U.S. Department of Energy
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P.O. Box 450, MSIN H6-60
Richland, Washington 99352

MAR 2 4 2006

06-TED-013

Mr. M. S. Spears, President
and Chief Executive Officer
CH2M HILL Hanford Group, Inc.
Richland, Washington 99352

Dear Mr. Spears:

CONTRACT NO. DE-AC27-99RL14047 – ASSESSMENT REPORT A-06-AMTF-TANK FARM-002, TANK FARM CONTRACTOR CRITICALITY SAFETY PROGRAM ASSESSMENT

This letter transmits the results of the U.S. Department of Energy (DOE), Office of River Protection (ORP) assessment of the CH2M HILL Hanford Group, Inc. (CH2M HILL) Criticality Safety Program. The assessment was completed on December 16, 2005.

The assessment measured compliance with the requirements contained within the American National Standards Institute (ANSI)/American Nuclear Society (ANS)-8.19, *Administrative Practices for Nuclear Criticality Safety,* as well as related ANSI/ANS-8 series standards. These consensus standards represent the best practices for Nuclear Criticality Safety (NCS) programs and are mandatory under DOE O 420.1A, *Facility Safety.*

The ORP assessment team identified four Findings and five Observations. The assessment team concluded that the CH2M HILL Nuclear Criticality Safety Program, with the four identified exceptions (Findings 1 through 4), is effectively implemented and meets the expectations of ANSI/ANS 8.19.

If you have any questions, please contact me, or your staff may contact Tom Nirider, DOE Richland Operations Office, Assessment Team Lead, (509) 376-7812.

Sincerely,

Roy J. Schepens, Manager
Office of River Protection

TED:WBS

cc: L. T. Nirider, RL

U.S. Department of Energy, Office of River Protection

U.S. Department of Energy
Office of River Protection

Tank Farm Contractor
Criticality Safety Program Assessment

Final Report
A-06-AMTF-TANK FARM-002

March 2006

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Executive Summary

An assessment of the U.S. Department of Energy (DOE), Office of River Protection (ORP) Tank Farm Contractor (TFC) Criticality Safety Management Program was performed by ORP from December 5, 2005, through December 16, 2005. A team of criticality safety professionals supported by engineering and operational oversight personnel conducted the assessment. The assessment measured TFC compliance with the requirements contained within the American National Standards Institute (ANSI)/American Nuclear Society (ANS)-8.19, *Administrative Practices for Nuclear Criticality Safety*, as well as related ANSI/ANS-8 series standards. These consensus standards represent the best practices for nuclear criticality safety (NCS) programs and are mandatory under DOE O 420.1A, *Facility Safety*. The DOE Standard (STD), DOE-STD-1158-2002, *Self-Assessment Standard for DOE Contractor Criticality Safety Programs*, was used as the main assessment tool for this review since it provides guidance on reviewing an NCS program for compliance with ANSI/ANS-8.19. This report provides the results of the assessment.

The team performed document reviews, conducted interviews, toured facilities, and observed work activities. The team interviewed TFC personnel across the criticality safety organization, including operations and project management personnel within the TFC. The team toured the 242-A Evaporator Facility and the 222-S Laboratory. Findings and Observations, as well as Noteworthy Practices are contained within this report.

A closeout meeting was conducted with the TFC on December 9, 2005. Following the meeting, the TFC provided additional information, clarification, and recommended changes to the assessment results. The feedback was evaluated and appropriate changes were made to the final assessment report.

Conclusion

The team identified four Findings, and five Observations. The TFC NCS Program, with the four identified exceptions (Findings F-01 through F-04), is effectively implemented and meets the expectations of ANSI/ANS-8.19.

A significant Finding involved Criticality Safety Engineer (CSE) support for Tank Farms Operations. The TFC criticality safety program does not meet the ANSI/ANS-8.19 requirement for retention of CSEs. Direct involvement of a CSE is required to periodically assess the analytical model underlying Tank Farms (TF) criticality safety evaluations. This periodic assessment is not presently being performed (see Observation O-02). As TFC operations do not require daily handling, movement, or processing of fissionable materials, part-time CSE support may be appropriate. However, appropriate funding must immediately be put in place and be continuously maintained to ensure all criticality safety program controls relied on in the safety analyses continue to be implemented by the TFC criticality safety program. Finding F-01 addresses this issue.

The second Finding involved problems identified within Procedure TFC-ENG-CHEM-P-18, Rev. A-4, “Response to Anomalous Sample Results.” The procedure does not require prompt

notification to management, and stopping operational activities when out-of-normal sample results are obtained.

The third Finding was associated with deficiencies identified with the training of nuclear chemical operators (NCO). As of Thursday, December 8, 2005, 31 NCOs were delinquent in completing the web-based criticality safety training which is required on a 2-year cycle. Therefore, none of these NCOs are currently qualified to participate in waste transfer operations. TFC management advised that no waste transfer operations involving non-qualified NCOs had occurred.

The fourth and last Finding resulted from the discovery that the Demonstration Bulk Vitrification Plant Process Hazard and Operability Analysis (PrHOA) did not utilize trained and qualified criticality safety personnel for the identification of criticality hazards and operations. The Demonstration Bulk Vitrification Plant, presently under design, recently underwent a PrHOA review. The PrHOA checklist used during the evaluation includes criticality safety considerations which must be evaluated for each system. Site procedures and ANSI/ANS standards require involvement of the criticality safety staff. Neither a CSE nor a CSR attended these meetings; rather a senior process transfer engineer, who supports the NCS program but is not a qualified CSE or CSR, addressed the criticality concerns.

Observations included the following: (1) The TFC does not have a Facility-Specific Qualification Card for CSEs as a requirement within the Statement of Work for CSE support. (2) The analytical model underlying the TFs Criticality Safety Evaluation Reports; (i.e., the Conservative Waste Model [CWM]), is not periodically assessed against the latest Best Basis Inventory database to ensure that assumptions within the CWM remain valid. (3) The TFC has not developed and used Criticality Safety related Performance Metrics appropriate to their operations. Observation (4) identifies documentation weaknesses in the Waste Compatibility Assessments program. The basis for concurring with the out-of-limit plutonium inventory (more than 10 kg equivalent plutonium) was not discussed in several assessments, and one assessment contained an out-of-date analysis without documentation affirming its validity. This program is fundamental to maintaining the form and distribution of the waste matrix in the tanks, thus additional attention to the quality of the Waste Compatibility Assessments is warranted. Observation (5) involves the absence of continuing training for qualified TFC CSRs. Internal procedures require continuing training at least once every two years and recommends attendance at the Los Alamos (now Nevada) three or five day criticality safety courses. The CSRs however, have attended annual half-day CSR meetings thus partially meeting this recommendation.

The consensus of the review team was that the TFC criticality safety program, in spite of some problems, retains a highly motivated criticality safety staff. The criticality safety program manager could benefit from participation in National Committees such as the ENDUSERS Group, the American Nuclear Society annual meetings, participation on ANSI/ANS standards development committees, and attendance at offsite training aimed at managers such as those classes offered by the University of New Mexico each summer. Continued programmatic reliance upon the CSRs who perform an essential function, retention of the criticality program management within the engineering group, adequate funding, and an appropriate level of CSE support will enable the high quality existing staff to make needed corrections and programmatic

improvements. The risk of a criticality event at the TFs is low, the consequences of such an event are significant. When an adequate safety management program is maintained, the risk remains acceptably low.

This review resulted in four Findings and five Observations:

Findings

Finding F-01: The TFC does not meet ANSI/ANS-8.19 requirements for retention of CSE support.

Finding F-02: Procedure TFC-ENG-CHEM-P-18, Rev. A-4, "Response to Anomalous Sample Results," does not comply with ANSI/ANS-8.19 requirements for response to deviations from normal process conditions that affect nuclear criticality safety.

Finding F-03: A significant fraction of the TFC operations staff has not completed required criticality safety training resulting in their loss of qualification to conduct waste transfer operations.

Finding F-04: The Demonstration Bulk Vitrification System (DBVS) PrHOA did not utilize trained and qualified criticality safety personnel for the identification of criticality hazards and operations.

Observations

Observation O-01: The TFC does not have a Facility-Specific Qualification Card for CSEs.

Observation O-02: The analytical model underlying the Tank Farms Criticality Safety Evaluation Reports (i.e., the CWM), is not periodically assessed against the latest Best Basis Inventory database to ensure that assumptions within the CWM remain valid.

Observation O-03: The TFC has not developed and used Criticality Safety related Performance Metrics appropriate to their operations.

Observation O-04: Documentation weaknesses were identified in several Waste Compatibility Assessments. This is important because these assessments are the primary control designed to ensure compliance of incoming wastes with criticality safety limits.

Observation O-05: The TFC CSRs do not attend continuing off-site training in criticality safety.

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The U. S. Department of Energy (DOE), Office of River Protection (ORP) conducted a formal assessment of the Tank Farm Contractor (TFC) criticality safety program. A team of criticality safety professionals supported by engineering and operational oversight personnel conducted an assessment of the TFC Nuclear Criticality Safety (NCS) Program on December 5 - 16, 2005. The assessment measured TFC compliance with the requirements contained within the American National Standards Institute (ANSI)/American Nuclear Society (ANS)-8.19, *Administrative Practices for Nuclear Criticality Safety*, as well as related ANSI/ANS-8 series standards. These consensus standards represent the best practices for NCS programs and are mandatory under DOE O 420.1A, *Facility Safety*. The DOE Standard (STD), DOE-STD-1158-2002, *Self-Assessment Standard for DOE Contractor Criticality Safety Programs*, was used as the main assessment tool for this review, since it provides guidance on reviewing a NCS program for compliance with ANSI/ANS-8.19. This report provides the results of the assessment.

2.0 PURPOSE AND SCOPE

The purpose of this review was to conduct a compliance assessment of the TFC criticality safety program. The team evaluated the improvements made to the structure and implementation of the criticality safety program since the last review in May 2001. The TFC NCS Program governs all fissile material operations. The assessment focused upon Tank Farms Operations, the Administrative structure of the program, and ancillary operations such as the Demonstration Bulk Vitrification Facility, the 222-S Laboratory Operations, the 242-A Evaporator, and various waste retrieval activities. ANSI/ANS-8.19 is a mandatory standard in the Tank Farms (TF) operating contract and it contains the requirements upon which this assessment was based. Assessment criteria were selected from the DOE-STD-1158-2002. Additional assessment criteria associated with the Best Basis Inventory (BBI), programmatic consistency, and the Waste Acceptance Criteria (WAC), outside the DOE STD were also utilized.

