. Einziger, 1986, Test Plan for Long-Term, Low-Temperature Oxidation of Spent Fuel: Series 1, HEDL-7560, Hanford Engineering Development Laboratory, Richland, WA.
- [11] R. E. Einziger, 1988, Long-Term, Low-Temperature Oxidation of PWR Spent Fuel: Interim Transition Report, WHC-EP-0070, Westinghouse Hanford Co., Richland, WA.
- [12] R. E. Einziger, 1988, Test plan for Long-Term, Low-Temperature Oxidation of BWR Spent Fuel, PNL-6427, Battelle, Pacific Northwest Laboratory, Richland, WA.
- [13] J. Bates and T. Gerding, 1985, NNWSI Waste Form Testing for Unsaturated Disposal Conditions, UCRL-15723, Lawrence Livermore National Laboratory Contractor's Report, Livermore, CA.

- [14] J. Bates and T. Gerding, 1986, One-Year Results of the NNWSI Unsaturated Test Procedure: SRL 165 Glass Application, ANL-85-41, Argonne National Laboratory, Argonne, IL.
- [15] J. Bates and T. Gerding, 1987, The Performance of Actinide-Containing SRL-165 Type Glass in Unsaturated Conditions, in, Materials Research Society Proceedings, v.112, pp. 651-662.
- [16] J. Bates and T. Gerding, (submitted to YMPO for review), Application of the NNWSI Unsaturated Test Method to Actinide-Doped SRL-165 Type Glass, Argonne National Laboratory, Argonne, IL.
- [17] Nuclear Waste Management Project, (draft for comment dated 12/18/87 - copy attached), Data Sources and Quality Assurance for the Completion of a Chemical Thermodynamic Data Base for use in Licensing of a High Level Nuclear Waste Repository: Position Paper, Lawrence Livermore National Laboratory, Livermore, CA.
- [18] K. Knauss et al., 1988, The Dissolution Kinetics of Quartz as a Function of pH and Time at 70°C, *Geochim. Cosmochim. Acta*, v. 52, p. 43-53.
- [19] K. Knauss et al., 1989, Muscovite Dissolution Kinetics as a Function of pH and Time at 70°C. *Geochim. Cosmochim. Acta*, v. 53, p.
- [20] P. Larsen et al., (in prep), The Dissolution of Natural and Synthetic Cristobalite Under Conditions of Varying pH and Temperature.
- [21] K. L. Nagy et al., (in prep), The Dissolution and Precipitation Kinetics of Kaolinite: Initial Results at 80°C with Application to Porosity Evaluation in a Sandstone.
- [22] A. Blum et al., (in prep), The Effect of Dissolution Density on the Dissolution Rate of Quartz.
- [23] W. O'Connell, D. Lappa, R. Thatcher, (submitted to YMPO for review), Waste Package Performance Assessment for the Yucca Mountain Project, UCRL-100395, Lawrence Livermore National Laboratory, Livermore, CA.
- [24] W. O'Connell and R. Drach, 1986, Waste Package Assessment: Deterministic System Model Program Scope and Specification, UCRL-53761, Lawrence Livermore National Laboratory, Livermore, CA.

Attachment 3
Copy of Draft Database Position Paper
(Submitted to YMPO and DOE-HQ in 12/87)



Lawrence Livermore National Laboratory

REFERENCE 6

LLYMP8908101
August 11, 1989

WBS #1.2.9
"QA"

NNA.890905.0056

Leo E. Little, Director
Engineering and Development Division
Yucca Mountain Project
U.S. Department of Energy
P.O. Box 98518
Las Vegas NV 89193-8518

REFERENCE: LLYYMP8906122, Ltr L. Little to L. Jardine dated 6/13/89
(YMP:MOC-4344), NN1-1989-2575

SUBJECT: Qualification of Existing Data at Lawrence Livermore National
Laboratory

Dear Leo:

As directed by the referenced letter, we have reviewed our data and models that were obtained or developed for the Yucca Mountain Project prior to the implementation of the YMP/88-9, Rev. 2, Quality Assurance (QA) program and have compiled a preliminary list of those items that we believe will be proposed for qualification or will need to be repeated under YMP/88-9, Rev. 2, controls. In doing this we have not included existing exploratory data which were obtained under QALA III and which will not require either qualification or reacquisition.

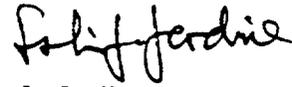
This submittal is an LLNL action item assigned and requested by J. Hale, DOE-HQ, during the 5/23/89 Waste Package Program Review Meeting. This submittal is due at DOE-HQ by 8/22/89.

This letter is accompanied by three attachments:

- 1) A 2-page summary table of the data and models we propose for qualification
- 2) Detailed information sheets for each of the data packages or models we propose to quality.
- 3) A copy of a draft position paper on the qualification on the EQ3/6 thermodynamic database (submitted in 12/87 to both YMPO and DOE-HQ), which we believe should be treated as a special case.

Please contact Henry Shaw of my staff at FTS 543-4645 if you have any questions on this material.

Sincerely,

A handwritten signature in cursive script, appearing to read "L. J. Jardine".

L. J. Jardine
LLNL Technical Project
Officer for YMP

LJJ/HFS:jw

Attachments

cc: M. Cloninger, YMPO



LLYMP890095
September 14, 1989

WBS #1.2.9
QA

Leo E. Little, Director
Engineering and Development Division
Yucca Mountain Project
U.S. Department of Energy
P.O. Box 98518
Las Vegas NV 89193-8518

REFERENCES: LLYMP 8908101 Ltr L. Jardine to L. Little
dtd 8/11/89
LLYMP88906122 Ltr L. Little to L. Jardine
dtd 6/13/89 (NN1-1989-2575)

SUBJECT: Qualification of Existing Data at LLNL, Revised

Dear Leo:

Attached is a revision of the information transmitted to you on August 11, 1989. The revised table and back-up information were faxed to Dick Morissette at SAIC on September 13.

