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NSHE/YMP Nuclear Waste Cooperative Agreement

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**NSHE/YMP Nuclear Waste Cooperative Agreement
2006 Administrative Audit Report**

Audit No. AA-06-01

Conducted July – Sep 2006

Approved:



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Raymond E. Keeler
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29 Sep 2006
Date



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29 Sep 2006
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The United States Department of Energy (DOE) and the Nevada System of Higher Education (NSHE) have established a Cooperative Agreement (Co-op) entitled: "Scientific & Engineering Studies of the High-Level Waste Repository at Yucca Mountain" (DE-FC28-04RW12232). The Harry Reid Center for Environmental Studies (HRC) administers the Co-op under project activity ORD-FY04-001. In accordance with 10 CFR 600.150, the HRC conducted an audit for the purpose of managing and monitoring project activities supported under the Co-op. The audit was limited to an investigation of technical productivity and schedule. Financial compliance and quality assurance compliance issues were outside the scope of this audit. The audit was conducted during the fourth quarter of federal fiscal year 2006 which is the third year of the Co-op's five year project period.

1.0 Background

Under the terms of the Co-op, work is incrementally funded by discrete project activity, or task. Each task is managed by a NSHE Principal Investigator (PI) who is responsible for ensuring that the work is properly executed and that DOE is kept abreast of task progress. In keeping with this requirement, each PI submits a quarterly technical progress report. In accordance with 10 CFR 600.151, which establishes the minimum requirements for these reports, each progress report contains "the findings of the investigator," a "comparison of actual accomplishments with the goals and objectives established for the period," and "reasons why established goals were not met, if appropriate"(10 CFR 600.151[d]).

To improve performance monitoring and reporting, the HRC maintains a baseline milestone schedule for each task. Once a task has been approved by DOE, task personnel meet with the Co-op's Project Director and establish goals and objectives (milestones) for the task's performance period. Tasks are expected to report progress toward meeting those milestones in each quarterly report. However, in the course of conducting quality assurance and administrative activities, concerns were raised that PIs were not clearly linking (in measurable terms) the "actual accomplishments" for the reporting period with the milestones established for the period. At times, tasks that appeared to be on schedule according to the information provided in the quarterly reports were requesting schedule extensions, failing to meet reporting deadlines, and, in rare cases, failing to complete whole segments of work. It therefore became apparent that without a clear comparison between actual accomplishments and the established milestones, the quarterly reports do not allow for an adequate understanding of a task's overall progress.

The current audit was therefore planned and executed with four principal objectives:

1. To gain a better understanding of the tasks' overall progress by comparing the actual accomplishments to date with the established milestones and assigning a numeric value to the level or degree of completion (i.e. number of data submittals to date, number of reports submitted to date, completion level of subtasks expressed as a percentage).
2. To more fully identify weaknesses in the reporting process.

3. To educate PIs on their responsibilities under the contractual terms of the Co-op to accurately communicate task progress, problems, and other key issues to affected individuals and organizations.¹

2.0 Scope

All active, Quality Affecting, technical tasks that had not yet submitted a final report to DOE as of September 01, 2006, were included in the audit. This includes all technical tasks with the exception of task ORD-FY04-003 (Geodetic Monitoring). ORD-FY04-003 was recently the subject of a comprehensive progress briefing at DOE which included detailed information regarding the task's progress to-date. Also, ORD-FY04-003 has been designated by DOE as a non-Quality Affecting activity. As such, the task is not required to develop a formal Scientific Investigation Plan that identifies subtasks (the key measure used in the audit for assessing overall task progress).

Table 1 is a listing of the audited tasks.

| Project Activity # | Description |
|--------------------|---|
| ORD-FY04-005 | Groundwater level measurements in selected boreholes near the site of the proposed repository |
| ORD-FY04-006 | Seismic Monitoring |
| ORD-FY04-007 | Precipitation gauge monitoring network |
| ORD-FY04-008 | Baseline Laser Strainmeter |
| ORD-FY04-010 | Chemical Analyses in Support of Yucca Mountain Studies |
| ORD-FY04-012 | Yucca Mountain Climate Technical Support Representatives |
| ORD-FY04-013 | Influence of Lithophysae Geometry and Distribution on Mechanical Properties of Topopah Spring Tuff |
| ORD-FY04-014 | Environmental Effects on Corrosion Properties of Alloy 22 |
| ORD-FY04-015 | Phase Stability and Segregation in Alloy 22 Base Metal and Weldments |
| ORD-FY04-016 | Geostatistical and Stochastic Study of Radionuclide Transport in Unsaturated Zone in the Yucca Mountain |
| ORD-FY04-018 | Groundwater Flow and Thermal Modeling of the Steep Hydraulic Gradient North of Yucca Mountain |
| ORD-FY04-019 | Sub-Surface Corrosion Research on Rock Bolt System, Perforated SS Sheets and Steel Sets for the YM Repository |