The objectives of the assessment were to:

- Verify that a comprehensive Criticality Safety Management Program (SMP) is defined and implemented according to DOE Order and ORP requirements;
- Verify compliance with the requirements contained within the ANSI/ANS-8.19 standard, as well as related ANSI/ANS-8 series standards;
- Verify that adequate numbers of technically competent, experienced, and fully qualified personnel are assigned to implement the Criticality Safety SMP; and
- Verify that the essential related programmatic elements: BBI database, and the WAC are adequately implemented.

3.0 APPROACH AND DELIVERABLES

The review was performed consistent with ORP Manual (M) 220.1, *Integrated Assessment Program*. Major elements of the review were developed from ANSI/ANS-8.19 and previous criticality safety program assessments.

Major elements of the review consisted of:

- Preparation of the Assessment Criteria;
- Selection of the review team;
- Pre-review activities;
- Entrance Meeting with the TFC;
- Fieldwork activities – interviews and facility tours;
- Development of the assessment results;
- Exit Meeting with the TFC; and
- Development of a final report, including a factual accuracy review by the TFC.

The Assessment Criteria were developed from ANSI/ANS-8.19, a mandatory standard in the TFC contract. The Review Criteria are included as part of the assessment forms in Appendix A.

The review team was selected from DOE ORP, Richland Operations Office (RL), Fluor Hanford, Inc. (FHI), and DOE Headquarters staff based on technical expertise and experience. The team was comprised of senior ORP and RL staff, an experienced Facility Representative, the FHI Criticality Safety Program Manager, and two Ph.D. Nuclear Engineers. Biographical summaries for each of the team members are included in Appendix B.

Pre-review activities consisted of gathering and reviewing TFC criticality safety program plans, procedures, operating procedures, criticality safety evaluations, and current DOE directives and standards as well as industry standards specific to nuclear criticality safety.

An entrance briefing was conducted on December 5, 2005, and field work began December 6, 2005, lasting until December 16, 2005. Field work consisted of TFC staff interviews and facility inspections. Team meetings were held periodically to discuss strengths and weaknesses of the criticality safety program discovered in the assessment. These were communicated to the TFC point of contact as they were identified. Feedback from the TFC regarding additional information and immediately corrected deficiencies was received in real time. The exit briefing was held on December 9, 2005, with senior TFC management, the ORP Manager, and ORP line management in attendance.

4.0 ASSESSMENT RESULTS

A summary of the results of the assessment, including Findings, Observations, and recommendations is provided below. Each of the Findings represents a non-compliance with standards requirements thus, the ANSI/ANS-8.19 Standard requirement is quoted with each Finding description. Observations may be non-compliances with internal policies, procedures or standard practices. Detailed discussions, references, a list of personnel interviewed, and additional information is provided in Appendix A.

4.1 Management Responsibilities

The performance objective and criteria for evaluation are:

Management demonstrates ownership and participation in the criticality safety program; authorities and responsibilities are defined, understood and implemented; management provides a nuclear criticality safety staff that is competent in the physics of criticality and associated safety practices as well as familiar with fissile material operations; management ensures that the nuclear criticality safety staff is independent of line management to the extent practicable; management assigns responsibility for criticality safety in a manner consistent with other safety disciplines; and, management establishes means of monitoring the criticality safety program and obtains feedback on the overall effectiveness of the program.

The criteria for this performance objective have been partially met. The criticality safety management program controls relied on in the safety analyses for all nuclear facilities were appropriately incorporated into, and implemented by, the TFC criticality safety program. There is an excellent level of management ownership of the criticality safety program which is managed through an engineering organization. This is particularly demonstrated by the criticality safety program manager, and the Criticality Safety Representatives (CSRs). Operations managers possessed an adequate understanding of safety responsibilities, unlike the results discovered in the 2001 Assessment which found operations supervisors relied extensively upon the CSRs and pointed to them as being responsible for safety. The criticality safety staff demonstrates an adequate level of independence from operations however one practice is somewhat questionable in that regard. The CSR for TFs, in one of his collateral duties, performs Waste Compatibility Assessments (WCAs). The WCA is a program that ensures that any waste received by the TFs is compatible with the current tank inventory and is bounded by the approved Documented Safety Analysis. Several controls are imposed including criticality safety limits. While an independent checker reviews the criticality calculations of the WCA, the CSR who prepared the WCA approves it for criticality safety considerations. As a result, the CSR is approving his own work, eliminating a separate or independent criticality safety review. This could be corrected by an administrative change that gives the alternate CSR the review authority over the WCAs produced by the TFs CSR. Appropriate management monitoring of the criticality safety program is evident. Recent management assessments and facility inspection records indicate that internal assessment processes are in-place and working.

However, some improvement is needed as the team found the TFC criticality safety program did not meet ANSI/ANS-8.19 requirement for retention of Criticality Safety Engineer (CSE) support. ANSI/ANS-8.19 requires that, *"Management shall provide personnel familiar with the physics of nuclear criticality.... to furnish technical guidance appropriate to the scope of operations."* CSE support and oversight is deemed necessary because the TFs criticality safety basis is contained within several documents and consists of complex arguments based upon the physical chemistry of the waste contained within the tanks. The TFC continuously updates the tank inventory database through the BBI program. It is a requirement implicit within TFC procedures and ANSI/ANS Standards, that the analytical model underlying the TFs Criticality Safety Evaluations be periodically assessed using the latest updates to the BBI database to ensure that model assumptions remain valid and bounded by the Conservative Waste Model for all TFs

facilities. This work requires the direct involvement of a CSE. As TFs operations do not require daily handling, movement, or processing of fissionable materials, part-time CSE support is probably appropriate. However, a fully funded Task-Order contract for CSE support must be immediately put in place and be continuously maintained. This will ensure that all criticality safety program controls relied on in the safety analyses are maintained into and protected by the TFC criticality safety program.

An interview with the NCS program manager revealed that there was no performance metrics developed for Criticality Safety. Performance metrics specific to encouraging self identification and reporting, timely closeout, and discouraging repeat occurrences is important to a healthy NCS infraction reporting system. Additonally, metrics measuring the participation of criticality safety staff in operations oversight, walkthrough activities, and training are important to establishing and maintaining healthy criticality safety programs.

One Finding and one Observation were identified in the review of this performance objective:

Finding F-01: The TFC does not meet ANSI/ANS-8.19 requirements for retention of CSE support.

Requirement: *ANSI/ANS-8.19, 4.4[1], "Management shall provide personnel familiar with the physics of nuclear criticality and with associated safety practices to furnish technical guidance appropriate to the scope of operations."*

Observation O-03: The TFC has not developed and used Criticality Safety related Performance Metrics appropriate to their operations.

4.2 Supervisory Responsibilities

The performance objective and criteria for evaluation are:

Line supervision accepts responsibility for the criticality safety of their operations; supervisors understand the controls, contingencies, and criticality safety basis for operations under their control; classroom and job-specific training in criticality safety is provided to personnel; procedures govern all work and there are effective change control and configuration control mechanisms; supervisors verify compliance with criticality safety specifications before authorizing work; and supervisors require conformance with good safety practices, good housekeeping, and unambiguous identification of fissile materials.

The criteria for this performance objective were partially met. Line supervisors (operations managers, and shift supervisors) accept responsibility for safety. Supervisors do not understand the contingencies and criticality safety basis beyond the basic controls applied, this level of understanding is appropriate. For the TFs, the safety of operations

depends upon maintaining the pH of tanks, controlling the inventory and chemistry of the tanks and of any incoming waste transfers, and following approved procedures. Supervisors and managers understand these principles very well. As the TFs criticality safety evaluation and safety basis for criticality safety are rather complex and unchanging, it is appropriate that operations personnel have no specific knowledge of the contingencies and the basis beyond the controls.

Procedures affecting tank wastes are appropriately controlled and contain criticality safety controls. The criticality safety representative reviews changes to procedures that affect nuclear criticality safety. Supervisors are familiar with the criticality prevention specifications and know who to ask if they have specific questions.

A Finding associated with deficiencies in the training of NCOs was identified during the review of this performance objective. As of Thursday, December 8, 2005, 31 NCOs were delinquent in completing the web-based criticality safety training which is required on a 2-year cycle. None of these NCOs was qualified to participate in waste transfer operations. It should be noted, that there have not been any waste transfer operations for the past several months, and none were scheduled for the near future. None of the unqualified NCOs participated in transfer operations. If a transfer is scheduled, it is the responsibility of the supervisor to ensure that untrained NCOs do not participate in transfer operations. Supervisors are required by TFC-PLN-49 to verify completion of training prior to start of the job. This is a concern as it can be easily overlooked.

The TFC training staff is very proactive in immediately notifying the delinquent individual and their manager, even though there is no requirement to do so. The training staff continues to send reminders as long as the individual is delinquent. Since management was aware of the delinquencies, many of which were more than a month overdue, it is apparent that there was a conscious decision by management to delay the retraining and only retrain on demand. There should be some formal process to flag the supervisor or an individual NCO prior to conduct of work to ensure they have completed all required training before they participate in transfer operations.

The TFC criticality safety procedure, TFC-PLN-49, "Nuclear Criticality Safety Program," refers to Fissionable Material Handlers and their certification and/or qualification requirements. The plan is out of date since there are no Fissionable Material Handlers at TFs facilities.

Two Field Work Supervisors (FWSs), and two Operational Engineers (OE) discussed their responsibility for criticality safety of operations in separate interviews. The FWSs and OEs understood that a criticality in the TFs was highly unlikely, but possible. The FWSs stated it was their responsibility to ensure that OEs and craft followed procedures and to encourage a questioning attitude. The FWSs explained they were involved with the development of procedures, but once the procedures were issued, their primary concern was verbatim compliance to the procedure and to recognize anomalies from the procedural bases in the field. If an anomaly was identified, the supervisors explained that they would stop the work activities until the issue was resolved by engineering and/or the

CSR. It was verified that supervisors did understand their responsibility for ensuring criticality safety during operations.

