



Department of Energy
Office of Civilian Radioactive Waste Management
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JAN 20 1995

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ISSUANCE OF SURVEILLANCE RECORD YMP-SR-95-010 RESULTING
FROM YUCCA MOUNTAIN QUALITY ASSURANCE DIVISION (YMQAD)
SURVEILLANCE OF U.S. GEOLOGICAL SURVEY (USGS) (SCPB: N/A)

Enclosed is the record of Surveillance YMP-SR-95-010
conducted by the YMQAD at the USGS facilities in Denver,
Colorado, December 12-14, 1994.

The purpose of the surveillance was to observe implementation of
technical recommendations made as a result of Audit YMP-94-06.

This surveillance is considered completed and closed as of the
date of this letter. A response to this surveillance record and
any documented recommendations is not required.

If you have any questions, please contact either Robert B.
Constable at 794-7945 or James Blaylock at 794-7913.

Richard E. Spence, Director
Yucca Mountain Quality Assurance Division

YMQAD:RBC-1773

Enclosure:
Surveillance Record YMP-SR-95-010

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JAN 20 1995

cc w/encl:

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OFFICE OF
RADIOACTIVE WASTE MANAGEMENT
U.S. DEPARTMENT OF ENERGY
WASHINGTON, D.C.

QUALITY ASSURANCE SURVEILLANCE RECORD

SURVEILLANCE DATA

¹ORGANIZATION/LOCATION:
U. S. Geological Survey
(USGS), Denver, CO

²SUBJECT:
Technical Recommendations from Audit 94-06

³DATE: 12/12-14/94

⁴SURVEILLANCE OBJECTIVE: Observe implementation of technical recommendations made as a result of Audit 94-06

⁵SURVEILLANCE SCOPE: The scope of the surveillance included ongoing geologic and modelling activities performed by the USGS.

⁶SURVEILLANCE TEAM:
Team Leader:

James Blaylock

Additional Team Members:

Jeff McCleary (Technical Specialist)

⁷PREPARED BY:

James Blaylock

12/11/94

Surveillance Team Leader Date

⁸CONCURRENCE:

N/A

QA Division Director Date

SURVEILLANCE RESULTS

⁹BASIS OF EVALUATION/DESCRIPTION OF OBSERVATIONS:
See pages 2 through 8

¹⁰SURVEILLANCE CONCLUSIONS:
See pages 8 through 10

¹¹COMPLETED BY:

James Blaylock

1/17/95

Surveillance Team Leader Date

¹²APPROVED BY:

Robert B. Cantale

1-18-95

QA Division Director Date

ENCLOSURE

Block 9 (continued) Basis of Evaluation/Description of Observations:

A surveillance was performed at the United States Geological Survey (USGS) during December 12 through 14, 1994. The purpose of the surveillance was to follow up on recommendations made during the audit of June 20 through 24, 1994 (YMP-94-06), and to assess technical progress since that time. Accordingly, the following discussion is organized by study plan, followed by a final section that provides observations that are applicable to more than one study.

Study 8.3.1.4.2.1, "Characterization of the Vertical and Lateral Distribution of Stratigraphic Units within the Site Area"

The first activity in this Study focuses on the acquisition of surface and subsurface stratigraphic information. The majority of the recent technical work has included detailed logging of core from project boreholes. The technical specialist previously noted a potential need for a core logging procedure (instead of the Scientific Notebook [SN] in use at the time) and the desirability of using standard nomenclature and scales to facilitate correlations/comparisons between boreholes. Based on interviews with Rick Spengler and Dave Buesch, it appears that significant progress has been made in this area. A multidisciplinary/multiparticipant team has been assembled, with Dave Kessel of Sandia National Laboratories (SNL) acting as the team coordinator, to develop a project wide procedure to standardize formats and scales when providing information on lithology, fractures, structures, hydrologic characteristics, etc. When completed this effort should make a significant contribution toward project goals.

The second activity in this study focuses on the collection and interpretation of surface based geophysical data. Rick Spengler indicated that data collection continues to go well. New seismic data was recently collected in Crater Flat and the rough field stacks indicated that the new data were useable. Geophysical data from Midway Valley indicated the presence of buried faults in that area. Several techniques (gravity, seismic, magnetics) are being utilized successfully. Scales have been standardized at 1:12,000 to facilitate comparisons between data sets and with mapped structure. This resolves a concern expressed during the June audit relative to the standardization of scales.