¹ In conjunction with the audit interviews, task personnel were also provided with an abbreviated list of administrative and regulatory requirements to which all tasks must comply (see Attachment A).

| | |
|--------------|--|
| ORD-FY04-020 | Precarious Rock Methodology for Seismic Hazard |
| ORD-FY06-022 | Extreme Ground Motion Studies |

Table 1-Audited Tasks

3.0 Audit participants

The audit team consisted of team members and observers from the Harry Reid Center for Environmental Studies. Task personnel interviewed or otherwise contacted for the audit include personnel from the Desert Research Institute (DRI); the University of Nevada, Reno (UNR); the University of Nevada, Las Vegas (UNLV); and the University of California, San Diego (UCSD).

3.1 Audit Team Members

- Raymond E. Keeler, University of Nevada, Las Vegas, Harry Reid Center for Environmental Studies, NSHE Cooperative Agreement Administration (Audit Team Leader)
- Sherry Marks, University of Nevada, Las Vegas, Harry Reid Center for Environmental Studies, NSHE Cooperative Agreement Administration

3.2 Audit Observers

- Morris M. Roosa, University of Nevada, Las Vegas, Harry Reid Center for Environmental Studies, NSHE Quality Assurance
- Julie M. Bertoia, University of Nevada, Las Vegas, Harry Reid Center for Environmental Studies, NSHE Quality Assurance

3.3 Task Personnel Contacted

| | |
|------------------|----------------------------------|
| Anderson, J. | ORD-FY04-006, ORD-FY06-022 (UNR) |
| Anooshehpoor, R. | ORD-FY04-020 (UNR) |
| Brune, J. | ORD-FY06-022 (UNR) |
| Chandra, D. | ORD-FY04-019 (UNR) |
| Decker, D. | ORD-FY04-017 (DRI) |
| Karakouzian, M. | ORD-FY04-013 (UNLV) |
| LaCombe, J. | ORD-FY04-015 (UNR) |
| Lamb, J. | ODR-FY04-019 (UNR) |
| McGraw, D. | ORD-FY04-018 (DRI) |
| McGinnis, N. | ORD-FY04-007 (UNLV) |
| McMillion, G. | ORD-FY04-014 (UNR) |
| Menegus, D. | ORD-FY04-008 (UCSD) |
| Oberlander, P. | ORD-FY04-018 (DRI) |
| Page, F. S. | ORD-FY04-005 (UNLV) |
| Rigby, D. | ORD-FY04-013 (UNLV) |

| | | |
|-----------------|--------------|--------|
| Sharpe, S. | ORD-FY04-012 | (DRI) |
| Smith, K. | ORD-FY04-006 | (UNR) |
| Stetzenbach, K. | ORD-FY04-010 | (UNLV) |
| Thomas, J. | ORD-FY04-017 | (DRI) |
| Wyatt, F. | ORD-FY04-008 | (UCSD) |
| Ye, M. | ORD-FY04-016 | (DRI) |

4.0 Audit results

4.1 Overall Milestone achievement

Of the 27 baselined technical report milestones due to date, 12 (44%) have been completed. 11 (41%) are currently overdue and four (15%) are being removed from the baseline. Table 2 is a list of Technical Reports and Model Reports submitted by task to-date. It includes reports from tasks that are complete and therefore excluded from the scope of the audit. It does not include software qualification reports which were included in the total number above. (Qualified reports are designated by Document Control Number.)

| Task | Report |
|--------------|--|
| ORD-FY04-004 | TR-06-002: Bomb-Pulse Chlorine-36 at the Proposed Yucca Mountain Repository Horizon: An Investigation of Previous conflicting Results and collection of New Data |
| ORD-FY04-006 | TR-04-001: Initial Borehole Accelerometer Array Observations Near the North Portal of the ESF |
| ORD-FY04-011 | TR-05-002: Results of Chemical Analyses for Alcove 8/Niche 3 Tracer Studies |
| ORD-FY04-019 | Sub-surface Corrosion Research on Rock Bolt System, Perforated SS Sheets and Steel" quarterly technical progress summary 7-01-04 to 9-31-04 |
| | Sub-surface Corrosion Research on Rock Bolt System, Perforated SS Sheets and Steel Sets for the Yucca Mountain Repository: Quarterly Technical Progress Report No. 2 |
| | Sub-surface Corrosion Research on Rock Bolt System, Perforated SS Sheets and Steel Sets for the Yucca Mountain Repository: Quarterly Technical Progress Report No. 3 |
| | Sub-surface Corrosion Research on Rock Bolt System, Perforated SS Sheets and Steel Sets for the Yucca Mountain Repository: Quarterly Technical Progress Report No. 4 |

