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**DEFENSE NUCLEAR FACILITIES  
SAFETY BOARD**

Washington, DC 20004-2901



May 12, 2014

The Honorable Frank G. Klotz  
Administrator  
National Nuclear Security Administration  
U. S. Department of Energy  
1000 Independence Avenue, SW  
Washington, DC 20585-0701

Dear Administrator Klotz:

The staff of the Defense Nuclear Facilities Safety Board (Board) recently reviewed the conduct of operations and maintenance programs at Sandia National Laboratories' (SNL) Technical Area V (TA-V) nuclear facilities and identified several issues of concern. Based on the number of issues documented during this review, the Board is concerned that Sandia Field Office oversight and SNL contractor self-assessments of the conduct of operations and maintenance programs are not meeting expectations outlined in Department of Energy directives and contractor guidance documents.

The enclosure highlights observations from the staff's review and is provided for your information and use as NNSA and SNL pursue opportunities to improve SNL safety management programs.

Sincerely,

A handwritten signature in black ink, appearing to read "Peter S. Winokur".

Peter S. Winokur, Ph.D.  
Chairman

Enclosure

c: Mr. Geoff Beausoleil  
Mr. Joe Olencz

# DEFENSE NUCLEAR FACILITIES SAFETY BOARD

## Staff Issue Report

April 8, 2014

**MEMORANDUM FOR:** S. A. Stokes, Technical Director

**COPIES:** Board Members

**FROM:** T. Hunt

**SUBJECT:** Conduct of Operations and Maintenance Review, Sandia National Laboratories

This report documents a review by the staff of the Defense Nuclear Facilities Safety Board (Board) of the conduct of operations and maintenance programs at the Sandia National Laboratories' (SNL) Technical Area V (TA-V). Technical staff members Z. Beauvais, T. Hunt, and Outside Expert D. Boyd performed the on-site portion of the review during the week of February 3, 2014. The staff conducted a review of the following Hazard Category 2/3 SNL facilities: Annular Core Research Reactor Facility (ACRRF), Auxiliary Hot Cell Facility (AHCF), and Sandia Pulse Reactor Facility (SPRF).

**Background.** The primary purpose of this review was to verify that operations and maintenance activities at SNL's defense nuclear facilities at TA-V are being performed with the appropriate rigor and formality. The observations of work and determination of adequacy to ensure the safety of the workers and public were based on requirements in DOE Order 422.1, *Conduct of Operations*, DOE Order 433.1B, *Maintenance Management Program for DOE Nuclear Facilities*, and associated guides, technical standards, and contractor requirements. The review team discussed oversight activities with Sandia Field Office (SFO) personnel, discussed programmatic elements with contractor personnel representing Sandia Corporation, a subsidiary of Lockheed Martin Corporation, performed field walkdowns of programmatic elements, and observed work. On the final afternoon of the on-site portion of the review, the review team convened an outbriefing to share preliminary impressions with senior contractors and SFO management. On March 11, 2014, the review team participated in a teleconference where TA-V and SFO personnel shared their current path forward to address some of the team's concerns.

**Crosscutting Program Observations.** The review team evaluated the adequacy and implementation of several elements of the DOE and SNL/TA-V crosscutting documents (as well as associated standards and implementing procedures) that impact both the conduct of operations and maintenance programs. (See Attachment 1.)

*Contractor and Federal Oversight and Assessment Programs*—The SNL corporate conduct of operations procedure mandates a 3-year assessment cycle for each of the 18 DOE

Order 422.1 conduct of operations program elements applicable to nuclear facilities. According to the TA-V FY2013 Integrated Assessment Schedule and management input, only one conduct of operations-related programmatic self-assessment was planned and performed in fiscal year (FY) 2013. In addition, the TA-V FY13-14 External Assessment Activity shows only one external conduct of operations assessment was planned and completed in FY2013, and one has been completed to date in FY2014. The SFO facility representatives at TA-V normally perform several conduct of operations program assessments annually, but temporary reassignments and a retirement reduced the number completed to one in FY2013.

In accordance with DOE Order 433.1B, federal and contractor organizations must conduct assessments of nuclear maintenance management program (NMMP) implementation at least every three years and periodic self-assessments must be conducted to evaluate the effectiveness of oversight of NMMPs. According to the TA-V FY2013 Integrated Assessment Schedule, there were no self-assessments scheduled at TA-V in FY2013 to address any of the 17 maintenance program elements identified in DOE Order 433.1B. In addition, the TA-V FY13-14 External Assessment Activity shows no planned or completed external assessments specific to the maintenance program in FY2013, and only one related assessment in FY2014.