Sincerely,

LLNL Technical Project
Officer for YMP

LJJ/JW:jw

Attachments

xc:

M. Cloninger, YMPO
~~DR~~ Morissette SAIC

ENCLOSURE 4

Attachment 1
Summary Table of Data/Models
Proposed for Qualification

Type of data/ model	Original QALA	Where to be used?	Source of data PI/Institution	Recommended Action	Comments
Spent Fuel Dissolution	I	Spent fuel dissolution models for PA	C. Wilson @ PNL and WHC	Confirmatory tests already incorporated in planned test matrix. Corroborating data from international programs are available in literature.	Three series of tests (1, 2.5, 1.5 years duration) at a cost of ~\$2M. Cost to conduct technical review of relevant data set is estimated at 6 months and \$150K.
Spent Fuel Oxidation	I	Spent fuel oxidation and dissolution models for PA	R. Einziger @ PNL and WHC	Use corroborating data from dry-bath oxidation tests (see below). Conduct limited confirmatory tests is necessary.	One series of tests (~2 years duration) at a cost of ~\$600K. Cost to conduct limited confirmation testing is 9 months and \$250K.
Spent Fuel Oxidation	I	.	R. Einziger @ PNL and WHC	These are ongoing tests. Bring documentation and controls into compliance with YMP/88-9 Rev.2 requirements.	Two series of long-term tests (started in 12/86 and 9/88). Total cost to date ~ \$1M. Cost of bringing these tests into compliance has largely been expended in FY89.
Glass release under un- saturated conditions	I	Validation (short term) of glass dissolution models.	J. Bates @ ANL	These are ongoing tests, but many of the test specimens have been terminated. Bring documentation and controls into compliance with YMP/88-9 Rev.2 requirements for the remaining samples. Conduct limited confirmation tests.	Over 3 years of continuous testing at a cost of > \$600K. Limited, short-term confirmation tests could be conducted in ~1.5 years and \$150-200K.
E Q 3 / 6 thermodynamic database	indeterminate (literature data)	PA	Numerous citations from the published literature (10 page list in small type)	Special case. See attached Position Paper	
Single mineral dissolution kinetics	III	Validation of near-field geochemistry model	K. Knauss @ LLNL and A. Lasaga @ Yale Univ.	No action recommended at this time. Qualify using peer review is necessary.	Time to repeat work would be 1-year at a cost of ~\$750,000.
PANDORA-1, a waste package PA code	III	PA planning, guidance on WP design and site characterization activities up to 1 st quarter FY91	D. Lappa @ LLNL	Baseline existing code, bring documentation into conformance with YMP/88-9 Rev.2 requirements per the LLNL Software QA Plan (in review at YMPO)	PANDORA is a first generation systems model and computer code for PA of individual waste packages. It will be superseded by more complex and capable codes, however, it is needed in the near-term for guidance. Cost to repeat is \$900K and 15 months. Cost to qualify is \$250K and 5 months.

Type of data/ model	Original QALA	Where to be used?	Source of data PI/Institution	Recommended Action	Comments
Conceptual models for γ -ray attenuation and a cylindrical heat source.	III	Waste package PA	W. O'Connell @ LLNL	No action recommended at this time. If necessary, reevaluate and issue a confirmatory report.	These are conceptual models not used in the current version of PANDORA, but which may be needed in future versions.
Mathematical derivation of errors arising from Latin Hypercube Sampling	III	PA across the YMP	W. O'Connell @ LLNL	Reevaluate and issue a confirmatory report.	This is a strictly theoretical result and does not involve a computer code directly. Cost to qualify is \$80K and 6 months (including document reviews).
Controlled sampling method and computer code CONTROL	III	Waste package PA, and perhaps PA in other parts of the YMP	R. Thatcher @ LLNL	Reevaluate the theoretical derivation, do confirmatory numerical testing, and issue a confirmatory report. For the computer code, CONTROL, bBaseline existing code, bring documentation into conformance with YMP/88-9 Rev.2 requirements per the LLNL Software QA Plan (in review at YMPO)	This is a more efficient sampling method for conducting probabilistic PA calculations and an implementation of the method in a computer code. Cost to repeat is \$650K and 12 months. Cost to qualify is \$330K and 6 months.

Attachment 2
Detailed Summaries of Data/Models
Proposed for Qualification
(and References)

Tech. Area: Waste Form Modeling and Testing
 Technical Area Leader: H. Shaw
 Task: Spent Fuel Dissolution (WBS 1.2.2.3.1.1)

Subactivity: Semi-static dissolution tests of spent fuel

Task Leader: H. Leider

1. LLNL Activity: D-20-42
2. Original QALA: I
3. References: See attached, [1-7]
4. Are data likely to be used at QL 1?
 Yes, for spent fuel dissolution model development and as data for use in those models.
5. Where likely to be used:
 Models for the aqueous release of radionuclides from spent fuel used in Performance Assessment
6. Source of data (PI/Institution)
 C. N. Wilson at PNL and WHC
7. Is further evaluation for NUREG-1298 recommended?
 Yes. We propose to use corroborating data and confirmatory testing to qualify existing results. Our existing plans already called for confirmatory tests to be conducted at an independent laboratory (Argonne National Lab.). A technical review of the entire relevant data set may be necessary once the confirmatory data have been obtained.
8. Comments:
 These data represent three series of fuel dissolution tests of 1, 1.5, and 2.5 years duration. The cost of completely duplicating these tests would exceed \$2M. The cost of obtaining confirmatory data has already been factored into our existing program. There are already independent, corroborating data obtained by similar testing programs in other countries (Sweden and Canada).

 The time and cost of conducting a technical review of the data is estimated at 6 months and \$150K.