The Closure Operations (CO), and Waste Feed Operations (WFO) Facility Directors, two FWSs, and two OEs were interviewed to access their knowledge of the criticality program at TFs. These personnel all stated that a criticality in the TFs was highly unlikely but possible. They clearly articulated that the fissile material within the TFs was controlled through distribution and form, but most did not know the quantity of fissile material in the tanks. When asked how distribution was controlled, all of them stated that the major control was that waste transferred into the tanks, or within the TFs, had to go though a rigorous waste compatibility review. The control that some did not completely understand was the physics of neutron absorbers physically bound to the fissile materials. Some did not understand what materials in the waste were neutron absorbers. The FWSs and Facility Directors interviewed did understand the two other controls, specifically, maintaining alkaline pH and limiting the fissile material concentration of incoming waste.

The team interviewed the TFs and 222-S Laboratory CSRs to assess their knowledge and role in criticality safety. Both of the CSRs stated that their responsibility was to implement criticality safety in the TFs and 222-S Laboratory through the criticality prevention specifications and operating procedures. They both demonstrated a thorough understanding of the three parameters that maintain criticality safety for the TFs fissile material. They discussed neutron absorber to fissile material mass ratio, expressed as "X/Pu," and how this ratio was required to be maintained for the conservative waste model. The CSRs answered completely and correctly every question the assessor asked pertaining to the criticality safety Program Plan (TFC-PLN-49), and other administrative documents and procedures. In addition to their knowledge, they both were energetic and methodical in describing the development of the waste compatibility documents required for waste disturbing activities.

Operators were individually interviewed to better understand their knowledge of the TFs criticality program. Most of these operators understand that criticality was possible within the TFs but was highly unlikely. Most operators could not communicate how fissile material was controlled in the TFs. They did not know criticality safety relied upon controlling distribution and form of the fissile materials. Most of them knew who the TFs CSR was and that this individual performed a waste compatibility review for waste disturbing activities. They all communicated that waste disturbing activities required approved in-hand procedures and verbatim compliance and understood that if operational conditions were outside of the procedure then the work was to be stopped until the procedure was appropriately changed. Follow-up questions revealed that operators were only exposed to fissile material controls during the two-year training cycle and did not get any refresher training between this two year training cycle. Some refresher training designed to address these specific knowledge deficiencies would be beneficial.

The assessors did note an inconsistency between the CO and WFO Facility Managers on their expectations of operator knowledge of TFs criticality safety. The WFO Facility

Director stated that operators should know how fissile material was controlled through form and distribution. The CO Facility Director stated operators and craft needed to understand strict compliance to procedures but did not believe they needed to know the bases for the criticality safety at the TFs. These inconsistent expectations may be contributing to the basic knowledge deficiencies identified in the previous discussion.

Supervisors and managers interviewed did demonstrate a working knowledge of two of the three criticality safety controls implemented for TFs. The physics of neutron absorbers was not consistently understood by all supervisors and managers and is an area recommended for improvement. Both CSRs demonstrated a detailed knowledge of the nuclear criticality programs they implement and were engaged in their work activities. Operators interviewed lacked an understanding of the TFs criticality safety controls. These parameters are: (1) Accounting for significant neutron absorbers; (2) maintaining alkaline pH; and (3) limiting of fissile material concentration of incoming waste. Most operators did not know criticality safety relied upon controlling distribution and form of the fissile materials. They communicated a good understanding of procedure compliance and the appropriate actions to take when operational conditions were outside procedural guidance. An inconsistency between the WFO and CO Facility Managers expectations for operator's knowledge in criticality safety may be contributing to these deficiencies in basic operator knowledge and should be resolved.

The involvement of the Nuclear Criticality Safety (NCS) staff in operational activities was reviewed. The TFs NCS staff interviewed included: the NCS program manager, the TFC-wide administration and procedure manager, and two CSRs. There were two contract Criticality Safety Engineers (CSE) that had been used in the past to perform criticality safety engineering familiar with TFs activities. The NCS staff does not routinely interact with operational activities. The NCS program manager explained that the NCS staff's responsibilities were to ensure that the three waste parameters that maintain criticality safety for the TFs fissile material were maintained. This was done by developing the waste compatibility document that precedes any operational activities and maintaining the conservative waste model. In the field, there were no criticality safety activities that operations performs to maintain fissile material in a sub-critical state. This is evident as there were no fissile material handlers assigned to the TFs nor were there any criticality safety postings located in the TFs. The NCS program manager explained that the NCS staff's sole responsibility was to ensure operational activities were accurately planned for criticality safety and operations needed to execute work activities as planned. The NCS staff focus for criticality safety was appropriate based on the criticality hazard at the TFs.

One Finding was identified in the review of this performance objective:

Finding F-03: A significant fraction of the TFC operations staff has not completed required criticality safety training resulting in their loss of qualification to conduct waste transfer operations.

Requirement: *ANSI/ANS-8.19, 5.3[1], "Each supervisor shall provide training and shall require that the personnel under his supervision have an understanding of procedures and safety considerations such that they may be expected to perform their functions without undue risk."*

4.3 Nuclear Criticality Safety Staff Responsibilities

The performance objective and criteria for evaluation are:

The nuclear criticality safety staff is comprised of specialists skilled in the techniques of nuclear criticality safety assessment and familiar with plant operations while, to the extent practicable, administratively independent of line management; the staff provides technical guidance for design of equipment, processes, and procedures; the staff reviews modifications to equipment, process, and procedures involving fissile material; the staff maintains familiarity with criticality codes, guides, standards, and best practices; the staff is interactive, both internally and externally having access to criticality safety professionals to provide assistance as needed; the staff understands the physics of criticality and makes use of experimental data, handbook data, and bounding methods where applicable; the staff participates in training personnel; the staff participates in audits of operations; and the staff examines reports of procedural violations and criticality infractions and recommends improvements in safety practices to management.

The criteria for this objective have been partially met. The Management Responsibilities performance objective contains a significant issue, Finding F-01. This Finding states in part that, "the team found the TFC criticality safety program did not meet ANSI/ANS-8.19 requirement for retention of CSE support." This deficiency would result in this objective being found inadequate. The deficiency is addressed under the Management Responsibilities section of this report.

There is no facility-specific qualification card for CSEs. CSEs are preparing Criticality Safety Evaluation Reports without benefit of facility-specific training. The TFC is presently working on a facility-specific qualification card for CSEs.

Interviews revealed that the TFC CSRs are past-due for continuing training. Internal procedures require continuing training at least once every two years and recommend attendance at the Los Alamos (now Nevada) three or five day criticality safety courses or equivalent courses. The TFC criticality safety program manager has not attended any of these offsite training courses.

One Finding and two Observations were identified in the review of this Performance Objective:

Finding F-01: The TFC does not meet ANSI/ANS-8.19 requirements for retention of CSE support.

Requirement: *ANSI/ANS-8.19, 4.4[1], "Management shall provide personnel familiar with the physics of nuclear criticality and with associated safety practices to furnish technical guidance appropriate to the scope of operations."*

Observation O-01: The TFC does not have a Facility-Specific Qualification Card for CSE.

Observation O-05: The TFC CSRs do not attend continuing off-site training in criticality safety.

4.4 Operating Procedures

The performance objective and criteria for evaluation are:

Procedures are written and organized to facilitate operator use and understanding; procedures contain criticality controls; mechanisms are in place to facilitate revising and improving procedures on a periodic basis; new or revised procedures involving fissile material are reviewed by the nuclear criticality safety staff; procedures are supplemented by postings; postings are easily visible, understood by operators and contain clear, and contain all criticality controls implemented by the operator; deviations from procedures and processes and criticality infractions are investigated promptly, documented, reported to management, categorized according to approved procedures, and actions are identified to prevent recurrence; criticality infractions are resolved in a timely manner; and, operations are reviewed frequently (at least annually) to assure that processes and procedures have not been altered in a way so as to affect the applicable nuclear criticality safety evaluation. The objectives of this section are met, in part, by nuclear criticality safety staff maintaining familiarity with day-to-day process operations through activities such as attendance at Plan-of-the-Day meetings, pre-evolution briefings, on-the-floor presence at the operations site, participating in regular audits, etc.

The criteria for this objective have been partially met. Procedures are well-written and facilitate use by the operating organization. They contain appropriate criticality safety controls, receive review and approval by the CSR, and are supplemented by the criticality prevention specifications.

Response to criticality safety infractions is addressed appropriately by the TFC-PLN-49 Section 12.0, "Criticality Safety Non-conformance Response." The TFC utilizes the Problem Evaluation Report (PER) process to address criticality safety issues. In the event of a non-ORPS reportable criticality safety infraction, a PER would be written, typically by the CSR. The PER is screened by a panel for significance, responsibility for closure is assigned (can be outside the generating organization), and corrective actions are begun. The TFC Management Assessment process looks at all criticality safety related PERs providing an independent look at the adequacy of corrective actions and closure of PER issues. This process adequately addresses the reporting, investigation, and corrective action development for criticality safety non-conformances.

Criticality safety postings are not used by the TFC except as notices indicating facility classification. For example at the 222-S Laboratory, postings at entrances restrict the introduction of additional fissionable materials. This practice is entirely acceptable given the nature of TFs operations.

A deficiency with regard to reporting potential criticality safety infractions was identified. During reviews of procedures affecting response to unusual conditions, it was discovered that TFC-ENG-CHEM-P-18, Rev. A-4, "Response to Anomalous Sample Results," and TFC-ENG-CHEM-D-23, Rev. B-1, "Preparation of Tank Sampling and Analysis Plans (TSAP)," do not comply with ANSI/ANS-8.19 requirements for timely response to deviations from operating procedures or unforeseen alterations in process conditions that affect nuclear criticality safety. The ANSI/ANS-8.19 Standard and Procedure TFC-PLN-49, "Nuclear Criticality Safety Program," require in part, prompt notification to management and immediately stopping operations activities when warranted. The review team considers anomalous sample results from the 222-S Laboratory analyses to be worthy of prompt notification and cessation of operations.