| | |
|--------------|--|
| | Sub-surface Corrosion Research on Rock Bolt System, Perforated SS Sheets and Steel Sets for the Yucca Mountain Repository: Quarterly Technical Progress Report No. 5 |
| | Sub-surface Corrosion Research on Rock Bolt System, Perforated SS Sheets and Steel Sets for the Yucca Mountain Repository: Quarterly Technical Progress Report No. 6 |
| | Sub-surface Corrosion Research on Rock Bolt System, Perforated SS Sheets and Steel Sets for the Yucca Mountain Repository, Quarterly Technical Report No. 8 |
| ORD-FY04-020 | TR-06-003: Precarious Rock Methodology for Seismic Hazard: Physical Testing, Numerical Modeling and Coherence Studies |
| ORD-FY04-021 | Long-Term Mechanical Behavior of Yucca Mountain Tuff and its Variability |

Table 2- Technical reports produced under DE-FC28-04RW12232.

Of the 25 currently baselined data submittal milestones due to date, 15 (60%) have been completed. 10 (40%) are currently overdue. An additional 45 submittals that were not identified on the milestone schedule have also been submitted. Figure 1 shows the distribution of data submittals by task. (Note: figure 1 includes tasks not included in the audit.)

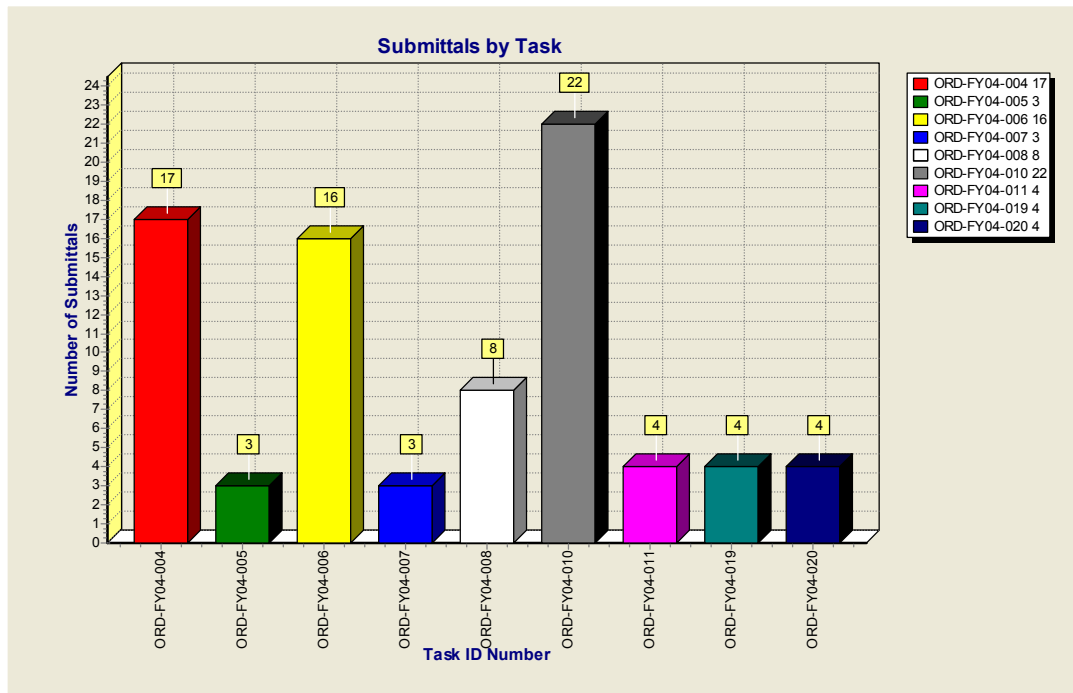


Figure 1- Data submittals by Project Activity

The current Co-op has transmitted a total of 81 data submittals, representing more than 563,000 files and directories.