The third activity in this study is the collection and interpretation of borehole geophysics. There is currently no USGS effort in this activity.

Conclusions

Significant progress is being made in those activities of this study where USGS work is ongoing. Progress both in the sense that additional data (core logs, geophysics, etc.) is being collected and in the sense that the scales and formats being used or developed will facilitate the integration and usefulness of the data.

Study 8.3.1.4.2.2, "Characterization of Structural Features within the Site Area"

In this study, the technical specialist focused on two activities: geologic mapping of zonal features in the Paintbrush Tuff and geologic mapping of the Exploratory Studies Facility (ESF). Relative to the mapping of zonal features the technical specialist interviewed Art Braun and Rick Spengler and examined detailed maps that have been completed along the Ghost Dance and Sundance Faults. The maps demonstrate careful attention to detail and portray complex geologic relationships in this highly fractured and faulted extensional terrain. The technical specialist also examined a review of the maps by D. R. Shawe, dated 10/20/94. This review included the development of numerous cross sections. There is controversy surrounding the interpretation of this data set because of the geologic complexity displayed on the maps. This is not surprising considering the intersecting north and northwest sets of faults, the amount of cover, and the difficulty in locating some of the contacts. Apparently mapping and other data collected in Fiscal Year (FY)93 and FY94 are still pending inclusion in the Local Records Center (LRC) due to the controversy over interpretation. Since the maps and data appear to have been very carefully collected and reviewed the technical specialist suggests that they be put in the LRC and made more widely available. The controversy over interpretation may continue. It is the understanding of the technical specialist that no additional mapping is planned for this activity. If this is correct there appears to be no purpose in developing a detailed procedure specific to this study as was previously suggested.

The technical specialist interviewed Steve Beason and Mike Fahy and examined the Underground Mapping Procedure (NWM-USGS-GP-32, R0) relative to the ESF mapping activity. Also examined were some of the map products (starter tunnel, etc.) produced to date. Significant progress is being made in this activity. The mapping of the starter tunnel, Alcove #1, the drainage channel, and the portal highwall are available and a letter report is due out at the end of January 1995. The new procedure for Underground Mapping provides excellent level of detail and provides a standard for estimating composition percentages visually. Use of this procedure should produce a set of consistent, high quality, useable maps of the underground workings, particularly with the Geologic Overview Underground Training (GOUT) provided to the mapping team.

After the data (maps, detailed line surveys, etc.) are collected, some analysis/interpretation is conducted. It appears to the technical specialist that the decisions as to what type of analysis/interpretation to perform are not well documented. It is recommended that the Principal Investigator's (PI) consider how to document those decisions (a SN for example) as the study progresses.

Conclusions

The work being done under these activities is being conducted in a highly competent manner that is producing useful information for the project.

Study 8.3.1.4.2.3, "Three-Dimensional Geologic Model"

There has not been a great deal of activity on the 3-D model since the June audit. The technical specialist interviewed Rick Spengler who indicated that two additional holes (SD-9 and SD-12) had been added to the model. These resulted in only minor adjustments to the layers already in the model. In addition, two lower layers (base of the Calico Hills and Prow Pass) were added to the model.

When questioned about the interface with process modelers (i.e., have any process models such as a flow model been run on the geometry [structure and stratigraphy] being developed in the 3-D model) the PI expressed some disappointment and indicated that the 3-D model was not being well utilized. This perception was reinforced later in the surveillance when another PI expressed surprise that a 3-D model existed.

Conclusions

It is the opinion of the technical specialist that it is important to the project to develop and utilize the 3-D model. It does not appear to be an efficient utilization of resources to be running process models such as hydrologic models, tectonic models, or heat flow models on an assumed or generalized geometry when the actual geometry as determined from numerous boreholes, surface mapping, and geophysics is available. If a process model requires a larger area or greater depth, the current 3-D model can be extended with the best available information, but at least the core area geometry would conform to that determined by the project's exploration program. The 3-D model should be a useful tool for the integration of a number of other studies.

Study 8.3.1.8.2.1, "Tectonic Effects"

There has been a low level of activity on this study since the June audit. The technical specialist interviewed Chris Fridrich, the PI who reported that the revised study plan has now completed U. S. Department of Energy (DOE) review and comments are being responded to. The details of how this study will be executed (ie. simplification of SNL event trees, and thresholds or criteria for eliminating unlikely scenarios) have not been finalized, however, a decision has been made to document the study with a scientific notebook. The PI made the comment that a recent milestone had been fulfilled by turning in whatever was available at the time. Unless submittals of this type are very clearly labeled on every page as preliminary information, this practice can lead to the utilization of incorrect or out dated information. It is the technical specialist's opinion that this practice should be discouraged.