Tech. Area: Waste Form Modeling and Testing
 Technical Area Leader: H. Shaw
 Task: Spent Fuel Oxidation (WBS 1.2.2.3.1.1)

Subactivity: TGA testing

Task Leader: R. Stout

1. LLNL Activity: D-20-44
2. Original QALA: I
3. References: See attached, [8,9]
4. Are data likely to be used at QL 1?
 Yes, for spent fuel oxidation model development and as data for use in those models.
5. Where likely to be used:
 Models for the oxidation and release of gaseous radionuclides from spent fuel used in Performance Assessment
6. Source of data (PI/Institution):
 R. Einziger at PNL and WHC
7. Is further evaluation for NUREG-1298 recommended?
 Yes. We propose to use corroborating data and confirmatory testing to qualify existing results. To some extent, corroborating data may be obtained in our planned testing program as we conduct oxidation tests of different fuel types. It is likely, however, that a limited number of confirmatory tests using the same fuel types as were used previously may be necessary. In addition, we are already conducting tests (see sheet for activity D-20-45) utilizing a different test method that will provide a data set that overlaps in part with the TGA data. There are also existing data in the literature obtained at higher temperatures. All these data could be used to corroborate the previous TGA results. A technical review of the entire relevant data set may be necessary once the confirmatory data have been obtained.
8. Comments:
 These data represent one series of tests on PWR spent fuel (Turkey Point and ATM-101) which lasted ~2 years and cost \$600K.

 The time and cost of conducting limited confirmatory (repeated) testing is estimated at 9 months and \$250K. A technical review of the entire relevant data set is estimated to take 6 months and \$150K.

Tech. Area: Waste Form Modeling and Testing

Technical Area Leader: H. Shaw

Task: Spent Fuel Oxidation (WBS 1.2.2.3.1.1)

Subactivity: Dry-bath testing

Task Leader: R. Stout

1. LLNL Activity: D-20-45
2. Original QALA: I
3. References: See attached, [10,11,12]
4. Are data likely to be used at QL 1?
Yes, for spent fuel oxidation model development and as data for use in those models.
5. Where likely to be used:
Models for the oxidation and release of gaseous radionuclides from spent fuel used in Performance Assessment
6. Source of data (PI/Institution):
R. Einziger at PNL and WHC
7. Is further evaluation for NUREG-1298 recommended?
Yes. It should be noted that these tests are ongoing. As such, we are in the process now of bringing the documentation and control system for conducting these tests into compliance with the requirements of YMP/88-9, Rev. 2. This will involve the use of surveillances and readiness reviews.
8. Comments:
These data represent two series of tests, one which started in 12/86 (Turkey Point PWR spent fuel) and one which started in 9/88 (Cooper BWR spent fuel). The samples in the two series are running simultaneously and have been in the test continuously since their respective start dates. The cost to date for this work is ~\$1M.

Most of the cost of bringing this test into compliance with YMP/88-9, Rev. 2 requirements has already been expended in FY89.

Technical Area: Waste Form Modeling and Testing

Technical Area Leader: H. Shaw

Task: Glass Wasteform (WBS 1.2.2.3.1.2)

Task Leader: R. Ryerson (acting)

1. LLNL Activity: D-20-27
2. Original QALA: I
3. References: See attached, [13,-16]
4. Are data likely to be used at QL 1?
Yes.
5. Where likely to be used:
In conceptual model development and validation of glass release models using intermediate-term test data. These tests do not, in general, provide quantitative data that will be used in modeling, but rather, provide repository-relevant simulations of glass release mechanisms against which to compare model predictions. The resulting models will ultimately be used in Performance Assessment.
6. Source of data (PI/Institution):
J. Bates at ANL
7. Is further evaluation for NUREG-1298 recommended?
Yes. We propose conducting limited confirmatory testing of shorter duration. To the best of our knowledge, no corroborating data are available.
8. Comments:
This work represents over three years of continuous testing at a cost of >\$500K. Most of the test samples have been terminated, however, a number of samples continue to run and will continue to be tested until the time of licensing in order to provide data over as long a period as possible. The estimated time and cost to conduct a limited series of confirmation tests is 1.5 years and \$200K. This estimate is subject to considerable uncertainty as the scope of the confirmation tests has not been determined at this time.

Tech. Area: Geochemical Modeling
Technical Area Leader: R. Aines
Task: Database Development (WBS 1.2.2.5.2, in FY90 to be 1.2.1.4.5)
Task Leader: J. Johnson

1. LLNL Activity: J-20-8
2. Original QALA: Indeterminate (literature data, assembled at QALA III)
3. References: See attached [17]
4. Are data likely to be used at QL 1?
Yes, will be used to refine data used for QAL I work. This body of data is a compilation of published thermochemical constants. It is a fundamental part of the EQ3/6 geochemical modeling code.
5. Where likely to be used:
Performance Assessment. The EQ3/6 database will be used in modeling geochemical processes and interactions involving the host rock, groundwaters, container material, waste forms, and other materials that might affect the chemical environment of the waste package.
6. Source of data (PI/Institution)
Numerous workers, as published in the open literature. A printout of the database is over 550 pages of 8-point type. A listing of the references alone is 10 pages of the same small print.
7. Is further evaluation for NUREG-1298 recommended?
Yes. See attached proposed plan by LLNL to approach this problem. This plan was transmitted to both the YMP and DOE-HQ in 12/87. No comments have ever been received.
8. Comments:
This is clearly a special case that will demand special treatment. The cost, in terms of both time and dollars, to conduct even limited confirmatory testing would be prohibitive, and would not be productive due to the numerous independent data sources involved.

7
7

Technical Area: Near-field Modeling and Testing
Technical Area Leader: D. Wilder
Task: Waste Package Environment Geochemistry and Mineralogy
Task Leader: W. Glassley

1. LLNL Activity: B-20-5
2. Original QALA: III
3. References: See attached, [18-22]
4. Are data likely to be used at QL 1?
Unlikely (intended use is for model development), though possible, if needed for model validation.
5. Where likely to be used:
If needed at QAL I, would be used for model validation and long-term predictions of waste package environment geochemistry.
6. Source of data (PI/Institution):
K. Knauss at LLNL
A. Lasaga at Yale University
7. Is further evaluation for NUREG-1298 recommended?
Not at this time. If necessary, data could be qualified by peer review.
8. Comments:
This work represents approximately one year of effort on the part of several scientists and students. The cost to reproduce the data is estimated at \$750,000.