4.2 Subtask progress

In order to evaluate task progress, the audit team identified 60 specific subtasks² (or discrete lower-level activities) that have been explicitly specified in the tasks' Scientific Investigation Plans. For tasks that have not identified specific subtasks, the entire task was counted as a single subtask. Representatives from each task were then interviewed and asked to assess the degree of completion for each subtask. The respondents were also required to provide justification for their estimate of the percent complete. For tasks that do not have subtasks, the degree of completion for the overall task was used.

Assessments were made for individual subtasks in order to provide a more detailed picture of a task's status. Of the 60 subtasks evaluated, 43 (72%) were found to be at (within 10%) or above the percentage of the task's total project period thus far expended. (*e.g.* A subtask that was at least 54% complete on a task that was 60% expended would be included.)

Caution however must be used when judging a task's overall progress by the progress made towards completion of individual subtasks. There is no requirement that the total effort required to complete a task be evenly divided among subtasks. Nor is it a requirement that all of a task's subtasks span the entire duration of the project period. Indeed, for most tasks, the bulk of work is usually concentrated under one or two key subtasks, and many subtasks are slated for completion during a specific temporal phase of the project. Thus it is quite possible for a task to be ahead of schedule, even if it has made little or no progress on a majority of its subtasks. Also, task closeout activities, such as report preparation, reviews, close-out calibrations, etc..., are frequently not identified as part of any specific subtask, yet they often can consume a significant amount of resources. Nevertheless an evaluation of individual subtasks can yield important information regarding the areas in which a task has made progress and the amount and nature of work yet to be performed.

4.3 Details of audit results

4.3.1 *ORD-FY04-005: Groundwater level measurements in selected boreholes near the site of the proposed repository*

This five year task is now ending its third year (60% of project period expended).

No subtasks have been identified for this activity. 60% of the planned work for this task has been completed.

No quality affecting reports have been due to date.

Three data submittal milestones have been due to date. All three milestones have been submitted and incorporated into the TDA and TDMS.

There have been no issues identified that are likely to delay the timely completion of this task.

² Tasks that did not identify subtasks or discrete lower-level activities were treated as having one subtask.

4.3.2 *ORD-FY04-006: Seismic Monitoring*

This five year task is now ending its third year (60% of project period expended).

This task has identified 10 subtasks. The percent complete for each subtask is as follows:

- Subtask 1) Record and archive data from a permanent seismic network consisting of approximately 30 digital and 10 analog seismic stations and from a network of approximately 18 strong-motion sites. 60% complete
- Subtask 2) Process seismic data obtained from the permanent network into a preliminary earthquake bulletin. 60% complete.
- Subtask 3) Maintain the seismic stations, the strong-motion stations, the telemetry network, and the computing lab. 60% complete
- Subtask 4) Prepare and submit a seismicity report on a yearly basis. 45 % complete.
- Subtask 5) Maintain and collect data from the nine accelerometers at three boreholes on the pad at the north portal of the ESF. 60% complete
- Subtask 6) Submit a report on observations through 12/31/2003 made with the borehole accelerometers. 100% complete.
- Subtask 7) Complete a two-year study on kappa in the Yucca Mountain region and submit a final report, including microtremor velocity surveys for SGBDSN stations. 85% complete.
- Subtask 8) Implement a recording system at the well UZ-16 and collect data from the downhole accelerometers. 60% complete.
- Subtask 9) Prepare and submit high-quality papers to peer-reviewed journals on seismic data and interpretations in the YM region. 0% complete.
- Subtask 10) Perform a multiyear telemetry upgrade in order to take advantage of IP packet transmission for the entire YM seismic monitoring network. 70% complete.

Eight quality affecting reports have been due to date (three Low Level Software Qualification Reports and five Technical reports). All three software reports have been completed. One Technical Report has been completed and submitted. Four Technical Reports are over due.

Four data submittals have been due to date. All four datasets have been submitted and incorporated into the TDA and TDMS. An additional 12 datasets not on the baseline have also been submitted.

There have been no issues identified that are likely to delay the timely completion of this task.

4.3.3 *ORD-FY04-007: Precipitation gauge monitoring network*

This five year task is now ending its third year (60% of project period expended).

No subtasks have been identified for this activity. 60% of the planned work for this task has been completed.

No quality affecting reports have been due to date.

Three data submittal milestones have been due to date. All three milestones have been submitted and incorporated into the TDA and TDMS.

There have been no issues identified that are likely to delay the timely completion of this task.

4.3.4 *ORD-FY04-008: Baseline Laser Strainmeter*

This five year task is now ending its third year (60% of project period expended).