Conclusions

This study is still in a preliminary stage of development. The technical specialist may have developed an incorrect impression but it appears that this study is evolving rather than being planned. If true, this may even be appropriate for this particular study. However, some serious consideration should be given to the benefits of more focused planning.

Study 8.3.1.17.4.3, "Quaternary Faulting within 100 km of Yucca Mountain, including the Walker Lane"

The technical specialist interviewed Larry Anderson, Lucy Piety, and Ralph Klinger and examined the following documents: The preliminary map and associated documentation of known and suspected Quaternary faults within 100 km of Yucca Mountain (a pending Open File Report [OFR]); a draft report titled Late Quaternary Slip Rate Estimates for the Death Valley and Furnace Creek Faults, Death Valley, California by Klinger and Piety; and a technical data records package titled Scarp Profiles and Geologic Map for the Death Valley and Furnace Creek Fault Zones, Death Valley, California. All of the work reviewed was of high quality, is being conducted in a competent manner by well qualified geologists, and will be useful for the project. However, during the course of the interviews and data reviews the technical specialist identified some quality management concerns that may need to be addressed. For example, there does not appear to be a systematic and consistent approach to air photo interpretation. As a literature survey, the fault map and supporting documentation in the pending Open File Report (OFR) only report on previously mapped faults, and coverage across the 200 km diameter region is not uniform. A uniform survey across the Nevada portion of this region has been completed by John Dohrenwend of the USGS. However, this "even look" is not included in the pending OFR because Dohrenwend's work, though familiar to the PI and fairly widely available, is apparently not yet officially published. Since publication of the OFR appears to be stalled due to budget problems and USGS editorial/format concerns, there may be an opportunity to include the reference cited above.

There is another concern that the remaining work is being fragmented. Larry Anderson is going to continue work on the Death Valley and Bare Mountain fault systems while Ernie Anderson, in a different office and different organization, is going to pursue the work in the rest of the region. It will require considerable communication, cooperation, and management attention to ensure that this single study is consistently and systematically executed.

In the opinion of the technical specialist the pending OFR is an excellent, well documented foundation for the remainder of the study, particularly if it is augmented as previously suggested. However it appears as though it is being viewed as an end in itself. For example, when the question was asked "Will the data sheets used to compile information on each fault for the OFR be

updated/annotated with observation from photo interpretation or field work?" the answer was negative. Apparently the additional work will be documented in separate reports rather than building on the existing resource. This may not be the best utilization of an existing quality document.

Conclusions

The work completed to date in this study is of high quality and will be useful to the project. It may be appropriate to consider how best to build on this foundation for the completion of the study.

Study 8.3.1.17.4.5, "Detachment Faults at or Proximal to Yucca Mountain"

This study includes five activities, mapping and evaluation in four areas (Calico Hills, Beatty/Bare Mountain, Crater Flat, and Spector Range/Camp Desert Rock) and dating/thermo-barometric studies. John Whitney provided the technical specialist with a brief overview of the progress on this study since the June audit. In addition the technical specialist had an opportunity to briefly examine two draft reports prepared as part of this study; "Geology and Hydrothermal Alteration of the Calico Hills, Nye County, Nevada", by Simmonds and Scott; and "Rock-Avalanche Breccia Deposits of the Yucca Mountain Region, Nevada, and their Tectonic Significance", by Simmonds and Fridrich. It is apparent that progress is being made in this study since reports are being written and are progressing through the review process. However, the technical specialist is concerned about the extremely uneven level of detail between activities within this study. It creates the perception that a systematic study to evaluate detachment faults at or proximal to Yucca Mountain has not been done. For example, at one end of the spectrum of level of detail is the above referenced report on the Calico Hills. This is a voluminous document which does include an evaluation of the Tertiary/Paleozoic contact as described in the Study Plan. In addition it contains information on the structure and stratigraphy of the Paleozoic rocks exposed in the Calico Hills, details of the hydrothermal alteration, etc. If all of this information is relevant to the detachment faulting issue, it should be collected in all areas studied. At the other end of the level of detail spectrum is the Spector Range and Camp Desert Rock areas where no report exists and none is planned. Apparently these areas have been visited in the field and a decision has been reached that the Tertiary/Paleozoic contact is depositional. It is assumed that this is documented in a field notebook. Apparently no mapping has been conducted although it is called for in the Study Plan. Perhaps midway on the level of detail spectrum is the report on breccia deposits. This report however goes considerably beyond the evaluation described in the study plan and appears to state the conclusion in the title, that all breccias in the Yucca Mountain region are rock-avalanche deposits. This style of writing is also of concern to the technical specialist and will be discussed in more detail in the final section of this surveillance report.