TFC-ENG-CHEM-D-23, Rev. B-1 requires the 222-S Laboratory to notify, via e-mail, selected individuals if sample results exceed limits important to criticality safety and which are provided in the Table A-1, "Notification Limits for Criticality."

TFC-ENG-CHEM-P-18, Rev. A-4 also provides direction for TF control personnel when sample data exceed the notification limits provided in the TSAP that allows the designated laboratory personnel to notify the Flowsheet & Process Models process engineer the following day, if any analytical results exceeded notification limits as specified in the TSAP. The process engineer then reviews the data for validity. Only upon the process engineer's determination of data validity are notifications made. If Technical Safety Requirements or Criticality Prevention Specification limits had been exceeded, the procedure allowed up to two days to make notification that an anomalous sample result had been obtained. At this point in the process there could be up to a three day delay in notifying operations to suspend work activities or make appropriate notifications. The process is based on the premise that all data is invalid until the validity reviews are completed. This delays the suspension of work and notifications unacceptably.

An immediate compensatory measure was implemented on December 9, 2005, when standing order ALT-2005-804 was issued. This standing order directs Advanced Technologies and Laboratories personnel at the 222-S Laboratory to make immediate notification to the TFs Shift office and others, as required, if any of the notification limits are exceeded for TFs tank waste samples.

Procedures in general are appropriate and adequate and contain criticality safety controls as needed. A single exception was discovered within Procedure TFC-ENG-CHEM-P-18, Rev. A-4, "Response to Anomalous Sample Results" described above. The CSR reviews operating procedures from a criticality safety perspective. However, the recent lack of

CSE involvement leaves a gap in programmatic implementation – ensuring that processes and procedures have not been altered in a way so as to affect the applicable nuclear criticality safety evaluation. This is a continuous process appropriately conducted by the CSE during the performance of his/her work.

The Demonstration Bulk Vitrification Plant, presently under design, recently underwent a PrHOA review. The PrHOA checklist used during the evaluation includes criticality safety considerations which must be evaluated for each system. This would require involvement of the criticality safety staff. Neither a CSE or a CSR attended these meetings. Although a senior process transfer engineer, who supports the NCS program, addressed the criticality concerns, this did not satisfy the TFC-PNL-49 requirement for qualified CSE or CSR involvement. TFC-PLN-49 directs that nuclear criticality safety staff shall provide design input for all new or modified equipment and review and concur on final equipment and process designs. Hazard operability analyses are part of that facility design review and should have been attended by appropriate criticality safety staff.

Supervisors and managers interviewed demonstrated a satisfactory working knowledge of the criticality safety controls implemented for TFs. The level of knowledge of the NCOs interviewed was found to be less than TFC management expectations. The WFO Director stated that operators should know how fissile material was controlled through form and distribution. Most operators could not communicate how fissile material was controlled in the TFs. Follow-up questions revealed that operators were only exposed to fissile material controls during the 2 year training cycle and 31 of them were overdue for this training.

Two Findings were identified in the review of this Performance Objective:

Finding F-02: Procedure TFC-ENG-CHEM-P-18, Rev. A-4, "Response to Anomalous Sample Results," does not comply with ANSI/ANS-8.19 requirements for response to deviations from normal process conditions that affect nuclear criticality safety.

Requirement: *ANSI/ANS-8.19, 7.7[1], "Deviations from operating procedures and unforeseen alterations in process conditions that affect nuclear criticality safety shall be reported to management, investigated promptly, corrected as appropriate, and documented."*

Finding F-04: The DBVS PrHOA did not utilize trained and qualified criticality safety personnel for the identification of criticality hazards and operations.

Requirement: *TFC-PLN-49, Tank Farm Contractor Nuclear Criticality Safety Program, Rev. A-2, Section 10.3.2, "During*

the design phase, a criticality safety engineer shall, upon request, provide preliminary guidelines for the geometrically safe and favorable dimensions and location, composition, and distribution of fixed poisons that must be determined before construction. …. All new or modified designs that may impact criticality safety shall have approval from a criticality safety engineer and the CSR."

ANSI/ANS-8.19, Section 6.1, "The nuclear criticality safety staff shall provide technical guidance for the design of equipment and processes and for the development of operating procedures.

4.5 Process Evaluations for Nuclear Criticality Safety

The performance objective and criteria for evaluation are:

All fissile material operations are analyzed to show that the processes will remain subcritical under all normal and credible abnormal conditions; the criticality safety evaluation is documented in a clear unambiguous manner; contingencies and controls are explicitly identified; calculational methods are properly validated; priority is placed on experimental data, handbook values, and bounding methods where applicable; engineered safety features are relied on to provide criticality safety to the extent practicable; procedures for producing criticality safety evaluations, limits, and postings are used; and criticality safety evaluations are independently peer reviewed before operations are authorized.

The criteria for this objective have been met.

The Project Management procedures for "Expense Funded" projects and DOE O 413.3, *Project Management for the Acquisition of Capital Assets*, contain a trigger for the project manager to consider the need for a criticality safety evaluation. If the criticality safety evaluation is provided early enough in the life of the project, the criteria would be met. In the example of the Interim Disposal Facility, criticality safety technical guidance was provided for the proposed facility through a subcontract mechanism with the ARES Corporation.

For some of Fiscal Year 2005, the TFC did not have in-house CSEs. This impeded the resolution of remaining issues regarding the use of the Conservative Waste Model (as identified in the Criticality Safety Support Group August 29, 2005, review of the DBVS). Another example was the draft Critical Safety Evaluation Report for the DBVS, where initial communication was minimal and did not allow for the development of an adequate product.

In response to DOE and Defense Nuclear Facility Safety Board concerns, the TFC criticality safety program manager directed that a comprehensive process description

document be prepared to support the development of a criticality safety evaluation report for the Demonstration Bulk Vitrification Project. This document represents a best practice and is commendable. The TFC should consider institutionalizing this practice in the procedure, TFC-PLN-49, "Nuclear Criticality Safety Program" and sharing the concept through the ENDUSERS group or other national forum.

The various CSERs reviewed by the team contained appropriate consideration of the physical parameters and a determination of their need to be controlled. In general, CSERs supporting TFs operations are all well-documented, and all CSERs reviewed had received an adequate independent review.

No Findings or Observations were identified in the review of this Performance Objective.

4.6 Additional Assessment Criteria

The performance objective and criteria for evaluation are:

Examine how Tank Farms Best Basis Inventory (BBI) database updates are incorporated into the criticality safety analysis and the Waste Compatibility Assessments. Determine if appropriate requirements and a formal process exist to incorporate the latest BBI data into the criticality safety analysis and the waste compatibility assessment.

Examine if there is adequate criticality safety programmatic consistency between the Tank Farms, 222-S Lab, and the 242-A Evaporator. The ownership of the 222-S lab and the 242-A Evaporator were transferred from FH to the TFC last year. The transition of criticality safety practices from FH to the TFC should have been completed. Determine if there exists an acceptable level of consistency between the criticality safety analyses and practices among Tank Farms, the 222-S Laboratory, and the 242-A Evaporator.

Review recent waste compatibility assessments. Waste compatibility assessment is conducted prior to waste transfer. Criticality safety is one of the items assessed. Determine if there is an appropriate level of rigor, validity, and QA (peer review) in the Waste Compatibility Assessment process.

TFC-PLN-49, CPS-T-149-00012, Rev. B-4, *"Criticality Prevention Specification for Tank Farm Operations"* and HNF-SD-WM-OCD-015, "*Tank Farm Waste Transfer Compatibility Program,"* Rev. 16, October 4, 2005, are rigorous and when properly implemented would together provide adequate assurance that Criticality Prevention Specification limits would not be exceeded due to waster transfers or waste receipts from non-TF facilities. Several weaknesses within the Waste Compatibility Program were identified.

Several Waste Compatibility Assessment reports were reviewed for this assessment. During the review, it was discovered that Waste Compatibility Assessment report RPP-RPT-25160, issued on November 17, 2005, contained spreadsheet calculations that were dated June 29, 2005. Although the TFC staff verified that the tank inventories had not

changed since the spreadsheet calculation was completed, the verification was not documented. With the on-going retrieval and waste transfer activities, tank waste inventory and the BBI database are dynamic and constantly changing. Therefore, it is important that when the waste transfer is delayed, TFC staff must verify and document that the BBI data has not changed and that the previously completed analysis is still valid. Several Waste Compatibility Assessment reports identified that the Plutonium-equivalent inventory in the receiver double-shell tank subsequent to transfer operations would exceed a pre-established 10 kilogram Pu mass limit. This was dispositioned by noting in the report that the TFs CSR had reviewed the data and concurred with the transfer. No basis for the CSR concurrence was provided in the report.

The BBI database is updated quarterly to incorporate new characterization data and to correct errors and inconsistencies. Over time, the cumulative changes in the BBI database for some tanks may become significant. It is important that the analytical model underlying the TFs criticality safety analyses be periodically assessed against the latest BBI database information to ensure that model assumptions remain valid for all TFs facilities.

The assessment team concluded that there is adequate programmatic consistency between the TFs, 222-S Laboratory, and the 242-A Evaporator. Ownership of the 222-S Laboratory and the 242-A Evaporator were transferred from FHI to the TFC recently. The transition of criticality safety practices from FHI to the TFC has been adequately completed. An acceptable level of consistency exists between the criticality safety analyses and practices among TFs, the 222-S Laboratory, and the 242-A Evaporator. Some of this consistency is dependent upon the continuation of CSE support from the Fluor Government Group who authored the original criticality safety evaluations and many of the more recent evaluations. The TFC criticality safety program is modeled to a significant extent after the FHI program. This represents a good practice.

One Observation was identified in the review of this Performance Objective:

Observation O-04: Documentation weaknesses were identified in several Waste Compatibility Assessments. This is important because these assessments are the primary control designed to ensure compliance of incoming wastes with criticality safety limits.

5.0 CONCLUSIONS

The review team concluded that the TFC NCS Program is adequately implemented and meets, with some exceptions, the requirements of ANSI/ANS-8.19. The team identified four Findings, and five Observations. The most significant of the four Findings was related to the loss of CSE support for TFs Operations.