This task has identified four subtasks. The percent complete for each subtask is as follows:

- Subtask 1) Operations and monitoring. 60% complete.
- Subtask 2) Processing and analysis. 40% complete.
- Subtask 3) Instrument activities upgrades. 66% complete.
- Subtask 4) ESF access. 60% complete.

One quality affecting report (Low Level Software Qualification Report) has been due to date. This report has been completed.

Four data submittal milestones have been due to date. Two of the baselined milestones have been submitted; two are overdue. The overdue submittals are currently in review and will be submitted following successful completion of the reviews. Six dataset that were not identified on the baseline have also been submitted.

There have been no issues identified that are likely to delay the timely completion of this task.

4.3.5 *ORD-FY04-010: Chemical Analyses in Support of Yucca Mountain Studies*

This 57 month task is now ending month 33 (58% of project period expended).

No subtasks have been identified for this activity. Assuming that the external programs that this task supports continue at the same level of effort as they did during the first three years of this project, 60% of the planned work for this task has been completed.

No quality affecting reports have been due to date.

No data submittal milestones have been due. However to date, 22 data packages have been submitted and incorporated into the TDA and TDMS. There are additional data that, although

not included on the baseline, are intended to be submitted and are behind the task's unofficial, self-imposed, schedule.

There have been no issues identified that are likely to delay the timely completion of this task.

4.3.6 *ORD-FY04-012: Yucca Mountain Climate Technical Support Representative*

This 56 month task is now ending month 32 (57% of project period expended).

In addition to climate representative responsibilities, this task has identified four key activities or products. These products are referred to as *deliverables* in the SIP. The percent complete for each product is as follows:

- Activity 1) Create data summaries from available data from the beginning of period of record for each station through 2002 (or 2003 if available). >100% complete.*
 - Activity 2) Develop station history files from 1985-2002 (or 2003 if available) for YM stations from available data. >100% complete.*
 - Activity 3) Obtain Nevada Test Site Network (different from Yucca Mountain network) historical digital 15-minute data and reformat into internal Western Regional Climate Center (WRCC) format. >100% complete.*
 - Activity 4) Complete web interface to data. Develop web page and links modeled after existing special purpose pages at Western Regional Climate Center. 100% complete.
- * Commitments in the SIP were for data that existed at the time the SIP became effective. Work related to the existing data has been completed, but additional data have become available since the development of the SIP and are being processed.

No quality affecting reports have been due to date.

No data submittals have been due to date.

There have been no issues identified that are likely to delay the timely completion of this task.

4.3.7 *ORD-FY04-013: Influence of Lithophysae Geometry and Distribution on Mechanical Properties of Topopah Spring Tuff*

This 32 month task is now ending month 31 (97% of project period expended).

This task originally identified 5 subtasks in its SIP. Due to budget reduction, one of these subtasks has been officially discontinued. The percent complete for each subtask is as follows:

- Subtask 1) Test Planning. 100% complete.
- Subtask 2) Material Scoping. 100% complete.
- Subtask 3) Specimen Preparation. 100% complete.

- Subtask 4) Testing. 100% complete.
 - Subtask 5) Numerical analysis and analysis of data. *Discontinued*.*
- * Due to budget reductions, subtask 5 was removed from the task's workscope. Although task personnel are no longer obligated to complete this work, they are continuing to perform as much analyses as possible in order to support end users of the data.

No quality affecting reports have been due to date.

One baselined data submittal was not submitted. This was an interim dataset which is now being combined with additional data and is on schedule for submittal on 10 October 2006.

Task personnel have completed all the effective subtasks and are currently in the close-out phase of the project activity. There have been no issues identified that are likely to delay the submittal of the final report beyond the 90 day regulatory period. The anticipated completion date for the final report is 30 November 2006.

4.3.8 *ORD-FY04-014: Environmental Effects on Corrosion Properties of Alloy 22*

This 52 month task is now ending month 28 (54% of project period expended).

This task has identified six subtasks. The percent complete for each subtask is as follows:

- Subtask 1a) Experimental Determination of Parameters for the General Corrosion Model. (Anionic). 30% complete.
- Subtask 1b) Experimental Determination of Parameters for the General Corrosion Model. (Cathodic). 20% complete.
- Subtask 2) Corrosion under Dust Deposits Containing Hygroscopic Salts. 15% complete.
- Subtask 3a) Heated Electrode Approach for the Study of Corrosion... (Anionic). 35% complete.
- Subtask 3b) Heated Electrode Approach for the Study of Corrosion... (Cathodic). 15% complete.
- Subtask 4) Effect of Hydrogen Permeation on the Stability of the Passive Film of Alloy 22. 50 % complete.