Attachment 3
Copy of Draft Database Position Paper
(Submitted to YMPO and DOE-HQ in 12/87)

Data/Models to Be Considered for Qualification at QAL1

1.

Tech. Area: Performance Assessment (1.2.2.5.1. in FY90 to be 1.2.1.4.2)

TAL: W. O'Connell

Task: Deterministic Performance Assessment

TL: D. Lappa

1. LLNL Activity: 1-20-5

Subactivity:

PANDORA-1 model and computer for system analysis of waste package performance.

2. Original QALA: 3

3. Reference:

Lappa and Hardenbrook, in review.

O'Connell, Lappa, and Thatcher. UCRL-100395 and WM89 Conference. [23]

4. Is data likely to be used at QL 1?

Yes, for any early decisions up through 1st quarter FY91 that require performance assessments as input information.

5. Where likely to be used:

Performance assessment planning, waste package design guidance, guidance on the importance of some site characterization activities.

6. Source of Data (PI / Institution):

Lappa / LLNL

7. Is further evaluation for NUREG-1298 recommended?

Yes. Documentation, baselining, technical reviews per LLNL Software QA Plan (itself in review).

8. Comments:

i. Subject: PANDORA-1 is a model and computer code for the long-term performance of individual waste packages under certain local conditions.

ii. This is not the final model, and will eventually be superseded. But for any guidance to near-term decisions and to the next steps in PA planning, this model is it.

iii. Cost to repeat: \$900 K

Time to repeat: 15 months

Cost to qualify: \$250 K

Time to qualify: 5 months

II.
Tech. Area: Performance Assessment (1.2.2.5.1, in FY90 to be 1.2.1.4.2)
TAL: W. O'Connell
Task: Deterministic Performance Assessment
TL: D. Lappa

1. LLNL Activity: 1-20-5

Subactivity:

Conceptual models for gamma ray attenuation and for hollow-cylinder heat source.

2. Original QALA: 3

3. Reference:

O'Connell and Drach, 1986. [27]

4. Is data likely to be used at QL 1?

Maybe. To the extent that 1-dimensional cylindrical models are useful, these submodels will be useful.

5. Where likely to be used:

Waste package performance assessment, and activities influenced by PA results.

6. Source of Data (PI / Institution):

O'Connell / LLNL

7. Is further evaluation for NUREG-1298 recommended?

Maybe: postpone until found needed. Method: re-evaluate, issue a confirmatory report, use technical document review.

8. Comments:

These conceptual models covered parameters and designs not needed in the current system model PANDORA-1, but the subjects may be needed in future system models.

An example of a hollow-cylinder source is consolidated spent fuel packed around a central cylinder of low-activity steel hardware.

III.

Tech. Area: Performance Assessment (1.2.2.5.1. in FY90 to be 1.2.1.4.2)

TAL: W. O'Connell

Task: Probabilistic Performance Assessment

TL: W. O'Connell

1. LLNL Activity: I-20-14

Subactivity:

Practical calculation of variance of estimators arising from Latin hypercube sampling (LHS).

2. Original QALA: 3

3. Reference:

O'Connell, in review.

4. Is data likely to be used at QL 1?

Yes. (See comments.)

5. Where likely to be used:

Performance assessment across the Project, and activities influenced by PA results.

6. Source of Data (PI / Institution):

O'Connell / LLNL

7. Is further evaluation for NUREG-1298 recommended?

Yes. Re-evaluate, issue a confirmatory report, use technical document review.

8. Comments:

i. This theoretical result does not need a computer program.

ii. LHS has been used in nuclear-related analysis and is being used in the national OCRWM Program. The current result tells you in what conditions LHS is more efficient than simple random sampling, and how much more efficient, and so it tells you when to use LHS and when to use some other method of sampling.

iii. Cost to repeat: Not Applicable. (This is a straightforward theoretical solution to a well-defined problem. It's of the same type as, although it will never be as widely applicable as, $E = MC^2$).

Cost to qualify: \$80 K.

IV
 Tech. Area: Performance Assessment (1.2.2.5.1, in FY90 to be 1.2.1.4.2)
 TAL: V. O'Connell
 Task: Probabilistic Performance Assessment
 TL: V. O'Connell

1. LLNL Activity: I-20-14

Subactivity:

Controlled sampling method and computer code CONTROL

2. Original QALA: 3

3. Reference:

Thatcher, in review.

O'Connell, Lappa, and Thatcher, UCRL-100395 and WM89 Conference.

4. Is data likely to be used at QL 1?

Yes. (See comments.)

5. Where likely to be used:

Performance assessment of waste package, and perhaps PA in other parts of the project.

6. Source of Data (PI / Institution):

Thatcher / LLNL

7. Is further evaluation for NUREG-1298 recommended?

Yes:

(A.) Theoretical aspect:

Re-evaluate, do confirmatory numerical testing, report, use technical document review.

(B.) Computer software:

Documentation, baselining, technical reviews per LLNL Software QA Plan (itself in review).

8. Comments:

i. Controlled sampling is a theoretical development of a more efficient sampling method. It is more efficient than Latin hypercube sampling (LHS), and is efficient over a wider range of model types (acceptance by some reviewers remains to be achieved across the wider technical community). It may replace LHS in many applications.

ii. Costs to repeat or qualify:

(a.) Theoretical aspect:

Cost to repeat: Not Applicable.

Cost to qualify: \$80 K, assuming the computer software is also qualified.

(b.) Software:

Cost to repeat: \$650 K.

Time to repeat: 12 months.

Cost to qualify: \$250 K.

Time to qualify: 6 months.