A significant Finding involved CSE support for TFs Operations. The TFC criticality safety program does not meet the ANSI/ANS-8.19 requirement for retention of CSEs. As TFs Operations do not require daily handling, movement, or processing of fissionable

materials, part-time CSE support may be appropriate. A fully-funded Task-Order contract for CSE support must be immediately put in place and be continuously maintained to ensure all criticality safety program controls relied on in the safety analyses continue to be incorporated into and implemented by the TFC criticality safety program. Finding F-01 addresses this issue. A related issue, Finding F-04, involved the lack of participation of a CSE in the Demonstration Bulk Vitrification Plant PrHOA. The PrHOA did not utilize trained and qualified criticality safety personnel for the identification of criticality hazards and operations, a significant oversight.

Other Findings involved problems identified with response to abnormal circumstances in Procedure TFC-ENG-CHEM-P-18, Rev. A-4, "Response to Anomalous Sample Results," and the discovery that 31 NCOs were delinquent in completing the web-based criticality safety training resulting in loss of qualification.

The consensus of the review team was that the TFC criticality safety program, in spite of these problems, retains a highly motivated and competent criticality safety staff. Continued programmatic reliance upon the Criticality Safety Representatives who perform an essential function, retention of the criticality program management within the engineering group, adequate funding, and an appropriate level of CSE support will enable the high quality existing staff to make needed corrections and programmatic improvements.

6.0 REFERENCES

References and personnel contacted for the assessment criteria are listed in Appendix A.

APPENDIX A

ASSESSMENT CRITERIA

Criteria for DOE-ORP Assessment of the TFC Criticality Safety Program, December 5-16, 2005

The applicable U.S. Department of Energy (DOE) Order (O) for criticality safety is DOE O 420.1A, *Facility Safety*. It requires compliance with certain American National Standards Institute (ANSI)/American Nuclear Society (ANS) Standards for criticality safety. The assessment criteria were drawn from the mandatory Standard, ANSI/ANS-8.19-1996, *Administrative Practices for Nuclear Criticality Safety*, and are categorized as follows:

- Management Responsibilities - Management demonstrates ownership and participation in the criticality safety program; authorities and responsibilities are defined, understood and implemented; management provides a nuclear criticality safety staff that is competent in the physics of criticality and associated safety practices as well as familiar with fissile material operations; management ensures that the nuclear criticality safety staff is independent of line management to the extent practicable; management assigns responsibility for criticality safety in a manner consistent with other safety disciplines; and management establishes means of monitoring the criticality safety program and obtains feedback on the overall effectiveness of the program.

- Supervisory Responsibilities - Line supervision accepts responsibility for the criticality safety of their operations; supervisors understand the controls, contingencies, and criticality safety basis for operations under their control; classroom and job-specific training in criticality safety is provided to personnel; procedures govern all work and there are effective change control and configuration control mechanisms; supervisors verify compliance with criticality safety specifications before authorizing work; and supervisors require conformance with good safety practices, good housekeeping, and unambiguous identification of fissile materials.

- Nuclear Criticality Safety Staff Responsibilities - The nuclear criticality safety staff is comprised of specialists skilled in the techniques of nuclear criticality safety assessment and familiar with plant operations while, to the extent practicable, administratively independent of line management; the staff provides technical guidance for design of equipment, processes, and procedures; the staff reviews modifications to equipment, process, and procedures involving fissile material; the staff maintains familiarity with criticality codes, guides, standards, and best practices; the staff is interactive, both internally and externally having access to criticality safety professionals to provide assistance as needed; the staff understands the physics of criticality and makes use of experimental data, handbook data, and bounding methods where applicable; the staff participates in training personnel; the staff participates in audits of operations; and the staff examines reports of procedural violations and criticality infractions and recommends improvements in safety practices to management.

- Operating Procedures - Procedures are written and organized to facilitate operator use and understanding; procedures contain criticality controls; mechanisms are in place to facilitate revising and improving procedures on a periodic basis; new or revised

procedures involving fissile material are reviewed by the nuclear criticality safety staff; procedures are supplemented by postings; postings are easily visible, understood by operators and contain clear, and contain all criticality controls implemented by the operator; deviations from procedures and processes and criticality infractions are investigated promptly, documented, reported to management, categorized according to approved procedures, and actions are identified to prevent recurrence; criticality infractions are resolved in a timely manner; and operations are reviewed frequently (at least annually) to assure that processes and procedures have not been altered in a way so as to affect the applicable nuclear criticality safety evaluation. The objectives of this section are met, in part, by nuclear criticality safety staff maintaining familiarity with day-to-day process operations through activities such as attendance at Plan-of-the-Day meetings, pre-evolution briefings, on-the-floor presence at the operations site, participating in regular audits, etc.

- Process Evaluation for Nuclear Criticality Safety - All fissile material operations are analyzed to show that the processes will remain subcritical under all normal and credible abnormal conditions; the criticality safety evaluation is documented in a clear unambiguous manner; contingencies and controls are explicitly identified; calculational methods are properly validated; priority is placed on experimental data, handbook values, and bounding methods where applicable; engineered safety features are relied on to provide criticality safety to the extent practicable; procedures for producing criticality safety evaluations, limits, and postings are used; and criticality safety evaluations are independently peer reviewed before operations are authorized.

In each of the sections that follows, specific lines of inquiry are presented for the criterion sections of ANSI/ANS-8.19-1996 which are of interest for this assessment.

1.0 Management Responsibilities

Criteria: Section 4.1, Responsibility for Safety

- Does the Contractor Facility Management demonstrate continuing interest in criticality safety as evidenced by conducting safety meetings, issuing safety bulletins, inspecting facilities on a regular basis, and ensuring continuous improvement in safety?
- Does the Contractor Facility Management demonstrate continuing interest in criticality safety as evidenced by regular meetings with the criticality safety engineers and the Nuclear Criticality Safety (NCS) manager?
- Does the Contractor Program Management regularly meet with the NCS manager?

Criteria: Section 4.2, Criticality Safety Policy

- Does the Contractor have a written criticality safety policy?
- Are all fissile material handlers and their supervisors familiar with the criticality safety policy?

- How is compliance to the Contractor criticality safety policy required of all program personnel performing work?

Criteria: Section 4.3, Responsibility for Implementing Policy

- Are the roles and responsibilities of the Criticality Safety Engineers (CSE) documented?
- Are the roles and responsibilities of the NCS Manager and Organization documented?
- Are the roles and responsibilities of the Criticality Safety Officers (CSO) documented, if applicable?
- Is there a clear distinction between the roles of the CSO and the CSE?
- Is line management assigned responsibility for criticality safety?
- Has the Contractor assigned responsibility for oversight of the NCS program?

Criteria: Section 4.5, Monitoring the Criticality Safety Program

- Who is responsible for monitoring the criticality safety program?
- Are criticality safety related performance metrics in place and used by management to monitor the effectiveness of the program?
- Do the criticality safety performance metrics encourage self-reporting of deficiencies and continuous improvement?
- Are the criticality safety performance metrics measurable and objective?
- Do the criticality safety performance metrics encourage development of a strong staff and program by measuring performance in the training and qualification program of nuclear criticality safety staff, professional development, participation in the American Nuclear Society Nuclear Criticality Safety Division, preparation of technical papers, etc.?
- Are all deficiencies related to criticality safety entered in a corrective action tracking system?
- Are mechanisms in place to validate closure of all criticality safety related deficiencies?
- Does line program management maintain awareness of criticality safety deficiencies through the use of a corrective action tracking system?
- Is there a program or procedure for trending deficiencies in the criticality safety program?
- How does the Contractor management determine that funding for NCS is sufficient and is there a mechanism for adjusting the funding during the fiscal year?

Criteria: Section 4.6, Participation in Audits

- Does the Contractor management participate in review teams or committees to assess facility criticality safety programs?
- Does the Contractor program management routinely audit operations for compliance to criticality safety requirements?
- Does the Contractor facility management routinely audit operations for compliance to criticality safety requirements?
- Does the Contractor perform NCS management self-assessments of their criticality safety staff and program?

Criteria: Section 4.7, Nuclear Criticality Safety Committees

- Does management utilize a nuclear criticality safety committee to assist in monitoring and improving the criticality safety program?

2.0 Supervisory Responsibilities

Criteria: Section 5.1, Responsibility for Safe Operations

- Do line program supervisors accept responsibility for criticality safety of their operations? Is ownership demonstrated by the following: 1) approving criticality safety postings; 2) reviewing and approving criticality controls in procedures; 3) participating in the development of criticality safety evaluations; 4) participating in the development of credible process upsets for the NCS staff to consider; and 5) approving criticality safety evaluations for operations?

Criteria: Section 5.2, Knowledge of Criticality Safety

- Do line program supervisors formally review credible process upsets and criticality accident scenarios analyzed by the NCS staff during development of the CSE?
- Do line program supervisors understand the underlying assumptions in CSEs which involve configuration of equipment, facility modifications, isotopic composition, etc.?
- Is the Nuclear Criticality Safety Staff requested to provide NCS training to line program supervisors?
- Does line program supervision know the safety basis for the criticality controls for their operations?
- Does the NCS staff provide advice and assistance to line program management regarding implementation of NCS controls?

Criteria: Section 5.3, Operator Training

At a minimum, operators receive criticality safety training in accordance with ANSI/ANS-8.20, "Nuclear Criticality Safety Training."

- Do supervisors provide job specific training on procedures?
- Are walkthroughs and dry-runs on procedures provided?
- Do pre-job briefs cover criticality controls specific to the operations at hand?
- Do Plan-of-the-Day meetings address criticality safety related topics like work restrictions due to criticality safety infractions, availability of new procedures and postings, need for NCS Staff participation, results of recent criticality safety assessments/surveillances, etc?
- Do supervisors maintain training records for their personnel?
- Do supervisors ensure that their personnel are current in criticality safety classroom training?
- Are there required reading records or other evidence that personnel are knowledgeable of changes to procedures, and criticality safety postings?