No technical reports have been due for this task to date.

Three data submittal milestones have been due to date. All three data submittals are currently past due. These interim submittals are being combined into a single transmittal which is currently in the technical and QA review process.

This task has experienced significant delays due to personnel problems and funding constraints. Extreme measures have been taken to correct the personnel problems, including the replacement

and removal of the task's principal investigator. Funding constraints (reductions and delays in funding) hampered the process of hiring replacement personnel for the task, but the task is now fully staffed. It is not clear if the task will be able to fully recover from the past schedule delays.

4.3.9 *ORD-FY04-015: Phase Stability and Segregation in Alloy 22 Base Metal and Weldments*

This 52 month task is now ending month 28 (54% of project period expended).

This task has identified two subtasks. The percent complete for each subtask is as follows:

- Subtask 1) Microstructural Characterization of Phase Stability and Variability in alloy 22. 50 % complete.
- Subtask 2) Electrochemical Methods to Detect Susceptibility of Alloy 22 to Localized Corrosion. 30% complete.

No technical reports have been due for this task to date.

Two data submittal milestones have been due to date. Both datasets are currently past due. These are interim data submittals that are currently planned to be merged into a single submittal.

This task's budget was significantly reduced in FY-2006 without a corresponding reduction in workscope. This has resulted in schedule delays that may affect the overall task schedule.

4.3.10 *ORD-FY04-016: Geostatistical and Stochastic Study of Radionuclide Transport in the Unsaturated Zone at Yucca Mountain*

This is a 36 month task that is now ending month 28 (78% of project period expended).

This task has identified 4 technical subtasks. The percent complete for each subtask is as follows:

- Subtask 1) Data collection. 95% complete.
- Subtask 2) Geostatistical Study of Heterogeneity. 100% complete.
- Subtask 3) Monte Carlo Simulation of Groundwater Flow and Solute Transport. 70% complete.
- Subtask 4) Develop and apply a numerical method of moments for a sensitivity study of how various random parameters affect flow and transport. 50% complete.

Six milestones for quality affecting reports have been due for this task to date. No reports have been submitted. All six reports were for internal software qualification. Due to technical changes, three of the software packages are no longer needed to support quality affecting work. The three reports supporting these software packages will be removed from the baseline. The remaining three reports are expected to be completed during the first quarter of FY-2007.

No data submittal milestones (on the current baseline) have been due to date.

No issues have been identified that are likely to delay the task beyond its currently scheduled end date.

4.3.11 *ORD-FY04-017: Yucca Mountain Saturated Zone Carbon-14 Project*

This 30 month task has completed 27 months (90% of project period expended).

No subtasks have been identified for this activity. ~90% of the planned work for this task has been completed.

No reports have been due to date.

One data submittal that was baselined for completion in May 2006 is currently over due. There are no other data submittals identified on the baseline for this task.

Amendment A009 of the Co-op's financial assistance award issued this task for an estimated cost of \$280,420.00. In no amendment or modification to the award has this estimated cost been reduced, nor has the task been instructed to reduce its scope of work. However this task has only received \$210,000.00 in total funding.

On September 5, 2006, the Co-op Administration received an electronic correspondence from DOE's Office of Procurement. That e-mail indicated that DOE's Office of Repository Development had not received funding to continue to support this task and that the funding source was unresponsive to inquiries about the balance of funding. The e-mail further advised that we should incur no additional costs (beyond what had been obligated) at that we should bring the activity to a completion.

In accordance with this recommendation, task personnel are currently reprioritizing activities in order to provide the best products possible given the lack of funding. A limited amount of data produced on the task will be submitted to the TDA and made available to Project personnel through the TDMS. However the full extent of data planned for in the Scientific Investigation Plan will likely not be completed and made available. The scope of the final report will also be affected.

4.3.12 *ORD-FY04-018: Groundwater Flow and Thermal Modeling of the Steep Hydraulic Gradient North of Yucca Mountain*

The approved project period for this 18 month task ended 30 November 2005. This task is now ending month 28 (156% of project period expended).

This task has identified two subtasks. The percent complete for each subtask is as follows:

- Subtask 1) Data Collection. 100% complete.
- Subtask 2) Model formulation. 75% complete.
- Subtask 3) Hydraulic Flow Calibrations. Unknown (see below).