Given the significant number of issues identified by the review team during its 3-day on-site review and the low number of self- and external assessments planned and completed by the contractor and SFO, respectively, the current periodicity and rigor of conduct of operations and maintenance assessments are not adequate to sufficiently validate the continued effectiveness of the programmatic elements. It would be advisable for DOE to evaluate the periodicity and rigor with which the contractor performs its conduct of operations and maintenance programs assessments, and evaluate its own role in overseeing the programs.

*Technical Procedure Quality*—The review team observed the execution of five operating procedures during the on-site review and one limited scope maintenance procedure. A tabletop evaluation of five maintenance procedures and work packages was performed prior to and after the review. (See Attachment 1.) Based on reviews of the technical work documents, the review team concluded that the maintenance and operating procedures should be enhanced to be clearer and more concise, ensure work is performed with the appropriate formality and rigor, reflect human factors considerations, and mirror actual conditions and practices in the field.

A sampling of operating and maintenance procedure deficiencies noted by the review team during tabletop reviews and observations of work activities is listed below. Deficiencies identified are inconsistent with the technical procedure requirements and expectations delineated in *TA-V Writer's Guide for Procedures*, *TA-V Document Lifecycle Management Procedure*, DOE Order 422.1, and/or DOE-STD-1029. These deficiencies are indicators that the training of the procedure developers should be reevaluated. Further, the verification and validation processes for procedures should be enhanced to ensure that procedures can be used as written.

<b>Operating Procedure Deficiencies</b>
The scope of an operating procedure inappropriately allows the procedure reader to direct steps to be performed out of order or in parallel.
Precautions and Limitations, as well as Caution statements, do not describe what the hazardous conditions or potential undesirable consequences are.
Steps are not listed in the order in which they would normally be performed.
Important safety information, such as the applicable technical safety requirement, is not suitably emphasized (e.g., bolded).

<b>Maintenance Procedure Deficiencies</b>
Tolerances, instead of ranges, are given for an alarm test. Also, the units are mixed (i.e., meters and centimeters), requiring mental math.
Steps are vague enough that workers must interpret or infer the intent of the steps.
Warnings are not appropriately highlighted and are phrased as action steps.

*Performance of Work*—Procedures must be technically and operationally accurate, up-to-date, and easy to follow, or workers will lack confidence in them and may not execute them as intended. An example of an inadequate procedure negatively impacting the safe performance of work occurred as the review team observed the contractor perform activities in the AHCF radiological confinement tent. During processing of material in the tent, the procedure did not allow for temporarily lifting a cask lid for a radiological swipe, installing jacking bolts to aid in removing the experiment assembly, putting the experiment assembly in a vice to assist in the disassembly, or attaching container tracking labels to inner containers. This resulted in the operators performing actions that were not proceduralized even though the proper response to procedures that cannot be executed as written is to stop work and notify management. Other noted deficiencies related to execution of work included:

<b>Execution Deficiencies Observed in AHCF</b>
During pre-operation checks, an operator failed to shut a vent before pressurizing a compressed gas system, resulting in an unintended gas discharge.
Some steps to repackage a second container were performed without an approved procedure.
An inner container was placed into a cask and moved out of the confinement tent, and then back into storage without procedural direction.

*Conduct of Operations Training*—There currently is not a comprehensive and structured conduct of operations training course offered to all potentially affected TA-V personnel. Although no DOE or TA-V directive mandates that operators and maintenance workers participate in conduct of operations training, DOE Order 426.2—as well as *TA-V Training Program Manual for Nuclear Facility Requirements*—requires that the “supervisory skills training program must include conduct of maintenance and conduct of operations.” Several years ago the contractor provided a single, stand-alone conduct of operations course. Currently, at ACRRF for example, since the on-the-job training program for reactor supervisors and operators provides training on only five of the 18 conduct of operations elements, the overall context of the program has been lost. To achieve continuous improvement in overall formality of operations, it is advisable for TA-V management to provide training on all germane elements

of the conduct of operations program. To enhance focus on conduct of operations at TA-V, reconstituting training in these areas is essential for supervisors and highly desirable for maintenance and operations personnel.