- Can supervisors and operators answer questions about the basic criticality controls for their operations?
- Can supervisors generally describe the contingencies and controls for the contingencies for their operations including credited engineered features and key facility assumptions, if any?
- Do supervisors ensure that personnel have demonstrated an understanding of modified or revised procedures, and criticality safety postings prior to authorizing work?
- Are there records of job specific training on procedures and criticality safety postings?
- Do supervisors request assistance from the Nuclear Criticality Safety Staff to provide training for operations personnel?

3.0 Nuclear Criticality Safety Staff Responsibilities

Criteria: Section 6.1, Technical Guidance for Design of Equipment and Processes

- Does the NCS Staff provide design input for all new or modified equipment?
- Does the NCS Staff review all operating procedures involving fissile materials?
- Does the NCS Staff review and concur on final equipment and process designs?

Criteria: Section 6.2, Required Knowledge and Capability

- Does the Contractor NCS Staff participate in professional development activities such as ANS Standards Committees, Nuclear Criticality Technology Project Workshop, ANS Meetings, LANL/LACEF courses, UNM courses, etc.?
- Is there a training and qualification program for the Contractor NCS Staff? Are all the members of the Contractor NCS Staff qualified?
- Does the NCS Staff have working knowledge of criticality safety related standards, guides, and codes?

Criteria: Section 6.4, Familiarity with Operations

- Does the NCS staff observe fissile material handling and processing operations?
- Are members of the NCS Staff knowledgeable of credible abnormal process upsets applicable to facility operations?
- Does the NCS Staff attend operations planning meetings for new or restarted processes?
- Does the NCS Staff have access to and familiarity with fissile material operating procedures?
- Does the NCS Staff attend pre-job briefs and Plan-of-the-Day meetings?
- Does the NCS Staff maintain familiarity with reports of deviations from expected process conditions even if these deviations do not result in a criticality infraction?

Criteria: Section 6.5, Assistance with Operator Training

- Does the NCS Staff participate in training personnel?
- Is the training documented?

- Does the training provided by the NCS Staff include job specific criticality safety related information?

Criteria: Section 6.6, Audits

- Does the NCS Staff participate in periodic audits of operations and procedures?
- Are the results of audits shared among the NCS Staff?
- Are the results of audits reported to appropriate Facility Management?
- Are corrective actions developed for deficiencies?

Criteria: Section 6.7, Investigation of Criticality Safety Violations and Deficiencies

- Does the TFC Plan 49 Procedure document or other related documents provide for the reporting of criticality safety non-conformances?
- Does the procedure address reporting findings and recommendations to Facility Management?
- Is there a requirement to develop lessons learned and recommendations to prevent recurrence to Facility management?
- Does the procedure require that criticality safety related deficiencies be captured in a database and tracked until closure is verified?
- Is there a mechanism for trending criticality safety related deficiencies so that the collective significance of multiple minor incidents can be assessed and corrected?
- Are lessons learned from other facilities reviewed by the NCS Staff for potential application at the facilities?

4.0 Operating Procedures

Criteria: Section 7.7, Response to Criticality Safety Infractions/Violations/Deficiencies

- How are infractions graded?
- Do procedures exist to upgrade the assigned severity level of infractions due to adverse trends?
- Do operators immediately stop work, leave the immediate vicinity, notify supervision, post the area, and contact the NCS Staff promptly when a potential infraction is identified?
- Does the NCS Staff respond to the scene of a potential infraction?
- Are the responsibilities defined for responding to a potential infraction?
- Are minor criticality infractions tracked and trended?

Criteria: Section 7.8, Annual Operations Reviews

- Are all operations reviewed at least annually?
- How do annual reviews determine that procedures are being followed?
- Do personnel with NCS experience and knowledge of the operations perform the reviews?

- Are the results of the review reported to senior management as well as Facility and Program Management?
- Are deficiencies and proposed corrective actions documented and tracked to closure?
- Are procedures in place that verify that changes to process equipment over time have not degraded compliance with criticality safety controls?
- Does the annual review of operations verify the vertical traceability of controls from floor level documents back to the parent CSE including verification that these chains are current and maintained properly?
- Do annual reviews of operations look at all the elements of the criticality safety program affecting operations?

5.0 Process Evaluation for Nuclear Criticality Safety

Criteria: Section 8.1, Analysis of New and Modified Operations

Criticality safety evaluations shall conform to the requirements of ANSI/ANS-8.1, "Nuclear Criticality Safety in Operation with Fissionable Material Outside Reactors."

- Are natural phenomena hazards, especially seismic, considered in developing accident scenarios?
- Are firefighting scenarios considered (i.e. addition of moderator, displacement of fissile material in water streams, etc.)?
- Do the contingencies credited represent events that are at least unlikely and incorporate lessons learned from previous process upsets and infraction of NCS limits?
- Are the contingencies to be evaluated jointly developed by the NCS staff, responsible operations personnel, and responsible support engineering organization?
- Is there a systematic approach that provides reasonable assurance that all credible criticality accident scenarios/initiators have been identified and understood?
- Are all credible process upsets considered and either controlled or dispositioned appropriately?
- Are the criticality safety evaluations performed in a timely fashion?
- Do formalized procedures exist for generating criticality safety evaluations?
- Does staff familiar with the facility and operations under consideration perform the criticality safety evaluations?
- Does the NCS Staff take full advantage of simplifying methods, bounding calculations, critical experiment data, handbook data, etc. where appropriate to minimize dependence upon monte carlo techniques?
- Are calculations validated by comparison to applicable experiment benchmark data?
- Is the Applicable Ranges of Bounding Curves and Data (AROBCAD) technique used to select and verify applicability of the selected benchmarks?
- Does the NCS Staff have access to archived criticality safety evaluations as reference?
- Do criteria and procedures exist to determine the magnitude of process change, which can be implemented without revising the criticality safety evaluation?
- Does the NCS Staff work as a team with operations to develop credible accident scenarios and controls?

Criteria: Section 8.2, Evaluation of Controlled Parameters

- Are controls developed in the criticality safety evaluation for each contingency?
- Do criticality safety evaluations and procedures for evaluations emphasize the preference for engineered controls over administrative controls?
- Are evaluation procedures in place to identify potential engineered controls and propose them to operations supervision for formal disposition? Do evaluations justify selection of administrative controls instead of engineered controls where the latter are practicable?
- Have computer-assisted techniques been utilized to enhance administrative controls and reduce failure rates?
- Are controlled parameters, contingencies, and credited barriers explicitly documented?
- Does the criticality safety evaluation identify those controls that are to be included in procedures and those that should be included in postings?

Criteria: Section 8.3, Documentation Requirements

- Do the criticality safety evaluations conform to DOE-STD-3007-93, *Guidelines for Preparing Criticality Safety Evaluations at Department of Energy Non-Reactor Nuclear Facilities*?
- Do the CSEs contain a system/process description with enough detail for an independent reviewer to understand the system/process sufficiently to judge the results of the criticality safety analysis?
- Is there a change control and document control system in place for criticality safety evaluations?
- Are internal memoranda used to communicate limits and controls in place of formal evaluations?
- Are temporary limits and evaluations (i.e. those that expire after a specified period) used?
- Are all assumptions fully documented in the criticality safety evaluation?
- Can appropriate sections of the criticality safety evaluation (e.g. the process description, discussion of contingencies and credible abnormal events, criticality safety controls) be read and understood by the line supervision?

Criteria: Section 8.4, Independent Review

- Do all criticality safety evaluations receive and independent technical peer review before approval for use?
- Does the independent review process provide assurance that engineered controls are given preference over administrative controls where practical?
- Is there a process for confirming that all credited engineered features of a system or process are in place and meet the specifications anticipated by the evaluation prior to starting operations?

Criteria: Section 9.4, Control of Fissile Material Areas

- Is access to fissile material handling areas controlled such that only trained, qualified, and authorized personnel can handle fissile material?

- Does facility management verify the qualification of fissile material handlers prior to authorizing work?

Criteria: Section 9.5, Control of Physical Parameters

Are fissile material storage areas in conformance with the requirements of ANSI/ANS-8.7, "Guide for Nuclear Criticality Safety in the Storage of Fissile Materials" where applicable?

- Are fissile solutions periodically monitored for changes in pH?
- Do double-block-and-bleed valve arrangements, or equivalent, where the addition of fissile material is prohibited, protect isolated, inactive fissile solution storage tanks?

Additional Assessment Criteria:

1. **How are TFs Best Basis Inventory (BBI) database updates incorporated into the criticality safety analysis and the Waste Compatibility Assessments?** The BBI database provides detailed waste information for each individual Hanford waste tank. The waste data were constructed based on characterization data, past process knowledge, waste transfer history, etc. The database is updated quarterly, and past experience indicates that errors and inconsistencies in the database were regularly identified during the update process. Do appropriate requirements and a formal process exist to incorporate the latest BBI data into the criticality safety analysis and the waste compatibility assessment?

2. **Programmatic consistency between the TFs, 222-S Laboratory, and the 242-A Evaporator.** The ownership of the 222-S Laboratory and the 242-A Evaporator were transferred from FHI to the TFC last year. The transition of criticality safety practices from FHI to the TFC should have been completed. Is there an acceptable level of consistency between the criticality safety analyses and practices among TFs, the 222-S Laboratory, and the 242-A Evaporator?

3. **Review recent waste compatibility assessments.** Waste compatibility assessment is conducted prior to waste transfer. Criticality safety is one of the items assessed. Is there an appropriate level of rigor, validity, and QA (peer review) in the Waste Compatibility Assessment process?

Purpose:

The purpose of this review is to provide an expert, comprehensive review of the Tank Farms Contractor (TFC) Nuclear Criticality Safety (NCS) Program. This review was requested by the ORP and will be conducted according to accepted guidelines for periodic monitoring of operational criticality safety programs.

Scope:

While the s TFC NCS Program provides support for all fissile material operations, this review will assess all the operations under their purview.

Assessment Requirements:

ANSI/ANS-8.19 is a mandatory standard in the TFC contract and will serve as the basis of requirements for this review. The DOE Standard, DOE-STD-1158-2002, *Self-Assessment Standard for DOE Contractor Criticality Safety Programs*, was used as an assessment tool for this review, since it provides guidance on reviewing an NCS program for compliance with ANSI/ANS-8.19.