References for Data to be
Considered for Qualification at QAL I

(Bold references are data reports)

- [1] C. N. Wilson, 1983, Test Plan for Spent Fuel Cladding Containment Credit Tests, HEDL-TC-2353-2, Hanford Engineering Development Laboratory, Richland, WA.
- [2] C. N. Wilson, 1984, Results from NNWSI Series I Spent Fuel Leach Tests, HEDL-TME-84-30, Hanford Engineering Development Laboratory, Richland, WA.
- [3] C. N. Wilson, 1983, Test Plan for Series 2 Spent Fuel Cladding Containment Credit Tests, HEDL-TC-2353-3, Hanford Engineering Development Laboratory, Richland, WA.
- [4] C. N. Wilson, 1987, Results from Cycles 1 and 2 of NNWSI Spent Fuel Dissolution Tests, HEDL-TME-85-22, Hanford Engineering Development Laboratory, Richland, WA.
- [5] C. N. Wilson, (in prep), Results from NNWSI Series 2 Bare Fuel Dissolution Tests, WHC-EP-0019, Westinghouse Hanford Co, Richland, WA.
- [6] C. N. Wilson, 1986, Test Plan for Series 3 NNWSI Spent Fuel Leaching/Dissolution Tests, HEDL-7577, Hanford Engineering Development Laboratory, Richland, WA.
- [7] C. N. Wilson, (in prep), Results from NNWSI Series 3 Spent Fuel Dissolution Tests. WHC-EP-0121, Westinghouse Hanford Co., Richland, WA.
- [8] R. E. Einziger and R. E. Woodley, 1986, Test Plan for Series 2 Thermogravimetric Analyses of Spent Fuel Oxidation, HEDL-7556, Hanford Engineering Development Laboratory, Richland, WA.
- [9] R. E. Woodley, R. E. Einziger, and H. C. Buchanan, 1988, Measurement of the Oxidation of Spent Fuel Between 140°C and 225°C by Thermogravimetric Analysis, WHC-EP-0107, Westinghouse Hanford Co., Richland, WA.
- [10] R. E. Einziger, 1986, Test Plan for Long-Term, Low-Temperature Oxidation of Spent Fuel: Series 1, HEDL-7560, Hanford Engineering Development Laboratory, Richland, WA.
- [11] R. E. Einziger, 1988, Long-Term, Low-Temperature Oxidation of PWR Spent Fuel: Interim Transition Report, WHC-EP-0070, Westinghouse Hanford Co., Richland, WA.
- [12] R. E. Einziger, 1988, Test plan for Long-Term, Low-Temperature Oxidation of BWR Spent Fuel, PNL-6427, Battelle, Pacific Northwest Laboratory, Richland, WA.
- [13] J. Bates and T. Gerding, 1985, NNWSI Waste Form Testing for Unsaturated Disposal Conditions, UCRL-15723, Lawrence Livermore National Laboratory Contractor's Report, Livermore, CA.

- [14] J. Bates and T. Gerding, 1986, One-Year Results of the NNWSI Unsaturated Test Procedure: SRL 165 Glass Application, ANL-85-41, Argonne National Laboratory, Argonne, IL.
- [15] J. Bates and T. Gerding, 1987, The Performance of Actinide-Containing SRL-165 Type Glass in Unsaturated Conditions, in, *Materials Research Society Proceedings*, v.112, pp. 651-662.
- [16] J. Bates and T. Gerding, (submitted to YMPO for review), Application of the NNWSI Unsaturated Test Method to Actinide-Doped SRL-165 Type Glass, Argonne National Laboratory, Argonne, IL.
- [17] Nuclear Waste Management Project, (draft for comment dated 12/18/87 - copy attached), Data Sources and Quality Assurance for the Compilation of a Chemical Thermodynamic Data Base for use in Licensing of a High Level Nuclear Waste Repository: Position Paper, Lawrence Livermore National Laboratory, Livermore, CA.
- [18] K. Knauss et al., 1988, The Dissolution Kinetics of Quartz as a Function of pH and Time at 70°C, *Geochim. Cosmochim. Acta*, v. 52, p. 43-53.
- [19] K. Knauss et al., 1989, Muscovite Dissolution Kinetics as a Function of pH and Time at 70°C. *Geochim. Cosmochim. Acta*, v. 53, p.
- [20] P. Larsen et al., (in prep), The Dissolution of Natural and Synthetic Cristobalite Under Conditions of Varying pH and Temperature.
- [21] K. L. Nagy et al., (in prep), The Dissolution and Precipitation Kinetics of Kaolinite: Initial Results at 80°C with Application to Porosity Evaluation in a Sandstone.
- [22] A. Blum et al., (in prep), The Effect of Dissolution Density on the Dissolution Rate of Quartz.
- [23] W. O'Connell, D. Lappa, R. Thatcher, (submitted to YMPO for review), Waste Package Performance Assessment for the Yucca Mountain Project, UCRL-100395, Lawrence Livermore National Laboratory, Livermore, CA.
- [24] W. O'Connell and R. Drach, 1986, Waste Package Assessment: Deterministic System Model Program Scope and Specification, UCRL-53761, Lawrence Livermore National Laboratory, Livermore, CA.



Science Applications International Corporation

REFERENCE 7

INTEROFFICE MEMO

DATE: 25-Sep-1989

TO: John Estella
Steven Nolan *M. Voegelé*

FROM: M. D. Voegele

SUBJECT: Meeting on August 16, 1989 to Discuss Singer Allegations on SCP Preparation

In response to questions raised during discussions that took place in my office on August 16, 1989 in relation to Sam Singer's allegations in the news media, I have prepared the following synopsis of information relevant to activities and decisions in the period 1985 and 1986 during the preparation of an early draft version of Chapter 1.7 of the SCP.

In September, 1985 the DOE was completing the EA and beginning to work on the SCP. At this time, a draft of Chapter 1 of the SCP, including Section 1.7, (mineral and energy resources), prepared by the USGS (the participant programmatically responsible for preparation) was ready for review. The draft did not include an adequate Section 1.7 and SAIC was informally asked to prepare a version of the SCP Section 1.7 that addressed NRC guidance as specified in Reg. Guide 4.17.