**Operations Program Observations.** The review team evaluated the adequacy and implementation of several elements of DOE and SNL/TA-V conduct of operations documents, as well as associated standards and implementing procedures. (See Attachment 1.)

*TA-V Conduct of Operations Matrix*—DOE Order 422.1 instructs contractors to develop a conduct of operations matrix (i.e., a list of requirements from the orders), citing the specific site documents (e.g., procedure, manual) that implement each requirement, or providing justification for each requirement that is partially or not implemented. Some of the requirements in the TA-V matrix are shown as partially or not applicable without adequate justification. A DOE Order 422.1 requirement for independent verification is an example of where the matrix identifies a requirement as not applicable, but gives inadequate justification. The requirement states that management must “develop the list of equipment/components requiring independent verification.” The justification in the matrix as to why the requirement is not applicable at TA-V nuclear facilities is that they “have no safety class structures, systems, or components; therefore, lists of equipment/components requiring independent verification are not required.” This is not a valid justification as the *TA-V Operations Management Program* procedure recognizes that “independent verification should not be limited to safety-related system components.” The review team also found examples of where the procedure cited as the implementing document for a particular requirement is incorrect or inadequate (e.g., reader-worker protocol). TA-V management personnel indicated that there are plans to review and revise the matrix to address the types of concerns identified by the review team.

*TA-V Operations Management Program*—The *TA-V Operations Management Program* (OMP) document “directs operations personnel in the command and control of activities in TA-V facilities” and “specifies the minimum requirements and guidelines to be implemented throughout TA-V.” The OMP is designed to be an implementing document, but inconsistent terminology and presentation of conduct of operations elements make it difficult to determine what the requirements are. The use of vague terms when describing the implementation of some requirements (e.g., need to, expected to) and the explicit use of shall/must in others creates confusion as to what management’s expectations are relative to “requirement” implementation. During discussions with cognizant TA-V personnel, the review team learned that consideration is being given to reissuing the OMP document as a conduct of operations-type manual (comprised of individual standards) with implementation of program requirements normalized and more clearly defined.

*Reader-Worker Protocol*—The reader-worker process is neither well-defined in TA-V documents, nor scrupulously implemented in the field. DOE Order 422.1 stipulates that procedure use requirements such as the reader-worker protocol be specified and defined in site directives. The *TA-V Conduct of Operations Matrix* indicates that ESH100.2.GEN.3 and *TA-V Document Lifecycle Management Procedure* address the process, but there is no relevant information in either document.

The review team observed instances of poor implementation of the reader-worker process, degrading the rigor of procedure execution. An example was a repackaging operation by AHCF personnel in a confinement tent. The supervisor reading the operating procedure outside the tent did not regularly read the Warnings, Notes, and Cautions embedded in the performance section of the procedure. Additionally, the workers did not consistently repeat back an understanding of the steps before executing them or verbally report successful completion. All of these actions are essential elements of an effective reader-worker protocol. The implementing document addressing the DOE Order 422.1 requirement should be revised to describe the reader-worker protocol, and affected personnel should be trained on its application.

*Pipe System Labeling*—The review team found deficiencies related to the TA-V pipe labeling program that could compromise the safe operation and maintenance of the systems and components. Some of the facility piping systems in the AHCF and ACRRF are not appropriately identified with the type of fluid in the system and flow direction as required by DOE Order 422.1. Although the fire suppression systems in the ACRRF and AHCF are in most cases painted red, they are not labeled with the requisite normal flow direction nor is the fluid identified. Other facility piping systems are only identified at one location—for example, compressed air piping at the manifold—and not at intervals along the length of the piping system, as required by DOE-STD-1044-93 and Occupational Safety and Health Administration (OSHA) references. TAV-PD-004.2-00 states that “where required by OSHA, piping shall be labeled to indicate the fluid contained and the normal flow direction.” (OSHA pipe labeling requirements are implemented through ANSI/ASME A13.1, *Scheme for Identification of Piping Systems*.) TA-V management should bring the labeling of facility piping up to DOE and industry standards to reduce the potential for errors resulting from incorrect identification of piping.