Results:

The review is scheduled for the weeks of December 5-16, 2005. The results of the review will be documented in a report by January 15, 2005. The report will draw conclusions about the adequacy of the TFC NCS Program relative to the expectations of ANSI/ANS-8.19, identify deficiencies and needed corrective actions, and provide recommendations to improve the program. The report will also identify noteworthy practices.

Approach:

Record Review:

Operating Procedures; Site Contractor criticality safety SMP policy and implementing documentation; Nuclear facility DSA and TSRs; Training records, waste compatibility assessments, criticality safety evaluations, criticality prevention specifications, facility classification records, facility fissile material inventory records, technical documents and papers related to nuclear criticality safety.

Interviews:

TFC criticality safety program managers, staff members, and criticality safety representatives. Engineering managers, engineers, line managers, operations supervisors, nuclear chemical operators.

Records Reviewed:

- Contract DE-AC27-99RL14047, CH2M HILL Hanford Group, Inc., Section J, Appendix C, *DOE Directives.*
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- Tank Farm Contractor Standards/Requirements Identification Document (S/RID), HNF-SD-MP-SRID-001, *Criticality Safety Program*, 5/20/2002.
- ORP M 420.1-1, *Nuclear Criticality Safety Program*, 3/11/2002.
- TFC-PLN-49, *Nuclear Criticality Safety Program*, Rev. A-2, dated 11/03/05.
- DOE O 420.1A, *Facility Safety*, Contractor Requirements Document Section 4.3, *Criticality Safety*, 5/20/2002.
- TFC-BSM-AD-C-07, Rev. A-1, *Standards/Requirements Identification Document Process*, dated 8/22/05.
- RPP-13033, *Tank Farms Documented Safety Analysis*, Rev. 1.
- HNF-SD-WM-TSR-006, *Tank Farms Technical Safety Requirements*, Rev. 4.
- TFC-PLN-32, *Tank Farm Contractor Safety Management Programs*, Rev. B-5.
- RPP-RPT-25891, *System Health Report for the 242A Evaporator Facility for 1st Quarter CY2005.*
- HNF-SD-WM-OCD-015, *Tank Farm Waste Transfer Compatibility Program*, Rev. 16, 10/4/05.
- CPS-T-149-00012, *Criticality Prevention Specifications*, Rev. B-4, 4/14/05.
- RPP-RPT-27462, *Waste Compatibility Assessment of Tank 241-S-112 & 241-S-102 Retrieval Wastes (SST-R-05-05 & SST-R-05-03) with Tank 241-SY-102 Waste*, Rev. 0-A, 11/22/05.
- RPP-RPT-25160, *Waste Compatibility Assessment of Tank 241-C-103 Waste with Tank 241-AN-106 Waste & Tank 241-AN-106 Waste with Tank 241-C-103 Waste*, Rev. 1, 11/17/05.
- RPP-RPT-27398, *Waste Compatibility Assessment of Tank 241-AZ-301 Condensate with Tank 241-AY-101 Waste*, Rev. 0, 9/30/05.
- RPP-RPT-27394, *Waste Compatibility Assessment of Tank 241-SY-101 Recirculation*, Rev. 0, 9/12/05.
- RPP-18702, *Waste Compatibility Assessment of 241-C-200 Series Tank Retrieval Waste (SST-R-05-04) Tank 241-AN-106 Waste*, Rev. 3-A, 8/23/05.

- RPP-20229, *Waste Compatibility Assessment of Tank 241-S-102 Waste (SST-R-05-03) with Tank 241-SY-102 Waste*, Rev. 3, 7/26/05.

- RPP-RPT-26349, *Waste Compatibility Assessment of 222-S Lab Waste (222-S-05-01) & Tank 241-SY-102 Waste with Tank 241-SY-101 Waste*, Rev. 0, 6/27/05.

- RPP-RPT-25889, *Waste Compatibility Assessment of Catch Tanks 244-A & 204-AR Waste with Tank 241-AP-107 Waste*, Rev. 1, 6/24/05.

- RPP-RPT-23820, *Waste Compatibility Assessment of Evaporator Slurry (EVAP-05-01) with Tank 241-AP-108 Waste & Tank 241-AW-102 Waste*, Rev. 0-B, 3/4/05.

- LO-180-107, *222-S Laboratory Operating Procedure, Radiological Sample Inventory Control*, Rev. H-0, 11/28/05.

- LO-090-101, *222-S Laboratory Sample Receiving and Custodianship*, Rev. Z-0, 8/25/05.

- ATS-310, *Analytical Technical Services, 222-S laboratory Administration, Criticality Safety Program*, Rev. 13, 8/11/05.

- HNF-14755, *242-A Evaporator Documented Safety Analysis*, October 2005.

- HNF-15279, *242-A Evaporator Technical Safety Requirements*, Rev. 0, November 14, 2003.

- CSER 03-011: *Transfer from Tank 241-C-106 to Tank 241-AN-106 using Oxalic Acid Dissolution*, HNF-15682, Rev. 0, April 2003.

- CSER 03-011: *Transfer from Tank 241-C-106 to Tank 241-AN-106 using Oxalic Acid Dissolution*, HNF-15682, Rev. 0A, August 2003.

- Project Manual TFC-PRJ-PM-C-02, Rev. B-9, *Project Management for DOE O 413.3 Projects*, November 2005.

- Project Manual TFC-PRJ-PM-C-11, Rev. B-7, *Project Management for Hanford Tank Waste Cleanup Expense-Funded Projects*, September 2005.

- Management Plan Manual TFC-PLN-49, Rev. A-2, *Tank Farm Contractor Nuclear Criticality Safety Program*, November 2005.

- Engineering Manual TFC-ENG-CHEM-P-18, Rev. A-4, *Response to Anomalous Sample Results*, October 2005.

- Engineering Manual TFC-ENG-CHEM-D-23, Rev. B-1, *Preparation of Tank Sampling and Analysis Plans*, October 2005.

- Engineering Manual TFC-ENG-CHEM-P-06, Rev. B-3, *Criticality Safety Specifications,* February 2005.

- Engineering Manual TFC-ENG-CHEM-P-04, Rev. B-2, *Criticality Safety Evaluations,* November 2005.

- Criticality Safety Specification CPS-T-149-00012, Rev. B-4, *Tank Farm Operations*, 4/14/2005.

- Criticality Safety Specification CPS-T-149-00020, Rev. A-2, *Tank Farm Operations*, 10/27/2003.

- *Qualification Card and Guide for Criticality Safety Representative*, 350004, Rev. 3.

Personnel/ Positions Interviewed:

- CH2M HILL Criticality Safety Program Manager
- CH2M HILL Vice President Engineering
- CH2M HILL Process Analysis Director
- CH2M HILL Waste Feed Operations Facilities Director
- 222-S Laboratory Building Manager
- 222-S Criticality Safety Representative
- Tank Farms Operations Criticality Safety Representative
- Facility Operations Managers
- Nuclear Chemical Operators
- Tank Farms Shift Operations Supervisors
- ORP Facility Representatives
- Field Work Supervisors

Facility Tours/Evolutions/Operations/Shift Performance Observed:

The following facility tours to verify fire protection program implementation including:

- Integrated Disposal Facility
- Tank Farms Facility
- 242-A Evaporator
- 242-T Evaporator
- 242-S Evaporator
- 222-S Laboratory

APPENDIX B

TEAM MEMBER

BIOGRAPHIES

Team Member Qualification Summary

Team Member Name: Tom Nirider, Assessment Team Leader

Title and Organization: Criticality Safety Program Manager
Engineering Support Division
Office of the Assistant Manager for Safety and Engineering
Richland Operations Office

Areas Assigned: Management Responsibilities
Supervisory Responsibilities
Nuclear Criticality Staff Responsibilities

Summary of Education and Technical Qualifications:

- B.S. Physics and Mathematics, Eastern Washington University
- M.S. Physics, University of Washington
- Post Graduate Research in Nuclear Physics, University of Washington.

Summary of Experience:

Mr. Nirider is Nuclear Criticality Safety Program Manager for the DOE-RL Assistant Manager for Safety and Engineering at the Hanford Site. He has over 11 years of specialized experience in establishing, managing, and implementing nuclear criticality safety programs both in operating fissile facilities and within DOE. Mr. Nirider is a trained and experienced DOE Facility Representative, is a Lead Auditor, and has participated in numerous site assessments, surveillances, and investigations, many involving nuclear criticality safety. Mr. Nirider also has experience as a nuclear facility Shift Operations Manager and was trained as a Building Emergency Director at Hanford's Plutonium Finishing Plant. He has participated in the development and review of DOE Standards and Orders related to nuclear and criticality safety. Author of Criticality Safety Evaluations, Criticality Safety Specifications, numerous Technical Documents and Reports related to Criticality and Nuclear safety at DOE facilities, Safety Analyses for Operations at Nuclear and Radiation Testing Facilities, Safety Evaluation Reports, Assessments, and Operational Procedures for Nuclear Facilities. Authored numerous test reports, technical papers and summaries related to Nuclear Weapon Effects and Low-Earth Orbit Space Simulation.

Mr. Nirider is familiar with nuclear facility design bases, operating procedures, training and qualification programs, safety oversight functions, and facility operating parameters. He has a working knowledge of Hanford Site Emergency Response Procedures, DOE Orders, Environmental Laws and Regulations, OSHA, Radiological Control, and Occurrence Reporting Requirements. Mr. Nirider holds a Bachelor of Science degree (Cum Laude) in Physics from Eastern Washington University, and a Master of Science degree in Physics from the University of Washington. Mr. Nirider has served in his current position for the past seven years. Previously, he was a Facility Representative at DOE-RL assigned to Pacific Northwest National

Laboratories' Environmental Molecular Sciences Laboratory. In addition to the nuclear experience listed above, Mr. Nirider has seven years experience in the operation, maintenance, design and construction of electron and positive ion linear particle accelerators (LINACs). He is experienced in laboratory dosimetry, has performed research in and published papers on the effects of natural space radiation upon spacecraft materials, space power systems, and nuclear weapon effects upon materials and semiconductor devices. He has significant laboratory experience in space and nuclear environment simulation. While employed as a Staff Scientist at the University of Washington Nuclear Physics Laboratory, he performed detailed computer analyses of magnetic spectrographs as well as ion and electron LINAC performance utilizing particle beam transport codes. Additionally, he has conducted fundamental research in charged particle detector development.