Mr. Ed Oakes, an SAIC employee working on the T&MSS Project in non-dedicated status as part of the Environmental Group, was asked to prepare a draft of the section, following the guidance in NRC Reg. Guide 4.17. Mr. Oakes prepared the section and it was submitted to a technical review group charged with review of Chapter 1 of the SCP.

During this review process, several problems were identified with the section 1.7 as submitted. First, Reg. Guide 4.17 calls for identification of a specific methodology for mineral resource evaluation (U.S. Geological Survey Bulletin 1450a as revised by USGS Circular 831). The method described by Mr. Oakes in response to this guidance was a non-standard technique, published only in abstract form. Reg. Guide 4.17 calls for a synopsis of the site, reviewing all relevant materials to the extent available such that (1) resource potential of the site could be compared with other comparable areas containing resources, (2) a tabulation of total resources describing the methods used in the tabulation for the site could be provided, and (3) the description and location of any past or present oil and gas wells in the candidate area could be provided. The technical review group, which was chaired by Dr. William Twenhoffel, an independent consultant, rejected the non-standard assessment methodology used and did not judge the information provided about the candidate site adequate in relation to that required by Reg. Guide 4.17.

Estella/Nolan
25-Sep-1989
Page Two

In the same time frame as the above described review was being undertaken, I had been directed by the project manager, M. E. Spaeth, to add dedicated staff members in several areas to support the required DOE work. It was thought that one of the new staff positions should require experience in mineral and energy resources and as a result, Dr. Steven R. Mattson joined T&MSS in this time frame. As a result of staff additions, I elected to reassign responsibility for completion of SCP Section 1.7 to Dr. Mattson because of his dedicated status in the T&MSS, because of his technical experience, and because the past preparations for section 1.7 of the SCP had been judged inadequate.

Mr. Oakes' supervisor, Michael Foley, and I agreed to submit the question of appropriateness of the methodology suggested by Mr. Oakes to an independent review. At Mr. Foley's insistence, Dr. Howard Pratt was chosen as the reviewer. Dr. Pratt had been the supervisor for both Mr. Foley and me prior to our transfers to the T&MSS project; additionally, Dr. Pratt was the designated Chief Scientist for the T&MSS Project. Dr. Pratt's review of the method proposed by Mr. Oakes supported the conclusions originally reached by the technical review group and added new concerns as to adequacy of the prepared draft section 1.7.

Dr. Pratt's review of the material in question is attached.

The decision to assign responsibility for completion of SCP Section 1.7 to Dr. Mattson was made with recognition of Mr. Oakes' interest in the section in mind. Accordingly, on October 3, 1986 I sent a letter to Mr. Oakes informing him that we would be interested in his review of the revised document and asking for him to inform us of a schedule for provision of his comments on the revised schedule. His reply to that request, dated October 14, 1986 indicated that he was willing to review the section. Subsequent to that memo, Mr. Oakes informed me, in a memo dated October 27, 1986, that he was no longer interested in providing review comments on the revised SCP section. Copies of the three letters are attached.

The newly drafted section 1.7 of the SCP, written by Steven R. Mattson, was extensively reviewed by T&MSS staff, DOE staff, DOE/HQ staff, the Chapter 1 technical review group and consultants from both the mineral and energy resource technical fields. No major difficulties with the draft section resulted from these reviews.

There are several other points that were discussed in the meeting in my office on August 16 that, although not directly relevant to the allegations of Mr. Singer, should be included in these notes. The first of these points is concerned with the preparation process of the SCP. The DOE developed an annotated outline for the SCP and met with the NRC to discuss it in February, 1985; subsequent to that, the DOE developed project office and headquarters SCP management plans. The Project Office SCP Management Plan was specifically designed with group consensus in mind; a formal dispute resolution mechanism was embodied in this concept. The comment resolution

Estella/Nolan
25-Sep-1989
Page Three

process attempted to obtain resolution at the level of the author and commenter. Means for elevating unresolved comments to a program review group were provided. Importantly, the resolution of such disputed comments was documented, and records of such resolutions were placed in the SCP project files. The entire CD/SCP utilized this review process; specifically, Chapter 1 of the CD/SCP was reviewed in accordance with this management plan concept. The CD/SCP Chapter 1 review was held during late 1986 and early 1987. It is relevant to note that at the time of preparation of what eventually became the CD/SCP, the programmatic intent was to prepare only the statutory SCP; the concept of issuing a CD/SCP was due to a decision made by DOE/HQ quite late in the preparation sequence. Subsequent to issuance of the CD/SCP and the receipt of comments from the NRC and USGS Headquarters, the SCP Management Plan was revised and the review process reexamined for preparation of the statutory SCP.

The project records clearly indicate that the decision to not participate in completion of the SCP was made by Mr. Oakes, albeit his role would have been as reviewer, rather than lead author. The review in which Mr. Oakes participated was not conducted under the formal SCP Management Plan; Chapter 1 was, however, subsequently reviewed under the SCP Management Plan.

I specifically note that we received no comments from either the NRC or the USGS to suggest that a methodology similar to the non-standard mineral resource evaluation methodology originally proposed by Mr. Oakes should have been included in the SCP. Actually, Mr. Oakes could have commented on the CD/SCP as a reviewer (Voegele letter dated Oct. 3, 1986) or as a member of the public, had he felt strongly that the CD/SCP approach to mineral resource evaluation was truly inadequate and that the DOE had left him no other recourse.

I personally do not believe that Mr. Oakes made a serious attempt to indicate that he wished to dispute the technical review committee conclusion. I know of no formal correspondence directed either to me, as designated manager of the T&MSS effort in support of the preparation of the SCP, or to Dr. W. Twenhoffel, the chairman of the committee that reviewed the draft of SCP Chapter 1, indicating that Mr. Oakes wished to dispute the conclusions of the review committee to include a mineral resource assessment methodology other than the one he proposed. Neither did Mr. Oakes ever inform me that he wished to dispute that conclusion. I believe the formal interchange of letters between Mr. Oakes and me on October 3, 1986, October 14, 1986, and October 27, 1986 demonstrates that ample opportunity was provided for Mr. Oakes to participate in the completion of Chapter 1, and, using the comment resolution forms implemented following issuance of the SCP Management Plan, express his views on the content of Chapter 1.