Conclusions

It is going to be challenging to produce a comprehensive final report on detachment faults at and proximal to Yucca Mountain given the documents produced to date, which would presumably form the basis for the final report. It may be necessary to conduct some mapping in the Spector Range and Camp Desert Rock areas in order to fulfill commitments made in the Study Plan.

Study 8.3.1.17.4.12, "Tectonic Models and Synthesis"

The technical specialist was provided with a brief overview of this study by John Whitney. In addition the draft report, "Tectonic Modeling of Yucca Mountain", by Janssen and King was briefly examined. The Study Plan for this effort is currently back at DOE for review/concurrence. Ongoing activities include revising/modularizing the code for the boundary element model. This is being done by a Macintosh programmer with the USGS at Woods Hole, Geoffrey King, the co-author of the above referenced report is the PI for the Study; he is located in France. The decision has been made to document model inputs in a SN. Plans include discussing all published models plus development of new models. The technical specialist is concerned that it will be difficult to manage this study given the diverse locations of personnel, the apparent introduction of a new computer system (Macintosh), and the need to have the input geometry for the model be consistent with the existing but evolving 3-D geologic model of the site (ie. integration with other modeling studies). Another concern is the language/writing style of the draft report. This will be discussed in more detail in the final section of this surveillance report.

Conclusions

This study appears to still be at a very preliminary stage. It was not clear how the various elements will be integrated with the 3-D geologic model or other modeling studies. Perhaps more effort needs to be put into formulation of the study and its integration with other studies.

Observations Applicable to Several Studies

In the Audit Report (YMP-94-06) for the June 20 through 24, 1994 audit the technical specialist made some observations and recommendations relative to what was called "conclusionary language". At the time, the observation was made relative to planning documents. The examination of other documents during this surveillance has increased the technical specialist's concern over conclusionary language, overstatements, and the writing style of project documents. The writing style of some project documents contributes to the perception of the regulatory and adversarial communities that the project is not integrated and does not adequately address alternative conceptual models. For example, in the report by Janssen and King, "Tectonic Modeling of Yucca Mountain", the statement is made, "a fault must exist under Crater Flat with an approximate throw of 3 km". Is

this true? There is absolutely no other possibility? It would be more correct to state - "Given the fault geometry input to the boundary element model and the way the model operates, a fault under Crater Flat with a throw of approximately 3 km is predicted. Ongoing geophysical data collection and interpretation will be useful in evaluating this prediction". Writing in that style will demonstrate that the author is aware of the limitations of his model and is integrating his efforts with other ongoing work in order to refine his model.

The report "Rock-Avalanche Breccia Deposits of the Yucca Mountain Region, Nevada, and their Tectonic Significance" essentially states the conclusion in the title. This can create the perception in the reader that a decision has been made (i.e., those breccias are rock-avalanche deposits) and data is then presented that supports this interpretation. The contention in this report that the rock-avalanches are seismically triggered may also be overstated. The purpose of these project documents is not necessarily to prove a point. An objective presentation of the data, a discussion of the models that could be supported by the data, and the selection of a preferred model (in this case rock-avalanches) is often all that is necessary.

The following personnel were contracted during the surveillance:

Larry Anderson	. . . PI	. . . . .	U.S. Bureau of Reclamation (USBR)
Steve Beason	. . . PI	. . . . .	USBR
Art Braun	. . . . . PI	. . . . .	Science Applications International Corporation (SAIC)/Golden
David Buesch	. . . PI	. . . . .	USGS
Michael Fahy	. . . PI	. . . . .	USBR
Chris Fridrich	. . . PI	. . . . .	USGS
Ralph Klinger	. . . PI	. . . . .	USBR
Lucy Piety	. . . . . PI	. . . . .	USBR
Richard SPengler	. . . PI	. . . . .	USGS
John Whitney	. . . PI	. . . . .	USGS
Mike Chadwick	. . . EST	. . . . .	USGS
Larry Hayes	. . . . .	Technical	USGS Project Officer (TPO)
Lou Ducret	. . . . .	Deputy TPO	USGS
Bruce Parks	. . . . .	Chief ESIP	USGS
Ardell Whiteside	. . . . .	ESIP QA	. . SAIC/Golden
Susan Zimmerman	. . . . .	Observer	. State of Nevada