*Lockout/Tagout Logs and Required Reading Indexes*—Several conduct of operations program elements require the logging and maintaining of key operational information. Among the documentation reviewed by the review team and found lacking necessary information were the lockout/tagout (LO/TO) logs and required reading indexes. Both documents failed to comply with all of the requirements and guidance laid out in DOE directives and TA-V procedures. The ACRRF and SPRF/Criticality Experiments (CX) LO/TO logs are both formatted such that important information is neither requested nor provided. A review of both logs showed information required to be logged per DOE Order 422.1 was missing, including the reason for the LO/TO, authorization for removing the LO/TO, removal documentation, and the use of an index/numbering system. TA-V follows OSHA guidelines for its LO/TO program and management should ensure that the requirements and best practices defined in DOE directives are being met by the use of industry codes and standards.

The SPRF/CX required reading index fails to meet the DOE Order 422.1 and *TA-V Operations Management Program* requirements to ascribe completion or due dates to each assignment and periodically review required reading assignments to ensure personnel are completing them by the requisite dates.

*Operator Aids—TA-V Operations Management Program* and DOE Order 422.1 contain provisions for implementing an acceptable operator aids program. The review team found that the AHCF master list/log was deficient in that it did not contain references to the source documents, two ACRRF operator aids and two AHCF operator aids were not in the location identified on the operator aid log, and three operator aids that had expired more than a year prior were still posted in the AHCF.

**Maintenance Program Observations.** The review team evaluated the adequacy and implementation of several elements of significant DOE and SNL/TA-V maintenance documents. (See Attachment 1.)

*Post Maintenance Testing (PMT)*—SNL does not have a document that implements the PMT process and the required PMT for the types of equipment in the preventive maintenance program. PMT is one of 17 specific requirements of an NMMP in DOE Order 433.1B. DOE Order 433.1B states that “contractor organizations must implement the NMMP through ... a manual or set of implementing procedures.” DOE Guide 433.1-1A notes that “maintenance [personnel] should include *predefined* [emphasis added] PMTs in job instructions.” The TA-V NMMP states that “Each facility supervisor, with the assistance of the CSEs, is responsible for determining the required PMT and developing a guideline procedure for the application and conduct of PMT on safety SSCs under his or her jurisdiction.” The lack of an implementing procedure results in subjective PMT requirements and acceptance criteria and the requirements are more likely to be developed and applied inconsistently.

*Predictive Maintenance (PdM)/Reliability-Centered Maintenance (RCM)*—TA-V does not have a comprehensive, documented PdM/RCM program. Per DOE Order 433.1B, the TA-V NMMP must clearly address “the process for utilization of ... predictive maintenance, reliability-centered maintenance ... to provide for safe, efficient, and reliable operation of safety SSCs.” DOE Guide 433.1-1A states that PdM “should be integrated into the overall maintenance program so that ‘proactive repair’ planned maintenance may be performed before equipment failure” and “for safety related systems and equipment, a technical analysis such as [RCM] should be used.” The TA-V implementing procedure for PdM is deficient in that it only provides a list of data collection processes for monitoring and trending (e.g., review of logs, material history records, and results of preventive maintenance and PMT). There are no descriptions of, for example, typical uses and commonly used techniques for on-line PdM, mechanisms to identify and evaluate new technologies for application to the program, or processes for performing diagnostic PdM. The review team believes that the data collection process described in the implementing procedure is not adequately structured or technically rigorous enough to achieve the goals of a demanding PdM program. If a more integrated program of equipment condition indicators was developed to include technologies as well as the feedback collection processes on which the program currently relies, a more effective use of resources and improved reliability and availability of critical equipment could be realized. The review team believes equipment such as the fans and motors supporting the safety-significant process ventilation system in AHCF and defense-in-depth high bay ventilation system in ACRRF could potentially benefit from incorporation into a PdM program.

*System Engineers*—ACRRF has no alternate/backup CSE assigned to its five active, safety-significant systems. DOE Order 420.1C states that a “qualified CSE must be assigned to each active system within the scope of the program ... large, complex, or very important systems may require assignment of more than one CSE.” TAV-PPL-003 asserts that each system should have a backup to provide flexibility and coverage when the primary CSE is unavailable. (TAV-PPL-003 also indicates that the engineering manager should maintain a list of backup passive safety system engineers, but TA-V does not have backup system engineers for passive systems—for example, AHCF safety-significant structures.) The review team believes the ACRRF plant protection system and reactivity control system, for example, are large, complex, and important enough to merit alternate CSE coverage. TA-V management verbally indicated to the review team that they have plans to fill the alternate CSE positions.