I consider the information upon which Mr. Singer based his allegation to be rumor and hearsay arising from Mr. Oakes' and Mr. Foley's displeasure at the

Estella/Nolan

25-Sep-1989

Page Four

replacement of Mr. Oakes, a non-dedicated staff member, by Dr. Mattson, as a dedicated T&MSS employee to complete preparation of SCP Chapter 1. I know of no information to substantiate Mr. Singer's allegation that Mr. Oakes was removed from the SCP preparation process because DOE wanted to maintain a position that there are no known mineral resources at Yucca Mountain.

The Mineral Resource investigations in the SCP (section 8.3.1.9.3) recognize that the evaluations required by 10CFR60 involve a sophisticated evaluation of mineral resource exploitation at times in the distant future. Independent HQ-selected consultants participated with the project office scientists in the preparation of SCP section 1.7, as well as section 8.3.1.9.3. The group was able to develop a consensus approach to the problem of mineral resource evaluation, including extrapolations into the future.

Teubner

2 to file
5.2.2.2.3.1

MEMORANDUM

DATE: JUNE 5, 1986

TO: MICHAEL VOEGELE

FROM: HOWDY PRATT *HRP*

SUBJECT: REVIEW OF SECTION 1.7 OF THE SITE CHARACTERIZATION PLAN FOR THE NNWSI PROGRAM, TITLE: MINERAL AND HYDROCARBON RESOURCES

This section of the SCP contained a preliminary assessment of the mineral and hydrocarbon potential for Yucca Mountain. It is an important consideration for the ultimate licensing for a repository. The objective of this section should be to quantitatively assess the potential for the occurrence and development of mineral and hydrocarbon resources at the Yucca Mountain Site, Nevada. The methodology that is required must be quantitative in nature and lead to definitive statements as to potential for occurrence and economic development. Specific comments are given in the margin of the text which is attached.

1. The methodology developed in the current write-up, although a starting point, will not allow us to evaluate the resources quantitatively to the level required for licensing, nor under this scenario, will we be able to probably gather enough data in the future to quantify our decision making process. The diagram (Fig. 1.7-1) showing the relationship between favorability and certainty is not quantitative enough for licensing. The quantitative methodology that needs to be developed must consist of a number of factors and includes the geological setting, including depth of the resource, lithology, geologic structure, age of the rocks, and poten-

tial economic models that might be applied to the site.

2. Scenarios must be developed that use the data base that exists at (a) the Yucca Mountain site, (b) the Nevada Test Site in general (I will cite some examples), and (c) the data base within Nevada and the Basin and Range tectonic province.

For example, we have to assess the probability of a given resource based on a geologic model for the Yucca Mountain area. It will be very important to evaluate:

- (1) Is there a pluton under Yucca Mountain and what is the probability for that pluton being there?
 - (2) Where is it potentially located and how deep?. This has implications on the probability of vein type deposits.
 - (3) What is the evidence for hydrothermal alteration?
 - (4) What are the probabilities of a caldera ring type fracture system under Yucca Mountain and how probable is that in the context of the caldera development in the vicinity of Yucca Mountain?
3. There is a vast data base at NTS in terms of facilities and boreholes associated with the Defense Department's underground test program that could be used to assess the potential for resources. Two lines of evidence for establishing the probability of a resource, for example, that should be discussed are:
 - a. Are there other intrusives and associated tuffaceous rocks for which we have a data base in the area. The Climax Stock has been studied extensively and has been the site of an underground test program

with shafts, tunnels and extensive boreholes. Analysis of that data base would be helpful. In close proximity to the granite stock is a large underground tunnel complex located in tuff at Rainier Mesa. This areas has been used for underground testing. The USGS has extensively studied the mineralogy, geology, geophysics, and structure of that area. No mention was made of these rocks which certainly has relevance to relationships between tufaceous rocks adjacent to granitic intrusives at the NTS.

- b. The geologic model of a tuff sequence overlain by Paleozoic sediments which in turn overlies an intrusive needs to be evaluated in terms of a geologic data, including borehole data, aeromagnetic data, seismic reflection data, and other kinds of geophysical data.
 - c. A quantitative assessment of the analogies between Yucca Mountain area, mining areas, and the area at Calico Hills, and other areas of the test site need to be evaluated. For example, based on geophysical data, a deep hole was drilled to explore for a potential buried intrusive at Calico Hills. No intrusive was found. These data need to be incorporated into any discussion of probability of a mineral resource at Yucca Mountain.
4. The analysis of Figure 1.7-1, A Diagram Showing the Relationship Between Favorability and Certainty, while qualitatively a potential approach, in my estimation, does not lead to an ultimate quantitative evaluation of how we might decide whether there is a potential for gold resources or other kinds of resources. How do we quantify either the upper or lower curve to the extent necessary and attach quantitative

measures, either probabilities or dollar values to these kinds of curves. I don't know how to quantify this type of methodology.