Block 10 (continued) Surveillance Conclusions:

Perhaps the clearest way to state the conclusions of this surveillance is in terms of the recommendations that the technical specialists made after the June Audit (recommendations 9 through 18 of audit report YMP-94-06). These are as follows:

1. Recommendation 9 concerned conclusionary language/writing style in planning documents. As discussed in Block 9 the technical

specialist is concerned that the writing style of some project documents contributes to the perception of the regulatory and adversarial communities that the project is not integrated and does not consider alternative conceptual models. Project participants need to begin writing in a style that demonstrates integration and consideration of alternate models.

2. Recommendation 10 concerned the need for greater consistency in formats for basic geologic data collection, such as in rock descriptions. The technical specialist notes significant progress in this area. The current team approach to developing a consolidated logging procedure (Dave Kessel, Dave Buesch, and others) is a good example of this progress, as is the recently completed "Underground Geologic Mapping" procedure by Steve Beason.
3. Recommendation 11 concerned ensuring that field notebooks directly support the scientific effort rather than being used as a personal diary. No recent field notebooks were examined during the surveillance. Some notebooks should be examined during the next surveillance or audit.
4. Recommendation 12 concerned the use of standard scales for maps, geophysical data, well logs, etc. to facilitate interpretation of multiple data sets. The technical specialist did not examine any new data sets directly, however it is apparent that progress is being made in this area. Dave Buesch indicated that the new logging procedure under development will provide for standard logging scales and Rick Spengler indicated that surface geophysical data is being displayed at 1:12,000; the same scale as the geologic map.
5. Recommendation 13 concerned earlier integration of data from multiple studies. The technical specialist is still concerned about the apparent lack of early integration. Some examples have already been provided in the context of writing style and the need to demonstrate integration in project documents. Another example is the lack of utilization of the 3-D geologic model which should form the base for process, tectonic, and other project models, and is an ideal way to demonstration integration. A third example from the June

audit is that when the question was asked by the technical specialist "A report on the C-wells suggests that the Paintbrush Canyon Fault was intercepted near the bottom of the wells. This gives the fault a dip of 55° to a depth of about 850 meters. Was this information used to constrain the depth of the postulated detachment below Yucca Mountain?" the response was negative. It is the opinion of the technical specialist that early data integration will generally lead to a higher quality report.

6. Recommendation 14 concerned timing of reviews and the need for early reviews to guide or focus the work. The technical specialist is still concerned about the apparent lack of early reviews to focus studies. For example, the lack of uniform detail between activities in the detachment faulting study could probably have been avoided had early reviews focused the work on resolution of issues as described in the study plan. Review criteria should include such items as: Is the work focused on achieving the goals described in the Study Plan? Are data sets from other activities being integrated with this work? Are data being collected objectively, and not to support a selected model?
7. Recommendation 15 concerned cross referencing of work funded and filed under one activity that is directly applicable to a different activity. The technical specialist was assured that this was occurring, this should be checked in future audits or surveillances.
8. Recommendation 16 concerned documenting work with procedures or scientific notebooks. The original recommendation was directed at modeling studies. The technical specialist found that decisions had been made to document the modeling studies with scientific notebooks. However, it appears that some analysis/interpretation work may be occurring without documentation. Refer to Study 8.3.1.4.2.2 (ESF mapping discussion) in this surveillance report for a description of this situation.
9. Recommendation 17 concerned formalizing procedures for studies that have progressed beyond the trial and error stage. Progress is being made in this area, as noted previously relative to the core logging

procedure (in process) and the Underground Geologic Mapping procedure. The project will benefit from continuing efforts of this type.

10. Recommendation 18 concerns the timely transmittal of technical data to the LRC. There appears to still be problems in this area, at least in the case where controversial interpretations are involved such as with the detailed mapping of zonal features in the Paintbrush Tuff. Perhaps in cases like this the data could be transmitted after it has been reviewed and approved, as the controversy over interpretation may continue for some time.

USGS has actively implemented many of the audit recommendations, both internally and in coordination with other affected organizations. As described in this surveillance report, there are still a few areas that need further attention. There were no Corrective Action Requests issued as a result of the surveillance.