The final report for this task is currently 10 months over due according to its originally baselined due date, and seven months over due according to federal guidelines (10 CFR 600.151[b]).

This task has one baselined data submittal which is now 11 months past due.

This task has experienced substantial delays. These delays were initially caused by software and modeling issues. The resolution of these technical issues was further delayed by some serious health issues of the PI. Task personnel have been working with scientists at Los Alamos National Laboratory and it is now believed that the technical issues delaying the completion of this work have been resolved. Also, the PI's health has stabilized to a degree that allows him regular, measured, participation in the task. With aggressive effort, the final report for this task should be transmitted before the end of calendar year 2006.

4.3.13 *ORD-FY04-019: Sub-Surface Corrosion Research on Rock Bolt System, Perforated SS Sheets and Steel Sets for the YM Repository*

This 51 month task is now ending month 27 (53% of project period expended).

This task has identified eight subtasks. The percent complete for each subtask is as follows:

- Subtask 1) Selection of Alloys for Rock bolts. 85% complete.
- Subtask 2) Electrochemical Tests to evaluate corrosion rate and corrosion mechanisms. 50% complete.
- Subtask 3) Electrochemical Impedance Spectroscopy (EIS). 50% complete.
- Subtask 4) Environmental Assisted Corrosion Tests. 40% complete.
- Subtask 5) Hydrogen Permeation tests. 50% complete.
- Subtask 6) Classical ASTM Type Immersion tests. 50% complete.
- Subtask 7) "Dry" Oxidation tests. 60% complete.
- Subtask 8) Characterization. 45% complete.

This task has had two interim quality affecting technical progress reports that were baselined for completion on or before 30 September 2006. These reports are now being consolidated into a single report which is currently in the preparation phase and will be submitted during the first quarter of FY-2007. There were an additional eight unqualified reports that were baselined, seven of which were and submitted; one was cancelled.

This task has had two data submittal milestones that were baselined for completion prior to 30 September 2006. These two datasets, plus an additional two, have been duly submitted.

The task is currently experiencing difficulties with the XPS tests run by Pacific Northwest National Laboratory (PNNL). PNNL is now asking for \$7,000 to run the tests which had

previously been done at no cost. This expense is not included in the current budget. The potential impacts of this condition are currently being investigated.

4.3.14 *ORD-FY04-020: Precarious Rock Methodology for Seismic Hazard*

The approved project period for this 25 month task ended 30 June 2006. This task is now ending month 28 (112% of project period expended).

This task has identified nine subtasks. The percent complete for each subtask is as follows:

- Subtask 1) Field work at precarious rock sites. 100% complete.
- Subtask 2) Survey areas for possible new precarious rock sites. 100% complete.
- Subtask 3) Numerical modeling of precarious rock response. 100% complete.
- Subtask 4) Cosmogenic ³⁶Cl surface age dating. 0% (This subtask was removed from the SIP during the course of this audit.)
- Subtask 5) Compare precarious rock results statistically with specific Probabilistic Seismic Hazard Analysis (PSHA) models. 100% complete.
- Subtask 6) PSHA sensitivity studies. 100% complete.
- Subtask 7) Visit ESF to assess the state of existing geophones that will be used in the coherence evaluation. 100% complete.
- Subtask 8) Install short-term portable data acquisition systems at selected locations along the ESF west wall. 100% complete.
- Subtask 9) Report results, analyses and interpretations, and implications for seismic hazard estimates. 100% complete.

The final report for this task was submitted during the course of the audit. No other quality affecting technical reports were baselined for this task.

Only one data submittal milestone was baselined for this task. This dataset was divided into four separate submittals, each of which was submitted during the course of the audit.

This task is complete.

4.3.15 *ORD-FY06-022: Extreme Ground Motion Studies*

This two year task is now in its ninth month (35% of project period expended).

This task has identified two subtasks. The percent complete for each subtask is as follows:

- Subtask 1) Evaluate ground motion constraints. >0% complete.
(A nominal amount of work has commenced on this subtask. However task personnel

did not provide an estimate of the amount of work as a percentage of total work required to bring the effort to completion.)

- Subtask 2) Prepare summary report on large recorded ground motions. 30% complete.

No quality affecting reports have been due to date.

No data submittals have been due to date.

One component of the work to be conducted under subtask 1 was planned to be performed by personnel primarily assigned to Project Activity ORD-FY04-021. However that task was terminated by DOE for budgetary reasons and thus the personnel from that task are no longer available for work on task ORD-FY06-022. The PI is now making arrangements for some other individual or organization to perform the work. The potential impacts of this condition to the overall task schedule are currently being investigated.