5. Figure 7.2.2.1 needs to be redrafted. It was impossible to read this particular figure.
6. Quantitative data discussed in the text is not used in any quantitative analysis. For example, the statement that 3 out of 98 gold producing regions within Nevada are associated with caldera complexes (p. 1.7-10), needs to be input into the development of a quantitative methodology. These data were presented as a statement, but then not followed through or used in the development of any kind of methodology. This needs to be done.
7. The analysis of other potential resources such as geothermal or oil and gas needs to be evaluated in a quantitative fashion. Statements like that on page 1.7-24, like "Yucca Mountain is favorable for low temperature geothermal resources," and then in the next sentence, "This potential exists for everywhere in the western United States," is the type of statement that does not give the reader any kind of discriminatory feeling for whether this kind of resource might be exploited. The answer is obviously, no, given the fact that the kinds of resources that are being developed in the Basin and Range, for example, Roosevelt Hot Springs, Utah or Raft River, Idaho, are completely different in nature. The reader is not given any kind of quantitative screening.
8. As far as hydrocarbon resources are concerned, p. 1.7-27, we need to avoid qualitatively vague statements like "Future economic development of requires that current large concentrations are close to the surface." Railroad Valley, Nevada is currently being drilled and produced at depths of 3 to 6 thousand feet and where oil fields on the order of a few

million barrels are being assessed carefully. This section doesn't represent an understanding of most recent thoughts on Basin and Range oil reservoirs, or the current kinds of exploration activities to define oil reservoirs associated with thrust or listric type faults that have been going on during the past few years. The final assessment that there is virtually no potential for oil/gas resources at Yucca Mountain is correct, but the analysis to come to that conclusion is not well conceived.

9. Section 1.7.3. The summary should be thought through very carefully. I personally don't agree with the statement that there is a moderate geologic favorability for gold between one and three kilometers below the surface at Yucca Mountain. As far as I know, there is no evidence at Yucca Mountain for these kinds of deposits with economic value. It is important that we assess the probability of a intrusive existing below Yucca Mountain. If an intrusive does not exist below Yucca Mountain and there is not a potential for a large fracture system, then the probability of economic deposits in or below Yucca Mountain, would be considered very improbable. These information needs to be assessed in light of the current data base (geologic, geophysical) and the data that we will gather during the site characterization program.



Science Applications International Corporation

10-3-86

INTER-OFFICE MEMO

DATE: October 3, 1986

M86-TPD-MDV-239

TO: E. Oakes

FROM: M. Voegele *MV*

SUBJECT: Draft Report on "The Assessment of Mineral and Hydrocarbon Resources at Yucca Mountain, Nevada"

Enclosed is a draft report entitled, "The Assessment of Mineral and Hydrocarbon Resources at Yucca Mountain, Nevada" by Steven R. Mattson and MaryEllen Giampaoli. This report was prepared for Section 1.7 of the SCP (Mineral and Hydrocarbon Resources) and will be submitted for review to Chapter 1 SCP PIRC members.

If you desire to review the prepared material, we have two requests:

1. Please inform us of your intent to review this material; we can then develop a mutually acceptable schedule for receipt of your comments, and
2. Please provide any comments that you may have on the comment response forms in use by other SCP reviewers.

MDV:pt

Enclosure:
As stated

cc w/o encl:
 H. Pratt
 J. Younker
 M. Teubner
 S. Mattson
 M. Spaeth/W. Macnabb/W. Devlin
 J. LaRiviere/R. Sweeney
 S. Klein/S. Metta
 M. Foley
 J. Donnell
 SCP Project File 1.2.5.2.2.2.2.2

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TAG, SRM, MB

② Proj

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file 1.2.5.222.

CA 3 5. 2. 2. 2.

10-14-86



DATE: October 14, 1986

TO: M. Voegele

FROM: E. Oakes *EO*

SUBJECT: Review of draft report on "The Assessment of Mineral
and Hydrocarbon Resources at Yucca Mountain, Nevada"

In response to your memo (#M86-TPD-MDV-239), I am willing to review the draft report mentioned above. I have begun reading the report and I will provide you with my comments on 'comment-response forms.' Please let me know when my comments are required.

cc

M. Foley



October 27, 1986

TO: Mike Voegele

FROM: Ed Oakes *EO*

SUBJECT: Review of Section 1.7 of SCP

In view of my current work schedule, and the fact that the USGS will be reviewing Section 1.7 of the SCP (Mineral and Hydrocarbon Resources), I have reconsidered my initial willingness to review this section. Therefore, I will not be submitting any written comments to you on Section 1.7.

cc
Mike Foley

INFORMAL INPUT

DATE: July 26, 1988

TO: Steve Nolan

BEST AVAILABLE COPY

FROM: Ed Oakes *Eto*

SUBJECT: Review of Section 1.7 of the Consultation Draft of the Site Characterization Plan (SCP/CD)

At the request of Steve Metta, I've completed my review of Section 1.7 of the SCP/CD (Mineral and Hydrocarbon Resources). The conclusions reached in that section are, with only minor differences, similar to the conclusions I reached in my original draft of Section 1.7 submitted in June of 1985.

My only criticism of Section 1.7 as it now stands concerns the scope of the assessment. As described in the first paragraph of Section 1.7, a repository site with a low potential for mineral resources is a desirable characteristic (10 CFR Parts 60 and 960) because the likelihood of future exploration in such a geologic environment is less than if the site had a high potential for mineral resources. I believe that most geologists would concur with this line of reasoning.

On page 1-257, however, the statement is made that it is "...standard practice (as of 1973) to exclude evaluation of mineral resources (base and precious metals) below 1 km..." due to the poor economics of mineral extraction at these depths. Because the Paleozoic rocks at Yucca Mountain are generally deeper than 1 km below the surface, the argument is made that the resource potential of the Paleozoic rocks can only be evaluated in a most general, qualitative sense.

Considering that a repository is to remain undisturbed for thousands of years, it seems rather shortsighted to exclude from a "quantitative" assessment those rocks that a future explorationist might find most interesting simply because they are "currently" too deep for economic extraction of mineral resources. As we all know, the economics of mineral extraction can change rapidly over short periods of time; over long periods of time (100s of years) extraction economics are simply not known.

I believe, therefore, that the "long-term" mineral assessment of Yucca Mountain should, to the extent possible, be based on an evaluation of the favorability of the geologic environment for specific types and sizes of mineral accumulations. This evaluation should be largely devoid of current economics associated with mineral extraction, and should include the Paleozoic rocks beneath Yucca Mountain.

EHO/gjj

CC:
J. R. Penland, SAIC, Campus Point, CA