Mr. Nirider has completed numerous credits of post-graduate coursework at the University of Washington in Aeronautics and Astronautics as well as Astrophysics, with an emphasis on the Structure and Evolution of Stars.

Team Member Qualification Summary

Team Member Name: John E. Fialkovich

Title and Organization: Team Leader
Nuclear Criticality Safety Program Manager
Fluor Hanford, Inc.

Areas Assigned: Training and Qualification

Summary of Education and Technical Qualifications and Experience:

- B.S. Degree in Nuclear Engineering from the Pennsylvania State University.
- Over 25 years of experience in the field of Nuclear Engineering and Nuclear Safety.

Summary of Experience:

Mr. Fialkovich has worked in the field of nuclear criticality safety for the past eleven years. Additionally, he has led and participated in numerous audits and assessments throughout his career. Attended Lead Auditors Training and has completed the 5-day Los Alamos Criticality Safety course. Mr. Fialkovich is currently the lead engineer for the Fluor Hanford criticality safety program, responsible for management of the program. He has frequent contact with other criticality experts throughout the DOE complex and is well versed in CRD 420.1A, and its associated ANSI/ANS standards.

Team Member Qualification Summary

Team Member Name: Jian-Shun Shuen

Title and Organization: Nuclear Engineer
Tank Farms Engineering Division
Office of Assistant Manager for Tank Farms Projects
Office of River Protection

Areas Assigned: Additional Assessment Criteria

Summary of Education and Technical Qualifications and Experience:

- B.S. Nuclear Engineering, The National Tsing Hua University (Taiwan)
- M.S. Nuclear Engineering, The National Tsing Hua University (Taiwan)
- M.S. Mechanical Engineering, The Pennsylvania State University
- Ph.D. Mechanical Engineering, The Pennsylvania State University

Summary of Experience:

Mr. Shuen has over 11 years experience in nuclear process engineering and safety analysis. He has more than 14 years experience in thermal system design and fluid mechanics and heat transfer R&D. He has authored or coauthored 21 refereed journal articles in the areas of heat transfer, thermodynamics, fluid mechanics, numerical analysis, and combustion. He has been with the Department of Energy since 1994. From 1994 to 1999, he served as the characterization program manager for the RL Spent Nuclear Fuel Project. He also participated in the review of SNF Project safety documentation. Mr. Shuen joined ORP in May 1999 and has worked on assignments related to the Waste Treatment Plant design and construction and TFs safety basis.

Team Member Qualification Summary

Team Member Name: Courtney A. Blanchard

Title and Organization: Facility Representative
Tank Farms Operations Division
Office of the Assistant Manager for Tank Farms Project
Office of River Protection

Areas Assigned: Tank Farm Closure Projects and Demonstration Bulk Vitrification System Project

Summary of Education and Technical Qualifications and Experience:

- Bachelor of Science in Engineering, Michigan Technological University, 1981
- Qualified as NRC nuclear Materials Regional Inspector
- Qualified Resident Inspector and Senior Resident Inspector
- Qualified as DOE Facility Representative at the Hanford TFs
- State of Washington Professional Engineer, Ref: 25348 - July 15, 1988 to present
- Twenty four years experience in various naval, commercial, and DOE nuclear facilities

Summary of Experience:

- ORP Facility Representative at the Hanford TFs.
- ORP Federal Interface Engineer responsible for managing the interface activities between the WTP and TF (TF) contractors, RL, and the RL contractors to support the design, construction, and commissioning of the WTP.
- Performed Office of Safety Regulation (OSR) design process inspection of the WTP contractor in the areas of training, fire protection, occupational safety, work control, and vital safety systems.
- Temporary assigned to the Brookhaven National Laboratory as the EM Facility Representative. Responsibilities during this six month assignment included the over site of four EM clean-up projects. These projects were the decontamination of a highly contaminated Brookhaven Graphite Research Reactor ventilation duct, removal and remediation of two radioactive underground storage tanks, Peconic River remediation, and remediation of a former hazardous waste site on the Brookhaven site.
- NRC Senior Resident Inspector at the Paducah Gaseous Diffusion Plant (GDP), dealing with inspection and enforcement of the facility license and design basis. Supervised the activities of one resident inspector.
- NRC Resident Inspector at the Portsmouth GDP. Conducted numerous inspections of licensee activities to ensure compliance with NRC requirements.

- NRC Fuel Cycle Inspector with responsibilities that included conducting routine and special inspections at Uranium Fuel Cycle facilities.
- Industrial Planning Coordinator at Puget Sound Navel Shipyard (PSNS): Supervised a staff of engineers and technicians that developed the technical guidance instructions used by machine shop personnel to repair equipment.
- Production Engineering Supervisor at PSNS: Supervised a team of engineers that were responsible for answering all technical questions during the CGN 41 availability and negotiated funding issues with senior shipyard management.
- Mechanical Engineering Branch Manager at PSNS: Responsible for planning, organizing, and controlling the actions of the branch of 30 engineers and technicians to accomplish assigned design task.
- Mechanical Engineering Supervisor at PSNS: Supervised and approved the work of 10-20 engineers and technicians that developed design projects to install and modify fluid systems on naval vessels.
- On-Site Engineering Representative at PSNS: Assigned to Long Beach Naval Shipyard as the project engineer to address design issues with the PSNS design packages during the overhaul of the USS Jouett.
- Mechanical and Lead Engineer at PSNS: Performed design activities for several types of firefighting system on Navy ships and prepared written design procedures, taught fluid and magazine sprinkling system classes, and reviewed the design products of engineers and technicians.

Team Member Qualification Summary

Team Member Name: Dr. Robert E. Wilson

Title and Organization: Nuclear Engineer
Office Engineering, EM-22

Areas Assigned: Process Evaluations for Nuclear Criticality Safety

Summary of Education and Technical Qualifications and Experience:

- Bachelor and Masters of Science degree in Engineering Physics from the University of California at Los Angeles
- PhD in Nuclear Engineering from the University of Washington.

Summary of Experience:

Dr. Wilson completed a dissertation in Critical Mass Physics at the Plutonium Critical Mass Laboratory in Richland, Washington and post doctoral work in safety analysis for the FFTF Reactor. Following academia he assumed responsibility for the Criticality Safety Program at the Idaho Chemical Processing Plant (ICPP). While at the ICPP he managed the safety response to a criticality accident in 1978 and managed the rebuilding of the criticality safety program. Following ICPP, he worked as the senior criticality safety specialist for the U.S. Nuclear Regulatory Commission. In 1995, he assumed responsibility for the criticality safety program at the Rocky Flats Environmental Technology Site and instituted the program manual, the Criticality Safety Officer Program and safety analysis methods. Since 2000, he has been the Criticality Safety Program Manager for the Rocky Flats Field Office and currently the Office of Environmental Management.

Dr. Wilson was appointed a Westinghouse Advisory Scientist in 1987, a Fellow of the American Nuclear Society in 1994, and earned a Meritorious Service Award for Engineering Excellence from the NRC in 1992. He has served as a member of the Argonne National Laboratory Nuclear Facility Safety Committee, the DOE Nuclear Criticality Technology and Safety Panel (1989 - 1993), and the DOE Criticality Safety Support Group (1997 - present). He has been the General Chairman and Program Chairman for ANS topical meetings in criticality safety. He has twice served as vice chair and chair of the ANS Nuclear Criticality Safety Division. He is currently chair of the Colorado Section of the ANS. He has served as an Affiliate Professor of Nuclear Engineering for the University of Idaho and has lectured at 17 sessions of the University of New Mexico Short Course on Nuclear Criticality Safety.

Dr Wilson is a member of several ANSI writing groups for criticality safety related standards and is a member of N-16, the Nuclear Criticality Safety Consensus Committee for the American National Standards Institute.

Team Member Qualification Summary

Team Member Name: Dr. Robert C. Nelson

Title and Organization: Sr. Nuclear Safety Technical Advisor
Office of the Assistant Manager for Environmental Safety and Quality
Office of River Protection

Areas Assigned: Process Evaluations for Nuclear Criticality Safety

Summary of Education and Technical Qualifications and Experience:

- BS, MS and PhD in Radiation Biophysics from the University of Kansas

Summary of Experience:

Dr. Robert C. Nelson is currently a Senior Nuclear Safety Technical Advisor for the Office of River Protection (ORP). In that capacity, he serves as Senior Safety Oversight in the areas of Nuclear Safety and Criticality Safety. Prior to joining ORP, Dr. Nelson was assigned to DOE RL where he served as Senior Nuclear Safety Technical Advisor to the Assistant Manager for Safety and Engineering.

Dr. Nelson has over 35 years of experience in the areas of safety analysis, risk management, reactor licensing, nuclear weapon safety, nuclear safety, radiation safety, environmental management and restoration, and space nuclear power and propulsion programs. His experience and expertise include project management, regulatory compliance, risk assessments, safety assessments, management assessments, and operational readiness reviews through involvements in DOE, DoD, NRC, and NASA activities.

Dr. Nelson served as lead technical advisor and chairman for EG&G corporate readiness reviews for Buildings 559 and 707 at Rocky Flats, and has led DOE ORRs for the B696 waste storage building at LLNL, project W460 at the Hanford Plutonium Finishing Plant, and the Foster Wheeler Environmental Corporation Waste Processing Facility at Oak Ridge. Dr. Nelson also served as deputy and lead technical advisor for the DOE ORR for the West Valley Demonstration Project Remote Handled Waste Facility. Dr. Nelson has conducted several special projects within the EM community. He served on detail as the initial lead of the Safety Basis project team directed by EM-1 for Oak Ridge EM activities, as a member of a special assessment team performing oversight of the administrative control programs for EM activities throughout the DOE complex, and as a member of a Sludge Review Board commissioned to review sludge removal activities at the K Basin facility at Hanford.

Dr. Nelson holds a BS, MS and PhD in Radiation Biophysics from the University of Kansas. In addition, Dr. Nelson has attended and taught numerous courses in various aspects of criticality and nuclear safety management.