5.0 Findings and recommendations

The overall results of the audit indicate that the majority of tasks are substantially on schedule. In general, tasks that are behind schedule have identified the cause(s) for delays and have taken remedial actions.

Technical data, the primary product of the Co-op, is being produced and submitted on-time, at rates above what was initially anticipated. Specific datasets that are behind schedule tend to be interim, internal, data products. A total of 60 datasets, representing 563,078 data files and directories have been submitted and made available.

Results of the audit interviews affirmed the assumption at the beginning of the audit that the current quarterly progress report process is insufficient to adequately convey actual progress of individual tasks and subtasks. In cases where tasks had no milestones associated with individual subtasks, lack of progress was not evident. Even when key milestones were identified and reported on in the quarterly reports, their mere completion was not an adequate surrogate measure of the overall progress towards completion of individual subtasks.

The audit team therefore recommends that:

- 1) *Quarterly milestones be established for each subtask identified in the scientific investigation plan.*

If milestones are identified for each subtask, it is more likely that delays in the subtask will be reflected as a delay in a corresponding milestone. This recommendation, if implemented, will require a change in the process of establishing milestones which currently occurs before the subtasks are identified in the SIP.

- 2) *Tasks be required to address the degree of completion for each subtask in the quarterly progress reports.*

Although degree of completion estimates are subjective, they can provide valuable information for assessing overall task progress. Also, their accuracy tends to increase as tasks approach completion.

- 3) *In addition to quarterly progress report, administrative audits be conducted on all tasks at three months and nine months, following the initial receipt of funding, and at least annually thereafter for the duration of the task.*

Many task experience difficulties, during the start-up phase. Conducting an administrative audit after three months may allow for early detection and resolution of problems that could negatively affect the task throughout its duration. After nine months, work on the task should be well under weigh and a true image of task progress should be immerging.

Results of the audit interviews demonstrated that in the majority of cases when tasks were behind schedule, or when transmittals were over due, task personnel had not communicated the delays in any venue other than the quarterly reports. Since the quarterly reports are administrative in nature, and provide only one-way communication, in most cases there was no evidence that organizations and individuals most likely to be impacted by delays were aware of the delays. As a result, task personnel were generally unaware or unsure about the potential impacts to the intended recipients of their delayed products.

The audit team therefore recommends that:

- 4) *Informal communication between task personnel, particularly the Principal Investigator, and YMP personnel (Federal and contractor) should be substantially increased.*
- 5) *Task personnel should actively inquire about the impacts of product delays.*

Each task's milestone schedule has been carefully formulated in order to budget adequate time to allow for orderly completion of task close-out activities. Nevertheless, task personnel often delay technical activities with the assumption that schedule delays can be compensated for during the task close-out period. Evidence from the audit demonstrates that there is little, or no, slack in close-out activity schedules and that tasks cannot compensate for schedule delays during the last few months of the task.

The audit team therefore recommends that:

- 6) *The Co-op Administration pay increased attention to tasks nearing completion in order to assure that activities preceding the task close-out phase are conducted in a timely fashion.*
- 7) *Formalized task close-out training be conducted to better educate personnel regarding the breadth of work that must be conducted during the close-out phase.*
- 8) *It be required that quality affecting reports be submitted for technical and QA review at least 15 calendar days before the end of a task's approved project period.*

6.0 List of attachments

Attachment I – Information for PIs

Information for PIs:

1. Tasks are expected to complete work within the originally allocated time.
2. No cost schedule extensions are for the purpose of granting additional time for the completion of originally planned work due to extenuating circumstances. No cost extensions are not intended to compensate for poor planning or execution of work, and may not legally be requested for the sole purpose of expending available funds.
3. A no cost extension may not be more than 12 months in duration.
4. Only one no-cost extension may be granted, regardless of its duration.
5. Federal funds may not be expended on the task for work or services provided after the task's end date.
6. Work performed on one task may not be charged to another task unless the work legitimately serves both tasks.
7. Work on the task must continue until the obligations (*e.g.* QA requirements) of the financial assistance award (*i.e.* contract) have been met.
8. If the work is not completed before the end of funding, the funded institution (*e.g.* DRI, UNLV, UNR) must cover the cost of completing the work.
9. Funds not expended at the end of the task are returned to DOE for them to use at their discretion.
10. Items and services may only be charged to the task if they are for the task.
11. Items or services may not be procured at the end of a task for the sole purpose of using available funds.