**Conclusions.** The Board’s staff review team noted numerous deficiencies and opportunities for improvement in the SNL/TA-V conduct of operations and maintenance programs. Significant SNL management attention is needed to upgrade conduct of operations governance documents, heighten the rigor and formality of operations and maintenance activities, develop nuclear facilities’ maintenance implementing documents, and improve oversight and assessments. Many of the deficiencies and opportunities for improvement noted were the type that would normally be identified during periodic and rigorous contractor self-assessments or SFO oversight activities. While no imminent safety concerns were identified, the number of failures to adhere to DOE Order 422.1, DOE Order 433.1B, and local requirements is troubling. Senior SFO and contractor personnel have been apprised of the review team’s observations and concerns. The review team was subsequently informed that a condition report has been generated, the issues are being analyzed, and near-term and longer term actions have been or will be developed and implemented where deemed appropriate.



## **Attachment 1 Document Lists**

DOE and SNL/TA-V Crosscutting Documents that Impact both the Conduct of Operations and Maintenance Programs:

- DOE Order 422.1, *Conduct of Operations*
- DOE Order 426.2, *Personnel Selection, Training, Qualification, and Certification Requirements for DOE Nuclear Facilities*
- DOE Order 433.1B, *Maintenance Management Program for DOE Nuclear Facilities*
- DOE-STD-1029-92, *Writer's Guide for Technical Procedures*
- ESH100.3, Issue B, *Perform Work*
- MN471018, *Work Planning and Control Manual*
- Sandia Field Office, Office of Operations. FY2014 Oversight Plan & Schedule
- *TA-V Document Lifecycle Management Procedure*, Rev. 3
- TA-V FY13-14 External Assessment Activity
- TA-V FY2013 Integrated Assessment Schedule
- *TA-V Training Program Manual for Nuclear Facility Requirements*, Rev. 1
- *TA-V Writer's Guide for Procedures*, Rev. 0

ACRRF and AHCF Operating Procedures:

- ACRR-OP-001, Rev. 7, *Pre-Operation Checklist*
- ACRR-OP-002, Rev. 6, *Pulse Operation*
- AHCF-OP-002, Rev. 6, *Checklist Procedure*
- AHCF-OP-004, Rev. 5, *Material Handling*
- AHCF-OP-017, Rev. 2, *Campaign Operating Procedure for Campaign No. 11*
- AHCF-OP-102, Rev. 2, *Radiological Confinement Tent Procedure*

ACRRF and AHCF Maintenance Procedures:

- ACRR-MP-003.00, *Reactor Pool Water Parameters*
- ACRR-MP-013, Rev. 3, *Hoisting and Rigging*
- WO 20130189219, *Semiannual PM on Exhaust Fan 16*
- WO 20130192315, *Semiannual PM on Exhaust Fan 15*
- WO 20140083039, *PM on A/C Unit in Building 6593 SPRF High Bay*
- WO 20140131451, *Troubleshoot and Repair (TS) Two Heating Units on North Wall of AHCF*

DOE and SNL/TA-V Conduct of Operations Documents:

- DOE Order 422.1, *Conduct of Operations*
- DOE-STD-1044-93, *Guide to Good Practices for Equipment and Piping Labeling*
- ESH100.2.GEN.3, *Develop and Use Technical Work Documents*
- ESH100.3.3, *Implement Conduct of Operations*
- MNL471020, *Lockout/Tagout Program Manual*
- *TA-V Conduct of Operations Matrix*, Rev. 1
- *TA-V Operations Management Program*, Rev. 1
- TAV-AP-011.01, *System Walkdowns and System Health*
- TAV-PD-004.2-00, *TA-V Engineering Management Program*

DOE and SNL/TA-V Maintenance Documents:

- AI/TA-V/PM, *Performance Monitoring and Trending of TA-V SSCs*
- DOE Guide 433.1-1A, *Nuclear Facility Maintenance Management Program Guide for Use with DOE O 433.1B*
- DOE Order 420.1C, *Facility Safety*
- DOE Order 433.1B, *Maintenance Management Program for DOE Nuclear Facilities*
- *Safety SSC CM Application and CSE [cognizant system engineer] Designation*
- TAV-PD-004.2-00, *TA-V Engineering Management Program*
- TAV-PD-004.3, *TA-V Maintenance Management Program*
- TAV-PPL-003, *TA-V System Engineering Program (SEP)*